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INFORMATION DISPLAY

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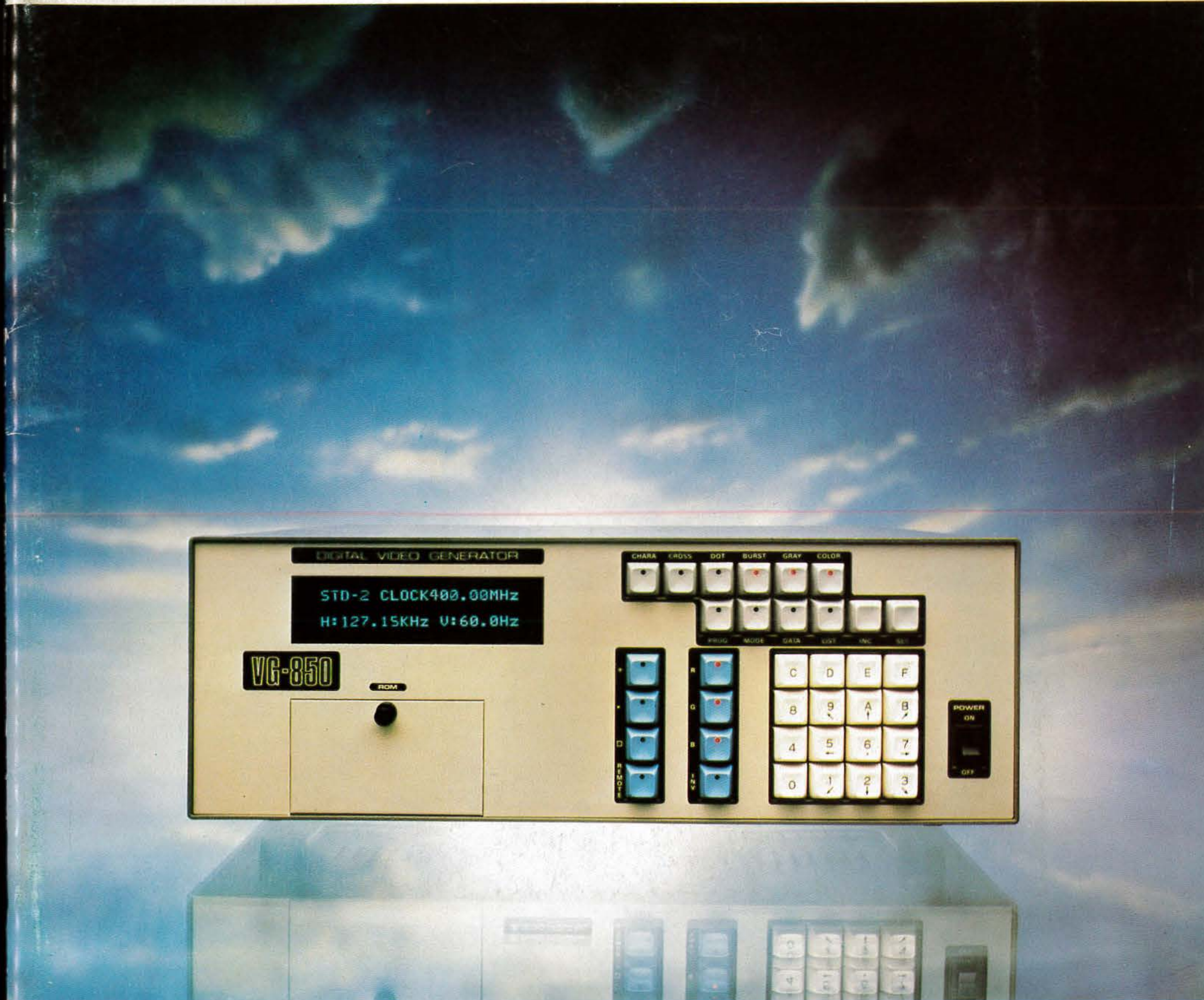

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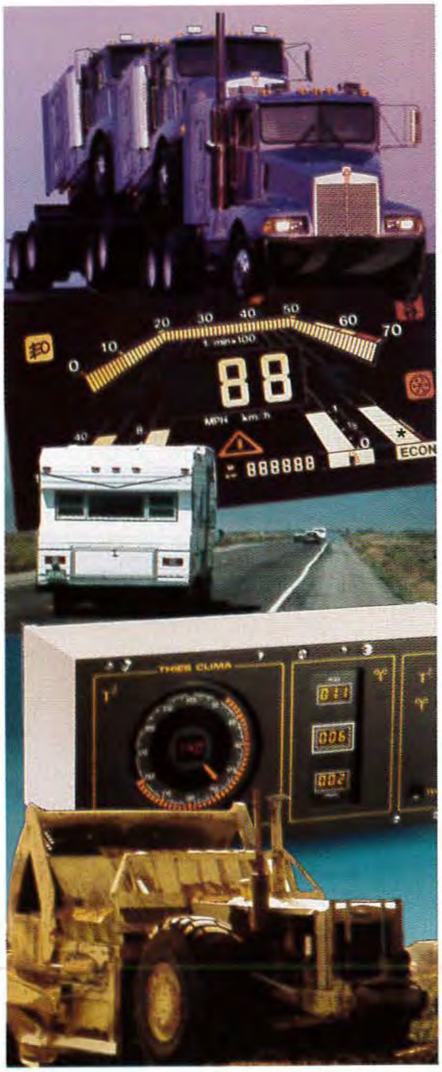

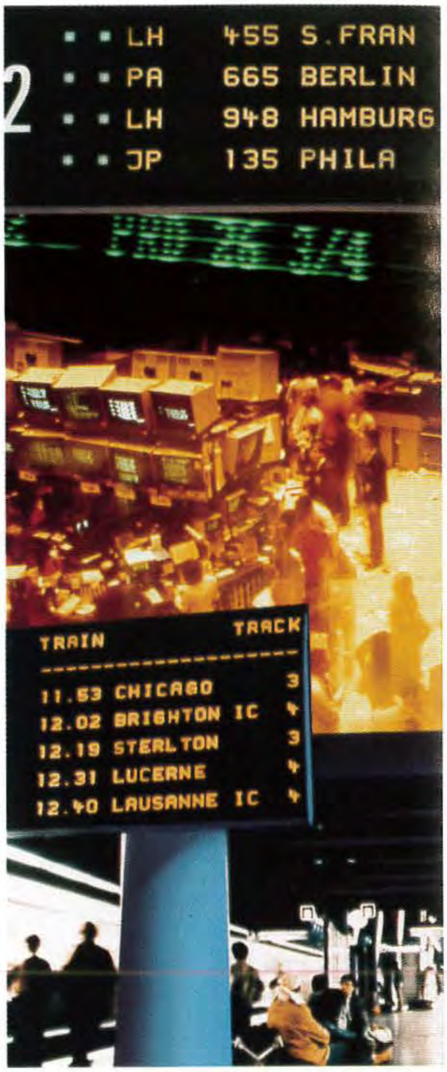

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*Instrument panel in first column, courtesy of Borg Instruments

Circle no. 1

American enterprise: pleasing the shareholders

This is the acceptance speech I would have given, had I been present (and had there been time) at the occasion of being awarded the first Karl Ferdinand Braun Prize of the SID:

While indeed I feel greatly honored in receiving this recognition, I cannot help reflecting on the ironies inherent in my receiving it. The first and obvious irony is that I have spent a good deal of my time in trying to displace and make obsolete the device invented by the illustrious scientist whose name my prize bears. I did this not just by working hard in the laboratory, but also by publicly ridiculing it, saying "Who's afraid of the C-R-T" or referring to it as "the brontosaurus with too much bulk and too little brain." Let me confess, however, that I was, am, and will continue to be respectful and very much afraid of the CRT, a great and indestructible invention—but I needed these flippant phrases to keep my own courage up in a seemingly endless battle, not really *against* the CRT, but *for* funding: always delayed, always inadequate.

The second, tragic irony resides in the fact that the company whose laboratory has been in the vanguard of many of the most important technological developments of this century—the company that sponsored the prize I have received—exists no more. It was bulldozed out of existence by the same forces which, in my opinion, are also directly responsible for the pathetic and continuing decline of this great country's industrial and economic strength. This is too large and bitter a subject to discuss here, so let me just say that I agree and sympathize with our President's sorrowful message on this topic in the April issue of this journal.

The third, personally mordant irony is implicit in the circuitous road I have traveled since I first started to think about a possible marriage between thin-film transistors and displays. I believe that the factors responsible for turning this path practically into a closed loop are much the same as those which wiped the name RCA off the slate, and are endemic to the way corporations are run and projects financed in the U.S. today. For many years now, no large American company would attempt to bring a new product or technology to the marketplace until their risk-hating bean counters had proven to their own and their equally gutless bosses' satisfaction that the internal rate of return would meet standardized corporate objectives and also that the net effect on the bottom line, ten years hence, would be positive. No real innovation can possibly stand up to such scrutiny. My active-matrix project missed these computerized objectives by a small margin at Westinghouse eight years ago—but the margin was big enough for the worried mid-level executives to wipe their brows with relief and say: "we really loved your project and wish the hell we could continue it, but our computer won't let us."

After this, turning to the so-called venture capitalist, I was told: "If this is so good, how come Westinghouse has dropped it?" and "Who else is doing this? We certainly don't want to be the first, far too risky." So another two years went by, and by the time I scraped enough money together to start Panelvision, our Japanese friends, who recognize a good thing when they see it and worry about the bottom line much later, were off and running. Our lead, which at one time was six to seven years, was rapidly shrinking but still allowed us to introduce the world's first active-matrix products in early 1984. Then came the crowning irony: we just needed one more round of financing to build up production volume to break-even, but were then told by our lead investor: "We have now missed the boat, the market belongs to Japan." To make quite sure this prophecy would fulfill itself, he didn't produce another cent of support.

My personal Odyssey, which after 20 years of reasonably fruitful—I might even

continued on page 30

Cover: *one of the new high-speed programmable video generators, the ASTRO VG-850 from TEAM Systems (Test & Measurement Systems, Santa Clara, California) with 400-MHz dot-clock capability (page 8)*

Next Month in Information Display

- SID '87 overview
- Matrix circuits
- Public information systems
- Company profile: TFD, Inc.

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INFORMATION DISPLAY

JUNE 1987
VOL. 3, NO. 6

New holography exhibit opens in New York

"The Holographic Instant: Pulse Laser Holograms," an exhibition of many of the most significant and recent works in the field of pulse holography will run at the Museum of Holography, New York, NY, May 15 through September 20, 1987. The exhibition includes approximately 45 holograms from nine countries and covers history, display holograms, scientific experiments, and a portrait studio where holography enthusiasts can have a unique holographic portrait made. Museum director Ian M. Lancaster says, "In this, the first exhibition to explore the wide range of holography possible with a pulse laser, we hope to bring these specialized achievements out of the laboratory and into the public eye."

Museum hours are Tuesday and Thursday-Sunday 12 noon-6:00 p.m., Wednesday 10:30 a.m.-6:00 p.m. The Museum of Holography is located at 11 Mercer Street, New York, NY 10013. 212/925-0526.

SID national library receives donated papers

The national office of the Society for Information Display announces two additions to its library. Dr. Albert George Fischer of the University of Dortmund, West Germany, has sent complimentary copies of two papers to the Society: "AC-EL Thin Film Structure for Low-Voltage Operation," H. Teves, J. Huggenberg, and A. G. Fischer, and "Toward Wall-Panel TV," D. Tizabi and A. G. Fischer. The Society sincerely thanks Dr. Fischer for his generous donation. The library is open Monday-Friday 8:30 a.m.-5:00 p.m. (Pacific time) for members' use. The SID national office address is 8055 West Manchester Ave., Suite 615, Playa Del Rey, CA 90293. 213/305-1502.

SPTC changes name

The Special Purpose Technology Corporation (SPTC) of Van Nuys, CA, announces a name change. The new company name is CRT Scientific Corporation. The present address and phone numbers remain the same: 14746 Raymer Street, Van Nuys, CA 91405. 818/989-4610 or 213/873-5107. ■

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INFORMATION DISPLAY

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editorial

Much has been said lately about balance-of-trade problems and the restructuring of industries. These are complex problems, requiring thoughtful long-term planning, not band-aids for short-term solutions, nor actions based on short-sighted interests. This is neither a political nor an economic journal. Nonetheless, because it represents an international organization in fields at the core of the problematic technologies, we in SID should attempt to face these issues.

These days, it sometimes seems that the main export of the United States is ideas and technology. We need to weigh what should be done. At any event, in this month's *Information Display* we focus on innovations in CRTs. Coincidently, both feature stories come from small organizations. Large corporations have the resources, budgets, and large dedicated staffs for intensive (and impressive) R&D work; perhaps because of their size, smaller firms have an added incentive—personal involvement.

A small firm with a good invention often must go outside itself to bring the idea into reality. This may include using outside consultants or going to vendors specializing in the missing expertise. Ted Lucas traces this sort of involvement in his story about a novel TV projection system, notable for its concave CRTs and lack of a shadow mask, developed by Marv Hodges and five full-time engineers.

Another way for a small firm to be successful is to look for a niche, to develop a product that fills a special need, in hopes of growing larger—or at least of retaining a share of the market when the bigger firms move in. Ed Jacklitch and George Stoeppel describe this sort of strategy in their story about a 400-MHz video generator. As we all know, CRTs keep getting better and better. High-resolution monitors and digital-to-analog converters capable of running at 360 MHz are now being manufactured, but the problem of utilizing them arises. Design engineers in particular need a video generator that can test this equipment when adapting it into a system, which should also prove useful for manufacturing and inspection purposes.

Our third article addresses a universal problem—choosing the proper desktop printer, whether for personal use, a small office, or a large organization. Juliana Lord and Alvin Keene do more than just describe the various options. They have developed an ingenious table for assigning weights to each technology's strengths and weaknesses. The table can be adapted to judge competing models in a given field. Please feel free to photocopy it.

This is being written before SID's 1987 International Symposium, Seminar, and Exhibition, which will have come and gone by the time you are reading this issue. (Such is the time frame of a magazine.) But I expect to return from New Orleans filled with stimulating ideas, fruitful discussions, and some incredibly good food.

Society for Information Display
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president's message

It is difficult to find a journal these days or even a newspaper that does not carry an article on superconductivity and the great promise of the newly discovered high-transition-temperature materials. It is indeed rare that a technical discovery or technological breakthrough will generate such excitement in so many laboratories all over the world. A co-worker of mine who attended the now famous New York meeting this spring—the one they call the "Woodstock of Physics"—made me sorry to have missed this historic event. I hate to miss big scientific happenings because, like Halley's Comet—which I also missed despite many attempts to see it—it will never come back, not in my lifetime at least.

I find it comforting, however, to see that this level of excitement can still occur because it has a lot to do with the reasons why I decided to pursue a technical career. And I remember the few instances when I myself was caught up in a project that appeared so promising that the time of day and my stomach became secondary. A long time ago I remember the race to develop the first 1-W argon laser and to make high-quality holograms; then there were the first images from a new vidicon, and of course the VideoDisc.

Obviously other scientists and engineers also get caught up in this kind of excitement. Many of my older colleagues at RCA remembered fondly the excitement during the early days of color television: the development of the shadow-mask CRT and specification of a compatible transmission system (NTSC); I would have liked to be there. Partly, what intrigues me about these occasions is the question, Is it the technical discovery that is responsible or the people involved who trigger the excitement that eventually generates energy, momentum, and success?

I was fortunate to be at RCA the day that George Heilmeier first demonstrated a dynamic scattering liquid-crystal cell consisting of a single pixel, approximately one square centimeter in size, that changed its appearance from transparent to milky white upon the application of a 45-V signal. In retrospect, I still admire my boss who, at that time, immediately recognized the potential for flat displays and helped trigger a period of excitement and discovery.

Now, as we look back on the late 1960s—as many of the display experts who were interviewed in the past issues of *Information Display* pointed out—the discovery of liquid crystals is perceived as one of the most important events in the display field of the past 25 years. And for many of us that one discovery led to other "happenings" along the way. I look forward to many more.

Sincerely,

Why you need a 400-MHz video generator

BY ED JACKLITCH AND GEORGE STOEPPEL

THE INDUSTRY supplying high-resolution video monitors is being driven to produce more and more resolution on the screen. Users are demanding more displayed information per frame. Additional information to be displayed usually includes more color variation, as well as shading of physical objects, to make them easier to recognize.

The military needs better tactical displays, as well as more realistic training simulators. CAD/CAE suppliers and those firms producing engineering workstations also need to display more data with finer resolution and to create pictures on the screen that have a certain depth or three-dimension-like realism. This requires the monitor to deal effectively with a large color range, as well as multiple shades of gray.

The industry has responded recently with several significant new products to add fuel to the engine driving higher screen resolution. Both Sony and Hitachi have announced color monitors with 2048 × 2048 pixel resolution, 125-kHz horizontal scan rate (at a 60-Hz frame rate), and dot-clock frequencies in excess of 360 MHz. Brooktree and Honeywell have introduced video digital-to-analog converters (DACs) capable of running at 360 MHz and above.

Ed Jacklitch started as a system designer in the aerospace industry and is currently a test and measurement marketing consultant in San Jose, California. George Stoeppel, a video design engineer, is president and founder of Test & Measurement Systems, Inc., Santa Clara, California.

Improved test equipment required

As these new high-performance display products become integrated into new systems, the need for testing them develops, not only for design lab characterization and product qualification, but also for inspection and production.

The new crop of monitors and video DACs allows system designers to develop graphics engines that generate dot-clock frequencies in excess of 360 MHz. The designer needs test equipment that is flexible enough to simulate a broad range of graphics engine parameters, so that design verifications can be performed on an actual monitor.

Why not use the actual graphics engine from the system as a test tool? Enthusiastic users of commercial video generators cite several reasons why that approach is not desirable:

- Dedicated graphics engines are expensive; some cost as much as $40,000, particularly if they run above 360 MHz.
- Because they are dedicated, it is difficult to program test patterns into them.
- They are not usually very flexible; e.g., there is no provision for varying the timing conditions and the dot-clock rate, desirable features for margin or tolerance testing of monitors.
- Development of video circuits in the color monitor often requires the use and availability of the graphics engine. Very often, engine development lags monitor development or qualification/selection, thus causing delays from development to production.

Because of these drawbacks, the designer has sought out a commercial video generator. Advances in video display technology have spawned the need for advances in video generator capabilities. Let's consider a set of features that have been found necessary as a result of the recent advances in video technology.

Video measurement needs

Typically, the transfer function of a given monitor is measured by driving the monitor with a clean video signal and optically measuring the response of the monitor at the face of the CRT. A video generator that can simultaneously generate color bars, gray scales, and graphics allows the designer to make dynamic transfer function measurements at several gray-scale levels and colors, which are much more meaningful than static measurements.

Very often, it is necessary to vary the dot-clock frequency to measure video bandwidth. The generator should be capable of adjustments in the dot clock without disturbing the horizontal scan rate. This means that the generator must have a scheme for generating independent clock signals for the dot clock and for the horizontal sync circuits.

Until recently, the only method available to generate narrow pixel pulses was to use a very-high-speed pulse generator, which is triggered by the horizontal sync pulse of the video generator. The output of the pulse generator and the video generator is then typically mixed together external to the video generator, then applied to the monitor being tested. The military R&D establishment has used this technique almost universally. Nevertheless, trigger jitter and the mixing process cause enough degradation to the resulting signal to make it almost unusable. It is just not possible to generate 2.7-nsec pulses (equivalent to a 360-MHz dot clock) with this approach.

What is needed is a generator capable of adjustable dot-clock frequencies up to 400 MHz, and crosshatch pattern control that allows the designer to put as many or as few pixels as desired into one raster line, without visible jitter from one line to the next.

To minimize generator-induced low-frequency cross talk on the monitor, a generator that allows precise adjustment of the horizontal scan rate is a must, because the designer must confirm that a problem seen on the monitor is not induced by the generator.

Video output drivers should be buffered and back terminated to ensure a sharp high-fidelity signal at the monitor input, rather than just at the output of the generator.

Finally, the generator should be easy and convenient to program, without having to connect it to a computer. For maximum flexibility, there should be pixel-by-pixel control of the instrument. The designer should also be able to store and recall front-panel setups for special or routine tests. This applies especially to the engineering department, where extremely flexible and fast storage of a set of patterns is needed to help keep track of particular design problems.

The instrument should also have provision for "locking out" the front-panel controls so that it may be used in the production test environment, where no designer wants his or her test parameters tampered with.

Specifications and features

Let's look at a typical high-performance video generator and consider what it offers. Refer to Fig. 1, a block diagram of the TEAM/ASTRO VG-850, a video generator with a 400-MHz dot-clock capability.

The unit has separate generators for screen graphics (pattern memory) and for color and gray-scale display components. Graphic patterns are stored as a bit image in the pattern memory, whereas color and gray scale are developed using separate hardware subsystems to set start and stop locations for each color and gray-scale level. High-speed components from GigaBit Logic Corporation are employed in the data path between the pattern memory and the video multiplexer circuits in the video output stage. This allows the designer to display complex combination patterns, including graphics, color, and gray scale, at the same time, at full-rated dot-clock frequency. This is important when observing the ability of the monitor to resolve and present those components without distortion.

Note that the instrument has two separate frequency synthesizers: a sync signal generator using a crystal clock source and a 480-MHz voltage-controlled oscillator for video. Using a high-speed LC frequency synthesizer circuit, the 480-MHz dot-clock source is phase locked to the horizontal sync signal. Having two synthesizers allows the designer to adjust the dot-clock frequency independently of the horizontal sweep rate. This ability to vary the dot clock by itself allows the measurement of monitor video bandwidth without affecting horizontal sync. Additionally, when any changes to the dot clock are made, there is no momentary loss of sync, because the two synthesizers are separate.

The horizontal period is precisely ad-

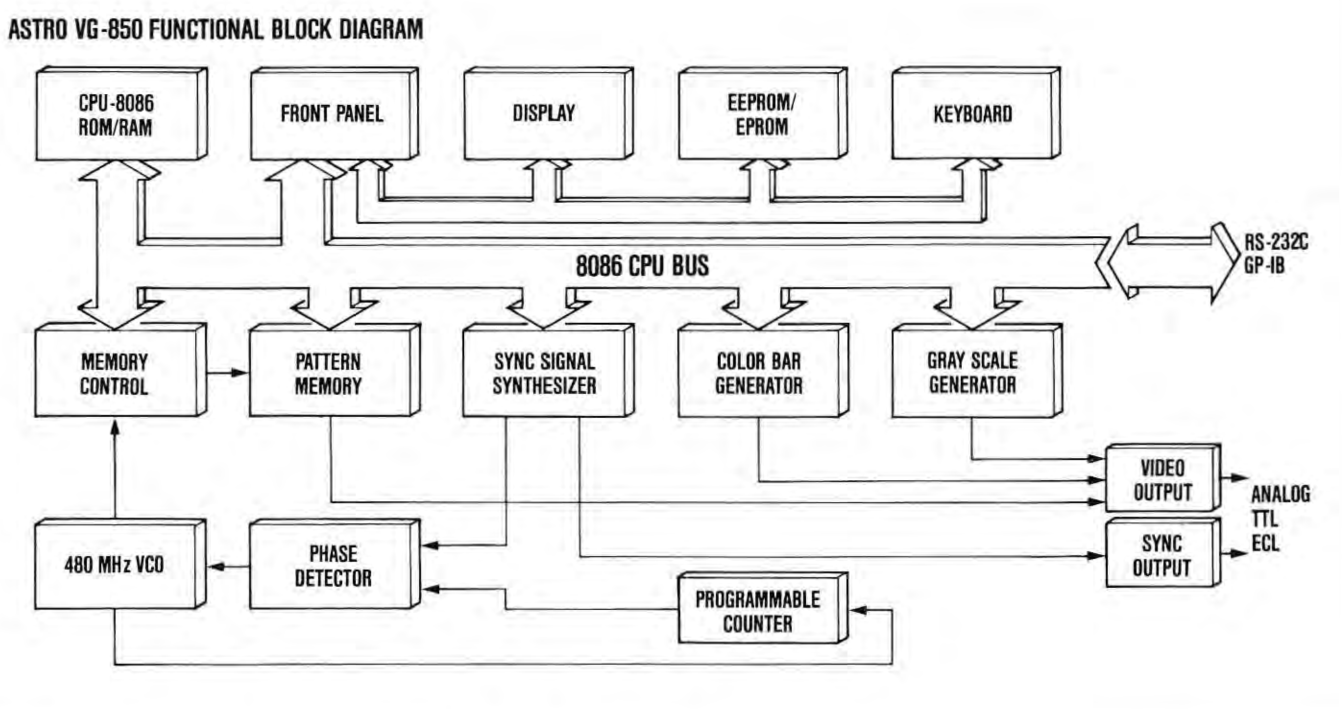


Fig. 1: Block diagram for the programmable 400-MHz video generator, Model ASTRO VG-850, Test & Measurement Systems, Inc., Santa Clara, California.

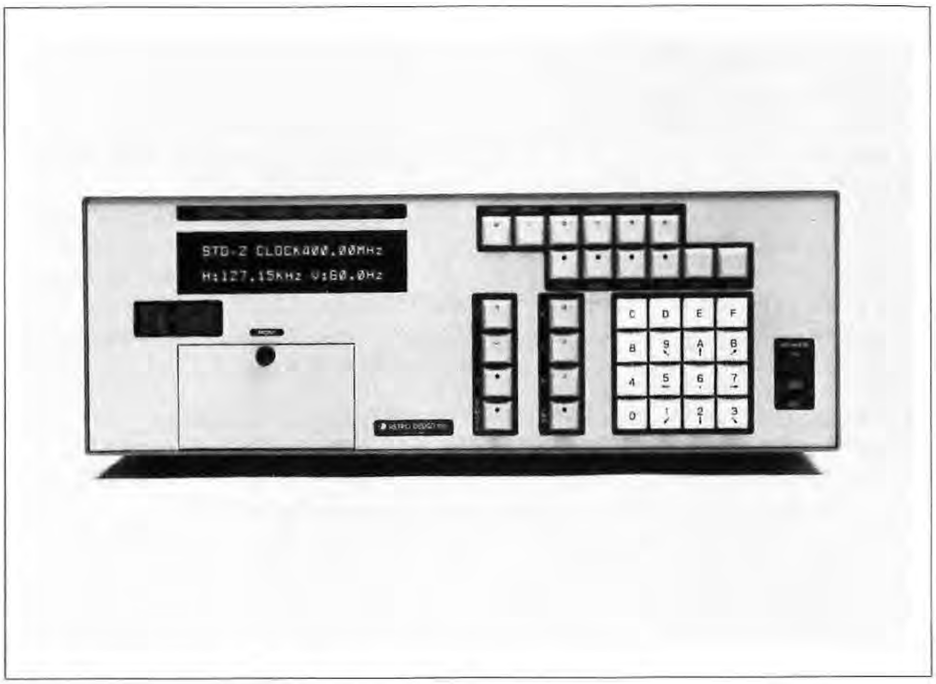


Fig. 2: Front-panel layout of the ASTRO VG-850.

justable in 20-nsec increments. This ability to set the period so precisely is important to minimize any possibility that the generator will cause low-frequency cross talk on the screen. Thus any cross talk observed is a result of distortions in the monitor.

The analog video-output stage uses a 400-MHz DAC from Honeywell or Brooktree and a high-speed buffer to ensure fast rise and fall times. The buffered and back-terminated output is a very important feature in this particular instrument. It ensures a wide-band video signal at the monitor, not just at the output of the generator. This results in a clean sharp image on the screen. It also protects the generator from high-voltage arcing at the monitor. Additionally, the designer can set the video and sync output voltages independently within the range of plus or minus 50% of their respective nominal peak-to-peak voltages (into 75 Ω) for added flexibility.

This unit has the ability to store front-panel setups in an EEPROM, easily and without using an external terminal. As many as 99 user-defined front-panel setups may be stored in EEPROM and recalled at any time [Fig. 2].

Convenient storage of front-panel setups is handy in the development lab. Let's say that a new monitor design is being put through its paces when the designer finds a particular combination of parameters that causes an interlace problem to appear on the screen. Those setup parameters can be stored. Then, after diagnosing and correcting the problem, the designer can recall the set of parameters, exercise the monitor, and easily determine if the problem has been solved.

The unit is a totally integrated system: one need not add any other devices to build a test system. If the need arises to integrate the unit into an automated test system, both RS232-C and IEEE 488 I/O interfaces are available to give full control of the unit.

In a production test environment, one can specify a set of test routines, store them in EEPROM, and "lock out" the front-panel controls. Now, all one can do at the front panel is to recall and execute those stored setups. Thus, the integrity of testing on the production floor is maintained.

The proliferation of personal computers and the tremendous growth in applications for engineering workstations will continue to generate demands for display systems that have extremely high resolution, along with lifelike colors and solid-object shading. To meet these demands, a 400-MHz programmable video generator offers flexibility and performance for the design lab, as well as rugged dependability for the production floor. ■

Improved single-lens projection TV system

BY TED LUCAS

IMAGINE a projection TV system providing a bright high-resolution color picture with a 25-in.-diagonal screen that folds down to the size of a briefcase when not in use. By scaling (with larger or smaller components), a wide range of products—from miniaturized cockpit displays to auditorium projectors—can be produced. Such a system, using a single lens and three CRTs having concave faceplates, has been developed, not by a major corporation, but by Triuniplex Display Systems, Inc., Simi Valley, California.

Evolution of a new company

Development of this novel projection system has occurred under the guidance of M. P. (Marv) Hodges, heading a team of optical, mechanical, and electronic engineers. In 1974, after more than 25 years with Eastman Kodak Company, he founded Marv Hodges, Inc., a small organization working on R&D projects in optics, TV distribution and display, solar concentration and conversion, and the reflectance of visible and near-visible energy. Usually, fewer than a dozen engineers and technicians were involved, most of them moonlighting consultants.

Because there was no history of the proposed technology, early work on the CRT was a trial-and-error affair. By 1978 Hodges and his group recognized the feasibility of the system and began serious work in proving the theory. In May of 1986 development of the project was assumed by Triuniplex, with Hodges as president, Donald Hill as vice president of engineering, and Al Malang as vice president of product planning. This firm, financed by venture capital, has five full-time (actually, overtime) engineers, plus seven experienced scientific and engineering consultants.

Obviously, with a staff of this size, outside help was needed to bring the system to completion. All design work was done in house, of course, but cooperative outside vendors were also required.

Among the CRT manufacturers turned to was the CRT Scientific Corporation (now SPTC, Inc.), headed by Kenneth Keller. Fortunately, this CRT facility was only about 20 miles from Triuniplex. With the help of Dr. Meier (Mike) Sadowsky and Samuel Carlisle, founders of SPTC, and Steve Karnes it was determined that special CRT tubes having concave faceplates, a requirement of the system conceived of by Hodges, were easily manufacturable.

While development of these special CRTs was under way, other parts of the system were being designed—the single-element aspheric projection lens, the system body containing coupling liquid and beam splitter (dichroic mirrors), and appropriate electronic circuits for supplying red, green, and blue signals, as well as drive and control voltages to the three CRTs. Dr. Buchroeder, Dick Altman, Brysen Coatings Labs, OCLI, and Schott Glass of America among others were valuable consultants.

Thus by turning to outside sources when necessary and by forming a new company when production seemed reasonably imminent, the means for commercial development had been achieved.

Evolution of a new design

In most projection systems that use three CRTs and three lenses, color convergence is achieved by physical alignment of three off-axis images on a suitable screen. The three images are focused and converged on a finite plane and can be difficult to refocus. Also, at any screen efficiency the color intensity from each lens diminishes with each degree of off-axis viewing. Thus a viewer on the right side of the audience sees a different color balance from that on the left side. (*Editor's note:* see the January 1987 issue of *ID* for an overview of video projectors.)

Figure 1 shows a typical energy lobe generated by a single phosphor dot on the inside of the CRT's faceplate. This lobe and approximately 385,000 others must be directed into a lens system for projection. Radiating energy from these dots must pass through the glass faceplate before reaching the air space between the CRT and the projection lens. At the air interface all rays refract away from normal, resulting in an approximate doubling of their reflective angles [Fig. 2].

Typically, CRTs transmit a maximum of 60% of the radiated energy from their phosphor screens. All energy radiating at angles greater than 60° (30° half-angles—Brewster's angle) are reflected back into the phosphor screen at the air interface and become internally absorbed. Such internal absorption reduces contrast and resolution and soaks up a sizeable amount of the available radiated energy. These defects tend to go relatively unnoticed in direct-view television, but they are magnified and can become serious flaws in projection applications.

The curved phosphor screen of each

Ted Lucas is a contributing editor to Information Display.

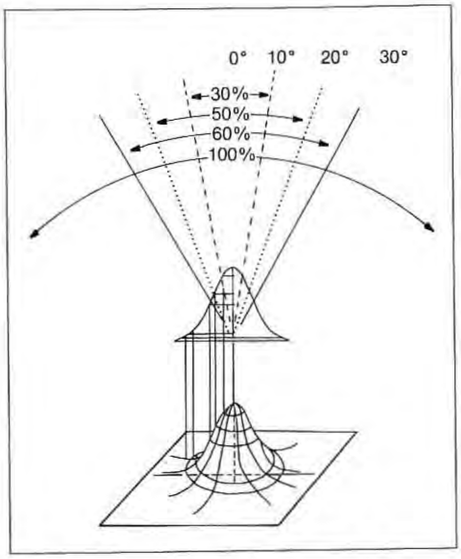


Fig. 1: Percentage of total available energy by radiation angle.

CRT used in the Triuniplex system, however, extends each energy lobe and aims all the radiated energy toward a selected zone determined by the spherical radius of the phosphor screen [Fig. 3]. Deposition of phosphor on the convex surface of a quad-element lens produces an aplanatic focal plane uniplexer. The aplanatic uniplexer has a liquid center that permits greater beam current without phosphor degradation. Elimination of the air interface makes Brewster's law inoperative and prevents internal flare. Thus the projection lens sees—and therefore enlarges—only the phosphor screen, not the glass surfaces, surface defects, and internal flare.

An essential feature of the new design is the optical coupler that is an immersion fluid with the same refractive index as glass. As such, it negates the air interface and is thick enough to prevent internal flare. Another benefit of this liquid coupler is that it serves as a significant heat sink for the CRTs.

Proprietary design of the dichroic beam splitters has resulted in lower light losses from absorption and cross polarization. Also, liquid immersion of the dichroics and CRT faceplates produce a greater range of contrast, higher resolution, and optical components that are more closely coupled and reduced in cost.

A novel three-element projection lens with one aspheric surface has been designed as the final element in the optics of the Triuniplex system. This is a relatively low-cost lens (being defraction limited), because the image planes of the curved CRT screens have been preshaped by

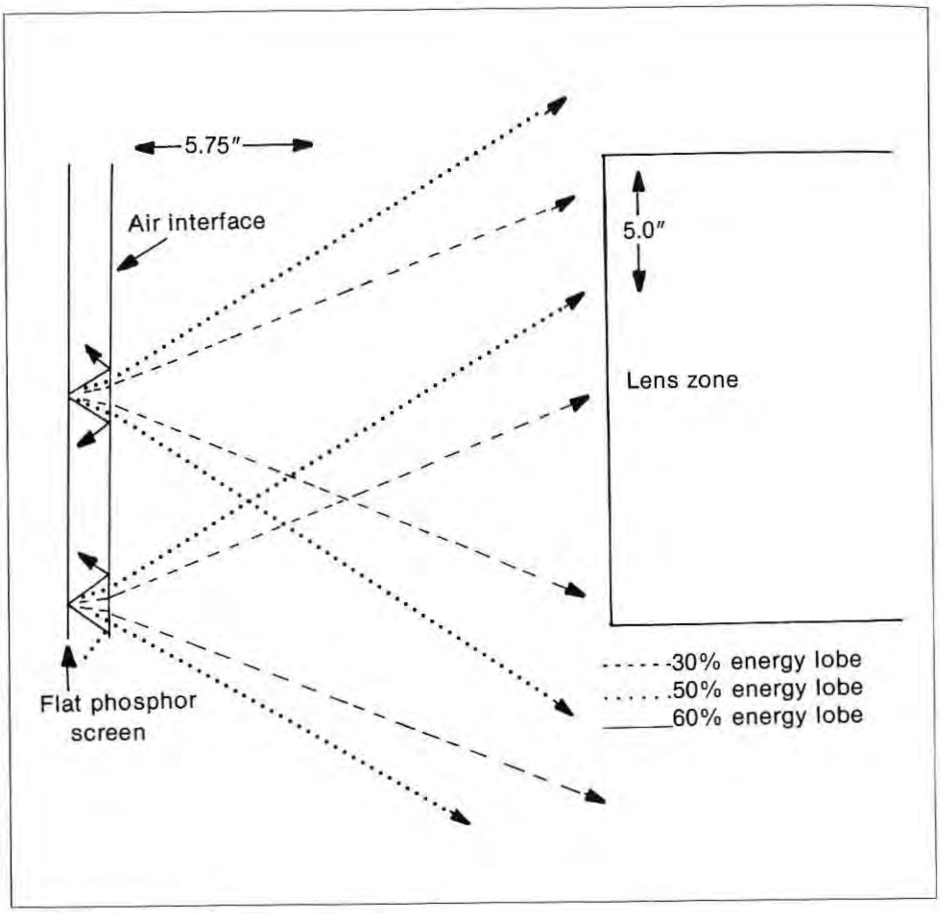


Fig. 2: Energy lobes in a conventional CRT.

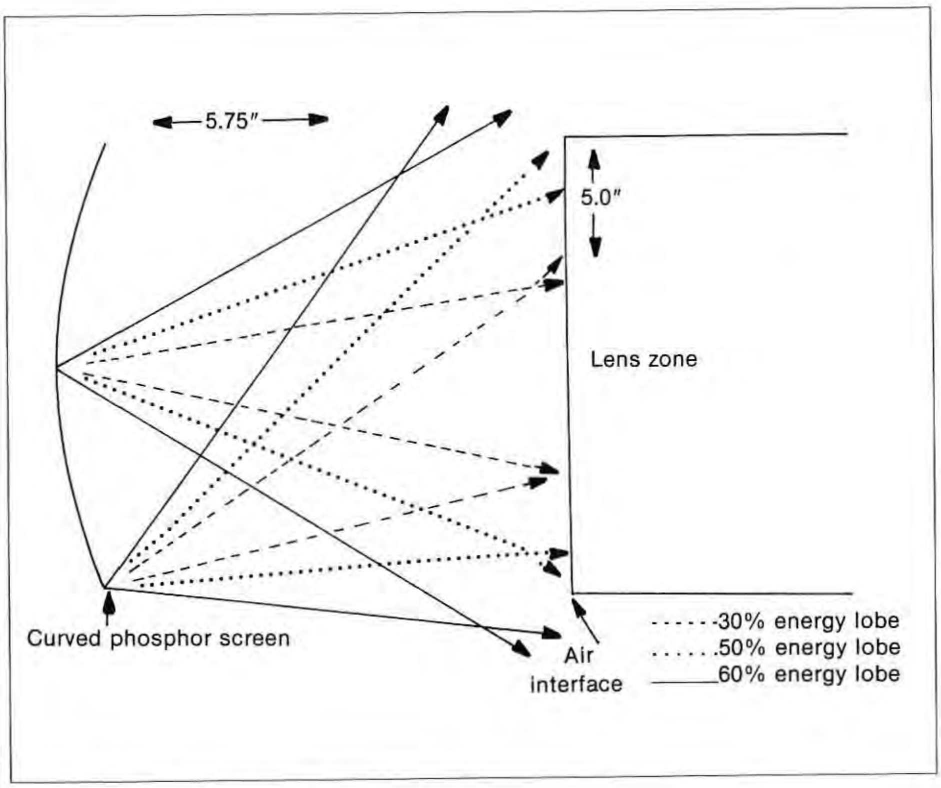


Fig. 3: Energy lobes in the Triuniplex CRT.

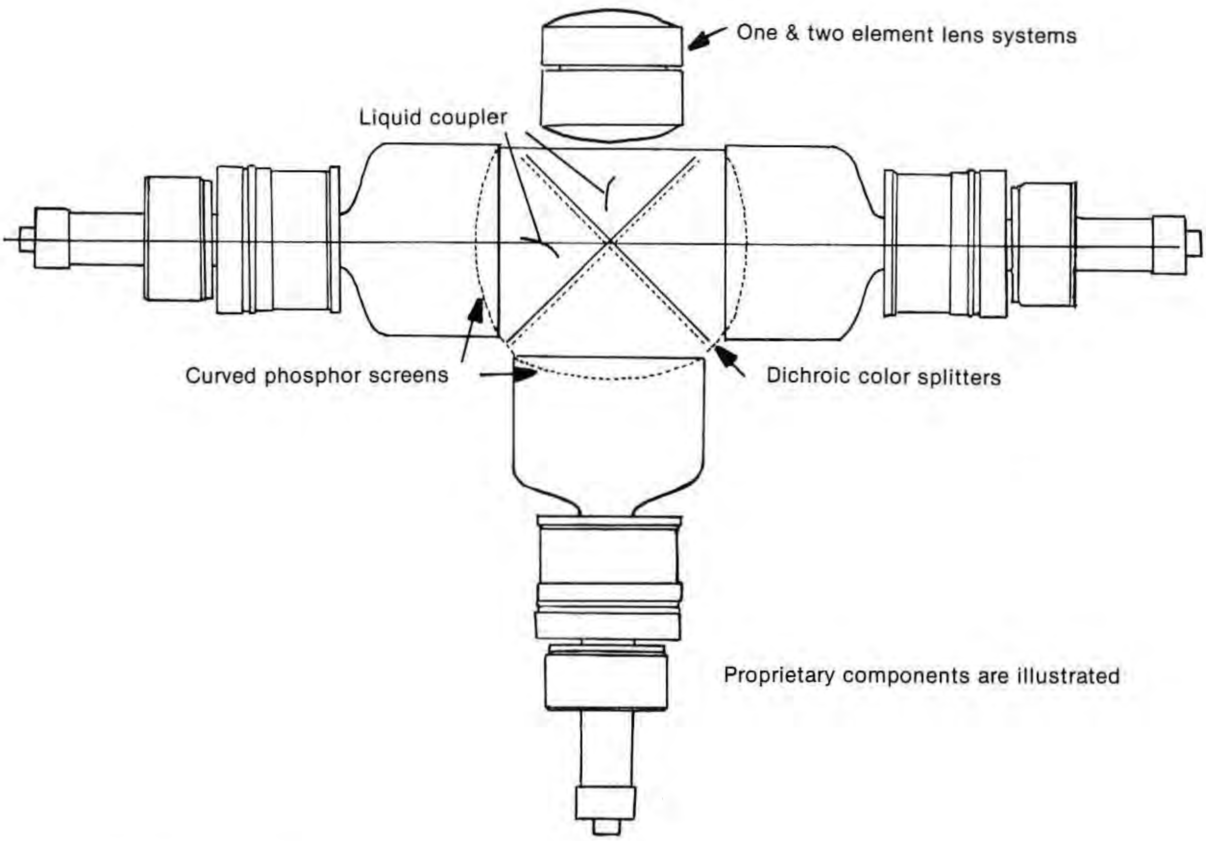


Fig. 4: Triuniplex CRT projection system.

computer-generated calculations to an optimum curvature. Each color CRT is parafocalized and no corrections are required for field, curvature, or chromatic abberation. There are none of the correcting elements or color-correcting coatings required of the lenses used in conventional CRT projection systems. Figure 4 shows the entire system. The three phosphor screens are optically converged within the liquid image combiner, presenting the ultimate in resolution, contrast, color saturation, and immunity to ambient light. While the red and blue virtual images are reflected from the edge filters, and superimposed over the green, the real images are spacially more distant within the light-guarded housing, now further protected from ambient light behind the filters.

Evolution of other applications

Triuniplex plans to have the first commercial units for datagraphic and conventional video applications available by the end of 1987. A slightly longer schedule appears to be possible for certain avionic, naval, and terrestial projection TV models for military uses.

The range of anticipated applications is broad—from briefcase-size to large-scale video theaters (including inflight aircraft entertainment), for CAD/CAM/CAE workstations, and for shipboard, airborne, and vehicular displays packaged in an exceptionally compact and lightweight form.

According to Triuniplex, the sole limitations of the system as it now exists are physical and well within the state of the art. In direct-view applications, a field lens can be used over the view window, to place the display at infinity and to enlarge the image up to 4 times, for heads-up displays, automated instrumentation, radar, and other critical viewing requirements (any CRT size can also be used).

It is also in this direct-view configuration that new options are introduced for the format conversion of video to film. Without the shadow mask and triads and with adequate illumination to expose preprint elements in real time, improved quality and economies are imminent. Color trimming can also be accomplished to color balance for the internegatives being exposed.

In projection applications the system lends itself to a variety of electronic interfaces, including NTSC 525- and 1000-line TVs and 2000-character graphic displays. Future extensions require electronic designs to provide increased power and a variety of computer interfaces and control circuitry to take advantage of modern components such as 32-bit microcomputers, DRAMs, and power transistors. Basically, the system is designed to be limited electronically only by the ingenuity of electronic engineers who interface with electro-optical systems. ■

Choosing the printer that "fits"

BY JULIANA G. LORD AND ALVIN G. KEENE

WHATEVER happened to the paperless society that, several forecasts projected, would evolve during this decade? Certainly, desktop computers have become more powerful and useful, less costly, and more widely used. But the paperless society that these events were expected to generate has not come about. On the contrary, paper consumption has increased because most people still want to view and distribute computer-generated information on a hard copy. The traditional view that paper is an ideal medium for storing, working with, and transporting information still prevails. Thus arises the need for a desktop printer.

But how does one choose the right printer among dozens of different models ranging in price from about $250 to several thousand dollars and having resolutions from 100 or so to more than 300 dots/in. and printing speeds of up to 10 or so pages per minute?

Even more bewildering is the variety of technologies—impact and dot-matrix printers; pen plotters; ink jet, thermal transfer, and laser printers.

Rather than look for the best technology, potential users of desktop printers should seek to identify the most suitable technology for their application. Each of the available printer technologies has strengths and weaknesses. Some are fast, inexpensive, have color capabilities, offer noiseless operation, or generate multiple copies. Some offer a combination of these attributes, but none is able to offer all features. A choice based on matching the user's requirements with the strengths of a particular printer and its technology type is likely to be the right one.

When selecting a printer the user must first identify the printer's primary function. Will it be used for utility applications; i.e., the printing of data for such purposes as payroll and inventory? In such cases, the cost for hardware and expendables such as paper, ribbon, toner, or ink is often a major consideration. Will it be used for communications such as interoffice memos and letters? Here legibility and print quality are likely to become the most important features. Will the printer be used for executive letters or advertising copy? In these cases the aesthetics of output become a major factor and color capabilities enter the picture.

After determining the printer's requirements, the available technologies and their ability to meet these requirements should be considered. Each technology should be regarded separately, its strengths and weaknesses weighed [see Table 1 at the end of this article]. The user should then match these attributes with those necessary for his or her purposes.

To help in the evaluation process, the following section briefly summarizes the most generally available desktop printer technologies.

Juliana G. Lord is directories manager at Gorham International, Inc., Gorham, Maine, where she is responsible for the production of its 1986 Printer Directory and Specification Guidebook Series *and* 1986 Graphics Terminal and Workstation Specification Guidebook. ***Alvin G. Keene*** *is vice president and director of marketing services at Gorham International, Inc., and directs its impactless printing activities.*

Impact printers

• *Impact-formed characters.* Considered the most traditional among those employed by desktop printers, this technology produces characters by impact and is implemented by a system that operates much like a typewriter, with a separate hammer for each character. The hammer strikes an inked ribbon, transferring the image onto the desired media. These operate in a number of forms, including daisy wheel, thimble, band, chain, and train. Daisy wheel and thimble systems are most often found in desktop printer designs.

These printers are capable of producing letter-quality correspondence and reports with multiple copies. They are a proven technology with proven reliability and are generally available at a low cost for desktop design. Some of the problems of this category of printers are high noise levels, slow operation, and limited graphics or color capabilities.

• *Impact dot matrix.* Most frequently used among desktop printers, impact dot-matrix printers operate through a matrix of wires that strike an inked ribbon and transfer dots onto the desired media. The dots form characters or designs. Although dot-matrix technology can produce letters in which the dot structure is barely visible, desktop printers based on this inexpensive technology are usually slow and have a low resolution, producing draft rather than letter-quality characters.

Many dot-matrix printers come with an optional three- or four-color ribbon

Fig. 1: IBM's 80286-based desktop model 50 and the new Personal System/2 monochrome display model 8053 being used to plot a subdivision. In the background, and IBM Quietwriter (R) III printer is ready to produce high-quality graphics.

design. Most produce one color at a time rather than three simultaneously. This trait along with problems with ribbon quality generally results in less-than-ideal color quality. Other potential disadvantages include operation at a high noise level, high energy consumption, and relatively low resolution. However, dot-matrix printers do offer proven reliability, low cost for both hardware and expendables, and the possibility of making multiple copies.

• *Pen plotters.* These operate with a pen attached to an arm that moves across the media (paper or transparencies) to produce both characters and line graphics. A proven technology, pen plotters are simple to operate, a fact that has helped to make them become a very reliable system. They offer low to moderate cost for hardware and expendables and a low noise level during operation. Color capabilities depend on the number of pens offered in the system, and color quality is dependent on the ink-print medium relationship.

A relatively low resolution and print speed is characteristic of most pen plotters. Here resolution pertains to the smoothness of the lines, curves, and characters produced, and speed means throughput, the amount of pages completed in a given time. This figure varies greatly in a pen-plotting system because it is dependent on the contents and complexity of the plot.

Impactless printers

Several printer technologies other than those based on impact have entered the desktop printer market recently. These have seen rapid growth because they offer features not available in traditional impact printers. All offer quiet operation, image flexibility, and higher reliability. Some offer high-quality color. Of major concern here is the relationship between price, performance, and reliability. These areas have seen great improvements in re-

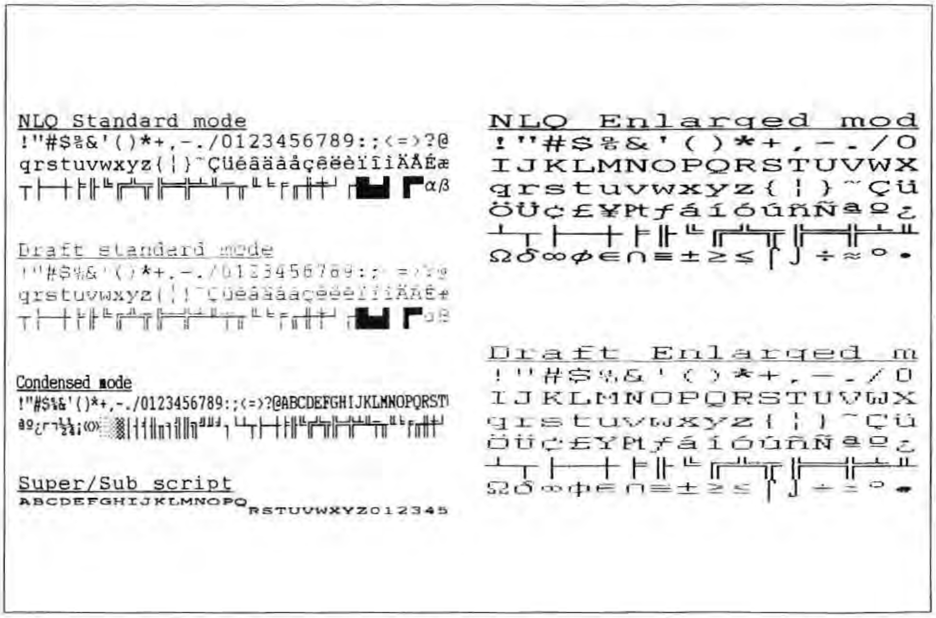


Fig. 2: Printout samples for Canon's BJ-80 bubble-jet printer (reproduced at 70% of original size).

cent years for impactless printer technologies [Fig. 1].

• *Ink jet.* These systems generate ink droplets and deposit them on a printing substrate. Generally speaking, there are two categories for ink-jet systems: continuous jet and drop-on-demand systems. Continuous-jet systems emit a continuous stream of ink droplets from a nozzle under pressure. These systems are considered by many to produce the best colors of all systems. Drop-on-demand systems generate an intermittent stream of droplets. Of the two designs, drop-on-demand ink-jet systems are most often used for desktop printer designs.

An immature printing technology, ink-jet printing has gained a reputation for being unreliable. The most prevalent problem has been the clogging of the nozzles emitting the ink droplets. In an attempt to solve the problem, more recent designs call for hot melts of solid inks. In these systems, heat is applied to the solid ink to turn it into liquid within the printer's ink system. Droplets are formed intermittently, in a manner similar to other drop-on-demand ink-jet systems. Other designs automatically clean the nozzles after a designated number of prints has been produced or a specified amount of time has passed without operation.

Ink-jet systems are very versatile and can print both alphanumerics and color graphics [Fig. 2]. One of their greatest strengths is in the variety and quality of colors produced. Most systems offer relatively high resolutions at low to moderate costs. Most can print on specially coated transparencies and their almost noiseless operation is a benefit in many office environments. Reliability is still relatively low in some systems, and other printing technologies are faster than ink jet. Most ink-jet systems require a special paper for best print and color quality, which may be a potential problem where the use of traditional office paper or letterhead is desired. However, the hot-melt ink system operates with common office paper.

• *Thermal transfer.* This type of printing operates through a print head that applies heat to a donor ribbon or sheet. This transfers characters and other marks from the ribbon or sheet onto the printing substrate. Because of the simple hardware design, there are few parts to break down, although some problems have arisen with print-head wear. Generally, thermal transfer has become a very reliable printing technology. Thermal-transfer printers are available at a low to moderate cost. The cost per copy is quite high, however, because ribbons are relatively costly.

Currently available thermal-transfer ribbons are capable of only single-pass printing. When used for color printing, this means that once a section of ribbon has been used to print one color, that section cannot be used again. This leads to the waste of large unprinted sections of ribbon. Multistrike ribbons are under development that should greatly reduce the per-copy cost, but none is yet commercially available.

Security issues also become a problem with thermal transfer because of the single-strike ribbon. After a page is printed, the image or text is easily viewed on the used ribbon. When printing confidential information, this issue must be considered.

Because thermal-transfer printing requires one pass for each color, some thermal-transfer printers exhibit poor color registration, although the problem has been overcome in many printers. Typical printers may use a plain paper, but some require a special smooth paper for the best print and color quality. This paper may not be suitable for other office uses. Good image quality in both black and color are available in most thermal-transfer printers. They too, operate at low noise levels.

• *Laser electrophotography.* Several models of desktop printers employ laser electrophotography, a technology based on that developed for electrophotographic copiers. Because of its success in the copier market, this is a generally accepted technology. In these systems a laser charges an image onto a photoconductive surface, which, in turn, attracts a toner and then transfers that image onto the printing substrate, generally paper.

The major advantage of electrophotograhy is its speed. The average desktop unit can print 8–10 pages per minute. Both alphanumerics and graphics can be produced on plain office paper with excellent image quality and flexibility. At present, color is not available in desktop design and paper size is usually limited to 8 1/2 by 11 in. sheets.

Because the system is complex, achieving a high reliability is costly. Designers are focusing on improvements in the paper-handling system and in drum maintenance to assure adequate reliability. The costs associated with these improvements have made the technology prohibitive to the desktop environment in the past, but recent model introductions are competitive.

Matching a printer to an application

Table 1 may be useful in deciding which desktop printer technologies should be considered for the intended printer applications. It lists key factors along the left side and the available technologies across the top. The authors rate each of the factors on a scale of 1 to 4, with 1 denoting a serious disadvantage and 4 a

Table 1: Desktop Printer Selection Exercise

PRINTER FACTORS	*WEIGHTING FACTOR FOR SPECIFIC APPLICATIONS	IMPACT FORMED CHARACTER		IMPACT DOT MATRIX		PEN PLOTTERS		INK JET		THERMAL TRANSFER		LASER ELECTROPHOTO-GRAPHY	
SPEED		2.5		2		1		2		3		4	
HARDWARE COST		3		3		3		2		2.5		1	
EXPENDABLES COST		3		3		3		2.5		2		2	
RESOLUTION		4		2		2		3.5		3		3.5	
ADDRESSABILITY		3		3		4		4		3.5		4	
NOISE LEVEL		1		1		3		4		4		2.5	
PRINT QUALITY		4		2.5		2.5		3		3		4	
COLOR QUALITY		0		1		2.5		3.5		3		2	
PRINT MEDIA		3.5		3.5		2.5		2		2.5		3	
RELIABILITY		3		3		3.5		2.5		3		2.5	
TOTAL POINT VALUE		27		24		27		29		29.5		28.5	

*Rate on scale of 1 to 4 for specific application: 1—not important 4—of maximum importance

Definition of Printer Factors

SPEED—The rate at which a printed page can be produced.
HARDWARE COST—The cost of printer plus any additions necessary to make it compatible with the computer.
EXPENDABLES COST—The cost for the consumables necessary for the operation of the system (paper, ribbons, toner, ink, etc.).
RESOLUTION—The number of distinguishable dots per linear measure, typically dots per inch.
ADDRESSABILITY—The number of print positions per linear measure to which the print-head positioning mechanism can be directed.
NOISE LEVEL—The level of acoustical noise generated by the printer during operation.
PRINT QUALITY—A subjective measure of the appearance of a printed page, taking into account such factors as addressability, resolution, and color registration.
COLOR QUALITY—Includes the factors important to print quality, along with hue, saturation, and lightness.
PRINT MEDIA—Adaptability to printing on different types of media.
RELIABILITY—Generally considered as mean time between failures. For rating purposes, how much of a problem is down time for your application?

Ratings Interpretation

1—Generally considered a serious limitation or problem
2—Generally considered a serious limitation in some applications
3—Generally considered an advantage in some applications
4—Generally considered an advantage for the technology

major advantage. As the technologies evolve and as readers become more familiar with the technologies, they may assign other ratings.

The first column enables each user to assign weights to the factors that meet specific application needs. As an example, for a high-quality color graphics application, the factors of resolution, addressability, and color quality might be weighted with multiples of 2, 3, or 4, depending on their perceived importance.

To use the table, first go down the weighting-factor column and assign a weight to each factor, according to its importance for the main intended applications. Consider who will view the printout and the environment in which the printer will operate, among other things. In the next step, each application's specific weighting factors should be multiplied by the ratings given in the table for each technology, with the resultant weighted rating to be written in the blank column under each technology. Finally, these weighted rating columns should be added to obtain a total point value.

Those technologies receiving the highest total point value should be the most appropriate for the specific application. Obviously, each specific printer model may have features and options that can influence the assigned ratings given in the table. Thus, a potential user can employ a similar weighted-rating approach by replacing the technology categories with specific printer models and by providing appropriate rating values.

While this exercise is likely to help users select printer models that most closely meet their requirements, there is no substitute for an actual trial of printers. Also, a user must also ascertain that the printer is compatible with his or her computer. ■

Compiled by Howard L. Funk
IBM Corp.

U.S. Pat. No. 4,643,530; Issued 2/17/87
Reflective Thin-Film-Transistor–Addressed Matrix Liquid-Crystal Display
Inventor: TSUNEO YAMAZAKI
Assigned to: DAINI SEIKOSHA

A matrix liquid-crystal display device is disclosed comprising a reflecting plate and a polarizing plate coated on an insulating substrate, a thin-film transistor arranged on the insulating substrate in matrix configuration, and a liquid-crystal sandwiched between the insulating substrate and a glass plate. A cross-talk between picture elements caused by transmission or reflection of light on the substrate is prevented. The thin-film transistor is formed by a semiconductor film made of amorphous silicon or a gate insulating film made of silicon dioxide which is easily formed at low temperature 40°C by plasma CVD method or the like.

U.S. Pat. No. 4,643,536; Issued 2/17/87
Liquid-Crystal Display Device Having a Resin-Coated IC Chip
Inventors: NAOTAKE ANDO, TOSHIHIDE HIROHARA, YOSHIO IINUMA, MASAAKI MATSUNAGA, EIICHI TAJIMA, SHIGEYUKI TAKAHASHI, TERUAKI TAKAHASHI, HARUO WATANABE
Assigned to: CITIZEN WATCH CO., LTD.

An IC chip is connected to terminal portions of conductive films on a lower substrate of a liquid-crystal display panel by face-down bonding. The IC chip and conductive films are coated with resin to protect the IC chip and films.

U.S. Pat. No. 4,643,532; Issued 2/17/87
Transflective Liquid-Crystal Display with Integral Heating Unit
Inventor: ELIAS S. HAIM
Assigned to: GENERAL ELECTRIC CO.

A heated transflective liquid-crystal display device has the heating element positioned behind the transflector to keep the heater out of the reflective light path. This construction significantly improves brightness of the display in the reflective mode. This invention relates to liquid-crystal devices, and more particularly to liquid-crystal displays incorporating a heating unit. While the instant invention will be described in the context of a cell of the guest-host variety, the invention is by no means limited thereto. The invention is equally applicable and useful in a liquid-crystal display utilizing a liquid-crystal solution of the twisted-nematic type and suitable polarizers.

U.S. Pat. No. 4,639,890; Issued 1/27/87
Video Display System Using Memory with Parallel and Serial Access Employing Selectable Cascaded Serial Shift Registers
Inventors: KARL M. GUTTAG, ANDREW HEILVEIL, MARK F. NOVAK, RAYMOND PINKHAM, DONALD J. REDWINE, JERRY R. VANAKEN
Assigned to: TEXAS INSTRUMENTS, INC.

In a computer system, an improved memory circuit is provided for accommodating video display circuits with CRT screens having different resolutions. The memory circuit includes a bit-mapped RAM unit or chip having sufficient cells to accommodate any CRT screen intended to be used, and it further includes a serial shift register having a plurality of taps at locations corresponding to different preselected columns of cells in the chip. In the system, provision is included for selecting taps to unload only the portion of the shift register containing the bits of interest, whereby unused portions of the chip may be effectively excluded and the time for transferring data of interest to the CRT screen is reduced.

U.S. Pat. No. 4,637,687; Issued 1/20/87
Cascaded Dual-Cell Transflective Liquid-Crystal Display
Inventors: RICHARD ALBERT, ELIAS S. HAIM
Assigned to: GENERAL ELECTRIC CO.

The contrast ratio of a transflective liquid-crystal display in the transmissive mode is improved by means of a cascaded dual-cell arrangement. By using cascaded cells, the light path and light absorption in the background portions of the light path is improved in the transmissive mode so that the contrast ratio in the transmissive mode can, if desired, be made equal to or better than the contrast ratio in the reflective mode.

U.S. Pat. No. 4,642,694; Issued 2/10/87
Television Video Signal A/D Converter
Inventors: TAKAHIRO FUSE, MASAO KAWAMURA, SHINICHI MATSUI, KOJI YAMAGISHI
Assigned to: CASIO COMPUTER CO., LTD.

A television video signal A/D converter apparatus has an A/D converter which samples a television video signal to A/D convert it in accordance with upper and lower reference potentials, and supplies the digital signals to a liquid-crystal display device. The apparatus also has detectors which detect digital values of the digital signals from the A/D converter which exceed a predetermined value and are below another predetermined value, and which respectively correspond to the upper and lower reference potentials for A/D conversion by the A/D converter. The digital values above and below the predetermined values are counted by a counter, and the upper and lower reference potentials are determined in accordance with the respective counts and are supplied to the A/D converter.

U.S. Pat. No. 4,642,710; Issued 2/10/87
Animated Display Controlled by an Audio Device
Inventors: MICHAEL C. CARTABIANO, MARK B. JOHNSON-WILLIAMS, THEODORE N. MADISON, EUGENE A. MURTHA
Assigned to: MILTON BRADLEY INTERNATIONAL, INC.

An animated display in the form of a representation of a face is controlled by an associated audio tape player and a microprocessor-controlled liquid-crystal display. The facial features are variable responsively to the audio signals of the tape player as controlled by the microprocessor.

U.S. Pat. No. 4,642,619; Issued 2/10/87
Non-Light-Emitting Liquid-Crystal Color Display Device
Inventor: SEIGO TOGASHI
Assigned to: CITIZEN WATCH CO., LTD.

A color display device of the type having a plurality of light-transmissible and non-light-emitting picture elements such as liquid-crystal display is disclosed. The plurality of non-light-emitting picture elements for red, green, and blue are arranged in checked arrangement. The number of the picture elements for green is larger than each of the other picture elements for red and blue and the total intensity of transmitting light at each of picture elements for said three colors is equal to each of the other picture elements, respectively. The number of picture elements for green is, for example, twice as many as either one of the other picture elements.

U.S. Pat. No. 4,642,626; Issued 2/10/87

Graphic Display Scan Line Blanking Capability

Inventor: KENNETH E. BRUCE

Assigned to: HONEYWELL INFORMATION SYSTEMS, INC.

The invention pertains to a computer display system for displaying text and graphics on a scan line basis wherein a scan line windowing apparatus for selectively blanking the graphics display is provided. A bit-map memory, in addition to storing information to be displayed on a CRT, further stores a bit for each scan line which is utilized to control the enabling or disabling of a portion of the information in the bit-map memory which is to be displayed on the CRT.

U.S. Pat. No. 4,641,262; Issued 2/3/87

Personal-Computer Attachment for Host System Display Station

Inventors: BARRY L. BRYAN, MARTIN DRUCKERMAN, ALLEN W. McDOWELL, GARY L. NEWKIRK, IRA H. SCHNEIDER

Assigned to: IBM CORP.

A personal-computer attachment is provided for a display station of the type that communicates with a host computer. The display station has a display unit and a keyboard to which a personal-computer system unit is attached. The personal-computer system unit typically supports floppy diskette drives and a printer. The display unit includes a CRT, a regeneration buffer, a keyboard adapter, and a feature bus. The personal-computer system unit includes a system bus, a microprocessor, memory, a keyboard adapter, and I/O interface connected to the system bus. A display adapter is connected to the I/O interface. An analog input switch is disposed between the buffer and the analog circuits driving the CRT. This switch has a second input from the display adapter and is controlled from inputs from the keyboard to selectively supply image data from the buffer or the display adapter. An attachment adapter mates with the I/O interface of the personal-computer system unit. The adapter includes an input/output interface, a switch control, a two-way keyboard adapter, and a feature bus adapter. The keyboard is connected to the two-way keyboard adapter. Each of the switch control, the two-way keyboard adapter, and the feature bus adapter communicates with the system bus of the personal-computer system unit via the input/output interface. The switch control is also connected to the control input of the analog input switch. The two-way keyboard adapter is also connected to the keyboard adapter in the display station and the keyboard adapter in the personal-computer system unit. The feature bus adapter is also connected to the feature bus of the display station. This arrangement allows keystroke signals from the keyboard to be transmitted by the two-way keyboard adapter via the input/output interface and system bus to the memory in the personal-computer system unit for interpretation by the microprocessor and then retransmitted back to the two-way keyboard adapter and then to a designated one of the keyboard adapters in either the display station or the personal-computer system unit. The switch control is responsive to a unique keystroke signal to control the analog input switch. In this way, the operator can control the mode of operation between either a host mode or a personal-computer mode. Further, data transfer can be made between the hose computer and the personal computer.

U.S. Pat. No. 4,641,135; Issued 2/3/87

Field-Effects Display System With Diode Selection of Picture Elements

Inventor: JOHAN O. HILBRINK

Assigned to: NCR CORP.

A liquid-crystal display system is comprised of a control system and a display circuit. The control system selectively generates first address signals and first mode control signals during a first mode of operation and second address signals and second mode control signals during a second mode of operation. The display circuit includes a matrix of display means and diode decoding means. Each of the display means comprises a field-effect liquid-crystal cell having first and second inputs and a diode switching array selectively coupled to the first and second inputs, with the diode decoding means selectively coupled to each diode switching array. During the first mode of operation, the first address signals and first mode control signals are selectively applied to the diode decoding means to selectively cause preselected cells to charge in a first direction through the associated diode switching arrays. During the second mode of operation, the second address signals and second mode control signals are selectively applied to the diode decoding means to selectively cause the preselected cells to charge in a second direction through their associated diode switching arrays.

U.S. Pat. No. 4,639,722; Issued 1/27/87

Liquid-Crystal Display Apparatus

Inventors: SHIGERU KOJIMA, TETSUO URABE

Assigned to: SONY CORP.

This invention relates to a liquid-crystal display apparatus and particularly to a liquid-crystal display apparatus based on a liquid-crystal light emitter actuated by the heat from a laser beam. A liquid-crystal display apparatus according to this invention is formed such that an energy beam is irradiated onto the arrays of smectic liquid-crystal particles having polarities equivalent in energy directions and opposite to each other in dipole moments of the particles and applied with a voltage, which is too low to switch the arrays to each other to provide the display. Consequently, according to the liquid-crystal display apparatus of this invention, the writing speed of the display can be improved significantly and a high contrast of the display can be presented.

U.S. Pat. No. 4,640,582; Issued 2/3/87

System for Driving a Liquid-Crystal Matrix Display so as to Avoid Crosstalk

Inventors: KIKUO OGUCHI, YOSHIRO UCHIKAWA

Assigned to: KABUSHIKI KAISHA SEIKO EPSON

The invention relates to a system for driving a liquid-crystal matrix display for use in a television wherein the signal applied to each pixel is inverted at a rate not greater than that necessary to scan a single pixel but greater than the rate necessary to cause cross-talk and in any event greater than the rate necessary to scan a line of pixels without inverting.

U.S. Pat. No. 4,642,628; Issued 2/10/87

Color Liquid-Crystal Display Apparatus with Improved Display Color Mixing

Inventor: MITSUHIRO MURATA

Assigned to: CITIZEN WATCH CO., LTD.

A color liquid-crystal display device such as a television receiver employing an array of R, G, and B color filters and corresponding liquid-crystal display elements, having the color filters arranged in different sequences in mutually adjacent scanning lines, and having a line memory in which display data for the R, G, and B display elements of each display line are successively stored and applied to a drive circuit, is provided with color signal processing circuits for controlling R, G, and B digital color signals which act to set these color signals into the line memory at the start of each horizontal scanning interval in a correct array sequence for the line of display elements which will be driven during that horizontal scanning interval.

U.S. Pat. No. 4,641,191; Issued 2/3/87

Standby System for Video Display

Inventor: LEROY SUTTON

Assigned to: ZENITH ELECTRONICS CORP.

A video display system is normally operated to produce a low-brightness display on a CRT. Viewer sensing apparatus, including a transmitter and a receiver, senses the presence of a viewer by reflection of ultrasonic energy and operates a transistor having a time delay switch coupled in its load circuit for instantaneously supplying full power to the display system to produce a normal brightness display on the CRT. A transistor override circuit simulates closure of the time delay switch in response to an override signal for producing a full-brightness display on the CRT independent of the time-delay switch. The time-delay switch maintains a full-brightness display on the CRT for a predetermined time after the viewer leaves.

U.S. Pat. No. 4,641,925; Issued 2/10/87

Liquid-Crystal Display Assembly with Phosphorescent Backlighting

Inventors: BERNARD V. GASPARAITIS, C. PATRICK RICHARDSON

Assigned to: MOTOROLA, INC.

A backlighted liquid-crystal display (LCD) assembly has a thin phosphorescent layer positioned between the display and the light source to provide an even distribution of light intensity across the viewing surface of the display. The phosphorescent layer includes a phosphor powder mixed into a resin. The mixture is molded into a thin sheet and then cut to size. The phosphorescent layer and an optical desiccant layer may be encapsulated between sheets of acrylic film. The phosphorescent layer may also include a phosphorescent coating that is applied to the rear surface of the LCD or to the front surface of the light source.

U.S. Pat. No. 4,640,581; Issued 2/3/87

Flexible Printed Circuit Board for a Display Device

Inventors: MITSUO MACHIDA, JUN NAKANOWATARI, YOSHIHIRO NAKURA, TOSHIYUK OKAMOTO

Assigned to: ALPS ELECTRIC CO., LDT.

A flexible printed circuit board has one end to be soldered to the terminal section of a display device, such as a liquid-crystal display, the terminal section being used for connection to an external circuit. The end of the circuit board is provided with a pair of protrusions on opposite sides. The display device has a small base sheet and a large base sheet bonded together to form a cell. When the protrusions are caused to bear on the side of the cell, a given gap is formed between the portion of the aforementioned end other than the protrusions and the small base sheet of the display device.

U.S. Pat. No. 4,639,090; Issued 1/27/87

Liquid-Crystal Dichroic Display with a High Brightness Contrast

Inventors: JEAN-FREDERIC CLERC, FRANCIS MULLER

Assigned to: COMMISSARIAT A L'ENERGIE ATOMIQUE

The display comprises a cholesteric liquid-crystal film in which are embedded dye molecules between the two walls separated by a shim. One wall is at least partly covered by a reflecting coating reversing the polarization of a circularly polarized electromagnetic wave. The optical anisotropy Δn and the helix pitch p are such that the least absorbed wave on passing through the cell has an ellipticity equal to or greater than $\pi/8$.

U.S. Pat. No. 4,639,088; Issued 1/27/87

Multicolor Display Device and Process of Fabricating Same

Inventors: KOJI IWASA, HITOSHI KAMAMORI, YUTAKA SANO, MITSURU SUGINOYA, YUMIK TERADA

Assigned to: SEIKO INSTRUMENTS & ELECTRONICS, LTD.

A liquid-crystal display having a multicolor display is fabricated with a plurality of display electrodes on a first substrate, on which a color filter is selectively formed by electrodepositing a polymer together with coloring matter and electroconductive particles so that the display electrodes have different colors and electroconductivity. A counterelectrode is formed on a second substrate and a liquid-crystal material is sandwiched between the first and second substrates, so that the material serves, in operation, as a light shutter controlled by the voltage applied between said color filter via said display electrodes and the counterelectrode.

U.S. Pat. No. 4,640,584; Issued 2/3/87

Spacers for Liquid-Crystal Display Device

Inventors: IWAO FUJIKAWA, MITSUO KUSHINO, TSUNEO TSUBAKIMOTO

Assigned to: NIPPON SHOKUBAI KAGAKU KOGYO CO., LTD.

Polymers for a liquid-crystal display device are disclosed, which comprise fine spherical cured particles of amino resin obtained from formaldehyde and at least one amino compound selected from the group consisting of benzoguanamine, melamine, and urea.

U.S. Pat. No. 4,638,308; Issued 1/20/87

CRT Picture Display Apparatus

Inventors: JUSHI IDE, YASUJI KAMATA, HIROSHI KUWABARA, KENKICHI YAMASHITA

Assigned to: HITACHI, LTD.

A CRT picture display apparatus of the raster-scan type comprises a CRT for raster scanning, a horizontal deflection circuit for supplying a horizontal deflection current to a horizontal deflection coil of the CRT, a vertical deflection circuit for supplying a vertical deflection current to a vertical deflection coil of the CRT, and a display data generator for supplying data to be displayed to the CRT. The horizontal deflection circuit produces as the horizontal deflection current a triangle current having one period which is twice the horizontal scanning period, and the triangular current has a first portion which increases in response to the horizontal sync signal at a predetermined inclination and a second portion which decreases in response to the next horizontal sync signal at the predetermined inclination and continues until the further next horizontal sync signal, whereby the period for a scanning line to proceed from lefthand end to righthand end of a raster on a screen of the CRT is made substantially equal to the period for the next scanning line to proceed from righthand end to lefthand end and data is displayed during both the periods. ■

Stereoscopic 3D system is IBM PC/AT compatible

Tektronix, Inc.'s liquid crystal shutter (LCS) strategic program unit (SPU) introduces the first commercially available stereoscopic 3D graphics system for use with IBM PC/ATs and compatibles. The Tektronix SGS 430 stereo graphics system includes a stereoscopic graphics adapter card; graphics subroutine software library; stereoscopic 3D 16-in. color monitor; stereoscopic modulator driver; and stereo viewing glasses. Stereo system components (including a 16-in. display system and stereo modulator drivers for 16- and 19-in. displays) are also available.

The Tektronix stereo graphics system uses a time-multiplexed stereogram technique involving the construction of a video frame containing separate sequential video fields for the left- and right-eye images. The liquid-crystal modulator encodes these images with left and right circular polarization for both eye images. The complete SGS 430 system costs $9800.

For further information contact Tektronix Liquid Crystal Shutter Marketing, P.O. Box 500, MS 48-300, Beaverton, OR 97077. 503/627-5000.
Circle no. 7

Color-graphics-designer workstation

A graphics-designer workstation (GDW) from Primagraphics, Ltd. gives true color capability and reduces visualization and

reduction time for slides and other graphical material. The GDW's TV-resolution frame stores provide 8 bits/pixel, giving high-quality 256-level gray scale output, or a true-color 24-bit output when three cards are fitted, at a display resolution of 768 × 575 pixels.

An optional video input module is available for inputting images from a camera or VCR, and the system may be used to produce frames for animations. The workstation is available as a complete package including 3D and "paintbox" graphics software. Features include object generation and editing using a digitizing tablet and object manipulation. The GDW also provides generation of shadows from a light source, and continuous shading of facets of the finished model.

For further information contact Mr. C. Childs, Primagraphics Ltd., Melbourn Science Park, Melbourn, Royston, Hertfordshire, SG8 6EJ, England. 763 62041.
Circle no. 8

Small flat-panel TFEL displays

Two high-contrast high-resolution alphagraphics TFEL flat-panel display subsystems have been introduced by Sigmatron Nova, Inc. The MDS-23 has a 2 × 3 in. active display area, and the MDS-35 a 3 × 5 in. area. Both have nominal contrast ratios of better than 20:1, offer resolutions of up to 66 lines/in., and are engineered primarily for instrumentation in high-performance applications.

Completely packaged with its drive electronics, each subsystem is 0.65 in. thick. Their amber-toned images are easily read, while overall size, power drain, and weight are very small compared to CRT readouts having equivalent display areas. With the inherent ruggedness of a truly solid-state technology, the MDS-23 and MDS-35 display subsystems are ideal for use under widely variable lighting and temperature conditions. The MDS-23 is priced at $350 in quantities of 100 units, and the larger MDS-35 is priced at $675.

For further information contact Sigmatron Nova, Inc., 1901 Oak Terrace La., Thousand Oaks, CA 91320. 805/498-4504.
Circle no. 9

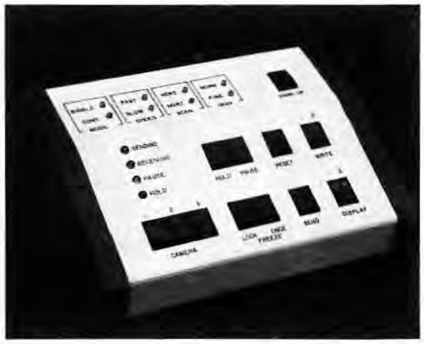
LCD modules for military applications

UCE Inc. announces the availability of a family of LCD modules for military and other broad temperature range applications storable and useable to temperatures as low as −40°C/F. UCE's optically clear heater allows low-temperature operations and backlighting. Application-specific LCDs are of great interest to the military because of their very low power consumption, and flat low-mass construction with

viewability under high ambient light. The price for custom prototype lots of 3-5 pieces is approximately $6500. Delivery is 6-8 weeks.

For further information contact R. J. Borstlemann, UCE Inc., 24 Fitch St., Norwalk, CT 06855. 203/838-7509.
Circle no. 10

Digital color freeze-frame unit



Colorado Video's Model 286 compact digital freeze-frame unit transmits high-quality still video images over any digital circuit up to 200 kbps for color images and 500 kbps for monochrome images. The unit contains an internal modem for transmission over voice-grade telephone lines at 9600 bps, with fallback rates of 7200 and 4800 bps, and can also be used with an external synchronous modem for transmission at selectable higher rates.

Other features and options include a choice of high (512 × 480), medium (512 × 240), and low (256 × 240) resolutions, 64- or 256-shade gray scales, up to four video memories, 625-line standards, and computer interface for mass storage or image manipulation. Model 286 may be operated manually, by remote-control console, or by infrared handheld controller, and can be used with any standard video camera, monitor, video printer, video optical laser disk, and with Colorado Video's Model 940 image storage system.

For further information contact C. Keen, Colorado Video, Inc., Box 928, Boulder, CO 80306. 303/530-9580.
Circle no. 11

High-resolution color printer for PC workstations

The Mitsubishi Electronics G650 high-resolution thermal-transfer color printer has a resolution of 300 × 300 dots/in. for A- and B-size prints, and provides high-quality color output for business graphics

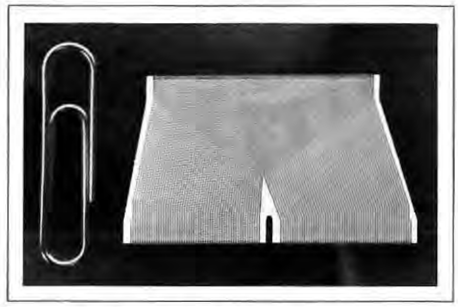
text and graphics art as well as advanced CAD/CAM applications including solids modeling and engineering/scientific design.

The printer uses sequential overprinting and color mixture techniques to produce a high-resolution graphics output in seven basic colors and allows for over 200,000 shades using dithering techniques. The unit has an 8-bit parallel interface and can be expanded by adding custom interface circuits to three additional printed circuit board slots in the printer. Designed for desktop operation, the G650 measures 20.8 (W) × 19.7 (D) × 9.6 (H) in. and weighs 82 lbs. The cost is $8995.

For further information contact Evie Turner, Mitsubishi Electronics America, Inc., Computer Peripherals Div., 991 Knox St., Torrance, CA 90502. 213/515-3993.
Circle no. 12

Fine heat-seal connectors

Elform Co.'s new line of heat-seal connectors are pitched as fine as 0.03 mm (0.0118 in.) from the center of one trace to the next. The connectors can be made with silver, copper, or graphite traces, and all traces are covered with a protective layer of graphite. Commonly used for interfacing LCDs to PCBs, the connectors offer mass termination of high density, save space and money, and enhance product reliability. Prices start at $0.09 per in.^{2}.



For further information contact Elform, Inc., P.O. Box 7362, Reno, NV 89510. 702/356-1734.
Circle no. 13

Circle no. 14

Compatibility spectroradiometer

EG&G Gamma Scientific's C-11ASR computer-controlled spectroradiometer system was designed to measure the compatibility of instrumentation panels and other sources with aviators' night vision imaging systems. Because it provides precise, accurate, and repeatable measurements, the C-11ASR was used to create military specification MIL-L-85762. The C-11ASR ensures that cockpit lighting and instrumentation will not interfere with the operation of night vision goggles, thus increasing the safety of pilots and crew. In addition, the C-11ASR can quickly and easily be reconfigured to do spatial analyses, and even secure lighting measurements.

Utilizing a GS-4100 "no-controls" radiometer and software for the IBM-PC, the C-11ASR system automatically performs zero compensation, signal averaging, and dark current subtraction. Through software control, the user can initiate ANVIS compatibility measurements and CIE analyses, as well as determine the ANVIS threshold levels specified in MIL-L-85762. Because it uses a high-sensitivity cooled S-1 detector, the C-11ASR has a spectral sensitivity reaching 1.1 μm, enabling it to be used for virtually all ANVIS applications, including night warfare and military or law enforcement surveillance.

For further information contact EG&G Gamma Scientific, Inc., 3777 Ruffin Rd., San Diego, CA 92123. 619/279-8034.

Circle no. 15

Sub-miniature assembly for helmet-mount displays

Thomas Electronics, Inc. has just announced the production of an ultralightweight sub-miniature assembly that is 0.7 in. in diameter and is less than 3.0 in. in overall length. The tube was developed for helmet-mounted displays for use in helicopters and fixed-wing aircraft.

The IM70P53MFO tube provides an 0.0008-in. line width across a 0.4-in.-diameter useful area and a 500-fL area brightness through the integral fiber optics faceplate. A low inductance coil is precision aligned within a mu-metal shield. Maximum weight, excluding lead, is 40 g.

For further information contact Ben Setticase, Vice-President, Thomas Electronics, Inc., 100 Riverview Dr., Wayne, NJ 07470. 201/696-5200.

Circle no. 16

Circle no. 17

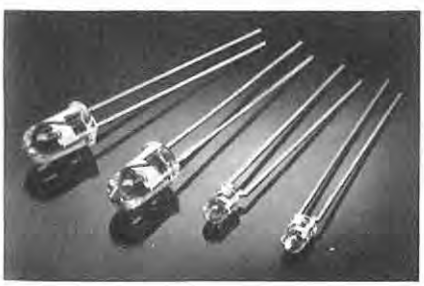
Surface-mount SOT-23 transistors

Hewlett-Packard Co. has introduced the HMSX-3131 and HMSX-3635 surface-mount SOT-23 package transistors for use in non-hermetic automated-assembly applications. The HMSX-3131 is a general-purpose transistor with a high gain of 14 dB at 1 GHz; the noise figure is typically 1.8 dB at 1 GHz. The HMSX-3635 is a low-noise high-gain transistor with a typical high gain of 15 dB and low-noise figure of 1.4 dB at 1 GHz. In quantities of 1000, the HSMX-3131 is $1.00 ea.; the HSMX-3635, $1.35 ea.

For further information contact Inquiries Manager, Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303. 800/367-4772.
Circle no. 18

Infrared LED lamps

A new family of LED lamps that emit infrared light is available from Hewlett-Packard Co. The HEMT-1001 and HEMT-3301 emitters come in untinted undiffused plastic packages with medium-wide ratiation patterns and 60° and 50° included angles, respectively. Their radiation patterns eliminate beam-focusing problems that may be encountered with more narrowly radiated patterns. Operating temperatures range from −55° to +100°C. In quantities of 10,000 to 49,999, the HEMT-1001 is $0.40 ea.; the HEMT-3301, $0.47 ea.



For further information contact Inquiries Manager, Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303. 800/367-4772.
Circle no. 19

6-μm microchannel-plate photomultiplier tube

Hamamatsu Corp. has introduced a high-speed microchannel-plate photomultiplier tube (MCP-PMT) with a 6-μm channel diameter MCP. This MCP-PMT (model R2809U) improves the time characteristics of the photomultiplier tube, while sustaining the same gain and sensitivity characteristics, and can be used for high-energy research requiring magnetic-field immunity and high-speed PMT response, and also for fluorescence decay-time measurements. The R2809U has a spectral response range of 300–650 nm, has a two-stage MCP dynode structure, and contains a bialkali photocathode material.

For further information contact

Hamamatsu Corp., 360 Foothill Rd., P.O. Box 6910, Bridgewater, NJ 08807. 800/524-0504 or 201/231-0960. ■
Circle no. 20

Bay Area Chapter

The Bay Area Chapter welcomed **Lyn Reynolds**, engineering manager for displays at **Apple Computer** to its April 21 meeting. Mr. Reynolds shared an extremely interesting insider's view of Apple's display strategy and outlook on the display world.

Mid-Atlantic Chapter

The Mid-Atlantic Chapter held its annual social meeting on Saturday, April 11, at the Park Side Restaurant and the **Hall of Science Museum** in New York. The principal attraction at the museum was "Seeing the Light," a participatory science lab that invites the public to experiment with interference patterns and optics, resonances and reflections, and lasers and illusions in a series of 87 exhibits.

The annual executive planning meeting of the Chapter will be held on Friday, June 19, at 6:00 p.m. in midtown Manhattan. For details, contact Vice-Chairman Terry Nelson at 201/758-3324.

San Diego Chapter

Andrew T. Young of **San Diego State University** was the guest speaker at the April 14 San Diego Chapter meeting. Dr. Young gave a very interesting presentation entitled "Color in the Solar System." He discussed the nature of color perception and the implications of colors on Jupiter's moon Io.

UK and Ireland Chapter

Cyril Hilsum, head of **GEC Research**, has been awarded the 1987 Max Born medal and prize for his contributions in the fields of semiconductor compounds, infrared, microwave devices, and flat-panel displays.

On February 25 the UK and Ireland Chapter held a joint meeting with the British Computer Society at IBM Research Laboratories, Hursley Park, Winchester. The one-day symposium on "Displays for the Future Needs of the Computer Industry" included talks on "Non-CRT Projection Displays" by **Tony Lowe** and **Jan Szatkowsky** of **IBM**, "Seeing Flat-Panel Displays" by **Bernard Green** of **Thorn EMI**, "Solid Modeling for Image Displays" by **Tom Heywood** of **IBM**, "3D Display Systems" by **Mike Clarke** of **GEC**, and "Liquid-Crystal Projection in Computerized Training" by **Derek Moore** of **STC**.

Upcoming meetings include:

July 6–7. University of Durham, "Color Displays."

Nov. 10. London, "CRT Displays." ■

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June

Special Applications for Electrostatic Imaging—Short Course. Diamond Research Corp., P.O. Box 128, Oak View, CA 93022. 805/649-2209.
June 7-9 Santa Barbara, CA

International Conference on Computer Vision. Azriel Rosenfeld, Univ. of Maryland, Center for Automation Research, College Park, MD 20742. 301/454-4526.
June 8-11 London, England

Second Annual Conference on Optical Storage for Large Systems. Judith Hanson, Technology Opportunity Conference, P.O. Box 14817, San Francisco, CA 94114-0817. 415/626-1133.
June 9-11 New York, NY

Machine Vision and Image Recognition—Short Course. Marilyn Martin, Integrated Computer Systems, 5800 Hannum Ave., P.O. Box 3614, Culver City, CA 90231-3614. 213/417-8888.
June 9-12 Los Angeles, CA
June 16-19 Washington, DC

Computer Graphics: A Comprehensive Introduction—Short Course. Marilyn Martin, Integrated Computer Systems, 5800 Hannum Ave., P.O. Box 3614, Culver City, CA 90231-3614. 213/417-8888.
June 9-12 San Diego, CA
June 16-19 Boston, MA

Electronic Imaging Industries—Short Course. Institute for Graphic Communication, 375 Commonwealth Ave., Boston, MA 02115. 617/267-9425.
June 14-16 Monterey, CA

National Computer Conference. Marketing Department, AFIPS, 1899 Preston White Dr., Reston, VA 22091. 800/NCC-1987.
June 15-18 Chicago, IL

Flat Panel Displays 1987 International Conference. International Planning Information and Stanford Resources, Inc. (IPI), Nordre Ringvej 201, DK-2600 Glostrup, Denmark. 45-2-63-2044.
June 17-18 Copenhagen, Denmark

Hands-On PC Networks—Short Course. Marilyn Martin, Integrated Computer Systems, 5800 Hannum Ave., P.O. Box 3614, Culver City, CA 90231-3614. 213/417-8888.
June 17-19 San Diego, CA

MARSIM '87: Fourth International Conference on Marine Simulation. Marsim '87, c/o SMS, Ladehammerv 6, 7000 Trondheim, Norway. 47-7-51-14-11.
June 22-24 Trondheim, Norway

45th Annual Device Research Conference. Jerry Woodall, IBM Corp., P.O. Box 218, Yorktown Heights, NY 10598. 914/945-1568.
June 22-24 Santa Barbara, CA

Electronic Imaging for Scientific and Research Applications—Short Course. Institute for Graphic Communication, 375 Commonwealth Ave., Boston, MA 02115. 617/267-9425.
June 22-24 Monterey, CA

Munich Laser Show. SPIE, P.O. Box 10, Bellingham, WA 98227-0010. 206/676-3290.
June 22-26 Munich, West Germany

Fiber Optic Communications—Short Course. Marilyn Martin, Integrated Computer Systems, 5800 Hannum Ave., P.O. Box 3614, Culver City, CA 90231-3614. 800/421-8166.
June 23-26 Boston, MA
June 23-26 Palo Alto, CA

Structured Design and Programming—Short Course. Nicolette Worley, Integrated Computer Systems, 5800 Hannum Ave., P.O. Box 3614, Culver City, CA 90231-3614. 213/417-8888.
June 23-26 Washington, DC

PC-Based Tools for Software Analysis and Design—Short Course. Nicolette Worley, Integrated Computer Systems, 5800 Hannum Ave., P.O. Box 3614, Culver City, CA 90231-3614. 213/417-8888.
June 23-26 Los Angeles, CA

Color Hard Copy—Short Course. Institute for Graphic Communication, 375 Commonwealth Ave., Boston, MA 02115. 617/267-9425.
June 28-30 Bedford, MA

Advanced Non-Metallic Composites—Short Course. Technology Training Corp. Dept. M. and CMC/ANMC, P.O. Box 3608, 3420 Kashiwa St., Torrance, CA 90510-3608. 213/534-3922.
June 29-30 Washington, DC

July

Hands-On Graphics Programming Using GKS/VDI Tools—Short Course. Marilyn Martin, Integrated Computer Systems, 5800 Hannum Ave., P.O. Box 3614, Culver City, CA 90231-3614. 213/417-8888.
July 7-10 Los Angeles, CA

Fiber Optic Communications—Short Course. Marilyn Martin, Integrated Computer Systems, 5800 Hannum Ave., P.O. Box 3614, Culver City, CA 90231-3614. 800/421-8166.
July 7-10 Washington, DC
July 14-17 Anaheim, CA

European Simulation Multiconference '87. European Simulation Office, c/o Philippe Geril, Univ. of Ghent, Coupure Links 652 B-9000, Ghent, Belgium. 0032-91-236961 ext. 233.
July 8-10 Vienna, Austria

Hands-On PC Networks—Short Course. Marilyn Martin, Integrated Computer Systems, 5800 Hannum Ave., P.O. Box 3614, Culver City, CA, 90231-3614. 800/421-8166.
July 8-10 Anaheim, CA
July 29-31 Washington, DC

PC-Based Tools for Software Analysis and Design—Short Course. Nicolette Worley, Integrated Computer Systems, 5800 Hannum Ave., P.O. Box 3614, Culver City, CA 90231-3614. 213/417-8888.
July 14-17 Boston, MA
July 21-24 Washington, DC

Digital Image Processing—Short Course. Marilyn Martin, Integrated Computer Systems, 5800 Hannum Ave., P.O. Box 3614, Culver City, CA, 90231-3614. 800/421-8166.
July 14-17 San Francisco, CA
July 21-24 Washington, DC

Structured Design and Programming—Short Course. Nicolette Worley, Integrated Computer Systems, 5800 Hannum Ave., P.O. Box 3614, Culver City, CA 90231-3614. 213/417-8888.
July 14–17 Los Angeles, CA
July 28–31 Boston, MA

Fourth Mid-Central Ergonomics/Human Factors Conference. Mid-Central Conference Committee, Institute of Aviation, Q5, Aviation Research Lab, #1 Airport Rd., Savoy, IL 51874. 217/333-7749.
July 15–17 Urbana, IL

Commercial Image Processing Markets '87: Present and Future—Short Course. Customer Service, Frost and Sullivan, Inc., 106 Fulton St., New York, NY 10038. 212/233-1080.
July 20–21 Denver, CO

Designing Modern Software/User Interfaces—Short Course. Nicolette Worley, Integrated Computer Systems, 5800 Hannum Ave., P.O. Box 3614, Culver City, CA 90231-3614. 213/417-8888.
July 21–24 Anaheim, CA

1987 Summer Computer Simulation Conference. The Society for Computer Simulation, P.O. Box 17900, San Diego, CA 92117. 619/277-3888.
July 27–30 Montreal, Canada

SIGGRAPH '87. Ellen Frisbie, SIGGRAPH '87, Conference MAnagement Office, 111 E. Wacker Dr., Chicago, IL 60601. 312/644-6610.
July 27–31 Anaheim, CA

Computer Graphics: A Comprehensive Introduction—Short Course. Marilyn Martin, Integrated Computer Systems, 5800 Hannum Ave., P.O. Box 3614, Culver City, CA 90231-3614. 213/417-8888.
July 28–31 Anaheim, CA

Machine Vision and Image Recognition—Short Course. Marilyn Martin, Integrated Computer Systems, 5800 Hannum Ave., P.O. Box 3614, Culver City, CA 90231-3614. 213/417-8888.
July 28–31 San Diego, CA

August

Information Display Systems Engineering—Short Course. (Larry Tannas, Instructor) P.O. Box 24901, Dept. K, UCLA Extension, Los Angeles, CA 90024. 213/825-3344.
Aug. 3–7 Los Angeles, CA

Circle no. 25

Circle no. 26

calendar

SPIE 31st Annual International Technical Symposium on Optical and Electro-Optical Engineering/Exhibit. SPIE, P.O. Box 10, Bellingham, WA 98227-0010. 206/676-3290
Aug. 16–21 San Diego, CA

COMDEX/Australia. The Interface Group, Inc., 300 First Ave., Needham, MA 02194. 617/449-6600.
Aug. 19–21 Sydney, Australia

14th Congress of the International Commission for Optics. SPIE, P.O. Box 10, Bellingham, WA 98227-0010. 206/676-3290.
Aug. 24–28 Toronto, Canada

Symposium on Business and Marketing Issues in Photography and Electronic Imaging. Conference Manager, SPSE, 7003 Kilworth La., Springfield, VA 22151. 703/642-9090.
Aug. 31–Sept. 2 New York, NY

Call for Papers

Medical Applications of Lasers, Fiber Optics, and Electro-Optics (O-E/LASE '88). Jan. 10–15, Los Angeles, CA. Papers are being solicited in the following areas: microsensors and catheter-based imaging technology; laser surgery: characterization and therapeutics; laser interaction with tissue; laser medical systems engineering; optical fibers in medicine; time-resolved laser spectroscopy in biochemistry; and applications of free-electron lasers in science, medicine, and industry. Send four copies of the following to SPIE: a 200-300 word abstract, typed double-spaced on 8 1/2 × 11 white paper; a brief professional biography; and the author application. For a complete listing of all 26 O-E/LASE '88 conferences, write SPIE. Address: SPIE Technical Program Committee, O-E/LASE Medicine '88, P.O. Box 10, Bellingham, WA 98227-0010. 206/676-3290. Late submissions will be considered.
Deadline for abstracts: June 15

Medical Imaging II (O-E/LASE '88). Jan. 10–15, Los Angeles, CA. Papers are solicited in the following areas: future potential of the several candidate signals for medical imaging; image formation; image processing; medical photography; digital image capture and formatting; digital image display; PACS system design and evaluation: and archives for PACS. Send four copies of the following to SPIE: a 200–300 word abstract, typed double-spaced on 8 1/2 × 11 white paper; a brief professional biography; and the author application. Address: SPIE Technical Program Committee/Medical Imaging '88, P.O. Box 10, Bellingham, WA 98227-0010. 206/676-3290. Late submissions will be considered.
Deadline for abstracts: June 22

NCGA '88. Mar. 20–24, Anaheim, CA. Papers are being solicited for these areas: architecture, engineering and construction; artificial intelligence; biomedical applications; busines, management and technical graphics; CADD/CAM/CAE/CIM; electronic publishing; future hardware directions; future software directions; human factors and user interfaces; industry standards; legal issues; mapping; statistical graphics; technical and professional education; videotechnology; and visual arts and design. For a copy of the Call for Papers, contact the Education Coordinator, NCGA, Suite 200, Fairfax, VA 12031. 703/698-9600.
Deadline for abstracts: July 15

1988 IEEE International Conference on Robotics and Automation. Apr. 25–29, Philadelphia, PA. Basic and applied papers in all areas of robotics and automation are solicited. The organizers encourage the submission of noncommercial papers from representatives of industry, universities, research institutions, and government. All authors will be expected to assist in the review process by reviewing two papers for each paper submitted. Four copies of long papers (15-20 double-spaced pages including figures) or short papers (5-7 double-spaced pages including figures) should be sent to Robert B. Kelley, ECSE Dept., Rensselaer Polytechnic Institute, Troy, NY 12180-3590.
Deadline for abstracts: Sept. 15 ■

letters

continued from page 2

say seminal—activity has left me considerably worse off than I was 20 years ago, would not be worth public recounting if it did not point up some lessons American industry and finance are reluctant (and perhaps today totally unable) to learn. I will try to express, in a few sentences, what I believe to be the kernel of our continued failures and that of continued Japanese successes, against which no amount of angry congressional rhetoric or punitive tariffs will protect us. It is simply this: American inventive genius and enterprise dominated the world when the manager or company president could say "I have dreamed up a new product and I am pretty sure we can make it. The public will love it, and even if they don't today, I will make sure they do tomorrow." And they had the authority, guts and financial clout to follow through. But today's budding David Sarnoffs and Edwin Lands have this sort of childish nonsense knocked out of them pretty quick. Today they *know* that only the bottom line and next quarter's earnings count, and if they don't learn it soon enough, they are out on their ear. Survival of the unfittest, I call it!

In contrast, Japanese managers have retained precisely this authority, of picking and pursuing new *products*. They are given time to prove their point, are not hounded by impatient shareholders and even less by those self-appointed guardians of the shareholders, the greenmail and takeover merchants. They are surrounded by a supportive climate which arises from the fact that their approach actually works very well. They try to provide new and improved products and services to their *customers*, while we spend our energies placating and justifying our existence to our *investors*, and not doing too well at that. Even more briefly put: our Japanese friends aim at pleasing their customers and are succeeding while we aim at pacifying our investors and are failing. I believe there is an important lesson here—are we capable of absorbing it?

—T. Peter Brody
Active Matrix Associates
Pittsburgh, Pennsylvania

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Research Services, Inc.
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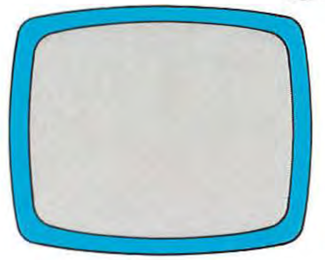
Jay Morreale, Advertising Mgr.
212/620-3371

Sales Office—Western States
Ted Lucas
P.O. Box 852
Cedar Glen, CA 92321
714/337-6627

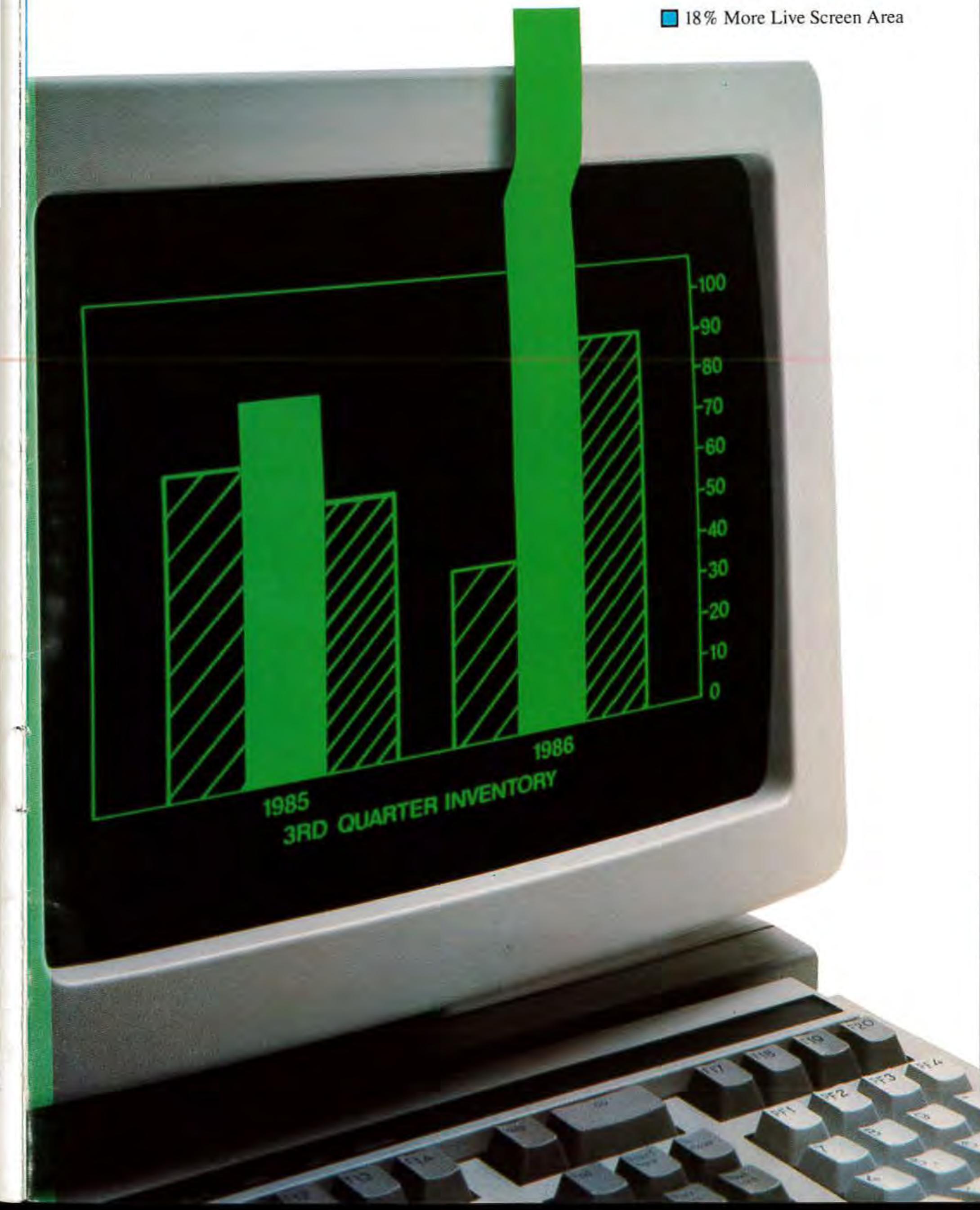
Ever wish your CRT screen was just a little larger?

Clinton Electronics' new 15-inch, 90-degree, 20 mm cathode ray tube gives you all the advantages of the popular 14-inch CRT and more! It gives you 18% more useful screen area!

The new 15-inch CRT utilizes the same mechanical mounting and faceplate dimensions as a standard 15-inch CRT.



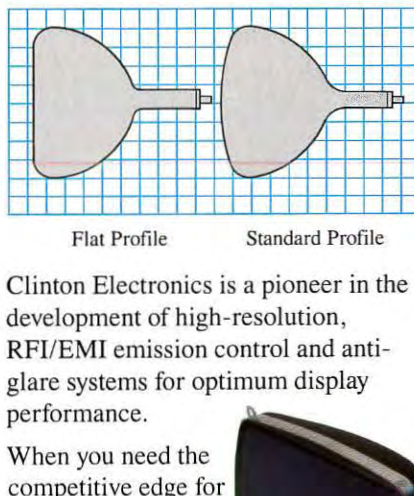
18% More Live Screen Area



It offers the additional cost savings of a 20 mm neck and a 90-degree deflection angle.

You gain the flexibility of using Clinton's new 15-inch CRT for low-cost data display, and a standard 15-inch CRT for high-resolution graphics... without retooling the terminal housing or front bezel.

Clinton's new 15-inch CRT uses 20 mm deflection components, so it uses less power and costs less than a standard 15-inch CRT. And it can be driven by the same electronics in your 14-inch display. The new 15-inch CRT is available in your choice of regular or flat profile faceplates.



Flat Profile Standard Profile

Clinton Electronics is a pioneer in the development of high-resolution, RFI/EMI emission control and anti-glare systems for optimum display performance.

When you need the competitive edge for your display, Clinton offers the solution.

CLINTON ELECTRONICS CORPORATION

6701 Clinton Road, Rockford, IL 61111
Phone: (815)·633-1444,
Telex: 6871504 CECRK,
Telefax: (815) 633-8712

Circle no. 29