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INFORMATION DISPLAY

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PREVIEW ISSUE: SID '95, MAY 21–26, 1995

SID '95 preview
Field-sequential color
SMAU '94 review

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Cover: The display community will find fireworks inside the Walt Disney World Dolphin as well as outside when the Society for Information Display moves in May 21–26, 1995. For a preview of the meeting, the largest devoted to display technology in North America, see the article beginning on page 20.

Walt Disney World Dolphin

Next Month in Information Display

SID '95 Show Issue
- Products on Display
- Advanced FPD Photolithography
- Displays in the Former Soviet Union
- DMTC '94 Review

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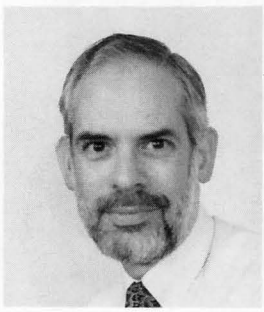

Short Takes

As I write this, Old Man 1994 is just about to hang up his scythe. You will read it as Baby New Year is entering his (hopefully) energetic adolescence. This editorial will consist of short tidbits, some of which will probably be out of date by the time you read them. So be it.

One item I can write with confidence is that SID '95 will be in full swing during the week of May 21. The technical program will be large and of high quality, the seminars will be excellent, the short courses will be useful, the networking will be intense, your colleagues will be ... well ... collegial, and the exhibits will be the largest, most lavish, and most varied ever. The location is extraordinary. SID '95 will be held entirely within the lavish Walt Disney World Dolphin just outside Orlando, Florida. For more details, see the SID '95 preview article in this issue.

Is the famine over? Top-of-the-line notebook PCs have been in short supply because of a scarcity of color active-matrix liquid-crystal displays (AMLCDs). In November, IBM and Compaq were reporting sharply increased supplies. IBM reported that some dealers were actually able to have color ThinkPads in stock.

What happens now? Depending on who you listen to, either we are headed for a glut of AMLCDs, or the production of laptops will explode and absorb the increased supply. Meanwhile, the prices of color and monochrome notebook PCs are dropping sharply.

There have been reports from different manufacturers of work on **recordable CD-ROM (CD-R)** drives that will sell for $1000 or less. In the December 1994 issue of *CD-ROM Today*, Tom Halfhill reported on the widespread rumors that Sony will introduce a CD-R drive in the first half of 1995 at a street price of less than $600. Halfhill says the technology is there, but that Sony has no reason to establish an aggressively low price. A CD-R at that price, says Halfhill, could threaten the market for other mass-storage devices, including Sony's own MD-DATA device, and would allow inexpensive copying of conventional CD-Rs. The device could also copy audio CDs, but with blank CD-R disks costing $20, that is not an immediate threat. However, Sony, which owns CBS records, could be worried if it thinks that the blanks could get much less expensive. Of course, NEC and Matsushita may not have the same qualms.

CD-Rs are becoming an all-but-essential peripheral, at least in PCs purchased for the home. Richard Wallace, *EE Times* Editor-in-Chief, reports that at Comdex some people were projecting that more than 90% of all PCs shipped to the home would contain CD-R drives. And that's significant since 1994 was the first year in which home PC sales were projected to exceed sales to conventional businesses. Writing in *Information Week*, consultant Cheryl Currid commented that people who work on their own sophisticated PCs at home will not remain contented with dull, laggardly boxes at work. She predicts another round of corporate upgrading as a result. That includes monitors, of course.

The idea of a display that uses a *low-power laser* to write directly on the retina has been around for a couple of decades, but was most often discussed, at least in my experience, after a couple of beers too many. Now, the concept is being put forth by a more sober source, Thomas Furness of the Human Interface

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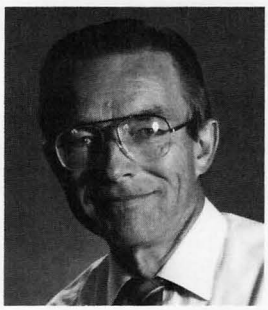
the display continuum



A Parking Meter in Dijon, France ...

by Aris Silzars

The crisp coolness of the late-fall evening would have been far more noticeable had it not been for the several glasses of Beaujolais Nouveau we had sampled along with our superbly prepared and very ample dinners. The 10-minute walk back to our hotel took us through the center of Dijon past the historic town cathedral, seemingly trapped in a cage of scaffolding erected for its well-deserved restoration and cleaning, and through the central arch, smaller but every bit as impressive as the Arc de Triomphe in Paris. Late fall notwithstanding, yellow and red flowers were still in bloom, adding splashes of color beneath each street light surrounding the main traffic circle.

John van Raalte – former SID President (1986-87) and current Director of the Electron Optics Laboratory at Thomson Tubes and Displays in Genlis, France – and his wife, Andree, had been our gracious dinner hosts and were now providing us with this late-evening tour. Since re-locating from their former residences in Princeton, New Jersey, and Lancaster, Pennsylvania, John and Andree had apparently found life in France quite to their liking. Our dinner conversation had thus quite naturally turned to a comparison of the differences in lifestyles between the USA and France.

As we now walked and talked, we happened to pass a metal box sitting rather serenely on top of a metal post. Pointing in the direction of this object, John asked, "For example, do you know what this is?" Well, I sort of knew. It was some kind of a box, maybe a mailbox. "This is a parking meter!" explained John in an increasingly emphatic tone. I had to admit that hadn't been one of my choices. "Not only does this meter serve more than one parking spot, it's a smart meter. When you put your money in, it calculates the time when your parking permit will expire. It knows when evening parking is free and that no respectable Frenchman would pay to park during the mid-day lunch break. Not only that, once you have bought your parking permit, you can use it to park anywhere in town as long as there is time left on it. This one meter serves the whole block. Doesn't that make more sense than the single-meter-per-parking-space system in the USA?" asked John, with a finality that already anticipated what my answer had to be.

Clearly, such a thought-provoking conclusion required further study. I arose early the next morning to find that the coolness of the previous evening had now been enhanced by a uniformly gray sky which was producing a steady drizzle. Undaunted, I set out on my research project. Fortunately, the object of my search was not too far down the tree-lined street. I wanted to see for myself just how this magic box operated and to capture its wisdom for further study back home. The local passersby, I am sure, wondered and puzzled over what this out-of-towner was doing photographing a parking meter.

On completing my analysis, I have to conclude that the fundamentals between this smart parking meter and the dumb ones in the USA are not much different. Both types of meter have a money slot, a simple numerical LCD, and easy-to-read instructions. But the folks in Dijon – and in Paris and in many other places in Europe – have apparently given careful thought to making the process of paying for a parking space less equipment-intensive, more versatile, and more con-

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Society for Information Display
1526 Brookhollow Drive
Suite 82
Santa Ana, CA 92705-5421
e-mail: socforinfodisplay@mcimail.com

Field-Sequential Color Takes Another Step

If CRT-based field-sequential color is the solution to a serious problem, why are so few systems in production?

by Christopher Sherman

THE DISPLAY INDUSTRY is facing yet another new challenge: providing high-resolution full-color displays that are very small – less than 2 in. on the diagonal. Such displays are required by a broad assortment of applications, including military simulation, flight simulation, industrial vision, virtual medicine, virtual reality, telepresence, and entertainment.

The one thing all these applications have in common is their need for a small high-resolution color display – a display that, until now, could not be manufactured. Color CRTs are limited to medium-size diagonals and larger. High-resolution shadow masks cannot be made in very small sizes. And the packaging of three electron guns and the convergence of three electron beams simply can't be done effectively in a CRT having a diagonal much less than 5 or 6 in.

Liquid-crystal displays (LCDs) can be made small but are low in resolution. The design rules for photolithographic processes are the primary limitation. As minimum feature sizes decrease, the achievable resolution of LCDs will improve. But LCD technology is a long way from delivering miniature SVGA displays.

Christopher Sherman *was, until recently, Senior Product Engineer and Director of Sales for Displaytech, Inc., Boulder, Colorado. He is currently employed by DCS Corp., Army Night Vision Electronics Sensors Division, 1330 Braddock Place, Alexandria, VA 22314; telephone 703/683-8430 or 703/704-1107, fax 703/704-3134.*

The only commercial technology capable of producing a very small high-resolution high-performance display right now is the venerable monochrome CRT. Today's miniature monochrome CRTs are capable of 500–1000 lines per inch (lpi), with screen diagonals as tiny as 0.5 in. These devices can support extended VGA resolution and beyond – but without color.

Field-Sequential Color

Field-sequential-color (FSC) technology provides the bridge between the capabilities of miniature monochrome CRTs and the need for color. Nearly all of today's displays create color images *spatially*. Each color element, or pixel, is actually a triad of three subpixels – red, green, and blue (RGB). The subpixels are spaced so closely that the eye cannot resolve the three individual elements, so the eye sees the spatial triad as a single color.

And it can be any of a great many colors, depending on the relative intensities of the individual subpixels. FSC displays create color images *temporally*. Each color image is decomposed into red, green, and blue color fields of varying intensity, and these fields are displayed in sequence over *time*. If the fields are displayed rapidly enough, the human visual system fuses the individual color fields into a full-color image. Using the visual system's ability to perform temporal blending of individual elements is nothing new: it is the mechanism by which we perceive motion from a rapid sequence of still images when watching a movie.

Practical FSC is implemented with a monochrome CRT having a white phosphor that emits light over a broad range of visible wavelengths when it is excited by the scanning of the CRT's single electron gun. The electronic information for a single color image

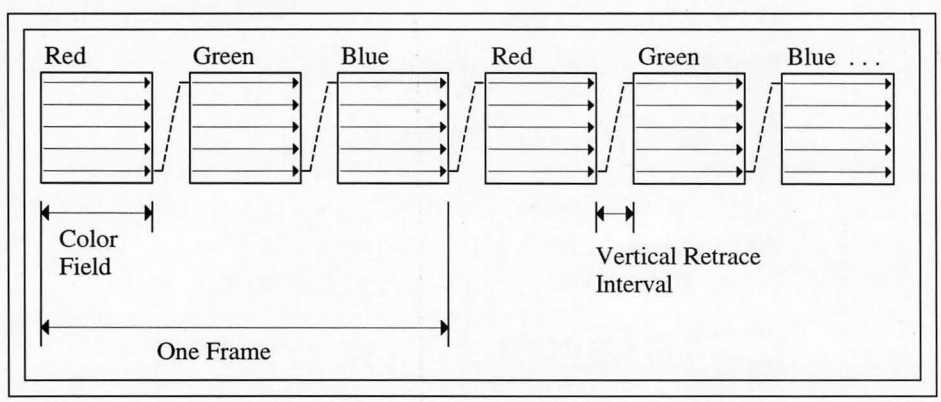


Fig. 1: *In a field-sequential color system, the three primary-color fields are displayed quickly – in the time it takes to display one frame in a conventional system.*

or frame is decomposed into its primary-color components – red, green, and blue. The red field of the image is then displayed on the CRT. Simultaneously, a red filter is placed in front of the CRT so the viewer sees only the red portion of the CRT's light. As soon as the scanning of the red field is completed, the information for the green field is displayed by the CRT. Simultaneously, a green filter is placed in front of the CRT. This time, the viewer sees only the green portion of the image. Finally, the blue portion of the image is presented to the viewer using the blue filter. The three primary-color fields are displayed quickly – in the time it takes to display one normal spatial-color frame (Fig. 1). Today's refresh rates – greater than 60 Hz for a full-color frame – are so fast that the color artifacts visible in the past are no longer a problem. The viewer sees a continuous blend of color and full-motion video. So an FSC design can supply a solution to the display industry's challenge. Small high-resolution monochrome CRTs satisfy the display requirements and FSC systems provide the color. But if these systems fill application needs so admirably, why aren't they already in large-scale production?

A Brief History of FSC

The concept of field-sequential color is not new. Its roots date back to the earliest designs for color television in the late 1940s. These designs implemented FSC with a mechanical color-filter wheel that rotated in front of the monitor. Each of the three filters on the wheel had to be as large as the television screen, so early FSC systems were too bulky and awkward for volume commercial implementation. Still, in special applications, FSC found an occasional niche. The Apollo space program used an FSC system to provide the first color pictures from the moon, and the Space Shuttle's television system is an FSC design.

FSC system designers must confront an essential question: how can one rapidly position color filters in front of a CRT to create the three color fields? The spinning color wheel faced its first challenger in 1950 when Edmund Land patented an entirely different method (U.S. Patent 2,493,200). Land used a series of dichroic color polarizers – stretched polymer films with absorptive dye – and an electro-optic device called a Kerr cell as a switchable polarization retarder (or wave

Displaytech, Inc.

Fig. 2: *A switchable color filter based on FLC technology is placed so that it covers only the left half of a 1.5-in. monochrome CRT showing a VGA image (unaltered Extachrome™ transparency).*

Displaytech, Inc.

Fig. 3: *When the filter completely covers the face of the CRT, the entire image is seen in color (unaltered Extachrome™ transparency).*

Displaytech, Inc.

Fig. 4: *Another image shown on a Displaytech FASTfilter™ exhibits saturated colors (unaltered Extachrome™ transparency).*

plate). This combination of elements formed an electrically switchable filter that could select all three colors without moving parts. The concept was brilliant, but the elements available to Land could not provide a practical device for commercial production. The next major step occurred in the 1970s with the growing sophistication of liquid-crystal (LC) technology. LCs can manipulate the polarization of light much as a Kerr cell can, and LC wave plates can be substituted for the Kerr cells in Land's original system design. LCs offer many advantages, and their introduction has made FSC color systems a reality in today's marketplace.

The State of the Art

Today, there are several ways of implementing an FSC design in a display system. The color wheel is available in a small-screen system from Myota in Japan. Although the Myota device is an impressive exercise in mechanical miniaturization, in our opinion, the three spinning filters still make it too large for truly small display systems, and there is the inherent disadvantage of moving parts. However, this system is a viable option for certain specialized applications.

Tektronix has developed an FSC display system based on pi-cells – a specialized version of a nematic-LC wave plate. This system has been used for a series of displays developed by Tektronix for its test equipment and for aerospace displays. This business was recently sold by Tektronix to Planar.

Nematic-LC-based FSC designs are a significant improvement over the color wheel, but there are still problems. Nematic LCs switch relatively slowly. The fastest LC filters take several milliseconds to change from one color to another, and this causes difficulties. Ideally, a filter should switch states during the vertical retrace period – the time it takes the CRT's electron gun to reset to the top of the screen for the next field's scan, which is only several hundred microseconds. To circumvent this problem, a nematic filter must be broken down into many individual and independently controllable filter segments. This requires additional timing and driving circuitry, and the filter's segments must be properly aligned with the CRT. Nematic pi cells also require high-voltage (15–30 V) driving schemes, which add additional circuitry and increase power consumption. As a result, although nematic-LC color filters are a good and reliable component for larger FSC displays, we do not believe they are the best choice for miniature systems in which weight, power, and simplicity are precious commodities.

Filters Get Faster

The latest development in FSC occurred in 1994 with the application of ferroelectric liquid-crystal (FLC) wave plates to color filters in the RGB FASTfilter™ introduced by Displaytech. The FASTfilter™ is an electrically switchable RGB color filter that uses FLC wave plates in place of Land's Kerr cells. These wave plates have a number of intrinsic advantages, especially for miniature displays.

FLCs are a distinct class of LC materials that are based on long molecules having a spontaneous polarization arranged in an organized layered structure which is called a smectic C* structure. Compared to nematic-LCs, FLCs have higher birefringence, dc voltage control, and fast switching – FLCs are over 100 times faster. These characteristics have important consequences for FSC designs.

Since the wave plate's birefringence is high, the filter's LC layer can be made very thin. This increases color uniformity and minimizes undesirable optical distortions. Fabricated from thin display glass, the device is light in weight – a 1-in. FASTfilter™ weighs just 10 g – a critical factor for head-mounted systems.

FLCs are fast. The wave plates used in the FASTfilter™ can make the transition from one color to another in just 100 µs. This makes filter segmentation unnecessary because the entire clear aperture of the filter can change color during the vertical retrace period. Driving the FASTfilter™ is simple: the FLC wave plates are controlled by two ±5-Vdc signals. This further simplifies the control electronics, which reduces weight and power consumption.

FLCs can be fabricated to have extremely uniform optical performance. A typical nematic wave plate will provide less than 100:1 broadband contrast ratio when placed between crossed polarizers. The increased uniformity of FLC wave plates makes possible broadband contrast ratios in excess of 1000:1, and this provides significantly greater transmission for each color. Peak transmittances range from 13 to 19% for each of the three colors.

The ultimate test of any display technology is how it looks when implemented. Figure 2 is an unaltered Ektachrome™ transparency of an FLC FASTfilter™ in front of a 1.5-in. monochrome CRT manufactured by Thomas Electronics. This miniature CRT is connected to a 386SX-based computer running Windows™ with standard VGA resolution (640 × 480). The JPEG image of the two parrots is being displayed by a Windows™ application. The filter has been placed so that it covers only the left half of the CRT screen, so the left half of the image is in full color while the right half is the black-and-white image displayed by the CRT. (The line of discoloration down the center of the photograph is due to the inability to manufacture an LC device that is perfect out to the edge of the glass. A border region is required for filling and sealing the cell.) When the filter completely covers the CRT screen, both parrots are displayed in their full glory (Fig. 3). And the device's effectiveness is not limited to parrots (Fig. 4). As the photographs illustrate, FSC provides a display system capable of a full range of color performance, from subtle shades and tinting to intense, bright, and saturated colors.

FSC systems have matured and can now provide high resolution in miniature displays – a combination not yet achievable by any other technology. ■

Blue Skies at SMAU '94

At a larger SMAU '94, the optimism among monitor people was palpable – and this year it was based on reality.

by Bryan Norris

THE 31ST International Exhibition of Information Systems, Telecommunications, Office Machines and Equipment (SMAU) was held in Milan, Italy, from October 13–18, 1994. The weather was beautiful, stories of improving business abounded, and there was an overall feeling that the recovery was really on the way this year – all in marked contrast to last year's show. The number of exhibitors, direct and indirect, was up to nearly 2150, compared to 1831 last year, and the exhibition area increased from 141,365 to 148,802 m^2. Thus, this year's SMAU theme, "revitalization," was appropriate, and signs were present that things were improving in the IT sector and maybe in the Italian economy in general.

New Monitor Vendors

There were a number of new-to-SMAU monitor suppliers to be seen in the halls.

Nokia from Finland introduced its high-end monitors to the Italian marketplace. The current range of 14–21-in. models, priced from Lire 880,000 (US$550) to Lire 5.7 million (US$3475), includes 17- and 15-in. models using Sony Trinitron® aperture-grille CRTs. Personnel from Nokia's German office were actively pursuing a distributor for their monitors in Italy.

***Bryan Norris** is Monitor Program Manager at BIS Strategic Decisions, Ltd., 40-44 Rothesay Road, Luton, Bedfordshire, LU1 1QZ UK; telephone 44-582-405-678, fax 44-582-405-828. He is a contributing editor to* Information Display.

Facit, the Swedish company known for calculators and printers, is new to monitors. It showed a range of six 14–20-in. monitors, all boasting power management. Two of the three 14-in. models had MPR-II. Additionally, the single 15- and 20-in. models, and the promised 17-in. model, are microprocessor-controlled. This suggests that the Milanese show was just being used as a launching pad, and that Facit intends to sell monitors throughout Europe alongside its printers.

Formenti updated its PC-monitor range launched at last year's SMAU, and provided preliminary information for a 20-in. model. In addition, the better-known YO range of open-frame 5-, 7-, and 9-in. monochrome monitors and 10-, 14- and 15-in. color monitors were on display, together with some examples of the YF range of broadcast monitors, which come in many screen sizes from 14 to 34 in.

MAG monitors, seen last year at the Great Tek stand, were promoted heavily this year by bustling distributor *Computer House Store*. The modern Elite MX Series of 15–21-in. monitors all have microprocessors, extra controls, and EPA* power-save, and they use both FS and Trinitron® tubes. A low-cost [Lire 600,000 ($US375)] 14-in. Trinitron®-tubed SVGA-at-72-Hz model (the Dx-1450S1) was also offered.

Bridge used one of the mini-booths in the Taiwanese complex in Hall 17 to promote its 14–20-in. range of monitors.

ViewSonic, on distributor *MCA*'s stand, showed off its range of 14–21-in. monitors. Interestingly, *ViewSonic* was showing both the relatively new full-featured 30–64-kHz 17G model for Lire 1.73 million (US$1080) and the rather old 6E (48-kHz, 14-in.) monitor, albeit still with MPR-II and capable of running SVGA at 72 Hz for Lire 550,000 ($US340).

Actebis – the $1-billion-turnover German distributor claiming the Number 2 distributor position in Europe and Number 5 in the world – announced the setting up of a 13-person Italian office in Milan. Thus, the company now has offices outside Germany in Austria, Switzerland, France, The Netherlands, Belgium, Denmark, and Italy, with a UK office opening in November.

Traditional SMAU Monitor Suppliers

CA&G had its usual extensive range of monitors on display. However, this year its OEM (high-end) models, most with microprocessor, full screen, and power-saving, no longer come from *IDEK* (Iiyama). (Judging by the similarities of specification and appearance, some of these high-end monitors now come from *Samtron*.) Nevertheless, *CA&G* is ramping up production of its own models at Cornedo (Fig. 1). *CA&G* still makes the low-end monitors for *Epson* (the Italian distributor for Eizo monitors); produces for a number of local Italian PC houses; has a range of open-chassis units, including some video-game models; and projected a production output of well over 200,000 monitors in 1994.

Cornerstone monitors were again displayed on the stand of the major vendor of document management systems in Italy, *nica sistemi*. This year's line-up of four document-image-system displays included the Dual Page 150i, a new 20-in. monochrome model with an

ImageAccel® controller giving 2048 × 1536-pixel (150-dpi) capability for an inclusive retail price of Lire 6150K (US$3820).

Eizo (Nanao), on distributor *Epson*'s stand, announced a new slimmed-down range of four "Professional" monitors. The 17-in. T562 and the 20-in. T662 both have Trinitron® tubes. With a horizontal frequency range of 30–85 kHz, they will both run 1280 × 1024 at a 75-Hz refresh rate. Retailing at Lire 3100K ($US1925) and Lire 4650K ($US2890), respectively, they are both fitted with a range of features including power management, FullScan and ScreenManager™, and come with TCO '92 as standard. Furthermore, the promotion leaflet touted the two models' "Plug and Play" capabilities! The two FST models, retailing at Lire 2390K ($US1485) and Lire 4390K ($US2730), respectively, the 27–65-kHz 17-in. F552 and the 30–80-kHz F760i.W have a similarly extensive range of features, with MPR-II and an option for a radiation-limit extension to TCO – for which no price was quoted. Is that because this option is one that Italian purchasers are unlikely to ask for?

Hitachi Sales showed its new "Value" version of its 17-in. MVX series. Upgraded with power-saving, the "Value" model has a reduced horizontal scan-frequency range – to 64 kHz compared to the 82 kHz of the "Plus" model – and therefore has a much more attractive price of Lire 1764K ($US1100).

Mitsubishi also has a slimmed-down range of computer/professional monitors from the 15- to the 21-in. Diamondtron® models. However, at the show it was the large-screen models that were being highlighted, both at the Mitsubishi booth and at distributor *Reis Elettronica*'s stand. Getting special attention was the new giant 42-in. EUM4201A, which has an impressive auto-scanning compatibility of 15.7/20–64 kHz [at an RRP of Lire 26 million ($US16,150)].

NEC was at an in-between stage at SMAU, promoting the current 4E and 5E models, but prevented at the last moment from announcing the new XE/P range of with-DDC models before Comdex '94. True, it has the new MultiSync 2V(alue) 14-in. monitor with EPA*, capable of running a "flicker-free" 1024 × 768 at 70 Hz, but at a price of Lire 690K ($US430), this is still a little expensive for the Italian market and must rely somewhat on NEC's quality-brand image.

CA&G

Fig. 1: *Italian brand names appear on many OEM monitors, but there is also substantial local production. CA&G's monitor production line in Cornedo, for example, was expected to produce over 200,000 monitors in 1994.*

Océ Graphics, 2 years from its Italian debut in monitors, again showed its microprocessor-upgraded stable of four high-end monitors (one 17-, two 20-, and one 21-in., OEM from Philips).

Philips had two of its top monitors, made locally at Saronno, listed in the *Getronics* price catalogue. The 20-in. aperture-grille-tubed C2082 for Lire 3294K ($US2025) and the 21-in. C2182 at Lire 5080K ($US3155), down Lire 500K ($US310) or nearly 9% compared to the price at last year's show. Other Philips monitors were to be seen at the booth of small local niche-PC maker *DMD*, whose catalogue listed all of Philips' current range.

Samsung monitors were promoted this year by main distributor *Athena*, another PC maker. (One-time outlet *MCA Elettronica* now sells *Daewoo* and *ViewSonic* monitors, as reported earlier.) The Samsung monitors offered in Italy were a curious mixture of old-ish and new models, with the older analogue 14-in. model and the "CSG9511" 20-in. model sharing the stand and product lists with the modern GL Series. All, however, boasted EPA* power-saving.

Samtron monitors were again shown by distributor *Datamatic*, which has now stopped supplying all other brands, including Acer. *Samtron* has with-or-without MPR-II models in 14-, 15-, and 17-in. screen sizes and a pricing structure ideally suited to the Italian market – hence, its rapidly increasing sales there.

Sony now has a range of aggressively priced, well-specified 15-, 17-, and 20-in. models – Trinitron®-tubed, naturally. Helped by a high regard in Italy for Sony's CTVs, where it is normal to expect and pay more for the Sony brand, the demand for the new 15SF1 monitor has already far exceeded supply.

Tatung's 14-in. monitors are really selling well in Italy via exclusive distributor *Executive* whose literature boasts that the best-selling 48-kHz 14-in. model (the TM4401VP) is a "price leader" at Lire 449K ($US279). It is certainly among the lowest-priced models for its specification. Another "price leader" from *Executive* is its entry-level Timeline own-brand 14-in. model, the SCR1438. This 38-kHz monitor has a 0.38-mm tube and retails for Lire 359K ($US223)! Finally, *Executive*

is also the successful *Sampo* outlet in Italy and from this range offers as its "price leader" the 60-kHz 20-in. KDM2055L for Lire 1750K ($US1090).

Wyse's new range of monitors could be seen on the *Ready Informatica* stand again, and now consists of four high-end models in 14-, 15-, and 17-in. sizes at prices ranging from Lire 521K ($US325) for the bottom (1024 × 768 ni) 14-in. model to Lire 1644K ($US1020) for the 17-in. model, capable of running at 1600 × 1280. *Ready Informatica* also offered two *Dielle Computers* badged monitors, a 14-in. monochrome at Lire 227K ($US140) and a 1024 × 768 ni 17-in. model at Lire 1533K ($US950).

Zenith Data Systems' (ZDS) energy-saving 15-in. monitor announced at last year's show was joined this year by a 17-in. Trinitron®-tubed model also made in Finland (by Nokia/Salcomp). Of course this monitor has EPA* power-saving, meets MPR-II low radiation levels, and, with a scanning-frequency range of 31–82 kHz, runs 1280 × 1024 at a "user-friendly" 75-Hz flicker-free rate. This monitor costs Lire 2000K ($US1250).

PCs Made in Italy

Olivetti again had an enormous stand in Hall 16, taking its place alongside other international PC houses such as *Compaq, Digital,* and *ICL.* The stand was worthy of *Olivetti*'s status as still the largest European-owned PC manufacturer in Europe. Its monitor range is still dominated by 14-in. models, but Olivetti now offers two high-end 30–82-kHz monitors, both with Trinitron® tubes and DPMs. These are 17- and 20-in. models for Lire 2340K ($US1350) and Lire 4400K ($US2730), respectively.

Contrary to 1993, other Italian PC makers seemed to be prospering in 1994, with their demand for monitors thus increasing.

Olidata now has its Italian PC plant and assembles over 60,000 of its own desktop PCs a year. It is also an important distributor of Toshiba portables.

Computer Discount (CDC) had a very razz-matazz stand from which mountain bikes and other items were regularly given away. CDC is doing well, and half of the 50,000 PCs it expects to sell will be assembled in-house.

Other local PC makers seen at SMAU included *Athena, DMD, Intercomp, Lemon Computers, OTC, Staver,* and *Unibit.*

Excellent Overview from SMAU '94

Examination of the monitors on display at this prestigious Milan show gives an excellent comprehensive guide to what the Italian market demands, and to the distribution outlets, pricing structures, and monitor needs of the local PC houses. Furthermore, because it is a forum for international monitor and PC suppliers to exhibit their wares, SMAU gives the opportunity to judge which existing and new features are considered necessary by monitor and PC suppliers to sell their products throughout Europe.

In Italy, the market is still dominated by sales of 14-in. models! – 84% of the monitor market there was taken by 14-in. models in the first half of 1994, compared to 68% for the total Western European market. And Italian users are still purchasing "economy" models fitted with 0.39-mm dot-pitch CDTs.

VGA/XGAl monitors using 14-in. 0.39-mm tubes were offered by *Andromeda, CA&G, Enoch,* newcomer *Facit, Formenti, Olivetti, Timeline (Executive),* and *Trust (Aashima)* at retail prices as low as Lire 359K ($US223)!

In the first half of 1994, less than 6% of the monitor market in Italy was taken by 15-in. models, compared with 14% for the total Western European market. Nevertheless, Sony's remarkable sales of its 15-in. monitor could well turn the tide and herald the beginning of appreciable 15-in.-monitor demand in Italy. Can Italians at last forego their preference for cheaper 14-in. models?

An interesting new product seen on the *Siemens/SNI* stand is produced for *SNI* by *Capetronic*, a Taiwanese manufacturer always at the forefront of "practical" new technologies. The entry-level 14-in. "Ergo" MCM1404 has most of the new "important" features, including EPA* power-saving and MPR-II, but only two scan frequencies, 31.5 and 37.8 Hz. However, this enables the monitor to operate both at VGA 640 × 480 at the old 60 Hz, and also at 72 Hz, which surely is perfectly adequate for most day-to-day applications on a 14-in. screen. This could well be the start of a trend for "basic but practical" monitors from PC houses, which could extend the life of "VGA-only" 14-in. screens.

A number of monitor suppliers also demonstrated that they understood the reluctance of many Italian purchasers to pay more for extras considered "unnecessary," even features such as MPR-II – Samtron being a notable example. Thus the likelihood of the average Italian paying an extra 4–6% for the more stringent TCO low-radiation recommendations is small. However, MPR-II, at least, is destined to be accepted by the European – and maybe international – monitor market, and surely it will become uneconomical to have additional production lines for monitors without it.

Finally, an interesting and not unimportant fact is obtained by comparing the average Italian distributors' published (but difficult-to-obtain) price lists. It seems that the public is still being asked to pay a one-third mark-up over the dealer price for monitors – but somewhat less if payment is cash-on-delivery instead of the normal Italian within 180 days or more! ■

SID '95 Comes to Orlando

The fantasy of the WALT DISNEY WORLD® Resort is unlikely to dim SID '95's real-world dazzle of new display and manufacturing technology.

by Ken Werner

THE Society for Information Display's annual International Symposium, Seminar, and Exhibition (SID '95), to be held May 21–26, is rarely presented at a hotel because few have adequate meeting space to accommodate SID's extensive technical program and ever-expanding exhibition. The Walt Disney World Dolphin just outside Orlando, Florida, is an exception (Fig. 1). The hotel's fanciful decor and luxurious facilities will provide a convenient, entertaining, and self-contained home for the 26th edition of North America's only professional conference and trade show devoted exclusively to display technology, components, products, systems, and manufacturing (Fig. 2). We can look forward to conserving some shoe leather while pursuing all that needs to be covered, and the hotel's white sand beach and "swimming grotto" can provide a quick boost when needed.

During the week of May 21, the Walt Disney World Dolphin will play host to two keynote addresses, four Sunday short courses, 16 technical seminars, six applications seminars, 45 technical sessions, a poster session, three author-interview sessions, an exhibition comprised of 225 exhibit booths, two receptions, a luncheon, three evening panel discussions, and an evening special event.

The first keynote speaker, Lance Glasser of ARPA, will describe the current status of ARPA's display initiative. He will be followed by a speaker from Motorola, who will outline the display requirements for mobile communication devices.

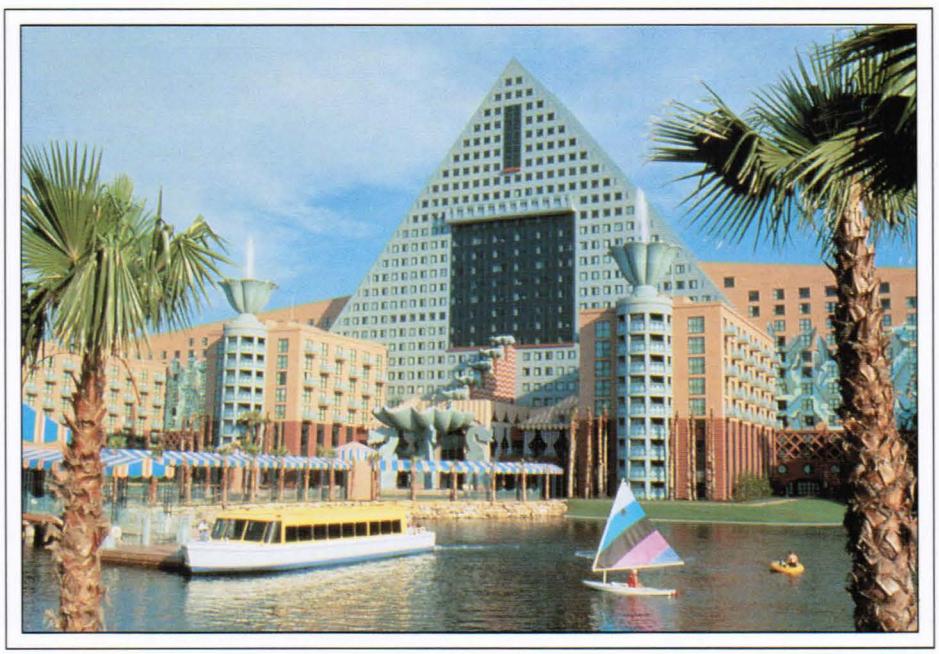
Ken Werner *is editor of* Information Display.

Sunday Short Courses

Hugo Steemers (Xerox PARC) will update *The Fundamentals of LCDs,* the extremely successful and well-regarded course he gave at last year's symposium. Brian Wandell (Stanford University) will also be presenting the second edition of his well-reviewed course, *Fundamentals of Vision Science.* Majid Rabbani (Eastman Kodak) will be expanding his 1994 course, *Fundamentals of Digital Image Processing.* And the extremely knowledgeable Chris Curtin (Silicon Video Corp.) and Peter Seats (Consultant) will provide a cross-technology survey of FEDs, CRTs, EL, and PDPs in *Fundamentals of Emissive Displays.*

Seminars

If you feel that the 4 hours for a short course is too much time out of the Florida sunshine, the 90-minute seminars might be more to your liking. (Actually, many people go to both the



Walt Disney World Dolphin

Fig. 1: *The Walt Disney World Dolphin will provide a fancifully decorated and entertaining home for the 26th edition of the Society for Information Display's annual International Symposium, Seminar, and Exhibition (SID '95), to be held May 21–26.*

short courses and seminars.) This year, 16 seminars are scheduled to be held on Monday and Friday: *Display Ergonomic Standards and Requirements* (John Cone, Consultant), *Field-Emission Displays* (Bruce Gnade, Texas Instruments), *Active-Matrix Liquid-Crystal Displays* (Webster Howard, AT&T Bell Laboratories), *CRT Display Measurement and Quality* (Carlo Infante, CBI Technology Consultants), *Digital Image Compression* (Paul Jones, Eastman Kodak), *Projection Displays* (Fred Kahn, Kahn International Consulting), *Display System Design* (Shaun Kerigan, IBM UK), *High-Definition Television* (Bernard Lechner, Consultant), *Electroluminescent Displays* (Gerd Mueller, Hewlett-Packard Laboratories), *Digital Halftoning* (Paul Roetling, Xerox), *Supertwisted-Nematic LCDs* (Terry Scheffer, Motif), *Color in CRT and LC Displays* (Louis Silverstein, VCD Sciences), *Overview of Electronic Information Displays* (Lawrence E. Tannas, Tannas Electronics), *Color Filters for Flat-Panel Displays* (Mizuhiro Tani, Toppan Printing), *Phosphors for Color Emissive Displays* (Aron Vecht, University of Greenwich, UK), and *Plasma Displays* (Larry Weber, Plasmaco).

Since 1993, early-morning applications seminars have been a very popular feature at SID. They are often over-subscribed despite being scheduled two-by-two at 7:30 am on Tuesday, Wednesday, and Thursday. This year's applications seminars are *LCD Modeling* (Jack Kelley, Liquid Crystal Institute), *LCD Addressing* (Arlie Conner, Consulting Services), *Assessment of Display Technology and Markets* (Walt Goede, Northrop Corp.), *LCD Optical Measurements* (Michael Becker, autronic GmbH, Germany), *Flat-Panel Module Electronics* (Alex Erhart, Vivid Semiconductor), and *How to Evaluate Display Image Quality* (Peter Barten, Barten Consultancy, The Netherlands).

The Technical Sessions

The 45 technical sessions and half-day poster session represent an abundance of riches – certainly too abundant to list all of them here. With inspiration from Internet and Mosaic, we'll just do some "surfing" of selected session titles and invited papers.

Among the sessions are "New AMLCD Technologies," "Automotive Displays," "Perception of Size, Depth, and Distance in Synthetic Displays," "Displays for Entertainment: Visual Requirements and Performance," "Virtual-Environment Interfaces," "Flat CRTs," "Economics of Manufacturing FPDs," "CRT Monitor Design," "Backlighting Systems," "HMDs in Medical Applications," "Field-Emitter Displays," "Color Plasma Displays," "Color Facsimile," "Electronic Photography," "LCD Projection Display Systems," "Active-Addressing Schemes," and "Emerging Display Technologies."

Walt Disney World Dolphin

Fig. 2: *The Walt Disney World Dolphin's luxurious facilities are large enough to house SID '95's parallel sessions and extensive trade show entirely within the hotel.*

There is also a wide range of invited papers, literally from around the world. These papers, which will be included in their appropriate technical sessions, include some unusually exciting talks. We'll mention a few of them here.

In *Micro Filter Color CRTs*, Takeo Itou and his colleagues from Toshiba's CRT Division will describe a new CRT design in which RGB filter dots are interposed between the phosphor dots and the tube's faceplate. When combined with adjustments in glass transmittance, phosphor design, and outer-coating design, this innovation produces striking improvements in contrast and color fidelity, and a luminance increase of 40%! The tubes have been manufactured on a modified mass-production line.

The world of light-emitting diodes (LEDs) was shaken last year when the first high-efficiency high-brightness blue LED was announced. The announcement came not from Hewlett-Packard or any of the other industry leaders but from Nichia Chemical Industries, a company with extensive experience in phosphors but none in semiconductor-device fabrication. The development makes high-brightness full-color LED displays possible for the first time. Nichia's Shuji Nakamura will discuss the technology and applications in *High-Brightness Blue LEDs Using III-V Nitrides and Their Applications.*

FED Corporation's Lyuji Ozawa reports on a 0.5-in. CRT capable of displaying SVGA images. The display, described in *Helmet-Mounted 0.5-in. CRT for SVGA Images*, has a high luminance of 2000 cd/m^2, a high resolution of 70 lines/mm, and a power consumption of only 4 W.

It is clear that aggressive expansion of the market for AMLCDs requires improved productivity and performance. In *Productivity Improvement Strategy for TFT-LCD Manufacturing*, Zenzo Tajima describes Hitachi's strategy for implementing productivity improvements, which includes a simple TFT-array process, higher throughput equipment, yield improvement, FA and CIM, and reduced use of power, chemicals, and water.

Nobuyuki Hashimoto and Shigeru Morokawa of the Citizen Watch Company will describe a real-time motion-picture holographic display system using liquid-crystal television spatial light modulators (LCTV-SLMs).

Among the subjects covered in other invited papers are a stereoscopic display system using backlight distribution (Terumo Corp., Medical Device Department), prospects for large-area direct-view TFT-LCDs (Sharp), and a full-color video-rate antiferroelectric LCD (Nippondenso).

Special Events

The President's Reception will kick off the conference proper on Monday evening, May 22. Shortly after the start of the reception, the limited-attendance Awards Dinner will begin. Tickets to the dinner are available only through advance registration.

On Tuesday at 6:00 pm, there will be an Exhibitor Reception in the exhibit hall, where registrants and exhibitors can mingle, eat, and drink. Suitably refreshed, the assembly can attend the Evening Panel Discussions at 8:00 pm. Attendees can choose from (or surf among) "Economics of Display Technologies," "Multimedia or Multimediocrity?" "Projection Display Technologies," and "Virtual Reality: Virtual or Real?" Interaction is encouraged.

The annual SID Luncheon, to be held on Wednesday, will feature the Best Paper Awards for SID '94 and an entertaining talk by Bran Ferren (Senior Vice President, Creative Technology and Research and Development, Walt Disney Imagineering) on the use of advanced imaging in Disney entertainment. Wednesday night's Special Event will be a trip to Sea World®, including dinner, a presentation about the technology of Sea World operations, and a Sea World show.

Exhibits

SID '95 will contain the largest exhibition ever mounted in North America devoted exclusively to display technology, systems, components, and manufacturing. From Tuesday through Thursday, approximately 170 exhibitors will fill the exhibit hall's 225 booths to capacity. Exhibits will range from the elaborate to the austere, but the average exhibitor's investment promises to be greater than ever before. Clearly, if it has anything to do with displays and you want to buy it, sell it, or see it, the exhibition at SID '95 is the place. In *Information Display*'s next issue – the combined April/May issue that will be delivered about May 1 – we will provide a detailed sampling of SID '95 exhibitors and their offerings.

Past SID conferences have proven to be the most cost- and time-effective ways of keeping in touch with display technology, people, manufacturing systems, products, applications, and vendors. SID '95 promises to be the best yet – an exciting, highly informative, and entertaining event that will make its participants more knowledgeable, effective, and productive. ■

SID '95

Symposium, Seminar and Exhibition

Walt Disney World Dolphin Hotel

Orlando, Florida

May 21–26, 1995

Please send new product releases or news items to Joan Gorman, Departments Editor, Information Display, c/o Palisades Institute for Research Services, Inc., 201 Varick Street, New York, NY 10014.

Please send new contributions or noteworthy news items to Aris Silzars, Contributing Editor, Information Display, c/o Palisades Institute for Research Services, Inc., 201 Varick Street, New York, NY 10014.

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venient for the customer. The only drawback that I could see was that one had to walk, perhaps up to 100 ft., to buy the parking permit. I could well imagine that in the USA some would find that a real imposition. And then, of course, there could also be the excuse that because there was no meter at each spot, one should not be expected to know that he should pay.

Interesting. Two parts of the world looked at the same problem, applied the *same technology*, and came up with two quite different answers. I know which one I prefer – the one that doesn't clutter up the street, saves costs and the environment by using less materials and less installation labor, and gives the user the most choices. But, as we have said in this column before, technology only facilitates. The users (most likely city administrators and/or politicians in this case) make the final choice of how it is implemented.

Over the next several years, as some of the newer display technologies are turned into real products, there will be many choices for implementing these technologies into final product configurations. The companies that succeed will be the ones that give careful attention to customer preferences and the user-friendliness of their technology – in other words, to what we usually call human factors. Sometimes, it's convenience of use. Sometimes, it's esthetics. Sometimes, it's cost or perceived value. But, once everyone is able to achieve nearly similar performance, which is inevitable with popular technologies, it is these subtle differences that separate the winners from the losers.

Consider the following as a recent and very real-life example. The laptop computer on which this column is being created was selected because of a *slightly* better-looking display, the nice "feel" of the keyboard, and the pleasing color and design of its case. Why? Because once I had decided on the $2000 price range as my budget, that was all that was significantly different among the dozens of models available. All had the same processor and memory, all had the same hard drive, etc. The basics were all so nearly the same that the human factors and esthetics made this unit the winner for me. Sometimes what has value is truly in the eye of the beholder – or maybe in the eye of the skillful promoter – and has nothing to do with technology or performance specs. For example, during my stay in France, everywhere we went we were greeted with signs and posters proclaiming, "Le Beaujolais Nouveau est arrivé." A new tradition, created over the last 20 years, is that on the third Thursday of November all over the world, the new Beaujolais wine is released for consumption. We happened to arrive in Dijon on just the right day to greet this year's new wine. What once

would have been considered a wine too new to drink has now become an item in great demand. There was, for sure, no new technology that made that happen. It was mostly great marketing.

In this month's industry-news segment, we feature several new companies that, over the next few years, may have successes similar to the Beaujolais Nouveau. They too may arrive to take their place among the older companies with more established traditions. But by then, who knows what the older ones will look like. We technologists sure like to keep things interesting!

A new flat-panel-display firm, **Kent Display Systems**, Kent, Ohio, has begun to market products that utilize a new liquid-crystal compound – PSCT (polymer stabilized cholesteric texture) – developed by scientists at **Kent State University**. The compound enables the production of lower-cost displays for a range of uses from pagers and portable phones to multiple-panel billboard-sized displays. These new displays do not require polarizers or filters, and the image stays on the screen if power is removed. The co-founders of Kent Display Systems are **William Manning**, Chairman of **Manning Ventures, Inc.**, of Rochester, New York; **Zvi Yaniv**, President of Kent Display Systems; and **J. William Doane**, Director of Kent State University's Liquid Crystal Institute. **Kent Research Corporation**, the commercialization arm of Kent State University, is also a partner in the new company. Kent Display Systems is currently demonstrating its initial products, single-color displays measuring up to 12.5 × 18 in., to potential customers. Full-color displays are planned. The founders are working with companies that supply informational displays for the retail electronics market, airline terminals and industrial equipment, and with the national intelligent-vehicle and highway programs. According to Zvi Yaniv, the focus will be on markets for inexpensive signs whose messages can be instantly updated instead of on video or computer-screen applications.

Silicon Video Corporation of Cupertino, California, has formed a number of alliances with companies such as HP and Compaq Computer, the U.S. Department of Defense, U.S. national laboratories, and venture-capital firms. HP formed a relationship with SVC in 1992 based on the expected strategic importance of flat-panel displays. In addition to undisclosed equity investments in SVC, HP conducts research in HP laboratories that augments SVC's Thin CRT engineering efforts. Compaq Computer has similarly decided to take a more active role in securing access to new advanced display technologies and is actively supporting SVC's development efforts. Advanced Technology Materials, Inc.

(ATMI) is supporting SVC through the development of novel carbon-based field-emission films and high-resistivity films for use with the Thin CRTs. Tektronix has also joined the SVC partner group to share its expertise in phosphor deposition, aluminization, black-matrix, and electron-optics technology. Lawrence Livermore National Laboratory (LLL) has a dual-use development program with SVC in which LLL contributes its expertise and facilities to help develop low-cost process and equipment technologies for cold-cathode production. Accu-Fab Systems (AFS) is contributing its core technology expertise, including clean-room materials handling, precision alignment, micro-machining, and micro-inspection. Finally, to ensure that SVC meets its private financing needs, the company recently began working with Robertson Stephens & Company, an investment banking firm with extensive experience in high-technology financing.

Kenneth E. Salsman has joined **Sarif, Inc.**, as Vice President of Business and Technology. Sarif was recently formed by the David Sarnoff Research Center and In Focus Systems. Sarif has established its corporate headquarters at 503 Columbia Shores Blvd., Vancouver, Washington. Prior to joining Sarif, Ken was, for over 7 years, a Manager of Business Development at the Sarnoff Research Center.

Virtual I/O, Inc., of Seattle, Washington, recently demonstrated a new head-mounted-display product that will provide excellent-quality three-dimensional images and head-tracking capability for game and other virtual-reality applications. **Greg Amadon**, President and Founder of Virtual I/O, got the company started, hired a new staff, and introduced the first product, all within the last 9 months.

Tom Long has joined Planar Advance as Director of Product Development. **Planar Advance, Inc.**, Beaverton, Oregon, is the former avionics product group recently acquired by Planar from Tektronix, Inc. They continue to occupy the same facilities as before on the Tektronix Beaverton campus. Tom Long has a long association with the display community. For a number of years, he was a Vice-President of Tektronix and, among other positions, headed the television products group.

Quantum Data of Elgin, Illinois, has appointed **Timothy P. Knutsen** to the newly created position of Sales and Marketing Manager. The announcement was made by **Allen Jorgensen**, President and founder of this 15-year-old manufacturer of video-signal generators for the electronic-display industry. In his new position, Mr. Knutsen is responsible for worldwide sales and marketing, including advertising and product management. He joins Quantum Data from SyQuest Technology, where he was Northeast Distribution Sales Manager.

Michael A. Fout, who earlier this year joined **Crystaloid** of Hudson, Ohio, as Director of Quality Assurance, has now been named Director of Operations and Quality. Crystaloid is a manufacturer and supplier of liquid-crystal displays for commercial and avionics applications.

As always, people news, company news, and comments about the topics covered (or not yet covered) in this column are most welcome. You may reach me by phone at 609/734-2949, by fax at 609/734-2174, by e-mail at aris_silzars@ maca.sarnoff.com. ■

editorial

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Technology Laboratory at the University of Washington in Seattle. I'm including this item as a note to myself to give Dr. Furness a call.

Finally, with support from ARPA, SI Diamond Technology, Inc. (Houston) and Supertext, Inc. (Sunnyvale) have formed **American Diamond Display Venture (ADDVent)** to develop an inexpensive 10-in. color VGA display using SI Diamond's amorphous-diamond-film-diode field-emitter display (FED) technology. SI Diamond's technology is interesting but it is in a relatively early stage of development. Investing the family savings in a company that wants to make nothing but controllers for diamond-diode FEDs might be a tad premature.

Information Display Magazine invites other opinions on this and related subjects from members of the international display community. The opinions expressed in this column do not necessarily reflect the opinions of the editor or publisher of *Information Display Magazine*, nor do they reflect the position of the Society for Information Display.

– Ken Werner

16 OCTOBER 95

Asia Display '95 – International Display Research Conference

ACT CITY, HAMAMATSU, JAPAN
OCTOBER 16 –18, 1995

• An international conference on display research and development aspects of:
– Display Fundamentals, Display Devices
– Hard Copy & Storage, Input Systems
– Integrated Devices and Applications
– Image and Signal Processing
– Color Perception, Human Factors

Please send new contributions or noteworthy news items to Aris Silzars, Contributing Editor, Information Display, c/o Palisades Institute for Research Services, Inc., 201 Varick Street, New York, NY 10014.

Compiled by HOWARD L. FUNK
H. L. Funk Consulting

U.S. Patent No. 5,373,172; Issued 12/13/94

Semiconducting Diamond Light-Emitting Element

Inventors: Kobashi, Koji; Kumagai, Kazuo; Matsui, Yuichi; Miyata, Koichi; Miyauchi, Shigeaki
Assigned to: Kobe Steel Ltd., Japan

A semiconducting diamond electroluminescence element comprises an electrically conductive substrate, a semiconducting diamond layer formed on the substrate, an insulating diamond layer formed on the semiconducting diamond layer, a front electrode formed on the insulating diamond layer, and a back electrode formed on the conductive substrate in ohmic contact with the same. The color of light to be emitted by the semiconducting diamond electroluminescence element can readily be determined by changing the impurity content in the semiconducting diamond layer. The luminescence intensity of the semiconducting diamond electroluminescence element can readily be changed by changing the voltage applied across the front and back electrodes without entailing dielectric breakdown.

U.S. Patent No. 5,374,489; Issued 12/20/94

Organic Electroluminescent Device

Inventors: Imai, Kunio; Inada, Hiroshi; Kobata, Tomokazu; Shirota, Yasuhiko; Wakimoto, Takeo; Shirota, Yasuhiko
Assigned to: Bando Chemical Industries, Ltd., Japan; Pioneer Electronic Corp., Japan

An organic electroluminescent device having an organic emitting layer and a hole transport layer laminated with each other and arranged between a cathode and an anode, and the hole transport layer is made of tris-phenothiazinyl-triphenylamine or trisphenoxazinyl-triphenylamine derivative. The hole transport layer has a high heat-resistant property and high conductivity to improve durability and emits light at a high luminance and a high efficiency upon application of a low voltage.

U.S. Patent No. 5,372,839; Issued 12/13/94

Process for Preparing an Electroluminescent Film

Inventors: Mikami, Akiyoshi; Nakajima, Shigeo; Tanaka, Koichi; Taniguchi, Kouji; Yoshida, Masaru
Assigned to: Sharp K K, Japan

A process for preparing an electroluminescent film which comprises causing a substrate held at a high temperature to simultaneous contact two kinds of vapors of (a) Group II element and a Group VI element or a compound thereof, capable of forming a Group II-VI compound semiconductor, and (b) a halide of an element capable of acting as luminescent centers in the Group II-VI compound semiconductor, in the presence of flowing hydrogen or an inert gas, whereby a thin electroluminescent film comprising the Group II-VI compound semiconductor and containing the element forming the luminescent centers is formed on the surface of the substrate.

U.S. Patent No. 5,372,837; Issued 12/13/94

Method of Manufacturing Thin-Film EL Device Utilizing a Shutter

Inventors: Inohara, Akio; Isaka, Kinichi; Kishishita, Hiroshi; Nakamura, Noriaki; Shimoyama, Hiroyuki
Assigned to: Sharp K K, Japan

A method of manufacturing a thin-film electroluminescent (EL) device in which an electron beam is directed to a pellet of a substance containing an additive agent, and the substance is evaporated and deposited on a substrate and a change per unit time of the growing deposit is monitored by a sensor, comprised of the following steps: (1) controlling the energy of the electron beam in accordance with an output of the sensor during a first time interval for adjusting an evaporation rate of the substance to a specified rate, (2) maintaining the controlled energy of the electron beam constant during a second time interval, larger than the first time interval and alternatively repeating steps (1) and (2).

U.S. Patent No. 5,372,836; Issued 12/13/94

Method of Forming Polycrystalline Silicon Film in Process of Manufacturing LCD

Inventors: Hama, Kiichi; Hata, Jiro; Imahashi, Issei
Assigned to: Tokyo Electron, Ltd. Japan

In a method of forming a polycrystalline silicon film in a process of manufacturing an LCD, a hydrogenated amorphous-silicon film is formed on a glass substrate by plasma CVD throughout areas serving as the pixel portion and driver unit of the LCD. A laser beam is radiated on a selected region of the film on the area serving as the driver unit. The energy of the laser beam is set such that hydrogen in the film is discharged without crystallizing the film and damaging the film. The energy of the laser beam is gradually increased to gradually discharge hydrogen from the film. The energy of the laser beam is finally set such that the film is transformed into a polycrystalline silicon film. The amorphous-silicon film can be poly-crystallized without damaging the film by the discharge of hydrogen.

U.S. Patent No. 5,374,945; Issued 12/20/94

Gray-Level Printing Using a Thermal Printhead

Inventors: Molieri, Eduardo M.; Robins, Nancy R.; Rust, Lauren M.
Assigned to: Motorola Inc.

A method for gray-level printing using a thermal printhead which includes characterizing the paper to be printed, defining a line of a gray-scale image using bitplane data sets, entering the first of the bitplane data sets into a shift register, transferring the first of the bitplane data sets from the shift register to a latch, beginning to print a section of the line of the gray-scale image using the first of the bitplane data sets in the latch, entering consecutively the remaining bitplane data sets in the shift register, transferring consecutively the remaining bitplane data sets to the latch, and completing the printing of the section of the line of the gray-scale image. Multiple refreshing of data per segment printing enables less than 10-ms line (1728 bit) printing in 16 shades of gray.

U.S. Patent No. 5,373,350; Issued 12/13/94

Xerographic/Thermal Ink-Jet Combined Printing

Inventors: Baldwin LeRoy A.; Dole, Otto R.; Taylor, Thomas N.
Assigned to: Xerox Corp.

A printer combines the technologies of xerographic and thermal ink-jet printing into a unit which is capable of high resolution text and color graphics. The printer is capable of forming a composite image including a xerographic printing portion and a thermal ink-jet (TIJ) printing portion by printing the xerographic portion using known xerographic techniques and the TIJ portion by a thermal ink-jet printing array associated with the printer. The portions may be printed in any order and may be dried by a drying station after printing of each portion or after both portions have been printed. At least one TIJ printing array can serve as an annotator which is capable of printing additional information onto a copy such as company letterhead, special instructions, addresses, or the like.

U.S. Patent No. 5,373,379; Issued 12/13/94

Repairable LCD Panel with Laser Fusible Links

Inventors: Nakai, Yutaka
Assigned to: Toshiba Corp., Japan

Disclosed is a wiring for an electronic circuit, comprising a substrate, a first conductor layer formed on said substrate, an insulating layer formed on said insulating layer, and a second conductor layer formed on said insulating layer such that said second conductor layer overlaps with at least a part of said first conductor layer, wherein an inner portion of at least one of the overlapping portions of said first conductor layer and said second conductor layer is removed at least partially to cause the peripheral portion to remain unremoved at least partially, thereby decreasing the area of the overlapping portion.

U.S. Patent No. 5,375,245; Issued 12/20/94

Apparatus for Automatically Reducing the Power Consumption of a CRT Computer Monitor

Inventors: San, Tang P.; Solhjell, Erik
Assigned to: Tandberg Data AS, Norway

A method and apparatus for automatically undertaking power reduction of a monitor in a computer system make use of the fact that, when the computer system is active, synchronization pulses will be transmitted to the monitor. In the method and apparatus herein, it is insured that when the computer system is inactive, transmission of those synchronization pulses ceases. Within the monitor, the reception of these synchronization pulses is detected, and in the absence of synchronization pulses, steps are taken to reduce the power consumption by the monitor. Power can be discontinued to different portions of the monitor as the length of time for which the synchronization pulses are absent increases.

U.S. Patent No. 5,375,193; Issued 12/20/94

Method and Apparatus for Reproducing Blended Colorants on an Electronic Display

Inventors: Adams, Louis W., Jr.
Assigned to: Milliken Research Corp.

An apparatus and method for reproducing the color of blended colorants on an electronic display such as a CRT, LCD, or other type of electronic device that utilizes RGB values. Predictions of blended colorants on or in substrates can be made from XYZ measurements of samples prepared with no colorants, one colorant, and pairs of colorants. The calculation method uses light absorption, light scattering, and light absorption blend coefficients. An image digitizer can be used to obtain XYZ values from samples. Furthermore, image digitizer RGB values are converted into XYZ values with a nonlinear model using a simple method. Furthermore, the above process to generate XYZ values from image digitizer RGB values can be used to generate RGB values from XYZ values for electronic display.

U.S. Patent No. 5,375,006; Issued 12/20/94

Twisted-Nematic LCD devices with Optical Axis of Birefringent Layer Inclined with Respect to Birefringent Layer Normal

Inventors: Haas, Gunther
Assigned to: Thomson Consumer Electronics SA, France

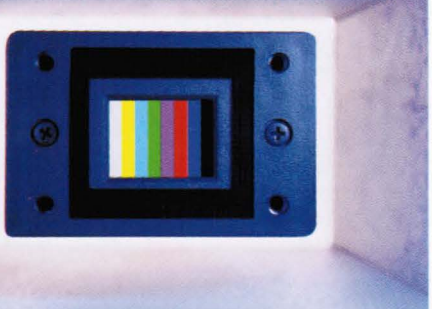
The disclosure relates to electrically controlled display devices that use the polarization rotation properties of twisted-nematic liquid-crystal layers. A display device comprises an optical cavity formed by two polarizers enclosing a layer of twisted-nematic liquid crystal with which uniaxial birefringent means are associated in order to compensate for the residual birefringence of the liquid-crystal layer which tends to reduce the contrast ratio of the display device. Thus, the homogeneity of the angular distribution of the contrast ratio is improved in relation to a device having no compensating means. The disclosed device can be applied in particular to data display devices for computers and to the display of television pictures directly or by projection.

U.S. Patent No. 5,375,003; Issued 12/20/94

Method of Connecting a Tab Film and an LCD Panel

Inventors: Hirai, Minoru
Assigned to: Rohm Co., Ltd., Japan

The improved LCD device has a slit formed in part of the TAB area where the electrodes on the LCD panel are connected to the output terminals on the TAB and the LCD panel is bonded to the TAB by means of a first anisotropic conductive adhesive having a comparatively weak adhesive force, such as a thermoplastic anisotropic conductive adhesive, whereas a second anisotropic conductive adhesive having a comparatively strong adhesive force, such as a UV curable adhesive, is coated in the slit. This LCD device can be produced by a process that proceeds basically as follows: the electrodes on the LCD panel are connected to the output terminals on the TAB by means of a thermoplastic adhesive as the first anisotropic conductive adhesive having a comparatively weak adhesive force; then, the assembly is subjected to an operating test; if the TAB is found to be defective in the operating test, it is replaced and, if no defect is found, a UV curable or a thermosetting adhesive as the second anisotropic conductive adhesive having a comparatively strong adhesive force is coated in the slit and then cured as the output terminals are compressed against the electrodes. ■



new products

Edited by JOAN GORMAN

Smaller auto-scanning monitor

Hitachi America, Ltd., Montvale, New Jersey, has introduced the Accuvue® Galaxy GX-17L, a 17-in. (CRT size) high-resolution color monitor that addresses the needs of PC and Macintosh users, who have asked for a smaller monitor that still offers the Accuvue® line's high performance and quality. The GX-17L auto-scanning monitor automatically adjusts to various modes from VGA to 1280 × 1024, has a wide horizontal frequency range of 30–64 kHz, allowing for a refresh rate of 60 Hz at 1280 × 1024, and has vertical refresh rates ranging from 47 to 100 Hz. In addition to meeting EPA Energy Star requirements, the GX-17L meets VESA DPMS™ power- and energy-saving standards. To lessen user eyestrain, the GX-17L is equipped with a silica anti-static screen coating and features a flat screen and a 0.28-mm dot pitch for sharper images and less reflection. The 17-in. monitor is suited to graphics applications such as CAD/CAM, desktop publishing, document imaging, Windows™, and multimedia. The Accuvue® Galaxy GX-17L is priced at $999 and will be available for $899 with the Hitachi End User Rebate of $100 until March 31, 1995. Product availability is scheduled for the first quarter of 1995.

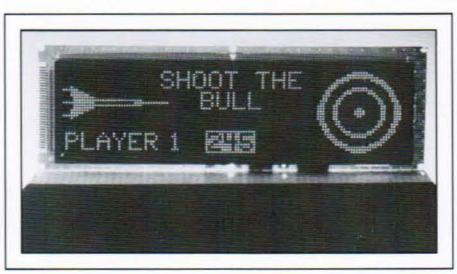
Information: Amy Edmonds, Office Automation Systems Division, Hitachi America, Ltd., 110 Summit Ave., Montvale, NJ 07645. 1-800-225-1370, fax 201/573-7660.

Circle no. 1

Intelligent gas plasma display

Cherry Electrical Products, Waukegan, Illinois, has announced the PD01-D221, a large dc gas plasma display designed to simplify the work of design engineers. It features an intelligent, time-saving, easy-to-use interface with embedded character tables, and supports both the RS-232 and 8-bit parallel communications protocols. The need to know how to drive displays, develop drive circuitry, or write driver software has been eliminated. The 128 × 32-pixel display is suitable for gaming/arcade and redemption machines, medical equipment, business machines, instrumentation, and industrial controls. The embedded character table includes eight fonts (five font sizes and three languages). The display automatically generates the correct bit map for the desired font and places it at the desired location. The PD01-D221 has a viewing area of 12.75 × 3.15 in. and an overall size of 14.8 × 4.93 in. The display features compact and rugged design, flicker-free high-brightness pixels, 130° viewing angle, 50,000-hour life, high contrast ratio (20:1), flat profile (depth less than 2.0 in.), and low power consumption. The bright neon orange color of the full-field dot-matrix display is readily filterable from yellow through the red end of the visible spectrum.

Information: Brad Taylor, Cherry Electrical Products, 3600 Sunset Ave., Waukegan, IL 60087. 708/360-3434 or 1-800-927-6298. Request data sheet CE-1563.



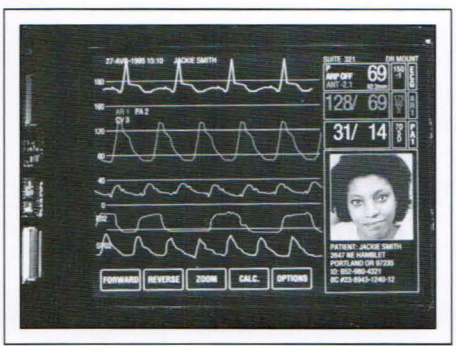
Circle no. 2

FPD for instrumentation market

Sharp Electronics Corporation, Camas, Washington, has announced a campaign to replace color CRTs in the instrumentation market with compact, efficient, active-matrix LCDs,

and their initial offering is a 6.4-in. VGA-resolution display. The LQ64D141 saves space and power and reduces complexity when compared with color CRTs used in current test-and-measurement, medical, scientific, and communications instruments. The active-matrix display is less than 0.25 in. thick, operates on 5 V, and consumes less than 3 W without sacrificing image quality. With 640×480 dots of resolution (VGA), the LQ64D141 has better color saturation than typical CRTs, and, with 100 nits of brightness and a special anti-reflection coating, is more viewable in bright ambient light. The 6.4-in. LCD offers roughly the same viewing area as an 8-in. CRT and fits easily into a standard 7-in. rack-height package. The LCD's size advantage, lighter weight, and reduced power consumption enable instruments to be truly portable and battery-powered. The LM64K11, a 6.4-in. monochrome display mechanically compatible with the LQ64D141 for instruments without a color requirement, is also available. Two mechanically compatible 8.4-in. color displays, the active-matrix LQ9D151 and the passive-matrix dual-scan LM64C26P, are available for larger instruments. Samples of the LQ64D141 are now available. Production quantities begin shipping in June 1995.

Information: Sharp Electronics Corp., 5700 N.W. Pacific Rim Blvd., M/S 20, Camas, WA 98607. 1-800-642-0261.



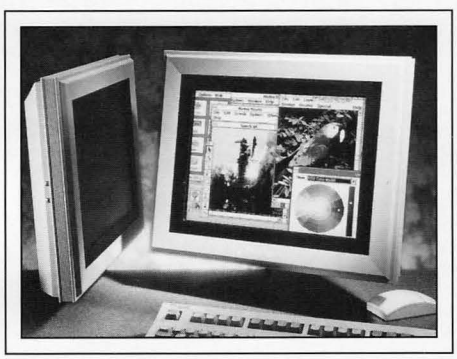
Circle no. 3

14.2-in. AMLCD color monitor

PixelVision, Acton, Massachusetts, has announced the PV460, the industry's first 14.2-in. active-matrix color flat-panel display to offer the graphic quality of active-matrix

LCD technology. The Model 460 features high contrast (60:1), 16.7 million colors, optional touch-screen and video capabilities, space-saving and ergonomic benefits, and a large screen for information-intensive applications. Only 3 in. deep, and with a wide variety of mounting possibilities, the PV460 makes it possible to present large amounts of information in almost any environment, even where space is at a premium. The display installs in just minutes, with no additional hardware or software required.

Information: Stuart Morgan, PixelVision, 43 Nagog Park, Acton, MA 01720. 508/264-9443, fax -9446.

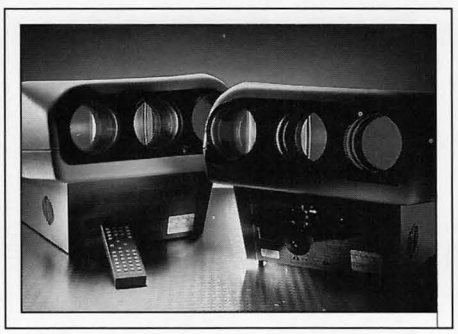


Circle no. 4

Re-engineered projectors

Electrohome Projection Systems, Kitchener, Ontario, Canada, has announced the re-engineering of its ECP series of video/data/graphics projectors, resulting in five new offerings. The ECP 2500, 3500, and 4500 projectors provide better price/performance, increased brightness, and reduced spot size. Their enhanced features include vertical scan rates of 45–120 Hz and autolock circuitry that automatically synchronizes to a wide range of signal timing; geometry circuits that correct top, bottom, and sides for flat, curved, or rear-screen applications; keystone circuitry that corrects images for angles up to ±15° vertically from the screen axis; and automatic source recall/interpolation that updates all set-up parameters when a new source is detected. The ECP 3501 and 4501 include a new ACON 3-minute automatic convergence and input module package option. In addition, all units, with the exception of the ECP 2500, are capable of resolving 1280 × 1024 pixels or 1020 screen lines. The ECP 2500 features a 15–50-kHz horizontal scan rate, 50-MHz bandwidth, 725-lum-peak light output, and has a suggested retail price of $9995. The ECP 3500 offers a 15–62-kHz horizontal scan rate, 60-MHz bandwidth, 725-lum-peak light output, upgraded system software, and is listed at $11,995 ($1000 less than the previous ECP 3100 list). The ECP 4500 offers a 15–90-kHz horizontal scan rate, 70-MHz bandwidth, 725-lum-peak output, upgraded software, and is listed for $18,995. The ECP 3501 includes all the features of the ECP 3500, plus an ACON 3-minute automatic convergence system and one additional source input of the buyer's choice, and is listed for $13,995. Likewise, the ECP 4501 includes all of the ECP 4500 features, plus the ACON system and one additional input, and lists for $20,995. When purchased separately as an upgrade after projector installation, ACON alone costs $1995 with no input module.

Information: Jeffrey Brum, Electrohome Ltd., Projection Systems, 809 Wellington St. N., Kitchener, Ontario, Canada N2G 4J6. 519/749-3144.

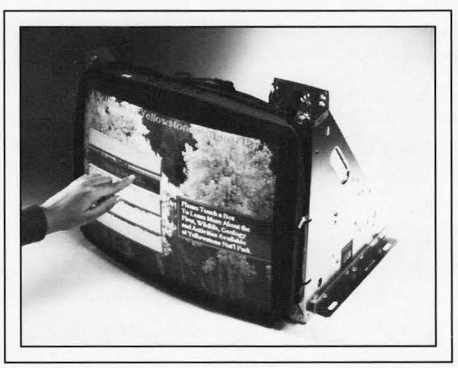


Circle no. 5

Kiosk touch monitor

MicroTouch Systems, Inc., Methuen, Massachusetts, has introduced the TruePoint Kiosk Touch Monitor, the first display that addresses the need for a large, low-cost, easy-to-integrate touch monitor for public computer kiosks. The TruePoint combines a 20-in. NTSC display, capable of running SVGA graphics, with a capacitive touch screen, and comes mounted in an open metal frame, making it easier to integrate the display into a kiosk housing. The monitor delivers an SVGA image at a savings of up to 50%, compared with a typical monitor of the same size, allowing cost-effective use of a large 20-in. display for non-text-intensive applications. With a touch resolution of 1024 × 1024, an 8–15-ms touch down speed, and all-glass construction, the TruePoint delivers high resolution, speed, optical clarity, and durability, all in one package. It features a horizontal scan frequency of 31.5 and 35.1 kHz, a vertical scan frequency of 56–70 Hz, and accepts power inputs from 90 to 264 Vac. The 20-in. TruePoint Kiosk Touch Monitor is available at a list price of $1495, with volume and dealer discounts available.

Information: Annette Petagna, MicroTouch Systems, Inc., 300 Griffin Park, Methuen, MA 01844. 508/659-9000, fax -9100.



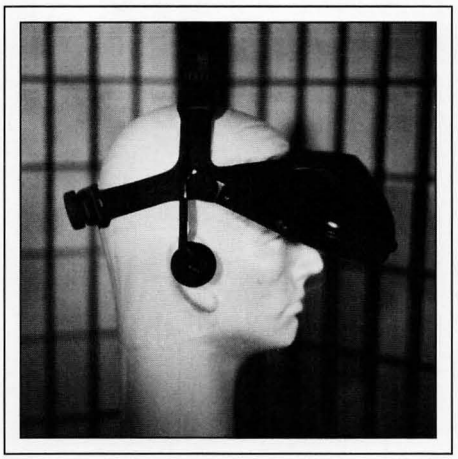
Circle no. 6

3-D stereoscopic HMD

RPI Advanced Technology Group, San Francisco, California, has begun shipment of the HMS-EYE2™, a low-cost, professional, robust, 3-D stereoscopic head-mounted display (HMD) that can be used with or without glasses. The HMD accepts any video source and offers instant on/off wearability; digital-grade earphones; pivot, focus, inter-pupil, bifocal, and head-comfort adjustments; robust shock resistance; and an avionics-grade headband with leather comfort pads. The HMS-EYE2™ comes with 110,300 pixels per eye, and upgrades to VGA are available. Prices start at $1895 for a full 3-D color stereoscopic unit. The Mouse-Sense3D™ accessory, a sourceless headtracker, unhooks to become a 3-D mouse or body-position tracker, and comes with a software utility to assist with

configuration to almost any game or application using a serial-port interface. The MouseSense3D™ pricing starts at $750.

Information: Kim Jordan, RPI Advanced Technology Group, P.O. Box 14607, San Francisco, CA 94114. 415/495-5671, fax -5124.



Circle no. 7

Multimedia projector

Proxima Corp., San Diego, California, has announced the Proxima 8400, a second-generation color multimedia LCD projector that produces crisp, bright images. Weighing just 29 lbs., the projector comes with a host of features, including a motorized zoom lens, integrated audio, and interactive control of software. The Proxima 8400's 2:1 zoom lens features a new coating process that improves light transmissivity. Its high-performance 190-W lamp is optimized for color temperature, resulting in brighter and more accurate color reproduction. It projects up to 16.4 million colors and has a brightness rating of 800 lux. The Proxima 8400 is compatible with all three international broadcast video standards, as well as SVHS. It features a three-LCD panel projection system, and incorporates a unique controller technology that automatically adjusts its scanning frequencies to accommodate the data rate from various computers. The Proxima 8400 is compatible with most popular microcomputers, and has a suggested retail price of $10,795.

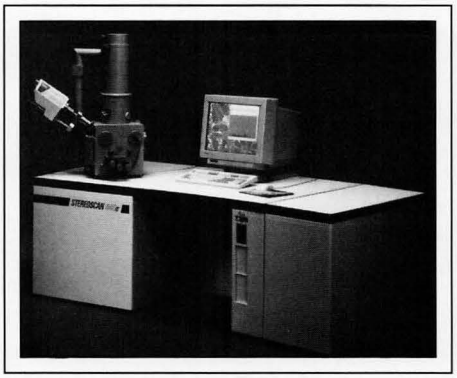
Information: George Wilson, Proxima Corp., 9440 Carroll Park Dr., San Diego, CA 92121-2298. 619/457-5500, ext. 246, fax -9647.

Circle no. 8

Choice in SEM x-ray systems

Leica, Inc., Deerfield, Illinois, has announced the Stereoscan S400σ Series of scanning electron microscopes (SEMs) that allow full integration of the Windows™-based Sigma x-ray-analysis system with any of the Stereoscan S400 Series SEMs. Recognizing the necessity for customers to choose an x-ray system for inclusion in the SEM/EDX package, Leica offers either the Oxford ISIS or Kevex Sigma, fully integrated. Like the Stereoscan S400i Series, the S400σ Series has functional as well as mechanical integration, and utilizes the S400 PC and peripherals.

Information: Pam Jandura, Leica, Inc., 111 Deer Lake Rd., Deerfield, IL 60015. 1-800-248-0123, fax 708/405-0030.

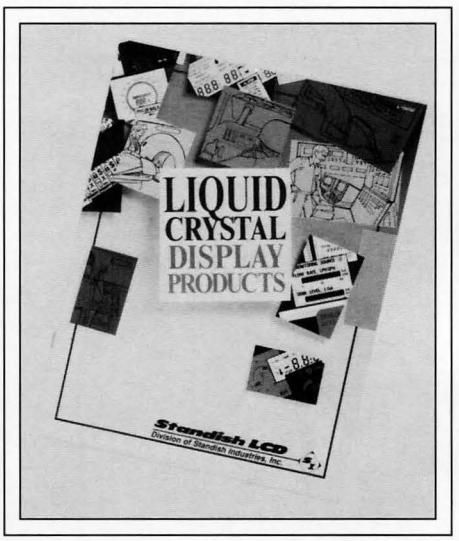


Circle no. 9

LCD products catalog

Standish LCD, a division of Standish Industries, Inc., Lake Mills, Wisconsin, has published a new 36-page four-color engineering-design catalog (No. A105153) that includes detailed specifications and extensive information on the company's custom and standard LCDs and LCD modules. Important design criteria are provided for drive methods, fluid characteristics, viewing modes, backlighting, and connection methods. The major types of LCDs are discussed, as well as Standish's newest LCD technology, enhanced super-twisted nematic (ESTN). Numerous examples of appearance options and color techniques are illustrated and explained, showing Standish's abilities to produce custom LCDs and LCD modules. Complete dimensional and operating information, pin-out assignment charts, and color and backlighting options are provided. Easy-to-complete design forms are included to assist the design engineer in preparing the appropriate application information for the development of specialized custom displays.

Information: Walter A. Bruenger, Standish LCD, W7514 Highway V, Lake Mills, WI 53551. 414/648-1000, fax -1001.



Circle no. 10

Multimedia monitor tubes

Philips Display Components, Eindhoven, The Netherlands, has introduced the M41EEM series of 17-in. high-brightness medium-resolution color monitor tubes designed to meet the demands of the rapidly expanding multimedia market. When combining text, graphics, and on-screen animation, multimedia monitors place more emphasis on screen brightness than on high resolution. This tradeoff requires monitor tubes with special properties. The M41EEM monitors provide bright images with resolutions up to 800 × 600 pixels, a mask pitch of 0.42 mm, a spe-

cially designed gun with improved focus performance, dual-mode operation, a maximum convergence error of 0.8 mm, and a line frequency up to 38 kHz, placing these tubes midway between domestic TV tubes and high-resolution color monitor tubes for data and graphic displays, both in terms of price and performance. The tubes are suitable for worldwide operation due to the use of internal magnetic shielding. They are supplied as a pre-aligned self-converging tube/coil assembly ready for installation into the monitor chassis. For inquiries, please refer to code DC-95-001.

Information: John den Holder, Marketing Communications, Philips Components, Bldg. BAE-1, P.O. Box 218, 5600 MD, Eindhoven, The Netherlands. 31-40-722832, fax 31-40-724547.

Circle no. 11

Inverters for CCFTs

Endicott Research Group, Endicott, New York, has introduced the ERG 8m Series of dc to ac inverters tailored to the specifications of individual flat-panel LCD assemblies, ensuring complete system compatibility as well as maximum LCD display life and reliability. The inverters are designed specifically to power cold-cathode fluorescent tubes (CCFTs), which are used in applications where the backlight is required to be on for long periods of time at high brightness. Less than 8 mm in height, these compact inverters offer a high efficiency rating (typically, 80–85%). Input voltages range from 5 to 24 Vdc, with custom input and output voltages available. Each part number in the ERG 8m Series is LCD-specific and tailored to match the manufacturer's specifications for driving the CCFT backlight. The inverters are available for LCD assemblies manufactured by Sharp, Hitachi, Toshiba, Seiko-Epson, Optrex, and others. Their configuration provides an extra control pin, allowing the inverter to be disabled and/or dimmed without the addition of extra components at the input. They also provide a flexible system interface and are notebook-display-head compatible. All ERG 8m Series inverters are manufactured in the U.S.A., with firm specifications, detailed application information, and full factory support. Pricing is $10.00 each in quantities of 5000. Delivery is 6–8 weeks ARO.

Information: Suzanne Thomas, Endicott Research Group, Inc., 2601 Wayne St., P.O. Box 269, Endicott, NY 13760. 607/754-9187, fax -9255.

Circle no. 12 ■

Please send new product releases or news items to Joan Gorman, Departments Editor, Information Display, c/o Palisades Institute for Research Services, Inc., 201 Varick Street, New York, NY 10014.

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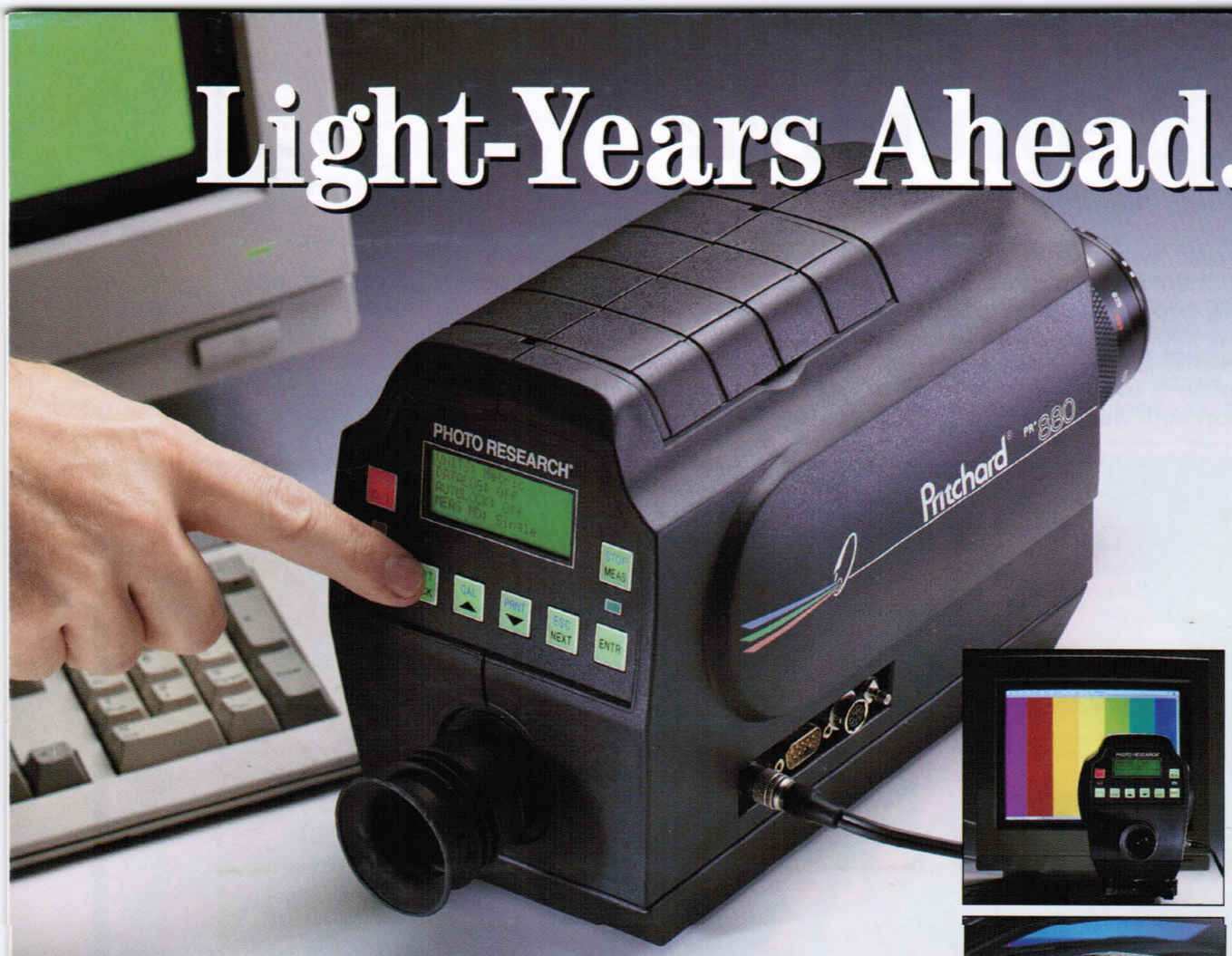

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