

SID 2000 SHOW ISSUE

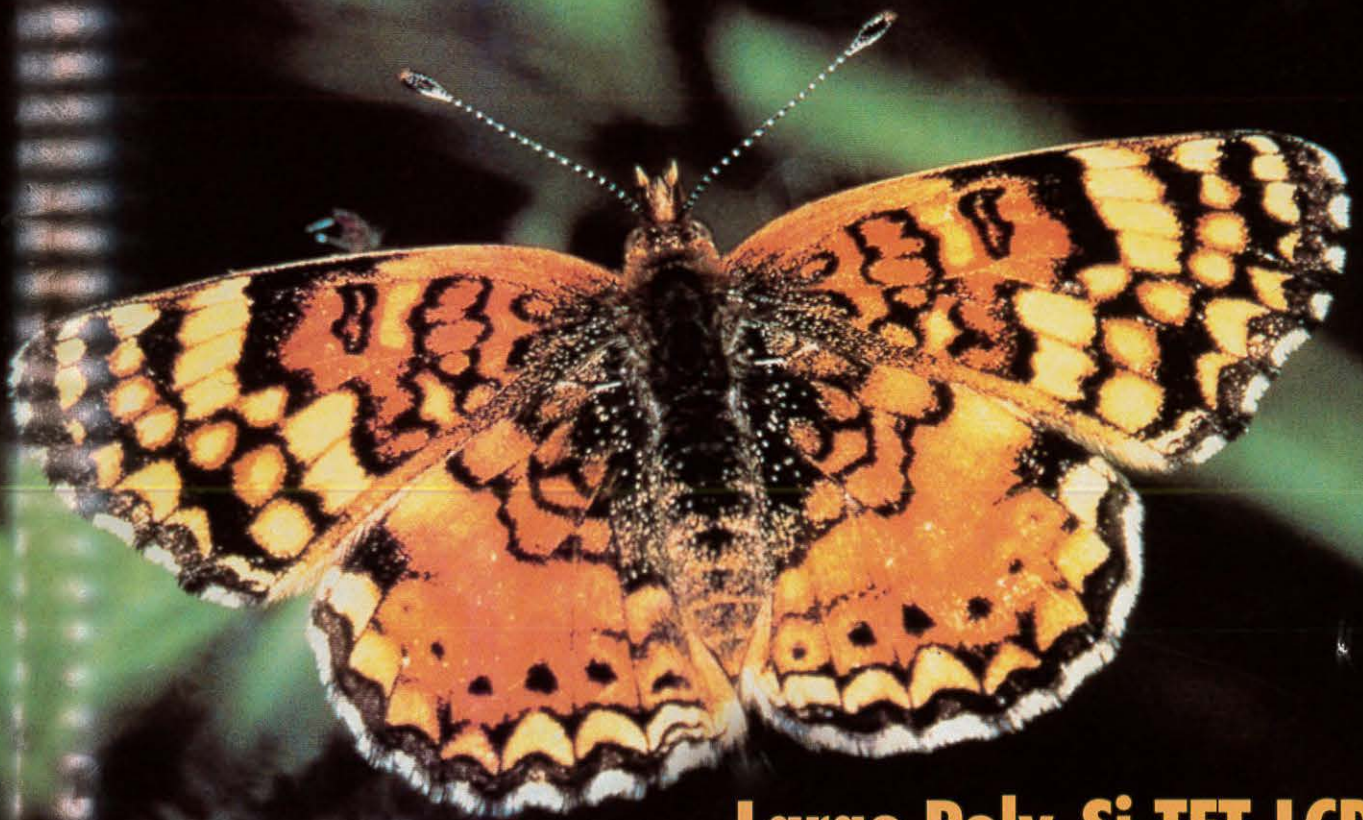
Information

April/May 2000

Vol. 16, No. 4/5

DISPLAY  
SID

Official Monthly Publication of the Society for Information Display



**Large Poly-Si TFT-LCDs  
Now Available to OEMs**

- **SID 2000 Products on Display**
- **FED Life and Reliability**
- **Low-Temp Poly-Si TFT-LCDs**
- **Military Integration of a COTS AMLCD**
- **IDW and SMAU Reports**

The world  
plans, navigates,  
measures, monitors,  
plays, fishes,  
communicates,  
computes  
and  
displays with  
**Optrex** LCDs

And that's just the beginning.

The applications for LCDs keep growing and so does Optrex. Why? Innovative engineering and design support, exceptional quality, and a nationwide distribution network. Our creative design approach allows you to develop new applications and enhance the performance of your existing products. Most importantly, it allows **you** to create the custom or semi-custom LCDs that

**turn your bright ideas into reality.**

Our customers like that. You will, too.

For more information, call (734) 416-8500, or fax (734) 416-8520 today.

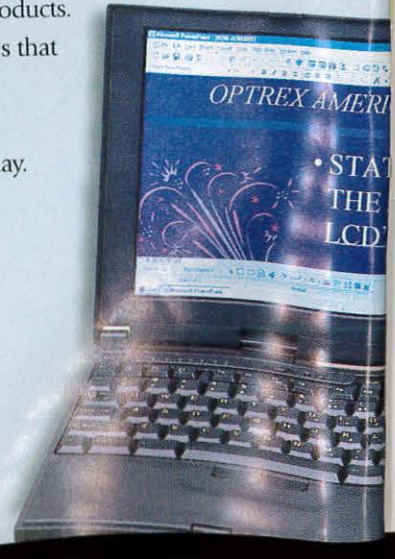
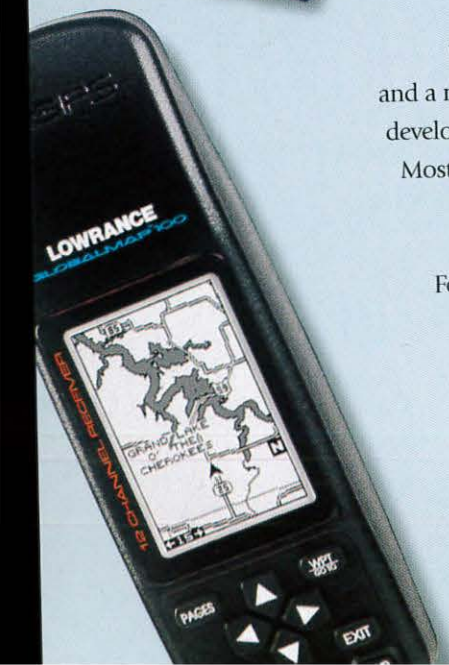
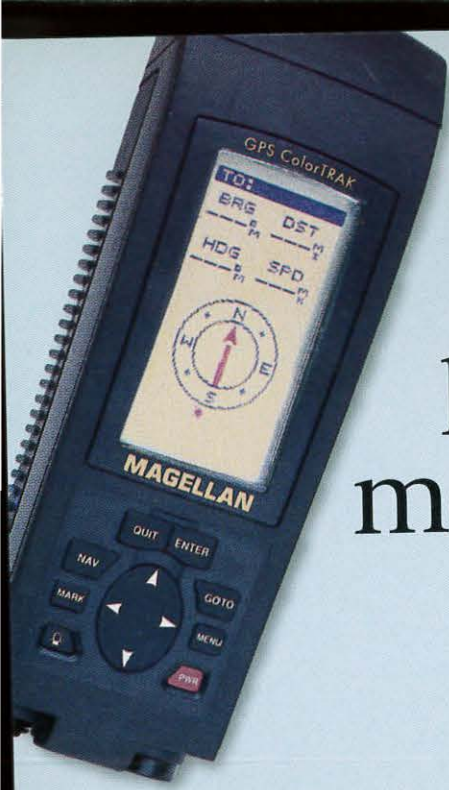


**OPTREX**  
AMERICA, INC.

44160 PLYMOUTH OAKS BLVD. • PLYMOUTH, MI 48170  
(734) 416-8500 • FAX: (734) 416-8520  
lcdinfo@optrexusa.com

See Us at SID '00 Booth 309

Circle no. 53



*COVER: This Toshiba 6.3-in. XGA low-temperature-polysilicon (LTPS) TFT-LCD – with a pixel density of 202 pixels/in. – is displaying a photographic image of a Monarch butterfly. The photo is not a composite and has not been retouched.*



Toshiba Corp.

For more on what's coming in *Information Display*, and for other news on information-display technology, check the SID Web site on the World Wide Web: <http://www.sid.org>.

## Next Month in *Information Display*

### CRT Issue

- Using FEAs as CRT Cathodes
- Printable Large-Area FEDs
- Displays and Computer Entertainment
- Image-Quality Metrics
- Color Conference Review

INFORMATION DISPLAY (ISSN 0362-0972) is published eleven times a year for the Society for Information Display by Palisades Institute for Research Services, Inc., 411 Lafayette Street, 2nd Floor, New York, NY 10003; Leonard H. Klein, President and CEO. EDITORIAL AND BUSINESS OFFICES: Jay Morreale, Managing Editor, Palisades Institute for Research Services, Inc., 411 Lafayette Street, 2nd Floor, New York, NY 10003; telephone 212/460-9700. Send manuscripts to the attention of the Editor, ID, Director of Sales: Michele Klein, Palisades Institute for Research Services, Inc., 411 Lafayette Street, 2nd Floor, New York, NY 10003; 212/460-9700. SID HEADQUARTERS, for correspondence on subscriptions and membership: Society for Information Display, 31 East Julian Street, San Jose, CA 95112; telephone 408/977-1013, fax -1531. SUBSCRIPTIONS: Information Display is distributed without charge to those qualified and to SID members as a benefit of membership (annual dues \$75.00). Subscriptions to others: U.S. & Canada: \$36.00 one year, \$7.50 single copy; elsewhere: \$72.00 one year, \$7.50 single copy. PRINTED by Sheridan Printing Company, Alpha, NJ 08865. Third-class postage paid at Easton, PA. PERMISSIONS: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limits of the U.S. copyright law for private use of patrons, providing a fee of \$2.00 per article is paid to the Copyright Clearance Center, 21 Congress Street, Salem, MA 01970 (reference serial code 0362-0972/00/\$1.00 + \$0.00). Instructors are permitted to photocopy isolated articles for noncommercial classroom use without fee. This permission does not apply to any special reports or lists published in this magazine. For other copying, reprint or republication permission, write to Society for Information Display, 31 East Julian Street, San Jose, CA 95112. Copyright © 2000 Society for Information Display. All rights reserved.

## 2 Editorial

*The Next Big Thing*

*Kenneth I. Werner*

## 4 A View from the Hill

*There's Something New and Different Here ...*

*Aris Silzars*

## 14 Toshiba's Low-Temperature-Polysilicon TFT-LCDs

*LTPS offers an impressive array of advantages for medium- and large-format TFT-LCDs – which are now available to OEMs in quantity.*

*Steven Vrablik*

## 24 Integrating Commercial Flat-Panel Displays for Military Applications

*A proven design procedure and a core set of inviolable value-adding enhancements enabled BAE SYSTEMS to successfully implement the military integration of a COTS AMLCD.*

*Anthony De Lorenzo, Richard Librandi, and Nathaniel Rothman*

## 34 FED Life and Reliability

*Candescent's display life and reliability research has produced improvements in design and manufacturing – and values that are approaching those needed for mainstream consumer products.*

*George Hopple and Chris Curtin*

## 44 SMAU '99, Milan, Italy

*Italian design, display products not seen outside Italy, and a full menu of international offerings makes Europe's second-largest IT trade fair a unique event.*

*Bryan Norris*

## 54 Sixth International Display Workshops

*In the old castle town of Sendai in northern Japan, IDW attendees learned of an explosion in plastic-substrate development and imminent FED commercialization in Taiwan.*

*Ken Werner*

## 66 Products on Display at SID 2000

*Some of the products on display at SID's largest exhibition ever are previewed.*

*The Editorial Staff*

## 91 Calendar of Display-Related Events

## 100 Index to Advertisers

## 100 Sustaining Members



### The Next Big Thing

We are once again on the brink of a new SID International Symposium. While assessing the international display industry is a year-round activity, the SID International Symposium – being held this year May 14–19 in Long Beach, California – offers a unique opportunity to take the industry’s pulse, view current technology, and get more than a small peak into the future. (For a preview, please see “Products on Display at SID 2000” in this issue.)

But what kind of broad-brush speculations can we make about the future of display technology before the abundance of papers and hardware at SID 2000 draws us too deeply into the concrete and specific. Such speculation is worthwhile because, if we look only at specifics, we will only spot “the next big thing” after it is speeding toward us like one of Nolan Ryan’s fastballs. But if we step back, we may at least be able to predict which side of the rubber the ball will come from.

First, we have a pretty good idea of what displays look like: there are emissive and non-emissive direct-view flat panels, there are CRTs for direct view and projection, and there are transmissive and reflective imagers for front and rear projectors. The last two big flat-panel “things” were FEDs and OLEDs.

A FED is essentially a thin CRT with a more-or-less flat cold cathode. It was made possible by an excellent understanding of the physics of field emission and the development of precision processing to create the cathode. The bloom, at least temporarily, is off the FED rose because rapidly falling AMLCD prices invalidated initial business models and because life and reliability issues raised their ugly heads when attempts were made to scale-up manufacturing (but see the article in this issue documenting impressive life and reliability improvements).

OLEDs are the current big flat-panel thing because organic phosphors promise high efficiency along with economical fabrication of large displays, and the technology is enjoying extremely rapid development. The pace of the development is being limited (to this still-rapid rate) by the need to develop and characterize better OLED materials and the need to develop active-matrix driving schemes for large panels that are not too power-hungry.

The enabler for FEDs was the ability to process Spindt tips for the cathodes. The impediment was making the transition from R&D to mass production. The enablers for OLEDs were materials development and easy processing. Materials and processes: one or both are almost certain to be at the heart of the next big thing, at least if flat panels are involved.

FEDs and OLEDs were both based on partially new electro-optical mechanisms. But there are other ways to blaze interesting new pathways. LCoS microdisplays and polysilicon TFT-LCDs are both LCDs. Materials and processing are essential to both, but what makes these approaches particularly interesting is that they embody new approaches to system partitioning and packaging.

Alien Technology, as reported previously in *ID*, is working on a scheme to fabricate pixel switches in single-crystal-silicon chips molded in NanoBlocks™, which would be floated in a suspending liquid for deposition into matching

## Information DISPLAY

**Editor:** Kenneth I. Werner  
**Managing Editor:** Jay Morreale  
**Administrative Editor:** Dian Mecca  
**Administrative Assistant:** Ralph Nadell  
**Contributing Editors:** Aris Silzars, Bryan Norris, Chuck McLaughlin, Joe Hallett, Alfred Poor  
**Advertising Manager:** Jay Morreale  
**Sales Manager:** Tracy Leibowitz

### Regional Associate Editors

Allan Kmetz (**Americas**)  
*Lucent Technologies*  
*Liberty Corner, New Jersey*  
 Shigeo Mikoshiba (**Asia**)  
*University of Electro-Communications*  
*Tokyo, Japan*  
 Alan Mosley (**Europe**)  
*Central Research Laboratories*  
*Hayes, Middlesex, U.K.*

### Advisory Editors

Carl Machover  
*Machover Associates*  
*White Plains, New York*  
 Alan Sobel  
*Consultant*  
*Evanston, Illinois*  
 Webster E. Howard  
*eMagin Corp.*  
*Hopewell Junction, New York*  
 Ernst Lueder  
*University of Stuttgart*  
*Stuttgart Germany*  
 Sungkyoo Lim  
*Information Display Research Center.*  
*Choongnam, Korea*

The opinions expressed in editorials, columns, and feature articles do not necessarily reflect the opinions of the editor or publisher of *Information Display Magazine*, nor do they necessarily reflect the position of the Society for Information Display.

*continued on page 94*

# The Evolution of Powerful Video Generators Continues!

*The Digital Video Generator for Digital CRT's and High-End FPD's*

## **ASTRO VG-852**

Do you engineer or evaluate high-end FPD's and/or interface circuits for Digital CRT's? The VG-852 provides the high speed signals through LVDS, TMDS (Panel Link) and parallel outputs (24 or 48 bits/pixel) via DVI and other standard connectors.

- ▼ 130 MHz/260 MHz dot clock per channel
- ▼ Fully DDC-compatible
- ▼ Bitmap operation supported
- ▼ Operated/Programmed from Frontpanel or PC
- ▼ Most flexible through simultaneous parallel and serial outputs

*Standalone Digital units from \$4000*



**DIGITAL . STANDALONE . DIGITAL . STANDALONE . DIGITAL . STANDALONE**

*Best 400 MHz Performance at the Lowest Price*

## **ASTRO VG-844**

Use your PC to program and a Remote Box to control/operate this brand new High Performance Video Generator. It even offers HDTV/Y-P<sub>B</sub>-P<sub>R</sub> compatibility. You will love its easy operation!

- ▼ 400 MHz dot clock
- ▼ 850 Programmable timing/pattern combos
- ▼ 150 Fixed timing/pattern combos
- ▼ Ideal for HDTV-manufacturing
- ▼ Ideal for any High Resolution Monitor

*Standalone Analog units from \$2,950*

**ANALOG . STANDALONE . ANALOG . STANDALONE . ANALOG . STANDALONE**

Contact us today!

[www.team-systems.com](http://www.team-systems.com)

1-800-338-1981

[info@team-systems.com](mailto:info@team-systems.com)

See Us at SID '00 Booth 221

Circle no. 54

*Team Systems...The Smart Choice!*

**TEAM**  
systems



### There's Something New and Different Here ...

by Aris Silzars

Perhaps some of you will remember that six years ago you elected me to be the Secretary of SID. Then, four years ago, you decided that I should become your Treasurer. Two years later, the nominating committee asked, I agreed, and you concurred that I should be the next President-Elect. Finally, one year ago, you were asked to re-confirm your earlier decision that starting in May 2000 I would, in fact, get the opportunity to serve as your President.

It is now May 2000 and I have been told that the time has come for me to act more "Presidential" — hinting, I suppose, that the column I have been writing in this space for the last seven and one-half years wasn't quite presidential enough. So we have decided that I will continue to do a monthly column, but with an emphasis on those people, management, and technology issues that can contribute to the increased effectiveness of SID and to enhancing the building of those relationships that provide value to all of us as members of this society. Can I do this and still keep the column interesting? There's only one way to find out. Let's begin.

To get you into the proper frame of mind for what is likely to come over the next year or two in these new-style columns, let us open the discussion by considering why the functioning of groups such as the SID is going to be of ever-growing worldwide importance in the 21st century. You may wish to view this as creating the vision for a "grand cathedral" that we intend to build.

Since the days of cave dwellers, control of land and natural resources has been the primary path to growth and survival. Those who controlled the most territory, had the greatest abundance of critical materials, and could most effectively exploit the people inhabiting their fiefdoms were the most powerful and richest. It was only in the last few centuries of the second millennium that a few groups of people found they could do even better if everyone participated in and shared more equitably in the creation of wealth. However, these people groupings were associated with certain land masses with well-defined borders — called countries, kingdoms, or states — and they continue to be.

Toward the end of the second millennium, some of the wiser countries realized that such government-imposed boundaries were an unnecessary impediment to economic growth. They took a bold step and removed the border-control points and began to allow for the free movement of people and goods. Some others had to overcome more difficult challenges because their barriers had been so severe. Yet, in spite of that, they made great strides in learning how to become more comfortable as "citizens of the world." A few laggards continued in their stubborn and old-fashioned ways of tightly controlling the activities of their inhabitants and even trying to expand their influence by the use of military force.

In the meantime (about one hundred and sixty years ago), we technologists gave birth to electronic communications. First there was the telegraph, then the telephone, then radio, and then television. Worldwide communications grew from radio, to transoceanic telephone cables, to communications satellites, to long-distance fiber-optic links. Then came computers, the Internet, the World

*continued on page 92*

#### SID Executive Committee

President: A. Silzars  
President-Elect: A. R. Kmetz  
Regional VP, Americas: J. Larimer  
Regional VP, Asia: A. Iwamoto  
Regional VP, Europe: A. Van Calster  
Treasurer: R. L. Wisnieff  
Secretary: S. Mikoshiba  
Past President: A. C. Lowe

#### Directors

Bay Area: J. Larimer  
Beijing: S. Ding  
Belarus: A. Smirnov  
Canada: T. Schmidt  
Delaware Valley: J. W. Parker III  
France: F. Maurice  
Greater Dayton: R. Holmes  
Hong Kong: C. C. Chang  
Japan: S. Mikoshiba  
Korea: M. Oh  
Los Angeles: P. Baron  
Metropolitan Detroit: V. Cannella  
Mid-Atlantic: D. Ketchum  
Mid-Europe: D. Theis  
Minneapolis/St. Paul: V. Born  
New England: W. Hamilton  
Pacific Northwest: J. Rupp  
Russia: M. Tomilin  
San Diego: R. Ruff  
Southwest: R. Seery  
Taipei: F. C. Luo  
Texas: Z. Yaniv  
U.K. & Ireland: A. Mosley  
Ukraine: V. Nazarenko

#### Committee Chairs

Academic: C. J. Summers  
Archives/Historian: R. C. Knepper  
Bylaws: C. Infante  
Chapter Formation: H. Uchiike  
Communications: J. Rupp  
Convention: P. M. Heyman  
Definitions & Standards: R. Miller  
Honors & Awards: A. I. Lakatos  
Long-Range Planning: A. Lowe  
Membership: J. W. Parker  
Nominations: W. E. Howard  
Publications: A. Silzars

#### Chapter Chairs

Bay Area: N. Balram  
Beijing: H. C. Hu  
Belarus: E. Kaloshkin  
Canada: A. Kitai  
Delaware Valley: L. Bryner  
France: R. Meyer  
Greater Dayton: J. Byrd  
Hong Kong: H. S. Kwok  
Japan: M. Maeda  
Korea: M. Han  
Los Angeles: M. Kesselman  
Metropolitan Detroit: S. Pala  
Mid-Atlantic: A. Ghosh  
Mid-Europe: D. Theis  
Minneapolis/St. Paul: H. Holec  
New England: S. Atwood  
Pacific Northwest: T. Yuzuriha  
Russia: S. Darevsky  
San Diego: A. Wilson  
Southwest: J. O'Donnell  
Taipei: H.-P. D. Shieh  
Texas: R. Fink  
U.K. & Ireland: C. Williams  
Ukraine: V. Sorokin

#### Office Administration

Executive Director: Dee Dumont  
Executive Assistant: Jenny Needham

#### Society for Information Display

31 East Julian Street  
San Jose, CA 95112  
408/977-1013; fax -1531  
e-mail: office@sid.org  
http://www.sid.org

# SPEED THRILLS



**BUCKLE UP!  
THE WORLD'S FASTEST  
DVI VIDEO SIGNAL GENERATOR  
IS NOW AVAILABLE:**

**330 MHz DVI DIGITAL  
PLUS 360 MHz ANALOG**

**CALL FOR A TEST DRIVE TODAY.**



The Art of Technology

**QUANTUMDATA**

2111 Big Timber Road, Elgin, IL 60123  
Phone: 847.888.0450 Fax: 847.888.2802  
Website: <http://www.quantumdata.com>  
E-mail: [sales@quantumdata.com](mailto:sales@quantumdata.com)

See Us at SID '00 Booth 101

Circle no. 55

# CRT Monitor Video Channels in Unique High Integration Chipset

National's LM1253A & LM2453 Chipset Simplifies Design, Eliminates Up to 60 Parts From the Neckboard and Reduces Time to Market

**Chipset Integrates:**

- OSD Generator
- 12C Preamp
- Monolithic Triple CRT Driver
- Bias Clamp
- G1 Blanking

**LM1253A Features:**

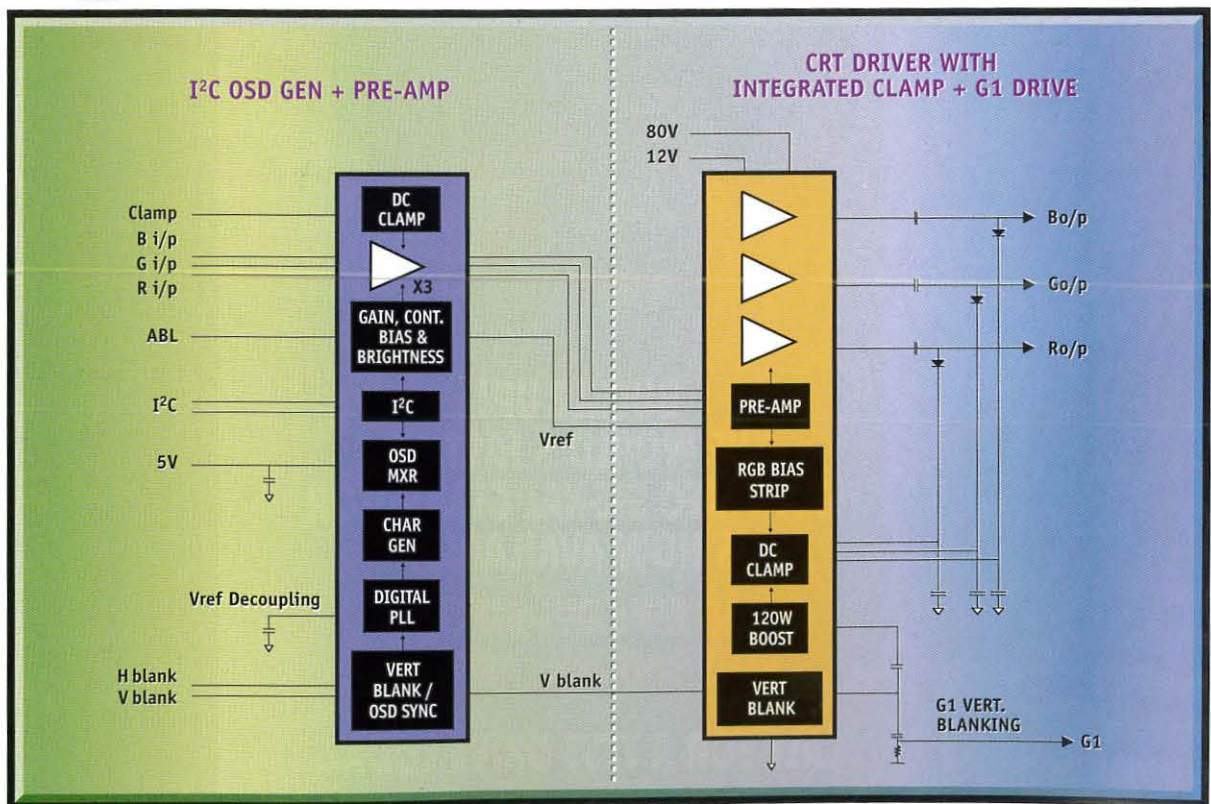
- 180MHz Preamp
- OSD 190 2-Color & 64 4-Color ROM Based Character Fonts
- OSD Programmable Up to 512 Characters

**LM2453 Features:**

- 6ns AC Coupled CRT Driver
- Low Power
- Integrated Clamp
- Integrated Boost Supply/ G1 Drive



Unique Architecture Permits Ideal Partitioning by Process Technology



© 2000 National Semiconductor Corporation. National Semiconductor and are registered trademarks of National Semiconductor Corporation. All rights reserved.

For Complete System Architecture Specifications and a Free CRT Monitor Technology CD-ROM:  
[www.monitorchipset.national.com](http://www.monitorchipset.national.com) 1-800-272-9959





# Show Your Colors

Red. Green. Blue. Amber. You choose and Three-Five Systems will provide your display solution in virtually any color. LCD™ (Liquid Crystal Intense Display) technology is designed to give you every advantage of an LED or VF display, but is viewable in all lighting conditions, including direct sunlight. This cost effective LCD technology has the highest contrast ratio in the industry, low power requirements and can fit the need for a wide variety of consumer and industrial applications.

For over a decade, Three-Five Systems has been a leading supplier of display solutions and is known for innovative solutions to tough display challenges. Three-Five Systems can revolutionize your products and your business. If a splash of color is what you need, please contact us.



**THREE-FIVE SYSTEMS, INC.™**

*We Display Excellence*

Three-Five Systems, Inc.  
Tempe • 602-389-8600 Fax: 602-389-8801

See Us at SID '00 Booth 901

Three-Five Systems Ltd.  
Europe • 44-1793-549100 Fax: 44-1793-549135

Circle no. 57

Three-Five Systems, Inc.  
[www.threefive.com](http://www.threefive.com) email: [Display@threefive.com](mailto:Display@threefive.com)

Whether the enemy  
is harsh sunlight or  
a hazardous work  
environment...

Your display will work better  
with HEA® Protect™ from OCLI



**Rugged Notebooks • Industrial Flat Panel Displays • Flat Panel Desktop Monitors**

When it comes to displays, two things matter. The image has to look good in many types of light and the display itself has to be rugged enough to withstand harsh work environments. OCLI's HEA® Protect™ reduces glare and reflection and adds ruggedness on all types of displays. So if you want to improve image quality and protect your valuable display, you need HEA® Protect™ from OCLI, the leader in optical thin film coatings.



**Sales Offices:**

**USA:** phone (707) 525-6957 fax (707) 525-7841 • **EUROPE (Scotland):** phone (44) 1383-823631 fax (44) 1383-824287

**ASIA (Japan):** phone (81) 42 739-3561 fax (81) 42 720-5211

**www.qli.com**

© 2000, Optical Coating Laboratory, Inc. All rights reserved. HEA® is a registered trademark of Optical Coating Laboratory, Inc.

See Us at SID '00 Booth 909

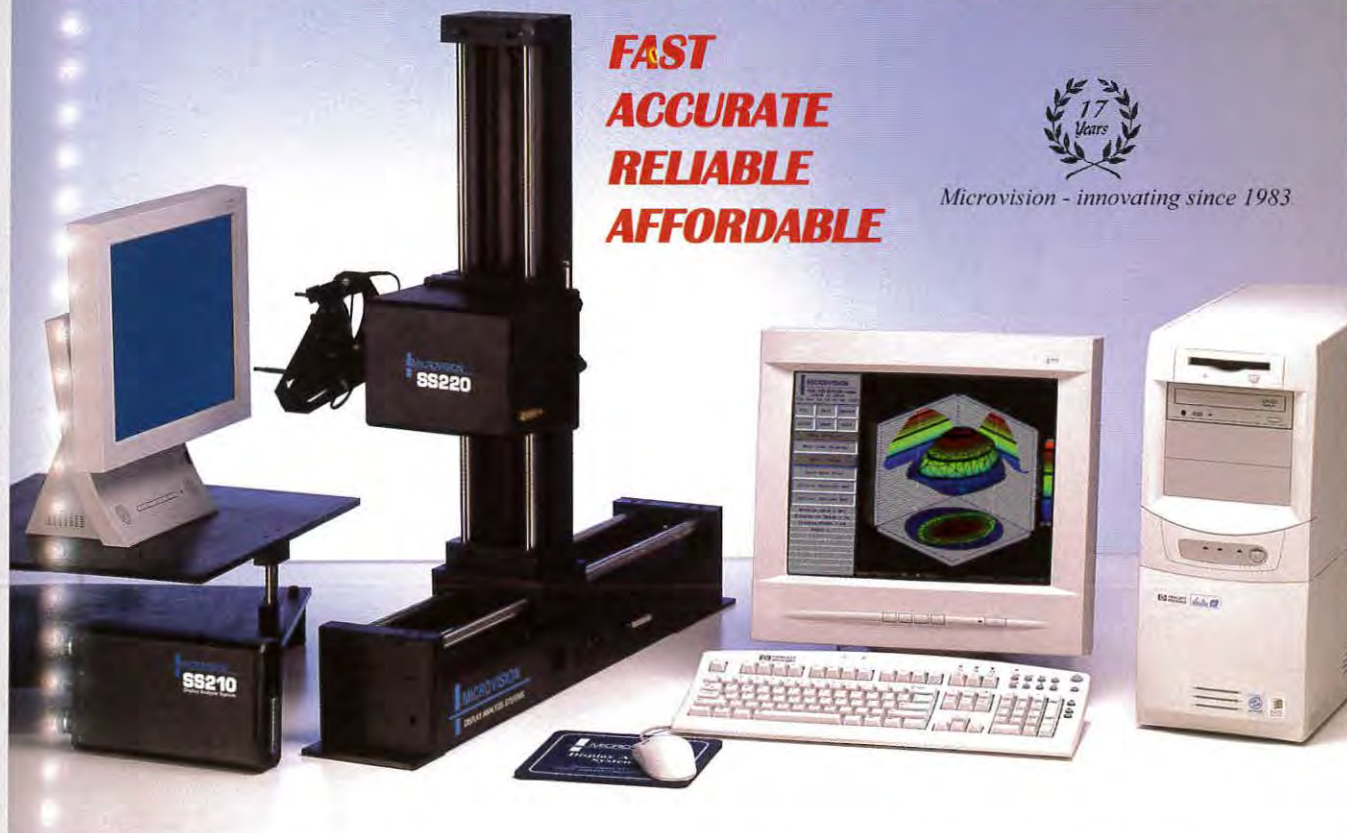
Circle no. 58

# SS200 SERIES DISPLAY ANALYSIS SYSTEMS

**FAST  
ACCURATE  
RELIABLE  
AFFORDABLE**



*Microvision - innovating since 1983*



Microvision's SS200 series of display analysis equipment allows you to precisely, automatically and quickly measure display performance. And with many test laboratories currently using the SS200 series as their standard test system, shouldn't you?

The SS200 series includes the SS210, SS220 and SS230 systems. Each system allows for modular field upgrades for increased functionality - Buy what you need, when you need it! Each system may be used on any display type from CRTs & FPD to projection, cockpit and microdisplays. The familiar *Windows*-based GUI makes the equipment easy to use and personalize. All versions come with the time tested Spotseeker five-axis positioning stage integrated into all test sequences. Each system is a complete turnkey system with a computer, 5-axis positioner, monitor, software, spectrometer, and camera system. For automatic testing to ISO, VESA, NIDL & TCO specifications, or comprehensive analysis for engineering and quality control requirements, the SS200 series has the system for you!

## **SS210 System:**

The SS210 package has a CCD camera to provide spatial measurements such as Line Width and MTF. It includes an integrated spectrometer for spectral analysis and color measurements and also includes an optional response time measurement capability.

## **SS220 System:**

The SS220 system is the perfect choice for flat panel testing. It features spectrometer-based, off-axis measurements, color analysis, contrast ratio and luminance testing.

## **SS230 System:**

The SS230 (pictured above) is a combination of the SS210 & SS220 system, resulting in the most comprehensive test system available. All tests are performed at NIST traceable accuracy.

**Used by Test  
Laboratories  
Worldwide**

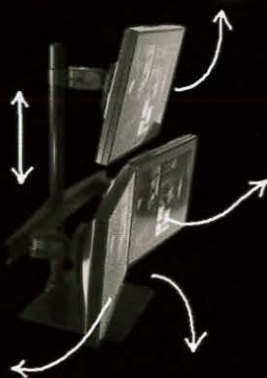
**MICROVISION**

*Dedicated to the Needs of the Display Industry*

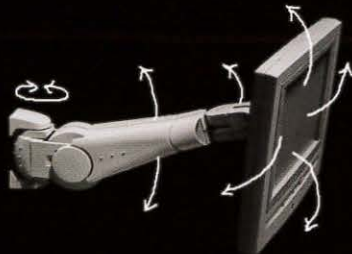
550 High Street, Auburn, CA 95603 USA  
Tel: (530) 888-8344 \* Toll Free: (800) 931-3188  
Fax: (530) 888-8349 \* Email: [info@microvsn.com](mailto:info@microvsn.com)  
Web site: [www.microvsn.com](http://www.microvsn.com)

International Representatives:  
Japan - ARGO CORP., 06 339 3366  
Taiwan - SUPERLINK TECH., 886 2 2698 3456  
Korea - B & P INT'L, 02 546 1457  
China - HUADONG, 86 25 5319677

# Mount Any Monitor Anywhere!

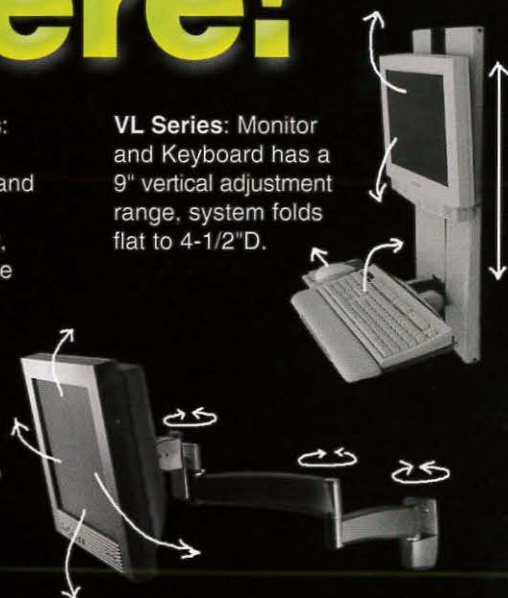


**DS 100 Series:** Suspend up to four monitors on a single stand.



**400 Series:** Provides horizontal and vertical adjustment, full tilt/rotate capability.

**200 Series:** Telescopes up to 20", full tilt/rotate capability, attaches to virtually any vertical or horizontal surface.



**VL Series:** Monitor and Keyboard has a 9" vertical adjustment range, system folds flat to 4-1/2"D.

## Ergotron® ARMS™



### Specialty Mounting For Flat Panel Monitors



Flat panel monitors compliant with the VESA® FPMPI™ Standard are Ergotron ARMS Compatible; this means your monitor will easily attach to an Ergotron ARMS product.

Contact Dan Hallberg, 651-681-7659, for more information or to discuss OEM and Reseller relationships.



[www.ergotron.com](http://www.ergotron.com)  
800-888-8458

# Once You've set the Standard

## There is nothing left but to

# RAISE IT

Unprecedented Sensitivity, Accuracy & Resolution



**PHOTO RESEARCH, INC.**

The Experts in Light and Color

While others have sought to equal our Video Photometers, Photo Research has lifted the standard once again. Introducing the PR-920 Digital Video Photometer (DVP). The PR-920 is designed to measure, test and inspect high-resolution CRTs and flat panel displays in automotive, aerospace, computer and commercial applications. It defines a new state of the art in three mission-critical areas:

**SENSITIVITY**

An advanced thermoelectrically cooled detector guarantees the utmost in both sensitivity and precision. The PR-920 measures extremely low light levels with high precision.

**ACCURACY**

The PR-920 is a photometrically corrected digital photometer. Regardless of the special power distribution of the source, the PR-920 provides exceptional luminance accuracy, without special calibrations.

**RESOLUTION**

The PR-920 delivers a dramatic increase in resolution and dynamic range. Its cooled digital camera incorporates a remarkable industry-leading 1024 x 1024 CCD with 14-bit resolution.

The PR-920 is the new standard by which other video photometers will be judged.

**Call Today for More Information:**

USA: 818-341-5151 Ext. 1

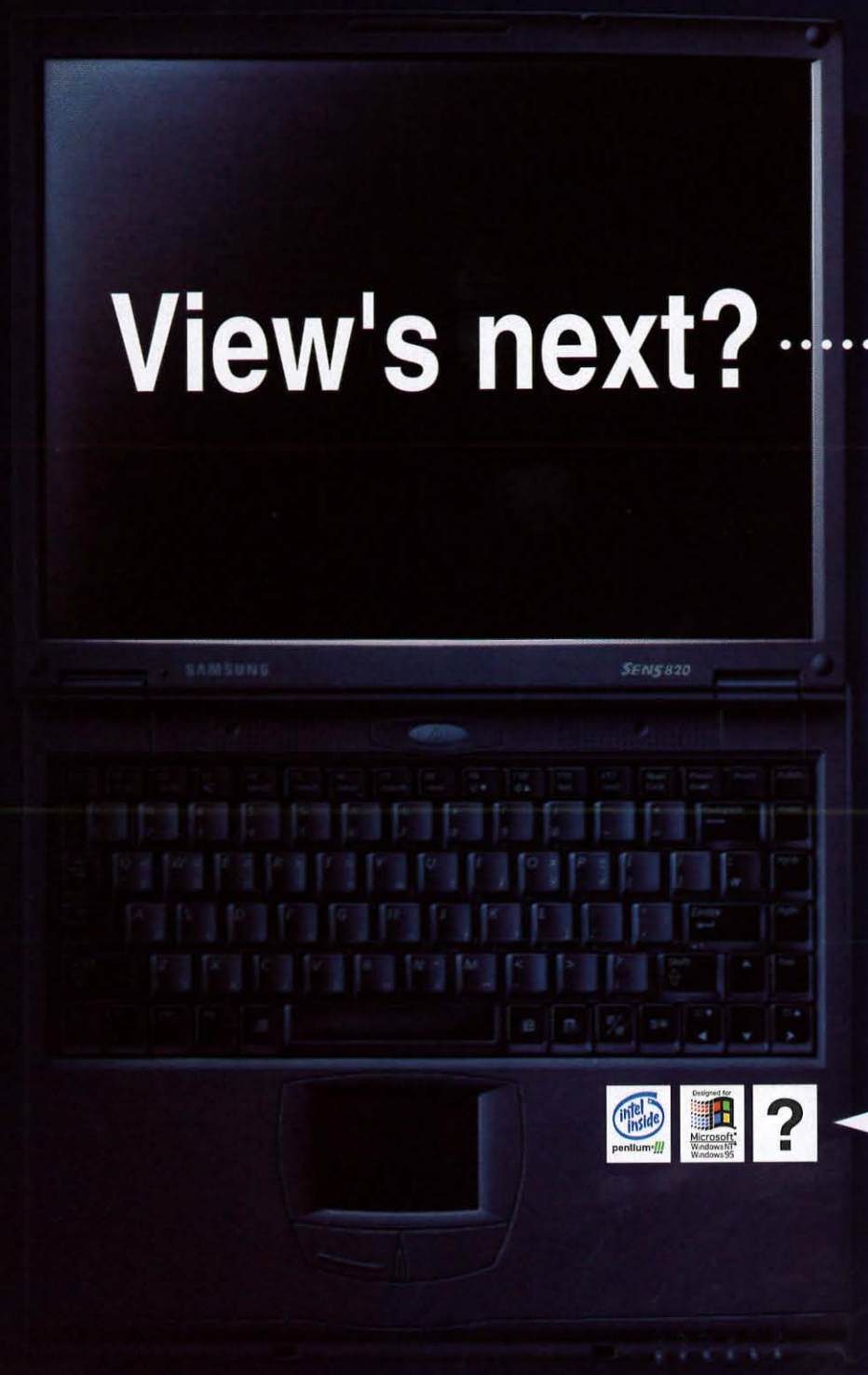
E-mail at [sales@photoresearch.com](mailto:sales@photoresearch.com) or visit [www.photoresearch.com](http://www.photoresearch.com)

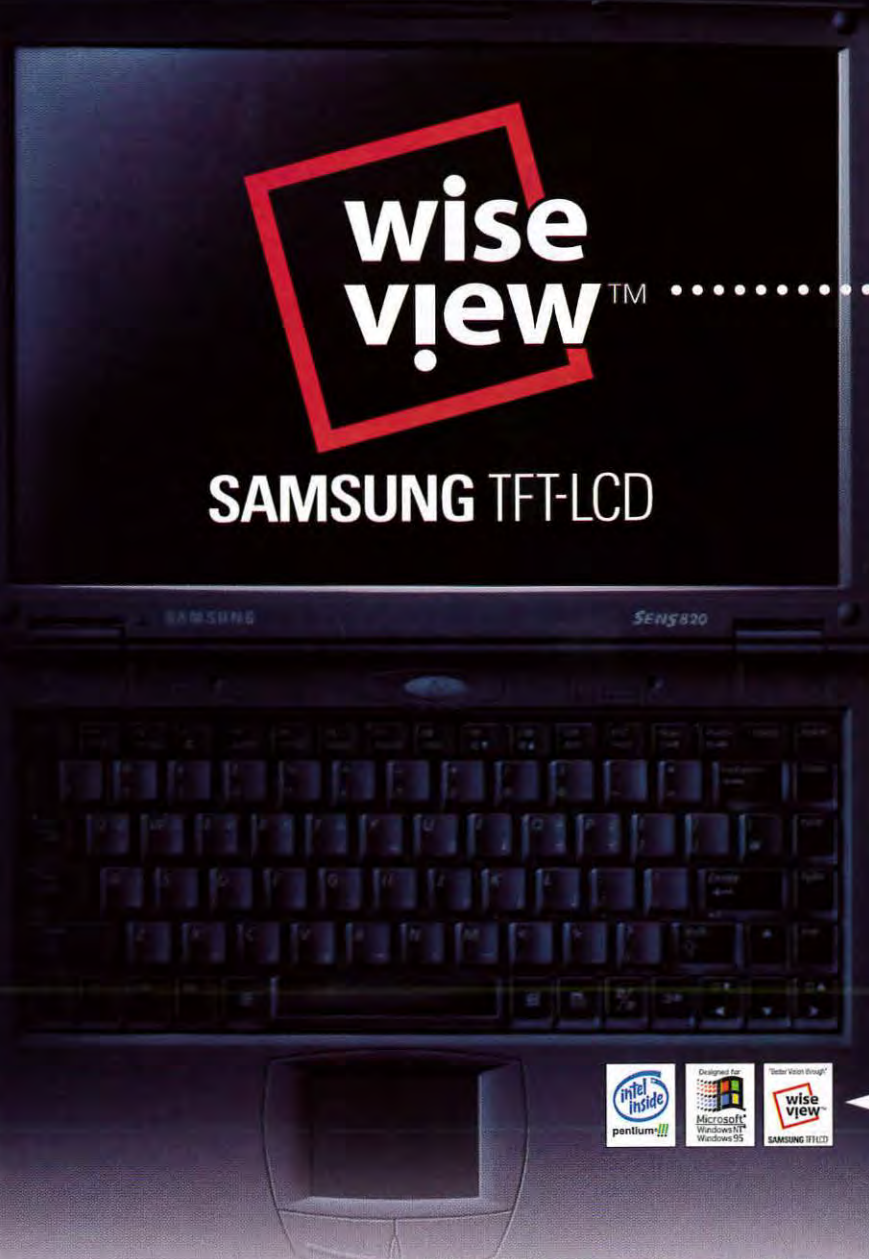
Photo Research Inc. ♦ 9731 Topanga Canyon Place ♦ Chatsworth ♦ CA ♦ 91311 - 4135

See Us at SID '00 Booth 201

Circle no. 61

# View's next?





## The new name of SAMSUNG TFT-LCD

When comparing notebook PCs and LCD displays, there's a new logo you should look for besides Intel Inside®, Certified for Windows®, and TCO 99. Introducing WiseView™, the new brand name for Samsung LCD modules. And a symbol of quality from the world's No. 1 TFT-LCD maker that ensures you're getting the very best view available. Samsung WiseView™ TFT-LCD

- Worldwide best product.
- Intelligent circuit design with state-of-the-art technologies.
- Slim and simple design for easy product engineering.
- Eye-catching images that are among the sharpest and truest available.



Wiseview is a trademark owned by Samsung Electronics Co. Ltd;  
Intel, the Intel Inside logo, and related Intel names and logos are trademarks of and otherwise owned by Intel Corporation;  
Microsoft, Microsoft Windows, and related Microsoft names and logos are trademarks of and otherwise owned by Microsoft Corporation.

**SAMSUNG**  
ELECTRONICS  
www.samsungTFTLCD.com

Circle no. 62

See Us at SID '00 Booth 731

# Toshiba's Low-Temperature-Polysilicon TFT-LCDs

*LTPS offers an impressive array of advantages for medium- and large-format TFT-LCDs – which are now available to OEMs in quantity.*

by Steven Vrablik

**T**HE LIQUID-CRYSTAL-DISPLAY industry thrives on technology advances as manufacturers continually come up with ways to improve image quality, brightness, production yields, or other important factors. It is rare, however, for a single development to make dramatic improvements across a wide range of attributes to the point where it allows designers to enable entirely new applications.

Low-temperature-polysilicon (LTSP) technology is one of those rare steps forward. It enables the complete elimination of the row-and-column driver IC chips used in the amorphous-silicon (a-Si) TFT-LCDs commonly found in today's notebook, desktop, and industrial LCD applications. LTSP displays offer high-resolution formats – up to 300 pixels/in. (ppi) – and are simple to assemble, light in weight, low in power consumption, high in brightness, durable, and highly reliable. They are well suited for current applications, as well as for a new class of emerging applications such as information appliances, electronic books, and electronic photo viewers.

*Steven Vrablik is Business Development Director for the Tubes/LCD/Battery/Materials Business Unit of Toshiba America Electronic Components, Inc., One Parkway North, Suite 500, Deerfield, IL 60015; telephone 847/945-1500, fax 847/945-1044, e-mail: steve.vrablik@taec.toshiba.com.*

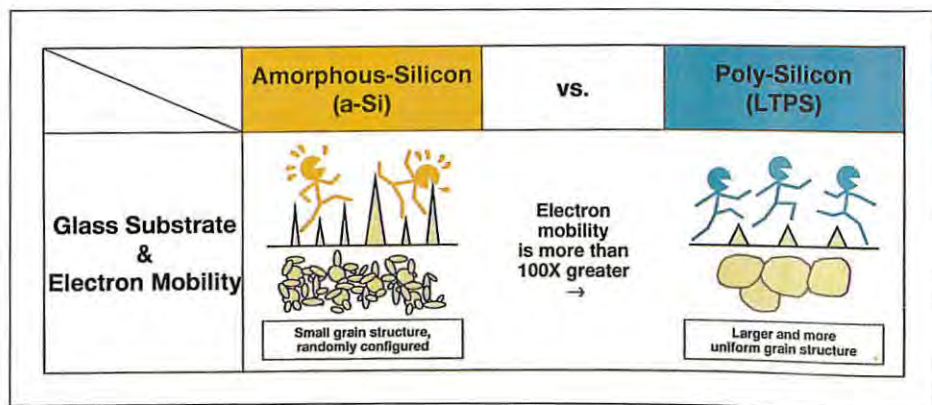
Independent studies show that high screen resolution translates into increased productivity and legibility. James Larimer, a member of NASA's Ames Research Center, concluded that pixel densities of 130 ppi or higher are desirable for reading the small 6–10-point fonts that are used in everyday printed materials. Larimer also concluded that pixel densities of 130 ppi or higher were also beneficial for displaying high-quality lifelike images.

Another study conducted jointly between the NASA Ames Research Center and the IBM T. J. Watson Research Center determined that “for many computer applications, displaying more information on a single screen improves user efficiency and utility.” They further stated, “displays are needed that

can render two full pages of text (and images) with paperlike quality. With increased information content, productivity improvements in the range of 20–30% have been obtained in CAD drawing tasks by simply reducing the amount of scrolling and zooming necessary to perform a specific task.” Thus, basic human ergonomic factors create a need for high-resolution displays, and LTSP technology can deliver them.

### Comparing LTSP with a-Si

On the glass substrate of a typical a-Si TFT-LCD, the silicon grains are very small and the grain structure is random, which greatly inhibits electron mobility in the substrate (Fig. 1). On a polysilicon (poly-Si) TFT-LCD



**Fig. 1:** The larger and more uniform grain structure of LTSP increases electron mobility.



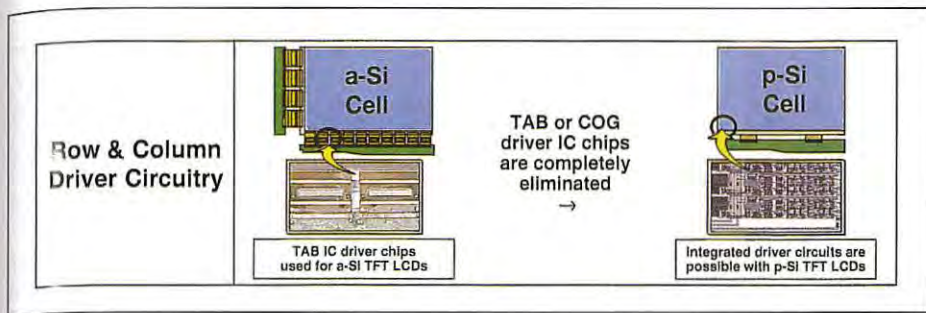


Fig. 2: Increased electron mobility makes it possible to fabricate row-and-column driver circuitry directly on the LTPS substrate.

substrate, the silicon grain structure is much larger and more uniform, permitting electrons to flow much more freely – more than 100 times faster than in an a-Si substrate.

The electron mobility in the LTPS substrate is high enough to permit the fabrication of the row-and-column driver circuitry *directly* on the glass substrate itself during the same processing steps used during the formation of the thin-film transistors (TFTs) (Fig. 2). LTPS technology makes it possible to completely eliminate the tape-automated-bond (TAB) or chip-on-glass (COG) row-and-column driver IC chips that normally surround the periphery of a-Si TFT-LCDs. As a result, the cell and array construction of an LTPS 10.4-in. XGA TFT-LCD is much simpler than that of a typical a-Si 10.4-in. SVGA TFT-LCD, even though the LTPS panel has 64% more pixels (Fig. 3).

By eliminating the TAB or COG driver chips, it is possible to reduce the number of row-and-column display connections in a typical XGA display from more than 4000 to roughly 200. In addition, 13 other driver chips can be eliminated, substantially reducing component material and assembly costs compared with an a-Si TFT-LCD. In the LTPS array, the row-and-column trace lines are routed along the edges to one side of the display, at which point a flat, flexible ribbon cable is connected directly to the glass. This flex cable then connects to the printed-circuit board located on the back of the display, which in turn is connected to the graphics system.

### LTPS Advantages

By eliminating TAB or COG driver IC chips, LTPS panels are more reliable. The most common cause of field failures in portable

a-Si TFT-LCD notebooks is breaks in the driver IC bonds caused by the severe mechanical stresses from dropping or other abuse. LTPS eliminates this problem because the driver circuitry is fabricated directly onto the glass – there are no bonds to break.

The elimination of TAB or COG driver IC chips, and their connections, provides even more benefits. In any complex system, electronic or otherwise, reliability increases if components are eliminated. The reduced number of connections and components inherent in LTPS results in improved product reliability. The reduction in connections and components also reduces the electromagnetic

emissions from an LTPS display, typically by as much as 5 dB when compared to an a-Si display. It is easier to control electromagnetic emissions in the system design.

The elimination of the TAB or COG driver IC chips has one other important benefit: LTPS displays are inherently thinner and lighter than a-Si panels. And since all the driver trace lines emanate from only one side of the display – where the flex ribbon cable is connected to the glass – LTPS displays make it possible to use very narrow bezels and a three-sides-free design approach. Such panels may be of interest for tiling and other multiple-display applications typically found in financial markets today.

These advantages mean that design engineers can focus more on enhancing system functionality, improving design aesthetics, and achieving their time-to-market goals, rather than on durability, emissions, size, and weight-reduction issues.

### Smaller Is Better

Due to the greater electron mobility in poly-Si substrates, each individual transistor in each individual sub-pixel is physically smaller than it would be if fabricated using an a-Si substrate. This produces an increased aperture ratio, which in turn provides increased bright-

	Amorphous-Silicon (a-Si)	vs.	Poly-Silicon (LTPS)
<b>Cell &amp; Array Construction</b> * a-Si SVGA vs. p-Si XGA	<p>SVGA: 480,000 pixels</p>	<p>Simpler, and functionally superior → 64% more pixels →</p>	<p>XGA: 786,432 pixels</p>
<b>LCD Module Construction</b> * a-Si XGA vs. p-Si XGA	<p>4128 connections (X: 3300 / Y: 828) 13 Drive ICs (X: 10 / Y: 3)</p>	<p>Simpler design → Fewer components →</p>	<p>200 connections (100/FPC * 2) No Driver ICs</p>

Fig. 3: An LTPS XGA panel has far fewer components and connections than an a-Si SVGA panel, even with 64% more pixels.

## LCD technology



*Fig. 4: LTPS technology may make it practical to put all computing components on the display glass substrate, which could lead to new products and applications.*

ness and lower power consumption. Higher brightness improves legibility, and lower power consumption translates to extended battery life or lighter weight in portable systems.

LTPS technology can achieve very high pixel densities of up to 300 ppi and beyond. At 200 ppi, text is very sharp, four-point text fonts are legible, and electronically generated computer images appear photographic and lifelike (see cover).

### How LTPS Displays Are Made

Toshiba has taken 10 years to develop its LTPS TFT-LCD technology. The process starts with a common glass substrate. An a-Si layer is initially formed on the glass substrate, and then a laser-annealing process transforms this layer into poly-Si, creating the much larger and more uniform grain structure. The laser-annealing process is extremely difficult to control in a production environment, especially for large-sized – 4 in. on the diagonal or greater – high-resolution displays. The power of the laser, the stability of the laser waveform, and the duration of the laser exposure all must be controlled precisely.

This process differs sharply from high-temperature-polysilicon (HTPS) fabrication. These displays tend to be small – 3 in. on the

diagonal or less – and are typically used in camcorder viewfinders, digital still cameras, and data projectors. HTPS displays are manufactured using special high-cost crystalline-quartz substrates. The special substrate material is required to prevent melting during the high-temperature manufacturing process, which can reach about 1800°F (1000°C). Since the crystalline-quartz material is very expensive, the HTPS process is used to manufacture only relatively small displays on small-sized substrates.

In contrast, the LTPS process works with commonly available low-cost large-sized glass substrates. As a result, it is possible to make relatively large displays ranging in size from 4 to 20 in. or more at an affordable cost.

Toshiba began commercialization of the LTPS technology in 1997 with the construction of a production pilot line at the company's Fukaya Works in Saitama Prefecture, Japan. As with any pilot line, it was used to initiate production and “work out all the kinks” as the company established the manufacturing know-how for LTPS technology. In the fourth quarter of 1998, Toshiba began production on this pilot line, manufacturing 8.4-in. SVGA and 10.4-in. XGA poly-Si single-lamp TFT-LCD modules designed for the portable-computing marketplace.

Even before all of the kinks were worked out, Toshiba began an aggressive plan to establish a new facility specifically designed for the high-efficiency manufacture of LTPS displays. Plans for the new facility were completed in 1998 and construction was started. By April 1999, manufacturing operations had begun. The new facility is also located in Fukaya and is based on the same motherglass size (400 × 500 mm) used by the pilot line. It is approximately 95 × 105 m in size, and incorporates state-of-the-art processing equipment. The first phase added a capacity of 50,000 LCDs per month (based on a 10.4-in. LCD size).

During the fourth quarter of 1999, a second phase was installed in the new facility which added a capacity of another 50,000 LCDs per month (again based on a 10.4-in. LCD size). By the end of 1999, Toshiba's total manufacturing capacity dedicated to LTPS TFT-LCDs had reached 150,000 10.4-in. LCDs per month (on an input basis) with a total investment exceeding \$430 million.

### Toshiba's LTPS Displays

Since the inception of our large-sized LTPS manufacturing capability, Toshiba has brought many TFT-LCD products to market. The first LTPS TFT-LCDs were an 8.4-in. SVGA single-lamp display with a pixel density of 119 ppi and a 10.4-in. XGA single-lamp display with a pixel density of 124 ppi. Both of these products were introduced in the fall of 1998 and were initially used in thin, lightweight, portable PC systems.

In the spring of 1999, Toshiba introduced a 4-in. VGA TFT-LCD with a pixel density of 202 ppi that was initially used in a personal digital assistant (PDA). This display has photolike image quality and was the first TFT-LCD on the market to provide over 200 ppi without incorporating any peripheral driver IC chips.

In the fourth quarter of 1999, Toshiba introduced three new LTPS TFT-LCDs:

- A 15-in. UXGA single-lamp TFT-LCD with a pixel density of 133 ppi, targeted for the large-screen high-resolution desktop-replacement portable PC market.
- A 5.8-in. wide-VGA-format (800 × 480) TFT-LCD with 160 ppi, designed for emerging portable DVD video applications.
- A 6.3-in. XGA TFT-LCD with 202 ppi, designed for very compact portable computing and/or imaging products.

Earlier this year, Toshiba introduced an 8.4-in. dual-lamp display (119 ppi) for "industrial" high-brightness applications. More recently, the company introduced a 7-in. wide-SVGA-format (1024 x 600) single-lamp TFT-LCD with 169 ppi, targeted again for portable notebook applications.

#### Future LTPS Products

Toshiba sees a wide variety of new and exciting applications for which LTPS TFT-LCDs are ideal candidates. Today, demand is growing to use LTPS TFT-LCDs in lightweight ultra-mobile portable computing systems. We also see a fast-growing demand from emerging portable applications such as PDAs, information appliances, and electronic books. Other potential applications may include electronic photo image viewers, ultra-high-resolution desktop monitors for CAD/CAM or desktop-publishing applications, pen-based tablet PCs, various consumer devices, and computers with unique designs or features.

In addition, the higher electron mobility of LTPS may make it feasible to integrate even more system functionality directly onto the glass substrate during the fabrication process. It is our dream to someday integrate functions such as touch screen, camera, or voice-recognition technology *directly* onto the glass substrate, thereby putting the entire system on glass (Fig. 4).

#### Industry Recognition

The commercialization of large high-resolution LTPS displays is a remarkable achievement, which has been recognized throughout the display industry. In December 1999, the Society for Information Display (SID) and *Information Display Magazine* awarded their 1999 Display of the Year Gold Award to Toshiba's LTPS displays. These products provide many unique features and benefits that can enable an entirely new world of electronic display-based applications and products. Toshiba intends to remain the leading provider of LTPS displays and to extend this exciting display technology. ■

# Display Power!

- MC Platform - **NEW** - the high-powered, low-cost solution for LCDs backlit by multiple CCF tubes; up to 40W of output power; encapsulated transformer
- IB Series - on-board encapsulated inverter powers up to 10 CCFTs; "plug & play"
- E200II - fully encapsulated for maximum reliability; a real workhorse for one or two CCFTs
- R Series - encapsulated; powers up to 10 CCFTs; lifetime warranty
- S Series - small, economical; PCB mountable; highly efficient

Call: 1-800-215-5866  
www.ergpower.com



Endicott Research Group, Inc.  
the power behind the display

Endicott, NY • 607-754-9187  
Fax: 607-754-9255

See Us at SID '00 Booth 434

Circle no. 63

## The Right Choice



### for Flip Chip Bonding

Ultimate bonding featuring  $\pm 1\mu\text{m}$  alignment accuracy for electronic optical sensor devices is now available.

Also available: an exposure type ID marking system for manufacturing control of TFT-LCD, OPC, FPC, and FED with high-resolution and no dust or particle generation.

# 'TORAY'

Toray Engineering Co., Ltd.

Asia's leader in electronics manufacturing equipment for more than 20 years

**Toray Engineering Co., Ltd.**  
Fine Process Division  
3-16, Nihonbashi-Hongokuchō  
3-chōme, Chuo-ku  
Tokyo 103, Japan  
Tel: 03-3241-1769  
Fax: 03-3271-7359

North American Agent  
**TEK (America), Inc.**  
2100 Rexford Road, Suite 216  
Charlotte, North Carolina 28211  
Tel: 704-364-1009  
Fax: 704-364-3321  
Contact: Kirk Minamii

See Us at SID '00 Booth 167

Circle no. 64

# ZC&R precision coatings... On display everywhere.

From Air Force One on down, manufacturers of display products trust us for the finest optical coatings available. Our wide range of custom designed display coatings make a visible difference, and they know it.

ZC&R's advanced transparent conductive ITO thin-films meet the precise sheet resistance control required by today's state-of-the-art displays. And we've created a whole new set of accurate, index-matched ITO coatings to reduce internal reflections in the display system.

Whether it's Durable AR or Broadband AR coatings, Edge Filters, or specialized Night Vision Filters, we can improve your image. From prototype to OEM volumes, our filters are available on glass plates up to 24" in diameter and can be customized to meet your requirements.

So go ahead, contact us for your next quote. ZC&R. We're at our best when we're on display.



- Durable / Broadband AR
- ITO and IM-ITO
- Night Vision / Surveillance
- Band Pass Color Filters
- Beamsplitters
- Heat and Color Coatings
- Hot and Cold Mirrors
- High Power Laser
- Metal Coatings
- Thin Film Polarizers
- Fluorescence Filters
- NVIS Filters

- Ion-assisted technology
- Up to 24" diameter
- Prototype to OEM volumes
- Fast delivery
- MIL-C-675, MIL-C-48497 & MIL-M-13508 qualified

**ZC&R**  
COATINGS FOR OPTICS

1401 Abalone Ave.  
Torrance, CA 90501  
310-381-3060 / 800-426-2864  
Fax: 310-782-9951

[info@zcrcoatings.com](mailto:info@zcrcoatings.com) / [www.zcrcoatings.com](http://www.zcrcoatings.com)

# Flat Display Measurement

Westar's FPD Performance Measurement Systems give you something unique -- precision and flexibility. Westar's FPM Systems provide photometric and colorimetric measurements, real-time reporting of test results, increased test and analysis productivity, and performs standard tests as well as your own custom tests.

## Westar's FPD Performance Measurement System

- Tests displays up to 54" automatically.
- Tests for luminance, chrominance, contrast & viewing angle performance...and more!
- Uses popular sensors, such as PR, Minolta, and Topcon.

Performs VESA, TCO '99 and ISO 13406-2 tests!

Powerful ViewPoint™ software integrates sensors, motion control, analysis, and reporting functions. It also includes a wide variety of fully integrated display interfaces!

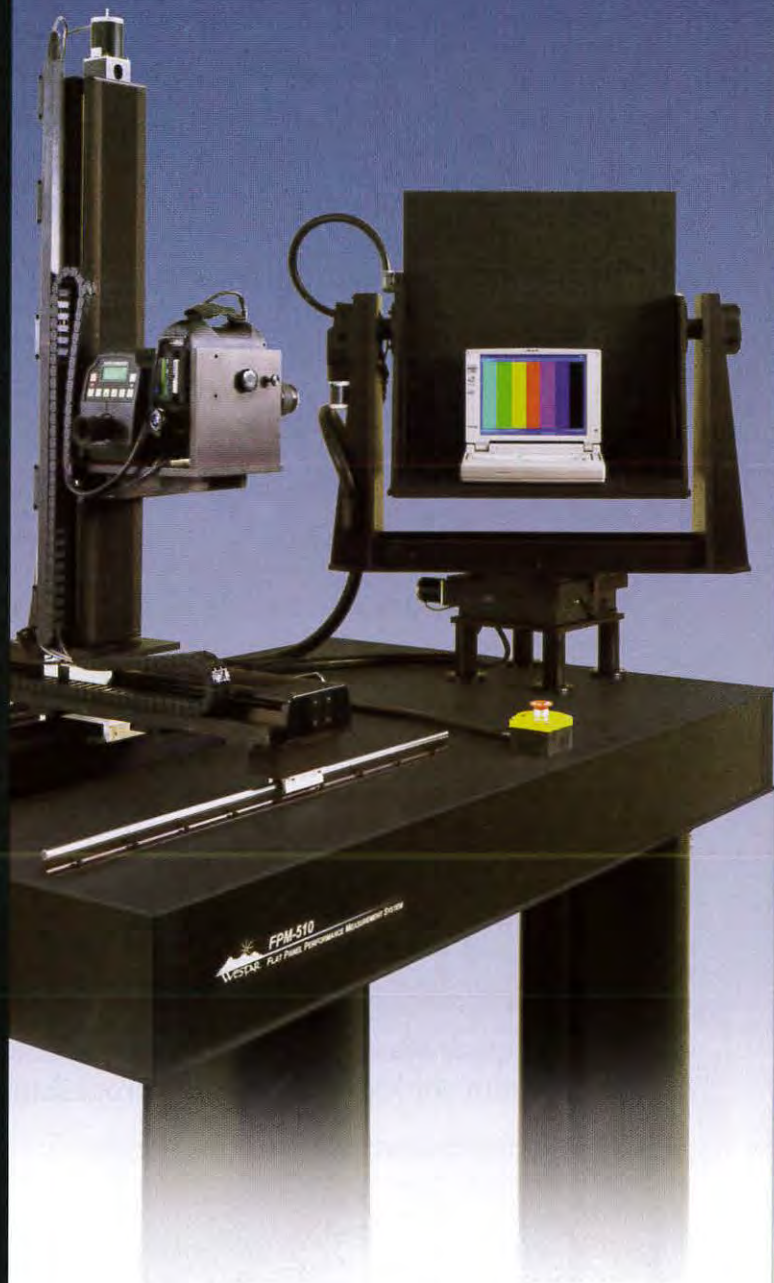


**FREE** Video and CD

For more information on Westar's revolutionary new systems, call today for our **FREE** video and CD.

Copyright © 2000, Westar Corporation  
Trademarks are property of their respective owners. Patents Pending.

See Us at SID '00 Booth 424



  
Products for better displays.™

USA: Westar Corporation, 636-498-6004 ext.286  
Japan: Kyokuto Boeki Kaisha, Ltd., 03-3244-3795  
Korea: Truco, Inc., 02-3465-2004  
Taiwan: Advanced Team Enterprise Co., Ltd., 02-27035466  
China: Advanced Team Technology Service, 769-632-6399  
Europe: Ginsbury Electronics, Ltd., +44 (0) 1634-298900

[www.westar.com/fpm](http://www.westar.com/fpm)

Circle no. 66

# Orgacon™ EL

Lighten up (y)our inspiration

The  
Polymer  
Alternative  
to ITO

Flexibility  
Transparency  
Stability  
Convenient Patterning  
Environmentally friendly

Visit us at SID - booth nrs 1003 and 1005



Sputtering of ITO and Optical Coatings ◀◀◀  
[www.isffilms.com](http://www.isffilms.com)

▶▶▶ Substrates and components for flexible displays  
[sfc.agfa.com](http://sfc.agfa.com)

AGFA Agfa

Circle no. 67

# LAMINATORS

Spire Corporation offers large-area vacuum lamination equipment for high throughput processing of:



© 1998 Spire Corporation

- LCD/AMLCD flat panel displays
- Touch screen panels
- Optical filters and polarizers

Spire laminators, widely used in the production of photovoltaic modules, apply uniform temperature and pressure over areas up to 4 m<sup>2</sup>.

**SPI-LAMINATOR™**  
Models 240, 350, 460, & 660:

- 1 m<sup>2</sup> to 4 m<sup>2</sup> process area
- 2.5 cm max. stack thickness
- Built-in vacuum system
- Conveyor load/unload option
- Clean room compatible
- Custom engineering available

**Programmable Processing:**

- Temperature, 180°C (max.)
- Pressure, 1 atm (max.)
- Chamber Vacuum, 1 mm Hg
- Automatic or Manual Cycles

For equipment specifications and additional information, please contact PV Sales at 781-275-6000

**Spire Corporation**  
One Patriots Park  
Bedford, MA 01730-2396/USA  
TEL 781-275-6000  
FAX 781-275-7470  
EMAIL [pvsales@spirecorp.com](mailto:pvsales@spirecorp.com)

**spire**

Circle no. 68

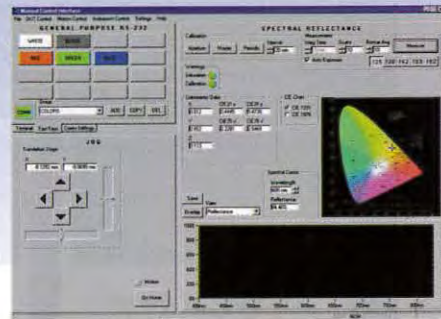
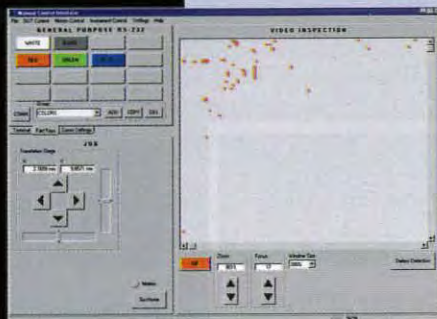
# Microdisplay Inspection

**The Westar Microdisplay Inspection System tests microdisplays with resolutions QVGA to beyond UXGA, without changing camera or optics!**

For laboratory, production, or QA/QC environments, the new Microdisplay Inspection System makes fast and accurate measurements using an integrated optical assembly with computer-controlled zoom and focus, spectrometer instrument, and a CCD camera.

**Perform standard tests, including:**

- % reflectance
- contrast ratio
- uniformity
- pixel defects
- spectral response
- plus others!



**Powerful MicroPoint™ Software** has two modes: Manual Control Interface for rapid laboratory measurements, and an Automated Test Sequencer for production.

**Call today for more information!**

Copyright © 2000, Westar Corporation  
Trademarks are property of their respective owners.

See Us at SID '00 Booth 424



USA: Westar Corporation, 636-498-6004 ext.286  
Japan: Kyokuto Boeki Kaisha, Ltd., 03-3244-3795  
Korea: Truco, Inc., 02-3465-2004  
Taiwan: Advanced Team Enterprise Co., Ltd., 02-27035466  
China: Advanced Team Technology Service, 769-632-6399  
Europe: Ginsbury Electronics, Ltd., +44 (0) 1634-298900

[www.westar.com/mdis](http://www.westar.com/mdis)

Circle no. 69

# Seeing is Believing

## EmiClare™ EMI Shielded Windows

- More light transmission — Less optical distortion
- Higher shielding performance — Lower cost

EmiClare windows deliver exceptional optical performance with high levels of EMI shielding. Their unique mesh system dramatically reduces text distortion. Light transmission is 65-70%. EmiClare windows utilize a proprietary shielding mesh, laminated between high optical polycarbonate layers, with front and rear protective coatings. Standard and custom EmiClare windows are available for LCDs, CRTs, PDPs and other flat panel technologies

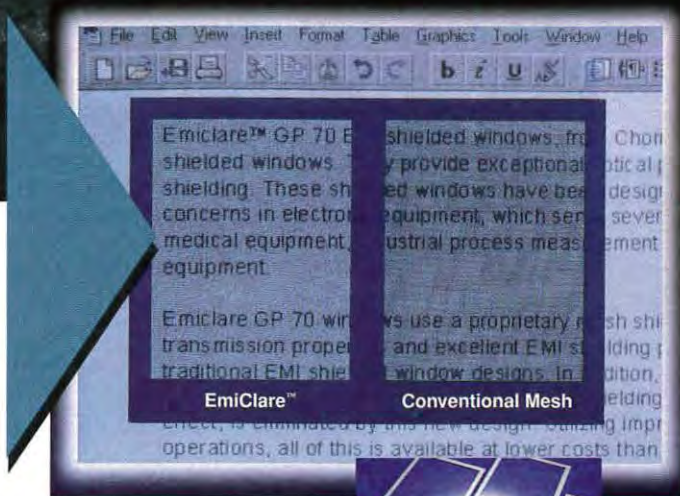
**Contact Chomerics for samples and complete technical details.**

[www.chomerics.com/emiclare](http://www.chomerics.com/emiclare)

Woburn, MA  
Tel: 781-935-4850  
Fax: 781-933-4318  
mailbox@chomerics.com

Marlow, UK  
Tel: (44) 1628 404000  
Fax: (44) 1628 404090  
chomerics-europe@parker.com

Hong Kong  
Tel: (852) 2 428 8008  
Fax: (852) 2 423 8253  
mailbox@chomerics.com



CHOMERICS

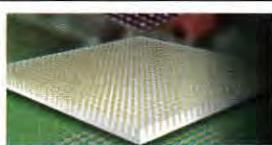
Parker Seals

See Us at SID '00 Booth 1402

Circle no. 70

## Too Many Connections to Make and Not Enough Board?

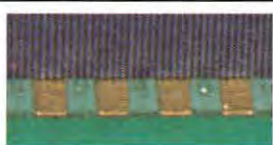
**ZEBRA® Elastomeric Connectors are the solution.** With conductor pitches as tight as .002", elastomeric connectors will accommodate pad spacing as close as .010". Whether you are connecting an LCD with very low current or connecting two boards with much higher current, Fujipoly has the interconnect solution.



**ZEBRA® W Series Matrix Style Connector**

Pitch .013"  
Current 500 mA  
Resistance 250 milliohms

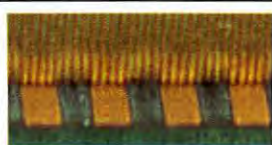
**Typical Applications:**  
BGA, PGA and PCB-to-PCB



**Carbon ZEBRA® Connector**

Pitch .002"  
Current 50 mA  
Resistance 1000 ohms

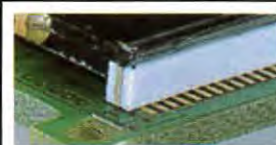
**Typical Application:**  
LCD-to-PCB



**ZEBRA® Gold Connector**

Pitch .006"  
Current 1 amp  
Resistance 25 milliohms

**Typical Applications:**  
Board-to-Board  
Flex-to-Board  
QFP, LCC



**Silver ZEBRA® Connector**

Pitch .005"  
Current 700 mA  
Resistance 250 milliohms

**Typical Applications:**  
Board-to-Board  
Flex-to-Board  
COG  
EL Display



365 Carnegie Avenue • Kenilworth, NJ 07033-0679  
tel: 908.298.3850 • fax: 908.298.1232  
e-mail: [fujipoly@aol.com](mailto:fujipoly@aol.com) • website: [www.fujipoly.com](http://www.fujipoly.com)

See Us at SID '00 Booth 148

Circle no. 71



# Flat Display Test and Integration

The Display Tuning System (DTS) is a comprehensive solution for test and integration of flat panel display (FPD) modules.



For manufacturers and user's of flat panel display modules, the DTS lets you:

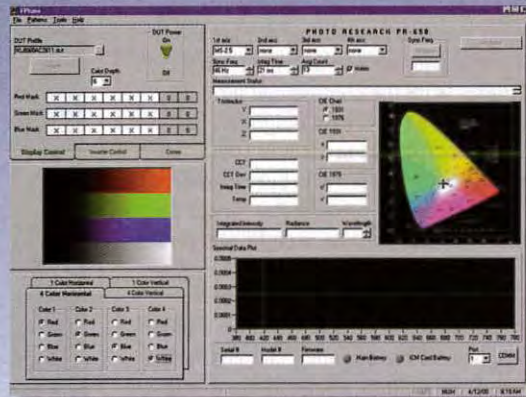
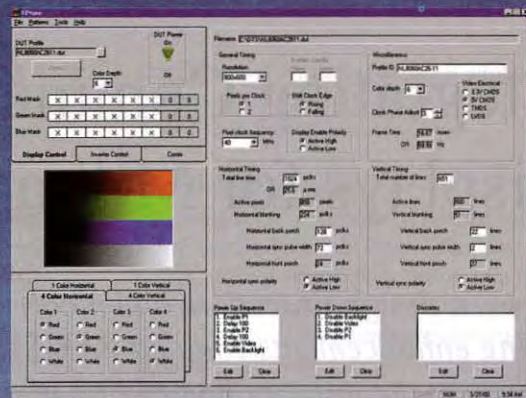
- Define the display timing and electrical interface, discrete control, and power sequences using the powerful FPtune™ Display-Under-Test Profile Editor.
- Control display image content with extensive pattern draw functions, or select your own images.
- Take optical measurements using your Light Measuring Device (LMD) with our integrated LMD interfaces.
- Define the display backlight inverter interface using the FPtune™ Inverter Editor
  - Mask digital video data bits, adjust timing, toggle discretets, and measure display power consumption.
- Connect quickly and easily to displays with a solution that is low-cost and low-noise with high-reliability.

Included in the DTS is everything you need to begin test and integration immediately: the PC, external personality module, and cabling.

**Call today for more information!**

Copyright © 2000, Westar Corporation  
Trademarks are property of their respective owners.

See Us at SID '00 Booth 424



USA: Westar Corporation, 636-498-6004 ext.286  
 Japan: Kyokuto Boeki Kaisha, Ltd., 03-3244-3795  
 Korea: Truco, Inc., 02-3465-2004  
 Taiwan: Advanced Team Enterprise Co., Ltd., 02-27035466  
 China: Advanced Team Technology Service, 769-632-6399  
 Europe: Ginsbury Electronics, Ltd., +44 (0) 1634-298900

[www.westar.com/dts](http://www.westar.com/dts)

Circle no. 72

# Integrating Commercial Flat-Panel Displays for Military Applications

*A proven design procedure and a core set of inviolable value-adding enhancements enabled BAE SYSTEMS to successfully implement the military integration of a COTS AMLCD.*

by Anthony De Lorenzo, Richard Librandi, and Nathaniel Rothman

**F**OR OVER 40 YEARS, BAE SYSTEMS, Advanced Systems Group, formerly Marconi Aerospace, has been providing display monitors for command-and-control applications to the military. With the commercial introduction of large-area (18–21-in. diagonal) flat-panel monitors (FPMs) in the late 1990s, we saw an opportunity to provide our customers with a rugged display product that would consume one-third the volume, weight, and power of a comparable CRT monitor while improving reliability by a factor of 3 (Fig. 1).

The challenge was how best to take a monitor developed for the commercial marketplace and adapt it for military applications so that it could meet the required electro-optical performance over the extended environmental conditions required by each Service.

## Setting the Bar

Based on our long-term involvement in the displays business and our supporting market research, we were convinced that there was a strong military demand for this type of prod-

*Anthony De Lorenzo is Director, Displays Systems Engineering, at BAE SYSTEMS, Advanced Systems Group, 450 Pulaski Rd., Greenlawn, NY 11740; telephone 631/262-8102, fax 631/262-8002, e-mail: rothman@hazeltine.com. Richard Librandi is Senior Member, Technical Staff, and Nathaniel Rothman is Director, Business Development, Display Systems, at BAE SYSTEMS.*



**Fig. 1:** BAE SYSTEMS has integrated NEC Technologies' commercial AMLCD into a rugged 20-in. flat-panel monitor for military applications.

BAE SYSTEMS

uct for new and, even more, for retrofit programs. The technical benefits an FPM brings, along with the potential cost savings from employing a commercially based monitor off a high-volume production line, make this an attractive opportunity for military users.

BAE Systems, as a value-added integrator, had to establish a set of essential objectives for such a product family. These objectives would have to be achieved before the product could be considered a successful integration of a commercial flat-panel display (FPD) into a monitor for military applications. The objectives were

- To be able to select one flat-panel technology that provides the required technical and business attributes, including electro-optical performance, robustness of commercial product designs, production capacity, and long-term product stability.
- To develop a close working relationship with a known leading provider of the chosen commercial flat-panel technology.
- To retain the maximum amount possible of the commercial monitor's design and components.
- To create a family of open-architecture modular flat-panel products that satisfy all military-Service requirements and can be put into volume manufacturing with confidence that manufacturing cost objectives will be met.

- To maintain flexibility in product design to accommodate the variability of the retrofit market without compromising product cost objectives.

### Selecting a Technology and a Supplier

Since we were focused on command-and-control systems requiring 18–21-in. high-resolution monitors, we had a limited field of technology entrants to consider. Only AMLCD, plasma, and digital micromirror devices offered potentially suitable solutions. Once we investigated, it became obvious to us that the AMLCD solution offered the greatest potential: excellent electro-optical performance, an ever-growing product and manufacturer base, and a projected steadily increasing market for the commercial product over the next 5–10 years.

Having selected the technology, our next task was to find a manufacturer that was a leader in AMLCD technology, was committed to the technology for the long haul, had robust designs, and would work with us as we applied its designs to our significantly more demanding environmental requirements.

Robustness of the electronic and mechanical designs, and of the manufacturing processes, became key characteristics and an important discriminator. The commercial off-the-shelf (COTS) product we wanted had to be very conservative in design. It also had to have a stable design and exceptional field performance, as well as exceed its published

characteristics on many fronts. We found such designs in the NEC Technologies AMLCD flat-panel monitors.

### The Design Process

The integration of a commercial monitor into a military product must follow the same design process as any other design of a military product. The key is to use a proven design process with inherent design checks and balances, such as the process used by BAE SYSTEMS (Fig. 2). For COTS-derived products, this process is augmented by significant testing in the early phases of the design, including a highly accelerated life test (HALT) program. HALT is a process of determining the robustness of a design by testing to environmental limits beyond the requirements envelope for parameters such as temperature and vibration.

HALT is a key component of the process because it helps the ruggedizer assess the robustness of the various parts of the COTS product. With this knowledge, the ruggedizer can preserve the greatest possible portion of the original COTS product, thereby obtaining the maximum benefit from the original manufacturer's higher-volume lower-cost production.

Deciding how much ruggedizing a COTS product needs requires a review of existing and anticipated customer needs. A range of customers and programs have to be taken into account because the ruggedized product must meet the needs of many programs with little or no modification. This review results in an "equipment-requirements document" that contains the electro-optical, environmental, design, and logistical (maintainability, reliability, and life) requirements of all forecasted programs. The equipment-requirements document is then coupled with the results of the HALT program to establish the ruggedization requirements for the new product (Fig. 3).

### LCD Glass

The LCD monitor's weakest link is the susceptibility of the LCD glass to vibration, shock, temperature, humidity, fogging, sand, dust, salt fog, and explosive decompression. The problem is that LCD glass is made for desktop use. When we tested it under vibration or shock, the glass was damaged and the glass spacer beads behind the glass shifted, causing permanent brightness non-uniformities. In addition, pressure differentials that

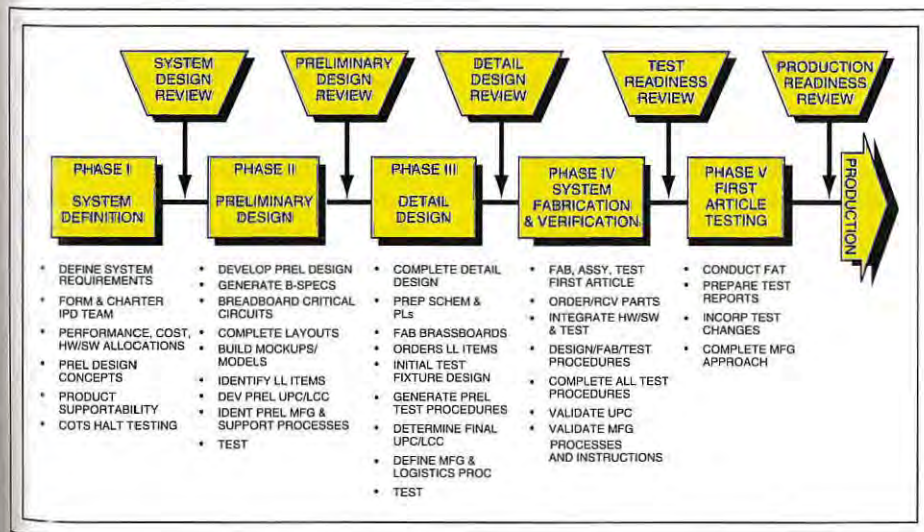
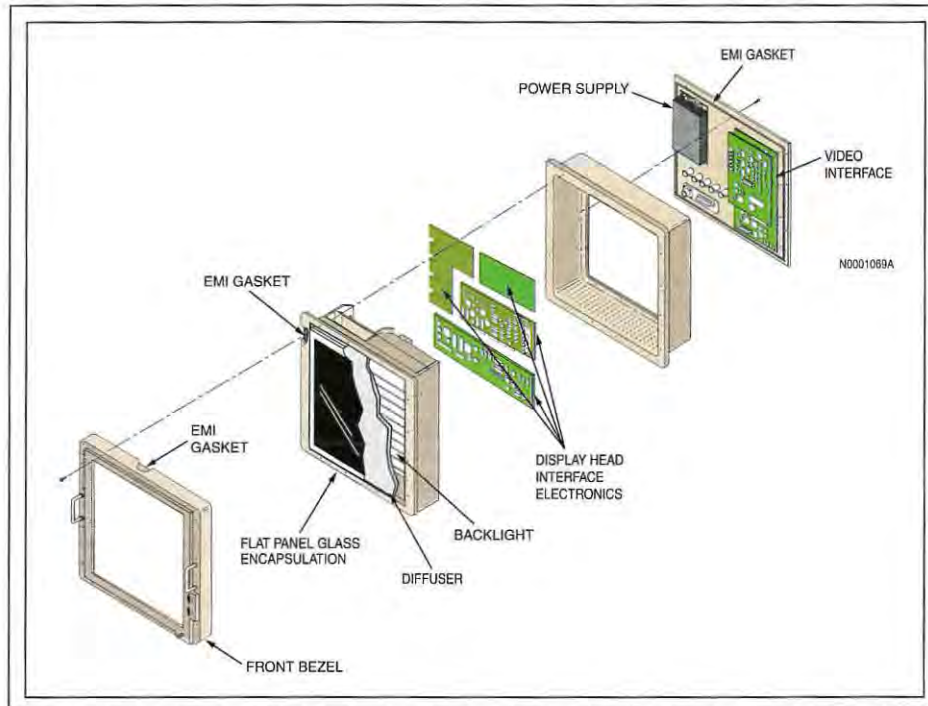


Fig. 2: A proven design process is the key to successfully integrating a commercial product for military applications.

## military applications



**Fig. 3:** The design approach for the ruggedized monitor retains the field-proven electro-optical performance of NEC Technologies' 20.1-in. commercial flat-panel display.

arise between LCD layers during rapid altitude changes can produce explosive decompression.

Humidity and glass fogging also posed serious problems for LCD glass. Humidity caused the front and rear polarizers to peel from their glass substrates, and glass fogging occurred behind the inner surface of the non-bonded glass sheet.

Based on these test results, we decided that a fully bonded, encapsulated LCD glass was needed to eliminate the environmental problems. Our unique process sandwiches the LCD glass between two panes of optical glass, and completely bonds them together with an optical-quality silicone material, making the entire assembly into a one-piece totally encapsulated module. Testing verified that this robust approach to ruggedization and protection of the LCD glass solved all of the noted environmental problems.

The single-piece construction also provides a secondary benefit: There is no light reflection from or refraction at the internal surfaces of the glass and the silicone encapsulant because all have matched indices of refraction. This provides faithful color rendition and enhanced contrast ratio.

### Video Interface, Power, and EMI

The other two areas requiring ruggedization for the military environment are the video interface and the power supply. Video interfaces for military programs, particularly retrofit programs for existing equipment, require varied video inputs, built-in testing and reporting, and enhanced image-performance features. We decided that the best way to implement these requirements was to give our product its own intelligent video interface and controller module. This approach provides a number of special features in a ruggedized package:

- Storage of up to 16 independent video-input formats.
- Automatic luminance adjustment based on ambient illumination.
- Automatic control of backlight output based on backlight life.
- Automatic gain control.
- Automatic color control.
- DC restoration.
- Serial communication.
- Built-in-test-equipment (BITE) software.

When the functions implemented by this video interface are coupled to the video-con-

trol capability already embedded in the COTS monitor, they provide the customer with exceptional performance and flexibility.

Military power systems, particularly those in retrofit programs, are stressful for display electronics. We therefore designed our own power supply so that the monitor can comply with power-supply specifications such as MIL-STD-704E, MIL-STD-461, and their equivalents.

EMI protection is dealt with by using the customary approaches for thoroughly sealing the box from electromagnetic interference (Fig. 3).

Test programs were run throughout all phases of the design process. As each area was addressed, design testing was performed. Successful completion of the design-validation testing gave us and our potential customers confidence in the product performance.

### Varying the Product

We realized that one "universal" monitor design could not possibly meet all the needs of our military customers. But we did believe that a fairly broad core product could be designed with a modular open-architecture framework that lends itself to the addition of features that are unique to certain applications. Here are three examples:

- **Sonar acoustic waterfall grams.** Certain Naval applications require displays that are slowly updated at rates of approximately 1–10 times per second. This causes perceptible "jumping" or "blinking" of the image upon each update when viewed on an AMLCD, a phenomenon unique to liquid-crystal technology. This results in operator fatigue and other human-factors problems. We developed our solution to this waterfall "blink" problem by designing a mezzanine module that processes the video signal for the liquid-crystal panel; the module simply attaches to the video-interface controller module. It thereby maintains all of the elements of the ruggedized monitor design. [For more information on waterfall gram blink, see "Bringing the NEC 20-in. LCD to Military Customers," *Information Display*, 32 (March 2000).]
- **Touch screens.** We have developed processes that permit the addition of capacitive and acoustic touch screens to the product without violating the integrity of

our one-piece laminated LCD glass structure.

- **Low-profile 19-in. drawer-mounted package.** We saw the need in military applications such as ground mobile and submarines, where rack space is at a premium, for a 20-in. monitor that could be horizontally recessed into a 19-in. 3U rack for storage. Because of the monitor's modularity, we were able to design a variant that fits in a 19-in. rack 3U tray while preserving the landscape orientation of the 20-in. flat panel (Fig. 4). The user merely opens the drawer and tilts the monitor to the desired vertical orientation for comfortable viewing. There is no need to physically rotate the 20-in. panel to achieve the landscape orientation. We also developed a 19-in. rack 2U tray variant. Ruggedization is preserved and all elements of the original monitor design are used.

#### Lessons Learned

This integration effort taught us that successful integration of a commercial FPD for military applications does not involve much more than good engineering practices. The key is to establish those practices, know them, and use them. The practices are

- *To treat the ruggedization of a commercial product for military applications as one would the development of any unique product for the military.* The customers' operational requirements and needs do not change just because we start with a commercial product as a baseline.
- *To use a proven design process for the product development.* This provides a comparison and checklist that has been used successfully on other military applications.
- *To know the commercial product design in detail, either through the supplier relationship and/or extensive testing.* That product design is the heart of the integrated product.
- *To make the most of the commercial product.* Although we may not believe it, the commercial world does design products to last. When supplying hundreds of thousands of units to the mass market, product recalls are not wanted.
- *To have a core set of value-added attributes that are inviolate.* An example



BAE SYSTEMS

**Fig. 4:** The flexibility of an open-architecture modular design permitted the 20-in. monitor to be adapted for installation in a drawer for a 19-in. rack.

is the encapsulation of the AMLCD substrate for the required environmental protection. Without this core set, it is questionable whether a product will deliver any added value to customers.

#### The Way Ahead

The integration effort described here has resulted in a rugged 20-in. FPM product that has been accepted in the military marketplace. The monitor has been selected for use on the U.K.'s Nimrod Maritime Patrol Aircraft and the Canadian Victoria Class Submarine, as well as other platforms. We are now using the design process proven on the 20-in. monitor to create rugged 18- and 21-in. FPMs. The first deployment of the 21-in. FPM will be on Australia's new 737 AEW Aircraft.

We are convinced that AMLCD-monitor products such as those described, along with

ensuing variations, will fill the military market's need for large-area FPDs for the next 5–10 years as the installed CRT base becomes less and less supportable. ■

# SID '01

**Symposium, Seminar,  
and Exhibition  
San Jose, California  
San Jose Convention Center  
June 3–8, 2001**

## The LCD Manufacturer Who Shares The Vision with You

### GOOD VISIBILITY

Goldentek produces high-quality, reliable LCDs for a wide range of electronic products.

### GREAT SERVICE

Goldentek provides advanced quality with competitive prices, timely delivery and comprehensive technical consultations.

### GROWING PROSPECT

With 9 years of LCD production experience, Goldentek is the rising sun in the world of LCDs with the best equipment and facilities, together with the top-ranking engineers.

- TN, STN, FSTN, Custom, Standard, LCD, LCM.
- Extended temperature ranges, low power, high contrast.
- COB, COG, TCP, E/L, LED, CCFL backlight.

## Goldentek Display America, Inc.

2115 W. Crescent Avenue, Suite 251, Anaheim, CA 92801 (U.S.A.)  
TEL: 714-774-4653 FAX: 714-774-4659  
E-mail: goldentek@aol.com  
www.goldentek.com.tw



The LCD Specialist

Circle no. 73

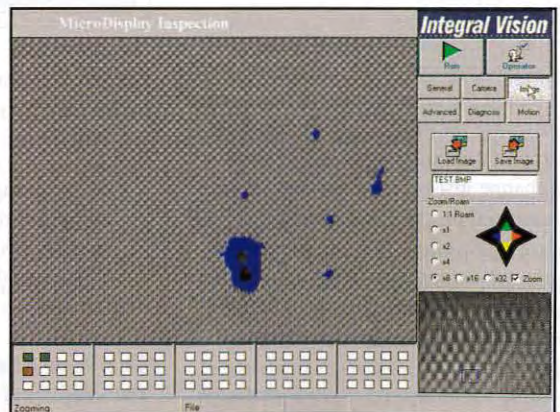


## SharpEye™ Inspection Station

*Inspection of Small Flat Panel Display Technologies*

The **SharpEye™** small flat panel display inspection station is designed for the inspection of LCoS, OLED, MEM, EL, LTPS, FED, LCD and other emerging technologies.

The **SharpEye™** station can be configured to inspect all industry display formats such as QVGA, VGA, SVGA, XGA, SXGA, SXGA+, UXGA and HDTV.



**SharpEye™** offers system configurations to meet the exact production inspection requirements of the display manufacturer. Inspection parameters for defect resolution and classification, cycle time, data reporting, and automation are considered with each customer's application requirements.

**For more product information visit our web site at [www.iv-usa.com](http://www.iv-usa.com)**

**Integral Vision**  
Simply **POWERFUL** Vision Solutions

**USA:** Tel. +1 (248) 471-2660 Fax. +1 (248) 615-2971 Email. sales@iv-usa.com  
**Europe:** Tel. +44 1234-843345 Fax. +44 1234-843390 Email. sales@integral-vision.co.uk  
**Japan:** Tel. +81 (27) 343-0571 Fax +81 (27) 343-1518

See Us at SID '00 Booth 330

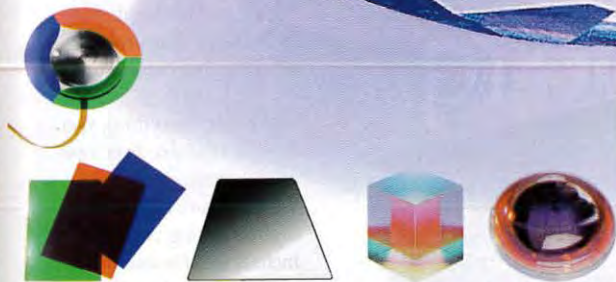
Circle no. 74

*balzers*

Thin Films



Light Management Solutions™



As multi-faceted as a diamond... are the many solutions we offer as a leading producer of thin films and optical components. Always providing a dedicated effort to benefit our worldwide partners – Balzers Thin Films has the professional skill and expertise to meet the needs of your most challenging applications.

Combining our proven thin film technology with our manufacturing knowledge – integrated solutions for optical components and assemblies are now available from one source. Optimized to the needs of the projection display manufacturer we offer the ColorCube™ and ColorWheel™ for color splitting and recombination, Silflex™ ultra-high reflective mirrors, Calflex™ hot mirrors and much more...

Balzers Thin Films  
FL-9496 Balzers  
Principality of Liechtenstein  
Tel. +41(0)75-388 44 44  
Fax +41(0)75-388 54 05  
E-Mail: sales@btf.balzers.net

USA, Golden, CO  
Tel. +1(303)273-9700  
Fax +1(303)273-2995

Germany, Geisenheim  
Tel. +49(0)67 22-99 30  
Fax +49(0)67 22-99 31 61  
<http://www.btf.balzers.com>



SID Symposium 2000 14–19 May, Long Beach CA, USA  
Infocomm 2000 15–17 June, Anaheim, California, USA

See Us at SID '00 Booth 229

Circle no. 75

**ist**

**Performance, quality, service.** IST provides a wide range of specialized capabilities and CRT solutions for your most challenging applications:

- Avionic Cockpit Displays
- Military Track Vehicle FLIR Displays
- Helmet-Mounted Displays
- Light-Valve Projection Displays
- Medical/Direct View Monitors
- Color Film Recorders
- GPS Displays
- Field Sequential Color Displays
- Microfilm Data Storage
- Printing/Publishing
- Radar Displays
- Flying Spot Scanners
- CRT Lamination
- Phosphor Coating

**Contact the CRT Group at IST today. We're up to the challenge!**

**Imaging and Sensing Technology Corporation**  
500 IST Center  
Horseheads, NY 14845 USA  
Tel. 607 562-4300  
Fax. 607 562-4490  
E-mail: [EOinfo@istcorp.com](mailto:EOinfo@istcorp.com)  
[www.istcorp.com](http://www.istcorp.com)

**CRT Solutions**

A013 0700

See Us at SID '00 Booth 204

Circle no. 76



Your Lifeline To The Digital Age Has Just Arrived. Introducing The MicroCross™ DVI.



High-res digital and analog displays are here. And so is *Digital Visual Interface* (DVI). It's the integrated, cost-effective interface that's your shortcut to the future of digital display technology. What ties it all together? The MicroCross™ DVI interconnect system from Molex.

The Digital Display Working Group (DDWG)\* chose the innovative MicroCross DVI system because it offers impressive bandwidth\*\* in a small, rugged package with excellent EMI shielding. MicroCross DVI also takes advantage of new plug and play extensions and it supports digital and analog display technology, plus provides hot-plugging capabilities.

Best of all, everything you need is available from one reliable source — Molex. We offer both digital and digital/analog versions, including cable assemblies, right angle and vertical receptacles and adapters.

So why just tread water when we're offering you a lifeline? To find out how MicroCross DVI can help you save PCB real estate and provide the ultimate video solution, contact Molex today.

**Americas Headquarters**  
Lisle, Illinois 60532 U.S.A.  
Tel: 1-800-78MOLEX  
Fax: 630-969-1352

**Far East North Headquarters**  
Yamato, Japan  
Tel: 81-462-65-2324  
Fax: 81-462-65-2361

**Far East South Headquarters**  
Jurong, Singapore  
Tel: 65-262-6868  
Fax: 65-265-6044

**European Headquarters**  
Munich, Germany  
Tel: 49-89-413092-0  
Fax: 49-89-401527

**Corporate Headquarters**  
2222 Wellington Court  
Lisle, Illinois 60532 U.S.A.  
Tel: 630-969-4550  
Fax: 630-969-1352



Bringing People & Technology  
Together, Worldwide<sup>SM</sup>

© 1999, Molex

\*DDWG promoters are: Intel Corporation, Silicon Image Inc., Compaq Computer Corporation, Fujitsu Limited, Hewlett-Packard Company, International Business Machines Corporation, NEC Corporation

\*\*9.9Gb/s over digital dual link implementation and 2.5 GHz analog.

Visit our Web site at <http://www.molex.com/ads/DVI.htm>

See Us at SID '00 Booth 849

Circle no. 77



inside  
our  
product ...

Single Chip Segment / Common LCD Driver Controller ICs  
**QUALIFIED BY THE WORLD'S LEADING MOBILE PHONES MAKER**  
 for Portable Telecommunications and Consumer Applications

**Slim Die for COG/COF**



**Bare Die for COB**



**TAB for Heat Seal/ACF**



- A full range of LCD driver controller ICs from 100x32 to 132x64 and 128x64/80/128 (SEGxCOM) display resolution for module design flexibility
- Simple system configuration for minimizing external components
  - Single operation voltage, on-chip DC/DC converter, bias generator, oscillator and display RAM
- Ultra low power consumption for overall system power saving
- High compatibility interface for most common MCUs
  - 6800/8080 series MCU parallel interface or high speed serial interface
- Powerful command set for easy programming and advance display performance
- Packaged in TAB, gold bump die or bare die form for compact applications

**Our Product - IC**



actual size

SAMSUNG DIGITAL  
everyone's invite

WINDOW  
FOR  
DIGITAL

# People are on the move. Are your products with them?

From mobile phones to PDAs, Samsung SDI LCD mobile displays help your products stand out in the crowd.

In today's hectic, crowded mobile marketplace, you need every advantage you can get to help your products stand out. And that's where LCD modules from Samsung SDI can make all the difference. Our low-power, high-response reflective color LCDs add superior value and performance to any phone or PDA. And with the industry's only touch panels built right into the module screen during production, you won't find a thinner, lighter panel anywhere for your PDAs or wireless Internet devices. Surf on over to [www.samsungsdi.com](http://www.samsungsdi.com) for all the details today. And open up a whole new window in your digital future.

SDI America : 18600 Broadwick Street Rancho Dominguez, Ca 90220 USA TEL (310) 900-5219 / FAX (310) 537-1033 E-mail : [joseph@sdiamerica.com](mailto:joseph@sdiamerica.com) [www.samsungsdi.com](http://www.samsungsdi.com)

**Samsung SDI, the new name of Samsung Display Devices, Co., Ltd (SDD) presents new display creation and total display solutions.**  
See Us at SID '00 Booth 731 Circle no. 79

SAMSUNG

# ONE PLACE TO GO!!

## TFD = FULL CAPABILITIES IN DISPLAY COATINGS and more

- ★ **GLASS:** cutting, polishing (5Klux), beveling
- ★ **COATINGS:** ITO, IMITO, BBAR, heaters, EMI shields, bus bars, Hot/Cold mirrors, High-Performance Hot Mirrors, matched ITO to LC or other media
- ★ **RUGGEDIZATION:** Mil qualified lamination of filters to LCD, EMI/AR or heaters onto LCDs or other flat panels, and Hot Mirror lamination on displays for sun protection.
- ★ **ETCHING/PATTERNING:** ITO, IMITO, Metallizations
- ★ **SIZES:** 16 x 20" now;  
36 x 36" spring 2000
- ★ **CAPABILITY:** for volume or custom
- ★ **QUALITY SYSTEM:** Mil I-45208

**ENHANCED SPUTTERING FOR SUPERIOR ADHESION, MORPHOLOGY AND LOW DEFECTS**

★ **QUALITY** ★ **PRICING** ★ **CAPABILITY**

# TFD

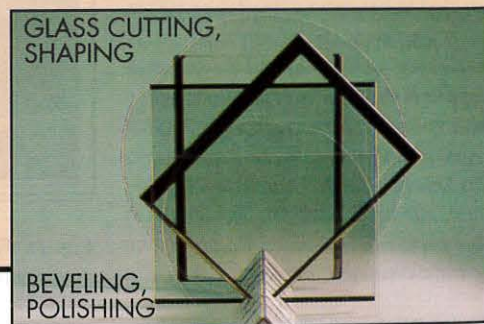
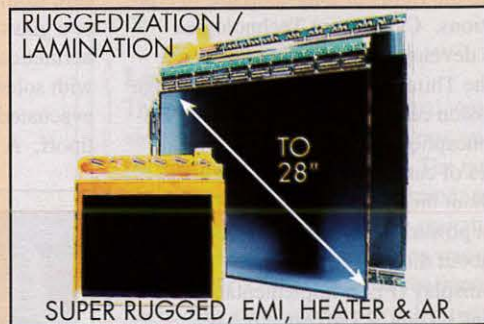
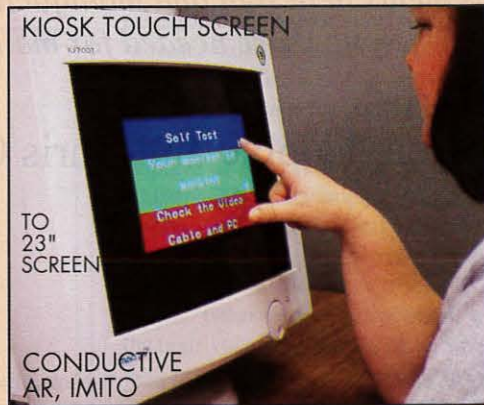
## THIN FILM DEVICES, INC.

Manufacturing and Corporate Office  
1180 N. Tustin Ave., Anaheim, CA 92807  
(714) 630-7127 • FAX (714) 630-7119  
Email: [sales@tfdinc.com](mailto:sales@tfdinc.com) • [www.tfdinc.com](http://www.tfdinc.com)

European Office • Tvb Germany  
Dr. Roland Muller  
Phone / Fax 07643-930550  
Email: [rowoco@aol.com](mailto:rowoco@aol.com)

Taiwan Office • TML  
Alex Wu  
Phone: 886-2-29634998 • Fax: 886-2-29556321  
Email: [wuchite@kmail.seed.net.tw](mailto:wuchite@kmail.seed.net.tw)

# INC



# FED Life and Reliability

*Candescent's display life and reliability research has produced improvements in design and manufacturing – and values that are approaching those needed for mainstream consumer products.*

by George Hopple and Chris Curtin

ONE OF THE MAJOR CONCERNS about any new display technology is whether it will stand up to the rigors of long-term use in typical conditions. Candescent Technologies Corp. has developed an emissive flat-panel display, the ThinCRT™, based on low-voltage field-emission cathodes and high-voltage aluminumized phosphors, which offers the visual advantages of cathode-ray-tube (CRT) displays without their disadvantages of bulk and high input power. Questions have been raised recently about the longevity of some field-emission-display (FED) implementations. Candescent's ThinCRT architecture is designed to meet the commercial market demands for life and reliability, and research has demonstrated its success.

Candescent's ThinCRT display technology, which operates at low switching voltages and high phosphor efficiency, is intrinsically power efficient, and being an emissive display, its power consumption scales in direct relation to brightness and image content (Fig. 1). Each of these factors directly affects life and reliability.

The ThinCRT consists of a 1.1-mm-thick glass backplate onto which is deposited the cathode structure and a 1.1-mm-thick glass faceplate onto which are deposited color phos-

phors. Internal support structures (horizontally oriented walls) keep atmospheric pressure from collapsing the display (Fig. 2). The two glass plates are separated by 1.25 mm and hermetically sealed around their perimeters with solder glass. The resulting "tube" is evacuated to about  $10^{-7}$  torr prior to final tipoff. A getter to adsorb residual gases from

the vacuum enclosure is located either along an inside border of the display or in an auxiliary chamber attached to the back of the display.

The majority of the technology development at Candescent has been done on small test displays of 2.3–5.3 in. on the diagonal. Some 13.2-in. SVGA ThinCRTs have also



**Fig. 1:** FED picture content is increasing. This 13.2-in.-diagonal ThinCRT™ has 800 × 600 pixels with a 200-cd/m<sup>2</sup> luminance and 200:1 contrast ratio.

Candescent Technologies Corp.

*George Hopple is Reliability Manager and Chris Curtin is the Senior Director for Product Engineering at Candescent Technologies Corp., 6320 San Ignacio Ave., San Jose, CA 95119; telephone 408/229-6150, fax -0850, e-mail: Ghopple@candescent.com and Ccurtin@candescent.com.*

been built to demonstrate the scalability of the technology, but this article will focus on the results from the 5.3-in. quarter-VGA-format (QVGA) devices.

### Life and Reliability

The life and reliability requirements of the

ThinCRT are divided into two separate specifications. "Life" is used to describe the time to half-luminance, and "reliability" describes the mean time to failure (MTTF).

The time it takes for the luminance (or, in the case of front projectors, luminous flux) to decrease to 50% of its initial value has histori-

cally been used by display technologists as a measure of lifetime. This applies to emissive displays – such as television receivers and PC monitors – as well as projector lamps and LCD backlights. Candescant's goal has been greater than 20,000 hours to 50% degradation.

MTTF is a probabilistic measure of sudden catastrophic failures in which a device becomes inoperable during the intended lifetime. The catastrophic failure rate is a summation of the rates for each of the various types of failures that result in an inoperable display. Candescant's goal for MTTF is 50,000 hours. Catastrophic failures for these displays include arcing and phosphor loss from high-voltage breakdown, or a row-to-column short that causes a black line on the screen. Other display components, such as the high-voltage power supply, TAB connections, and PC-board components typically have failure rates that are low enough not to significantly influence the ThinCRT failure rate.

### Luminance Degradation

The primary cause of the gradual loss of luminance in the ThinCRT is "wearing out" of the phosphor, or phosphor aging. The rate of this phosphor aging was first measured in 1996 at Candescant in special tubes operating at 6000 V. The last of these tubes was recently retired after 25,000 hours of continuous operation. The electron dose to half-brightness ranged from 120 coulombs/cm<sup>2</sup> (C/cm<sup>2</sup>) for the blue (ZnS:Ag) phosphor to 390 C/cm<sup>2</sup> for the red (Y<sub>2</sub>O<sub>3</sub>:Eu), with green (ZnS:Cu) in between at 260 C/cm<sup>2</sup>. These phosphor aging rates are similar to those reported in the literature for monitors and TV sets, with blue aging the quickest and red the slowest (Fig. 3).

It is customary to report phosphor aging in electron dose to half-brightness rather than time because of the design trade-off between luminance and lifetime. In other words, a display operated at a fixed luminance would degrade to 50% of its initial brightness twice as fast as a display operated at half that luminance. It is predicted that operation at higher voltages – 8 kV and 200 cd/m<sup>2</sup>, for example – with expected phosphor screen improvements will increase the time to 50% degradation to greater than 33,000 hours in office or home use. Proper white color balance (color temperature) will be maintained by the use of column-driver ICs with independent control of red, green, and blue output voltages. By vary-

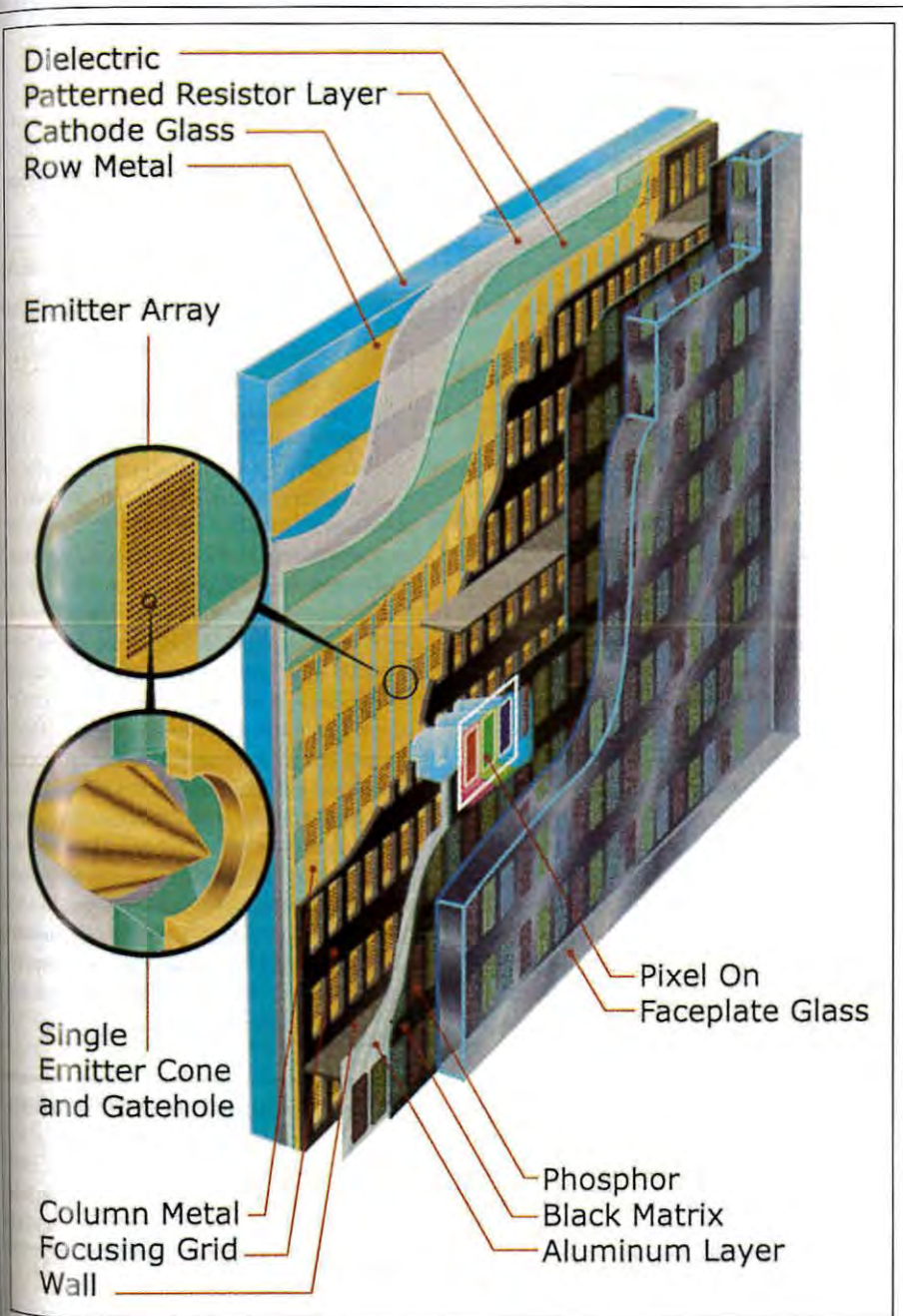


Fig. 2: FEDs have a very thin cross section, as indicated by the structure of Candescant's ThinCRT™.

# FED development

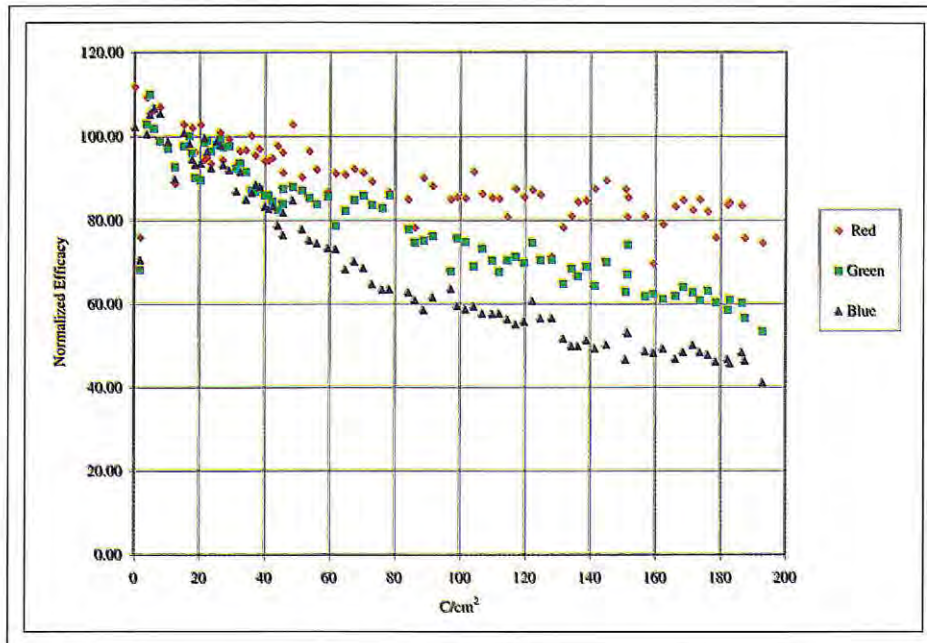


Fig. 3: Phosphor efficacy is a function of electron dose in coulombs/cm<sup>2</sup>.

ing the current to each phosphor, the luminance of each primary color can be independently controlled, both initially and throughout the life of the display.

The use of high voltage – more than 4 kV – is a key design feature of the ThinCRT, providing several advantages over “low-voltage” field-emitter displays. Among them is that standard P22 phosphors can be used with their known good color gamut and ready commercial availability. Because the life of color phosphors is, in general, inversely proportional to coulombs of charge deposited, the lower the excitation current and the greater the voltage for a given power input, the longer the phosphor life. Also, the efficiency of high-voltage phosphors is intrinsically greater than that of low-voltage (less than 1 kV) phosphors. In addition, at voltages greater than 4 kV, the efficiency can be enhanced by adding an aluminum film to the rear surface of the phosphor that reflects light generated in the phosphor back towards the viewer. The higher efficacy – measured in lm/W – results in less current used to achieve a given luminance, hence increased life. Candescent’s displays currently use P22 phosphors (Y<sub>2</sub>O<sub>2</sub>S:Eu for red, ZnS:Cu,Al for green, and ZnS:Ag,Al for blue) and have demonstrated efficacy greater than 12 lm/W at 7 kV.

### Catastrophic Failure

While there are a number of failure mechanisms that can result in a catastrophic failure or an inoperable display, the most predominant for our 5.3-in. QVGA ThinCRT has been high-voltage breakdown or arcing.

A number of design and process innovations have increased our initial MTTF for high-voltage breakdown from 100 hours at 5 kV in a 2.3-in.-diagonal display to greater than 36,000 hours for 5.3-in. QVGA displays operating at 6 kV (Table 1). Most notable were design changes associated with our proprietary spacer technology. An important process change was an inspection for defects in the components prior to assembly to determine if subsequent arcing was associated with a particular type of defect. Thorough analysis of failed devices also played an important role in identifying the root causes of arcing failures. Another very important change for arcing reliability was increasing the burn-in/conditioning voltage to a level above the operating voltage. This is similar to the process used for conventional CRTs. Although the tube yield through burn-in was reduced, the reliability of the tubes that survived increased significantly. This was a major improvement that supports the high-voltage-stress screen strategy for improving reliability.

Following initial design and cleanliness improvements, the predicted MTTF increased to 36,000 hours at 6 kV. Preliminary data on current displays with still more design and processing improvements show an MTTF at 7 kV of 24,000 hours. Laboratory tests further indicate that display voltages approaching 10 kV can be sustained with the same basic design.

### Other Reliability Concerns

**Cathode emission vs. time.** Emitter life depends on the initial vacuum processing of the display and the vacuum quality maintained during the life of the display. Residual gases left in the display prior to sealing or gases generated during display operation can adversely affect the operation of the emitters. A number of factors can minimize vacuum degradation in the display.

- Proper selection of materials exposed to the display vacuum.
- Proper cleaning and vacuum processing of the components.
- Fabricating a vacuum-tight peripheral seal joining the faceplate and cathode substrate.
- Controlling the thermal outgassing and electron-induced desorption of gases from internal display components.
- Providing a chemically active getter within the vacuum envelope of the display.

Candescent has developed several design features, as well as cleaning, vacuum processing, and sealing technologies, to minimize residual gases in the tube. Proof of emission stability is shown by a number of 2.3-in.-diagonal test displays that have run for over 30,000 hours with only small changes ( $\pm 15\%$ ) in the switching voltage necessary to maintain a constant current. Although current displays have not been operating as long, they exhibit even better stability (Fig. 4). These data

Table 1: Evolution of Operating Voltage and MTTF

Test Vehicle	2.3 in.	5.3 in. QVGA	5.3 in. QVGA
Sample size (displays)	15	48	24
Operating voltage (V)	3500	6000	7000
MTTF (hours)	6300	36,000	24,000

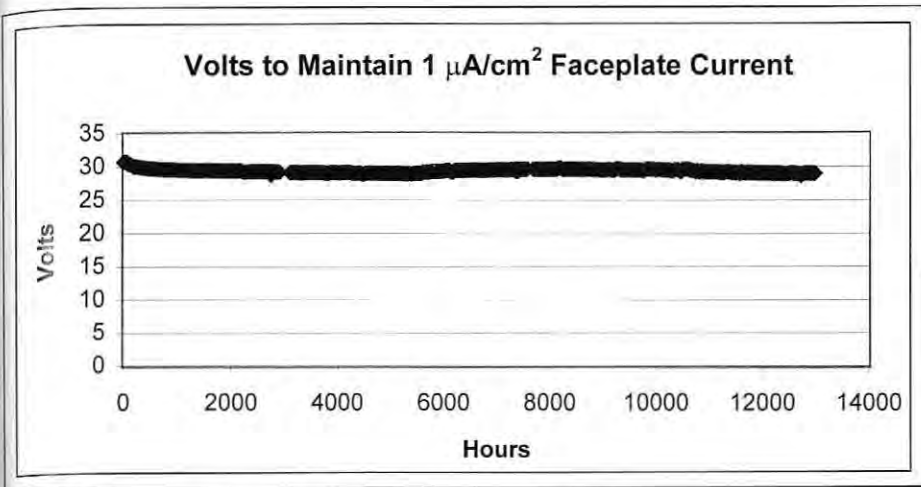


Fig. 4: The emitter-tip-to-gate voltage required to maintain a constant current during life is relatively stable.

demonstrate that cathode-emission aging will not be a serious issue in long-life ThinCRT operation.

**Vacuum level.** Early research on field-emission cathodes at SRI International was done at very high vacuum levels, and many people were concerned that these vacuum levels would be needed in an operating FED. Experience has shown that the partial pressures of gases that degrade the work function of the emission sites are critical to reliability, not the total pressure. For example, partial pressures of hydrogen and methane can be beneficial, while oxygen, water, and carbon dioxide cause rapid deterioration of the emission process. Operation in pressures of inert gases in the range of  $10^{-6}$ – $10^{-7}$  torr for tens of thousands of hours has been successfully demonstrated at Candescant.

**Perimeter-seal leaks.** Seal leaks have not been a problem because solder glasses, or "frits," developed for the traditional CRT industry are used. When melted, these materials bond to the cathode and faceplate surfaces and form a hermetic seal. The coefficient of thermal expansion is matched to the substrate glass so that no stress is induced during thermal processing. Leak-rate test systems – to which all displays are subjected at Candescant – are capable of  $10^{-11}$  L-torr/sec detection. Diagnostic systems have been developed to test selected displays to less than  $10^{-14}$  L-torr/sec.

**Emitter-tip aging.** Many authors have reported severe aging of the field-emission

process in the presence of sulfide phosphors. We have not experienced this at Candescant, even though Auger spectroscopy shows the presence of sulfur on the cathode after life test. Data from ThinCRTs containing only oxide phosphors show emitter life identical to those of devices with sulfide phosphors.

**Mechanical reliability.** In order to use high-voltage phosphors, internal supports having height-to-width ratios of 20:1 or greater are required. The height must be great enough to provide anode/cathode spacing sufficient to prevent arcs, and the width must be narrow enough to fit between rows of pixels. The supports must be quite strong under compression as well as mechanically and electrically invisible, *i.e.*, the supports must not disturb the emitted electrons as they pass from the cathode to the phosphor.

Candescant has developed an engineered ceramic material and a mechanical alignment system to provide and place such supports. The six supports used in a 5.3-in. ThinCRT are in the form of continuous horizontal walls. The faceplate-to-backplate separation (the support height) is approximately 1.25 mm, and the supports are 55  $\mu$ m thick. The compressive ceramic strength is greater than 18,000 psi. The traditional CRT design guideline of testing to 3-atm overpressure is used, and the 5.3-in. devices typically survive 6–7 atm of pressure in a hydrostatic test. In addition, these displays have proven to be mechanically reliable in shock and vibration testing. A series of operating devices were

successfully tested to 5-g's vibration over a range of 10–2000 Hz and shock-tested to 150 g's in all six axes.

### Summary

Whenever any new technology is developed, life and reliability are key factors in determining its commercial viability. The ongoing research and testing programs at Candescant have led to a series of design and materials developments that conclusively demonstrate that ThinCRT displays can meet life and reliability requirements, although further development is required. Our work continues in the exploration of materials and processes that can yield further improvements. ■

**930mm / 600mm / 375mm**  
World Class, Double-Side, Vertical, In-line  
Cryo Pumped Sputter Coating Systems

### Save 80%

- Up to 8 double-side process stations
- Substrates 930mm, 600mm, or 375mm wide
- Automated for Production • Rack & Pinion Drives • Exc Condition • Professionally De-Installed • Ready to ship now
- PhD Process Development Support

**Alcatel - Comptech**  
Model SP-1 • 375mm (qty 1)

### Ulvac

- 930mm (qty 3)
- 600mm (qty 3)

### WEB CATALOGUE

Throttle Valves, Pumps, Controls, Chambers  
plus Motion Components of all kinds.

**SYSTEM INTEGRATION • FIELD SERVICE**  
certified for Anorad and other Precision  
Motion & Robotic Systems.

**LMDC** Laser & Motion  
Development Co.  
[www.lasermotion.com](http://www.lasermotion.com)

3101 Whipple Road Fax-429-1065  
Union City, CA 94587 510-429-1060  
office@lasermotion.com

Circle no. 81



## Redefining capacity.

Micronic is at the forefront in display photomasks and now offers the multi-beam pattern generators for increased productivity at maintained precision. We have created an innovative way of writing complex patterns in a highly cost-effective way.

We help our customers become world-leaders. If your business employs high-precision microlithography, and you are ready for the next step forward, you are invited to contact Micronic.



**MICRONIC LASER SYSTEMS**

MICRONIC LASER SYSTEMS AB (publ.) | Box 3141, SE-183 03 Täby, Sweden | tel: +46 8 638 52 00 | fax: +46 8 638 52 90 | e-mail: [info@micronic.se](mailto:info@micronic.se) | website: [www.micronic.se](http://www.micronic.se)

See Us at SID '00 Booth 927

Circle no. 82



# Teamwork.



The essence of teamwork at Lexel is talented, dedicated people working together and striving to achieve ever-increasing levels of excellence. Excellence is evident everywhere at Lexel and is the reason our special purpose CRTs are so valued in the industry.

Pride in achieving excellence is the cornerstone of the Lexel Team. Pride in the design and manufacturing of CRTs which exceed customer requirements and expectations; pride in continually improving our processes and products; pride in our commitment to our customers and in providing them with superior quality, value, performance and service; but most of all, pride in ourselves and in our continuing commitment to each other.

**Excellence, Pride and Teamwork -  
That's Lexel**



A SUBSIDIARY OF LEXEL CORPORATION

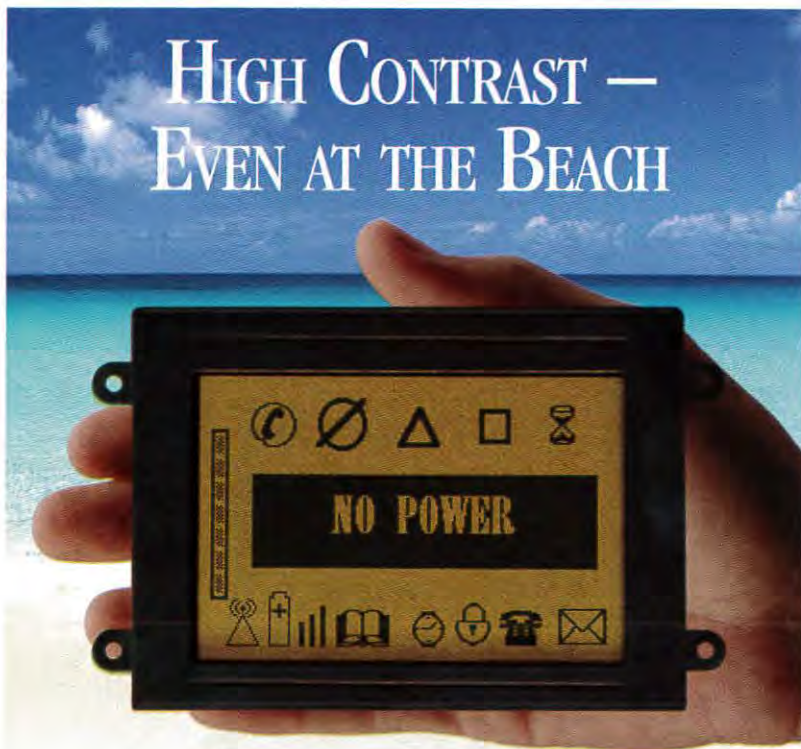
1501 NEWTOWN PIKE • LEXINGTON, KY 40511  
PHONE (606) 243-5500 • FAX (606) 243-5555  
SALES & MARKETING (970) 731-5260 • FAX (970) 731-5261

Visit our website: [www.lexelcorp.com](http://www.lexelcorp.com)



Circle no. 83

# HIGH CONTRAST — EVEN AT THE BEACH



## KENT ChLCD™ No Power Displays

### EASIEST TO READ REFLECTIVE TECHNOLOGY

Compared to conventional LCD technologies, KENT Displays' ChLCD (Cholesteric Liquid Crystal Display) technology offers better reflectivity, a 360 degree viewing cone and exceptional daylight contrast, even in direct sunlight — all without backlighting.

### BREAK THE BATTERY-DRAIN BARRIER

Since ChLCD reflective and transparent textures are both stable states, an image can be displayed indefinitely without consuming battery energy — for seconds, hours, weeks, months or even years.

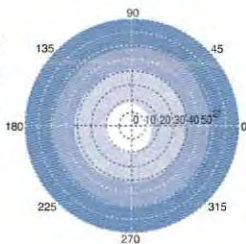
### STANDARD OR CUSTOM DISPLAYS AVAILABLE

Standard ChLCD displays and modules are available in sizes and colors to meet your needs. Have a special application? KENT Displays offers ChLCD displays and modules custom designed to your requirements.

### ASK FOR THE FACTS

To learn more about this technology that enables you to do more, ask for this package today.

Circle no. 84



*This contrast ratio polar representation illustrates KENT's 360 degree viewing cone.*



**KENT** DISPLAYS  
INCORPORATED

A MANNING VENTURES BUSINESS UNIT

Kent Displays, Inc. • 343 Portage Boulevard • Kent, OH 44240 • Phone: 330.673.8784 • Fax: 330.673.4408

Internet: <http://www.kentdisplays.com> • E-mail: [sales@kentdisplays.com](mailto:sales@kentdisplays.com)

Products and technologies of Kent Displays, Inc. are protected by the following patents: United States: 5,453,863; 5,437,811; 5,384,607; 5,251,618  
People's Republic of China: 92101982.2; Israel: 101,746; Taiwan: 801405631; PCT EP; Canada, Korea, Japan and Norway: 92/01594; 92/09367. Other Patents Pending.

See Us at SID '00 Booth 633

## New Redesigned Infosign™

1997 ★★★★★  
Product of the  
Year Award  
ELECTRONIC  
PRODUCTS MAGAZINE



Kent Displays' next generation of Infosign products, this Three-Panel Infosign is available with or without a controller. A single "Three Panel Infosign" with controller can control up to 9 additional displays for a total of 12. This means that you can combine individual Info-Strips with Three-Panel Modules in any combination to fit your particular signage needs. Like the original Single-Panel Infosign, this Three-Panel can be updated quickly from a remote computer with the Windows 95 compatible software that is included. Options include wall mount and floor stand enclosures in silver, black and gold, with or without battery pack, in 3, 6 or 12 display configurations.

Infosigns are ideal for point-of-sale displays, door signage, battery-powered signage, kiosks, airport- and bus-terminal signage and more.

Infosign displays feature ChLCD technology for high contrast and wide viewing angle. They are available with a standard resolution of 20 dpi and an active viewing area of three, 12 in. x 1.5 in. panels. Display color combinations of yellow/black, yellow-green/black, green/black and blue/white are available.

KENT Displays, Inc., 330-673-8784

E-mail: [sales@kentdisplays.com](mailto:sales@kentdisplays.com)

Circle no. 85

## 1/4 VGA "No Power" Displays



Kent Displays' 1/4 VGA ChLCD "No Power" design not only provides exceptional readability but also requires no power to maintain displayed images, only to change them. Because power isn't constantly being drawn upon to retain the image, expect exceptionally long battery life. As such this display is ideally suited for portable battery-operated applications as well those information display projects where the display must be easily readable at any angle even in direct sunlight.

The 1/4 VGA format is ideal for portable communication devices, data collection products, global positioning systems and more. Available with or without an on-board controller, in 4 color combinations yellow/black, yellow-green/black, green/black or blue/white and featuring an imaging area of 4.48 in. x 3.36 in. with a pixel resolution of 72 dots per inch.

KENT Displays, Inc., 330-673-8784

E-mail: [sales@kentdisplays.com](mailto:sales@kentdisplays.com)

Circle no. 86



## WHICH TOOL IN YOUR FAB IS THE WEAK LINK?

Excess static charge in just one tool can start a chain reaction that ends in product damage and downtime. That's why the leading experts in electrostatics introduced SEMI E78, also known as The Static Budget Guide for Capital Equipment, through the SEMI® International Standards Program.

It's simple. E78-compliance enables faster ramp-up of new tools and processes by improving OEE and uptime.

Now you can prevent static-induced problems where they start: at the tool. E78-compliant tools are your link to greater productivity. Contact Ion's Professional Services for more information and a free set of sample static control requirements for your equipment purchase specifications at 800-367-2452 or [www.ion.com/E78.html](http://www.ion.com/E78.html).

THE ELECTROSTATICS  
MANAGEMENT EXPERTS

See Us at SID '00 Booth 508

800.367.2452

510.548.3640

[www.ion.com](http://www.ion.com)

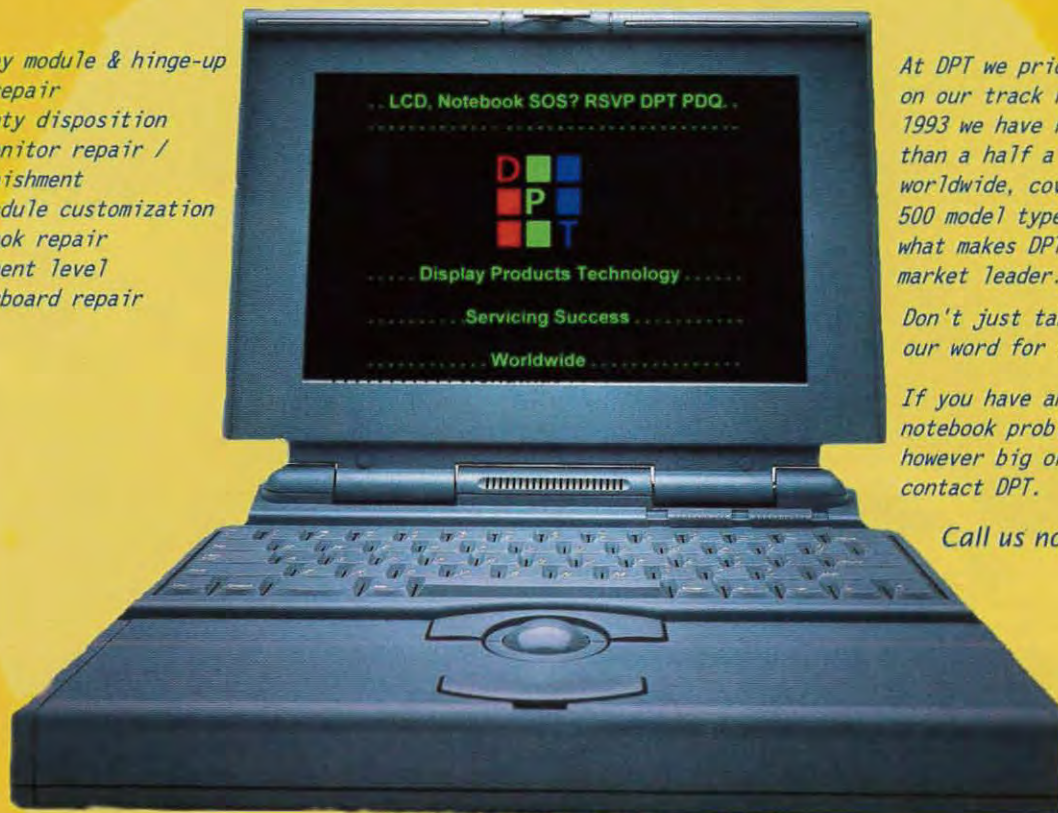
Circle no. 87



SYSTEMS

**DPT. A one stop shop for all your LCD and notebook requirements.**

- \* Turnkey module & hinge-up LCD repair
- \* Warranty disposition
- \* LCD monitor repair / refurbishment
- \* LCD module customization
- \* Notebook repair
- \* Component level motherboard repair



*At DPT we pride ourselves on our track record. Since 1993 we have repaired more than a half a million units worldwide, covering over 500 model types. That's what makes DPT the market leader.*

*Don't just take our word for it.*

*If you have an LCD or notebook problem, however big or small, contact DPT.*

*Call us now.*

**FOR MORE INFORMATION CONTACT CHRIS PATON:**

**Tel: +44 (0) 1355 239199**

**Email: [cpaton@dpt-uk.co.uk](mailto:cpaton@dpt-uk.co.uk)**

**Fax: +44 (0) 1355 241190**

Circle no. 88

**5 SEPTEMBER 00**

**IDMC 2000**

**September 5 - 7, 2000**

**Sheraton Walker Hill Hotel**

**Seoul, Korea**

**<http://tftlcd.kyunghee.ac.kr/idmc>**

- The 1st International Display Manufacturing Conference & Exhibition
- IDMC 2000 features:
  - Keynote Address
  - Technical Sessions, Poster Session
  - FPD Exhibition
  - Free Presentation of Products

**SID**

Korea Chapter

**KIAS** The Korean Information Display Society

**SID '01**

San Jose, California

San Jose

Convention Center

June 3-8, 2001

**Mark Your Calendar Now!**



**Syntronic**  
SYNTRONIC INSTRUMENTS, INC.

# A Half Century of Extraordinary Focus

The past 50 years have brought about dynamic technological changes in the CRT display field, eliminating most competitive manufacturers through the transitions. Syntronic, however, has continued to step-up and meet those challenges time and time again - where others could not. This is the reason why everywhere one turns in the electromagnetic component market, Syntronic's name and expertise is ever present.



100 Industrial Rd. • Addison, IL 60101 • Phone: 630-543-6444 • FAX: 630-543-0287  
E-MAIL: [sales@syntronicinst.com](mailto:sales@syntronicinst.com) • WEB SITE: [www.syntronicinst.com](http://www.syntronicinst.com)

**EASTERN REGIONAL OFFICE** : 30 TWO BRIDGES ROAD, STE 330 • FAIRFIELD, NJ 07004 • PHONE: 973-808-6676 • FAX: 973-808-6860  
**WESTERN REGIONAL OFFICE** : 28202 CABOT RD., STE 250 • LAGUNA NIGUEL, CA 92677 • PHONE: 949-365-1337 • FAX: 949-365-1341

## SMAU '99, Milan, Italy

*Italian design, display products not seen outside Italy, and a full menu of international offerings makes Europe's second-largest IT trade fair a unique event.*

by Bryan Norris

**S**MAU is an international event that nevertheless retains a very vibrant Italian flavor: Many of the home-grown PC and display companies seen at SMAU are virtually unknown outside Italy. Therefore, despite being held only a week after the Orbit Show in Switzerland and inevitably duplicating some of the products seen at the earlier show, SMAU is the place to find unique-to-Italy products.

In 1999, SMAU – the International Information and Communication Technology Exhibition – reverted to its traditional timeslot and was held from September 30 to October 4 in Milan. Naturally, it is Italy's premier IT trade fair; surprisingly, it is also the world's second-largest IT show (by visitor numbers). SMAU '99 attracted a record audience of 490,000 visitors – an increase of 18,000 over 1998.

These visitors were able to see the products of nearly 3000 direct and indirect exhibitors, a prospect exciting enough to attract a number of distinguished Italian dignitaries, notably the President of the Republic, Carlo Azeglio

---

*Bryan Norris is the Senior Partner and founder of Bryan Norris Associates, Consultants in Electronics, 7 Biddenham Turn, Biddenham, Bedford MK40 4AT, U.K.; telephone +44-(0)-1234-26-7988, fax +44-(0)-1234-26-2345, e-mail: bnorris@kbnet.co.uk. The company specializes in all aspects of VDU markets in Europe and provides the highly respected VDU Vision market-analysis service. Mr. Norris is a contributing editor to Information Display Magazine.*

Ciampi, and the Prime Minister, Massimo D'Alema.

And just in case visitors had any spare time after touring the exhibits, they could attend

over 100 seminars or take part in 27 conferences arranged by the SMAU organizers, in addition to those which had been organized by individual companies. If all that sounded too



**Fig. 1:** Seleco-Formenti's 15-in. ego TFT-AMLCD provided a good example of the Italian design that is not often seen in other display markets.

Seleco-Formenti

exhausting, there was always the option of staying at home and visiting the show Web site, Magellano On Line ([www.smau.it/magellano](http://www.smau.it/magellano)), which registered nearly nine million hits during the five exhibiting days.

### The "Must-See" Models

Keeping with the times, there were considerable numbers of LCD monitors on show from both the well-known international branded suppliers and smaller indigenous companies. Overall, it was the considerable number of 18-in. LCD monitors that formed the display highlight of SMAU '99.

But other LCD sizes were also worthy of close inspection, such as *Apple's* 22-in. Cinema Display, just launched in Europe. This model actually became available to European buyers on the Friday during the show (October 1) – through Web site orders only – and sales that morning were reported to be running at two a minute! And, like last year, *Panasonic's* "forthcoming" LC90S 19-in. model attracted attention, though this product was again not due for delivery until "the end of the year."

With reference to CRTs, the star exhibits were definitely the "flats" – stunning new Sony FD Trinitron®-tubed monitors on the stands of *Sony* (naturally) and *Nokia*, and Mitsubishi NF DiamondTron™-tubed units from *Mitsubishi* and *LaCie*. In addition, LG Flatron tubes were seen in new models from *LG*, and *Samsung* was showing its Dynaflat™ tubes in two (17- and 19-in.) models.

### The March of the 15-in. LCD

Fifteen-inch LCD models were everywhere, so it wasn't easy to pick out products from the crowd. But it was interesting to look at the products from the local boys – such as PC assembler *ASEM's* Vision 151, the Tango 500 from *McPerson* of Pordinone, and the ego TFT-AMLCD by *Seleco-Formenti* (Fig. 2). In its press release, ASEM claimed to be the "market leader in selling TFT-LCD monitors for office and industrial use, with sales of over 10,000 units in Italy during 1998"! Many of these were shipped through Bull to fulfill the first phase of a contract with the Italian Post Office. *McPerson* got the second phase of the PO contract and had been busily shipping its *McPerson*-branded LCD monitors for about a year. These were initially 10.4-in. models, then 12.1-in. units.

*Seleco-Formenti's* ego unit was shortlisted for the 1999 SMAU Industrial Award. It had been specially designed so it could function as an Internet surfer and a color TV screen, as well as a PC monitor. Accordingly, the strapline attached to this model was "a TV for the office or a monitor for your home." It was selling for Lire 3120k (US\$1715). [All prices quoted here are recommended retail prices (RRPs) excluding local tax (20% in Italy), unless otherwise stated.] The company

planned to launch an 18-in. version in January 2000.

Offerings from the international suppliers included the new 1525H XGA 15-in. model, with both an analog and a digital input, from *NEC*, and the company's 15.4-in. LCD15125S, claimed to be the only model of its size to offer a resolution of 1280 × 1024. *Panasonic* had its three latest 15-in. models on display at the show, all with viewing angles of 160°. The top-of-the-line LC50SP can be rotated 90° on its axis.

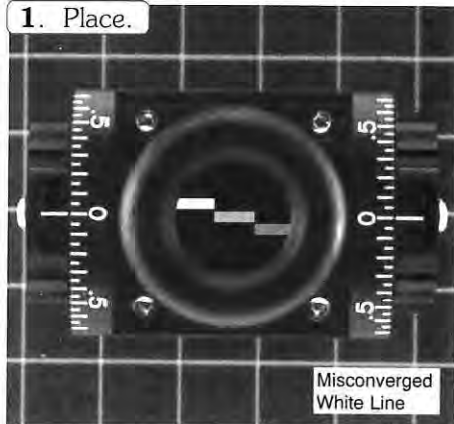


Sambers

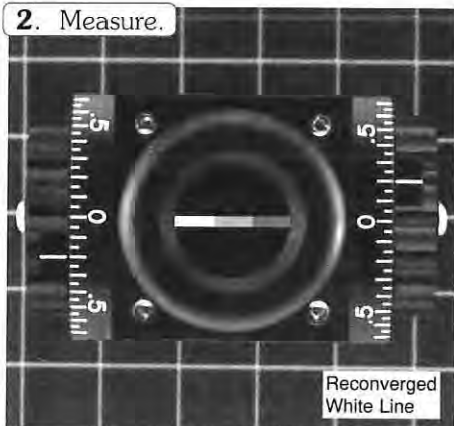
*Fig. 2: Sambers introduced the Hantarex PD42 Expansion plasma display, which had been nominated for the SMAU Industrial Design Award.*



### 1. Place.



### 2. Measure.



**KLEIN**  
Instruments Corporation

Contact us now at  
**Klein Instruments**  
Portland, OR USA  
ph (503) 245-1012  
fax (503) 245-8166  
www.kleininc.com

Circle no. 90

## show report

those increasingly seen in new airport installations. In addition, Fimi still builds and sells its profitable range of monochrome and color 14–21-in. medical monitors.

**CA&G Elettronica** continues to manufacture around 200,000, mainly industrial, monitors at its plant in Cornedo, near Venice. Italy is the prime market for CA&G's monitors, though it also sells into other European countries such as Spain, Germany, and the U.K. (Nowadays, however, many of its computer monitors, which sell under the "Vidi" brand name, are brought in from the Far East.) Milanese maker **Sambers** reported steady growth of production and sales of its large-screen (CRT and plasma) Hantarex-branded information monitors.

Talking of the once great **Hantarex**, **Semio** of Florence could now be said to be the true successor to this company, which used to make a million monitors a year. Using experience gained at Hantarex, the Semio team has been quite successful selling its Boxer range of mostly industrial monitors on the Italian market. Semio now aims to expand into other European countries. The current Boxer range, designed in Italy and made in China at a factory in which the Semio Group has a share, comprises 10 models from 10 to 19 in. Semio also has the Techno 14- and 17-in. professional open-frame monitors.

Finally, a new brand, **Vibrant** from **Tatung**, was displayed on the stand of distributor **ECC Elettronica**. The range shown included entry-level (54 kHz) and high-end (69 kHz) 15-in. CRT models, a 70-kHz 17-in., a 95-kHz 19-in., and a 15-in. TFT monitor. Distribution of the Vibrant brand started in the U.K. and is planned across most of the European countries. (The product is made in the Far East, not in Tatung's U.K. plant.)

### The Italian Fortunes of the International Players

**Fujitsu Siemens Computers** had a large stand at the show on which all the exhibits (including the Siemens 18-in. LCD monitor) had been overbranded with the new joint-name logo. This new merger, with an official start date of October 1, 1999, had recently been given the go-ahead by the EC competition authorities.

Meanwhile, **CTX**, which last year celebrated the opening of an office in Italy and had a booth at SMAU for the first time, was

absent from this year's show. Unfortunately, the company has been operating under financial constraints during 1999 and the Italian office was closed in June. (The CTX office in France was also closed in June.)

SMAU '99 also witnessed another disappearance from the Italian scene, though this time not a company, but a brand name. The President of NEC Computer Systems Division **EMEA** announced that he and his team at **NEC/Packard Bell/Zenith Data Systems (ZDS)** had recently decided to stop running the ZDS brand of professional PCs. Henceforth, the NEC brand will be used for professional PCs and peripherals, and the Packard Bell brand will be kept for the consumer products. The ZDS brand of PCs has enjoyed a good name in the Italian corporate market, as well as those of France and Spain.

But if one brand name disappears, there are always plenty of new ones to take its place. **Toshiba** was demonstrating its range of Tekbright CRT monitors alongside its Equium desktop PCs introduced to Italy the month before the show. The local Toshiba representatives were promoting the 520 (30–69 kHz) 15-in., the 715 (30–86 kHz) 17-in., and the 920 (30–95 kHz) 19-in. CRT monitors – but no LCD models!

### Summing SMAU

So, once again SMAU proved to be a vibrant show with a surprising number of new, previously unseen displays on exhibition, many of them from local companies. Although LCD monitors were everywhere, the cost-conscious Italians have yet to embrace the flat-panel monitor, except for certain buyers in niche markets. Therefore, LCDs accounted for less than 2% of the total monitor market in Italy for the half-year 1999, which is still dominated by the growing CRT market.

The "branded" color CRT-monitor market in Italy, which accounted for just under 8% of total Western European branded shipments in 1998, grew to account for over 9.5% of shipments during the half-year 1999. So prospects for another successful SMAU next year (to be held from October 19–23) look good indeed. ■



# TAILOR-MADE LIGHT

FOR PRECISION MANUFACTURERS EVERYWHERE

Light-based assembly solutions from EFOS deliver speed, precision, control and repeatability, making them a perfect fit in any manufacturing environment.

EFOS is the world's leading developer of precision spot-curing technologies and has an ideal system for your unique application – one you can rely on. All of our products are backed by a global service and support network and our quality system is ISO 9001 registered.



Want to learn more about how light-based assembly solutions from EFOS give you stronger, faster cures? Improve quality? Save you money?

Follow this thread:

[www.efos.com/precision](http://www.efos.com/precision)

Or call us at: 1-800-668-8752

## EFOS

MANUFACTURING SOLUTIONS  
*with the POWER of LIGHT™*

# Society for Information Display CONFERENCE

**14 MAY 00**

SID '00  
International Symposium,  
Seminar and Exhibition  
May 14-19, 2000  
Long Beach, California  
Long Beach Convention Center

- **SID's MAJOR ANNUAL EVENT**, featuring:
  - Technical Sessions, Poster Session
  - Author Interviews, Evening Panels
  - Short Courses, Application Seminars
  - Technical Seminars, Application Sessions
  - Product and Technology Exhibits
  - Display Technology Showcase

**SID**

**25 SEPTEMBER 00**

IDRC  
International Display  
Research Conference  
September 25-28, 2000  
Palm Beach, Florida

- An international conference on display research and development aspects of:
  - Display Fundamentals, Display Devices
  - Hard Copy & Storage, Input Systems
  - Integrated Devices and Device Applications
  - Multimedia Systems
  - Image and Signal Processing
  - Color Perception, Human Factors
  - Product and Technology Exhibits

**SID**

**6 NOVEMBER 00**

Display Phosphors Conference  
November 6-8, 2000  
San Diego, California

- 6th annual international conference on display phosphors

**SID**

*For Information on SID Conferences, Contact:*

Dee Dumont  
Society for Information Display  
31 East Julian Street, San Jose, CA, USA 95112-4006

TEL: 408-977-1013  
EMAIL: [office@sid.org](mailto:office@sid.org)

FAX: 408-977-1531  
WorldWideWeb: <http://www.sid.org>

# Information Display CALENDAR

**14 NOVEMBER 00**

IED '00  
NOVEMBER 14-16, 2000  
Fisher, Surrey, UK

IED is a single-track technical conference and exhibition featuring UK and European display products.

**SID**

**14 NOVEMBER 00**

Color Imaging Conference  
November 14-17, 2000  
Scottsdale, Arizona

- An international multi-disciplinary forum for dialogue on:
  - Creation and capture of color images
  - Color image reproduction and interchange
  - Color image display
- Co-sponsored with IS&T

**SID**

**IS&T**

**29 NOVEMBER 00**

IDW '00  
November 29-December 1, 2000  
Kobe, Japan

- Information Display Workshops
- Invited experts will present talks at workshops on:
  - Emissive Displays
  - Non-Emissive Displays
  - Plasma and EL Displays
- Sponsored by SID/Asia Region, Japan Chapter, IEICEJ, ITEJ

**SID**

**ITE**

*Since 1962, a professional worldwide interdisciplinary society committed to the advancement of information display.*

**SID**  
SOCIETY FOR INFORMATION DISPLAY

# Going Flat out...

➤ **Pre-IPO!** iFire Technology Inc. offers many career opportunities for professionals interested in working in the exciting field of flat panel displays. iFire is home to one of North America's premier flat panel and phosphor research facilities, where its proprietary Solid State Display (SSD) technology is uniquely positioned to address the needs of tomorrow's high performance video display applications at truly affordable prices. SSD is capable of producing both small graphic and HDTV-class screen sizes with the industry's thinnest profile. iFire recently announced it has entered into a US\$25-million strategic partnership agreement with TDK Corporation of Japan for technology collaboration and production of iFire™ based flat panel displays. Applications will target the automotive display sector, including full-color console displays, instrumentation, navigation and passenger entertainment units, and applications in industrial, medical, home appliance, and consumer markets.

➤ iFire is a division of The Westaim Corporation, which specializes in launching high potential technologies into the marketplace. iFire's state-of-the-art pilot manufacturing plant and phosphor and display research center is located in Toronto, Canada. Join our team as we create the next generation in color flat panel displays.

➤ **Section Leaders, Opportunity #1464**

Provide hands-on technical leadership to a team consisting of engineers, scientists, technicians and operators. Leadership positions are available for the Photolithography, Thin Films and Integration teams. BS in Engineering or Science and 10+ years hands-on experience from either a semiconductor or flat panel industries in one or more of the following areas: photolithography, thin films or integration. Previous experience leading technical teams to meet the business requirements a must.

➤ **Process Engineers, Opportunity # 1440**

Develop and implement novel processing techniques for the commercialization of the Solid State Display technology. BS in Engineering or Science and hands-on experience from either the semiconductor or flat panel industries in one or more of the following: photolithography, thin films, thick films, integration, or other processes used in the specification and qualification of equipment.

➤ **Chemical Process Engineer, Opportunity # 1453**

Characterize and optimize material production processes and improve and scale up production of existing materials. BS in Chemicals/Materials Engineering and 5 years related experience.

➤ **Test Engineer, Opportunity # 1465**

Develop optical/electrical test methods and validation procedures of flat panel devices. BS or equivalent, experience in electronics display manufacturing and demonstrated knowledge of electronic assembly and manufacturing processes.

➤ **Research Scientist, Opportunity # 1455**

Experience with integration of processes, analysis of structures, electrical characterization and Stoichiometry analysis. Advanced degree in Physics, Chemistry, Materials Science or related discipline plus knowledge of Phosphors, ZnS and SrS.

➤ **Equipment Engineer, Opportunity # 1466**

Develop operational systems focussed on improving current performance in the areas of equipment installation, preventative maintenance, spare parts consignment and the repair. Related degree, experience in a high volume and yield sensitive environment and experience in complex troubleshooting resulting in rapid and successful repairs.

iFire offers full relocation, above average salary, bonuses, equity, medical, dental, pension, educational assistance and more! Qualified candidates are encouraged to submit a resume quoting opportunity # to:

For complete job descriptions and information about our company and Toronto, visit us on the web at [www.ifire.com](http://www.ifire.com). No telephone calls, please. Only those candidates selected for interviews will be contacted.



Resumes can be submitted by:

mail: iFire Technology Inc.

15 City View Drive  
Toronto, Ontario, Canada M9W 5A5

fax: 416.246.0458 (fine or superfine resolution only)

email: [hr@ifire.com](mailto:hr@ifire.com) (ASCII Text or Rich Text files only)

or visit our website at: [www.ifire.com](http://www.ifire.com)

# DRIVE UP WEDDING WINDOW



Will they still support your design 5 years from now?  
Or will they drop you like a bad habit when they get  
a bigger and better opportunity for their TFT displays?

With Mitsubishi, you won't have to worry about our product life cycle. Just like you, we don't want to lose access to legacy design wins. That's why each time we release a new display, it's backward compatible with its predecessor.

You see, unlike some major TFT suppliers, we're making a big commitment to the industrial, medical, multimedia and other non-PC markets. Which means we won't be tempted to drop your project just because a big PC OEM comes on to us.

And we're not talking about just any displays here. We're talking ANGLEVIEW™, our exceptional TFT-LCDs that deliver wide viewing angles, exceptionally high contrast, color saturation and luminance. All with the very low power consumption, emissions and glare your applications demand.

So if you need the best TFT displays backed by great support and a long term commitment, call us at 1-408-774-3143. Or check out our Web site at [www.angleview.com](http://www.angleview.com).



SO JUST HOW SOLID  
IS YOUR RELATIONSHIP  
WITH YOUR TFT  
SUPPLIER?



[www.angleview.com](http://www.angleview.com)

© 2000 Mitsubishi Electronics America, Inc. ANGLEVIEW is a trademark of Mitsubishi Electronics America, Inc. All other trademarks are the property of their respective owners.

See Us at SID '00 Booth 139

Circle no. 93

## Sixth International Display Workshops

*In the old castle town of Sendai in northern Japan, IDW attendees learned of an explosion in plastic-substrate development and imminent FED commercialization in Taiwan.*

by Ken Werner

**F**ROM December 1 to 3, 1999, SID's Japan Chapter and the Institute of Image Information and Television Engineers (ITE) welcomed the last month of the old millennium with a technical conference possessing a unique character. As SID President Aris Silzars (Northlight Displays, Issaquah, Washington) put it: "This is where the people who actually make displays talk to each other."

IDW '99 had 998 registrants, roughly 300 more than IDW '98, owing in part to the presence of 127 registrants from Korea and 44 from Taiwan, said Organizing Chair Shigeo Mikoshiba (University of Electro-Communications, Tokyo, Japan). Two hundred eighty-four technical papers were presented, including 149 from Japan, 58 from Korea, and 26 from the U.S.

The technical program kicked off with a keynote address, "HDTV-Based Digital Broadcasting in Japan," by Toyoaki Hasegawa of Japan's national broadcasting company NHK. Unlike the U.S., which tailored its HDTV standard to the needs of terrestrial broadcasting, NHK began its much earlier efforts with satellite broadcasting in mind.

Japan's MUSE system was developed in 1983, and experimental MUSE broadcasting began in 1989 with 1 hour of broadcasting per day. By the end of 1999, 13 million households were receiving satellite TV signals. NHK and commercial broadcasters are now providing 119 hours of HDTV service per week. More than 1.9 million Japanese house-

holds now have HDTV receivers or wide-screen TV with MUSE/NTSC converters. Increasing the hours of broadcasting and reducing the prices of receivers are recognized as being critical to growth, said Hasegawa.

NHK plans to launch its BSAT-2a satellite in 2000. It will have channel assignments in the 12-GHz band for seven HDTV programs and three SDTV programs, along with audio and data services, with one HDTV channel and two SDTV channels operational in 2000.

Hasegawa stated strongly that International Satellite Digital Broadcasting (ISDB) should

not just be a digitalization of the current TV service. "It must bring new benefits to individuals and society. It must be a new service."

The second keynote address, "Display Technology and Computer Entertainment," was given by Masayoshi Tanaka, Senior Director of R&D, Sony Computer Entertainment, Japan (filling in for S. Okamoto, who was unable to attend).

Tanaka said that the electronic game business, which had \$9 billion in sales in Japan in 1997, is in four distinct segments: PC, con-



**Ken Werner** is the Editor of Information Display Magazine.

Ken Werner

*The technical sessions and exhibits for ID '99 were held in the Sendai International Center.*



Ken Werner

*IDW participants frequently crossed paths and discussed papers in the lobby of the Sendai International Center.*

sole (such as Sony PlayStation), portable (such as GameBoy), and location-based (arcade) systems. Each segment has a different business model, system technology, and display needs.

Portable game systems are making the transition from monochrome to color, and from standalone to connected systems. Currently, communication is local via IrDA or direct connection, but remote communication via cellular phone is coming. Portable games will have high performance and large memories.

The console segment has an interesting business model. The system maker, who owns the rights to his system's format, generally sells the hardware at such a low price that it is not profitable. However, software publishers pay a format user fee to the format holder, which makes the business profitable overall. Formats typically have a long life before they are replaced, and creating a major game is a big software project that typically has a creative staff of 15 people, takes 12-18 months to complete, and costs \$2 million. For many years, the display for such games has been an NTSC/PAL consumer TV monitor. Will digital TV require or inspire breakthroughs on the part of content creators? Probably, said Tanaka, but digital receivers must become widely accepted first.

The new PlayStation 2 console, scheduled for March 2000 release in Japan and autumn 2000 release in North America and Europe,

will be a high-performance graphics workstation, although the initial display focus will still be NTSC/PAL. There are two processors in the system: the "Emotion Engine" and a graphics synthesizer (or rendering engine), which can be upgraded independently for future versions. The PlayStation 2's Emotion Engine has 10 million transistors, the same as a Pentium III. Emotion Engine 2, scheduled for 2002, will be built with a 0.12- $\mu$ m process and have 40 million transistors. The EE3 (in 2005) will be made with a 0.1- $\mu$ m process and contain 100 million transistors. This growth curve is substantially faster than that for PC processors, Tanaka said.

In an invited paper in the CRT session, Hideki Kofune, formerly chief engineer for Mitsubishi Electric Corp. and now a consultant to LG Electronics, offered some proposals for CRT survival. Although the "last day of the CRT" has been frequently predicted - and just as frequently postponed - the LCD in its current state of development is a real threat, he said, and the price differential between 15-in. AMLCD monitors and 17-in. CRT monitors is decreasing.

Kofune predicted that the CRT's "last day" (as a mass-production product) would be the day when an AMLCD monitor compatible



Ken Werner

*A popular place for IDW attendees to visit before and after the conference was the remarkably scenic Matsushima Bay, a half-hour train ride from Sendai. On the main street of the town of Matsushima, a friendly vendor offered Matsushima oysters and freshly grilled local fish.*

## conference report



Mitsubishi showed a large indoor display based on surface-discharge plasma technology rather than LEDs. The  $160 \times 160$ -mm modules can be tiled at will to make a display of almost any size. The unit on display had a 64-in. diagonal.

with a 20-in. CRT monitor has a street price less than 50,000¥ (US\$420) and one compatible with a 17-in. CRT monitor has a street price less than 35,000¥ (US\$290). Kofune based his prediction on the likely premium the market would accept for an AMLCD monitor based on the cost of space in an average Japanese house, but he believes the estimates looks reasonable in general.

However, Kofune listed a variety of things that can be done to extend the competitive lifetime of the CRT. The most critical of these is depth. Objects on a desk must be less than the width of the books on the desk, say 210 mm. Making a 210-mm-deep CRT monitor would be difficult, he said. This is especially true because, after the initial enthusiasm, short-necked tubes have not done well. Kofune had no immediate solution, but appealed to display engineers to do what is necessary to bring CRTs into the 21st century.

H. J. Kim and J. H. Souk (AMLCD Division, Samsung Electronics) presented another invited paper, "Low-Temperature Polycrystalline-Si TFT Technology," in which they

described a new half-gate structure that reduces the number of required masks, and provides a self-aligned and symmetrical LCD structure. Using intrinsic silicon for the capacitor instead of embedding the plate would further reduce mask steps. They noted that the choice and preparation of the a-Si precursor is important to the structure and performance of the final polysilicon. Kim said they had made several small displays using the new structure and showed performance data.

In the question and answer session, Ernst Lueder (University of Stuttgart, now "retired" in Arizona and writing a book on LCD addressing) commented that the data showed variability in threshold voltage across the displays. Kim said, "Yes, we have to fix that."

H. Sekiguchi and his colleague from Dai Nippon Printing discussed in "Ultra-High-Contrast Screen" the basic limitation of the currently used double lenticular "black screen" (BS) for rear-projection (RP) displays. The screen offers good absorption of ambient light and, therefore, high contrast, but the lenticular pitch necessarily equals

about 70% of the lens, *i.e.*, the screen's thickness. Since, for stability, the screen must be more than 0.5 mm thick, the pitch can't be much less than 0.3 mm. Because the ratio of lenticular pitch to pixel pitch must be at least  $2/9$  [actually  $2/(2N+1)$  with  $N$  no less than 4] to keep moiré invisible, double lenticular lenses can not be used for the high-resolution HDTV images.

DNP's solution is the "ultra contrast screen" (UCS), a single-lenticular screen with a tinted surface. Incident ambient light is guided through the tinted portion and is absorbed much more than is the image light, which passes through the tinted portion perpendicularly. The final effect is that the UCS has lower transmittance than a BS, but equal contrast. However, the screen can be used only with projection engines producing a single light source, *i.e.*, that is with an LCD or DLP projector, not a CRT projector.

A member of the audience noted from the presented data that the viewing angle of the UCS seemed to be less than that of the BS. "Can this be improved?" The answer was: The viewing angle seems less from the presented data but it depends on various factors and is not always less.

In the succeeding paper, "Screens for Rear-Projection LCDs," Jeff Shimizu and Jill Goldenberg (Philips Research, Briarcliff Manor, New York) noted that CRT screens are inappropriate for LCD projection displays. Some DMD and LCD light-valve systems now deliver much higher MTF than CRT systems, which makes moiré more of a problem. Another problem with decreasing the pitch of a double lenticular screen and decreasing its thickness is that the number of diffusion particles is reduced, which leads to speckle. (For an explanation of how laser-like speckle can arise from a white-light source, please refer to the original paper, FMC2-3, in the printed or CD-ROM version of the IDW '99 Digest.) Another difference, this one advantageous, in the screens for LCD and DMD projectors is that because of the single light source, a Fresnel lens is not needed for color correction.

The authors feel that rear-projection LCDs are the most cost-effective approach for large-screen television. Screens designed for rear-projection CRT TV receivers are not appropriate for LCD and DMD rear projectors. The screen is a critical component, and solutions are coming – "but perhaps more slowly than we would like."



J. A. M. M. van Haaren and his colleagues from Philips Research (Eindhoven, The Netherlands) provided an extensive survey of various approaches to making reflective LCDs. The potential market for color reflective LCDs is large. Nokia and other customers have told Philips that cellular phones and other portable electronic products will have bright color displays. But a solution that gives a bright and colorful image under all lighting conditions has yet to be found. On the positive side, there are attractive areas for exploration.

In "Polysilicon TFT Drivers for Light-Emitter Polymer Displays," Simon W-B. Tam of the Epson Cambridge Laboratory and his colleagues presented the advantages of polysilicon driving for LEP displays (LEPDs). Both analog and digital driver circuits are possible, but digital circuits are more appealing because they allow faster driving rates, self-diagnosis, and feedback to compensate for LEPD's inherent luminance fall-off with time. "It is possible to put a lot of functionality into a pixel driver with several transistors and other components, but at the cost of size and aperture ratio." The authors discussed several driver circuits and discussed the pros and cons of each. Among their conclusions is that "digital circuits combined with area dithering can provide a viable alternative for low- to intermediate-resolution displays."

Robert L. Wisnieff's "Super-High-Resolution AMLCD Technology" (IBM Research, Yorktown Heights, New York) made the point that although the goal in high-information-content display development is to allow electronic information to be displayed with the clarity and ease of paper, realizing that goal makes stringent demands on technology. Among the technologies needed for high pixel density are short-channel-length (6- $\mu\text{m}$ ) TFTs, high-conductivity row-and-column lines, fine-featured color filters, and tight cell-alignment tolerance.

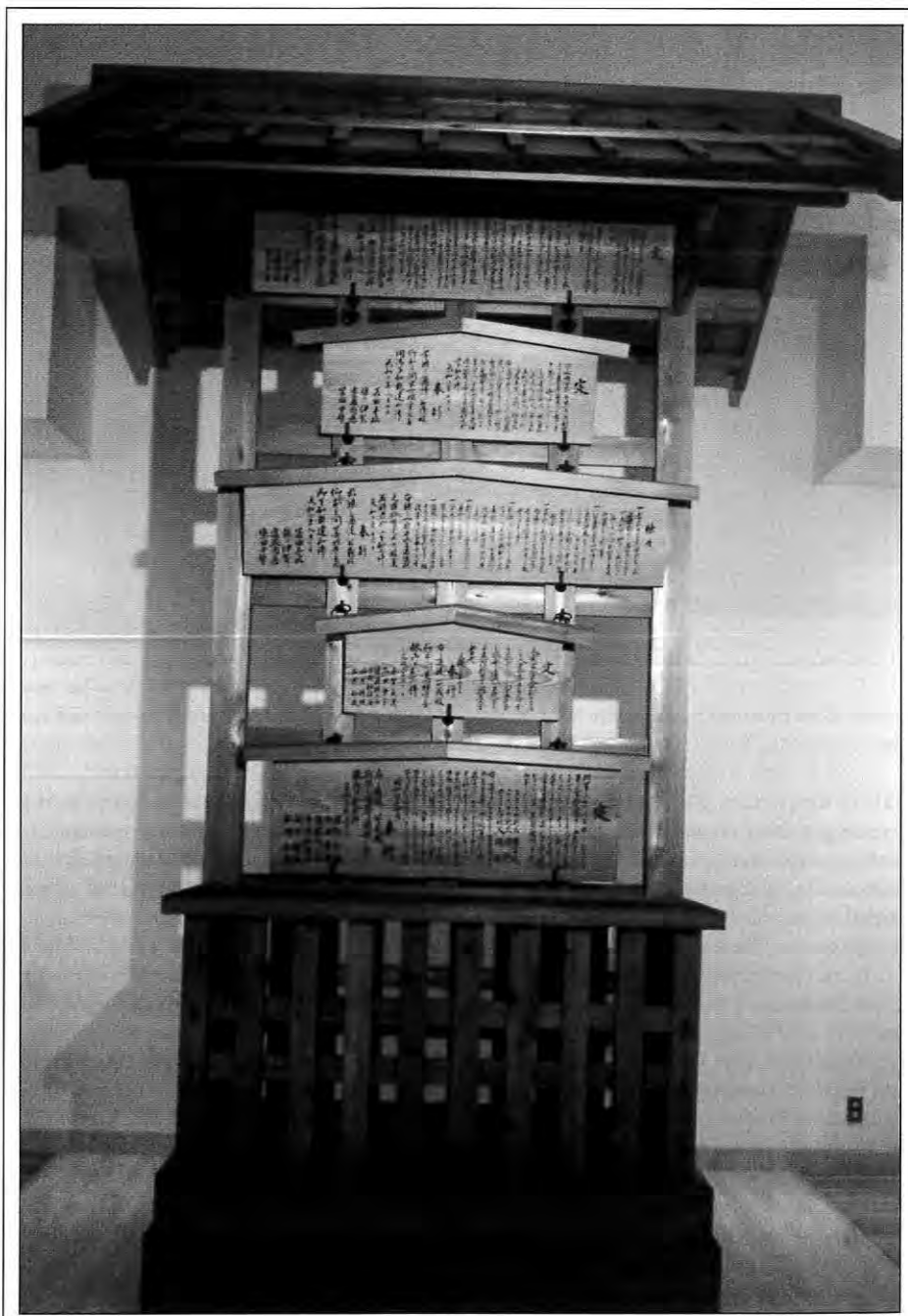
### One Word: Plastics

When Motfumi Watanabe began to present "Plastic LCDs for Mobile Applications," written by himself and two colleagues from Sharp Corp. (Nara, Japan), the room was packed. The advantages of plastic substrates, said Watanabe, are that they are half the thickness of glass (0.2 mm instead of 0.4 mm) and one-third the weight. It's 10 times stronger, making it hard to break when dropped. In addition, the thin substrate permits a virtually par-

allax-free display, so there is no double image in the reflective mode.

In 2000, Sharp will have the capacity to fabricate 4 million plastic displays a year. The company's technology road map includes a second-generation gray-scale display in

March 2000, color-technology development in mid-2000, and the technology for a high-speed color display in early 2001. The development of low-birefringence plastic is important for improved optical performance, Watanabe said.



Ken Werner

*Display kiosks are not new to Sendai. This style, shown in the Sendai City Museum, was used in the 17th century.*

## conference report



Ken Werner

Hitachi showed its very impressive 18.1-in. SXGA "Super-IPS" TFT-LCD with 20-ms response time.

There was, in fact, other evidence of increasing activity on plastic substrates, with one four-paper session entitled "Polymer-Based LCDs," a separate three-paper session entitled "Plastic Substrates," and at least four more papers in other sessions.

In the invited paper "Present Status and Future Prospects of Technological Development on Color PDPs," Tadatsugu Hirose and Kyoji Kariya (Fujitsu Hitachi Plasma Display Ltd., Japan) covered many design issues and surveyed the characteristics of three current Fujitsu plasma-display panels (PDPs).

To achieve a luminance in high-definition television panels equivalent to that in VGA PDPs, Hirose said, we must either use a high-speed single scan or a dual scan. Dual scan allows more time to display a pixel but needs double the drivers, which raises the cost. So if we stick with traditional technologies, we are stuck with higher cost or reduced luminance.

The solution, Hirose said, is Fujitsu's ALIS structure, in which 512 electrodes produce 1024 lines. Each line gets one electrode, not a pair of electrodes as in a traditional structure. There are no non-luminous areas between cells as in traditional designs, so overall luminance is higher.

FHP began mass production of the ALIS product in mid-1999, and new process ideas for further reducing the cost have been proposed.

"PDP is penetrating the market steadily," said Hirose. "But digital broadcasting must be the trigger for the growth of PDP. It will be brought to life and we will see its capabilities utilized." Two million units are projected for 2003.

Improving luminous efficiency and luminance by a factor of 2 or 3 is the most critical issue now. When achieved, a 42-in. PDP will have a luminance of 500 nits and a power consumption of 150 W.

In the question and answer period, moderator Larry Weber commented that ALIS is a clever approach to interlaced scanning that appears to be a good solution for TV, but may not be good for data applications. If, as projected, people wish to use their large displays for some computer/data functions, ALIS may not be suitable.

On Friday morning, Huang Chung Cheng (National Chiao Tung University, Hsinchu, Taiwan) delivered the paper "Research and Development of Field Emission Diodes and Displays in Taiwan" to a standing-room-only audience. Cheng sketched the history of FEDs from the first observance of field emission from a sharp point by Wood in 1897, through the development of the Fowler-Nordheim equation in 1928, to today's FEDs and FED companies.

Taiwan's ERSO/ITRI research laboratories have committed substantial R&D time to FEDs over the last few years, and they are enthusiastic about the potential. A new development is the carbon nanotube (CNT) FED. The cathode consists of bundles of CNT emitters in a thick-film paste. A high current density of 2000  $\mu\text{A}/\text{cm}^2$  that is stable with time has been obtained. Other novel emitters under investigation and characterization are chimney-shaped FEDs, diamond-clad silicon tips, and SiCN nanorods.

The Taiwan display industry isn't sitting on the sidelines. Unipac has invested \$20 million in PixTech and has entered into an agreement to supply foundry services. Cheng predicts rapid FED industrialization starting now as a result of Taiwan's persistent R&D and existing marketing structure.

Immediately following Cheng's presentation, K. Konuma and his colleagues from NEC's Silicon System Research Lab presented a paper on using field-emission arrays (FEAs) to replace the traditional hot cathode in CRTs. NEC has put 868 emitters within a 50- $\mu\text{m}$ -diameter circle. The FEA features a high current density of 50  $\text{A}/\text{cm}^2$ , a low modulation voltage that is independent of anode voltage, a precise on-chip focus electrode, and overcurrent protection. Konuma showed a gun structure with an FEA cold-cathode electron gun. The overall structure was similar to the traditional one. It should be possible to get a spot size smaller than one gets with a hot cathode, and the system's low  $V_{\text{gk}}$  is appropriate for HDTV.

A sizeable team from Polaroid, ColorLink, and ROLIC Research presented a very-well-attended presentation entitled "Integral-Color Plastic Liquid-Crystal Display – The Ultimate Flat-Panel Display." The presenter, Joseph DelPico of Polaroid, described how the three companies have been pooling their expertise: ColorLink's polarizer/retarder/LC color-shutter technology, ROLIC's thin-coated LCP/optical-axis-selectable biaxial retarders, and Polaroid's roll-to-roll precision coating onto thin plastic substrates.

There is still substantial development to be done, but the approach is very appealing for several reasons:

- Because light is controlled by polarization rather than absorption, transmission is six times greater than that of a DSTN display.
- If the entire integrated display is made on a plastic substrate it can be very thin.
- Roll-to-roll processing can make large (and small) displays very inexpensively.

There's room for a new partner to get on board. Troubled Polaroid is pinning its salvation on a "back-to-basics" (back to buggy whips?) approach that gets the company out of high-technology initiatives such as this one.

The preceding sections of this article have just scratched the surface of a very rich, high-quality technical program. If you are interested in digging deeper, I recommend obtaining a copy of the IDW '99 Proceedings in either its hardcopy or CD-ROM version.

### Heard in the Hall

Don Carkner (Westaim ADT) had an 8.4-in. thick-dielectric EL display in his room in the Sendai Tokyu Hotel, which was overflowing with interested observers following the conference banquet. The display was running video and pumping out 100 or so nits, said Don. The blue looked very rich, saturated, and quite bright in the subdued lighting of Don's room. It's the old blue phosphor compound but a new preparation. The red was a bit orangey, which was due to a slightly misaligned mask, he said. It wasn't a problem with the phosphor.

On the following day, Xingwei Wu, Westaim ADT's Director of R&D, explained that the company is now using patterned phosphors: cyan under a blue filter and yellow under red and green filters. The two phosphors are well-known, he said. The yellow is

very efficient, and the cyan under blue is giving them good results. They did nothing special to the demo unit to get the good CR and anti-reflection seen in the hotel room. The materials are inherently non-reflective, and, below threshold, the phosphor is completely off. Both phosphors have a lifetime of 10,000 hours or more; Westaim has not yet done life testing of the patterned display.

In the lobby of the Sendai International Convention Center, where the technical sessions were being held, Sony's Mike Maeda told *ID* that 70% of Sony CRTs will be completely flat this year; 90% next year. Flat CRTs require 10% more glass than conventional tubes. Now that everyone is jumping into the flat-CRT business, there's a glass shortage. But the glass companies have no plans to produce more CRT glass because investment in other glasses, including LCD glass, promises more return. It's a problem.

### Exhibits

A respectable collection of desktop exhibits enhanced IDW '99. **Hunet LCD** was showing the latest implementation of its field-sequential-color (FSC) LCD approach – an impressive 1.5-in.-diagonal quarter-VGA display for cellular phones. The refresh time is 2 ms, and the production version will display 260,000 colors. (The demo was displaying eight colors.) The price is \$20 each if one buys 1 million a month.

**Chuo Precision Industrial Co.** was featuring its Optical Measurement System (OMS) for measuring liquid-crystal properties such as pre-tilt angle, retardation, and anchoring energy. The system was developed in cooperation with Prof. Tatsuo Uchida of Tohoku University.

**Toyo Corp.** showed its liquid-crystal-evaluation system, and **Otsuka Electronics** was providing information on its Photal inspection systems for LCD production lines.

**Mitsubishi** showed the first large full-color indoor text and graphical display device to be based on a surface plasma-discharge structure, which uses two electrodes. The panel will compete with large LED displays, and is not only more efficient than LED modules but is also more efficient than traditional surface-discharge PDPs at 2.5 lm/W. The display is tiled, with each 160 × 160-mm module containing 256 full-color pixels on a 10-mm pitch and weighing 650 grams. The maximum luminance is 2000 cd/m<sup>2</sup>; service life is

30,000 hours. A 64-in. assembly was being shown, and the technology was described in late-news paper PDP5-4.

**Fujitsu Kyushu System Engineering, Ltd. Software and Service (FQS)** was promoting the new seventh edition of the LiqCryst 3.3 database of liquid-crystal compounds.

**OSRAM** showed the Planon™ mercury-free planar backlight shown at SID '99 and EuroDisplay, and also hosted a reception Thursday evening to discuss the lamp's technology. The lamp's lifetime is very much longer than tube-type backlights, in which the light guide discolors, causing luminance to decrease faster than the lamp output decreases, said Product Manager Udo Custodis. The lamp's luminance is equivalent to a ten-tube backlight. Efficacy is about 35 cd/W.

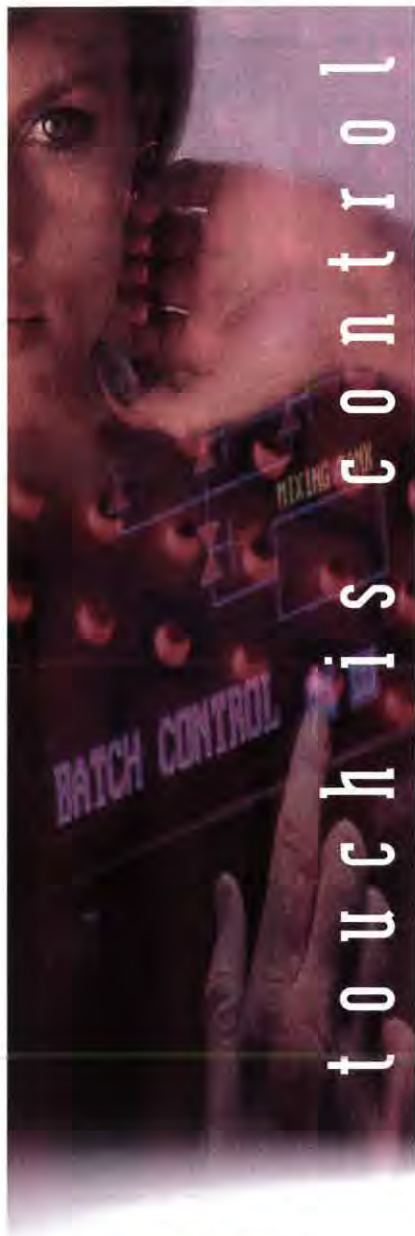
The lamp is currently in testing with several partners, including Samsung, said System Integration Specialist Hermann Schweizer. The current plant in Germany is being expanded to a capacity of one thousand lamps per month. The next plant, much larger, will probably be located near a major customer. The price in small quantities is \$500, which includes an inverter power supply that also supplies the monitor with 12 Vdc. The price in high-volume quantities will be about \$250.

**Agfa** was showing its Agfasphears™ (LCD spacer spheres) and **Orgacon** DIS foil with organic conductors for TN-LCD displays and Orgacon EL for EL lamps, as shown at EuroDisplay in Berlin.

**Furuya Metals** was enthusiastically showing its new AgPdCu (APC) target that solves the corrosion and etching problems encountered with traditional alloy targets, said Kuni Kanno. APC can be deposited directly on SiO<sub>2</sub> and ITO, with a contact resistivity of 20–25% that of Al alloy, so Kanno regards it as a candidate for replacing Al, Al alloy, Ti, Ta, Cr, and Mo. APC is highly reflective, so Kanno also sees it as a candidate for reflective AMLCDs.

**ULVAC Coating Corp.** was showing its non-chrome ULCOAT low-reflectance metal film for the black-matrix color filters.

**Sumitomo Chemical** was presenting its wide range of optical films for LCDs, including SUMIKALAN™ polarizing films (some with additional functions such as anti-reflection, smudge resistance, and anti-static characteristics) and SUMIKALIGHT™ retardation films (including those for wide viewing



### Touch Screens

The most powerful man-machine interface since advent of the keyboard and the mouse. Harness this power to your advantage; improve your products by making them easier to use.

It's that simple!  
Get in touch with CyberTouch.



## CyberTouch

Touch Screens • Touch Monitors • Touch Systems

805.499.5000 • Fax 805.499.5888  
sales@cybertouchusa.com  
www.cybertouchusa.com

## conference report

angle, temperature compensation, and high-wavelength dispersion).

**Hakuto Co.** was promoting its PDP photo-processing line. The company has installed six or seven R&D units for most of the leading makers, and has now developed in-line systems for mass production, starting next year.

**Seria** presented information about its high-precision screen-printing machine from Tokai Seiki Co. (Gifu, Japan). The machine features low printing pressure for fine patterns and high uniformity in PDP fabrication.

**Tokyo Cathode Laboratory** was featuring its Field Emission Profiler and **ISE Electronics Corp.** was showing a range of **Noritake** Itron VFDs. **Shintech** was showing its "Optipro" retardation measuring device and LCD Master modeling and simulation software. TFLCD is an additional module that models the transient characteristics of TFT-driven LCD panels. **Minolta** was showing its well-known array of display measuring equipment.

**Hitachi** showed its TFT-LCD with Super-IPS mode that delivers a 20-ms optical response. The 18.1-in. SXGA display delivered a beautiful image. Also shown was the Hitachi Prius Deck 610M monoper with Hitachi's handsome 15-in. Super-IPS AMLCD. This nicely packaged computer was completely invisible behind the display. Only the slots were visible in front. Video was being shown on the display, and it was beautiful. Here was digital crispness with no artifacts that I could see.

**SAES Getters** was showing small getters for micromachines, as well as larger getters for CRTs and FPDs. The company's HQ is in Milano, Italy, and has a sales office in Tokyo, Japan. **Nissho Electronics**, DisplayTech's Japanese distributor, was enthusiastically showing **DisplayTech's** quarter-VGA microdisplay for camcorder viewfinders.

**Pioneer** was showing its 50-in. WXGA PDP-502MX Hi-Vision PDP. From the model number I assume the panel is a product. But if what I saw is typical, commercializing this very promising panel is a bit premature. The panel exhibited swimming artifacts (which have been common in the industry) and subtle more-or-less vertical dark lines that I've never seen before. Except for these artifacts, still images were striking, with good detail and rich colors, but there was also a slight jitter on slow panning.

In contrast, the **Plasmaco/Panasonic** 60-in. prototype shown in the author interviews was absolutely beautiful and virtually defect-free. Plasmaco's Larry Weber said the minor artifacts seen at SID '99 are now gone, and that the panel will be a product in 2001. This is the best large PDP I've ever seen, and I would have called it artifact-free. But Shigeo Mikoshiba has a more educated eye than I do. He spotted a subtle green leading edge on black moving objects, which he attributed to the characteristics of the P1 phosphor used by Plasmaco (and virtually all other PDP makers). He agreed that the display was excellent.

The International Display Workshops has become a technical display conference of excellent quality and extraordinary interest. The next IDW will be held from November 29 to December 1, 2000, at the International Conference Center in Kobe, Japan. ■

- *Ferroelectric Shutters?*
- *Spatial Light Modulators?*
- *Stereoscopic Displays?*
- *High Speed CRTs?*

...or something difficult?

## JMEC Ltd

www.jmec.co.uk

Electronic display consultants  
Designs, prototyping,  
Custom drive electronics  
Computer interfaces  
Contract work



JMEC Ltd 17 Kings Grove  
Barton Cambridge CB3 7AZ  
U.K.

Tel +44(0)1223 262580

Fax +44(0)1223 264491

email john.moore@jmec.co.uk

Circle no. 94

# Swing the odds in your favor

Go for quality LCD modules go for **SOLOMON**



**SOLOMON** [www.solomonlcm.com.tw](http://www.solomonlcm.com.tw)

SOLOMON Technology Corp. LCM Div.

Chang Tai Street, Hsiao Kang Dist. TW-812 Kaohsiung, Taiwan ROC

TEL: 886-7-8721787 FAX: 886-7-8721786

E-mail: [jl@solomonlcm.com.tw](mailto:jl@solomonlcm.com.tw)

SOLOMON Technology (USA) Corp. LCM Div.

21038 Commerce Pointe Dr. Walnut, CA 91789, USA

TEL: 909-468-3732 Ext. 3038/3039 FAX: 909-869-6258

E-mail: [jbutler@solomonusa.com](mailto:jbutler@solomonusa.com)



See Us at SID '00 Booth 457

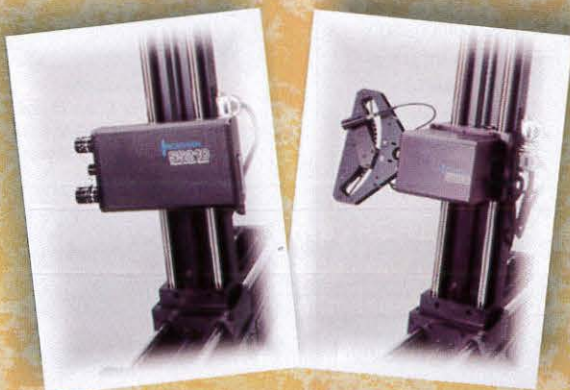
Circle no. 95

Are you **CONFUSED**  
by **TESTING STANDARDS?**

Let Microvision's display test systems  
simplify them for you with **AUTOMATIC** test suites!

Microvision's SS200 series of display test equipment offers fully automatic test suites for flat panels, CRTs, projection & cockpit displays, in monochrome or color. One click of the mouse and your test suite is automatically initiated, performing fast & accurate measurements in accordance with ISO (9241 parts 3, 7 & 8 and 13406-2), TCO (95 & 99), NIDL and VESA (FPDM) specifications. Or you can develop your own test sequence with Microvision's proprietary MATL software. With the SS200 family, you can quickly interchange between CRT and flat panel testing. And the system is portable and compact, fitting easily into any test area.

Used by testing laboratories  
world-wide.



**MICROVISION**

550 High Street, Auburn, CA 95603

Tel: (530)888-8344 \* (800) 931-3188

Fax: (530)888-8349

Email: [sales@microvsn.com](mailto:sales@microvsn.com)

Visit our Website at:  
[www.microvsn.com](http://www.microvsn.com)

Circle no. 96  
See Us at SID '00 Booth 215

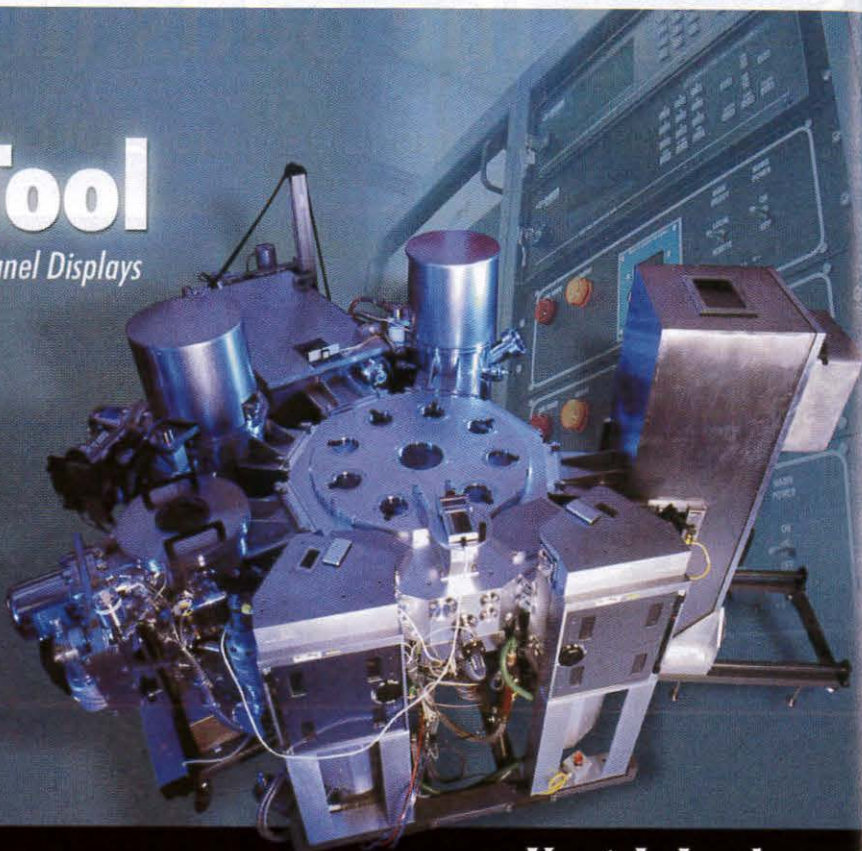
# Lesker Cluster Tool

for PLED/OLED Flat Panel Displays

Processes substrates with exceptional film uniformity, repeatability, and reliability.

- Flexible
- Modular
- Scalable
- High Performance
- Cost Effective

For more information...



United States  
1.800.245.1656

Canada  
1.800.465.2476

United Kingdom  
+44 1424 719101

Germany  
0800 812 843

Hungary  
+36 1 383 5322

**Kurt J. Lesker**  
Company  
www.lesker.com 412.233.4200

See Us at SID '00 Booth 937

Circle no. 97

## QUALITY GLASS!



- Custom Glass Melting in Platinum
- Laboratory Test Melts
- Production Volumes

VIOX considers our customers' needs for purity, service, and confidentiality all important. Look to us as a partner, able to deliver the ultimate in custom melted, fritted, or powdered glass products. We can melt to your proprietary formula, up to 2000 pounds in a single platinum pot. This provides uniform consistency.

So team up with VIOX's 40 years of glass manufacturing for a great composition.

For more information or a sample melt, contact:

**VIOX**  
CORPORATION

6701 Sixth Ave. S.  
Seattle, WA 98108  
(206) 763-2170  
Fax (206) 763-2577

ELECTRONIC GLASS MATERIALS

See Us at SID '00 Booth 459

Circle no. 98

## Flat Panel Monitors

*International*

Designed for System Builders

- Rugged OEM Chassis & Display Heads
- Console, Desktop and Rackmount Formats
- 12Vdc or 15 - 30Vdc or 110/230Vac Choices
- Dual Input (Switchable) Data + PAL/NTSC Models
- Sizes 6.5" to 20" with Touchscreen Options



Now available  
for 15 - 30kHz Scan range.  
(Sync-on-Green, CGA, EGA)  
CRT Replacement solutions.

Kent Modular Electronics Ltd.

Tel: +44 (0) 1634 830123

Fax: +44 (0) 1634 830619

E-Mail: sales@kme.co.uk

www.kme.co.uk

MONITORS & DISPLAY MODULES

INTELLIGENT DISPLAY SOLUTIONS

**KME**

Circle no. 99

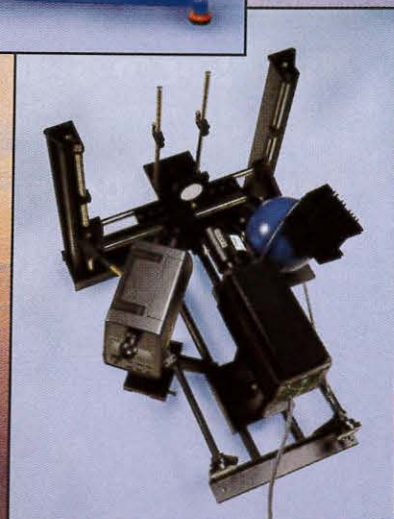
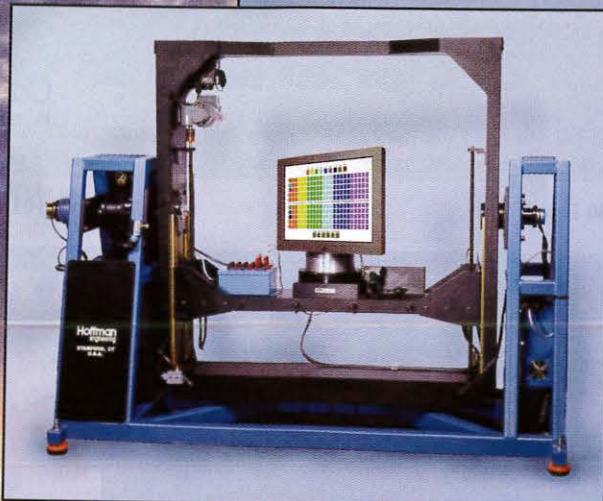
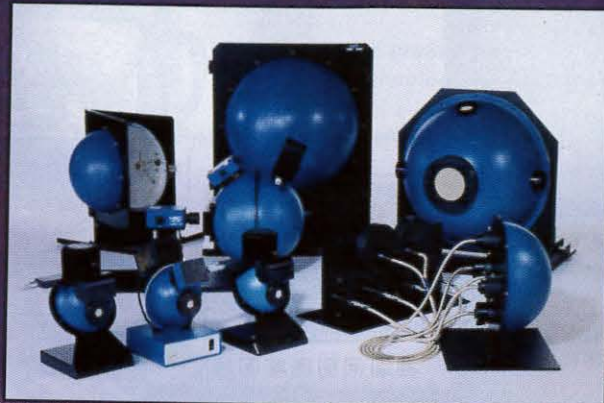
# Hoffman engineering

AT HOFFMAN ENGINEERING,  
we know light. We simulate it and  
detect it. We filter it and focus it;  
we design, build, test and calibrate  
equipment to measure it.

Accurate light and energy data is  
critical to the success of any lighting  
project. We combine mechanical and  
electro-optical skills to provide flat  
panel display manufacturers the  
gonio-photometric resources to  
completely analyze today's  
advanced displays with confidence.  
Hoffman's photometric test and  
contrast measurement systems  
support automotive, aerospace and  
display equipment manufacturers –  
industries where precision lighting  
measurement is essential.

As a recognized leader in lighting  
standards, integrating spheres and  
test equipment, Hoffman's extensive  
experience and philosophy of  
personal service has given us a  
well deserved reputation for electro-  
optical engineering excellence.

Our mission is to design and  
produce the next generation of  
test and measurement equipment.  
With over 40 years of experience  
in photometric and radiometric  
technology, we accept that  
challenge with confidence.



**Where innovation  
comes to light**

8 Riverbend Drive • P.O. Box 4430 • Stamford, CT 06907-0430

TEL: (203) 425-8900 • FAX: (203) 425-8910

EMAIL: [sales@hoffmanengineering.com](mailto:sales@hoffmanengineering.com) • [www.hoffmanengineering.com](http://www.hoffmanengineering.com)

Us at SID '00 Booth 829

Circle no. 100



# A resolution for all your problems.

▶ Mission is nothing without vision. Whatever your operational need we have a display to fit. Our full line of combat proven, in-service displays including electroluminescent gray shade and Active Matrix Liquid Crystal flat panels have earned us a dominant position as a military displays supplier. Come to the world leader in display solutions for land, sea and air applications.

For more information please contact us at:

3785 Richmond Road,  
Nepean, Ontario, Canada K2H 5B7  
Tel: 1 (613) 596-7009 Fax: 1 (613) 596-7697  
floyd.bosko@cdott.com  
website: www.computingdevices.com/fpd

Computing Devices Canada  
A GENERAL DYNAMICS COMPANY

See Us at SID '00 Booth 724

Circle no. 101

## MINIATURE LCDs

- High resolution
- Transmissive/Reflective
- Ferroelectric/TN LC material
- No minimum order quantity
- Technical Support available

## HIGH SPEED SHUTTERS

- Custom design ferroelectric or TN Shutters
- Standard product FLC Shutter

## SPECIALIST COATINGS SERVICE

- Thin film Coatings
- Photolithographic patterning for low volume manufacturing organisations

For more information:

CRL · Dawley Road · Hayes · Middlesex · UB3 1HH · UK

Tel: +44 (0)20 8848 9779

Fax: +44 (0)20 8848 6653

Email: [marketing@crl.co.uk](mailto:marketing@crl.co.uk)  
Internet: [www.crl.co.uk/liquid](http://www.crl.co.uk/liquid)

©CRL 1999. CRL is a scipher Company

CRL

See Us at SID '00 Booth 433

Circle no. 102



## Problems with strays?

Protect your equipment from stray magnetic fields. We understand your criteria, your mechanical constraints, and your environmental conditions – and we make certain your shield meets those criteria.

As your single source for Low EMI interference problem solving, we offer

- EMI design and testing
- High permeability nickel shielding grade alloys
- Complete in-house manufacturing facility
- Geometric shapes supported by hydroform draw process

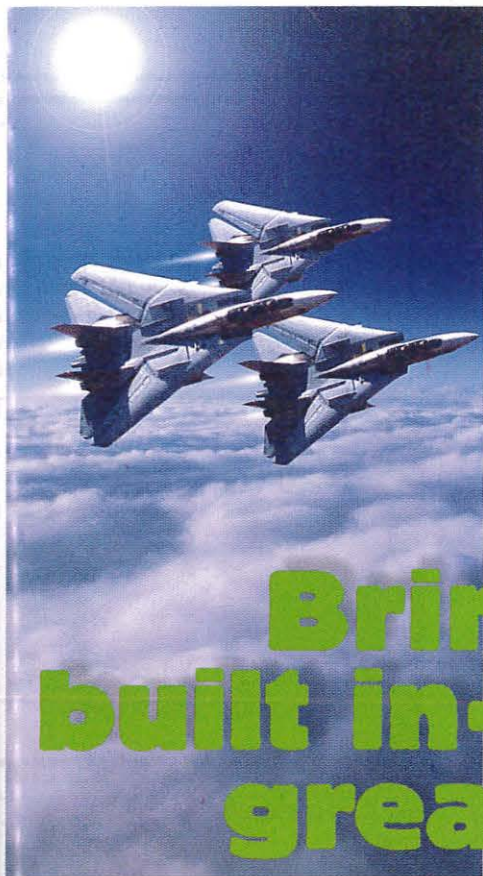
To find out how Magnetic Radiation Laboratories can solve your problems, fax or E-mail today. Or call (630) 285-0800.

MAGNETIC RADIATION LABORATORIES, INC.

690 Hilltop Drive • Itasca, IL 60143-1326  
Phone: 630-285-0800 • Fax: 630-285-0807 • E-mail: [sales@magrad.com](mailto:sales@magrad.com)

Circle no. 103





**A**ir and ground forces around the globe depend on Brimar technology for capability and survival.

It's been that way ever since Brimar developed the world's first head-up and helmet-mounted tubes.

And because all Brimar CRTs are designed and built entirely in-house, they're backed by total on-site quality control. That means complete reassurance in fields as diverse as military and civil aviation, photography, telecine and medicine.

And promises absolute confidence—indoors and out.



**Brimar Limited**

Viewed as the finest in the world

# Brimar CRTs - built in-house for the great outdoors

Brimar Ltd., Greenside Way, Middleton, Manchester M24 1SN, England. International Telephone: +44 161 681 7072 Fax: +44 161 682 3818.

Brimar Inc., 25358 Avenue Stanford, Valencia, California 91355 - 1214 USA. Telephone: (661) 295 5770 Fax: (661) 295-5087

See Us at SID '00 Booth 321

Circle no. 104

**Announcing an extraordinary advance in fluorescent lamps...**

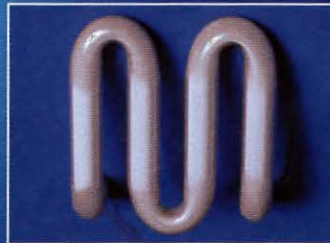
# Ultra-Bright™

- ▲ Double the efficacy (lm/watt)
- ▲ Improved lumen maintenance
- ▲ Maximized lighting uniformity

Slashed power requirements, greatly extended maintenance intervals, and enhanced display readability — LCDL's new Ultra-Bright™ lamps can dramatically improve your AMLCD's. Visit our web site at [www.LCDL.com](http://www.LCDL.com) or call us to learn all about this important new advance.



After 10,000 hours of use, LCDL's Ultra-Bright™ lamp (above) shows no evidence of phosphor degradation or discoloration and significantly outperforms the standard technology lamp (below) with an equal number of hours.



**LCD Lighting, Inc.**

**Lighting commercial and military avionics displays for over 15 years.**

37 Robinson Boulevard • Orange, CT 06477 U.S.A.  
Phone: 203 795-1520 • Fax: 203 795-2874 • [www.LCDL.com](http://www.LCDL.com)

See Us at SID '00 Booth 538

Circle no. 105

# Products on Display at SID 2000

*Some of the products on display at SID's largest exhibition ever are previewed.*

by The Editorial Staff

**T**HE SID 2000 *International Symposium, Seminar & Exhibition* will be held at the Long Beach Convention Center in Long Beach, California, the week of May 14. For 3 days, May 16-18, leading manufacturers will present the latest displays, display components, and display systems. To give you a preview of the show, we invited the exhibitors to highlight their offerings. The following is based on their responses.

**AD-VANCE MAGNETICS**  
Rochester, IN 219/223-2524  
Booth 109

**Magnetic shield**

Ad-Vance Magnetics will feature a magnetic shield that will be used with the Telecine Millennium Machine being produced by Innovation TK, Hertfordshire, England. With its 4K option, the Millennium machine provides the user with total control over resolutions up to 4096 x 4096. As the video production community gears up for both HDTV and high-resolution data scanning of film, this device will become more and more popular.

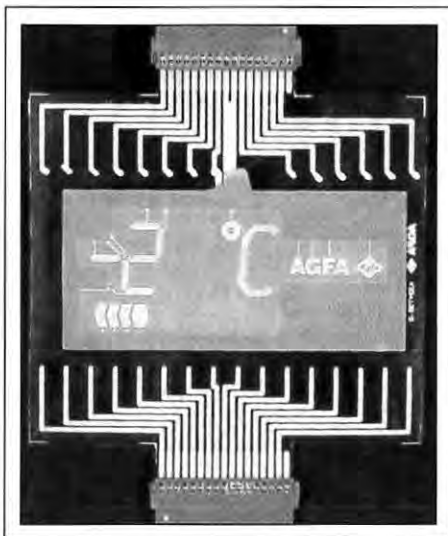


Circle no. 1

**AGFA GEVAERT**  
Mortsel, Belgium +32-3-444-2996  
Booth 1003

**Polymer alternative to ITO**

Agfa Gevaert will feature Orgacon™ EL, a newly developed transparent conductive film for electroluminescent and display applications composed of a PET base coated with PEDOT (polyethylenedioxythiophene) conductive polymer. The film, offering a sheet resistance of 2500 Ω/□ at a transparency of over 85%, has been validated for EL lamp manufacturing. Orgacon™ EL features a much higher scratch resistance when compared to ITO (no protective liner needed), and it can be embossed. Manufactured in a high-speed wet coating process, the film is stable in water and many solvents. Conductive patterns are easy to create by using a one-step de-activation ink, leaving a smooth surface after patterning.

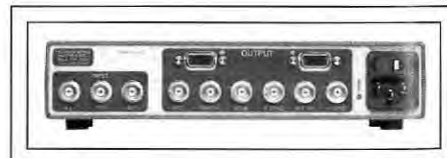


Circle no. 2

**ALTINEX, INC.**  
Brea, CA 714-990-2300  
Booth 114

**HDTV transcoder**

ALTINEX will be exhibiting the TR6102HD, an HDTV transcoder that accepts a component video signal in a Y, Pb, Pr format and converts it to a standard RGBS or RGBHV format. It is capable of handling SMPTE 240, 480p, 720p, and 1080i formats. The TR6102HD also offers a built-in distribution amplifier, providing three simultaneous outputs (two on female 15-pin HD connectors and one on six BNC connectors (RGBSHV)).



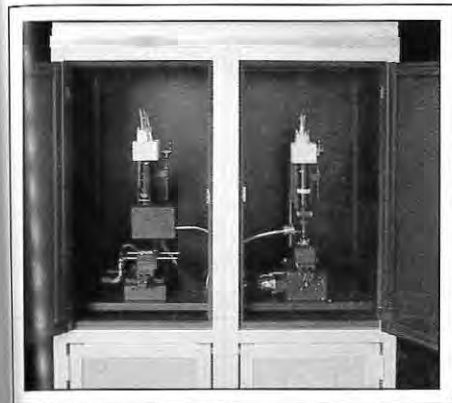
Circle no. 3

**ANTEON CORP.**  
Mystic, CT 860/572-9600  
Booth 932

**Automated microdisplay inspection system**

Anteon Corp. will feature DisplayCheck-μD™, the latest release in their family of high-performance display-inspection systems. Based on National Instruments' LabVIEW™ and TestStand™ software development tools, DisplayCheck-μD provides a flexible open development environment for inspecting microdisplay devices. The system consists of high-resolution optics, image acquisition, and DUT motion-control hardware, as well as image analysis software for the testing of pixel and line defects, gray-scale uniformity, absolute bright-

ness, contrast, blemishes, Newton fringes, texture, and crosstalk. A spectrometer can be optionally added for color measurement. The system can also inspect seal and wiring integrity or package labeling.



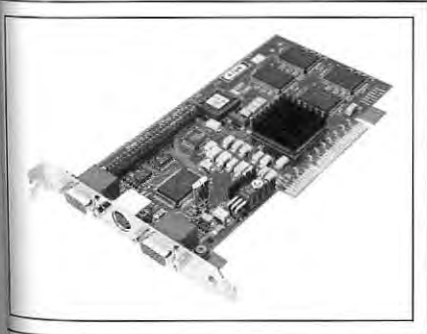
Circle no. 4

#### APPIAN GRAPHICS

Redmond, WA 425/882-2020  
Booth 530

#### Gemini DVI-I

Applan Graphics' Gemini™ DVI-I is the first card to power two digital flat panels using DVI 1.0 specifications. Offering combined analog and digital support, the card is available in an ATX form factor for AGP or PCI slots and delivers accelerated graphics across multiple displays with resolutions up to 1280 x 1024.



Circle no. 5

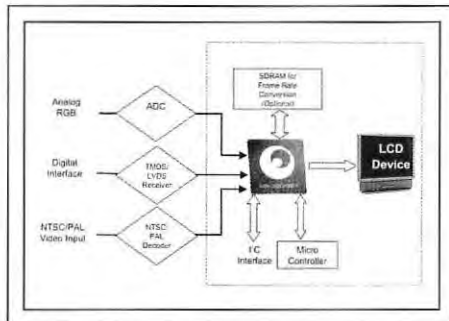
#### URORA SYSTEMS

San Jose, CA 408/452-5559  
Booth 531

#### Digital processors

Uro Systems will feature the ASI 320/321, a digital processor that integrates multiple high-perfor-

mance image components to produce superior image quality. Its principal features include an advanced fully programmable up/down scalar, a frame-rate converter, a frame interlock engine, integrated on-screen display, a Genlock generator, an advanced video processor, integrated video de-interlacer, and embedded systems features support. The scaling engine supports maximum UXGA (1600 x 1200) resolution.



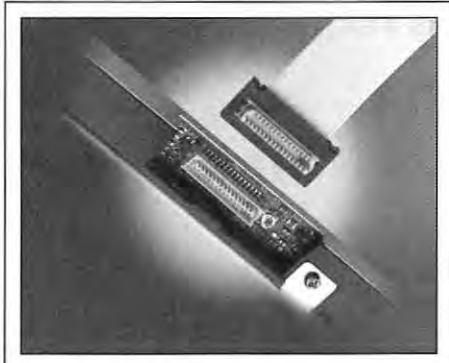
Circle no. 6

#### AXON' CABLE

Mount Prospect, IL 847/699-8822  
Booth 657

#### Flat cable assemblies

Axon' Cable will feature AXOLINK®, a flat cable assembly that consists of a 0.5-mm flat flexible cable with 31 or 41 conductors connected to a Hirose DF-9 interface at one end and either another DF-9 connector or a ZIF termination on the other end. A molded strain relief mechanically strengthens the DF-9 connector. AXOLINK® can be used for all board to flat-panel-display interconnects where the Video Electronics Standards Association (VESA) Flat Panel Display Interface (FPDI-1) is specified. The main advantages of AXOLINK® is lower cost, reduced dimensions due to the 0.5-mm flat cable, low profile, and narrow-width design. The length of the assembly can be adapted to any application. To resolve any EMI issues, Axon' Cable also offers shielded versions of AXOLINK®.



Circle no. 7

#### CELCO (CONSTANTINE ENGINEERING LABORATORIES CO.)

Rancho Cucamonga, CA 909/481-4648  
Booth 200

#### High-definition film recorder

CELCO will introduce the *eXtreme HDR*, a high-definition film recorder optimized to image HDTV to film in 5 sec/frame. The *eXtreme HDR* makes feature-length digital motion pictures a reality. It can accommodate 35mm film at up to 2K resolution and image to either camera negative or Eastman 5244 intermediate stock. The *eXtreme NITRO™* provides all the power for the *HDR* and adds the ability to shoot up to 8K resolution to any format from 16 to 65 mm IMAX.



Circle no. 8

Modeling of reflective displays finally made easy!



# DIMOS LCD WORKBENCH AND TOOLKIT VERSION 2.0

- ▶ enhanced support of reflective displays, including polarizing beamsplitter, scattering reflectors, ...
- ▶ extended stack model with shared layer properties
- ▶ enhanced graphics and user interface
- ▶ and more

The perfect complement to our visual performance evaluation instruments

**DMS** and **CONOSCOPE**

autronic-MELCHERS GmbH 

autronic-MELCHERS GmbH • Rosswald 18 • D-76229 Karlsruhe/Germany

Phone ++49-721-9 62 64 45 • Fax ++49-721-9 62 64 85 • [www.autronic-melchers.com](http://www.autronic-melchers.com) • [sales@autronic.melchers.de](mailto:sales@autronic.melchers.de)

See Us at SID '00 Booth 338

Circle no. 106

bringing light  
to the world  
through innovation...

We can modify any TFT-LCD!

#### " THE APPROPRIATE SOLUTION FOR TFT-LCD INTEGRATORS"

- ♦ Sunlight Readable Brightness
- ♦ Improving the Brightness of TFT-LCD
- ♦ Wide Viewing Angle of TFT-LCD
- ♦ Increasing the Contrast Ratio of TFT-LCD
- ♦ Technology Can Be Applied To Any TFT-LCD
- ♦ Solution Ready, Low Lead Times
- ♦ TFT-LCD Experts
- ♦ Low Cost Solution

Call for more information:

Tel: 714.223.7111

Fax: 714.223.7711

600 South Jefferson St. Unit K

Placentia, CA 92870

[www.vertexlcd.com](http://www.vertexlcd.com)



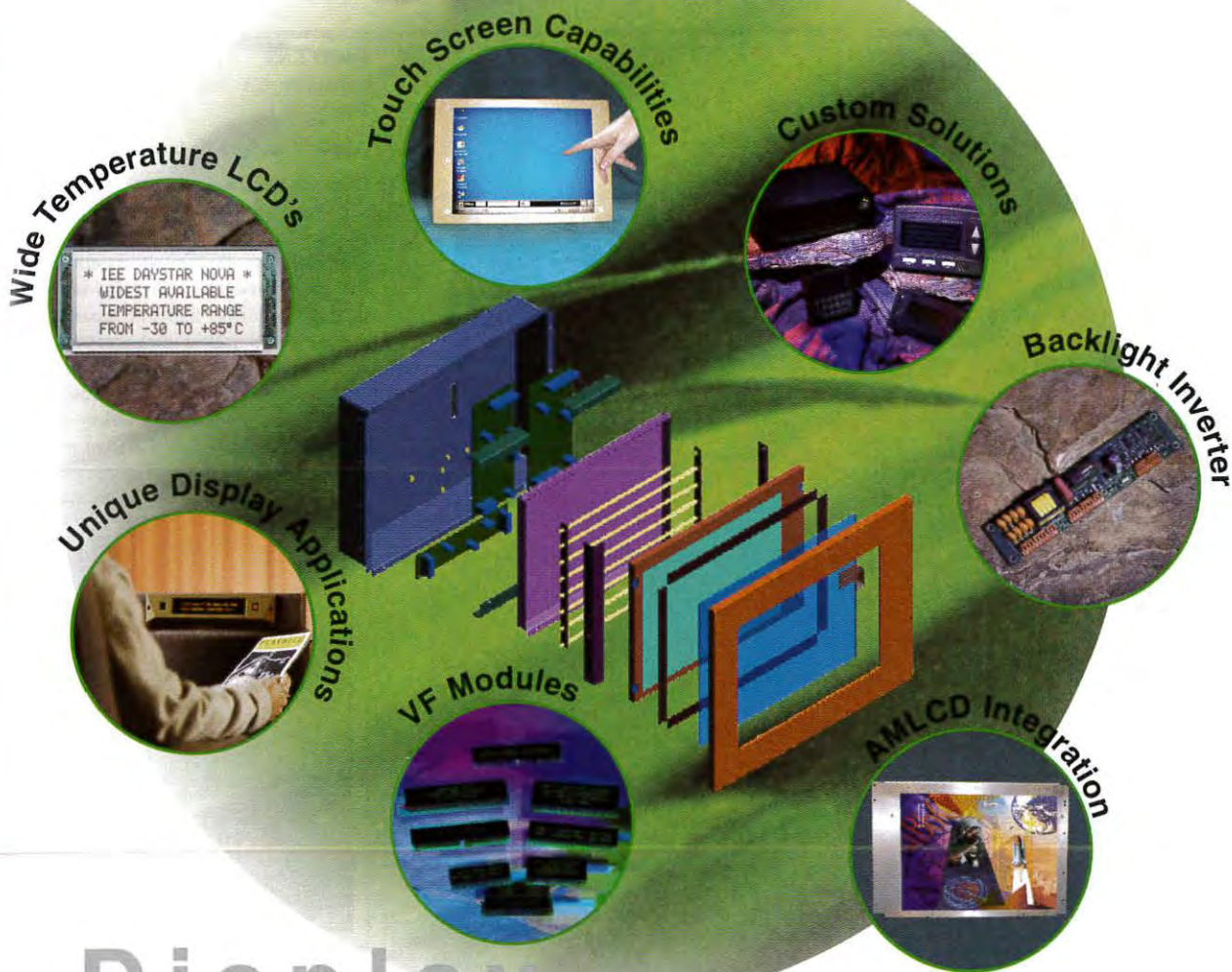
**Vertex LCD Company**

"ENGINEERED FOR EXCELLENCE"

See Us at SID '00 Booth 314

Circle no. 107

# Bringing it all TOGETHER



## Display Integration

A recognized leader in innovative electronic display products, IEE offers a wide range of VF, LCD, Plasma and AMLCD display modules. Multiple display formats and features are available to meet a number of requirements such as temperature range, viewing distance, lighting conditions, interface requirements, character sets, and budget.

IEE's unequaled ruggedized packaging and software capabilities also make us the perfect source for integrated solutions. Specializing in the development, design, manufacturing, enhancement and ruggedization of electronic displays, IEE addresses market requirements for industrial, government, commercial, medical, entertainment, hospitality and retail markets.

IEE is the one source, the best source for the display technology you need.

Call us today 1-800-422-0867  
or visit our web site at  
[www.ieeinc.com](http://www.ieeinc.com)

Visit  
us at  
SID 2000,  
Booth #546



7740 Lemona Avenue, Van Nuys, CA 91409-9234 • 818-787-0311 • 800-422-0867 • FAX: 818-901-9046 • [www.ieeinc.com](http://www.ieeinc.com)

## trade-show preview

### COLORADO MICRODISPLAY

Boulder, CO 303/546-9700  
Booth 757

#### Microdisplays

CMD's microdisplays feature high resolution, high refresh rate, full color, and low power at low cost, and are fabricated using a breakthrough liquid-crystal-on-silicon technology referred to as Dynamic Nematic Liquid-Crystal on Silicon™ (DNLCOs). The DNLCOs microdisplay technology and accompanying interface ASICs support a full range of content from text to full-motion video.



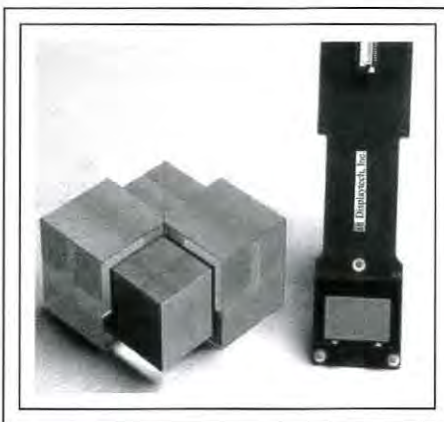
Circle no. 9

### COLORLINK

Boulder, CO 303/545-5843  
Booth 1301

#### Color-management architecture

ColorLink will introduce ColorQuad™, color-management architecture for three-panel LCoS-based projection systems that achieves contrast in excess of 800:1 at  $f/2.0$  and covers the SMPTE 274 color gamut with a UHP lamp. High throughput is achieved with ColorLink's proprietary lossless retarder stack filters, and the novel architecture is insensitive to thermally induced stress birefringence. Lifetime-tested, production-ready, and priced less than market designs currently available, ColorQuad™ will meet the demands of the LCoS-based projection market.



Circle no. 10

### CYRO INDUSTRIES

Rockaway, NJ 973/442-6000  
Booth 930

#### Antireflection acrylic sheet

CYRO Industries will introduce ACRYLITE®, an abrasion-resistant AR acrylic sheet for flat-panel-display protection that is lightweight, impact resistant, rigid thermoplastic, and coated with the proprietary 3M 906 abrasion-resistant coating under exclusive license from the 3M Company. ACRYLITE AR sheet is ideal for protecting flat-panel displays in medical, industrial, touch-screen, or rugged military applications, and provides premium optical quality and the chemical and abrasion resistance needed to stand up to frequent cleaning and handling. ACRYLITE AR sheet is available in clear, contrast-enhancing tints, and a matte finish surface to reduce glare.



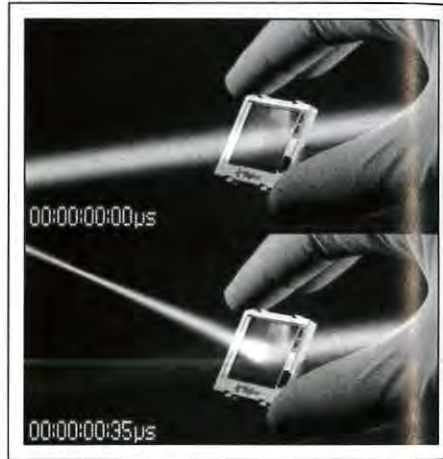
Circle no. 11

### DIGILENS

Sunnyvale, CA 408/737-1100  
Booth 845

#### Application-specific integrated lenses

DigiLens has developed optical switching applications for displays and telecommunications. Components and subsystems are created from multiple, electrically switchable, holographic optical layers that can either encapsulate the prescriptions of multiple lenses or filter light into separate R, G, and B colors. This noiseless miniature component saves space, weight, complexity, and cost. The company packages its technology as application-specific integrated lenses (ASILs) for a variety of display and filtering applications used in front projection, rear projection, TV, and miniature near-eye displays.



Circle no. 12

# 25

00

## SEPTEMBER

20th International Display  
Research Conference  
(IDRC '00)

PALM BEACH, FLORIDA  
SEPTEMBER 25-28, 2000

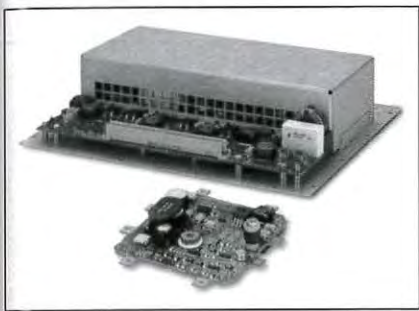
- An international conference on display research and development aspects of:
  - Display Fundamentals, Display Devices
  - Hard Copy & Storage, Input Systems
  - Integrated Devices and Applications
  - Image and Signal Processing,
  - Color Perception, Human Factors

#### ELDEC

Lynnwood, WA 425/743-8301  
Booth 136

#### Power Supplies

ELDEC designs and manufactures high-voltage power supplies for CRT applications, low-voltage power supplies for flat-panel applications, and patented backlight drivers for totally integrated AMLCD power solutions. ELDEC also provides custom and semi-custom power solutions for demanding commercial and military applications where operating under severe conditions is an everyday occurrence.



Circle no. 13

#### ELDIM

St. Clair, France +33-02-31-94-76-00  
Booth 557

#### Video photometer

ELDIM will feature Muratest, a highly sensitive video photometer that examines area uniformity on backlights, FEDs, LCDs, dashboard displays, and microdisplays. The measurement of luminance, contrast, and color, as a function of the position on the sample, is realized in less than a minute, with a resolution of  $512 \times 768$ . The 16-bit converter combined with a very low-noise cooled CCD make it the ideal tool for measurements on very dark samples. Various lenses are available.



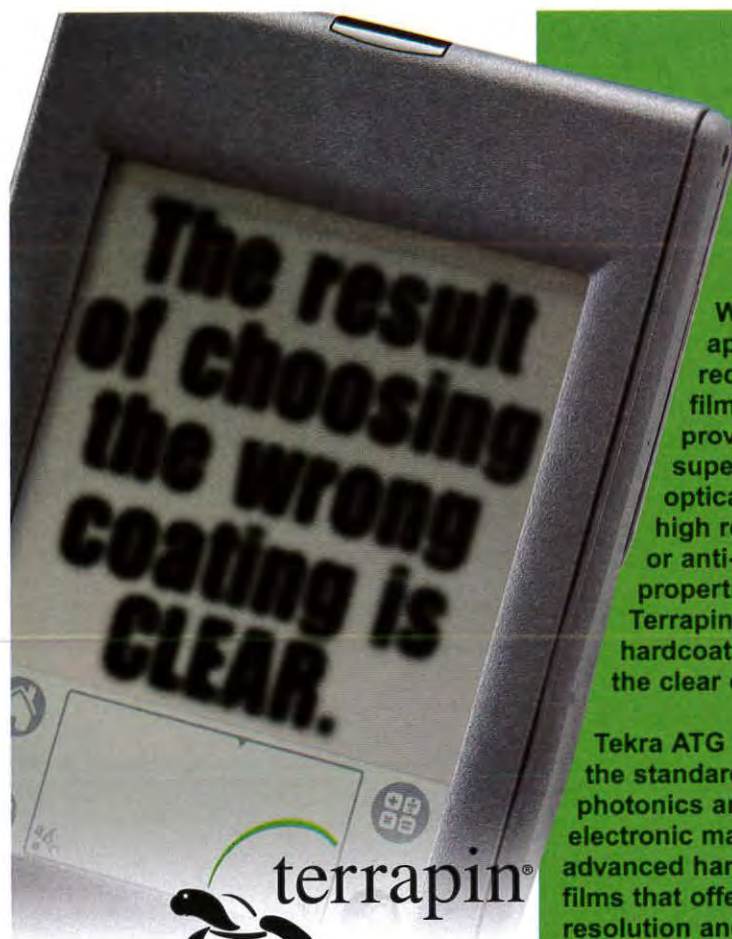
Circle no. 14

#### EL KOREA CORP.

Taejon, Korea +042-864-0277  
Booth 835

#### High-brightness EL lamps

EL Korea Corp. will feature high-brightness green and white EL lamps with high luminous efficiency, resulting in low current and low power consumption for both high- and low-voltage operations, making them suitable for mobile-phone applications as well



When your application requires a film that provides superior optical clarity, high resolution or anti-glare properties, Terrapin™ hardcoats are the clear choice.

Tekra ATG is raising the standard in the photonics and opto-electronic markets for advanced hardcoated films that offer superior resolution and extreme durability.

Visit Tekra ATG at this year's SID Show, booth #6665, to find out more about the advantages of Terrapin hardcoated films.

IT'S ALL ABOUT ANSWERS

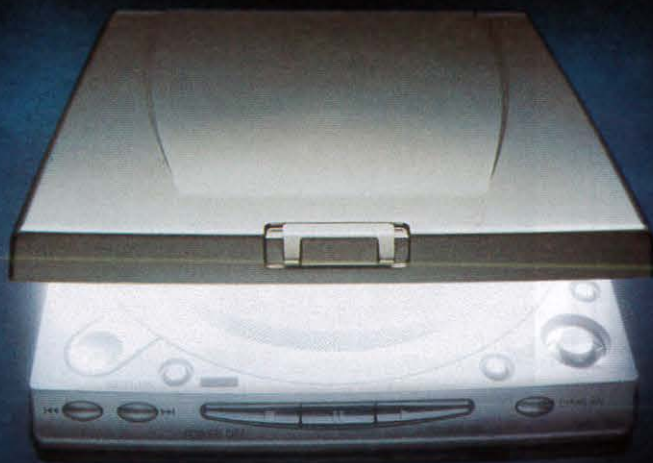
1-800-448-0291 or  
[www.tekraatg.com](http://www.tekraatg.com)



See Us at SID '00 Booth 665

Circle no. 109

"BRILLIANT."  
"UNBELIEVABLE."  
"VERY COOL."  
"FABULOUS."  
"WOW."



When people see OLED Display Technology from Kodak for the first time, their eyes go wide. Then come the praises. And it doesn't take a technical explanation to dazzle them (although they're pretty impressed with that, too). Bright, sharp, full-color images packed into a thin, lightweight display that almost defies reality. That's why companies like Pioneer and Motorola are already putting it into their state-of-the-art products.

We're talking maximum impact. And it's available today.

We can't wait to hear what you think of it, too!



OLED Display Technology from Kodak: See it. Believe it.

See it at SID, booth #914. [www.kodak.com/go/OLED](http://www.kodak.com/go/OLED)

Circle no. 110

Kodak, and Kodak Professional (a division of Eastman Kodak Company) are trademarks.  
© Eastman Kodak Company, 2000



# SIMULATION SOFTWARE AND CONSULTING FOR LCD AND BACKLIGHTING

MEET US AT THE SID' 00 • BOOTH 1404



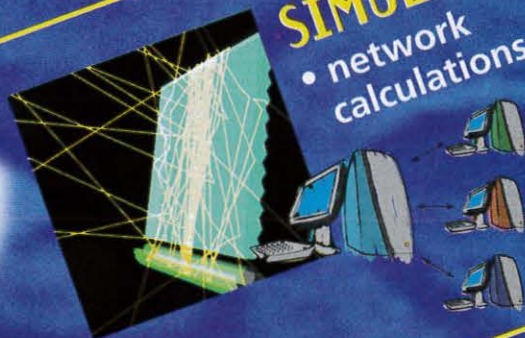
- DESIGN**
- 3D patterns mapping (texturing)
  - CAD import (IGES, STEP, DXF, SAT, CATIA)
  - LCD screen design
  - simulate any type of lamp and LED

NEW FOR ILLUMINATION DESIGN

THE FASTEST AND EASIEST WAY TO DESIGN AND OPTIMIZE YOUR DISPLAY SYSTEMS

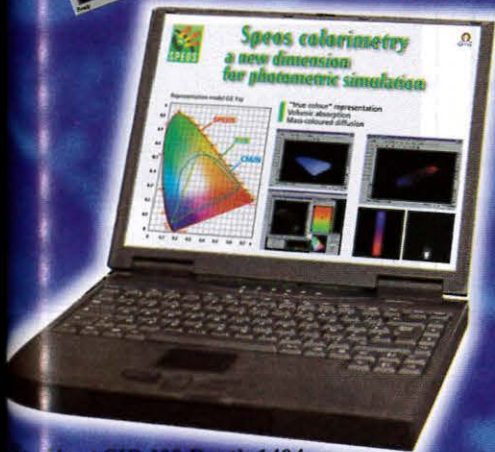
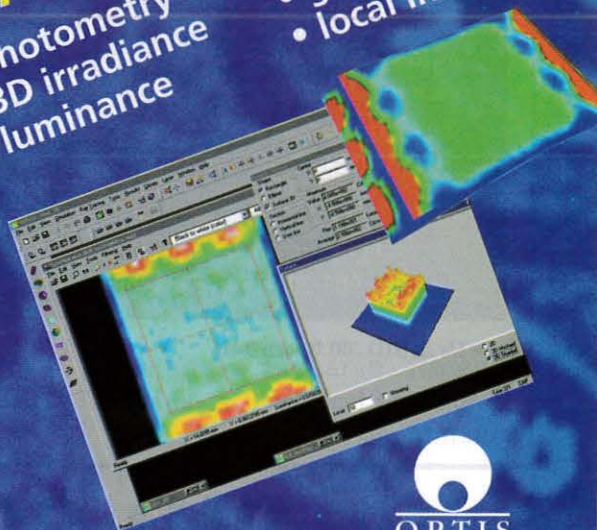
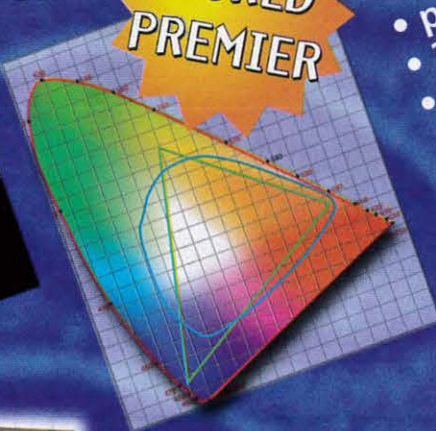
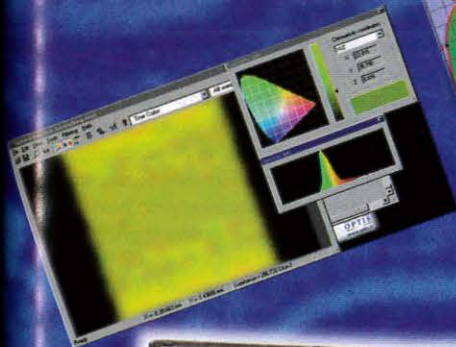


WORLD PREMIER



- SIMULATION**
- network calculations

- ANALYSIS & OPTIMISATION**
- photometry
  - 3D irradiance
  - luminance
  - colorimetry
  - global intensity
  - local intensity



[www.optis.fr](http://www.optis.fr)

toll free (877) 883 1088  
fax (877) 833 1315

L&H CONSULTANTS INC.

L&H Consultants  
distributor for North America  
tel. (1) 514 340 1818

## trade-show preview

as for any LCD backlighting application. The maximum brightness attainable at 100 V and 400 Hz is in excess of 90 and 100 cd/m<sup>2</sup> for green and white EL lamps, respectively. Current consumption does

not exceed 0.2 A/cm<sup>2</sup>. Large-sized EL lamps in standard sizes up to a maximum of 420 × 600 mm are also available either in plain or custom design patterns. **Circle no. 15**

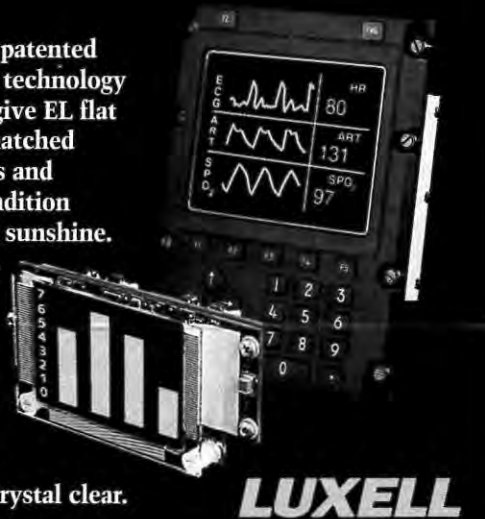
### Put the Black Layer™ between you and reflection.

*Make your product look  
and work its very best.*

It took patented Black Layer technology from Luxell to give EL flat panel displays unmatched crispness of characters and graphics in any light condition from total darkness to full sunshine.

BlackLITE™ displays offer industry's highest contrast and lowest reflectance ratings. At-a-glance, easy viewing. Friendly to the eye.

Want the product you're developing to look and work its very best? The choice is crystal clear.



5170A Timberlea Blvd. • Mississauga, Ontario L4W2S5  
905-206-1708 • fax 905-206-9174 • www.luxell.com

See Us at SID '00 Booth 941

Circle no. 112

# SID 2001

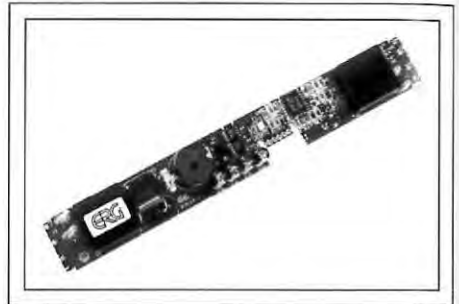
San Jose Convention Center  
San Jose, California  
June 3-8, 2001

### ENDICOTT RESEARCH GROUP

Endicott, NY 607/754-9187  
Booth 434

#### Closed-loop dc/ac inverter

ERG will feature the DMB Series of closed-loop dc/ac inverters designed to provide reliable, highly efficient power for backlighting large LCDs with up to four cold-cathode fluorescent tubes. The power efficiency when using the DMB Series is as high as 90%, unsurpassed by dc/ac inverters of its type. Brightness can be controlled while remaining "flicker-free" throughout the entire range. An optimized form factor for direct display connection to popular 17- and 18-in. flat-panel displays is included.



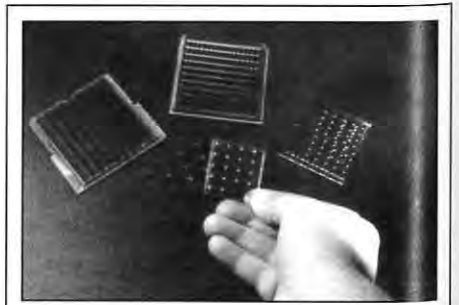
Circle no. 16

### FRESNEL OPTICS

Rochester, NY 716/647-1140  
Booth 164

#### Projection-display lens array

Fresnel Optics will exhibit lens arrays used in projection systems as light integrators, traditionally manufactured in glass but now available in a wide variety of optical-grade polymers including high-temperature plastics. Using Fresnel's High Precision Molding (HPM) Processes, these components have improved efficiencies and very low birefringence for polarization-sensitive applications. Specialized coatings and surface treatments are available to enhance the performance of these lens array for dual functionality in a single component.



Circle no. 17

## FUJITSU MICROELECTRONICS

San Jose, CA 408/922-9000

Booth 312

### High-definition plasma displays

Fujitsu Microelectronics will feature ImageSite color plasma displays. System integrators can build their own monitors based on ImageSite color plasma components.



Circle no. 18



Circle no. 20

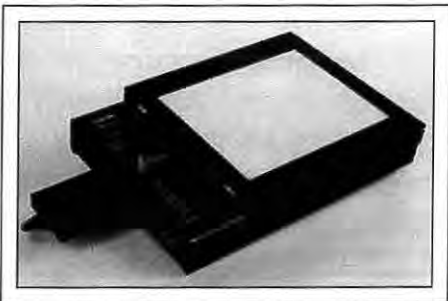
## INCLINE

Newbury Park, CA 805/376-3300

Booth 651

### LCD universal test system

Incline will exhibit a universal test solution for flat panels. The test system facilitates comprehensive testing of the individual LCD assembly as well as the whole screen assembly and electronics. Test functionality includes immediate boot-up, quick connect and disconnect, a menu-driven software interface, and a unique modular interface connector system that facilitates current and future interface technologies. The small footprint incorporates built-in illumination, a single-board computer, power adapter, and a backlight inverter. The system will support network connection, data collection, and full I/O connectivity.



Circle no. 21

## INNOVA ELECTRONICS

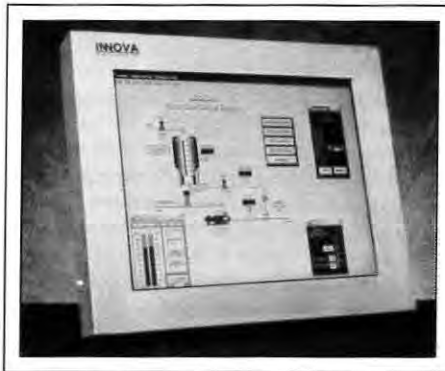
Houston, TX 713/690-9909

Booth 443

### Industrial color monitors

Innova Electronics will feature the STS-4000 series of rack- and panel-mounted LCD color monitors designed for use in a wide range of applications requiring large touch-screen-based displays. The monitors are available in sizes up to 18.1 in. with

auto-dimming sunlight-viewable display options. Visible regardless of ambient light conditions, the new monitors feature resolutions up to SXGA (1280 × 1024) and standard analog VGA interfaces, making special drivers or interfaces unnecessary. Operating temperatures range from 0° to +50°C; storage temperature range from -20° to +70°C.



Circle no. 22

## HOLTRONIC TECHNOLOGIES

Marin, Switzerland

Booth 540

### Lithography systems

Holtronic Technologies will be presenting the HMA500, a high-precision lithography system for high-resolution flat-panel-display manufacture. The system features Holtronic's patented holographic imaging optics that allows for full-field display patterning up to 14 in. on the diagonal (stitched patterns for larger displays), with resolutions as small as 0.5 μm. The HMA500 is suitable for both R&D and production environments, with fully automated substrate and mask handling. With a 500 × 400 mm substrate capacity, this product provides an important new capability for manufacturers of polysilicon TFT-LCDs and FEDs.

Circle no. 19

## HUNET LCD

Tokyo, Japan +81-3-3780-2511

Booth 156

### Color filterless LCDs

Hunet LCD will feature 1.5-in. high-density QVGA full-color LCDs without color filters for mobile applications. These LCDs demonstrate less power consumption, lower manufacturing costs, increased information capacity, and higher contrast.

## Internet Consulting and Database Research

Get on the "Net." Training, lectures, Web sites, and consulting by the former Executive Director of the Internet Society. Visit the SID homepage at

<http://www.sid.org>

Database research. Patent Searches, Technical Literature, Competitive Analysis, Market Research, Demographics

**H.L. Funk Consulting**  
7 Diane Court  
Katonah, NY 10536  
Telephone/Fax: 914-232-3530  
E-mail:  
[consult@hlfunk.com](mailto:consult@hlfunk.com)

Circle no. 113

## trade-show preview

### INTERFACE DISPLAYS & CONTROLS

Oceanside, CA 760/945-0230

Booth 630

#### Multi-purpose control and display unit

Interface Displays & Controls will feature their Multi-Purpose Control & Display Unit (MCDU) designed to accommodate a variety of avionics applications. The MCDU can communicate with multiple systems through standard protocols or message formats and display a variety of messages, including system control parameters, navigation, communication, annunciation, or verification of data inputs. The unit is flexible in design, providing ease of use, low cost, light weight, and low power. The form factor is a standard Dzus mounted control panel, and is 9 in. high by 5.75 in. wide. Connectors can be customer specified and accommodate navigation or display control functions.



Circle no. 23

### INVISIO

Sunnyvale, CA 408/734-9200

Booth 751

#### Display module

Inviso will show their OptiScape II display module that combines a digital backplane with advanced liquid-crystal technology with patented viewing optics to create a low-power highly integrated color display for mobile appliances. Typically viewed at about 30 mm from the eye, OptiScape II creates a virtual image equivalent to a 19-in. SVGA desktop monitor viewed at 2.5 ft.



Circle no. 24

# SID '01

San Jose, California

San Jose Convention Center

June 3-8, 2001

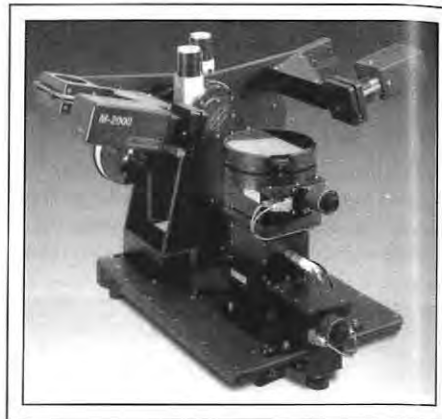
### J. A. WOOLLAM CO.

Lincoln, NE 402/477-8214

Booth 210

#### Spectroscopic ellipsometer

J. A. Woollam Co. will introduce the M-2000X, a spectroscopic ellipsometer designed for thin-film characterization for the display industry. The M-2000X simultaneously measures 300 wavelengths from 370 to 1700 nm. The high speed and large spectral range make it ideal for either *ex-situ* large-area mapping or *in-situ* deposition monitoring and control. Display applications include conductive oxides; transparent films on transparent substrates; poly-Si; liquid crystals; SiNx, SiOx, and SiON; color filters; metals; and polymers.



Circle no. 25

### KORRY ELECTRONICS CO.

Seattle, WA 1-800-257-8921

Booth 430

#### NVIS-compatible AMLCDs

Korry Electronics will feature night-vision-compatible AMLCD products designed for avionics cockpit applications, offering a wide dimming range and full-sunlight readability. Optional Nightshield® NVIS filtering provides high-performance at reduced cost and is compliant with MIL-L-85762.



Circle no. 26

### KURT J. LESKER CO.

Clairton, PA 412/233-4200

Booth 937

#### Organic OLED/PLED cluster tool

The Kurt J. Lesker Co. will be offering flexible cluster tool systems for OLED/PLED film R&D

and pilot-production applications. The cluster tools feature substrate entry and exit locks, plasma cleaning chambers, small-molecule organic material deposition chambers, metal evaporation chambers,

magnetron sputtering chambers, and mask storage and changing capability. Systems are fully computer controlled including extensive recipe creation and data logging capabilities.

### FPD Laser Cutting Machines Capabilities and Features by PTG

**New Process Capabilities** - with a 200W laser it scribes 1.1 mm Corning 1737 at a speed higher than 1 m/sec - separates without cooling 0.5 mm thick Corning 1737 at a speed of 250 mm/sec (application sensitive)

**Laser Cut Initiation Tool\*** - (patent pending) - eliminates particle debris

**Carbon Dioxide Chill Jet** - (patent pending) or CO<sub>2</sub>J is a major advance in thermal stress generation for critical applications

**Micro-Compensator\*** - adds the capability to operate with an accuracy and repeatability of +/- 5.0 microns

**Planar Linear Stepper\*** - maintenance free and clean room compatible motion platform

**Titanium Vacuum Holder** - no contact surface vacuum table

**New Structural Design** - smaller footprint for the same substrate size

## Flat Panel Display Laser Glass Scribing

Featuring Zero Width Cutting Technology® by PTG

**Zero Width Cutting Technology® (0WCT®)** delivers superb quality cuts with zero material loss and extremely high yield on glass from 0.050 mm to 3.0 mm thick.

Visit PTG's Booth #216 at SID 2000 Long Beach, CA May 16-18



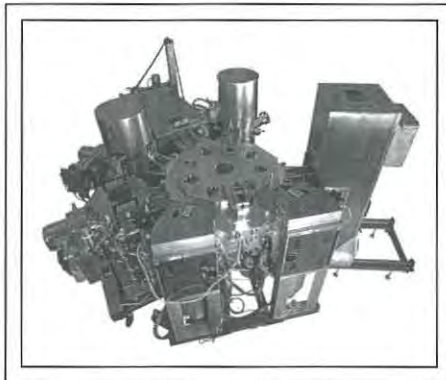
Visit our website [www.ptgindustries.com](http://www.ptgindustries.com)  
Email: [fpdsales@ptgindustries.com](mailto:fpdsales@ptgindustries.com)  
Phone: 407-804-1000 or Fax: 407-804-1002

**P.T.G.**

Precision Technology Group

WELCOME TO THE FUTURE

Circle no. 114



Circle no. 27

### LAMBDA RESEARCH CORP.

Littleton, MA 978/486-0766  
Booth 325

#### Virtual prototyping software

Lambda Research will introduce Tracepro 2.1, a 3-D virtual prototyping software that designs and analyzes display systems. Tracepro reduces the time to bring products to market and typically reduces standard trial-and-error prototyping by 30%. Tracepro is the only software product based on the ACIS kernel, allowing import and export from almost any CAD product using SAT, IGES, or STEP formats.

Circle no. 28

### LCD LIGHTING

Orange, CT 203/795-1520  
Booth 538

#### Single-lamp backlighting system

LCD Lighting has announced the development of RoBo-Bend, a new manufacturing process technology that now enables serpentine hot-cathode lamps to be manufactured with automatic bending processes. Now, a single 8- or 9-mm lamp can cost-effectively replace multiple lamp systems. By reducing the number of cathodes in a backlight, the power loss is greatly reduced. A typical 2:1 power savings is possible by replacing the six cold-cathode lamps with a single hot-cathode lamp, and the complexity, assembly time, and cost and risk elements of the electronics and wiring are reduced while wider dimming ratios are permitted compared with cold-cathode lamps.

See Us at SID '00 Booth 214



# INFORMATION DISPLAY CHINA

# 2000

October 19th-21st, 2000 Shaanxi International Exhibition Center

**Sponsor:**

 China Electronic Appliance Corporation

**Organizer:**

 Howell International Trade Fair Limited

**Supporters:**

- Administration of Electronic-Information Products of Ministry of Information Industry, PR China
- China Information Industry Chamber of Commerce
- China Engineering Research Center for Flat Panel Display
- Beijing Tsinghua Engineering Research Center of Liquid Crystal Technology
- Society for Information Display, Beijing Chapter

**Overseas Supporters:**

- Society for Information Display, Asia Region
- Society for Information Display, Japan Chapter

**For all the suppliers of:**

CRT Displays / Liquid Crystal Displays / Liquid Crystal Technologies / PDP / Colour Plasma Displays / Electroluminescent Displays / Field Emission Displays / Large Area Displays / VFD / LED / Display Measurements / Display Materials / Other Display Technologies



**Held in Conjunction with:**

**ASID'00 - The 6th Asian Symposium on Information Display**  
18th - 20th October, 2000  
Xi'an Jiaotong University, Shaanxi, China



**Action now to secure a prime location!!! INFORMATION DISPLAY CHINA 2000 will see the pavillions from China, Japan, Korea and Taiwan.**

**For booth reservation or ask for visit tickets, please complete the following form**

Company: \_\_\_\_\_ Add: \_\_\_\_\_  
 Contact: \_\_\_\_\_ Job Title: \_\_\_\_\_  
 Tel: \_\_\_\_\_ Fax: \_\_\_\_\_ E-mail: \_\_\_\_\_

Please return the completed form to the Organizer:

**Howell International Trade Fair Limited**

Rm. 215-217, GAODE Office Building, No. 11, West Beisanhuan Road, Haidian District, Beijing 100088, PR China

Tel: +86-10-82090810, 82090817 Fax: +86-10-82090953 E-mail: howell@public.east.cn.net

Mr. Han Zhihai, Mr. Wang Wei



DDTX



DDRX

## EXTRON DDTX/DDRX

# Break the Distance Barrier for Direct Digital Signal Distribution

### What is Direct Digital Technology?

Direct Digital technology is a new form of video for computers which uses a direct digital video link between the computer's video output and the local monitor. With Direct Digital the video signal stays in digital form from the computer to the monitor; this maintains the original signal and image quality perfectly. Two Direct Digital connectivity standards have been created that use the same digital signal but vary in terms of the pin configuration and connector type. The Digital Flat Panel (DFP) connector/pin configuration was developed by VESA. The Digital Visual Interface (DVI) connector/pin configuration was developed by a group of companies called the Digital Display Working Group (DDWG). Both of these connectors carry the same digital signal format referred to as transition minimized differential signaling (TMDS). This signal format was developed by Silicon Image, and is a component of Silicon Image's PanelLink® technology.

### Distance Limitation

Normally, DFP/DVI—TMDS/PanelLink®—signals are designed to travel a maximum distance of 15 feet; however, with use of the DDTX/DDRX, DFP/DVI signals are able to travel up to 330 feet (100 meters), depending on the type and quality of cable used. The DDTX/DDRX uses proprietary digital technology to compensate for signal loss and ringing. And ensure high quality results.

### Direct Digital Long Distance Line Driver

Extron's DDTX/DDRX is a direct digital video transmitter-receiver set designed for long-distance transmission of DFP or DVI signals between a source and direct digital display. The DDTX/DDRX set is comprised of a direct digital transmitter (DDTX) and direct digital receiver (DDRX).

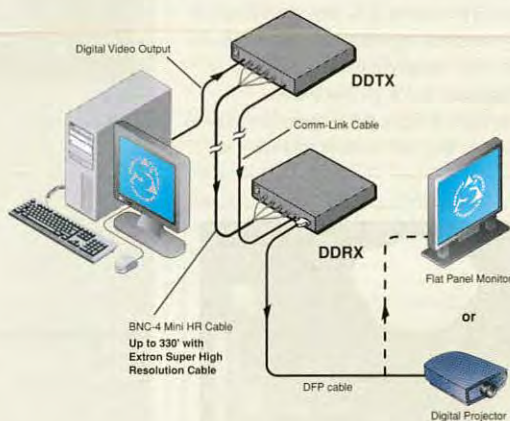
### Direct Digital Distribution Amplifier

Extron's D/2 DA4 is a one input, four output, direct digital distribution amplifier that distributes DFP or DVI signals to up to four comparable displays. The D/2 DA4 is ideal for applications requiring identical images on multiple direct digital monitors or projectors with identical resolutions and refresh rates. The D/2 DA4 accepts DFP/DVI—Panel Link/TMDS—signals and distributes them up to four identical, independently buffered outputs for cable runs up to 15 feet.



Extron's DDTX/DDRX and D/2 DA4 provide the following advantages:

- Compatible with direct digital sources and direct digital displays
- DFP connectors for DFP signals; DDTX uses attached DFP input cable
- Accept single-link DVI signals via optional DVI-to-DFP adapter
- Housed in 1U high, 1/2 rack width enclosures
- 100-240VAC, 50/60 Hz, auto-switchable internal power supplies



The DDTX/DDRX part number is 60-316-01.  
The D/2 DA4 part number is 60-315-01.

For complete details, visit Extron's website at [www.extron.com/m/ddtx](http://www.extron.com/m/ddtx)  
[www.extron.com/m/d2da4](http://www.extron.com/m/d2da4)

# Extron Electronics

800.633.9876 • [www.extron.com](http://www.extron.com)



See Us at SID '00 Booth 122

EXTRON ELECTRONICS/RGB SYSTEMS, INC.  
1230 South Lewis Street, Anaheim, CA 92805  
800.633.9876 714.491.1500 FAX 714.491.1517  
U.S.A.

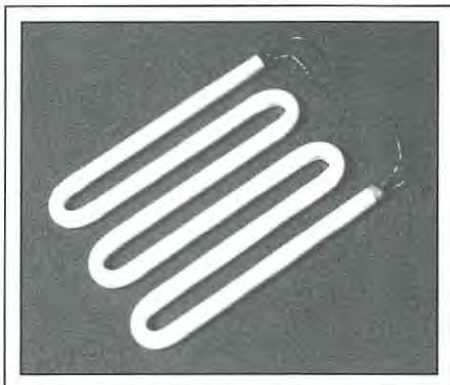
EXTRON ELECTRONICS, EUROPE  
Beeldschermweg 6C, 3821 AH Amersfoort  
+31.33.453.4040 FAX +31.33.453.4050  
The Netherlands

EXTRON ELECTRONICS, ASIA  
41B Kreta Ayer Road, Singapore 089003  
+65.226.0015 FAX +65.226.0019  
Singapore

EXTRON ELECTRONICS INFORMATION  
EXTRONWEB™: [www.extron.com](http://www.extron.com)  
EXTRONFAX™: 714.491.0192  
24-hour access—worldwide!

Circle no. 116

## trade-show preview



Circle no. 29

### LUMIN-OZ

Culver City, CA 310/838-1199  
Booth 533

#### Polymer video screens

Lumin-oZ will feature Revolution optical polymer video screens that can be vacuum formed into any 3-D shape and can be built to any size specification with a virtually seamless appearance. The screens are flexible and offer excellent color rendition, image control options, and high resolution. Because of their light weight, the screens are easy to install and ship, and they are durable and easy to maintain.



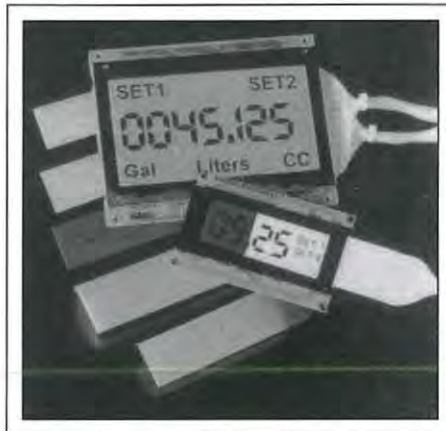
Circle no. 30

### LUMITEX

Strongsville, OH 1-800-969-5483  
Booth 130

#### Fiber-optic backlights

Lumitex will feature fiber-optic backlighting panels that offer the performance of EL without degradation in brightness. Ideal for LCDs, membrane switching, and a variety of special backlighting applications, these thin light-emitting panels are woven from plastic optical fibers and provide long life, operate at very low power, emit no heat or EMI, and require no inverter to power them up. A standard  $2 \times 16$  LCD (assuming a viewing area of  $16.0 \times 200$  mm) can be backlit using just one LED, with an output of about 30 fL at just 30 mA. Larger panels may require additional LEDs.



Circle no. 31

### MERITEC

Painesville, OH 1-888-637-4832  
Booth 920

#### High-speed cabling system

Meritec will introduce the HPM-5 2mm high-speed cabling system featuring a strain relief without overmolding, a slightly inductive contact, and the most reliable form of wire termination. The HPM-5 is available in  $1 \times 5$  and  $1 \times 5+2$  configurations. The  $1 \times 5+2$  unit provides ground tabs to mate with the optional side grounding pins in the mating header. Both configurations are stackable to  $25 \times 5$  and are available with shielded backshells. With each  $1 \times 5$  wafer having its own shield that comes within 0.010 in. of the pin header floor, crosstalk and reflections are minimized.

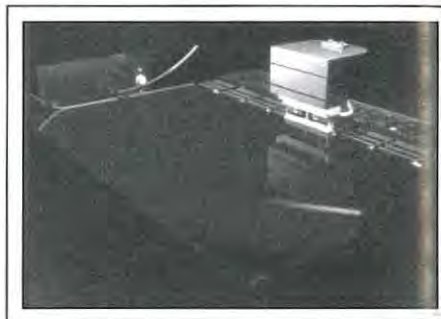
Circle no. 32

### MICROJOIN

Poway, CA 858/877-2100  
Booth 431

#### FPD manufacturing and rework equipment

MicroJoin's new Model 3200 Tracker and Model 6300 Laminator systems combined with the Model 6800 Bonding system provides a comprehensive integrated solution for the manufacture of flat-panel LCDs. The Model 3200 tracker system automates the precision application of anisotropic conductive film material to the substrate. The Model 6800 bonding system is a full-function bonding workstation which combines an advanced positioning and handling system with Ceramic Hotbar Technology™. The Model 6300 laminator system further enhances LCD manufacturing productivity by providing an automated method for applying overlays to the screen, such as polarizing film.



Circle no. 33

# 14

00

## NOVEMBER

*8th Color Imaging  
Conference: Color Science,  
Engineering, Systems &  
Applications*

SCOTTSDALE, ARIZONA  
NOVEMBER 14-17, 2000

• An international multidisciplinary forum  
for dialogue on:

- Creation and capture of Color Images
- Color Image reproduction and interchange
- Co-sponsored with IS&T



**MINOLTA**  
 Ramsey, NJ 201/825-4000  
 Booth 220  
**Spectroradiometer**

Minolta will feature the CS-1000, a spectroradiometer that measures spectral power distribution, luminance, color, and the correlated color temperature of CRTs, LCDs, and lamps/LEDs. The CS-1000 is used in R&D centers of monitor and LCD

manufacturers. Models that can measure areas as small as 0.45 mm and angles as small as 0.14° are available. Its Windows® data-processing software allows for easy calculation, statistical analysis, data storage, and printout. The CS-1000 can be operated as a standalone or can be connected to a PC through a standard RS-232C interface.

## LCD / CRT / TV Testing Total Solution

**Manufacturing Test Equipment  
 for CRT and Flat Panel Displays  
 Video Test Generators  
 Video Distribution Amplifiers  
 Magnetic Field Simulators**



**ACCESS**  
 A company leads you to sucCESS



Small Video Test Generators



Signal Distribution Amplifiers



IP106-DG: Magnetic Field Simulator  
 IP106-KH: Auto-Adjuster  
 ACCESS-3D: 3D Gauss Meter

ACCESS TECHNOLOGY CO., LTD  
 Taipei Hsien, Taiwan  
 Tel : +886-2-22996272  
 Fax : +886-2-22996271  
 email : sales@accesstech.com.tw  
 http : //www.accesstech.com.tw

U.S. Office  
 ACCESS TECHNOLOGY CO., LTD  
 Tel : 605-362-7960  
 Fax : 605-362-7961  
 email : wgdawn@accesstech.com.tw

**See us at SID 2000  
 Booth 243**

Circle no. 117



Circle no. 34

**MITSUBISHI ELECTRONICS AMERICA**  
 Sunnyvale, CA 408/730-5900  
 Booth 139

### ANGLEVIEW™ TFT-LCDs


Mitsubishi Electronics America will demonstrate the AA150QA02, a 15-in. QVGA ANGLEVIEW® TFT-LCD for the CRT monitor replacement market. Because the display demonstrates 24-bit true-color performance and offers 1280 × 960 pixels with a 0.238-mm dot pitch, a typical brightness of 250 nits, 16.7 million colors from true 8-bit RGB drivers, and a typical contrast ratio of 350:1, it is ideal for DVD multimedia applications. The display also features wide viewing angles of 130° (H) and 105° (V), as well as a low-power 3.3-V CMOS interface.



Circle no. 35

# WINTRON

Technologies



*Our products are  
high above the rest*

***Put us to the test!***

Designer and manufacturer of deflection yokes, flyback transformers, high voltage supplies and coils.

winsales@wintrontech.com

phone: 814-625-2720

www.wintrontech.com

fax: 814-625-2725

# WINTRON

Technologies

614 Spearing St., Howard, PA 16841

*A division of Video Display Corp.*

# PRECISION GLASS & OPTICS...



Precision Glass & Optics is a world leader in the precision machining of glass. For years we have met the exacting needs of the precision optical and glass communities.



## PRODUCTS

A wide variety of glass in stock, ready for immediate processing. Microsheet glass including 1737F, 7059, 0211, AF-45, D263, B270 and Glaverbel Float. Pyrex, BK7, Fused Silica, Borofloat, Starphire and color filter glass also available. ITO coated microsheet, Anti-Reflective coated glass, Beam Splitters, Hot Mirrors, Cold Mirrors and Front Surface Mirror in stock and ready quick delivery.

## SERVICES

Precision scribing, CNC machining, annealing, slicing, grinding & polishing, diameter edging from 2mm to 800mm diameter and precision beveling.

# PGO

**PRECISION GLASS & OPTICS**

3600 W. Moore Avenue • Santa Ana, CA 92704

714.540.0126 • Fax: 714.540.1482

Email: [info@pgo.com](mailto:info@pgo.com)

Send for our product and services brochure or visit our website.

Web: [www.pgo.com](http://www.pgo.com)

See Us at SID '00 Booth 328

Circle no. 119

REV	DESCRIPTION	DATE
GV-2	LCD SUBSTRATE	12/99
ALL DIMENSIONS IN INCHES		

*Man, Have any idea who can meet this spec?*

1. Transparent Conductive Coating  
< 25 Ohms/Square, > 90% Ave. Trans.

2. Poly. - 22 x 34 Polycarbonate Sheet  
0.060 thick

*Call GENVAC, they do ITO on plastic sheets up to 24 x 36 inches everyday.*

*GM*

**GENERAL VACUUM**  
*Bringing Solutions to the Surface*

1 (888) 646-9986

**GENVAC**  
FAX: (440) 646-9987  
[www.genvac.com](http://www.genvac.com) email: [info@genvac.com](mailto:info@genvac.com)

Circle no. 120

## trade-show preview

### MOLEX

Lisle, IL 1-800-78MOLEX  
Booth 849

#### DVI connector system

Molex will feature the MicroCross™ DVI connector system, chosen by the Digital Display Working Group (DDWG) as the standard digital video I/O interface design for connecting a host and a display device to support high-resolution video applications. The MicroCross DVI interconnect system provides up to two digital TMDS links (9.9 Gbps) and 2.5 GHz for the analog coax interface. The MicroCross family offers a complete system solution for adapting to existing video standards, including VGA, DFP, and P&D. It can accommodate analog only, digital only, and digital/analog integrated video functions.



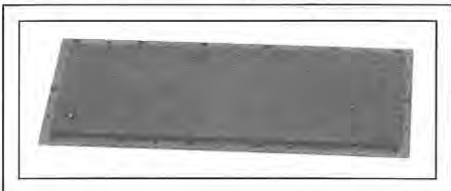
Circle no. 36

### NIMTEC

Chandler, AZ 602/732-9857  
Booth 663

#### Ultra- and super-high-density targets

NIMTEC will feature ultra- and super-high density targets manufactured by a unique oxygen sintering method. The raw materials used, such as high-purity indium, are produced and supplied internally, resulting in consistent quality and a stable supply.



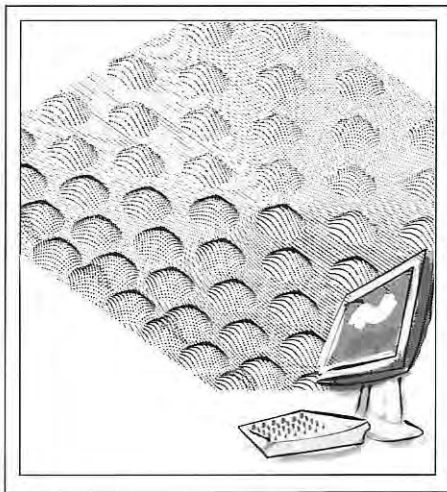
Circle no. 37

### OPTIS

Toulon, France +33-494-086-690  
Booth 1404

#### Modeling tool

OPTIS will feature SPEOS, a modeling tool that allows for the easy application of textures on surfaces with complex shapes. By using 3-D textures, thousands of shapeless patterns for microstructure-based applications (LCD backlighting systems, micro-lens matrix, etc.) can be created. The type of shape (cone, cylinder, box, or sinusoidal deformation) and its distribution on a surface can be defined. This tool is very useful when the surface deformation is small compared to the size of the geometry or when it is difficult to perform modeling with traditional CAD software.



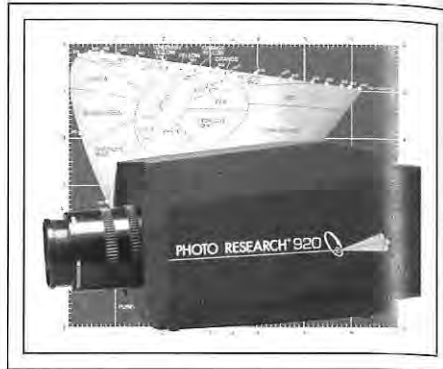
Circle no. 38

### PHOTO RESEARCH

Chatsworth, CA 818/341-5151  
Booth 201

#### Video photometer/colorimeter

Photo Research will feature the PR-920 Video Photometer/Colorimeter, the latest addition to a family of industry-standard instruments designed to deliver the utmost accuracy. The PR-920 is the result of 15 years' experience in imaging photometry and colorimetry, and the mating of a cooled 1024 x 1024-pixel digital CCD, CIE tristimulus filtering, high precision, and high dynamic range.



Circle no. 39

### PLASMACO

Highland, NY 914/883-6800  
Booth 300

#### Plasma displays

Plasmaco will feature their 60-in.-diagonal full-color ac plasma display designed for the growing HDTV market. The wide-screen 16:9 aspect ratio display has a striking image due to its high luminance of 450 cd/m<sup>2</sup> and a contrast ratio of greater than 500:1. The panel is capable of displaying both 720p and 1080i HDTV signals. These displays can show 16.7 million colors with a 160° viewing angle, the widest of any flat-panel technology.



Circle no. 40

# SID '01

San Jose, California  
San Jose Convention Center  
June 3-8, 2001

## PORTRAIT DISPLAYS

Pleasanton, CA 925/227-2700  
Booth 1502

### Wide-screen software tool

Portrait Displays will feature Pivot® Plasma, a software program that allows the image on a wide-screen display operating on Windows™ platforms to be rotated 90°. The software "plug-in" supports wide-screen resolutions on the most popular graphics cards that support wide-screen resolutions.



Circle no. 41

## ROMAG GLASS PRODUCTS LTD.

Wynne & Wear, U.K. +44-191-414-5511  
Booth 1102

### Filters

Romag Glass Products specializes in the manufacture of flat and curved laminated glass and acrylic or polycarbonate filters for use on all types of displays. Their range of filters include Sunvue, to improve readability under adverse lighting conditions; Ultrashield, Clearshield, and Surfshield for EMI/RFI shielding; Hitrans heater panels for de-icing and de-icing; and Zytouch projected capacitive touch sensors.

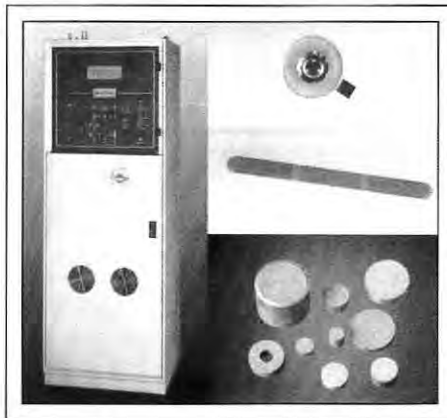
Circle no. 42

## SAES GETTERS

Colorado Springs, CO 719/576-3200  
Booth 922

### Gettering materials and configurations

The SAES Getters Group has announced an extensive new range of products and solutions for any type of information display, from getters that serve as internal pumps inside CRTs, FEDs, PDPs, OLEDs, and VFDs to purifiers and analyzers used during LCD manufacturing. Various types of getter materials and configurations are being developed.



Circle no. 43

## SAMSUNG SEMICONDUCTOR

San Jose, CA 408/544-4000  
Booth 731

### AMLCDs

Samsung will offer a complete line of AMLCDs including a 21.3-in. UXGA TFT-LCD as well as a 24.0-in. wide-viewing angle UXGA PVA TFT-LCD with a 500:1 contrast ratio. Other products to be featured include a 17-in. PVA and a 15.0-in. small-form-factor wide-viewing-angle TFT-LCD for monitor-type applications. In addition, ultrathin 12.1- and 14.1-in. TFT-LCDs as well as 14.1-in. SXGA+, 15.0-in. XGA, 15.0-in. SXGA+, 15.4-in. SXGA, and 16.5-in. SXGA+ TFT-LCDs for the mobile desktop market will be demonstrated.



Circle no. 44

## SOLOMON LCM

Walnut, CA 909/468-3733  
Booth 457

### Graphic modules

Solomon LCD will demonstrate the LM6530 and the LM6520, two new standard graphic modules for the industrial market. All modules feature low voltage and COB technology that uses high-volume telecom ICs, meeting the demands of low voltage and ultra-low power consumption. The module offers all the advantages that small-sized telecom modules have had for the last 5 years: maximum utilization of a new driver/controller chip, a 2.4–6.0 Vdc power supply, high-speed microprocessor interface, 8-bit serial or parallel interface, and inverse display mode.



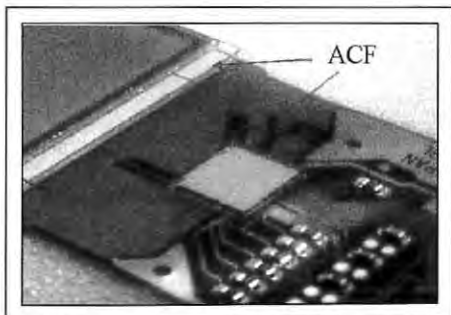
Circle no. 45

## SONY CHEMICALS CORP. OF AMERICA

Mt. Pleasant, PA 724/696-8931  
Booth 158

### Anisotropic conductive film

Sony Chemicals Corp. of America will feature the latest anisotropic conductive film (ACF) for LCDs and PDPs. Chip-on-glass flex board and the new concept of multilayer flex circuits will be demonstrated.



Circle no. 46

## trade-show preview

### TEAM SYSTEMS

Santa Clara, CA 408/720-8877  
Booth 221

#### High-performance video generator

TEAM Systems will introduce the ASTRO VG-844, a high-performance video generator with 400 MHz of pixel frequency. This flexible unit can be fully programmed with a PC or controlled/operated with a remote box. It has a surprisingly small footprint and offers full HDTV/Y-PB-PR compatibility. This is an ideal low-cost unit for manufacturing and servicing high-resolution and HDTV monitors. The 850 programmable and 150 fixed timing/pattern combos combined with "Flash Card" storage make it very easy and fast to operate.



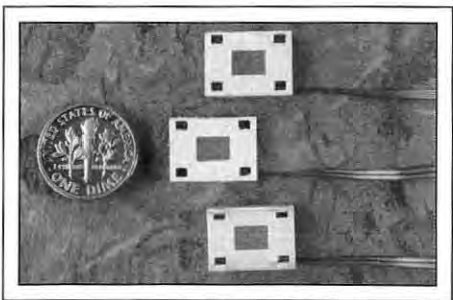
Circle no. 47

### TELEDYNE LIGHTING & DISPLAY PRODUCTS

Hawthorne, CA 323/242-1900  
Booth 121

#### LED illuminators

Teledyne will feature ALPHALIGHT™ 0.25-in.-diagonal (QVGA) and 0.50-in.-diagonal (VGA) aperture-sized LED illuminators, available in white and full-color RGB standard formats. High optical efficiencies significantly optimize LCD and spatial light modulator (SLM) display performance. The QVGA and VGA illuminators provide users with a variety of design implementation advantages compared to other technologies.



Circle no. 48

### THREE-FIVE SYSTEMS

Tempe, AZ 602/389-8800  
Booth 901

#### Microdisplays

Three-Five Systems will feature the MD1280, a microdisplay developed for front projection, rear projection, monitor, and TV applications. The 1280 × 1024 microdisplay has a 0.78-in. array diagonal (12- $\mu$ m pixel pitch), is supported by custom digital and analog ASICs, and has a color resolution of 24 bits. Similar microdisplays will be offered for viewfinder-type ("near to eye") applications such as wireless data viewers or head-mounted displays. Microdisplays with resolutions greater than SXGA, such as those needed for HDTV, are also being readied.



Circle no. 49

### TRICOR SYSTEMS

Elgin, IL 847/742-5542  
Booth 159

#### Video photometer

TRICOR Systems will feature the Model 822 video photometer that measures the absolute brightness of any size sample or scene and provides quantitative data in foot-lamberts (fL) or candela per square meter ( $\text{cd}/\text{m}^2$ ). The 822 is used to measure the performance of displays, lamps, LEDs, backlit panels, control switches, etc. It also quantifies reflectance, luminance, contrast, viewing-angle performance, flatness, haze, residue, and other appearance characteristics. The 822 generates 1024 × 1024-pixel images digitized to 4096 gray levels.



Circle no. 50

### U.S. ELECTRONICS

Minneapolis, MN 612/591-2605  
Booth 916

#### Medical-grade digital LCD monitors

U.S. Electronics will feature the CDL1521A, a 15.1-in. digital AMLCD monitor with a 1024 × 768 maximum resolution and a viewing angle of 160° in all directions. The monitor, designed exclusively for medical applications, meets the fast response times, excellent gray scales, and true color required by state-of-the-art medical imaging. The unit comes with universal VESA mounting for wall mount and other robotic fixtures and is available with various touch panels integrated with USEI controller boards. The product meets worldwide safety approvals in addition to medical safety approvals.



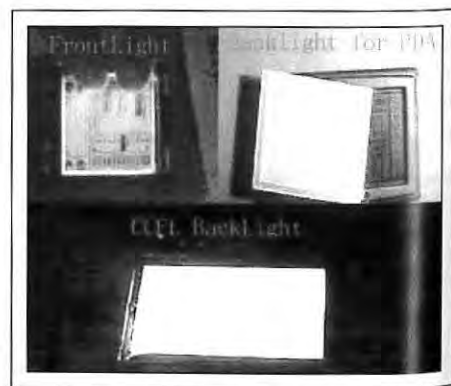
Circle no. 51

### U.S. MICRO PRODUCTS

Los Angeles, CA 310/215-1800  
Booth 134

#### Backlights

U.S. Micro Products will feature a full line of backlights.



Circle no. 52 ■

# Simplicity with Power.



That's the Klein VPG250.

- |  | yes                                 | no                       |
|--|-------------------------------------|--------------------------|
| • Programmable custom patterns?              | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| • Displays and runs DDC 1/2B from test unit? | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| • Programmable timings?                      | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| • Pre-loaded VESA timings?                   | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| • Displays xyY from colorimeter accessory?   | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| • Helps test work flow smoother?             | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

Call today for a FREE five-day trial!

**KLEIN** Instruments  
Corporation

2236 SE Belmont St, Portland, OR 97214 USA  
tel 503.245.1012 fax 503.245.8166  
sales@kleininc.com www.kleininc.com

Circle no. 121

## Get In Touch



### ▶ ONE SOURCE

IP is your global one-stop source for:

- Conductive coatings
- Anti-reflective coatings
- Thin Film Deletion
- Thick film conductors
- Spherical & Cylindrical Bending
- Anti-Newton ring glass
- Chemically strengthened glass
- Anti-glare finishes
- Protective overcoats
- Glass cutting
- FPD and CRT applications

### ▶ ONE SOLUTION

Our mission is to supply you with a complete solution to support the touch screen market. With over 20 years of manufacturing and technical experience, IP is your one stop solution. We can supply you with a turnkey solution to make integration of touch technology simple, quick and profitable.

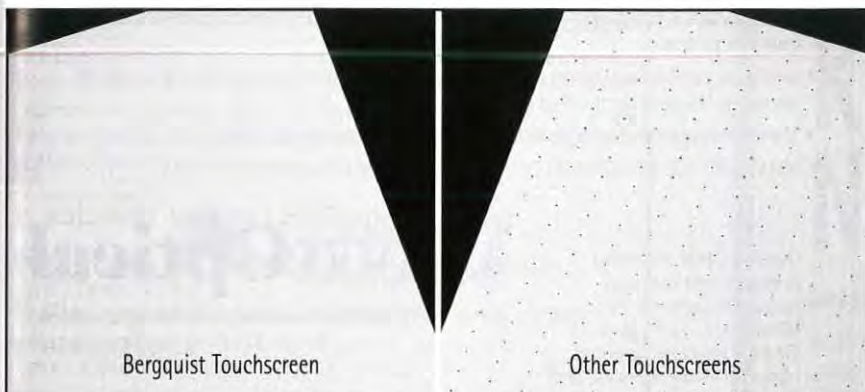


Information Products, Incorporated  
A wholly owned subsidiary of Donnelly Corporation  
414 E. 40th Street / Holland MI 49423  
Phone: 616/786-5300 Fax: 616/786-5042  
E-mail: infoip@donnelly.com  
www.infoproductsinc.com



See Us at SID '00 Booth 326

Circle no. 123



Bergquist Touchscreen

Other Touchscreens

## When You Put A Bergquist Touchscreen Next To Others, The Comparison Is Clear.

With Bergquist, you don't see the effect of the separator dots so your panel display stays clear. In a simple side by side comparison with the touchscreen you're using now and a Bergquist touchscreen, it's easy to see greater clarity. Brilliant colors, sharper images and crisper words, will all make your touchscreen easier to read and navigate. Better clarity, better product. See the clear difference today. **Call 1.800.949.4021**

TOUCH PRODUCTS DIVISION

**BERGQUIST**

301 Washington Street, Cannon Falls, Minnesota 55009 507.263.3766 Fax 507.263.5085  
www.bergquistcompany.com



Circle no. 122

# Elegant Simplicity in Precision Video Display Test

Affordable! Just \$1,695.00 each

**Check it out!**  
[videoinstruments.com](http://videoinstruments.com)

**VIDEO INSTRUMENTS**

2155 Bellbrook Ave. • Xenia, OH 45385  
 Phone: 800-962-8905 • 937-376-4361  
 Fax: 937-376-2802



The Model 890 provides instant selection of up to 16 test images you choose from the V.I. Image Master library. Just assemble the images (combination of pattern and scan format) you want on your personal computer and download to the generator.

(Actual Size) →

Circle no. 124



## He's Checking His Portfolio.

He can see perfectly in all directions, yet hovering in front of his eyeglasses appears an "Invisible Monitor"™ showing his stock portfolio, e-mail, faxes—anything he can call up on his personal communicator, cell phone, WatchMan® or PDA.

For more industrial uses, imagine what your customer will be able to do:

- Troubleshoot a tiny circuit with the oscilloscope wave form directly superimposed over the probes
- Medically perform a surgical procedure with patient monitoring data continuously shown at the side of the field of view
- View sonoscope/endoscope images superimposed on the patient

Clever uses for the "Invisible Monitor" are nearly endless.

Qualified OEMs are invited to expand their business horizons by sampling the MicroOptical CO-3 Clip-On or the EG-7 Integrated EyeGlass Display "Invisible Monitors," and finally answer the question, "What do you want to see today?"

**THE MicroOptical CORPORATION**

33 Southwest Park, Westwood, MA 02090

Tel 781.326.8111 Fax 781.326.4110

[www.microopticalcorp.com](http://www.microopticalcorp.com)



CO-3 Clip-On



EG-7 Integrated EyeGlass Display

See Us at SID '00 Booth 910

Circle no. 125



## HIGH GRADE LCD MONITORS FROM U.S.Electronics

### CV211R (12.1"LCD)

- \*a-si TFT active matrix
- \*Compact size
- \*Resolution:VGA to 800x600
- \*Resistive touch panel optional

### CV511T (15"LCD)

- \*a-si TFT active matrix(Fujitsu Panel)
- \*Resolution:NTSC to 1280x1024
- \*2 input: D-sub mini 15 pin
- \*1 input: NTSC/PAL (Video/Audio)
- \*Wide angle range (Both Vertical and horizontal:160 deg)

### CV811R (18.1"LCD)

- \*a-si TFT active matrix
- \*Resolution:VGA to 1280x1024
- \*2 input: D-sub mini 15 pin x 2
- \*High Contrast (300:1)

- \*High Contrast (300:1)
- \*High Brightness (250cd/m.sq)
- \*Response time 10ms
- \*MTBF = 50,000 hours

#### MEETS WORLDWIDE SAFETY STANDARDS

UL1950,CSA950,TUV-GS(EN60950, ZH1/618), TUV-Ergo (ISO9241-3, MPR-II), SEMKO,DEMKO, NEMKO, FIMKO, TCO/99, FCC-class B, EMC/CE, Energy Star

\*\*\*Manufactured by **TOTOKU** Electric Co.,Ltd,Japan\*\*\*



### U.S.Electronics, Inc.

5730 Duluth Street  
Minneapolis, MN 55422  
Phone:612-591-2605  
www.uselectronix.com  
E-mail: uselectr@aol.com

See Us at SID '00 Booth 916

Circle no. 126

### Can you think outside the box?

PFE is developing a unique cathode technology that is the key to consumer priced, large area flat panel field emission displays for TV and multimedia. We have vacancies for the right individuals with skills in one or more of the following areas:

- Vacuum device / FED engineering
- Printing ink chemistry and formulation
- Flat panel display fabrication and drive electronics

Successful applicants will join a highly motivated team developing core technology and prototypes. They will have at least three years post graduate experience and will be hands on, flexible, self reliant and inventive team workers. Leadership skills and experience in design for manufacture are desirable for some positions.

PFE offers the right candidates a good working environment coupled with a competitive package that includes private health insurance. If you have the right skills, good lateral thinking and dogged persistence please send your CV to Peter Jones at:

#### Printable Field Emitters Ltd.

Atlas Centre, Rutherford Appleton Laboratory, Chilton,  
Didcot, Oxfordshire, OX11 0QX, United Kingdom  
Tel: +44 (0)1235 445959 Fax: +44(0)1235 445960  
email: peter.jones@pfe-ltd.com

For more details see Employment at www.pfe-ltd.com

# SURFACE MOUNT

## HIGH VOLTAGE



**ISO 9001  
REGISTERED**

- FAST RECOVERY
- DISCRETES
- HYBRID ASSEMBLIES



**VOLTAGE MULTIPLIERS INC.**  
8711 W. Roosevelt Ave. • Visalia, California 93291  
559 651-1402 FAX 559 651-0740  
www.voltagemultipliers.com

See Us at SID '00 Booth 558

Circle no. 127

# KNOW NOW.



### Introducing the VESA Flat Panel Display Measurement Standard

VESA's Flat Panel Display Measurement Standard has been developed by experts in the field of display metrology. Its easy to use format provides a description of each measurement with respective setup, procedure, analysis, reporting and comments. Data, examples and configurations are also included, as well as technical discussions and a glossary for those who are new to display metrology. \$39.95 plus shipping (CDROM with PDF version included)

VESA is the international non-profit organization that sets and supports industrywide electronic standards for the video, audio and graphics interface of computer designs. It develops open, interoperable and international standards for the global marketplace, thus ensuring worldwide market growth.



Working to make electronics  
work together.

For more on VESA, visit us at:  
[www.vesa.org](http://www.vesa.org)  
or email us at  
sales@vesa.org

920 Hillview Court, Ste. 140  
Milpitas, CA 95035  
408.957.9270 fax 408.957.9277

See Us at SID '00 Booth 512

Circle no. 128



PHOSPHOR  
TECHNOLOGY

Manufacturers  
of inorganic  
phosphors  
and  
scintillators

Middle Street,  
Nazeing, Essex  
EN9 2LP, England

TELEPHONE  
+ 44 (0) 1992 893424

FAX  
+ 44 (0) 1992 893729

WEB  
[www.phosphor-technology.com](http://www.phosphor-technology.com)

E-MAIL  
[sales@phosphor-technology.com](mailto:sales@phosphor-technology.com)

Circle no. 129

# 300MHz Video Test Generator

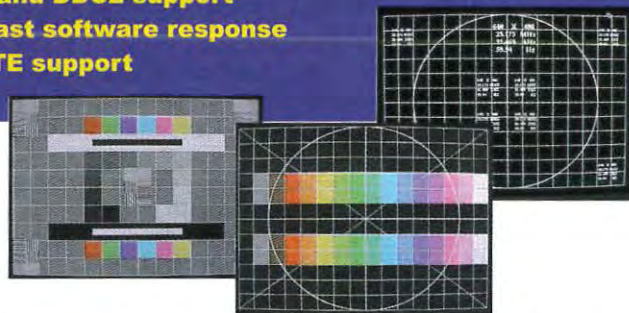


## Unigraf VTG-1300

High-performance Video Test Generator on a board

As the other Unigraf video test generators, VTG-1300 comes loaded with features and backed by extensive software support

- Pixel frequency up to 300 MHz
- Fully programmable
- Fast bitmap patterns
- 255 colours, 16.7 million shades
- 2k x 2k x 8 VRAM
- DDC1 and DDC2 support
- Very fast software response
- Full ATE support



VTG-1300 is the latest addition to the family of High-performance Video Test Generators from Unigraf. The 300 MHz pixel frequency enables 1800 x 1440 display resolution at 85 Hz and above. Fast software response makes the VTG-1300 an ideal choice for ATE systems. It is full of features like DDC1/DDC2, fast bitmap patterns, 255 simultaneous colours and a powerful software support for both DOS and Windows including drivers for Windows 95 & NT 4.0.

 **UNIGRAF**  
ISO 9001 CERTIFICATED FIRM

UNIGRAF Oy, Ruukintie 18  
FIN-02320 Espoo  
Finland  
Tel. +358 9 802 7641  
Fax + 358 9 802 6699  
<http://www.unigraf.fi>

See Us at SID '00 Booth 245

Circle no. 130

**FPD Expo Taiwan 2000.** Sponsored by SEMI Taiwan. Contact: Sue Chung, SEMI Mountain View; 650/940-7961, fax-7953, e-mail: schung@semi-org.  
**June 12-13, 2000 Hsinchu, Taiwan**

**Microdisplay 2000.** Sponsored by Displaytech, Inc., and the SID Southwest Chapter. Contact: United Engineering Foundation Conferences; 212/591-7836, fax -7441, e-mail: engfind@aol.com.  
**Aug. 7-9, 2000 Boulder, CO**

**The First International Display Manufacturing Conference (IDMC 2000) and Vendor Exhibition (FPD Expo 2000).** Sponsored by the SID Korea Chapter and Korea Information Display Society. Contact: Prof. S. Lim, Secretary General; telephone +82-417-550-3542, fax -3592, e-mail: limsk@ns.dankook.ac.kr.  
**Sept. 5-7, 2000 Seoul, Korea**

**Twentieth International Display Research Conference (IDRC '00).** Sponsored by SID. Contact: Ralph Nadell, Palisades Institute for Research Services, Inc., 212/460-8090 x203, fax -5460, e-mail: Rnadell@newyork.palisades.org.  
**Sept. 25-29, 2000 Palm Beach, FL**

**Seventh Annual Symposium on Vehicle Displays.** Sponsored by the SID Detroit Chapter. Contact: V. Cannella; 248/540-7830.  
**Oct. 3, 2000 Dearborn, MI**

**The Sixth Asian Symposium on Information Display (ASID '00) and Information Display China 2000.** Sponsored by the SID Asia Region, ITE, IEICE, and XJTU. Contact: Prof. C. Liu, Xi'an Jiaotong University; +86-29-2668657, fax -2668659, e-mail: chliu@xjtu.edu.cn.  
**Oct. 18-20, 2000 Xi'an, Shaanxi, P.R. China**

**The Sixth International Conference on the Science and Technology of Display Phosphors.** Sponsored by DARPA and SID. Contact: Mark Goldfarb, Palisades Institute for Research Services; 212/460-8090 x202, fax -5460, e-mail: mgoldfar@newyork.palisades.org.  
**Nov. 6-8, 2000 San Diego, CA**

**Eighth Color Imaging Conference: Color Science, Engineering Systems & Applications.** Sponsored by IS&T and SID. Contact: Dee Dumont, SID HQ, 408/977-1013, fax -1531, e-mail: office@sid.org.  
**Nov. 14-17, 2000 Scottsdale, AZ**

**Electronic Information Displays (EID 2000).** Sponsored by SID. Contact: Trident Exhibitions, +44-(0)-1882-614671, fax -614818, e-mail: info@trident-exhibitions.co.uk.  
**Nov. 21-23, 2000 London, UK**

**The Seventh International Display Workshops (IOW '00).** Sponsored by ITE and SID. Contact: IDW '00 Secretariat; +81-3-3423-4180, fax -4108.  
**Nov. 29-Dec. 1, 2000 Kobe, Japan ■**

# More Light. Fewer LEDs.

Lumitex<sup>®</sup> SolidState™/MicroLens™ backlighting technology means fewer LEDs, and higher brightness, for your LCD backlighting. Sizes as large as 1.0" W x 5" L can be uniformly backlit with as few as one LED. 5" diagonal backlights (1/4 VGA size) with white light to 50 Ft-L or more.

More light, fewer LEDs and lower costs. More output, less power.

It's that simple.  
Lumitex...We engineer light!



**Lumitex<sup>®</sup>, Inc.**

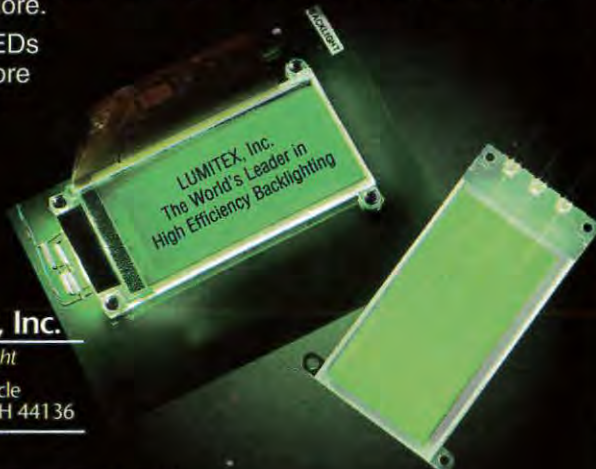
*We engineer light*

8443 Dow Circle  
Strongsville, OH 44136

800-969-5483

Phone: 440-243-8401 • Fax: 440-243-8402

Web: www.lumitex.com



See Us at SID '00 Booth 130

Circle no. 131



Call For A  
Sample And Our  
New Literature

## Light Shaping Diffusers<sup>®</sup>

- High transmission efficiency (up to 92%)
- Controlled light distribution (0.2° to 95°)
- Homogenized light
- Mass produced technology

**Poc** Physical Optics Corporation<sup>®</sup>

Ph: (310) 320-3088 Fax: (310) 320-8067 Web: www.poc.com

Manufactured under U.S. patent nos. 5,365,354; 5,534,386; 5,609,939; 5,631,754; 5,629,996 and other patents pending.

See Us at SID '00 Booth 638

Circle no. 132

## a view from the hill

continued from page 4

Wide Web, and cellular phones. As these communications methods proliferated and as the cost of communicating began to decrease, we all, almost imperceptibly, broadened our

circle of daily contacts. Not so many years ago, receiving a telegram or making a long-distance telephone call was an event of some importance. Today many of us make more

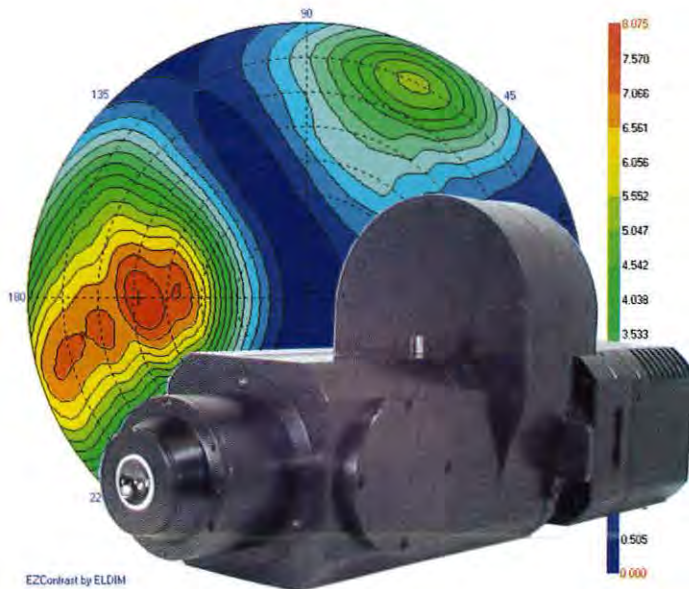
long-distance calls each day than local ones and we have the ability to send e-mail messages at costs so low that almost everyone can do it without having to consider budgetary limitations. In the first two decades of the 21st century, worldwide voice and e-mail messaging will continue to expand and costs will decrease further – eventually approaching zero.

Therefore, as we enter the third millennium, fewer and fewer countries will be able to function effectively while attempting to exert arbitrary control over these communications channels. Electronic communications is creating a new world order that is becoming independent of geographic or political boundaries. As the traditional political alignments based on territorial boundaries become less and less meaningful, people will begin to realize that the most beneficial groupings are by common interests and not by geography. No longer will we need to organize as our cave-dwelling ancestors did to control certain pieces of land. Instead, we will organize based on personal or business relationships with others in the global community. The ones who do that most effectively will be the winners in what will continue to be a highly competitive environment. The traditional government structures will hang on, most likely longer than they should, and serve as arbitrators to keep any one group from gaining too great a competitive advantage.

Therefore, organizations such as our Society for Information Display will play a vital and pre-eminent role in this new world order that will be driven by the ability to exchange information freely and instantaneously with colleagues anywhere on planet Earth – and someday beyond. The electronic information exchanges will be supplemented by frequent “real-life” meetings, so that we can solidify these personal relationships, as we human beings have done throughout history.

Over the last seven-and-a-half years of “The Display Continuum” columns, we have contemplated a future in which we will have an overabundance of opportunities for new and existing display technologies – a future where we can expect to have reliable and simple-to-use Internet appliances, desktop knowledge-space displays, digital photography and DVDs, high-resolution 2-D electronic imaging displays, hardware-based knowledge cubes, sunlight-readable displays in all sizes from micro- to billboard-size, and location-

### ELECTRO-OPTICAL MEASUREMENTS OF DISPLAY TO CARRY OUT ? LIMITED BUDGET ?



## Think About EZLITE from EZContrast Family

- > Realizes a +/- 60° Incident angle, 0-360° azimuth angle luminance measurement in **less than 15 s.**
- > Compatibility with main display measurement standards (ISO, TCO, VESA...).
- > Luminance, Contrast, Color, BRDF, Reflectivity...
- > **Transmissive and Reflective LCDs, LEDs, Microdisplays...**

ELECTRONICS FOR DISPLAYS AND IMAGING DEVICES

1185 rue d'Epron 14200 HEROUVILLE SAINT CLAIR - France  
Phone : + 33 2 31 94 76 00 - Fax : + 33 2 31 94 09 50  
E-Mail : eldim@eldim.fr - Internet address : <http://www.eldim.fr>



© ELDIM SA - 1995 / Aug0109 - V1.1

See Us at SID '00 Booth 557

Circle no. 133

independent data and voice communications devices. And we have also thought about some ways in which our lives will change – hardly at all.

The Society for Information Display has an important role to play in the personal and technical interactions that will be the catalysts for many of the new developments that will facilitate rapid progress in the Information Age. Therefore, we can and must look for ways to take a few well-measured steps toward creating an even stronger and more vibrant technical society that grows and broadens its influence in all regions of the world. This conviction, that we can and should be an important and fundamental contributor to the 21st-century Information Society, is a guiding principle on which we can base how we build SID, how we decide which new directions to take, and which new ideas to implement.

I am anxious to hear from you. Please send me your suggestions. Offers of participation and help will be most graciously accepted. I look forward with enthusiasm to serving as your President. You may contact me by e-mail at silzars@attglobal.net, by phone at 425/557-8850, by fax at 425/557-8983, or by regular mail to the hilltop at 22513 S.E. 47th Place, Issaquah, WA 98029.

Aris Silzars is President of the Society for Information Display. He lives on a hilltop in Issaquah, Washington. ■

# SID '01

Symposium, Seminar,  
and Exhibition

San Jose, California

San Jose Convention Center

June 3–8, 2001

## Show Your True Color



**Precise, High-Speed Colorimeter for Monitor Calibration**

### Chroma 7130 Mini colorimeter

The *Chroma 7130 mini colorimeter* is a *compact CIE-based* colorimeter. It is designed with a *built-in processor* for fast and accurate measurement data. It offers a variety of measurement functions like *chromaticity luminance* and *color temperature* for calibration, characterization, and control of color monitors

**Chroma**  
CHROMA ATE INC.

CHROMA ATE INC.  
43, Wu-Chuan Road, Wu-Ku Ind. Park,  
Wu-Ku, Tainpei Hsien, Taiwan, F.O.C.  
Tel : +886-2-2298-3855 ext.8209  
Fax : +886-2-2298-3596  
E-mail: chroma@chroma.com.tw

CHROMA ATE INC. (U.S.A.)  
15279 Alton Parkway, Ste. 400  
Irvine, CA 92618  
Tel : +1-949-788-0822  
Fax : +1-949-788-0608  
Toll Free: 1-800-478-2026

EUROPE B.V.  
Max Planckstraat 4  
6716 BE Ede, The Netherlands  
Tel : +31-318-648262  
Fax : +31-318-648268

<http://www.chromaate.com.tw>

Circle no. 134

continued from page 2

depressions on the outside of the LCD's back plate. There are also other schemes afloat for repartitioning the elements in a familiar AMLCD using different technologies and

architectures. In each case the goal is to reduce cost or improve performance (or both) by modifying the partitioning of the system in such a way that materials and processes are

better matched to the structures and devices being fabricated.

Materials, processes, partitioning, packaging — anything else? Is there any new way of creating an image that has not yet reached the display mainstream? The only one I can think of is direct optical writing with laser beams (or other highly collimated light sources). Done on a screen with high power, this approach becomes an alternative to projection displays. Done directly on the retina with very low power, it substitutes for a variety of virtual and head-mounted displays. But interesting as they may turn out to be in the long run, laser-based displays appear to be years away from the mainstream.

So we're back to materials, processes, partitioning, and packaging as the sources of the "next big thing," whatever it may be. I would be surprised to find any new electro-optic effects raising themselves from the primordial ooze in the foreseeable future. So I come to the conclusion that the "next big thing" will arise from the application of the "three p's and m" to one of the current electro-optical effects that we know and love. It will be an LCD, OLED, PDP, EL, or FED that is cheaper, brighter, lighter, has higher pixel density, or is more energy-efficient through the creative application of repartitioning, repackaging, new processes, or new materials — or perhaps some combination of the four.

That doesn't exclude too much, of course. Except the snake-oil salesman who says, "We've discovered a unique electro-optic effect and we'll be in volume production in 18 months." That's not a bad thing to exclude, come to think of it.

— KIW

We welcome your comments and suggestions. You can reach me by e-mail at [kwerner@nutmegconsultants.com](mailto:kwerner@nutmegconsultants.com), by fax at 203/855-9769, or by phone at 203/853-7069. The contents of upcoming issues of *ID* are available on the *ID* page at the SID Web site (<http://www.sid.org>).

**We enhance your display**

Helping you get **from here** to here

**Polar Vision** can help make your displays brighter, clearer and easier to read within a wide range of viewing conditions. You can achieve the integration of an optimally performing display by partnering with us in the following ways:

- Our Engineers will analyze your display performance problems.
- Our Sales Staff will advise the best available options.
- Our Development Lab will prepare samples for analysis.
- Our Manufacturing Division will deliver to your specifications.

Call or login to our Web site for more details about how we can partner creatively with you.

**Polar Vision** is a leading full production manufacturer and outsource for optical filters and custom linear and circular polarized and retardation films.

In addition, we provide turn-key engineering, prototype and full clean room manufacturing services for the creation of "rugged" and "high brightness" LCDs and custom performance enhancement filters for all other display types.

625 Alaska Avenue • Torrance • CA 90503  
310.320.9768 • 800.269.8801 • FAX: 310.320.9357  
[www.polarvision.com](http://www.polarvision.com) e-mail: [sales@polarvision.com](mailto:sales@polarvision.com)

**POLAR VISION INC.**

See Us at SID '00 Booth 539

Circle no. 135

# electronicAsia 2000

International Trade Fair for Components, Assemblies, Electronics Production and Display Technologies

*in-corporating*

## World of Display Technology

October 11-14, 2000

Hong Kong Convention and Exhibition Centre

### Into the Electronic Millennium

The enthusiastic participation of thousands of decision makers in the electronics industry has seen electronicAsia thrive as a forum for information exchange and global trade.

Close to 22,900 industry professionals from 103 countries and regions converged at electronicAsia 99. The key industry makers from the Chinese Mainland, Taiwan, Korea, the US and Japan were amongst them!

With the convergence of such qualified buyers at the region's foremost trade fair of its kind, it would be an excellent opportunity for companies supplying electronics components, assemblies and production equipment.

electronicAsia 2000 promises to be bigger, better and more booming as even more internal exhibitors and visitors will use it as the leading global electronics components trade show for the new electronics millennium. But there's more...

### Fair within a fair- World of Display Technology

"World of Display Technology", a special section at electronicAsia, is designed to provide a look at the challenges and solutions for the electronic display industry. In addition to companies exhibiting their display products and services, the event also brings in top professionals from around the world to speak and exchange information on this field at forums and symposia.



<http://www.electronicasia.com.hk>

### LaserAsia 2000

International Trade Fair for Laser Technology & Technical Optics

LaserAsia 2000 is Asia's premier trade fair on the latest trends in the innovative and applied optoelectronics. LaserAsia is expected to attract visitors from a broad spectrum of interest in the industry - development and production engineers, technical designers, physicists, the medical profession, manufacturers and system providers.

<http://www.laserasia.com>

Also held concurrently with electronicAsia is Asia's largest consumer electronics trade show, Hong Kong Electronics Fair, and the exciting Hong Kong International Lighting Fair.



Act now! Make electronicAsia 2000 your springboard to success.

#### Organizers:

AMESS MUNICH INTERNATIONAL  
MMI - Munich International Trade Fairs Pte Ltd  
Tel: (65) 236-0988  
Fax: (65) 236-1966  
E-mail: [mmi\\_sg@mmiasia.com.sg](mailto:mmi_sg@mmiasia.com.sg)



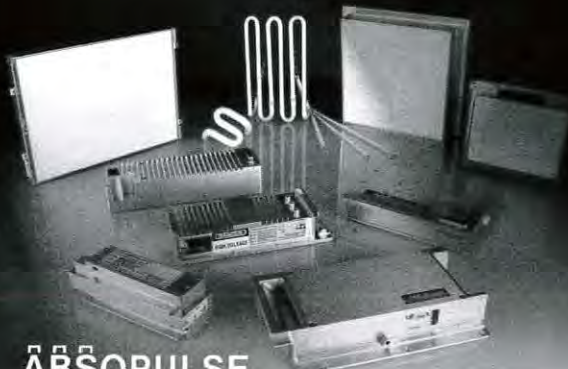
Hong Kong Trade Development Council  
Tel: (852) 2584-4333  
Fax: (852) 2824-0026 / 0249  
E-mail: [exhibitions@tdc.org.hk](mailto:exhibitions@tdc.org.hk)

#### Europe Coordinator:

IMAG - International Exhibition & Fair Services Ltd  
Tel: (49) 89-949-22-0 / (49) 89-949-22-119  
Fax: (49) 89-949-22-350 / (49) 89-949-22-122  
E-mail: [imag@imag.de](mailto:imag@imag.de)

## DC-INPUT DIMMABLE BACK-LIGHT INVERTERS

- \* Broad range of field-proven designs
- \* Very high reliability and rugged construction
- \* DC-input 12V; 24V; 28V; 36V or custom
- \* Output power 1W to 200W and higher
- \* Open circuit voltage up to 3000V rms
- \* Dimming ratio 2000 : 1 and wider
- \* Fast turn-around, even for custom designs
- \* Applications include aviation, transportation, mining, scientific instrumentation



**ABSOPULSE**

ELECTRONICS LTD.

110 Walgreen Road, Carp, ON, K0A 1L0, CANADA

Tel.: (613) 836-3511 Fax: (613) 836-7488 e-mail: absopulse@absopulse.com  
visit us at www.absopulse.com

Designers and Manufacturers of quality Converters, Inverters, UPS systems, complete Rack-mount systems and DC-input Fluorescent Inverters since 1982. Custom or Standard.

Circle no. 137

## TIMELINE INC.

Over 15 years and 32,000 customers and still growing

Call, fax or email us for a complete flyer of products.

### LIQUID CRYSTAL DISPLAYS

#### 240x64 dot LCD with built-in controller.

AND 4021ST-EO. Unit is EL back-lit. \$59.<sup>00</sup> or 2 for \$109.<sup>00</sup> or  
OPTREX. DMF5005 (non back-lit) \$49.<sup>00</sup> or 2 for \$89.<sup>00</sup>

20 character x 8 line 7/8L x 2 1/2H The built-in controller allows you to do text and graphics.

#### Alphanumeric—parallel interface

16x1 .....	\$6.00	20x2 .....	\$8.00	32x2 .....	\$8.00
16x1 (lg. char.) .....	\$8.00	20x4 .....	\$8.00	40x1 .....	\$8.00
16x2 .....	\$6.00	20x4 (lg. char.) .....	\$10.00	40x2 .....	2 for \$20.00
16x2 (lg. char.) .....	\$10.00	24x2 .....	\$8.00	40x4 .....	\$20.00
16x4 .....	\$12.00	32x4 .....	\$10.00	4x2 .....	\$5.00

5V power required • Built-in C-MOS LCD driver & controller • Easy "microprocessor" interface • 98 ASCII character generator • Certain models are backlit, call for more info.

#### Graphics and alphanumeric—serial interface

size	Mfr.	price	size	Mfr.	price
640x480 (backlit)	Epson	\$20.00	480x128	Hitachi	\$10.00
640x400 (backlit)	Panasonic	\$15.00	256x128	Epson	\$20.00
640x200	Toshiba	\$15.00	240x128 (backlit)	Optrex	\$20.00
480x128 (backlit)	ALPS	\$10.00	240x64	Epson	\$15.00
			160x128	Optrex	\$15.00

6" VGA LCD 640X480, Sanyo LMDK55-22 \$19<sup>00</sup>

### MONITORS

#### Non-Enclosed TTL

Comes with pinout. 12V at 1.4 Amp input • Horizontal frequency 15Khz. • Ability to do 40 and 80 column.  
5 inch Amber \$19.00 • 7 inch Amber \$19.00  
9 inch Amber or Green \$19.00

#### 5" COLOR MONITOR \$29.<sup>00</sup>

- Flat Faceplate • 320 x 200 Dot Resolution • CGA & Hercules Compatible
- 12 VDC Operation • 15.75 KHz Horiz. Freq. • 60 Hz Vert. Sync. Freq.
- Open Frame Construction • Standard Interface Connector • Degaussing Coil included • Mfr. Samtron

2 for \$49<sup>00</sup>

9" COLOR SVGA MONITOR \$169.<sup>00</sup> Fully Enclosed - Tilt and swivel type.

#### NTSC COMPOSITE 4" LCD MONITOR \$69.<sup>00</sup>

2539 W. 237th Street, Bldg. F, Torrance, CA 90505 • Order desk only: USA: (800) 872-8878  
CA: (800) 223-9977 • L.A. & Technical Info: (310) 784-5488 Fax: (310) 784-7590  
email: mraa@earthlink.net • http://www.digisys.net/timeline

Circle no. 138

# SID '01

San Jose, California

San Jose

Convention Center

June 3-8, 2001

Mark Your Calendar Now!

## AEI 2000 Components

### COMPONENT TFT COLOR LCD MONITORS

#### CONTROLLER BOARD



New SVGA, XGA, NTSC/PAL controller board. Part No. LCDCB

#### 1.8" TFT COLOR LCD MODULE



Part No. LCD18M

#### COMMERCIAL GRADE VCR WITH BUILT IN TUNER



Part No. VCRSTT

#### 22" TFT COLOR LCD MODULE



New, 16:9 wide screen SXGA computer and video NTSC monitor features the largest, clearest and sharpest pictures. Part No. LCD22

#### 2.5" TFT COLOR LCD MODULE

Part No. LCD25



#### OTHER SIZES AVAILABLE:

1.8", 5.6", 6.4", 6.8",  
10.4", 12", 15", 18", 22"

TEL: (562) 809-8262  
FAX: (562) 865-5640

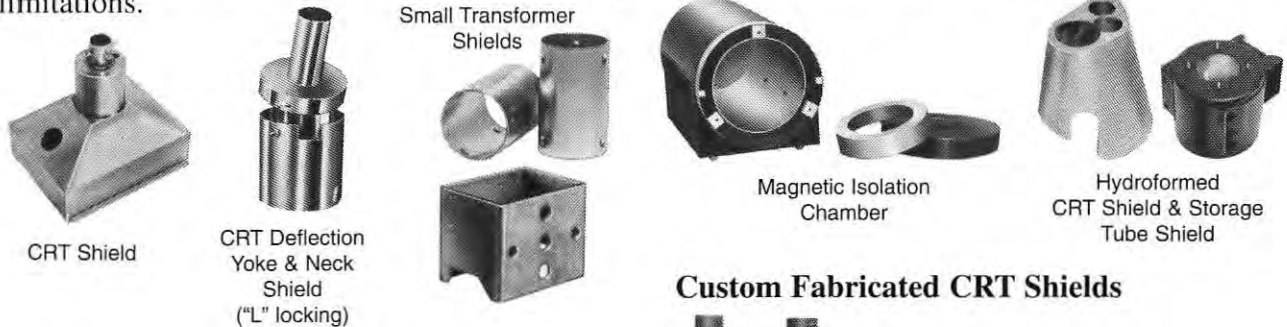
Circle no. 139

See Us at SID '00 Booth 243



# Magnetic Shields Any Size or Shape, Already Tooled-Up...No Tooling Costs For You

Ad-Vance Magnetics is tooled for hundreds of magnetic shields components. Take advantage of the immense quantity of tooling available. We keep it all on hand to help reduce your costs and to serve you faster. Only a few of the hundreds of pre-tooled shields can be shown because of space limitations.



CRT Shield

CRT Deflection Yoke & Neck Shield ("L" locking)

Small Transformer Shields

Magnetic Isolation Chamber

Hydroformed CRT Shield & Storage Tube Shield

## AD-MU Alloys Protect Permanently

1. AD-MU alloys will not saturate when properly used.
2. No excessive loss of permeability from shock.
3. Relatively stable permeability characteristics are exhibited after final anneal avoiding the expense and inconvenience of regularly repeated annealings.
4. Minimal retentivity is displayed by AD-MU alloys for any alloy of a given permeability.

## Custom Fabricated CRT Shields



Made from high permeability AD-MU-80 or AD-MU-78

## Electrical Characteristics

Typical DC Magnetic Properties for AD-MU Shielding Alloys						
	Material	Initial Permeability at 40 gauss	Permeability at 100-200 gauss	Maximum Permeability	Saturation Induction gauss	Coercive Force oersteds
High Permeability	AD-MU-80	75,000	100,000	300,000	8,000	0.015
	AD-MU-78	60,000	43,000	250,000	7,600	0.01
Med. Permeability	AD-MU-48	11,500	20,000	130,000	15,500	0.05
Low Permeability	AD-MU-00	*300	1,300	3,000	22,000	1.00

\*Unannealed State

## Typical Physical Properties of AD-MU Alloys

(Forming Temper - Not Annealed)

	AD-MU-80	AD-MU-78	AD-MU-48	AD-MU-00
Density (lb/in <sup>3</sup> )	0.316	0.305	0.294	0.283
Thermal Expansion Coefficient* <sup>o</sup> F(68°-212°F)	7.0x10 <sup>-6</sup>	7.5x10 <sup>-6</sup>	4.6x10 <sup>-6</sup>	7.6x10 <sup>-6</sup>
Thermal Conductivity (BTU/in/ft <sup>2</sup> /hr/°F)	136	115	90	-
Electrical Resistivity (ohm-cir mil/ft)	349	331	290	-
Curie Temperature (F)	845	761	932	-

## Typical Mechanical Properties of AD-MU Alloys

(Forming Temper - Not Annealed)

	AD-MU-80	AD-MU-78	AD-MU-48	AD-MU-00
Tensile Strength (lbs/in <sup>2</sup> *10 <sup>3</sup> )	90	85	85	45
Yield Strength (lbs/in <sup>2</sup> *10 <sup>3</sup> )	35	30	40	30
Modulus of Elasticity (lbs/in <sup>2</sup> *10 <sup>3</sup> )	32.0	30.0	24.0	29.5
Elongation in 2" (%)	40	30	25	30
Hardness (rockwell B)	62/75	64/74	59/68	65

# AD-VANCE MAGNETICS, INC.



P.O. Box 69 • 625 Monroe Street • Rochester, Indiana 46975  
 (219) 223-3158 • FAX (219) 223-2524  
 E-Mail: sales@advancemag.com  
 Web Home Page: <http://www.advancemag.com>

## DURALAN II™

High Performance  
Windows/Lenses/Filters...  
Custom Fabricated to Meet  
Your Design Requirements

**Features Include:**

- ▶ EMI/RFI and ESD Protection
- ▶ Excellent Clarity
- ▶ Superior Contrast Enhancement
- ▶ Unique Antiglare Properties
- ▶ Scratch and Chemical Resistance
- ▶ Custom Graphics
- ▶ "Privacy" Windows
- ▶ Custom Fabrication

**SILVER CLOUD**  
MANUFACTURING CO.  
GRAPHICS AND ELECTRONICS

For additional information call 856/825-8900,  
fax 856/825-8969, or visit our web site at  
[www.silver-cloud.com](http://www.silver-cloud.com)

**Transforming Design Concepts Into Reality**

See Us at SID '00 Booth 358

Circle no. 141

## TROUBLESHOOTING MONITORS?

### 15 Day Evaluation Period



Every video pattern you need  
for complete monitor  
troubleshooting and alignment.

only  
**\$995**

from

**Xtronix®**

*The Troubleshooter*  
Model 3030

• 200KHz Horizontal Freq.

• DDC Test

• Auto Configuration Setup

Optional Color Measurement



**Xtronix Corporation**

3150 Clinton Court • Norcross, GA 30071

tel: 770.495.4881

[www.xtronix.com](http://www.xtronix.com)

Circle no. 142

# Large Area Hard Masks.

Substrate sizes up to 32" x 24"  
(800 mm x 600 mm).

Precision and resolution in the  
micron range.

Highest Accuracy.

Excellent pattern and contour  
definition.

Manufacture with Direct Write Laser  
from customer CAD data.

Speedy times of delivery.

Highly skilled CAD staff.

Materials: Iron oxide and Chrome.

Visit us at the SID 2000 – booth 256

IMT Masken und Teilungen AG  
Im Langacher, Greifensee  
P. O. Box, CH-8606 Nänikon  
Switzerland  
Phone +41 1 943 19 00  
Fax +41 1 943 19 01  
E-Mail [imtadmin@imtag.ch](mailto:imtadmin@imtag.ch)  
[www.imtag.ch](http://www.imtag.ch)

**IMT**  
PRECISION ON GLASS

See Us at SID '00 Booth 256

Circle no. 143

## sustaining members

Acer Display Technology  
 Ad-Vance Magnetics, Inc.  
 Advance Reproduction Corp.  
 American Panel Corp.  
 Applied Concepts, Inc.  
 Arconium  
 Artesyn Solutions, Inc.  
 ATI Technologies  
 autronic - Melchers GmbH  
 BPS  
 Brewer Science, Inc.  
 Brimar Ltd.  
 Brown & Sharpe Surface Inspection Systems, Inc.  
 Canon, Inc.  
 CELCO  
 Cherry Electrical Products  
 Chunghwa Picture Tubes, Ltd.  
 Clinton Electronics Corp.  
 Colorado Microdisplay, Inc.  
 Compaq Computer Corp.  
 Corning Incorporated  
 Corning Japan K.K.  
 Crystaloid Technologies  
 CTX Opto-Electronics Corp.  
 DigiLens, Inc.  
 Display Laboratories, Inc.  
 DisplaySearch  
 Displaytech, Inc.  
 Dolch Computer Systems, Inc.  
 Earth Computer Technologies  
 ELDEC Corp.  
 Electro-Plasma, Inc.  
 Emco Electronics Ltd.  
 Endicott Research Group, Inc.  
 ERSO/ITRI  
 FED Corp.  
 F-P Electronics  
 Futaba Corp. R&D Center  
 General Vacuum, Inc.  
 Gerome Manufacturing Co., Inc.  
 Hannstar  
 Hewlett-Packard Co.  
 Hitachi, Ltd.  
 HOYA Corporation USA  
 IBM  
 Imaging & Sensing Technology  
 Imaging Systems Technology  
 IMT Masken und Teilungen AG  
 Incom, Inc.  
 Industrial Electronic Engineers, Inc.  
 Infinite Graphics, Inc.  
 Infodex, Inc.  
 Innova Electronics, Inc.  
 Instrument Systems  
 Interface Display & Controls, Inc.  
 Interserv Corp.  
 Interstate Electronics Corp.  
 Ion Systems  
 Ise Electronics Corp.  
 Kent Displays  
 LCD Lighting  
 Lexel Imaging Systems, Inc.  
 Linfinity Microelectronics, Inc.  
 Lite Array, Inc.  
 Lumin-Oz, LLC  
 Micron Display Technology, Inc.  
 Micronic Laser Systems AB  
 Microvision Corp.  
 Mitsubishi Electric Corp.  
 Mitsubishi Electronics America  
 Molex, Inc.  
 Motorola FPD Division  
 NEC Corp.  
 Nippon Seiki Co., Ltd.  
 OES/ITRI  
 OKI Electric Industry Co., Ltd.  
 Optical Coating Lab., Inc.  
 Optrex America, Inc.  
 Philips Flat Display Systems  
 Phosphor Technology Ltd.  
 Photon Dynamics  
 Photo Research  
 Pilkington Micronics Ltd.  
 Pix Electronics, Inc.  
 Planar Standish, Inc.  
 Planar Systems  
 Plasmaco, Inc.  
 Polar Vision, Inc.  
 Polytronix, Inc.  
 Premium Allied Tool  
 Progressive System Technologies  
 Q.C. Optics, Inc.  
 Quantum Data Inc.  
 RF Power Products  
 ROLIC Research Ltd.  
 Sarnoff Corp.  
 Schott Corp.  
 Semiconductor Systems, Inc.  
 Sharp Corp.  
 SI Diamond Technology, Inc.  
 Sony Corp. Research Center  
 Stanford Resources, Inc.  
 Superior MicroPowders  
 Supertex, Inc.  
 Symbol Technologies, Inc.  
 Syntronic Instruments, Inc.  
 Tamarack Scientific  
 TDK Corp.  
 TEAM Systems  
 Technoglas, Inc.  
 Teledyne Lighting & Display  
 Terapixel, Inc.  
 Thomas Electronics, Inc.  
 Thomson Components & Tubes  
 Three-Five Systems, Inc.  
 Torrey Pines Research  
 Toshiba America Electronic Components, Inc.  
 Ultra Electronics Command & Control Systems  
 ULVAC Technologies, Inc.  
 UNIGRAF  
 Unipac Optoelectronics Corp.  
 Universal Display Corp.  
 Ushio America, Inc.  
 Video Electronics Standards Association  
 Viratec Thin Films Inc.  
 Vishay-Dale Electronics, Inc.  
 Westaim Advanced Display Technologies  
 Westar Corp.  
 White Electronic Designs, Inc.  
 WINTEK Corp.  
 WinTron Technologies  
 XCITEK, Inc.  
 XMR, Inc.

## index to advertisers

Absolpulse Electronics.....97  
 Access Technology Co.....81  
 Ad-Vance Magnetics.....98  
 AEI Components.....97  
 Agfa.....20  
 autronic-Melchers.....68  
 Balzars Thin Films.....29  
 Bergquist.....87  
 Brimar Ltd.....65  
 CELCO (Constantine Engineering Laboratory Company).....C4  
 Central Research Laboratories.....64  
 Chomerics.....22  
 Chroma ATE.....93  
 Computing Devices Canada.....64  
 CyberTouch.....60  
 Display Products Technology.....42  
 EFOS.....49  
 ELDIM.....92  
 ElectronicAsia 2000.....96  
 Endicott Research Group.....17  
 Ergotron.....10  
 Extron Electronics.....79  
 Fujipoly.....22  
 General Vacuum.....83  
 Goldentek Display America.....28  
 H. L. Funk Consulting.....75  
 Hoffman Engineering.....63  
 Howell Intl. Trade Fair Ltd.....78  
 IEE.....69  
 iFire Technology.....52  
 Imaging and Sensing Technology Corp.....29  
 IMT Masken & Teilungen AG.....99  
 Information Products.....87  
 Integral Vision.....28  
 Ion Systems.....41  
 JMEC.....60  
 Kent Displays.....40  
 Kent Modular Electronics, Ltd.....62  
 Klein Instruments.....48,87  
 Kodak.....72  
 Kurt J. Lesker.....62  
 LCD Lighting.....65  
 Lexel Imaging Systems.....39  
 LMDC.....37  
 Lumitex.....91  
 Luxell.....74  
 Magnetic Radiation Laboratories.....64  
 Micronic Laser Systems.....38  
 MicroOptical Corp.....88  
 Microvision.....9,61  
 Mitsubishi.....53  
 Molex.....30  
 National Semiconductor.....6  
 OCLI.....8  
 Optis.....73  
 Optrex America.....C2  
 Phosphor Technology.....90  
 Photo Research.....11  
 Physical Optics Corp.....91  
 Polar Vision.....94  
 Precision Glass and Optics.....83  
 Precision Technology Group.....77  
 Printable Field Emitters.....89  
 Quantum Data.....5  
 Samsung Electronics.....12,13  
 Samsung SDI.....32  
 Silver Cloud Manufacturing.....99  
 Society for Information Display.....50,51  
 Solomon Systech Ltd.....31  
 Solomon Technology.....61  
 Spire Corp.....20  
 Syntronic Instruments.....43  
 Team Systems.....3  
 Tekra ATG.....71  
 Thin Film Devices.....33  
 Three Five Systems.....7  
 3M Optical Systems.....C3  
 Timeline.....97  
 Toray Engineering Co., Ltd.....17  
 Unigraf.....90  
 U.S. Electronics.....89  
 Vacuum Technology & Coating.....95  
 Vertex LCD.....68  
 VESA.....89  
 Video Instruments.....88  
 Viox Corp.....62  
 Voltage Multipliers.....89  
 Westar Corp.....19,21,23  
 WinTron Technologies.....82  
 XtroniX Corp.....99  
 ZC&R Coatings for Optics.....10

### Business and Editorial Offices

Palisades Institute for Research Services, Inc.  
 411 Lafayette Street, 2nd Floor  
 New York, NY 10003  
 Jay Morreale, Managing Editor  
 212/460-8090 x212 Fax: 212/460-5460  
 jmorreal@newyork.palisades.org

### European Sales Office

George Isaacs  
 12 Park View Court  
 The Paddock, Eaton Ford  
 St. Neots, Cambridgeshire  
 PE19 7SD U.K.  
 Phone/Fax: +44-(0)-1480-218400  
 george@gandg.demon.co.uk

### Sales Office

Palisades Institute for Research Services, Inc.  
 411 Lafayette Street, 2nd Floor  
 New York, NY 10003  
 Tracy Leibowitz, Director of Sales  
 212/460-8090 x211 Fax: 212/460-5460  
 tleibowitz@newyork.palisades.org

### Korean Sales Office

Jung-Won Suh  
 Sinsegi Media, Inc.  
 Bldg. Room 301  
 437-3 Ahyun-dong  
 Mapo-ku, Seoul, Korea  
 +82-2-313-1951/2 Fax: +82-2-312-7335  
 sinsegi@chollian.net



**Attract more attention to your display with Vikuiti™ Enhancement Films from 3M.**

They offer multiple enhancement solutions for the electronic display industry that include transmissive display products and new polarizers for transmissive/reflective mode LCDs. Most of all, these films can dramatically increase screen brightness—making any display virtually irresistible to anything that sees it. Customers included.

To speak with a representative call 1-800-553-9215, or e-mail [ostechserv@mmm.com](mailto:ostechserv@mmm.com) for technical information.



See us at SID Booth #147

© 3M 2000

*Brighter. Wider. Better.*

Circle no. 144

**3M** Innovation

1950 **CELCO** 2000

# OUR VISION OF THE NEW MILLENNIUM

CELEBRATING OUR 50TH ANNIVERSARY



Mahwah, NJ  
Yokes & Focus Coils

[www.celco.com](http://www.celco.com)

Rancho Cucamonga, CA  
Digital Motion Picture Recorders

See Us at SID '00 Booth 200

Circle no. 145