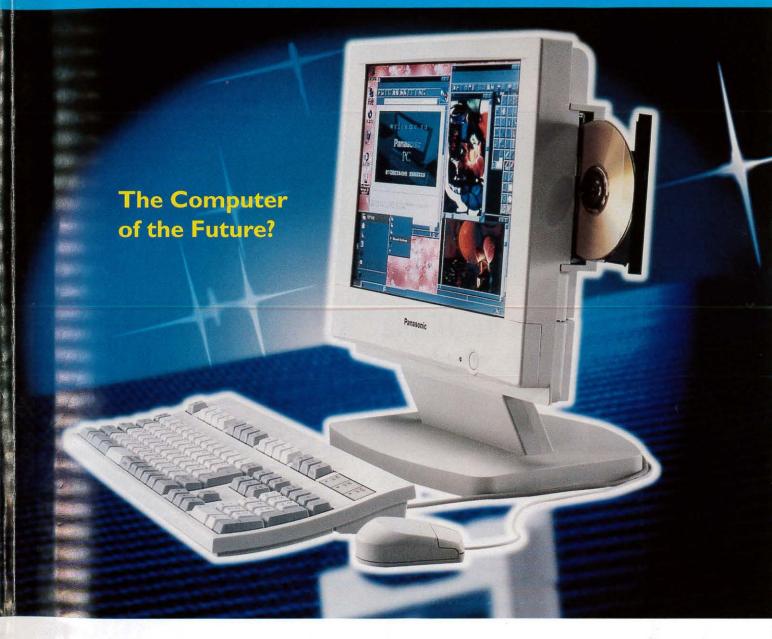


ANNUAL DIRECTORY OF THE DISPLAY INDUSTRY



Industry Directory Scanning Laser Projectors Photocathode Displays MPEG-2 *vs.* MPEG-1 Letters: Holzel Attacked!

The Future Is Brighter with TDK.



If You've Got the Display, We've Got the Power.



AC to DC

- 3 to 2,000 watts
- · Standard output voltages -2 to 48 volts
- · Single, dual and multiple output models
- Power factor correction
- Wide range input AC or DC
- · Low-cost open frame, modular and industrial models
- CISPR 22/FCC Class B

Circle no. 1



DC to DC

- 0.3 to 200 watts
- High density 50 watts/in.3
- Low profile .3 inch
- · High switching frequency
 - up to 1 MHz
 - Surface mount technology
- Synchronous rectifiers · Encapsulated or open frame
- · Isolated and non-isolated
- designs · Special designs for VFD
- PCB mountable packages
- Circle no. 2



DC to AC

- 1.5 to 20 watts
- 1 to 4 lamps
- · Wide range of inputs
- · Integrated dimming control voltage/resistive/PWM
- · Short circuit protection
- Remote on/off
- · Open load protection · Resonant design for low noise · DC or AC input available
- and high efficiency · Low profile - 6mm
- · Narrow width 12mm
- Circle no. 3



Ballast

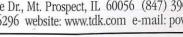
- 150 to 575 watts
- Power factor correction Microprocessor programma-
- ble to different lamps
- True power control · DC or AC lamp technology
- Power density 4 watts/in.³
- · Integrated low voltage
- CISPR 22/FCC Class B
- · Custom electrical and
- mechanical available

Circle no. 4



- - EMI filters
 - Transformers
 - Inductors
 - · High voltage capacitors





- - Components

 - · Safety capacitors
 - Circle no. 5

ISO 9001 CERTIFIED



COVER: One of the main attractions at CeBIT '97 was Panusonic's Panel PC CF55, scheduled for a September '97 launch. The compact housing contains a 14.5-in. 1024 × 768 (XGA) LCD monitor and the necessary parts of a PC – notably a 150-MHz Pentium processor, a 1.2-GB hard drive, two PCMCIA card slots, a floppy disk drive, and a CD-ROM drive. For more on CeBIT, see Bryan Norris's article beginning on page 26.



Credit: Panasonic Deutschland GmbH

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

SID '97 Review Issue

- Overview
- CRTs/FEDs
- · LCDs
- Emissive displays
- · Flat-panel displays
- · Manufacturing

INFORMATION DISPLAY (ISSN 0362-0972) is published eleven times a year for the Society for Information Display by Palisades Institute for Research Services, Inc., 201 Varick Street, New York, NY 10014; David Slater, Chief Executive Officer; Leonard H. Klein, President; Laura Manganiello, Secretary/Treasurer. EDITORIAL AND BUSINESS OFFICES: Jay Morreale, Managing Editor, Palisades Institute for Research Services, Inc., 201 Varick Street, New York, NY 10014; telephone 212/620-3371. Send manuscripts to the attention of the Editor, ID. Director of Sales: Erika Targum, Palisades Institute for Research Services, Inc., 201 Varick Street, Suite 1006, New York, NY 10014; 212/620-3375. SID HEADQUARTERS, for correspondence on subscriptions and membership: Society for Information Display, 1526 Brookhollow Drive, Suite 82, Santa Ana, CA 92705-5421; telephone 714/545-1526; fax 714/545-1547. SUBSCRIPTIONS: Information Display is distributed without charge to those qualified and to SID members as a benefit of membership (annual dues \$55.00). Subscriptions to others: U.S. & Canada: \$36.00 one year, \$5.00 single copy; elsewhere: \$72.00 one year, \$6.50 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 0362-0972/97/\$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, 1526 Brookhollow Drive, Suite 82, Santa Ana, CA 92705-5421. Copyright © 1997 Society for Information Display. All rights reserved.

Official Monthly Publication of the Society for Information Display
IDFORMATION
AUGUST 1997
VOL. 13, NO. 8

2 Editorial

Shootout at the SID Corral Ken Werner

4 The Display Continuum Illusory 3-D Illusions ...

Aris Silzars

14 Photocathode Displays

Marrying an inexpensive monochrome display to a photocathode image intensifier/color converter provides all the benefits of an FED without any of the problems.

Brad Culkin

20 Where Do the Different MPEG Standards Fit? MPEG-2 provides bigger, higher-definition images than MPEG-1, so MPEG-1 is obsolete, right? Wrong.

Pier L. Del Frate

26 Euro-Monitors Are Hot in Hannover Europeans can't agree on a common currency, but they like to see "Made in Europe" on their monitors – and they are intrigued when those monitors are flat.

Bryan Norris

32 Scanning Laser Projectors Why do scanning laser projectors look better than the measurements say they should?

William K. Bohannon

- **43** Industry Directory ID's eleventh annual directory of the display industry. Editorial Staff
- 94 SID News
- 95 Letters to the Editor
- 99 Calendar
- 104 Sustaining Members
- **104** Index to Advertisers

editorial



Shootout at the SID Corral

Tom Holzel's guest editorial in our March issue on alleged deficiencies in the ways PDPs and LCDs render video imagery has stimulated vigorous response. The responses have ranged from a casual verbal "Of course people prefer to watch video on CRTs" from several people in the CRT and TV businesses to a wide range of verbal, faxed, and e-mailed responses from people in various segments of the display indus-

try. For a sampling, see the "Letters to the Editor" column in this issue.

In the "Letters" column, Holzel responds by suggesting a side-by-side comparison of 40-in. displays showing entertainment programming in a controlled viewing environment. Consultant Fred Kahn goes further, and recommends a broadly based "shootout" of direct-view technologies with a variety of input material. Kahn's model is a smaller, direct-view version of the Video Projection Shootout that has become a popular feature of the annual InfoComm show.

Initial conversations at SID '97 in Boston indicated substantial interest in this kind of event, particularly if a wide range of imagery is used. Ray Soneira of Sonera Technologies, which supplied custom test patterns for this year's Info-Comm shootout, has offered to develop appropriate custom patterns for a direct-view shootout. Phil Heyman, SID Convention Chairman, has authorized incorporating the event as part of SID '98 in Anaheim, California, if there is sufficient interest.

So, this is an RFP – request for participation – in the first SID direct-view display-technology shootout. Technical, ergonomic, and imagery details will be worked out with a committee of participating companies, but here are the initial ground rules:

- Participation is open to all exhibitors at SID '98 with products that fit into one of the shootout categories.
- There will not be any fee for participation, but participants will be expected to provide technical support for the event as a whole.
- All displays (or all displays within a particular category) will be provided with the same imagery. Care will be taken to use a distribution network that provides all displays with equivalent signals, and controller issues will be addressed fairly.
- Participants will be invited to join technical, ergonomic, and general advisory committees.

If you are interested in participating in the shootout or in obtaining more information, please contact: Shootout at the SID Corral, c/o Nutmeg Consultants, 2 Shady Brook Lane, Norwalk, CT 06854, e-mail: kwerner@netaxis.co, fax: 203/855-9769, phone: 203/853-7069.

We believe the shootout will be an exciting event that will draw even more people to the SID '98 show and symposium and increase SID's profile among OEMs and corporate users. Equally important, the show will provide designers and manufacturers of displays, monitors, and controllers with a valuable source of subjective performance information we do not now have.

Oil your six-shooters, pahdner, and sign up now for your place in *The Shootout at the SID Corral.*

- Ken Werner



Editor: Kenneth I. Werner Managing Editor: Jay Morreale Administrative Editor: Ralph Nadell Departments Editor: Joan Gorman Assistant Editor: Dian Mecca Contributing Editors: Aris Silzars, Bryan Norris, Chuck McLaughlin, Joe Hallett Advertising Manager: Jay Morreale Director of Sales: Erika Targum

Regional Associate Editors

Allan Kmetz (Americas) Lucent Technologies Murray Hill, New Jersey

Shigeo Mikoshiba (Asia) University of Electro-Communications Tokyo, Japan

Alan Mosley (Europe) Central Research Laboratories Hayes, Middlesex, U.K.

Advisory Editors

Ken Compton Clinton Electronics Corp. Rockford, Illinois

Carl Machover Machover Associates White Plains, New York

Peter Pleshko PEMM Services Kingston, New York

Alan Sobel Consultant Evanston, Illinois

Webster E. Howard FED Corp. Hopewell Junction, New York

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.

Powerful Video Generators. The Smart Choices.

STANDALONE

ASTRO VG-823

Dot Clock to 250 MHz Horizontal Scan to 255KHz

Operated directly from a PC or with "Remote" Frontpanels

Compact/High Performance

256 Levels at all Frequencies

Standalone Units from \$2950

If you want a very flexible Video Generator, the Astro VG-823 is a high performance, lightweight and compact unit that offers the capability to test any high resolution display system up to 1600x1280 at high refresh rates.

With a RB-649 controller it's a bench top video generator. With the RB-614C Remote Box it's perfect for the manufacturing area and it can easily be programmed and operated from a PC via RS-232C—that's true multi functionality.

DIGITAL

ASTRO VG-826 True "Digital" Video

Dot Clock to 60MHz / 120 MHz

Operated directly from a PC or with "Remote" Frontpanels

Very Compact & Lightweight

8 Bits resolution/ pixel/ color

PC-BASED

UNI VG-D250pc



PC-based Performance Dot Clock to 250MHz Horizontal Scan to 250KHz Fully Programmable Patterns Fully DDC Compatible Accepts Bitmap-Files

If you service, repair, evaluate or engineer modern Flat Panel Devices, the Astro VG-826 is the Digital Generator for you.

It's small and light enough to fit in your briefcase, yet has the performance to drive any single or multiplexed Flat Panel Device with a resolution of 24 bits per pixel up to a multiplexed frequency of 120MHz.

It can be programmed and operated from a PC or with the RB-646 "Remote" frontpanel or operated only with the RB-614C Controller.

PC-Based Units from \$2500

This is the best PC-Based Video Generator if you work with Display Systems up to a 1600x1280 resolution. Its "DDC" capability is an increasingly important asset in service & manufacturing applications.

The UNI-VG-D250pc allows VESA-D.P.M.S. testing and the ability to import preset data files from other sources as "test patterns".

The user interface is DOS- and Windows 3.1 and very easy to operate.

Call 1-800-338-1981

Visit www.team-systems.com



TEAM Systems, Inc. 2934 Corvin Drive, Santa Clara, Cailifonia 95051

the display continuum



Illusory 3-D Illusions ...

by Aris Silzars

A long, long time ago, in the October 1993 issue of *Information Display Magazine*, there appeared a column by this very author under the provocative title, "Is Virtual Reality About to Become Real Reality?" In this column, I suggested that by January 1997 there *could* be a consumer product called a Virtual

Reality Chair – a home-entertainment experience with 3-D computer graphics, surround sound, and interactivity. I asserted that all the necessary technological pieces were in place, and one would simply need to integrate them cleverly to create the product. Of course, the implicit assumption was that there would be a company or business entity that would find such an undertaking financially interesting.

Ah, but the world is not such a simple and predictable place. Just because a technology is available to create a certain product does not mean that the marketplace will respond. The progress of virtual reality for consumer applications hit a major snag when people and companies began to have concerns about display-induced motion sickness and even the possibility of long-term disorientation – like a lumpy airplane ride into eternity. And to complicate matters further, at about the same time, video games hit a temporary plateau in their popularity.

Nevertheless, the concept of an entertainment experience must have continued to bubble in at least a few creative technical and business minds. "If we can't get a product into a home and if we can't get quite everything that we want from the display technology, then what can we do?" must have gone the thinking. And with a bit of creativity and a slight modification of the Virtual Reality Chair concept, what recently burst onto the Seattle entertainment scene was ... **Game-Works.** This venture – bankrolled by DreamWorks SKG, Universal Studios, and Sega Enterprises – at the corner of Seventh and Pike, right next to Niketown, has not just one Virtual Reality Chair, it has several hundred of them. Not only that, the price for a few minutes of fun is measured in dollars instead of quarters. Additional features are that some of the simulated auto and motorcycle races allow several players to simultaneously and interactively compete with each other.

Since GameWorks opened its doors within one month of when I had predicted we would have a Virtual Reality Chair product, it was no coincidence that I was one of the early visitors to search out what this purportedly new experience was all about. "Just how good is the display technology and what technologies are they using," I was anxious to know. The actuality turned out to be somewhat more mundane than the local newspaper articles had indicated. The game stations are all based around 50-in.-diagonal (approximately) projection displays, with each player sitting in a mock-up of a simulated car, motorcycle, or space vehicle that provides a modest amount of interactive mechanical motion. Sound is added with a rudimentary surround system. The display quality is similar to that of a good conventional projection television playing from a laser disk. The displays are bright and crisp-looking, with good off-axis brightness. Some of this is due to the dark walls and subdued lighting within the two-story open-ceiling building. At the simulated Indy 500 auto race game, which has eight side-

continued on page 86

SID Executive Committee

President: W. E. Howard President Elect: A. C. Lowe Regional VP, Americas: E. Stupp Regional VP, Asia: H. Uchiike Regional VP, Europe: E. Lueder Treasurer: A. Silzars Secretary: A. Kmetz Past President: A. I. Lakatos Directors Bay Area: H. Sherman Beijing: S. Ding Belarus: A. Smirnov Canada: V. Angelo Delaware Valley: J. W. Parker III France: F. Maurice Greater Dayton: R. Holmes Japan: A. Iwamoto Korea: C. Lee Los Angeles: P. Baron Metropolitan Detroit: Z. Yaniv Mid-Atlantic: D. Ketchum Mid-Europe: R. Mauch Minneapolis/St. Paul: V. Born New England: W. Hamilton San Diego: R. Ruff Taipei: W. Hsu U.K. & Ireland: R. Johnson Ukraine: V. Nazarenko **Committee Chairs** Academic: C. J. Summers Archives/Historian: R. C. Knepper Bylaws: C. Infante Chapter Formation: J.-N. Perbet Convention: P. M. Heyman Definitions & Standards: R. Miller Honors & Awards: J. van Raalte IDRC: F. J. Kahn Intersociety: Z. Yaniv Long-Range Planning: W. F. Goede B. J. Lechner Membership: L. Palmateer Nominations: A. I. Lakatos Office Liaison: D. Pinsky Publications: A. Silzars Journal Editor: A. Sobel Information Display Editor: K. I. Werner Communications: R. K. Ellis **Chapter Chairs** Bay Area: J. Larimer Beijing: H. C. Hu Belarus: E. Kaloshkin Canada: A. Kitai Delaware Valley: S. Kalatucka, Jr. France: H. Brettel Greater Dayton: J. Byrd Japan: S. Mikoshiba Korea: M. Oh Los Angeles: P. Joujon-Roche Metropolitan Detroit: R. Donofrio Mid-Atlantic: T. Nelson Mid-Europe: M. E. Becker Minneapolis/St. Paul: H. Holec New England: P. Breen San Diego: R. Ditzik Taipei: H.-P. D. Shieh U.K. & Ireland: P. Emmerson Ukraine: V. Sorokin **Office Administration** Executive Administrator: Lauren Kinsey

Executive Administrator: Lauren Kinsey Membership Coordinator: Nancy Stafford

Society for Information Display 1526 Brookhollow Drive, Suite 82 Santa Ana, CA 92705-5421 714/545-1526, fax -1547 e-mail: socforinfodisplay@mcimail.com

Put your CRT on a Diet



Nutrition	nal Facts
Serving size Serving per container	14.5" Diagonal 1
CTX PanoView 745 TF	T LCD Monitor
Description	Desktop
Pixels	1024 x 768 XGA
Colors	16.7 Million
Brightness (typical)	200 nit
Power Consumption	30W
Multiscan	Yes
PC/Mac Compatible	Yes
Weight	12.1 lbs. (w/ stand)
Dimensions (WxHxD)	15.2"x15"x7.1" (w/ stand)

Watching what you put on your desktop? Choose the future in high performance LCD flat panel display monitors, the CTX PanoView 745. Featuring a 1¹/₂" ultra thin space saving design, this compact high resolution active matrix monitor can fit anywhere. Direct analog RGB input makes set up to your PC or Mac easy.

CTX Opto is a world leader in LCD products with a complete line of TFT LCD

color monitors. Call us today toll free –

1-888-289-6786 or visit our website www.ctxopto.com.



PanoView 600MF, LCD monitor module ready to integrate into equipment design.



Circle no. 7

Your image... it's everything



There's much more to Clintons performance and total value

Duplicate...

Roply Image ...

alculations.

than meets the eye. With over a million possible **CRT** configurations ranging from 3" - 23", no one offers a more extensive selection of phosphors and mounting systems than Clinton. In addition to consistent quality, on-time delivery and technical support, we guarantee the quality of the final image.

In today's world, selecting suppliers you can count on

is a must. And when it comes to monochrome CRT's,

high resolution displays, and contract assembly, only one company can provide the technology to meet your

total requirements... Clinton Electronics.

Clinton also applies it's display technology to the design and manufacturing of **high resolution monitors.** These variable frequency, microprocessor controlled 19", 20" and 21" monitors are the most flexible monitors, continually setting industry standards for image, quality and readability.

We can support your company with **contract assembly** programs, using a flexible work cell technology center which can handle everything from component assembly to full turn key production. Tap into Clinton expertise in engineering, manufacturing, material sourcing, plus agency testing and approvals.

If you are planning a new product line, reengineering an existing system, or considering a make-vs-buy scenario, we can help you determine the best solution. Contact our specialists today for a review of your requirements.

CLINTON ELECTRONICS... THE COMPLETE PICTURE.



Clinton Electronics Corporation 6701 Clinton Road Rockford, 11 61111 815.633.1444 Fax: 815.633.8712 Website: http://www.cec-displays.com E-Mail: 105503.2223

Circle no. 8



crt's



contract assembly

SUPERIOR QUALITY

CUNTON

COMPETITIVE, PRICES

HIGHEST RESOLUTION MICROPROCESSOR CONTROLLED GREYSCALE DISPLAYS

PUTTING OUR EXPERTISE IN DISPLAY TECHNOLOGY TO WORK FOR YOU

- All TFT designer kits include:
- AM/TFT Display
- Your choice of controller (ISA Bus or VGA In-line)
- Backlight inverter
- Cables

on of

upport,

n and

These 1' and

obility.

mbly

• JACO support.

JACO helps you get to market faster with super low-priced, plug and play flat panel kit solutions!

*10.4" VGA 15A-BUS KIT

Prices start as low as

ORDER/KIT #	DESCRIPTION/DISPLAY SIZE AND TYPE	PRICES
TFTG104VGA-S	10.4" color VGA ISA Bus	\$839
TFTG104VGA-M	10.4" color VGA In-Line	\$875
TFTG104SVGA-S	10.4" color SVGA ISA-Bus	\$895
TFTG121SVGA-S	12.1" color SVGA ISA-Bus	\$1150
TFTG121SVGA-M	12.1" color SVGA In-Line	\$1275



Fax: 1-888- FAX-JACO http://www.jacoelectronics.com

Ask about touchscreens and value-added services. For more information contact our LCD Marketing Group 1-800-989-5226.

ORDER TOLL FREE: 1-800-883-JACO

Circle no. 10

Both models are compatible with PC, Mac, Workstation or any VESA compliant analog R6B signal, no special card required.

and presents a brighter, flicker-free im While they consume less space than reg monitors, our LCDs also weigh in abou 70% lighter. Which makes wall mounti the LCD2000 a breeze. Plus, they both bu

There is, however, plenty inside. For starters, both of our space-saving MultiSync[®] LCD monitors feature XtraView[™] technology, which opens up the viewing angle to a panoramic 160°. The screen itself is flat,

Matrix	Active Matrix	LCD Type
lew technology	160° conical XtraView technology	Viewing Angle
180 cd/m ²	150 cd/m ²	Brightness
14.1 x 14.3 x 6.7"	19.7 x 19 x 8.7"	Dimensions (W. H. D)
11.5 lbs	22.0 lbs	Weight
1024 x 768	1280 x 1024	Max. Resolution
14.1*	20.1"	Viewable Size
LCD400	LCD2000**	MultiSync LCD Series

MultiSync is a registered trademark and LCD2000, LCD400, XtraView, "Expect more. Experience more." and the NEC Technologies icon are trademarks of NEC Technologies, Inc. All other trademarks or registered trademarks are the property of their respective holders. @1997 NEC Technologies, Inc.

A big thumbs up to our R&D department for creating the MultiSync LCD2000, the first ever 20.1* viewable LCD monitor to be made for commercial use.

reduced emissions and energy consumption. So really, what's behind our MultiSync LCD monitors is, as always, a continued commitment to creating

1

^{te} ima ⁿregul labout

ounting

th boa

1

1

御 御 御

outstanding products. To learn more, call 1-800-NEC-INFO. Or, if you prefer, please visit us at www.nec.com. Expect more. Experience more.

XtraView.

NEC



MaltiSine ICD

000000

Check what you need in your display analysis system:

- flat panel tests
- CRT tests
- easy upgrades (hardware and software)
- standard for ISO, NIDL, and VESA testing
- optimized for fast, accurate, and automatic testing with many packaged test suites

If you checked all of the above, you have chosen the Microvision SS200 Family of Display Analysis Systems

With the SS200 family, you can precisely, automatically, and completely measure display performance and that includes flat panels.



SS200

Complete turnkey system with computer, 6-axis positioner, monitor, software, and SS200 camera system. Automatically performs spatial and luminance measurements.



You can easily field upgrade to the more powerful SS210 package, which provides all SS200 functions, plus an integrated spectrometer for spectral analysis and color measurements. Includes response time measurement capability.



SS220

For flat panel testing, a field upgrade to the SS220 is easy. The SS220 provides spectrometer-based off-axis measurement, color analysis, color shift and luminance testing. Coupled with the SS210, this is the most comprehensive test system ever offered—at a fraction of the cost of individual test instruments. All tests are performed at NIST-traceable accuracy.

Circle no. 11

Microvision. Innovating since 1983.

If you checked all of the above and would like more information, call Microvision at (800) 931-3188.

MICROVISION

Dedicated to the Needs of the Display Industry

180 Knowles Drive, Suite 209 / Los Gatos, CA 95050 US Tel: (408) 574-5158 / Fax: (408) 374-9594 Toll Free: 1 (800) 951-5188 Email: sales@microvsn.com Web site: http://www.microvsn.com

International Reps: Japan - ARGO CORP., 06 559 5566 Taiwan - SUPERLINK TECH., 02 705 7090 Korea - B & P INT'L, 02 546 1457

GET UNPLUGGED FROM OLD DISPLAY IDEAS



KENT ChLCD[™] NO POWER DISPLAYS

Ready to get unplugged from the energy-robbing LCD displays you're now using? KENT Displays' ChLCD (Cholesteric Liquid Crystal Display) technology offers a solution for your electronic products.

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.

EASIEST TO READ REFLECTIVE TECHNOLOGY

Compared to conventional LCD technologies, ChLCD displays offer better reflectiveness, 360 degree viewing cone and exceptional daylight contrast, even in direct sunlight, all without backlighting.

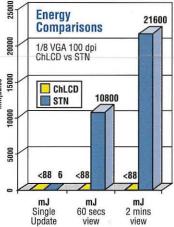
STANDARD OR CUSTOM DISPLAYS AVAILABLE

Standard ChLCD displays and modules are available in 1/8 and 1/2 VGA sizes in 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

10 USA

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



Unlike STN displays which use power to continuously refresh images, ChLCDs do not require refreshing to keep energy usage to a minimum.





A MANNING VENTURES BUSINESS UNIT

Kent Displays, Inc. • 343 Portage Boulevard • Kent, OH 44240 • Phone: 330.673.8784 • Fax: 330.673.4408 • E-mail: 73360.2157@compuserve.com Products and technologies of Kent Displays, Inc. are protected by the following patents: Unites States; 5,463,863; 5,437,811; 5,384,067; 5,251,048. People's Republic of China; 92103952.2. Israel; 101,766. Taiwan; 801405631. PCT (EP, Canada, Korea, Japan and Norway); 92/03504; 9209367. Other Patents Pending.

Circle no. 12

Taiwan's Largest LCM Manufacturer.



- * SOLOMON Technology is ISO 9001 & 9002 certified.
- * We 100% TEST: electrical, visual, optical & environmental.
- * Lowest failure rate in the industry less than 1/10th of 1%.
 - (Failure rates do not include freight damage or misuse.)
- * Over 300 standard designs to choose from.
- * We stock our most popular designs for immediate delivery.
- * Simple modifications to our standard designs to fit your special needs is not a problem.
- Complete custom design is our specialty. From simple LCD designs to ALL-IN-ONE solutions to maximize cost savings.
- Modest NREs and the lowest minimum quantity requirements for custom designs in the industry - 1K pieces.



 21038 Commerce Pointe Drive, Walnut, California
 91789

 Sales: (909) 468-3733 ext 3039
 Fax: (909) 869-6258



Circle no. 14

Circle no. 15

You need a reliable device from a name you know-

and it has to be accurate...

and it has to be clean...

and it has to be fast ...

Active Blanking

Monitor Timing

Figure this in:

The Klein VPG250 250 MHz for just \$3800.00 Higher Performance - Lower Price!

600+ stored timings

 $\frac{\text{Dot Clock} = \text{Hpix} \times \text{Hfreq}}{(\text{Hfreq} = \text{Vlines} \times \text{Vfreq})}$

unlimited storage space on the PC

Call Klein!

Pc(MHz)=(HApix+HBpix)x(VAlines+VBlines)xVf

32 patterns

Vert. Frequency: .1 Hz to 999.9 Hz KLEIN INSTRUMENTS VPG250 UNKO PATERI CEMBATIK VGC20 UNKO PATERI CEMBATIK VG

PC Interface and

PC program

Back porch

Dot clock= Hpix x Vlines x Vfreq where Hpix=HApix+HBpix Vlines=VAlines+VBlines

> 1024 x 768 640 x 480 800 x 600 2048 x 2048

remote controllable

KLEIN INSTRUMENTS CORPORATION

8948 SW Barbur Blvd., Dept. 100 Portland, Oregon 97219 USA Ph: (503) 245-1012 Fax: (503) 245-8166 Email: sales@KleinInc.com web site at www.Kleininc.com

Circle no. 16

Blanking

new technology

Photocathode Displays

Marrying an inexpensive monochrome display to a photocathode image intensifier/color converter provides all the benefits of an FED without any of the problems.

by Brad Culkin

HE NEW TECHNOLOGY that currently seems most likely to provide some honest competition for plasma display panels (PDPs) and liquid-crystal displays (LCDs) is the field-emission display (FED). The FED combines a field-emitting cold cathode with light-emitting phosphors to produce a CRT-like image from a thin, flat package. At New Logic International, we are using another cold-cathode technology that, we believe, offers significant advantages over the FED approach. This new cold-cathode display uses a photocathode instead of field emitters to produce electrons. The resulting display is called a photocathode display (PCD) (Fig. 1).

How It Works

A PCD is a proximity-focused diode intensifier, the photocathode of which is closely coupled to a monochrome flat-panel display (FPD) (Fig. 2). The device can be modified to function as a color converter as well as an intensifier.

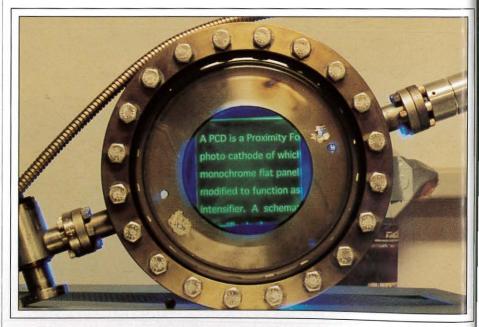
Conceived in 1930, and mass-produced beginning in the 1970s for military nightvision devices, the diode intensifier uses a semitransparent photocathode to produce an electron image through the photoelectric effect. The electron image emerging from the front of the photocathode is analogous to any photo image impinging upon the rear of the

Brad Culkin is President of New Logic International, Inc., 1295 67th St., Emeryville, CA 94608-1120; telephone 510/655-7305 x230; fax 510/655-7307; e-mail: nli@vsep.com. photocathode. The high potential of the aluminized phosphor screen accelerates these photoelectrons directly across the high-vacuum gap, providing a luminance gain of about 100. (The screen is aluminized to prevent light from returning to the photocathode.)

PCD vs. FED

The limiting resolution of a proximity-focused diode intensifier is determined by the random energy of the photoelectrons as they leave the photocathode. Fortunately, this random energy is only about 0.2 eV, which is much less than the random energy of field-emission electrons. The low photoemission energy sets the limiting resolution of a proximity-focused diode intensifier at about 70 line pairs/mm. This is the key reason why a photocathode is a better source of cold electrons than a fieldemitter array (FEA).

FEDs would be nearly as simple to build as the intensifier described here if only the field-



New Logic Internationa

Fig. 1: Shown is a 3×3 -in. photocathode display (PCD) prototype fabricated by New Logic International.

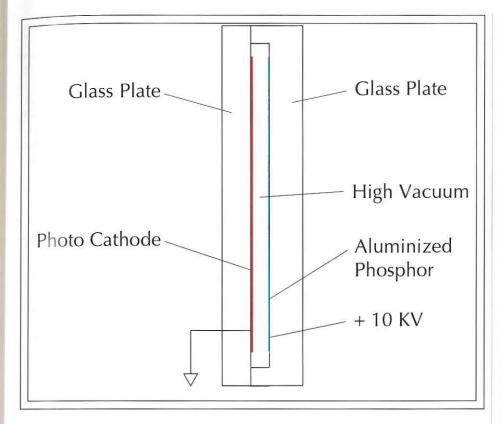


Fig. 2: A PCD is a proximity-focused diode intensifier, the photocathode of which is closely coupled to a monochrome flat-panel display.

emitted electrons were as low in energy as photoelectrons. Unfortunately, this is not the case.

ion

sets

is a

las

ld-

The field-emission process uses high electric fields to extract electrons. The high field is produced by focusing an extraction potential of about 100 V at the tip of a micro-electrode. The tip of the electrode is roughly hemispherical, and the high-field region extends over this half sphere.

Electrons extracted by this field emerge at a velocity equivalent to about one-fourth the extraction potential, *i.e.*, at about 25 eV, in the direction of the extraction field. Since the electric-field lines near the tip are everywhere normal to the half sphere, the field-emitted electrons spray in all directions normal to the half sphere. They have parabolic trajectories instead of trajectories that are straight lines across the gap, as occurs in a photocathode image intensifier. More precisely, there is beam spreading in both PCDs and FEDs because of randomly directed electron emission, but the spreading in PCDs is only one-hundredth of that found in FEDs.

FED designers are currently attempting to overcome this field-emission problem with two competing FED designs. The low-voltage approach uses very-narrow-gap proximity focusing to prevent beam divergence from degrading the screen resolution. The second approach uses a focusing structure to control beam spreading and a high anode voltage with a wider anode-to-cathode gap. The low-voltage system is commercially available, but there are many questions concerning life and luminous efficiency, especially for color displays. The high-voltage systems - which require focusing electrodes to be supported above the emitters - are in development. Only time will tell how easy or difficult it will be to build these more complex displays.

Manufacturing a PCD

The input signal to an FED is electronic; the input signal to a PCD's image-intensifier section is necessarily optical. In fact, the input signal is provided by another display. The case for PCDs requires that they be less complex than FEDs, *i.e.*, the input display must

not add more complexity to the finished device than do the cathode and focusing structures of FEDs.

In a color PCD we have developed, the monochrome video image source that is closecoupled to the photocathode is an ac powder thick-film electroluminescent (TFEL) display (Fig. 3). This technology, which is used for LCD backlights, never achieved serious consideration for direct viewing because the contrast ratio (CR) of a Destriau-type powder EL display is very poor at a usable luminance of 200 cd/m². The poor CR is due to insufficient output nonlinearity (Fig. 4). Note the small luminance variation between 100 and 200 V. The technology also suffered from high emissivity, leading to poor CR in ambient lighting, and good color was never achieved.

In a photocathode display, these issues are of no concern. The video image source only needs to produce about 2 cd/m². Figure 3 shows that drive nonlinearity and CR are excellent at this low luminance. The image source's emissivity is irrelevant since it is close-coupled into the photocathode, and the blue-green output of common EL phosphors is perfect for producing efficient photoemission. Both the drive voltage and current are low, so STN drivers can be used. Most important, since the thick-film display is outside the high-vacuum envelope it can be prefabricated and tested at ambient pressure using standard thick-film methods.

The total cost to manufacture a PCD is therefore the combined cost of the STN drivers, a thick-film monochrome EL panel, and a diode intensifier/color converter. Because the design is modular, each subcomponent can be tested before proceeding to final integration of the image source and the intensifier. The same modularity allows many choices for the image source.

By registering the monochrome EL panel pixels to coincide one-to-one with corresponding red, blue, and green phosphor domains on the anode, this display can produce a full-color direct-view image. There is no need for registration between the photocathode and the phosphor screen or the image source, because the photocathode is a featureless metal film.

Electronically, the intensifier is a diode. Inside the high-vacuum envelope there are no focusing structures, current-limiting resistors, emitter arrays, matrix-addressing electrodes,

new technology

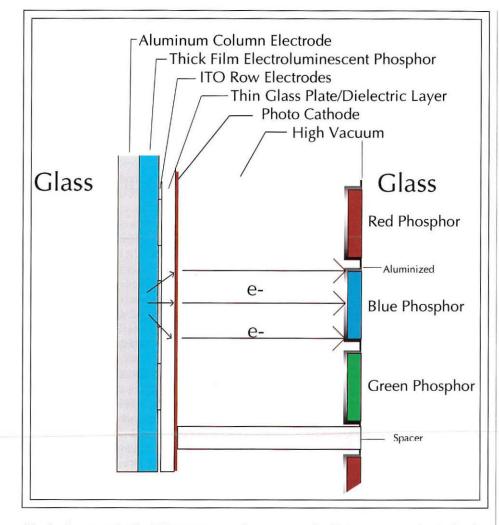


Fig. 3: One type of color PCD uses a monochrome ac powder EL image source that is closely coupled to the PCD's photocathode.

or extraction grids, as are found in FEDs. Only two electrodes pass through the highvacuum seal.

Making the photocathodes used in the proximity-focused intensifier is well understood because of the decades of manufacturing experience in the night-vision industry. Photocathodes are also used in image orthicons, photomultipliers, x-ray intensifiers, and scintillation counters. Typically, a thin film of antimony is applied by sputtering. It is then reacted with an alkali metal by vapor infiltration after the device is assembled, and pumped down. Alternatively, in the "spray method," the antimony and alkali metal are co-deposited under high vacuum, and the device is then assembled using an indium press seal. Photocathode performance requirements for a PCD are much less rigorous than those needed for night vision. Night-vision devices require sensitivity to red, so multi-alkali metal films are used.

These films require elaborate procedures to produce and they are limited to about 60°C operation and storage. Because their lowwork-function surface layers are susceptible to chemical attack, very high vacuums are required, and gettering doesn't help because the photocathode itself is a getter.

But if we only require the photocathode to be sensitive to blue light, much simpler and more chemically robust films can be used. An easily made sodium-potassium-antimony film, for example, gives excellent quantum efficiency at 450 nm, and can operate at well over 150°C. This cathode is unaffected by small residual gas concentrations of oxygen, water, etc.

The only element of PCD design and manufacture that is not a *fait accompli* is spacers. Spacers are not used in night-vision systems because they can easily be eliminated in small intensifiers spanning less than 6 cm, and small PCDs can be manufactured using night-vision assembly methods without modification. This means that small PCDs for cellular-phone displays, automotive displays, toys, and ocular displays can be produced by known methods.

For laptop-computer displays spanning 20 cm or so, spacers must be used. Candescent Technologies claims to have successfully used 50×500 -µm spacers of proprietary composition in a high-voltage FED. Our own work suggests that spacers with even higher aspect ratios can be made by using strips of mica. This material is ideal because it is ductile, like aluminum, and thus suitable for load sharing by adjacent beams. More-rigid materials – like glass or ceramic – are problematic because point loading at high spots results in fracture instead of yielding behavior.

Typical cathode-to-anode distances in PCDs are between 0.5 and 1 mm. A typical spacer is a strip of 50-µm-thick mica that is made slightly conductive by applying a conductive oxide film. The mica strips are then sheared or die cut to the desired width and placed periodically as simple beam supports between the cathode and anode. The conductive layer bleeds charge away from the spacer, preventing avalanche ionization and dielectric breakdown. The conductive layer also guarantees the electric field will be uniform, even near the spacers. Mica is strong, available in large sheets, and compatible with high-vacuum bake-out requirements.

All of the discrete PCD subsystems – the monochrome image source, the photocathode, and the aluminized P22 phosphor screen – are proven, readily manufactured components. In contrast, it remains to be seen whether FEDs can economically overcome the problems of lifetime, low-voltage color-phosphor development, electron focusing, micro-tip and microresistor array processing, and high-yield manufacturing.

Advantages of PCD Technology

High efficiency. PCDs are very efficient. Power consumed by the image source is negligible at 2 cd/m^2 . By shifting the energy con-

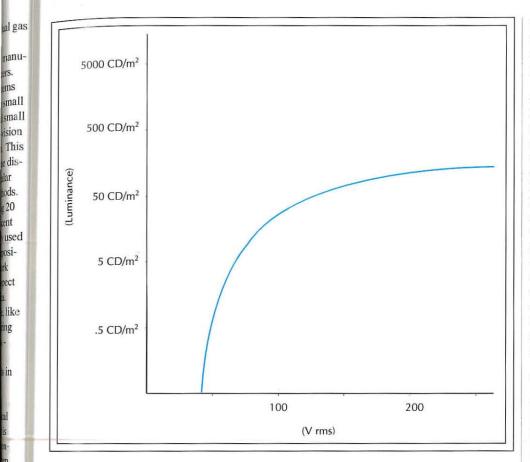


Fig. 4: Powder EL never achieved serious consideration for direct-view displays because the contrast ratio is very poor at high luminance due to insufficient output nonlinearity. This not a problem in PCDs because the powder EL display is operated in the low-luminance portion of its luminance-voltage curve.

sumption away from the image source and toward the intensifier, the overall efficiency is dominated by the intensifier efficiency, which for the aluminized P22 phosphor running at 10 kV is 40-50 lm/W.

ng

in

ns luc-ker, tric ur-ten in

de, are In

Shifting energy use away from the image source and toward the intensifier has other advantages, too. Running the monochrome image source at 2 cd/m² means low drive voltage, low drive currents, and excellent life. These are important when producing very large displays, where line capacitance and ohm/square limits often define performance.

High luminance. PCDs can produce very high luminance. An intensifier gain of 100 combined with an image-source luminance of 50 cd/m² implies an output luminance of 5000 cd/m2. Directly sunlit applications, such as avionics, automotive, and industrial process control, can exploit this capability using, for

example, a TFEL display or a backlit LCD as the image source.

Simplicity. The early promise of FEDs which were remarkably similar to PCDs in their theoretical simplicity - has yielded to a more complex reality based on hard experience. In contrast, far from being a theoretical construct, the PCD is an integration of two mature technologies. We have extensive experience making the elements of PCDs, and we know that intensifiers and low-luminance monochrome displays can be built.

Where Do We Go from Here?

We believe PCDs can compete across the gamut of display applications. From miniatures through laptop computers to wall-sized displays, PCDs offer high luminance, high efficiency, and full color. They yield directview images of CRT quality at temperatures

to 150°C and above. Most technical hurdles to volume manufacturing have already been overcome through decades of experience in producing diode intensifiers and CRTs.

The low required luminance of the image source invites the use of remarkably simple, low-cost, and easy-to-build monochrome display technologies. This idea of using a display as part of a display may seem like unnecessary complexity at first, but it is really an elegant solution to a general and vexing problem. It is extremely hard to achieve high luminance and good color and high efficiency and good contrast and long life and direct view, all at the same time, from any fully integrated display technology, whether it be PDP, FED, TFEL, or LCD. It is much simpler to demand only good contrast and long life from a monochrome image source, and to demand only high luminance, good color, direct view, and long life from an image intensifier. The marriage of these is the PCD, a product much greater than the sum of its parts.

SID '98 Anaheim, California Anaheim Convention Center May 17-22, 1998



A Great VIEW From Any Angle,

Anyway you look at them, Mitsubishi's ANGLEVIEW^{TT} TFT-LCDs give you a great view. And with a 4.3µm cell gap design, they give you a high contrast ratio without off-axis image reversal, plus rich, saturated color for breathtaking front-ofscreen viewing.

As a leader in display technology for over 20 years, Mitsubishi continues to develop advanced color TFT-LCD technologies:

- Wide Viewing Angle (120°+)
- High Luminance (200+ Nits)
- EMI Compliant (CISPR B)
- Low Power Consumption (<2.0 Watts)

The Mitsubishi TFT-LCD product line includes displays designed specifically for key markets, including: portable computing, flat panel monitor,



 workstation, instrumentation and industrial control. Interface support includes CMOS/TTL, FPD Link[™] and Flat Link[™]

(LVDS), and PanelLink[™].

Worldwide Service and Support

For a great competitive advantage, Mitsubishi provides service and support on three continents: Europe, North America and Asia. Enjoy the view. Call 408-774-3189, or get a great view from our web site at www.angleview.com.

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

Circle no. 17



video compression

Where Do the Different MPEG Standards Fit?

MPEG-2 provides bigger, higher-definition images than MPEG-1, so MPEG-1 is obsolete, right? Wrong.

by Pier L. Del Frate

C_{OR YEARS}, the PC industry has looked for improved ways of delivering higher-quality video and audio content to the home. Transmitting video and audio in digital format is a major step toward achieving this goal, but it requires high-speed transmission and storage to succeed.

A single frame of uncompressed digital video displayed on a TV equates to roughly 1 Mbyte of data that must be transmitted. For 1 second of video – roughly 30 frames – 25 Mbytes must be transmitted. Saving a standard full-length feature film – 135 min – requires roughly 200 Gbits of storage space. Without some form of digital compression, cost-effective storage or transmission of such data isn't possible. Fortunately, a solution exists that delivers compression factors of up to 100:1.

MPEG Solves the Problem

MPEG refers to the Moving Pictures Expert Group – the industry group established to develop an algorithm for compressing and decompressing moving pictures – but perhaps a more deft interpretation of the acronym is Moving Pictures by Educated Guesswork! Guesswork is apt because the algorithm tries

Pier L. Del Frate is vice president of marketing at Mediamatics, a wholly owned subsidiary of National Semiconductor, located at 48430 Lakeview Blvd., Fremont, CA 94538; telephone 510/668-4850 x225; fax 510/668-4860; e-mail: pdelfrate@mediamatics.com. Mr. Del Frate has over 20 years' experience in graphics digital video and multimedia engineering and marketing. to eliminate unnecessary replication of data by predicting future frames and eliminating areas that don't change from one frame to the next. By anticipating these "static" areas, MPEG stores the frames in a more efficient way.

The MPEG algorithm splits a picture frame into a grid of 16×16 macro blocks, and then determines the change between each macro block in succeeding frames. High-quality compression is achieved by the encoder's ability to look both forward and backward from a given frame to accurately compress the information. The decoding process works similarly: information on what has changed from frame to frame is used to efficiently play back the content.

With the emergence of the Digital Versatile Disc (DVD) and MPEG-2 technology, many are questioning the future of MPEG-1. Will the higher video quality of MPEG-2 eliminate MPEG-1 just as 16-bit audio quickly replaced lower-quality 8-bit audio? To set the record straight, MPEG-2 wasn't designed to replace MPEG-1. Rather, MPEG-2 supplies a different market that needs higher levels of video and audio quality. Because MPEG-1 and MPEG-2 serve different needs, they can coexist without infringing on each other. To better understand this, let's look at the differences between these technologies and then examine where each fits in the PC market.

Technology: Separate but Not Equal MPEG-1 produces video of a quality equivalent to that produced by most VCRs. It provides a picture that is 352 × 240 pixels in size

- about one-quarter the size of an NTSC TV

picture - and provides CD-quality audio. It

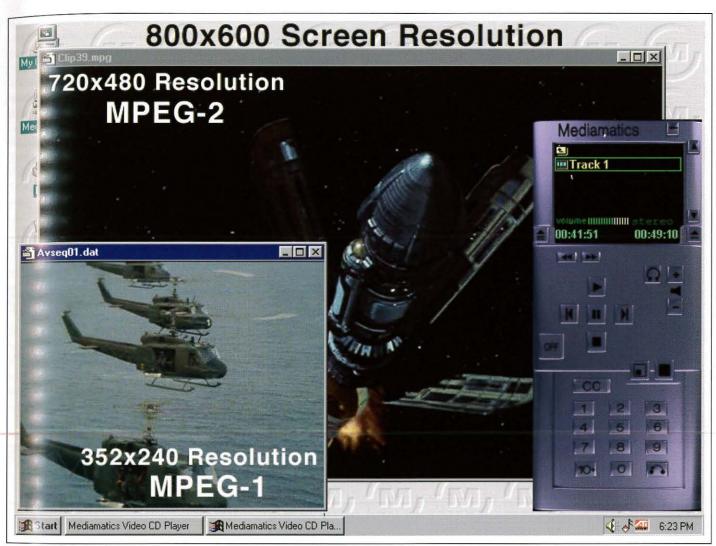
requires approximately 150 kbytes to store 1 second of MPEG-1 video and audio data.

MPEG-2 produces images of 720 × 480 pixels – four times the size of MPEG-1 images – with higher resolution and Surround Sound (Fig. 1). The technology provides a "better-than-TV" display of laser-disc quality and requires a minimum of 600 kbytes to store 1 second of video and audio information. It would follow then that MPEG-2 is better than MPEG-1. But is it?

MPEG-2 does indeed provide better video and audio quality than MPEG-1, but it does so at notably higher cost. MPEG-2 requires more decoder memory, faster processors, higher-density storage devices (both players and CDs), added speakers, and expensive video and audio decoders. For best results, the technology also requires high-end display monitors and TVs. A 133-MHz Pentium® processor, for example, can decode and display an MPEG-1 video and audio stream in real time - 30 frames per second (fps) - all in software (Table 1). With MPEG-2, a P55C MMX-enhanced processor running at 266 MHz is required to achieve similar performance. Such processors are not expected until 1998. In addition, MPEG-2 encounters system bottlenecks that affect delivery of laser-disc-quality playback on PCs. (Fortunately, this issue is being addressed by a new breed of MPEG-2 accelerated graphics controllers.)

A Matter of Taste

MPEG-1 and MPEG-2 are designed for two very different market segments (Table 2). MPEG-1 is designed for a market where vide⁰



Mediamatics

Fig. 1: This screen shot from an SVGA display clearly indicates a major difference between the two versions of MPEG. MPEG-1 offers maximum logical image dimensions of 352 × 240 pixels; MPEG-2 offers a maximum of 720 × 480 pixels.

quality is not paramount, but where cost, file size, and data-transmission rate are the major concerns. In the consumer-electronics market, MPEG-1 proved ideal for VideoCD and Karaoke players, particularly in Asia, where content was readily available. But in the United States and Europe, where content was scarce, MPEG-1 achieved limited acceptance.

?

ound

ality store It than

SSO

olay

lin

The market for MPEG-1 is in PCs, primarily on the desktop. With PCs, MPEG-1 became a standard feature, fueled by the availability of cost-effective software-based MPEG playback in Microsoft's Windows[™] operating ^{system}. (The software was licensed from Mediamatics.) Currently, every Pentium PC sold to the home market provides this functionality without additional cost.

Because of the technology's worldwide availability and its standard Windows interface, MPEG-1 clips are becoming widely used to demonstrate ideas and enhance learning. Uses range from electronic encyclopedias and games to educational applications and training programs. These applications do not require HDTV-level quality, but they do need better video quality than was previously provided by AVI technology. MPEG-1 fits the bill.

MPEG-1 is also seeing increased use over corporate intranets. While the Internet does not have the necessary bandwidth to transmit video in real time, local-area networks (LANs) and intranets do. Companies can enhance corporate and training materials with streamed video and immediately distribute it via the intranet. Users can easily access this centralized information from their desktops at their convenience.

This functionality comes with little added cost, for most PCs today offer software MPEG-1 decoding as a standard feature. Since MPEG-2 requires four times the bandwidth of MPEG-1, this technology would bring even the most advanced intranet to its knees, particularly if several users were accessing content simultaneously. For this

video compression

Table 1: CPU Usage for MPEG-1 and MPEG-2					
Function	MPEG-1 P5-133 (no MMX)	MPEG-1 P55C-200 (with MMX)	MPEG-2 P55C-200 (with MMX)	MPEG-2 P55C-233 (with MMX)	
Basic graphics controller					
Frames per second (fps)	30	30	22	24	
Audio quality	AM	CD	AC3	AC3	
CPU utilization	80%	40%	100%	100%	
MPEG-2 accelerated graphics controller					
Frames per second (fps)	30	30	30	30	
Audio quality	AM	CD	AC3	AC3	
CPU utilization	80%*	40%*	90%	80%	

*Does not use acceleration logic for MPEG-1 decoding.

reason and others, MPEG-2 will achieve greater success in markets with different needs and demands.

Top-of-the-Line Entertainment

The main focus of MPEG-2 is home entertainment rather than the office. In this market, motion-picture-quality video and audio are most important. We are speaking here of users who will watch movies on 35-in. livingroom displays using a PC rather than relying on the standard TV/VCR combination. Because MPEG-2 delivers theater-quality video and Surround Sound, ordinary PCs are transformed into full-featured entertainment systems.

MPEG-2/DVD formats promise to improve on VHS videotape in cost, durability, and content. The cost of manufacturing a VHS tape is around \$2.00, while the cost of pressing an MPEG-2/DVD disc is under \$1.00. While VCR tapes degrade with time and use, DVD discs retain their high-quality levels. DVD technology also gives content providers - primarily Hollywood movie makers - enhanced copyright protection that makes content piracy difficult. This should help promote the creation of DVD content, and should rapidly make available a wide variety of MPEG-2 titles. As these titles become available, the consumer-electronics industry will likely adopt this standard in lieu of MPEG-1.

MPEG-2 is also used in Digital Video Broadcast (DVB) technology, which provides HDTV to digitally savvy homes. As the demand for higher-quality video increases, MPEG-2 should also penetrate digital TV cable systems.

Staking PC Ground

Since MPEG-2 provides better video and audio quality, why not use it for all applications, including the PC? The answer lies in cost and storage capacity.

Currently, MPEG-1 is free on the PC when done in software. Today's CPUs have enoug processing power to perform video and audio decoding tasks with low-cost software. Standard CD-ROM drives, shipped with most PC provide MPEG-1 playback. MPEG-1 on the PC clearly demonstrated that to succeed a technology must be low in cost. More accurately, it must be free to the end user. Buyers will not tolerate additional cost for functions that are used sparingly.

So, will MPEG-2 make it to the PC? Yes, but only if the technology is free or if the PC moves into the living room and attaches to the TV as a "living-room PC." The "free technol ogy" scenario is more likely.

To play MPEG-2 on PCs using software only, CPUs need to be faster, and system bot-

Table 2: Comparison between MPEG-1 and MPEG-2

Function	MPEG-1	MPEG-2
Design focus	PC, games, video, CD	Digital broadcast TV, DVI
Image quality	VCR	Laser disc
Image resolution	352 × 240 (NTSC) 353 × 288 (PAL)	720 × 480 (NTSC) 720 × 576 (PAL)
Audio quality	CD quality	Surround Sound
Speakers/channel supported	2 (stereo)	6 (5 plus a subwoofer)
Average bit rate (kbps)	150	600
Drive	Single-speed CD-ROM	6X CD-ROM or DVD
CD-ROM-drive price	~\$50	~\$75
CD-ROM storage (600 MB)	72 minutes	17 minutes
DVD-drive price	not required	>\$300
DVD storage (4.7 GB)	564 minutes	141 minutes
Decoder memory required	1/2 Mbyte (\$5)	2 Mbyte (\$20)
CPU requirement for full software playback	P5 133 MHz ^a	P55C 200 MHz ^b
Hardware video-decoder price ^c	~\$15 (includes audio)	~\$35
Hardware audio-decoder price ^c	\$0 (in video decoder)	~\$23

^aRequires video accelerated graphics controllers.

^bRequires MPEG-2 accelerated graphics controllers. ^cNot required on PCs using software decoders. tlenecks need to be solved. Faster CPUs with MMX technology are starting to resolve the speed issues, while MPEG-2 accelerated graphics controllers are addressing system bottlenecks. Together, they will provide the processing horsepower needed for free MPEG-2 playback on the PC.

ca-

in

when

nough nudio

Stan-

t PCs,

the

cu-

iyers

ions

Yes,

PC

to the

hnol-

ibot-

DVD

Matching the Product to the Consumer

The bottom line for the success of either MPEG standard is user experience. If users like it they'll buy it, regardless of how it's implemented. If it's free, even better!

On the consumer-electronics side, MPEG-2 has the advantage of providing improved video and audio quality. Unlike VHS tapes, DVDs won't degrade over time. DVD also offers interactive features and parental control. We believe users will want and enjoy these features.

To content providers, DVD provides inexpensive copyright protection. Also, the price point of DVD players will quickly decrease as production capacity increases and as more and more of the electronics is integrated on fewer and fewer chips. Users will like this even more.

On the PC side, MPEG-1 has the lead. It is shipped free with most home PCs today; Microsoft includes an MPEG-1 player with its Windows OS. Also, MPEG-1 is well suited for use in training applications and over the corporate intranet. But MPEG-2 is virtually certain to gain similar acceptance on PCs when, like MPEG-1, it is offered free to end users. This will occur as CPU manufacturers provide added horsepower and graphics-controller companies provide the necessary acceleration to allow software-only playback.

At Mediamatics, we have committed ourselves to helping bring cost-effective MPEG-2 to the PC, as we did with MPEG-1. It is software decoders such as those developed by Mediamatics that will enable DVD functionality in PCs at no additional cost to end users. A likely result is that users will continue to demand larger, higher-resolution displays when they buy their PCs, and that "livingroom PCs" accompanied by very large, highresolution displays will grow in popularity.

SID '98 Anaheim, California Anaheim Convention Center May 17–22, 1998

ADI 5200 QA INSPECTOR

Point for Precision.

Speed, Flexibility, Accuracy and Multi- Measurement Capability all in a Cost Effective Portable Package.

The IPS ADI 5200 QA Inspector provides a cost effective, highly accurate and *Portable* display inspection tool which can be used in a variety of inspection and adjustment applications such as:

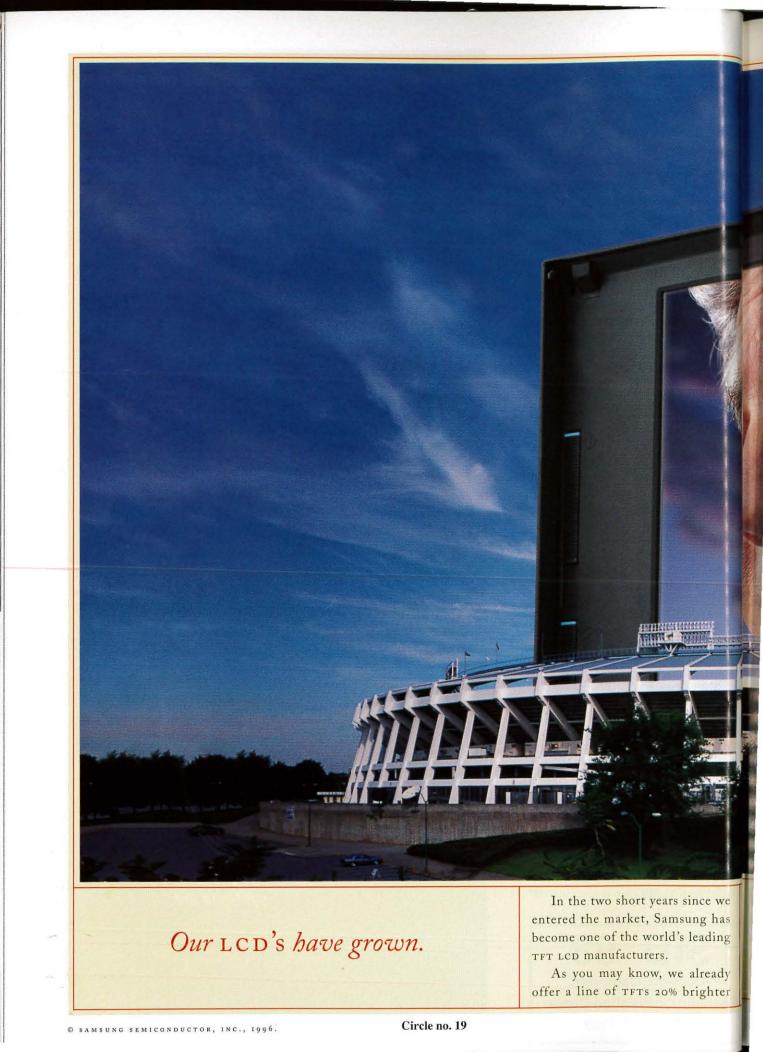
- Quality Inspection for CRT's, TV's and Monitors
- Production Line Correction Stations
- Product Evaluation
- Factory Service

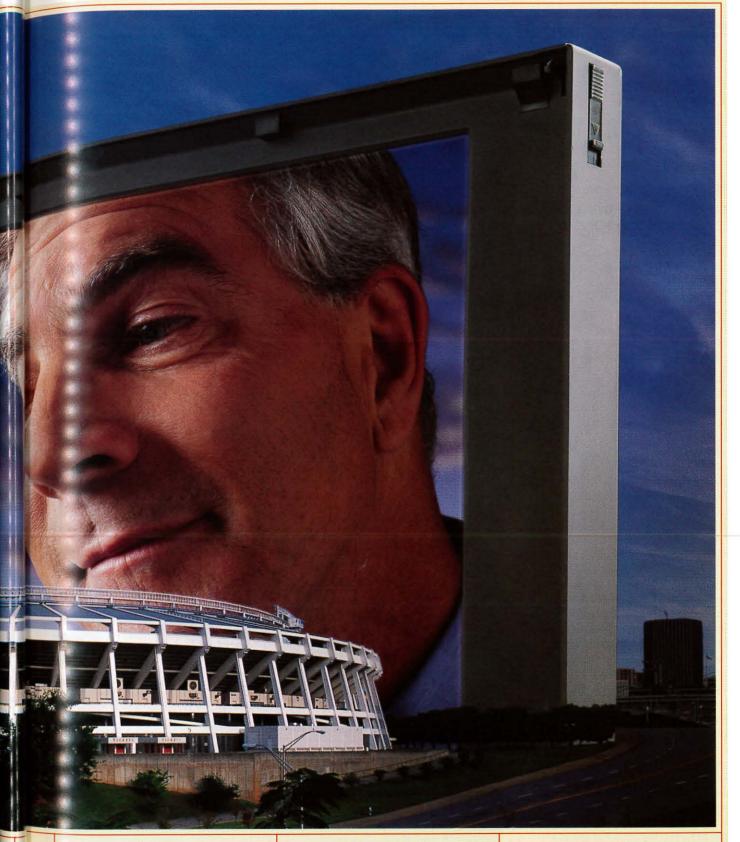
Measures Convergence, Purity, Focus, Color, White Balance and Luminance with a single instrument.



image processing systems inc.

Image Processing Systems Inc. 3440 Pharmacy Avenue, Scarborough , Ontario, Canada M1W 2P8 Phone: 416-492-4000 Fax: 416-492-4001



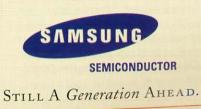


and with 30% more color saturation than the closest competitors.

We'll be following up soon with more products that are—well larger than life. Including a 13.3" XGA notebook panel, and XGA and SXGA panels actually designed for desktop monitors—in a whopping 14" and 15.1".

And hey, with the desktop impending, can the coliseum really be far behind?

Onward and upward, guys.



show report

Euro-Monitors Are Hot in Hannover

Europeans can't agree on a common currency, but they like to see "Made in Europe" on their monitors – and they are intrigued when those monitors are flat.

by Bryan Norris

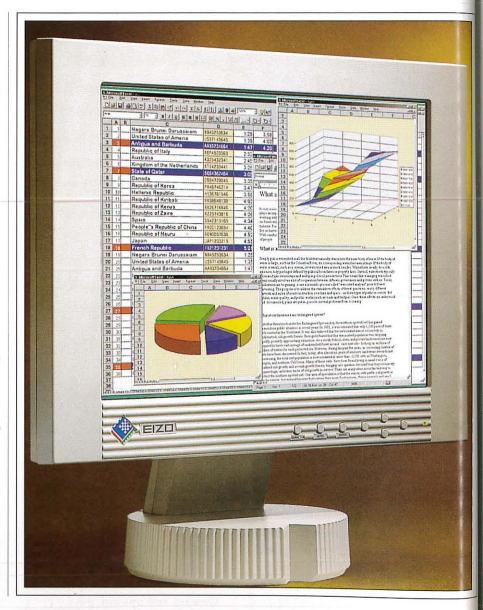
As the world's largest international IT trade fair, CeBIT is just too big to manage. How could it be otherwise? Nowhere else is so much information available in one week on one site.

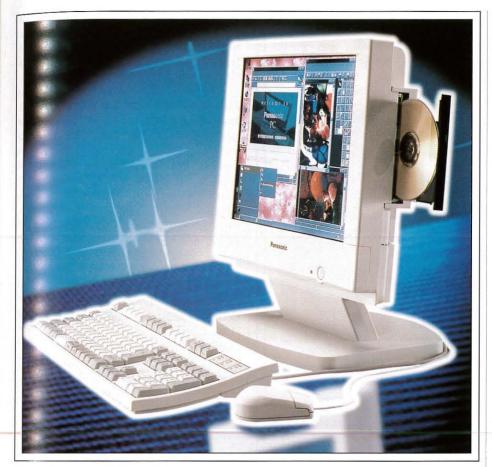
During the 7 long days from the 13th to the 19th of March, the 11th CeBIT show, held as always in the enormous permanent fair site at Hannover, Germany, was the promotional ground of 6855 exhibiting IT companies – up 4.7% from 6549 in 1996. Their exhibition areas covered 352,623 m² of floor space in 23 of the 27 halls, compared with 339,108 m² in 1996! Forty-percent (2650) of the exhibitors came from outside Germany, with the largest "foreign" contingent of 445 from the U.S. and the next largest (401) from Taiwan.

Some 610,000 mostly professional visitors fought their way to and from the show site amid horrendous traffic congestion made

Fig. 1: Eizo's 13.8-in. L23 LCD monitor runs normally at 1024 × 768 (XGA). In VGA and SVGA modes, it uses an ASIC to interpolate and provide an image that almost fills the screen.

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. Before establishing Bryan Norris Associates, he created and managed the Monitor Information Program at BIS Strategic Decisions. He is a contributing editor to Information Display Magazine.





Panasonic Deutschland GmbH

Fig. 2: Panasonic's Panel PC CF55 drew a lot of attention. The compact case houses a 14.5in. 1024 × 768 (XGA) LCD monitor and the necessary parts of a PC, including a 150-MHz Pentium processor, two PCMCIA card slots, a floppy disk drive, and a CD-ROM drive.

worse by the construction work for Expo 2000. A significant proportion of the 100,000 attendees from outside Germany were from the Asia-Pacific region (16,400), Eastern Europe (14,000), or from America (5200). One-third of the visitors from these three regions were first-timers.

LCD Monitors Everywhere

This year, it was most noticeable that many of the stands showing displays had an *own-brand*, *working* stand-alone LCD monitor. Around 40 exhibitors took the opportunity to launch, or at least show, these new products. But it must be emphasized from the start that many of the models shown were just prototypes or pre-production units. Nevertheless, at least three exhibitors had 10–12-in. LCD monitors on their stands as demonstration units, notably *Fujitsu/ICL*, *Raab Karcher* for *Eizo*, and distributor/PC assembler *Wortmann Terra*. The screen sizes of the LCD monitors ranged from 10.4 in. through 11 larger sizes to the whopping 20.1 in. from *NEC*. (This NEC LCD2000 is scheduled for sale in the third quarter of 1997 at a price of around DM12,000/US\$7200.) Although quite a few of the LCDs at CeBIT employed D-STN panels, the dominant technology being used was AM-TFT.

It was interesting to see that, whereas the resolution of the LCD monitor had previously been fixed by the LCD-panel manufacturer, many of the monitors displayed now use special circuitry that allows resolutions lower than the maximum to fill the screen without the former reduced picture size and broad black border.

Eizo's 13.8-in. L23 LCD monitor runs normally at XGA (1024 × 768) but it uses digital technology with an application-specific integrated circuit (ASIC) to interpolate in VGA or SVGA modes and to provide a display that almost fills the screen (Fig. 1). The photograph clearly indicates the major advantages of LCD monitors: considerably less bulk, depth, and weight when compared to conventional CRT-based models, features that provide opportunities for some innovative casing designs.

And capping it all was what must have been one of the stars of CeBIT '97: *Panasonic*'s Panel PC CF55 (Fig. 2). Scheduled for a September '97 launch and described as "an innovative concept for the desktop computer of the future," this unit's small housing contained both a 14.5-in. 1024 × 768 LCD monitor and the necessary parts of a PC – notably a 150-MHz Pentium processor, 1.2 Gbytes of hard disk, two PCMCIA card slots, and floppy disk and CD-ROM drives.

But the CDT Fights Back

It was also evident at CeBIT that the age of the CDT/CRT monitor is far from over. This year, Hannover witnessed the launching of monitors employing no less than four new CDT types: *Hitachi*'s 19 in., *Sony*'s 24 in., *Panasonic*'s PANA FLAT, and *Toshiba*'s Microfilter, as well as a large number of monitors using *Mitsubishi*'s and *Sony*'s aperturegrille CDTs.

Hitachi's brand-new 19-in. flat square black-matrix Invar shadow-mask CDT was presented in a surprisingly large number of prototype monitors. Along with Hitachi's own model, 19-in. CDT monitors were displayed and promised from mid-1997 onwards by ADI (Fig. 3), Bridge, Eizo, iiyama, Lite-On, MAG, Nokia, Princeton, Royal, Sampo, and Shamrock. So it looks as if this new screen size will be popular. Its prime advantage is the fact that the 19-in. screen is the ideal size to run CAD-type applications at 1280 × 1024 (with high refresh rates) or at higher resolutions, where a monitor with a 17in. tube is not really adequate. Furthermore, the 19-in. tube is less bulky and less expensive than the 21-in tube.

The *Matsushita/Panasonic* PANA FLAT tube – with its plain screen that is flat both horizontally and vertically – was shown at Hannover in *Panasonic*'s new PF17 17-in. 30-86-kHz monitor that displays 1280 × 1024 pixels at 80 Hz. This tube, which is due for general release in Europe in mid-1997, pro-

show report



Fig. 3: ADI showed one of a surprisingly large number of prototype 19-in. color monitors using Hitachi's brand-new 19-in. flat square black-matrix Invar shadow-mask CDT.

duces a clear and precise image, whatever the angle of vision. The flatness, assisted by the anti-reflection panel, results in considerably minimized reflections. The clarity of small characters is especially good because of the very fine 0.24-mm stripe pitch, and because this tube uses a stretch shadow mask there are no damper wires as in aperture grill tubes, and thus no lines across the screen.

Toshiba's new Microfilter 17-in. 0.24-dotpitch (flatter-squarer) tube provides a 30-point improvement in luminance and contrast ratio, and was seen in use in *Microvitec*'s advanced Pro 17 (95) SX monitor at Hannover. This 30–95-kHz monitor can operate at a resolution of 1280 × 1024 at 85 Hz or, if required for special applications, 1600 × 1200 at 76 Hz.

Sony's 24-in. aperture-grill Trinitron tube has a 16:10 format, can run 1920 × 1200 pixels at 75 Hz, and was seen in monitors from Sony itself, *Elsa, miro*, and *Step Electronics*. Sony's example, the Multiscan GDM-W900, was promised for April '97 delivery at a price of DM6500/US\$3900 (Fig. 4). Any monitor using this sharp, high-contrast tube has the advantage of being able to display two full A4-sized pages, and is thus ideal for CAD, graphics, layout, and document-imaging applications.

Aperture-grill tubes in general – both the Trinitron from *Sony* and the Diamondtron from *Mitsubishi* – are increasingly employed by monitor suppliers. At CeBIT, European brands with these tubes included models from *Peacock, miro Displays, Step Electronics, Vobis,* and *Yakumo.* Even *NEC* showed a new Diamondtron-tubed 21-in. model, the MultiSync P1150.

On the other hand, *NEC*'s CromaClear[™] tubes, seen, of course, in both existing and

new *NEC* 15- and 17-in. models, were also found in new 15- and 17-in. models from Taiwanese *Smile*, on whose stand parent company *KFC*-branded product was also displayed.

Environmental Issues Are Still Important

Germany and Sweden have the most active bodies in Europe concerned with promoting environmental issues. Therefore, it was not surprising to find that again a great deal of emphasis was placed on environmental aspects at the Hannover fair, and that both the important TÜV Rheinland test house (which awards the definitive Eco-Kreis certificate) and the Swedish Confederation of Professional Employees Development Unit (TCO) (which awards the TCO '92 and TCO '95 accreditation certificates) had booths at CeBIT. In addition, a considerable amount of effort was spent by the display suppliers in promoting environmental features, notably TCO '92 and '95, and higher refresh-rate capabilities. The forthcoming 19-in. monitor from Nokia, for example, exploits its new tube fully, producing a specification of 30-107 kHz to allow flicker-free resolutions of 1280 × 1024 at 100 Hz and 1600 × 1200 at 85 Hz, and it will comply with TCO '95.

Present at CeBIT were most of the 63 companies that have among them about 600 monitor models meeting the stringent TCO '92 requirements. (These companies are currently listed in the February 1997 issue of the "Environmentally-labelled Computer Displays" pamphlet.) TCO '95, with its extra environmental conditions, was accredited in February '97 to 133 CRT monitors from 26 suppliers and to two PC monitors from *Tandberg Data*.

At the Hannover show, *NEC* announced that from April 1, 1997, it would have a new recycling partner in Germany, *RPG*, a Pan-German cooperative of socially engaged, flexible, and highly specialized recycling companies. Together, *NEC* and *RPG* undertake to handle any kind of electronic waste made by any manufacturer and to recycle this material safely to existing ISO standards.

What's New, Doable, and Sellable?

Along with the environmental factors, new features are being sought by all monitor suppliers to give them an edge over the competition and to help sell their brands. Once-novel features such as Plug & Play and assorted onscreen-display (OSD) systems are now seen to be commonplace. Three-year warranties are becoming the norm.

'ai-

3

the

ch

))

of

01

at

m-

ni-

itly

vi-

ary

ta.

al

vel

One of the most interesting – although yet unproved – new features is the Universal Serial Bus. USB was being offered with a number of the monitors on display, indicating that many suppliers consider this to be a thing of the future. Prominent suppliers committed to having USB models included ADI, CTX, GVC, Hyundai, Nokia, Philips, Sampo, Samsung, and Shamrock.

German distributors and PC assemblers are nowadays well aware that selling monitors is often more profitable than selling PCs or other computer peripherals. Many have added their own-brand "label" monitors to their catalogues, as well as promoting a range of other well-known branded monitors. Typical examples of "me-too" own brands being promoted included M-Brand from *Actebis* (in addition to its 'Targa' range), PC2000 from *C2000*, Diamond from J & W, Macom from Macrotron, Magic from Wortmann Terra, Highscreen from Vobis, and Yakumo from Frank & Walter Computer (now part of the CIS Group), plus the outstandingly successful Belinea from Maxdata. Belinea was the bestselling monitor brand in Germany during 1996, with sales of over 400,000, and was also sold in Austria, France, and Switzerland. With the Maxdata U.K. office beginning operations in April 1997, another step was taken by Maxdata to fulfill its plans of selling 700,000 monitors in Europe during 1997 and becoming Europe's No. 1 brand by the end of 1997.

The move towards monitors with larger screen sizes continues throughout Europe, especially in Germany. But, judging from products still on offer from some suppliers, there is still an entry-level market for low-end 14-, 15-, and 17-in. monitors. (In Germany in 1996, the market-volume share for 14-in. branded monitors went down to 17.4%, com-



Sony

Fig. 4: Sony's Multiscan GDM-W900 monitor is built around Sony's 24-in. Trinitron tube, which has a 16:10 aspect ratio and can display up to 1920 × 1200 pixels at a 75-Hz refresh.

pared with 32.7% in 1995!) SVGA-only 14in. models could still be seen in the catalogues of Cotton, Daewoo, Philips, and Samsung (but since 1996 Samsung has not sold 14-in. models in Germany). Models with 15-in. screens and horizontal scan frequencies up to just 50-57 kHz were offered by Cotton, Funai, GVC, Hyundai, Lite-On, Peacock, Philips, Sampo, Samsung, Shamrock, Tatung, and Yakumo. Models with 17-in. screens, scan frequencies up to 50-57 kHz, and 0.39-mm tubes were not as numerous as expected, although companies which had such models in their range included Bridge, Chun Yun, Hyundai, LG, Lite-On, Peacock, and Yakumo.

Manufacturing monitors in Europe is now perceived to be a positive selling feature. New data sheets from *Hitachi* have a special EU symbol to indicate which of its monitors are made in Wales. At the Korea Data Systems/Aquarius Robotron Systems (now Fujitsu/ICL) plant in Sömmerda, Germany, 200,000 15- and 17-in. monitors were produced in 1996. Overall, the 20 companies producing in Europe made over 4.6 million monitors in 1996. During 1997, in the U.K. alone, Hitachi, iiyama, Microvitec, Samsung, Sony, and Tatung all plan to increase their monitor production, and Lite-On and LG will come on-stream. Expect around six million monitors to be produced in Europe during 1997!

Next year's CeBIT will be from 19th to 25th March, and, according to the organizers, 90% of 1997's exhibitors have committed to attending CeBIT '98. In the meantime, why not take a business-funded holiday to Italy at the beginning of October and, while you are there, attend Europe's other important IT Fair? SMAU, a friendly show that is well worth visiting, will be held in Milan from 2–6 October. For further details about SMAU, call +34-2-760-6757 or fax +39-2-760-7300. ■

SID '98 Anaheim, California Anaheim Convention Center May 17–22, 1998

PixTech flat panel displays. The edge you need . . .

... the edge in viewing.

- >160° viewing angle, horizontally and vertically, for rack-mounted instruments.
- High image brightness (70 to 200FL) for outdoor readability.
- Smooth, continuous, full-range dimming from maximum brightness to extinction.

...the edge in performance.

- Full-motion video speed for fast TV, waveforms, and ultrasound imagery.
- Portable power mode ... 70FL at one watt.
- 5.2 inch, 320x240 monochrome green FE532M-1 ... available now.

PixTech's state-of-the-art cold cathode Field Emission Display (FED) is the graphical flat panel that breaks LCD performance barriers. FEDs are the next generation imaging technology. Cold-cathode emitters (1000/pixel) assure high redundancy images with no lost pixels, black dots, or lines out.

Temperature extremes are no problem, with instanton available for -45°C to +85°C operation. Emissive FEDs provide higher brightness than backlit and reflective LCDs, yet dim way down for nighttime use.

PixTech FEDs have the velvet texture, lush colors, and crisp focus of computer CRT monitors because the FEDs are CRTs. But, at a "thinness" of just 2.5mm, the PixTech FED shows computer-quality images without the bulk, weight, or heat of a monitor. And, unlike LCDs, FEDs are the perfect displays for fast-moving imagery such as ultrasound, sonography, heart-rate and waveform monitors, oscilloscopes, TV, and FLIR images. A 20-microsecond response time eliminates image-persistence or "lag".

Try the many advantages of monochromatic FEDs from PixTech now. Full color 5.2-inch Evaluation models available, Winter, 1998.



The Field Emission Display Company 3350 Scott Boulevard, Bldg. 37 Santa Clara, CA 95054

(408) 986 8868 Fax: (408) 986 9896



Call us! 1-888-PIXTECH

PixTech FED... the new generation of flat panel displays.

Circle no. 20

Industries' leading source for custom designed and manufactured illumination





Precision made in the U.S.A.

For over 15 years LCD Lighting has been fulfilling our customers' most demanding illumination needs with custom designed and precision manufactured lamps. From copiers, to UV dermatological, to machine vision, avionics display backlighting and more — LCD lamps are lighting up industries throughout the world.

Complete capabilities

- Shape: no matter what, we can bend it
- Size: 2.6mm to 20mm O.D. custom lamps, plus T-5, T-8 diameters to any length
- Color: full spectrum to choose from plus tri-band phosphors and high color rendering index
- Engineering: built to meet environmental extremes (MIL Std. 810)

- Lifetime: 20,000 hours average life with superior dependability
- Power: high output, yet dimmable
- Precision: custom cut laser apertures
- Assemblies: harnesses, special bases, sockets, connectors and heater wiring

Trust LCD's advanced technologies and experience to quickly solve your illumination challenges. Contact us with your needs today:



37 Robinson Blvd. • Orange, CT 06477 U.S.A. Phone: 203 795-1520 • Fax: 203 795-2874

display measurements

Scanning Laser Projectors

Why do scanning laser projectors look better than the measurements say they should?

by William K. Bohannon

S_{CANNING} a modulated high-intensity light beam across a screen would seem to be an obvious approach to making a projection display. Obvious, but not easy to implement. And once implemented, not easy to measure or compare to conventional projectors.

First, although experiments with scannedlight-beam projectors were conducted before World War II - decades before the laser was invented - lasers make it much easier to construct a projector that produces an image that is bright and has high resolution, both at the same time. Second, the well-developed techniques for making routine illumination measurements of conventional projection displays break down with video-rate scanned-line displays. And third, now that credible measurement techniques have been developed for laser projectors, we find that the subjective responses to the measured values are not what we would expect from conventional projection displays.

This is not to say that scanning laser projectors are not being built (Fig. 1). In fact, many methods have been proposed to construct them. One method is to scan a laser beam across the screen in two dimensions, much as an electron beam is scanned inside a CRT. The scanned spot is modulated at every pixel

William K. Bohannon is Chief Scientist at Manx Research, a display technology and marketing consultancy, located at 2060 Ridgecrest Place, Escondido, CA 92025; telephone 619/735-9678, fax 619/735-8987. He is the author of a series of reports on LC projection systems and the Japanese display industry. point to create an image that the eye can retain without flicker – if the scanning is done quickly enough, at 60 Hz or better. If a very fast freeze-frame image were taken of the pixel-scanned laser-projector screen just described, only a single point of



Fig. 1: A laser projector displays colors that are more saturated and subjectively brighter than conventional measurements would lead us to predict. This projector from the Corporation for Laser Optics Research (COLOR) is in the baggage area at the Manchester, New Hampshire, airport.

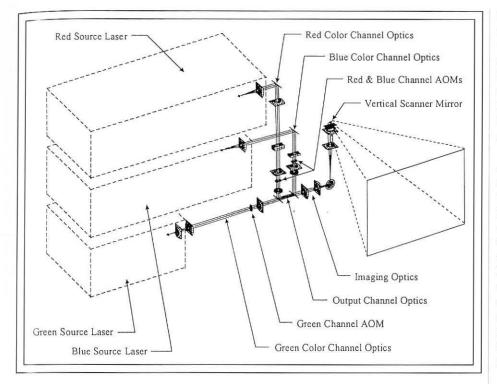


Fig. 2: In the laser projector developed by the Corporation for Laser Optics Research (COLOR) of Portsmouth, New Hampshire, a laser beam is formed into a thin, line-shaped beam that is modulated by a high-resolution AOM to contain one entire line of video information.

light would be seen, not the full image seen with an LCD or CRT projection system, and not the bright image that persists on the screen of a CRT because of the phosphor's persistence.

To lessen the modulation speed and signal bandwidth required of the scanning laser system, several laser-projector development groups have proposed using multiple lasers operating in parallel - an idea that has been used by designers of high-performance CRTs many times over the years. These individually modulated parallel laser beams could be of lower power than the beam in a one-beam laser system and could be scanned together at a lower speed using a rotating polygon or some other kind of movable mirror. The resulting image would be produced by several scanning spots instead of one. However, several problems need to be solved to make the individually addressable lasers compact enough, to allow the beams to be sufficiently close together to produce an image with adequate screen resolution, and to ensure there are no artifacts due to the fact that the various beams are not precisely equivalent.

Two of the groups working on scanning multiple beams - Advanced Laser Technologies (ALT) of Moorpark, California, and Laser Power Optics (LPO) of San Diego, California - have solutions for these problems. ALT has constructed a dual x and y plane acoustical-optical modulator (AOM) system that spreads one beam of laser light into 28 individually modulated laser spots which are then scanned onto the screen in parallel with a rotating polygon. In an alternative approach, LPO creates "hundreds" of spots from one beam with a special diffractive optical element. Each spot is then individually modulated by a proprietary electro-optical element before being scanned onto the screen, as is done in ALT's system.

Another method – one that takes advantage of coherent laser light without forcing designers to worry about developing compact laser sources or tiny diffractive optical elements – also involves combining an AOM with a scanning laser beam. In the laser projector developed by the Corporation for Laser Optics Research (COLOR) of Portsmouth, New Hampshire, a laser beam is formed into a thin line-shaped beam that is modulated by a highresolution AOM to contain one entire line of video information (Fig. 2). With the COLOR method, the resulting laser line only needs to be scanned in one direction, vertically, instead of two. By vertical stepwise scanning of the laser line with a movable mirror, the image is built up on the screen without additional optical elements.

The COLOR method requires that the AOM be loaded with an entire line of video data within about one pixel period. Otherwise, noise with duration greater than one pixel period would degrade the image. The AOM's data is "read out" with a similarly short burst of laser light and then projected onto the screen. Since the pixel period in an NTSC video signal of maximum resolution – 440 × 525 interlaced – is about 80 ns, a burst of light shorter than 80 ns is necessary to avoid smearing. The laser must also be ready to pulse again within the line period (about 60 µs) necessary for running two interlaced 30-Hz video fields at 60 Hz.

According to COLOR, the individual red, green, and blue lasers used in their test system pulse at approximately the rate just described. However, because of timing issues, most of the light from the combined red, green, and blue pulses (necessary to form "white") occupies a window about 180 ns wide. This limits the test system's screen resolution to that of a normal NTSC VCR.

Determining the Brightness of Scanned Systems

How bright are the images resulting from scanning laser projectors? How can their luminance be measured? How powerful would the laser have to be to make a person see a reasonably bright image – and how would one compare the luminance to that of an ordinary projection system?

If a light meter, such as a simple Minolta meter with a 1-in.-diameter sensor area, were placed on a screen scanned by a laser projector to measure footcandles, it would only see the rapidly moving spot (or spots or line) for the short time that the spot was actually on the sensor head. The Minolta meter doesn't read out quickly enough – it has a response time of 1 ms – to even record the data of one "flying" laser spot. If the meter could record and then display that data on an oscilloscope, one would see a peak-shaped waveform about one

display measurements

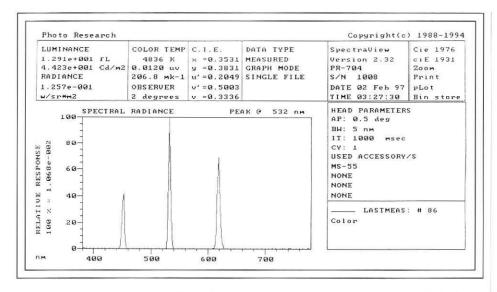


Fig. 3: "White" light from a laser projector is actually narrow-band red, green, and blue light that is mixed in the right proportions to be perceived as "white."

pixel (180 ns) wide once every 16.7 ms for an image with a 60-Hz refresh. As a result, when the trusty Minolta T1 Illumination Meter was held up to a scanning laser projector's screen, it could not record the expected illumination value in footcandles (based upon input power). The value we obtained was far lower.

If we could use a screen-sized meter – something like a giant solar cell that could capture and integrate the entire image – then we might be able to record the expected value. Unfortunately, such a meter is not available, and users of laser projectors need some other method to validate their systems. Even though we can't possibly see the flying spot or moving line in a scanned laser projection system that completely lacks optical persistence, we perceive an image that looks brighter than conventional instruments predict.

Laser Power and Pulse Timing

Experts in human perception have long held that time-varying light sources are as luminous as the time-average of their luminance. For example, if a 10-fC spot is repeatedly turned on for 10 ms and off for 10 ms, the spot's illumination is the average of 10 and 0, or 5 fC. For a single-spot laser-beam projection system, the illumination of any measurement might be taken as the average resulting from being on for 180 ns once per 16.67-ms frame and off the rest of the time. Even if an "all white" frame were projected, the laser

on 16.67 ms, the time-averaged illumination is 0.00018/16.67, or about 0.0000107 times the spot's peak amplitude in footcandles. A 10⁶-

fC spot would therefore be required to make a 10-fC time-averaged image across the whole screen. We can calculate how many footcandles or lumens a laser makes from the CIE photopic efficiency function.

would only visit any one spot once per frame

time - 1/60 of a second for most data signals.

When the spot is on for 180 ns and off for

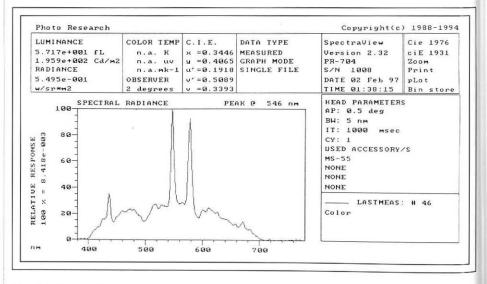
or 1/30 of a second for interlaced video.

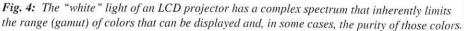
For example, if 1 W of green laser light, centered at 555 nm, equals 683 lm, then that 1-W laser could create a 683-lm image onscreen. Additional 1-W (or so) lasers operating in appropriate red and blue wavelengths would also have to be used to achieve proper color balance. But would a 3-W total RGB laser system really provide about 1000 lm of color-balanced light when all of the power is dumped into one or more tiny spots that whiz past the eyes?

Single-Line Measurements

One of the COLOR laser systems was used as a measurement testbed to see if the calculated results could be verified. This laser can put an over-sampled NTSC video image on a 7 × 10ft. screen. The green laser alone put about 10.6 W of 532-nm green on the screen – appropriately balanced with several watts of red and blue. At 532 nm, 10.6 W should equal 6360 lm, taking CIE efficiencies into account. Since the COLOR system scans a single line vertically on the screen, we began our calculations with line widths.

A one-pixel-tall line on a 7×10 -ft. screen should contain less than 0.03 m². We stopped the line-scanning function and measured the line at 0.78 × 113.75 in. (0.057 m²). There was some broadening of the line, perhaps resulting from its extreme intensity (the line had to be viewed through safety goggles). With 6360 lm in 0.057 m², the illumination, if constant, would have been 10,365 fC!





But the luminous power described above must be time-averaged because the system writes the 180-ns-wide line over and over every 60 μ s. So, 0.18/60 × 10,365 fC gives an average of about 31.09 fC. If this illumination could be averaged over the entire screen – and this should be possible since the line-to-line timing doesn't change – then 31.09 × 10.76 × 6.75 (the entire screen area) gives 2258 lm.

Our measurements of the illumination of a single line with the Minolta meter were almost 800 fC on average. But measurements taken of the system scanning normally across the entire screen were less than 6 fC on average, which indicates the light output from the projector to be about 430 lm. Obviously, the Minolta meter couldn't keep up with either the intensity of a single line or the sparse activity of a fully scanned image. This isn't surprising, and Alan Sobel, editor of the *Journal of the SID*, observes that it's a problem that is continually being forgotten and rediscovered. (See The Meter, the Eye, and Scanned Displays.)

Narrow-Strip Measurements

Since we couldn't construct a screen-sized integrating light meter, the vertical scan on the laser projector was adjusted to move over a wider range but at the standard line timing and laser power levels. If we can assume that the eye-brain system has a minimum detection time of 1 ms, then the pixel- or line-scanner will have moved down about 8 lines at a 30-Hz rate. At the throw distance and screen size used for the measurements to be taken, these eight lines equal a height of about 3-4 in. on the screen – a fraction of an arc degree at a reasonable viewing distance.

The resulting bright band was measured and found to be about 5.25 in. high by 114 in. long, giving an area of 0.39 m². This band had several times the area of the Minolta's sensor head. Measurements taken at a wellpositioned series of points gave a value of more than 135 fC on average. If it is assumed that the meter was reading an accurate value for that limited area, the illumination for a single line can be calculated by taking the ratio of the heights. So, 135 fC times 5.25/0.78 gives 908 fC. Taking the time average of this value at 30 Hz (for the average vertical scan rate) gives 30.2 fC. With the assumption that this should approximate the average illumination for a single line anywhere across the

The Meter, the Eye, and Scanned Displays

The measurement problem with scanned optical displays involves tremendous overloading of the meter. Let's assume that the TV picture has $480 \times 640 = 307,200$ elements. The laser light has no persistence, so if a pixel is to produce an average luminance of 100 fL over a frame, then all of that light must be delivered in one pixel-time, and the instantaneous luminance of the pixel is approximately $100 \times 307,200 \approx 30 \times 10^6$ fL (ignoring things like flyback times).

There is no meter available with this kind of range: 100,000:1. If the meter is set to read 100-fL full scale, that instantaneous blast of light just overpowers it.

Quite a bit has been published about the eye's response to short pulses, and it turns out that the eye is considerably more flexible than an illumination meter. The research – including some done with very-short-persistence CRTs years ago at Zenith – indicates that a short pulse does not affect the perceived brightness.

The fundamental issue is reciprocity: If a stimulus is Bt, where B is the luminance and t is the time, is the response just proportional to Bt or does it depend on the values of B and t? The Zenith experiments showed that it's just a matter of Bt within the range that is most interesting to display makers, although at very low intensities there is a failure of reciprocity, and there is surely a failure at very high intensities.

Incidently, reciprocity works for photographic film as well as for the eye, and photographic reciprocity has been studied extensively. The standard photographic tactic of maintaining an exposure by halving the lens area (increasing f/stop by one) and simultaneously doubling the exposure time depends on the reciprocity of photographic film. Few people other than astronomical photographers – who sometimes expose film for hours using motor-driven camera mounts that can track a constellation across the sky – run into reciprocity breakdown in the photographic domain.

- Alan Sobel and Ken Werner

entire 6.75-m² screen, we can calculate a total illumination of 2200 lm. This value is very close to that predicted from the lasers' output power levels.

Color, Saturation, and Brightness

In addition to brightness, laser projection systems offer a unique color gamut because of the intense saturation simultaneously available for all three primaries with single-line light. This allows the display to show a greater range of saturated colors. This is beneficial for a variety of reasons, including the fact that highly saturated colors appear brighter than less-saturated colors with the same luminance, an observation first made by Chapanis and Halsey in 1955 (see note).

The narrow-band color produced by laser projectors comes very close to the peak absorption point of human light-sensing cones – at least for blue and green. Many systems use a narrow-band 532-nm green and a narrow-band 450-nm blue light along with a red near 624 nm. Some developers of laser projection systems think that the human eye's response to single-line color produces a "resonance" effect when the laser line coincides with the sensitivity peak of the eye's cones, and this heightens color perception. But the increase in perceived brightness may just be a consequence of increased saturation, as Chapanis and Halsey first reported years ago.

When a typical high-powered LCD projector - a BARCO 9100 that produced 2720 measured ANSI lumens - was set up to project side by side with a laser projector, the difference was dramatic. The laser projector produced colors that appeared far more saturated, and it seemed to match or exceed the BARCO's overall brightness. A comparison of measured CIE red, green, and blue endpoints for these projectors does not fully explain the large perceived color difference between the laser- and lamp-based systems, although the measured endpoints are very different.

One explanation might involve the different white points of the two systems. *Journal of the SID* editor Alan Sobel observes, "The higher the color temperature (the 'bluer' the white), the brighter the display appears to be." An additional phenomenon might have con-

The Smart Choice in Multi-Function Video Generators

ASTRO VG-823



Dot Clock to 250 MHz Horizontal Scan to



Operated directly from a PC or with "Remote" Frontpanels



Compact/High Performance

255KHz

256 Levels at all Frequencies



If you want a very flexible Video Generator, the Astro VG-823 is a high performance, lightweight and compact unit that offers the capability to test any high resolution display system up to 1600x1280 at high refresh rates.

With a RB-649 controller it's a bench top video generator. With the RB-614C Remote Box it's perfect for the manufacturing area and it can easily be programmed and operated from a PC via RS-232C—that's true multi functionality.

Make the *Smart Choice*... Contact TEAM.

Call **1-800-338-1981** or visit us at http://www.team-systems.com



display measurements

tributed to the overall effect. The coherent laser light can interfere with itself inside the eye, producing tiny beat patterns that are seen as points of flashing light. These patterns, called "speckle," can even be perceived by people with terrible vision, because they occur within the eye itself.

It would be very interesting to try an experiment with human observers to determine how bright laser colors appear, with and without speckle, in comparison to broader-band filtered light. Light from a laser projector that is perceived as "white" (Fig. 3) is very different from an LCD-projector "white" (Fig. 4), and it is possible that these different types of waveforms, which have their counterparts in many of the colors actually shown on displays, can stimulate the eye differently. It is interesting to ask whether the subjectively greater color saturation of laser projectors is primarily the result of narrow-band excitation itself or is speckle involved?

Conclusion

Manufacturers of projection systems have long traded off color saturation, contrast, and other image-quality parameters for illumination. Laser projectors seem to verify the predictions of Chapanis and Halsey that deep color saturation can be worth a substantial tradeoff in illumination.

Note

Alphonse Chapanis and Rita Halsey, "Luminance of Equally Bright Colors," *J. Opt. Soc. Am.* **45**, No. 1, 1 (January, 1955). The paper describes an experiment in which a group of subjects reported that highly saturated colors look as bright as less-saturated colors with almost twice the luminance.

IDRC '97

17th International Display Research Conference Toronto, Canada

September 15–19, 1997

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

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

Circle no. 23

SID '98

Symposium, Seminar, and Exhibition Anaheim, California Anaheim Convention Center May 17–22, 1998

Circle no. 22

ONE RELIABLE SOURCE FOR TWO DISPLAY TECHNOLOGIES

CRT

STATE OF THE ART CRT TECHNOLOGY

The leader in CRT design and manufacturing since 1948, Thomas offers the greatest breadth of designs of any CRT producer. Thomas CRT's are used with confidence in high performance display systems that service the military, commercial, and industrial markets worldwide.

Our engineering staff is the largest in the industry dedicated to the design and support of special purpose CRTs in all sizes from miniature to large area. Typical CRT applications include Automotive, Avionics, Infrared Imaging, Medical Imaging, Photo-Imaging, Projection, Test Instruments and Virtual Reality, among others. Our products are produced at three fully integrated manufacturing plants guaranteeing our customers multi-source protection with single source procurement.

Please contact us to learn more about how our design and manufacturing capability can fulfill your CRT requirements.

LCD BACKLIGHTING

THOMAS FLAT LAMPS® OFFER MANY UNIQUE ADVANTAGES

For applications with color LCD displays for military, medical, as well as commercial ATM displays, Thomas flat fluorescent lamps are designed to eliminate problems associated with other LCD backlights. They offer many unique advantages such as state-of-the-art brightness, efficiency, and uniformity demanded today.

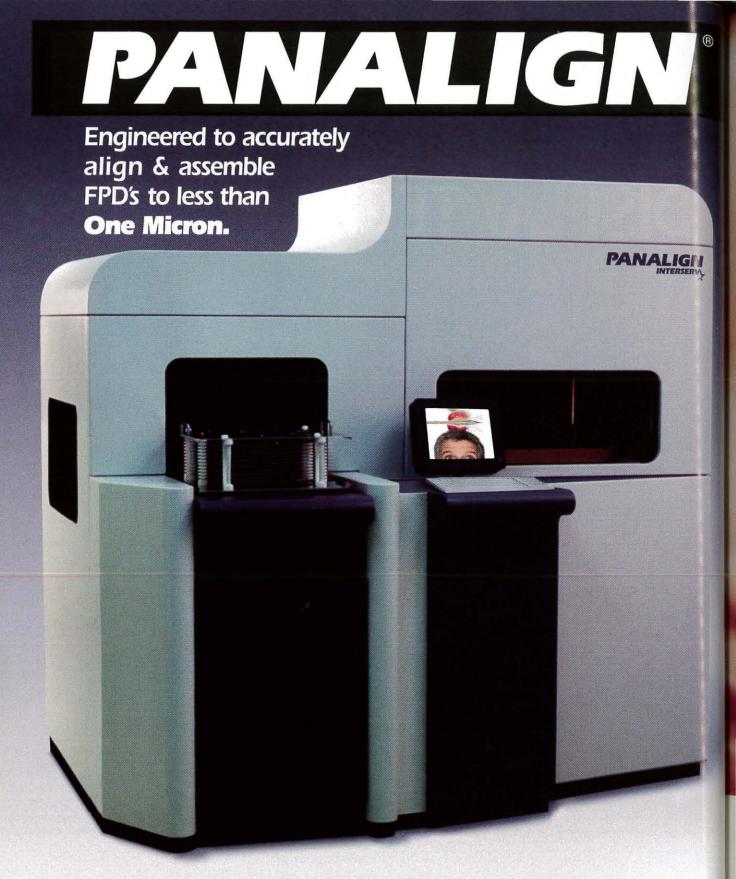
Advantages include compact spacing between adjacent discharge length, unique HG vapor control feature that guarantees high luminous efficiency, and ultra compact design that minimizes non-useful area, especially at the borders. All with minimal tooling and set-up costs. And there's no need to change the operational voltages or currents to enjoy the benefits of Thomas' Flat-Lamp technology. You can use the same cathode (hot or cold) and same discharge parameters used with conventional tubular lamps. So make Thomas Flat-Lamps your backlights to the future, today.

THOMAS ELECTRONICS

Thomas Electronics, Inc., 100 Riverview Drive, Wayne, New Jersey 07470. (201) 696-5200. Fax: (201) 696-8298. www.thomaselectronics.com e-mail: sales@thomaselectronics.com or eng@thomaselectronics.com

Circle no. 24

CLEAR VISION BY DESIGN



For accurate alignment with uniform cell gap, PANALIGN is the only system to aim for.

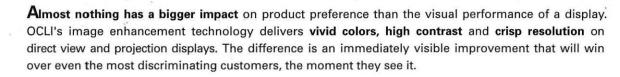
- +/- One micron alignment
- Uniform cell-gap
- Hi throughput
- Field proven
- Fully automatic or manual
- Controlled process variables
- Graphical user interface
- Substrates up to one meter
- R&D or inline production





From the day we're born, we go into the world looking for what we want **With our eyes**.

ENHANCEMENT



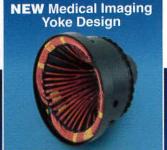
Contact us for more information: www.ocli.com USA (707) 545-6440 (888) 312-0848 EUROPE (49) 6162-93030 JAPAN (81) 3-3225-8974

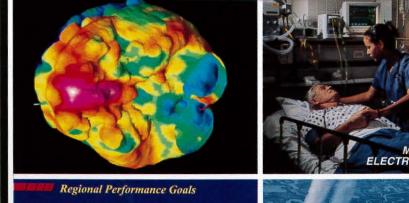
Circle no. 26



Worldwide Leader In CRT Deflection Component Development And Manufacture.

For nearly a half century, Syntronic has specialized in the design and manufacture of deflection yokes, focus coils, beam alignment/shaping coils and precision alignment devices for CRT displays. Syntronic's innovative, diverse components are widely used within high tech military avionics, helmet mounted/miniature displays, flight simulation systems, film processing/ imaging and high resolution medical monitor applications. The Syntronic "distributed" saddle coil/bell core yoke is a new concept in beam deflection design for the high resolution large screen CRT monitors. Superior Display Systems require the best deflection components ... Syntronic's products and advanced technology are recognized throughout the world for unsurpassed quality performance.





Gathered from District Managers Based on current sale plus 15% growth - conservative estimate - sales goals will be set to exceed these levels Will be reviewed at





PHONE, FAX OR E-MAIL US TODAY - WE'LL HELP YOU GAIN THE COMPETITIVE EDGE YOU NEED!

INSTRUMENTS, INC. 100 Industrial Rd. • Addison, IL 60101 • Phone: 630-543-6444 • FAX: 630-543-0287 INSTRUMENTS, INC.

EASTERN REGIONAL OFFICE : 30 TWO BRIDGES ROAD, STE 330 • FAIRFIELD, NJ 07004 • PHONE, 201-808-6676 • FAX, 201-808-6860 WESTERN REGIONAL OFFICE: 28202 CABOT RD., STE 250 • LAGUNA NIGUEL, CA 92677 • PHONE, 714-365-1337 • FAX, 714-365-1341

High Quality Hot Bar Bonding

Patented Technology and Process Expertise from Toddco General

Advanced Technology

- All Ceramic Hot Bars
- Pulse or Constant Heat
- Improved Quality and Yield

Features Common to All Our Bonders

- Pulsed, constant, or hybrid heat modes
- ACF, heat seal or solder
- All-ceramic hot bars-uniform thermal distribution, stays very flat
- Extra thermocouple ports for process development
- Real-time display of process and control variables
- Automatic recording of bond data
- Custom fixturing available
- Profiles compatible across full line of bonders (17 models)

RSM 2200 Features

- Flex or connector to PCB
- Microprocessor control of pressure, temperature and time
- Multiple, selectable profiles
- Automation options
- Inspection system
- Vision image system
- Crosshair generator
- Off-line graphical programming software

ACF 6000 Features

- TAB to glass
- TAB to PCB
- Glass to 425 mm on edge
- Semi-automatic TAB alignment
- Automatic camera position
- Camera inspection above or below
- Fine pitch <70 micron</p>
- Graphical user interface
- Teach mode programming



RSM 2200

Two Head Bonder with Rotary Table

ACF bond or solder two products while loading and unloading two.



Fine Pitch Anisotropic Film Bonder

Automated functions reduce process variation, improve quality.

Turn Key Systems Available

Call today to get more information. Ask for your FREE short form catalogue.



TODDCO GENERAL, Inc. 7888 Silverton Ave., Suite A San Diego, CA 92126, USA (619) 549-9229 • (619) 549-2162 FAX Email: toddco@toddco.com http://www.toddco.com

Superior clarity, right in the palm of your hand.

Only Klein Optical has this finely calibrated, handheld instrument which measures convergence error between colors on CRT displays. It's easily manipulated to identify the degree of error, placing superior clarity right in the palm of your hand.

Also available are Klein's IMX, MX and GMX Inspection Microscopes modified to enhance CRT phosphor and faceplate inspection. They allow you to view your CRT like never before, with powers of 25x and 50x.

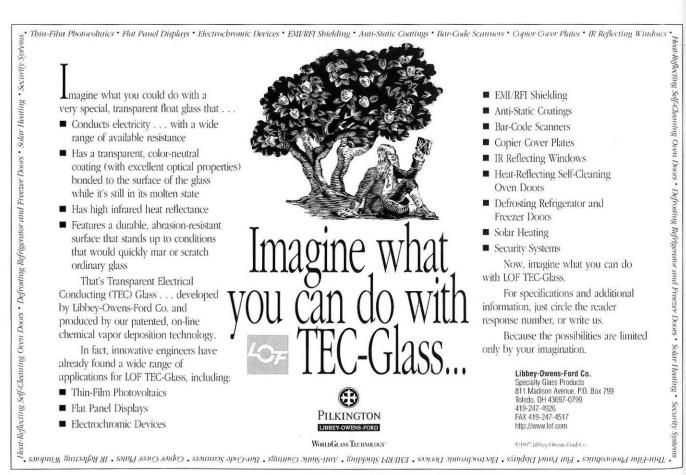
More information on Klein's advance quality assurance products is just a phone call away. We'd love to hear from you.



phone 503-245-1012

8948 S.W. Barbur Blvd, Dept. 100 Portland, OR 97219 USA FAX (503) 245-8166

Circle no. 29



Circle no. 30

data bank

Industry Directory

ID's eleventh annual directory of the display industry.

COMPILED AND EDITED BY THE EDITORIAL STAFF

Part I, beginning on this page, is a listing of products and services relevant to the display industry. Part II, the company directory, begins on page 50.

Part I: Products and Services

ANTIREFLECTION COATINGS See optical coatings

ANTIREFLECTION SCREENS

See filters

ANTISTATIC CHEMICALS AND DEVICES

□ ACL/Staticide □ Exxene □ Homalite □ Ion Systems □ Lamination Technology □ Screen Shield □ Tech Spray □ Teknek Electronics □ 3M Electronic Products □ 3M Product Information □ UNIAX □ Viratec

ASSOCIATIONS AND PROFESSIONAL SOCIETIES

□ ALCOM □ American Institute of Small Business □ Display Works □ Human Factors Society □ Instrument Society of America □ National Computer Graphics Associates □ Society for Information Display □ SPIE □ SPSE □ Univ. of Michigan □ VESA

BACKLIGHTS (for liquid-crystal displays)

AlliedSignal D Astra Products Axonix BKL Briteview Technologies D Craft Data Ltd. D D&T Dolch Computer Dynamic Displays CRL CTX Opto Diamond Tech One D Dimension Technologies Display Engrg. D Display Systems Earth Computer D EG&G Optoelectronics
 Elform
 ELtech □ Electro-Optics □ Eurecran □ Flat Candle □ Flat Panel Display □ Futaba America C General Electric C Ginsbury D H-P D IEC D Image Quest Imaging & Sensing IST Jaco
Electronics JKL Components Korry Electronics D Lamination Technology Lamplighter Industries Landmark Technology
LCD Lighting
Linfinity
Loct te
LSI
L-3 Communications Lumitex D Milgray Electronics Modutec D National Research Resources D National Semiconductor D Pacifio Technologies D Performance Display Systems D Precision Lamp

□ Racal Acoustics □ Racal-Mesl □ Raytheon □ Regisbrook □ Reynolds Industries □ Rikei Corp. □ SAIC □ SAI⁺ Technology □ Seiko Instruments □ SI Diamond □ I. I. Stanley □ Stanley Electronics □ Three-Five Systems □ 3M Optical Systems □ 3M Product Information □ Transicoil □ Ushio America □ Visus □ VL Electronics □ Voltarc Technologies □ Wedgelight □ Winsor □ World Products □ Wyle Electronics □ XTEK

BALLASTS

U WPI Electronics

BARCODE READERS

Electro-Optics
 Minolta
 Optical
 Electronics
 Panasonic Industrial
 Pentax Teknologies
 Percon
 Spectra-Physics

CATHODE COMPONENTS

□ Eldor □ General Vacuum □ Incom □ Intevac □ Kurt J. Lesker Co. □ Mushield □ Philips Display Components □ SI Diamond □ UTI Corp. □ VDC (Apex) □ VDC (Southwest Vacuum)

CCD IMAGERS AND CAMERAS

American ELTEC D Ball Aerospace □ Burle Industries □ CID Technologies Circon ACMI Coreco Data Plus Display Labs DynaColor Eastman Kodak 🗆 EEV 🗆 EEV Ltd. 🗆 EG&G Optoelectronics D EG&G Reticon □ Electro-Optics □ Incom □ Instrument Systems D Kollmorgen D Kontron Lighting Sciences Loral Fairchild McMahan Electro-Optics
 MegaVision
 Mekel Engrg.
 Milgray Electronics
 Optical Radiation
 Optronics D Philips Components D Photometrics D Pulnix America D Raytheon D Sarnoff Research Center
Security Defense
Systems
Security Defense
Systems
Security Defense Device Group □ Symco □ Telesensory □ Vanzetti Systems □ Wyle Electronics Xvbion

CHARACTER RECOGNITION DEVICES

□ Coreco □ CRL □ Eastman Kodak □ Jaco Electronics □ OAI □ Physical Optics □ Sharp Digital Information Products □ Telesensory □ Voice Connexion □ Xerox Imaging Systems

CID IMAGERS AND CAMERAS

□ CID Technologies □ Digital Vision □ Raytheon

CLEANING AGENTS

□ Applied Technology □ Arizona LCD □ Borer Chemie AG □ 3M Product Information □ Valtech

COLOR MATCHING SYSTEMS

□ Color Technology Solutions □ Electronic Image Systems □ Electro-Optics □ Graseby Optronics □ Minolta □ Photo Research □ 3M Product Information

COMPUTER VIDEO INTERFACES

AVED L Cambridge Research
 Covid L Data Plus D Densitron
 Digital View Eaton PSD
 Electrohome Epson America
 Extron D Fakespace G Genesis
 Microchip Kent Displays Laversab
 Luminary Technologies Miligray
 Electronics Mintronix PsiTech
 Racal-Mesl RGB Spectrum SAIC
 SI Diamond D Simtech 3M Product
 Information Univision ViewTEK
 WACOM Westar Wyle
 Electronics

CONNECTORS AND SOCKETS

□ Caton Connector □ Elastomeric Technologies □ Elform □ Eurecran □ Fujipoly America □ General Atronics □ Hoffman Engrg. □ Hosiden America □ HP Reid □ ITT Cannon □ Jaco Electronics □ Pacific Technologies □ Raytheon □ Reynolds Industries □ Stan-Allen □ Teledyne Kinetics □ 3M Electronic Products □ 3M Product Information □ Uniglobe Kisco □ Young Technology

CONSULTANTS

□ Abbie Gregg □ ALCOM □ Applied Technology □ ARD □ Arizona LCD □ ASM America □ AVT □ AZ LCD □ David Baldauf □ Leo Beiser □ Beta Products □ Carroll Consulting □ Color Technology Solutions □ Constellation □ CSERIAC □ Display Engineering □ Eagle Magnetics □ Electronic Image Systems □ Ergonomics □ Ergosyst Associates □ FAI □ Flatscreen Technologies □ H. L. Funk □ Future Focus □ Jerold Gard □ GEC Hirst Research Centre □ H. W. Grossbohlin □ Joe Hallett & Associates □ Walter Hett & Associates D Mary Hodges D Hornell Automation D Interlingua D Kahn Intl. □ Kamstra Communications □ Kenix Industries D Bernard J. Lechner □ Machine Vision and Control Intl. □ Machover Associates □ Manx Research D Matrix Components McLaughlin Consulting Group
 Meissner & Wurst
 MIRC
 Monterey Technologies
 National Research Resources D Nutmeg Consultants D O'Mara & Associates □ Optis □ Optics 1 □ Pacific Media Associates □ Pacifio Technologies Pearson & Associates
 PEMM Services D Phosphor Technology D Pixel Interconnect
Rainbow Optics
Scott Redmond □ Louis Budzinsky Associates D Peter Seats D Alan Sobel D Solomon Technology D Stereomedia D Tannas Electronics
Tech-Com
Technology Transfer Institute
Telic Optics 3D Imagetek
 3DTV
 Tyson Consulting Group □ UCE □ Aron Vecht & Associates D VDC (HQ) D Visus Westland Electronics

CONVERTERS, DIGITAL/ANALOG

□ AVED □ Best Power Technology □ Calspan SRL □ Cardion Electronics □ Colorado Video □ Data Translation □ Digital View □ Digital Vision □ Digital View □ Digital Vision □ Display Labs □ Grass Valley Group □ Infax □ Info-Lite □ Interaction Systems □ Jaco Electronics □ Kollmorgen □ Linfinity □ Luminary Technologies □ Mekel Engrg. □ Ornega Electronics □ Rantec □ Raytheon □ Recognition Concepts □ ViewTEK □ Westain □ Wyle Electronics □ Xentek Vamaha Systems Technology

CONVERTERS, DIGITAL/VIDEO

□ AVED □ Best Power Technology □ Calspan SRL □ Colorado Video □ Coreco □ Data Translation □ Digital Vision □ DRS Military Systems □ Extron □ General Electric □ Grass Valley Group □ Hitachi Denshi America **□ Jaco** Electronics □ Raytheon □ RGB Spectrum **□ ViewTEK** □ Wyle Electronics

CONVERTERS, POWER

□ Advanced Conversion □ AHV □ Astrosystems □ Best Power Technology □ Del Electronics □ Endicott □ Hyacinth Technology □ Jaco Electronics □ Lorad Power Systems □ Pacífio Technologies □ Swiss Controls □ TDK □ Toko America □ World Products □ Zytronics

CRT DESIGN SERVICES

□ Astronautics □ Brimar □ Display Labs □ Electrohome □ Hughes Lexington □ IST □ Jaco Electronics □ Milgray Electronics □ Planar Advance □ Raytheon □ Sascal Displays □ Syntronic □ Teltron □ Thomas Electronics □ VDC (HQ) □ VDC (Teltron) VDC (Z-Axis) □ Zenith Electronics

CRT DISPLAYS

See also large-screen displays, projection displays, simulator displays, 3D display systems, touch interactive displays, deflection yokes, electron guns, focus coils, glass for CRTs

CRT monitors, full color

ADT Astronautics AVT Aydin Corp. □ Barco □ Barco Chromatics □ Barco Display □ Barco Video & Commun. I Burle Industries I Calcomp 🗆 Canadian Marconi 🗆 Candescent Technologies
Capetronic
Cardion Electronics Citronix Craft Data. Inc. Data Ray Digitran Display Technologies 🗆 Dotronix 🗆 Dynamic Displays Eaton IDT EDL Displays Electrohome
 Electronic Image Systems
Electro-Optics
Elographics
FIMI Philips General Electric Ginsbury Gritz's Emporium D Honeywell D IBM Ikegami Electronics I Image Systems □ Infodex □ Intecolor □ Interstate Electronics D Jaco Electronics C Keltron C Kristel C Lockheed Sanders L-3 Communications D Manitron Displays I Marshall Industries Hatsushita HicroTouch Systems Milgray Electronics I Mitsubishi Electronics America C Moniterm C MTL Systems D Nortech Engineering D Nortech Imaging D Orwin Associates D Panasonic Communications & Systems Panasonic Computer Peripherals D Panasonic Industrial D Pegasys Displays D Philips Consumer Electronics □ Philips Display Components □ Pixelink □ Planar Systems □ Precision Imaging □ Rasterops □ Raytheon □ Relisys □ Richardson Electronics □ Sampo America □ Sarnoff Research Center □ Sascal Displays □ Siemens AG Sony Sony Display Device Group □ Sony Graphic Display □ Stanley Palmer
Symco
Systems Research
Labs
Tatung
Tektronix
Thomson Components & Tubes □ Thomson-CSF □ Thomson Tubes Electroniques □ Toshiba America □ Totoku Electric Touch Controls Ultimate Display Solutions D Unigraf D Vidiwall D Vivitek U Wells Gardner U Wyle Electronics UVDC (Z-Axis)

CRT monitors, high-resolution (1024 x 768 and over)

□ Advanced Video Products □ Apricot Sigmex □ Astronautics □ AVT □ Aydin Corp. □ Barco □ Barco Chromatics □ Barco Display □ Barco Video & Commun. □ Candescent Technologies □ CeLCO Pacific □ Clinton Electronics □ CELCO Pacific □ Clinton Electronics □ Cerrerstone Technology □ CRT Intl. □ Dage-MTi □ Data Plus □ Data Ray □ Digitra □ Display Technologies □ Display Tek □ Dotronix □ Dynamic Displays □ EDL Displays □ Electrohome □ Electronic Image Systems □ Elographics □ Evans & Sutherland

Computer D FIMI Philips D Ginsbury 🗆 Honeywell 🗆 IBM 🗆 Ikegami Electronics I Image Systems I Imaging & Sensing I Infodex I Intecolor Interstate Electronics I IST I Jaco Electronics C Kristel C Litton Electron Devices
Lockheed Sanders
L-3 Communications Systems
Manitron Displays D MicroTouch Systems Milgray Electronics I Mitsubishi Electronics America
Moniterm
MTL
Systems
Mational Semiconductor Nortech Engineering D Nortech Imaging C Orwin Associates C Panasonic Computer Peripherals D Panasonic Industrial D Pegasys Displays D Philips Consumer Electronics D Philips Display Components □ Pixelink □ Plessey Naval Systems D Precision Imaging □ Rasterops □ Raytheon □ Relisys Richardson Electronics
 Sampo America D Sarnoff Research Center Sascal Displays Siemens AG Sony Sony Display Device Group Sony Graphic Display Stanley Palmer D Systems Research Labs □ Tatung □ Tektronix □ Teltron □ Thomson-CSF □ Thomson Tubes Electroniques D Toshiba America Totoku Electric Touch Controls Ultimate Display Solutions Unigraf

CRT monitors, monochrome

ADT Advanced Video Products Astronautics AVT Ball Aerospace D Burle Industries D Calspan SRL Capetronic Cardion Electronics Clinton Electronics C Cornerstone Technology CRT Intl. CRT Scientific Dage-MTI Data Plus Data Ray Digitran Display Technologies Dotronix D Dynamic Displays
 Electrohome Electronic Image Systems D El-Op Electrooptics Industries ETC Computer
 General Electric
 Ginsbury
 Gritz's Emporium □ Honeywell □ IBM □ Ikegami Electronics I Image Systems I Imaging & Sensing □ Infax □ Infodex □ Interstate Electronics □ IST □ Jaco Electronics C Keltron C Kristel Lockheed Sanders L-3 Communications D Manitron Displays □ Moniterm □ National Semiconductor □ Noritake Imaging □ Opto-Cal □ Orwin Associates D Palomar Products Panasonic Industrial
 Pegasys
 Displays
 Philips Consumer Electronics Philips Display Components
 Pixelink D Plessey Naval Systems D Precision Imaging D Rasterops D Raytheon □ Relisys □ Richardson Electronics Sampo America SAMTEL USA Sarnoff Research Center D Sasca Displays
Siemens AG
Sony Display Device Group
Stanley Palmer Symco Systems Research Labs □ Tatung □ Tektronix □ Teltron Thomson Tubes Electroniques □ Toshiba America □ Totoku Electric TSD Display Products D VDC (Z-Axis) U Wells Gardner

CRTs, beam-index

□ CRT Intl. □ Digitran □ Electronic Image Systems □ Ginsbury □ Honeywell □ Keltron □ L-3 Communications □ Planar Advance □ Raytheon □ Sarnoff Research Center □ Sony Display Device Group □ Thomas Electronics □ Thomson Components & Tubes □ Thomson Tubes Electroniques

CRTs, conventional

ADT Aydin Corp. D Brimar D Burle Industries Canadian Marconi Cardion Electronics Clinton Scientific Digitran Dotronix DEDL Displays C EEV Ltd. C Electronic Image Systems
General Atronics
General Electric Ginsbury Honeywell □ Ikegami Electronics □ Imaging & Sensing □ ISE Electronics □ IST □ Matsushita □ MicroTouch Systems □ MII □ Milgray Electronics Mitsubishi Électronics Sales America Moniterm
 MTL Systems D Panasonic Industrial D Planar Advance □ Pegasys □ Raytheon □ Richardson Electronics D Rockwell Intl. D SAMTEL USA I Sarnoff Research Center I Sony Display Device Group D Stanley Palmer □ Tektronix □ Teltron □ Thomas Electronics C Thomson Components & Tubes
Thomson Tubes Electroniques
Toshiba America
VDC (Chroma) □ VDC (Data Display) □ VDC (Teltron) UVDC (Video Electronics) UVidiwall □ World Products □ Zenith Electronics

CRTs, flat

□ Advanced Video Products □ AVT □ Aydin Corp. □ Clinton Electronics □ CRT Intl. □ CRT Scientific □ Digitran □ Dotronix □ EDL Displays □ EEV Ltd. □ Electronic Image Systems □ Futaba □ Ginsbury □ Honeywell Defense Avionics □ Ikegami Electronics □ Infodex □ Jaco Electronics □ MicroTouch Systems □ MTL Systems □ Milgray Electronics □ Mitsubishi Electronics Sales America □ Panasonic Computer Peripherals □ Panasonic

Industrial D Planar Advance D Raytheon Didustrial D Planar Advance D Raytheon D Richardson Electronics D Sarnoff Research Center D SI Diamond D Sony D Sony Display Device Group D Teltron D Thomas Electronics D Toshiba America D VDC (Teltron) D ViewTEK D Wyle Electronics D Zenith Electronics

CRTs, miniature

□ ADT □ Brimar □ Burle Industries □ CRT Intl. □ CRT Scientific □ Digitran □ Dotronix □ EEV Ltd. □ Electronic □ mage Systems □ General Atronics □ Ginsbury □ Gritz's Emporium □ Honeywell □ Hughes Lexington □ Imaging & Sensing □ IST □ Litton Electron Devices □ MicroTouch Systems □ Panasonic Industrial □ Planar Advance □ Raytheon □ Richardson Electronics □ Sarroff Research Center □ Sony Display Device Group □ Stanley Palmer □ Thomson Tubes Electronics □ Thomson Tubes Electronics

CRTs, multibeam

□ CRT Intl. □ Digitran □ General Atronics □ Ginsbury □ Honeywell □ Hughes Lexington □ Infodex □ Litton □ Richardson Electronics □ Sarnoff Research Center □ Sony Display Device Group □ Teltron □ Thomas Electronics □ Thomson-CSF □ Thomson Tubes Electronics □ VDC (Teltron)

CRT MATERIALS

See individual listings for filters, getters, glass, magnetic shielding, materials, optical coatings, phosphors, polarizers

CRT TESTING LABORATORIES

□ Citronix □ Display Labs □ DynaColor □ Erogonomics □ Gamma Scientific □ MECC □ Thomas Electronics □ TÜV Rheinland

DEFLECTION AMPLIFIERS

□ Astronautics □ Brimar □ CELCO □ CELCO Pacific □ Citronix □ Ginsbury □ Infodex □ MECC □ Motorola □ National Semiconductor □ Orwin Associates

DEFLECTION YOKES

□ CELCO □ Display Components □ DynaColor □ EEV Ltd. □ Eldor □ Ginsbury □ Infodex □ K & R Engrg. □ Panasonic Industrial □ Philips Display Components □ Sampo □ Sarnoff Research Center □ Sony Display Device Group □ Stanley Palmer □ Syntronic Instruments □ Totoku Electric □ WinTron

DEPOSITION EQUIPMENT

□ Applied Films □ Applied Technology □ Balzars Process Systems □ BOC Coating Technology □ CRL □ Diamond Tech One □ Edwards □ FAS Technologies □ General Vacuum □ Innotec □ Intevac □ Kurdex □ Materials Research Corp. □ SI Diamond □ Specialty Coating Systems □ Spectrum Sciences □ Temescal □ TSC

N L N

T

D

ę

1 [

DEPOSITION SERVICES

Applied Films
 Dynapro
 Edwards
 Florod
 General Vacuum
 Intevac
 Kurdex
 Speciatry Coating Systems
 Thin Film
 Technology
 Thomas Electronics
 VDC (Teltron)

DIGITAL FILM RECORDERS

□ CELCO Pacific □ CRT Intl. □ Eastman Kodak □ ECRM Trust □ Ektron Applied Imaging □ Hybrid Micrographics □ Imapro □ Lasergraphics □ Management Graphics □ Mekel Engrg. □ Polaroid □ Tartan Technical □ 3M Product Information

DIGITAL VIDEO SYSTEMS

□ Burle Industries □ Colorado Video □ CRT Intl. □ Digital Vision □ Dynair □ Eastman Kodak □ Eltime Vision Systems □ Genesis Microchip □ Grass Valley Group □ Honeywell □ Incom □ Infodex □ Innovated Image □ Mekel Engrg. □ Primagraphics □ PsiTech □ Sarroff Research Center □ SI Diamond □ Simtech □ Teledyne Electronic □ Texas Instruments □ 3M Product Information □ Univision □ VDC (Teltron) □ VDC (Z-Axis) □ Virtual Vision

DIGITIZING TABLETS

Calcomp Dynapro BBM
Numonics Scriptel SMART
Technologies Summagraphics
WACOM

DISABLED DISPLAY USER AIDS

Enabling Technologies
 Regisbrook
 Telesensory

DISPENSER CATHODES

□ Electronics Sources □ Formosa Advanced Tech. □ Raytheon □ Semicon Associates □ Sony Display Device Group □ Thomas Electronics

DISPLAY DRIVERS AND CONTROLLERS

Advanced Conversion D Anorad Astronautics Avalex AVED Barco D Barco Chromatics D Barco Display Cambridge Research Chips & Technologies
Girrus Logic
Computer Dynamics
Craft Data, Inc. Craft Data Ltd. CRL Densitron Diagnostic/Retrieval Systems Diamond Tech One Digital View Digitran Display Systems Dolch Computer DDRS Military Systems ☐ EG&G Power Systems □ Epson America □ F-P Electronics □ Gennum General Digital Honeywell Iníodex I International Micro I Jaco Electronics C Kent Displays Lockheed Sanders Luminary Technologies Marshall Industries MECC Metheus Milgray Electronics C Mintronix C Moniterm Motorola D National Research Resources D National Semiconductor □ Night Vision Corp. □ Omega Electronics D Photonics Systems D Pixelink D Primagraphics D PsiTech D Pulseview D Racal-Mesl □ Regisbrook □ RGB Spectrum Bytrak Sage SI Diamond Smart Alec S S-MOS Supertex □ Tektronix □ Texas Instruments Japan □ Thomson-CSF Services □ Trident Microsystems D Unigraf D Univision □ Versatec □ Vidiwall □ ViewTEK □ Westar D Western Digital D Wyle Electronics D Xentek D Yamaha Systems Technology

DISPLAY HOUSING, RUGGEDIZED

DADT DAstronautics DAVED DAVT Barco Chromatics Barco Display □ Burle Industries □ Calspan SRL Craft Data, Inc. Crystaloid D D&T Diagnostic/Retrieval Systems Digital View □ Digitran □ Display Systems Dolch Computer DRS Military Systems
Eaton PSD
Electrohome EI-Op Electrooptics Eurecran □ General Digital □ Ginsbury □ Honeywell □ Image Quest □ Infodex □ Jaco Electronics □ LCSP-Deeco □ L-3 Communications □ Marshall Industries D Milgray Electronics □ Mushield □ Nortech Engineering D Photonics Systems D Plessy Naval Systems D Precision Imaging D Racal Acoustics D Raytheon D Regisbrook Retroscan SAIC SAI Technology □ Sascal Displays □ Stanley Palmer □ Tektronix □ Thomson-CSF Services UVDC (Data Display) UVDC (Teltron) D ViewTEK

DISPLAY SIMULATION AND MODELING SYSTEMS

□ ADT □ ALCOM □ autronic □ Coryphaeus □ Diagnostic/Retrieval Systems □ DRS Military Systems □ Evans & Sutherland Computer □ Hitachi Denshi America □ Hughes LV Products □ Infodex □ Liberty Mirror □ Milgray Electronics □ MTL Systems □ Optis □ Sarnoff Research Center □ Shintech □ Star Technologies □ Shintech □ Star Technologies

DISPLAY SUBSYSTEMS

DC

up

□ AED □ Aerospace Display Systems □ Astronautics □ AVED □ Babcock □ Balzars AEG □ Balzars Thin Films □ Barco □ Barco Chromatics □ Barco □ bsplay □ Calspan SRL □ Cambridge Research □ Clinton Electronics

Computer Dynamics Craft Data, Inc. Craft Data Ltd. CRL D&T Densitron Diagnostic/Retrieval Systems Diamond Tech One Digital View Dimension Technologies Display Systems Dolch Computer DOME E Eaton PSD E EG&G Optoelectronics
Fakespace
General Digital C Genesis Microchip I Infinity Multimedia D Interface Products D Jaco Electronics C Kent Displays C Korry Electronics D Litton Systems Canada Mark IV Industries Marshall Industries I Milgray Electronics □ National Research Resources □ Night Vision Corp.
Nortech Engineering
Optical Devices
Optical Radiation Optotek D Palomar Products Performance Display Systems Photonics Systems
 PixelVision
 Positive Technologies
 Quantum Electronics D Racal-Mesl D Raytheon □ Regisbrook □ RGB Spectrum □ Sage □ SAI Technology □ Silicon Light Machines □ Teledyne Electronic □ Texas Instruments D Thomas Electronics □ Thomson-CSF Services □ UCE UNIAX U Univision U ViewTEK □ Vista Controls □ WACOM

DISPLAY SYSTEM INTEGRATORS

Astronautics AVED Barco Chromatics 🗆 Barco Display 🗆 Calspan SRL 🗆 Canadian Marconi 🗆 Carroll Touch □ Computer Dynamics □ Craft Data, Inc. DBI Densitron Diagnostic/Retrieval Systems Digital View Digitran Display Systems DRS Military Systems D Eastman Kodak D Eaton PSD D Elographics EI-Op Electrooptics Industries □ Eurecran □ Fakespace □ F-P Electronics D General Digital □ Honeywell □ Hoya Electronics □ Jaco Electronics C Kollmorgen C LCSP Deeco 🗆 Litton Systems Canada Lockheed Sanders L-3 Communications
Mark IV Industries □ Marshall Industries □ Milgray Electronics D National Research Resources D National Semiconductor Performance Display Systems D Photonics Systems D Planar Advance D Plessy Naval Systems D Quantum Electronics C Retroscan C Rockwell Intl. □ SAI Technology □ Sanders Associates □ Scriptel □ SEOS Displays □ SI Diamond D Smart Alec D Tech-Com Thomson-CSF Services Transicoil □ Unigraf □ Vidiwall □ ViewTEK □ Vista Controls □ Westaim □ Whittaker

DISPLAYS

See listings under specific technology, i.e., CRT, plasma, electroluminescent

DISTORTION CORRECTION DEVICES

□ Display Components □ Display Labs □ DynaColor □ Eldor □ Ginsbury □ Intronics □ K & R Engrg. □ Thomson-CSF

ELECTROCHROMIC DISPLAYS

□ Mito Fine Glass □ Polyvision □ 3M Product Information □ VDC (Teltron)

ELECTROLUMINESCENT DISPLAYS

□ Aydin Computer/Monitor □ Barco Chromatics □ Barco Display □ Canadian Marconi □ Capetronic □ Craft Data Ltd. □ Densitron □ Digitran □ Durel □ Earth Computer □ Eaton IDT □ Eldec

□ ELtech □ Electro-Optics □ Honevwell Defense Avionics D Hoya Electronics □ IEC □ IEE □ Infodex □ Interface Products
Interstate Electronics □ Kaiser Electronics □ Lamplighter Luxell I Marshall Industries I Milgray Electronics D National Research Resources I Night Vision Corp. I PEMM Services D Phosphor Products D Planar Advance D Planar America D Planar Intl. D Planar Systems D PPM Photomask D Pulseview D Quantex D Racal-Mesl Regisbrook D Rogers Corp. D Sarnoff Research Center D Seiko Instruments Sharp Digital Information Products □ Sharp Electronics □ Spire □ I. I. Stanley D Stanley Electric D Swiss Controls D Thomson-CSF D 3M Product Information C Transicoil C UNIAX UVDC (Teltron) WAMCO Westaim □ James Wilson □ World Products Wyle Electronics I XTEK

ELECTROMECHANICAL DISPLAYS

□ Astronautics □ Ametek Aerospace Products □ Densitron □ Digitran □ Displays Inc. □ Earth Computer □ F-P Electronics □ Honeywell Defense Avionics □ Infax □ Interface Products □ Korry Electronics □ Mark IV Industries □ Omega Electronics □ Pulseview □ Regisbrook □ Rockwell Intl. □ Sharp Digital Information Products □ Stan-Allen □ Thin Film Technology □ 3M Product Information □ Transicoii □ XTEK

ELECTRON GUNS

□ CRT Intl. □ General Atronics □ Innotec □ Kurt J. Lesker Co. □ Matrix Components □ Philips Components □ Raytheon □ Sarnoff Research Center □ SI Diamond □ Silicon Light Machines □ Sony Display Device Group □ Thomson-CSF □ **3M Product** Information □ VDC (Apex) □ VDC (Southwest Vacuum) □ VDC (Video Electronics) □ Zenith Components Group □ Zenith Electronics

ENCLOSURE DESIGN SYSTEMS

□ Eaton PSD □ Info-Lite □ Jaco Electronics □ MicroTouch Systems □ Mushield □ Retroscan □ Tech-Com □ 3M Product Information

EYE AND HEAD MOVEMENT TRACKERS

□ Applied Science Labs □ El-Op Electrooptics Industries □ Fakespace □ Honeywell □ ISCAN □ Night Vision Corp. □ Polhemus □ Rediffusion Simulation □ Reynolds Industries □ Sarnoff Research Center

FACSIMILE ("FAX") MACHINES

□ Canon, Inc. □ Eltime Vision Systems □ IBM □ Mitsubishi Electronics Sales America □ Relisys

FIBER-OPTIC FACEPLATES

□ Digitran □ Future Focus □ General Atronics □ Incom □ Lumitex □ Raytheon □ Schott Fiber Optics □ 3M Electronic Products □ 3M Product Information □ Transicoil

FIELD-EMITTER DISPLAYS

Candescent Technologies CRL

- Diamond Tech One
 Futaba America
 Motorola FPD
 MRS Technology
 Night Vision Corp.
 PixTech
- □ Planar Advance □ SI Diamond
- C Spire

FILTERS

American Polarizers Astra Products ADT D Balzers AEG D Balzars Thin Films □ Brewer Science □ ColorLink Crystaloid D&T D Denglas Denton Vacuum Dontech D E for M □ Flex Products □ Fosta-Tek □ Genesis Microchip
Ginsbury
Hoffman Engrg. □ Homalite □ Hoya Electronics □ Hoya Optics □ International Polarizers □ ITG □ Jaco Electronics □ Kaiser Optical □ Lamination Technology □ Liberty Mirror □ LMT □ Melles Griot □ Metavac □ Milgray Electronics □ Mito Fine Glass □ Nitto Denko □ NoRad □ O&S Research □ OCA □ OCLI □ Optical Devices
Opto-Cal
Panelgraphic Panelview Planar Advance Polaroid
 Precision Optical Filters
 Raytheon
 RMF Products C Rockwell Intl. C Romag Glass □ Schott Glass □ Screen Shield □ Silver Cloud Mfg.
Southwall Technologies
Stanley Palmer
Systems Research Labs D Thin Film Technology D Toko America I 3M Optical Systems I 3M Product Information
TSP U.S. Precision Glass
Viratec
WAMCO

FLAT-PANEL DISPLAYS

See individual listings for backlights, electroluminescent displays, electromechanical displays, electrochromic displays, field-emitter displays largescreen displays, light-emitting diode displays, liquid-crystal displays, plasma displays, filters, projection displays, simulator displays, 3D displays, touch interactive displays, vacuum fluorescent displays

FLAT-PANEL MATERIALS

See individual listings for masks, filters, glass, magnetic shielding, materials, optical coatings, photolithography equipment, polarizers

FOCUS COILS

□ CELCO □ Del Electronics □ Display Components □ Eldor □ Ginsbury □ George D. Harris Associates □ K & R Engrg. □ Raytheon □ Sarnoff Research Center □ Syntronic Instruments □ WinTron

GETTERS

□ Andrews Glass □ CRT Intl. □ Raytheon □ SAES Getters

GLASS FOR COMPONENTS

□ Andrews Glass □ Applied Technology □ Denton Vacuum □ Donnelly Applied Films □ Hoya Optics □ Lamination Technology □ Libbey-Owens-Ford □ Nippon Electric Glass □ OCLI □ Optical Devices □ Philips Components □ Precision Glass Technologies □ Raytheon □ Romag Glass □ Schott Glass □ VDC (Data Display) □ VIOX □ Viratec

GLASS FOR CRTs

□ Corning Asahi □ Donnelly Applied Films □ Hoya Electronics □ Hoya Corp. □ Lamination Technology □ Metavac □ MicroTouch Systems □ Mito Fine Glass □ Nippon Electric Glass □ 0&S Research □ Precision Electronic Glass □ Raytheon □ Schott Corp. □ Schott Glass □ SEM-COM □ Techneglas □ U.S. Precision Glass □ VDC (Video Electronics) □ Viratec

GLASS FOR FLAT-PANEL DISPLAYS

□ Applied Films □ Billco Mfg. □ Brewer Science □ Corning ADP □ Denglas □ Denton Vacuum □ Donnelly Applied Films □ EEV Ltd. □ E for M □ Flachglas AG □ Glaverbel □ Hoya Electronics □ Hoya Optics □ Lamination Technology □ Libbey-Owens-Ford □ Metavac □ MicroTouch Systems □ Mito Fine Glass □ National Research Resources □ Nippon Electric Glass □ O&S Research □ Optical Devices □ Planar Advance □ Planar Systems □ Romag Glass □ Rytak □ Scriptel □ Schott Corp. □ SEM-COM □ Three-Five Systems □ U.S. Precision Glass □ VIOX □ Viratec

GRAPHICS BOARDS AND PROCESSORS

American ELTEC Astronautics Avalex AVED Barco Barco Chromatics □ Barco Display □ Calcomp □ Calspan SRL □ Cambridge Research Chips & Technologies Computer Peripherals Coreco Crystal Vision Data Translation Densitron Diagnostic/Retrieval Systems DOME Evans & Sutherland Computer General Electric Honeywell Hybrid Micrographics
 IBM
 Imagraph
 Imapro
 Kollmorgen Lasergraphics L-3 Communications Luminary Technologies D Matrox Electronic Systems D Metheus D Nth Graphics D Omnicomp Graphics D Parallax D Pixelink D Polaroid □ Positive Technologies □ Primagraphics □ PsiTECH □ Racal-Mesl □ Rasterops □ Richardson Electronics □ Simtech □ Sony □ Sony Graphic Display □ Star Technologies
Tatung
Thomson-CSF Services
3M Product Information □ Trident Microsystems □ Unigrat Univision Vivitek Western Digital □ Yamaha Systems Technology

GRAPHICS SUBSYSTEMS

□ American ELTEC □ Astronautics □ AVED □ Barco □ Barco Chromatics □ Barco Display □ Calspan SRL □ Cambridge Research □ Densitron □ Diagnostic/Retrieval Systems □ L-3 Communications □ Positive Technologies □ Silicon Light Machines □ Thomson-CSF Services □ Univision

GRAPHICS WORKSTATIONS

□ Aydin Computer/Monitor □ Aydin Corp. □ Barco □ Barco Chromatics □ Barco Display □ Diagnostic/Retrieval Systems □ Eaton IDT □ Evans & Sutherland Computer □ Grass Valley Group □ Hughes LV Products □ IBM □ Laversab □ Lockheed Sanders □ Management Graphics □ McMahan Electro-Optics □ NuVision Technologies □ Primagraphics □ SAIC □ Sanders Associates □ Thomson-CSF □ 3M Product Information

HARD-COPY DEVICES

See individual listings for digital film recorders, facsimile machines, plotters, printers (impact, ink-jet, thermal-transfer, electrophotographic, color graphic), printer supplies, printheads

HOLOGRAPHIC LIGHT-SHAPING DIFFUSERS

IMAGE COMPRESSION

Genesis Microchip
Imagraph
PsiTech
Schott Fiber Optic
Symco
3M Product Information

IMAGE STORAGE

□ Colorado Video □ CRT Intl. □ Kent Displays □ Stereomedia □ Symco □ 3M Product Information □ VDC (Teltron)

IMAGE TUBES

□ Burle Industries □ CRT Intl. □ EEV □ EEV Ltd. □ Incom □ Kollmorgen □ Litton Electron Devices □ MII □ Panasonic Industrial □ Philips Components □ Sony Display Device Group □ Teltron □ Thomson Tubes Electroniques □ VDC (Teltron)

IMAGING BOARDS

American ELTEC
Barco
Computer Peripherals
Coreco
Crystal Vision
Data Plus
Data
Translation
DOME
DynaColor
Eastman Kodak
EPIX
IBM
Imagraph
Kollmorgen
Matrox
Electronic Systems
ORC Electronic
Philips Components
Primagraphics
PsiTECH
Sharp Digital Information
Products
Symco
Univision

IMAGING WORKSTATIONS

□ Advanced Video Products □ Decision Images □ Diagnostic/Retrieval Systems □ Genesis Microchip □ IBM □ Image Analytics □ Imagraph □ Kollmorgen □ Laversab □ Management Graphics □ McMahan Electro-Optics □ McMahan Research Labs □ MegaVision □ SAIC □ Sarnoff Research Center □ Sharp Digital Information Products □ Syntronic □ 3M Product Information □ Visual Information Technologies

JOYSTICKS

ADT Digitran D Jaco Electronics
 WICO

KEYBOARDS

□ ADT □ Computer Keyboards Systems □ Craft Data, Inc. □ Digitran □ Display Systems □ Futaba □ IBM □ IEC □ IEE □ Innovated Image □ Interface Products □ Jaco Electronics □ Korry Electronics □ Laversab □ Marshall Industries □ Panasonic Industrial □ Racal-Mesl □ Regisbrook □ Silver Cloud Mfg. □ Three-Five Systems □ Transicoil □ Two Technologies

LAMPS AND LIGHT SOURCES

□ autronic □ BKL □ Dialight □ Diamond Tech One □ EG&G Optoelectronics □ EG&G Power Systems □ Gamma Scientific □ Gordon Instruments □ ILC Technology □ Info-Lite □ Jaco Electronics □ LCD Lighting □ LSI □ Lumitex □ Man & Machine □ National Research Resources □ OAI □ Opto-Cal □ Optronic Labs □ ORC Lighting □ Pacific Technologies □ SAIC □ Seiwa Optical □ Schott Fiber Optics □ SI Diamond □ Teledyne Electronic □ UCE □ Ushio America □ Visus □ WAMCO □ Welch Allyn

LARGE-SCREEN DISPLAYS, ALL TECHNOLOGIES

See also projection displays

□ Adaptive Micro Systems □ Advanced Display Systems □ AEG □ Aydin Computer/Monitor D Barco Projection □ Barco Video & Commun. □ Capetronic Comfuture Convac-APT Cornerstone Technology Crystop Display Davies Densitron Digitran Display Tech Dolch Computer Dontech Dotronix EDL Displays Epson America Eurecran Evans & Sutherland Computer D Flat Panel Display D F-P Electronics D Fresnel Optics □ General Digital □ General Electric C Genesis Microchip C Hitachi America 🗆 Hitachi Denshi America Hudson Photographic Hughes-JVC □ Hughes LV Products □ IEC □ Incom □ Infinity Multimedia □ Innovated Image □ Infolex Corp. □ Jaco Electronics L-3 Communications Lamination Technology Man & Machine Micrion □ MicroTouch Systems □ Mito Fine Glass D Mitsubishi Electric Sales America C Moniterm C MRS Technology D NEC Electronics □ Noritake □ Nortech Imaging □ nView Omega Electronics Optical Radiation Optical Solutions
 ORC Electronic ORC Lighting
Palomar Products D Panasonic Computer Peripheral D Panelight D Performance Display Systems D Physical Optics D Plasmaco PPM Photomask D Prolux D Proxima D Pulseview D Quantum Electronics C Rasterops C Raytheon C Rediffusion Simulation
Regisbrook
Retroscan
Rytrak
SAI Technology
Sarnoff Research Center D SEOS Displays D SI Diamond I Silicon Light Machines Smart Alec I SMART Technologies Sony Sony Display Device Group □ Stereomedia □ Systems Research Labs D Tatung D Tech-Com D Tektronix Telesensory
 Telex Communications
 TDSD
 Texas instruments □ Thomson-CSF Services □ Thomson Tubes Electroniques
Tru-Lyte Systems UCE Varitronix Video Display Corp. □ Vidiwall □ Viratec □ World Products D Zenith Components Group

LIGHT-EMITTING DIODES AND LED DISPLAYS

□ Acculex □ Adaptive Micro Systems Astronautics Comfuture Craft Data Ltd. Daktronics Data Display Products
Dialight
Digitran
Display
Systems
Earth Computer
EG&G Optoelectronics
 Electro-Optics
 F-P Electronics
Future Focus
General
Electric
H-P
IBM
IEE
Incom □ Infolex Corp. □ Info-Lite □ Interface Products D Jaco Electronics D JKL Components D Litton Systems Canada □ Mark IV Industries □ Marubeni □ Milgray Electronics □ Modutec D Morrison Electronics D Nichia America □ Night Vision Corp. □ Optotek □ PPM Photomask D PRP Optoelectronics □ Pulseview □ Quantum Electronics Reflection Technology Regisbrook □ Seiko Instruments □ Smart Alec □ I. I. Stanley
Stanley Electric
Teledyne Electronic Technologies
Three-Five Systems I Univ. of Michigan I Varitronix U WAMCO U James Wilson U XTEK

LIGHT PENS/POINTING SYSTEMS

□ Interactive Computer Products □ Digitran □ IBM □ MicroTouch Systems □ Rikei Corp. □ Scriptel □ SMART Technologies □ 3M Product Information □ WACOM

LIQUID-CRYSTAL DISPLAYS, ACTIVE-MATRIX

Acculex ADT Applied Technology ASM America Astronautics Barco 🗆 Canadian Marconi 🗆 Casio LCD Convac-APT Craft Data, Inc. Craft Data Ltd. CRL CTX Opto Data Plus Davies DBI 🗆 Densitron 🖾 Digitran 🗆 Display Systems
Dolch Computer
dpiX
Dynamic Displays
Earth Computer Eaton PSD EEV Ltd. Electrohome Electronic Image Systems

Epson America

Flat Panel
Display

Fujitsu

GEC Hirst Research
Centre
General Electric

BF Goodrich Hitachi America Honeywell Defense Avionics D Honeywell D Hosiden America Hyundai Electronics I Image Systems □ Image Quest □ Incom □ Innovated Image □ Interface Products □ Interstate Electronics D Jaco Electronics D Kopin Kristel Laversab LCD Lighting
Night Vision Corp. Litton Systems Canada □ Lockheed Sanders □ L-3 Communications
Micrion
Micro-Optics D MicroTouch Systems D Milgray Electronics I Mintronix I Mitsubishi Electric Sales America 🗆 Mitsubishi Electronics America D Miwa D Modutec □ MRS Technology □ National Research Resources □ National Semiconductor D NEC D NEC Electronics I Nippon Electric Glass In View I OIS I Omega Electronics D Palomar Products D Panasonic Computer Peripherals D Performance Display Systems D PixelVision D Planar Advance
Polytronix
PPM Photomask
Proxima
Pulseview
Racal-Mesl RDI Computer
 Regisbrook □ Richardson Electronics □ Rikei Corp. □ Rytrak □ SAIC □ Samsung Electronics I Sarnoff Research Center Sayett Sharp Electronics □ Shintech □ Siliscape □ Stereomedia □ Systems Research Labs □ Technical Visions D Tektronix D 3-D ImageTek 3M Product Information
 Timeline □ Toshiba America □ UCE □ Univ. of Michigan D Varitronix D Vivid Semiconductor D World Products □ XTEK □ ViewTEK □ VL Electronics □ WAMCO □ Wyle Electronics

LIQUID-CRYSTAL DISPLAYS, CHOLESTERIC

L Kent Displays D Microtech

LIQUID-CRYSTAL DISPLAYS, COLOR

Advanced Display AEG ALCOM Applied Technology Arizona LCD □ Astronautics □ Barco □ Casio LCD □ Craft Data, Inc. □ Craft Data Ltd. CRT Intl. Crystaloid CTX Opto Data Plus DBI DCI Densitron Dolch Computer D dpiX D Dynamic Displays
Earth Computer
Eaton PSD □ Electrohome □ Electronic Image Systems 🗆 Electro-Optics 🗆 Epson America D Flat Panel Display D FPD Technologies 🗆 Hantronix 🗆 Hitachi America D Hosiden America D Image Quest I Innovated Image I Interface Products D Jaco Electronics D Kent Displays
Kisco Santa Clara Kristel
Kyocera Micrion MicroTouch Systems D Milgray Electronics Mitsubishi Electronics America □ National Semiconductor □ NEC Electronics D Nippon Electric Glass □ Night Vision Corp. □ NuVision Technologies 🗆 nView 🗆 OIS Optrex/Satori D Palomar Products

Performance Display Systems D PixelVision D Polytronix D Proxima Racal-Mesl CRDI Computer Regisbrook C Richardson Electronics Rikei Corp. SAIC Seiko Instruments Sharp Electronics Shintech Stanley Electric Stalaw I.I. Stanley Systems Research Labs □ 3-D ImageTek □ Three-Five Systems □ Toshiba America □ UCE □ Uniglobe Kisco I Varitronix I ViewTEK I Vivid Semiconductor D Vivitek D Wyle Electronics C XTEK C VL Electronics

LIQUID-CRYSTAL DISPLAYS, FERROELECTRIC

ALCOM Arizona LCD AZ LCD Canon, Inc. CRL Crystop Display Digitran Display Systems DEEV Ltd.
Electronic Image Systems Eurecran GEC Hirst Research Centre D BF Goodrich D Hornell Elektrooptik D Micro-Optics D Night Vision Corp. D PPM Photomask □ Regisbrook □ Rytrak □ Shintech T Varitronix

LIQUID-CRYSTAL DISPLAYS, PASSIVE

ADT Advanced Display Systems AEG Aerospace Display Systems □ ALCOM □ Ametek Aerospace Products Applied Technology Arizona LCD Astronautics AZ LCD Batron Casio LCD Craft Data, Inc. Craft Data Ltd. CRL CRT Intl. □ Crystaloid □ Crystop Display □ CTX Opto □ Data Plus □ DBI □ DCI Densitron Dicrystal Images Digitran Display Systems Dynamic Displays D Earth Computer EEV EEV Ltd. EM Microelectronic D Epson America Eurecran Excel Technology FPD Technologies GEC Hirst Research Centre C General Electric C Hantronix D Hitachi America D Hornell Elektrooptik Hosiden America D IEE D In Focus Systems
Interface Products
Kent Display Systems D Kisco Santa Clara □ Kyocera □ Kristel □ Kyocera □ LXD □ Mark IV Industries □ MicroTouch Systems □ Mito Fine Glass □ Mitsubishi Electric Sales America D National Research Resources D National Semiconductor D Night Vision Corp. □ nView □ Ocular □ Omega Electronics Optrex America D Optrex/Satori □ Polytronix □ Proxima □ Pulseview □ Racal Acoustics □ Regisbrook □ Rikei Corp. □ Rytrak □ SAIC □ Satori Electric Seiko Instruments D Sharp Electronics Shintech S-MOS Solomon Technology□ Sony Display Device Group □ Standish Industries □ I. I. Stanley D Stanley Electric D Stereomedia D Telex Communications D Three-Five Systems D Timeline D Toshiba America D Transicoil D UCE D Uniglobe Kisco □ Varitronix □ VGI □ VL Electronics D World Products D Wyle Electronics DXTEK

LIQUID-CRYSTAL DISPLAYS PASSIVE, ACTIVE ADDRESSING

D Arizona LCD D Astronautics Densitron Display Systems Hantronix D Hitachi America □ Hosiden America □ Interface Products □ Iristal □ Jaco Electronics □ Kent Displays
Luminary Technologies
ULXD
MicroTouch Systems □ Milgray Electronics □ Motif □ National esearch Resources D Night Vision Corp. Optrex America D Optrex/Satori

 PEMM Services
 Polytronix □ Regisbrook □ SAIC □ Sharp Electronics
Shintech
Stanley Electric □ Stalaw □ Stereomedia □ Three-Five Systems
UCE
Varitronix
Vivid Semiconductor
VL Electronics
Wyle
Electronics
XMR

LIQUID-CRYSTAL LIGHT-VALVE PROJECTORS

See projection displays

MAGNETIC SHIELDING

□ Ad-Vance Magnetics Magnetics □ Amuneal □ Astronautics □ Barco Chomerics C Eagle Magnetics E for M E Fosta-Tek General Atronics C General Vacuum C Gerome □ Ginsbury □ Homalite □ Hoya Electronics □ K & R Engrg. □ Lindgren RF Enclosures □ Liberty Mirror □ Magnetic Radiation Labs □ Magnetic Shield D Mushield D NoRad D Raytheon □ Siemens Components □ Silver Cloud Mfg. D 3M Product Information □ Vacuumschmelze □ Viratec

MANUFACTURING EQUIPMENT

□ Accudyne □ Advanced Display Systems AeroTech Anorad Applied Technology
 ASM America
 autronic
 Aydin Computer/Monitor AZ LCD Best Power Technology □ Billco Mfg. □ BOC Coating □ Brewer Science D Brooks Automation D CFM Technologies Convac-APT CRT Intl. Dark Field Technologies Display Labs Donnelly Applied Films DynaColor Eaton Corp. Eaton IDT Fairchild Convac FAS Technologies D Florod D Genmark Gerber Systems Glen Technologies Holographic Lithography Hornell Automation D Hornell Engrg. D H-Square Hybrid Micrographics D Image Processing Systems
Innotec □ International Micro □ Interserv □ Intevac □ Kenix Industries □ Kisco Santa Clara D Kurdex D Laversab □ Kurt J. Lesker Co. □ Leybold Lighting Sciences D Materials Research Corp. D Micrion D Miwa □ MRS Technology □ Nalpak Sales □ Nanometrics □ Nikon Precision □ Nippon Seiko K.K. □ OAI □ Optical Radiation Corbotech CORC Electronic D Pacifio Technologies D Palomar Products D Photon Dynamics □ Plasma-Therm □ PRI Automation Semiconductor Systems Semitool □ Sony □ Specialty Coating Systems □ Spectrum Sciences □ Spire □ Teknek Electronics
Temescal
3M Electronic Products
 3M Product Information Toddco Tokyo Electron America Ultra t Uniglobe Kisco □ Veeco/Sloan Technology □ VDC (Apex) □ VDC (HQ) □ Viratec

□ Watkins-Johnson □ Wande □ XMR Young Technology

MARKET RESEARCHERS/PUBLISHERS

American Institute of Small Business Dempa Display Technology Library □ Electronic Trend □ Ergonomics Ergosyst Associates I FAI I Future Systems D Joe Hallet & Associates □ Walter Hett & Associates □ Interlingua □ Kahn International □ Machover Associates
MIRC
Multimedia and Videodisc Monitor D Nutmeg Publishing Consultants D O'Mara & Associates

D Pacific Media Associates D Photonics Spectra D Pixel Interconnect D Ramey Scientific D SEMI-FPD D Stanford Resources I Tyson Consulting Group

MASKS

Applied Image Convac-APT Electrografics Eurecran Hoya Electronics I Image Quest I Micronic Laser Systems I Microphase Labs MRS Technology D Photronics D Photronics-Colorado D PPM Photomask
Process Technologies Terapixel
 3M Product Information

MATERIALS

electrochromic displays

Applied Films D Brewer Science □ Donnelly Applied Films □ E for M □ Feldman Technology □ General Vacuum □ Glaverbel SA □ IDM □ Indium America □ Lamination Technology D Mushield D Orbotech D Photronics D Rexam Custom □ Target Materials □ Tekra □ Terapixel □ 3M Electronic Products □ 3M Product Information D U.S. Precision Glass D Vacuum Engineering

electroluminescent displays

American Polarizers Applied Films Arconium Astra Products Atomergic Chemetals D BKI □ Brewer Science □ Courtaulds □ D&T Donnelly Applied Films Dontech Durel E for M ELtech Feldman Technology
 General Digital
 General Vacuum
 Glaverbel SA DIDM DIndium America D Kisco Santa Clara L Lamination Technology □ Marubeni □ National Research Resources D Nichia America D Nitto Denko D Photronics D Planar Systems Rexam Custom
 Spire
 Stan-Allan □ Target Materials □ Tekra □ Terapixel SM Electronic Products DUCE UNIAX U.S. Precision Glas □ Vacuum Engineering □ VisPro □ WAMCO I James Wilson

electromechanical displays

□ Brewer Science □ E for M □ F-P Electronics □ IDM □ Mark IV Industries □ Mushield □ Photronics □ Tekra Terapixel
 3M Electronic Products U.S. Precision Glass D Vacuum Engineering

large-screen displays

Adaptive Micro Systems D AEG □ Applied Technology □ Barco Video & Commun.
Brewer Science
Dana Enterprises D Donnelly Applied Films Dontech Dynair E for M General Vacuum Glaverbel SA □ Incom □ Indium America □ Feldman Technology
General Digital
Genes Microchip D Hyacinth Technology D IDM □ Kaiser Optical □ Kisco Santa Clara □ Lamination Technology □ National Research Resources D Nitto Denko Optical Radiation D Optical Solutions Photronics Physical Optics D Plasmaterials D Rantec D Retroscan Rexam Custom I SI Diamond □ Target Materials □ Tech-Com □ Tekra □ Terapixel □ Tosoh SMD □ U.S. Precision Glass
Vacuum Engineering □ Viratec □ Visus

light-emitting diode displays

Adaptive Micro Systems American Polarizers D Arconium D Astra Products Brewer Science Display Systems E for M E F-P Electronics H-P □ IDM □ Indium America □ Infolex Corp. D Marubeni D Nichia America □ Nitto Denko □ Photronics □ Plasmaterials □ Quantum Electronics □ Stanley Electric □ Tekra □ Terapixel □ U.S. Precision Glass □ Vacuum Engineering D VisPro D WAMCO □ James Wilson

light pens/pointing systems

American Polarizers D Photronics □ Plasmaterials □ Scriptel □ Tekra U.S. Precision Glass U Vacuum Engineering

liquid-crystal displays

□ Adhesives Research □ ALCOM □ AlliedSignal □ American Polarizers □ Applied Films □ Applied Technology Arconium Arizona LCD Astra Products C AZ LCD D BDH D Brewer Science CRL Crystaloid Dainippon Ink & Chemicals D D&T Dana Enterprises Display Systems Donnelly Applied Films D Dontech □ Earth Computer □ E for M □ EM Industries □ Exxene □ Feldman Technology □ F-P Electronics □ General Digital D General Vacuum D Genesis Microchip C Glaverbel SA C F. Hoffmann La Roche 🗆 Incom 🗆 Indium America □ Kaiser Optical □ Kenix Industries □ Kent Displays □ Kisco Santa Clara Lamination Technology LCD Lighting Mark IV Industries □ Marubeni □ Merck □ Nagase California D National Research Resources □ Nitto Denko □ Optotek Optrex/Satori D Pacifio Technologies □ Photronics □ Plasmaterials □ Polaroid Holographic D Rexam Custom D Rytrak Solomon Technology D Target Materials I Tekra I Terapixel I 3-D ImageTek C 3M Optical Systems C 3M Product Information
Tosoh SMD UCE Uniglobe Kisco Univ. of Michigan D U.S. Precision Glass □ Vacuum Engineering □ Viratec □ Visus □ WAMCO □ XTEK

plasma displays, ac

C American Polarizers C Applied Films □ Applied Technology □ Astra Products □ Brewer Science □ Donnelly Applied Films □ E for M □ Feldman Technology Genesis Microchip Glaverbel SA □ IBM Canada □ IDM □ Kisco Santa Clara D Marubeni D Nichia America D Photronics D Rexam Custom D SEM-COM I Target Materials I Tekra □ Terapixel □ Uniglobe Kisco □ U.S. Precision Glass D Vacuum Engineering □ Viratec □ WAMCO

plasma displays, dc

- American Polarizers D Applied Films
- □ Applied Technology □ Astra Products
- □ Displays □ Donnelly Applied Films □ E for M □ Feldman Technology
- Genesis Microchip Glaverbel SA
- DIDM D Kisco Santa Clara D Marubeni
- □ Micrion □ Nichia America
- D Panasonic Industrial D Photronics
- Quantum Electronics
 Rexam Custom
 Target Materials
 Tekra
 Terapixel
- □ Uniglobe Kisco □ U.S. Precision Glass
- □ Vacuum Engineering □ Viratec □ WAMCO

plasma displays, color

□ American Polarizers □ Applied Films □ Applied Technology □ Astra Products □ Brewer Science □ E for M □ Feldman Technology □ General Digital □ Genesis Microchip □ Glaverbel SA □ IDM □ Kisco Santa Clara □ Marubeni □ Mitsubishi Electronics America □ Nichia America □ Photronics □ Rexam Custom □ Target Materials □ Tekra □ Terapixel □ Uniglobe Kisco □ U.S. Precision Glass □ Vacuum Engineering □ Viratec □ VisPro □ WAMCO

spacers

□ Adhesives Research □ Applied Technology □ Bangs Labs □ Dana Enterprises □ Kenix Industries □ Kisco Santa Clara □ Marubeni □ Pacífio Technologies □ Photronics □ Sekisui Fine Chemical □ SEM-COM □ Tekra □ Uniglobe Kisco □ U.S. Precision Glass □ Vacuum Engineering

thin films

□ Applied Technology □ Atomergic Chemetals □ Balzars AEG □ Balzars Thin Films □ Courtaulds □ Dontech □ Edwards □ Feldman Technology □ General Vacuum □ Indium America □ Kaiser Optical □ Lamination Technology □ Marubeni □ NIMTEC □ Photronics □ Spire □ Stan-Allen □ Target Materials □ Tekra □ TFD □ 3M Product Information □ Tosoh SMD □ ULVAC Technologies □ U.S. Precision Glass □ Viratec

touch screens

□ Adhesives Research □ American Polarizers □ Astra Products □ AVED □ Carroll Touch □ **Courtaulds** □ Crystaloid □ D&T □ Dynapro □ Elo TouchSystems □ General Vacuum □ Genesis Microchip □ Glaverbel SA □ Lamination Technology □ MicroTouch Systems □ Pacifio Technologies □ Photronics □ Racal-Mesi □ Rexam Custom □ Target Materials □ Tekra □ TFD □ U.S. Precision Glass

MATERIALS HANDLING

□ Accudyne □ Applied Technology □ Gerber Systems □ Progressive System Technologies

MICE AND OTHER POINTING DEVICES

Digitran D Hosiden America D IBM Innovated Image D ISCAN D Jaco Electronics D Proxima D Scriptel SMART Technologies D ViewTEK WACOM

MICROCHANNEL PLATES

□ Galileo □ Intervac □ Philips Components

MONITOR MOUNTING DEVICES

OPTICAL COATINGS

See also filters, polarizers

- Adhesives Research ADT
- AlliedSignal C American Polarizers
- □ Applied Films □ Applied Science Labs □ ASM America □ Astra Products
- □ Balzars AEG □ Balzars Thin Films
- Brewer Science Courtaulds D&T
- Denglas Denton Vacuum
- Diagnostic/Retrieval Systems
- Donnelly Applied Films Dontech

□ E for M □ Exxene □ Elex Products D Fosta-Tek D General Vacuum D Hoechst Celanese D Homalite D Hoya Electronics I Hoya Optics I IBM Canada ITG I Kollmorgen I Liberty Mirror
LMT Lumitex Marubeni Melles Griot 🗆 Merck 🗆 Metavac 🗆 MicroTouch Systems I Mito Fine Glass I Nitto Denko D O&S Research D OCA D OCLI Optical Devices
 Optic Sigma Optronic Labs D Panelgraphic Plasmaterials
 Plasma-Therm
 Polaroid
 PPM Photomask
 Precision Glass Technologies
 Racal-Mesl
Romag Glass
Silver Cloud Mfg. Southwall Technologies D Tech-Com TFD Thin Film Technology 3M Product Information TSP ULVAC Technologies D U.S. Precision Glass □ Viratec □ WAMCO

OPTICAL COMPONENTS

□ Adhesives Research □ AlliedSignal □ Astra Products □ Atomergic Chemetals □ Balzars AEG □ Balzars Thin Films □ Colort.ink □ Fresnel Optics □ Gamma Scientific □ Hoya Corp. □ Hudson Photographic □ Incom □ Lumitex □ Melles Griot □ OCA □ Opto Sigma □ Optro-Mechanics □ Precision Glass Technologies □ Rainbow Optics □ Seiwa Optical □ Teledyne Electronic Technologies □ 3M Product Information □ U.S. Precision Glass □ Viratec □ Visus □ WAMCO □ Carl Zeiss

OPTICAL DESIGN SERVICES

□ Breault □ Fresnel Optics □ Future Focus □ Kaiser Optical □ Lumitex □ Night Vision Corp. □ Optis □ Opto Sigma □ ORC Lighting □ Physical Optics □ ORC Electronic □ Shintech □ Tech-Com □ Teledyne Electronic Technologies □ Viratec □ Visus

OPTICAL DISCS AND SYSTEMS

□ Canon, Inc. □ Eastman Kodak □ Honeywell □ IBM **□ Jaco Electronics** □ Kisco Santa Clara □ Mito Fine Glass □ Pentax Teknologies □ Sony Display Device Group □ **3M Product Information**

OPTICAL SEMICONDUCTOR DEVICES

Melles Griot
 3M Product
 Information
 Seiwa Optical

PC-BASED TEST EQUIPMENT

□ Anorad □ autronic □ Dark Field Technologies □ Data Plus □ Display Labs □ Florod □ Hornell Engrg. □ Image Processing Systems □ Jaco Electronics □ Laversab □ SAIC □ Team Systems □ 3M Product Information □ Unigraf □ Veeco/Sloan Technology □ ViewTEK □ Westar

PHOSPHORS

Atomergic Chemetals
 Brimar
 CRT Intl.
 EEV Ltd.
 General
 Atronics
 Hoya Electronics
 Intevac
 LCD Lighting
 Marubeni
 Nichia
 America
 Phosphor Products
 Phosphor Technology
 Planar
 Advance
 Quantex
 Raytheon
 Sarnoff Research Center
 Sony
 Display Device Group
 Spire
 ULVAC
 Technologies
 Zenith Electronics

PHOTOLITHOGRAPHY CHEMICALS

Hoechst Celanese
 Hoechst
 Celanese AZ
 3M Product Information

PHOTOLITHOGRAPHY EQUIPMENT

□ Canon USA □ Brewer Science □ Convac-APT □ Fairchild Convac □ FAS Technologies □ Gerber Systems □ Holographic Lithography □ Holtronic □ Interserv □ Kisco Santa Clara □ MRS Technology □ Nikon Precision □ OAI □ ORC Electronic □ Steag MicroTech □ Karl Suss □ Tamarack Scientific □ 3M Product Information □ Tokyo Electron America □ Ultra t □ Uniglobe Kisco

PHOTOLITHOGRAPHY SERVICES

Brewer Science Holographic
Lithography Holtronic Process
Technologies Technical Visions Thin
Film Technology 3M Product
Information

PHOTOMASKS

See masks

□ Micronic Laser Systems □ Photronics □ Photronics-Colorado □ Process Technologies □ Terapixel □ 3M Product Information

PLASMA DISPLAYS, AC

□ Craft Data Ltd. □ Densitron □ Donnelly Applied Films □ Eaton PSD □ Electro-Optics □ Electro Plasma □ General Electric □ Interstate Electronics □ Mitor Fine Glass □ NEC Electronics □ PEMM Services □ Photonics Systems □ Plasmaco □ Plessey Naval Systems □ Plaseview □ SAIC □ Thomson Components & Tubes □ Thomson-CSF □ Thomson Tubes Electroniques □ ViewTEK □ Whittaker □ World Products

PLASMA DISPLAYS, DC

□ Babcock □ Cherry Electrical □ Craft Data Ltd. □ Dale Electronics □ Densitron □ Displays □ Donnelly Applied Films □ General Electric □ IEE □ Micrion □ Milgray Electronics □ Mito Fine Glass □ Panasonic Industrial □ PEMM Services □ Pulseview □ Quantum Electronics □ SAIC

PLASMA DISPLAYS, COLOR

Densitron
 Craft Data Ltd.
 Fujitsu
 Hitachi America
 Man & Machine
 Micrion
 Milgray Electronics
 NEC
 Electronics
 PEMM Services
 Photonics Systems
 Plasmaco
 SAIC
 ViewTEK

PLASTIC MOLDING EQUIPMENT

PLASTIC MOLDINGS

Astra Products RMF Products

PLOTTERS

□ Calcomp □ John Fluke Mfg. □ Gerber Systems □ IBM **□ Micronic Laser** Systems □ Orbotech □ Summagraphics □ Tempest Technologies □ Versatec □ Xerox Engrg. Systems

POLARIZERS

□ ADT □ Advanced Display Systems □ American Polarizers □ Applied Technology □ Balzars AEG □ Balzars Thin Films □ ColorLink □ D&T □ Da-Lite Screen □ Dana Enterprises □ Dontech □ E for M □ Fosta-Tek □ Hoya Electronics
Hoya Corp.
Hage
Analytics
International Polarizer
Jaco Electronics
Kisco Santa Clara
Marubeni
Melles Griot
MicroTouch Systems
National
Research Resources
Nitto Denko
OCLI
Optical Devices
Opto
Sigma
Panelview
Polaroid
Precision Optical Filters
Reel 3-D
Romag Glass
Santiz
Silver
Cloud Mg.
SMP roduct Information
UCE
Uniglobe Kisco

POLYMER FILMS

□ Adhesives Research □ AlliedSignal □ Brewer Science □ E for M □ Kent Displays □ Lamination Technology □ Rexam Custom □ SI Diamond □ Specialty Coating Systems □ Tetra □ 3M Product Information □ ULVAC Technologies

POWER SUPPLIES, HIGH VOLTAGE

□ Advanced Conversion □ AHV □ Astronautics □ Astrosystems □ Best Power Technology □ Burle Industries □ Cherry Electrical □ Data Plus □ Data Translation □ Davalcc □ Del Electronics □ Digitran □ Display Components □ E and M Electronics □ EEV Ltd. □ E6&G Optoelectronics □ Electron Tubes □ Endicott □ John Fluke Mfg. □ Ginsbury □ HC Power □ Honeywell □ Hyacinth Technology □ Innotec □ K and M Electronics □ K & R Engrg. □ Keltron □ Kisco Santa Clara □ Linfinity □ Lorad Power Systems □ National Semiconductor □ ORC Lighting □ Panasonic Industrial □ Racal-Mesl □ Rantec □ Regisbrook □ Reynolds Industries □ Sampo America □ Sanders Associates □ Schott High Voltage □ TDK □ Wasatch High Voltage ■ WinTron □ Zytronics

PRINTER SUPPLIES

Acculex
 Computer Peripherals
 Eastman Kodak
 Harris Corp.
 IBM
 Lasertechnics
 QMS
 Tartan
 Technical
 3M Product Information

PRINTERS, COLOR GRAPHIC

□ Data Plus □ IRIS Graphics □ Lasergraphics □ Lasertechnics □ Polaroid □ QMS □ Syntest □ Tartan Technical □ Tempest Technologies □ Texas Instruments □ 3M Product Information

PRINTERS, ELECTROPHOTOGRAPHIC (LASER AND LED)

□ Canon, Inc. □ Harris Corp. □ IBM □ Lasertechnics □ NBS Southern □ Pentax Technologies □ QMS □ Raytheon □ Tartan Technical □ Tempest Technologies

PRINTERS, IMPACT

DH Print
 IBM
 NBS Southern
 Relisys
 SAIC
 Syntest
 Tempest Technologies

PRINTERS, INK-JET

□ Canon, Inc. □ Howtek □ IRIS Graphics □ Summagraphics □ Syntest □ Tartan Technical

PRINTERS, THERMAL-TRANSFER AND DYE-SUBLIMATION

□ Acculex □ Calcomp □ Craft Data Ltd. □ Data Plus □ DH Print □ Eastman Kodak □ IBM □ Lasergraphics □ Lasertechnics □ Panasonic Industrial □ OMS □ Raytheon □ Syntest □ Tartan Technical □ Team Systems □ Toyo Spectrum □ Versatec □ Xerox Engrg. Systems

PRINTHEADS

ara

□ Craft Data Ltd. □ DH Print □ GEC Hirst Research Center □ Optotek □ Stanley Electric

PROJECTION DISPLAYS

Liquid-crystal projectors

Image D Palomar Products D Panasonic Computer Peripherals

□ Prolux □ Sarif □ Stalaw □ Symco □ Tartan Technical □ Viratec

Liquid-crystal light-valve projectors

Astronautics D Barco D Barco Projection CRT Intl. Davis A/S Draper Screen D Electrohome □ Electronic Image Systems □ Eurecran Evans & Sutherland Computer D Flat Panel Display GEC Hirst Research Centre D General Electric D Genesis Microchip D Gritz's Emporium D Hitachi America D Hosiden America D Hughes LV Products D Incom D Keltron Lamination Technology Micrion Micro-Optics National Research Resources □ nView □ Optical Solutions □ Panasonic Communications & Systems □ Panelight □ Polytronix □ PPM Photomask D Proxima D Regisbrook E Retroscan E Rytrak E Sarnoff Research Center Sayett Silicon Light Machines Sony Display Device Group □ Tech-Com □ Telex Communications □ 3M Product Information □ UCE

Projection CRTs

□ Barco □ Barco Projection □ Calspan SRL CRT Intl. Digitran Draper Screen Dynair DEEV Ltd. DEI-Op Electrooptics
 Electrohome
 Electronic Image Systems D Evans & Sutherland Computer
General Atronics
Genesis Microchip
Ginsbury
Gritz's Emporium □ Hitachi Denshi America □ Incom □ IST □ Keltron □ Mitsubishi Electric Sales America D Optical Solutions Raytheon Rediffusion Simulation D Retroscan D Sarnoff Research Center Sony Display Device Group
 Stereomedia Symco TDSD Tech-Com D Thomas Electronics □ Thomson Components & Tubes Thomson-CSF Thomson Tubes
 Electroniques 3M Product Information UVDC (Novatron) Vidiwall □ ViewTEK □ Viratec □ Zenith Electronics

REPAIR AND MAINTENANCE

of computer systems

□ Astronautics □ Hitech Intl. □ IBM □ Man & Machine □ Matrix Components □ Recognition Concepts □ Tempest Technologies VDC (Data Display)

of display systems

Astronautics □ AVT □ CRL □ D&T
 Display Technologies □ Florad
 General Electric □ Electrohome
 Graseby Optronics □ IBM □ Incline
 Kiein Instruments □ LCD Lighting
 Man & Machine □ Matrix Components
 Micrion □ Midwest Computer □ Miwa

□ Noritake Imaging □ Photonics Systems □ Quantum Electronics □ Raytheon □ Signatone □ Team Systems □ Tech-Com □ Teltron □ TNP ∪ VDC (Data Display) □ VDC (Teltron)

of high-voltage power supplies

□ American High-Voltage □ Astrosystems □ Best Power Technology □ Display Components □ F-P Electronics □ Hyacinth Technology □ Keltron □ Noritake Imaging □ Reynolds Industries

SCAN CONVERTER TUBES

SCANNERS, DOCUMENT AND FILM (GRAPHICS)

□ Advanced Video Products □ Dark Field Technologies □ Data Plus □ Digital Vision □ Eastman Kodak □ ECRM □ Howtek □ IBM □ Imapro □ Mekel Engrg. □ Mitsubishi Electric Sales America □ Pentax Teknologies □ SEOS Displays □ Summagraphics □ Tartan Technical □ Telesensory □ Versatec

SCANNERS, DOCUMENT (TEXT)

Eastman Kodak
 IBM
 Pentax
 Teknologies
 Summagraphics
 Xerox
 Imaging Systems

SCOREBOARDS

□ Adaptive Micro Systems □ Daktronics □ EEV Ltd. □ F-P Electronics □ Futaba America □ Hughes LV Products □ Infolex Corp. □ Mark IV Industries □ National Research Resources □ Quantum Electronics □ Racal Acoustics □ Regisbrook □ SI Diamond

SCRIBERS

□ Applied Technology □ Kenix Industries □ Kisco Santa Clara □ TNP □ Uniglobe Kisco □ Villa Precision

SEALANTS

 Applied Technology
 Dainippon Ink & Chemicals
 Kisco Santa Clara Marubeni
 3M Product Information Uniglobe Kisco

SEMICONDUCTORS

□ Atomergic Chemetals □ Chips & Technologies □ Eaton Corp. □ EM Microelectronic □ Genesis Microchip □ H-P □ HP Reid □ Intevac □ International Micro □ Kenix Industries □ Linfinity □ Panasonic Industrial □ Spire □ 3M Electronic Products □ 3M Product Information □ Vivid Semiconductor

SIMULATOR DISPLAYS

□ Applied Science Labs □ Astronautics □ Barco □ Barco Chromatics □ Barco Display □ Barco Video & Commun. □ Calcomp □ Coryphaeus □ Draper Screen □ DRS Military Systems □ EDL Displays □ Electrohome □ Electronic Image Systems □ El-Op Electrooptics Industries □ Evans & Sutherland Computer □ Fakespace □ Kristel □ Hughes LV Products □ Night Vision Corp. □ Optical Radiation □ Optical Solutions □ Palomar Products □ Photonics Systems □ Precision Imaging □ Primagraphics □ Rediffusion Simulation
Sanders Associates
SEOS Displays
Shintech
Ship
Analytics
Simtech
Tech-Com
Westaim

SOFTWARE

Applied Simulation Technology

SOFTWARE FOR DISPLAYS

design & optimization software

□ ADT □ American Institute Small Business □ autronic □ Breault □ Cardion Electronics □ Contec CAE □ Coryphaeus □ CSERIAC □ Display Systems □ DRS Military Systems □ EI-Op Electrooptics Industries □ Honeywell Defense Avionics □ IBM □ Kent Displays □ Kollmorgen □ Ligature Software □ Lighting Sciences □ L-3 Communications □ n&k Technology □ Optis □ Orbotech □ Sarnoff Research Center □ Shintech □ Sound Decisions □ Stereomedia

graphics systems software

□ ADT □ Astronautics □ Barco Chromatics □ Barco Display □ Calspan SRL □ Cambridge Research □ Cardion Electronics □ Coryphaeus □ Dalim Computer □ Data Translation □ Display Systems □ Dynair □ Honeywell Defense Avionics □ IBM □ Infax □ Infinity Multimedia □ Kollmorgen □ L-3 Communications □ Polaroid □ Primagraphics □ Racal-Mesl □ Rediffusion Simulation □ Sarnoff Research Center □ Ship Analytics □ Thomson-CSF Services □ 3M Product Information □ Trident Microsystems □ Univision

image processing software

ADT Amerinex Applied Science Labs Cardion Electronics Coreco CRL Dalim Computer Graphic Systeme Data Translation Decision Images D Diagnostic/Retrieval Systems DOME DRS Military Systems Electrooptics Industries
Eltime Vision Systems
 EPIX
 Global Imaging □ Honeywell Defense Avionics □ Howtek □ IBM □ Kaiser Optical □ Kollmorgen L-3 Communications D McMahan Electro-Optics D McMahan Research Labs D MegaVision D Orbotech □ Photometrics □ Rediffusion Simulation Sarnoff Research Center D Security Defense Systems
Sharp Digital
Information Products
M Product Information
Univision
Versatec UVideotek Systems UVidiwall Xerox Imaging Systems Carl Zeiss

optical analysis software

□ ADT □ Applied Science Labs □ autronic □ Breault □ Eldim □ El-Op Electrooptics Industries □ Eltime Vision Systems □ Global Imaging □ IBM □ Honeywell □ Kollmorgen □ Kontron □ Lighting Sciences □ Contec CAE □ n&k Technology □ Optis □ Orbotech □ Photo Research □ Sarnoff Research Center □ Shintech □ Sound Decisions □ Telic Optics □ Carl Zeiss

signal processing software

□ Aydin Computer/Monitor □ Calspan SRL □ Cardion Electronics □ Data Translation □ Diagnostic/Retrieval Systems □ Display Systems □ DRS Military Systems □ DynaColor □ Honeywell Defense Avionics □ IBM □ Kaiser Optical □ Kollmorgen □ McMahan Research Labs □ Racal-Mesl □ Sarnoff Research Center

SPEECH INPUT/OUTPUT DEVICES

TEST AND MEASUREMENT EQUIPMENT

automatic convergence systems

□ Barco Projection □ Display Labs □ DynaColor □ EeRise □ Electro-Optics □ Gamma Scientific □ General Electric □ Image Processing Systems □ Meylan □ Microvision □ Minolta □ Photo Research □ Telesensory □ 3M Product Information □ Video instruments

automated test equipment

AeroTech Anorad autronic Calspan SRL Chroma ATE □ Coreco □ CR Technology □ Cybeq □ Crystop Display □ Data Plus □ Data Translation DIS Display Labs DynaColor D EeRise D Ergonomics □ Gamma Scientific □ Eltime Vision Systems □ Ergonomics □ Florod □ John Fluke Mfg. D GenRad D Hoffman Engrg. Hornell Engrg. C Kenix Industries □ Image Processing Systems □ Inter-Logic □ KLA Acrotec □ KLA Instruments □ Kontoy Products □ Landmark Technology 🗆 Lasertec 🗆 Laversab □ Leica □ Lighting Sciences □ MECC □ Micromanipulator Co. □ Microvision Minolta D Miwa D MTL Systems □ Nanometrics □ Nippon Seiko K.K. Optro-Mechanics
Optronic Labs
Orbotech
Photon
Dynamics D Photo Research D Rockwell Intl. Rytrak
 SAIC
 Sencore □ Signatone □ Spectron Engineering □ Steag MicroTech □ Team Systems Teletrac
 Tencor Instruments
 3M Electronic Products
3M Product Information [] TNP Instruments □ Vanzetti Systems □ Veeco/Sloan Technology D Video instruments U Wande U Westar U J. A. Woollam Carl Zeiss

colorimeters

□ autronic □ Chroma ATE □ Data Plus □ DynaColor □ Eldim □ Electro-Optics □ Gamma Scientific □ Graseby Optronics □ Hoffman Engrg. □ Image Processing Systems □ Institute for Photometry & Radiometry □ Leica □ Lighting Sciences □ Microvision □ Minolta □ n&k Technology □ Opto-Cal □ Photo Research □ Sencore

convergence gauges

Chroma ATE DynaColor Klein
Instruments Minolta Quantum
Data

gonioreflectometers

□ autronic □ Gamma Scientific □ Lighting Sciences □ LMT □ Optronic Labs □ n&k Technology

hot stages

□ autronic □ Instec □ Micromanipulator Co. □ Palomar Products □ TNP □ Carl Zeiss

microscopes

□ autronic □ CELCO □ Gamma Scientific □ Inter-Logic □ Leica □ Lasertec □ Micromanipulator Co.

Nikon Precision D Olympus America
 Optro-Mechanics D Seiwa Optical
 TNP D Carl Zeiss

photometers

□ autronic □ Breault □ Gamma Scientific □ Eldim □ Electro-Optics □ Graseby Optronics □ Hoffman Engrg. □ Institue for Photometry & Radiometry □ Instrument Systems □ Labsphere □ Lighting Sciences □ LMT □ McMahan Research Labs □ Microvision □ Opto-Cal □ Optronic Labs □ Photo Research □ Spectron Engineering □ Tektronix □ Video Instruments □ Carl Zeiss

radiometers

□ autronic □ Breault □ Electro-Optics □ Gamma Scientific □ Hoffman Engrg. □ Institute for Photometry & Radiometry □ Instrument Systems □ Labsphere □ McMahan Research Labs □ Minolta □ OAI □ Opto-Cal □ Optronic Labs □ Photo Research □ Optcronic Engineering □ Tektronix

spectrometers

□ autronic □ Breault □ Gamma Scientific □ Instrument Systems □ Laversab □ Leica □ Microvision □ MKS Instruments □ n&k Technology □ Nanometrics □ Olympus America □ Opto-Cal □ Optronic Labs □ Spectron Engineering □ Carl Zeiss

video generators

□ Aydin Computer/Monitor □ Barco □ Barco Chromatics □ Chroma ATE □ Colorado Video □ Data Plus □ Diagnostic/Retrieval Systems □ DRS Military Systems □ DynaColor □ Eldim □ Extron □ John Fluke Míg. □ Image Processing Systems □ MECC □ MTL Systems □ Optro-Mechanics □ Quantum Data □ Sencore □ Team Systems □ Unigraf □ Video instruments □ Westaim

video oscilloscopes

□ Colorado Video □ General Electric □ Laversab □ Photon □ Sencore

THIN FILMS

□ Applied Films □ Applied Technology □ Atomergic Chemetals □ Balzars AEG □ Balzars Process Systems □ Balzars Thin Films □ Dontech □ Dynapro □ Edwards □ E for M □ Feldman Technology □ General Vacuum □ Hoya Corp. □ Innotec □ Intevac □ Kaiser Optical □ Lamination Technology □ Leica □ Kurt J. Lesker Co. □ Materials Research Corp. □ Melles Griot □ Nanometrics □ OCA □ OIS □ Opto Sigma □ Specialty Coating Systems □ Spire □ Stan-Allen □ Technical Visions □ TFD □ Thin Film Technology □ 3M Product Information □ TNP □ ULVAC Technologies □ Viratec

3D DISPLAY SYSTEMS

□ Coryphaeus □ Dimension Technologies □ Electrohome □ Electronic Image Systems □ Evans & Sutherland Computer □ Fakespace □ Flat Panel Display □ General Electric □ Infinity Multimedia □ Matrox Electronic Systems □ McMahan Electro-Optics □ National Research Resources □ Night Vision Corp. □ NuVision Technologies □ Optical Solutions □ Polhemus □ Reel 3-D □ Sarnoff Research Center □ Security Defense Systems
StereoGraphics
Stereomedia
Tektronix
3-D
ImageTek
3DTV
UCE
Visonics
Labs

TOUCH-INTERACTIVE DISPLAYS

Astronautics AVED AVT Barco Chromatics
 Barco Display Craft Data Ltd. D&T Densitron Digitran Dolch Computer D Eaton PSD Eaton IDT EDL Displays Eldec
 Electrohome
 Electro Mechanical Systems D Electro Plasma Elographics ETC Computer Exzec
Flat Panel Display
General
Digital
IBM
Image Quest □ Intecolor □ Interaction Systems □ Jaco Electronics □ Kristel Laversab Lockheed Sanders ☐ MicroTouch Systems □ Nortech Engineering D Optical Solutions D Palomar Products D Performance Display Systems
Phosphor Products D Photonics Systems D Racal-Mesl Regisbrook RGB Dynamics □ Scriptel □ SMART Technologies □ I. I. Stanley D Thomson Tubes Electroniques D Touch Controls Transicoil D Varitronix D ViewTEK T WACOM

TOUCH SCREENS

ADT AVT Avdin Corp. CAM Graphics Carroll Touch Craft Data Ltd. Crystaloid D&T Dale Electronics D DBI Densitron D Dolch Computer □ Draper Screen □ Dynapro Earth Computer Electro Mechanical Systems
Elographics
Epson America
ETC Computer
Exzec
John Fluke Mfg. IBM Intecolor Interaction Systems I Jaco Electronics I Kent Displays D Lamination Technology Laversab MicroTouch Systems Mintronix
 Mitsubishi Electronics America
O&S Research
OCLI
Optical Devices
Optical Solutions D Pacifio Technologies D Phosphor Products D Photonics Systems D Racal-Mesl
Regisbrook
RGB Dynamics Richardson Electronics Scriptel SMART Technologies D Telesensory □ Thin Film Technology □ TFD □ Touch Controls Varitronix ViewTEK

TOUCH TABLETS

□ ADT □ Carroll Touch □ Exzec □ Jaco Electronics □ Scriptel □ SMART Technologies □ WACOM

TRACKBALLS

Computer Keyboards Systems
Digitran D Intecolor D Polhemus

VACUUM EQUIPMENT

□ AeroTech □ Anorad □ Applied Films □ Applied Technology □ ASM America □ Balzars Process Systems □ Brooks Automation □ Edwards □ General Vacuum □ Hornell Automation □ Hornell Engrg. □ Innotec □ Intevac □ Kontoy Products □ Kurdex □ Leybold □ Materials Research Corp. □ MDC Vacuum Products □ MKS Instruments □ OCLI □ SAES Getters □ TSC □ ULVAC Technologies □ Viratec

VACUUM FLUORESCENT DISPLAYS

□ Babcock □ Futaba America □ IEE □ ISE Electronics □ LCSP-Deeco □ Kurt J. Lesker Co. □ Noritake □ Morrison Electronics □ Pulseview □ Regisbrook

VIDEO AMPLIFIERS

CELCO Pacific Dynair Ginsbury
Kollmorgen MECC Motorola
National Semiconductor

VIDEO AND DISPLAY STANDARDS

Color Technology Solutions
DynaColor Ergonomics SAIC
Team Systems 3M Product
Information VESA

VIEWING SCREENS

D Physical Optics D Tech-Com

VIRTUAL IMAGING

□ Future Focus □ Gritz's Emporium □ Reflection Technology □ Reel 3-D □ Siliscape □ Stereomedia □ VDC (Teltron) □ Virtual Vision

VIRTUAL-REALITY DISPLAYS

□ Electrohome □ Fakespace □ Future Focus □ Gritz's Emporium □ Incom □ Night Vision Corp. □ Reflection Technology □ Reel 3-D □ Siliscape □ Stereomedia □ Tech-Com □ 3-D ImageTek □ 3DTV □ VDC (Teltron) □ 01 Products

X-RAY IMAGE STORAGE SCREENS

□ Incom □ Levy Hill □ Phosphor Technology □ Quantex □ Security Defense Systems

WIRE Caton Connector

Part II: Companies

Listings are in strict alphabetical order. Punctuation, spaces, and the initial definite article "The" are ignored. Numbers (3D, 3M, 01), symbols (&), and abbreviations (Co., Corp., Inc., Ltd.) are listed as though fully spelled out. Companies bearing the name of an individual are usually listed under his last name.

ABBIE GREGG, INC. (AGI), 5025 South Ash Ave., Ste. B-4, Tempe, AZ 85282

Providers of engineering and consulting services; cleanroom layout and facility design; fit-up semiconductor and FPD process, test, and assembly equipment; process, test, and cleanroom training; process analysis; factory simula-tion and modeling; CAD services; yield enhancement and troubleshooting. Michelle Martinez, Dir. Finance/Admin. 602/897-1162, fax: 602/897-1486

ACCUDYNE CORP., 1415 Foundation Park Blvd. S.E., Palm Bay, FL 32909

Manufacturers of flat-panel-display mid-line processing equipment: rubbing, cleaning, spacer applicators, spacer counters, assembly, filling, laser-based glass separation, and in-line material handling. All equipment is clean-room compatible and operator friendly. Jim Lawson, Pres. 407/724-6500, fax: 407/727-1632 ACCULEX CORP., 440 Myles Standish Blvd., Taunton, MA 02780

Manufacturers/distributors of industrial process monitoring and display products. Surface-mount technology designs; rugged digital panel meters (LCD and LED) for measuring temperature, pressure, voltage current, etc. Richard Mullen, Prod. Mktg. Mgr. 508/880-3660, fax: 508/880-0179

ACL, INC./STATICIDE, 1960 E. Devon Ave., Elk Grove Village, IL 60007 Manufacturers of STATICIDE topical antistatic solution, a highly effective method for long-term static control, which is nontoxic, non-flammable, non-staining, and completely biodegradable. Available in

general-purpose and heavy-duty sprays or wipes for use on CRT screens. Tony Banks, V.P. Sis./Mktg. 708/981-9212, 1-800/782-8420, fax: 708/981-9278

ADAPTIVE MICRO SYSTEMS, INC., 7840 N. 86th St., Milwaukee, WI 53224

Manufacturers of high-quality indoor and outdoor color LED message displays, including PowerView, Beta-Brite, and indoor and outdoor Alpha lines and custom modules for OEM products. Single- and multi-line signs with characters from 1.5 to 7.2 in. high for displaying text, graphics, and logos. Curt Lille, V.P. Alpha SIs. 414/357-2020 x223, 1-800/558-7022 fax: 414/357-2029

ADAPTIVE MICRO SYSTEMS, INC., SMART ALEC, 7840 N. 86th St., Milwaukee, WI 53224

Developers of intelligent messaging software that automatically messages real-time and scheduled information to PowerView LED message displays, e-mail, intranets, pagers, voice mail, PA systems, and more. Aquires information from virtually any source using DDE, serial, ASCII delimited flies, MAPI compliant e-mail, or custom interface. Mike Rimrodt, Smart Alec SIs. Mgr. 414/357-2020, 1-800/558-7022 fax: 414/357-2029

ADHESIVES RESEARCH, INC., P.O. Box 100, Glen Rock, PA 17327

Manufacturers of optically clear pressuresensitive adhesive-coated products designed for use within touch screens, polarizers, filters, retarders, LCDs, and flat-panel displays. Pressure-sensitive tapes for electronics assembly, low-outgassing applications, EMI/RFI shielding, static control, grounding, sealing, and electrical interconnections, along with custom development capabilities also available. ISO 9001 certified. Dave Williams, Mkt. Devel. Mgr. 717/235-7879, 1-800-445-6240 fax: 717/235-8820

ADVANCED CONVERSION TECHNOLOGY, 2001 Fulling Mill Rd.,

P.O. Box 70, Middletown, PĂ 17057 Designers/manufacturers of military and commercial standard and custom highvoltage CRT power supplies for multioutput subminiature helmet-mounted units (7.5 kV). to very-high-power color units (35 kV). Also, low-voltage system supplies, flat fluorescent drivers, transformers, and circuit card assemblies. Mike L. Endy, Sales Admin. 717/939-2300, fax: 717/939-7170 ADVANCED DISPLAY SYSTEMS, INC., 10901 Airport Blvd., No. 1, Amarillo, TX 79111

Manufacturers of fast-response multistable LCDs (FMLCDs), a new videorate-speed reflective low-power zero-field memory LCD with ultra-fine resolution and full-color capabilities. Product equipment for passive-matrix LCD manufacturing. James Lupino, Mktg. Dir. 806/335-3225, fax: 806/335-3322

ADVANCED VIDEO PRODUCTS, 2 Robbins Rd., Westford, MA 01886

Designers/manufacturers of ultra-highresolution monitors and display stations. Resolutions range from 2048 × 2560 gray scale to 4096 × 3300 single bit. Monitors can be configured for a variety of platforms including AT and MicroChannel. Henry Kunicki, V.P. Display Sls. 508/692-2020, fax: 508/486-8488

AD-VANCE MAGNETICS, INC.,

625 Monroe St., Rochester, IN 46975 Manufacturers of custom-fabricated magnetic shields; magnetic shields for CRTs; magnetic-shielding alloys, sheet, and foil; magnetic-tape data protectors; photomultiplier-tube shields; shielded enclosures for computer floppy disks; and computer-monitor shields. Kay Nixon, V.P.

219/223-3158, fax: 219/223-2524

ADVANCED DISPLAY SYSTEMS, INC., 10901 Airport Blvd., No. 1, Amarillo, TX 79111

Manufacturers of fast-response multistable LCDs (FMLCDs), a new video-ratespeed reflective low-power zero-field memory LCD with ultra-fine resolution and full-color capabilities. Production equipment for passive-matrix LCD manufacturing. James Lupino, Mktg. Dir. 806/335-3225, fax: 806/335-3322

lly

ADVANCED VIDEO TECHNOLOGIES, INC. (AVT), 34 Simarano Dr., Marlborough, MA 01752

Specializing in the sales, marketing, engineering, and implementation of modifications for companies requiring customized applications, including rackmount, ruggedized, touch screen, hemisphere conversion, and OEM re-design. Leisha Stevens, V.P. Sales

508/485-3380, fax: 508/485-3509

AEG M.S GmbH, Soeflinger Strasse 100, Um D-890077, Germany Manufacturers of LCDs for display systems, avionics, instrumentation, vehicles, and large-area informationdisplay systems, featuring chip-on-glass interconnect technology. Wolfram Wiemer, Sls. Mgr. 149-731-9331-247, fax: +49-731-9331-601

AEROTECH, INC., 101 Zeta Dr., Pittsburgh, PA 15238

Manufacturers of air bearing and linearmotor-Lased positioning systems featuring submicron accuracy and extremely tight 'elocity control for manufacturing and 'repection of FPDs. Custom and standard designs for OEMs and end-users available. Cleanroom and high-vacuum applications. Steve A. Botos, Mktg. Mgr. 412/963-7470, fax: 412/963-7459 AEROSPACE DISPLAY SYSTEMS, INC., 2321 Topaz Dr., Hatfield, PA 19440 Designers and manufacturers of custom fixed-format LCD products for worldwide use in military and commercial avionics instruments and systems. Barry G. Speck, Mgr., Domestic SIs. 215/997-3528, fax: 215/822-7974

ALCOM, Liquid Crystal Institute, Kent State University, Kent OH 44242

National research center for liquidcrystal devices, performing basic research and technology development. Educational services for liquid crystals and related technologies at all levels available. Staff includes liquid-crystal professionals from technicians to Ph.Ds. Characterization and modeling of LCDs also available. John L. West, Assoc. Dir. 216/672-2581, fax: 216/672-2796

ALLIEDSIGNAL, INC., MicroOptic Devices, 101 Albright Way, Los Gatos, CA 95030 Manufactures of SpectraVue™ products that dramatically improve color and grayscale performance over wide viewing angles for both active and passive LCDs. Products consist of a thin, highly collimating backlight and a new low-scattering diffusing

screen. Thelma Ramm, Mktg. Commun. 408/341-3004, fax: 408/341-3001

AMERICAN ELTEC, 101 College Rd. East, Princeton, PA 08540

Manufacturers of board-level computers (VMEbus and PClbus based), as well as designers of sofware, for industrial image processing and machine-vision applications. Products include ICC imaging computer, Eurocom 27 general-purpose VMEbus CPU, PCImagine, and the HiPerCam 1 PowerPC camera with bult-in image processing computer. Charles Birkhead

215/348-1010, fax: 215/348-1050

AMERICAN HIGH VOLTAGE (AHV), 1957-A Friendship Dr., El Cajon, CA 92020 Manufacturers of high-voltage power supplies for CRTs, photomultipliers, xray imaging tubes and beam-index tubes. Line of low-cost rack-mount HV supplies for laboratory work. Full-MIL-approved ruggedized hostile-environment products.

Fred Farrac, Gen. Mgr. 619/258-5804, fax: 619/258-6816

AMERICAN INSTITUTE OF SMALL BUSINESS, 7515 Wayzata Blvd., Minneapolis, MN 55426

Publishers of software, books, and videos on small-business operation and start-up, business-plan writing, the Internet, Windows 95, advertising, and public relations. Max Fallek, Dir.

612/545-7001, 1-800-328-2906 fax: 612/545-7020

AMERICAN POLARIZERS, INC., 141 S. Seventh St., Reading, PA 19602 Manufacturers of circular polarizers,

and contrast-enhancement and imagequality filters for electronic displays. Features include diffusion coatings to eliminate external glare, hard coats for abrasion and chemical resistance, EMI/RFI shield-ing, silkscreening, machining, and adhesives for assembly-ready parts. Mary E. Dybalski, Mktg. Mgr. 610/373-5177, 1-800-736-9031 fax: 610/373-2229 AMERINEX A.I., 409 Main St., Amherst, MA 01002

Manufacturers of a wide range of software products for image processing and image understanding applications and research which include graphical user interfaces, algorithm and access-function libraries, visualization tools, segmentation libraries for feature extraction, and tools for domain-specific reasoning. Richard Kretschmann, Pres. 413/256-8941, tax: 413/253-4203

AMETEK AEROSPACE PRODUCTS, Sellersville, PA 18960

Manufacturers of a complete line of LED and dichroic LCD displays and cockpit instrumentation for a wide range of aerospace applications. Jerry Anderer, Sales Mgr. 215/257-6531, fax: 215/257-1888

AMUNEAL MANUFACTURING CORP., 4737 Darrah St., Philadelphia, PA 19124

Manufacturers of custom-fabricated magnetic shields, magnetic shields for CRTs, photomultipliers, power supplies, and computer monitors. High-permeability shielding materials in both sheet and foil. In-house design, engineering, heat treat, and testing capabilities. Adam Kamens, SIs. Engr. 215/535-3000, fax: 215/743-1715

ANDREWS GLASS CO., 410 S. Fourth St., Vineland, NJ 08360

Custom manufacturers of glass and quartz components for the opto-electronics industry; envelopes, getters, plasma tubes, etc. Precision forming, grinding, polishing, glass-to-metal, and graded seals available. Dennis Courtney, Pres. 609/692-4435, 1-800-845-0026 fax: 609/692-5357

ANGEWANDTE DISPLAY TECHNOLOGIE GmbH (ADT), Allmandring 3/4, D-70569 Stuttgart, Germany

Manufacturers of standard and customdesigned active-matrix display and modules for automotive applications and mobile communications. Peter M. Knoll, Gen. Mgr.

+49-711-67962-20, fax: +49-711-67962-90

ANORAD, 110 Oser Ave., Hauppauge, NY 11788

Manufacturers of high-accuracy FP-720 positioning system for manufacturing and inspection of flat-panel displays; chip-onglass (COG) and TAB-on-glass bonding and assembly machines; linear positioning stages; vision inspection systems; linear servo motors; and motion-control components for submicron positioning in clean room and vacuum. Kevin Purdy, Sls. Mgr. 516/231-1995, fax: 516/435-1612

APPLIED FILMS CORP., 6797 Winchester Circle, Boulder, CO 80301

Manufacturers of thin-film coatings and sputtering systems. In-line sputtering systems that meet the high-throughput and stringent particulate requirements of the plasma and LCD industries. SiO_/ITOcoated glass substrates supplied to the LCD industry worldwide. Ping Wu, U.S. & Taiwan Sis. Rep. 303/530-1411, fax: 303/530-3214 APPLIED IMAGE, INC., 1653 E. Main St., Rochester, NY 14609

Manufacturers of large glass photomasks with linewidth resolution of 0.0002 in. and accuracy of ± 0.000020 in. made of highgrade chromium-coated glass for flat-panel, automotive, EL, and plasma displays or any other precision image application. Eduardo J. Navarro, V.P. SIs./Mktg. 716/482-0300, fax: 716/288-5989

APPLIED SCIENCE LABS, 175 Middlesex Tpke., Bedford, MA 01730

Manufacturers of a full range of eyetracking and pupillometry equipment, ranging from low-cost limbus tracker to complex TV-based eyehead systems. All necessary operating and analysis software is included, along with contract research services for all products. John M. Flannery, V.P. 617/275-4000, fax: 617/275-3388

APPLIED SIMULATION TECHNOLOGY, 2188 Bering Dr., San Jose, CA 95131

Providers of software solutions for the modeling and simulation of high-speed digital and analog circuits and systems. Products suited for signal integrity and EMI simulation and can be integrated into industry-standard CAD environments. Fred Balistreri, Tech. SIs. Mgr. 408/434-0967 ×102, 1-800-955-0967 fax: 408/434-1003

APPLIED TECHNOLOGY INTL., 70 W. Red Oak Lane, White Plains, NY 10604 Distributors of manufacturing equipment with U.S. maintenance support and process consulting, including Pi printing, rubbing, cell-gap pressure, spacer spray, COG mounting, and polarizer lamination; LCD glass/modules from China and Japan; ITO sputter targets; ITO glass; gold paste; and sealing epoxy. David Breeman, SIs Mor.

David Roseman, Sls. Mgr. 914/682-0424, fax: 914/682-0431

APRICOT SIGMEX LTD., Sigma House, N. Heath La., Horsham, West Sussex, U.K. RH12 4UZ

Manufacturers of a range of high-resolution high-reliability full-color monitors, including FST versions, designed for end users, systems integrators, and OEM markets. Custom ruggedized monitors. Configurable between 32 and 65 kHz. Tony Greatbatch, Sales Mgr. +44-40-350-445, fax: +44-40-341-121

ARCONIUM, 50 Sims Ave., Providence, RI 02909

Manufacturers of ITO and ITM sputtering targets, including planar, rotatable, and custom designs. Fully integrated approach from indium refining and oxide manufacturing capability to localized bonding in U.S., Belgium, and Hong Kong; available in all custom and standard geometries. Brian O'Neill, Prod. Mgr., PVD Materials 401/456-0800, 1-800-343-0282, fax: 401/421-2419

ARD CORP., 9151 Rumsey Rd., Columbia, MD 21045

Consulting services dedicated to workplace improvement through the integration of technology and the human element. Services include advanced software development, human-factors engineering, product design and evaluation, and usability testing.

Tamara K. Fuller, Bus. Dev. Coord. 301/997-5600, 1-800-969-ARD1 fax: 301/997-3902

ARIZONA LCD, INC., (AZ-LCD), 3738 W. Commonwealth Ave., Suite 14, Chandler, AZ 85226

Designers and manufacturers of LCD and LCD-related technology equipment for research, development, and production applications. Consulting and program management services offered. Suppliers of refurbished and reconditioned hightechnology equipment. Wing Li, Pres

602/899-6830, fax: 602/345-9338

ASM AMERICA, 4302 E. Broadway, Phoenix, AZ 85040

Manufacturers of LPCVD equipment for silicon and oxide films used to fabricate TFT networks that drive active-matrix LCDs. Ray Schott

602/437-1405, fax: 602/437-1403

ASSOCIATION EXHIBITIONS, 6 Foldyard Close, Sutton, Goldfield, Birmingham, West Midlands, U.K. B76 1QZ

Trade show/conference organizers of Electronic Information Displays (EID), successfully relaunched as a new series in 1993 in London, England. The 1994 and 1995 shows were highly successful, and the event, sponsored by SID, is now Europe's major display event. Next show: Oct. 1-3, 1996.

Terry C. Brandon, Event Director 44-121-313-0750, fax: 44-121-313-2423

AST PRODUCTS, INC., 9 Linnell Circle, Billerica, MA 01821-3902

Manufacturers of the VCA-4000 surface analysis system designed to measure surface characteristics such as cleanliness, coating uniformity, adherence, and quality through the analysis of contact angles obtained using video imaging and specialized software. Robert G. Layman, Jr., Sls. Rep. 508/667-4500, fax: 508/667-9778

ASTRA PRODUCTS, INC., P.O. Box 479, Baldwin, NY 11510

Manufacturers of high-performance precision Clarex® acrylic optical filters for ambient, backlit, and edgelit displays; reflective, transmissive/reflective, diffusing, and light-guide panels; optical-quality non alare filters with scratch-resistant, EMI, ITO, and other coatings (weatherable); new high-scatter panels for improved brightness. M. Bogin 516/223-7500, fax: 516/868-2371

ASTRONAUTICS C.A. LTD. ISRAEL #23 Hayarkon St., P.O.B. 882 Bnei-Brak, Israel 51261

Manufacturers of various types of color and monochrome displays, ranging from 1 to 19 in. Display processors capable of driving sophisticated video matrices for all video standards. Yosf Keinan, Mktg.

+972-3-5791553, fax: +972-3-5704404

ASTRONAUTICS CORP. OF AMERICA, 4115 N. Teutonia Ave., Milwaukee, WI 53209

Designers/manufacturers of display systems for ground, sea, air, and space applications. Systems include ruggedized high-resolution high-brightness monochrome and color CRT and active-matrix LCDs, together with graphics generators and drivers. Displays are produced to customer specifications. Robert D. Seinfeld, V.P. Bus. Dev. 414/447-8200 x306, fax: 414/447-8231

ASTROSYSTEMS, INC., 6 Nevada Drive, Lake Success, NY 11042 Manufacturers of high-voltage power supplies for CRT displays. Cecilia Marcus, Sales Admin. 516/328-1600, 1-800-645-8454 fax: 516/328-1658

ATOHAAS NORTH AMERICA, INC., 100 Independence Mall West, Philadelphia, PA 19106-2399

Manufacturers of film and sheet from Plexiglas@ brand "L"-type resin specified for increased efficiency in LCD backlights and avionic displays. Rear-projection screens of Plexiglas® "L" that perform like optical screens at one-half the cost. William Rindosh, Mktg. Mgr. 215/592-3520, fax: 215/592-2218

ATOMERGIC CHEMETALS CORP., 222 Sherwood Ave., Farmingdale, NY 11735-1718

Manufacturers of birefringent IR-window, nonlinear, photochromic, and UV-window materials, laser crystals, and rods. Also, optical coating and polishing services Gary Newman, Prod. Mgr. 516/694-9000, fax: 516/694-9177

AUTRONIC-MELCHERS GmbH, An der Rossweid 18, Karlsruhe D-76229, Germany Manufacturers of measuring and modeling equipment for LCD manufacturers and users. The Display-Measuring System series (DMS) for automated evaluation of electro-optic and colorimetric characteristics of LCDs vs viewing direction. The Display Modeling Software (DiMOS) package for simulation of LCD electro-optical performance in one and two dimensions using a finite-element approach. Juergen Kreis, Sls. Mgr. +49-721-96264-45, fax: +49-721-96264-80

AVALEX TECHNOLOGIES CORP., 5825 Glenridge Dr., Ste. 1-127, Atlanta, GA 30328

Designers/manufacturers of embedded graphical processors, video processors, and flat-panel-display controllers offering a RS-232 interface, digital or analog inputs, operating with digital or analog panels Tad Ihns, Pres. 404/256-3010

AVED DISPLAY TECHNOLOGIES,

14192 Chambers Rd., Tustin, CA 92780 Manufacturers of ISA, PCI, and analog flat-panel controllers with a wide range of price/performance options. State-of-the-art board and IC technology combined with world-class manufacturing and customer technical support. Shelby Miles, Sls. Admin

714/573-5035, fax: 714/573-5039

AXONIX CORP., 844 South, 200 East, Salt Lake City, UT 84111 Manufacturers of portable peripherals for laptop computers and a backlighting retrofit for laptops with non-backlit LCDs. David L. Cox, V.P. Mktg. 801/521-9797, fax: 801/521-9798

AYDIN COMPUTER AND MONITOR DIV., 700 Dresher Rd., Horsham, PA 19044

Manufacturers of Command & Control military display processors, ruggedized monitors, and color workstations, largescreen displays, air-traffic-control equipment and systems, satellite modems, and signal-processing equipment. Cathy DeWolf, Mktg. Admin. 215/657-8600 fax: 215/657-5470

AYDIN CORP. EAST, 414 Commerce Dr., Fort Washington, PA 19034

Designers/manufacturers of a comprehensive line of commercial and industrial autosync color monitors, and special OEM monitors ranging in size from 10 to 28 in. Configurations include open frame, metal cabinet, low-profile, rack-mount, consolemount, or special orders. David Smith, V.P. Sales

215/542-7800, fax: 215/542-8447

BABCOCK DISPLAY PRODUCTS, INC., 14930 E. Alondra Blvd., La Mirada, CA 90638-5752

Manufacturers of dc plasma displays. from seven-segment numeric to full-dotgraphic panels. Also, vacuum-fluorescentdisplay modules. Carl Doria, Sls. & Mktg. Mgr.

714/994-6500, fax: 714/994-3013

DAVID BALDAUF, 15 S. Hinterland Dr., Rhinebeck, NY 12572

Consulting services specializing in display requirement and tradeoff studies. Particular competence in the visual attributes of the various technologies, including CRT, gas panel, and liquid crystal. David Baldauf

914/876-2153

BALL AEROSPACE & COMMUNICATIONS GROUP, 9675 W. 108th Circle, Broomfield, CO 80021

Manufacturers of militarized CRT displays, ruggedized and militarized CCDs, and intensified CCD cameras. Robert M. Baker, Mktg. Mgr 303/460-5869, 1-800-428-7145 fax: 303/460-5888

BALZERS AKTIENGESELLSCHAFT, Thin Film Components, P.O. Box 1000, FL-9496

Balzers, Principality of Liechtenstein Providing consulting, prototyping, and volume production of optical components and sub-assemblies. Products include dichroic color filters, hot/cold mirrors, polarizers, cold light reflectors, and patterned dichroic color filters for LCDs. SILFLEX mirrors provide enhanced reflectance with reduced polarization effects.

Hagen Pöehnert, Bus. Dev. Mgr. +41-(0)75-388-47-89 fax: +41-(0)75-388-54-05

BALZERS PROCESS SYSTEMS. 25 Sagamore Park Rd., Hudson, NH 03051 Manufacturers of FPD thin-film production processing equipment for FED, LCD, PDP, and EL applications. Processing syster include the KAI 1, 10, & 20; PECVD system; Aristo in-line and SSP 700 cluster sputtering system; and KAI 1 etching system.

Tony Sisca, Display Sls. Engr. 603/594-1500, fax: 603/594-1538

BALZERS THIN FILM COMPONENTS, 32980 Alvarado Niles Rd., Ste. 752, Union City, CA 94586

Providing consulting, prototyping, and volume production of optical components and sub-assemblies. Products include dichroic color filters, hot/cold mirrors, polarizers, cold light reflectors, and patterned dichroic color filters for LCDs. SILFLEX mirrors provide enhanced reflectance with reduced polarization effects.

Philip Krüeger, Sales Mgr. 510/471-1232, fax: 510/471-1777 BALZERS THIN FILMS, INC., 16080 Table Mountain Parkway, Suite 100, Golden, CO 80403

Providing consulting, prototyping, and volume production of optical components and sub-assemblies. Products include dichroic color filters, hot/cold mirrors, polarizers, cold light reflectors, and patterned dichroic color filters for LCDs. SILFLEX mirrors provide enhanced reflectance with reduced polarization effects

Leo Bannon, Gen. Mgr. 303/273-9700, fax: 303/273-2995

BANGS LABORATORIES, INC. 979 Keystone Way, Carmel, IN 46032 Distributors of microparticles of different sizes, colors, and surface chemistries. Now providing polymeric and silica microspheres for use as spacers in FPDs. Thomas Petro, Sales Mgr. 317/844-7176, fax: 317/575-8801

BARCO, INC. 2558 Mountain Industrial Blvd., Tucker, GA 30048-3893

Manufacturers of ruggedized and commercial color CRTs and FPDs. Highperformance VME & PCI-based graphics controllers and video boards with the capability to mix real-time graphics, video, and radar data simultaneoulsy. Peggy Grimm, Mgr. New Bus. Devel. 770/492-5105, 1-800-543-3576 fax: 770/492-5101

BARCO, INC., 1000 Cobb Place Blvd.. Bldg. 100, Kennesaw, GA 30144

U.S. subsidiary of Belgian-based BARCO. Distributors of large-screen video/ data/graphics projectors (including LCDs), broadcast monitors, video and data presentation monitors, high-resolution imaging displays, and color-critical displays with calibration software. George Walter, Prod. Mgr. 404/590-7900, fax: 404/590-8836

BARCO nv, DISPLAY SYSTEMS. Th. Sevenslaan 106, B-8500 Kortrijk, Belaium

Designers/manufacturers of avionics head-down displays, CDUs, ruggedized and MIL-tailored displays (10-20-in.), highbrightness displays (ATC towers), 2.5K 2K 27-in. displays, and color graphics display generators displaying up to 2 million vectors/sec at a resolution of 2560 × 2048. Guy Putman, Prod. Mgr. +32-56-233-282, fax: +32-56-233-462

BARCO nv, PROJECTION SYSTEMS, Noordlaan 5, B-8520 Kuurne, Belgium

Designers/manufacturers of front and rear projectors for video, data, graphics, and HDTV projection. LCD light-valve projector using three active-matrix LCD panels (5.8in. diagonal) and offering an overall resolu-tion of more than 1.2 million pixels with an equivalent CRT peak white of over 5000 lumens

Sjoerd De Clerck, Mktg. Mgr. +32-56-368-378, fax: +32-56-368-354

BARCO nv, VIDEO & COMMUNICATIONS, Th. Sevenslaan 106, B-8500 Kortriyk, Belgium

Designers/manufacturers of color video monitors for broadcast (viewing, control, measurement, or HDTV); color monitors for video, data, or graphics presentation; highresolution imaging displays; and colorcritical displays with color-calibration software. Piet Candeel, Sales Mgr. +32-56-233-242, fax: +32-56-233-374

BATRON GmbH, Landsberger Str. 320. Munchen, 8000, Germany

Large-character alphanumeric and graphic LCD modules in STN technology with extended temperature range. Control boards for graphic LCD modules. Axel Schaefer

+49-560-17-292, fax: +49-560-17-295

BDH, LTD., Advanced Materials Div., Broom Rd., Poole, Dorset, U.K. BH12 4NN

Manufacturers of LCs for electro-optic displays; thermochromic LCs; single crystals for UV and IR optics; scintillators; fluoride glass components for fiber optics; precursors for high T_c superconductors. M. G. Pellatt, Bus. Mgr., Adv. Mater. Div. +44-202-745-520, fax: +44-202-738-299

LEO BEISER INC., 151-77 28 Ave., Flushing, NY 11354-1548

Consultancy specializing in design of image and data laser scanning and recording subsystems. Advancing speeds and resolutions for printing, graphic arts, quality and defect inspection, microscopy, triangulation, and display. Expert witness and litigation research and guidance. Leo Beiser, Pres.

718/353-7298, fax: 718/353-7098

BEST POWER TECHNOLOGY, INC.,

P.O. Box 280, Necedah, WI 54646 Manufacturers of uninterruptible power supplies ranging from 500 VA to 18 kVA. Trade names are FERRUPS and MICRO-FERRUPS. Protects sensitive electronic equipment from power problems. Don Soe 608/565-7200, 1-800-356-5794

fax: 608/565-2221

BETA PRODUCTS, INC., P.O. Box 38, Millwood, VA 22646

Consultant and manufacturer's representative for color FPDs and monitors. Norman M. Fine, Pres. 703/837-1436, fax: 703/837-3063

BILLCO MANUFACTURING

100 Grandview Blvd., Zelienople, PA 16063 Manufacturers of glass cleaning equipment for critically clean applications. Machines may be chosen from a standard line or engineered for specific requirements. Bob Long, Sales Mgr. 412/452-7390 fax: 412/452-0217

BKL, INC., 421 Feheley Dr., King of Prussia, PA 19406

Manufacturers of EL lamos for backlighting LCDs, instrumentation, watches/ clocks, portable devices, membrane switches, etc. K Series screen-printed lamps for small lit areas, and continuousroll lamos for medium-to-large square/ rectangular lit areas. Lamps available with either magnetic resonating transformer inverters or IC chip inverters. Rick Mental, Tech. Sls. Mgr. 610/277-2910, fax: 610/277-2956

BOC COATING TECHNOLOGY 4020 Pike Lane, Concord, CA 94524

Manufacturers of in-line vacuum sputtering equipment for directly coating CRTs and FPD components. Coatings include anti-reflective, anti-static, contrast enhancing, and transport conductive, as

well as various metal coatings. Richard E. Keough, Sls./Mktg. Mgr. 510/680-0501, fax 510/689-8468

BORER CHEMIE AG, Gewerbestrasse 13, Zuchwil, Solothurn CH-4528, Switzerland

Manufacturers of high-performance aqueous cleaning concentrates for all manufacturing phases of LCD production. ISO 9001 certified. René Gasser, Mktg. Dir. +41-(0)32-686-56-00, fax: +41-(0)32-686-56-90

BREAULT RESEARCH ORGANIZATION, INC., 6400 E. Grant Rd., Ste. 350, Tucson, AZ 85715

Developers of ASAP 5.1, a complete design and analysis package for LCD, entertainment, and projection systems Its menu-driven interface propagates light through optical systems without costly prototypes. Chris Campillo, Sls. Engr. 520/721-0500, 1-800-882-5085

fax: 520/721-9630

BREWER SCIENCE, INC., Optical Materials Div., 2401 Brewer Dr., Rolla, MO 65401

Manufacturers of specialty color resins, patterned color filter glass, front-end processing equipment for the sensor and display industries. Distributors for Nissan alignment and silicon hardcoat resins. Products include: PIC RGB, CMY, and black color filter resins; patterned color filter glass; Cee precision coat-bake equipment for large-area glass processing. Jeffery Hunninghake, Mgr., Intl. Mktg./Sls. 314/364-0300 fax: 314/368-3318

BRIMAR, INC., 25358 Avenue Stanford, Valencia, CA 91355-1214

Manufacturers of high-performance special-purpose CRTs for military and civil aviation, telecine, medical, and photographic color print reproduction. Glenn Barone, Pres./CEO 805/295-5770, fax: 805/295-5087

BRIMAR LTD., Greenside Way, Middleton, Manchester M24 1SN, U.K.

Manufacturers of high-performance special-purpose CRTs for military and civil aviation, telecine, medical, and photographic color print reproduction. David P. Eldridge, Sls. Dir. +44-161-681-7072, fax: +44-161-682-3818

BRITEVIEW TECHNOLOGIES, INC. 1810 Eber Rd., Unit C, Holland, OH 43528

Manufacturers of LCD-backlighting systems. The flat collimator uses total internal reflection to send all light from the backlight directly towards the viewer. resulting in very bright output. A stacked light-pipe assembly provides very bright backlighting for sunlight-readable displays and for day/night-vision modes of operation. Chen-Yu Tai, Pres. 419/868-7290, fax: 419/868-7291

BROOKS AUTOMATION, INC. 15 Elizabeth Dr., Chelmsford, MA 01824 Manufacturers of cluster-tool platforms

and other automation products that increase FPD production yields and decrease defects. James T. Jenson, FPD Prod. Mgr. 508/262-2430 fax: 508/262-2500

BURLE INDUSTRIES, INC., Security and Tube Products, 1000 New Holland Ave., Lancaster, PA 17601-5688

Manufacturers of CCD cameras, alarm products, surveillance kits, monitors, video recorders, lenses, pan/tilts, scanners, indoor/outdoor housings, mounts, video switchers, video signal equipment, gates and turnstiles. Tubes, including power, photomultiplier, image, and display products Security: Rob Drob, Mgr. Sales 717/295-6123, 1-800-326-3270 fax: 717/295-6097

Tube: Luis Vera, Mgr. Tube Prod. Sls. 717/295-6031, 1-800-366-2875 fax: 717/295-6096

CALCOMP INC., P.O. Box 3250, Anaheim, CA 92803

Manufacturers of graphics subsystems that include boards and terminals using both raster-scan and vector-refresh technologies; computer graphics products include digitizers, plotters, and plotter/printers. Debbie Corwin, Adv. Mgr. 714/821-2142, 1-800-CALCOMP, fax: 714/821-2901

CALSPAN SRL, 2800 Indian Ripple Rd., Dayton, OH 45440

Manufacturers of a line of ruggedized/ militarized avionics displays. Producers of avionics graphics processors for symbology generation and video mixing. Day/night HMDs for special mission applications. Steve Nelson, Dir. Bus. Dev. 513/427-7364, fax: 513/427-7459

CAMBRIDGE RESEARCH SYSTEMS. LTD., 80 Riverside Estate, Sir Thomas Longley Rd., Rochester, Kent, U.K. ME2 4BH

Manufacturers of graphics systems for vision research. Precision color control (36 bit), photometric linearization, optional 36-MB framestore, and 42-bit grating generator. Configurable for many displays. Custom-software library for C, PASCAL, and BASIC. Carol Luscombe, Mktg. Mgr.

+44-1634-720-707, fax: +44-1634-720-719 CAM GRAPHICS CO., INC., 15 Ranick Dr.

W., Amityville, NY 11701 Manufacturers of state-of-the-art custom-

designed membrane switches, value-added membrane switches, resistive analog and digital touch-view screens, front panels, and overlays. All touch screens can be customized to work with many FPDs including LED, LCD, EL and CRT dislays. Manny Cardinale, Pres. 516/842-3200, fax: 516/842-1005

CANADIAN MARCONI, Avionics Div., 415 Legget Dr., P.O. Box 13330, Kanata, Ontario, Canada K2K 2B2

Manufacturers/integrators of avionics products including control display units and multifunction display systems using thinfilm EL displays, color CRT displays, and segmented LCDs. Display systems using active-matrix LCDs are available. Al Letcher, Mktg. Mgr. 613/592-7454, fax: 613/592-7427

CANDESCENT TECHNOLOGIES. 6580 Via Del Oro, San Jose, CA 95119 Manufacturers of thin CRTs, a new class of flat-panel display that delivers full-motion true-color video-image quality in a lowpower low-cost FPD, viewable in bright

ambient light and from any viewing angle.

It features instant turn-on from -20° to +70°C. Nicholas G. Sturiale, Dir. Mktg.

408/229-6150, fax: 408/229-0664 CANON, INC., 30-2, Shimomaruko

3-Chome, Ohta-ku, Tokyo 146, Japan Manufacturers of cameras, videos,

copiers, facsimile machines, word processors, desktop publishing systems, printers (LBP, BJ), ferroelectric LCDs, medical equipment, and semiconductor production equipment, including LCD production equipment. Kazuo Minoura, Gen, Mor. +81-3-5482-8117, fax: +81-3-5482-5145

CANON U.S.A., INC., 3200 Regent Blvd.,

Irving, TX 75063 Manufacturers of the MPA-5000 mask aligner that can expose nine 12.1-in. LCD panels on an 830 × 650-mm substrate without stitching. It features a high-throughput all-reflective step-and-scan optical system with a resolution of 3 μ m and overlay accuracy of 3σ ≤ 1.0 µm. Phillip M. Ware, Dir. Tech. Mktg., Semiconductor Equip. Div. 972/830-9696 x2800, fax: 972/556-1620

CAPETRONIC COMPUTER USA,

140 Knowles Dr., Los Gatos, CA 95030 OEM supplier of displays. Products include 14-21 in., FS, Trinitron, conven-tional radius, or flat panel; microcontroller, multiscanning, or fixed-frequency displays. Products address PC, workstation, xwindows, terminal, and multimedia markets. Richard Maslana 408/364-2222, fax: 408/364-0395

CARDION ELECTRONICS, Long Island

Expwy., Woodbury, NY 11797 Manufacturers of air-traffic-control indicators, shipboard radar graphics indicators, shipboard indicators, miniature airborne TV cameras, solid-state digital scan converters, BRANDS, air-trafficcontrol display systems, and high-resolution circonmilitarized monochrome and color CRT displays. Francis Gareffa, V.P. Bus. Devel.

516/921-7300, fax: 516/921-7330

CARROLL CONSULTING CO., 20930 Panorama Dr., Los Gatos, CA 95030

Consulting and design services for all types of CRT monitors and video systems, especially high-resolution color multisync. Maintains a fully-equipped laboratory for accomplishing turnkey new product development projects, including fabrication of prototypes. Gus Carroll, Pres.

408/353-5114, fax: 408/353-1203

CARROLL TOUCH, INC., (A Division of AMP) 811 Paloma Dr., Round Rock, TX 78664

Manufacturers of touch systems and operator interface systems utilizing scanning IR and guided-acoustic-wave touch technologies for a range of applications and market sectors. Mike O'Brien, Inside Sls. Supervisor 512/388-5678, 1-800-386-8241 fax: 512/244-7040

CASIO LCD SALES (Div. of Kanematsu USA, Inc.), 543 W. Algonquin Rd., Arlington Hts., IL 60005

Manufacturers of LCDs/modules; passiveand active-matrix monochrome and color TFTs. Standard product offerings range

from small character displays to large graphic modules. Technologies include chip-on-glass, plastic-film LCDs, thin backlighting, and touch-panel integration. David Ross, Natl. Sls. Mgr 708/981-5621, fax: 708/981-6764

CATON CONNECTOR CORP., 26 Wapping Rd., Kingston, MA 02364

Manufacturers of high-voltage connectors and cable assemblies for operation up to 60 kV. Single- and multi-conductor configurations. Standard designes are stocked, while custom designs are dependent on complexity. James Tantillo, Sls. Mor 617/585-4315, fax: 617/585-2973

CELCO, 70 Constantine Dr., Mahwah, NJ 07430

Manufacturers of deflection yokes, including the Discom line of deflection yokes, focus coils, and magnetic assemblies for precision CRT displays, flight simulators, HUDs, cockpit displays, helmet displays, and medical monitors. Art Weirgin, Sls. Engr. 201/327-1123, fax: 201/327-7047

CELCO, Pacific Division, 1150 E. 8th St., Upland, CA 91786

Suppliers of the eXtreme MPX motionpicture digital color film recorder to the film industry. Manufacturers of a wide range of direct-drive deflection amplifiers, precision CRT systems, and CRT test equipment.

John Constantine, Mktg. & Sls. 909/985-9868, fax: 909/982-2464

CFM TECHNOLOGIES, INC., 1336 Enterprise Dr., West Chester, PA 19380 Manufacturers of the FPD Full-Flow™

system that executes cleaning, etching, stripping, and drying of various-sized FPDs. The patented Direct-Displace™ processing and drying method uses a totally enclosed processing vessel for high performance. Peter Hauser, V.P., FPD Equipment 610/696-8300, fax: 610/696-8309

CHERRY ELECTRICAL PRODUCTS, 3600 Sunset Ave., Waukegan, IL 60087

Manufacturers of segmented bargraphs and dot-matrix dc plasma displays and display systems. PLASMADOT™ display systems offered with high-voltage drivers, dc-dc converters, and display refresh controllers with parallel and serial interface. Also, keyboards, switches, and automotive products.

Brad Taylor, Product Mktg. Mgr. 708/360-3434, fax: 708/360-3566

CHIPS AND TECHNOLOGIES, INC.

2950 Zanker Rd., San Jose, CA 95134 Manufacturers of flat-panel graphics/video accelerators for portable and desktop display systems. The HiQVideo™ family provides high-performance graphics, fullmotion video, and other advanced display capabilities. Recently announced products incorporate HiQColor™ technology to improve color and image fidelity of low-cost passive displays. Mike Endris, Dir, Distrib, Sls.

408/434-0600, fax: 408/894-2085

CHOMERICS, Division of Parker Hannifin Corp., 77 Dragon Ct., Woburn, MA 01888 Manufacturers of low-cost EMI-shielding

laminates for display shields, made of copper or aluminum foil which is adhesivebonded to polyvinyl chloride (PVC) film.

The conductive foil layer provides 20-60 dB of EMI shielding. William Lionetta, Natl. Sls. Mgr. 617/935-4850, 1-800-225-1936 fax: 617/933-4318

CHROMA ATE, INC., 43 Wu-Chuan Rd., Wu-Ku Industrial Park, Wu-Ku, Taipei Hsien, Taiwan, R.O.C.

Manufacturers of programmable video pattern generators for monitor and LCD testing; CRT color analyzers; and monitor auto-alignment systems. Jack Hsu, Mktg, Mgr. +886-2-2983855, fax: +886-2-2983596

CID Technologies, Inc., 101 Commerce Blvd., Liverpool, NY 13088

Manufacturers/marketers of a full line of high-resolution solid-state monochrome video cameras incorporatino patented charge injection device (CID) sensors. In-house design and fabrication of custom or application-specific sensors and cameras. Tony Chapman, Tech. Mktg. Mgr. 315/451-9410, fax: 315/451-9421

CIRCON ACMI CORP., 460 Ward Dr., Santa Barbara, CA 93111 Manufacturers of the Endo Video-V™ CCD camera. Featuring over 400 lines of horizontal resolution, this camera is ideal for all endoscopy applications. David Calvin, Mktg. Mgr. 805/967-0404

CIRRUS LOGIC, INC., 1463 Centre Pointe Dr., Milpitas, CA 95035

Manufacturers of graphics controller semiconductors for CRT and LCD displays, providing full VGA (including mode 13), EGA, CGA, MDA and HGC computability. William Caparelli 408/945-8300, fax: 408/263-5682

CITRONIX, INC., 5342 Halsted Ave., Carmichael, CA 95608 Designers and manufacturers of magnetic

deflection amplifiers for high-resolution CRTs. The display format is in either calligraphic, raster, or both. Typical uses include projection displays for flight simulators. Al Pletz, Pres.

916/489-9858, fax: 916/481-0288

CLINTON ELECTRONICS CORP., Contract Assembly Div., 6701 Clinton Rd., Loves Park, IL 61111

Consignment to build full turnkey color and monochrome CRT and flat-panel products. Design service and follow-through engineering support, including agency packaging and direct-to-customer distribution. Lary Johnson, Product Mgr., Display Prod. 815/633-1444, fax: 815/633-8712

CLINTON ELECTRONICS CORP., Cathode-Ray Tubes, 6701 Clinton Rd., Loves Park, IL 61111

Manufacturers of 3-23-in. ultra-highresolution monochrome CRTs for display, medical, and photographic applications. Extensive selection of phosphors and antiglare treatments for customizing optical performance available.

David Salamone, Dir. Sls. & Mktg. 815/633-1444, fax: 815/633-8712.

CLINTON ELECTRONICS CORP., Monitors, 6701 Clinton Rd., Loves Park, IL 61111

Designers and manufacturers of highresolution monochrome displays for document and medical imaging using embedded microprocessor control. Multifrequency operation from VGA to 1280 lines. Hi-Brite and custom products available

Lary Johnson, Product Mgr., Monitors 815/633-1444, fax: 815/633-8712

COLORADO VIDEO, INC., 6235 Lookout Rd., Ste. G, Boulder, CO 80301 Manufacturers of a line of specialized

video instruments, including test and measurement, image analysis, unique frame stores, and slow-scan TV communications equipment. Larry McClelland, Pres 303/530-9580, fax: 303/530-9569

COLORLINK, INC., 4730 Walnut St., Suite 105, Boulder, CO 80301 Manufacturers of solid-state switchable RGB color filters for color-sequential solutions in imaging and display applications. Filters provide high brightness, color saturation, and resolution for converting monochrome into color. Also, manufacturer and licenser of tunable optical filter technologies.

Thomas Boysen, Op. Mgr. 303/545-5843, fax: 303/545-5802

COLOR TECHNOLOGY SOLUTIONS, 2894 NW 127th Ave., Suite 101, Portland, OR 97229

Consulting services in color technology and applications for electronic imaging systems, color displays, television/video, multimedia, printing, instrumentation, and color-management systems. Technology/ product evaluations, benchmarking, application of color standards, market research, and color quality assurance. Joann M. Taylor, Pres. & Chief Consultant 503/645-5129, fax: 503/645-5129

COMFUTURE LTD., 7 Habonim St., Ramat Gan, Israel 25251

Manufacturers of alphanumeric or graphic displays and sunlight-visible color graphic displays, with animation of 24 frames/second. All products driven by PC compatibles. Eilon Ginsburg, CEO +972-3-751-0940, fax: +972-3-752-2935

COMPUTER DYNAMICS, 7640 Pelham Rd., Greenville, SC 29615

Manufacturers of a broad line of complete flat-panel computers (286's through Pentiums) and flat-panel monitors, both with optional touch screens, for OEM and end-user operator interface applications. +864/627-8800, fax: +864/675-0106

COMPUTER KEYBOARDS SYSTEMS, 3250 Ocean Park Blvd., Suite 370 Santa Monica, CA 90405

Manufacturers of standard and custom sealed keyboards, illuminated and stainless-steel keyboards, trackpads, and trackballs.

Laura Rudnitsky, Mktg. Commun. 310/664-9272, fax: 310/664-1072

COMPUTER PERIPHERALS, INC., 667 Rancho Conejo Blvd., Newbury Park. CA 91320

Manufacturers of font cartridges and expandable memory for the HP LaserJet printer and enhancement board products for IBMs, PC/XT/AT/XT286/PS2, and true compatibles.

Susan Humpting, Mgr. Inside SIs. 805/499-5751, 1-800-854-7600 fax: 805/498-8848

CONRAC DISPLAY PRODUCTS, INC., 1724 S. Mountain Ave., Duarte, CA 91010-2746

Manufacturers of color and monochrome monitors for computer graphics, process control, medical, broadcast, ruggedized products for hostile environments, simulator systems, and other custom applications. Monitor screen sizes range from 9 to 27 in. Ali Hussein, Dir. Mktg. & SIs. 818/303-0095, fax: 818/303-5484

CONSTELLATION, P.O. Box 117, West Olive, MI 49460

Consultancy specializing in the design, installation, and turn-on of high-volume LCD and FPD production lines, including TN, STN, active-matrix, and PBCT. Upgrading of existing production lines available. Specialist in ITO deposition. Jerry Garies, Managing Dir. 616/786-9988, fax: 616/786-9160

CONTEC CAE, 2188 Bering Dr., San Jose, CA 95131

Providers of a software system which can be used as a tool to facilitate the design and optimization of flat-panel displays using AMLCD technology. The system provides tools for simulation and modeling of all the components of the electronic modules in an FPD. Fred Balistreri, Sls. Mgr. 408/434-6767 x120, 1-800-888-8884 fax: 408/434-6884

CONVAC-APT, 24 Third Ave., Burlington, MA 01803

Manufacturers of photolithographic process equipment for the automatic processing of large glass substrates 200 x 200 mm (8 x 8 in.) up to 400 x 400 mm (16 x 16 in.). Mark Mason, Dir., Eastern Reg. 617/229-7772, 1-800-622-8060 fax: 617/272-8079

CORECO, INC., 6969 Trans Canada Hwy., Ste. 113, St. Laurent, Quebec, Canada H4T 1V8

Designers/manufacturers of board level frame grabbers and digitizers compatible with the IBM PC bus taking any video input for vision-related applications, including machine vision, robotics, factory automation, scientific, medical, security and desktop publishing. Patrick Urbain 514/333-1301, 1-800-361-4914 fax: 514/333-1388

CORNERSTONE IMAGING, INC.

1990 Concourse Dr., San Jose, CA 95131 Designers/manufacturers of large-screen high-resolution (1600 × 1280) display controllers and subsystems for PC/AT and microchannel architecture, specifically for document image processing and publishing applications.

Ken Westrick V P SIs 408/435-8900, fax: 408/435-8998

CORNING ASAHI VIDEO PRODUCTS, 2 East Denisen Parkway, Corning, NY 14831

Manufacturers of a complete line of CRT panels, funnels, bulbs, and TV glass components.

Alan G. Herklotz.

607/974-7791, fax: 607/974-7731

CORNING INCORPORATED, Advanced Display Products, MP VX-1-3. Corning, NY 14831

Manufacturers of 7059F and 1737F glass substrates for advanced technology flatpanel displays.

Ben J. Garbowski, Mgr./N.A. Sls. 607/974-4308, fax: 607/974-7097

CORNING INCORPORATED,

Corning Engineering, HP-ME01-003-C10, Corning, NY 14831 Provider of worldwide turnkey services

for the design, supply of equipment, training, and on-site assistance concentrating in glass components for entertainment and display CRTs (b/w and color); lighting (ribbon machine, Vello tubing); pharma-ceutical tubing; and consumer products.

Zia Haider, Sls. & Mktg. Mgr. 607/974-6023, fax: 607/974-8354

CORYPHAEUS SOFTWARE, INC. 985 University Ave., Ste. 31, Los Gatos, CA 95030

Software developers of a comprehensive line of real-time visual-simulation products, including Designer's Workbench™ (DWB), a 3D modeling and editing environment; EasyTTM, a terrain-creation system; and EasyScene™, a real-time scene-display

Bill Oliver, Dir. Sls./Mktg. 408/395-4537, fax: 408/395-6351

COURTAULDS PERFORMANCE FILMS, 21034 Osborne St., Canoga Park, CA 91304

Manufacturers of vacuum sputter coated films in roll form. All coatings are electrically conductive; several are also optically transparent. Standard products include ITO and silver and gold based transparent coatings on PET. In addition to standard coatings, speciality coatings are also available

Bunny Russitti-Buckley, Sls. Mgr. 818/882-5744, fax: 818/882-6519

COVID, INC., 1725 W. 17th St., Tempe, AZ 85281

Manufacturers of high-resolution 100-MHz computer-video interfaces, distribution amplifiers, switches, and umbilical cables. Interfaces link PCs, terminals, and graphics workstations to RGB data projectors and monitors for viewing on large displays. Suzanne Jones 602/966-2221, 1-800-638-6104

fax: 602/966-6728

CRAFT DATA, INC., 27022 Cordero La., Mission Viejo, CA 92691 Value-added distributor for Planar and

Panasonic. Distributor for Casio LCD. Manufacturer of CD650 controller for llat-panel displays. Modules assembled with/without touch panels to customer specifications.

Fred W. Holstein, Jr., Pres. 714/582-8284, fax: 714/248-2390

CRAFT DATA LTD, 92 Broad St. Chesham, Bucks., HP5 3ED, U.K. Distributors of electronic displays:

monochrome and color LCDs, LEDs, ELs, ano plasma displays. Monitors, industrial terminals, IR and guided-wave touch sys ems; plus thermal printheads, mechanisms, and standalone printers. Also, all types of magnetic card readers. F. G. Tagg, Dir. Sls/Mktg.

+44-1-494-778-235, fax: +44-1-494-773-645

CREW SYSTEM ERGONOMICS INFORMATION ANALYSIS CENTER, AL/CFH/CSERIAC, 2255 H Street, Bldg. 248, Wright-Patterson AFB, OH 45433-7022

Information and technology distributor of a variety of products and services to help incorporate ergonomic principles in the design and development of visual display systems. Provides technical summary and analysis support for human-factors-related inquiries.

Kathy Reineke, Sls. Mgr. 513/255-4842

CRL, Dawley Road, Hayes, Middlesex, 4B3 1HH

Suppliers of spatial light modulators and ferroelectric LC shutters. Developers of novel and prototype nematic and ferroelectric LCDs, field-emission displays, and electrodeless backlights. Consultancy, IPR searches, and display repairs also undertaken. Alan Mosley

+44-181-848-6400, fax: +44-181-848-6653

CR TECHNOLOGY, INC., 27752 El Lazo Rd., Laguna Niguel, CA 92677-3914 Suppliers of automated or manuel vision and x-ray inspection systems for fast, accurate, and repeatable CRT, flat-panel displays, and loaded board testing. Don Miller, Dir. Sls.

714/448-0443, fax: 714/448-0445

CRT INTERNATIONAL CORP., 429 N Street S.W., #S-106, Washington, DC 20024

Distributors of CRTs for photorecording, special-application CRTs, e-guns, and various flat-panel displays. Boris L. Chervinsky, Pres. 202/863-0539, fax: 202/863-0539

CRT SCIENTIFIC CORP., 14746 Raymer St., Van Nuys, CA 91405 Manufacturers of a wide range of mono-

chrome CRTs from 0.5 in. to 25V. Ken Keller, Pres.

818/989-4610, fax: 818/989-4617

CRYSTALOID ELECTRONICS, 5282 Hudson Dr., Hudson, OH 44236

Manufacturers of LCDs for commercial, industrial, avionic, and military applications. Technologies include TN, STN, RCTN, and dichroic displays and modules. Charles E. Holland, Sls. Mgr. 216/655-2429 x240, 1-800-888-BEST-LCD fax: 216/655-2176

CRYSTAL VISION, INC., P.O. Box 3960, Rolling Hills Est., CA 90274

Manufacturers of video LCD controller board that digitizes real-time "video-in-awindow" (NTSC, PAL, SECAM, or S-Video). Such a 32,768 color video is overlaid with VGA graphics and displayed on two AMTFT color LCD panels and a VGA CRT

simultaneously. Richard Hopkins, Engrg. Mgr. 310/316-1770

CRYSTOP DISPLAY GmbH, Hansastrasse 29 C, D-7500 Karlsruhe 21, Germany

Manufacturers of LCD modules and systems; pattern-recognition systems for auto-matic test of LCDs and systems. Development and prototyping. Werner Pauls

+49-721-579-048, fax: +49-721-50-1116

CTX OPTO, INC., 1257 Tasman Drive, Suite B, Sunnyvale, CA 94089 Manufacturers of the CTX EzPro 550 LCD projector featuring true SVGA 800 × 600 resolution and portability. Each unit comes complete with carrying case, accessories, remote, and spare bulbs. Michael Romley, Sls. Mgr. 408/541-6060, 1-888-289-6786 fax: 408/541-6068

CTX OPTO-ELECTRONICS CORP., 3F, No. 22 Industry E. Rd. 9, Science-Based Industrial Park, Hsinchu, Taiwan 300, R.O.C

Manufacturers of passive- and activematrix LCD monitors, custom-made LCD backlights, and LCD projection panels. Wilson Chan, Dir +886-35-772-000, fax: +886-35-772-530

CYBEQ, 150 Independence Dr., Menio

Park, CA 94025 Manufacturers of flat-panel-display

robotic handler. Ali Darvish 415/688-8921, fax: 415/326-2446

DABURN ELECTRONICS & CABLE CORP., 224 Pegasus Ave., Northvale, NJ 07647

Manufacturers of a full line of computer cable, shrink tubing, modular cords, retractile cords, and electronic hardware. Howard Danzhgai, Dir. Mktg. 201/768-5400, fax: 201/768-9642

DAGE-MTI, INC., 701 N. Roeske Ave., Michigan City, IN 46360

Manufacturers of high-performance high-resolution b/w CCTV cameras and monitors.

Paul Thomas, V.P. Sls./Mktg. 219/872-5514, fax: 219/872-5559

DAINIPPON INK & CHEMICALS, INC., Imaging and Reprographic Products Div 7-20, Nihonbashi 3 chome, Chuo-ku, Tokyo 102. Japan

Manufacturers of a variety of LC materials for LCDs and related products such as sealants and color filters. T. Takahashi, Gen, Mor.

+81-3-272-4511, fax: +81-3-272-1565

DAKTRONICS, INC., 331 32nd Ave., Brookings, SD 57006 Designers and manufacturers of large-

scale programmable display systems for sports, business, and government. Display technologies include LEDs, incandescent, and reflective in a wide variety of character sizes and matrix configurations. Frank Kurtenbach, Sls. Mgr. 605/697-4300, 1-888-325-8766 fax: 605/697-4700

DALE ELECTRONICS, INC., 1122 23rd St., Columbus, NE 68601

Manufacturers of resistive products along with plasma display panels and touch screens. Products are ISO-9000 certified for use in all display applications, including industrial controllers, medical equipment, aviation (including GPS), and gaming and redemption equipment. Custom plasma or touch-panel engineering support will adapt technology to a wide range of applications. Neal J. Kratochvil, Sls. Appl. Engr. 402/563-6308, fax: 402/563-6418

DALIM COMPUTER GRAPHIC SYSTEME GmbH, Daimler - Str. 2, 7640 Kehl-Sundheim, Germany

Manufacturers of the Dalim Litho which is both a graphic creation system as well as a comprehensive retouching and imagecomposing system. Dalim Litho is targeted specifically at repro houses, photolaboratories, and the packaging industry (i.e., all companies involved with the pre-press production cycle. Winard Suffrian

+49-7851-4021, fax: +49-7851-7737

DA-LITE SCREEN CO. INC., 3100 State Rd. 15 North, P.O. Box 137, Warsaw, IN 46580

Manufacturers of a neutral polarizing filter which is stable at 100°C for the UV and visible spectrum. Arvid Martin, Prod. Mgr. 219/267-8101, fax: 219/267-7804

DANA ENTERPRISES INTERNATIONAL INC., 1440 S. De Anza Blvd., San Jose, CA 95129

Distributors of polarizers manufactured by Sanritz, Fujioka-City, Japan; spacers for LCDs, manufactured by Sekisul Chemical, Osaka, Japan; and equipment for LCD manufacturing exported by Com-Tech Ltd., Tokyo, Japan. Offering precision polarizer die-cutting services — no tooling needed. David Nakamura, Pres. 408/257-6686, fax: 408/973-9620

DARK FIELD TECHNOLOGIES, 110 Richards Ave., Suite 100, Norwalk, CT 06854

Distributors of laser-inspection systems for coated and uncoated glass panels and plastic film. Extensive application experience with on-line real-time production processes, float glass, and photoresist metalized film and polyester, including wetcoating inspection. Timothy A. Potts, Pres 203/853-2035, fax: 203/853-2350

DATA DISPLAY PRODUCTS, 445 S.Douglas St., El Secundo, CA 90245 Manufacturers of LED indicators and lamps to replace incandescents in PCBmount, panel-mount, and lamp-based applications Roy Appleman, Sis, Engr.

310/640-0442, 1-800-421-6815 fax: 310/640-7639

DATA PLUS - CALIFORNIA, 2970 Bannister Ave., Gilroy, CA 95020

Distributors of a wide range of video and imaging products from companies such as TEAM Systems, Graseby Optronics, Integral Technologies, Pacifitek, In-Line, Hitachi, Multimedia, Radiographic Digital Imaging, and Komax Technology. Bill Nicklin, Pres Phone/fax 408/842-9907

DATA RAY CORP., 12300 Pecos, Westminster, CO 80234

Designers and manufacturers of highperformance color and monochrome CRT displays. OEM and system-integration applications include medical and industrial imaging, PACS and teleradiology, simulation, and data display. ISO 9001 certified.

Ann Woodley, Dir. Sls./Mktg. 303/451-1300, 1-800-926-5556 fax: 303/451-1143

DATA TRANSLATION, INC., 100 Locke Dr., Mariboro, MA 01752

Manufacturers of microcomputer analog I/O systems, image-processing products, and array-processing boards for the IBM PC/PS2, MicroVax II/Q-bus and Unibus, Mac II, VMEbus, Multibus, Multibus II. Neil Cronin, Sls. Mgr. 508/481-3700, fax: 508/481-8620

DAVALCO, 15506 Commerce La., Huntington Beach, CA 92649 Manufacturers of high-voltage power supplies for HUD/NV, target acquisition, and radar

David Neitberger, Sls. Mgr. 714/892-7631, fax: 714/897-1949

DAVIS A/S, P.O. Box 380, Drammen 3001, Norway Manufacturers of LCD projection panels,

LCD data and video projectors, and LCD monitors. The projectors are based on DLP technology. Jon Rortveit, V.P. Mktg.

+47-3281-9500, fax: +47-3281-8115

DBI, INC., 4103 S.E. International Way, Milwaukie, OR 97222

Manufacturers of rugged LCD monitors and touch screens, and 10.4- and 12.1-in. color AMLCDs less than 1.60 in. in depth. Also, a VT220 terminal that uses a TFT display for under \$2000. Bill Finch

503/654-6216, 1-888-654-4052 fax: 503/654-6486

DCI, INC., 14812 W. 117th St., Olathe, KS 66062

Product line includes panel meters, custom passive I CD modules, custom TN-LCDs, contract manufacturing services build to print and turnkey, microassembly, heat-seal equipment, and engineering services.

Maureen Conran, Cust. Service/Inside SIs. 913/782-5672, fax: 913/782-5766

DECISION IMAGES, INC., 196 Tamarack Circle, Skillman, NJ 08558

Manufacturers of color resource imageprocessing software for image editing and enhancement, transforms, 3D perspective, and multispectral classification. Supports selective video cameras, scanners, printers, film recorders, and image boards. Robert Mills, Pres.

609/683-0234, fax: 609/683-4068

DEL ELECTRONICS CORP.,

1 Commerce Park, Valhalla, NY 10595 Manufacturers of custom and standard high-voltage power supplies and transformers for the display industry. Jeremy Simon, Mgr. Mktg./Sls. 914/686-3600, fax: 914/686-5424

DEMPA PUBLICATIONS, INC.

275 Madison Ave., New York, NY 10016 Publishers of trade magazines (Display Devices, JEE, JEI, OEP, AEU, EBG, Almanac).

Soo Sonntag, Subscription Mgr. 212/682-4755, fax: 212/682-2730

DENGLAS DIVISION OF DENTON VACUUM, INC., 8 Springdale Rd., Cherry Hill, NJ 08003

Manufacturers of antireflective coatings for antiglare screens, projection windows and instrument windows, clear and neutral density glass, neutral and nonabsorbing beam splitters, color-correction filters,

and hot and cold mirrors using soda-lime or borosilicate glass for dichroics. F. Lee Swillinger, Gen. Mgr. 609/424-1012, fax: 609/424-5105

DENSITRON, 3425 W. Lomita Blvd., Torrance, CA 90505

Manufacturers of standard and custom LCD modules and integrated VGA flatpanel subsystems. Products include character and graphics LCD modules with a wide range of options. Products combine FPDs, single-board computers, graphics controllers, and housings. Chuck Britten, Regional SIs. Mgr. 310/530-3530, fax: 310/534-8419

DENTON VACUUM, INC., 2 Pin Oak Ave., Cherry Hill, NJ 08003

Manufacturers of antiglare filters for VDTs, broadband AR coatings on clear and absorbing glasses, dichroic filters, and beamsplitters. James Gavlas, Oprns. Mgr. 609/424-1012, fax: 609/424-5105

DH PRINT, Technical Research Park, Riverton, WY 82501 Manufacturers of 40-column dot-matrix

printers. Also manufactures the Cypher series of demand barcode label printers. Howard Kingbury, Mgr. 307/856-4821, fax: 307/856-0412

DIAGNOSTIC/RETRIEVAL SYSTEMS, INC., 16 Thornton Rd., Oakland, NJ 07436 Designers/manufacturers of high-speed processing and display systems for target detection and analysis with military and industrial applications. Color high-resolution raster-based systems are multifunctional and capable of processing and displaying

sonar, radar, ECM, infrared, and strategic and tactical C³I data. P. Williamson, Asst. V.P./Corp. Comm. 201/337-3800, fax: 201/337-4775/3314

DIALIGHT CORPORATION, 1913 Atlantic Ave., Manasquan, NJ 08736

Manufacturers of LED circuit-board indicators; neon, incandescent, and LED panel-mount indicators; and illuminated switches. Also, LED surface-mount solutions and secondary optics products. Gary Baker, Mktg. Mgr. 908/223-9400, fax: 908/223-8788

DIAMOND TECH ONE, INC., 12100 Technology Dr., Austin, TX 78727 Providers of engineering and fabrication services for microelectronics packaging, FPD electronics, materials deposition, and back-end semiconductor-water processing. supporting an accelerating industry demand for high-performance systems requiring higher interconnect density, such as flipchip packaging. Michael Feeley, V.P. Sls./Mktg.

512/331-6200 fax: 512/250-2730 DICRYSTAL IMAGES, 345 Industrial Blvd., McKinney, TX 75069

Manufacturers of high-tech dichroic and special TN displays. Ken Richardson, Pres

214/562-3140, fax: 214/548-9890

DIGITAL VIEW, 20/F Kam Chung Communication Bldg., 19-21 Hennessy Rd., Wanchai, Hong Kong

Manufacturers of interface controllers for flat panels, including active- and passivematrix LCDs, color and monochrome, for

connection to analog VGA to SXGA and PC bus. James Henry

+852-2861-3615, fax: +852-2520-2987

DIGITAL VISION, INC., 270 Bridge St., Dedham, MA 02026 Manufacturers of Computer Eyes full-

color and b/w video digitizers for PCs. Versions are available for IBM PC, Macintosh, Apple II, Atari, and Commodore computers Paul Terrio 617/329-5400, fax: 617/329-6286

DIGITRAN, Division of XCEL Corp. 4290 E. Brickell St., Ontario, CA 91761

Providers of display and data-input subsystem engineering, manufacturing, and integration services. Manufacturers of custom front-panel displays, keypads, and keyboards, and digital switch products including sunlight-readable, VIS-compatible, and secure-lighting displays. Frank Ganz, Sr. Prod. Engr 909/391-4321, fax: 909/391-4558

DIMENSION TECHNOLOGIES, INC., 315 Mt. Read Blvd., Rochester, NY 14611

Developers/manufacturers of advanced LCD performance-enhancement technologies, i.e., autostereoscopic, high-brightness, high-definition displays. The DTI 1100C Virtual Window™ is a 3D visualization display for viewing, without glasses, 3D computer-generated and video imagery. Jeffrey J. Tokarz, Mktg./Sls. Mgr. 716/436-3530, fax: 716/436-3280

DIS (DISPLAY INSPECTION SYSTEMS. INC.), 46992 Liberty Dr., Wixom, MI 48393-3693

Manufacturers of surface-analysis and inline inspection machines combining high throughput and high sensitivity. The BB/FP 350 and BB/FP 700 offer in-line inspection of glass substrates for flat-panel manufacturers.

Jim Morgenstern, V.P. Marketing 810/669-7314, fax: 810/669-7310

DISPLAY ENGINEERING, INC.

972 Hamilton Ave., Palo Alto, CA 94301 Engineers flat-panel displays, especially LCDs, into end products. Develops related technologies for displays such as LCD backlighting systems. Specializes in optics (including holographic technologies), mechanics, and materials for displays. Substantial international experience. Kevin J. Hathaway 415/329-0900, fax: 415/329-0912

DISPLAY LABORATORIES, INC., 2540 Frontier Ave., Suite 109, Boulder, CO 80301-2400

Manufacturers of DLAB590A™ MIMiC®-2D and 3D: Monitor controller and dynamic convergence chips generating digitally controlled horizontal/vertical rate dynamic correction waveforms for geometry and convergence. MIMiCAM® Alignment System: Patented single-camera alignment system. Display Labs® SoftOSD™: An onscreen display requiring no hardware. Craig T. Ridgley, Dir. Mktg. 303/938-9099, fax: 303/938-9199

DISPLAY PRODUCTS TECHNOLOGY LTD., 1 Langlands Court, Kelvin South Business Park, East Kilbride, G75 0YB Specialists in the repair of LCDs.

Providers of a high-volume quickturnaround repair/analysis service. Subassembly and test facilities available in addition to new product and technical consultany. +44(0)-1-3552-39199.

fax: +44(0)-1-355241190

DISPLAYS & TECHNOLOGIES (D&T), INC., P.O. Box 3501, Zip 98668-3501 14511 N.E. 13th Ave., Vancouver, WA 98685

Manufacturers of display contrastenhancement products; ruggedized and enhanced COTS AMLCDs, EL, and CRTs; full-backlit ruggedized and enhanced AMLCDs for military and commercial platforms; full NVIS compliance and testing. Leon B. Ledave, Pres./Dir. Mktg. 360/574-5000, fax: 360/573-4635

DISPLAYS, INC., 87 Industrial Park Rd., Lewistown, PA 17044

Manufacturers of a wide range of custom and standard displays, including digital, alphanumeric, bargraph, and dot-matrix versions, used in audio equipment, pinball games, cash registers, operator interfaces, instruments, etc Kit C. Kennedy, Pres. 717/242-2541, fax: 717/248-8680

DISPLAY SYSTEMS, INC., 15 Barber Pond Rd., Bloomfield, CT 06002

Designers/manufacturers of custom LCD, LED, EL, and VF display modules. Also, controls for meters, process-variable controllers, and many types of industrial controls. Applications include security systems, medical, military, and industrial. Richard C. McComb, Pres 203/726-1201, fax: 203/726-1202

DISPLAY TECH, INC., 1731 Albion Rd., Albion, MI 49224

Manufacturers of electronic (LED) information displays, over 200 sizes available with "canned graphics," editable messages, full network capability, time scheduling, operated by keyboard or with IBM PC compatible

Dave Bridges, Sls. Mgr. 517/629-2670, 1-800-533-3477 fax: 517/629-3098

DISPLAY TECHNOLOGIES, INC., 1355 Holmes Rd., Elgin, IL 60123

Manufacturers of 5-21-in. monochrome and color CRT monitors, and large-screen monochrome 15- and 19-in. monitors in enclosures. Also, OEM custom monitors. Carl Cobb, West. Regional Mgr 415/694-7411, 1-800-544-8823 fax: 415/694-7413

DISPLAY TECHNOLOGY LIBRARY FROM INTERLINGUA, 423 S. Pacific Coast Hwy. #208, Redondo Beach, CA 90277

Market researchers/publishers of a unique collection of documents from Japan on manufacturing, R&D, and market and technology trends in the electronic-display field. Tables of contents can be viewed at http://www.japanese-translation.com. David Andrews, CEO 310/792-3636, fax: 310/792-3642

DOLCH COMPUTER SYSTEMS, INC. 3178 Laurelview Ct., Fremont, CA 94538 Manufacturers of environmentally

protected flat-panel TFT-based display systems sold as operator interfaces, complete monitors, and OEM subsystems. Touch screens and network-ready embedded Pentiums are available. Vince Tarpey, Dir. DPG 510/661-2220, 1-800-538-7506 fax: 510/490-8345

DOME IMAGING SYSTEMS, INC. 400 Fitth Ave., Waltham, MA 02154

Manufacturers of medical-imaging hardware and software for the PCI, SBUS, and Hewlett-Packard workstations. Medical Applications include PACS, teleradiology, mammography, CT, and nuclear medicine. Karen D. Miller, V.P. SIs. & Mktg. 617/895-1155, fax: 617/895-1133

DONNELLY APPLIED FILMS CORP., 6797 Winchester Circle, Boulder, CO 80301 Manufacturers of substrates suitable for color STN, color EL, AMLCD, and FED product manufacturing. Also, substrates for TN-LCD and ITO coatings for electrochronic mirrors, and a variety of transparent conductive thin films for a wide range of product applications. Graeme L. Hennessey, V.P. Sls./Mktg. 303/581-5490, fax: 303/530-3214

DONTECH, INC., 700 Airport Industrial Blvd., Doylestown, PA 18901

Designers/manufacturers of optical filters for anti-reflection/contrast-enhancement and EMI/RFI shielding of electronic displays. Line of rigid rear-projection screens (marketed under Optical Solutions). Jeffrey S. Reid, Dir. Mktg./Sls. 215/348-5010, fax: 215/348-9959

DOTRONIX, INC., 160 First Street S.E., New Brighton, MN 55112-7894

Manufacturers of OEM video displays in both monochrome and color, specializing in medical imaging and multimedia presentation monitors.

D. Michael Hunter, Natl. Sls. Mgr. 612/633-1742, 1-800-720-7218 fax: 612/633-1065

dpiX, A XEROX NEW ENTERPRISE COMPANY, 3406 Hillview Ave., Palo Alto, CA 94304-1345

Manufacturers of high-performance AMLCDs and a-Si x-ray image sensors. Eagle cockpit displays deliver high brightness, low reflectance, and support for full-motion video. Advanced fabrication facility is capable of producing flat-panel products up to 20 in. on the diagonal. David B. Rose, Mktg. Mgr. 415/842-9783, fax: 415/842-9808

DRAPER SCREEN CO., INC., 411 S. Pearl St., Spiceland, IN 47362

Manufacturers of front- and rear-projection screens: manual, motorized, and permanently tensioned fixed; rigid rear screens: integrated systems furniture: video-projector lifts; laser pointers; rearprojection systems; video walls; mediawall systems.

John D. Pidgeon, Mktg. Mgr. 317/987-7999, fax: 317/987-7142

DRS MILITARY SYSTEMS DIVISION, 16 Thornton Rd., Oakland, NJ 07436

Manufacturers of high-technology, militarized and ruggedized display, signal processing, and trainer products for military and industrial applications. Joe Dunn, Sr. V.P. 201/337-3800, fax: 201/337-4775

DUREL CORP., 2225 W. Chandler Blvd., Chandler, AZ 85224-6155

A joint venture between 3M and Rodgers Corp. High-volume manufacturers of DUREL®3 microencapsulated EL lamps for automotive, watch, and wireless communications applications. Lamp systems for phone and keypad applications offering significant benefits compared to conventional backlighting technologies. Chris Shol, Mktg. Mgr. 602/917-6000, fax: 602/917-6049

DYNACOLOR, INC., 4F, No. 10, Lane 609, Sec. 5, San Chung City, Taipei County, Taiwan, R.O.C.

Manufacturers of display automation products. The D8000 can perform the measurement and alignment of geometry, convergence, focus, and purity for monitors and CRTs. With the addition of displaycontrol ICs, total solutions can be provided. Charles Chuang, V.P. +886-2-278-1938, fax: +886-2-278-1817

DYNAIR ELECTRONICS, INC. 5275 Market St., San Diego, CA 92114 Manufacturers of PRISM, a large-format interactive video-wall display system that

can simultaneously display output from four graphics workstations and four video formats in sizes up to 324 ft.² with 1024 × 1024-pixel resolution. Bob Jacobs, Sls. 619/263-7711, 1-800-854-2831 fax: 619/264-4181

DYNAMIC DISPLAYS, INC., 1625 Westgate Rd., Eau Claire, WI 54703 Manufacturers of color and monochrome

CRT and flat-panel displays for the industrial, medical, and commercial/military markets. Len Stewart, V.P. Mktg./Sls.

715/835-9440, 1-800-793-6862 fax: 715/835-2436

DYNAPRO THIN FILM PRODUCTS, 7025 W. Marcia Rd., Milwaukee, WI 53223 Manufacturers of analog and matrix

resistive touch screens; touch-screen controlling electronics; driver software for DOS, Windows, OS/2, and other operating systems; custom design services and off-the-shelf products for OEMs interested in incorporating touch-input devices into their products; custom thin-film coatings; vacuum sputtering chamber. Kevin Brown, Sls./Mktg. Mgr.

414/365-6210, fax: 414/365-1133

EAGLE MAGNETIC CO., INC., 7417 Crawfordsville, Rd., P.O. Box 24283, Indianapolis, IN 46224

Manufacturers providing the magneticshielding market with high-permeability (sheet stock and foil) 0.002-0.090-in. standard or ultimate annealed fabrication (prototypes to production), annealing, finishing, and assembly. Gary H. Noble, Inside SIs. 317/297-1030, fax: 317/299-1323

EARTH COMPUTER TECHNOLOGIES,

P.O. Box 7089, Laguna Niguel, CA 92607 Manufacturers of VGA and graphic LCD controllers and subsystems. PC-based controllers in OEM quantities offered. Also, enclosures and VGA-input LCD monitors. Design assistance available. Jason Alkire, Oper. Mgr. 714/448-9316

EASTMAN KODAK CO., 343 State St., Rochester, NY 14650

Manufacturers of off-the-shelf imagers with video interline, full-frame, IR and linear CCDs. Color capabilities are available for both area and linear arrays. The Kodak professional digital camera, infrared camera, and KM-2 camera systems are examples of products using Kodakmanufactured CCDs. Helen Malz, Sls. 716/588-7612, fax: 716/477-4947

EATON CORP., Flat Panel Equipment, 35 Cherry Hill Dr., Danvers, MA 01923 Manufacturers of ion implanters for flatpanel-display manufacturing. James Stevens, Sls./Mktg. Mgr. 508/524-9233, fax: 508/524-9224

EATON CORP., Pressure Sensors Div., 15 Durant Ave., Bethel, CT 06801

Manufacturers/suppliers of high-quality instrumentation and control equipment to the U.S. Navy. The VISION 500™ series of flat-panel displays are offered in various technologies, resolutions, and sizes, Jeffrey Kilgore, Sls. Manager 203/798-3122, fax: 203/798-3214

EATON IDT, INC., 173 Heatherdown Dr., Westerville, OH 43081-6166

Manufacturers/suppliers of a comprehensive selection of products, systems engineering, training, service, and warranty. Industrial workstations provide real-time control from control room to plant floor; Factory Mate, AMI, PanelMate. David Keifer 614/882-3282, fax: 614/875-7111

ECRM TRUST, 554 Clark Road, Tewksbury, MA 01876-1631 Designers, manufacturers, and marketers of high-resolution monochrome laser graphics systems, laser scanning systems, and raster image recorders for the graphic arts and printing industries. Products designed to permit integration with a variety of electronic publishing systems and desktop publishing. Vince Cooper, Dir. Sls. 508/851-0207, fax: 508/851-7016

EDL DISPLAYS, INC., 1300 Research Park Dr., Dayton, OH 45432 Manufacturers of a wide range of multisync color monitors, custom and speciality video monitors. Michael J. McArdle, Gen. Mgr. 513/429-7423 fax: 513/429-6985

EDWARDS HIGH VACUUM INTERNATIONAL, 301 Ballardvale St., Wilmington, MA 01887

Manufacturers of a complete line of highquality vacuum components and systems Products include dry pumps, turbomolecular pumps, rotary vane pumps, vacuum instrumentation, leak detectors, thin-film coatings systems, and a wide range of vacuum accessories. George Courville, Mktg. Mgr, General Vacuum

508/658-5410 x3133, 1-800-848-9800 x3133, fax: 508/658-7969

EeRISE CORP., 7F, No. 1, Alley 16, Lane 235, Pao Chiao Rd., Hsin Tien City, Taipei County, Taiwan, R.O.C.

Manufacturers of three-dimensional automatic measurement/alignment systems for digitally controlled monitors, including the ER 9300, a geometry measurement/ alignment system; the ER 6700, a misconvergence measurement system; and the ER 2300, a one-dimensional white-balance measurement/alignment system. Joe Li, Sls. Mgr.

+886-2-914-5762, fax: +886-2-914-5763

EEV, INC., 4 Westchester Plaza, Elmsford, NY 10523

Manufacturers of display systems and LCD transportation signboards for airport, rail, and bus applications; CCD sensors and CCD cameras for scientific, medical, and industrial applications. Stuart Hesselson, Dir. New Bus. Dev. 914/592-6050, fax: 914/682-8922

EEV LTD., Waterhouse Lane, Chelmsford, Essex, U.K. CM1 2QU

Manufacturers of a range of specialized CRTs for defense systems, including miniature high-resolution and projection displays. LCDs of all technologies, and CCDs and solid-state cameras. D. Wickham

+44-245-493-493, fax: +44-245-492-492

E FOR M CORP., Polarizer Film Group, 625 Alaska Ave., Torrance, CA 90503 Manufacturers of standard and custom polarizers and retarder films, contrastenhancement filters, and custom glass and acrylic laminations. William Bandel, Sls. Mgr. 310/320-9768, 1-800-269-8801 fax: 310/320-9357

EG&G POWER SYSTEMS, INC., 1330 E. Cypress St., Covina, CA 91724 Manufacturers of custom AMLCD backlight drivers and lamp assemblies featuring digital control, wide dimming range, high reliability, and regulated luminance output; FED power supplies; and high-intensity

xenon and metal-halide lamps for projection

displays. Ed Motokane, Mgr. Bus. Dev. 818/967-9521, fax: 818/967-3151

EG&G OPTOELECTRONICS, 35 Congress St., Salem, MA 01970

Manufacturers of xenon lamps and light systems; power supplies for xenon and metal-halide lamps; AMLCD backlight inverters and lamp assemblies; CCD line scan and array imagers and cameras; and LEDs, laser diodes, and a complete range of detectors. Jim Reade, Sr. Prod. Spec. 508/745-3200, 1-800-775-6786 fax: 508/745-0894

EG&G OPTOELECTRONICS, 1330 Cypress St., Covina, CA 91724

Manufacturers of custom and off-the-shelf power supplies and inverters for AMLCD backlights, offering dimming from sunlightreadable to night-vision goggle levels. Available stand-alone or as integrated backlights for avionics, computer, and medical applications. Also, short-arc xenon and metal-halide-based light sources optimized for specific applications such as projection systems. Ed Motokane, Mgr. Bus. Devel. 818/967-9521, fax: 818/967-9862

EG&G RETICON, 345 Potrero Ave., Sunnyvale, CA 94086 Manufacturers of solid-state image sensors and solid-state cameras. Dianna Jones, Mktg. Mgr. Comp. Prod. 408/738-1009, fax: 408/738-6979

EKTRON APPLIED IMAGING, INC., 23 Crosby Dr., Bedford, MA 01730 Manufacturers of laser imaging recorder,

Model 811, a high-resolution output device for generating continuous-tone 8-bit images onto dry-silver media. Input is via an

IEEE-488 interface from user's host computer. Alan Flament, Mktg./Sls. Mgr. 617/275-0475, fax: 617/271-1977

ELASTOMERIC TECHNOLOGIES, INC. 2940 Turnpike Dr., Hatboro, PA 19040

Manufacturers of STAX silver-based elastomeric connectors used to connect ITO traces on glass to PC boards, including thin-film EL (TFEL), gas plasma, vacuum fluorescent displays, and any display module to an external PC board. Brad Lizotte, Mktg. Mgr. 215/672-0787, fax: 215/672-4633

ELDEC CORP., 16700 13th Ave. W., P.O. Box 100, M/S M1-15, Monitor & Control Div., Lynnwood, WA 98046-0100

Designers, developers, and manufacturers of military flat-panel EL displays and custom high- and low-voltage power supplies for aerospace and industrial display applications, including CRT and FED requirements. John Ardussi, Mgr./Mktg. 206/743-8238, 206/743-8399;

fax: 206/743-8256, 206/743-8599,

ELDIM S.A., Unicité, 4 rue Alfred Kastler, Caen 14000, France

Manufacturers of spatial LCD photometers and colorimeters for testing reflective and transmissive displays under illumination. Instant evaluation of LCDs and their component versus viewing angle (up to ±80°) for R&D and production (contrast, gray level, response time, uniformity). Jean-Noel Curt, V.P.

+33-2-31-94-76-00, fax: +33-2-31-47-37-77

ELDOR CORP., 70 Walnut St., Wellesley, MA 02181

Manufacturers of high-resolution deflection yokes with pre-set raster geometry; high-voltage power supplies; flyback and switch-mode transformers. B. Valle

617/965-0002, fax: 617/965-0003

ELECTROGRAFICS INTERNATIONAL CORP., 1825 Stout Dr., Warminster, PA 18974

Manufacturers of the Polychrome LFC 7000, a large-format camera for direct imaging on chrome or iron oxide. Also, projection steppers for the generation of silicon walers, precision photomasks, and printed-circuit boards. Ann Grossi, V.P.

215/443-5190, fax: 215/443-9564

ELECTROHOME LTD., 809 Wellington St. N., Kitchener, Ontario, Canada N2G 4J6

Display Systems: Manufacturers of customized CRT and LCD high-resolution color and monochrome monitors for the medical, process-control, finance, and specialty markets. Projection Systems: Manufacturers of CRT- and LCD-based video/data/graphics projectors and 3-D visualization systems. 519/744-7111, fax: 519/749-3151

ELECTRO MECHANICAL SYSTEMS INC., 801 W. Bradley Ave., Champaign, IL 61820 Designers, manufacturers, and marketers of totally integrated touch terminals, touch monitors, and custom touch panels. Mike Lazarevich, Pres. 217/359-7125, fax: 217/359-9839 ELECTRONIC IMAGE SYSTEMS, INC., A Member of the BARCO Group, 600 Bellbrook Ave., Xenia, OH 45385-4053 Designers and manufacturers of projection displays used in full flight, vehicular, and maritime simulation. Gunnery

and target displays, along with stroke and vector systems for land-based entertainment, are also available. Full raster image distortion can be implemented. Michael T. Raines, Mktg. Dev. Mgr. 937/372-7579, fax: 937/372-8645

ELECTRONIC TREND PUBLICATIONS, 1975 Hamilton Ave., Ste. 6, San Jose, CA 95125

Market research in flat-panel displays and other electronics industry topics. Karen Selven, V.P. Mktg. 408/369-7000, 1-800-726-6858 fax: 408/369-8021

ELECTRO-OPTICS, INC., Orlando Div., 2160 Park Ave., Winter Park, FL 32789 Manufacturers of photometers, spectrophotometers, and spectroradiometers for testing and evaluating displays. Dr. Robert K. McMahan, Dir. 407/645-1000, fax: 407/644-9000

ELECTRON TUBES, INC., 100 Forge Way, Unit F, Rockaway, NJ 07866 Distributors of Brandenburg standard and custom high-voltage power supplies including multi-output reliable low-cost CRT supply modules for monochrome/color displays with UL/CSA/VDE approval. Also, digital high-voltage meters/testers. Gary Shah, Appl. Engr. 201/586-9574. 1-800-521-8382 fax: 201/586-9771

ELECTRO PLASMA, INC., 4400 Martin-Moline Rd., Millibury, OH 43447 Manufacturers and integrators of ac plasma-based display systems with extensive experience in complex systems integration. Industrial process control. Thomas P. Zouhary, Sls. Mgr. 419/255-5197, fax: 419/242-9713

ELFORM, INC., P.O. Box 7362, 1025 Ridgeview, Ste. 200, Reno, NV 89510 Suppliers of z-axis adhesives and flexible heat-seal connectors as well as custom EL lamps for backlight and panel applications. Bob Short, Dir. Sis. 702/829-1905, fax: 702/829-1693

ELOGRAPHICS INC., 105 Randolph Rd., Oak Ridge, TN 37830

Manufacturers of touch screens, including AccuTouch@ (resistive technology) and IntelliTouch@ (surface-acoustic-wave technology). Line of fully integrated plug-and-play TouchMonitors in sizes ranging from 14 to 19 in. Joseph Barresi, V.P. Sls. 510(651-2340

EL-OP ELECTROOPTICS INDUSTRIES, LTD., P.O. Box 1165, Rehovot, Israel 76110

Manufacturers of avionics and tank-fire control systems such as head-up displays, helmet-mounted displays and sights, multifunction displays, and up-front control panels.

, Ami Yachin, Dir. Corp. Intl. Mktg./Sls. +972-8-486448, fax: +972-8-486748

ELO TOUCHSYSTEMS, INC., 41752 Christy St., Fremont, CA 94538 Manufacturers of two touch-screen technologies: IntelliTouch (surface wave) and AccuTouch (resistive). IntelliTouch is used extensively in public-access and merchandising klosks, training, and gaming. Accu-Touch is widely used in retail POS and process-control applications. Software (mouse emulation) for all popular operating systems, including Windows (3.X, NT, 95), DOS, and OS/2. Elo Direct Marketing Group 1-800-356-8682

ELTECH, 5524 Bee Cave Rd., Austin, TX 78746

Manufacturers of NovaLite@ (screen printed) and fusion-sealed Aclar@, foil type, electroluminescent (EL) lamps; active-matrix large-pixel-size PC-boardbased EL lamps; and dc-ac inverters. Brad Lizotte, V.P. Sls. 215/441-0633, fax: 215/441-8299

ELTIME VISION SYSTEMS, 10/14 Hall Rd., Heybridge, Maldon, Essex, U.K. CM9 7LA

Manufacturers of frame stores, imageprocessing systems, automatic visual inspection systems, and a video-fax system. D R Hurst Dir

+44-621-859-500, fax: +44-621-855-335

EM INDUSTRIES, INC., 5 Skyline Dr., Hawthorne, NY 10532

Manufacturers and suppliers of display materials for liquid crystals, fiber spacers, thin-film materials, UV photoinitiators, dip coatings, and optical crystals. Frank Allan

914/785-5840, fax: 914/592-9469

EM MICROELECTRONIC - MARIN S.A., Rue des Sors 3, CH 2074 Marin, Switzerland

Manufacturers of high-precision custom LCD products. LCD technologies include TN (direct and multiplexed), first minima TN, SBE-STN, and a full range of dichroics. Capabilities include use of very thin glass substrates, shaped displays, and HSC bonding technology. Also producers of a range of LCD driver chips available in a variety of packages including TAB. Gary Broder, LCD Mgr. +41-32-755-5111, fax: +41-32-755-5403

ENABLING TECHNOLOGIES CO., 3102 S.E. Jay St., Stuart, FL 34997

Manufacturers of complete line of braille embossers and computer equipment for the blind.

B. T. Kimbrough, V.P. Sls. 407/283-4817, fax: 407/220-2920

ENDICOTT RESEARCH GROUP, INC., P.O. Box 269, 2601 Wayne St., Endicott, NY 13760

Designers/manufacturers of custom and standard dc-input power-supply products for various information-display applications, including dc-ac inverters for CCFT and ELbacklit LCD modules, dc-dc converters for gas plasma displays, and dc-dc/ac converters for vacuum fluorescent displays. Scott L. Barney, SIs./Mktg. Mgr. 607/754-9187, fax: 607/754-9255

EPIX, INC., 381 Lexington Dr., Buffalo Grove, IL 60089

Variable resolution, image sequence acquisition, processing, display, transmission, and archival boards for the PC/ATbased imaging systems. Products are unique in their ability to acquire images from non-standard sources and standard video formats. Arthur Schwytzer 708/465-1818, fax: 708/465-1919

EPSON AMERICA, INC., 20770 Madrona Ave., Torrance, CA 90503

Manufacturers of a full line of small to medium size LCDs. Product line includes alphanumeric displays, passive-matrix graphics modules, polysilicon TFT displays, and ultra-MIM active-matrix modules. Ken Nagai, Group SIs. Mgr. 310/787-6300, fax: 310/782-5350

ERGONOMICS, INC., P.O. Box 964, Southampton, PA 18966

Distributors of test and measurement equipment for international non-ionizing radiation standards such as MPR2/TCO and the new IEC harmonics and flicker test requirements. Also manufacturers of accessibility and safety test probes. Eric A. George, Mgr. Mktg./Sls. 215/357-5124, fax: 215/364-7582

ERGOSYST ASSOCIATES, INC., 123 W. Eighth St., Ste. 210, Lawrence, KS 66044-2605

Publishers of reference books and journals in the areas of artificial intelligence, display design, CAD/CAM, ergonomics, human-factors, human-computer interaction and VDT health and safety. John L. Burch 913/842-7334, fax: 913/842-7348

ERGOTRON, INC., 1181 Trapp Rd., St. Paul, MN 55121

Manufacturers of adjustable arms for mounting flat-panel monitors, allowing adjustment of angle and height of monitor from sitting to standing height, and anywhere in between. Mount to wall, desktop, machines, or mobile stands. Specialty applications and OEM opportunities available. John Asturias, FP Prod. Mgr. 612/681-7644, 1-800-888-8458 fax: 612/681-7715

C

d

C

T

70

fa

F/

Sp

CĖ

M

Co

CL

pro cle

pir

un

pro

SQL

Ral

510

FAI

St.,

foci

nole

con

rese

Deh

516/

FAK

Men

De

seau

syste

which

with

sim i

comp

and t

visua

Davic

415/6

F

ETC COMPUTER, INC., 2917 Bayview Dr., Fremont, CA 94538

Manufacturers of small-footprint specially display monitors: 10-in. color (super VGA) and 9- and 10-in. monochrome monitors, designed for space-limited applications. Also, providers of turnkey integrated louch screens for 10-, 14-, 15-, and 17-in. monitors.

Kent Huang, Pres. 510/226-6250, fax: 510/226-6252

EURECRAN SA, ZA Cap Alpha Lot No. 1, Rue Monnet, Clapiers 34830, France Manufacturers of fast LCD development and delivery of larger lots. Specially LCD for military, optics and others. Driving circuitry, interconnection, design and production of complete modules. Heat-seal technology. Reinhard G.O. Hampel, Pres.

+33-67-594-510, fax: +33-67-591-712

EVANS & SUTHERLAND COMPUTER CORP., 600 Komas Dr., Salt Lake City, UT 84108

Manufacturers of visual systems for commercial airlines, military, engineering, and aerospace applications. The visual system includes computer image generators, a wide range of high-resolution display devices and associated database preparation and evaluation equipment. Stephen Black

801/582-5847 x6501, fax: 801/582-5848

EXCEL TECHNOLOGY INTERNATIONAL CORP., 5-4 Stryker La., Belle Mead, NJ 08502

Manufacturers of custom and standard glass-panel LCDs and LCD modules. Michiko Chen, Sls. Mgr. 908/874-4747, fax: 908/874-3278

EXTRON ELECTRONICS, 1230 S. Lewis St., Anaheim, CA 92805

Manufacturers of computer-video interfaces. RGB switchers, distribution amplifiers, video test generators, and scan conversion equipment. Computer-video routing equipment is used to connect computers to large-screen displays and other presentation equipment. Jim Costigan, Natl. Sls. Mgr. 714/491-1500, 1-800-633-9876 lax: 714/491-1517

EXXENE CORP., 5939 Holly Rd., Corpus Christi, TX 78414

Manufacturers of coatings for CRTs, displays, and plastics. Low gloss, laser, IR, and UV blocking; anti-static; and anti-fog. Weathering, hardness, and chemical resistance are common properties of all coatings. Coating services and custom formulation available. Foward Bernheim, Pres.

512/991-8391, fax: 512/991-9057

EXZEC, INC., 1840 Oak Ave., Evanston, IL 60201

Manufacture, research, and development of touch-input devices for computers and electronics using guided acoustic waves (bulk, shear mode). SureTouch touch screens respond to varying pressures and can be operated with gloves or in wet or dity surroundings. Supplier of panels, controllers, and consulting services. Terence J. Knowles, Pres. 708/060-1808, 1-800-523-5883 [at: 708/866-1808

FAIRCHILD CONVAC USA, 47613 Warm Springs Blvd., Fremont, CA 94539-7470 Manufacturers of photolithography processing equipment, including the LCD Model 600 and Verti-CeI™ 3100 Series. Configured as stand-alone modules or clustered for a full production line, processes include stations for coating, cleaning, developing, etching and stripping, hot plates, and wave coater. These uniquely designed tools are fully production proven for substrates from 4 to 16 in. square.

Ralph Mason, Sr. V.P. Sls./Mktg. 510/659-8370, fax: 510/659-9407

FAI TECHNOLOGY MARKETING, 82 Main St., Ste. 300, Huntington, NY 11743 Full-service market research organization locused on leading-edge electronics technologies. Significant experience in semiconductor, ATE, CIM, and AMLCD market research.

Debbora Ahlgren 516/351-2100, fax: 516/351-2199

FAKESPACE, INC., 4085 Campbell Ave., Menio Park, CA 94025

Designers/manufacturers of fieldsequential displays, glove-based control systems, trackers, and scan converters which enable natural, intuitive interaction with virtual environments in entertainment, simulation and training, workstation-based Conputer-aided design and engineering, and telepresence research and scientific visualization.

David Eggleston, V.P. Sls. 415/688-1940, fax: 415/688-1949 FAS TECHNOLOGIES, 10480 Markinson Rd., Dallas, TX 75238

Manufacturers of FAS-COAT™, a nextgeneration extrusion coating system for FPD, MCM, and semiconductor industries. Unlike spin coaters, FAS-COAT directly deposits color filters, photoresists, polyimides, and other polymers with less waste, greater throughput, and ±2% uniformity. Kyle Gardner, Dir, Mktg./Sls.

214/553-9991, fax: 214/553-9919

FELDMAN TECHNOLOGY CORP., 5 Hangar Way, Watsonville, CA 95076 Providers of APCVD deposition and fineline etching of transparent conductors. Bernard Feldman, CEO 408/724-3000, fax: 408/768-8326

FIMI PHILIPS, via S. Banfi 1, Saronno 21047, Italy

Manufacturers of high-resolution 17-, 20-, and 21-in. color CRT monitors with line scan frequencies up to 115 kHz and digital autoscan monitors (models C2082-DAS and C2182-DAS) equipped with microprocessor-controlled features and RS-232 interface. S. Bonfiglio

+39-2-9618-237, fax: +39-2-9618-305

FLACHGLAS AG, Technical Glass Div., Otto-Seeling Str. 7, P.O. Box 1309, 5810 Witten, Germany

Producers of a wide range of coated and uncoated soda-lime glasses for all display applications. With MICROWIT and MICRO-WIT PLUS, standard or specific customer

requirements can be met. Uwe Vogt +49-2302-582-256, fax: +49-2302-582-353

FLAT CANDLE CO., 4725 B, Town Center

Dr., Colorado Springs, CO 80916 Manufacturers of flat-form-factor fluor-

escent lamps and accessories for LCD backlighting. Sizes range from 0.8 to 10.4 in. on the diagonal. Judd Lynn, Pres.

719/573-1880, fax: 719/573-2080

FLAT PANEL DISPLAY CO. (FPD) B.V., 2099 Gateway Pl., Ste. 100, San Jose, CA 95110

Manufacturers of ¼-VGA to XGA activematrix monochrome and color LCD modules from 2.8 to 11.34 in. on the diagonal; datagraphic, direct-view, and projection modules with features such as sunlight readability; long-lifetime backlights with brightness up to 300 cd/m² and >50,000 hours to half-life. Leo Pekelharing, Natl. SIs. Mgr. 408/453-7002, 1-800-235-7373 fax: 408/453-6444

FLATSCREEN TECHNOLOGIES CORP., 633 Michigan Ave., Evanston, IL 60202

Consultancy providing research, development, and engineering of display systems and devices. Integration of electronic displays with optical systems. Specialist in gas-discharge and gas-electron-phosphor displays. Alan Sobel, Pres.

Phone/fax 847/869-5607

FLEX PRODUCTS, INC., 2793 Northpoint Pkwy., Santa Rosa, CA 95407-7350 Manufacturers of advanced sputtered and

electron-beam deposition coatings on flexible LumiFlexTM transparent conductive films used in touch screens, EL displays, and LCD panels. Optional features include EMI/RFI shielding and anti-reflection filters. Richard Bonkowsky, Sls. Mgr. 707/525-7532, fax: 707/525-7725

FLOROD CORP., 17360 S. Gramercy Pl., Gardena, CA 90247-5212

Manufacturers of process, test, repair, and inspection equipment for all types of FPDs, including the VLS vacuum-laser (glass) sealer, GMS glass-marking system, AIM automatic inspection machine, RAMP random-access multi-probe scanning test system, PPS programmable probing station, a full line of laser-based repair systems, and the MEL-40 laser micromachining center. Rod Waters, Pres. 310/532-2700, 1-800-323-7691

fax: 310/329-1015

JOHN FLUKE MANUFACTURING CO., INC. P.O. Box 9090, Everett, WA 98206-9090

Fluke touch control screens are sophisticated operator interfaces for computerbased machinery or systems. With a minimum of training, operators can accurately and efficiently control even the most complex systems simply by touching the screen.

206/347-6100, 1-800-426-0361 fax: 206/356-5116

FORMOSA ADVANCED TECHNOLOGIES CO. LTD., No. 10 R&D Road, 2 Science-Based Industrial Park, Hsinchu, Taiwan, R O C.

Manufacturers of dispenser cathodes. C.-W. Shih

+886-35-784855, fax: +886-35-782970

FOSTA-TEK OPTICS, INC., 320 Hamilton St., Leominster, MA 01453

Manufacturers of custom display readout windows and optical filters for all optoelectronic and display technologies including CRT, LED, LCD, plasma, EL, touch panel, EMI, and TEMPEST. Also, antireflective coatings, custom molding, hard coating, and supercoatings. Michael B. Smith, Dir. West. Region 508/534-6511, 508/493-2084 fax: 508/537-2168

FPD TECHNOLOGIES, INC., 4525 Production Dr., Dallas, TX 75235 Manufacturers of high-resolution dot-

matrix graphic LCD modules, color ARLCDs, and color M-STN LCDs. Color ARLCDs have the peformance and quality comparable to AMLCDs. M-STN LCDs are equal to or better in quality than DSTN. David Chen, V.P. Mktg. & Bus. Dev. 214/638-6668, fax: 214/638-6676

F-P ELECTRONICS, 6030 Ambler Dr.,

Mississauga, Ontario, Canada L4W 2P1 Manufacturers of display components, electromagnetic hybrid flip disk/LED modules, and hybrid flip disk/liber-optic LED modules for indoor and outdoor applications, including airport terminals, gasoline pump displays and price signage, time/temperature displays, and clock and advertising signs.

Douglas Greenwood, Gen. Sls. Mgr. 905/624-3020, fax: 905/625-6197

FRESNEL OPTICS, A Reflexite Co., 1300 Mt. Read Bivd., Rochester, NY 14606 Manufacturers of Fresnel lenses and

precision microstructured surfaces, Gi including lenticulars, lens arrays, screens, 20

micro prisms, retro-reflectors, and other microstructures to control the intensity and direction of light for illumination systems. Donna Desmarais, SIs./Mktg. Mgr. 716/647-1609 x114, fax: 716/254-4940

FUJIPOLY AMERICA CORP., P.O. Box 679, 365 Carnegie Ave., Kenilworth, NJ 07033

Manufacturers of both high- and lowresistance elastomeric connectors and other related silicone rubber extrusions and moldings. Also, thermal-management silicone rubber products. Robert Biornsen, Apol. Enorg

Robert Bjornsen, Appl. Engrg. 908/298-3850 x207, fax: 908/298-1232

FUJITSU MICROELECTRONICS, INC., 3545 N. First St., San Jose, CA 95134-1804

Manufacturers of high-resolution color acmemory plasma displays, AMLCD modules, and LCD front-projection systems for OEMs and system integrators in the PC, medical instrument, financial transaction, industrial, tele-videoconferencing, public information display, and business/consumer markets. Customer Response Center 1-800-866-8608

H. L. FUNK CONSULTING, 7 Diane Ct., Katonah, NY 10536

Consultancy offering 20 years of experience in patent searches and patent trend analysis, market research, competitive intelligence, and demographics. Subscriber to major electronic databases and provider of technical literature and database training. H. L. Funk

914/232-3530, fax: 914/232-3530

FUTABA CORP., 629 Oshiba, Mobara, Chiba 297, Japan

Manufacturers/distributors of vacuum fluorescent displays and dot/character display modules. Also, graphic displays for automotive applications, and electronic instrument panels utilizing vacuum fluorescent technology and multicolor displays. T. Maeda, Mgr. Overseas Miktg. Dept. +81-475-24-1111, fax: +81-475-23-1346

FUTABA CORP. OF AMERICA, 14492 Sheldon Rd., Ste. 370, Plymouth, MI 48170

Manufacturers and distributors of graphic displays for automotive applications; electronic instrument panels utilizing VF technology; and multicolor displays. C.L. Slupek, Automotive Mktg. Mgr. 313/459-1177, fax: 313/459-1268

FUTABA CORP. OF AMERICA, Electronic Components Div., 1605 Penny Lane, Schaumburg, IL 60173

Manufacturers of high-brightness multicolor vacuum fluorescent display products, ranging from simple numeric and dot-matrix displays to large multifunction graphic panels. High-brightness monochrome and color FED standard products. Gary Murrell, Mktg./Sls. Mgr. 847/884-1444, tax: 847/884-1268

FUTURE FOCUS, INC., 14724 NE 177th St., Woodinville, WA 98072

Consultancy in optical design, specializing in sensors, fiber optics, and display optics.

Gordon Mitchell, Pres. 206/481-5577, fax: 206/489-9360

FUTURE SYSTEMS, INC., P.O. Box 26, Falls Church, VA 22040

Publishers of the Multimedia & Videodisc Monitor (formerly the Videodisc Monitor) which provides news and analysis of multimedia, interactive video, compact disc, and related technologies. Covers product applications in areas including training, retailing, education, the military, and home entertainment.

John Wilson, Mktg. Mgr. 703/241-1799, 1-800-323-DISC fax: 703/532-0529

GALILEO CORP. (Formerly Galileo Electro-Optics Corp.), Galileo Park, P.O. Box 550, Sturbridge, MA 01566

Manufacturers/marketers of fiber-optic and electro-optic components and systems that sense, transmit, or intensify light and images, or detect and multiply electrons, charged particles, and electromagnetic radiation. Provides the scientific detector products market with its Long-Life™ microchannel plates.

Robert White, Gen. Mgr., Sci. Detect. Prod. 508/347-9191, 1-800-648-1800 fax: 508/347-3849

GAMMA SCIENTIFIC, 8581 Aero Dr., San Diego, CA 92123

Manufacturers of radiometric, photometric, and spectroradiometric instruments and accessories. The GS-1280 RadOMAcam is specifically designed for FPD color and luminance measurements. Bill Oker, SIs. Mgr. 619/279-8034, 1-800-637-2758 fax: 619/576-9286

JEROLD H. GARD, Displays Consultant, 5469 Beechwood Ln., Los Altos, CA 94024

Consultancy in cockpit displays, including head-up, head-down, and helmet displays, with special emphasis on the human/ display interface and piloting and safety considerations. Ex-chief scientist at Kaiser Electronics. Jerold H. Gard, Displays Consultant 415/968-2731, fax: 415/968-4795

GEC-MARCONI LTD., HIRST RESEARCH CENTRE, East Lane, Wembley, Middlesex, U.K. HA9 7PP

Developers of prototype LCDs and devices based on nematic, supertwist, active-matrix, and ferroelectric liquidcrystal technologies. Computer modeling of liquid-crystal devices and consultation also undertaken. L H. C. Boe

+44-81-908-9143, fax: +44-81-908-9090

GENERAL ATRONICS CORP., 1200 E. Mermaid Lane, Windmore, PA 19038

Manufacturers of special-purpose I&M cathode-ray tubes. Howard Brown, SIs, Mar.

Howard Brown, Sls. Mgr. 215/233-4100, fax: 215/233-9947

GENERAL DIGITAL CORP., Interactive Display Systems Div., 198 Freshwater Blvd., Enfield, CT 06082

Manufacturers and developers of application-specific flat-panel display systems with touch input often included with the units, available as monitors or full computer systems. Large displays (up to 30 in. on the diagonal) and resolutions up to 1280 × 1024 are being developed. Lawrence T. Guzowski, V.P. 203/741-7171, fax: 203/741-7071 GENERAL VACUUM, 190A Alapha Park, Cleveland, OH 44143

Providers of vacuum equipment and vacuum coating services to the FPD industry. Coatings include clear conductive costings (ITO), diamond, diamond-like carbon, single and multilayer AR, metallization, and custom coatings for electronic, electro-optic, and optical devices including FPDs. Gerald T. Mearini, Pres. 216/646-9986, fax: 216/646-9986

GENESIS MICROCHIP, INC., 200 Town

Centre Blvd., Suite 400, Markham, Ontario, Canada L3R 8G5 Manufacturers of leading-edge digital

video/image scaling ICs, digital video deinterlacing ICs, and filters. Product support includes evaluation software and boards. Dan Adam, Sis. Rep. 905/470-2742 x334. (ax: 905/470-9022

GENMARK, 310 Caribbean Dr., Sunnyvale, CA 94089

Manufacturers of robots for precision transport and prealignment of Ilat-panel displays within manufacturing capital equipment. Genmark robots uniquely enable in-line cassette- and processingmodule placement without capital-intensive linear tracks and enable on-the-fly FPD centering and prealignment. Bernard R. Casey, V.P. 408/745-6520, fax: 408/745-0635

GENNUM CORP., 970 Fraser Dr., Burlington, Ontario, Canada L7L SP5 Manufacturers of bipolar integrated circuits for driving electromechanical displays. Ian Scott, Mgr. Spec. Appl. 416/632-2996, 1-800-263-9353

GENRAD, INC., 300 Baker Ave., Concord, MA 01742-2174

Manufacturers of the GenRad/TEL GTS-1 LCD Test and Measurement System for LCD substrates, offering advanced measurement capability which provides fault type and address data for repair, and highly precise measurement data for process and product improvements. Gerd Lipski, Sr. Mktg. Mgr. 508/369-4400, 1-800-4-GENRAD fax: 508/371-3039

GERBER SYSTEMS CORP., 83 Gerber Rd. West, South Windsor, CT 06074

Manufacturers of MaskWrite 800 and MaskWrite 500 large-area high-resolution direct-write imaging systems using raster technology to image on film, glass, and other photosensitive-type plates. Both imagers are used for producing lead frames, FPDs, shadow masks, as well as other applications where high-precision high-resolution images are required. George Murray, Prod. Mgr. 800/648-8117, fax: 800/251-0653

GEROME MANUFACTURING CO., INC. P.O. Box 1089, Oliver Rd., Uniontown, PA 15401

Manufacturers of custom-fabricated metal components for the electronic-instrument industry. Products include magnetic shields, instrument enclosures, internal chassis assemblies, and NEMA-rated cabinets. Inhouse capabilities include annealing, metal treating, painting, and silk-screening. Joseph J. Putila, Plant Mgr. 412/438-8544, fax: 412/437-5608 GEROME MANUFACTURING CO., 403 N. Main St., P.O. Box 737, Newberg, OR 97132

Manufacturing division specializing in hi-tech custom metal fabricated assemblies, usually including high-attenuation magnetic shields, instrument chassis, and exterior cabinetry to customer's design. Mike Stoyko, Gen. Mgr. 503/538-8356, fax: 503/538-1090

GINSBURY (UK) LTD., Ginsbury House, Sir Thomas Longley Rd., Rochester, Kent, U.K. ME2 4DU

Representatives for display products. Specialists in CRT-based standard and custom components, including CRT deflection yokes, HVPs, optical filters, video and deflection amplifiers, test equipment, color/monochrome monitors, and flat panels.

Neville Milward, Dir. +44-1634-290903, fax: +44-1634-290904

GLAVERBEL S.A., 166 Chaussee de la Hulpe, B-1170 Brussels, Belgium Manufacturers of soda-lime glass for the

display industry, specializing in extra-thin glass (0.4 mm). Alain Dinaux +32-26-74-35-82, fax: +32-26-74-32-87

+32-26-74-35-82, Tax: +32-26-74-32-87

GLEN TECHNOLOGIES, INC., 690 Glen Court, Milpitas, CA 95035 Manufacturers of plasma cleaning

equipment for removal of organic contaminants from panel surfaces, John Klipfel, Pres. 408/262-3385, fax: 408/262-3385

GLOBAL IMAGING, 201 Lomas Santa Fe Dr., Ste. 380, Solana Beach, CA 92075 Software and systems integration for image-processing applications. Turnkey superworkstation for scientific visualization of remotely sensed data.

Michael Guberek 619/481-5750, fax: 619/481-1258 1-800-345-4624, 1-800-822-4624 (CA only)

BF GOODRICH AEROSPACE DISPLAY SYSTEMS, INC., 2321 Topaz Dr., Hatfield, PA 19440

Custom designers and manufacturers of dichroic LCD and modules for the military and commercial avionics industry. D.F. Dillon 215/997-3500, fax: 215/997-3508

GORDON INSTRUMENTS, INC., 3645 California Rd., Orchard Park, NY 14127-1755

Manufacturers of freestanding digitizing workstations. Planar light sources can be used with all types of digital/analog cameras. The light source is halogenbased with 3200K. Richard Whipple, Sis. Mgr. 716/662-5353, 1-800-333-2672 fax: 716/662-7839

GRASEBY OPTRONICS, 12151 Research Pkwy., Orlando, FL 32826-3207

Manufacturers of CRT colorimeters for measurement of white-balance absolute chromaticity, luminance, and correlated color temperature. Luminance and illuminance meters also available. All systems are certified to be traceable to NIST or PTB. Leland Johnson, Apol. Engr.

Leland Johnson, Appl. Engr. 407/282-1408, fax: 407/273-9046 GRASS VALLEY GROUP, P.O. Box 1114, Grass Valley, CA 95945

Manufacturers of TV switching products; video processing, timing, and distribution equipment; production and routing switchers, digital effects devices, and fiber-optic communications systems. Russ Johnson, V.P. Sls. 916/478-3160, fax: 916/478-3187

GRITZ'S EMPORIUM, INC., 2708/2711 Via Roberto, Carlsbad, CA 92008 Distributors of color and monochrome

miniature CRT displays 0.6, 1.0, and 1.5 in, on the diagonal. Color shutter is 600 TV lines. A 1.5-in. display provides 1200 lines for addressing LCLVs. A 0.6-in. b/w display with 500 TV lines can be provided for IR viewfinders.

Edward Gritz, Pres. 619/434-4676/3452, fax: 619/434-7875/4758

H. W. GROSSBOHLIN, 3224 Crazy Horse Dr., Simi Valley, CA 93063 Consulting and troubleshooting in CRTs

and CRT displays. H. W. Grossbohlin, Consultant 805/581-1467

JOE HALLETT & ASSOCIATES, 22370 S.W. Grahams Ferry Rd., Tualatin, OR 97062-8022

Consultant to manufacturers and users of display products. Investigation and analysis of user needs, product definition, proposals, and market information for end users and OEMs. Background in consumer, industrial, aerospace, TV, and computer applications. Development, application, and marketing of CRT, flat-panel, and related technologies also available. Joe Hallett, Consultant

503/692-5554

HANTRONIX, INC., 10080 Bobb Rd., Cupertino, CA 94014 Manufacturers of LCD displays, LCD dolmatrix character modules, and LCD dolmatrix graphic modules. June Kim, SIs. Mgr. 408/252-1100

GEORGE D. HARRIS ASSOC., INC., The Plaza Bldg., Fair Lawn, NJ 07410

Representatives of manufacturers of magnetic deflection components for CRTs; yolks, focus coils, stigmators, centering coils, precision in-line, and delta magnetic components. George D. Harris, Pres. 201/796-2644, fax: 201/796-0070

HARRIS CORP., 505 John Rodes Blvd., R3/7248, Melbourne, FL 32935

Manufacturers/marketers of the PhotoPro 2000 and 2500 gray-scale printers that offer high-resolution continuous-tone dry photographic prints. Ronald Reed, Bus. Dev. Mgr. 407/242-5691, fax: 407/242-4249

0

D

B

9 fa

H

A C T

p

0

B

97

fa

HC POWER, INC., 17032 Armstrong Ave., Irvine, CA 92714

Designers/manufacturers of high-power MOSFET switching power supplies, in power ranges from 500 to 3000 W, with one to five outputs, and 250,000-hour MTBF. Also, the PowerMiser series of power factor correctors, which cut power usage by 35%. Jack Graham, Dir. Mktg.

714/261-2114, fax: 714/261-6584

WALTER HETT & ASSOCIATES 334 Hudson Rd., Stow, MA 01775-1403

Consulting services assisting industry in developing and managing electronics business in the aviation/aerospace marketplace. Walter Hett, Aviation Consultant

508/567-0760, fax: 508/567-0761

HEWLETT-PACKARD CO., Components Group, 370 W. Trimble Rd., San Jose, CA 95131

Manufacturers of high-efficiency LED products. Broad range of optical packages, thru-hole and surface-mountable LED lamps. Large variety of LED display sizes, fonts, and colors available. Mark Chandler, Mktg. Mgr. 408/435-6017, fax: 408/435-4980

HITACHI AMERICA, LTD., 3850 Holcomb Bridge Rd., Ste. 300, Norcross, GA 30092

Manufacturers of tube-related devices: TV quality, monitor sizes and resolutions, and projection tubes. Flat-panel devices: color active and passive matrix, color plasma, 1–1.4-in. poly-Si displays, and midresolution color and monochrome graphics displays.

Tim Patton, Bus. Devel. Mgr. 770/409-3000 x205, fax: 770/409-3028

HITACHI DENSHI AMERICA, LTD., 150 Crossways Park Dr., Woodbury, NY 11797

Manufacturers of high-resolution and high-definition large-screen display systems, 15.75-70 kHz. High brightness for use with computer graphics, data, and video sources. Switchers and accessories. Six display sizes. 516/921-7200, fax: 516/496-3718

HITACHI, LTD., 5-1, 1-chome, Marunouchi, Chiyoda-ku, Tokyo 100, Japan Manufacturers of color picture tubes; color display tubes; projection tubes; passive and active LCDs; imaging devices; and pickup tubes. G. Watanabe, Mgr. Sls. Engrg. +81-3-211-1111, fax: +81-3-212-3857

MARV HODGES, INC., 1565 Shadowglen Ct., Westlake Village, CA 91361

Designer, manufacturer, and consultant of proprietary liquid projection optics for multiplexing two or more image sources (electronic) for single-lens applications; mostly for high-heat, high-brightness, and high-resolution requirements. Marv Hodges, Pres. 805/497-4051, fax: 805/379-9605

HOECHST CELANESE CORP., AZ Photoresist Products, 70 Meister Ave., Somerville, NJ 08876

Manufacturers of photoresists, developers, and ancillary chemicals for imaging of flat-panel displays. The TFP-600 series photoresist is for spin coat/extrusion coat, and the RFP-210K series is for roller coat. Bruce Kiker, E. Sis. Mgr. 972/458-8056, 1-800-422-3884 fax: 972/661-1512

HOECHST CELANESE CORP., AZ Photoresist Products, 12001 North Central Expressway, Suite 1170, Dallas, TX 75243

Manufacturers of a complete line of photoresists, developers, removers, and organic anti-reflective coatings. Bruce Kiker, Regional Mgr. 972/558-8056, 1-800-422-3884 fax: 972/661-1512 HOFFMAN ENGINEERING CORP. 8 Riverbend Dr., P.O. Box 4430, Stamford, CT 06907-0430

Manufacturers of systems to measure luminance, illuminance, color contrast, sunlight readability, radiance, and irradiance. Jack DeSoye, VP Sls./Mktg.

203/425-8900, fax: 203/425-8910

F. HOFFMANN-LA ROCHE LTD., Division RLC, Bldg. 49/325, Postfach, CH-4002 Basel, Switzerland

Manufacturers of liquid mixtures for TN, STN, DSTN, active-addressed, guest-host and ferroelectric displays; cholesteric filters as well as dichroic dyes.

W. Kocher +41-61-688-6468, fax: +41-61-691-3856

HOLOGRAPHIC LITHOGRAPHY SYSTEMS, INC., Three Preston Court, Bedford, MA 01730

Developers of manufacturing tools and processes. The HLS System 1000 can generate sub-half-micron structures in a maskless high-throughput production environment process and features largefield high-resolution patterning. Jim Nole, VP Mktg. 617/276-4060, fax: 617/276-4074

HOLTRONIC TECHNOLOGIES SA, 12B Champs-Montants, 2074 Marin, Switzerland

Manufacturers of high-resolution exposure equipment for FPD manufacturing using a unique mask technology. Two systems are available: the HIMA150 for 6-in. substrates and the HIMA400 for large panels. Typical applications are FED and poly-Si TFT-LCDs. Simon Gray, Appl./Mktg. Mgr. +41-32-753-6800, fax: +41-32-753-6501

HOMALITE, Division of Whitco, Inc., 11 Brookside Dr., Wilmington, DE 19804

Manufacturers of custom contrastenhancement display lillers made from thermoset polyester or allyl diglycol carbonate. Standard and custom colors with or without low-reflectance surface. Custom fabrication and bending also available.

Kyle K. Whittaker, Pres. 302/652-3686, 1-800-346-7802 fax: 302/652-4578

HONEYWELL INC., Defense Avionics Systems Division, 9201 San Mateo Blvd. N.E., Albuquerque, NM 87113-2227

Manufacturers of fully militarized high-resolution monochrome and color CRTs and flat-panel displays in a wide variety of sizes for fixed-wing or rotary aircraft applications. Randall E. Horn 505/828-5107, fax: 505/828-5500

HORNELL AUTOMATION, Tunavägen 281,

Borlänge S-781 73, Sweden Manufacturers of the MELP (modular equipment for LCD production): modules for rubbing, dry cleaning, adhesive application, dry-type spacer application, alignment and assembly, filling, and edge sealing. LCD optics test instrumentation for viewing angle, light scattering, and switching time. Niclas Granér, Pres.

+46-243-390-95, fax: +46-243-390-55 HORNELL ELEKTROOPTIK AB,

Gagnef, Sweden, S-78041 Manufacturers of LCD shutters for use in welding filters and similar applications. Custom-designed optical components based on LC technology. John Danielson, Mktg. Mgr. +46-241-62030, fax: +46-241-62107

HORNELL ENGINEERING, INC., 9337 Ravenna Rd., Suite B-14, Twinsburg, OH 44087

Manufacturers of the MELP (modular equipment for LCD production) system: modular equipment for LCD production, covering the following process steps: bakecuring, rubbing, dry cleaning, spacer application, gasket seal printing/dispensing, combined alignment-assembly, curing of the gasket seal, and filling. Date B. Pfriem, Pres.

216/405-1419, fax: 216/405-1420

HOSIDEN AMERICA CORP., 120 E. State Parkway, Schaumburg, IL 60173 Manufacturers of active and passive

LCDs for a variety of applications including automotive, avionics, cellular, desktop computer monitors, office automation, personal communicator, and projection. Rich Maryanski, LCD SIs. & Mktg. Mgr. 708/885-8870, fax: 708/885-0063

HOWTEK, INC., 21 Park Ave., Hudson, NH 03051

Manufacturers and marketers of color input and output peripherals for PCs and Mac IIs with supporting software. These peripherals include the Scanmaster series of flatbed and 35-mm film scanners and the Pixelmaster solid ink-jet printer, capable of up to 262,000 colors. Jim Lloyd, V.P. SIs./Mktg. 603/882-5200, fax: 603/880-3843

HOYA CORP. USA, OPTICS DIV., 960 Rincon Circle, San Jose, CA 95131 Exclusive U.S. distributor of NH TECHNO

NA-series glasses for llat-panel display manufacturing. Contrast and color correction filters, and custom coatings for CRT, LED, and other displays available. Gerald Bottero, V.P. 408/435-1450, fax: 408/435-1536

HOYA ELECTRONICS CORP., 50 Tice Blvd., Woodcliff Lake, NJ 07675-7664 Manufacturers of optical glass for the IC

and display industry. Products includes thin-film deposition (ITO and AR coating). Robert E. Gesullo 201/307-0003, fax: 201/307-1937

HP REID CO., 1 Commerce Blvd., Palm Coast, FL 32135

Manufacturers of AI, Cu, and Au-plated Cu bonding wires. Ultrafine sizes of insulated and bare wires available. Rob Specht, VP Mktg. 904/445-2000, 1-800-772-9473 fax: 904/446-2244

H-SQUARE CORP., 1289 Reamwood Ave., Sunnyvale, CA 94089

Manufacturers of H-Square cassettes that ensure maximum cleanliness while providing ESD controls and high-temperature compatibility. Exclusive vertical mizo plates provide the support required to safely transport large (up to 840 × 1025 mm) substrates. Bud Barclay, V.P. Sls./Mktg. 408/734-2543, tax: 408/734-1132

HUDSON PHOTOGRAPHIC INDUSTRIES, INC., P.O. Box 227, Irvington, NY 10533 Manufacturers of MIRROLITE@ glassless projection-grade mirror panels (type PGR

projection-grade mirror panels (type PGR and PGX) used in rear-projection systems.

The mirror panels are optically equivalent to glass mirrors, light weight, rigid, selfsupporting, and have built-in mounting devices. Sizes range from 24 × 24 in. to 68 × 240 in.

Norman Rabinowitz, V.P. Sls./Mktg. 914/591-8700, fax: 914/591-8859

HUGHES LEXINGTON, 1501 Newtown Pike, Lexington, KY 40511

Designers/manufacturers of a broad range of special-purpose CRTs for headmounted high-resolution medical, projection, recording, and avionics displays used in many commercial and military applications. Chuck Martino, Mktg. Mgr.

606/243-5519, fax: 606/243-5555

HUGHES-JVC TECHNOLOGY CORP., 2310 Camino Vida Roble, Carlsbad, CA 92009

Manufacturers of large-screen projectors with brightness ranging from 2000 to 3500 Im, filling screens from 8 to 40 ft. wide. These projectors utilize Image Light Amplifier® technology, providing bright, resolute, and pixel-free images. Cress Carter, V.P. Sls./Mktg. 619/929-5680, 1-800-225-4582 fax: 619/929-5410

HUGHES LIGHT VALVE PRODUCTS, INC., 2310 Camino Vida Roble, Carlsbad, CA 92009

Manufacturers of liquid-crystal lightvalve projectors with high brightness, high resolution, and high contrast ratio and wide horizontal frequency range and video bandwidth; available in a variety of screen sizes. Alan Brawn

619/929-5300, 1-800-USA-LVPI fax: 619/929-5708

THE HUMAN FACTORS AND ERGO-NOMICS SOCIETY, P.O. Box 1369, Santa Monica, CA 90406-1369

Offering membership and publications for professionals working or interested in human factors/ergonomics. HFES members include researchers, scientists, and designers of many products and systems, including displays. 310/394-1811 or -9793, fax: 310/394-2410

310/394-1811 or -9793, fax: 310/394-2410

HYACINTH TECHNOLOGY, INC., 155 L New Boston St., Woburn, MA 01801 Manufacturers of high-voltage power supplies, amplifiers, and systems for CRTbased, direct-view, color and monochrome, projection, film-recorder applications. Rajen Patel

617/937-0619, fax: 617/937-6319

HYBRID MICROGRAPHICS, INC., 5216 Greenpine Dr., Murray, UT 84123 Manufacturers of digital film recorders, computer-output microfilm recorders, digital-output microfilm recorders. Thomas A. Hoopes, Pres. 801/264-1818, fax: 801/264-10855

HYCOM, INC., 16841 Armstrong Ave., Irvine, CA 92714

Manufacturers of flat-panel EL displays and integrated display systems. Specialists in shaded-picture video displays for vehicles and portable equipment. Distributors of standard and customized Sharp TFEL products. Iohn Lewis SIs. Mdr.

John Lewis, Sls. Mgr. 714/261-6224, fax: 714/261-9321

HYUNDAI ELECTRONICS INDUSTRIES CO., LTD., Ichon-si, Kyoungki 467-701, Korea

Manufacturers of a line of TFT-LCDs for notebook PCs.

D. K. Kim, Sls. Dir. +336-39-6404, fax: +336-39-6415

IBM CANADA LTD., 23 Airport Blvd., Dept. 594/MI, Bromont, Quebec, Canada J0E-IL0 Providers of metallization and personal-

Ization services for glass panels for plasma displays and color filters. Sputtered materials include ITO, chrome, copper, and aluminum. Maximum panel size is 38 × 27 in. High throughput photolithography manufacturing line also available. E. Pires, Mgr./Thin-Film-on-Glass Prod. 514/534-6658, fax: 514/534-6688

IBM CORP., Old Orchard Rd., Armonk, NY 10504

Manufacturers of a line of display and printer products connecting to large systems, mid-range systems, workstation systems, and personal computers. Many of these products have graphics and image capability. Software support for many graphics and image applications is available. 914/765-1900

National organization. Please refer to your local telephone directory.

IDM (INTERNATIONAL DESIGN MODEL-ING), 70 Horizon Dr., Bedford, NH 03110 Manufacturers of interconnects with densities of 700 in./in.², hole sizes down

densities of 700 in./in.², hole sizes down to 2 mills (25 µm), areas up to 29 × 29 in., and up to 20 layers. N. Edward Berg, Pres. Phone/fax 603/472-7068

IEC CO., 1450 E. 17 St., Ste. 122, Santa Ana, CA 92701

Distributors of high-brightness VFDs, NVG-compatible displays, EL lamps, and hardware for edgelift display panels. Consultants for display applications. Gene Hu, Pres.

714/543-6295, fax: 714/543-7383

IEE (INDUSTRIAL ELECTRONIC ENGINEERS, INC.), 7740 Lemona Ave., Van Nuvs. CA 91409-9234

Manufacturers of standard and custom vacuum-fluorescent, liquid-crystal, LED, and dc plasma flat-panel displays. Also, keypads, keyboards, and integrated panel assemblies. Steve White, Dir. Sls. 818/787-0311, 1-800-422-0867 fax: 818/901-9046

IKEGAMI ELECTRONICS (U.S.A.), INC., 37 Brook Ave., Maywood, NJ 07607

Manufacturers of a line of computer monitors from 17 to 20 in., gray scale and color, with INVAR masks and Trinitron tubes with resolutions to 1600 × 1280. Joe Guzman, Dir. Sls./Mktg. 201/368-9171, 1-800-368-9171 fax: 201/368-1305

ILC TECHNOLOGY, INC., 399 Java Dr., Sunnyvale, CA 94089

Manufacturers of Cermax® xenon arc lamps and Daymax® metal-halide lamps. Complete illumination systems for video/data projectors. Wes Moloney, Mkt. Dev. Mgr. 408/745-7900, 1-800-347-2474 lax: 408/744-0829 IMAGE ANALYTICS CORP., 275-D Marcus Bivd., Hauppauge, NY 11788 Manufacturers of custon-designed filters (polarized and color) and image analysis

systems for biological research. Ronald M. Miller, Pres. 516/273-8900, fax: 516/273-1190

IMAGE PROCESSING SYSTEMS, INC., 3440 Pharmacy Ave., Scarborough, Ontario, Canada M1W 2P8

Designers and manufacturers of automated display inspection and alignment systems for monitors and TVs using machine-vision technology. Products include handheld measurement tools, geometry alignment systems, and complete turnkey ITC installations. David J. A. Morrison, VP Mktg. 416/492-4000, fax: 416/492-4001

IMAGE QUEST TECHNOLOGIES, INC., 48611 Warm Springs Blvd., Fremont, CA 94539

Manufacturers of AMLCD products for avionic, military, and other highperformance applications. Providers of both custom IQT and COTS glass, ruggedized for demanding applications. Large-area photomask with automated optical inspection to ensure high quality also available.

Donald Harris, Mktg. Mgr. 510/249-0500, fax: 510/249-0550

IMAGE SYSTEMS CORP., 6103 Blue Circle Drive, Minnetonka, MN 55343

Manufacturers/designers of gray-scale high-brightness monitors that sync from NTSC to 2560 × 2048 in portrait or landscape mode. Sizes range from 9 to 24 in. landscape and 21 and 24 in. portrait. Compatible with multiple platforms, including PCs, Macs, and workstations such as Sun, Silicon Graphics, and H-P. Marta S. Volbrecht, V.P. Sls. 612/935-1171, fax: 612/935-1386

IMAGRAPH CORP., 11 Elizabeth Dr., Chelmsford, MA 01824

Manufacturers of PCL/VL-bus video imaging boards. IMASCAN accepts NTSC/ PAL, RS-170, RGB, and YUV video signals, and includes SVGA on-board single/dual monitor operation. WINS 3.1 and NT are supported. Joe Plonski, V.P. Sls. 508/256-4624, fax: 508/250-9155

IMAPRO CORP., 2400 St. Laurent Blvd., Ottawa, Ontario, Canada K1G 5A4

Manufacturer and distributor of professional color scanners that scan 24-bit color at 600 and 1200 dpi; an 8K film recorder with no DAC lines in 35mm, 4 × 5, and 8 × 10 formats; a color pre-press system which includes four-color film output. G. McKinlev

613/738-3000, fax: 613/738-5038

INCLINE, INC., 2192 Anchor Ct., Newbury Park, CA 91320

Providers of worldwide service support and engineering for FPDs, including repair, remanufacturing, inventory management, and test-equipment design and engineering. In/out of warranty programs for LCD and laptop manufacturers include screening, repair, polarization, and TFT laser repair. Chuck Menzel, V.P. Bus. Devel.

805/376-3300, fax: 805/376-3302

INCOM, INC., 294 Southbridge Rd., Charlton, MA 01507

Manufacturers of fiber-optic faceplates and components, including tapers, CCD windows, image conduit, clad rod, and rigid lightguides. Michael A. Detarando, Dir. Sls./Mktg. 508/765-9151, fax: 508/765-0041

INDIUM CORPORATION OF AMERICA, 1676 Lincoln Ave., Utica, NY 13502

Suppliers of indium tin oxide (ITO) powder to makers of ITO sputtering targets; ONSPEC@ metal indium/tin targets; indium ingot, foil, and wire for target bonding to backing plates. Also, indium reclaim service.

Phil Scalise, Sls. Associate 315/853-4900, 1-800-446-3486 fax: 315/853-1000, 1-800-221-5759

INFAX, INC., 2485 Lithonia Industrial Blvd., Lithonia, GA 30058

Manufacturers of digital-to-video converters: multiple CGA, EGA, VGA outputs, serial and parallel data inputs. Monochrome display monitors: 5-, 9-, and 23-in. models. Mike Davis, Pres. 404/482-2755, tax: 404/482-4057

INFINITY MULTIMEDIA INTL., 14225 Ventura BIvd., Sherman Oaks, CA 91423 Manufacturers/distributors of autostereoscopic 3-D displays and content for the arcade, video-game, and consumerelectronics markets. Multi-view systems provide motion-parallax as well as stereo information. Suzanne Ponder, Sr. V.P.

818/981-4950 x26, fax: 818/501-6224

IN FOCUS SYSTEMS, INC., 27700B SW Parkway Ave., Wilsonville, OR 97070 Manufacturers/distributors of a complete line of monochrome and color PC Viewer LCD projection panels that are placed on an overhead projector to display data and graphics from a PC onto a screen or wall. The Liteshow II™, a portable presentation manager for organizing, enhancing, and

displaying computer generated images in brilliant color. Mike DeWitt. Natl. SIs.

503/685-8888, fax: 503/692-8887

INFODEX, INC., 10 Venus Dr., Wolcott, CT 06716

Designers/manufacturers of a full line of monochrome and color CRT and flat-panel EL display monitors for the military, industrial, and medical markets. Roger Lemire, SIs. Engr. 203/879-4944, fax: 203/879-4944 x230

INFOLEX CORP., 12 West 27th St., New York, NY 10001 Manufacturers of the multicolor, dynamic

Manufacturers of the millicolor, optimic LED LightWall for indeor and outdoor applications, which displays graphics, animation, and multilingual text in brilliant colors, with special effects. The LightWall represents an energy efficient alternative, with the added advantage of rebates from local energy suppliers. Ani Bedrossian, V.P. Mktg./Sls.

212/213-2622, fax: 212/213-3142

INFO-LITE CORP., 422 Cliff St., Fairview, NJ 07022

Manufacturers of large numeric displays and instruments, alphanumeric displays and message signs, backlighted indicators and annunciators, matrix pinboard switches, and reed switches.

Joseph M. Cartelli, Tech. Mktg. Mgr. 201/941-4455, fax: 201/941-4919 INNOTEC GROUP, INC., 61W Moreland Rd., Simi Valley, CA 93065

Manufacturers of vertical in-line sputtening systems and in-line evaporation systems for the manufacture of flat-panel displays; rf, dc, and electron-beam power supplies; and vacuum components. William T. Read, Dir. Sls./Mktg.

805/522-9040, fax: 805/522-6017

INNOVATED IMAGE, INC., 710 Denbigh Blvd., Bldg. 6, Suite A-1, Newport News, VA 23608

Providers for presenters, trainers, and educators of LCD and DLP projectors and LCD panels from leading manufacturers, including nView, In Focus, Proxima, Telex, and NEC.

J. Landon Lovett, Pres., Mktg 757/872-6896, 1-888-771-6896 fax: 757/872-6783

INSTEC, INC., P.O. Box 7246, Boulder, CO 80306

Manufacturers of precision hot stages for applications in optical microscopy and research of liquid crystals. The HS1-i stage provides for large volume with convenient access to samples, stable sample positioning, and precision position control for optimum optical performance and productivity. Caitlin Clark-Zigmond, Dir. Oprns.

303/444-2564, fax: 303/541-9354

INSTITUTE FOR PHOTOMETRY AND RADIOMETRY, 16 Jac-O-Lyn Way, Chico, CA 95926

Manufacturers of high-precision photopic detectors, CIE tristimulus colorimeters, spot-photometers; P65 light sources; standard LEDs, and testers. Measurement and calibration services for photometric and radiometric parameters; light sources, detectors, transmissivity, reflectivity. Kathleen Muray, Pres. 916/894-3932, fax: 916/894-3847

INSTRUMENT SOCIETY OF AMERICA, 67 Alexander Dr., Research Triangle Park, NC 27709

Worldwide organization for instrumentation and control engineers and technicians. ISA also publishes videotape and interactive videodisc instruction products as well as applications software. Gale Girer, Mgr. Media Pub. 919/549-8411, 1-800-334-6391 fax: 919/832-0237

INSTRUMENT SYSTEMS, 576 Golden Ave., Ottawa, Ontario, Canada K2A 2E9

Distributors of display test systems for automotive, avionic, NVIS, and general display testing. Scanning diode array and CCD-based spectrometers for spectroradiometry, spectrophotometry, LED, and small lamp testing. Also, polarization analyzers and the IQCam, an imaging photometric camera. Tim Moggridge, N.A. Mktg. Mgr. 613/729-0614, fax: 613/729-9067

INTECOLOR CORP., 2150 Boggs Rd., Duluth, GA 30136

Manufacturers of monitors and workstations for industrial and ruggedized applications. Marine-certified, NEMA-4 and 4x rated, plus x, y, and z purged versions featuring touch-screen integration, magnetic shielding, and integrated high-performance computers.

Tracy Cole, Mktg. Assoc. 770/623-9145, fax: 770/623-9163 INTERACTION SYSTEMS, INC., 10 Commerce Way, Wolburn, MA 01801 Manufacturers of Crystal Clear™ capaci-

Manufacturers of Crystal Clear M capacitive touch screens, providing better than 95% light transmission with less than 0.5% reflection in hostile environments with up to 100% humidity.

Phil Baker, Mktg. 617/932-0700, fax: 617/932-3088

INTERACTIVE COMPUTER PRODUCTS INC., 23482 Peralta, Unit C, Laguna Hills, CA 92653

Manufacturers of light pens and complete light-pen systems for computer terminals, workstations (SUN, SPARC, and HP), and personal computers (IBM PCs, clones, and PS/2s). Available for monochrome and color CRT displays. Resolution to 1280 × 1024.

Pat Cooper, SIs./Mktg. Mgr. 714/770-5332, 1-800-392-0540 fax: 714/770-8137

INTERFACE PRODUCTS, INC.,

4630 North Ave., Oceanside, CA 92056 Manufacturers/designers of controls and displays for commercial and military applications, including AMLCDs, passive, touch screens, integrated switch panels, becklights, electroluminescent displays, and display components manufactured in an ISO9001 facility. Bill Lang, Mktg. Mgr.

760/945-0230, fax: 760/945-0239

INTERLINGUA (see DISPLAY TECHNOL-OGY LIBRARY), 423 S. Pacific Coast Hwy. #208, Redondo Beach, CA 90277

Market researchers/publishers specializing in display-technology literature from Japan. Translated documents concerning manufac-turing, R&D, marketing, new-product releases, competitive activities, and technology trends. Jack Bernstein, Pres.

310/792-3636, fax: 310/792-3642

INTER-LOGIC SYSTEMS CO., INC., 12708 Hoover St., Garden Grove, CA 92641

Manufacturers of probe test fixtures to test display substrates for electrical shorts and opens. LINEAR CONTACTOR can contact stripes as close as 0.010 in. and as many as 100 at one time. Also, probe stations for mounting test fixtures, and substrates.

John K. Logan, Pres. 714/891-4456, fax: 714/894-6668

INTERNATIONAL MICRO IND., INC., 8000 Commerce Parkway, Mount Laurel, NJ 08054-2227

Manufacturers of equipment to bond driver chips to FPDs. Also, contact assembly, including TAB and flip-chip technologies.

Thomas L. Angelucci, Sr., CEO 609/273-0200, fax: 609/273-4364

INTERNATIONAL POLARIZER, INC., 320 Elm St., Mariboro, MA 01752

Manufacturers of linear and circular polarizing sheet, wave-retarder films, and polarized products for displays. High-transmittence high-efficiency polarizers and veryhigh-efficiency polarizers. Wave-retarder films up to 17 in. wide. Polarizing filters. Donald F. Rickert, V.P. Sls. 508/481-4943, fax: 508/481-0222

INTERSERV CORP., 9555 James Ave. S., Ste. 230, Bloomington, MN 55431 Manufacturers of PANALIGN™, a ±1-µm

Manufacturers of PANALIGN™, a ±1-µm automatic alignment assembly system for large-area LCD panels. The GDX product line of adhesive dispensing system, with real-time active z-axis control, dispenses adhesive on substrates up to 1200 × 1600 mm. ELECTROMASK® II large-area lithography and photomask imaging systems. Ron McKay, Sls. Mgr. 612/888-9767, 1-800-445-2738

fax: 612/888-0796 INTERSTATE ELECTRONICS CORP., 1001 E. Ball Rd., P.O. Box 3117, Anaheim,

CA 92803 Manufacturers of displays for spaceborne, airborne, shipboard, and land-based applications. The product offering includes high-resolution color CRTs, thin-film electroluminescent, ac plasma, and LCDs specifically designed for military environments.

Russ Summers 714/758-4032, 1-800-854-6979 fax: 714/758-4111

INTEVAC, INC., 3550 Bassett St., Santa Clara, CA 95054

Manufacturers of the D-STAR™ sputtering system, updated for third-generation ITO and metal thin-film production with rates to 90/hour. The CP-3545 RTP system provides high-throughput processing for crystallization, dopant activation, and dehydrogenation in poly-Si LCDs. Stacy H. Oresman, Mgr. FPD Sys. Mktg. 408/496-2214, fax: 408/988-8145

INTRONICS, 150 Dan Rd., Canton, MA 02021

Manufacturers of monolithic distortion correction devices that accurately correct for geometric or focus distortion in CRT displays. Gene Stancato 617/828-4992, 1-800-367-0004

fax: 617/527-3310 ION SYSTEMS, 1005 Parker St., Berkeley,

CA 94710 Designers/manufacturers of air/nitrogen ionizers and instrumentation for controlling damage and contamination caused by static charge. Products range from ultracleanroom ionization systems to point-ofuse ionizing blowers.

Ted Wilson 510/548-3640, 1-800-367-2452 fax: 510/548-0417

IRIS GRAPHICS, INC., 6 Crosby Dr., Bedford, MA 01730

Manufacturers of a family of high-resolution color printers, based on continuous ink-jet technology, used in a wide range of color-oritical applications. They offer a perceived resolution of 1500–1800 dpi, support a variety of low-cost substrates, and output four-color images up to 34 × 46.3 in.

John Williamson, Natl. Sls. Mgr 617/275-8777, fax: 617/275-8590

IRISTAL LTD., 25 Hapoel St., Herzliya 46626, Israel

Manufacturers of full-color LCD monitors featuring very wide field of view and high brightness. Ilana Stolov-Hecht, Dir.

+972-050-217-445

ISCAN INC., 89 Cambridge St., Burlington, MA 01803 Manufacturers of the HEADHUNTER

head- and eye-tracking system that automatically tracks head and eye position and computes a line-of-sight vector over a 360° azimuth by 180° elevation range. The system can designate targets within a field of view just by looking at them. Other applications include simulator control and human-factors research. Rikki Razdan, Pres. 617/273-4455, fax: 617/273-0076

ISE ELECTRONICS CORP., P.O. Box 46, Ise, Mie, 516-11 Japan

Manufacturers of vacuum fluorescent displays; VFD module and sub-system; picture-element displays for large-screen information panel; and related products. Kazuhiko Kasano, Gen. Mgr. Engr. Div. +81-596-39-1111, fax: +81-596-39-0366

IST (IMAGING & SENSING TECHNOLOGY CORP.), 300 Westinghouse Circle, Horseheads, NY 14845-2299

Manufacturers of high-performance CRTs and custom high-resolution displays. CRT sizes range from 0.5 to 10 in. on the diagonal. Miniature ruggedized displays are available in 1.0-, 1.5-, or 2.0-in. packages. Ray Boyce, Sr. Mktg. Rep. 607/796-4441, fax: 607/796-4579

ITG (INTERNATIONAL TECHNOLOGY GROUP, LLC), 58 Oakdale Ave., San Rafael, CA 94901

Manufacturers of thin-film optical coatings on plastic; anti-reflection and transparent conductive coatings; clear and tinted optical-grade plastic sheets 1–4, 4.5, 5, and 6 mm with -2 µm/20 mm; and XR-series of glare and radiation filters. Dieter W. Grabis, Pres. 415/454-8054, fax: 415/457-5983

413/434-0034, 188. 413/437-3903

ITO AMERICA CORP., 123 NW 13th St., Suite 308, Boca Raton, FL 33432

Distributors of NGI FlexEL electroluminescent lamps for LCD backlighting. NGI touch screens for LCDs. Toshiba TAB attach and final bond equipment. Ishiyama Polarizer laminating equipment. Ohashi heatseal and TAB bonding equipment for LCDs and PWBs. Callum Gallagher, Equip. Specl. 516/392-2555, fax: 516/392-0807

ITT CANNON, 1851 E. Deeve Ave., Santa Ana, CA 92705 Suppliers of connectors and interconnec-

Suppliers of connectors and interconnection systems to a variety of markets, including information systems, microminiature, automotive, fiber optics, industrial controls and military/spare applications. Dick Torson

714/261-5300, fax: 714/757-8301

JACO ELECTRONICS, 145 Oser Ave., Hauppauge, NY 11757

Distributors of a full line of LCDs. Four value-added services: kitting (cables, inverters, and controllers); touch-panel solutions (touch screens, cables, and controllers); flat-panel monitors (metal/plastic with or without touch); full system integration for flat panels. Richard E. Walsh, Dir. FPDs 516/273-5500, fax: 516/273-5506

JKL COMPONENTS CORP., 13343 Paxton St., Pacoima, CA 91331

Manufacturers of miniature lighted devices, cold cathode fluorescent lamps, LEDs, optical lamps for projectors, quartzhalogen lamps, and xenon lights. Joe Velas, SIs. Mgr. 818/896-0019 Toll Free: 1-800/421-7244

fax: 818/897-3056 KAHN INTERNATIONAL, 782 Southampton

Dr., Palo Alto, CA 94303

Publishers and consultants. Monthly multiclient report tracks and interprets worldwide developments in flat-panel and projection display technology and markets for industry decision-makers. Quarterly data and video projector database. Technology assessment, due diligence, program review, and expert witness. Frederic J. Kahn, Pres.

415/327-2043, fax: 415/429-2035

KAISER ELECTRONICS, 2701 Orchard Pkwy., San Jose, CA 95134

Supplier of head-up displays, multifunction displays, display processor and integrated heimet displays, and LCDs for combat aircraft. 408/432-3000 x1705

KAISER OPTICAL SYSTEMS, P.O. Box 983, 371 Parkland, Ann Arbor, MI 48108 Manufacturers of holographic head-up

displays, laser eye-protection devices, LCD holographic diffusers and projection screens, holographic filters and components, imaging spectrographs, Raman fiberoptic probes and microscopes, high-resolution CCD cameras, and spectroscopy software.

James McNaughton, Dir. Bus. Dev. 313/665-8083, fax: 665-8199

KAMSTRA COMMUNICATIONS, INC., 5914 W. Courtyard Dr., Ste. 320, Austin, TX 78730

Marketing-communications firm, coordinating planning and implementation of integrated marketing communications on behalf of clients such as Canon USA, Integrated Designs, Inc., Eagle-Picher Industries, Inc., and 3M Company. Rick Odell, Acct. Supvr. 512/343-8484, fax: 512/343-6010

K AND M ELECTRONICS, INC., 11 Interstate Dr., W. Springfield, MA 01089 Manufacturers of high-reliability high-

voltage ruggedized dc power supplies (30 W + 60 W series) for commercial, military, medical, analytical, and other highdefinition high-resolution custom display applications (digital film recorders, CAD stations, etc.).

Rick Brighenti, Product Mgr. 413/781-1350 x285, 1-800-442-4334 fax: 413/737-0608

K & R ENGINEERING SALES CORP., 227 Rt. 206, Flanders, NJ 07836 Manufacturers representative for magnetic shielding, dellection yokes, focus coils, and high-voltage power supplies. Bob Resker, Pres. 201/584-5235, fax: 201/584-4375

KELTRON, CORP., 225 Crescent St., Waltham, MA 02154

Manufacturers of high-voltage power supplies from 10 to 150 W and available as standard low-cost modules or custom units combining dynamic focus and anode modules, all with UL/CSA approvals. Ted Chadurjian, Mktg. Mgr. 617/894-8700, fax: 617/899-9607

KENIX INDUSTRIES, INC., 2006 E. 5th St., Tempe, AZ 85281

Manufacturers of a full line of LCDmanufacturing equipment, including PI printer, rubbing machine, seal/Ag printer, dry-spacer applicator, align/assembly machine, press/cure, scriber/breaker, endseal machine, polarizer laminator, LC fill machine, and related equipment. W. Joe Cho, V.P. 602/967-9461, fax: 602/921-0836

KENT DISPLAY SYSTEMS (A Manning Ventures Business Unit), 343 Portage Blvd., Kent, OH 44240

Manufacturers of display systems modules and other products using bistable reflective cholesteric LCD technology with Image "No-Power" memory. Applications include low-power handhelds, such as data collectors, cellphones, PDAs, remote controls, signage, transportation marquees, hotel billboards, menus, and other publicinformation systems. Gerald P. Willnecker, Sls./Mktg Mgr. 330/673-8784, fax: 330/673-4408

KISCO SANTA CLARA, Div. of Kishimoto Sangyo Co., Ltd., 4655 Old Ironsides Dr., Ste. 390, Santa Clara, CA 95054

Distributors of manufacturing materials and equipment for TN/STN/AMLCDs, including polarizers, spacers, ITO glass, sealants, and systems for polarizer lamination, scribe/break, PI coating, rubbing, and LC injection. Distributors of TN/STN-LCD cells from Japan/China/ Taiwan on an OEM basis. Thomas L. Climer, Mgr. LCD Group 408/748-1888, fax: 408/748-1064

KLA ACROTEC, 12-1 Fujimi 1-chome, Chiyoda-ku, Tokyo 102, Japan

Manufacturers of automated inspection systems that locate defects on flat-panel displays as they are being manufactured. Other products include review microscopes and data analysis computers that complement the inspection systems. N. Higashi-Iriki

+81-3-3230-7011, fax: +81-3-3230-4120

KLA INSTRUMENTS, 160 Rio Robles, San Jose, CA 95134

Distributors (for all locations outside Japan) of KLA Acrotec's automated inspection equipment for flat-panel displays. See "KLA Acrotec" listing for description of this equipment.

Douglas Hendricks 408/434-4200, fax: 408/456-6864

KLEIN INSTRUMENTS, INC., 8948 S.W. Barbur Blvd., Dept. 100, Portland, OR 97219

Manufacturers of state-of-the-art video pattern generators designed for reliability, durability, and alfordability from the makers of the Klein Convergence Gauge. Molly Mossman, Sls. Mgr. 503/235-6333, fax: 503/245-8166

KOLLMORGEN CORP., Electro-Optical Div., 347 King St., Northampton, MA 01060-2390

Manufacturers of integrated optronic systems utilizing CCD and thermal imaging cameras together with image processing and control technology at an image control/ graphics workstation. Douglas R. Jones 413/586-2330, fax: 413/586-1324

KONTOY PRODUCTS CO., LTD. 166 Wai Yip St. 9/F, Kwun Tong, Hona Kona

Manufacturers of LCD production equipment and tools. P. L. Mok, Oprns. Mgr. +852/341-3238, fax: +852/357-4237

KONTRON IMAGE ANALYSIS, 4440 Von Karman Ave., #200, Newport Beach, CA 92660

Manufacturers of digital cameras and image processing, analysis, and archiving software with applications in material analysis, process and quality control, cell

and tissue analysis in biomedical, forensics, and microscopy, knowledge-based classifi-cation and 3-D reconstruction. Norbert Schuster, SIs. Mgr. 714/851-1872, fax: 714/851-3180

KOPIN CORP., 695 Myles Standish Blvd., Taunton, MA 02780

Manufacturers of small-format highresolution AMLCDs, including a 0.25-in.diameter 320 × 240 display that requires less than 30 W to operate. Because of their low cost and high information content, these small CyberDisplays™ are the first AMLCDs that can be effectively used in personal information devices and other consumer devices.

Glen G. Kephart, V.P. Mktg. Display Prod. 508/824-6696, fax: 508/824-6958

KORRY ELECTRONICS CO., 901 Dexter Ave. N., Seattle, WA 98109

Manufacturers of night-vision-compatible backlights for AMLCDs. Designed for avionics cockpit applications, Korry's backlights offer high brightness and full sunlight readability. Mike Phillips, Dir. Sls. 206/281-1300, 1-800-257-8921 fax: 206/281-1365

KRISTEL CORP., 555 S. Kirk Rd., St. Charles, IL 60174-3433

Manufacturers of 3-28-in. custom monochrome and color open-frame and OEMcabinet CRT display monitors. Broad variety of horizontal frequencies and video inputs available. Touch-screen integration and color TFT-LCD monitor modules also available.

Kevin Michael, Sls. Mgr. 630/443-1290, fax: 630/443-1390

KURDEX/THINFILM EQUIPMENT DIV., 343 Gibraltar Dr., Sunnyvale, CA 94089 Manufacturers/suppliers of high-precision production equipment for large-area substrates up to 600 × 750 mm. Providers of tools for R&D/pilot and high-volume production. Equipment products include sputtering, evaporation, box coaters, PECVD, RIE etching, and PR stripping. Options: stand-alone or configured to full automatic casette-to-casette reactors or casetteless substrate transfer system, cluster, or in-line systems. William H. Kneeland, Dir. Sls./Mktg. 408/734-8181, fax: 408/734-5151

KYOCERA INDUSTRIAL CERAMICS CORP., 5713 E. Fourth Plain Blvd., Vancouver, WA 98661

Manufacturers of full line of color STN LCDs with 1/4-VGA, VGA, SVGA, and XGA resolutions. Diagonal viewing areas range from ¼-VGA 4.7-in. panels up to the KCT1026B with its XGA (1024 × 768) resolution and 15-in. viewing diagonal. Joseph R. Maurer, Mktg. Mgr. 360/750-6124, 1-800-826-0527 fax: 360/750-6184

LABSPHERE, INC., P.O. Box 70, Shaker St., North Sutton, NH 03260

Specialists in the design and manufacture of diffuse reflectance products: integrating spheres, integrating sphere instrumentation, diffuse reflectance coatings and materials. Douglas S. Baxter, V.P. Sis 603/927-4266, fax: 603/927-4694

LAMPLIGHTER INDUSTRIES, INC., 96 Lamplighter St., Oak Hill, WV 25901 Manufacturers of metal-ceramic electroluminescent panels. M. D. Emmett, V.P.

304/469-2474, fax: 304/499-3380

LAMINATION TECHNOLOGY CORP., 12423 Gladstone Ave., Bldg. 27, Sylmar, CA 91342

Manufacturers of custom optical filters, screens, and lenses for cleanroom/optical lamination. Also, polarizers, IR filters, diffusers, anti-glare filters, flexible film to glass or plastic sheet. Contract R&D/ fabrication services available. Jack Wignot, Pres. 818/898-1989, fax: 818/365-2488

LANDMARK TECHNOLOGY, 2160 Old Oakland Rd., San Jose, CA 95131

Designers/manufacturers of custom and special-feature backlights for a wide variety of LCDs sizes (0.7-17 in.), including veryhigh-brightness backlights for sunlightreadable applications to low-power back-lights for EL replacement. Color LCDs using very high brightness backlights achieve a screen brightness ranging from 500 to 1100 nits. Also, a computerized LCD optical performance tester for characterization of LCDs. Ronald E. Copps, Mktg. Mgr 408/434-9302, fax: 408/434-0954

LASERGRAPHICS, INC., 20 Ada, Irvine, CA 92718

Manufacturers of the LFR Plus™ and LFR™ 4000-line digital film recorders; the family of rasterizers, Rascol II, III, IV and Mac Rascol Print, which drive virtually any color printer to produce sharp text and brilliant color prints or transparencies; the RISC Rascol line of controllers, a design based on the high-speed MIPS processor offering a dramatic speed increase by a factor of as much as 15. Mike DeLucca 714/753-8282, fax: 714/727-9282

LASERTECHNICS, 5500 Wilshire Ave.,

N.E., Albuquerque, NM 87113 Manufacturers of the DIR gray-scale printer, a high-resolution monochrome continuous-tone printer producing photographic-quality digital prints; StarBurst dual-mode color printer; 300-dpi thermalwax or dve-diffusion printer. Rich Macklin, Mktg. Mgr. 505/822-1123, fax: 505/821-2213

LASERTEC U.S.A., INC., 1778 Technology Dr., San Jose, CA 95110

Manufacturers of a new LCD-inspection machine that automatically inspects color filters for defects. Also, a Confocal Laser Scanning Microscope to profile the display surfaces. Tom Pomposo, Dir. Sls.

408/437-1441, fax: 408/437-1430

LAVERSAB INDUSTRIAL COMPUTERS, 10503 Rockley Rd., Ste. 103, Houston, TX 77099

Manufacturers of industrial computers, terminals, and monitors. All products are NEMA-4 rated and feature TFT activematrix b/w or color flat-panel displays. Industrial keyboards and resistive touch screens are also available. Mike Ewell, Mktg. Mgr. 713/568-8394, 1-800-285-7337 fax: 713/568-8399

LCD LIGHTING, INC., 37 Robinson Blvd., Orange, CT 06477

Manufacturers of custom-designed miniature fluorescent lamps for LCD backlighting; direct- and edge-lighting schemes. Available in 2.6-20-mm diameters, hot and cold cathode, straight or

bent configurations, tri-phosphor coatings, aperture and reflector styles. Alton G. Hudson, SIs./Mktg. Mgr. 203/795-1520, fax: 203/795-2874

LEADER INSTRUMENTS CORP 380 Oser Ave., Hauppauge, NY 11788 Manufacturers of a wide range of test equipment, including programmable RGB generators capable of driving advanced displays. Featured are dot-clock rates to 300 MHz, on-screen techniques for raster and test-pattern design, and memory control Robert Sparks, Dir. Sls. 516/231-6900, 1-800-645-5104

fax: 516/231-5295

BERNARD J. LECHNER, Consultant, 98 Carson Rd., Princeton, NJ 08540-2207 Consultancy in display devices and systems and all aspects of television, including HDTV systems and standards. Knowledgeable about patent matters: infringement, interference, etc. Experienced expert witness.

Bernard J. Lechner, Consultant 609/924-7545, fax: 609/924-7547

LEICA, INC., 323D Vintage Park Dr., Foster City, CA 94404

Manufacturers of fully automatic opticalinspection and metrology systems for LCD panels up to 550 × 650 mm. High-resolution CD measurements on low-contrast patterns, film thickness on glass, and filled and unfilled LCD gaps. Richard D. Eandi, Product Mgr 415/578-0488, 1-800-716-0900 fax: 415/578-8116

LEICA, INC., 111 Deer Lake Rd., Deerfield, IL 60015

Manufacturers of Inspection microscopes and systems for film-thickness analysis, gap measurement, and colorimetry on FPDs up to 650 × 550 mm. Automatic plate loaders can be integrated. 847/405-0123, 1-800-248-0123 fax: 847/405-0147

KURT J. LESKER CO., 1515 Worthington Ave., Clairton, PA 15025-2700

Manufacturers of flat-panel-display PVD and CVD coating systems, production-sized Torus magnetron sputter guns, pure materials, and targets; rf/dc power supplies, guns, and target bias and quartz-crystal thin-film monitors and ellipsometers for realtime measurement of physical and optical film thicknesses. Duane Bingaman, V.P. Sls. 412/233-4200, 1-800-245-1656 fax: 412/233-4275

LEVY HILL LABORATORIES LTD., 5 Sheffield House, Fieldings Rd., Cheshunt, Herts., U.K. EN8 9TJ

Manufacturers of scintillators, x-ray screens, and detectors for x-ray image displays. Also, x-ray image storage screens.

Guy Hill, Managing. Dir. +44-99-230-808, fax: +44-99-221-909

LEYBOLD AG, Wilhelm-Rohn-Strasse 25, Postfach 15-55, D-6450 Hanau, Germany 6450

Suppliers of vacuum coating systems and vacuum processing technology (sputtering, PE-CVD, plasma-etching) for production of active-matrix LCD and color displays. Dr. Reineck

+33-6181-34-0, fax: +33-6181-34-1690

LEY3OLD TECHNOLOGIES, INC., 1860 Hartog Dr., San Jose, CA 95131 Manufacturers of high-throughput in-line sputtering systems, complete with ITO, silicon dioxide, and metal processes commonly used in LCD and other FPD manufacture. Substrate areas range from 350 × 400 mm to 830 × 1500 mm. Also, the Panel 450, a large-area plasma etching system. And the LC 350, a large-area LPCVD system for the deposition of a-Si and p-Si.

Tony Sisca, Sls. Engr. 408/436-2822, fax: 408/436-2847

LIBBEY-OWENS-FORD CO., 811 Madison Ave., P.O. Box 799, Toledo, OH 43697-0799

Manufacturers of float glass, including on-line pyrolytic coalings using atmospheric CVD technology. Industrial products include TEC-glass, on-line multilayer tin-oxidecoated float glass, and UltraFloat, a superflat high-quality clear float glass. Peter F. Gerhardinger, Mgr. New Prod. Technology

419/247-3931, fax: 419/247-4517

LIBERTY MIRROR, 851 Third Ave., Brackenridge, PA 15014

Custom design and engineering of optical thin films, specialty mirrors, and optical components. Capabilities cover a broad range from coating customer's material to supplying a complete optical product. Coatings range from highly reflective frontsurface mirrors to low-reflection coatings to dichroic and beamsplitter coatings. Also, conductive coatings for EMI and RFI applications.

Steve Zebert, Coatings Sls. Engr. 412/224-1800, fax: 412/224-8754

LIGATURE SOFTWARE, INC., 25 Burlington Mall Rd., Ste. 300, Burlington, MA 01803

Developers of CharacterEyes, 32-bit OCR software that scans documents, analyzes page layout, and outputs directly to a word processor. CharacterEyes supports all major scanners and image file formats. It is available for Windows and Macintosh and is priced at \$695. Ed McGuiggan, Dir. No. Amer. Oprns. 617/238-6734, 1-800-888-0060 fax: 617/272-3085

LIGHTING SCIENCES, INC., 7830 E. Evans Rd., Scottsdale, AZ 85260

lies

real

unt.

and

٦g

of

Manufacturers of custom photometric test equipment, including high-speed vidi-photometer systems (backlight and display technology) and automated goniometer and photometer systems. Also, developers of Raymaster®. Consulting services for a wide tange of illumination/optical-design applications. Dana Hunton Sts. Mor.

Dana Hunton, Sls. Mgr. 602/998-9252, fax: 602/998-9498

LINDGREN RF ENCLOSURES, 3138 El Segundo, Hawthorne, CA 90250 Manufacturers of rf-shielded enclosures, rf-shielded anechoic chambers, RFI/EMI power, signal, data and control line filters, rf-shielded honeycomb air vents. Janet O'Neill, Sls. Adm. 213/870-9383, 1-800-969-9383 lax. 213/870-0828

iax. 213/8/0-0828

LINFINITY MICROELECTRONICS, INC., 11861 Western Ave., Garden Grove, CA 92641

Manufacturers of linear and mixed-signal ICs and modules and the LXM1590 series of single-stage LCD backlight inverters ideal for driving LCD backlight lamps in portable computers, including the latest 12.1-in. panels. John Lynes, West. Reg. Sls. Mgr. 714/898-8121, 1-800-LMI-7011 fax: 714/893-2570

LITTON ELECTRON DEVICES, 1215 S. 52 St., Tempe, AZ 85281 Manufacturers of high-resolution CRTs

for a wide range of recording, scanning, and viewing applications, including typesetting, color graphics, medical imaging, and flying spot scanning. Bryan Harding, Sls. Mgr. 602/968-4471, fax: 602/966-9055

LITTON SYSTEMS CANADA LTD., 25 Cityview Dr., Etobicoke, Ontario,

Canada M9W 5A7 Designers/manufacturers of LED- and AMLCD-based displays and display systems for military and avionic

applications. Van Angelo, Mgr. Displ. Bus. Dev. 416/249-1231 x3905, fax: 416/246-2955

LMT, P.O. Box 269046, MB 116, San Diego, CA 92196

Manufacturers of a complete line of photometers (both luminance and illuminance meters) and colorimeters for display measurements and high-accuracy lab use. Some are NiCd-battery operable for field use with lab accuracy. Margaret M. Watson

619/271-7474, fax: 619/693-3670 LOCKHEED SANDERS, INC.,

P.O. Box 868, 95 Canal St., Nashua, NH 03061

Manufacturers of ruggedized and militarized cockpit display systems, intelligent graphic terminals, and display workstations using color liquid-crystal flat panels and CRTs for application in aircraft, ground vehicles, movable shelters, ships, submarines, and space. Robert Perutz, Prog. Devel. Mgr. 603/885-3524, 1-800-258-1573 fax: 603/885-7264

LOCTITE LUMINESCENT SYSTEMS, INC., 101 Etna Rd., Lebanon, NH 03766-9004

Manufacturers of electroluminescent (EL) lamps and dc-ac inverters that are performance-matched to the lamps they drive. The thin, solid-state, low-power lamps are used to backlight LCDs, and come in a wide range of colors, including NVIS-compatible green. Michael R. Hartman, V.P. SIs/Mktg. 603/448-3444, fax: 603/448-3452

LORAD POWER SYSTEMS, 36 Apple

Ridge Rd., Danbury, CT 06810 Manufacturers of custom high-voltage power supplies. Dan Lyke, V.P.

203/790-1188, fax: 203/743-3370

LORAL FAIRCHILD IMAGING SENSORS, INC., CCD Imaging, 1801 McCarthy Blvd., Milpitas, CA 95035

Manufacturers of line-scan and area sensors, line-scan development boards and modules, and line-scan and area cameras. Jim Johnson, Dir. Commer. Mktg. 1-800-325-6975, fax: 408/433-2508

LOCKHEED MARTIN DISPLAY SYSTEMS (Formerly Loral Information Display Systems), 1355 Bluegrass Lakes Parkway, Alpharetta, GA 30201

Manufacturers of ruggedized and militarized cockpit and workstation display systems using CRTs and AMLCDs for application in aircraft, ships, submarines, and ground vehicles. Current product line offers AMLCD screen sizes up to 20.1-in. on the diagonal. John Balderston, Dir. Mktg.

770/752-5485, fax: 770/752-5525 LSI, 101 Etna Rd., Lebanon, NH 03766 Manufacturers of new, state-of-the-art

electroluminescent lamps providing thin (0.012 in.), low-current-draw, uniform illumination. Built with the latest moistureresistant materials, the lamps are inexpensive and appropriate for highvolume applications. Louise Stark, Regional SIs. Mgr. 603/448-3444 x3173, fax: 603/448-3452

LUCAS CONTROL SYSTEMS PRODUCTS - DEECO™ SYSTEMS, 31047 Genstar

Rd., Hayward, CA 94544-7831 Manufacturers of ruggedized industrial computers, serial graphics and text terminals, VGA monitors, and embedded modules for NEMA-4/12 (IP65) applications. Systems incorporate resistive or infrared touch electroluminescent or color LCDs. Sunlight-readable models are available. Frank Pensa, Natl. SIs. Mgr. 908/850-5889, 1-800-376-1154 fax: 908/850-6009

LUMINARY TECHNOLOGIES, 6640 Lusk Blvd., Ste. A-200, San Diego, CA 92121 Manufacturers of custom flat-paneldisplay controller cards and module electronics for graphics and video systems. Products include controllers for PMLCDs, AMLCDs, EL, and FEDs. Enhancement technologies include Adaptive Scanning™, Adaptive Addressing™, and WFRC. Robert Hotto, Chief Tech. Off. 619/457-5151, fax: 619/457-4646

LUMITEX, INC., 8443 Dow Circle, Strongsville, OH 44136

Manufacturers of woven liber-optic backlighting for LCDs, membrane switches, control panels, and automotive applications. Specialized light sources for inspection and vision systems. New products include molded light panels, super-bright LED sources, and new low-cost high-volume product designs. David A. DeAgazio, Sls. Mgr. 216/243-8401, 1-800-969-5483 fax: 216/243-8402

LUXELL TECHNOLOGIES, INC., 5170A Timberlea Blvd., Mississauga, Ontario, Canada L4W 2S5

Engaged in the research, development, and manufacturing of the first highperformance sunlight-legible TFEL display. Features include long life, high brightness, wide viewing angle, fast response time, extended operating range, ruggedness, high contrast, and crisp clear images. The displays are suitable for portable instruments, vehicle displays, ground positioning systems, and computer displays. Available in standard and custom display tormats. Fred Prins, Intl. Mktg. Mgr.

905/206-1708, fax: 905/206-9174

LXD, INC., 7650 First Place, Oakwood, OH 44146

Manufacturers of standard and custom LCDs. Specializing in long-life high-reliability products featuring wide temperature ranges, fast response times, and wide viewing angles. Innovators in large-area and sign displays. Colored polarizers also available.

Chuck Oravec, Sls. Mgr. 216/786-8700, fax: 216/786-8701

MACHINE VISION AND CONTROL INTERNATIONAL, INC., 1804 Johni Dr., Glenview, IL 60025

System design, integration, and installation in the application of infrared- and visible-image capture and analysis for measurement, process control, quality control, and troubleshooting; training in the use of these techniques; system maintenance also provided. Gary Shubinsky, Pres. 200/57 2000, Iow. 200 720, 0120.

708/657-0200, fax: 708/729-9120

MACHOVER ASSOCIATES CORP., 152A Longview Ave., White Plains, NY 10605

A computer-graphics consultancy providing a broad range of management, engineering, marketing, and financial services worldwide to users, suppliers, and investors. Application areas served include animation, art, business, CAD, CAM, CAE, CIM, documentation, engineering, graphic arts, multimedia, presentations, process control, science, visualization, and virtual reality. Carl Machover, Pres. 914/949-3777, fax: 914/949-3851

MAGNETIC RADIATION LABORATORIES INC., 690 Hilltop Dr., Itasca, IL 60143 Manufacturers of magnetic shielding components for CRT and related fields. Alan J. Barone, V.P. 630/285-0800, fax: 630/285-0807

MAGNETIC SHIELD CORP., 740 N. Thomas Dr., Bensenville, IL 60106-1643 Manufacturers of standard and custom magnetic shields for CRT monitors as well furnishing CO-NETIC AA and NETIC 53-6 magnetic-shielding alloys in a wide selection of sheets and coils. Brad Friestedt, SIs. Mgr. 630/766-7800, 1-800-304-5665 fax: 630/766-7813

MANAGEMENT GRAPHICS, INC., 1401 E. 79th St., Minneapolis, MN 55425

Manulacturers of Solitaire image recorders, offering up to 16K resolution on a variety of film formats from 16 mm to 8 × 10 in. and Mac, PC, and workstation compatible. Every Solitaire features patented Digital Geometry Control, an alldigital image-alignment system. All image characteristics are available from Solitaire's front panel.

Bill Hansen, Mktg. Mgr. 612/854-1220, fax: 612/851-6159

MAN AND MACHINE, INC., 3706 West St., Landover, MD 20782 Specializing in the repair of flat-panel

Specializing in the repair of flat-panel displays, including replacement of TAB drivers, polarizers, and backlight bulbs for TFT, DSTN, and color gas-plasma displays. Also supports ruggedization of FPDs and buys and sells new and refurbished FPDs. Clifton Broumand, Pres. 301/341-4900, fax: 301/341-4078

MANITRON DISPLAYS LTD., Millbuck Way, Sandbach, Cheshire, U.K. CW11 9HT Manufacturers of very-high-resolution

monochrome and color monitors up to 3K x 2K resolution; raster radar monitors (16and 23-in. round, 16 x 16 and 20 x 20 in. square) with digital dynamic focus, dynamic astigmatism correction and 1.2-nsec risetime video amplifiers.

Alan Hesketh +44-270-764-171, fax: +44-270-763-160

MANX RESEARCH, 2060 Ridgecrest Pl., Escondido, CA 92025

Reports covering the Japanese display industry, projector test and evaluation, manufacturing cost trends — projection systems. Also, custom design reviews, strategy sessions, and consultation. William K. Bohannon, Chief Scientist 619/735-9678, fax: 619/735-8987

MARKET INTELLIGENCE RESEARCH CORP. (MIRC), 2525 Charleston Rd., Mountain View, CA 94043

Market researcher/publisher of high-tech market research reports covering displays, graphics, and image processing. Mel Neri, Mktg. Mgr. 415/961-9000, fax: 415/961-5042

MARK IV INDUSTRIES, LTD., F-P Electronics Div., 5959 Ambler Dr., Mississauga, Ontario, Canada L4W 2P1 Manufacturers of electronic display

Manufacturers of electronic display products for passenger-information display systems for bus, rail, and airport terminals; highway-traffic information; bus-destination signs; scoreboards; fuel-pump displays; time/temperature; and advertising signs. Douglas Greenwood, Gen. Sls. Mgr. 905/624-3020, 1-800-265-7773 fax: 905/238-3141

MARSHALL INDUSTRIES, 9320 Telstar Ave., El Monte, CA 91731 Distributors of a complete line of flat-

Distributors of a complete line of natpanel-display standard or customized solutions for a variety of major applications. Products include FPD kits utilizing singleboard computers, embedded micro PC cards, PC 104 modules, touch screens, and accessories.

Diana Beckman, Strategic Mktg. Mgr. 818/307-6101, 1-800-800-2970 fax: 818/307-6298

MARUBENI SPECIALTY CHEMICALS, INC., 10 Bank St., White Plains, NY 10606

Suppliers of a complete line of materials for the FPD industry, including UV-cure sealants, polarizing tilm, and spacers for TN-, STN-, and TFT-LCDs. Also, a line of planarization, RGB, and black-matrix resins for TFT applications; and phosphors, anisotropic conductive film, and moisturebarrier sealants for FED, EL, and plasma displays. Will Liu, Sls. Coord.

914/428-5933, fax: 914/428-7524

MATERIALS RESEARCH CORP., 560 Rte. 303, Orangeburg, NY 10962

Manufacturers of sputtering systems for pilot-line and high-volume production of ITR, silicon nitride, amorphous silicon, and metal layers. Systems are delivered complete with a guaranteed process to meet film specifications. Gil Chaput, Dir. Prod. Mktg. 914/398-8585, fax: 914/398-8415

MATRIX COMPONENTS, INC., 13581 Pond Springs Rd., Suite 315, Austin, TX 78729

Flat-panel repair center. Services include fine-pitch bonding, custom laminating polarizers, formulation to match OEM color specifications, prototype development, product consulting, processor repairs, failure analysis, in and out-ofwarranty repair programs, and end-of-life product support. Len Bejlich, V.P. Engr.

Len Bejtlich, V.P. Engr. 512/258-7590, 1-800-737-3955 fax: 512/219-0021 MATROX ELECTRONIC SYSTEMS LTD., 1055 St. Regis Blvd., Dorval, Quebec, Canada H9P 2T4

Designers and manufacturers of video controllers targeted to several distinct markets: graphics, imaging, interactive videodisc, videographics, and financial information. Markets encompass a large variety of applications including CAD, 3D-display, medical electronics, and robolics.

Bruce Seidel, Sls. Mgr. 514/685-2630, 1-800-361-4903 fax: 514/685-2853

MATSUSHITA ELECTRONICS CORP., 1-1 Saiwai-cho, Takatsuki, Osaka 569, Japan

Manufacturers of the "Pure Flat" tube, the first high-resolution color CRT with a completely flat screen, a slot-type shadow mask, and auto-scanning, providing a "paper-like" image with excellent white quality and brightness uniformity. M. Sanogawaya, Mgr., CRT SIs. Dept. +81-0726-82-7614, fax: +81-0726-85-0345

McLAUGHLIN CONSULTING GROUP, 1150 University Dr., Ste. 113, Menlo Park, CA 94025

Providers of marketing and technical consulting, both strategic and tactical. Multi-client reports and custom studies. Areas of market specialization include flat-panel monitors, personal displays, and embedded flat panels. Technology expertise in PDLC, plastic displays, and miniature imagers. Chuck McLaughlin 415/323-7155, fax: 415/323-7744

McMAHAN ELECTRO-OPTICS, INC., P.O. Box 14026, 79 T. W. Alexander Dr., Bldg. 4201, Ste. 101, Research Triangle Park, NC 27709 Manufacturers of the Model MRL-V1701 high-performance 40-MFLOP image-oriented workstation. Standard and custom software are available. Tracy Frantz, Office Mgr. 919/549-7575, 1-800-733-7575 fax: 919/549-0421

McMAHAN RESEARCH LABORATORIES, P.O. Box 14026, 79 T. W. Alexander Ave. Research Triangle Park, NC 27709 Manufacturers of image-processing workstations, ranging from low-cost image controllers for analysis and reporting to high-speed image-oriented digital signalprocessing workstations designed for various image-processing applications. Robert H. Hart, Tech. Staff 919/549-7575, 1-800-733-7575 fax: 919/549-0421

MDC VACUUM PRODUCTS CORP., 23842 Cabot Blvd., Hayward, CA 94545 Manufacturers of a complete line of UHV components including flanges and liftings, roughing components, electrical and motion feedthroughs, and valves. Also, a complete line of e-beam evaporation sources matching 6-, 10-, and 15-kW solid-state switching power supplies. 510/265-3500, 1-800-443-8817 fax: 510/887-0626

MECC, 200 E. Howard St., Suite 286, Des Plaines, IL 60018

Manufacturers of universal CRT and yoke testing systems (drivers) featuring multiinductance and multi-frequency. Universal LCD module drivers and moisture meters. Development, quality assurance, and production of CRTs, deflection yokes, and LCDs. Megumi Usui, Sls. Mgr. 847/827-4874, fax: 847/827-4875

MEGAVISION, P.O. Box 60158, Santa Barbara, CA 93160

Manufacturers of image acquisition, display, processing, and analysis systems oriented toward engineering, and research and development. Ken Boydston, Pres. 805/964-1400, fax: 805/683-6690

MEKEL ENGINEERING, INC., 777 S.

Penarth Ave., Walnut, CA 91789 Manufacturers of the M400 microfilm digitizer that scans 16 and 35mm roll microfilm for quick transfer to digital storage medias; featuring unattended operation, selectable resolution, built-in sensors to detect start and end of each image, and PC controlled. Maurice Amesbury, Pres. 909/594-5158, fax: 909/594-1216

MERCK LTD., Merck House, Poole, Dorset, U.K. BH15 1TD

Manufacturers of liquid crystals for electro-optic displays, liquid-crystal polymers, thermochromic LCs, single crystals for UV and IR optics, scintillators, fluoride glass components for fiber optics, and precursors for high-T_c superconductors. Martin G. Pellatt, Bus. Mgr., Adv. Mater. +44-202-745-520, fax: +44-202-723-824

MERCK KGaA, Frankfurter Str., 64271 Darmstadt, Germany

Manufacturers of liquid crystals, alignment materials, and optical coatings for LCDs.

Werner W. Becker, Tech. Mgr., LCs and Pls.

+49-6151-72-7360, fax: +49-6151-72-3132

MEISSNER + WURST GmbH + CO., Rossbachstr. 38, 70499 Stuttgart, Germany

Manufacturers and designers of ultraclean production facilities worldwide. Infab, a key subsidiary, provides automation solutions, a growing demand in the production arena. Stephan Durr, Mgr. Corp. Relations +49-711-8804-303, fax: +49-711-8804-566

+49-711-8804-303, fax: +49-711-8804-56 MELLES GRIOT PHOTONICS

COMPONENTS, 1770 Kettering St., Irvine, CA 92614

Manufacturers and distributors of optical components, coatings, optomechanics, fiber optics, and He-Ne and diode lasers. Products include lenses, mirrors, beam splitters, filters, prisms, polarizers, optical tables, and more. Routinely supply custom and OEM components for specialized needs.

Jeff Silverman, Sls. Mgr. 714/261-5600, 1-800-835-2626 fax: 714/261-7790

METAVAC, INC., 4000 Point Street, Holtsville, NY 11742

Manufacturers of high-efficiency reflection-reducing coatings and transparent conductive coatings; contrast-enhancement filters for P43 CRT and color displays. Clifford E. Sisler, Sls. Mgr. 516/447-7700, fax: 516/447-7715

METHEUS CORPORATION, 1600 NW Compton Dr., Beaverton, OR 97006

Manufacturers of high-resolution graphics display controllers. The 5700 Series of graphics display controllers are a series of single-slot 6U VME boards designed for ATC, G³I, and other high-resolution dataintensive applications. Dynamic video and radar-scan converters with resolutions up to 2048 × 2048, all under X-Window/PEX Control, are available. Art Yerkes, Sys. SIs. Mgr. 503(690-1550, 1-800-638-4387 fax: 503/690-1525

MEYLAN CORP., 543 Valley Rd., Upper Montclair, NJ 07043

Manufacturers and distributors of stopwatches, chart recorders, event loggers, gas detectors, tachometers, stroboscopic-tachometers, precision electric timers, elapsed time meters, time study boards, and all related time study equipment. Alex Pirnaris, SIs. Mgr. 201/744-6400, fax: 201/744-1011

MICRION CORP., One Corporation Way, Centennial Park, Peabody, MA 01960-7990 Manufacturers of the L1 system for in-process repair of AMLCD panels. This system repairs "open" defects by a patented photolytic laser CVD metal process and short defects by laser ablation. David Casey, Prog. Mgr. 508/531-6464, fax: 508/531-9648

THE MICROMANIPULATOR CO., 1555 Forrest Way, Carson City, NV 89706

Manufacturers of analytical probing stations including the model 2250, a largearea flat-panel-type tester for diagnostic probing substrates or board-mounted delidded packaged devices. Full line of accessories including thermal chucks, measurement equipment for low-current testing, or for high-frequency testing, manipulators, and probes. Karen Schanhals, Advert./Promotion Mgr. 702/882-2400, 1-800-654-5659 fax: 702/882-7694

MICRONIC LASER SYSTEMS AB, Box 3141, Nytorpsvagen 16, Taby 18303, Sweden

Manufacturers of a complete line of largearea laser plotters producing photomasks for CRTs, active and passive displays, lead frames, plasma displays, and fine line interconnects. Sven Lofquist, V.P. Mktg./SIs.

+468-792-6095, fax: +468-792-2480

MICRO-OPTICS TECHNOLOGIES, 8608 University Green #5, P.O. Box 620377, Middleton, WI 53562 Manufacturers of liquid-crystal-based

Manufacturers of liquid-crystal-based spatial light modulators, shutters, polarization optics, and related light-control devices. Produces both stock items and custom devices.

Larry Gunseor, Appl. Engr. 608/831-0655, fax: 608/831-5821

MICROTECH LIQUID CRYSTALS, INC., 1720 Macklind Ave., St. Louis, MO 63110 Manufacturers of cholesteric liquid crystals.

Les Neudorf, Pres. 314/773-7099, fax: 314/773-7888

MICROTOUCH SYSTEMS, INC., 300 Griffin Park, Methuen, MA 01844

Manufacturers of high-resolution capacitive touch screens and quality five-wire resistive touch screens. Built to last, they come with a 5-year warranty. Available as kils or integrated CRT monitors and flatpanel displays.

Arthur Demirjian, Telesales Mgr. 508/659-9000, 1-800-642-7686 fax: 508/659-9100 MICROVISION CORP., 180 Knowles Dr., Ste. 209, Los Gatos, CA 95030

Manufacturers of the SS200 Series of display analysis equipment. These complete and comprehensive systems are designed to make fully automatic measurement monitors, CRTs, projection systems, and LCD flat panels. Kraig Chellow, Appl. Engr. 408/374-3158, 1-800-931-3188 fax: 408/374-9394

MIDWEST COMPUTER, 1441 Branding Lane, Suite 100, Downers Grove, IL 60515

Specializing in the repair of robotic and CNC CRTs, mainframe, mid-range, and PC monitors. Fast turn-around, preventative maintenance, circuit board, and flyback reproduction. Authorized repair depot for major Japanese Iirms. Kim Mueller, Acct. Mgr. 630/963-6500, fax: 630/963-6681

MII, 3110 West Ridge Pike, Sanatoga, PA 19464

Distributor of all brands and all types of replacement camera tubes and CRTs for medical imaging and display systems. Upgrades available for R&F and C-arm xray systems from all makers. Clyde A. Mock, Mktg. Mgr. 610/323-2825, 1-800-835-8766, fax: 610/718-0755

MILGRAY ELECTRONICS, INC.

77 Schmitt Blvd., Farmingdale, NY 11709 Manufacturers of a complete line of FPDs, including LCDs, active and dual scan color, ac plasma, and vacuum fluorescent; VGA, SVGA, XGA, and custom LCD monitors. Also, custom monitor enclosures for industrial/commercial specs; unique packaging, plastic/metal enclosures; smallfootprint PCs. All touch technologies available. Controllers, inverters, and sunlightreadable technology also available. Tony Cannone, Dir. Mktg. 516/420-9800, fax: 516/420-9884

MINOLTA CORP., 101 Williams Dr., Ramsey, NJ 07446

Manufacturers of a complete line of convergence meters, including the CC-200 On-Line System, designed for use on TV and computer-monitor production lines, that simultaneously measure horizontal and vertical misconvergence of red, green, and blue. Color-analyzer Models 100 and 110 for white-balance adjustment on CRTs and LCD panels. CS-100 hand-held colorimeter for non-contact measurements of light sources and reflective surfaces. 201/934-4642, fax: 201/825-4374

MINTRONIX, 5251 Verduge Way, Suite J., Camarillo, CA 93012

Manufacturers of LCD digital video controller cards, LCD monitors with integrated touch screens, and custom interface solutions for LCDs. Digital video controllers cards designed for both PCI bus and ISA bus and feature 5- and 3.3-V functionality, NTSC/PAL video output, and compatibility with LVDS signal delivery system.

Derek Nguyen, Sls. Mgr. 805/482-1298, fax: 805/987-8088

MITO FINE GLASS CO., LTD., 2-1-2 Marunouchi, Chiyod-ku, Tokyo 100, Japan

Manufacturers of large polished substrates for displays. Mgr. Sls. Dept.

+81-3-218-5861, fax: +81-03-213-5486

MITSUBISHI ELECTRONICS AMERICA, INC., 5665 Plaza Dr., Cypress, CA 90630 Manufacturers of a line of 14-42-in.

(13-40-in.-diagonal viewable image) color monitors, including Diamond Scan® and high-performance Diamond Pro® desktop monitors, and large-screen Megaview® presentation and projector products. Lisa Headley, Product Mktg. Mgr. 714/220-2500, 1-800-843-2515

MITSUBISHI ELECTRONICS AMERICA, INC., 1050 E. Arques Ave., Sunnyvale, CA 94086

Manufacturers of the ANGLEVIEW™ family of color TFT-LCDs, offered in 12.1, 14.2, and 15.1 in. in XGA; 15.1 in. in SXGA; 12.1 in. SVGA; and 13 in. in EWS versions. All feature 18-bit color, state-ofthe-art 4.3-µm cell gap, and low-reflectivity black-matrix technology. Pam Holbrook

408/730-5900, fax: 408/773-1495

MITSUBISHI ELECTRONICS AMERICA, INC., 800 Cottontail Lane, Somerset, NJ 08873

Manufacturers of video copy processors for all imaging/hard-copy requirements; monitors; professional S-VHS VCRS; and video projectors. Most units are autoscan (15-35 kHz) capable. Rich Williams, Reg. Sls. Mgr. 201/563-9889, fax: 201/981-9492

MIWA CO., LTD., 720-3, Unane, Takatsu,

Kawasaki, Kanagawa 213, Japan Importers/exporters of laser/electrooptics products; LCD laser annealing systems; beam homogenizer; various types of microscopes; laser trigger systems; optical thickness measurement systems; Ti: sapphire pulsed laser; YVO₄ microlaser; Nd:Yag pulsed laser; phacoemulsification system; ellipsometers; spectral radiometer; elc. K. Uno. Pres.

+81-44-812-7801, fax: +81-44-812-7800

MKS INSTRUMENTS, INC., 6 Shattuck Rd., Andover, MA 01810

Multi-divisional global supplier of vacuum/pressure and flow measurement and control instrumentation; vacuum fittings, flanges, valves, and gauging; process-monitoring systems and residualgas analyzers; pressure and flow calibration systems. Products used throughout the flatpanel-display manufacturing industry. Applications Engrg. Dept. 508/975-2350, 1-800-227-8766 fax: 508/975-0093

MODUTEC, INC., 920 Candia Rd., Manchester, NH 03103 Manufacturers of backlights for LCDs. Charles Davis, V.P. Mktg./Sls. 603/669-5121, fax: 603/622-2690

MONITOR TECHNOLOGY CORP., 2864 Vicksburg Lane, Minneapolis, MN

55447-1878 Domestic manufacturers of 19–24-in. monochrome and gray-scale monitors for OEM applications requiring resolutions from 1024 × 768 to 2560 × 2250. Joe Lloyd, Sls. Mgr.

612/551-1478, fax: 612/551-1581

MONTEREY TECHNOLOGIES, INC., 987 University Ave., Suite 12, Los Gatos, CA 95030

Human factors and ergonomic consulting and support services related to display and workspace design and compliance with ANSI standard 100-1988. Robert T. Hennessy, V.P. 408/625-5285, fax: 408/625-5286

MORRISON ELECTRONICS CORP.,

1776 Lone Eagle St., Columbus, OH 43228 Manufactures and engineers large and small alphanumeric and numeric displays for plant floor communications. These displays range from 0.5 in. to as large as needed. Charlie Morrison, Pres.

614/851-1100, fax: 614/851-1121

MOTIF, INC., 27700A S.W. Parkway Ave., Wilsonville, OR 97070

Manufacturers of low-cost video-speed LCDs. Active Addressing™ is a fundamentally different way of applying electrical signals to LCDs that maximizes overall display performance, including response time and contrast, without limiting potential resolutions or display size. Active Addressing™ places proprietary pixel-addressing algorithms and circuitry in custom ICs, reducing LCD-manufacturing costs significantly from more complex active-matrix LCDs.

503/682-7700, fax: 503-682-7036

MOTOROLA INC., Semiconductor Products Sector, 5005 E. McDowell Rd., Phoenix, AZ 85008

State-of-the-art semiconductor products for video input processing, video amplification, horizontal output, and power supplies in high- and very-high-resolution CRT monitors.

Bill Roman 602/244-3101, 1-800-521-6274 fax: 602/244-3810

MOTOROLA FLAT PANEL DISPLAY DIVISION, 7700 S. River Parkway, Tempe AZ 85284

Manufacturers of flat-panel displays based on field-emissive technology. The new displays will offer TV-like performance in a thin and lightweight format, and will be suitable for a variety of OEM comsumer applications.

Tom Credelle, Dir., Prod. Mktg 602/755-5500, fax: 602/755-5502

MRS TECHNOLOGY INC., 10 Elizabeth Dr., Chelmsford, MA 01824

Manufacturers of the Model 5200 Series high-throughput large-area PanelPrinter™ systems designed to produce the most advanced AMLCDs, FEDs, color filters, etc. A broad range of imaging requirements are met with the industry's highest-performance wide-field G-line lens. Providers of the world's first 1.0-µm imaging capability useful for large-area poly-Si and FED manufacturing. PanelPrinters™ can also be equipped with wide-field I-line lenses for exposing pigment-dispersed color-filter and other DUV-sensitive materials. James F. Quinn, Sls. Mgr. 508/250-0450, fax: 508/256-3266

MTL SYSTEMS, INC., 3481 Dayton-Xenia

Rd., Dayton, OH 45432-2796 Manufacturers of flat-tension-mask color monitors; 29-in. autosync color monitors;

the Comprehensive Display Evaluation System (CODES); and video test-pattern generators. Ray Wabler, Dir. Products Div.

513/426-3111, fax: 513/426-8301

THE MULTIMEDIA AND VIDEODISC MONITOR, P.O. Box 26, Falls Church, VA 22040

Monthly newsletter focusing on nonconsumer industrial, governmental, and educational uses of multimedia, and emphasizes new products, market statistics and analyses. John Wilson, Mktg. Mgr. 703/241-1799, 1-800-323-DISC fax: 703/532-0529

THE MUSHIELD COMPANY, INC., P.O. Box 439, 5 Springfield Rd., Goffstown, NH 03045

Manufacturers of a line of CRT-monitor enclosures designed to eliminate problems related to EMI at levels up to 30 G. The GB enclosures are painted to match any computer system and take up minimal desktop space. Custom magnetic shielding also available. David Grilli, Pres.

603/666-4433, fax: 1-800-666-4013

NAGASE CALIFORNIA CORP., 710 Lakeway, Ste. 135, Sunnyvale, CA 94086

Distributors of SUMIKALAN® polarizing film, high-quality film that performs several functions such as anti-glare, anti-reflection, and low reflection. Also, SUMIKALIGHT® retardation film includes color compensation film for STN-LCDs and viewing-angle improvement film for STN-LCDs. Mitch Watanabe, Mgr., Mktg. & SIs. 408/773-0700, fax: 408/773-9567

NALPAK SALES, INC., 1937-C Friendship Dr., El Cajon, CA 92020

Providers of quality support equipment. Manufacturers of the octagon-shaped tripod case. Distributors of many other case lines, and carries full line of accessory items for the video and motion picture industry including travel karts, cableties, Magliner trucks, Leatherman tools, Accu-charts, plus many more. Robert Kaplan, Pres.

619/258-1200, fax: 619/258-0925

n&k TECHNOLOGY, INC., 3150 De La Cruz Blvd., Ste. 105, Santa Clara, CA 95054

Manufacturers of thin-film characterization products that simultaneously determines thickness, n and k spectra (190–900 nm), E, and surface roughness of thin-film structures. The substrate can be opaque or transparent. Examples include a-Si:H, ITO, SiN,H, and SiO,:H. John Reilly, Dir. SIS./Mktg.

408/982-0840, fax: 408/982-0252

NANOMETRICS, INC., 310 DeGuigne Dr., Sunnyvale, CA 94086-3906

Manufacturers of the NanoSpec 5500FPD, a film metrology tool for FPD production applications. Accommodating substrates up to 650 × 550 mm, providing discrete measurements at specific locations or the generation of film-thickness maps. A robolic substrate holder is available as an option. The NanoSpec 4000 FPD is a thinfilm measuring system, accommodating flat panels up to 400 × 500 mm. R. Buchanan, Dir. Mktg. 408/746-1600, 1-800-955-6266 fax: 408/720-0196

NATIONAL COMPUTER GRAPHICS ASSOCIATION, 2722 Merrilee Dr., Ste. 200, Fairfax, VA 22031

Trade and professional organization with approximately 7000 individual and corporate members. Sponsors annual computer graphics conference and exposition. Martha Filson, Dir. Corp. Sls. 703/698-9600, 1-800-225-NCGA tax: 703/250-2752

NATIONAL RESEARCH RESOURCES, INC., B 166 Centershore Rd., Centerport, NY 11721

Manufacturers of development-type liquid-crystal light valves, shutters, and patterns for direct-view and projection displays. High-luminance throughput systems for electronic, cinema, fiber-optic switching and control. Standard scan electronic barcodes and custom ELs are also available. J. Burns. MTS/OPR.

Phone/fax: 516/754-0365

NATIONAL SEMICONDUCTOR CORP., Box 58090, 2900 Semiconductor Dr., C2-475, Santa Clara, CA 95052-8090

Manufacturers of ICs for CRT applications, including RGB and single-channel preamps, RGB CRT drivers and deflection/ geometric correction chip sets. Also, ICs for LCD applications, such as notebook-todisplay interface chip sets, panel power supplies, and buffers for gray-scale voltage reference.

Raphael Tam, Dir. Monitors Mktg. 408/721-8786, fax: 408/721-5691

NBS SOUTHERN, INC., 11451 S. Belcher Rd., Largo, FL 34643

Manufacturers of impact printers, electrophotographic laser printers, and non-impact ion-deposition printers. Richard Busbee, V.P. Sls. 813/541-2200, 1-800-327-5602 fax: 813/546-8042

NEC CORP., 2880 Scott Blvd., P.O. Box 58062, Santa Clara, CA 94052-8062

Manufacturers of TFT active-matrix color LCDs for workstation, desktop monitors, industrial equipment, instrumentation, automotive, navigation systems, and notebook PCs. Plasma display panels for HDTV and data monitor applications. Panel sizes for TFTs range from 5.5 to 20.1 in. on the diagonal, with resolutions from QVGA to SXGA. Plasma displays are available in 33-in. (VGA) and 42-in. (853 × 480) diagonal versions. Omid Milani, Sr. Prod. Mktg. Mgr.,

AMLCD Products 408/588-6000, fax: 408/588-6130

NEC ELECTRONICS, INC., 475 Ellis St., Mountain View, CA 94039-7241 Manufacturers of an extensive line of

5.5-14.1-in. TFT panels and have announced a 33-in.-diagonal plasma display panel (PDP). Products address a wide range of markets, including mobile computing, in-flight entertainment, multimedia projection systems, information kiosks, factory automation, and medical instrumentation.

Joany Winkler, Sr. Pub. Rel. Spec. 415/965-6495, 1-800-729-9288 fax: 415/965-6130

NICHIA AMERICA CORP., 3775 Hempland Rd., Mountville, PA 17554

Manufacturer of super-bright green/blue LEDs and phosphors for CRT, EL, and fluorescent lamps

Scott Ushida, Sls. Mgr

717/285-2323, fax: 717/285-9379

NIGHT VISION CORP., 7301 N. Lincoln Ave., Ste. 180, Lincolnwood, IL 60646 Designers of high-performance personal

optical systems, including image intensifiers, night-vision systems, and very-wideangle binoculars, which are helmetmounted, safe for ejection from highperformance aircraft, and can integrate electronic displays and imaging devices. Danny Filipovich, Pres. 847/329-1300, fax: 847/329-1358

NIKON PRECISION, INC., 1399 Shoreway Rd., Belmont, CA 94002-4107

Manufacturers of production photolithography systems for large-area and high-resolution displays. Line includes the LS-500P proximity printer, the FX-301D and FX-501D for large high-resolution displays, and the FX-401E and FX-402E for very-high-resolution HDTV projection displays. David E. Kettering, Sr. Sls. Mgr. 415/508-4674, fax: 415/508-4600

NIMTEC, INC., 125 N. Price Rd., Chandler, AZ 85224

Manufacturers of high-quality and highdensity ITO targets for sputtering. Also, related metals for flat-panel displays. Martin Matsuzawa, SIs. Mar. 602/732-9857, 1-800-NIMTEC-1 fax: 602/899-0779

NIPPON ELECTRIC GLASS, 650 E. Devon, Ste. 110, Itasca, IL 60143-1251 Manufacturers of glass substrate for AMLCDs and STN-LCDs. Also, image sensor cover glass and micro-rod spacers. Wesley Jelinski, O-E Prod. Mgr. 630/285-8500, fax: 630/285-8510

NIPPON SEIKO CO., LTD., 2-2-34 Higashizaoh, Nagaoka, Niigata, 940 Japan Manufacturers of passive LCDs (including TN, STN, and D-STN), LCD modules (including large-area dot-matrix and multicolor), and thick-film EL and driving circuits (inverters) Intl. Dept. +81-258-24-3311

fax: +81-258-24-6543

NIPPON SEIKO K.K., Nissei Bldg., 6-3, Ohsaki 1-chome, Shinagawa-ku, Tokyo, 141 Japan

Manufacturers of large high-precision pattern generators (mask making for FPD. exposure for shadow masks); automated test equipment; large high-precision pattern measuring machine for mask-making process. Main products relate to photofabrication system. +81-466-21-3217, fax: +81-466-21-3109

NITTO DENKO AMERICA, 55 Nicholson Lane, San Jose, CA 95134

Manufacturers of a line of display-related products, including the linear polarizer NPF-E.G. Series with anti-glare and anti-reflective coating, customized elliptical polarizers, special polymer film retarder for controlling viewing angle, circular polarizers for contrast enhancement, and acromatic polymer film retarders. Yoshi Shinozuka, Mgr. NPF Prod. 408/432-5422, 1-800-356-4880 fax: 408/432-5480

NITTO DENKO AMERICA, INC., c/o PERMACEL, U.S. Highway #1, New Brunswick, NJ 08903 Manufacturers of linear and circular polar-

izing film, retardation film, and other optical plastic materials. Mike Yoshikawa, Prod. Mgr. 908/418-2775, fax: 908/418-2777

NITTO DENKO CORP., 3rd Floor, Mori Bldg.-31, 5-7-2 Kojimachi Chiyodaku, Tokyo 102, Japan

Manufacturers of polarizing film, retardation film, and other optical plastic materials. Masato Yoshikawa 908/418-2775, fax: 908/418-2777

NoRAD CORP., 1160 E. Sandhill Ave., Carson, CA 90746 Manufacturers of radiation-blocking

optical filters and magnetic- and electric-field shields for CRTs/VDTs. UltraGlass

and NoRad shields provide front-mounted radiation, glare, and static shielding. ELF ProTech panels and JitterBox enclosures provide *ELF* magnetic-field shielding. Bruce Sperka, Dir. Mktg. 310/605-0808, 1-800-262-3260 fax: 310/605-5051

NORITAKE CO., INC., 2635 Clearbrook Dr., Arlington Heights, IL 60005

Manufacturers of standard or custom vacuum-fluorescent displays or glass packages in dot-matrix, graphics, or 14segment formats. Five models now available as drop-in replacements for LCD modules. New VFD AMLCDs introduced. ISO9001 certified

Albert Smith, V.P. 847/439-9020, 1-800-837-4727 fax: 847/593-2285

NORTECH ENGINEERING, INC., P.O. Box 266, 153 Washington St., East Walpole, MA 02032-0266

Manufacturers of 15-, 17-, and 20-in. industrial video and touch-video monitors, standard and fault-tolerant industrial PCs. and stand-alone NEMA-4 workstations for machine and process control and test and measurement applications.

Melvin F. Silverstein, Pres. 508/668-3490, fax: 508/669-3568

NORTECH IMAGING TECHNOLOGIES, 2500 Niagara Lane, Plymouth, MN 55447 Designers/manufacturers of high-

performance display monitors with resolutions from 525L NTSC to 2048 × 2560, brightness levels to over 300 fL horizontal frequencies from 15 to 200 kHz, and vertical frequencies from 25 to 240 Hz. Screen sizes from 15 to 23 in.

Joe Lloyd, V.P. Sls. 612/404-0226, 1-800-341-4585 fax: 612/404-0227

Nth GRAPHICS, 11500 Metric Blvd., Suite 210, Austin, TX 78758

Designers and manufacturers of PCbased 2-D CAD and 3-D visualization graphics accelerators and NTSC conversion hardware and software. Tony Tittle, Sls. Mgr. 512/832-1944, 1-800-624-7552 fax: 512/832-5954

NUMONICS CORP., 101 Commerce Dr., Montgomeryville, PA 18936

Manufacturers of digitizers: opaque, translucent, and backlighted with 0.010-0.005-in. accuracy. Active digitizing area from 6 × 6 to 44 × 60 in. Seven step sizes in corded and cordless versions. Also pressure sensitive in 12 × 12 × 18 in. Morris B. Bowles, Sls. Mgr. 215/362-2766, fax: 215/361-0167

NUVISION TECHNOLOGIES, INC., 1815 N.W. 169th Pl., Bldg. 3060, Beaverton, OR 97006

Developers/manufacturers/marketers of a broad array of high-quality color display and stereoscopic 3-D components and systems for medical, entertainment, and scientific applications. Vince Power, Sls. Mgr.

503/614-9000, 1-800-920-9527 fax: 503/614-9100

NUTMEG CONSULTANTS

2 Shady Brook Lane, Norwalk, CT 06854 Corporate communications services and products including marketing, press and new-product releases, news releases, and reports for investors and brokers, press and sales kits, proposals, presentations, technical/company backgrounders, executive biographies, brochures, newsletters, product documentation, and writing/rewriting technical material for any audience. Communications products created and formatted for delivery via traditional print media, facsimile, floppy disk, e-mail, and/or World Wide Web Home Page. Create and maintain home pages to customer specifications. Kenneth I. Werner, Pres.

203/853-7069, fax: 203/855-9769

nView Corp., 860 Omni Blvd., Newport News, VA 23606

Manufacturers of LCD projection products with a worldwide network of dealers and resellers

nView Sales Dept. 804/873-1354, fax: 804/873-2153

O&S RESEARCH, INC., 1912 Bannard St., P.O. Box 221, Riverton, NJ 08077

Manufacturers and suppliers of aircraft instrument lighting wedges, cover glasses, and CRT contrast-enhancement filter glass. Line of antireflection coatings includes MIL-C-14806A, AMS 2521A, and MIL-C-675C.

Anderson L. McCabe, Pres. 609/829-2800, fax: 609/829-0482

OCA/OPTICAL CORP. OF AMERICA, 170 Locke Dr., Marlborough, MA 01752

Manufacturers of a variety of optical components including color filters and antireflection coatings compatible with a variety of display systems. Included are microplasma products which can be deposited on glass or plastic and which demonstrate excellent hardness and humidity stability. Walter Lekki, V.P. Mktg./Sls. 508/481-9860, fax: 508/485-0526

OCLI, Santa Rosa Div., 2789 Northpoint Pkwy., Santa Rosa, CA 95407

Manufacturers of patented thin-film multilayer coatings and filters for all display types. Designed to improve brightness and contrast, enhance transmission, widen viewing angle, provide EMI shielding, and incorporate OCLI's high-efficiency antireflection (HEA®) properties. These coatings can be applied by the display manufacturer, added by the OEM after the display is manufactured, or by OCLI. Mark Parish, Display Mkt. Specialist 707/525-7038, fax: 707/525-7841

OCULAR, INC., 746 Lingco Dr.,

Richardson, TX 75081 Manufacturers of custom and standard LCDs and LCD modules. Engineering design and turnkey manufacturing of LCD-related products. Ben Kwang, Mktg. Dir. 214/437-2561, fax: 214/437-2562

OIS OPTICAL IMAGING SYSTEMS, INC., 47050 Five Mile Rd., Northville, MI 48167 Manufacturers of active-matrix LCDs for military, avionic, and other ruggedized applications. Sizes range from 2.4 × 2.4 in. up to 8 × 8 in.

Catherine Matthews, Customer Service 313/454-5560 fax: 313/207-1350

OLYMPUS AMERICA, INC., 2 Corporate Center Dr., Melville, NY 11747

Manufacturers of FPD inspection equipment, including microscopes, macrostations, and automated inspection systems. Objectives corrected for 0.7and 1.1-mm-thick glass. Also, linewidth and registration metrology systems and microspectrophotometers for color-filter evaluation.

V. Boccio, Tech. Mktg. Mgr. 1-800-446-5967, fax: 516/844-5112 OMARA & ASSOCIATES, 2443 Ash St., Palo Alto, CA 94306

Providers of technical market research in liquid-crystal flat-panel displays, display applications, and display markets. Analysis of technology and markets for displaymanufacturing equipment and materials. Display-industry surveys from Japan and other Far East locations. William C. O'Mara, Principal 415/323-2175, fax: 415/323-0864

OMEGA ELECTRONICS, S.A., P.O. Box 6, Rue des Prés 149, Bienne 2504, switzerland

Manufacturers of color video replay, black-and-white matrix, alphanumeric and numeric information boards with character heights from 40 to 520 mm; and timing and judging equipment for all sports. Haldemann Heinz

+41-32-42-97-15, fax: +41-32-41-33-21

0MNICOMP GRAPHICS CORP., 1734 W. Sam Houston Pkwy. N., Houston, TX 77043-2723

Manufacturers and designers of graphic display controllers for a wide range of computing devices, from PCs to highperformance engineering workstations, minis, and mainframes. H. H. Parker, Pres.

713/464-2990, fax: 713/827-7540

OPTICAL ASSOCIATES, INC. (OAI), 1425 McCandless Dr., Milpitas, CA 95035 Designers/manufacturers of automated, semi-automated, and manual mask aligners and exposure systems for substrates up to 20 × 20 in. Also, edge-bead exposure systems and optical-character-recognition systems, and a full line of UV measurement instrumentation. Mike Gillete, Dir. Sis./Mktg. 408/263-4944, 1-800-843-8259 lax: 408/263-6389

OPTICAL CORP. OF AMERICA (OCA), 170 Locke Dr., Marlborough, MA 01752 Designers/manufacturers of optical components and filters for use in UVvisible-IR applications including display and photon-managed products. Walter J. Lekki, V.P. Mktg./SIs. 508/481-9860, fax: 508/485-0526

OPTICAL DEVICES INCORPORATED, 805 Via Alondra, Camarillo, CA 93012 Manufacturers of linear and circular polarized film and contrast-enhancement filters utilizing polarized film. Also, glass and acrylic windows with matte and antireflection surfaces. William Bandel, SIs. Mgr. 805/987-5993, 1-800-987-8801 Jax: 805/987-5789

OPTICAL ELECTRONICS, Box 11140, Tucson, AZ 85734 Manufacturers of low-light-level video image processor. Enhancement including

video tape. Suzanne Gerdes, Pres. Phone/tax: 520/889-8575

OPTICAL RADIATION CORP., 1300 Optical Dr., Azusa, CA 91702 Manufacturers of highly collimated UV-

light exposure systems used to produce liat-panel displays. Systems range from manual load to fully automated in-line configurations.

Michael L. Yatsko, Dir. Mktg./Sls. 818/969-3344 x2428, fax: 818/969-3681 OPTICAL SOLUTIONS, INC., P.O. Box 889, 700 Airport Blvd., Doylestown, PA 18901

Manufacturers of patented rigid rearprojection screens for single-aperture light sources. Performance properties such as viewing angles, brightness, resolution, contrast, and control of surface reflections can be custom engineered. These newtechnology screens are smooth surfaced, with an internal optical structure. Jack A. Dorazio, V.P.

215/348-4649, fax: 215/348-9959

OPTICS 1, INC., 3050 Hillcrest Dr., Ste. 100, Westlake Village, CA 91362 Consultancy in the optical design,

engineering, and production of imaging systems, from initial specifications

through detailed lens design, analysis, tolerancing, fabrication, assembly, and alignment.

Milton Lee, V.P. Oper. 805/373-9340, fax: 805/373-8966

OPTIS, INC., 8230 E. Broadway, Suite E2, Tucson, AZ 85710

Distributors of two products to design and analyze information-display devices using software simulation. Newest product, SPEOS, has been used to analyze everything from LCD notebook dipslays to LED-lit cellular telephone displays. Michael Gauvin, Pres.

520/721-1010, fax: 520/721-1221

OPTO-CAL, INC., 13891 Deanly Ct., Lakeside, CA 92040

Optical radiation calibration laboratories specializing in photometric and radiometric calibrations and measurements. Calibration of photometers, radiometers, power meters, and light sources; spectral transmission of filters and materials from 200 to 1700 nm; and MIL-STD-85762A NVIS testing. Robert Ruff, Pres.

619/561-9983, fax: 619/561-8810

OPTO SIGMA CORP., 2001 Decec Ave., Santa Ana, CA 92660

Manufacturers of precision optical components, including lenses, mirrors, prisms, beam-splitter cubes, polarizers, and filters. Thin-film dielectric coatings including high reflection, high transmission, polarizing, non-polarizing, narrow band, broad band, and anti-reflection. Translation stages and opto-mechanical assemblies. All products available with OEM discounts. Kevin Liddane, OEM Bus. Mgr. 714/851-5881, fax: 714/851-5058

OPTOTEK, LTD., 62 Steacie Dr., Kanata, Ontario, Canada K2K 2A9

Manufacturers of LED displays for visual and photoexposure applications. Package configurations include flat panel, alphanumeric, programmable switch, and linear bargraph displays. All are available in red, orange, yellow, green, and blue. Alphanumeric and switch products are also available in multicolor configurations. Steve Wilson, Mgr. Design Engrg. Svcs. 613/591-0336, fax: 613/591-0584

OPTREX AMERICA, INC., 44160 Plymouth Oaks Blvd., Plymouth, MI 48324

Manufacturers of a complete line of standard and custom LCDs in both character and graphic type.

Rob Harrison 313/416-8500, fax: 313/416-8520

OPTREX/SATORI, 3830 Del Amo Blvd.,

Torrance, CA 90503 Marketers of alphanumeric and graphic

LCD panels and modules. Extended

temperature, EL, LED and CCT backlighting, NTN, black-and-white, highcontrast fluids, passive color, VGA, and XGA options available. Ken Yoshikama, Pres. 310/214-1791, fax: 310/214-1721

OPTRO-MECHANICS (USA) CORP., One Blue Hill Plaza, Pearl River, NY 10965-8667

Distributors of a line of microscopes and LCD inspection systems manufactured by Seiwa Optical Co., Ltd., Tokyo, Japan. Sal Miwa, Pres. 914/620-1999, 1-800-890-3333

fax: 914/620-1950

OPTRONIC LABORATORIES, INC., 4470 35th St., Orlando, FL 32811

Manufacturers of spectroradiometers, photometers, and custom systems for measuring light sources, displays, and material properties to military and

commercial specifications. Also, provides traceable standard lamps, power supplies, amplifiers, and measurement sevices. William A. Schneider, V.P. & Dir. SIs. 407/422-3171, 1-800-899-3171 fax: 407/648-5412

OPTRONICS ENGINEERING, 175 B Cremona Dr., Goleta, CA 93117

High-resolution high-sensitivity color video cameras for fluorescence and lowcontrast surface inspection. The auto exposure system has a shutter range of 1/10,000–4 sec with light sensitivity as low as 0.0025 lux. Doug Marker, Sls. Dir.

805/968-3568, fax: 805/968-2046

ORBOTECH, 44 Manning Rd., Billerica, MA 01821

Manufacturers of a comprehensive line of advanced automated optical inspection systems for Ilat-panel displays and CRT products. AOI systems provide highly accurate detection of all critical defects in the manufacturing process and act as a true quality guardian for process control during the ramp-up stages of operation and during full production. Robert A. Wironen, Natl. Sls. Mgr., Display Prod.

508/667-6037 x207, fax: 508/667-9969

ORC ELECTRONIC PRODUCTS, 1300 Optical Dr., Azusa, CA 91702

Manufacturers of high-speed, fully automatic, and manuel UV exposure systems for FPD, MCM, and etched leadframe technologies. The systems utilize high-intensity short-arc mecury/xenon lamps, with highly collimated optics for fineresolution printing. Thomas Keddy, N. A. Sls. Mgr. 818/815-3130, fax: 818/815-3131

ORC LIGHTING PRODUCTS, 1300 Optical Dr., Azusa, CA 91702

Manufacturers of xenon and mercury short-arc lamps, fiber-optic lamps, modules, and complete illumination systems for use in information-display systems, LCD and large-screen projection systems, and miniature spotlight applications. George Bacher, V.P. Sls. 818/815-3100, 1-800-755-LAMP fax: 818/815-3074

ORWIN ASSOCIATES, INC., 88 Seabro Ave., Amityville, NY 11701

Designers/manufacturers of specificpurpose CRT monitors: high-bright color and monochrome for ATC towers, special large-screen high-resolution workstations, gray scale/high resolution for medical diagnosis and image analysis. Ben lannotta

516/842-7177, fax: 516/842-7410

PACIFIC MEDIA ASSOCIATES, 1121 Clark Ave., Mountain View, CA 94040

Market researchers offering multi-client and custom studies on large-screen display markets. Publishers of the continuing Large-Screen Displays Industry Service (detailed market estimates) and conducts the annual North American Large-Screen Displays Reseller Survey. William L. Coggshall, Pres. 415/948-3080, fax: 415/948-3092

PACIFIO TECHNOLOGIES, INC., 123 N.W. 13th St., Ste. 308, Boca Raton, FL 33432

Distributors/authorized representatives of Toshiba, Ishiyama, and Chuo Riken LCDmanufacturing equipment; NGI heat-seal connectors, FPCs, and electroluminescent lamps; Kandabashi Tek APR print mattes; and a wide variety of related FPD technologies.

Peter J. Opdahl, Managing Dir. 407/392-2555, 1-800-575-3560 fax: 407/392-0807

PALOMAR PRODUCTS, INC., 2051 Palomar Airport Rd., Carlsbad, CA 92009

Manufacturers of automatic die attach, wire bond, wedge bond, and TAB bond equipment with manual stations for hot-bar edge connectors and anisotropic film bonders. Manufacturing equipment supplier to TAB driver bonding machines for flatpanel displays, CRT gun welders, and lamp filament and lamp lead welding equipment. Laurie S. Roth, V.P. SIs & Mktg. Mgr. 760/931-3427, 1-800-854-3467 fax: 619/931-5191

PALOMAR PRODUCTS, INC., Specialized Displays Group, 2051 Palomar Airport Rd., Carlsbad, CA 92009

Manufacturers of display systems: CRT, biocular, AMLCD (SolarStar™ and NovaStar™) high-resolution bright displays required in ground vehicles, helicopters, aircraft, and air-rtaffic-control towers. Russ Schwarzer, V.P. Specialized Displays 760/931-3236, fax: 760/931-5198

PANASONIC COMMUNICATIONS & SYSTEMS CO., 2 Panasonic Way, 7D-2, Secaucus, NJ 07094

Manufacturers of the PanaFlat[™], Pana-Sync[™], PanaMedia[™], and PanaSync' Pro 15-in. (14-in. visual image) to 28-in. (25.9in. visual image) CRT color monitors with multiscan up to 113 kHz and dot pitches down to 0.25 µm. PanaMedia monitors feature Dome Speakers[™]. Also, polysilicon LCD color projectors and overhead panels. Dave Kelly, Natl. Sls. Mgr. 201/392-4185, 1-800-742-8086 fax: 201/392-4504

PANASONIC COMPUTER PERIPHERAL CO., 2 Panasonic Way, 7D-2, Secaucus, NJ 07094

Manufacturers of entry-level E-Series, the business-class standard or S-Series, the high-end Pro or P-Series, and the multimedia-ready PanaMedia or PM-Series monitors.

Mike Marusic, Natl. Prod. Mgr. 201/348-7282, 1-800-348-8086 fax: 201/392-4504

PANASONIC INDUSTRIAL CO., Display Products Dept., 2 Panasonic Way, 7H-1, Secaucus, NJ 07094 Manufacturers of high-resolution monochrome and color CRTs in sizes from 5 to

27 in: high-resolution monochrome and color display monitors, cabinet style, in sizes from 14 to 21 in.; high-resolution dc plasma display panels in formats from 200 x 640 to 1152 x 900; and vidicon and newvicon camera lubes. Mario Bartalotta 201/392-4502, fax: 201/392-4815

PANELGRAPHIC CORP., 10 Henderson Dr., West Caldwell, NJ 07006 Manufacturers of Chromafilter contrast-

enhancing antiglare filter materials for all types of optoelectronic and CRT displays; antifog, antistatic Vueguard™ coatings to protect display readout windows from scratching and harsh chemicals Jane Ryan, V.P. Mktg. 201/227-1500, 1-800-222-0618 or 0617 (NJ only), fax: 201/227-7750

PANELIGHT DISPLAY SYSTEMS, INC., 101 Embarcadero, #100A, San Francisco, CA 94105

Distributor of flat-panel display products for end-users. So-hail Malik

415/772-5800, fax: 415/986-3817

PANELVIEW, INC., 7870 S.W. Nimbus Ave., Beaverton, OR 97008

Manufacturers of filters and windows for glare reduction, contrast enhancement, and environmental protection on all types of flat-panel displays and IR devices. Users of plastic and glass substrates, specializing in hardcoating and EMI/RFI suppresion. Rim Eltinge 503/643-9311, 1-800-788-4088

fax: 503/643-8923

PARALLAX GRAPHICS, INC.,

2500 Condensa St., Santa Clara, CA 95051 Manufacturers of high-resolution video and graphics display controllers for Qbus, VMEbus, and PC/AT PC/XTbus. Stu Taylor, V. P. Intl. Sls. 408/727-2220, fax: 408/980-5139

PEARSON & ASSOCIATES, INC., 11811 N. Tatum Blvd., Ste. P.129, Phoenix, AZ 85028

Consultancy specializing in personnel and business development in flat panels and CRTs. Chuck Pearson, Pres 602/953-9783, 1-800-541-3384 fax: 602/996-1261

PEGASYS DISPLAYS, INC., P.O. Box 1795, Eau Claire, WI 54702-1795

Designers/manufacturers of custom highresolution color and monochrome monitors for medical imaging and other OEM markets, including custom ruggedization. Screen sizes range from 7 to 21 in., with resolutions up to 1600 × 1280. Oscar Martinez, Dir. Engrg. 715/832-5170, fax: 715/832-5170

PEMM SERVICES, 1 Friars Tale Place, Staatsburg, NY 12580-5104

Consultancy specializing in display technologies, providing technology evaluation and comparisons, strategies, technology recommendations for a given application, and assessments of the viability, cost, and availability of various display technologies. Peter Pleshko, Consultant 914/889-4246, fax: 914/889-4246

PENTAX TEKNOLOGIES CORP. 100 Technology Dr., Broomfield, CO 80021 Manufacturers of precision optical components and subassemblies for computer peripherals. Robert Ariniello, Mgr. Opt. Prod. Mktg.

303/460-1600, fax: 303/460-1628 PERCON, INC., 1720 Willow Creek Circle,

Suite 530, Eugene, OR 97402 Manufacturers and distributors of barcode reading equipment and accessories for many different computer/terminal systems, including IBM, Dec, Wyse, and Apple MacIntosh. Five-year warranty on all decoders. One-year warranty on all input devices

Beth Daniels, Dir, Mktg. 503/344-1189, 1-800-873-7266 fax: 503/344-1399

PERFORMANCE DISPLAY SYSTEMS, INC., 7 Waterside Crossing, Ste. 204B,

Windsor, CT 06095 Manufacturers of flat-panel-display computer systems for bright environments, including direct sunlight. Models now use 10.4-, 13-, and 16-in.-diagonal displays. Lawrence Guzowski. Pres 860/683-8070, fax: 860/683-8073

PHILIPS COMPONENTS, P.O. Box 218, 5600 MD Eindhoven, The Netherlands Worldwide manufacturers of electronic

components, including display components and electro-optical components. Jeannet Harpe, Press Off. +31-40-724-173, fax: +31-40-724-825

PHILIPS COMPONENTS, 100 Providence Pike, Slatersville, RI 02876

Manufacturers of full-frame and frame-transfer CCD imagers and CCD camera modules. Also, custom CCD image sensors for high-speed high-resolution imaging. Carlo Sabetti, Mktg. Mgr., CCDs 401/767-4428, fax: 401/767-4493

PHILIPS CONSUMER ELECTRONICS CO. 1 Philips Dr., Knoxville, TN 37922

Manufacturers of a broad range of CRTbased display products from 12-in monochrome through 21-in. FSQ color. Resolution levels up to 1600 × 1280 are supported by dedicated and multifrequency designs John Neilson 719/593-4297

PHILIPS DISPLAY COMPONENTS CO., P.O. Box 963, 1600 Huron Pkwy., Ann Arbor, MI 48106-0963

Manufacturers of color display tubes for TV and monitor applications, monochrome tubes and deflection units for monitor applications, flyback transformers, degaussing colls, various wirewound components, tuners for TV and satellite receivers. Patrick Canavan, Sls. Mgr.

313/996-9400, fax: 313/761-2776

PHOSPHOR PRODUCTS CO., LTD., 1 Factory Road, Upton, Poole, Dorset BH16 5SJ, England Manufacturers of DCEL displays and

phosphors. N Bainton

+44-202-632-116, fax: +44-202-631-980

PHOSPHOR TECHNOLOGY LTD., Middle St., Nazeing, Essex EN9 2LP, England

Manufacturers of inorganic phosphors for CRTs, FEDs, PDPs, x-ray imaging screens, IR detection, UV detection, and other radiation-detecting scintillatots. Gerry Sorce, CEO +44-1992-89-3424, fax: +44-1992-89-3729

PHOTOMETRICS, 3440 E. Britannia Dr., Tucson, AZ 85706

Manufacturers of digital imaging systems for research and industrial applications. CCD technology-based applications include life sciences, high-energy physics, astronomy, spectroscopy and deep-water imaging fields. Still-imaging cameras offer response linearity, geometric stability, and high dvnamic range.

John Allard, Sls. Mgr. 602/889-9933, fax: 602/573-1944

PHOTON DYNAMICS, INC., 6325 San Ignacio Ave., San Jose, CA 95119

Manufacturers of systems to test, inspect, and repair FPDs during product development and commercial production. Supports display manufacturers. Vince Sollitto, CEO 408/226-9900, fax: 408/226-9910

PHOTONICS SPECTRA (LAUREN PUBLISHING CO., INC.), 2 South St., Pittsfield, MA 01201 Publishers of Photonics Spectra, a

magazine devoted to photonics technology: optics, lasers, fiber-optics, electro-optics, imaging, and optical computing. Also, the four-book set of The Photonics Directory: The Corporate Guide, Buyers Guide, Handbook, and Dictionary. Tomi Renee Ransom, Mktg./Sls. Coord. 413/499-0514, fax: 413/442-3180

PHOTONICS SYSTEMS, INC. 6975 Wales Rd., Northwood, OH 43619

Manufacturers of ac plasma displays and AMLCD gray-scale monochrome and fullcolor monitors with options including embedded computers and touch panels Compatibility with VGA through emerging HDTV, various VESA and other standard computer workstation interfaces Donna Schantz, Admin. Asst. 419/666-6325, fax: 419/666-0875

PHOTON, INC., 1115 Space Park Drive, Santa Clara, CA 95054

Manufacturers of test instrumentation that records the energy distribution pattern of optical sources including imaged spot size. Jim Darchuk, Mktg./Sls. Mgr. 408/492-9449, fax: 408/492-9659

PHOTO RESEARCH, INC., 9330 DeSoto Ave., Chatsworth, CA 91311

Manufacturers of a full spectrum of display measurement equipment including photometers, spectroradiometers, colorimeters, automated video-manufacturing test equipment, and optical calibration. Also, measurement services available Mike Klein

818/341-5151, fax: 818/341-7070

PHOTRONICS, INC., 15 Sector Rd., Brookfield, CT 06804

Globial supplier of photomask photographic and design center services as well as plasma etch systems. Photographic services include photomask fabrication, imaging on film, step-and-repeat, and largearea masks. Nora McClelland, Acct. Mgr.

408/245-7342, 1-800-292-9396 fax: 408/733-2225

PHOTRONICS-COLORADO (Formerly Microphase Laboratories) 815 N. Wooten Rd., Colorado Springs, CO 80915

Manufacturers of masks for all types of FPDs, with linewidth precision of 2 µm on soda lime or quartz substrates with emulsion, iron oxide, or chrome coatings. Also, mask-design services. Martin H. Boothman, Large-Area Mask Mgr.

719/596-8899, fax: 719/596-8333 PHYSICAL OPTICS CORP., 20600 Gramercy Pl., Bldg. 100, Torrance, CA 90501-1821

Manufacturers of a line of holographic light-shaping diffusers which shape, direct, and homogenize light with high transmission efficiency. Technology can be used for front- and rear-projection screens, LCD backlights, LED displays, barcode readers, and light-source homogenizing. David Mintzer, Sls. Engr. 310/320-3088, fax: 310/320-8067

PIXELINK CORP., 577 Main Street, Hudson, MA 01749

Importers/resellers of high-resolution monitors, color and monochrome, for Philips, IDEK and others. Authorized depot repair center with parts inventory for quick turnaround on repairs. Custom mechanical and electrical modifications and graphic display controllers. Bill Ingraham, Sls. Mgr.

508/562-4803, fax: 508/568-0514

PIXEL INTERCONNECT, 11040 SW 63rd St., Portland, OR 97219

Consultancy providing TAB/COF, heat seal, flex, and COG process engineering development and process improvement. Interconnect equipment and test. Design and equipment reliability improvement. Strategic and tactical marketing product planning and implementation. Scott Cockey, Pres.

503/244-0646, fax: 503/244-1224

PIXELVISION, 43 Nagog Park, Acton, MA 01720

Manufacturers of flat-panel core products designed for integration convenience. Display, touch sensor, and interface electronics combined in special bezel assembly for rack-mount, kiosk, or ruggedized monitor development. 16-in. SXGA compatible with most any computer source. 508/264-9443, 1-800-264-9443

fax: 508/264-9446

PIXTECH, INC., 3350 Scott Blvd., Bldg. 37, Santa Clara, CA 95054

Manufacturers of FEDs, emissive flat panels characterized by 160° viewing angles, low power consumption with high brightness (1 W at 70 fL), full video speed, and instant-on at -40 to +85°C. Currently delivering monochrome FEDs to qualified display integrators and OEMs. Larger sizes and color units available late in 1997. Greg King, Sls. Mgr. 408/986-8868, 1-888-749-8324 fax: 408/986-9896

PLANAR ADVANCE, INC., P.O. Box 4001, Beaverton, OR 97075

Manufacturers of a full range of highquality high-performance displays for military, industrial, and commercial applications. Display types include electro-luminescent, miniature, active-matrix electroluminescent (AMEL), AMLCDs, and monochrome and color CRT-based systems.

Bob Johnson, Mktg. Mgr. 503/614-4110, fax: 503/614-4101

PLANAR AMERICA, INC., 1400 N.W. Compton Dr., Beaverton, OR 97006 Manufacturers/distributors of highperformance flat panels using electroluminescence (EL) technology. Included

are high-performance monochrome. multi-color, and full-color displays. Rick Phillips, Dir. Sls., EL Displays 503/690-1100, fax: 503/690-1493

PLANAR INTERNATIONAL LTD. Olarinluoma 9, P.O. Box 46, Espoo SE-02201 Finland

Manufacturers and suppliers of electroluminescent flat-panel displays, providing crisp bright images of text and graphics viewable from wide angles and under most lighting conditions. Preferred for industrial applications.

Jukka Eskelinen, Sls. Mgr. +358-0-420-01, fax: +358-0-422-143

PLANAR SYSTEMS, INC., 1400 N.W. Compton Dr., Beaverton, OR 97232

Manufacturers of display components for medical, industrial, transportation, federal avionics, and non-military federal applications. Complete display systems for specialty information processing Jerry Vieira, Dir. Strategic Mktg. 503/690-7383, fax: 503/690-1541

PLASMACO, INC., 180 South St., Highland, NY 12528

Manufacturers of full-color ac plasma displays featuring high brightness and contrast, and a 160° viewing angle. Jane D. Birk, Appl. Engr. 914/883-6800, fax: 914/883-6867

PLASMATERIALS, 3223 Crow Canyon Rd. (#290), San Ramon, CA 94583

Manufacturers of high-purity materials for the thin-film industry. Specializing in sputtering targets, evaporation materials, bonding service, and backing plates. Specific materials for transparent conduc-tive coatings include fully oxidized and reduced ITO as well as ZnO. Don Sarrach, Pres. 415/277-0440, fax: 415/277-0469

PLASMA-THERM I.P., INC.,

9509 Intl. Ct., St. Petersburg, FL 33716 Manufacturers of plasma process equipment (deposition and etch) for the electronics display industry. Small systems are available for R&D. Fully automated multichamber production systems process substrates to 22 in. sq. Complete process support is included. Scott Deferrari, Dir. Sls./Mktg. 813/577-4999

PLESSEY NAVAL SYSTEMS LTD., Command Systems Group, 241 Station Rd., Addlestone, Weybridge, Surrey, U.K. KT15 2PW

Manufacturers of naval command-andcontrol systems. NAUTIS (Naval Autonomous Information System) has color raster on cursive monochrome displays. Rugged monochrome raster monitors and 512 x 512 ac plasma terminals also available. Mike Brooks, Supp. Mgr. Sls./Mktg. +44-932-824-336, fax: +44-932-824-723

POLAROID CORP., Holographic Products Div., 2 Osborn St., 2nd fl., Cambridge, MA 02139

Manufacturers of Imagix™ diffusers based on a proprietary process which yields high-volume cost-effective material that dramatically increases the brightness and contrast of reflective, transflective, and transmissive LCDs. The appearance of illumination is achieved without any increase in power consumption. Glenn Barone, Sr. Mktg. Mgr. 617/386-8661, fax: 617/386-8671

POLAROID CORP., 1 Upland Road, Norwood, MA 02062

Manufacturers of polarizers for emissive electronic displays that improve contrast and reduce glare on virtually any emissive electronic display and available in plastic acrylic or glass laminations with various EMI/RFI and abrasion resistant coatings in a variety of colors.

Terry Holmes, Mktg. Mgr. 617/446-4505, fax: 617/446-4600

POLHEMUS, P.O. Box 560, 1 Hercules Dr., Colchester, VT 05446

Manufacturers of 3D position/orientation tracking and digitizing systems used in CAD, virtual reality, animation, and biomedical and scientific applications. Product family includes the Digitizer, Tracker and the Isotrack Tom Jones, Sales Rep. 802/655-3159, fax: 802/655-1439

POLYTRONIX, INC., 805 Alpha Dr.,

Richardson, TX 75081 Manufacturers of custom twisted-nematic displays, standard TN displays, dichroic displays, polymer-dispersed liquid-crystal film, PDLC displays, active-matrix displays, and special shutters. Gordon Laulie, Mktg./Sls. Mgr.

214/238-7045, fax: 214/644-0805

POLYVISION CORP., 50 Barnes Park North, Wallingford, CT 06492 R&D company specializing in electrochromic flat-panel displays.

Thomas C Richards Dir Res 203/291-0203 x 5840, fax: 203/265-7762

POSITIVE TECHNOLOGIES, 6640 Lusk Blvd., Ste. A200, San Diego, CA 92121 Manufacturers of adaptive-scanning

controllers for passive- and active-matrix displays. Adaptive scanning increases the contrast and gradations by employing selective multi-line control of both the rows and columns, depending on the image to be displayed. Robert Hotto, Pres.

619/457-5151, fax: 619/457-4646

PPM PHOTOMASK, INC., 4950 Fisher St., St.-Laurent, Quebec, Canada H4T 1J6

Specializing in photomask fabrication and phototooling services for flat-panel displays including digitizing, drafting of Calma GDS II. and data conversion from various software; photomasks for optoelectronics laser diodes, photodiodes, integrated guided-wave optics devices, surfaceacoustic-wave devices, and VLSI. Tony Smith

514/737-7030, fax: 514/737-9893

PRECISION ELECTRONIC GLASS, INC., 1013 Hendee Rd., Vineland, NJ 08360

Manufacturers of hand-crafted roundglass CRT bulb blanks in diameters ranging from 0.5 to 7 in. Soft and hard glass tubes are produced to customer specifications. Manufacture prototypes and short runs. Francis M. Ciancarelli, Sls. Mgr. 609/691-2234, fax: 609/691-3090

PRECISION GLASS TECHNOLOGIES 3110 W. Ridge Pike, Saratoga, PA 19464

Manufacturers of optical components, including glass parts, lenses, prisms, flats, mirrors, blanks, achromats, windows, and optical coatings for medical, scientific, laser, military, and harsh-environment applications. Specialties include prototypes, small lots, and custom specifications in glass of all types.

Arthur V. Mengel, Oprns. Mgr. 610/323-2825, 1-800-835-8766 fax: 610/718-0755

PRECISION IMAGING, 320 Martin Ave., Santa Clara, CA 95050

Manufacturers of high-resolution monochrome and color CRT and flat-panel displays used in simulation, military, medical, archival, and stereoscopic imaging

Skip McLaughlin, Sls. Engr.

408/988-1871, fax: 408/988-1873 PRECISION LAMP, 720 Portal St., Cotati,

CA 94931 Manufacturers of panels for backlighting

LCD displays using incandescent, LED, or cold-cathode light sources. Also, miniature incandescent lamps that solder directly to PCBs. Precision lamp is ISO 9001 certified. Bob Carlson, Sls. Mgr. 707/792-0333, fax: 707/792-2738

PRECISION OPTICAL FILTERS, P.O. Box 507, Cedar Ridge, CA 95924

Manufacturers of contrast-enhancement filters and windows for flat-panel displays. Products available in both glass and acrylic Circular polarizers for light-emitting displays. Complete line of services, including screen printing, machining, and laser cutting. Short lead times. Craig Edlund

916/273-5226, 1-800-522-8903 fax: 916/273-2195

PRECISION PHOTOMASK INC. 4950 Fisher St., St. Laurent, Quebec, Canada H4T 1,J6

Manufacturers of large-area photomasks for LCDs and other applications. High tolerance masks available up to 10 x 10 in. and regular tolerance up to 20 x 24 in. Materials available are emulsion, chrome, and iron oxide.

M. Jain, Mktg. Mgr.

514/737-7030, fax: 514/737-9893

PRI AUTOMATION, INC., 805 Middlesex Tpk., Billerica, MA 01821

Manufacturers of FPD material transport systems, factory automation, FPD stockers, cassette loaders, and process tool loaders with mini-environment.

John Davidson, Syst. Mktg. Mgr. 508/670-4270 x3378, fax: 508/663-1825

PRIMAGRAPHICS LTD., Melbourn Science Park, Melbourn, Royston, Herts., SG8 6EJ, U.K.

Manufacturers of a range of modular. VME-based hardware and software for graphics and image handling. The range includes TV, high- and ultra-high-resolution display controllers (up to 2048 × 2048), a RISC processor, and an advanced VME memory card. Kevin Jones

+44-763-262-041, fax: +44-763-262-551

PROCESS TECHNOLOGIES, INC., 436 W. Rawson Ave. Oak Creek WI 53154

Providers of hard-surface photomask services for 2 × 2 to 18 × 24-in. sizes; 1-µm lines and spaces up to 8 × 8 in.; and larger plates with a minimum of 15-um lines and spaces; R&D quantities of InSO electrodeon-glass or plastic available. Chrome-onglass, iron oxide, and chromium-gold images can be generated. Manfred Stelter, Pres. 414/571-9200, fax: 414/571-9202

PROGRESSIVE SYSTEM TECHNOL-OGIES, INC., 11000 N. Mopac, Ste. 100, Austin, TX 78759

Manufacturers of materials-handling and isolation technology products for the semiconductor and flat-panel display manufacturing industries. Products include

wafer and substrate sorters, wafer transfer systems, lot verification systems, OEM automation, cassettes, and

minienvironments. Greg Greskovich, V.P. Sls. & Mktg. 512/342-2500 x1017, 1-800-369-3691 fax: 512/342-2010

PROLUX CORP., 32961 Calle Perfecto, San Juan Capistrano, CA 92675

Designers, manufacturers, and marketers of large-display LCD projector products. The WallZapper 1000S is a portable multimedia projector with SVGA resolution and 700 ANSI lumens. The WallZapper 1000V is VGA and 1000 ANSI lumens. The INFOWALL is a lightweight rollable 67-in. rear-projection display at SVGA resolution. Steve Lieberman, V.P. Mktg./Sls. 714/661-5400, fax: 714/661-3400

PROXIMA CORP., 9440 Carroll Park Dr., San Diego, CA 92121 Manufacturers of a complete line of LCD

panels and projectors for displaying computer and video images to large or small groups. Proxima's Cyclops interactive pointer provides remote mouse control directly on the projected image. Customer Service 619/457-5500, 1-800-447-7692

fax: 619/457-9647

PRP OPTOELECTRONICS LTD., Wood Burcote Way, Towcester, Northants, U.K. **NN12 6TF**

Manufacturers of custom LED arrays with associated drive electronics for use in civil and military aircraft cockpits. Also, finegeometry monolithic LED arrays for thermal imaging, optical systems, and printing applications. P. B. Hart, Prod. Dir.

+44-01327-359135, fax: +44-01327-359602

PSITECH, 18368 Bandilier Cir., Fountain Valley, CA 92708

Manufacturers/marketers of image frame buffers and grabbers, graphics controllers, image-compression/decompression devices. OpenGL and X Window systems products, providing resolution-independent image display and capture hardware with host-based industry-standard application program interfaces

John Kerr, V.P. Sls.

714/964-7818, 1-800-872-7385 fax: 714/968-7884

PULNIX AMERICA, INC., 1330 Orleans Dr., Sunnyvale, CA 94089

Manufacturers of miniature CCD cameras, lenses, and accessories. Intensified low-light CCD cameras, high-speed shuttered and gated cameras, integration cameras, and custom OEM cameras. Rollande Young 408/733-1560, 1-800-445-5444 fax: 408/737-2966

PULSEVIEW, LTD., Units 1&2, Suffolk Way, Drayton Rd., Abingdon, Oxfords., U.K.

Manufacturers of display hardware and software. Optical design of display modules in all technologies, especially VFDs and LCDs. Conventional and surface-mount manufacturing. Noah Smallshaw

+44-235-554-433, fax: +44-235-28971

QMS, INC., One Magnum Pass, Mobile, AL 36618

Manufacturers of intelligent graphics controllers for dot-matrix printers, and complete laser-printer systems for

industry directory

barcoding, WP/OA, electronic publishing, CAD/CAE, and other applications. John Corbett, V.P. Sls./Svc. 205/633-4300, fax: 205/633-0013

QUANTEX CORP., 2 Research Ct., Rockville, MD 20850

Manufacturers of electroluminescent displays and lamps, filmless x-ray storage screens, and imaging systems. Ken Charbonneau, Sls. Mgr. 301/258-2701, 1-800-992-5149 fax: 301/258-9871

QUANTUM DATA, INC., 2111 Big Timber Rd., Elgin, IL 60123 Manufacturers of a complete line of

programmable video test generators, distribution buffers, and convergence gauges for use in research, production, and quality control. Al Jorgensen

847/888-0450, fax: 847/888-2802

QUANTUM ELECTRONICS, INC., 31 Industrial Park Rd., Lewistown, PA 17044

Manufacturers of a wide range of standard and custom display systems using LED, plasma, incandescent, and mechanical flipper technologies. Unit size ranges from 4 × 6 in. up to 6 × 12 ft. Kit C. Kennedy, Pres. 717/242-1132, fax: 717/248-8680

RACAL ACOUSTICS LTD., Waverley Industrial Park, Hailsham Dr., Harrow, Middlesex HA1 4TR, U.K.

Manufacturers of public-information display signs using guest-host LCD technology for indoor and outdoor applications.

Stephen Hatch, Sls. Controller +44-81-427-7727, fax: +44-81-427-0350

RACAL-MESL LTD., Lochend Industrial Estate, Newbridge, Edinburgh EH28 8LP, Scotland

Designers/manufacturers of display modules aimed at professional and military applications. Technologies include LCD and electroluminescent modules and feature rugged construction, wide temperature range, touch panels, controllers, and interfaces.

Tony Bland, Sis. Mgr. +44-1344-300091, fax: +44-1344-385880

RAINBOW OPTICS CO., 6 Countryside Lane, Salem, MA 01970-1768

Optical design association providing optical engineering and consulting services to manufacturers of LCD projectors. Designers of optics and mechanics of projection zoom lenses and of complete optical benches, including lamp, condenser, and keystone distortion corrector. Providers of tolerancing and radiometric analysis and builders of prototypes. Leon Reznikov, Consultant

508/741-3906, fax: 508/741-8122

RAMEY SCIENTIFIC COMPUTING, 5 Mandeville Ct., Ryan Ranch Business Park, Monterey, CA 93940

Providers of contract scientific software, engineering, CAD, video animation, technical illustration and documentation services for FPD industry, and magnetic modeling. Also, library of training videotapes on plasma etching, plasma physics, and plasma chemistry. Custom windows software programming for machine and process control applications available

Tom Ramey, Pres. 408/655-2772, fax: 408/655-4858 RANTEC MICROWAVE & ELECTRONICS, INC., 1173 Los Olivos Ave., Los Osos, CA 93402

Manufacturers of high- and low-voltage power supplies, dc/dc converters, and power systems designed, manufactured, and marketed to a broad range of industries worldwide for commercial. industrial, avionics, and full military applications. Francesca Peterson, Sr. Mgr., Sls./Mktg. 805/528-5858, 1-800-235-4148

fax: 805/528-6932 RASTEROPS, 2500 Walsh Ave., Santa

Clara, CA 95051 Manufacturers of color display systems, accelerators, monitors, video image capture, and display hardware and multimedia accessories for the Apple Macintosh, IBM MicroChannel, and Sun SPARCstation platforms. Products designed primarily for the graphic arts, printing, publishing, and related industries. 408/562-4200, 1-800-SAY-COLOR fax: 408/562-4065

RAYTHEON CO., Submarine Signal Div., 1847 West Main Rd., Portsmouth, RI 02871 Manufacturers of the Thermal Display Unit with true gray shades at high speeds and high resolution, producing recordings of near-photographic-quality full tonal images, capable of displaying digital data in graphic or alphanumeric forms. John Lorea, Sls. Mgr.

401/847-8000 x2054, fax: 401/847-8002

RAYTHEON ELECTRONIC SYSTEMS, 465 Centre St., Quincy, MA 02169

Manufacturers of specialty CRTs for head-down and HUD avionics, air traffic control, and shipboard applications. Also developing high-brightness monochrome and color FEDs for use in avionics and vehicular applications. Gary Smith, Engr. Mgr.

617/984-8529

RDI COMPUTER CORP., Little Haining, Brockenhurst Rd., Ascot, Berkshire SL5 9HB

Manufacturers of the PowerScreen, a stand-alone, high-resolution LCD in a compact, lightweight, design, with low emissions and low power consumption, and available with a 12.1-in. 1024 × 768 high-resolution active-matrix LCD. Reg Broughton, Gen. Mgr. Eur. Oprns. +44-1344-25999, fax: +44-1344-25652

RECOGNITION CONCEPTS, INC. 5200 Convair Dr., Carcara, NV 89076 Manufacturers of real-time image processing system and video digital storage systems. Ron Earwood, Ad. Mgr. 702/831-0473, fax: 702/831-8035

REDIFFUSION SIMULATION LTD., Visual Business Unit, Plant 5, Jenner Rd.,

Crawley, West Sussex, RH10 6JY U.K. Manufacturers of monitor, projection, and laser-based large-area displays, primarily for the aviation industry. WIDE is a collimated projection display offering fields of view of up to 40 (V) x 200 (H). A.P. Usher, Tech. Sls. Exec. +44-293-518-941, fax: +44-293-560-231

SCOTT REDMOND, P.O. Box 14607, San Francisco, CA 94114 Specialized consulting for 3-D stereo-

scopic and immersive simulation display systems. Scott Redmond, Consultant 415/978-2301

REEL 3-D ENTERPRISES, INC., P.O. Box 2368, Culver City, CA 90231

Mail-order retail suppliers of stereoscopic viewers for stereo-pair prints and slides, polarized and anaglyphic (red/blue) 3-D viewing glasses, books about 3-D photography, and books illustrated with 3-D images. David Starkman, V.P./Tech. Dir.

310/837-2368, fax: 310/558-1653

REFLECTION TECHNOLOGY, INC. 230 Second Ave., Waltham, MA 02154

Manufacturers and designers of full-color and monochrome virtual displays for OEM customers and proprietary handheld telecommunications products that incorporate these displays. Low-cost miniature scanned linear array displays that provide resolutions up to full VGA with high image quality and extremely low power consumption compared to LCDs. John Summers, Dir. Bus. Devel 617/890-5905 x2, 1-800-890-5905 fax: 617/890-5918

REGISBROOK GROUP LTD.,

Units 1&2, Suffolk Way, Drayton Rd., Abingdon, Oxon OX14 5JY, U.K.

Manufacturers of a full range of vacuum fluorescent, liquid-crystal, and LED display modules, and sub-systems with ruggedized housings with/without touch-screen overlays. Extended-temperature products available.

Chris Williams, Director

+44-123-555-4433, fax: +44-123-552-8971

RELISYS, 320 S. Milpitas Blvd., Milpitas, CA 95035

Manufacturers of a line of popular monitors ranging from color, EGA, VGA, multisync, and super-multisync including a monochrome VGA at competitive prices. 408/945-9000, fax: 408/945-0587

RETROSCAN SCREEN, INC., 148 Madison Ave., New York, NY 10016

Distributors of DNP high-resolution Fresnel/lenticular rear-projection screens in sizes from 50—160 in. Manufacturers of rear-screen projection enclosures, rear projector/mirror mounts, and ancillary rearscreen products.

Charles Levitt, Pres. 212/532-4647, fax: 212/532-4725

REXAM CUSTOM, 700 Crestdale St., P.O. Box 368, Matthews, NC 28105

Providers of custom precision coating and lamination of flexible materials used in high-performance products for FPD components. Production resources include cleanroom facilities for the most demanding coating requirements and the most advanced pilot coating facility in the world. Production resources are available in the U.S. and Europe to meet worldwide coating requirements Craig S. Sheppard, Mgr., Mkt. Res. &

Commun 704/847-9171, 1-800-688-9171 fax: 704/845-4333

REYNOLDS INDUSTRIES, INC., 5005 McConnell Ave., Los Angeles, CA 90066-6734

Manufacturers of Avvion HV connectors for CRT applications which allow operation at high altitudes without the need to pot the neck; anode leads adapted to high-altitude requirements; HV connectors, wire, and cabling to interconnect CRT power supplies; HV multipliers. Dale Hollis, Mgr. Mktg. 310/823-5491, fax: 310/822-8046

RGB DYNAMICS, INC., Research Park 419 Wakara Way, Salt Lake City, UT 84108

Designers and manufacturers of standard and custom touch-entry systems for system integrators and OEMs using zoned and buried-layer capacitive sensing technology. Wayne Maw

801/581-9200, fax: 801/466-9220

RGB SPECTRUM, 950 Marina Village Pkwy., Alameda, CA 94501 Designers/manufacturers of products

which integrate computer and video signals for display and communications. Products include multi-screen display controllers, high-end scan converters, real-time video windowing systems, and computer signal synchronizers.

Sales Dept. 510/814-7000, fax: 510/814-7026

RICHARDSON ELECTRONICS, LTD., 40W267 Keslinger Rd., LaFox, IL 60147 Distributors of CRTs, monitors, and

electronic components to complement the display industry. Represents and distributes CRTs from every major CRT manufacturer in the world. Color and monochrome monitors and flat panels available Charles J. Acurio, V.P. Display Products 630/208-2200, 1-800-222-2787 fax: 630/208-2350

RIKEI CORPORATION OF AMERICA, 10050 N. Wolfe Rd., #130, Cupertino, CA 95014

Representative of makers of LCD modules, including monochrome graphic; color graphic, passive and TFT; custom graphic, COG, TAB, STN, and F-STN. Also, LCD panels; including custom, TN, STN, and

F-STN; and touch panels, including transparent resistive. Louis Leong, Sls. Mgr. 408/257-7943, fax: 408/257-9001

RMF PRODUCTS, INC., P.O. Box 520, Batavia, IL 60510

Manufacturers of plastic bezels and filter assemblies.

Richard Frieders, Pres. 630/879-0020, fax: 630/879-6749

ROCKWELL INTERNATIONAL Air Transport Div., 400 Collins Rd. N.E., Cedar Rapids, IA 52498

Manufacturers and designers of integrated flight display systems and electronic flight instrument systems used in Boeing and Fokker aircraft.

C.M. Watts, Gen. Sls. Mgr. 319/395-2841, fax: 319/395-5429

ROGERS CORP., One Technology Dr., Rogers, CT 06263

Manufacturers of DUREL® electroluminescent lamps.

Robert D. Wachob, V.P. Sls./Mktg. 203/774-9605, 1-800-227-6437 fax: 203/774-9630

ROHM CORP., 3034 Owen Dr., Antioch, TN 37013

Marketers of LEDs, lamps, modules for indoor/outdoor signage, and other electronic components including LCDs and Hibrite LEDs.

Mike Halverson, Mgr. Sls. 615/641-2020 x121, fax: 615/641-2022

ROMAG GLASS PRODUCTS, LTD., Patterson St., Blaydon, Tyne & Wear, NE21 5SG, U.K.

Manufacturers of laminated glass, acrylic, and polycarbonate optical filters for contrast enhancement, radio-frequency shielding, and privacy viewing. For CRTs, both flat

and curved filters are available with etched and anti-reflection coated surface finishes. For flat-panel displays, filters incorporating polarizers and transparent coatings are available.

Peter C. Jones, Sls./Managing Dir. +44-191-414-5511, fax: +44-191-414-0545

ROMAG, INC., 8 Faneuil Market Place, Boston, MA 02109

Manufacturers of laminated glass, acrylic and polycarbonate optical filters for contrast enhancement, radio-frequency shielding, and privacy viewing. For CRTs, both flat and curved filters are available with etched and anti-reflection coated surface finishes. For flat-panel displays, filters incorporating polarizers and transparent coatings are available.

Peter Jones 617/720-4204, fax: 617/367-0533

LOUIS RUDZINSKY ASSOCIATES, INC., Harrington Park, 394 Lowell St., Ste. 17, Lexington, MA 02173

Personnel recruiting in electro-optics, display, and image processing, hardware, so'tware, and marketing professionals. Louis Rudzinsky 617/862-6727, fax: 617/862-6868

RYTRAK LTD., Wavertree Technology Park, Liverpool, U.K., L7 9PF

Specialists in process development and equipment design and assembly. Producers of a fully automated CVD system for polysificon that will make possible flat-panel displays up to 14 x 14 in. Douglas Moakin, Tech. Dir. 44-51-259-6221, fax: +44-51-228-4459

SAES GETTERS U.S.A., INC., 1122 E. Cheyenne Mtn. Blvd., Colorado Springs, CC 80906

Manufacturers of evaporable and nonevaporable getter products for FEDs, CRTs, gas purifiers, and electronic devices. Also, dispensers for safe mercury deposition in plasma displays. Mike Hagen, Appl. Engr. 715:527-4135, fax: 719/576-5025

SAGE, INC., 4633 Old Ironsides Dr., Ste. 420, Santa Clara, CA 95054

Providers of radiation-free power-saving green LCD monitors with innovative LCD controller boards with both digital (ISA/PCI) and stand-alone analog RGB (CRT like) interfaces, customized video bios, LCD monitor ASIC components, and a complete OEM LCD kit for plug-and-play LCD monitor applications. Supports all the major LCD vendors.

408/748-0500, fax: 408/748-8540

SAIC LTD., 26 Craven Court, Stanhope

Road, Camberley, Surrey GU15 3BW, U.K. Designers/manufacturers of sunlight-

readable LCDs, both monochrome and colo:, for military, rugged, and severe environments, and ATM and video applicalions. Also, rugged military computers and peripherals for complete systems integration.

Richard Oliver, Bus. Dev. Mgr. +44-(0)-1276-675511

fax: -44-(0)-1276-676262

SAI TECHNOLOGY (Science Applications Intl. Technology), 4224 Campus Point Ct., San Diego, CA 92121

Designers/manufacturers of display Subsystems for specialized environments, Such as military platforms, industrial and commercial vehicles, and severe-environment fixed-site applications. Lynn Altadonna, Bus. Dev. Mgr. 619/450-2205, fax: 619/450-3733

SAMPO CORP. OF AMERICA, 5550 Peachtree Industrial Blvd., Norcross, GA 30071

Manufacturers of display peripherals for IBM and Apple platforms. Also, 286 and 386 personal computers, laptops, and notebooks. Color displays in sizes ranging from 14 to 21 in.; horizontal scan from 30 to 90 kHz fixed and/or multi-frequency. Monochrome displays in sizes from 9 to 24 in.; fixed frequency with resolutions ranging from 640 × 480 up to 1600 × 1280. Chester Kramarski

404/449-6220, fax: 404/447-1109

SAMSUNG ELECTRONICS, 3655 N. First St., San Jose, CA 95134

Manufacturers of a wide variety of display products, especially TFT devices for portable computer and desktop monitor applications.

T. Striegler; Sr. Strategic Mktg. Mgr. 408/954-7839, 1-800-423-7364, fax: 408/954-7100

SAMTEL USA, INC., 644 Upper Mountain Ave., Montclair, NJ 07043-1623

Manufacturers of monochrome display tubes from 3 to 23 in., standard catalog selections or custom-designed. Suprasad Baidyaroy, Pres. 201/783-4332, fax: 201/783-0733

SANDERS ASSOCIATES INC., Information Systems Div., P.O. Box 2035, Nashua, NH 03061-2035

Manufacturers of ruggedized and militarized displays, intelligent terminals, and display workstations for application in aircraft, ground vehicles, shelters, ships,

and submarines. Robert Perutz, Mgr. Bus. Dev. 603/885-3524, fax: 603/885-4603

SANRITZ CORP., 1-30-13 Narimasu, Itabashi-ku, Tokyo 175, Japan

Manufacturers of polarizers for LCDs, optical instruments, sunglasses, including high-durability, high-optical-performance, super-high-contrast, AR-coated polarizers

and retardation films. D. Nakamura 408/257-6686, fax: 408/973-9620

SARIF, INC., 501 SE Columbia Shores

Blvd., Suite 900, Vancouver, WA 98661 Designers and manufacturers of electronic imaging devices and display products. The Shuttle LT800 portable multimedia projector is designed for the automated sales force.

1-888-937-2743, fax: 360/750-0244

DAVID SARNOFF RESEARCH CENTER, CN 5300, Princeton, NJ 08543-5300

Providers of design, simulation, modeling, development, and prototype fabrication of electron guns, yokes, CRT lubes, shadow mask, coatings, phosphor screens, activematrix LCDs, and TFEL panels. Product design services available (optical, process/ material development, system).

Ken Salsman 609/734-2553, fax: 609/734-2443 SASCAL DISPLAYS, Unit 1, Hayes Metro Centre, Springfield Road, Hayes, Middx UB4 OLE, U.K. Designers/manufacturers of CRT-display

products for custom applications. Monochrome and color displays in all sizes for industrial, ruggedized, and full MIL-SPEC applications are available in small to medium quantities. Stuart Caldecourt +44(0)-181-573-0303, fax: +44(0)-181-569-1515

SATORI ELECTRIC (AMERICA), INC., 3830 Delamo Blvd., Suite 101, Torrance, CA 90503

Marketing agent for Optrex LCDs. Optrex is a joint venture between Asahi Glass and Mitsubishi Electric Corp. Optrex offers a broad line of LCDs including alphanumeric and graphic types. Displays are offered with the latest high-contrast fluids. David Liu

310/214-1791, fax: 310/214-1721

SAYETT GROUP, INC., 17 Tobey Village Office Park, Pittsford, NY 14534

Designers, developers, manufacturers, and marketers of electronic imaging equipment components for the multimedia marketplace. Recently formed a venture to produce a proprietary innovative activematrix liquid-crystal display. The newly formed venture has contracted with U.S. manufacturers to produce AMLCDs with diagonals of 1–2 in.

Jim Crowley, Dir. Mktg. 716/264-9250, 1-800-678-SHOW fax: 716/264-9265

SCHOTT CORP., Technical Glass Div., 3 Odell Plaza, Yonkers, NY 10701-1405 Marketers of CRT bulbs for industrial and military displays, and thin glass substrates for LCDs and other display technologies. Bill Mol auching Pure Merc

Bill McLaughlin, Bus. Mgr. 914/968-8900, fax: 914/968-8585

SCHOTT FIBER OPTICS, INC., 122 Charlton St., Southbridge, MA 01550-1960

Manufacturers of custom fused, flexible, and rigid fiber-optic imaging components: fiber-optic faceplates; high-resolution tapers (magnifiers/reducers) and taper arrays; flexible single- and multiple-branch bundles and economical rigid components. Jay DiGregorio, Tech. Sls. Rep. 508/765-9744, 1-800-343-6120 fax: 508/764-6273

SCHOTT GLASS TECHNOLOGIES, INC., 400 York Ave., Duryea, PA 18642

Manufacturers of contrast-enhancement filters for flat-panel and CRT applications, CRT faceplates, color filter glass, and NVIS-compatible filters per MIL-L-85762A. Steve J. Sokach, Product Mgr. 71/1457-7485, fax: 717/457-7330

SCHOTT HIGH VOLTAGE, 1161 W. 2320 S., Salt Lake City, UT 84119

Manufacturers of high-voltage and combination high/low-voltage power supplies for use in monitor, imaging, avionics, and medical applications.

Andrew Schmitt, Sls. Mgr. 801/972-3690, fax: 801/972-3699

SCREEN SHIELD, 426 Mulberry St., Ste. 410, Scranton, PA 18503

Manufacturers of optical filters for all types of displays to control RFI/EMI emissions for compliance with FCC, VDE, MIL, Tempest, BS6527, and EEC legislation. Jim Max

717/961-3727, fax: 717/969-6274

SCRIPTEL CORP., 4145 Arlingate Plaza, Columbus, OH 43228

Manufacturers of patented electrostatic digitizers for use in CAD/CAM, desktop digitizers, and pen computers. Transparent glass and opaque versions available. Sizes 606/255-3664, fax: 606/255-6829

range from 12 × 12 in., 12 × 18 in., and custom sizes smaller than 12 × 12 in. Kevin Toshok, Sls. Mgr. 614/276-8402, fax: 614/276-7615

PETER SEATS, Consultant, Display Technology, 300 Indian Springs Rd., Williamsburg, VA 23185

Consultancy in phosphor, CRT, and FED technologies.

Peter Seats, Consultant 804/220-3183, fax: 804/220-3263

SECURITY DEFENSE SYSTEMS CORP., 139 Chestnut St., Nutley, NJ 07110

Manufacturers of high-resolution real-time x-ray imaging displays for security and nondestructive-testing quality-control applications. Don Airey, Gen. Mgr. 201/235-0606, fax: 201/235-0132

SEIKO INSTRUMENTS USA, INC., 1130 Ringwood Ct., San Jose, CA 95131 Manufacturers of the CH-5500 series of thermal-transfer color hard copiers and the GR-4400 series of advanced raster display systems.

Cheryl Landman, Mktg. Comm. Mgr. 408/922-5800, 1-800-255-7617 fax: 408/922-5840

SEIKO INSTRUMENTS USA, INC., Electronic Components Div., 2990 W. Lomita Blvd., Torrance, CA 90505

Manufacturers of STN, FSTN, and color LCD products for telecommunications, instrumentation, medical, GPS, and handheld applications. New standard low-cost ECB color modules. New chip-on-glass custom modules in mono and color for high-volume applications.. Don Feeney, SIs. Mgr.

310/517-7771, fax: 310/517-7792

SEIWA OPTICAL CO., 1 Blue Hill Plaza, Pearl River, NY 10945-8667

Manufacturers of optics/vision alignment systems, cameras, optics, and illuminators. Sal Cortorillo, V.P. 914/620-1999, 1-800-890-3333 fax: 914/620-1950

SEKISUI FINE CHEMICAL CO., LTD., 1259 Izumi Minakuchi-cho, Koga-gun 528, Japan

Manufacturers of plastic spacers for LCD in-cell use, conductive spacers for transfer material connecting ITO glass substrates, COG, and anisotropic use; photosensitive resin for LCD cell closure; and color filters. D. Nakamura

408/257-6686, fax: 408/973-9620

SEM-COM CO., INC., 1712 N. Westwood, Toledo, OH 43607

Manufacturers of custom glass and glass ceramics for display components, including powdered frits, seal cane, tubulation, spacers, and press-cast parts. Specializing in small-diameter rod and tubing, and various rectangular cross sections. Also offering compositional development services supported by comprehensive database of over 30,000 glasses. Paul Train, Sls. Engr. 419/537-7054

SEMICON ASSOCIATES, INC., 1801 Old Frankfort Pike, Lexington, KY 40510 Manufacturers of CPD and I-type dispenser cathodes for all types of monochrome and color CRT applications.

industry directory

SEMICONDUCTOR SYSTEMS, INC. (A Subsidiary of FSI International), 47003 Mission Falls Ct., Fremont, CA 94539-7819

Manufacturers of fully automatic cluster systems designed to clean, coat, cure, and develop photoresist, polyimide, and color filter films on large-area FPD substrates. The unique architecture of the APEX™ FPD microlithography cluster provides complete flexibility in a minimum footprint. William O'Connor, FPD SIs. 510/683-8858, 1-800-542-9888 fax: 510/656-3226

SEMI-FPD, 805 E, Middlefield Rd., Mountain View, CA 94043

A division of an international trade association dedicated to expanding the global market for FPD equipment, material, and services suppliers. Provides tradeshow opportunities; educational publications, posters, and videos; marketing and technical programs; international standards committees; and economic information on FPD supplier markets. Heidi Hoffman, Mgr., FPD Div. 415/940-6904, fax: 415/940-7919

SEMITOOL, INC., 655 W. Reserve Dr., Kalispell, MT 59901

Manufacturers of the Centurium FPD process automation and control system that links large-substrate fabrication steps with materials handling, creating a clustered batch wet-process tool. Centurium can be configured with modules for stripping, cleaning, and etching applications, with automatic transfer between sequential processes.

Jason Manger, Prod. Mgr. 406/752-2107, 1-800-548-8495 fax: 406/752-5522

SEMITOOL, INC., Equinox Div., 655 W. Reserve Dr., Kalispell, MT 59901 Manufacturers of wet-processing equip-

ment used in the manufacture of flat-panel displays. Also, etching, cleaning, stripping, developing, coating, and electroplating systems. Peter Baxter, Equinox Sls. Mgr

406/752-2107, fax: 406/752-5522

SENCORE INC., 3200 Sencore Dr., Sioux Falls, SD 57107

Designers, manufacturers, and marketers of an exclusive line of computer monitor analyzing instruments that are designed specifically for the servicer. Tom Hort, CMD SIs. Rep. 605/339-0100, 1-800-736-2673 fax: 605/339-0317

SEOS DISPLAYS LTD, Marchants Way, Burgess Hill, West Sussex, RH15 8QY U.K.

Manufacturers of out-of-the-window display systems for simulation, CRT monitor-based collimated displays, wide-angle edge-matched multichannel projection displays, and unique laserscanned imaging and display systems. Owen J. Wynn +44-444-870-888, fax: +44-444-870-777

SHARP DIGITAL INFORMATION PRODUCTS, INC., 16841 Armstrong Ave., Irvine, CA 92714-4979

Manufacturers of TFEL video monitors with 31 shades, includes capability for split-screen H&V, dual inputs (RS-170 or 5-bit digital), two-frame storage, +24 input to PS. Also, real-time image processing, development systems, and PC/AT general-purpose board which

includes memory (19-512 × 512 × 8), I/O, bus interface, and image-processing VLSI. John Lewis, Sls. Mgr. 714/261-6224, fax: 714/261-9321

SHARP ELECTRONICS CORP.

Microelectronics Group, 5700 N.W. Pacific Rim Blvd., Ste. MS-20, Camas, WA 98607 Manufacturers of color passive-matrix LCDs in a full range of sizes, with

technolgy improvements such as Sharp addressing and memory addressing. Color TFT-LCDs ranging in size from 6.4 in. VGA to larger XGA sizes. Monochrome technologies including monochrome STN, DMTN, and EL.

Joel Pollack, Dir. Sls. Mtkg. 360/834-8926, 360/834-8903

SHINTECH, INC., 90 Ogo-Oku Tabuse-Cho, Kumage-Gun, Yamaguchi 742-15 Japan

Developers of modeling and simulation software for LCD designers and researchers.

Michiyuki Miyashita, Chief Engr. +81-820-52-5230, fax: +81-820-52-5237

SHIP ANALYTICS, 183 Providence New London Turnpike, North Stonington, CT 06359-1738

Manufacturers of computer-generated ship handling and tactical simulation imagery projected on screens. Roger C. Cook, Mktg. Mgr. 203/535-3092, fax: 203/535-0560

SI DIAMOND, INC., 2435 North Blvd.,

Houston, TX 77098 Involved in the commercialization of diamond technology through its sub-sidiaries: Diamond Tech One, Inc. (interconnect electronics for displays, fabrication operations such as gold bumping, flip-chip, and back-end semi conductor-wafer processing) and SIDT Coatings, Inc. (deposition and vacuum equipment, and specialized coatings to improve production and enhance longevity. Howard Schmidt, Pres. 713/529-9040, fax: 713/529-1147

S.I. DIAMOND TECHNOLOGY, INC. 12100 Technology Blvd., Austin, TX 78727 Manufacturers of display elements for large electronic billboards, in particular for outdoor applications. As a research organization, developer of FED technology utilizing diamond films. DTO, Inc., and Plasmatron, Inc., are wholly owned subsidiaries providing service to the display and semiconductor industries. Zvi Yaniv, Pres. 512/331-6200

SIEMENS AG, Siemensallee 84, Karlsruhe 76185, Germany Designers/manufacturers of high-contrast

high-brightness high-performance monochrome CRT displays for medical systems (includ-ing workstations), air-traffic control, and document imaging. Also, highperformance color displays for medical, industrial, and CAD applications Edgar Litzler, Dept. AUT 31 PM +49-721-595-6096, fax: +49-721-595-4558

SIEMENS COMPONENTS, INC., VAC Div., 186 Wood Ave. S., Iselin, NJ 08830

Agency of Vacuumschmelze GmbH. Magnetic shieldings from low-frequency ac fields through to earth's fields; customer-specified monitor shielding, standard monitor shielding, shielding sheets for monitors; foils, parts, and magnetically shielded rooms Wolfgang Eggert 908/603-5905 or 908/494-3530 fax: 908/603-5994

SIGNATONE, Probing Division, 393-J Tomkins Ct., Gilroy, CA 95020

Manufacturers of a line of analytical probe stations, including custom-made flatpanel probers in sizes ranging from 8 to 20 in. sq., and analytical lasers for repair. Brian Dickson, V.P. Mktg. 408/848-2851, fax: 408/848-5763

SILICON LIGHT MACHINES (formerly Echelle, Inc.), 385 Moffett Park Dr., Ste. 115, Sunnyvale, CA 94089-1208

Manufacturers/marketers of products based on their Grating Light Valve™ technology. GLV™ devices are highefficiency, reflective light valves which use micromechanical structures to form images on silicon and can be used for a wide

range of applications. Robert W. Corrigan, V.P. Mktg. 408/541-4902, fax: 408/541-1244

SILISCAPE, INC., 1032 Elwell Court, Suite 101, Palo Alto, CA 94303

Manufacturers of low-cost low-powerconsumption monochrome high-resolution virtual displays for portable data communications products. Small package size (30 × 40 × 12 mm) allows incorporation into pagers, cell phones, and pocket communicators.

Alfred P. Hildebrand, Pres./CEO 415/691-9700, fax: 415/691-9909

SILVER CLOUD MFG. CO., 525 Orange St., Millville, NJ 08332

Manufacturers of custom display filters and lenses. Filters can be fabricated to include hardcoated anti-glare surface finishes, polarizers, EMI/RFI shielding, light-control films, and other applicationdesigned features. All filters are customlabricated and can include graphics. Robert C. Cowperthwait, Sls./Mktg. Mgr. 609/825-8900 x201, fax: 609/825-8969

SIMTECH LTD., 29 Hamerkava St., Holon 58101. Israel

Manufacturers of simulators for military applications. The display is based on high-resolution (1280 × 1024) color digitized images with an overlay of graphic elements in real time. The images are displayed on video projectors, color monitors, and LCD monitors

Ben Z. Beiski, Chief Engr. +972-3-5577-680, fax: +972-3-5564-471

SMART TECHNOLOGIES, INC., 600-1177 11th Ave. S.W., Calgary, Alberta T2R 1K9, Canada

Manufacturers of a family of large-area (4 × 3 ft.) touch surfaces for use with or without projectors for interactive displays Software tool kits provided for UNIX, Macintosh, Windows, or OS/2 applications for data conferencing, copyboard replacements, or command and control. Jed Southerland, OEM Project Mgr. 403/245-0333, fax: 403/245-0366

Sang Hy, Product Mktg. Engr.

ALAN SOBEL, 633 Michigan Ave.,

tems, specializing in flat-panel technologies. Technical consultation, analysis, problem solving, report and proposal writing and evaluation.

Phone/fax: 847/869-5607

SOCIETY FOR INFORMATION DISPLAY, 1526 Brookhollow Dr., Ste. 82, Santa Ana, CA 92705-5421

International society for the presentation, exchange, and preservation of information display technology. Sponsor of annual Symposium, Seminar, and Exhibition. Publishers of Information Display Magazine, Journal of the SID, as well as other publications.

Lauren Kinsey, Exec. Dir. 714/545-1526, fax: 714/545-1547

SOLOMON TECHNOLOGY (USA) CORP., 21038 Commerce Pointe Dr., Walnut, CA 91789

Taiwanese-based manufacturers of passive monochrome dot-matrix LCD modules, offering upwards of 400 standard designs of character and graphic LCMs. Specializing in custom designs that require only a 1K minimum quantity order. Many reflective and LED backlight designs stocked for immediate delivery for 50-piece minimum quantity orders. John Butler, Natl. Sls. Mgr

909/468-3732 x3038, fax: 909/869-6258

SONY CORP., Display Device Group, 2-10-14 Osaki, Shinagawa-ku, Tokyo 141, Japan

Manufacturers of the super-high-resolu-tion Trinitron[™] color CRT; beam-index CRTs; high-resolution image pick-up tubes; projection CRTs; and other display devices. S. Morikawa, Mor +81-3-495-3630, fax: +81-3-495-3724

SONY CORP., 10833 Valley View Street, Cypress, CA 90630

Manufacturers of sensing products that includes both advanced CCD cameras and Staticon tube cameras. Lisa Tollner

714/229-4170, fax: 714/229-4333

SONY CORP., 16550 Via Esprillo, San Diego, CA 92127

Manufacturers of 16:9 aspect-ratio 28V 1920 × 1080 graphic wide-monitor computer displays. X-Windows graphic controller, 2048 × 2048, for air-trafficcontrol applications. Fully integrated camera, speaker, and microphone peripheral to enable desktop video conferencing. GDM 17- and 20-in. multimode color monitors. John Wyckoff, Prod. Mktg. Mgr. 619/673-2860, fax: 619/451-0412

SONY GRAPHIC DISPLAY, 3300 Zanker

Rd., San Jose, CA 95134 Manufacturers of 13-, 16-, 19-, and 20 × 20-in. Trinitron color graphic displays, and high-resolution displays with high-performance CRT technology.

Kim Nero, Mktg. Coord. 408/955-4202, fax: 408/955-5631

SOUND DECISIONS, 6646 Clearhaven Circle, Dallas, TX 75248

Thin-film interference program for the study of dielectric mirrors and A/R coatings, reflection characteristics of thin evaporated or sputtered films, and ellipsometric evaluation of layered structures. Runs on an IBM PC.

Raymond Whisnant, Pres. 214/404-9445

SOUTHWALL TECHNOLOGIES, INC., 1029 Corporation Way, Palo Alto, CA 94303

Manufacturers of sputtered coatings on optical-grade film. Applications include AR, electrochromic half-cells, EL lamps, EMI/ RFI shielding, flexible circuits, IR rejection, LC displays, optical tape media, specular

S-MOS SYSTEMS, INC., 2460 N. First St.,

San Jose, CA 95131-1002 Designers/manufacturers/distributors of

a full line of LCDs and flat-panel-display controllers and drivers.

408/922-0200, fax: 408/922-0238

Evanston, IL 60202

Consultant on display devices and sys-

Alan Sobel, Principal

reflectors, touch panels, and VDT/CRT filters (flat or formed). Ming Tong, Product Mgr 415/962-9115, x150, 1-800-477-4784 fax: 415/967-0182

SPECIALTY COATING SYSTEMS, INC., 5707 W. Minnesota St., Indianapolis, IN 46241

Manufacturers of precision application equipment, including spray coaters, CAVEX meniscus coaters for FPDs, and spin coaters. Kurtis Olson, Mktg. Asst. 317/244-1200, fax: 317/240-2073

SPECTRA-PHYSICS SCANNING SYSTEMS, INC., 959 Terry St., Eugene, OR 97402

Manufacturers of barcode readers. Tony Seidell, Mktg. Comm. Mgr. 503/683-5700, 1-800-547-2507 fax: 503/345-7140

SPECTRON ENGINEERING, INC., 255 Yuma Ct Denver, CO 80223

Manufacturers of optical measuring devices, spectrometers, spectroradiometers, and automated display-testing systems

Zozislav Krzystek 303/733-1060, fax: 303/733-2432

SPECTRUM SCIENCES, INC., 3050 Oakmead Village Dr., Santa Clara, CA 95051-0808

Manufacturers of large-substrate ion implanters for processing technologics. Michael Tucker, V.P. Sls./Mktg. 408/727-1567 ×24, fax: 408/727-1322

SPIE, P.O. Box 10, Bellingham, WA 98227-0010

SPIE, The International Society for Optical Engineering, is a nonprofit technical society dedicated to advancing scientific and engineering applications of optical, electro-optical, and optoelectronic technologies through its publications, symposia, and short courses. Sue Davis, Dir.

206/676-3290, fax: 206/647-1445

SPIRE CORP., One Patriots Park, Bedford, MA 01730-2396

Manufacturers of laminators for LCD and AMLCD panels; ion-implantation services for TFEL. AMLCDs, phosphor activation; MOCVD of II-VI, III-V, and oxide phosphor materials; and solid-state devices, including laser-diode arrays and high-performance solar cells

Ward D. Halverson, Dir., Thin Film Tech. 617/275-6000, fax: 617/275-7470

SPSE, THE SOCIETY FOR IMAGING SCIENCE AND TECHNOLOGY, 7003 Kilworth Lane, Springfield, VA 22161 A nonprofit technical society devoted to

meeting the information needs of imaging professionals - scientists, engineers, and technicians working in the area of photographic and electronic imaging. Its purpose is to advance the understanding and application of imaging science and technology. Lori Jones, Membership, 703/642-9090

STALAW CO., P.O. Box 516, Herzliya 46105, Israel

Manufacturers of extremely slim LCD rear projectors with wide viewing angle in all directions. Speaker-independent speechrecognition commands for LCD projectors with 100% accuracy of recognition. Michael Stalaw, Dir

+972-9-9580-261, fax: +972-9-9561-282

THE STAN-ALLEN CO., INC., P.O. Box C, 656 Center St., Ludlow, MA 01056 Manufacturers of close-tolerance steel rule dies and specializing in tools for cutting

films for electroluminescent displays. Michael Ghareeb, V.P. Sls./Mktg. 413/589-9961, 1-800-428-3324 fax: 413/589-0006

STANDISH INDUSTRIES, INC., W7514 Highway V, Lake Mills, WI 53551 Manufacturers of both standard and

custom liquid-crystal displays and modules. TN, STN, and ESTN LCD technologies are offered. Engineering assistance and complete design services are available. Brent Hering, Natl. Sls. Mgr 414/648-1000, fax: 414/648-1001

STANFORD RESOURCES, INC., 3150 Almaden Expwy., Ste. 255, San Jose, CA 95118

Market researchers/publishers of reports in the electronic-display industry, including quarterly and annual reports on shipments of CRTs, CRT monitors, LCDs, projection displays, other FPDs, and associated market and technology sectors. Laura Barretto, Dir. Sls. & Mktg 408/448-4440, fax: 408/448-4445

I. I. STANLEY CO., INC., 2660 Barranca Pkwy., Irvine, CA 92714

Manufacturers of super-high-intensity LEDs, chip-type SMD LEDs, light-bar LED modules, and LED dot-matrix displays. A full complement of LCDs with LED, CFL, and EL backlighting is available. Also, touch-panel LCDs. Roy Mader, Mktg. Mgr.

714/222-0777, fax: 714/222-0555

STANLEY ELECTRIC CO., LTD. 2-9-13, Nakameguro, Meguro-ku, Tokyo 153, Japan

Manufacturers of super-bright LEDs, LED displays, LED printheads, LCDs, ELs, CFLs, photoreceptors (OPC, a-Si), sub-miniature lamps, miniature halogen lamps, and driver and controller electronics for displays. Takashi Kashiwagi

+81-3-3710-2222, fax: +81-3-3792-0007

STANLEY ELECTRIC CO., LTD, R&D Laboratory, 1-3-1 Eda Nishi, Midori-ku Yokohama 225 Japan

Manufacturers of super-bright LEDs, LED displays, LED printheads, LCDs (TN, STN, GH-D, TFT, CSH), ELs, CFLs, photo-receptors, subminiature lamps, miniature halogen lamps, and driver and controller electronics for displays. Takashi Kashiwagi +81-3-3710-2222, fax: +81-3-3792-0007

G. A. STANLEY PALMER LTD., Island Farm Ave., West Molesey, Surrey KT8 2UR, U.K.

Distributors of CRTs, wound components (coils), filters, and sockets and frames for monitors, with back-up consultancy services.

Dennis Wickham +44-81-979-7254, fax: +44-81-941-6521

STAR TECHNOLOGIES, INC., Graphicon Products Div., P.O. Box 13951, Research Triangle Park, NC 27709

Manufacturers of the Graphicon family of high-performance 3D graphics processors for simulation, C³I, MCAE, and molecular modeling applications. Robert Collins, V.P.

919/361-3866, fax: 919/361-3888

STEAG MICROTECH, INC., 8305 Cross Park Dr., Austin, TX 78754

Manufacturers of precision clean/coat develop cluster tools or stand-alone modules and surface film thickness measurement tools. Providers of capillary coating technology for precision, low-cost coatings.

Dana Scranton, V.P. Sls./Mktg. 406/755-8367, fax: 406/755-8368 STEREOGRAPHICS CORP. 2171 E.

Francisco Blvd., San Rafael, CA 94901 Manufacturers of hardware producing flickerless professional-quality computer or video-generated 3D images for viewing

on computer monitors or with highresolution 3D projection systems. Amy Mar, Sls. Admin. 415/455-1832, 1-800-783-2660 fax: 415/450-3020

STEREOMEDIA, INC., 2307 W. Olive Ave.,

Burbank CA 91506 Suppliers of stereoscopic 3-D (S3-D) video systems and broadcast-quality 3-D video production. Distributors for Reality® LCD Glasses (60/120 Hz), special-application display modules, and the world's largest selection of 3-D video stock and file footage for virtual-reality developers.

Anthony Coogan, Pres. 818/559-6515, fax: 818/559-6598

SUMMAGRAPHICS CORP., 60 Silvermine Rd., Seymour, CT 06483

Manufacturers of a full line of input and output devices which include the Summa-Sketch II Series, the Microgrid III, and Summagraphics LCL graphics tablets, as well as the Houston Instrument JetPro monochrome bubble jet printer/plotter, Image Maker desktop plotter, DMP 60 and 60 DL Series pen plotters, and the LDS 4000 wide-format scanner. Charlene Chiaro, Sls. Comm. Admin. 203/881-5400, fax: 203/881-536

SUPERTEX INC., 1235 Bordeaux Dr., Sunnyvale, CA 94089

Manufacturers of high-voltage monolithic HVCMOS driver ICs and DMOS discretes/ arrays for EL/plasma/VF/LC display panels and printer/plotter ultrasound imaging heads. Suitable for monochrome, grayscale, and color applications up to 64 channels and 800 V. Dilip Kapur, Dir. Mktg

408/744-0100, fax: 408/222-4895

KARL SUSS AMERICA, INC., P.O. Box 157, Route 100 & Suss Dr., Waterbury Ctr., VT 05677

With a well established installation base in both the U.S. and Europe, Suss aligners are uniquely suited to meet specific process requirements, with resolutions in the 2-5-um range on panels up to 8 × 8 in. The coaters utilize the patented Gyrset closed cover system to provide highly uniform coatings on substrates up to 24 × 24 in. with manual or automated handling. Paige Lowry, Mktg. Coord. 802/244-5181, 1-800-685-7877 fax: 802/244-5103

KARL SUSS AMERICA, INC., PROBER DIV., P.O. Box 157, Suss Dr., Waterbury Ctr., VT 05677

Manufacturers of a complete line of manual, semi-automatic, and fully automatic probing systems and accessories, including manual and motorized probe heads, dc to W band probes, microscopes, microwave and hot chucks, and localized environmental chambers.

Robert Jamison, Sls. Mgr., Prober Div. 802/244-5181, fax: 802/244-5103

SWISS CONTROLS, INC., 2603 E. Barker Ave., P.O. Box 567, Michigan City, IN 46360

Manufacturers of EL lamp power inverters, dc-ac for custom design and fabrication. Large and small volume requirements welcome. Two-week turnaround on prototype requests in most cases. Thomas Smith, V.P. Sls./Mktg.

219/872-5544, 1-800-348-3257 fax: 219/872-5882

SYMCO, INC., 29 Poplar Dr., Stirling, NJ 07980-1527

Suppliers of imaging products for resale including CCD cameras, imaging frame grabbers, TV lenses, monitors, encoders, decoders, video printers, and LCD projectors. Frank Culotta, Pres.

908/647-6262, fax: 908/647-4904

SYNTEST CORP., 40 Locke Drive,

Marlboro, MA 01752

Manufacturers of industrial, narrow column, and mobile impact and thermal printers. IBM graphics are available on all models.

Ted Seligowski, Sls. Mktg. 508/481-7827, fax: 508/481-5769

SYNTRONIC INSTRUMENTS, INC., 100 Industrial Rd., Addison, IL 60101

Manufacturers of magnetic components for CRTs. Full line of deflection yokes, focus coils, heam-alignment devices, and mounting systems. Products for military avionics, medical monitors, full-color displays, helmet-mounted/miniature displays, and other special-purpose CRTs. Mallory P. Segal, Dir. SIs./Mktg. 630/543-6444, fax: 630/543-0287

SYSTEMS RESEARCH LABORATORIES, INC., Military Displays, 2800 Indian Ripple Road, Dayton, OH 45440-3696

Designers and manufacturers of a line of monochrome and color military avionics displays, graphics symbol generators with aircraft navigation interfaces, and nightvision equipment.

Jack T. Dehait, Prod. Mgr 513/427-7608, fax: 513/427-0205

SYSTEMS RESEARCH LABORATORIES, INC., Information and Displays Visual & Training Systems Center, 2800 Indian Ripple Road, Dayton, OH 45440-3696

Designers and manufacturers of commercial, ruggedized, and high-resolution color monitors and projection display equipment for training and simulation, C3I, airborne and mobile systems. Raster and/or raster/calligraphic systems available; unique designs and application services a specialty; small quantity requirements welcomed. Chuck Silcott, Mktg. Mgr. 513/427-7266, fax: 513/426-1984

TAMARACK SCIENTIFIC CO., INC. 1040 N. Armando St., Anaheim, CA 92806 Manufacturers of photolithographic exposure production systems, including new high-yield scanning projection tools with exposure areas up to 840 × 1025 mm for FPD, color filter, and MCM manufacture. Ivan Courtright, Sls. Mgr. 714/238-7400, fax: 714/632-1455

TANNAS ELECTRONICS, 1426 Dana Pl., Orange, CA 92666

Consulting services in electronic information displays; design of display compon-ents and products; evaluation of display companies and component sources; tours

industry directory

(Asia) and seminars; and marketing, human factors, and electro-optic studies. Lawrence E. Tannas, Jr., Pres. 714/633-7874, fax: 714/633-4174

TARGET MATERIALS, INC., 1145 Chesapeake Ave., Columbus, OH 43212

Full-service manufacturer of high-performance thin-film materials, providing a vast array of metals, ceramics, and alloys for sputtering targets and evaporation sources in virtually any customer defined configuration

Michael D. Murphy, V.P. Sls. & Mktg. 614/486-7055, 1-800-292-8639 fax: 1-800-292-8654

TARTAN TECHNICAL, INC., 24 Westech Dr., Tyngsboro, MA 01879

Value-added resellers of color output and input devices, including color printers, digital projectors, large-format printers, digital label systems, film recorders, and scanners. Printing technologies from leading manufacturers include dye sublimination, thermal transfer, laser, solid ink, and ink jet. Kathleen McLeod, V.P.

508/649-8940, 1-800-869-0507 fax: 508/649-8947

TATUNG COMPANY OF AMERICA, INC., 2850 El Presidio Street, Long Beach, CA 90810

Manufacturers of a variety of monochrome and color monitors, ranging in screen size from 12 to 20 in. and designed for basic and sophisticated applications. Michael Lee

213/979-7055, 1-800-827-2850 fax: 213/637-8484

TDK CORP. OF AMERICA, 1600 Feehanville Dr., Mt. Prospect, IL 60056

Manufacturers of a broad line of standard dc/ac inverters for CCFL lighting, dc/dc converters for VFDs and LCD bias, and ballasts for HID metal-halide lamps. Other products include power compnents and standard ac/dc switching supplies. Pat Carson, Mgr., Power Conversion 847/390-4371, fax: 847/803-6296

TDSD CORP., 9005A Eton Ave., Canoga Park, CA 91304 Manufacturers of a family of single-lens

CRT projectors from economy models to very-high-power models for simulators, sports arenas, etc. M. Akhavi

818/407-8991, fax: 818/407-1050

TEAM SYSTEMS, INC., 2934 Corvin Dr., Santa Clara, CA 95051

Manufacturers/distributors of complete lines of PC-based and stand-alone analog and digital video generators, which are all fully programmable and can cover display resolutions up to 2K × 2K (440-MHz dot clocks). Their applications are in engineering, manufacturing, and servicing of monitors, projection systems, and, most recently, flat-panel devices. George Stoppel, Pres. 408/720-8877, 1-800-338-1981 fax: 408/720-9643

TECH-COM INTERNATIONAL, INC., 8341 E. Evans Rd., Suite 108, Scottsdale, AZ 85260

Manufacturers of compound curved highgain projection screens. DURAGAIN® and AquaBRIGHT® high-gain maintainable coatings. Integrator of large-screen displays

Max Mariani, Dir. Oper. 602/998-4600, fax: 602/443-8833

TECHNEGLAS, INC., 707 E. Jenkins Ave., Columbus, OH 43207

Manufacturers of CRT glass bulbs and parts for industrial, avionics, military, and monitor applications. James E. Kyle, Sls./Mktg. Mgr 614/445-4800, fax: 614/445-4702

TECHNICAL VISIONS, INC., 14000 S.W. Karl Braun Dr., M/S 46-944, Beaverton, OR 97077

A contract engineering company special-izing in liquid crystal, plasma, and plasmaaddressed liquid-crystal (PALC) flat-paneldisplay development. Capabilities include fabrication of display prototypes measuring 21 in. diagonally. Thomas S. Buzak, Pres.

503/627-1411, fax: 503/627-2225

TECHNOLOGY TRANSFER INSTITUTE. 516 Fifth Ave., Suite 305, New York, NY 10036

Consulting, research, and reporting services on Japanese display technology and markets. Ryoji Koiko, Exec. V.P. 212/719-5771, fax: 212/719-5874

TECH SPRAY, INC., P.O. Box 949, Amarillo, TX 79105

Manufacturers of chemical products used to clean, coat, and protect components and finished products from grease, moisture, mildew, fungus, acid, and caustic contaminates. Static control products for carpets, glass, and plastics. Don Schrowangen

806/372-8523, 1-800-858-4043 fax: 806/372-8750

TEKNEK ELECTRONICS LTD., Quarriers Village, Bridge of Weir, Renfrewshire PA11 3SA, U.K.

Manufacturers/designers of equipment for removal of particulate contamination from sheet and web substrates, especially prior to coating, laminating, and printing. Mark Sunderland, Commercial Mgr +44-0505-690-707, fax: +44-0505-614-708

TEKRA ATG, 16700 W. Lincoln Ave., #2800, New Berlin, WI 53151

Manufacturers of Terrapin hardcoated plastic films to meet the hardness (3H) and optical requirements for touch screens, flatpanel displays, and vacuum-deposition coatings.

Peter Moulds, Bus. Unit Mgr. 414/784-5533, 1-800-448-0291 fax: 414/797-3276

TEKTRONIX, INC., P.O. Box 500, Beaverton, OR 97077

Manufacturers of portable handheld digital photometer/radiometer/colorimeter products capable of making a wide range of display measurements. Several pre-calibrated plug-in heads are available for high-accuracy display and ambient measurements. Chuck Price, Mktg. Mgr. 503/627-5077, fax: 503/627-5622

TEKTRONIX, INC., Display Products Operation, P.O. Box 500, Beaverton, OR

97077 Manufacturers of display products, providing high-resolution color and monochrome displays as well as 3-D stereoscopic display systems based on

its liquid-crystal technology developments. Richard Osborn, Prod. Mktg. Mgr. 503/627-5064, 1-800-TEK-WIDE x5000 fax: 503/627-1070

TELEDYNE ELECTRONIC TECHNOLO-GIES, E-O Lighting & Display Products 12525 Daphne Ave., Hawthorne, CA 90250 Manufacturers of ALPHA LIGHT™ and

DYNELAMP™ lighting for LCDs, spatial light modulators, projection displays, and other specialized illumination radiation applications over the visible portion or in the near-infrared regions of the spectrum. Also, TOPS™ advanced performance photonic products. Light sources include low-power LEDs, as well as fluorescent arc and other lamp types. Bill Kennedy, Bus. Dev. Mgr

213/777-0077, fax: 213/242-1924

TELEDYNE KINETICS, 410 S. Cedros Ave., Solana Beach, CA 92075 Manufacturers of connectors for con-

necting flat-panel displays to printedcircuit boards. Doreen Deschamps, Mktg. Commun. 619/755-1181, 1-800-344-4334 1-800-991-9988 (CA only)

fax: 619/755-6163 TELESENSORY, 455 N. Bernardo, P.O.

Box 7455, Mt. View, CA 94039-7455 Manufacturers of access devices for blind and low-vision people. Product line includes

computer-screen enlargers, speech and braille output devices, OCR system, braille printers and video magnifying reading aids. Kathy Kinkaid 415/960-0920, 1-800-227-8418

fax: 415/969-9064

TELETRAC CORP., 137 Aero Camino, Santa Barbara, CA 93117

Manufacturers of large-scale inspection, electrical test, and repair systems for flatpanel displays. Produces turnkey systems with closed-loop laser interferometer servo motion control, computer vision systems, and robotic load/unload.

Barton F. Norton, V.P. Mktg./SIs 805/968-4333, fax: 805/968-5653

TELEX COMMUNICATIONS, INC., 9600 Aldrich Ave. S., Minneapolis, MN 55420

Manufacturers of LCD desktop panels and projectors, including the 13-lb. P170 data/video projector with built-in sound. 16-million colors, backlit remote, multilingual on-screen menus, 140 ANSI lumens of brightness, and accepting 3 video sources and 2 computer inputs. Todd Theilmann, Dir. Sls. 612/887-5531

1-800-828-6107 x531, fax: 612/887-5595

TELIC OPTICS, INC., 420 Maple St., Suite 25, Marlborough, MA 01752

Consultants in optical design and analysis including lens design, illumination systems analysis, and stray-light analysis. Custom optical analysis software also provided

Jim Howard, V P 508/485-4088, fax: 508/485-4618

TELTRON TECHNOLOGIES, INC.,

2 Riga La., Birdsboro, PA 19508 Manufacturers of imaging devices, including various camera tubes and monochrome CRTs for high-resolution and ruggedized applications. Special-purpose tubes available

Arthur H. Mengel, COO 610/582-9450, fax: 310/582-0851

TEMESCAL, A Division of BOC Coating Technology, P. O. Box 2529, 2700 Maxwell Way, Fairfield, CA 94533-0252

Developers/manufacturers of thin-film deposition systems for ICs, optics, flatpanel displays, and research; electronbeam sources and power supplies; deposition fixturing; deposition monitors and controllers; and vacuum hardware and accessories.

Brian Kaemmer, Sls. Mgr. 707/423-2100, 1-800-522-1215 fax: 707/425-1706

TEMPEST TECHNOLOGIES, INC., 460 Herndon Parkway, Herndon, VA 22070 Manufacturers and sellers of dot-matrix

(200-400 cps), line (300-600 lpm), letterquality (55 cps), and page (6 ppm) printers, and plotters (8 pen) for use when processing sensitive data in office and engineering activities.

James L. Leatherman 703/471-0157

TENCOR INSTRUMENTS, One

Technology Drive, Milpitas, CA 95035 Designers and manufacturers of innovative wafer defect inspection, software-based yield management, thin-film measurement, and metrology systems used in semi-conductor manufacturing and related industries

Tony Aniello, Worldwide SIs 408/571-3000, fax: 408/571-3030

TENCOR INSTRUMENTS, 3231 Scott Blvd., Santa Clara, CA 95054

Manufacturers of the FLX-2350FP, a thinfilm stress-measurement system designed for flat-panel-display applications. The system monitors stress at room temper-atures, and features a 500-mm scanning capability to allow local stress analysis along the scan.

Dov Hirsch, Sr. Prod. Mgr., Film Stress Prod 408/654-2436, 1-800-358-6784

fax: 408/982-9654

TERAPIXEL, Olarinluoma 9, 02200 Espoo, Finland

Manufacturers of large-area photomasks for display manufacturing. Maximum areas, 22 × 24 in.; minimum lines, 3 µm. Applications include LCDs, FEDs, ELs, plasma, and others. Arto Salin, Pres. +358-9-423-537, fax: +358-9-423-813

TEXAS INSTRUMENTS, P.O. Box 655474,

M/S 429, Dallas, TX 75265 Digital Light Processing (DLP™) solutions deliver compelling all-digital images as further evidence of projection display and near-photographic printing quality 214/995-2426, fax: 214/995-2217

TEXAS INSTRUMENTS JAPAN LTD.,

4-13-23, Shibaura, Minato-ku, Tokyo 108, Japan

Manufacturers of color plasma display drivers/controllers for future A/V systems, including new chip process of high-voltage CMOS based on technology exchange agreement with Supertex. LCDs in slim TAB packages and chip-on-glass assembly covering all flat panels. Plasma: Hiro Kawai; LCD: Toshi Ikai +81-3-3769-8724, fax: +81-3-3457-6777

THIN FILM DEVICES, INC., 1180 N. Tustin Ave., Tustin, CA 92807

Manufacturers specializing in FPD coatings: transparent conductors (ITO), index-matched ITO (IMITO), low-glare coatings (ARs, BBARs), black chrome, display heaters, metallized electrodes, and hot or cold mirrors. Other products and services include fine-line patterning, lamination, backlight heaters, touch-screen coatings, sensors, and a resistivity meter. The addition of a large-capacity low-defect ITO-coating machine will increase TFD

production an additional 1.5-2.5-million ff a vear. Richard Trembly, Mktg. Mgr.

714/630-7127, fax: 714/630-7119

THIN FILM TECHNOLOGY, INC., P.O. Box 1942, 153 Industrial Way, Buellton, CA 93427

Offering complete vacuum-coating and substrate patterning services for fast, flexible response to customer requirements. Both evaporation and rf/dc magnetron sputtering techniques are employed to produce conductive, resistive, dielectric, wear-resistant, or optical coatings on a variety of substrates. Coating chamber sizes range from 18 in. in diameter to 8 ft. diameter × 14 ft. deep. Doug Cambell, Sales 805/688-4949, fax: 805/688-8487

THOMAS ELECTRONICS, INC.,

100 Riverview Dr., Wayne, NJ 07470 Manufacturers of CRTs and CRT assemblies for the military, industrial, and commercial marketplace. Applications include air-traffic control, avionics, medical imaging, simulations, photo-recording, and CHI. New products include flat fluorescent lamps for use in backlighting LCDs.

Bruce Piaget, V.P. Sls. 973/696-5200, fax: 973/696-8298

THOMAS ELECTRONICS, INC., 208 Davis Parkway, Clyde, NY 14433

Manufacturers of CRTs and CRT assemblies for the military, industrial, and commercial marketplace. Applications include air-traffic control, avionics, medical imaging, simulations, photo-recording, and CHI. New products include flat fluorescent lamps for use in backlighting LCDs. Bill Kuney, Sls. Engr.

315/923-2051, fax: 315/923-4401

THOMSON COMPONENTS & TUBES CORP., 40G Commerce Way, Totowa, NJ 07512

Manufacturers of color VGA 64-dpi flat plasma displays, monochrome high-resolution plasma panels, ruggedized color CRT monitors, 9-in. RGB projection CRTs, color team index and monochrome avionic displays, and 26-in. diagonal plasma displays.

Jeffrey G. Ohstrom, Sls. Mgr., Optoelec. Products

201/812-9000, fax: 201/812-9050

THOMSON-CSF SERVICES INDUSTRIE. 105 Avenue de General Eisenhower #31023, Toulouse BP1009, France

Manufacturers of high-performance graphics generators and full-featured X-Window terminals that support 1280 × 1024 to 2048 × 2048 resolution and provide standard X11R6 software interface and high-speed drawing and pixblt capabilities. A wide scope of interfaces are available (Ethernet, FDDI, PCI, etc.). Alain M. Cousin, Bus. Dev. Mgr +33-1-4537-8937, fax: +33-1-4537-8938

THOMSON TUBES ELECTRONIQUES. 38, rue Vauthier, B.P. 305, Boulogne-Billancourt F-92102 France

Manufacturers of professional CRTs. very-high-resolution, head-up, head-down, helmet-mounted, projection, beam index, and ruggedized shadow-mask monitors; ac plasma displays (military and civil), color and monochrome with gray scale and high brightness. Models suitable for PC monitors.

P. Menes, SIs. & Mktg. Dir. +33-1-4909-2828, fax: +33-1-4604-5209 3-D IMAGETEK CORP., 23701 Birtcher Dr., Lake Forest, CA 92630

Manufacturers of the 3DP-2000/NVP (NTSC, VGA, PAL) for LC-based HMD or projector designs, which de-multiplexes and distributes left-eye/right-eye and stereoscopic 3-D video encoded in either field-sequential or line-segmentation (ENIGMA) formats; ASIC package in production quantities; NTSC/VGA and PAL/VGA compatibility to end-user products. Craig M. Crawford, Pres.

714/455-1806, 1-800-355-5565 fax: 714/455-1990

3DTV CORP., P.O. Box Q, San Rafael, CA 94913-4316

Manufacturers/distributors of a wide variety of hardware and software for making and displaying stereoscopic video and computer graphics, ranging from lowcost consumer kits to professional systems. Michael Starks, Pres. 415/479-3516, fax: 415/479-3316

THREE-FIVE SYSTEMS, INC., 1600 N.

Desert Dr., Tempe, AZ 85281 Designers/manufacturers of user-interface devices for operational control and information-display functions in OEM products. Specializing in LCD and LED components and technology in providing custom design and manufacturing services for the communications, medical electronics, industrial process control, wireless data collection, and office automation marketplaces.

Bruce Sedlak, V.P. Sls. 602/389-8975, fax: 602/389-8801

3M, 3M Center, Bldg. 260-5N-10, St. Paul, MN 55144

Manufacturers of optical-enhancement films for use in transmissive, transflective, reflective, and LCD projection displays. Films are designed to enhance brightness, increase power savings, and offer wide viewing angle. Bill Hibbard, Sls. & Mkt. Mgr.

612/737-8686, 1-800-328-7098 x1 fax: 612/736-4503

3M ELECTRICAL SPECIALTIES DIV., Bldg. 130-3N-56, P.O. Box 2963, Austin, TX 78769-2963

Designers, manufacturers, and marketers of products for a variety of specialty electrical applications including control of static electricity, insulating tapes, resins and heat-shrink products. Harry Borrelli, V.P.

1-800-328-1368, fax: 512/984-2211

3M ELECTRONIC PRODUCTS DIVISION. 3M Austin Center, 6801 River Place Blvd., Austin, TX 78726-9000

Manufacturers of electronic interconnects, assemblies, sockets, wire, and cable for all electronic/electrical applications. 512/984-1800, 1-800-225-5373 or 1-800-3M-HELPS, fax: 512/984-6972

3M OPTICAL SYSTEMS, 3M Center, Bldg. 225-4N-14, St. Paul, MN 55144-1000

Manufacturers of specialty optical films to control and enhance lighting for CRTs, LEDs, plasma displays, EL, and LCDs. Mike Burns

612/733-4403, 1-800-553-9215 fax: 612/736-2298

3M PRODUCT INFORMATION CENTER 3M Center, Bldg. 515-3N-06, St. Paul, MN 55144-1000

Manufacturers of commercial graphics, visual systems, sound products, and image processing systems, components, and

equipment for the trade-show, display, POP, and promotional industries 612/737-6501, 1-800-3M-HELPS fax: 612/737-7117

TIMELINE, INC., 23605 Telo Ave., Torrance, CA 90505

Distributor of surplus inventories of LCDs, both graphic and alphanumeric, non-enclosed monitors; computer-related equipment. Ron Klein

310/217-8912, fax: 310/532-6304

TNP INSTRUMENTS, INC., 20695 S. Western Ave., Suite #128, Gardena, CA 90249

Manufacturers of LCD probe station laser repair systems, and thin-film, cell-gap, and CIE measuring systems for substrates up to 650 × 650 mm. Auto loader, auto focus, and motorize turret for fully automatic systems. Integrates with inspection systems and test instruments. Vu Tran, Pres.

310/787-4620, fax: 310/787-4621

TODDCO GENERAL, INC., 7888 Silverton Ave., Ste. A, San Diego, CA 92126

Manufacturers of high-quality hot-bar bonding equipment used for production, rework, and repair or process development. Unique all-ceramic hot bars provide exceptional thermal distribution and flatness. Specializing in display attachment. Debie M. Burford, Ntl. Sls. Mar.

TOKO AMERICA, INC., 1250 Feehanville

Manufacturers of miniature dc/dc converters for powering VFDs, modems, RS-232 interfaces, and other subsystems.

312/297-0070, fax: 312/699-7864

Cupertino, CA 95014 Distributors of AMLCD plasma etching/ ashing systems for single-substrate processing and AMLCD photoresist coater/developer systems which are capable of handling large substrates

Alex Kawano, Mktg. Mgr. 408/777-2600, fax: 408/777-2650 TOSHIBA AMERICA ELECTRONIC

COMPONENTS, INC., 1060 Rincon Cir., San Jose, CA 95131 Manufacturers of color AMLCDs:

medium-size 4-6-in. LCDs for navigational, visual, and entertainment; notebook-size 7.8- 12.1-in. LCDs for portable computing; industrial applications.

Manufacturers of a wide range of passive

range of high-resolution color and monochrome CRTs; FS display tubes in 15, 17, and 21 in.

708/945-1500, fax: 708/945-1044

TOSOH SMD, INC., 3600 Gantz Rd., Grove City, OH 43123-1895

evaporation sources in a wide variety of materials and custom materials for all sputtering and evaporation systems. Offers research/development support, technical support, proprietary non-destructive testing data, and customer service support for all semiconductor, specialty, media, and FPD customers.

Michael W. Morris, Prod. Mgr. 614/875-7912, fax: 614/875-0031

TOTOKU ELECTRIC CO., LTD., 3-21, Okubo 1-Chome, Shinjuku-ku, Tokyo 169, Japan

Manufacturers of high-resolution monochrome and color CRT monitors and

deflection yokes. FOREIGN TRADE DEPT. +81-3-5273-2008 fax: +81-3-5273-2092

TOUCH CONTROLS, INC., 4167 Auenida de la Plata, Bldg. 108, Oceanside, CA 92056

Manufacturers of 14-, 15-, 17-, and 20-in. CRTs; 9.4-, 10.4-, 12.1-, and 13.8-in. LCDs. NEMA-4X Class I, Division I and II. David McKay, V.P. Sls./Mktg. 619/631-7911, 1-800-848-4385 fax: 619/631-7910

TOYO SPECTRUM CORP., 2934 Corvin Dr., Santa Clara, CA 95051

Manufacturers of color and gray-scale thermal video printers with an integrated video interface and frame buffer to directly capture the picture for a "screen-dump" in less than 1 sec.

408/720-8877, 1-800-338-1981 fax: 408/720-9643

TRANSICOIL, INC. 2650 General Armastead Dr., P.O. Box 9011, Valley Forge, PA 19485-9011

Manufacturers of custom integrated switch panels and bezels for display interface, high-brightness incandescent displays, night-vision compatible displays, panels, and annunciators. Complete component and electronic packaging capability. Military, commercial, highreliability, and environmental applications. Mark LeMire

215/539-4400, fax: 215/539-3400

TRIDENT MICROSYSTEMS, INC., 205 Ravendale Dr., Mountain View, CA 94043 Developers and marketers of highperformance graphical-user-interface accelerators, mixed-signal SVGA controller chips, LCD graphics controllers, doublebyte character chipsets, and video processing chipsets for video-windowing and desktop video production. Mike Lollabaugh, Dir. N. Amer. Sls.

415/691-9211, fax: 415/691-9260

TRONIX, INC., 31 Business Park Dr., P.O. Box 635, Branford, CT 06405 Manufacturers of high-voltage power

supplies for x-ray image intensifiers. J. Wood 203/488-0109, fax: 203/481-6370

TRU-LYTE SYSTEMS, INC., 327 South Walnut Street, Beaver, PA 15009

Researchers of display and imaging technologies involving the use of fiber optics. Product lines under development include large-screen displays, highdefinition television (HDTV), threedimensional television systems (3D-TV), and head-up displays (HUDs). Augustus Castinis

412/728-6655, 1-800-232-5983 fax: 412/728-0778

TSC, 322 Lindbergh Ave., Livermore, CA 94550

Re-manufacturers of sputtering and evaporation systems, providing vacuum rebuild to full PLC computer integration and

George Stoeppel

619/549-9229, fax: 619/549-2162

Dr., Mt. Prospect, IL 60056

Tony Abarquez, Prod. Mgr

TOKYO ELECTRON AMERICA, LTD., 20300 Stevens Creek Blvd., Ste. 380,

(maximum size, 550 × 650 mm).

and large-size high-brightness 12.1-15-in. LCDs for desktop LCD monitors and Cameron Zand, Sls. Engr. 408/456-8900, fax: 408/456-9002

TOSHIBA AMERICA ELECTRONIC COMPONENTS, INC., 1 Parkway North, Ste. 500, Deerfield, IL 60015-2547

b/w and active-matrix color LCDs; a full

Steven Vrablik, Mgr. Sls./Mktg.

Manufacturers of sputtering targets and

industry directory

rewiring, new instrumentation and power supplies. Jerry L. Martin, V.P. 510/373-9730, fax: 510/373-9574

TSD DISPLAY PRODUCTS, INC.

35 Orville Dr., Bohemia, NY 11716-2598 Manufacturers of high-resolution monochrome CRT display monitors. Steven R. Sloan, Dir. Sls. 516/589-6800, fax: 516/589-6800

TSP, INC., 2009 Glenn Parkway, Batavia, OH 45103-1676

Manufacturers of diplay windows and filters for all types of optoelectronic displays. Providing anti-glare hardcoats, contrast-enhancing tints, printed graphics, mounting adhesives, full CNC or laser fabrication, ITO or gold EMI shielding. Sheets also available. Stewart Nellis, SIs. Mgr 513/732-8900, 1-800-APP-XPRT fax: 513/732-6988

TÜV RHEINLAND OF NORTH AMERICA, INC., 5860 W. Las Positas Blvd., #19, Pleasanton, CA 94588

Testing house providing ergonomics testing and certification services for hardware and firmware for the European market. Other services include certification to the ANSI/UL 1950 standard for the U.S. market, EMC testing, and ISO 9000 registrations Klaus Ehrlich

510/734-8100, 510/734-8455

TWO TECHNOLOGIES INC., 419 Sargon Way, Horsham, PA 19044 Designers and manufacturers of hand-

held terminals. Joan Rickards, V.P. Sls. 215/441-5305

TYSON CONSULTING GROUP, 612 White Pine Rd., Buffalo Grove, IL 60089-3330

Consultancy in medical-device development covering: market evaluation, demographics, and needs analysis; concept testing and refinement; and marketingprogram planning, including direct sales, distribution, and promotion. Seminars available on the health-care industry, with emphasis on product-related activities and trends.

Ted R. Tyson, Pres. 847/459-9189, fax: 847/215-6141

UCE, INC., 1580 Route 52, Hopewell Junction, NY 12533

Manufacturers of LCDs, applicationspecific displays, and custom and standard displays. Liquid crystals include nematic, scattering, dichroic, phase-change, and stored scatter. Also, optical light valves, shutters, attenuators for projection and direct-view, and optical switches. Greg Borstelmann, Sls. Mgr 914/892-1700, Fax: 914/892-1710

ULTIMATE DISPLAY SOLUTIONS, INC., 1495 Hembree Rd., Ste. 900, Roswell, CA 30076

Distributors of new and reconditioned computer monitors (12, 14, 15, and 17 in.). CGA through 1280 × 1024 resolution. Also, repair of color and monochrome monitors. Chuck Wood, SIs. Mgr. 404/664-1010, 1-800/221-1490 fax: 404/664-4103

ULTRA t EQUIPMENT CO., 2391 Zanker Rd., #370, San Jose, CA 95131

Manufacturers of configurable photolithography cluster tools for coating, devel-oping, and cleaning of substrates up to 34 in. on the diagonal. Also spin coaters for

uniform coating of square and rectangular substrates, high-pressure and megasonic spray cleaners, spray developers, and highaccuracy flip-chip bonders. Fred Namek, V.P. Mktg./Sls 408/955-7850, fax: 408/955-7878

ULVAC TECHNOLOGIES, INC. 6 Riverside Dr., Andover, MA 01810 Manufacturers of a line of evaporators for the FPD industry. The END Series of cluster tools and the EIH/ECH Series of inline evaporation equipment for MgO deposition for PDP users and various metals for FED users. Rob Gardner, Dir. Sls./Mktg. 510/226-0151, fax: 510/226-0167

UNIAX CORP., 6780 Cortona Dr., Santa Barbara, CA 93117

Developing low-power polymer electroluminescent displays for use in hand-held electronic applications. Initial commercial prototypes will be ready for OEM evaluation by late 1997. Nick Colaneri, Bus. Devel. Mgr.

805/562-9293, fax: 805/562-9144

UNIGLOBE KISCO, INC., 709 Westchester Ave., White Plains, NY 10604 Distributors of TN/STN-LCD cells from

Japan/China/Taiwan/Malaysia on an OEM basis. Manufacturing materials and equip-ment for TN/STN/AMLCDs, including liquid crystal, polyimide, spacer, ITO glass, heatseal connector, ACF, and systems for rubbing, alignment/lamination, spacer dispersion, LC injection, and scribe/break. David Roseman, Mgr. Sls./Engrg. 914/949-5434, fax: 914/997-0195

UNIGRAF, Ruukintie 18, Espoo 02320 Finland

Manufacturers of industrial computers and monitors for process automation and mobile and military applications. Also, video test generators for video-monitor service and manufacturing. Jouko Ala-Tuori, Mktg. Mgr. +358-9-802-76423, fax: +358-9-802-6699

UNIVERSITY OF MICHIGAN, Display Technology & Manufacturing Center, 2360 Bonisteel Blvd., Ann Arbor, MI 48109-2108 University research facility offering R&D in FPD manufacturing and materials technologies. Capabilities in FPD devices, materials, and circuits; process control; microelectronics on low-temperature substrates; and factory optimization and control.

Linda K. Owens, Admin. Mgr. 313/764-4336, fax: 313/936-0347

UNIVISION TECHNOLOGIES, INC., 3 Burlington Woods Dr., Burlington, MA 01803

Manufacturers of graphics display con-trollers and frame grabbers for VME, PC-ISA, VL, PCT, and IBMRISE 6000 computers. Supports CRTs and EL displays with resolutions from 640 × 480 up to 1600 × 1280 with 8, 12, 24, and 32 bits per pixel. Digital and analog video inputs are also supported.

Larry H. Taitelbaum, Dir. Sls. East 617/221-6700 x125, fax: 617/221-6777

USHIO AMERICA, INC., 10550 Camden Dr., Cypress, CA 90630

Manufacturers of metal-halide and halogen lamps for projection systems. Low-voltage dc and ac metal-halide lamps. Lorena Chavez, Mktg./Cust. Relations 714/229-3147, 1-800-326-1960 fax: 714/229-7147

U.S. PRECISION GLASS, 1900 Holmes Rd., Elgin, IL 60123

Manufacturers of flat-glass components for a variety of touch screens and flatpanel-display manufacturers. Services include cutting, grinding, polishing, chemical tempering, optical coating, silk screening, and light assembly. Greg Olson, Natl. Sls. Mgr 847/931-6403, fax: 847/931-4144

UTI CORP., Collegeville, PA 19426 Manufacturers of precision miniature metal components in 100 different alloys; specifically, oxide and dispenser cathode components.

P. J. Koehler, VP Mktg./Sis. 610/539-0700, 1-800-523-0441 fax: 610/489-2720

VACUUM ENGINEERING & MATERIALS CO., INC., P.O. Box 4480, Santa Clara, CA 95956-4480

Manufacturers of sputtering targets, evaporation materials, and backing plates. A large selection of high-purity metals, intermetallics, dielectrics, and cermets for PVD coatings. Sputtering targets and evaporation materials manufactured to customer's exact specifications of size and purity. Also, a complete line of cathodes and crucible liners. Jack Kavanaugh, Sls. Mgr. 408/986-8900, fax: 408/986-8980

VACUUMSCHMELZE GmbH, Gruener Weg 37, Hanau D-6450, Germany

Manufacturers of magnetic shieldings from low-frequency ac fields through to earth's fields; customer-specified monitor shielding, standard monitor shielding, shielding sheets for monitors; foils, parts, and magnetically shielded rooms. Hans-Dieter Naunheim, Dipl.-Ing. +49-6181-38-2768, fax: +49-6181-38-2645

VALTECH CORP., 1011 Daisy Point Rd., Pughtown, PA 19465

Manufacturers of high-purity VALTRON® detergents formulated for precision cleaning of FPDs, available in acidic, neutral, and alkaline formulations, and effective in contact and non-contact cleaning equipment. Supplied in liquid concentrate for dilution with deionized water allowing various dilution rates for specific precision cleaning applications. Robert T. Girard, Pres

610/469-9634, fax: 610/469-9635

VANZETTI SYSTEMS, INC., 111B Island St., Stoughton, MA 02072

Manufacturers of MIDAS 8500 automatic optical inspection equipment for conductors on plasma display panels up to 30 × 30 in. (762 × 762 mm). Pixel size is 0.25 mil (6 µm) or 0.5 mil (12.5 µm). Inspection speed is 20 in.²/min. at 0.25 mil and 40 in.²/min at 0.5 mil. Gas purge of inspection area; 7.5-Mpixel/sec. image processing rate in a microcoded RISC-style architecture. John P. Ward, Dir. Sls./Mktg. 617/828-4650, fax: 617/341-2084

VARITRONIX LTD., 4-F Liven House, 61-63 King Yip St., Kwun Tong, Kowloon, Hong Kong

Manufacturers of custom and standard LCDs, custom and standard dot-matrix and graphic LCD modules, touch-sensing customer input terminals, and touch screens.

S.M. Chung +852-2389-4317, fax: 852-2343-9555

VARITRONIX S.A.R.L., 74 Avenue Charles de Gaulle, 91420 Morangis, France Distributors of custom and standard LCDs, custom and standard dot-matrix and graphic LCD modules, touch-sensing customer input terminals, and touch screens.

Guy Cresson

+33-1-6909-7070, fax: +33-1-6909-0535

VARITRONIX LTD., King's Stable, 3/4 Osborne Mews, Wind., Berks SL4 3DE, U.K.

Distributors of custom and standard LCDs, custom and standard dot-matrix and graphic LCD modules, touch-sensing customer input terminals, and touch screens Wyn Griffiths

+44-753-833-060, fax: +44-753-833-040

VARITRONIX (UK) LTD., 3 Milbanke Ct., Milbanke Way, Bracknell, Berks RG12 1RP, UK

Manufacturers of both custom and standard liquid-crystal displays and modules. New products include graphics panels and direct-contact touch overlays. Robert Hill, Appl. Engr. +44(0)-1344-303-077 fax: +44(0)-1344-300-099

VDC, One Apple Hill, Natick, MA 01760 Business planning, product planning, and market research for the electronics industry: materials, components, subsystems, and systems level. Marc Regberg, V.P. 508/653-9000, fax: 508/653-9836

ARON VECHT & ASSOCIATES, 95 Corringham Rd., London NW11 7DL, U.K.

Consultants specializing in displays: phosphors, EL, LCDs, etc. Also, superpure chemicals, thin-film technology, CVD, financial and marketing, assessment of new technologies, technology transfer, and liaison between Europe and U.S. Aron Vecht +44-1-81-455-4361, fax: +44-1-81-316-8405

VEECO/SLOAN TECHNOLOGY, 602 E. Montecito St., Santa Barbara, CA 93103 Manufacturers of the Dektak line of flat-

panel-display surface profilers that provide extremely accurate film-thickness measurements of RGB color filters, ITO, and TFTs on large flat panels up to 720 mm square. Tim Ballinger, Mktg. Commun. Mgr. 805/963-4431, fax: 805/965-0522

VESA (Video Electronics Standards Association), 2150 N. First St., #440, San Jose, CA 95131

Worldwide video electronics standards association representing more than 300 members. Membership is drawn from hardware, software, PC, display and component manufacturers, cable and telephone companies, and service providers Cathy Egan, Member/Mktg. Services Mgr.

408/435-0333, fax: 408/435-8225

VGI, INC., 1800 Vernon St., Ste. 2, Roseville, CA 95678

Manufacturers of custom and standard TN- and STN-LCDs; graphic, dot matrix, and general-purpose LCD modules; LCD keypad assemblies; turnkey LCD product assembly. Singapore and Malaysia manufacturing locations. Gary Johnson, V.P. Sls.

916/783-7878, fax: 916/783-7845

VIDEO DISPLAY CORPORATION, 1868 Tucker Industrial Rd., Tucker, GA 30084

International headquarters of parent company, guiding a group of eight divisions, manufacturing CRTs, camera tubes, electron optics, and custom monitors.

A. J. Kenerleber, Pres./COO 770/938-2080, 1-800-241-5005 fax: 770/493-3903

VIDEO DISPLAY CORPORATION APEX ELECTRONICS DIVISION), 100 8th St., Passaic, NJ 07055 Manufacturers of electron-optics

equipment and manufacturing equipment. M. Dorota, Gen. Mgr.

201/773-1220, fax: 201/838-1298 VIDEO DISPLAY CORPORATION

(CHROMA VIDEO DIVISION), P.O. Box 119, White Mills, PA 18473

Manufacturers of entertainment and highresolution data display color tubes from 10 to 35 in. Automated 150,000-ft.² in-line production facility.

Ervin Kuczogi, Gen. Mgr. 717/253-3910, fax: 717/253-3912

VIDEO DISPLAY CORPORATION (DATA DISPLAY DIVISION), 1868 Tucker Industrial Rd., Tucker, GA 30084

Manufacturers of monochrome CRTs, avionics and military CRTs, and research and development. Robert S. Liss, Prod. Serv. Mgr. 770/938-2080, 1-800-241-5005

fax: 717/493-3903

VIDEO DISPLAY CORPORATION (NOVATRON DIVISION), 416 Alpine Blvd., Bossier City, LA 71111

Manufacturers of projection tubes and assemblies from 5 to 9 in. Automated 35,000-ft². in-line production facility. Charles Acurio, Gen. Mgr. 318/747-0140, fax: 318/747-6690

VIDEO DISPLAY CORPORATION (SOUTHWEST VACUUM DIVISION), 4601 Lewis Rd., Stone Mountain, GA 30083

Manufacturers of electron-optics, components, custom cathodes, and custom gun mounts.

Robert Wolfkiel, Gen. Mgr. 770/934-2245, fax: 770/934-2286

VIDEO DISPLAY CORPORATION (TELTRON TECHNOLOGIES DIVISION), Baltic Mews Corporate Center, 2 Riga Lane, Birdsboro, PA 19508

Manufacturers of general, military, and special-purpose image and cathode-ray tubes to the most stringent specifications. MIL-145208A qualified supplier to DoD, FAA, NASA, DESC, and government prime contractors.

Arthur Mengel, Gen. Mgr. 610/582-9450, fax: 610/582-0851

VIDEO DISPLAY CORPORATION (VIDEO ELECTRONICS DIVISION), Calle Zinc #99, Garza Garcia, Nuevo Leon 66210 Mexico

Manufacturers of monochrome CRTs from 7 to 24 in. Automated 150,000-ft.2 inline production facility. Fafael Garcia, Gen. Mgr +52-8-336-1897, fax: +52-8-336-0578

VIDEO DISPLAY CORPORATION (Z-AXIS DIVISION), 15 Eagle St., Phelps, NY 14532

Manufacturers of specialty monochrome and color monitors.

Carl Beechler, Gen. Mgr.

315/548-5000, fax: 315/548-5100

VIDEO INSTRUMENTS (VI), 2155 Bellbrook Ave., Xenia, OH 45385-4043

Manufacturers of a comprehensive product line of precision video generators and performance-evaluation equipment for all types of video displays, video cameras, and recorders/image processors. Standard products, modified equipment, and special custom instrumentation are available. John Harshbarger, Sls. Coord. 937/376-4361, 1-800-962-8905 fax: 937/376-2802

VIDEOTEX SYSTEMS INC., 8499

Greenville Ave., Ste. 205, Dallas, TX 75231 Manufacturers of display terminals with digitized video pictures, featuring TV quality pictures. Sold as a complete terminal or software only (T-VIEW). **Bob Gillman**

214/343-4500 VIDIWALL CORP., 30 Chapin Rd.,

Pinebrook, NJ 07058 Manufacturers of videowall processor,

stackable projection cubes, and monitors, and a complete line of peripheral control products and software. Michael Serwe, Mktg. Dir. 201/882-0584, fax: 201/882-0656

VIEWTEK, INC., 150 Executive Dr., Edgewood, NY 11717

Manufacturers of analog controller and interface cards for flat-panel LCDs. Complete line of flat-panel LCD monitors designed for industrial applications. Monitors are available in a range of diagonal sizes from 6.4 to 13.8 in. Don Buckout, Dir. Sls. 516/243-6500, fax: 516/243-3308

VILLA PRECISION, INC., 3027 W. Indian School Rd., Phoenix, AZ 85017-4186 Manufacturers of fully automatic precision

glass scribers and semi-automatic breaking equipment.

Thomas Muir, Pres. 602/266-2366, fax: 602/266-2926

VIOX CORP., 6701 Sixth Ave. South, Seattle, WA 98108

Manufacturers of electronic glass frits, powders, and preforms. Custom glass development of high-quality electronic glass materials from laboratory samples through large volume production. Offering economical melting with platinum crucibles. Tom Burnett, V.P. Mktg. & Engrg. 206/763-2170, fax: 206/763-2577

VIRATEC THIN FILMS, INC., 2150 Airport Dr., Faribault, MN 55021

Manufacturers of high-performance sputter-deposited optical thin-film coatings for electronic visual displays. Patented multilayer coatings are designed to reduce glare and reflection, improve light transmission and contrast, and provide static dissipation and electromagnetic shielding. Applications include directly coated CRTs (Optium 2020™), anti-glare filters, LCD projection panels, industrial instrumentation displays, automotive dashboard displays, and navigational (electronic maps) displays. Bruce Kuhlman, Dir. Sls./Mktg. 507/334-0051, fax: 507/334-0059

VIRTUAL VISION, INC., 7659 N.E. 178th Pl., Redmond, WA 98052

Developers/marketers of monocular, monochromatic 640 × 480 VGA digital head-mounted display systems that integrate either a 1-in.-diagonal AMLCD or an AMEL display for medical, manufacturing, military, and other highly customized professional applications. Sandra D'Adam, Mktg. Assoc. 206/882-7878, fax: 206/882-7373

VISONICS LABS, 8401 E. Desert Steppes Dr. Tucson, AZ 85710

Manufacturers of 3-D oscillographic displays in real time; multiple viewers each see a unique view without glasses; autostereoscopic, autoparallactic displays. Homer Tilton, Pres. 520/885-5840, fax: 520/885-2922

VISPRO CORP., P.O. Box 6239, Beaverton, OR 97007-0239 Manufacturers of structural ceramic pro-

ducts typically used as envelopes for CRTs. Multilayer ceramic packages include LTCC, HTCC, and MCMs. Steven E. Annas, Pres. 503/526-5268, fax: 503/644-9652

VISTA CONTROLS CORP., 27825 Fremont Ct., Santa Clarita, CA 91355

Manufacturers of helmet-mounted displays providing unrestrained inertialsensed head-position and high-resolution stereoscopic video using active-matrix VGA FPDs. The family of products include the Vista Vision, See-Thru-Armoor™, and the Wireless Stereo Vision System. Edie Hathaway, Sls./Mktg. Asst. 805/257-4430, fax: 805/257-4782

VISUAL INFORMATION TECHNOLOGIES,

INC., 3460 Lotus Dr., Plano, TX 75075 Designers and manufacturers of a second-generation image computer, targeted tor high-end imaging functionality, that introduces supercomputer performance on a single-board architecture. The VITEC-50 Image Computer™ delivers more than 300 MOPS to incorporate image-based information.

Karen Rodgers

214/596-5600, 1-800-325-6467 fax: 214/867-4489

VISUS LTD., 2A Katzir St., Tel-Hashoner,

Ramat-Gan, 52656 Israel Design, simulation, and production of backlights. CAD for optical/lighting systems design including simulation of light behavior, total internal reflection, and more. Design of low-profile planar light sources. Reflector design, and human factors and applications.

J. Lorch, Dir. Mktg. +972-3-535-0968, fax: +972-3-534-1650

VIVID SEMICONDUCTOR, INC., 7400 W. Detroit St., #100, Chandler, AZ 85226 Designers of a patented extended voltagerange architecture that allows for the fabrication of enhanced-performance FPDs with 24-bit color and full-motion video. Direct-drive LCD panels with superior image quality and lowest power consumption compared to other solutions. Driver products optimized for CRT replacement, MLS/AA STN, and low-power notebook TFTs. Available for a range of panel resolutions up to SXGA. Dan Clarke, V.P. Mktg./Sls 602/961-3200, fax: 602/961-1135

VIVITEK CO., LTD., 27 Industrial East 9th Rd., 1st Fl., Science-Based Industrial Park, Hsinchu, Taiwan, R.O.C.

Manufacturers of field-sequential full-color LCDs. Sizes range from 1-, 5-, 7-, and 9-in. monitors for industrial and commercial applications. ASIC IC and video boards for conversion from computer (VGA) or video (NTSC/PAL) signals to field-sequential format.

Henry Chern, Gen. Mgr. +886-3-5779-436, fax: +886-3-5779-449 VIVITEK CO., LTD./DELTA PRODUCTS CORP., 4905 S.W. Griffith Dr., Ste. 203, Beaverton, OR 97005

Manufacturers of a wide range of unique high-resolution small-size color displays, ranging from 1 to 10 in., using liquid-crystal color shutter (LCCs) technology. Also, large-area (21 in.) virtual-image displays and liquid-crystal shutter-based 3-D stereoscopic displays.

Sat Narayanan, Mktg. Mgr. 503/641-6246, 1-800-959-3660 fax: 503/641-7269

VL ELECTRONICS, INC., 3250 Wilshire Blvd., Ste. 1901, Los Angeles, CA 90010-1502

Manufacturers of custom and standard LCDs; custom and standard graphic, dotmatrix LCD modules; TN, STN, filmcompensated b/w STN, b/w double STN, color-coded STN, guest-host, Heilmeir, extended-temperature STN displays; touchsensitive screens; turnkey complete product development and manufacturing. Christopher Kreslake, Oper. Mgr. 213/738-8700, fax: 213/738-5340

VOICE CONNEXION, 17835 Skypark Cir., Ste. C, Irvine, CA 92714

Manufacturers of voice recognition and synthesis products for PCs. Also, handheld computers with voice I/O, keypad, and barcode.

Shirley Dworak, V.P. Sls. 714/261-2366, fax: 714/261-8563

VOLTARC TECHNOLOGIES, INC., 186 Linwood Ave., P.O. Box 688, Fairfield, CT

Manufacturers of custom-designed hotand cold-cathode fluorescent lamps for use in backlighting of liquid-crystal displays, and aperture lamps for use in scanning and inspection.

Ellen Debs, Sls. Engr. 203/256-4163, 1-800-962-6366 fax: 203/259-1194

WACOM TECHNOLOGY CORP., 501 S.E. Columbia Shores Blvd., Ste. 300, Vancouver, WA 98661

Manufacturers of digitizer pen tablets and pen input subsystems. The patented, battery-free, eraser-pen technology works with a variety of display devices, including TFT color LCDs. The low-frequency rf signal is fully compliant with host radiocommunication systems, and is integrated into many ruggedized and commercial pen computers.

Steve Sechrist, Technology Mktg. Mgr. 360/750-8882, 1-800-922-6613 fax: 360/750-8924

WACOM CO., LTD., 4-1-12 Ikebukuro, Toshima, Tokyo 171 Japan Manufacturers of LCD integrated

digitizers with a cordless stylus; LCD integrated data terminal with handwriting recognition. Masahiko Yamada, Dir. Intl. Div.

+81-33-985-0097, fax: +81-33-985-8636

WAMCO, INC., 11555 A Coley River Circle, Ft. Valley, CA 92708 Developer and manufacturer of optical

filters for all display applications. Filters optimized for contrast enhancement, color correction, and NVIS compatibility. Producer of customized NVIS diffuser/filter for AMLCD backlighting. On-site optical and environmental test capabilities. Exclusive U.S. distributor of Oshino sub-miniature

incandescent lamps. Harry Reichardt, SIs. Engr. 714/545-5560, 1-800-225-4810

fax: 714/545-6093

industry directory

WANDE, INC., 4088 Lindberg Dr., Dallas, TX 75244

Manufacturers of a complete line of automated equipment for LCD production. The integrated system includes glass scribing/breaking/polishing, glass cleaning, imaging, developing/etching/stripping, printing/coating, buffing, spacer application, liquid-crystal filling, ITO sputtering subsystems, etc. David Chen, V.P. Mktg./Bus. Dev.

972/701-8886, fax: 972/701-8885

WATKINS-JOHNSON COMPANY,

Semiconductor Equipment Group, 440 Kings Village Rd., Scotts Valley, CA 95066 Manufacturers of high-throughput continuous process APCVD reactors for thin-film deposition in flat-panel-display array fabri-cation. The WJ 16CVD system provides high-quality deposition of SiO₂ dielectric films for large-size AMLCD substrates and most advanced TFT devices. High utilization capability and high throughput provide for extremely low total cost of

ownership. Linda Johnson, Sls./Mktg. 408/439-6265, fax: 408/438-6827

WELCH ALLYN, Lighting Products Div., 4619 Jordan Rd., Skaneateles Falls, NY 13153-0187

Manufacturers of miniature metal-halide arc lamps with arc gaps of 1-2 mm. Lamps are ideal for compact LCD projectors. Jim Kiesa, Sls. Mgr. 315/685-4347, fax: 315/685-2854

WELLS-GARDNER ELECTRONICS CORP., 2701 N. Kildare Ave., Chicago, IL 60639

Manufacturers of monochrome and color CRT displays. Products range from CGA through SVGA. Custom and standard products are available. Video-related contract assembly also available. Lawrence J. Brady, V.P., Sls. Mgr. 312/292-5640, fax: 312/252-8072

THE WESTAIM CORP., 10101 114th St., Ft. Saskatchewan, Alberta T8L 3W4, Canada

Manufacturers of thick dielectric electroluminescent (TDEL) displays and light sources, including 120-mm-diagonal monochrome and multicolor quarter-VGA panels, and high-brightness 90-mm-character-height numeric and alphanumeric displays. Super-bright fixed-format light sources are also available. Don Carkner, Appl. Engr. 403/992-5320, fax: 403/992-5325

Westar Corp., 11520 St. Charles Rock Rd., Suite 208, St. Louis, MO 63044

Designers/manufacturers of AMLCD interface, test, and evaluation products. Systems are turnkey or customized, including drive electronics and video conversion and processing. Products include cell drivers, motion base systems, and functional testers. Michael T. Madden, Prog. Mgr. 314/298-8748 x286, fax: 314/298-8067

WESTERN DIGITAL, 800 E. Middlefield Rd., Mountain View, CA 94043 Manufacturers of high-performance

graphics display controllers and sub-systems for PC platforms for CAD/CAM, engineering, and desktop applications. Charles H. Haggerty, CEO 415/960-3353, 1-800-433-5780 fax: 415/747-1398

WESTLAND ELECTRONICS LTD., P.O. Box 214, Old Chatham, NY 12136-0084 Consulting services for electronic information displays. Technology and marketing studies and reports on computer graphics, presentation systems, and flat-panel displays. Conferences and seminars on information displays. Patent reviews. Sol Sherr, Pres. 518/794-8151

WHITTAKER ELECTRONIC SYSTEMS, 1785 Voyager Ave., Simi Valley, CA 93063 Manufacturers of MIL-SPEC high-resolution color and monochrome monitors for domestic and international naval appli-cations that pass MIL-S-901C Grade B shock. Also provide plasma programmable entry panels for airborne applications. Stephen C. Jones, Mgr. Product Dev. 805/584-8200, fax: 805/527-8332

WICO, 6400 W. Gross Point Rd., Niles, IL 60648

Manufacturers of analog and digital joystick controls for video arcade games and home computer entertainment systems. Dave Ruber, Sls. Mgr. 1-800-323-4258, fax: 312/647-8526

JAMES WILSON, 1640 5th Street, Ste. 224, Santa Monica, CA 90401 Manufacturers of illuminated panels and keyboards.

Trevor Bray, Sales Mgr. 310/576-0783, fax: 310/393-6040

WINSOR CORP., Ceramic Lighting Div., 410 S. 96th St., #7, Seattle, WA 98108 Manufacturers of high-performance backlights for LCDs. These are typically flat monolithic fluorescent lamps using hot-cathode technology to achieve high output and high luminous efficacy. John Pace, Mgr. Sls. Engrg. 206/767-4070, fax: 206/767-3747

WINTRON, INC., 250 Runville Rd., Bellefonte, PA 16823

Designers/manufacturers of custom deflection yokes, high-voltage power supplies, flybacks, transformers, width coils, linearity coils, degaussing coils, and specialty/custom coils. Engineering services also available. Both commercial and military products available. Melissa Hein, Dir. Mktg. 814/355-1521, fax: 814/355-1524

J. A. WOOLLAM CO., INC., 650 J Street, Ste. 39, Lincoln, NE 68508

Providers of non-contact measurement of thin films (thickness and optical constants) used in the production of flat-panel displays. Manufacturers of a line of spectroscopic ellipsometers for use in R&D and QC of flat-panel thin-film processes. Gerry Cooney, Engr. 402/477-7501, fax: 402/477-8214

WORLD PRODUCTS, INC., 19654 8th St. East, Sonoma, CA 95476 Distributors of NEC EL lamps and

inverters; NEC ac plasma displays; STC/ Displaytech custom LCDs; Goldstar LTD LCDs

Bruce Francisco, Sls. 707/996-5201, fax: 707/996-3380

WPI ELECTRONICS, INC., 40 Depot St., Warner, NH 03218

Manufacturer of electronic ballasts for metal-halide, halogen, and xenon projection systems. Standard, custom, and semicustom ballasts designed to worldwide standards requirements, with features such as hot restrike, remote ignitor, dimming, and auto line select Steven B. Seiavitch, V.P. Sls. & Mktg. 603/456-7111, fax: 603/456-2498

WYLE ELECTRONICS, 15370 Barranca Parkway, Irvine, CA 92618 Distributors of flat-panel displays by

Sharp Electronics. Products include AMLCDs, passive color and monochrome displays, character displays, and EL displays. Integrates displays in ISO 9002 facility.

714/788-3720, 1-800-283-9953 fax: 714/789-1461

XANTEK, INC., A Taiyo Yuden Co., 1770 La Costa Meadows Dr., San Marcos, CA 92069

Manufacturers of low-profile dc to ac inverters are designed to drive CCFTs for LCDs. In addition, a line of super-compact dc/dc converters. Scott Sato, Bus. Mgr. 619/471-4001, 1-800-493-6835 fax: 619/471-4021

XENTEK, INC., 1770 La Costa Meadows Dr., San Marcos, CA 92069 Manufacturers of low-profile dc/ac

inverters designed for driving CCFLs. Offering a line of super compact dc-dc converters for use with LCDs. Scott Sato, Bus. Mgr. 760/471-4001, 1-800-443-6835 fax: 760/471-4021

XEROX COLOR GRAPHICS, 5853 Rue Ferrari, Bldg. A, MS 3-12, San Jose, CA 95138

Manufacturers of engineering copiers, printers. Versatec plotters, and supplies for document management. Pamela Rivers, Mktg. 1-800-538-6477

XEROX IMAGING SYSTEMS, 535 Oakmead Parkway, Sunnyvale, CA 94086

Manufacturers and marketers of the Kurzweil intelligent scanning system for PCs, and data copy scanners and software imaging products for the Apple Mac and PCs

408/245-7900, 1-800-248-6500 fax: 408/522-3800

XMR INC., 47281 Bayside Parkway, Fremont, CA 94538

Manufacturers of high-power industrial excimer lasers and laser-based systems for use in manufacturing high-definition display devices. Developed and proven processes for recrystallizing a-Si to poly-Si for improved AMLCD manufacturing. Len Goldfine, Dir. Sls./Mktg. 510/668-1517, fax: 510/668-0169

XTEK ELECTRONICS, 27101 Aliso Creek Rd., Aliso Viejo, CA 92656

Distributor of LCDs specializing in VGA graphic displays. Design assistance and replacement displays available. Buyer of all types of LCDs and re-marketer at up to 50% off normal cost. Randy Schafer, Pres. 714/448-9281

XYBION ELECTRONIC SYSTEMS, 8380 Miralani Dr., San Diego, CA 92126-4347

Manufacturers of low-light intensified gated CCD scientific imaging systems. Scientific-application video cameras and image-processing software, including

intensified, multispectral and gated video cameras. Integrated and cooled b/w and color cameras produced for the microscopy market.

Richard A. Sturz, Sls. Mgr. 619/566-7850, fax: 619/566-2032

YAMAHA SYSTEMS TECHNOLOGY, 100 Century Center Court, Suite 800, San Jose, CA 95112

Manufacturers of single-chip or board-level IBM VGA, EGA, CGA, MDA, and Hercules compatible graphics controllers for driving EL, plasma, LCD (color or mono-chrome), or CRT displays all from a single device.

Robert Starr, Natl. Sls./Mktg. Mgr. 408/437-3133, 1-800-543-7457 fax: 408/437-8791

YOUNG TECHNOLOGY, 48012 Fremont Blvd., Fremont, CA 95051

Manufacturers of a line of thermal press equipment used for bonding of heat-seal connectors for connecting flat-panel displays to PCBs. Dan Fritschen, Sls. Engr. 510/490-6373, 1-800-394-6373 fax: 510/490-3214

CARL ZEISS, INC., Microscope Division, One Zeiss Dr., Thornwood, NY 10594 Manufacturers of advanced microscope

systems for the testing, inspection, and measurement of all microelectronic components. Microscopes available for all applications including stereo, confocal, video, and fully automated systems. Also, image analysis software to support all applications. Microscope Div.

r

d

7

Ľ

W

P

ne

m

C/

Se

N

1-800-233-2343, fax: 914/681-7446

ZENITH COMPONENTS GROUP, 1000 Milwaukee Ave., Glenview, IL 60025 Manufacturers of 5–19 in. (monochrome) and 9-25 in. (color) displays with a wide range of phosphors, face treatments. operating frequencies, and auxiliary power. Robert Uhlir

708/391-7733, 1-800-827-8720 fax: 708/391-7078

ZENITH ELECTRONICS CORP., Rauland Div., 2407 W. North Ave., Melrose Park, IL 60160

Manufacturers of 19V, 20V, 25V, and 27V consumer-grade CRTs, with expansion to 17-in. conventional monitor tubes in 1997. Also, manufacturers of electron guns for both consumer and display-grade applications. Richard Steinmetz, V.P. Tech. Sls./Mktg.

708/450-8306, fax: 708/450-8393

01 PRODUCTS, INC., 3050 Hillcrest Dr., Ste. 100, Westlake Village, CA 91362 Manufacturers of head-mounted display products designed for industrial, medical, and virtual-reality OEMs, featuring the PT-01 professional-use HMD, which permits extended use without eyestrain and provides multiple adjustments for userselectable image placement. Garrick Matheson, V.P. Mktg. 805/446-1453, 1-800-538-3008 fax: 805/373-8966

ZYTRONICS, INC., 70 Tirrell Hill Rd., Bedford, NH 03110

Manufacturers of high-quality low-tomedium-volume custom linear and switchmode power supplies. Kerry D. Smith, Dir. Mktg./Sls. 603/623-8888, 1-800-770-8880

fax: 603/623-4009

Directory notes

• Listings are free and without obligation. Companies advertising in this issue are listed in boldface type in both Parts I and II.

Suggestions for new categories of products and services relevant to the display industry, or further subdivisions or clarification of existing categories, are welcomed.

• If your organization is not included in this year's directory and would like to be listed in next year's directory, the Twelfth Annual Directory, please write to Jay Morreale, c/o Palisades Institute for Research Services, Inc., 201 Varick Street, Suite 1006, New York, NY 10014; 212/620-3371, fax 212/620-3379.

Company divisions can be listed separately if they are at different locations with different product lines – please submit a separate application form for each division.

Application forms for the *Twelfth Annual Directory of the Display Industry* will be mailed with the February 1998 issue.



New York, NY 10014.



NOVEMBER

Third International Conference on the Science and Technology of Display Phosphors HUNTINGTON BEACH, CALIFORNIA NOVEMBER 3 – 5, 1997

 An international conference on the future prospects of phosphors for: __ELDs - FEDs __CRTS - Plasma Displays __PL Devices - LC Backlights

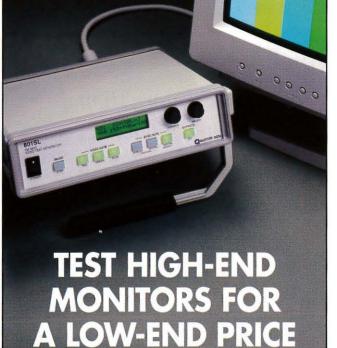


Fifth Color Imaging Conference: Color Science, Systems & Applications SCOTTSDALE, ARIZONA NOVEMBER 17 – 20, 1997

 An international multidisciplinary forum for dialogue on: — Creation and capture of Color Images — Color Image reproduction and interchange — Co-sponsored with IS&T.



For additional information: Lauren Kinsey Society for Information Display 1526 Brookhollow Drive Santa Ana, CA 92705-5421 714/545-1526, fax - 1547 socforinfodisplay@mcimail.com



Test displays up to 1600 x 1280 with the new 801SL video generator. The programmable clock rate of up to 160 MHz generates up to 256 colors from a palette of 16.7 million colors.

Over 150 test images and over 100 formats come preprogrammed. A builtin graphics user interface as well as a PC Windows-based interface program make customizing images and formats easy. BNC, CGA/EGA, Mac, VGA, and VESA output connectors make it simple to service most kinds of monitors.

Portable, lightweight and userfriendly, the 801SL also has mounting options for rack or bench, plus an optional carrying handle/support stand.



2111 Big Timber Road • Elgin, IL 60123 USA Phone: (847) 888-0450 • Fax: (847) 888-2802 URL: http://www.quantumdata.com E-mail: sales@quantumdata.com

Microsoft Windows is a trademark of Microsoft Corporation.

SID Conference Calendar

Next Show! The 1997 International Display Research Conference

The 17th edition of the International Display Research Conference will be held at the Sheraton Centre Toronto Hotel in Toronto, Canada on September 15–19, 1997. The conference will emphasize research and fundamental development activities in display technology and related human interfaces. Full-day workshops on September 15 and 19 will focus on passive LCDs and materials; AMLCDs; and light-emitting materials and devices. Invited talks for these workshops will be presented in a format designed to stimulate discussion on recent advances and future directions of display research. Papers relevant to the advancement of the state of the art of electronic displays will be presented September 16–18, 1997.





NOVEMBER

Third International Conference on the Science and Technology of Display Phosphors HUNTINGTON BEACH, CALIFORNIA NOVEMBER 3 – 5, 1997

 An international conference on the future prospects of phosphors for: ____ELDs ____FEDs ____CRTs ___Plasma Displays ____PL Devices ___LC Backlights

For additional information: Lauren Kinsey Society for Information Display 1526 Brookhollow Drive Santa Ana, CA 92705-5421 714/545-1526, fax - 1547 socforinfodisplay@mcimail.com **16**⁹⁷

NOVEMBER

Fifth Color Imaging Conference: Color Science, Systems & Applications SCOTTSDALE, ARIZONA NOVEMBER 17 – 20, 1 9 9 7

• An international multidisciplinary forum for dialogue on:

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

Display Works 98: SAN JOSE, CALIFORNIA JANUARY 20–22, 1998

20

JANUARY

98

- An international conference addressing all aspects of Display Manufacturing including:
- Flat Panel and CRT Manufacturing
 - Display Materials
 - Manufacturing Equipment
- Cost Reduction and Yield Improvement
- Industry Forecasts
- Investor Presentations
- International Standards

S I D

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



3M⁺ Dual Brightness Enhancement Film

Any way you look at it, 3M[™] DBEF improves display brightness.

The benefits of 3M Dual Brightness Enhancement Film (DBEF) are truly dual. It not only boosts display brightness up to 60%, but it does so



Enhanced screen brightness

over the entire LCD

viewing range. With DBEF, you can increase your screen brightness OR translate

the brightness into power savings. And by saving power you not only get more time

between battery charges, but longer lamp life as well.

What is 3M DBEF? It's actually a thin film reflective polarizer that's placed



Increased power efficiency

right behind your LCD. It adds virtually no weight or thickness to the display, yet it's amazingly effective at recycling light otherwise lost to absorption. The wide angle brightness provided by DBEF is perfect for multi-viewer LCD applications such as



monitors, TVs, instrumentation and multi-media notebook computers.

For more information on 3M Dual Brightness

Enhancement Film - or any of our other 3M[™] Optical Enhancement Films - call us at 1-800-328-7098, ext. 1. Any way you look at it, your displays will be better.



Introducing the ultimate screen test.

MINELTA SPECTADRADIOMETER CS-1000

Minolta's new CS-1000 Spectroradiometer. It turns in a winning performance measuring light and color...every time.

Now you can get CRT, LCD, lamp and LED testing right

on the first "take." The CS-1000 offers the perfect combination of absolute accuracy, short-term repeatability and high speed for dozens of applications.



Performs solo or with a PC.

Lightweight and portable, the CS-1000 can measure luminance, color and relative color temperature either as a stand-alone unit or connected to a PC. It includes user-friendly, flexible Windows[™]-based software that

lets you easily display, calculate, print and store measured results.



The CS-1000 utilizes

autosynchronization for greater accuracy while sensor cooling improves the S/N ratio for precise low-luminance measurement. Plus, its minimal polarization error is ideal for measuring LCDs.

Minolta. The world leader in optical technology brings you another star performer: the CS-1000 Spectroradiometer. For more information, call toll free 1-888-ISD-COLOR today, or check out our Website at www.minoltausa.com



INSTRUMENT SYSTEMS DIVISION

ISO 9001 CERTIFIED

Our Customers Are As Varied As Our Films.

By providing the world with the best sputter coated film technology for over a decade, Courtaulds Performance Films has helped a wide variety of industries launch innovative products. Brighter longer-lasting EL lamps, transparent touch panels, membrane switches, specialty two-side-coated satellite blankets, and miniaturized fine-line flex circuits have all benefited from the consistency and cost effectiveness of Courtaulds' sputter coated films. Backed by our superior coating technology, engineering, and technical support, Courtaulds will help you convert ideas into realities. So, no matter what the application, bring your ideas to Courtaulds. We have your film needs covered.



21034 Osborne Street • Canoga Park, California 91304 • 818.882-5744 • FAX: 818.882-6519 Circle no. 34

display continuum

continued from page 4

by-side screens for simultaneous competition, the feeling of motion and depth is quite convincing because of the wide periphery-encompassing view. So, can we honestly say that the Virtual Reality Chair happened on almost the day I predicted? Well, it kind of did and kind of didn't. The GameWorks version sure looks



like one, moves like one, and sounds like one, *but* they're not really a consumer product for the home. And most important, what happened to the 3-D display?

The consumer-product part we should and could have anticipated. New technological concepts often find their first introductions in commercial applications, and then, when production volumes grow enough to drive prices down, home sales develop. A good displayrelated example of this is projection television. It developed its initial successful market for group viewing in sports lounges and only later appeared as a lower-priced product for home use.

But 3-D? When are we going to see really good 3-D? Doesn't the very concept of virtual reality demand that we have realistic 3-D images into which we can immerse ourselves?

Not ever having seen a compelling demonstration of 3-D, I decided to do a bit of exploring on my own. What would it take to create a 3-D image that is as good as my eyeballs? I decided that the first step would be to get two images with resolution better than my eyeballs and then to keep these images free from visible blemishes. So out came the 6 × 7-cm format camera, and, with careful alignment on a sunny and calm day, I photographed positivetransparency stereo-image pairs of scenes around our house and neighborhood. These larger transparency photographs did indeed produce images that were as perfect as my eye could discern. All the color, tonal depth, and dimensionality were there - but the scenes didn't look real. They looked like I had photographed accurately rendered models of our house and neighborhood. So much for this try at virtual reality!

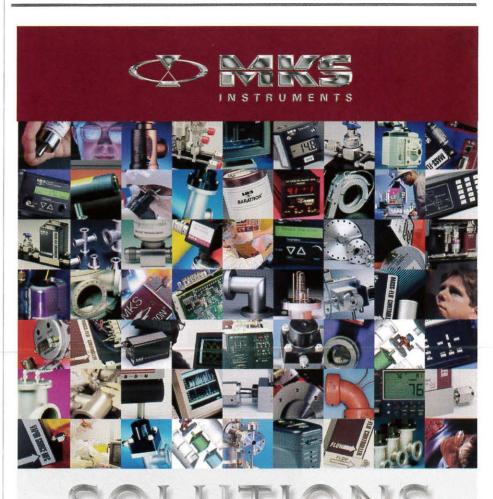
But what had gone wrong? There were certainly more pixels than my eye knew what to do with. The stereo separation was just right. There was no "noise" in the information content of the picture. But why the look of artificiality? Why didn't my images look or feel like the scenes I had photographed? It couldn't be the lack of motion, since I had taken the photos on a calm day and buildings and furniture don't move around much anyway. The stereo effect was accurate and every object was in sharp focus.

Subsequent observations and discussions with colleagues at Sarnoff and an over-dinner discussion with Rick Knox of Compaq have led me to the following conclusions: *Our perception of reality is not only made up by pro*- cessing the two images as seen by our corresponding eyeballs – or sometimes one eyeball as we move through a scene – but is also affected by our slightest head movements and changes in the focus plane as our eyes continuously scan a scene.

As I tried these experiments for myself using the familiar settings I had photographed, at first I couldn't believe how sensitive the human visual system is to such effects. I found that I could sit at my desk, look out at the house across the street, and detect changes in parallax several hundred feet away just by moving my head a fraction of an inch. How will we ever create an interactive virtual scene that can simulate this level of positional sensitivity on an instantaneous and interactive basis? And even if we could, that is only for a single viewer. Wow, I had no idea that adding 3-D to virtual reality would be this tough. No wonder the folks who created GameWorks decided on a nice easy-to-implement projection TV system.

We engineers love challenges and I must admit that I also like a bit of a stretch once in a while. Furthermore, I hate to ever admit that something can't be done - or at least that I haven't a clue as to how to do it. Nevertheless, when I combine the challenges of two high-resolution images (as a minimum, at the limit of eye resolution) with the need to dynamically and instantaneously change these images in response to a person's slightest head movement, along with the need to anticipate and accommodate where our eyes are focusing within a scene, I admit it: I haven't a clue as to how we can accomplish all that with an external imaging system. The only way I can even imagine making this work is perhaps by direct projection onto the retina or direct coupling into the optic nerve. At least we could then take advantage of the very small high-resolution and color-sensing imaging area within our eyes so as to limit the amount of information that needs to be processed to create the sense of reality.

Perhaps the direct coupling to an optic nerve sounds a little too drastic for now. But direct projection of high-quality images onto the retina may not be such a stretch. In fact, it's being done right now with a research instrument called a scanning ophthalmoscope. This may be the one application that encourages this technology to develop – as the only conceivable way to implement the virtualreality dream. In the meantime, what is to become of all the current attempts at 3-D imaging? I believe that today's virtual-reality "glasses" (in both stereo and mono versions) will find use in specialty areas such as medical imaging, where a sensor-acquired and computer-processed image can be interactively superimposed on the actual patient during surgery, in



We build instruments. But we're in the business of providing solutions. MKS builds the most exacting and reliable gas management instrumentation in the world — instruments that measure, control, isolate, calibrate and analyze gases in many different vacuum processes. But to our customers, our real products are the solutions our instruments bring to these manufacturing processes. So we build products that are more repeatable, more accurate and offer the highest levels of performance. We focus on excellence around the process, from our research and development people who listen to your needs, to innovative engineering and design systems, to a solid worldwide engineering, sales and service network that helps you bring our products together to create a solution. Because when you're in the business of providing solutions, nothing less than the most complete solution will do. To find out more about MKS solutions, call us at 1-800-227-8766.

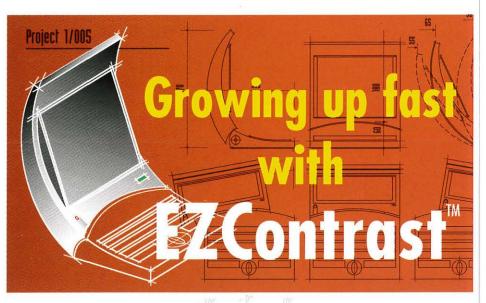
Six Shattuck Road, Andover, MA, USA 01810 Tel: (508) 975-2350 Fax: (508) 975-0093 e-mail: mks@mksinst.com http://www.mksinst.com ©1997 MKS Instruments, Inc. All rights reserved.

display continuum

dangerous or remote environments where only a robot can be sent to act as the "eyes" for a human, or for creating 3-D models of new product concepts and trying out their function and/or assembly sequences. There are so many of these interesting applications that it will be years before we approach maturity or saturation in exploring them. And sure, we

> REFLECTIVE now available!

> > ELDIM



Realizes a +/- 80° incident angle, 0-360° azimuth angle coverage colorimetric characterization in less than

1 minute.

Through fast, simple and accurate measurements and analysis of :

> Photometric

- > Colorimetric
- > Optical

properties and characteristics versus viewing angle and under various device conditions (illumination, voltage, temperature...). Suitable for LCDs and FPDs components evaluation (contrast, transmittance, reflectance, tilt angle, retardation...) in R&D, Production and QA.

ELECTRONICS FOR DISPLAYS AND IMAGING DEVICES

4 rue Alfred Kastler 14000 CAEN - France **Phone : + 33 2 31 94 76 00 - Fax : + 33 2 31 47 37 77** EMail : eldim@eldim.fr — Internet address : http://www.eldim.fr

Circle no. 37

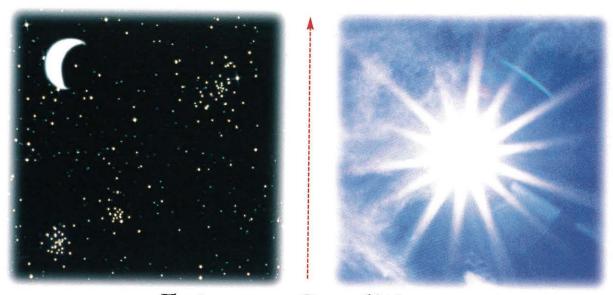
will have some games and other entertainment experiences that purport to be 3-D, such as the one I proposed in my December 1994 column, "The Tour Bus with a Thousand Eyes."

But realistic 3-D images for group viewing, where an audience can become immersed in a replicated scene? I believe this will only happen "A long, long time from now and in a galaxy far far away ..." In other words, not in my lifetime and not in yours.

Fortunately, we humans don't need all that much reality to experience deep emotions. We do quite well with the limited and unreal images of movies, live theater, operas, and even books. Our imaginations nicely fill in the missing pieces and maybe even protect us by keeping us from getting too involved.

The need to adjust our expectation for what is likely to be the reality part of virtual reality seems to be occurring already within the display community. The many efforts to produce small displays, which were initially intended for 3-D eyeglass products, have now mostly been redirected to other product opportunities such as cell phones and pagers with e-mail viewers. These small displays, which are going to be built right into the phone or pager, are demonstrating VGA-like resolutions and the ability to display full pages of text in sizes no greater than a couple of centimeters. The implementation can be either as a small handheld viewer or as an attachment to a lightweight eyeglass frame. It looks like we have managed to create yet another way to overwhelm ourselves with information as we move about. It just won't be the realistic, three-dimensional kind that might cause us to lose contact with our real reality.

It was great to have the opportunity to interact with many of you during the SID Symposium in Boston. Thanks for all the good words and constructive suggestions. To keep the information flowing, you can reach me by e-mail at silzars@ibm.net, by phone at 425/557-8850, by fax at 425/557-8983, or by the original virtual-delivery medium – the post office – at 22513 S.E. 47th Place, Issaquah, WA 98029. ■



Extreme Conditions --





Call for Extreme Displays

Laptop displays just don't cut it. IQT's true production capabilities meet or exceed every requirement for avionic, military, and ruggedized high-performance applications: < 1% specular reflectance, < 0.25% diffuse reflectance, > 200 fL output luminance, and wide temperature range.



Advanced avionic AMLCDs start with our own highquality display glass — the best available anywhere. We go to extremes so you don't have to. Our integrated information management and control system works to ensure rapid concept-to-product turnaround, on-time delivery, low prices, and responsive service and support. Find out more. Call us today at 510-249-0500. Fax 510-249-0550.

Or write us at 48611 Warm Springs Boulevard, Fremont, California 94539.

4" X 4" AVIONIC 6.2" X 8.3" AVIONIC



CUSTOM DISPLAYS TO 17" OPTIMIZED PERFORMANCE

HIGH-PERFORMANCE AMLCDS FOR DEMANDING APPLICATIONS

Circle no. 38



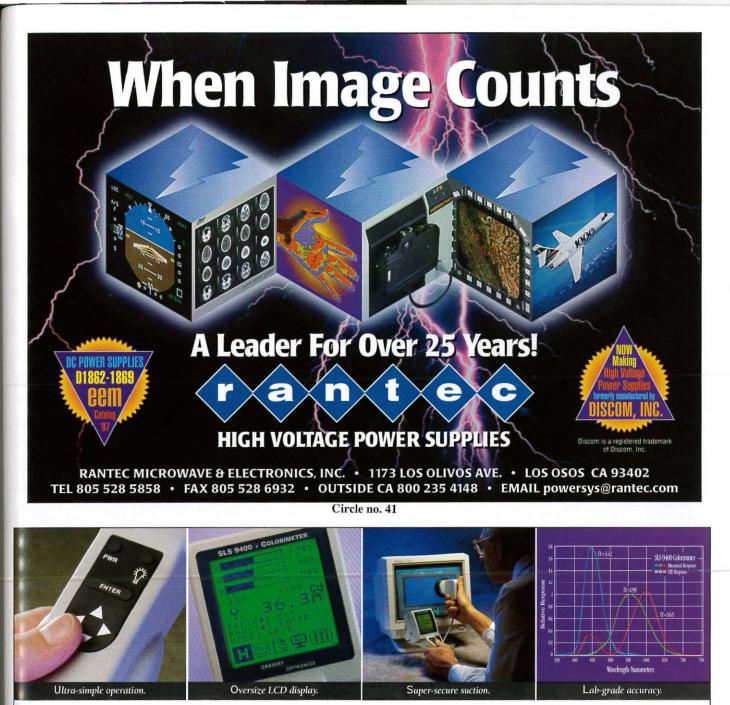
Circle no. 39

The Only Complete (220 MHz Bandwidth) Monitor Analyzing Solution!

Introducing the only complete system for troubleshooting, testing, and aligning high bandwidth computer monitors from the input to the CRT (including color output analysis) for servicing security and growth for years to come.



Circle no. 40



The Graseby SLS 9400 Colorimeter. Unsurpassed Performance And Convenience.

Want to make your job easier and more effective? Pick up the SLS 9400 Colorimeter from

Graseby Optronics, a world leader in advanced photometric instrumentation.

First you'll notice its unique ergonomic design. Comfortable. Extremely light weight. And tilted for easy viewing—even when you set the instrument on a tabletop.

Next you'll discover its refreshingly simple operation. Including intuitive, menu-driven commands. A four-position toggle switch that puts total control at your fingertips. An oversize, backlit LCD display for strain-free viewing. And

an RS-232 port for remote operation. It's all so simple, you'll hardly need the instructions.

Then there's the sensor head. You'll enjoy a low-profile design that's perfect for hard-to-reach places. And a vacuum-seal suction cup that holds securely—yet releases in moments.

And the performance? Nothing short of lab grade. A combination of four sensors (others

use only three) closely mirror the CIE tri-stimulus curve, making it ideal for a complete range of demanding applications.

Oh yes-the SLS 9400 also beats competitive units on price, too.

For more information, please call today. (407) 282-1408. Fax (407) 273-9046. Or write 12151 Research Parkway, Orlando FL 32826.







First US company to provide equipment for AMLCD production

First lithography system capable of processing 500mm x 500mm plates

First to automatically compensate for in-process substrate shrinkage

First to eliminate costly send-ahead substrates with automatic self-calibration

First to offer on-line support and service documentation (PrinterDOC™)

First user-friendly graphical job set-up & execution software (PanelCAD[™])

First to offer patented dual-lens design for added flexibility and productivity

First to introduce a stepper designed specifically for FED production (PanelPrinter™ 5200HR) SINCE 1986, we've supplied world leaders in microelectronics production with the tools they need to become world leaders in FLAT PANEL DISPLAY production.

- Check the specs. For all advanced FPD applications, you'll find the most COMPETITIVE SPECIFICATIONS in the industry.
- We're focused on the issues that concern you most. Display yield. HIGH THROUGHPUT. Cost-of-ownership.
- Quick, simple set-up and operation. Continuous self-calibration. And the HIGHEST RESOLUTION in the industry.

Our focus on the future means you'll be prepared for next-generation production challenges with flexible architecture to handle a wide range of substrates, LOW COST-OF-OWNERSHIP, and responsive service and support.

And with the development of the first stepper designed specifically for the production of Field Emission Displays, MRS continues to advance the state-of-the-art in **EMERGING** flat panel technologies.



What's next? Find out now. Call us today at 508 250 0450

ADVANCED FLAT-PANEL MANUFACTURING SOLUTIONS



10 ELIZABETH DRIVE 📕 CHELMSFORD, MA 01824 📕 TEL 508.250.0450 📕 FAX 508.256.3266

Circle no. 43

SID '98

Anaheim, California

Anaheim Convention Center

May 17-22, 1998

Mark Your Calendar Now!

Shield Yourself From The High Cost Of "Off-The-Shelf" Monitor Shields.



Magnetic interference can make your CRT display jittery and distorted. But most off-the-shelf monitor shields are bulky, overbuilt, and expensive. On the other hand, custom monitor shields from Eagle Magnetic can provide unsurpassed protection from magnetic interference ... at a cost lower than off-the-shelf shields!

- Ideal for: military, industrial, power plant, government, medical, research, and office applications – even the harshest magnetic environments.
- Choice of materials or a nested combination to meet your environmental requirements.
- Custom designs that fit your monitor precisely.
- Available in closely matching computer colors to enhance appearance.
 Matching bezels and shrouds provide additional facial shielding.
- Matching bezels and shrouds provide additional
 Fast turn around of prototypes and production.



EAGLE MAGNETIC CO., INC. P.O. Box 24283 • Indianapolis, IN 46224 PHONE (317) 297-1030 FAX (317) 299-1323 E-MAIL: INTERNET EAGLEAAA@AOL.COM

Circle no. 44

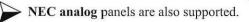
Interface Solutions for flat panels

Speed up development and product realisation time with our high quality flat panel interface controllers for your LCD, Plasma or EL projects. Suitable for small or high volume projects and monitor production.

Analog - Computer

AC series: A range of interface controllers for LCD, Plasma or EL, to connect to analog graphics source. VGA (640x480), SVGA (800x600), XGA (1024x768), SXGA (1280x1024).

SV-Series: A combination interface for both computer graphics and video (PAL, NTSC) for LCD & Plasma.



<u>Digital View</u>

USA: Tel: 408-287 4935, Fax: 408-287 3952 **England:** Tel: (0)1438-816 600, Fax: (0)1438-816 909 **Hong Kong:** Tel: 2861 3615, Fax: 2520 2987

Bus card - PC

DC series: Includes PCI bus LCD graphics card for providing LCD digital signal output from a PC.



Video - PAL/NTSC

PN series: Advanced multi system video interface for TFT LCD and Plasma panels.

Accessories: A wide variety of support accessories.

Enclosure options:

- Open frame kits: panels & interface
- controllers in easy to use frames.
- Industrial display systems
- Desktop monitors
- LCD multimedia systems

Internet: www.digitalview.com Email: sales@digitalview.com

SOCIETY FOR INFORMATION DISPLAY

Detroit Chapter to Sponsor FPD Strategic Forum and Technical Symposium

The Metropolitan Detroit Chapter of the Society for Information Display (SID) and the University of Michigan's Center for Display Technology and Manufacturing are sponsoring the Flat Panel Display Strategic Forum and Technical Symposium on September 22 and 23, 1997, at the Marriott Hotel in Ypsilanti, Michigan. The symposium incorporates the successful Vehicle Displays Conference, which was run as a separate event in 1995 and 1996.

This symposium features two days of sessions on topics of strategic importance to the global and U.S.-based display industry. On the first day, the important issue of next-generation display manufacture will be discussed by the current leaders of the flat-panel-display industry. Challenges in technology, manufacturing, markets, location, and timing will be considered. The U.S. role in displays, including the often overlooked areas of infrastructure and electronics, as well as panel manufacture, will be discussed by key U.S. players.

The second day will begin with a session on the important and growing vehicle displays market, including strategic perspectives by the major automobile makers. Two technical sessions will follow: the first on issues in civilian and military vehicle displays, the second on emerging new technologies. A poster session is also to be included in the program. As in last year's Vehicle Display Conference, an exhibit area is available to show items of interest to the display community.

To obtain more information about attending, contact Robert Donofrio, Display Device Consultants (DDC), Ann Arbor, Michigan; telephone 313/665-4266, fax 313/665-4211 or consult SID's Web site at http://www.sid.org.



SID Publications on the Web

Are you trying to remember where you saw that article on optics for helmet-mounted displays or on how you have to modify the modulation transfer function when it's applied to LCDs? Help is at hand.

SID's Web site now allows you to search all of the following:

Proceedings of the SID from 1976 to 1991 Journal of the SID from 1993 to 1996 Information Display from 1994 to 1996 Symposium Digest for 1995

In addition, you can view indices sorted by author, organization, and subject.

In fact, there is a wealth of information on SID's Web site at http://www.sid.org, including information on SID conferences, links to many display-oriented companies, and a wide variety of display information, activities of local SID chapters around the world, employment ads, and the contents of forthcoming issues of Information Display. SID's Web site is a great place to catch up on new developments, as well as to optimize the use of your SID hardcopy publications.



Conference: Color Science, Systems & Applications SCOTTSDALE, ARIZONA NOVEMBER 17 - 20, 1997

- An international multidisciplinary forum for dialogue on:
- Creation and capture of Color Images - Color Image reproduction and
- interchange Co-sponsored with IS&T.

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



letters to the editor

Tom Holzel's guest editorial, "The Emperor and His Flat-Panel Displays," which appeared in our March issue, excited the most written and verbal response to an ID editorial in recent memory – and there may be some very interesting consequences. Here are four samples, and a general comment from the author.

- Ken Werner, Editor

To the Editor:

For years I have been looking at the optical response specifications for AMLCDs, saying to myself that those specs did not seem consistent with the speed demands of full video, and assuming that there was something basic I didn't know. I am grateful to Tom Holzel for letting me – and probably a great many other people – know that this is a real issue the industry needs to address.

– Robert L. Saxe President Research Frontiers, Inc. Woodbury, NY

To the Editor:

Please never stay away from work again! Was your "jest" editorial intended for April First? Certainly, I fully understand the necessity of the disclaimer on page 2 of the March issue and am sure that you will be inundated by mail explaining (better than I can) the absurdities of the self-serving nonsense from your writer (who just happens to be from an FED company).

My affiliation is omitted here, not because I am in fear and trembling about my employer's reaction, but rather to emphasize that this is a personal response to the diatribe which you published.

Ossining, NY P. S. Fish are quite unable to ambulate, somnor otherwise!

- Frank V. Allan

To the Editor:

The theme of Tom Holzel's March editorial, "The Emperor and His Flat-Panel Displays," is that active-matrix LCDs, plasma displays, and micro-mirror arrays will never replace CRT technology because they can not render movies that look good. He says the culprit is the eye and the poor understanding of its requirements by the manufacturers of these devices.

According to Holzel, the new displays do not produce the "dynamic contrast" – the speed by which a picture element can go from one brightness level to another – required for motion. The switching time for active-matrix devices using TN liquid-crystal technology is around 30 msec, STN devices require more than 100 msec, and the CRT phosphor rise and fall time is about 4 msec. Current STN devices are too slow to render motion, but can this be said of today's TN-based AMLCDs?

The details in an image are in the high spatial frequency components of the image's Fourier spectrum. We lose sensitivity to these frequencies when images move. A display can slightly blur a moving image without the blur being noticed. Why did Holzel see the moving tiger lose its stripes? He believes the AMLCD was too slow. But the mechanisms of vision that see spatial details best are slow too. The mechanisms sensitive to motion are poor at detailed vision. This suggests that we should look for another cause to explain the vanishing stripes; unless, of course, the eye's insensitivity to detail in moving images is a sufficient explanation. A likely candidate is the image processing system that processed the image data stream prior to its reconstruction on the display device.

Liquid-crystal materials take longer to switch when the change in the electric field is small. This sluggishness is most apparent at the transition from one grayscale level to



Web Home Page: http://www.advancemag.com

Circle no. 46

letters

another close by in intensity. The small step problem is equally unlikely to be detected by human vision, since the fast temporal mechanisms of vision do not see detail at all well. The overall contrast range, on the other hand, is a significant contributor to image quality.

Plasma and micro-mirror displays are typically faster than conventional CRTs. Holzel notes a problem with moving images and fades on some of these devices. He is referring to the stair-stepping that occurs during motion in image regions with shallow intensity gradients. This could be due to the elevated sensitivity of the eye to low spatial frequencies when objects move. Or it could be due to the way the grayscale is created by pulse-width modulation. The latter possibility is more likely, and has been discussed extensively at technical conferences and in the literature. The effect can be eliminated by dithering. Dithering moves the quantization noise to higher spatial frequencies where the eye is less sensitive. Dithered plasma and micromirror devices do not exhibit the stair-stepping artifact.

> – Jim Larimer NASA Ames Research Center MS 262-3 Moffett Field, CA 94035-1000

Note: A more detailed version of this letter may be found at http://www.ba-sid.org.

To the Editor:

The situation with regard to comparing direct-view display technologies is even more complicated than Tom Holzel indicates, but



he is nonetheless raising a significant and often neglected issue.

I believe the Society for Information Display and the information display industry should confront this question, as well as many others, head on by establishing a direct-view display technology "shootout." This direct comparison of different technologies and different technology implementations could be modeled somewhat after the projection display shootout that has been a popular feature of the InfoComm show for years.

I have discussed this idea with Ken Werner, Editor of *Information Display*, and I understand that he and Phil Heyman, SID Convention Chairman, are seriously investigating the concept.

> –Fred Kahn Kahn International Palo Alto, CA

Mr. Holzel responds:

I am delighted that my remarks in the March issue of Information Display have stimulated so much lively discussion on what I believe is an important question for the display community. That question can be posed this way: Which 40-inch flat panel would make the best television display, and how do FPDs compare to the "venerable" CRT. Defenders of the True Faith (CRTs) claim that when showing moving scenes, AMLCDs are too slow and plasma panels too jerky. These anomalies will cause unconscious eyestrain. The Young Lions (flat-panel admirers) respond with counterclaims that any such minor faults are well known and can be solved merely by tweaking electronics. Who is right?

I propose a simple test to answer the question. But please note which question is being asked: Which *available* 40-inch TV display is preferred by average viewers watching average TV content over a period of two hours. (By average TV content, I mean a movie such as *Top Gun* or afternoon football – not CNN talking heads or the static visages of soapopera divas sullenly glaring at each other.)

Thus, this TV test is *not* about testing one aspect of each type of TV display – say, motion artifacts or contrast ratio – and would *not* therefore "equalize" all other parameters.

Circle no. 47

PUTTING IT ALL TOGETHER

Test procedure: Set up two 40-inch displays side-by-side at a proper distance from a single viewer seat. Adjust each TV for its own optimum picture quality. Tell the nonengineer viewers that you will be simultaneously showing them a film on both displays and afterwards asking a few questions about the number of times the heroine lisps (or any other camouflage question), the point being to distract the viewers from the technology and point them toward image content. A video camera records the eye direction of the viewer and records (picture-in-a-picture?) the scene the viewer is watching.

We could learn several things from this simple experiment:

A. Do viewers begin with one screen and later switch to another screen?

B. Do they oscillate back and forth at random or choose a screen and stick with it?

C. Do they watch one screen for static images and switch to the other for motion?

D. Does a screen position - being on the left or right - make a difference?

Such a macro-level test should answer the burning question most of us want answered without explaining why viewers selected one technology over another. This ambiguity will actually satisfy both sides. The winner will have the luxury of struggling to avoid saying "I told you so," while the losers will have sufficient fodder to conduct scores of human factors studies, after which the test can be run again with "new and improved" flat-panel displays. It could become an annual event. It would certainly improve the breed.

> - Tom Holzel V.P., Marketing and Sales PixTech, Inc. Santa Clara, CA

SID '98

Symposium, Seminar, and Exhibition Anaheim, California Anaheim Convention Center May 17-22, 1998

At Gerome Manufacturing, you can get a wide range of magnetic shields to reduce Electro Magnetic Interference or Electro Magnetic Radiation - And, you can get a complete assembly! We will fabricate and assemble the

metal structure of your instruments.



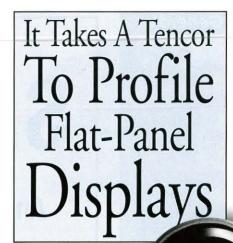
We receive orders by mail, disc, tape and electronic transmission, and parts are made on the most accurate and advanced equipment available.

Order just the part or get the entire package! Either way you'll

> save time and money when you call Gerome!



Circle no. 48



When surface quality is critical...

For high-precision measurement and QA of flat panel displays, Tencor® has the profiling instrument of choice.

Whether you're monitoring surface roughness, smoothness or waviness. Etch depths, coating thickness or micro features ...

Whether you manufacture color filters, thin film transistors - you name it! Tencor profilers give you repeatable, non-destructive measurements down to the sub-microinch range. To one thousandth of a mil!

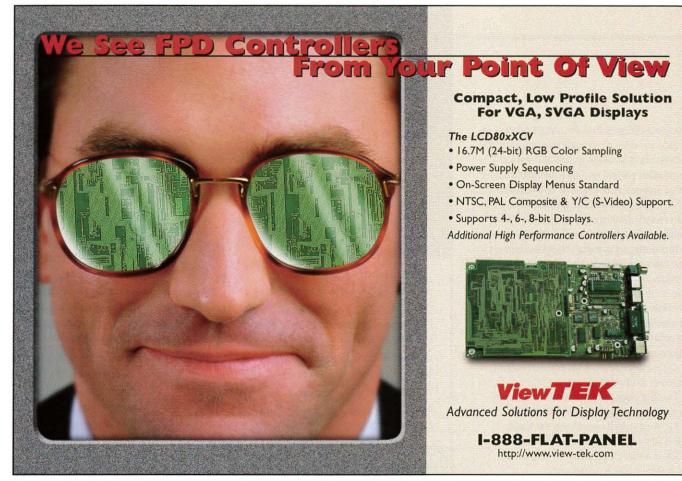
Instantly, you get dozens of automatically-computed surface parameters. And intuitive 3-D surface imaging software lets you analyze topograghic features in detail.

Tencor profilers accept sample sizes from very small up to 25" by 25" and up to 2.5" thick. So the possibilities are endless... For full details, just call:

Metrology Division

Tencor Instruments One Technology Drive Milpitas, California 95035 (408) 571-3000. Fax: (408) 571-2700 http://www.tencor.com a registered trademark of Tencor Instru





Circle no. 50



SID '98

Anaheim, California

Anaheim Convention Center

May 17–22, 1998

Mark Your Calendar Now!

2155 Bellbrook Avenue • Xenia, OH 45385-4043 Phone: 937-376-4361 • Fax: 937-376-2802

calendar

Display Technology

The 17th International Display Research Conference and Workshops (IDRC '97).

Co-sponsored by SID and the Advisory Group on Electron Devices (AGED) in co-operation with the IEEE Electron Devices Society. Contact: Ralph Nadell, Palisades Institute for Research Services, Inc., 201 Varick Street, Suite 1006, New York, NY 10014; 212/ 620-3341, fax -3379, e-mail: rnadell@ newyork.palisades.org. Sept. 15-19, 1997 Toronto, Canada

1997 Flat-Panel Display Strategic Forum and Technical Symposium. Co-sponsored by the University of Michigan, Center for Display Technology and Manufacturing. Contact: R. Donofrio, Display Device Consultants, 6170 Plymouth Rd., Ann Arbor, MI 48105; 313/665-4266, fax -4211. Sept. 22-23, 1997 Ypsilanti, MI

The Third International Conference on the Science and Technology of Display Phosphors. Co-sponsored by the Phosphor Technology Center of Excellence, Defense Research Projects Agency, and Society for Information Display. Contact: Bill Klein, Palisades Institute for Research Services, Inc., 201 Varick Street, Suite 1006, New York, NY 10014; 212/620-3377, fax -3379, e-mail: bklein@newyork.palisades.org.

Nov. 3-5, 1997 Huntington Beach, CA

Fifth Color Imaging Conference: Color Science, Systems & Applications. Co-sponsored by IS&T and SID. Contact: IS&T, 7003 Kilworth Lane, Springfield, VA 22151; 703/642-9090, fax -9094. Nov. 17-20, 1997 Scottsdale, AZ

Electronic Information Displays (EID '97). In association with the Society for Information Display. Contact: Association Exhibitors; +44-1822-614671, fax -614818. Nov. 18-20, 1997 Surrey, U.K.

The Fourth International Displays Workshop (IDW '97). Co-sponsored by the Institute of Television Engineers of Japan and the Japan Chapter of SID. Contact: IDW '97 Secretariat, c/o The Convention; +81-3-3423-4180, fax +81-3-3423-4108. Nov. 19-21, 1997 Nagoya, Japan



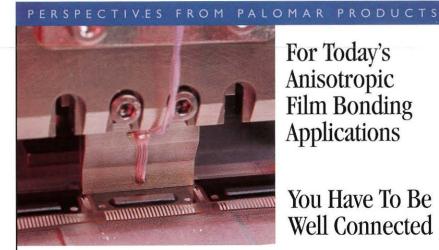
Gamma Scientific's new RadOMAcam gives you absolute accuracy in display measurement. Featuring a unique, patent-pending AVS viewing system and polarization de-coupling, RadOMAcam combines state-of-the-art electronics with sophisticated camera technology. It works by superimposing an image of the exact measurement aperature area onto the display image. You see exactly what

you're measuring. No polarization. No shadowing. No inaccuracy. RadOMAcam comes with Windows™-based spectral control and analysis software, and is ideal for CRT, LCD, and flat panel display applications. For error-free spot measurement, call Gamma Scientific today, ask for our

brochure and pricing at 1-800-637-2758.

Gamma Scientific, 8581 Aero Drive, San Diego, CA 92123 619/279-8034 · (FAX) 619/576-9286

Circle no. 52



For Today's Anisotropic Film Bonding Applications

You Have To Be Well Connected

Palomar Products IS the solution.

· A patented self-leveling thermode (SLT) bonding head that eliminates coplanarity issues . Dual video cameras that facilitate precise alignment and accommodate virtually any size display panel - plus a range of other applications • Industry standard, time-at-temperature power supplies that ensure reliable bonding parameters . Plus the applications engineering support to help you design the anisotropic film bonding solution that's ideal to make the connections you want!

We've set the industry standards in anisotropic film bonding equipment for over five years - and we continue to offer the most advanced technology available today.

For more information, contact the Applications Engineering Department, Palomar Products, Inc., TODAY at 619-931-3622, Fax: 619-931-5191. You can also visit our Website at www.palpro.com.



PALOMAR PRODUCTS, INC. ASSEMBLY & TEST PRODU 2051 PALOMAR AIRPORT ROAD CARLSBAD, CA 92009

Stable, High Resolution Probing

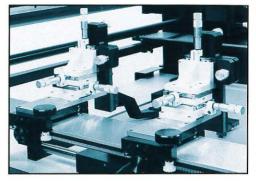
The Leader in Semiconductor Probing now offers a Flat Panel solution; Model 2250.

- Built-in Vibration Isolation Table.
- Large area 15" x 24" microscope movement range.
- Independently positionable platens with manipulator "track drive" for maximum flexibility.
- · Fast pull out chuck for easy load and unload.



14" x 14" panels standard, larger available

Phone: 702-882-2400 • Fax: 702-882-7694 Visit our web site: www.micromanipulator.com Track driven manipulators with lock downs



m Brimar

Choose standard vacuum or magnetic base manipulators. Manipulator driven link arms support:

- Probe Cards
- Microwave Probe Heads



ormance

Circle no. 54

As world leaders in display technology, Brimar offer you the finest CRT qualityplus the flexibility to custom-build to your exact requirements.

And because all Brimar CRTs are produced entirely in-house, they're backed by total on-site quality control. That means complete reassurance in fields as diverse as

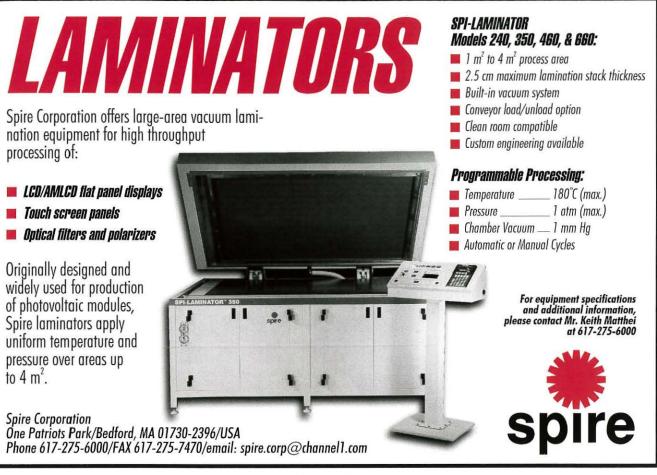
telecine, medicine, photography, military hardware and civil aviation,

And promises you the clearest possible benefits.

Brimar Limited

Viewed as the finest in the world

 Brimar Ltd., Greenside Way, Middleton, Manchester M24 ISN, England. International Telephone: +44 161 681 7072 Fax: +44 161 682 3818.
 Brimar Inc., 25358 Avenue Stanford, Valencia, California 91355 - 1214 USA. Telephone: (805) 295 5770 Fax: (805) 295 5087



Circle no. 56

Looking for "leading edge" artwork?

The Micronic pattern generators are recognized as world leaders for large area mask writing.

Regardless of your application:

- active displays
- shadow masks
- passive displays
- lead frames

Micronic provides outstanding image quality.

Call us in USA at (603) 635-9636 or e-mail: info@micronic.se Internet: www.micronic.se

Micronic Laser Systems AB PO Box 3141 Täby S-183 03 Sweden In Europe contact Micronic Tel: +46 8 638 52 00 Fax: +46 8 638 52 90 In Japan contact Hakuto Co Tel: +81 3 3225 8910 Fax: +81 3 3225 9012



Flat Panel Monitor **ARMS**[™]

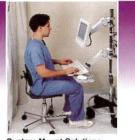


Ergonomically position your flat panel monitors, laptops and keyboards wherever you need them-with Ergotron's Adjustable Rotating Mounting Solutions



Mobile Solutions





Custom Mount Solutions





Circle no. 58

Custom Designers and Manufacturers of Military and Commercial Components and Systems.

- DEFLECTION YOKES STATOR & SADDLE
- HIGH VOLTAGE POWER SUPPLIES
- FLYBACK TRANSFORMERS MULTIPLIERS
- CRT / YOKE MATCHING
- DEGAUSSING COILS
- CUSTOM DEFLECTION CIRCUITS

WinTron Inc.

250 Runville Road Bellefonte, Pa 16823

PHONE (814) 355-1521

STOP

FAX (814) 355-1524

CALL OR FAX US FOR OUR FREE PRODUCT CATALOG

SID '98

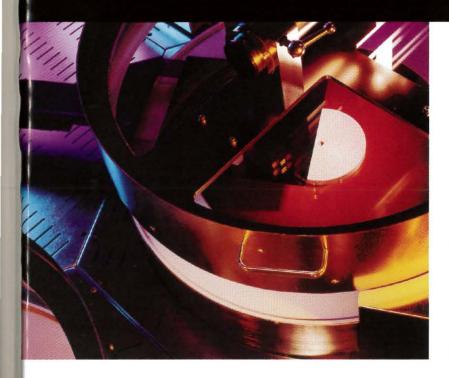
Anaheim, California

Anaheim Convention Center

May 17–22, 1998

Mark Your Calendar Now!

FPD Fabs Trust and Rely on Apex...



APEX – THE ADVANCED CLUSTER TOOL FOR FPD PHOTORESIST COAT, DEVELOP, COLOR FILTER, AND CLEANING

FPD fabs demand reliable, flexible process tools. These tools must offer multi-process capabilities, reproducible results, high uptime, increased yields - the keys to high-volume FPD production. APEX provides the **PRODUCTION- AND COST-PROVEN SOLUTION** for flat panel display technologies.

With APEX's intelligent design, substrates are transferred FROM ONE CENTRAL POINT. No transfer lanes. Smaller

"IQT demands strong performance and high uptime reliability from the process tools supporting our line. SSI's APEX has met and exceeded our requirements. It is unquestionably a key contributor to our success."

Scott Holmberg President/CEO, Image Quest Technologies, Inc.

"After evaluating multiple vendors, we chose the APEX system. Its compact size and high throughput capability meet the requirements for high-volume manufacturing applications."

Dr. Malcolm Thompson CEO dpiX, a Xerox Company

Circle no. 60



footprint. Higher throughput. Higher yield. Makes sense, doesn't it? FPD fabs trust and rely on APEX.

- Production-Proven Design
- High Throughput/Small Footprint
- **Reproducible Results**
- Full Range of Substrate Sizes
- **Extensive Process Experience**



47003 MISSION FALLS COURT FREMONT, CALIFORNIA 94539 USA TEL 510 683 8858 FAX 510 656 3226 PROCESS EQUIPMENT FOR THE NEW MILLENNIUM

FSI INTERNATIONAL COMPANY

sustaining members

index to advertisers

Acer Peripherals Ad-Vance Magnetics, Inc. Advance Reproductions Corp. AlliedSignal, Inc./ MicroOptic Devices Arconium Brewer Science, Inc. Brimar Ltd. Canon, Inc. Capetronic Computer USA (HK), Inc. Celco Cherry Electrical Products Chunghwa Picture Tubes, Ltd. Clinton Electronics Corp. Corning Inc. Corning Japan K.K. Crystaloid LCDs Dale Electronics, Inc. David Sarnoff Research Center Diagnostic/Retrieval Systems, Inc. **Display Inspection Systems Display Laboratories DNP** Denmark dpiX, A Xerox Company Electronic Designs, Inc. Electro-Plasma, Inc. Endicott Research Group, Inc. Epson America FED Corp. **F-P Electronics** Flat Panel Display Co. (FPD) B.V. Futaba Corp. General Vacuum Gerome Manufacturing GE Plastics Japan Ltd. Graseby Optronics Grimes Aerospace Co. Hewlett-Packard Co. Hitachi, Ltd. F. Hoffmann-La Roche Honeywell, Inc. Hoya Corporation USA **Hughes** Lexington Hyundai Electronics America IBM Corp. Imaging & Sensing Technology Incom, Inc. Industrial Electronic Engineers, Inc. Industrial Technology Research Institute In Focus Systems, Inc. Infodex, Inc. Innotec Group, Inc. Interface Products, Inc. Interserv Corp. Interstate Electronics Corp. ISE Electronics Corp. Kent Display Systems Libbey-Owens-Ford Co. Linfinity Microelectronics

Litton Systems Canada Ltd. (2) Loral Librascope Man & Machine, Inc. Micron Display Technology, Inc. Micronic Laser Systems AB Microvision Corp. Minolta Corp. Minolta Hong Kong Ltd. Mitsubishi Electronics America Motif, Inc. Motorola FPD Division MRS Technology, Inc. NEC Corp., Japan Nippon Seiki Co., Ltd. Norden Systems Westinghouse OIS Optical Imaging Systems, Inc. OKI Electric Industry Co., Ltd. Optical Coating Lab., Inc. Photonics Systems, Inc. Photo Research Photronics, Inc. Pilkington Micronics Ltd. Planar Systems, Inc. Plasmaco, Inc. Polytronix, Inc. Progressive Systems Technology, Inc. Q.C. Optics, Inc. Quantum Data Inc. Raytheon Company Regisbrook Group, Ltd. Rockwell International ROLIC Liquid Crystals R&D Co. Schott Corp. Semiconductor Systems, Inc. Sharp Corp. - Japan SI Diamond Technology Sony Corp. of America Sony Corp./Corporate Research Labs Standish Industries, Inc. Stanford Resources, Inc. Steag MicroTech, Inc. Supertex, Inc. Syntronic Instruments, Inc. Tamarack Scientific Co., Inc. **TEAM Systems** Techneglas, Inc. Teledyne Electronic Technologies Terapixel, Inc. Thomas Electronics, Inc. Thomson Components and Tubes Corp. Toshiba America ULVAC Technologies, Inc. Viratec Thin Films Inc. Wande, Inc. The Westaim Corp. WinTron XMR Inc.

Ad-valice Magnetics	
Brimar Ltd	100
CELCO	C4
Clinton Electronics	6
Courtaulds Performance Films	85
CRT Scientific	90
CTX Opto	5
Digital View	93
Eagle Magnetics	
ELDIM	
Ergotron	102
H. L. Funk Consulting	
Gamma Scientific	
Gerome Manufacturing	
Graseby Optronics	91
Image Processing Systems	23
Image Quest Technologies	
Interserv	
Jaco Electronics	7
Kent Displays	11
Klein Instruments	13,42
LCD Lighting	
Libbey-Owens-Ford	
The Micromanipulator Co	100
Micronic Laser Systems	101
Microvision	
Minolta	
Mitsubishi	
MKS Instruments	and the second

MRS Technology
NEC Technologies
OCLI
Palomar Products
Panelight12
Photo ResearchC3
PixTech
Quantum Data81
Rantec
Samsung Semiconductor24,25
Semiconductor Systems103
Sencore
Society for Information Display82
Solomon12
Spire Corp
Syntronic Instruments40
TDK Corp. of AmericaC2
TEAM Systems
Tencor Instruments97
Thomas Electronics
Thomas Electronics
TNP Instruments96
TNP Instruments
TNP Instruments
TNP Instruments
TNP Instruments

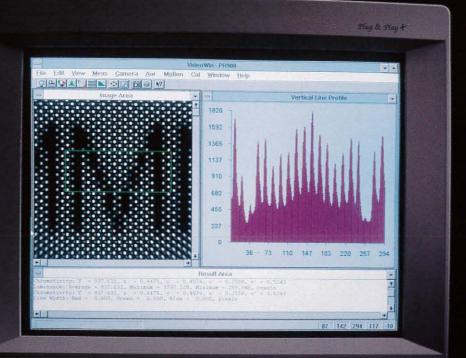
Business and Editorial Offices

Palisades Institute for Research Services, Inc. 201 Varick Street, Suite 1006 New York, NY 10014 Jay Morreale, Managing Editor 212/620-3371 Fax: 212/620-3379

Sales Office

Palisades Institute for Research Services, Inc. 201 Varick Street, Suite 1006 New York, NY 10014 Erika Targum, Director of Sales 212/620-3375 Fax: 212/620-3379

The Total Solution to Accurate CRT/FPD Measurement.





For more than 50 years Photo Research Inc. has provided solutions to measurement needs in all sectors of the information display industry. We are acknowledged experts for NIST traceable measurements of CRT's, LCD's, FPD's, LED and Night Vision displays.

If lack of versatility and low light sensitivity for luminance measurements is the problem, the PR-880 fully automated photometer is the solution. Using through-the-lens Pritchard optics, the PR-880 makes accurate, automatic measurements of displays - just push a button!

If color is the question, the PR-650 SpectraColorimeter is the answer. The only true hand-held spectroradiometer in the world, the PR-650 measures displays spectrally, guaranteeing precise color results regardless of the spectral signature of the source.

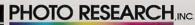
Combining state-of-the-art CCD technology and Photo Research's proven measurement expertise, the PR-900 Video Photometer is the industry standard for testing for compliance to the ISO's demanding ergonomic requirements. The PR-900 is the instrument of choice whenever accurate photometric and spatial measurements of displays are a must.

Call us today for a free full color CIE chromaticity diagram!

Circle no. 62

"The Industry Standard for Display Measurements."





9330 DeSoto Avenue Chatsworth, CA 91311-4926 USA Telephone: 818/341-5151 • Fax: 818/341-7070 http://www.photoresearch.com

.12

Into The 21st Century

CELCO leads the industry into the 21st century. Our recent acquisition of DISCOM Inc.'s CRT deflection yoke and related component line, enables us to provide continuing supply to DISCOM customers enhanced by CELCO's unparalleled customer service and well-known CELCO YOKES and components design/manufacturing capabilities.

CELCO designs and manufactures high resolution CRT Deflection Yokes & Focus Coils, **CRT Deflection Amplifiers**, **CRT Spot Measurement** Analyzers & CRT Test Equipment, X-Y Traveling **Microscopes, Correction** Coils, Circuitry, and The CELCO eXtreme **Digital Motion Picture** Film Recorder for animation and special effects for Film Producers worldwide.

http://www.celco.com

With CELC

http://www.deflectionyoke.com