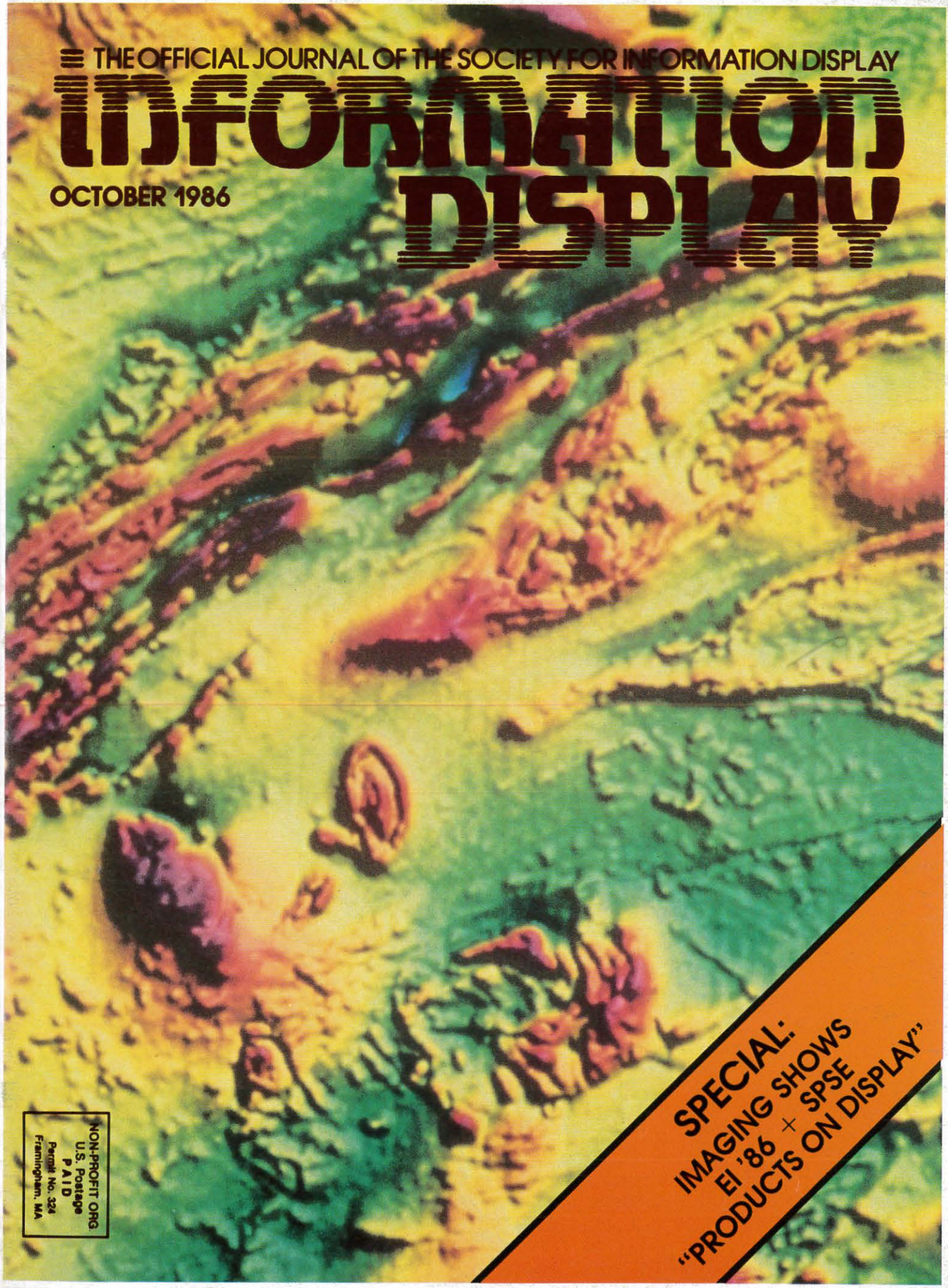
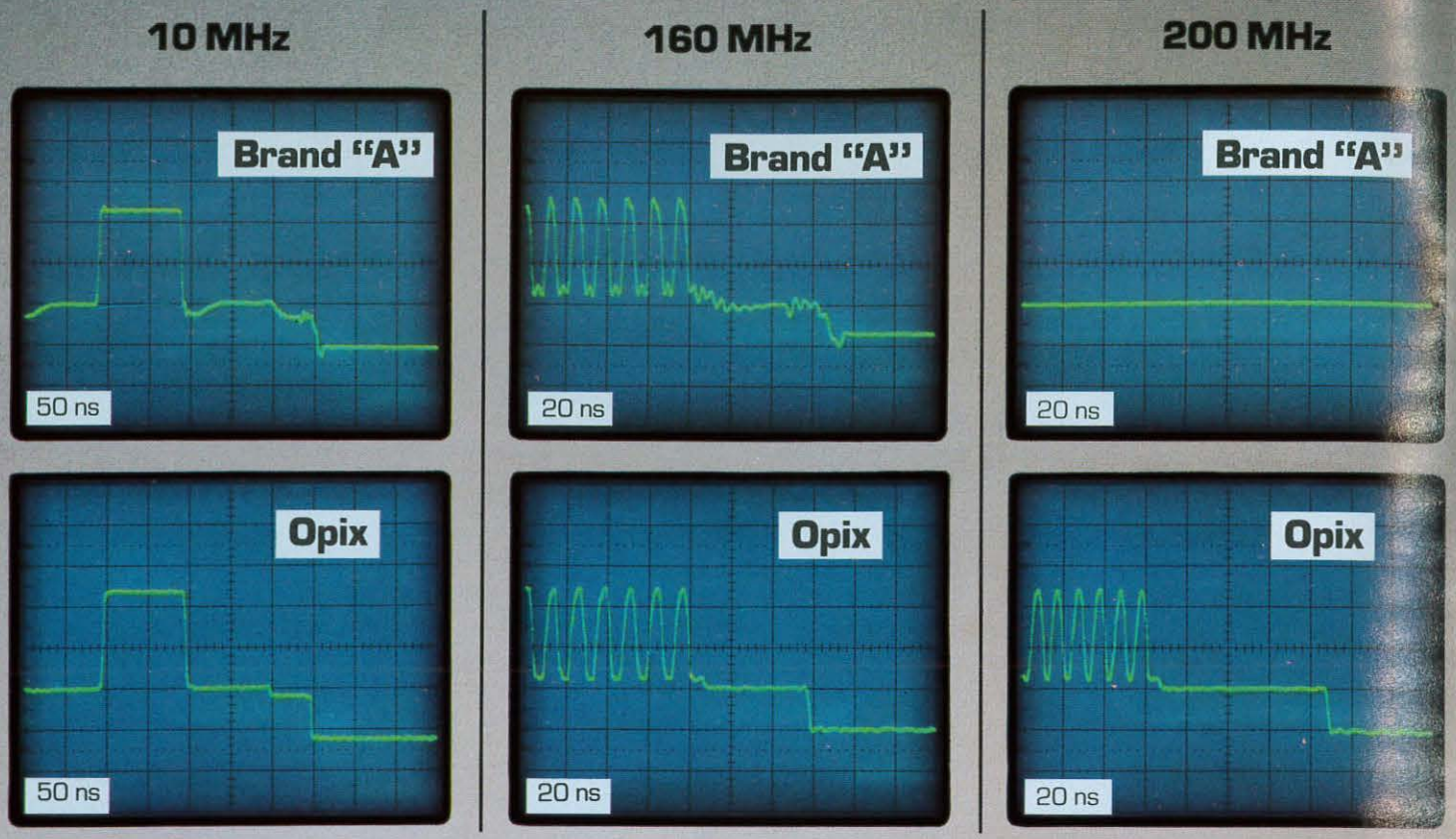
THE OFFICIAL JOURNAL OF THE SOCIETY FOR INFORMATION DISPLAY

INFORMATION DISPLAY

OCTOBER 1986



SPECIAL:
IMAGING SHOWS
EI '86 × SPSE
"PRODUCTS ON DISPLAY"



All illustrations are unretouched photographs taken from a Tektronix Oscilloscope screen (Model 7854)

COMPARE SIGNALS AND YOU'LL SEE WHY THE OPIX VIDEO SIGNAL GENERATOR IS THE BEST THERE IS.

The test tool you choose for video correlation has to be better than the product you're testing. With signal generators, the proof of performance is the signal each produces.

In this oscilloscope comparison of two generators, the OPIX™ Imager on the bottom easily delivers cleaner, sharper waveforms at 10, 160 and 200 Megapixels per second—and everywhere in between. The Brand "A" generator doesn't even produce a signal at 200 MHz.

The slower rise time, ringing, poor step recovery, and overshoot you get with an inaccurate generator creates color bleeding and other correlation problems with your finished CRT products. That's why we designed OPIX to be an extremely accurate instrument, first and foremost. But, we didn't stop there.

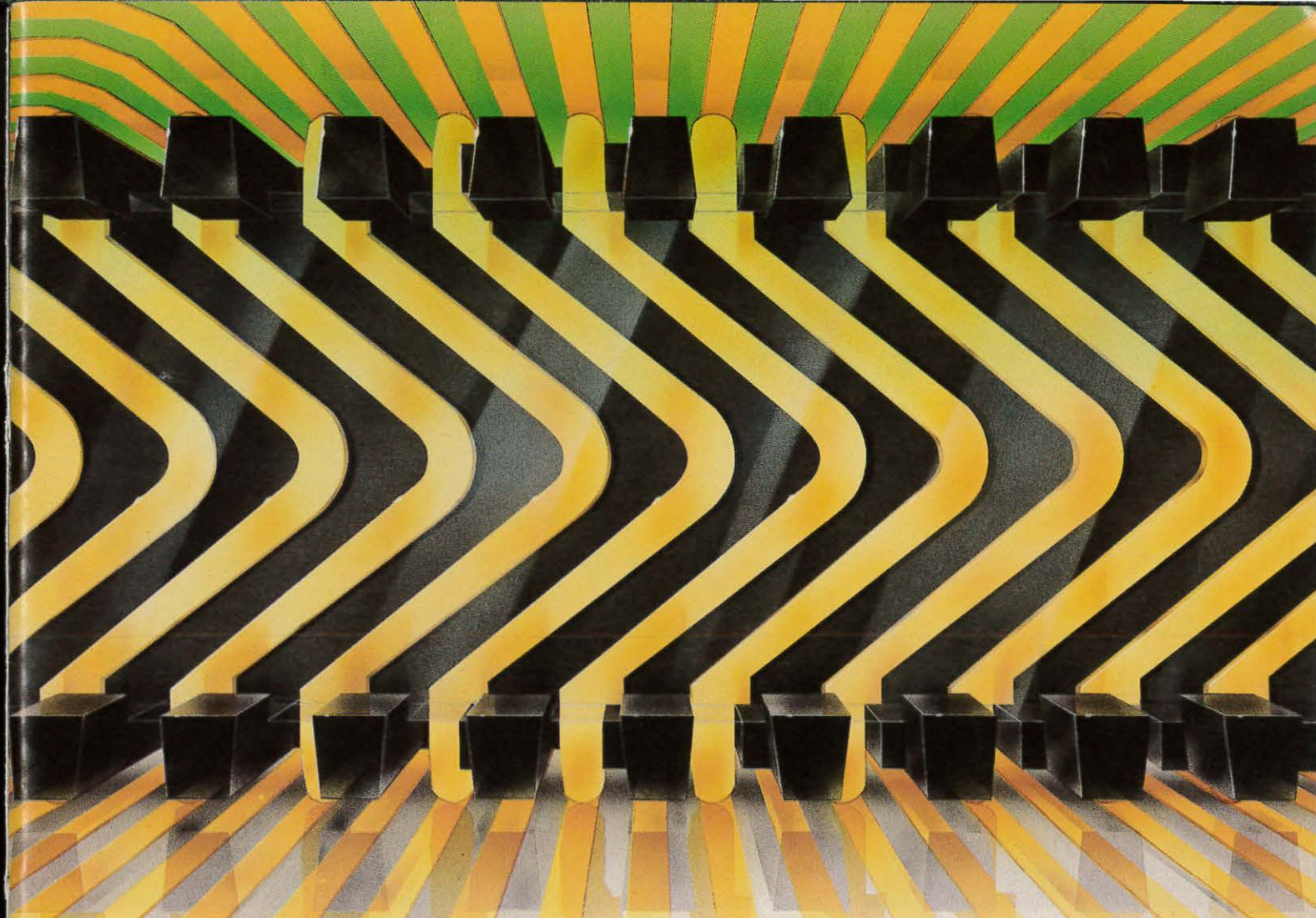
OPIX carries built-in Instant-Expert™ test patterns that allow anyone to perform sophisticated video tests from day one. Or, you can easily design your own. Then save your best tests with battery backed-up internal memory or on disk. With disk, you can transfer test data around the plant, or around the world.

Why settle for less than the most accurate signal generation? Buy the OPIX Imager and bring your video testing to a point of performance you can trust.

For technical data, or a hands-on demonstration contact: Quantum Data, 455 E. Kehoe, Carol Stream, IL 60188. Telephone: 312-668-3301. TELEX 206725

QUANTUM DATA®

Circle Reader Service #1



Together in 60 seconds flat.

Introducing ITT Cannon's Parallel Interconnect (PI).

It takes less than a minute to assemble this high density, low resistance interconnect for flat panel displays. No soldering required.

Using positioning pins, the connector is positively aligned, creating a gas-tight interface with printed circuit boards and glass panels. Its unique design allows it to perform to close tolerances over longer dimensions while handling higher voltages and currents.

In addition, the Parallel Interconnect expands and contracts with the glass or printed circuit boards, ensuring a positive contact interface.

The fast, accurate assembly and high dependability ultimately result in lower installed costs. You save time *and* money.

Talk to us about the Parallel Interconnect's wide range of applications, including board to board stacking. Or let us design-in specifically to your needs.

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ITT CANNON

Circle Reader Service #2

High resolution, rugged CRT's for avionics ... a brighter idea from AEG!

The new color display tube from AEG, the M18-E851, is specifically designed to meet the needs found in avionics applications.

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The CRT achieves its high resolution via the use of a fine 0.2mm pitch shadow mask and a very rugged in-line electron gun.

Assembly technology for the very bright 5″ × 5″ display includes a self-converging deflection system, static color purity with convergence correction and an effective contrast enhancement filter. All of these innovations result from the many years of AEG leadership and experience in tube technology for avionics.

AEG is a world wide source for technological innovation in areas which include not only technical tubes for avionics but information systems, electronic packaging, power semiconductors, robotics and office systems, to name a few.

For more information on our high resolution color CRT's or on any of our other high technology products, contact:

AEG Corporation
Route 22-Orr Drive
PO Box 3800
Somerville, NJ 08876-1269
or call (201) 722-9800.

AEG

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INFORMATION DISPLAY

OCTOBER 1986 VOL.2 NO.10

Cover picture: On a standard line contour map, the values of mapped quantities must be read from contour labels. Color adds an independent dimension making such maps faster and easier to interpret features accurately. Shadow mapping further improves readability by displaying additional independent variables simultaneously on the same map—the amplitude and the gradient of the quantity measured over the mapping region.— *Dataplotting Services Inc., Don Mills, Ontario, Canada.*

FEATURES

DEPARTMENTS

afips
American Federation of Information Processing Societies

INFORMATION DISPLAY (The Official Journal of the Society for Information Display) is edited for corporate research and development management; and engineers, designers, scientists, and ergonomists responsible for design and development of input and output display systems used in various applications such as: computers and peripherals, instruments and controls, communications, transportation, navigation and guidance, commercial signage, and consumer electronics.

Editorial covers emerging technologies and state-of-the-art developments in electronic, electromechanical, and hardcopy display devices and equipment; memory; storage media and systems; materials and accessories.

Events

OCTOBER 22-24: Applied Imagery Pattern Recognition, Cosmos Club, Washington, DC. Contact: Dennis Lynch, PSC Inc. 10340 Democracy Lane, Fairfax, VA 22030 (703/385-6880)

OCTOBER 24-26: Workshop on Charged Coupled Devices, Columbia University, Arden House, Harriman, NY. Contact: Prof. Eric R. Fossum, Dept. of Electrical Engineering, 1321 Mudd Bldg., Columbia University, New York, NY 10027 (212/280-3115)

OCTOBER 26 - November 3: 5th World Congress on Medical Informatics, Sheraton Washington Hotel, Washington, DC. Contact: Secretariat, George Washington Univ., Medical Center, 2300 K Street, NW, Washington, DC 20037 (202/676-8929)

OCTOBER 27-28: Fifth Annual Pacific Northwest Computer Graphics Conference, Eugene Conference Center/Hilton Hotel Complex and the Hult Center for the Performing Arts, Eugene, OR. Conference features general session presentations, workshops on applications, trade exposition and film and video show. Sponsor: University of Oregon. Contact: Paul Katz, Conference Manager, University of Oregon Continuation Center, 1553 Moss Street, Eugene, OR 97403 (503/686-3537)

OCTOBER 27-29: 32nd IEEE Holm Conference on Electrical Contacts, Copley Plaza Hotel, Boston, MA. Contact: Ms. Fern Katronetsky, IEEE Headquarters, 345 East 47th Street, New York, NY 10017 (212/705-7405)

NOVEMBER 2-6: ACM/IEEE Computer Society Fall Joint Computer Conference, INFOMART, Dallas, TX. Contact: ACM/IEEECS FJCC, 1730 Massachusetts Ave. NW, Washington, DC 20036 (301/344-6282)

NOVEMBER 2-6: CEIDP - 1986 Conference on Electrical Insulation and Dielectric Phenomena, Hilton Hotel, Claymont, DE. Contact: Mr. Roy E. Wooton, 501-357, Westinghouse Research and Development Center, 1310 Beulah Road, Pittsburgh, PA 15235 (412/256-2108)

NOVEMBER 3-5: Electronic Imaging '86, Sheraton-Boston Hotel, Boston, MA. Contact: Institute for Graphic Communications Inc., 375 Commonwealth Avenue, Boston, MA 02115 (617/267-9425)

NOVEMBER 3-6: AM86 — Man and Machine the New Partnership, Automated Manufacturing Exhibition and Conference, Greenville, SC. Contact: AM86, PO Box 5616, Greenville, SC 29606 (803/242-3170)

NOVEMBER 4-7: PLANS '86 — Position, Location and Navigation Symposium, Caesar's Palace, Las Vegas, NV. Contact: Larry Atkins, Lockheed-California Co., Dept. 96-60/Bldg. 63, Burbank, CA 91520 (818/847-2867)

NOVEMBER 5-7: The Second Scientific Computing & Automation Conference and Exposition, Convention Center, Atlantic City, NJ. Sponsor: Scientific Computing & Automation Magazine. Contact: Expocon Management Associates Inc., 3695 Post Road, Southport, CT 06490 (203/259-5734)

NOVEMBER 5-7: 1986 IEEE ASSP Workshop on Signal Processing, Davidson Conference Center, University of Southern California, Los Angeles, CA. Contact: Dr. S.Y. Kung, Image Processing Institute, Powell Hall, University of Southern California, University Park, Los Angeles, CA 90007 (213/743-6581)

NOVEMBER 7-10: 1986 IEEE/Engineering in Medicine & Biology Society — Eighth Annual Conference, Worthington Hotel, Fort Worth, TX. Contact: George V. Kondraske, University of Texas at Arlington, Box 19138, Arlington, TX 76019 (817/273-2335)

NOVEMBER 10-12: European Computer Equipment Ergonomics Standards, Legislation, Market Requirements, Evolving Trends, San Francisco, CA. Three-day seminar focuses on latest information on interpreting and complying with European laws, and competing in the European and US marketplace. Co-sponsors: The Koffler Group, Santa Monica, CA; Ergonomic Institut fur Arbeits- und Sozialforschung Forschungsgesellschaft mbH, Berlin, Germany; Ergolab, Stockholm, Sweden; System Concepts Ltd., London England. Contact: The Koffler Group, 3029 Wilshire Blvd., Suite 200, Santa Monica CA 90403 (213/453-1844)

NOVEMBER 10-13: ICCAD '86 — International Conference on Computer-Aided Design, Santa Clara Convention Center, Santa Clara, CA. Contact: ICCAD, Ian Getreu, Tektronix Inc., MS 94-520, PO Box 4600, Beaverton, OR 97075 (503/629-1462)

NOVEMBER 10-13: ICALEO '86 — Fifth International Congress on Applications of Lasers and Electro-Optics, Sheraton National Hotel, Arlington, VA. Sponsor: Laser Institute of America. Contact: Haynes A. Lee, Congress Manager, Laser Institute of America, 5151 Monroe Street, Toledo, OH 43623 (419/882-8706)

NOVEMBER 10-13: ADCIS — 28th International Conference of the Association for the Develop- of Computer-Based Instructional Systems, Hyatt Regency-Crystal City, Arlington, VA. Contact: Conference Presentation, ADCIS, 409 Miller Hall, Western Washington University, Bellingham, WA 98225 (206/676-2860)

NOVEMBER 10-14: Photometry and Colorimetry for Information Displays, UCLA Extension, Los Angeles, CA. Short Course, Professional Designation Extension Program. Coordinator and Lecturer: Larry E. Tannas, Jr. (SID Vice President). Contact: Technical information—L.E. Tannas, Jr. (714/633-7874); Registration information—Short Course Program Office (213/825-3344 or 825-1295)

NOVEMBER 11-14: First International Conference on Computer Workstations, Red Lion Inn, San Jose, CA. Contact: Dr. Robert Long, Lawrence Livermore Lab., L-130, PO Box 808, Livermore, CA 94550 (415/422-8934)

NOVEMBER 17-18: IEEE Computer Networking Symposium, Loews L'Enfant Plaza, Washington, DC. Contact: Computer Networking Symposium, Tuncay Saydam, Univ. of Delaware, Dept. of Comp. & Info. Sciences, 103 Smith Hall, Newark, DE 19716 (302/451-2716)

NOVEMBER 17-18: 1986 Third ASSP Workshop on Spectrum Estimation and Modeling, Northeastern University, Boston, MA. Contact: Chrysostomos L. Nikias, Dept. of Electrical and Computer Engineering, Digital Signal Processing Lab., Dana Research Center, 411, Northeastern Univ., 360 Huntington Ave., Boston, MA 02115 (617/437-3352)

NOVEMBER 17-19: 1986 IEEE Ultrasonics Symposium, Colonial Williamsburg Conference Center, Williamsburg, VA. Contact: R.A. Moore, Westinghouse Defense and Electronic Center, PO Box 746, MS-335, Baltimore, MD 21203 (301/765-4027)

NOVEMBER 17-20: 31st Annual Conference on Magnetism & Magnetic Material, Hyatt Regency, Baltimore, MD. Contact: Diane Suiters, Courtesy Associates Inc., 655 15th Street NW, Washington, DC 20005 (202/347-5900)

NOVEMBER 18-21: Western Electronic Show & Convention — WESCON '86, Anaheim Convention Center, Anaheim Hilton, Los

Angeles, CA. Contact: Dave Litherland, Electronics Conventions Inc., 8110 Airport Blvd., Los Angeles, 90045 (213/772-2965)

NOVEMBER 19: Images, Information, Interfaces: Directons for the 1990s, New York Telephone Co. 1095 Ave. of the Americas, New York, NY. Annual symposium of the NY Metropolitan Chapter, Human Factors Society, will bring together human factors and film/TV specialists to examine human factors issues in designing graphic and full-motion interfaces. Contact: Renee Schultz or Derek Schultz, Media Design Associates, 151 Route 206, B24-5, Flanders, NJ 07836 (201/829-4284)

DECEMBER 7-10: 1986 International Electron Devices Meeting — IEDM '86, Westin Bona Venture Hotel, Los Angeles, CA. Contact: Ms. Melissa Widerkehr, Courtesy Associates Inc. 655 15th Street NW, Washington, DC 20005, (202/347-5900)

DECEMBER 17-19: DEXPO East 86 — 11th DEC Compatible Exposition, Javits Convention Center, New York, NY. Contact: Expoconsul International Inc., 3 Independence Way, Princeton, NJ 08540 (609/987-9400)

JANUARY 11-17: O-E/LASE '87, and concurrent symposium ELECTRO-OPTIC IMAGING SYSTEMS & DEVICES, Los Angeles Airport Marriott & Hilton Hotels, Los Angeles, CA. SPIE's Annual Symposium on Optoelectronics and Laser Applications. Contact: SPIE PO Box 10, Bellingham, WA 98227 (206/676-3290)

INTERNATIONAL

OCTOBER 28-30: Electronic Displays, Kensington Exhibition Centre, London, UK. Contact: Tom Webb, British Trade Development Office, 845 Third Avenue, New York, NY 10022 (212/593-2258)

NOVEMBER 11-15: ELECTRONICA 86 — International Trade Show for Electronic Components, Semiconductors and Quality Assurance, Munich Trade Fair Centre, Munich, West Germany. Contact: Kallman Associates, Five Maple Court, Ridgewood, NJ 07450 (201/652-7070)

NOVEMBER 17-18: 1986 — 5th Annual VLSI Packaging Workshop, Hotel Saint James at Albany, Paris, France. Contact: Karel Kurzwell, BULL — Rue Jean Jaures, 78340 Les Clayes Sous Bois, France (1/34-62-70-48)

NOVEMBER 24-28: ESANZ — 23rd Annual Conference of the Ergonomics Society of Australia and New Zealand, Perth, Australia. Contact: David Kemp, Ergonomics Branch, Dept. of Occupational Health, Safety, and Welfare, Willmar House, PO Box 294, West Perth, Western Australia 6005 (09-327-8627)

NOVEMBER 26-28: 3rd International Exhibit and Symposium on Artificial Intelligence and Productivity, Paris, France. Cosponsors: Association Francaise d'Intelligence Artificielle et des Systemes de Simulation, and the Society for Computer Simulation. Contact: Association Francaise d'Intelligence Artificielle et des Systemes de Simulation, 211 Rue St-Honore, 75001 Paris, France.

DECEMBER 1-3: Laser Optics & Beam Propagation — Short Course, Orlando, FL. Contact: Education Dir., Laser Institute of America, 5151 Monroe St. — Ste 102W, Toledo, OH 43623 (419/882-8706)

DECEMBER 8-12: Fundamentals & Applications of Lasers — Short Course, San Diego, CA. Contact: Education Dir., Laser Institute of America, 5151 Monroe St. — Ste 102W, Toledo, OH 43623 (419/882-8706)

TECHNOLOGY *PLUS* ECONOMY

FOR DISPLAY MONITOR AND POWER SUPPLY VALUE, NO ONE ADDS UP TO IKEGAMI

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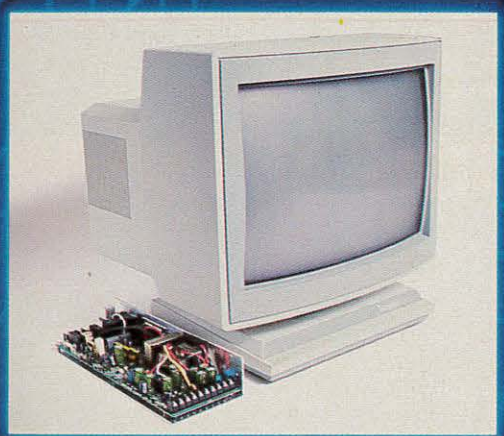

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- ☐ Designed for a variety of applications, including computer and communications systems.
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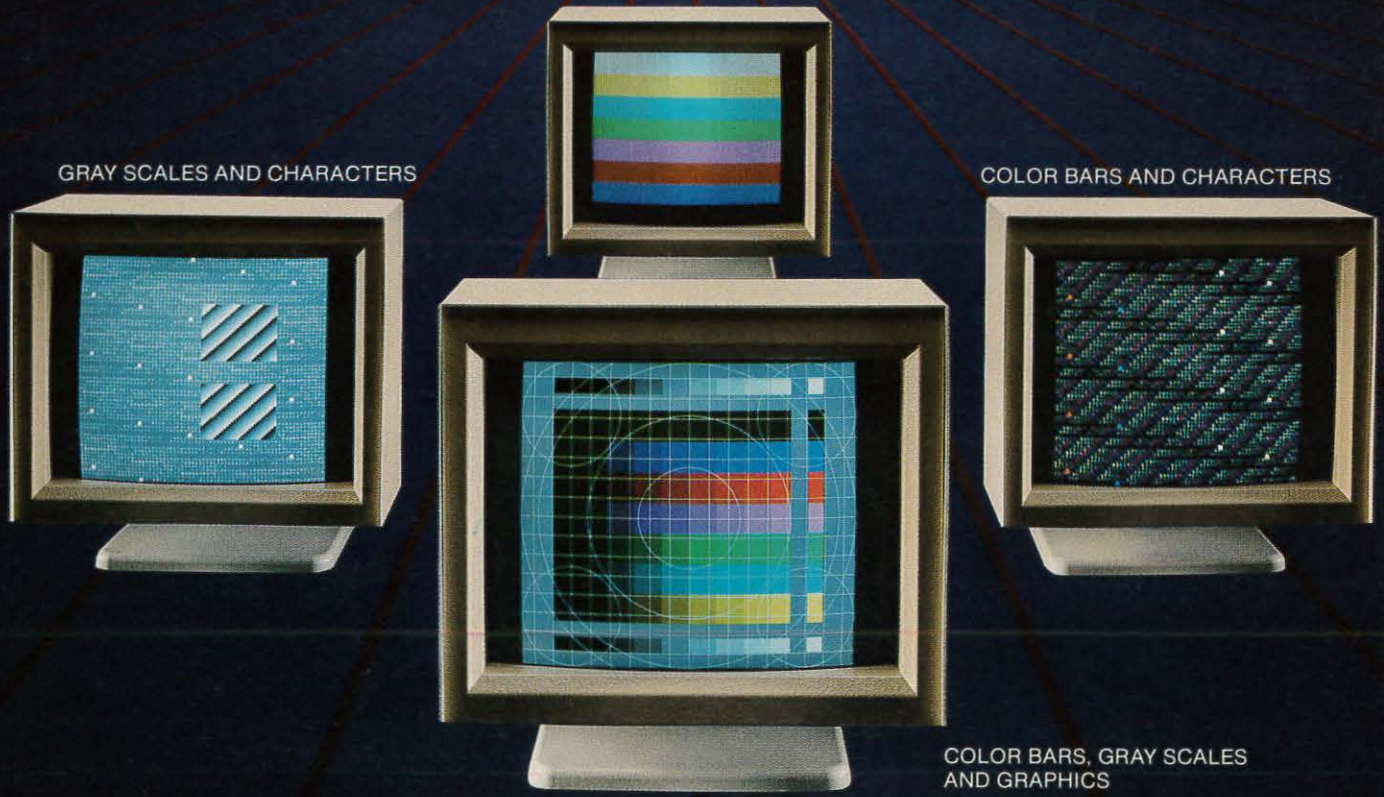
Circle Reader Service #7

ASTRO VG-807A

COLOR BARS AND MULTIBURST

GRAY SCALES AND CHARACTERS

COLOR BARS AND CHARACTERS



COLOR BARS, GRAY SCALES AND GRAPHICS

ONLY THE VG-807A GIVES YOU THESE PATTERNS AT 160 MHz

Today's High Resolution Color Monitors have to have the best possible performance to be successful in a very competitive marketplace.

And "Performance" needs to be designed into a product and continuously tested and evaluated.

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"Images of the collective unconsciousness . . . are deposits of thousands of years of struggle for adaptation and existence . . ."
—Carl Jung

The dynamic growth in the use and application of image processing for numerous vertical markets over the past ten years is evident in the number of technical conferences and exhibits that have burst upon the show circuit recently.

From a modest beginning as a special sessions adjunct to more general conferences on other electronic systems and technologies, just a few years ago, electronic imaging shows today encompass more than a dozen full-blown professional and technical events dedicated exclusively to the many facets and applications of image processing. Within the current '86/'87, fall-winter season, no fewer than six major conferences have been scheduled—with at least half-a-dozen more planned for the remainder of next year.

This phenomenal increase in demand for, and interest in, image processing and display is attributable to at least two major factors:

- Dynamic importance of image processing applications in such areas as television, computer graphics, graphic arts, medical imaging, remote sensing, surveillance and mapping, and machine vision (robotics).
- Substantial maturing of image processing technology whereby systems are economically feasible for the numerous applications that exist today and are continually being developed.

And the end is nowhere in sight. Only exponential growth of capability and complexity are forecast as the major trends in image processing technology—with electronic imaging becoming as broad-based a discipline as, for example, electronics.

Electronic imaging and information display comprise two distinct, yet interdependent technologies—each utilizing somewhat similar systems and devices for the input, processing, storage, display and transmission of information—data or images, or both.

At the heart of every image processing system and information display device is a microprocessor—which processes the raw data input to the computer by a data collection subsystem. But, before that processed data can be useful information, most applications require an output device—a display system of some sort, be it screen, plotter/printer, or film recorder—which generates visual images and records for analysis, presentation, and storage.

Thus the reason for extending INFORMATION DISPLAY's editorial coverage to encompass the complete spectrum of these technologies—from the input of data to the transmission of processed information. And, because two major image processing conferences and exhibitions are scheduled this month and next—SPSE, October 14-17, Arlington, VA; and EI '86, November 3-6, Boston, MA—this issue of ID also includes a special preview of some of the systems, devices, and components important to the imaging and display community that will be displayed and demonstrated at the two shows.

Joseph A. MacDonald
Editorial Director

Computer board seeks to stem erosion of US leadership

The National Research Council has established an 18-member Computer Science and Technology Board from industry and academia to advise federal agencies and private firms on ways to strengthen US international competitiveness in this field, and to ensure that the full promise of this area is realized.

Board chairman Joseph F. Traub of Columbia University outlined the board's objectives, stating that its first job is "to identify the most important national issues relevant to computer science and technology, and then to form strategies for dealing with them." At its first meeting (May 7-8, 1986, Washington, DC) the board identified initial topics for study, including:

- **Competitiveness** — How can the US best ensure the continued leadership of its science and technology enterprise in the face of intensified global competition?
- **Talent** — How can the gap be closed between the small number of US citizens graduating with PhD degrees in computer science and computer engineering, and the large demand for graduates with these skills? How can high school graduates be taught to deal with the computers and high technology they must use on the job in fields that range from the military to banking?
- **Scope and Support** — What will the nature of computer science and technology be in the 1990s? How can its health and vitality be sustained during a period of uncertainty and stringency in federal research and development budgets?
- **Supercomputers** — How can the power of supercomputers be exploited to promote scientific and technological advances, and how can US leadership in this area be maintained?
- **Software** — What can be done to promote the economical production of reliable software, which represents a major portion of the cost and effort in the design and use of new computer systems?
- **Infrastructure** — What are the important underlying capabilities, such as national networks and electronic libraries, that are needed to support the healthy evolution of computing? How can they be provided in a timely and effective fashion and integrated into daily activities to enhance national productivity?

Funding for the board's activities is being sought from federal and private sources. Contact: Gail Porter (202/334-2138).

NATIONAL RESEARCH COUNCIL, 2101 Constitution Ave. NW, Washington, DC 20418

Calibration services available for pulsed laser power, energy

The National Bureau of Standards offers calibration services for low-level pulsed laser systems, such as those used in guidance receivers and range finders. Based on NBS-calibrated transfer standards that are sent to the customer's site, or used for measurements at NBS, the services are for laser pulses at 1.064 micrometers from about 10 nanowatts to 100 microwatts (peak

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This compact unit is ideal for objective white-balance measurement and color adjustment of color monitors, CRT's, and for quality control of new products. It measures luminance and chromaticity in addition to primary beam intensities. In chroma mode, any white standard can be input directly in Yxy units. In analyzer mode, primary beam measurements simplify setting white balance by allowing individual adjustment of red, blue, and green intensities.

LUMINANCE METERS

Minolta's three luminance meters permit accurate measurements of small subject areas. Measurements of light source or surface brightness are taken through a flare-free optical system. Each meter has a bright, single-lens-reflex viewfinder with a clearly marked center spot. An LED digital display inside the viewfinder lets you take measurements while viewing the object.

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Minolta also has three illuminance meters that are exceptionally accurate and easy to operate. Each has a custom-designed LCD that indicates illuminance in either foot candles or lux. And a built-in memory lets you store a single reading for simplified comparison with other sources or monitoring of single source illumination.

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This highly accurate colorimeter measures light source color and color differences between sources. Zero calibration is quick, and you can calibrate the meter to any standard. The sensor head is detachable for remote use. And this meter can be interfaced with Minolta's Data Processor DP-100 to expand its measuring capabilities and to provide memory storage and hard copy print out.

For more information, write Minolta Corporation, Industrial Meter Division, 101 Williams Drive, Ramsey, N.J. 07446. Or call (201) 825-4000. © 1986 Minolta Corporation.

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MINOLTA

Circle Reader Service #10

power); and about 100 attojoules to 10 picojoules (energy). A detailed description of the services and instrumentation is included in **Documentation of the NBS APD and PIN Calibration Systems for Measuring Peak Power and Energy of Low-Level 1.064 Micrometer Laser Pulses.** Order number: PB #86-182367. Price: $11.95 (prepaid).
NATIONAL TECHNICAL INFORMATION SERVICE, Springfield, VA 22161.

Graphics exchange spec for CAD data expanded

An updated version (3.0) of the Initial Graphics Exchange Specification (IGES), contains expanded capabilities for representing part geometries, new capabilities to allow for creating standard "libraries" of parts, and a new method of reducing the size of IGES files. The new version also includes many clarifications and refinements to the IGES standard based on experience with using an earlier version of IGES across a wide variety of CAD systems.

While continuing to upgrade and improve the graphics exchange standard, the IGES organization has also begun to work on a Product Data Exchange Specification (PDES) that will allow a complete product model database to be exchanged and used directly by advanced computer-integrated manufacturing programs such as automatic process-planning or inspection systems. Information such as manufacturing features, tolerance specifications, material properties, and surface finish specifications will be made available to application programs in the PDES format.
To order: **Initial Graphics Exchange Specification (IGES) Version 3.0**, PB #86-199759. Price: $40.95 (prepaid).
NATIONAL TECHNICAL INFORMATION SERVICE, Springfield, VA 22161.

Science, engineering, technology topics of several new reports

Several recently released government publications provide information on a range of R&D needs and problems in government and industrial science, engineering and technology programs:

- **Basic Research: The Key to Economic Competitiveness** — Erich Bloch, director of the National Science Foundation. The booklet cites three musts for a society that wishes to remain competitive in the modern world: It must support basic research, educate scientists and engineers, and invest enough in research facilities and equipment. NATIONAL SCIENCE FOUNDATION, Washington, DC 20550.
- **Microelectronics Research and Development** — Office of Technology Assessment. The 44-page report identifies changes in various areas, such as automation and supercomputers, for which computer and communications technologies are the basis. Price: $1.75. US GOVERNMENT PRINTING OFFICE, Dept. SSMC, Washington, DC 20402.
- **Science Indicators: The 1985 Report** — National Science Board. The 330-page report gives information about American science, engineering and technology and discusses R&D support, industrial science and technology, public attitudes toward science and tech-

nology, advances in science and engineering, and science and mathematics education below the college level. Price: $15.00 (Document 038-000-00563-4)
SUPERINTENDENT OF DOCUMENTS, Washington, DC 20402 (202/783-3238)

- **The Science and Technology Data Book** — National Science Foundation. This 45-page pocket-sized reference provides basic information on federal and industrial R&D spending, manpower, science, and engineering enrollments and international comparisons. Price: FREE.
NATIONAL SCIENCE FOUNDATION —Div. of Science Resources Studies, 1800 G St. NW, Washington, DC 20550.

(Developed from AFIPS Washington Report, Vol. XII, No. 6 — June 1986.)

Imaging science center planned for degree programs and research

Rochester Institute of Technology, already established as the premier center in photography, graphic arts and imaging, plans to further strengthen its position in the field of imaging science with construction of an $8.5 million Center for Imaging Science.

The new center will be used academically for RIT's undergraduate and master's degree programs in imaging science, for the imaging science component of the Institute's microelectronic engineering program, and for future post-graduate development in imaging science. Research, however, will be the dominant focus of the facility — especially in the areas of optics and electro optics, digital imaging and remote sensing, robotic or machine vision.
ROCHESTER INSTITUTE OF TECHNOLOGY, Rochester, NY (716/262-2626)

Electromagnetic measurements subject of bibliography

The Electromagnetic Fields Division of the National Bureau of Standards has published a bibliography of its publications from 1970 through September 1985, covering measurement methods and standards for microwaves, antenna systems, electromagnetic noise, emission, immunity, susceptibility and interference, non-ionizing radiation, and waveform metrology.
To order: **A Bibliography of the NBS Electromagnetic Fields Division Publications**, PB #86-191947. Price: $11.95 (prepaid).
NATIONAL TECHNICAL INFORMATION SERVICE, Springfield, VA 22161.

PC publications update technology trends, advances

PC Perspectives, a monthly newsletter geared toward professionals whose work involves IBM PC use, covers products, industry news, and technology trends. Price: $195/year ($245/year outside the US).

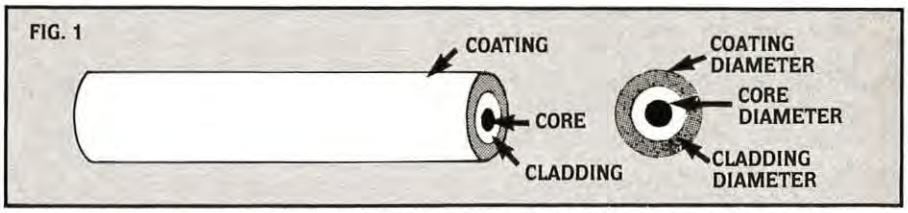
The Personal Computer Local Networks Report (271 pages) covers PC network theory and applications, including discussion of basic network technology, advanced hardware and software developments, and available PC LANs and LAN operating systems. Price: $192 ($232 outside the US).
ARCHITECTURE TECHNOLOGY CORP., Minneapolis, MN (612/935-2035)

Optical fiber choice a function of specific application

Fiber optic cables are rapidly replacing metallic coaxial cables, in both new and retrofit systems, for a large number of applications, such as LAN, long distance telephone lines, and military field cables.

Although there are many different types of optical fiber construction that have evolved to meet the needs of existing applications, their basic structures are similar—comprising a fiber core, protective cladding and outer coating. (Fig. 1) Different fiber sizes are designated by their core/cladding diameters ratio: thus a 50/125 fiber has a 50 μm dia core and a 125 μm dia cladding.

Selecting a particular type fiber for a specific application requires not only analysis of parameters affecting optical fiber performance, but also evaluation of advantages and disadvantages of various fiber constructions.



Basic components and method of construction are similar for all optical fibers, regardless of the type.

Multimode Graded-index fibers

50/125 Fiber—initially the workhorse for long distance telecommunications. Its low attenuation of 3dB/km at 850 μm makes it well suited for long runs. Typical numerical apertures are 0.20 and 0.23. In addition, the 50/125 fiber can have a bandwidth as high as 1000 MHz-km, and is one of the least expensive fiber types available today. Using either a high quality LED light source or (for longer distances) a laser source, the 50/125 fiber is well suited for point-to-point use.

More recently, however, the 50/125 fiber is being replaced by single-mode fiber for long distance (100 to 1000 km) telephone lines. The single-mode fiber's higher bandwidth and lower attenuation are important advantages for long distance.

Telephone companies also initially chose the 50/125 fiber for shorter interexchange runs (10 km). Today, however, all new installations use single-mode fiber to provide high circuit capacity.

The military still uses 50/125 multimode fiber for field deployable cable, because of the fiber's high bandwidth and immunity to EMI, RFI, nuclear radiation, and electromagnetic pulses. In addition, communication using optical fibers is extremely secure because it is easy to determine when the system is being tampered with.

100/140 Fiber—first type to be introduced as an alternative to 50/125 for local area networks (LANs). Its larger core diameter allowed more optical power to be coupled into the fiber—a distinct advantage for LANs, which use a large number of connectors to link computers and terminals ("nodes") together. These fibers also have larger numerical apertures—0.29—than the 50/125 fiber, helping to provide high collection factors, and thus permitting the use of inexpensive LED light sources.

The 100/140 fiber features a medium bandwidth—20 to 500 MHz/km—and medium attenuation—5 to 7 dB/km. Because most LAN applications have very short links (several hundred meters) this attenuation and bandwidth serve the need well. Its moderate attenuation, however, limits the fiber to runs of 2km or less for best operation. The higher optical power coupled into the fiber allows for the use of several connectors on one link.

A disadvantage of the 100/140 fiber is that it is more expensive than 50/125. In addition, special connectors are required to fit the larger 140 μm dia cladding.

85/125 Fiber—introduced as an alternative to 100/140. It is quite similar to the 100/140 fiber, having the same applications, as well as similar medium bandwidths and attenuation characteristics. Because of its smaller core diameter and lower numerical aperture—0.25—the fiber's collection factor is 62% that of 100/140.

The primary advantage of 85/125 is that its smaller diameter is less expensive to produce than 100/140. In addition, 85/125 uses the same standard, and widely available, connectors as does 50/125.

Optical, mechanical properties

Performance of an optical fiber can be characterized by several parameters:

- **Attenuation**—specifies the amount of optical power loss due to absorption and scattering of optical radiation at a specified wavelength in a length of fiber. The optical loss is proportional to the distance the light has travelled within the fiber, and is dependent upon the wavelength of the light being transmitted.
- **Bandwidth**—represents the highest sinusoidal light modulation frequency that can be transmitted through a length of fiber, while incurring an optical signal power loss of 50% (3dB) or less. The higher the bandwidth, the more information that can be transmitted in a specified time interval. One of the reasons the bandwidth limitation arises is that light entering the core at different angles travels a different distance.
- **Numerical aperture**—represents the angle over which light can be accepted by the fiber core. If the light from the source enters the core at too sharp an angle, it will be absorbed in the cladding, rather than being transmitted down the core. Numerical aperture is related to the amount of optical power that can be accepted by the core itself . . . the larger the aperture, the easier it will be to couple light into the core.
- **Core diameter**—can vary from 10 μm to over 1000 μm, thus permitting efficient coupling to various commercially available light sources, such as LEDs or laser diodes. Core diameter is an optical measurement.
- **Collection factor**—an overall measurement relating to the fiber's collection efficiency for optical radiation. It takes into account the effect of core diameter and numerical aperture.

62.5/125 Fiber—emerging as a new "standard" for LANs as an alternative to 100/140. Its collection factor is 40% that of the 100/140 fiber.

The 62.5/125 fiber has similar use, as well as similar attenuation and bandwidth characteristics, as the 100/140 fiber. It uses the same connectors, however, as the 50/125 fiber. Although the 62.5/125 fiber couples less light energy than the 100/140 fiber, this is becoming less important because of improved light sources and connectors.

Present cost of the relatively new fiber is artificially high, but ultimately it should stablize between the cost of the 50/125 and the 100/140 fibers, since such costs are based largely on core diameter and fiber volume.

Multimode Step-index Fibers

These fibers are capable of coupling large amounts of optical energy, and are well suited for applications requiring low cost light sources, connectors, or splices.

Plastic Clad Silica Fiber—originally developed when light sources and connectors were poor, and the fiber had to be capable of coupling large amounts of light. Today, it is used in short run applications requiring inexpensive components and allowing for inexpensive sources, and lower tolerance connectors. The PCS fiber core, made of silica (glass), offers very large diameters—200 to 1000 μm—for applications requiring large amounts of optical energy to be coupled into the fiber. The large core diameter, however, substantially reduces the precision required by the connectors.

PCS fibers feature medium attenuation, with a low bandwidth of 10 to 20 MHz-km. The attenuation worsens at low temperatures, making operation below −10C difficult.

PCS fiber uses a soft plastic cladding that is so soft connectors cannot be fastened directly to it. Instead, cladding must first be removed from the core; a harder cladding material is attached to replace the removed portion; and then the connector is fastened. This extra operation makes installation of a connector more difficult than with glass-clad fibers.

Hard Plastic Clad Silica Fiber—very similar type fiber to PCS, except that it has improved low temperature performance. But, unlike PCS, the hard cladding does not have to be removed prior to connection. And, because of its low cost and ease of connection, HPCS fiber use is expected to grow for short distance communications links.

Plastic Core/Plastic Clad Fiber—very inexpensive fiber that is easy to connect; however, it has very high attenua-

FIG. 2

Light entering a multimode fiber travels along "zigzag" paths, referred to as modes.

FIG. 3

Grading an optical fiber with slightly differing indices of refraction causes light rays traveling in the outer layers to travel faster than those traveling along the center path, equalizing the propagation times and producing curved light paths.

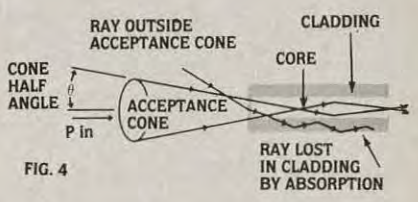


FIG. 4

Angle of acceptance cone designates the angle in which the optical energy stays in the fiber core.

Optical fiber construction

Optical fibers have an all dielectric construction in which a central, circular core region propagates the optical energy. This material typically is transparent silica (glass). Core diameters can vary from 10 μm to over 1000 μm, depending on the application.

Surrounding the core is another layer—the cladding—made of glass or polymer material. Cladding serves two purposes: It protects the core from surface contamination, which would lead to high light losses; and it deflects optical energy that would tend to leave the core back towards the core center, thereby continuing its propagation. This deflection results from the cladding having a lower index of refraction than the core.

Reflections between high and low index media are described as total internal reflections because 100% of the energy is reflected back, provided the interface is smooth. If the angle at which the light enters the core is too acute, however, light will leave the core completely and will be absorbed entirely in the cladding or lost in the cladding and surrounding media.

More complex fiber constructions have their core comprised of gradually varying indices of refraction. Such graded index fibers are used to achieve high signal bandwidths.

In a multimode fiber, a variety of modes are transmitted—represented by the "zigzag" light path through the fiber's core. (Fig. 2) Multimode fibers include both step and graded index construction. In step index fibers, the indices of refraction between core and cladding are distinctly different. In graded index fibers, on the other hand, the indices of refraction gradually change from the center to the outside of the core—achieved by using a number of layers, each with slightly differing indices of refraction.

This grading causes the light rays in the outer layers of the fiber core to travel faster than those rays travelling along the core's center path directly down the axis. The result is an equalization of the propagation times of the various modes that produces curved light paths. (Fig. 3)

Fibers also can be constructed so that light is transmitted only through the center of the core, thus eliminating zigzag reflections. These so-called single mode fibers, which permit only one path, have very small diameters, such as 10 μm.

A final layer or coating serves to protect the core and cladding of the optical fiber. This coating typically is made of epoxy acrylates, with its outside diameter dependent upon the type of cable construction.

In loose fiber buffer cables, the fiber is free to move within a larger diameter plastic tube. The coating diameter of such a cable typically is 250 μm. Loose buffer tube cables have the advantage of providing the fibers with substantial protection from external mechanical forces.

In tight buffer cables, a 500 μm dia fiber protective coating is utilized. An additional buffer often is placed directly over this protective coating. Tight buffer cables are more flexible, and generally are smaller in diameter than loose buffer tube cables.

A completed cable may consist of several fibers, including added components such as strength members, jackets, armoring, filling, and so on, to give the cable the desired mechanical performance characteristics.

tion—200 dB/km—which limits its use to very short runs.

Single-mode Fibers

The biggest advantage of single-mode fibers is their extremely high bandwidths of 50-100 GHz-km. The most common size in current use is the 10/125 fiber, which is often used by telephone companies for long haul lines.

To achieve such a high bandwidth, however, other parameters are sacrificed. The small mode field diameter of 10 μm, and its accompanying low numerical aperture make it difficult to couple large amounts of light into the fiber. Thus, lasers or highly specialized LEDs must be used as light sources. In addition, the 10 μm mode field diameter requires that the cores be precisely aligned for connection—thus making single-mode connections very expensive.

Second window (1300 μm) attenuation in single-mode fibers is extremely low—less than 0.5 dB/km (third window, 1550 nm-rated versions, are also available). Single mode fibers typically do not operate at 850 μm.

As communications technology evolves and the need for extremely high bandwidth will grow to importance, the single-mode fiber's high bandwidth will become increasingly necessary. At the same time, connector and source technology will continue to improve, thus reducing the significance of single-mode disadvantages. Multi-mode fiber, however, will continue to be used for applications where its advantages warrant it.

(Developed from **Analysis of Optical Fiber Types**, by Gene Anderson, Project Manager, Optical Fiber, Belden Technical Research Center, Geneva, IL.)

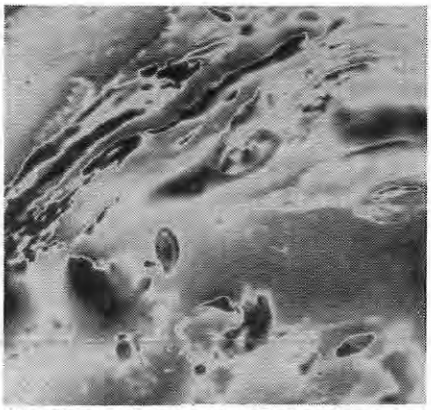
Shadow enhancement provides 2-D maps with 3-D imagery

Although satellite imagery has become a valuable tool for the geologist in quest of natural resources, the traditional pen-plotted geophysical contour map (developed from aeromagnetic surveys conducted from an airplane) remains the primary method for interpreting geoscience data on formations beneath the earth's surface. Unfortunately, displaying such three-dimensional data on a two-dimensional contour map doesn't provide the same degree of detail as found in a satellite photograph.

To overcome this, and other drawbacks of 2-D contour mapping, engineers use a software method of "shaded relief" — or "shadow" mapping, as it is also called — that carries the aeromagnetic data display a step further. The method enables geologists to turn a 2-D contour map into a 3-D detailed map that resembles a satellite-like image — but that contains information not normally obtainable by satellite sensors.

Mapping subsurface formations

Electromagnetic radiation gathered by a satellite's sensors comes from the top few microns of the land surface (or top few meters of the sea surface) yielding vivid 3-D images of exposed geophysical formations, but not very much information on the contents below the earth's surface. Aeromagnetic survey, on the other hand, records the earth's magnetic or gravitational strength. This data can be used to produce maps that show in detail the earth's contents — to depths of about 20 km.

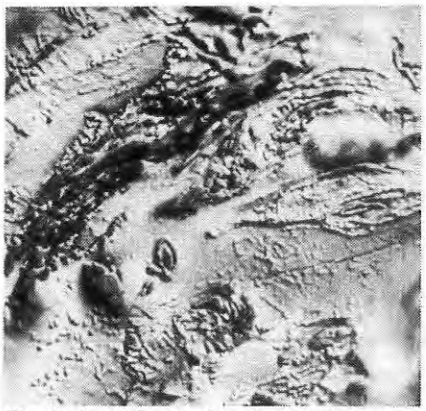


Standard color mapping: *Data values over a map region are directly represented by a range of colors, with the hue at any point on the map representing a specific data value at that point.*

Conventional 2-D contour maps, though, have their drawbacks:

- values of mapped quantities cannot be viewed directly, but must be read from contour labels;
- features on large-scale maps (1:500,000 and up) are often too small and convoluted to permit easy visual recognition; and
- magnetic intensities of major land features can greatly distort or even eradicate minor features that may be exactly what the geologist is seeking.

Gradating a map's contour rings with colors improves readability by adding a truly independent third dimension to the 2-D map sheet. Relative amplitude of recorded data is visible at a glance — with low values represented by the blue end of the spectrum; and the highest values, by the deep red end.



Shaded relief mapping: *As with the color map, the hue at every map point represents the data value, but the lightness/darkness of the hue varies according to the slope or gradient of data at that point.*

Although adding color to the contour rings can greatly enhance a map's readability, the 40-hue spectral scale used for geophysical mapping limits visibility of fine detail to high amplitude recordings; low amplitude features are not clearly expressed.

Detailing subtle features

Shadow mapping, on the other hand, enables geologists to enhance pen-plotted geophysical images, thereby revealing the more subtle features that are normally lost in conventional 2-D contour mapping. Shadow mapping provides a means of displaying two independent variables simultaneously on the same map — amplitude (hue) and gradient (shadow) of the quantity of aeromagnetic data measured over the mapping region.

As with a conventional color contour

(Continued on p 35 . . .)

Real-time, created images lead growth in electronic imaging

Electronic imaging, one of the fastest growing segments of the information processing and display industry, is comprised of two general types of applications: artificial vision systems, and all others.

Artificial vision systems derive data from the world much as an unaided human eye would; while the other systems derive data that is visible only through a microscope, telescope, or non-visual signal sensing device.

The first category of applications includes: measurement and testing, industrial robot vision, process control, security systems, and other artificial vision systems. Non-artificial vision systems, on the other hand, include: medical (non-diagnostic), remote sensing, geophysical, printing/publishing, graphic arts, and others.

According to a recent Frost & Sullivan study, the US market for these image processing systems was estimated to be $414.8 million (1985); and forecast to reach $1.576 billion (1990)—in constant 1985 dollars. (ID June 1986, p. 11)

Among the many conclusions the researchers drew from their study of major applications categories (see table, below) in the image processing market: real-time applications are in the majority, but only barely; most uses of image processors involve treatment of natural images; and research applications for image processing dominate production applications. Their studies indicate, however, that real-time image processing, treatment of human-created images, and production applications are growing faster than non-real-time image processing, treatment of natural images, and research applications.

The need for real-time is increasing as systems are used more in production and commercial laboratory settings; while an increased share of human-created image applications is due to the increasing use of computer graphics and programmed imagery techniques in conjunction with image processors.

Video input dominates the automated scene-capturing methods, accounting for 24.6% of the total; and computer graphics, as a means of entering image data manually with computer assistance, accounts for 27.9%. X-ray, laser scanning, infrared, and LANDSAT or telescope input methods respectively account for 6.7%, 7.6%, 3.8%, and 13.3%; while other methods, including computer-aided tomography, seismic radar, microscope, and ultrasound add up to 16.1%.

IMAGE PROCESSING SYSTEMS SALES PROJECTIONS (MILLIONS)

	1983	1984	1985	1986	1987	1988	1989	1990	GROWTH/ YR 1985-90 (%)
Medical (Non-Diagnostic)	29.4	38.8	50.4	64.5	80.7	97.6	115.2	132.5	21.3
Remote Sensing	30.0	34.5	38.6	42.5	46.3	50.2	54.3	58.6	8.7
Geophysical	3.9	5.9	8.2	10.7	13.0	15.1	17.0	18.8	18.0
Artificial Vision	26.5	58.7	113.7	191.3	289.4	405.7	535.2	687.4	43.3
Measurement & Testing	17.1	37.7	70.4	116.2	168.4	227.4	293.3	366.7	39.1
Industrial Robot Vision	2.7	8.2	20.5	39.0	66.2	99.3	131.1	167.8	52.3
Process Control	4.6	7.4	11.5	17.6	26.6	39.3	57.0	82.1	48.2
Security Systems	1.7	3.8	6.5	10.4	15.6	21.8	29.3	38.0	42.4
Other	0.4	1.6	4.8	8.2	12.6	17.8	24.4	32.8	46.8
Printing & Publishing	48.3	64.7	84.8	108.5	135.7	165.5	198.6	234.4	22.5
Graphic Arts	37.5	54.4	76.1	102.7	134.6	170.9	211.9	256.4	27.5
Other	19.8	29.7	43.0	60.2	81.9	109.7	144.8	188.3	34.4
TOTAL	195.3	286.6	414.8	580.4	781.5	1014.8	1277.1	1576.1	30.6

Source: *Frost & Sullivan, Inc.*

Imaging Products on Display

Image processor

ADSI provides turnkey integration of image processing systems (hardware and software) that frees the individual components to perform as a system with a level of speed normally found only in mainframe single-design configurations. The integrated software configuration is operatively simple, does not compromise the integrity of individual components, yet performs multitask functions at a very high speed.
ADVANCED DIGITAL SYSTEMS INC., Metairie, LA (504/885-2291)
EI '86

Circle Reader Service #71

TV camera tubes

Plumbicon TV camera tubes, designed and constructed to a clean-room concept, provide high-resolution imaging devices for a number of applications, including general purpose color or monochrome imaging, medical x-ray, fluoroscopy, high signal digital x-ray subtraction imaging, and color broadcasting. Other products include: Vidicon camera tubes, solid state frame transfer sensors, image intensifier tubes, liquid crystal displays, and high-resolution CRTs.
AMPEREX ELECTRONIC CORP., Slatersville, RI (401/762-3800)
EI '86

Circle Reader Service #72

Thin-film coatings

Low resistance ITO, gold coatings on polyester, and various metal coatings are featured products offered to the high technology communities covering the military, aerospace and commercial markets. ANDUS specializes in the development and manufacture of custom thin-film coatings on polymer substrates for both prototype and production runs.
ANDUS CORP., Canoga Park, CA, (818/882-5744) SPSE

Circle Reader Service #73

Graphics boards/software

Truevision Advanced Raster Graphic Adapter (TARGA) family, Image Capture Board, and Video Display Adapter with Digital Enhancement enable AT&T and compatible personal computers (such as IBM PC/XT/AT) to capture, create, store, display, manipulate, and transmit television-quality images. Other products include Truevision Film Printer and several software packages: Truevision Image Processing Software, PC Carousel Presentation Software, and Still Frame-Teleconferencing Software.
AT&T, Electronic Photography and Imaging Center, Indianapolis, IN (317/352-6120)
EI '86

Circle Reader Service #74

Image analyzer

Complete IBM PC-based image analysis system, IMAVISION, incorporates Number Nine hardware plus hundreds of image analysis functions, including: geometric corrections;

Products on Display

spatial filtering; radiometric correction; transforms; classification; edge, line and shape extraction; and geographic information system. IMAVISION is configured as a stand-alone system or as an intelligent workstation to VAX computers. Software is upwards compatible with software on several minicomputers; and the system supports many image I/O devices and formats. The IBM PC-based Geographic Information System (CML-GIS), available as a stand-alone or integrated with IMAVISION, features digitization workstation and vector and raster analysis.
ROY BALL ASSOC. LTD., Ottawa, Ontario, Canada (613/226-7890)
EI '86

Circle Reader Service #75

Data processing software

Image-Pro 1000 provides complete image processing on an IBM PC/AT, including capturing, processing, and combining of high resolution photos, graphics, and text. Major areas addressed are image analysis, enhancement, spatial filtering, measurement, annotation, digitization, storage and retrieval, and halftone printing. System includes utility software for disk store/recall, image compression, and control of all programmable factors.
CHORUS DATA SYSTEMS, Merrimack, NH (603/424-2900)

Circle Reader Service #76

Machine vision system

The Cognex 2000 machine vision system, combining high-performance hardware and high-level vision software on a single board, is especially suited for incorporation into factory automation systems and devices produced by OEMs and systems integrators.
COGNEX CORP., Needham, MA (617/449-6030)
EI '86

Circle Reader Service #78

Solid-state CCD camera

High-resolution pictures are attainable without geometric distortion, lag, or image retention with the 4800 Series solid-state CCD (Charge-Coupled Device) cameras. The ⅔-in. format image sensor of the camera generates sensitivity closely matching standard silicon target imaging tubes. Weighing just 15.5 oz, the camera is suited for numerous applications including machine vision, image processing, robotics, process control and microscopy.
COHU INC., Electronics Div., San Diego, CA (619/277-6700)
EI '86

Circle Reader Service #77

Video frame stores

Model 493 Video Peak Store adds new information to memory contents, if such new data is of higher amplitude than that already recorded. Model 494 Video Scan Converter digitizes, stores, and displays video information while performing a scan format conversion. Model 495 Asynchronous Frame Store captures transient events that cannot be synchronized to the timing of a television camera. All three devices have been developed for use by researchers and engineers with special video memory applications.
COLORADO VIDEO INC., Boulder, CO (303/444-3972)
EI '86

Circle Reader Service #79

Array processors

MINI-MAP XL series of array processors feature speeds up to 140 Mflops, very large memory capacity (up to 32 Mbytes) and real-time digital and A/D acquisition modules. Mature image processing software and FORTRAN compiler complement this product line.
CSPI, Billerica, MA (617/272-6020)
EI '86

Circle Reader Service #80

Instrumentation videos

Model HR-2000 monitor providing super resolution for high-performance instrumentation applications (including medical x-ray, microscopy, tracking systems, digital imaging) features a 14-in. CRT, auto-locking to multiple scan rates, 50 MHz bandwidth, variable enhancement, selectable inputs, and separate data input. Other products include Model 81, high-resolution video camera (featuring 1600 TV lines), and other cameras produced for critical imaging applications.
DAGE-MTI INC., Michigan City, IN (219/872-5514)
EI '86 SPSE

Circle Reader Service #81

Signal processing boards

MaxVideo and MaxVision signal processing board modules communicate through Maxbus, the Datacube video imaging interconnect standard, to allow OEMs and researchers to solve image processing requirements. Software drivers are available in "C." The modular architecture of the boards allows for flexible system configuration and expansion plus the ability to perform real-time image processing and implement standard algorithms in hardware.
DATACUBE INC., Peabody, MA (617/535-6644)
EI '86 SPSE

Circle Reader Service #82

Digital imager

Diagnostic-quality, digital imager DataSprint features a variety of high-speed image enhancements including edge enhancement, windowing, electronic zoom, image subtraction, and inversion capabilities. The portable system (less than 30 lb) has a dual-purpose monitor that permits viewing menu or images. The system stores up to 25 images electronically with half a second interval. Other products include Frame-Freeze, an automatic digital image capture, display, and storage system that reproduces high-resolution, diagnostic-quality, real-time digital images directly from the fluoro video camera; and a Universal Video Interface that is capable of converting any common video display rate between 625/50 and 1000/60 as would be generated by a CT scanner or MRI to standard RS-170 NTSC.
DATASPAN INC., Orchard Park, NY (716-662-5360)
EI '86 SPSE

Circle Reader Service #83

Frame grabbers/processors

Model DT2851 High Resolution Frame Grabber and Model DT2858 Auxiliary Frame Processor are designed for IBM PC/AT image processing. Model DT2651 High Resolution Frame Grabber and Model DT2658 Auxiliary Frame Processor is designed for MicroVax II image processing. Both systems offer 512 x 512 x 8-bit resolution and real-time digital image processing.
DATA TRANSLATION INC., Marlboro, MA (617/481-3700)
EI '86

Circle Reader Service #84

Imaging workstations

Series of imaging workstations based on either the PC or VME-bus architecture, features real-time acquisition from any video source, storage on Winchester or optical media (or both), and hard-copy from a digital grayscale laser printer. In addition to a library of image processing routines, the system offers image transmission and local-area networking. Software operation includes touch-pad and mouse input devices. Table-top, roll-under, and complete desk systems provide a turnkey solution to imaging applications.
DAX SYSTEMS INC., Deerfield Beach, FL (305/427-0783)
EI '86

Circle Reader Service #85

Picture archiver

ColorCatcher, picture archiving and communications system for IBM PC and compatibles, digitizes an image into a 768 x 488 pixel array using a palette of 16 millon colors. The ColorCatcher achieves a typical 15:1 reduction in image data; and provides windowing, split screen, text and graphics overlay, and more. OEMs, VARs, and systems integrators can apply the system in ap-

plications ranging from document conferencing in medical and law enforcement image consultation and archiving to CD/ROM image authorizing.
DIVERSIFIED TECHNOLOGY, INC., Dallas, TX (214/631-2235)
EI '86

Circle Reader Service #86

Solid state cameras

Line of CCD cameras, suitable for monochrome CCTV applications in industry, surveillance and machine vision, feature custom designed ceramic covered hybrid circuits that provide sensor drives and video processing in a miniature housing. The Photon line of CCD cameras offers selectable gamma correction, reduced power consumption, automatic gain control and high speed imaging. Other products include: CCD sensors and support components for the Photon camera family; cathode-ray tubes; image intensifiers, and Leddicon and Vidicon camera tubes.
EEV INC., Elmsford, NY (914/592-6050)
EI '86

Circle Reader Service #87

Spatial scanner

Model GS 4500, tri-photomultiplier-based spatial scanning system for automatic convergence measurement provides information as to the physical relationships of the red, green, and blue components of a white line. Individual beam profiles and displacement relationships are also obtained by using a special algorithm and calibration. Single location measurements can be made in less than 15 sec with three micrometer repeatability. The convergence system complements existing GS 1000 automatic CRT measurement system, which allows measurement of display characteristics such as spot size, deflection linearity, pincushioning, barelling, and astigmatism.
EG&G GAMMA SCIENTIFIC, San Diego, CA (619/279-8034)
EI '86 SPSE

Circle Reader Service #88

Image sensing multiplexers

The M Series multiplexers are digital scanners, suitable for coupling with infrared detector arrays made with compound semiconductor materials that can scan each individual detector in a sequential fashion and transfer the charge from the sensing elements one by one to a single video output circuit. Detector arrays for both near-infrared imaging and broadcastband infrared imaging can also use the M Series for simple and efficient readout. The T Series family of monolithic self-scanned linear photodiode arrays, optimized for spectroscopy applications, provide a sensitivity of 2.8×10^{-4} coloumb/joule/cm^2—twice that of existing standard devices.
EG&G RETICON, Sunnyvale, CA (408/738-4266)
SPSE

Circle Reader Service #89

Digital imaging camera

High-resolution, high-quality digital imaging camera systems offer precise digital representations of original images in black and white or color for remote sensing, mapping, medical, color graphics and other applications. Interfaces include those for IBM PC and IEEE-488-based computers, as well as DEC UNIBUS and Q-BUS-based units.
EIKONIX CORP., Bedford, MA (617/275-5070)
EI '86 SPSE

Circle Reader Service #90

Products on Display

Laser image writer

Model 217 laser-based writer produces photographic-quality continuous tone hard-copy from digital data. The device writes images using a 256-tone gray-scale at resolutions up to 400 pixels-per-inch on dry silver paper or film. It produces a dry, finished image in 60 seconds, given a typical digital image size of 1536 x 1536 pixels at 200 pixels per inch. The Image Writer can be interfaced to computers that are bus-compatible with VMEbus, Ethernet, or Multibus.

EKTRON APPLIED IMAGING, Bedford, MA (617/275-0475)
EI '86

Circle Reader Service #91

Video digitizer

Plug-in board for the IBM PC/XT/AT, and compatible computers, digitizes, processes, and displays an RS-170 or RS-330 video signal. Video data is digitized and displayed at 8 bits per pixel, at a maximum frequency of 14.318 MHz. The sampling resolution is user programmable from 4 to 752 pixels per line and from 1 to 480 lines of image data. The system—Silicon Video—is available with either 256 Kbytes or 1 Mbyte of image memory, and supports digitization and display of single images or image sequences. Optional look-up tables and D/A converters support RGB output of 256 colors from a palatte of 16 million.

EPIX INC., Chicago, IL (312/764-9186)
EI '86

Circle Reader Service #92

Video instrumentation

Line of video instruments and ancillary equipment includes:

- FM-80 Frame Memory - black-and-white video frame memory unit with 8-bit processing, plus RS232 output.
- IV-560 Video Measuring Gage—quick, precise measurement of position, object size, and distance between two points.
- FA-400 Time Base Corrector—automatic/manual full-color frame-freeze, field-freeze and remote control capabilities.
- VTW-100 Video Typewriter—portable unit with 32 pages of memory, 20 characters x 8 lines per page, one-month memory backup, and preview function.
- IV-530 Contour Synthesizer—black-and-white video enhancement with conversion of image densities into bas relief.
- VP-380 Video Pointer—superimposition of symbols including arrow, +, ○, ◯, or □, onto a TV picture with movement of symbol freely around the picture using a joystick control.

FOR-A CO. LTD., Newton, MA (617/244-3223)
EI '86

Circle Reader Service #93

Array processors

FPS-5000 Series and MP32 multiprocessor array processors compliment the FPS M64 Series Minisupercomputers in the imaging sciences market including medical, remote sensing, and digital imaging applications. Non-destructive testing is a related application where FPS processors improve system performance in the detection of flaws in manufactured materials.

FLOATING POINT SYSTEMS INC., Beaverton, OR (503/641-3151)
EI '86

Circle Reader Service #94

Digital scan converter

Model 8342 radar digital scan converter and digital image processor features video digitizing, image memory, map/graphic overlays, messages and annotations, programmable fade, and display offset. Options include remote display system, radar target tracking and plotting, and range height indicator. Other products are digital and video display processors, NDT imaging systems, and underground imaging radar.
FOLSOM RESEARCH INC., Folsom, CA (916/985-2481)
EI '86 SPSE
Circle Reader Service #95

Large screen image processor

Series IP9000 Image Processor enhances and processes a maximum of 2048 x 2048 x 32-bit, true color images presented from any digital format including RS 170 video sources. The system provides 1280 x 1024, 60 Hz flicker-free image displays. The programmable resolution feature of the system allows a user to download a program in any size up to 1024 x 1024 at scan rates of 30, 40, and 60 Hz. An arbitrated bus structure permits multiple functions to run concurrently, permitting a user to run a Fast Fourier Transform while simultaneously acquiring, processing, and displaying an image. Other products include: the IP 800 standard resolution series image array processors with real-time digital disk and the GRSS bundled remote sensing series.
GOULD IMAGING & GRAPHICS DIV., Fremont, CA (415/498-3200)
EI '86 SPSE
Circle Reader Service #96

Video cameras

Computer compatible video camera series C1000-20 features 1200 TV line resolution for high resolution image processing, high signal/noise ratio, low geometric distortion and built-in shading correction. Other products include: Model C2741 high-performance industrial video camera that features a variety of tube selections—from ultraviolet to infrared—with standard image enhancement circuitry and optional gamma boost, video invert and external synchronization for interfacing with imaging digitizers; and C2399 Position Sensor System that provides real-time X,Y coordinates of an infrared LED and can input data directly to a CAD/CAM system for applications such as robotic sensing, target tracking, and motion analysis.
HAMAMATSU PHOTONIC SYSTEMS, Waltham, MA (617/890-3440)
EI '86
Circle Reader Service #97

Video instruments

The HEI 582A Video coordinate Digitizer takes measurements of objects in a TV picture in real-time or from recorded video, in full speed, slow motion, or freeze-frame. The system generates a precision reticle (cross-hair) that is inserted into a standard TV picture and then positioned through the host computer interface port or manually by using an optional controller. Reticle position may be read by the host computer or visually displayed by an optional LED front panel readout, or both. Other products include: HEI 522B Video Instrumentation Annotator that inserts timing and text into a standard TV picture; and HEI 921A Multi Frame Buffer for video disc recorders that can be partitioned into 384, 512, or 768 x 512 x 8-bits deep, storing up to 180 frames of 512 x 512

Products on Display

video individually addressable by a host computer.
H/E INC., Las Vegas, NV (702/457-6118)
EI '86

Circle Reader Service #98

Solid state cameras

Black and white CCTV camera ITC-510, is a 1-in. system for medical, industrial, and process control applications, designed to meet specific requirements of monitoring equipment and to provide high resolution and high sensitivity. The camera has an ALC range of 100,000:1; high-resolution of 850 lines or better; and an automatic beam control. Model ICT-200 camera features a charge coupled device ⅔-in. in size. The solid state camera is designed for robotic, medical, security, surveillance and military applications. Its picture element is 386 x 488 pixels; resolution is 285 H and 350 V lines.
IKEGAMI ELECTRONICS (USA) INC., Maywood, NJ (201/368-9171)
EI '86

Circle Reader Service #99

Imaging subsystem

The IMAX, a HW/SW imaging subsystem for the MicroVAX, consists of the QD512, Q-bus-compatible RGB display board, driven by Research System Inc.'s IDL—a high-level interactive imaging language. The board may be operated as a 512 x 512 x 8-bit display, or as the controller of a system that can be expanded to 4096 x 4096 x 8 bits. IMAX converts a MicroVAX into a full-featured imaging workstation without sacrificing any of the multi-user capability of the computer. It features RGB output, 256 colors, mouse interface, cyclical animation, contour plots, algebraic operations, signal processing capability, zoom, minification, pan, scan and other attributes.
IMAGE ANALYTICS CORP., Montchanin, DE (302/652-3386)
EI '86

Circle Reader Service #100

Image processors

Single board, image processing modules—Series 100—are capable of digitizing analog video from standard RS-170, or RS-330 (or 50Hz CCIR) sources, processing the digital images in real-time and displaying the stored image in monochrome or pseudo-color. Modules are plug-compatible with VMEbus, Multibus, Q-Bus, and IBM PC/ATs. Series 151 Image Processor is a VMEbus-based packaged subsystem that connects to the PC AT through a proprietary interface, allowing the PC to control operation of the subsystem. Using a hardware implementation of area-of-interest processing, the 151 processes user-defined subregions of an image through the pipeline at 10 MHz per pixel, without need to conform to restricting RS-170 video standards.
IMAGING TECHNOLOGY INC., Woburn, MA (617/938-8444)
EI '86

Circle Reader Service #101

Color graphics controllers

IMAGING series for the PC XT/AT/RT and compatibles, and a VME bus graphics controller, utilize the Hitachi HD-63484 VLSI Graphic Controller and dual ported 256 K Video RAMs. The VMEbus advanced graphic controller provides resolution of 1280 x 1024 and a pixel depth of 4 bits/pixel. IMAGING series boards are capable of displaying 8 to 24-bit, 2D/3D shaded color or gray-scale images for solids modeling, video art productions, graphic arts, medical imaging, and landsat applications. Resolution for IMAGING series products ranges from 1280 x 1024 to as low as 512 x 480; a programmable palette of 16.8 million colors is standard.
IMAGRAPH CORP., Woburn, MA (617/938-5480)
EI '86

Circle Reader Service #102

Electronic publishing system

System integrates fast text processing with five kinds of graphics and multiple font laser printing or phototypesetting. Release 3.0 version of publishing software includes:

- Automatic index generation—alphabetizes all entries, sorts page numbers, and creates index documents;
- Automatic numbering—handles documents with many numbered sections;
- Math package—mixes equations easily with other graphics as well as integrates text; and
- Scanned images—electronically "airbrushes" scanned photos by painting with any 256 levels of gray, and clones (copies) one part of an image onto another as well as zooms in on any portion of scanned art and edits at that zoom level.

INTERLEAF, INC., Cambridge, MA (617/577-9800).
EI '86

Circle Reader Service #103

Image processors

Digital image processing system IPS/68K features the UNIX operating system, and a choice of FORTRAN 77, PASCAL, and C programming languages. Microprogrammable pipeline processor has 6 kbyte microprogram storage, 1024 16-bit registers, and 8 kbyte high-speed cache memories. Processing speed is 10 million instructions per second. Image memory is 2 to 64 Mbyte, expandable with freely definable range sizes. Other products include DEC/IPS add-on system for DEC VAX, MicroVAX and PDP computers; and SUN/IPS for SUN-3 workstations.
KONTRON ELECTRONICS, Mountain View, CA (415/965-7020)
EI '86 SPSE

Circle Reader Service #104

Cathode ray tubes

Line of CRTs includes the L4146-09 high resolution, high-contrast color recording tube for multi-thousand line color imagery; L4369 14-in. useful line scan fiber optic "Laser Emulator"; L4360 red enhanced color recording tube; and L4272 miniature tube for helmetmount and low volume displays.
LITTON ELECTRON DEVICES, Tempe, AZ (602/968-4471)
EI '86

Circle Reader Service #105

Vision processor

Two-board vision system provides PC/AT systems with vision processing power normally associated with systems costing two to five times more. The MVP-AT system provides four 512 x 512 x 8 Video RAM image buffers, real-time frame grab, real-time frame averaging, Area-of-Interest window processing, 32-bit planes, histograms and area profiles and ALU and statistical processing up to 10 million pixels per second. PC-imaging board combines color, gray scale and binary processing in a single board set. Price: $4995.
MATROX ELECTRONIC SYSTEMS LTD., Dorval, Quebec, Canada (514/685-2630)
EI '86

Circle Reader Service #106

Image-processing software

Image-Pro series of image-processing software, for use in IBM-AT or compatible, is a complete solution for image processing in 512 or 1K resolutions. The series supports many of the most popular imaging boards. Functions include image storage and retrieval, interactive enhancement, analysis and image processing functions, image editing and annotation, report generation and hardcopy, and image database management.
MEDIA CYBERNETICS INC., Silver Spring, MD (301/495-3305)
EI '86

Circle Reader Service #107

Hi-res camera tubes

Line of high-resolution camera tubes includes: near-IR, ultraviolet, ruggedized, fiber optic; TV camera tubes and imaging components; radar and special purpose cathode-ray tubes.

Shedding a little light on color...

Color. It is everywhere around us, and has been a major force in our lives since pre-history. It permeates our culture. Every shade of color is imbued with meaning and emotion. Red is hot and red is danger. Blue is cool. Much of our literature and art—from Homer's "wine dark sea" to a child's coloring book—has been concerned with trying to describe and define color.

But what precisely is color? And how can we measure it accurately, objectively and repeatably?

The first definition of color in Webster's New Unabridged Dictionary is "The sensation resulting from stimulation of the retina of the eye by light waves of certain lengths." That doesn't tell us much. Or does it?

Indeed it does. It tells us the two critical parameters that define color: the wavelength of light, and the eye of the beholder. While not all beholders always agree on color, at Photo Research SpectraMetrics we can define color precisely and repeatably by analyzing the wavelengths of light emitted or reflected.

The PR-1980B/SC Pritchard SpectraRadiometers are the definitive color measurement systems in the industry today. The PR-700 SpectraScan Family of Self Scanned Array Systems leads the field in precise real-time color and intensity analysis—and both lines are PC compatible.

If you'd like more information about our spectral and spatial scanning systems, and how you can put them to work for you, call at (818) 843-6100, or write us at the address below.

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Thomson-CSF is your winning partner for professional display tubes and devices. Whether your applications are in radar, avionics, defense, industry or medicine, you can be sure of our technology for reliability and performance, even under the most adverse conditions.

Our vast CRT range incorporates the latest models for video projection, short head-up and head-down displays, helmet-mounted displays, ground/airborne monochrome and color radars, photographic data recording, instrumentation, etc.

And our proven AC plasma panels offer the ultimate in readability and ruggedness for medium and high density graphics display, in all environments.

With manufacturing plants in Europe and the US, we are at hand to let you benefit from our quality products with the best customer care. Just as we did for major programs worldwide.

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Very high definition CRTs
Linewidth as small as 20 µm
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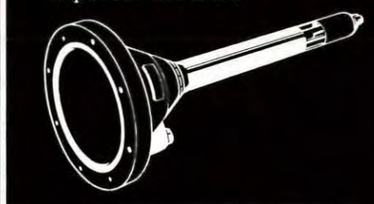

Special monitor CRTs including ruggedized color radar and helmet mounted displays

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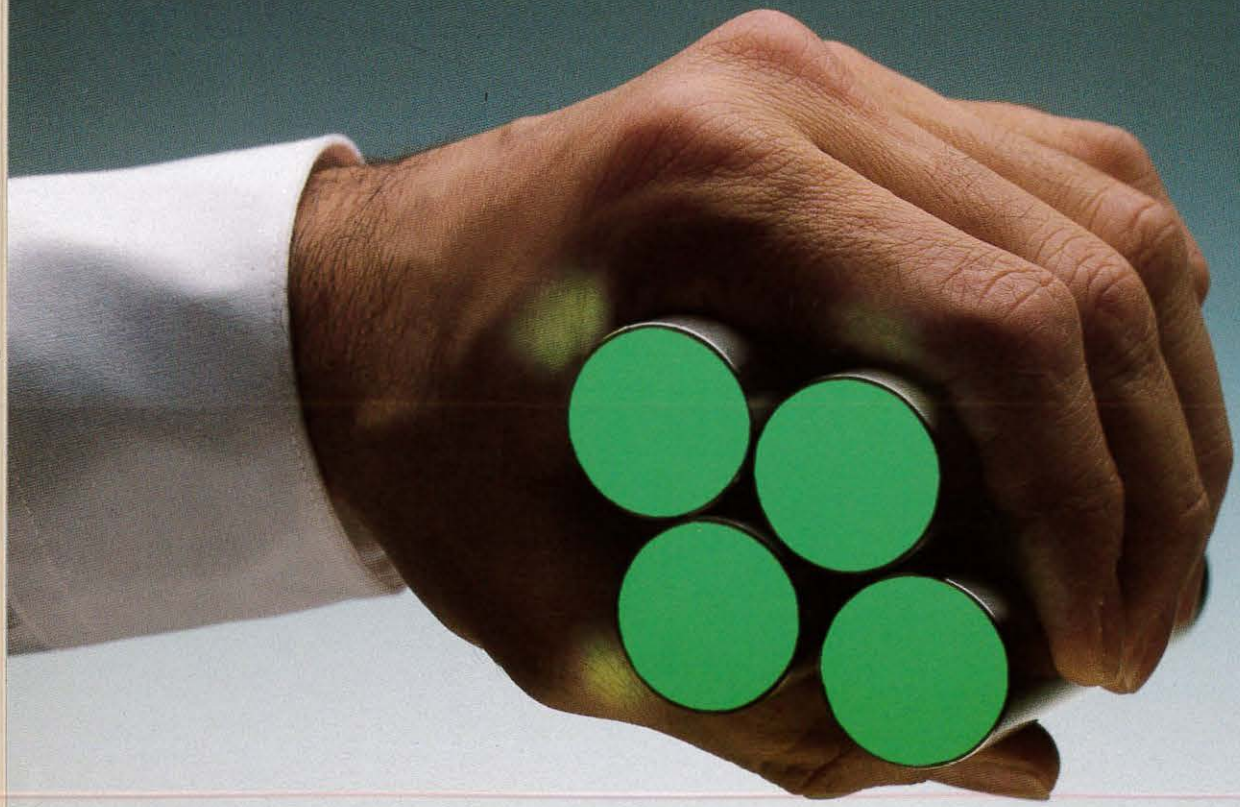
Circle Reader Service #21

5583

Our new CRTs are quite a handful.



Introducing Litton's 1" tube.

Now let's see. What could you use a miniature CRT for?

How about a helmet-mounted display.

A compact film recorder.

A hybrid typesetter.

Or a compact display inside a crowded tank.

Litton's L-4272 cathode ray tube is the newest sub-miniature on the market.

And one of the best.

It's made by the leader of high resolution, high precision CRT's. Litton's reliable CRT products have been used in everything from advanced reconnaissance systems to sophisticated photocomposition machines.

The L-4272 is ruggedized, so it'll survive inside a tank, an aircraft or any vehicle using forward-looking infrared systems.

And it's a high performer. Spot size is 0.0008 inch. Brightness is 100 foot-lamberts with standard 525 line TV raster at 30 Hz filling the useful screen.

You can buy it as a stand-alone item or with a small coil and magnetic shield.

To get the small picture, contact Litton Electron Devices Division, 1215 S. 52nd Street, Tempe, AZ 85283. Phone (602) 968-4471. TWX: 910-950-0149.

Litton

Electron Devices

See us at Electronic Imaging (EI'86), booth #1615

Circle Reader Service #22

MII/TELTRON INC., Birdsboro, PA (800/835-8766)
EI '86 SPSE
Circle Reader Service #108

Instrumentation

TV Color Analyzer II enables objective white-balance adjustment of color monitors. The microcomputerized unit provides standard primary-analyzer mode for red, green, and blue-beam intensities; and features a chroma mode that shows chromaticity coordinates (x,y) and luminance in either cd/m² or foot-lamberts. In this chroma mode, white standard or reference colors can be put into memory by simply adjusting the monitor until the desired coordinates are displayed. Other products include: silicon photo cell illuminance meter that is combined with a microprocessor and liquid-crystal display for measuring illuminance instantaneously and continuously; and a luminance meter for spot readings of light sources and surface brightness that measures only the light within a 1-deg reading spot with no influence from the surrounding areas.

MINOLTA CORP., Ramsey, NJ (201/825-4000)
EI '86
Circle Reader Service #109

Motion analyzer

ExpertVision "EV" computer-based instrument recognizes, tracks, and quantifies the movement of objects recorded by either video or film cameras. The turnkey system provides a means of data capture, analysis and report generation; and features noncontact/noninvasive sensing, tracking multiple targets with one camera, capability to customize measurement variables, and capability to automate repetitive testing. The system has applications in vehicle impact testing, fluid dynamics, vibration, and kinematic analysis.
MOTION ANALYSIS CORP., Santa Rosa, CA (707/579-6511)
SPSE
Circle Reader Service #110

Flat-bed image scanner

Using an IBM AT, PC-compatible interface board, a high resolution flat-bed image scanner transfers graphic images of characters and photographs to IBM AT, PC-compatible computers as fast as six seconds per page. With 16-shade monochrome output, the scanner offers multi-mode resolution—up to 400 dpi. The unit, 11.6-in. wide, 20.5-in. long, and 4.4-in. high, has a user-adaptable 8½" x 14" scanning area. Price: under $2,000.
PANASONIC INDUSTRIAL CO., Secaucus, NJ (201/348-7000)
EI '86
Circle Reader Service #111

Image processor

Model 9200 system processes images up to 1024 x 1024 in either the spatial or the frequency domain. Its transform accelerator module permits full 32-bit floating point Fourier transforms and frequency filtering without having to have an additional array processor. The 9200 has an embedded 68010 microprocessor that offloads much of the image processing workstation demands from the host computer.
PERCEPTICS CORP., Knoxville, TN (615/966-9200)
EI '86
Circle Reader Service #112

Products on Display

Instrumentation

Photometer Model 1980A provides photometric and radiometric measurements simply, quickly, and accurately, with a minimum of set-up time. The unit has a broad light-sensitivity range, from pitch-dark to sunbright (from 10^{-5} to 10^{7} ft-L full scale). Model 1980B Scanning Spectroradiometric system reduces the complexity of computer assisted spectroradiometric scanning and "sees" considerably further into the ultraviolet and infrared ranges. The unit features wavelength range of 300 to 500 nanometers, order sorting filters to eliminate second-order effects and stray light, and at least 3:1 improvement in signal to noise ratio through use of thermoelectric photomultiplier tube cooler. Other products include: PR-1530AR AnviSpot Night Vision Radiometer/Photometer/Colorimeter; PR-1500/PR-1600 Spectra Spotmeters; and PR-719/702AM Fast Spatial Scanners.
PHOTO RESEARCH, Burbank, CA (818/843-6100)
EI '86

Circle Reader Service #113

Video image recorder

FreezeFrame Video Image Recorder delivers high quality instant color prints or slides from video images. The recorder features digital freeze field capture, advance raster fill technology, color preview capability, NTSC signal acceptance and RGB computer input. Palette Computer Image Recorder permits "painting" computer graphics from a 72-color palette and production of finished, dry 35-mm instant slides, ready to mount and project—within minutes. Prices: $1899, FreezeFrame Video/Recorder; $1999, Palette Computer Recorder.
POLAROID CORP., Cambridge, MA (800/225-1618)
EI '86

Circle Reader Service #114

CCD cameras

Full line of solid state linear and array cameras, designed for industrial use and machine vision applications, includes high-resolution TM-540 monochrome CCD camera, TM 1-54 RGB color CCD camera, remote imager cameras, intensified cameras, and CCIR/PAL compatible cameras. Other products include special sync systems for multiple camera imaging and miniature camera optics.
PULNIX AMERICA INC., Sunnyvale, CA (408/733-1560)
EI '86 SPSE

Circle Reader Service #124

Long-distance microscopes

Line of long-distance microscopes designed for photovisual applications includes: QM 1, with a focusing range of 22 to 66 in. and a field of view variable from 1.6" to 0.04" depending on distance and auxiliary optics; DR1, dual-range instrument that has a focusing range from 36 in. to infinity; and QM2 having an effective aperture of 8½", more than twice the size of the QM1, and having twice the resolution and four times the light grasp.
QUESTAR, New Hope, PA (215/862-5277
EI '86

Circle Reader Service #115

Intelligent vision engines

Board level and integrated RTI systems offer high performance vision solutions for OEMs and end users in imaging/display applications. Systems have modular, intelligent architecture and an extensive software library, making it possible for users of all levels of experience to inexpensively develop real-time vision systems customized to their needs. Sample functions include: region shrinking and growing, convolutions, pyramid processing, contrast enhancement and frame subtraction. Systems are available for MULTIBUS and VMEbus, IBM PC, and workstations from Sun and Masscomp.
RECOGNITION TECHNOLOGY INC., Holliston, MA (617/429-7804)
EI '86

Circle Reader Service #116

Programmable signal processors

High-speed scientific array processors for ST-100 and ST-PSP image and signal processing provide 100 and 50 million floating point operations per second, respectively. Both systems provide real-time imaging at video rates.
STAR TECHNOLOGIES INC., Portland, OR (503/227-2052)
EI '86

Circle Reader Service #117

Array processors

PC-100, plug-in array processor board set can increase the computational speed of the IBM XT/AT over 10 times normal speed. Board features IEEE standard arithmetic, a 32/64-bit floating point processor, DMA on the IBM XT/AT bus, an extensive mathematical software library, and a high-resolution graphics package. Over 100 PC-100 routines/procedures are callable from Microsoft FORTRAN, Microsoft C Compiler (3.0) and Microsoft PASCAL. PC-87 MATHPAC includes commonly used matrix/vector routines, linear equation solvers, numerical integration methods, simulation tools, optimization algorithms, and eigenvalue analysis.
SYSTOLIC SYSTEMS INC., San Jose, CA (408/286-0421)
EI '86

Circle Reader Service #118

CCD imager

Charge-coupled device imagers for scientific and machine vision applications feature low read-out noise, high sensitivity, wide dynamic range, and high resolution. Model TK2048M, has 2048 x 2048 pixel resolution, with an active sensing area of 55.3 x 55.3 mm^2.
TEKTRONIX INC., Beaverton, OR. (503/627/7111)
EI '86

Circle Reader Service #119

Frame transfer image sensor

Line of linear CCD transfer image sensors includes 192H x 165V full frame and 754H x 488V frame transfer devices that provide increased dynamic range and low dark current; utilize single phase clocking; and have increased blue response and greater quantum efficiency.
TEXAS INSTRUMENTS, Dallas, TX (214/997-3410)
SPSE

Circle Reader Service #120

Image analyzer

TN-8500, high-performance image analysis system features dedicated imaging hardware and software for optical and electron microscopy. System is totally integrated, offering advanced features in image acquisition, processing and analysis. During acquisition, the TN-8500 uses Kalman Frame Averaging for optimal Signal/Noise improvement. System may be combined with an extensive library of advanced scientific applications software.
TRACOR NORTHERN, Middleton, WI (608/831-6511)
EI '86

Circle Reader Service #121

Digital video system

Black-and-white and color high-speed sampling digital video systems are designed to monitor recurring events, such as printing or marking at speeds up to 6000 FPM. Other products include the DR72 Microfreezer and the Stilstar 86, NTSC color frame store for a variety of video applications. The Stilstar 86 features onboard recursive filtering for noise reduction and has an S/N ratio of better than 48db.
TOKO AMERICA INC., Mt. Prospect, IL (312/297-0070)
EI'86

Circle Reader Service #122

PHOTONICS TECHNOLOGY, INC.

PIONEERS AND LEADERS IN THE Design, Development, and Production of AC Gas Discharge Displays

PHOTONICS TECHNOLOGY PRESENTS

THE WORLD'S FIRST METER-SIZE, HIGH RESOLUTION FLAT DISPLAY TERMINAL

DEVELOPED FOR MILITARY PROGRAMS INCLUDING U.S.ARMY AFATDS

This is the world's first large area, high resolution, non-projected, flat display terminal. Utilizing AC gas discharge plasma display technology, the terminal has an active display matrix of 1600 by 1200 pixels measuring over 39 inches (one meter) diagonally with 5.3 square feet of viewing area and a resolution of 2500 pixels per square inch. All drive electronics are mounted in a 4 inch thick picture frame package around the perimeter of the transparent, thin (0.5 inch) display screen allowing for rear-projected and see-through applications.

Jointly developed by Photonics Technology, Inc., Luckey, Ohio and Magnavox Electronic Systems Co., Ft. Wayne, Indiana.

Photonics and Magnavox are presently completing the development of AC gas discharge flat panel displays ranging in size up to 3 meters with active display matrices up to 4096 by 4096 pixels. Multicolor displays are also being developed.

Photonics is the world's leading developer and manufacturer of sophisticated, high technology AC gas discharge displays. We are able to design and manufacture flat display panels, monitors, and/or terminals in a variety of sizes at relatively low costs. Our flat displays range in size from a few centimeters up to one meter. Some of our standard and custom displays include the following:

Panel Size, Pixels	Resolution, Pixels Per Linear Inch
128 x 256	40, 60
128 x 512	60
256 x 256	60
256 x 512	64
512 x 512	60, 64, 73, 83
512 x 1024	60
1024 x 1024	60, 73, 83
1200 x 1600	50.8, 101

Our standard display resolution ranges from 30 to 100 pixels per linear inch (900 to 10,000 pixels per square inch). Display resolutions up to 200 pixels per linear inch are available.

For Further Information, Contact:

Donald K. Wedding Sr., VP Marketing Photonics Technology, Inc., P.O. Box 432, Luckey, Ohio 43443, 419-666-0033.
Research, Development, and Manufacturing facilities located at 6967 Wales Road, Northwood, Ohio 43619.

Circle Reader Service #24

Products on Display

Gated image intensifiers

Model 5772 (18 mm) and Model 9323 (25 mm) gated image intensifier tubes are proximity focused wafer types incorporating microchannel plates (MCPs) for high gain. Tubes can be supplied with either a quartz or fiber optic cathode substrate and either an image inverting or non-inverting fiber optic screen substrate. Tubes can be gated at 5 nanoseconds or less when equipped with the proper power supply; and offer a luminance gain of 10,000, with improved responses in the 200 nm to 900 nm regions.
VARO INC., ELECTRON DEVICES DIV., Garland, TX (214/487-4100)
EI'86

Circle Reader Service #123

Image processing workstations

Stand alone and host controlled image processing workstations offer real-time image processing capabilities, a command library of over 180 image processing commands, reconfigurable acquisition and display systems, as well as full programming capabilities. Both versions offer options such as UNIX System V or VERSAdos operating systems, real-time digital video disks, 1024 high-resolution display capabilities, and special applications packages.
VICOM SYSTEMS INC, San Jose, CA (408/946-5660)
EI'86 SPSE

Circle Reader Service #125

Solid state cameras

MEGAPLUS camera contains an imager array of more than 1.3 million pixels that provides 5 to 6 times more resolution than conventional CCD cameras. Sensor contains 1320H × 1035V light-sensitive pixels, each measuring only 6.8 microns square; 100% of the sensor area is light-sensitive (unit fill ratio). Other products include: Series 20 Programmable Sensors, Linear Array Cameras, Fluorescent/Tungsten Halogen light sources; and Series 100 machine vision systems.
VIDEK, Canadaigua, NY (800-44-KODAK)
EI'86

Circle Reader Service #126

Solid state cameras

SC Series CCD cameras, with array sites of 604 × 576 (SC501-CCIR standard) and 610 × 485 (SC505-RS 170 standard), offer true 500 TV-line resolution. Multiple external/internal synchronization methods are available, including pixel clock. VR Series tube cameras offer unique high-resolution features, utilizing either 1-in. Plumbicon or Newvicon tubes, or a 45-mm Plumbicon tube that offers true 1024 × 1024 imaging capability.
VSP LABS INC., Ann Arbor, MI (313/769-5522)
EI'86

Circle Reader Service #127

Infrared TV cameras

The XS-412R and XS-420 Infrared TV cameras employ pyroelectric vidicons as the sensor and can do steady-state imaging with the integral chopper. A flicker-free image is provided with the patented Image Difference Processor. Housekeeping circuitry provides automatic target runway detection and correction, automatic balance control and automatic gain control.
XEDAR CORP., Boulder, CO., (303/443-6441)
EI'86

Circle Reader Service #128

Thermal array recorder

Model AR-100, programmable thermal array recorder can print a programmable background while overprinting trace data, real-time annotations, graphics, and so on. In the lowest of the recorder's multiple printing layers, a special character buffer allows user-designed 4" x 6" formats to be drawn from memory for repetition while trace data, graphics, or other information is being overprinted. The next-lowest recording level is trace data in which the system provides up to four channels of analog or digital trace input with 10-bit dynamic range. Above the trace layer is an annotation layer of up to four lines for marking traces with special notations or messages. The user can access any of 832 printhead elements (200 dpi or 8 dpmm). The AR-100 has a multifunction memory interface (32 Kbytes RAM) that enables the host computer to communicate with the recorder at speeds comparable to communicating with its own RAM. Price: $1,050.
GENERAL SCANNING INC., Watertown, MA (617/924-1010)

Circle Reader Service #61

Video display adapter

An IBM PC/XT/AT video display adapter with

ENHANCED MAP IMAGERY
(. . . continued from p 19)

map, at every point on the shadow map the hue represents the data value. Simultaneously, at each point on the shadow map, the lightness/darkness of the hue is varied accordingly to the slope or gradient of the data at the point. Gradient is measured with respect to a chosen "illumination direction." The resulting map resembles, to some degree, a satellite photograph in color — the smaller the scale (finer detail), the greater the resemblance.

Using the shadow mapping technique on old data, whose usefulness was thought to have been exhausted, can often reveal much valuable new information.

(Developed from Color Imagery for Minerals Exploration, by Dr. M.T. Holroyd, Dataplotting Services Inc., Don Mills, Ontario, Canada.)

enhanced graphics capabilities is 100% hardware compatible with all alphanumeric and graphic display capabilities of IBM's Enhanced Graphics Adaptor. The DMC/EGA uses a custom VLSI chip set. It includes 256 Kbytes of video display memory on board, eliminating the need for a graphics memory expansion cord. In alphanumeric modes, 8 x 8 and 8 x 14 character cells are supported in 40 x 25 and 80 x 25 display formats. In graphics mode, the DMC/EGA supports 16 colors simultaneously from a palette of 64 colors at resolutions varying from 320 x 200 pixels to 640 x 350 pixels. The character generator can be loaded from RAM to allow up to eight sets of 256 characters to be used. Price: $200 (quantities of 1000).
DATAMEDIA CORP., Nashua, NH (603/886-1570)

Circle Reader Service #45

Computer image generators

Family of Computer Image Generators—POLY 250, 500, 500e, 2000, and 2000e—displays graphics objects as polyhedral surfaces with color-shading, clipping, occulting, and perspective transformations, performed automatically to produce real-time scenes. User-programmable 4 x 4 homogeneous matrix transformations are used to provide real-time scaling, translation, and rotation for each object. Systems display from 250 to 2000 flat-shaded polygons of average four sides in real time; "e" models also produce smooth-shaded polygons. Prices: $57,322 to $240,000.
GTI CORP., San Diego, CA (619/578-7885)

Circle Reader Service #52

Recording thin-film spectra has its parameters, pitfalls

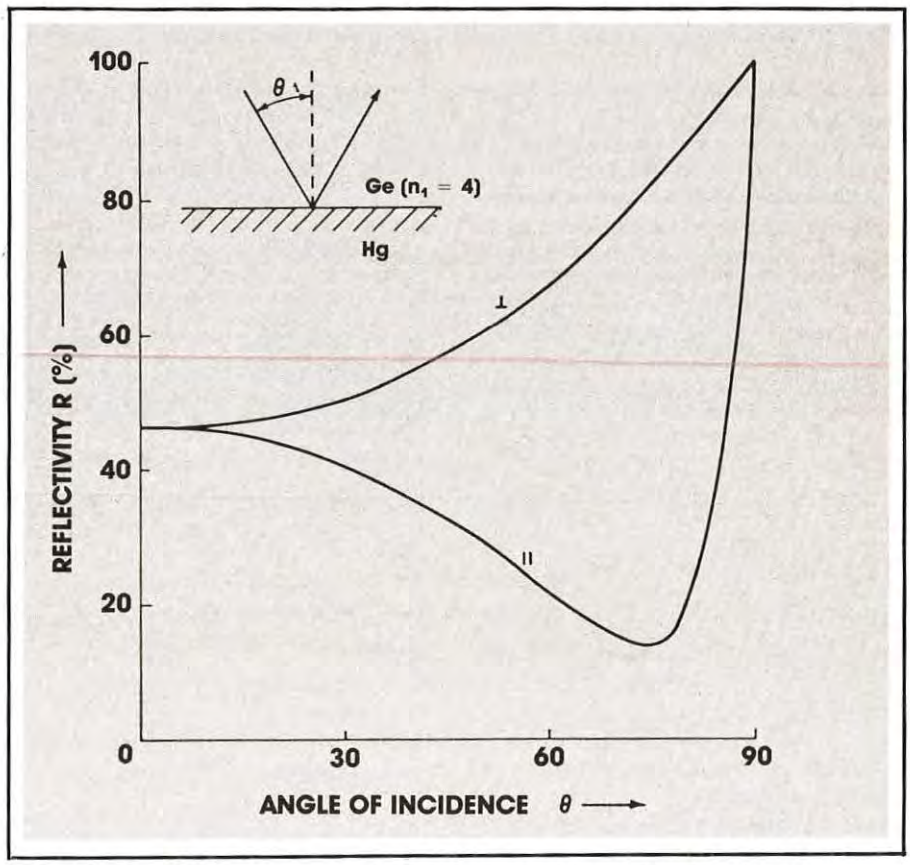
Of the several optical spectroscopy techniques used for observing the spectra of thin film on metal surfaces, External Reflection Spectroscopy (ERS) has proved to be particularly useful to record interference fringes for film thickness measurements and to study thin films. A non-destructive, non-contact method, ERS relies on light impinging on the surface of the sample to record the specular component. The sensitivity of the method for thin films on metal surfaces is dependent on the polarization of the light and the angle of incidence. (Fig. 1)

Spectra recording experiments, using a Harrick Scientific VRA and RMA, and a single diamond Brewster's Angle Polarizer, indicate that a good choice for optimum angle of incidence for an external reflection attachment is 75 deg—using parallel polarization. At this angle, the absorption coefficient is shown to be more than one-half the highest attainable and the beam width is one-fifth that attainable at highest angles.

Furthermore, the studies show that at 75 deg it is possible to utilize the light beam at full aperture also with a moderate beam demagnification (such as 2X). At 87 deg no demagnification is possible; in fact, it is necessary to vignette the beam by a factor of 2-3 to reduce the beam spread to about ± 2 deg.

The results of these studies apply to most situations and particularly to the disk checker used to measure lubrication film thickness on hard magnetic disks.

There are, however, certain parameters and pitfalls to consider when using ERS for thin film on smooth metal surfaces.



Reflectivity of a Ge-Hg interface at $\lambda = 3\mu$ for light approaching the interface through the germanium—an example of the reflectivity of a dielectric-metallic interface.

PARAMETERS

- **Polarization**—Spectra of thin films can be recorded only with parallel polarized film, such as light whose electric field vector is in the plane of incidence. The reason is that for perpendicular polarization (and parallel polarization near normal incidence) there is an interaction of the incident and reflected light that sets up a standing light wave, with a node (E = 0) at the surface and there can be no interaction with an absorbing film. Therefore, a spectrum cannot be recorded.
- **Angle of incidence**—To record spectra, not only must the light be polarized parallel, but also large angles of

incidence must be used. In actual practice, the angle should be about equal to the polarizing (Brewster's) angle. For a dielectric this is given by:

$$O_B = \tan^{-1} n$$

and is equal to 76 deg for Ge (n = 4), 67 deg for ZnSe (n = 2.4), and 54 deg for Quartz (n = 1.4). For a conductor, on the other hand, the angle is given by:

$$\sin \phi t 2n\phi = \sqrt{2}/(1.05 \times 10^{-6} (\nu \epsilon \rho)^{1/2})$$

Here, ν is the frequency of the light, ϵ the dielectric constant of the adjoining medium (for air $\epsilon = 1$), ρ the resistivity (in ohm-cm) of the metal. For high conductivity materials such as Al, Ag, Au, Cu, Pt, this angle is very large (greater than 89.5 deg) and is not readily attainable.

Fig. 2 shows the greater the angle, the higher the sensitivity. The highest practical angle to work at is 87 to 88 deg, but this generally requires vignetting the light beam (with loss of energy) to reduce the angular beam spread.

SiO (700 Å) on Al
Parallel Polarization

Angle	I/I (%)	1/COS
0°	0	1
15°	9.7	1.035
30°	11.5	1.155
45°	25.0	1.414
60°	46.2	2.000
75°	61.7	3.864
85°	80.3	11.474
87°	—	19.107
88°	—	28.654

PITFALLS

- **Baseline reference**—The light beam is partially polarized in both FT and dispersive spectrometers and is different for different spectrometers. In dispersive instruments, the light beam is strongly polarized and the energy increases with wavelength for parallel polarization. For a flat baseline, one must ratio against a reference for a light beam with appropriate polarization. When employing unpolarized light, the state of polarization of the instrument must be known when recording external reflection spectra.
- **Beam width**—Oblique incidence gives rise to a smearing (spreading) of the beam on the sample—this follows a $1/\cos \Theta$ law. In Fig. 2, at $\Theta = 75$ deg, the beam width has increased by about a factor of 4 over normal incidence; while at 88 deg, it has increased by almost a factor of 30.
- **Film thickness**—Because the waves being analyzed are standing and nonpropagating, the absorption ($\triangle$ I/I) will not increase linearly with increase of film thickness. For external reflection spectra, significant band distortions occur with broadcasting and shifts to higher frequencies relative to transmission spectra.

(Developed from External Reflection Spectroscopy: Selection of Optimum Parameters for Thin Films on Smooth Metal Surfaces, by Dr. N.J. Harrick, President, Harrick Scientific Corp., Ossining, NY, 914/762-0020.)

Hi-res color hardcopy meeting user needs and image-quality

Increasing demand for color CRT displays has produced a corresponding demand for fast, low cost, high-quality color hardcopy plotters. And a number of manufacturers have responded by adapting non-impact raster printing technologies — electrostatic, ink-jet, and thermal transfer plotters — to produce color hardcopy, with laser-xerographic color units just around the corner.

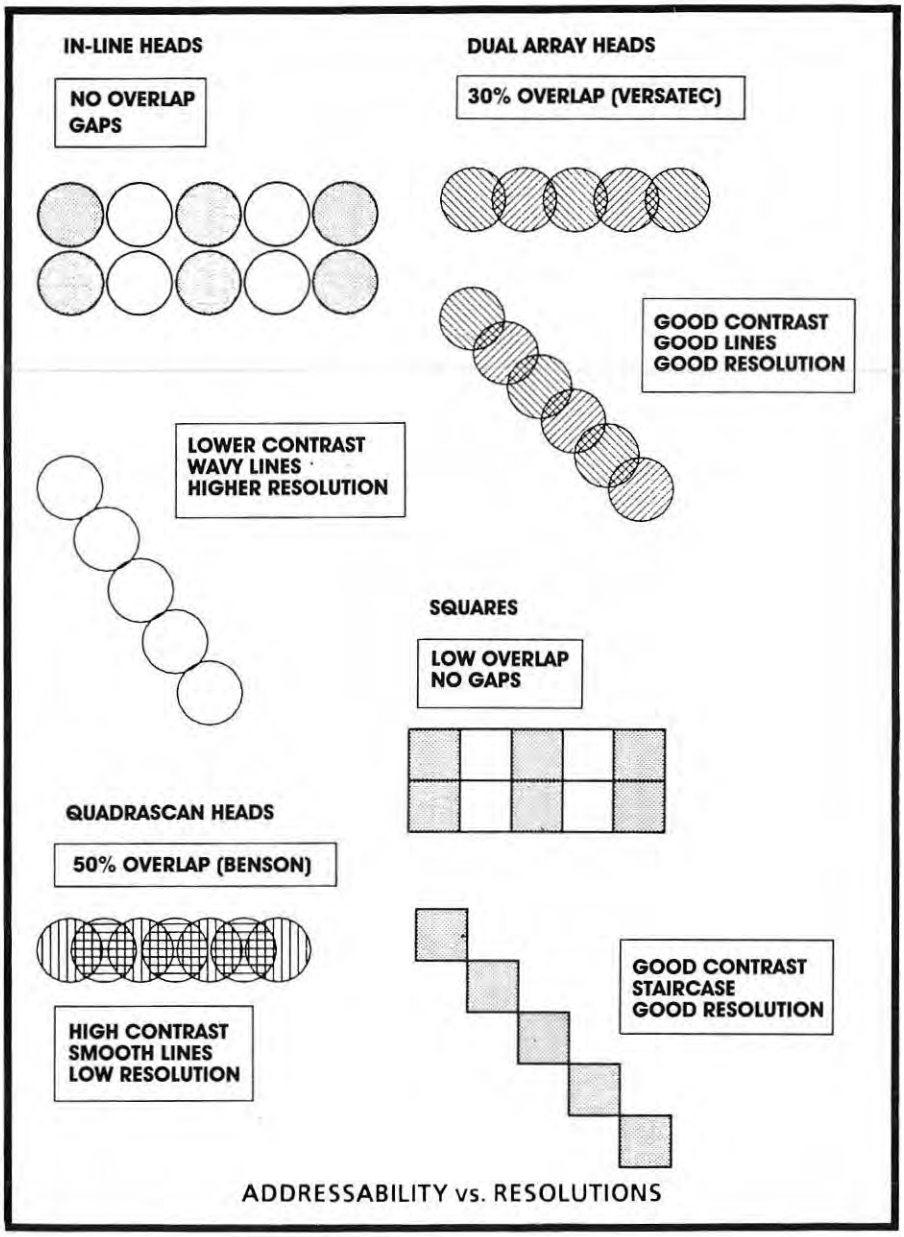
While resolution of today's color hardcopy products ranges from 72 to 400 points per inch (ppi), CRT resolution still is only 72 to 100 ppi — even in so-called high performance units. As such, CRT's are capable of displaying 1024 to 1280 pixels per raster line; up to 1024 lines per screen — about 1.25 megabits of data.

Yet the trend clearly is toward still higher resolution hardcopy products. A number of factors have contributed to this interest.

For one, current CRT resolution is not acceptable in many applications — such as for final copies published in reports or for transparencies used in presentations. In general, the minimally acceptable level of resolution for such hardcopy is 200 ppi (400 Kbytes of data) — almost 2.5 times the present screen resolution of even high-quality color CRT.

Color limitation

Another reason for seeking greater hardcopy resolution is to reproduce the range of colors available on high performance CRTs. Many of today's CRT displays can vary the intensity of the system's red, green, and blue phos-



phors that combine to produce each pixel. The more levels of control available for each primary color, the greater the range of color each pixel can represent. Least expensive systems display eight colors, while higher performance units produce from 64 to over 4000 colors. Very high performance systems are capable of displaying millions of colors.

But, because most hardcopy devices use binary marking engines, each mark on the media is the same size, shape and intensity. Thus, the amount of primary color used on each dot is fixed — which automatically limits each dot to eight colors. (Table 1)

And, because the number of colors per dot on hardcopy is limited to eight, the only way to produce a broader range of colors is to vary the number and color of the dots in a given area. The method used, known as dot patterning or "dithering," combines two adjacent dots horizontally and two adjacent lines vertically to produce a 2 x 2 superpixel containing four dots. By combining 3 x 3, 4 x 4, and up to 8 x 8 dots into larger and larger superpixels, it is possible to provide a broader range of colors per superpixel.

This superpixel approach to expanding hardcopy color range is the principal force behind the need for higher resolution. Producing an image having more than eight colors in hardcopy requires a device with a resolution of at least 144 - 200 ppi for a 2 x 2 superpixel; and as much as 400 ppi for a 4 x 4 superpixel.

Resolution/addressability

Resolution and addressability are frequently confused when used to describe raster hardcopy devices. The key difference between them is the size and shape of the dot or mark.

Resolution of a hardcopy device is its ability to display alternating light (not printed) and dark (printed) lines, generally referred to as line pairs. Most hardcopy devices produce overlapping dots on the matrix to provide smoother lines and better filled-in areas. The eye also perceives the larger marks as higher contrast because more media is covered.

A hardcopy plotter described as having a resolution of 400 ppi actually has an addressability of 400 points per linear inch and 160,000 points per square inch.

Pen plotters provide a good example of this effect. The more common pen plotter designs have an addressability of 0.001 (1 in 1000); the pens used, however, produce lines that are often 0.008 to 0.013 in. wide. This combination of broad pen lines and high addressability produces bold, high-contrast images with smooth curves and arcs. Resultant hardcopy is very acceptable and frequently the standard for electronically produced hardcopy.

Raster hardcopy devices, unlike pen plotters, have a problem with sizes of dots or marks. Small dots would produce little overlap and allow greater resolution, but they would also produce lines that resembled strings of beads. And the filled-in areas would be unacceptable because the printed dots would not cover all of the media in the area to be filled.

In the case of color, any area not covered would allow the white of the media to show through, producing a faded or pastel shade of the true color. Conversely, too much dot overlapping would reduce the effective resolution and thereby limit the range of colors that could be produced using the superpixel technique.

An obvious solution to the overlays/resolution trade-off would appear to be using a square, instead of round, mark or dot. In fact, the heads produced using printed circuit boards and similar automated manufacturing techniques do produce marks that are shaped more square than round. Overlays using these marks, however, can be reduced, thus expanding the color range capability and improving resolution while retaining line quality and area fill performance.

Perfectly square marks, though, are not desirable for most hardcopy applications. Not all lines are orthogonal, many are circular or diagonal lines. The corners of perfectly square (or rectangular) marks would cause such lines, especially the diagonals, to look more like staircases (jaggies, or aliasing) instead of smooth lines. Jaggies are one of the major reasons that users demand higher resolution.

Hi-res disadvantages

While high resolution has substantial advantages in both color and monochrome, some disadvantages do exist.

Additive vs subtractive color

The primary difference between color CRT and hardcopy images is that CRT images are produced using an additive process — combining red, green, and blue light in varying amounts to form a wide range of colors — while most hardcopy devices use a subtractive process — combining cyan, magenta and yellow (plus black in higher quality devices) to produce the varied colors. The additive and subtractive processes produce opposite results.

In the additive process, the three primary colors represent the two ends plus the middle of the visible color spectrum. They also correspond to the three types of color receptors in the human eye. When none of the colors is present, the eye perceives no color, or black. When all three colors are present in equal amounts, the eye perceives white light since only a small part of the visible spectrum is not represented. (Color television is a good example of the additive color process.)

The subtractive method, however, produces color by absorbing light frequencies from white light. Frequencies not absorbed are reflected off the hardcopy media (most often white paper, but frequently transparency material) and sensed by the eye as the color. Thus, blue paper looks blue because all frequencies of visible light are absorbed except blue, which is reflected to the eye and perceived as blue. (Paint is a good example of a familiar subtractive color process.) In the subtractive process, the absence of color is perceived as white. All colors are perceived as black, since the presence of all three primaries (cyan, magenta, and yellow) causes no light to be reflected to the eye.

Since the subtractive process absorbs wavelengths, the resulting reflected color is of a lower intensity than the light source. A subtractive process, therefore, cannot produce as wide a range of colors as an additive one.

This poses a particular problem when trying to create a hardcopy of color images on a CRT. The CRT phosphors have different spectral characteristics than the hardcopy device inks. In addition, the media color, other optical characteristics, and the viewing light all have a significant impact on the colors the eye perceives with the subtractive color process.

For example, if 400 ppi color is better than 300 ppi, and it can be achieved at reasonably high speed in today's devices, then why not 600 ppi or 800 ppi?

One reason, of course, is the cost to upgrade resolution of the hardcopy device; the other is the burden of generating the raster data from the computer's digital input.

Improvements in hardcopy image quality are harder to see beyond 300-400 ppi, making the higher cost of such devices harder to justify. Additionally, higher resolution devices generally are slower than lower resolution units.

As far as data burden is concerned, improved price performance of microprocessors, availability of new VLSI graphics processors, and continued memory improvements (1 MB chips at lower prices) will allow hardcopy device vendors to build more powerful rasterizers into the hardcopy units. These embedded rasterizers, in turn, will allow the host computer, terminal or workstation to describe the image and transfer the rasterization burden to the output device. The combination of these high level page/image description languages and the inclusion of rasterizers in the hardcopy products will make the burden of higher resolution transparent to the user. Even different resolutions on different devices will be able to be used on such systems.

But, again, to achieve this higher resolution, it generally will cost more and will be much slower than low resolution units.

Bridging the gap

The missing element to help broaden the use of color hardcopy and hardcopy devices, of course, is the color copier. Most companies do not have color copiers today. As a result, hardcopy users are demanding faster production speeds for their plotters so that they can create multiple originals on those devices.

Although producing multiple originals is relatively fast, by today's office copier standards it is still much too slow to be practical for producing a sizeable number of copies. And, depending on the color hardcopy device, it can also be very expensive.

An alternative approach is to use color page scanners to convert higher speed color hardcopy units into multiple-use devices by adding an "original-copier" capability. Several companies are presently developing a new generation of color devices that should soon solve this problem.

Higher resolution hardcopy devices eventually will be developed in the 500, 600, and 800 ppi range — most likely, to meet specific applications. In the meantime, manufacturers are working toward reducing cost and improving the speed of 300-400 ppi devices to meet growing user demands for the higher quality color hardcopy.

(Developed from The Effects of Higher Resolution on Hard Copy, by Dale Richmond, Manager, Plotter Marketing, Versatec, a Xerox Co, Santa Clara, CA)

Flat tension-mask yields brighter image with higher contrast

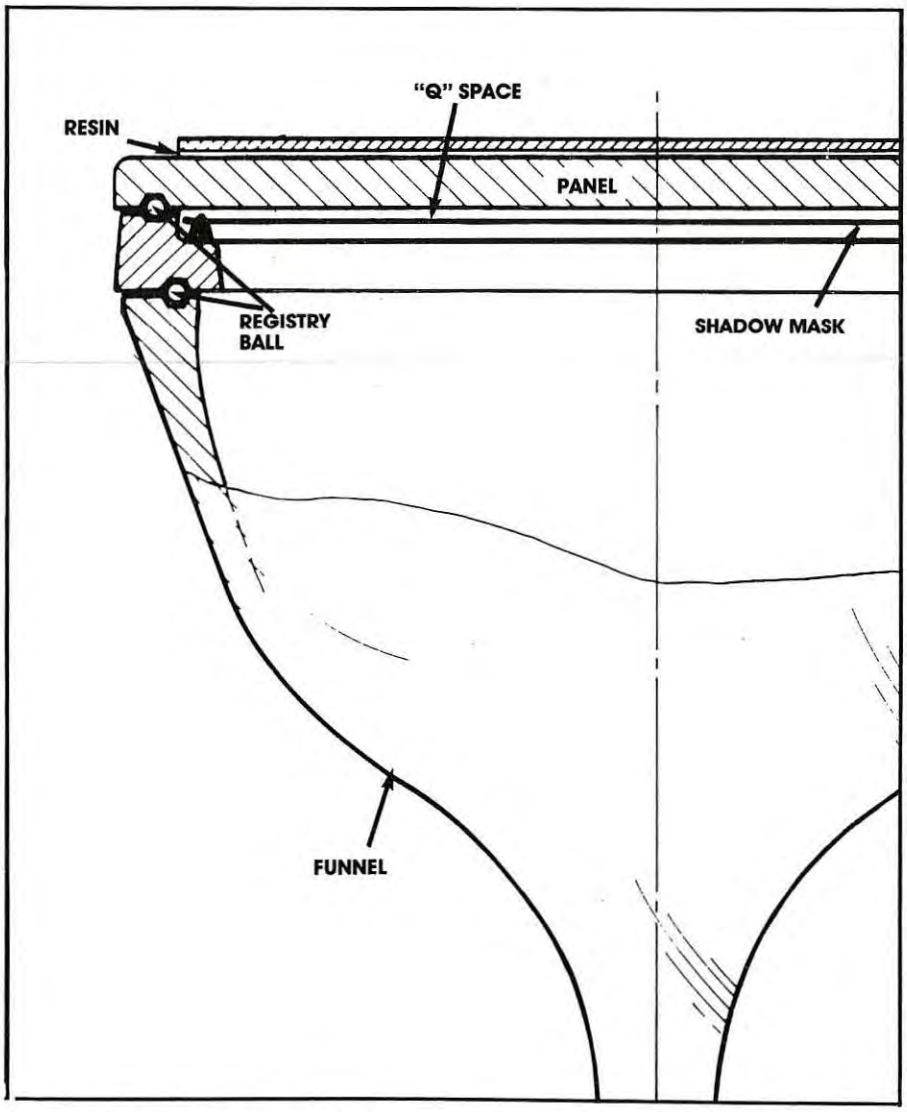
In an effort to meet increased demand for high resolution color CRT video displays, manufacturers have had to refine and tighten tolerances of conventional components — often a costly and difficult process.

Now, however, a less expensive and relatively simple method for constructing flat shadow masks has been successfully developed by Zenith engineers that they claim provides 80% higher brightness or 70% greater contrast ratio as compared with conventional color CRTs — while offering a virtually reflection-free viewing screen.

The technology — **Flat Tension Mask** — consists of thermally stretching a steel foil shadow mask across a glass frame (called a "B"-ring) and frit-sealing the subassembly between the CRT's faceplate and funnel so that the shadow mask becomes an integral part of the glass envelope. Inexpensive window glass, bonded to the perfectly flat faceplate, serves as an effective implosion safety system for the tube. The flat safety window also facilitates surface treatments, such as anti-reflective coatings.

Tension mask

Unlike conventional CRTs, in which a spherical shadow mask is supported by a frame and suspended by springs inside the tube, the Flat Tension Mask method keeps the flat shadow mask stretched under tension directly behind the tube's flat glass faceplate. A curved shadow mask, when bombarded by electron beams, heats up and moves, producing color distortion in the image displayed. The Flat Tension Mask, on the other hand, does not move at all under most display conditions — even at much higher brightness levels that would normally discolor images in conventional tubes.



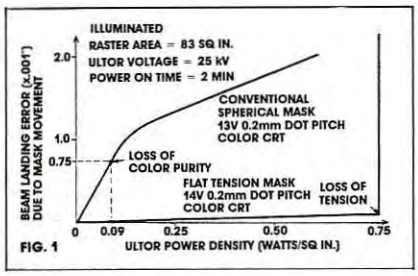


FIG. 1

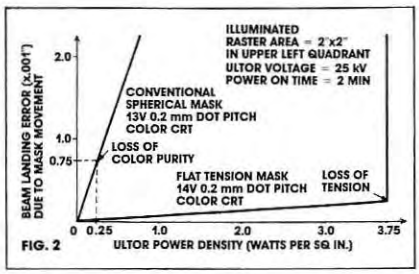


FIG. 2

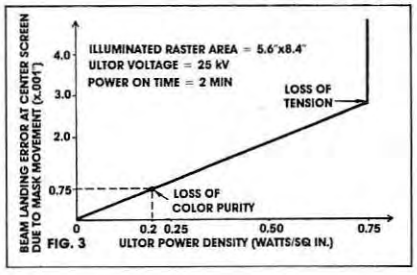


FIG. 3

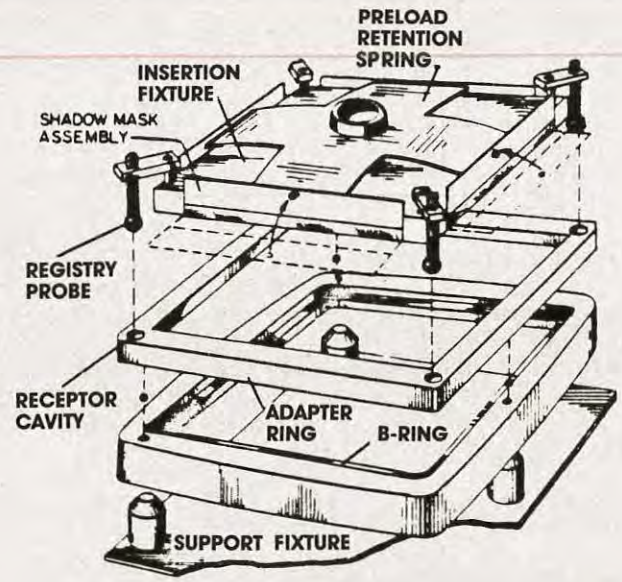
Studies indicate that Flat Tension Mask tension loss occurs at 62.5 watts of dc ultor power input, yielding a power density of 0.75W/in² (117 mW/cm²), as compared with 7.5 watts for the conventional CRT, with a resulting yield of 0.09W/in² — eight times greater full raster power input occurs at first loss of purity. (FIG. 1)

Mask shift with ultor power in a small (2" x 2") area near the edge of the screen exhibits about 15 times greater small area raster power handling ability, Flat Tension Mask over conventional spherical mask. (FIG. 2)

The worst case display pattern — with respect to mask movement for the Flat Tension Mask — is that in which one side of the vertical center line is illuminated, while the other is not. (FIG. 3)

Movement occurs at the screen center as the illuminated half of the mask expands and the dark half contrasts elastically to reach uniform tension. First loss of color purity in such a case occurs at 0.2W/in² (31 mW/cm²) — again, compared to the 0.09W/in² for a conventional tube — exhibiting about twice the half-raster watts handling ability.

(Developed from Performance of High-Resolution Flat Tension-Mask Color CRTs and Construction of a Flat Tension-Mask Color CRT, by L. Dietch, K. Palac, and W. Chiodi, Zenith Electronics Corp., Glenview, IL — SID '86, San Diego, CA, May 5-9, 1986.)



Mask to B-ring assembly

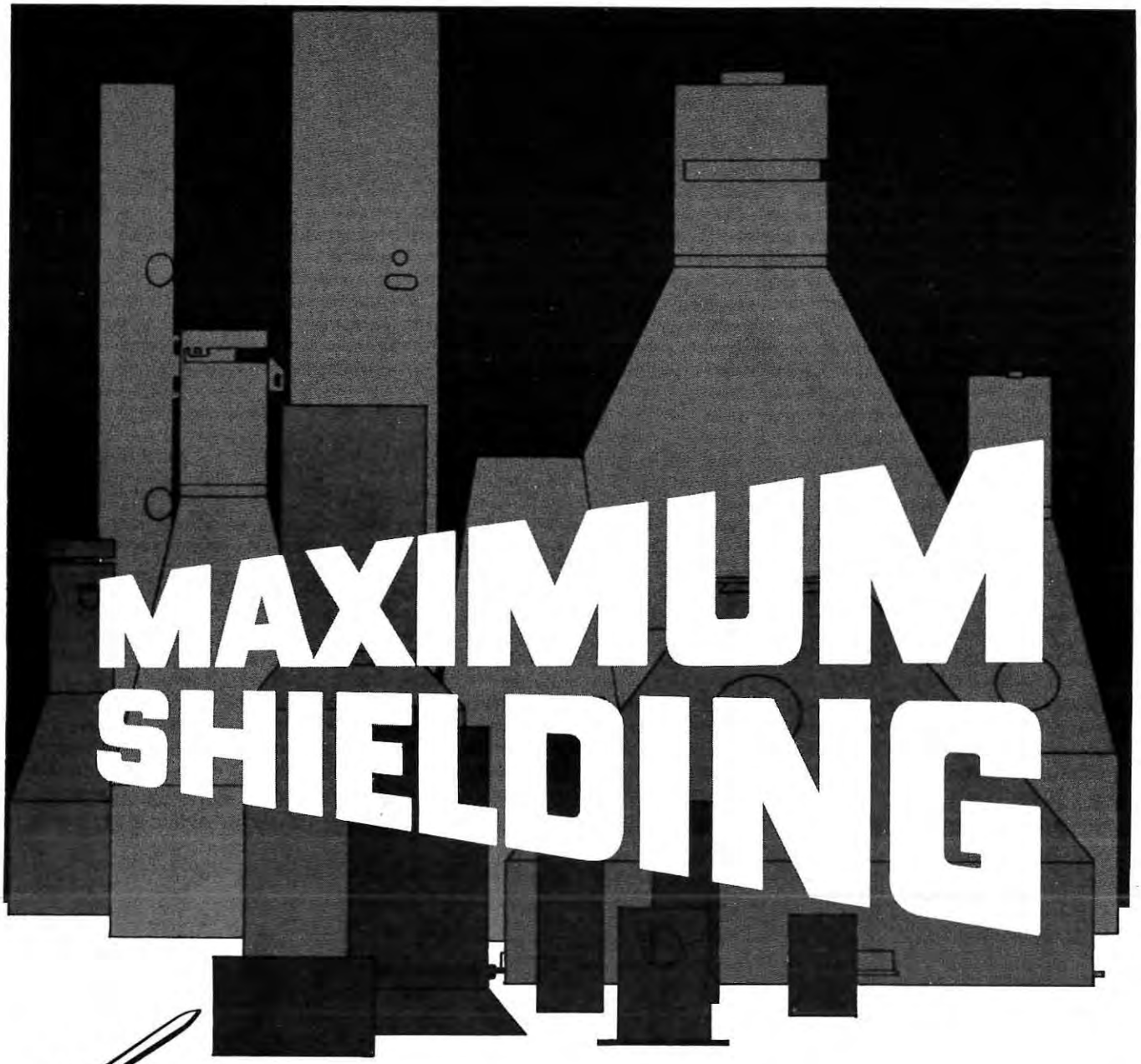
In the prototype assembly, the flat tension shadow mask is first attached to an insertion assembly and put under tension with a preload retention spring (a). Next, the B-ring, glass frame structure to which the foil mask is to be attached is positioned on a fixture that provides support directly under three alignment grooves on the ring's frit land surface (b). An adapter ring with opposing alignment grooves in its underside is then registered to and supported by the B-ring at the groove locations (c). Finally, the insertion fixture, together with the shadow masks, is placed into the B-ring cavity with the fixture registry probes seated in the adapter ring's receptor cavities.

At this stage, the narrow bead of frit deposited along the central portion of the fritting band that surrounds the central screen array is dry and relatively rigid. It supports the mask and insertion fixture on the B-ring land, with the registry grooves not yet fully seated in the adapter ring receptor cavities.

The entire subsystem then is fired in a lehr. When the frit melts, the insertion fixture and mask settle until the registry probes seat in the adapter ring receptor cavities. At this stage, the shadow maskplane is precisely located to establish the mask-to-screen spacing (Q) required during screening and in final bulb firing. "Q" is held to within a tolerance of 0.0025 in.

When the subassembly cools, the shadow mask is rigidly secured to the B-ring. Anchoring strips are then detached from the pre-tension sustaining spring and the insertion fixture is removed. Next, the mask wings, used to anchor the mask to the insertion assembly, are torn off at the perforation lines extending just outside of the frit beads.

The differential contraction between the color glass frame and the steel mask from the fritting temperature of 435C provides a tension of about 30 lb/linear inch on the B-ring frame for the foil mask.



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Circle Reader Service #28

Fiber optic LAN supports many networks

A number of different local area networks (LANs) can be supported simultaneously over a digital broadband LAN called FiberWay. The network, using fiber optic technology, provides data transmission rates up to 200 Mbps and is designed as an alternative to coaxial cable broadband LANs.

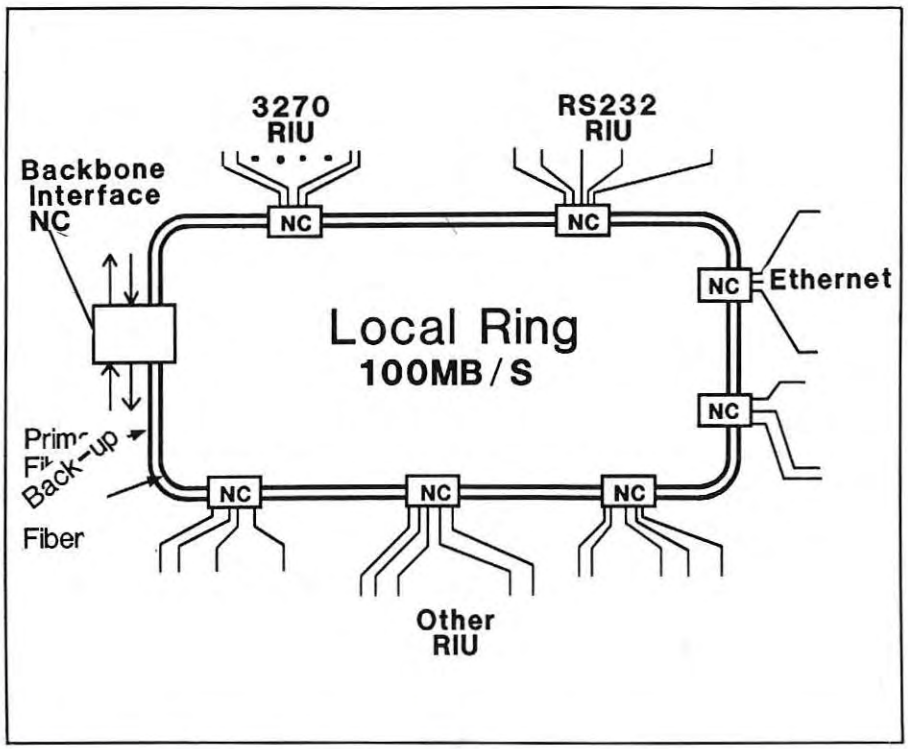
Based on a hierarchy of rings — fiber optic for very high speed, and twisted copper pairs for slower speed — FiberWay offers standard interfaces to commonly used LANs and communications equipment, including Ethernet, RS-232, IBM Token Ring, and others.

It is not a point-to-point system, but a true fiber optic LAN. It includes network interfaces and network management software that support a multivendor environment; and it can be used within a department, throughout a high-rise building, or across a campus or metropolitan area.

The system follows a modular, building block approach consisting of five components:

- **Rings** — Local and backbone fiber optic rings transmit information and form the basis of FiberWay, which operates at 200 Mbps or 100 Mbps depending on the application, to link local ring networks. The backbone is divided into eight 25 Mbps bands to which the local rings are connected. Each local ring operates at 100 Mbps and serves a communications region such as a multi-story building, a wing of a factory or a large engineering laboratory. Each local ring can be further divided into channels and subchannels. All channels are synchronized with each other, but otherwise are independent as far as data traffic or communications protocols are concerned.
- **Ring Interface Units and Node Concentrators** — Ring Interface Unit (RUI) connects end-user devices — such as terminals, workstations, and hosts — to the local rings. RIUs can attach directly to the fiber ring in high speed applications like Ethernet or via intermediate Node Concentrators for lower cost and lower speed connections.

Node Concentrators use existing telephone wiring to connect them to the RIUs, which are compatible with IBM, 3270, and RS-232 devices and plug directly into telephone outlets.



Node concentrators are capable of interfacing to FiberWay's RIUs and other devices such as IBM Token Ring or ISDN interfaces.

- **Network Bridges** — Bridges connect local rings to backbone rings so that devices on different local rings can communicate. Bridges route information on and off the master ring.
- **Network Management** — Net Server software package provides sophisticated management capabilities for the network. From the PC, a network manager can configure nodes and bands, monitor performance and initiate changes in the network. Information stored in the PC includes types of devices at each node, the addressing of each device and which bands carry what type of data.

ARTEL COMMUNICATIONS CORP.,
Worcester, MA (617/752-5690)
Circle Reader Service #63

Optical disk storage

The OAS 100 (optical archiving system) plugs into a computer system and integrates instantly, without need for modification of hardware or software. The system interfaces to any PERTEC-type tape controller over standard I/O cables and accepts all standard I/O commands. In an on-line mode, the disk drive appears to the host computer as a 9-track tape formatter and deck. But when data archiving takes place, the data is written by the OAS to optical disk, instead of tape.

In the pass-through mode, the device allows the host computer to access the magnetic tape drive in the same way it did prior to the introduction of the OAS. And, in the off-line mode, the user has the capability of controlling an attached 9-track magnetic tape unit and an optical disk drive without host computer intervention.

AQUIDNECK DATA CORP., Middletown, RI (401/847-7260)

Circle Reader Service #47

Cartridge tape drive

RoadRunner 5¼" cartridge is a 1/4-in. streaming tape drive with full function SCSI formatter. Model I has 60 Mbytes capacity, is compatible with the popular QIC-24 format, and has an optional formatter with QIC-36 and QIC-02 interfaces using a QIC-24 recording format. Model II has 125 Mbyte capacity, is fully compatible with QIC-02, measures only 5.75 in. wide, 1.63 in. high, and 8 in. long. Drives require +5V and +12V DC power to operate.

NORTH ATLANTIC INDUSTRIES, Hauppauge, NY (516/582-6060)

Circle Reader Service #56

Optical disk

GIGADISC, a 12-in., non-erasable optical disk system with a storage capacity of 1 gigabyte per side is adaptable to mini or microcomputers through the SCSI interface. The system's optical internal controller, which can host up to 8 disk drive units, features a real-time error detect and correct scheme that boasts a 10^{-12} non-recoverable error rate for normal data reliability in the EDP environment. Key features are removability of the disks, direct access to any sector in the read or write mode, high quality of data integrity, high potential levels of data compression, compatibility with existing data management software, and preservation of data processing quality level over a minimum of 10 years with the recorded disks. The Thomson GIGADISC uses a special "sampled format" on the disk that enables the drive units to accept media from 3M and Hoechst, as well as its own.

ALCATEL THOMSON GIGADISC INC., Waltham, MA (617/890-0801)

Circle Reader Service #51

Hard disk cartridge

Internal Winchester subsystem DuraPak is a single-drive, 15-Mb system that features a removable hard disk cartridge for IBM PC, XT, AT, and compatibles. The device measures 4¼ in. x 4⅜ in. Hardware is included with the system. Price: $1,295, 15 Mb; $2,095, 30 Mb.

SYSGEN INC., Fremont, CA (415/490-6770)

Circle Reader Service #58

Optical file

Laser optical filing system (LOFS) combines computer technologies with laser optics and laser printing to provide an electronic replacement for conventional paper-based filing systems. LOFS is able to store digital images of up to 60,000 letter-sized documents — the contents of 20, four-drawer filing cabinets — on a single 12-in.-dia optical disk. Each write-once/read-many-times (WORM) optical disk can hold 2.6 Gigabytes of image data. The system can automatically scan and record 12 documents per minute. After scanning, the original document is displayed on a vertically-oriented 15-in. monitor (1728 x 2368 pixels). Portions of the document can be selectively enlarged or rotated on screen using special function keys. An icon/menu-driven data manager and computerized indexing system speed filing functions. Price: $125,000.

CIE SYSTEMS INC., Irvine, CA (714/660-1800)

Circle Reader Service #55

Optical storage

Model 525 WC, direct mass storage device for IBM PCs and compatibles running under MS-DOS, features a 5¼" removable cartridge with 115 Mb formatted capacity on line, a data transfer rate of 2.5 million bits/sec, and an average access time of less than 150 milliseconds. System components include the optical disk drive, with integral power supply, external interface cable, an optical drive controller, and ISIDOS system software. Price: $3,995.

INFORMATION STORAGE INC., (ISI), Colorado Springs, CO (303/579-0460)

Circle Reader Service #60

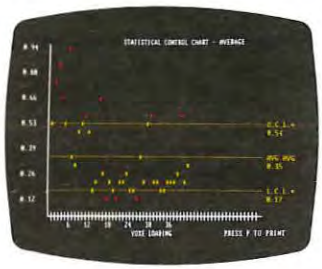
(Continued on p 50 . . .)

Clinton innovation lets you add color without adding the cost of a color monitor.

The only way to add color to a display used to be with an expensive color monitor. But now, Clinton Spectrum CRTs let you select from a huge array of colors to highlight specific areas of your display—at significantly less cost than ever possible before!

Clinton Spectrum CRTs, with this new technology, offer you incredible design flexibility. With a selection of over 30 different colors, you can add as many phosphors as you like... on any size, any resolution Clinton CRT. The Clinton segmented phosphor process on Spectrum CRTs offers you the design capability to highlight dedicated areas of your screen with any color you choose. Whether you're designing a word processing system, a process control system or gauge-type displays, Clinton CRTs with segmented phosphors open new doors of design opportunity for you!

Clinton Electronics is a pioneer in the development of high-resolution, RFI/EMI emission control and anti-glare systems for optimum display performance. And now, only Clinton offers you this patented, segmented phosphor technology.



When you want the advantage of color, without the cost of a color monitor, depend on the source in display technology. Depend on Clinton Electronics. Contact us today.

Clinton Electronics Corporation, 6701 Clinton Road, Rockford, IL 61111. Phone 815/633-1444. Telex 257-484. Telefax 815/633-8712.

CLINTON ELECTRONICS CORPORATION

Optical disk

Removable 5¼" optical disk drive offers 200 Mb per side capacity at a data transfer rate over 2 Mb/sec and an average access time of 220 milliseconds. Model 5984 stores up to 20,000 letter-sized pages or 200,000 ASCII-coded pages. Each unit includes a set of controller boards for installation into a standard IBM-PC, XT, AT, or compatibles; a software package of "C" interface modules that run under Lattice 2.12 or 2.15 with large memory model to transfer and read files to and from the optical disk drive; and all necessary cable connections for installing the disk drive into a PC. Price: $5,000.
OPTOTECH, INC., Hopkinton, MA (617/435-9733)

Circle Reader Service #57

Compact laser disc

Compact Disc Read Only Memory (CD ROM) is a 4.27" dia optical disc that offers a capacity of 552 Mbytes, the equivalent of some 270,000 pages of printed information, over 1000 single-sided floppy disks, or 50 standard Winchester disks. Data stored on CD ROM discs is read back by a laser beam focused on the disc surface. The drive detects the reflected optical signal as digital information. Information recorded on a CD ROM is non-magnetic, thus there is no data loss due to accidental magnetic erasure. And, because no pickup comes in contact with the disc, there is no danger of head crashes and no measurable disc wear.
3M OPTICAL RECORDING PROJECT, St. Paul, MN (612/733-3142)

Circle Reader Service #49

Optical disk drive

Model 1000/S, optical disk drive subsystem compatible with PC-DOS, is designed to meet the need for permanent, on-line high-capacity archival storage for computer-aided design and engineering systems, computer graphics, medical records management, and other professional applications. The drive can be attached to any IBM PC/XT/AT or compatible operating system under DOS 3.0 or 3.1. It is based on an Optimem 1000, 12-in., 1-Gbyte write-once optical disk drive identical to the model now being used in large-scale mini- and super-micro-based applications. Also included in the subsystem is a full SCSI-standard controller, a host adaptor for linking the controller to the PC bus and cabling. Price: $20,000.
OPTIMEM, Sunnyvale, CA (408/737-7373)

Circle Reader Service #48

Glass sphere couplers

Precision machined balls of glass and sapphire are lapped and diamond polished to exact specifications to solve problems attendant to coupling optic fibers through separable connectors. The spheres provide low-insertion-loss connection; typical losses at the sphere/fiber interface is 1.5 dB or less.
PRECOMP INC., Great Neck, NY (516/466-8284)

Circle Reader Service #53

Image intensifier

Image detector screens (dense needle structure Csi base and higher absorption efficiency) produce an image with typically 15% - 20% higher gain, greatly reduced quantum noise level expressed as higher

QDE, and, in conjunction with the dark screen output phosphor, a 20% improvement in contrast ratio. The improved QDE and contrast have particular significance in the efficient digital processing of a video image and in 105 mm or 35 mm filming, allowing use of low gamma films, resulting in greater dynamic range.

Standard tube configurations are 6 in. and 9 in., single field; 9/6 in. dual and 9/6/4.5 in. tri-field. Systems with multiple modes have the benefit of magnifying field size, instantly increasing resolution (up to 135 lp/in.) and contrast (up to 27:1).

Large tubes — 12 in. and 16 in. — offer an enhanced medical diagnostic capability and are available in dual-field 12/9 in., 16/12 in., and tri-field 12/9/6-in. and 16/12/9-in. versions for even greater performance. Systems with these tubes can instantly increase field size, resolution (up to 128 lp/in.) and contrast (up to 27:1) by simply changing to the magnified mode, thus providing the user with maximum, minimum, or intermediate fields for general and detailed examinations.

PRECISE OPTICS, PhotoMedic Equipment Inc., Bay Shore, NY (516/242-6600)

Circle Reader Service #54

Disk controller

V/SMD 4200 Cheetah, SMD disk controller boosts DMA throughput to 30 Mb/sec and above. The device's BUSpacket Interface is combined with other features, including Virtual Buffer Architecture, zero latency reads and writes, and UNIX-optimized Intelligent Caching — with 128 Kb of multitrack cache memory. The V/SMD 4200 is fully software compatible with the company's other disk controllers (V/SMD 3200 and V/ESDI 3201) giving users "plug and play" flexibility with their existing operating system drivers.

INTERPHASE CORP., Dallas, TX (214/350-9000)

Circle Reader Service #59

Large screen video projectors

IMAGER 100 and 200 projectors provide sharp, clear images up to 10 ft. diagonal; accept inputs from all video formats, broadcast television, cable and satellite feeds. In addition, they offer an optional RGB interface for computer information display from most computers including IBM and compatibles. The IMAGER can be ceiling-mounted, or used free-standing with both front and rear-projection. Dimensions: 12½ in. high, 24 in. wide, 30½ in. deep. Output: 330 lines, NTSC video resolution; 1.5 w, 5" oval speaker built-in audio.

GENERAL ELECTRIC CO., Projection Display Products, Syracuse, NY (315/456-2152)

Circle Reader Service #46

Imaging test patterns

Complete line of standard test targets and test arrays for image evaluation includes: microcopy, RIT alphanumeric, star, density, resolution, motion, small and large area, check size, video resolution, static, copier, calibration small and large scale, film strip, aperture card, microfiche grids, slits and round apertures, and others.

APPLIED IMAGE INC., Rochester, NY (716/482-0300)

Circle Reader Service #44

Chapter Notes

CHAPTER MEETINGS PLANNER

UK & Ireland: November 12, 1986
Program: Technical Meeting
Location: Martlesham Heath
Topic: Interactive Displays, and SID/Japan Display '86 feedback

UK & Ireland February 1987
Program: Technical Meeting
Location: Winchester (hosted by IBM)
Topic: Computer Displays

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The proven performer for electro-conductive designs

Intrex thin film coating technology has been solving design problems for over 15 years. Our standard polyester based product line has been used successfully in many highly sophisticated electronic applications... for transparent and flexible displays, LCDs, heaters, touch panels, EMI shields, and as a groundplane in electrophotography applications.

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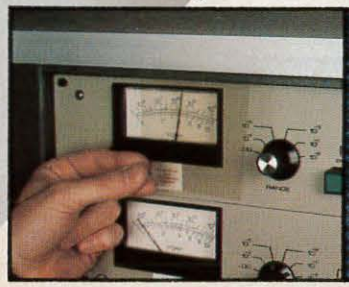

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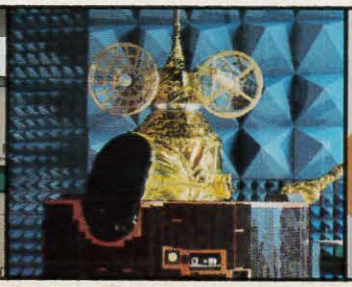

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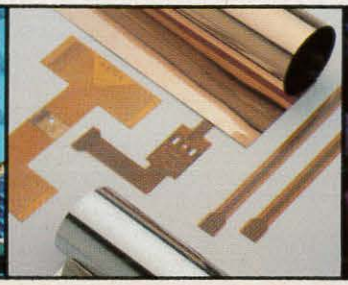

For transparent touch panels

Circle Reader Service #37

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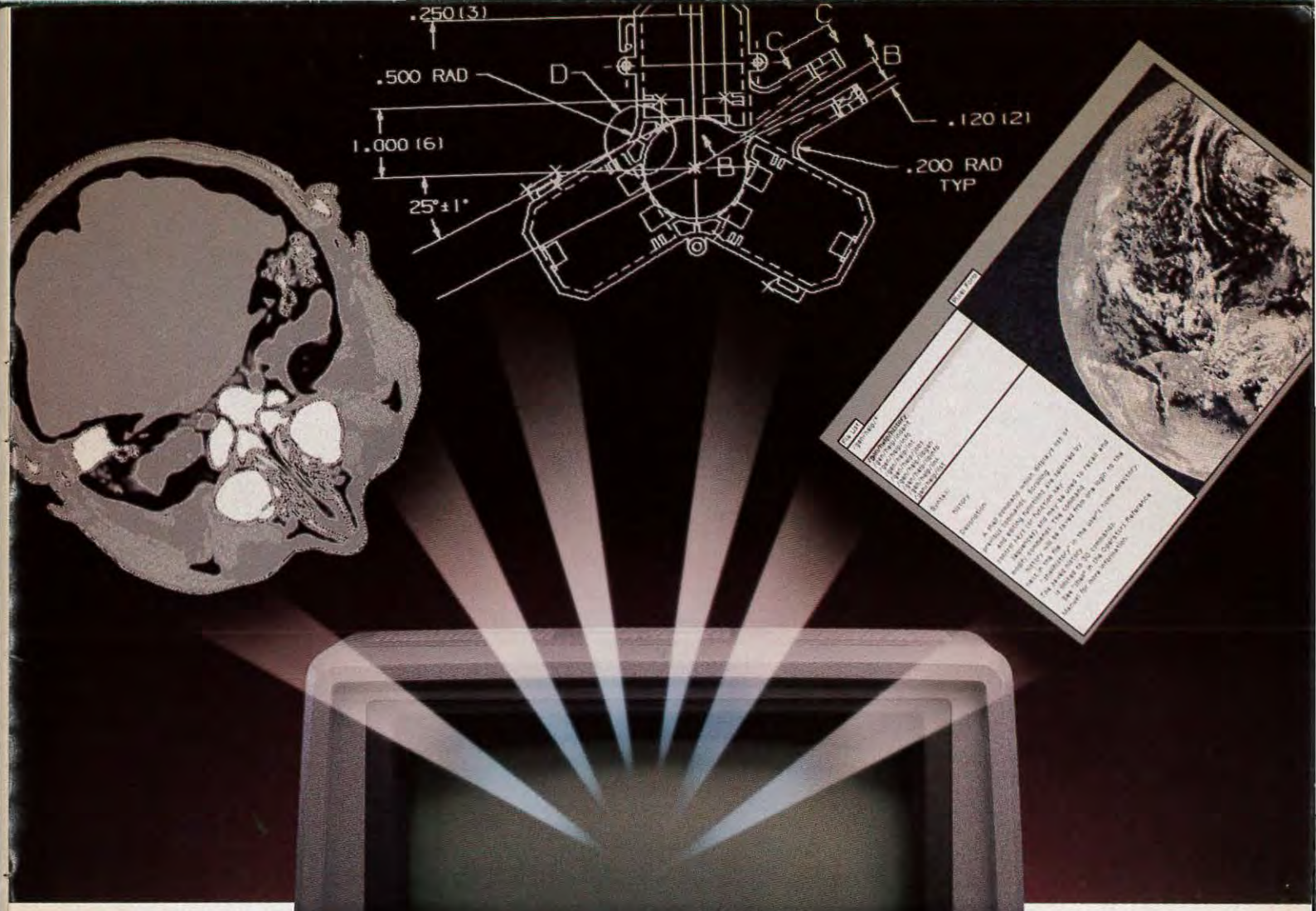
**Litton Systems Canada—Two Sustaining Memberships*



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December Issue—INFORMATION DISPLAY

In this First Annual Review & Forecast, the editors will provide a retrospective on the major imaging and display developments thus far in the 80's . . . and consider the future impact on the consumer market of technologies that are only now evolving in the laboratory.

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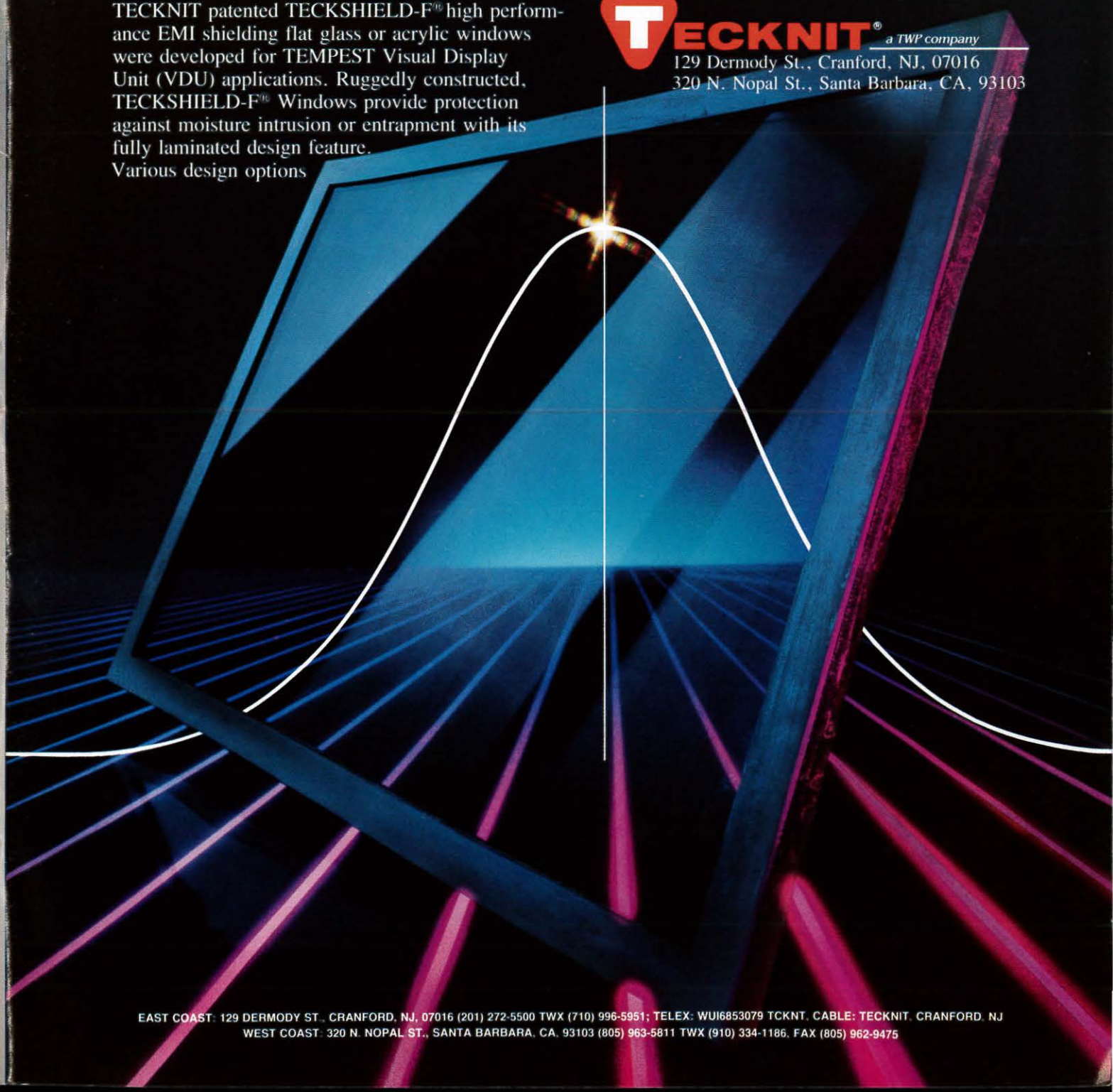

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Celco *Junior* Color Film Recorder

16mm, 35mm, 4″ x 5″

CELCO *Junior* produces 16mm, 35mm or 4″ x 5″ imagery for volume producers of high quality animation and presentation business graphics.

- **Animation**
- **Business Graphics**
- **Bright, rich colors**
- **Low cost**
- **Compact size**
- **Fast film production**
- **Fast film recording speeds:**
  - **—15 seconds for 16mm image**
  - **—Less than 1 minute for a complex 35mm slide**
- **Precise addressability: 8192 x 8192**

APPLICATIONS

The CELCO *Junior* is designed to fill a specific need where high throughput and high quality 16mm, 35mm or 4″ x 5″ computer-generated imaging is required.

OTHER FEATURES

Low cost, compact size, ease of operation and CELCO reliability make this system ideal for animation and business graphics producers worldwide.

The CELCO *Junior* Color Film Recorder provides extremely accurate film registration for the most demanding animation sequences.

OPTIONAL CELCO CONTROL SOFTWARE

—Plotting control
—File handling
—Complete diagnostic and calibration routines
—Job Control Block (JCB) for animation files handling

Original photo was digitized by Eikonix in preparation for computer-controlled retouching by Magicmation, Seattle, WA. Digital image was then output to CELCO Film Recorder.

CELCO *Junior* saves time and makes money for animators: Data courtesy Pacific Data Images.

For further information call CELCO today.

CELCO-Constantine Engineering Labs, Co.
70 Constantine Drive, Mahwah, NJ 07430
201-327-1123

CELCO, Pacific
1150 E. Eighth Street, Upland, CA 91786
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Circle Reader Service #40

CELCO Catalog Sheet No. 158.3A
File Under Color Film Recorders