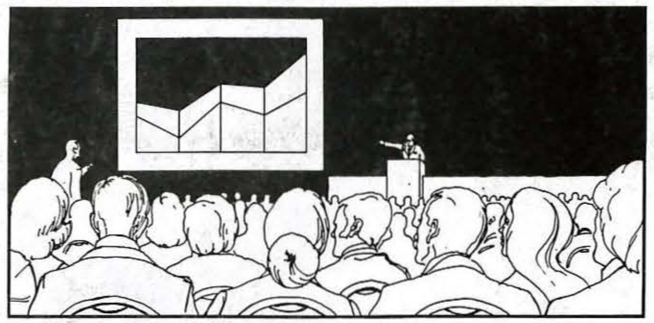
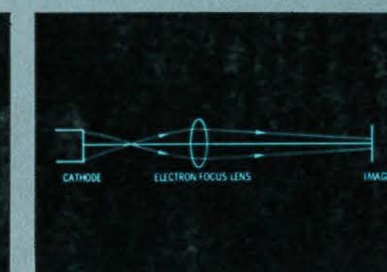


SID JOURNAL

The Official Journal of the Society For Information Display

Formerly INFORMATION DISPLAY JOURNAL



Application of the Laminar Flow Gun to Cathode-Ray Tubes
By NORMAN H. LEHRER

CRT?
By JIM E. WURTZ

Multicolor and Multipersistence Penetration CRTs
By ANDRE MARTIN

Four Test Patterns for Vector (line drawings) Computer Displays
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SID 1974 International Symposium and Exhibition

San Diego, California
Town & Country Hotel

May 21—22—23, 1974

SYMPOSIUM

vol. 11, Number 2
Mar./Apr. - 1974

SID JOURNAL

The Official Journal of the Society For Information Display

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vol. 11, number 2

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PRESIDENT'S MESSAGE

A professional society such as ours should and must provide a variety of services to its membership if it is to fulfill its role of fostering improved avenues toward increased professionalism of its individual members. There are many vehicles by which such a role can be fulfilled among which are publications, symposia and technical meetings, standards, recognition by means of awards of significant achievements and the encouragement of chapter activities. Your National Officers and your Board of Directors are, and have been, fully aware of their need to strive continuously to improve all aspects of the value of your membership in the Society. In a small society such as ours, however, in which our resources are limited and in which we depend so heavily upon the voluntary activities of dedicated people who also have other jobs, we have, unfortunately, not been able to do everything at once.

For that reason, your Board has, in the past, put primary effort upon two areas of activity, that is, publications and technical meetings. In both areas we shall continue to improve our activities. For example, we are exploring means of sponsoring Fall technical meetings on each coast in alternate years with other technical societies in order to stress the inter-disciplinary nature of our Society.

I believe, however, that our Society's efforts in these two areas have reached the point that we can all take pride in the professionalism which these activities foster. The efforts of your National Board can now turn to other areas for which we have a responsibility as National Officers to improve. Of particular concern to me has been the aid which the National can and should provide to our Chapters.

In many ways, this is a complex problem. A number of our Chapters have been vigorous and energetic in providing their membership with opportunities for local technical activities. Others, however, have faced serious problems in providing for viable Chapter activities and in meeting the necessary administrative obligations associated with the operation of a Chapter. Your Board has already had some discussions about possible methods of improving this situation. We are most anxious to exchange local technical activities, and yet we recognize that the geographic areas covered by some chapters makes it difficult to meaningfully schedule events for all members. We have considered many approaches, including the possibility of providing small subsidies to any group of our members to conduct technical meetings even if not under the aegis of a formal Chapter organization. Since I believe that this area of local professional activities is the next most pressing matter deserving the attention of your Board, I am most anxious to hear from any of you, particularly those not realistically participants of existing chapters, about ideas you may have.

Dr. Carlo P. Crocetti
President

SID National Headquarters/654 N. Sepulveda/Los Angeles, Calif. 90049/Tel. 213/472-3550

Application of the Laminar Flow Gun to Cathode-Ray Tubes

By NORMAN H. LEHRER
Staff Scientist
Watkins-Johnson Co.
Palo Alto, California

Consideration is given to the merits of the laminar flow gun versus the crossover gun which has been virtually the CRT standard for the past 40 years.

■ The ultimate objective in the design of a CRT electron gun is usually the achievement of a tube with the highest resolution and brightest spot with the least power, and longest life-time and smallest volume for any given display area.

For approximately the past 40 years, this objective has been satisfied by the crossover electron gun (References 1-4) as evidenced by the fact that almost every CRT produced incorporates such a gun.

Recently, David J. Bates and Aris Silzars (References 5, 6 and

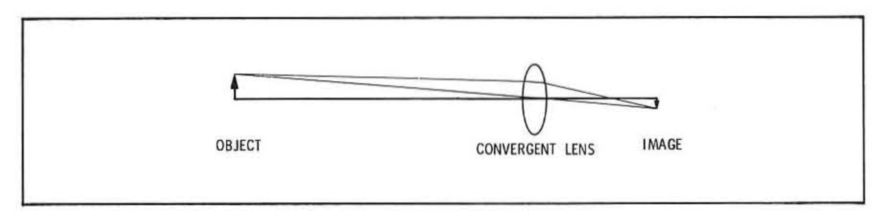

Figure 1. Concentrating optical system

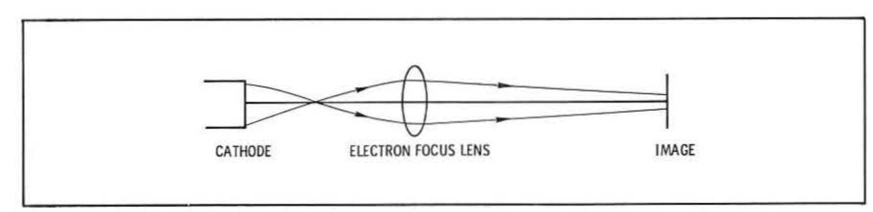

Figure 2. Crossover gun electron trajectories

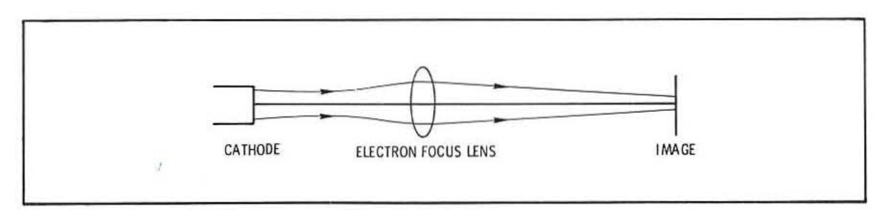

Figure 3. Laminar flow gun electron trajectories

By NORMAN H. LEHRER

7) indicated that a laminar flow gun is capable of superior performance to that of the crossover gun. The work reported here is an application to CRT electron guns of the laminar flow concepts disclosed and advocated by them.

Conceptual Comparison between Crossover and Laminar Flow Guns

The function of the electron gun is to provide a small intense spot of controllable brightness on the phosphor viewing screen. This spot should be as small as possible and as bright as possible to provide an optimum display.

In the simplest sense, the electron gun is analogous to an optical system which produces an intense image of a bright object. As illustrated in Figure 1, a bright source serves as the object for the convergent glass lens which focuses its image into a small spot. In the optical case, image brightness is dependent on source intensity and distribution. Within limits, this is also true for electron guns. The crossover gun attempts to provide an intense source by shaping the electric field lines in the vicinity of the cathode so that the electrons are converged to a crossover almost immediately upon leaving the cathode. It is this crossover which is the object that is imaged on the phosphor screen. To produce this crossover, the electric field is very high at the center of the cathode and falls off rapidly with radial distance. The emission density, in a gross sense, is conical-like in shape, assuming a circular cathode. This conical distribution is converged into a crossover and then re-imaged on the viewing screen as shown in Figure 2. Of course, the intensity distribution at the cathode is reflected in the crossover and ultimately in the spot on the screen. Thus, even with an ideal imaging system, the best that can be achieved is a spot with an intense center, surrounded by a region of lesser intensity, rapidly decreasing with radius. Passing the beam through an aperture can improve the uniformity of the spot by masking the outermost portion of the beam. This requires increased signal strength (grid drive), however, since more cathode current must be provided to compensate for the reduced current to the screen.

In contrast, in the laminar flow gun (Figure 3), the electric field across the surface of the cathode is relatively uniform. The electrons emitted from the cathode tend to flow in streamline paths until they are converged to a focus at the viewing screen. Because of the shape of the electric field lines, the emission density across the cathode is relatively constant and may be considered for comparative purposes to have the shape of a cylinder. Thus, for the same peak cathode loading, in the ideal case, the laminar flow gun can provide three times the current density from the same cathode area. (The volume of the cylinder is three times the volume of a cone.) This means it can provide the same total emission from a cathode region 60% of the diameter of the crossover gun, therefore achieving a 40% reduction in the diameter of the emitting region. Alternately, for a given beam current and emitter diameter, the peak cathode loading will be considerably lower in the laminar flow gun.

The energy distribution of the electrons also affects the resolution. Electrons with energy components transverse to the tube axis move radially from their origin as they proceed toward the viewing screen. These transverse velocities cause a spreading of the image on the screen.

Of course, electrons are emitted from the cathode with a certain energy distribution. In the case of the crossover gun, the aberrations present in short focal length lenses further degrade the energy distribution. The use of longer focal length lenses which have less aberrations in the cathode region of the laminar flow gun reduce this degradation.

Space-charge, or the mutual repulsion of electrons, is another factor which limits resolution. Such space-charge repulsion can occur in the crossover and as the beam is brought to a focus at the viewing screen. By eliminating the crossover, the laminar flow gun avoids one space-charge source of degradation.

The basic design of the laminar flow gun is such that it has a higher perveance (transconductance) than the crossover gun, that is, any given change in electrode voltage produces a larger charge in cathode current.

Advantages of the Laminar Flow Gun

The basic advantages of the laminar flow gun compared to a

Figure 4. Photograph of 8″ CRT

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crossover gun are as follows:

1) Two to three times stronger source intensity due to more uniform cathode loading.
2) Lower noise (normal velocity components) in beam because of reduced lens aberrations.
3) Avoidance of space-charge limitations in crossover.
4) Higher transconductance, that is, a larger change in cathode current for a given change in grid voltage.

These characteristics can improve the performance of a CRT in several ways, although, not necessarily all at the same time. Trade-offs between the improvements may be possible.

1) Resolution: Because factors such as space-charge in the beam, electron energy distribution and lens aberrations limit the resolution as well as source intensity, the anticipated improvement in spot size is less than the reduction in the size of the source. As much as a 30% reduction in spot size, or double the current density in the spot at the screen, appears as a reasonable expectation when a crossover gun is replaced with its direct replacement laminar flow gun. By "direct-replacement" is meant that the laminar flow gun is the same length and width as the crossover gun and operates at the same voltage. The importance of comparing direct replacement guns is discussed in the next section.

2) Higher Brightness: The brightness of a phosphor generally increases with current density of the exciting electron beam over a wide range of densities. The increased brightness is not always directly proportional to the current density because of saturation effects in the phosphor. Depending upon the phosphor and the current density, the ability of the laminar flow gun to produce an increase of two times the current could result in a similar increase in the peak line brightness without a corresponding reduction in resolution.

3) Reduced Grid Base: The higher transconductance of the laminar flow gun means that for the same charge in grid potential, much larger screen currents can be produced. This permits either a reduction in the amplitude of the signals to the tube or a brighter picture for the same signal level.

Direct-Replacement CRT Electron Guns

Several parameters determine the condition under which the optimum spot size is achieved. These include:

1) Viewing screen potential
2) Focus potential (for electrostatic focus tubes)
3) G2 potential
4) G1 cut-off potential
5) Gun length and diameter
6) Tube length
7) Current efficiency (ratio of screen current to cathode current)
8) Cathode loading

A comparison of electron gun performance (resolution) must be based on consideration of all those parameters which characterize the gun. Thus, it is usually possible to improve the resolution of any given gun by lengthening its focus structure. This improved resolution is obtained at the expense of tube length and generally current efficiency, since less of the cathode current reaches the screen. This lengthened gun is not actually better than the shortened gun because it gives higher resolution, but rather different because it has been optimized for a different set of parameters.

A truly superior gun would be one that exhibits improved resolution without trading off any of the parameters. Such an improved gun would yield improved performance (better resolution) under the same conditions as an existing gun and would serve as a direct replacement for it without any change in the physical or electrical parameters that describe the display system. It is this criteria that has been applied in comparing the laminar flow gun with a crossover gun.

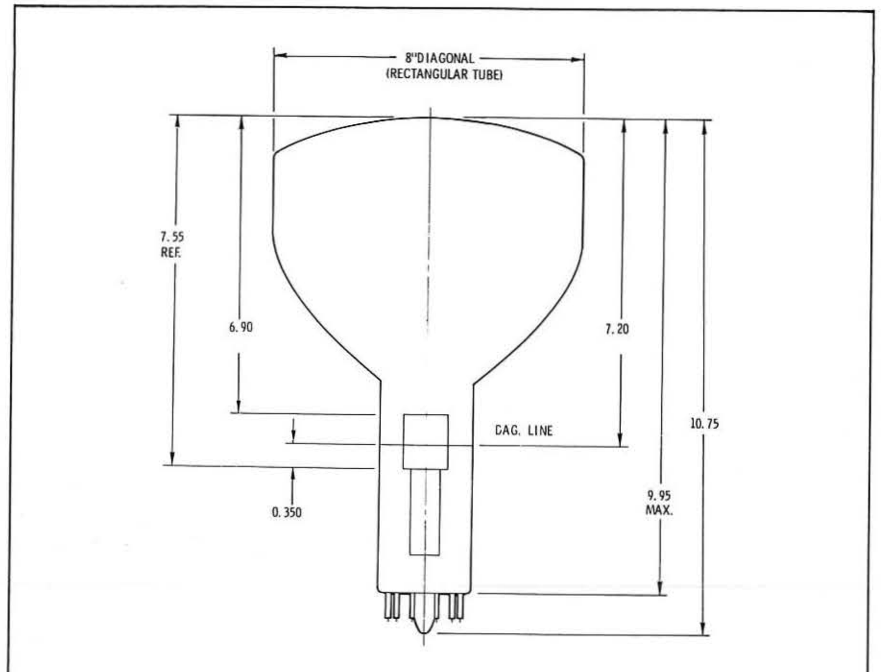

Figure 5. 8" CRT schematic

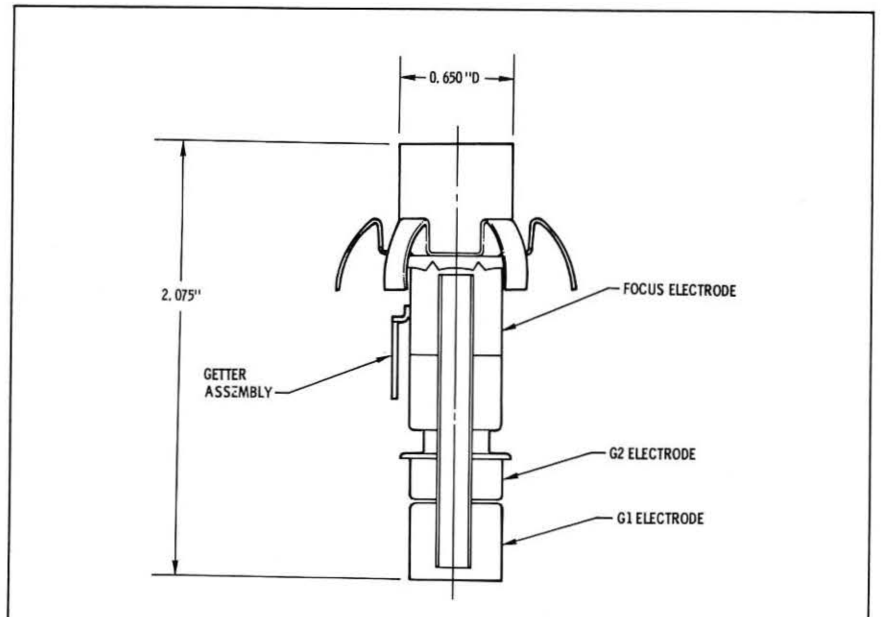

Figure 6. Crossover gun schematic

Comparison of a Crossover Gun CRT with its Direct-Replacement Laminar Flow Gun CRT

The concept of the laminar flow gun design can be advantageously applied to all types of CRT's including magnetic deflection—electrostatic focus, magnetic deflection—magnetic focus and electrostatic focus and deflection.

As pointed out previously, in order to obtain a meaningful evaluation of the laminar flow gun, its performance must be compared with that of a crossover gun CRT for which it is a direct replacement.

As a starting point, the crossover gun tube chosen was an 8" high resolution 70° deflection electrostatic focus-magnetic deflection device. This particular tube was selected because it represented a significant effort on the part of another organization to develop a high resolution 8" CRT.

A photograph of the 8" tube incorporating the laminar flow gun is shown in Figure 4. Of course, the 8" tube with the crossover gun has an identical appearance. A schematic of the tube is shown in Figure 5. The crossover gun is shown in Figure 6.

Using this crossover gun design as a starting point, a direct-replacement laminar flow gun was developed. The laminar flow gun developed employed different electrode shapes but the electrode diameters, focus electrode and overall gun lengths were identical. One significant change that had to be made was a reduction in the size of the final aperture from .075" to .050". This had to be done to achieve the same current efficiency in both guns at 30μA screen current. The following data was obtained on the tubes using a single slit analyzer technique. In the following tables and discussion, the laminar flow gun tube is identified by "LFG Tube" and the crossover gun tube by "COG Tube".

Tube	Cathode Current (μA)	Screen Current (μA)	G-2 Potential (Volts)	G-1 Cut-Off Potential (Volts)	Spot Size Inches to 50%	to 100%
COG Tube	68	30	300	−70	.0057	.0142
LFG Tube	65	30	300	−30	.0040	.0037
	85	30	916	−70	.0030	.0082

For both tubes, the screen potential was 12 KV and the focus potential about 2000 volts. The writing speed was 10 microseconds per inch with a 60 hertz repetition rate. Examination of the above data indicates that the LFG tube has 30% more resolution and less than ½ the cut-off voltage of the COG tube. By raising the G2 potential so that the cut-off voltage is the same as that of the COG tube, the resolution of the LFG tube becomes almost twice that of the COG tube.

There are other comparisons that can be made between the COG tube and the LFG tube as shown below:

Tube	Exit Aperture Diameter Inches	Cathode Current (μA)	Screen Current (μA)	G-2 Potential (Volts)	Grid Drive for 30 μA Screen Current (Volts)	0 Bias Current mA
COG Tube	.070	68	30	300	26	1.7
LFG Tube	.050	65	30	300	15	0.65
	.050	85	30	916	24	2.6+

Note that at a G2 potential of 300 volts, the current efficiency (screen current divided by cathode current) is comparable for both tubes even though the exit aperture is 30% smaller in diameter for the LFG tube. This means, in this case, that the laminar flow gun can produce twice the current density in the final aperture than the crossover gun. This should produce about a 30% decrease in the deflection defocusing which is proportional to the beam bundle diameter. (In the case of electrostatic deflection tubes it may mean up to twice the brightness plus higher current efficiency.) The grid drive is only 15 volts for the laminar flow gun as opposed to 26 volts for the crossover gun.

Increasing the G2 potential to 916 volts on the laminar flow gun makes the cut-off voltage at −70 volts, the same as that of the crossover gun. The resolution of the laminar flow gun is almost twice that of the crossover gun but the current efficiency of the laminar flow gun is now only 35% as opposed to 46% for the crossover gun. The grid base of the laminar flow gun at 24 volts is still shorter than that of the crossover gun if only by 2 volts. Note that the "0" bias current for the laminar flow gun is about 50% greater than that of the crossover gun when the cut-offs are equal. This higher value of "0" bias current results in a much shorter grid base for the laminar flow gun and permits corresponding reductions in video drive requirements when cathode modulation is used. Space-charge limitations are theoretically encountered at lower values of beam current or the exit aperture is reduced in size.

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Thus, the use of a smaller exit aperture in the laminar flow gun would suggest at a sufficiently high value of beam current, the resolution of the crossover gun would be better than that of the laminar flow gun. However, this would only be true if the space-charge limitation in the crossover is small compared to those in the beam after it leaves the final aperture.

Although data for only one value of cathode and screen current is presented here, similar results were obtained over a wide range.

Conclusion

The basic design concept of the laminar flow gun appears to offer improvements over the crossover gun. These include more intense and uniform source, lower beam noise, avoidance of space-charge in crossover and a higher perveance structure. Although this paper reports on only one type of CRT,

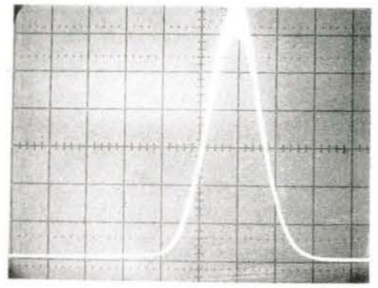

Figure 7. Typical trace width profile. Vertical scale: arbitrary intensity units. Horizontal scale: Distance, 0.00355 inches/cm.

these advantages can probably be translated into many types of CRT's with higher resolution, increased brightness and reduced grid drive requirements. Furthermore, these improved CRT's can be direct physical and electrical replacements for existing CRT's using crossover guns.

Acknowledgements

The work described in this paper was conducted at the Watkins-Johnson Company, Tube Division, Palo Alto, California. Alan J. Dawes made a major contribution to the results reported in this paper. Richard Franseen (Night Vision Laboratories, Fort Belvoir, Virginia), Paul Decker (formerly of the Night Vision Laboratories) and Waldo R. Robinson (Naval Electronic Laboratory Center, San Diego, California) also contributed to this work. ■

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2. Hillary Moss, "Electron Gun of the Cathode Ray Tube", Part I Journal of the British Institution of Radio Engineers, dated January 1945.
3. Hillary Moss, "Electron Gun of the Cathode Ray Tube", Part II Journal of the British Institution of Radio Engineers, June 1946.
4. Hillary Moss, "Engineering Methods in the Design of the Cathode Ray Tube", Journal of the British Institution of Radio Engineers, dated January 1945.
5. Silzars and Bates, U.S. Patent No. 3,740,607—Laminar Flow Electron Gun and Method.
6. L. A. Roberts, David J. Bates, Aris Silzars and James A. Long: "Design and Performance of Deflected-Beam Electron Bombarded Semiconductor Amplifiers", IEEE Trans. Vol. ED-20, pp. 439-447, April 1973.
7. A. Silzars, D. J. Bates and A. B. Ilanoff: "Electron Bombarded Semiconductor Devices", Proc. IEEE (to be published).

GE World Service

General Electric was to feature its globe-spanning MARK III Information Services in its exhibit at the National Computer Conference, Chicago, May 6-10. A complete data processing service, MARK III provides timesharing, networking and remote batch computer services to customers through the world's largest commercial computer network.

Composed of more than 100 interconnected communications and data processing computers, GE's MARK III Information Services network spans 17 time zones and is available in more than 360 cities in the U.S., Canada, Western Europe, Japan and Australia. It is accessed by local telephone call from more than 90% of the free world's business telephones.

60-Plus Papers Set For San Diego SID Meet

A great program, reflecting the most advanced worldwide developments in the field of information display design and applications, will be presented during the 1974 International Symposium and Exhibition, May 21-23. This year's International Symposium will be held in the setting of the beautiful Town and Country Hotel in suburban San Diego, California.

As this issue of SID JOURNAL closed, the program was not totally finalized; but as can be seen on Page 17, Symposium registrants will have access to more than 60 papers in the field, prepared by more than 200 specialists in the United States, Europe and the Far East.

Among highlights will be early development reports on video disc technology; a session on visual flight simulation; a luncheon talk on bioluminescence; and an opening-session invitational address on the evolution of the shadow-mask TV tube.

Chairman H. Gene Slottow advises that the popular 2-day seminars, introduced at San Francisco during the 1972 Symposium, will be continued under the co-sponsorship of SID and University of California/Berkeley.

The annual 3-day exhibition of operational equipment, components and systems, for information display uses will be held with the Symposium at the Town and Country Hotel.

As in the past, 800-1,000 word illustrated condensations of all program presentations will be available at the meeting and will be distributed to all registrants (additional copies will also be on sale, $15.00 to SID members, $20.00 to non-members. Advance programs, substantially the same as the one beginning on Page 17, but probably with some changes, are available from the SID National Office, 654 N. Sepulveda Bl., Los Angeles, CA 90049; phone Area 213-472-3550; or from Lewis Winner, 152 W. 42nd St., New York, N.Y. 10036, phone 212-279-3125.

Registration can be accomplished as follows: (1) By mail, in advance, to SID 74, P.O. Box 3357, Anaheim, California 92803. Advance registrations postmarked before May 14, are $30 for SID members, $40 for non-members. (2) At the Symposium, Town & Country Hotel, San Diego, California, is $40 for members, $50 for non-members. Special rates apply to students. To reserve sleeping accommodations, write direct to the Town & Country Hotel. Registration can also be accomplished by using card in this issue of SID Journal.

Chairman of the 1974 Symposium is H. Gene Slottow, Owens-Illinois. Other 1974 Symposium officials are: Secretary, Joseph Markin, Zenith Radio; Treasurer, Robert C. Knepper, Hughes Aircraft; in charge of Technical Program, Samuel M. Stone, GTE Laboratories; Program Secretary, Verne J. Fowler, GTE Laboratories; Advisor on Overseas Program and overseas contributors, Rudi S. Engelbrecht, RCA/Zurich; in charge of local (San Diego) arrangements, Richard E. Thoman, General Dynamics Electronics; in charge of Awards, John L. Simonds, Eastman Kodak; in charge of Special Events, John B. Flannery, Xerox.

Symposium Consultant/Exhibit Manager is Lewis Winner, of Lewis Winner/Consultants, 152 W. 42nd St., New York, N.Y. 10036.

AMA Talk Concerns Computer Auditing

Computer auditing software programs which enables security checks was discussed by Joseph J. Wasserman, president of Computer Audit Systems, Inc., of East Orange, N.J., at a recent conference of the American Management Association, at the Americana Hotel in New York.

Wasserman, whose talk covered "Data Security and EDP Auditing," also discussed implementing effective data security in the corporation.

Auditing packages, Wasserman stated, give the auditor complete independence from his programming staff. "They enable the auditor to gather accurate audit data in a fraction of the time once required. If used properly, they permit the auditor to select data that requires further analysis and this ultimately will provide management with more meaningful audit reports."

Wasserman also discussed evaluation and selection of audit packages, auditing on-line, real-time systems, computer security and EDP auditing techniques.

Computers and Law Theme of Book

A new, softcover book "Computers, Society and the Law: the Role of Legal Education" has been published by the American Federation of Information Processing Societies (AFIPS). The 270-page book—edited by Joseph E. Leininger, Associate Dean of the Stanford Law School, and Bruce Gilchrist, Director of Computing Activities at Columbia University—contains major presentations, papers and discussions from an invitational conference held June 25-27, 1973 at the Stanford Center for Research and Development in Teaching, Palo Alto, Ca.

The conference, sponsored by the Stanford Law School and AFIPS, brought together 91 lawyers, legal educators and leading computer experts to analyze how computers and computer-related material should be introduced into legal education.

Copies may be ordered at $6.00 per copy from AFIPS Press, 210 Summit Avenue, Montvale, New Jersey 07645.

According to Gilchrist, "The major thrust of the conference and the resulting proceedings is directed to determining what should be included about computers in legal education. Our aim has been to pull together in one volume a comprehensive overview of immediate value to those in the legal profession, legal educators and computer scientists concerned with the impact of computers on society. We believe this book provides one of the most authoritative sources of information on current activity at the interface between computers and the law."

SID 1974 INTERNATIONAL SYMPOSIUM and EXHIBITION

SAN DIEGO, CALIFORNIA, TOWN AND COUNTRY HOTEL

MAY 21-22-23, 1974

symposium

MONDAY
20 *Senate-Committee Rooms*

ALL DAY 9:00 am - 4:30 pm
SID
UNIVERSITY OF CALIFORNIA SEMINAR

TUESDAY
21 *San Diego Room*

Formal Opening
MORNING 9:00 am - 9:45 am
Welcoming Remarks
H. G. Slottow
General Chairman, SID 74
S. M. Stone
Program Chairman, SID 74
Annual SID Business Meeting
Presiding
C. P. Crocetti
President, SID
SID Honors and Awards Presentations
L. Beiser
Chairman, SID Honors and Awards Committee
1973 Symposium Best-Paper Awards
H. G. Slottow

TUESDAY
21 *San Diego Room*

MORNING 9:00 am - 12:10 pm
Session 2
OPENING SESSION
INVITED ADDRESS
Chairman
H. G. SLOTTOW
University of Illinois
Urbana, Ill.

2.1 Invited
DEVELOPMENT OF THE SHADOW-MASK COLOR PICTURE TUBE
Edward W. Herold
Consultant

TUESDAY
21 *San Diego Room*

MORNING 10:30 am - 12:10 pm
Session 3
DISPLAY DEVICES & TECHNIQUES
Chairman
D. E. LIDDLE
Xerox Palo Alto Research Center
Palo Alto, Cal.

3.1 A Digital 4 x 4 Matrix-Multiplier for Computer Graphics with Realtime Dynamics
K. F. KRAIB
Forschungsinstitut fur Anthropotechnik
Meckenheim, W. Germany

3.2 Source Coding as an Aid to Optimal Display Terminal Design
J. J. O'REILLY
University of Essex
Essex, England

3.3 A Dual Gun Scan Converter Tube with Organic Film Storage Target
T. NISHINO AND H. MAEDA
Matsushita Research Institute Tokyo, Inc.
Ikuta Kawasaki, Japan

3.4 A Stretched Segment LED Display
G. T. IKARI, R. H. HAITZ, P. JEUNG AND R. SOLOMON
Hewlett-Packard Co.
Palo Alto, Cal.

TUESDAY
21 *Golden West Room*

MORNING 10:30 am - 12:10 pm
Session 4
GAS DISCHARGE DISPLAY SYSTEM TECHNIQUES
Chairman
R. L. JOHNSON
University of Illinois
Urbana, Ill.

4.1 Internal Random Access Address Decoding in an AC Plasma Display Panel
J. D. SCHERMERHORN
Owens-Illinois, Inc.
Perrysburg, O.

4.2 Light Pen Capability on a Plasma Display Panel
P. D. T. NGO
Bell Telephone Laboratories, Inc.
Holmdel, N.J.

4.3 Dynamic Light Pen Tracking on a Plasma Panel
P. D. T. NGO AND W. H. NINKE
Bell Telephone Laboratories, Inc.
Holmdel, N.J.

4.4 AC Plasma Panel Television Display with 64 Discrete Intensity Levels
B. C. ANDERSON AND V. FOWLER
GTE Laboratories
Waltham, Mass.

TUESDAY
21 *San Diego Room*

AFTERNOON 2:00 pm - 5:10 pm
Session 5
VIDEO DISC TECHNOLOGY
Chairman
J. MARKIN
Zenith Radio Corp.
Chicago, Ill.

5.1 A Review of Video Disc Principles
A. KORPEL
Zenith Radio Corp.
Chicago, Ill.

5.2 Transmission Mode Optical Video Disc System
R. L. WHITMAN
Zenith Radio Corp.
Chicago, Ill.

5.3 Title to come
E. M. KACZOROWSKI AND J. A. JEROME
I/O Metrics Corp.
Sunnyvale, Cal.

5.4 Title to come
G. BROUSSAUD, E. SPITZ AND C. TINET
Thomson CSF
Orsay, France

SID 1974 International Symposium and Exhibition

SAN DIEGO, CALIFORNIA, TOWN AND COUNTRY HOTEL

MAY 21-22-23, 1974

TUESDAY
21 *Council-Chamber Rooms*

EVENING 5:15 pm - 6:30 pm
Author Interviews

EVENING 6:00 pm - 7:30 pm
Social Hour—

EVENING 8:00 pm - 11:00 pm
Panel Discussions

WEDNESDAY
22 *San Diego Room*

MORNING 9:00 am - 12:10 pm
Session 6

LASER, HOLOGRAPHIC, AND 3-D DISPLAYS
Chairman
V. J. FOWLER
GTE Laboratories
Waltham, Mass.

6.1 Computer Holograms Revisited
J. C. NEWELL, D. O. DICKMAN AND M. A. WINKLER
University of California/Los Alamos Scientific Laboratories
Los Alamos, N.M.

6.2 The Integram—The Integration of Motion Pictures into Holograms
T. H. JEONG AND H. SNYDER
Lake Forest College
Lake Forest, Ill.

6.3 Stereoscopic Television Display for Remote Vision
J. R. TEWELL AND C. E. POLHEMUS
Martin Marietta Aerospace
Denver, Colo.

6.4 A Three Dimensional Display for Radar Returns
H. S. COLE, J. C. REICHE, D. W. SKELLY AND C. R. STEIN
General Electric Co.
Schenectady, N.Y.

6.5/1 Advanced Integrated Modular Instrumentation System (AIMIS)
W. G. MULLEY
Naval Air Development Center
Warminster, Pa.

6.5/2 Acoustooptic Deflection Display System
H. GREEN
Naval Air Development Center
Warminster, Pa.

6.5/3 Hologram Optics in Head-Up Displays
D. H. CLOSE
Hughes Research Laboratories
Malibu, Cal.

6.5/4 Holographic Multicolor Moving Map Display
K. D. QUIRING
Naval Air Development Center
Warminster, Pa.

WEDNESDAY
22 *Golden West Room*

MORNING 9:00 am - 12:10 pm
Session 7

SOFTWARE AND SYSTEM TRADEOFFS
Chairman
W. D. PETTY
Owens Illinois
Toledo, O.

7.1 Tradeoffs in the Design of an Intelligent Display Terminal
D. I. CAPLAN
Raytheon Data Systems
Norwood, Mass.

7.2 Satellite-Host Tradeoffs in Computer-Aided Design
J. HATVANY
Hungarian Academy of Sciences
Budapest, Hungary

7.3 Developing Man-to-Machine Software with Structured Programming Techniques
A. D. THOMPSON
IBM Corporation
Morris Plains, N.J.

7.4 Tutor Graphic Capabilities
P. TENCZAR
University of Illinois
Urbana, Ill.

7.5 Conic Curves for Graphics
L. VILLALOBOS
Hughes Aircraft Co.
Oceanside, Cal.

7.6 Menus as Devices
R. A. BERMAN
Vector General, Inc.
Canoga Park, Cal.

WEDNESDAY
22 *California Room*

12:00 noon - 1:50 pm
LUNCH
INVITED ADDRESS/DEMONSTRATION
Bioluminescence—Light Without Heat
W. D. McELROY
Chancellor, University of California
San Diego, Cal.

WEDNESDAY
22 *San Diego Room*

AFTERNOON 2:00 pm - 5:30 pm
Session 8

MATRIX - ADDRESSED PANELS
Chairman
B. KAZAN
IBM T. J. Watson Research Center
Yorktown Heights, N.Y.

8.1 LED Color Display with Memory Functions
C. SUZUKI, T. UNO AND S. MITO
Sharp Corp. Central Res. Lab.
Tenri City, Nara, Japan

8.2 The Thyroptor—A Gallium Phosphide LED with Integral Storage
A. R. PEAKER, V. PASTORE, A. MOTTRAM AND B. HAMILTON
Ferranti Ltd.
Oldham, England

8.3 Stable High-Brightness Thin-Film Electroluminescent Panel
T. INOGUCHI, M. TAKEDA, Y. KAKIHARA, Y. NAKATA AND M. YOSHIDA
Sharp Corp. Central Res. Lab.
Tenri City, Nara, Japan

8.4 TV Imaging System using Thin-Film Electroluminescent Panels
S. MITO, C. SUZUKI, Y. KANATANI AND M. ISE
Sharp Corp. Central Res. Lab.
Tenri City, Nara, Japan

8.5 Recent Progress in Electrophoretic Displays
A. L. DALISA
Philips Laboratories
Briarcliff Manor, N.Y.

8.6 A Low Power Single Chip Calculator using A Multiplexed Liquid Crystal Display
E. T. FITZGIBBONS AND R. G. CARLSON
Rockwell International Microelectronics Div.
Anaheim, Cal.

8.7 Transient Times of the Dielectric Deformation in a Nematic Liquid Crystal
M. F. SCHIEKEL, K. FAHRENSCHON AND H. GRULER
AEG Telefunken
Donau, W. Germany

WEDNESDAY
22 *Golden West Room*

AFTERNOON 2:00 pm - 5:30 pm
Session 9

DISPLAY QUALITY — IMAGE AND MESSAGE PERCEPTION AND CONTENT
Chairman
A. SOBEL
Zenith Radio Corp.
Chicago, Ill.

9.1 Human Factors of Optical Displays
R. S. KICKLIGHTER AND R. F. WITZEL
Eastman Kodak Co.
Rochester, N.Y.

9.2 Measuring the Information Content of Visual Scenes
J. C. McKECHNIE
Naval Training Equipment Center
Orlando, Fla.

9.3 Analysis of Perceived Image Quality
R. W. COHEN AND I. GOROG
RCA Laboratories
Princeton, N.J.

9.4 Perpheral-Visual Response Time and Visual-Display Layout Design
R. F. HAINES
AMES Research Center/NASA
Moffett Field, Cal.

9.5 Optical Characteristics of Display/Memory Panels*
R. W. BURKE, H. J. HOEHN AND M. E. FEIN
Owens-Illinois, Inc.
Perrysburg, O.

9.6 The Format and Color of Small Matrix Displays for use in High Ambient Illumination
B. ELLIS, G. J. BURRELL, J. WHART AND T. D. F. HAWKINS
Royal Aircraft Establishment
Farnborough, Hampshire, England

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WEDNESDAY
22 *Council-Chambers Rooms*

EVENING 6:00 pm - 7:30 pm
Author Interviews

WEDNESDAY
22 *San Diego Room*

EVENING 8:00 pm - 11:00 pm
Session 10 - INVITED:

VISUAL FLIGHT SIMULATION
Chairman
W. G. GOOD
General Electric Co.
Syracuse, N.Y.

10.1 Simulation/Past-Present-Future
R. McLANAGHAN
Redifon Flight Simulation, Ltd.
Sussex, England

10.2 Computer-Generated TV Imagery
B. J. SHINN
General Electric Co.
Daytona Beach, Fla.

10.3 Developments in Pilot Training
R. A. WALDROP
American Airlines
Fort Worth, Tex.

THURSDAY
23 *San Diego Room*

MORNING 9:00 am - 12:10 pm
Session 11

GAS DISCHARGED DEVICES
Chairman
I. REINGOLD
US Army Electronics Command
Ft. Monmouth, N.J.

11.1 Xenon-Based Gas Mixtures for Phosphor Panels*
D. C. HINSON
Owens-Illinois, Inc.
Perrysburg, O.
R. A. BENNETT
Owens-Illinois, Inc.
Toledo, O.

11.2 Color-TV Display Using a Flat Gas-Discharge Panel
M. FUKUSHIMA, S. MURAYAMA AND T. KAJI
Hitachi Central Res. Lab.
Tokyo, Japan

11.3 DC Gas Discharge Storage Displays
F. WALTERS
Ferranti Ltd.
Oldham, Lancs., England

11.4 The Multilayer Gas-Discharge Display Panel
C. D. LUSTIG, A. W. BAIRD AND H. VERON
Sperry Research Center
Sudbury, Mass.
J. B. ARMSTRONG AND G. WATTS
Beckman Instruments, Inc.
Scottsdale, Ariz.

11.5 32-Inch Graphic Plasma Display Module
R. A. STROM
Control Data Corp.
Minneapolis, Minn.

11.6 Single Substrate AC Plasma Display
G. W. DICK
Bell Telephone Laboratories, Inc.
Holmdel, N.J. 07733

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THURSDAY
23 *Golden West Room*

MORNING 9:00 am - 12:10 pm
Session 12

LARGE AREA DISPLAYS
Chairman
S. SHERR
North Hills Associates
Glen Cove, N.Y.

12.1 INVITED: Optical Characteristics of Projection Display Screens
J. J. DePALMA
Eastman Kodak Co.
Rochester, N.Y.

12.2 High Gain Specular Screens
Y. G. HURD
L. E. Carpenter & Co.
Norwalk, Conn.

12.3 A Light-Reflecting Electromagnetic Display
H. O. PEPRNIK
Ferranti-Packard Ltd.
Toronto, Ont., Canada

12.4 7000 Lumen Color TV Projector Development
D. B. HAKEWESSELL
Conrac Corp.
Duarte, Cal.

12.5 Optimum Photoconductor Thickness and Dielectric Constant for the γ-RUTICON
A. I. LAKATOS, W. H. COOK AND K. W. PIETROWSKI
Xerox Corp.
Webster, N.Y.

12.6 Read-Out Considerations for a Class of Liquid Crystal Display
G. DIR, J. ADAMS, W. HAAS AND J. STEPHANY
Xerox Corp.
Webster, N.Y.

THURSDAY
23 *San Diego Room*

AFTERNOON 1:00 pm - 3:00 pm
Session 13

DISPLAY APPLICATIONS
L. N. HEYNICK
Stanford Research Institute
Menlo Park, Cal.

13.1 On-Board Vehicle Route Instructions Via Plasma Display Panel
R. L. FRENCH
Avcon, Inc.
Ft. Worth, Tex.

13.2 Pilot Warning/Collision Avoidance Display System
W. E. BUCHANAN AND E. F. KILEY
Johns Hopkins University
Silver Spring, Md.

13.3 Naval Environmental Display Station (NEDS)
W. O. KERMAN AND E. R. REINS
U.S. Navy Environmental Prediction Research Facility
NPS Monterey, Cal.

13.4 The Epic-II System for Experimental Electronic Painting
V. J. FOWLER
GTE Laboratories Inc.
Waltham, Mass.

THURSDAY
23 *Golden West Room*

AFTERNOON 1:00 pm - 3:00 pm
Session 14

INTERACTIVE SYSTEMS
Chairman
T. B. CHEEK
Tektronix, Inc.
Beaverton, Ore.

14.1 Knowledge Workshop Terminal Systems
R. W. WATSON
Stanford Research Institute
Menlo Park, Cal.

14.2 Systems Aspects of Displays
D. E. LIDDLE
Xerox Research Center
Palo Alto, Cal.

14.3 Image Storage and Retrieval
L. Hausman
Infodetics Corp.
Anaheim, Cal.

14.4 Micrographics/Computer Information Display System
R. L. MERWIN
Dynamic Information Systems, Inc.
Lakeville, Minn.

FRIDAY
24 *Senate-Committee Rooms*

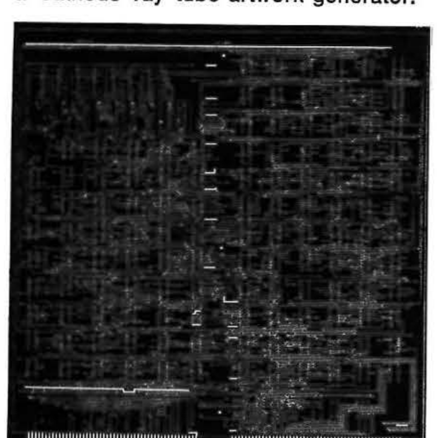
ALL DAY 9:00 am - 4:30 pm
SID
UNIVERSITY OF CALIFORNIA SEMINAR

WHITHER THE CRT?

It has been suggested (with an assist from adherents to the cult of 'newness') that the cathode ray tube is on its way out. The author points out that despite various new technologies, the CRT survives, and continues to find new areas of application. One reason for this is that few applications have fully exploited its capabilities.

By JIM E. WURTZ
Senior Applications Engineer
Litton Industries
San Carlos, California

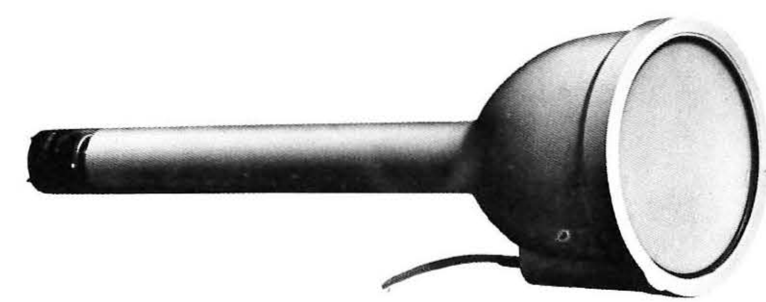
Circuit board produced by a cathode ray tube artwork generator.



■ The cathode ray tube is a very mature electronic device. Lately, a combination of the cult of "newness" plus emerging technologies such as LED's, plasma displays and the laser have led many to predict that the CRT is on its way out. To paraphrase Mark Twain, when his name accidentally appeared in the obituary column, reports of its death are greatly exaggerated.

Certainly many areas of display have been taken over by new technologies. But the CRT continues to survive and find new areas of application. Part of the reason for this is that very few applications have fully exploited the capabilities of this device. The CRT provides a virtually inertialess point of light controllable in brightness over a great range with the capability of fully random placement anywhere in a two-dimensional plane. Neither the data source nor the order of information arrangement is important. It has sufficient memory for smooth presentation of data, but is capable of instantaneous change.

While there have been no major breakthroughs in recent years, slow and steady improvement in CRT technology continues. Today a number of new phosphors are available, cathodes are better, assembly techniques are better, and with greater cleanliness, tube life is longer. But it has been the spectacular progress in semiconductor technology that has made it possible to more fully utilize the "power" of the CRT.



5", photo recording cathode ray tube producing a 13 micron spot size.

The impact of solid state on CRT's is twofold. Because solid state memories, microprocessors, and information handling circuitry have become smaller, better and cheaper, the data to be displayed is available at higher rates. More importantly, the circuits and components for driving the tube itself have become smaller, faster, more stable, cheaper, and more efficient. Deflection amplifiers, high voltage supplies, video drivers, and shaping circuits have shrunk from vacuum tubes to discretes and then to IC's. An example of one area of progress in drive circuitry are the cathode ray tube plotters now in operation which have sufficient accuracy and stability to generate circuit board artwork, interconnect patterns for large scale integrated circuits, and even diffusion masks.

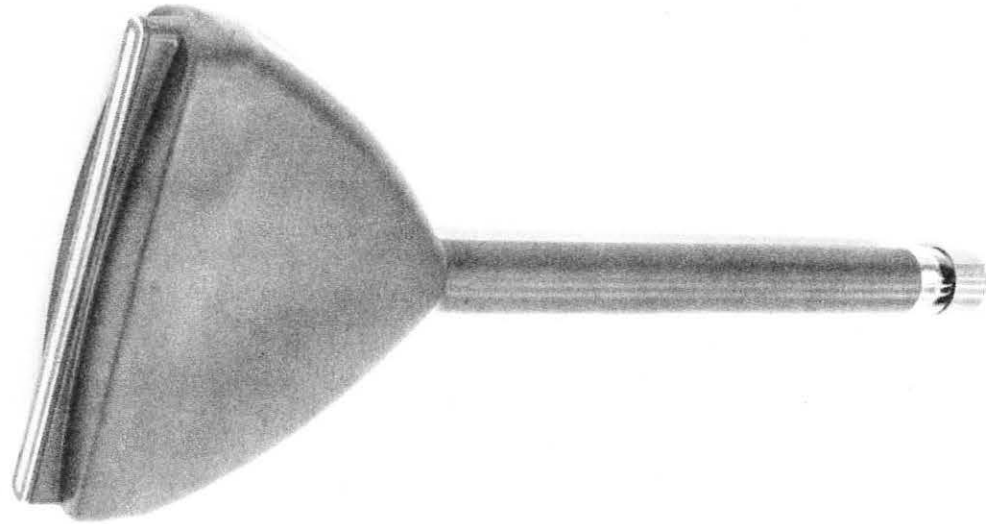
Progress in the areas of drive circuitry and information processing devices continues, along with the growth of requirements for information display devices. Because of these factors, the CRT has only begun to realize its full potential in the last few years.

Aside from the great proliferation of computer display terminals and oscilloscopes, there follows a partial list of applications where the CRT is the workhorse. Most of the listed applications are film oriented.

- Satellite imagery
  - ATS
  - ERTS
  - TIROS
  - NIMBUS
  - Mariner, etc.
- Forest fire detection and mapping (IR readout)
- Seismic section recording
- Well logging
- Biomedical
  - Ultrasonagraphs
  - Cell counting
  - Image analysis
- Automatic nuclear particle scanning
- Computer on microfilm recording
- Magnetic tape to film recording
- Graphic displays
- Mask and circuit board generation
- Radar land mass simulators
- Simulator scene generators
- Side looking radar recording
- Document reading (OCR)
- Color picture "camera"
- Computer image research
- Helmet-mounted displays
- Photorectification (aerial survey)
- Facsimile
- Electronic phototypesetting
- Photo color separations
- Sonar recording
- High speed oscillography
- Large screen displays

Many of these applications can be done no other way than with the CRT, especially in cases where random scanning or nonlinear spot motion is required.

Of great interest right now is image processing for earth resources, computer on microfilm,



9", line scan fiber optic cathode ray tube for dry process film recording.

and electronic phototypesetting. Many other new applications have opened up with the emergence of more sensitive quick process films such as 3M brand dry silver which allows almost instant access to the image without chemicals. The availability of good quality fiber optic faceplates for cathode ray tubes has reduced recording system size while increasing the performance level in many applications.

As previously noted there have been some advances in CRT technology. New rare earth phosphors which are a fallout from research into improved materials for entertainment TV have made possible excellent color recording and high contrast cockpit displays. Brightnesses of over 15,000 foot-lamberts have been reported for tubes used in large screen projection displays.

The current practical state of the art in spot size is about 13 microns. The word practical is used advisedly here in that it is possible to order and receive a CRT from a tube manufacturer which will exhibit this spot size when measured in a scientific fashion. It is appropriate to note that although there are still some weak areas (particularly in brightness specifications), measuring and evaluating CRT's have also improved, again due in part to solid state technology.

Teamed with normal degradations encountered in electron beam control and lens losses, it is possible to order a CRT system which will record a 4000 x 4000 element picture where the picture element structure can still be seen. Photographic-like quality is achieved by the use of redundant element position digital-to-analog converters of 8000 positions or more. For a single line type display close to 8000 elements can be demonstrated where the element structure can still be seen. All of the above figures have the usual tradeoff of brightness or speed, versus resolution.

Electron gun design has not changed significantly over the years, although there have been many improvements in precision of assembly and cathode materials. The only new gun technology of note is the development of multibeam guns announced by Sylvania a few years ago. Although Sylvania chose to withdraw from the industrial and military CRT business (as did GE and Rauland), others have picked up the technology. Currently, the single gun multibeam CRT is being used for multielement infrared display with up to 20 beams of less than 25 microns each in size swept together, but individually modulated. There is, of course, further potential for this device in high speed alphanumeric character generation.

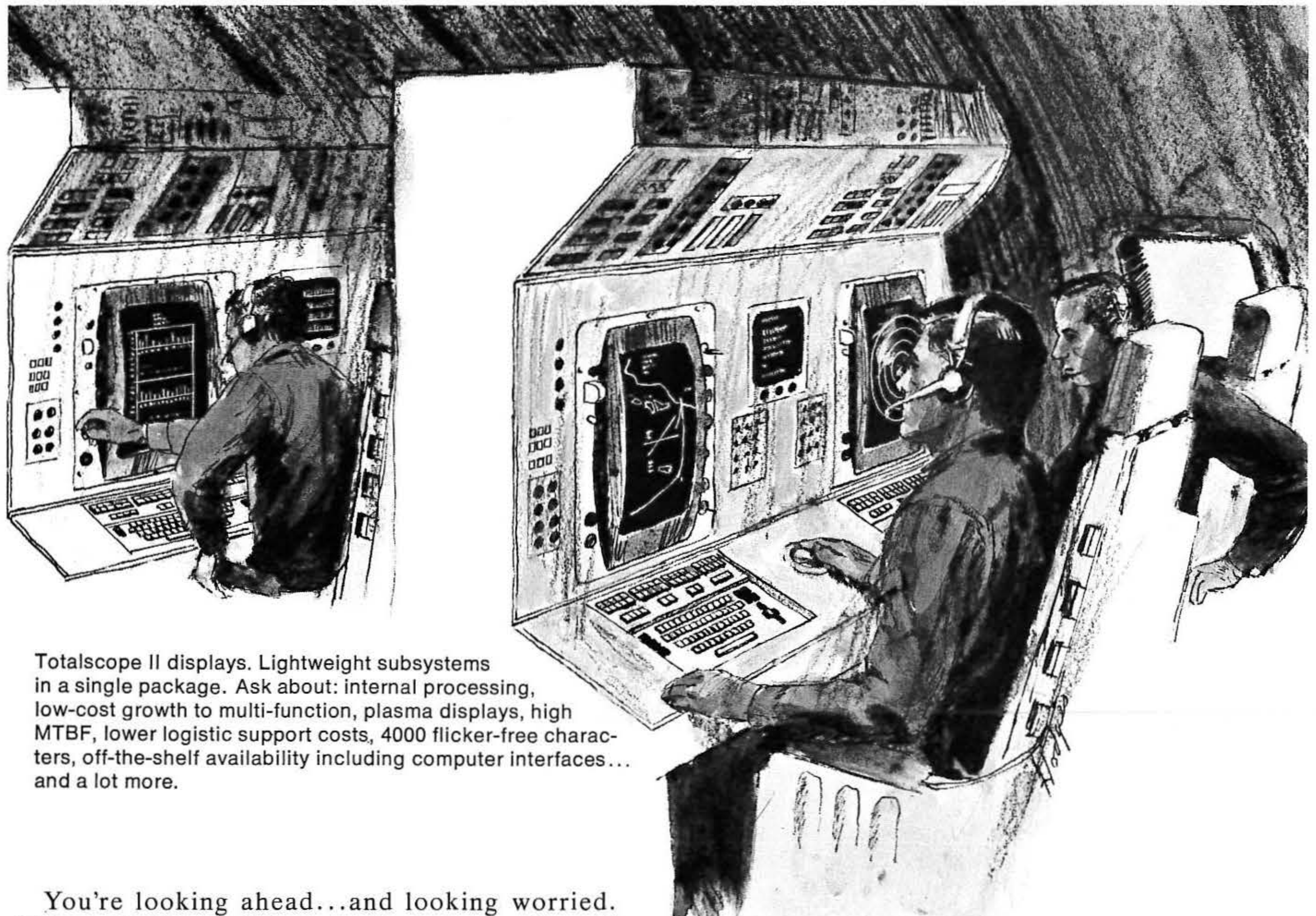
Perhaps some day it will be possible to electronically deflect the laser in a practical manner, or LED's can be packed closely enough and with enough brightness to be useful and practical. In the meantime, the ubiquitous CRT continues to achieve its true destiny with the help of the exploding field of solid state technology. ■

Coming in the May-June Issue, 1974 of SID Journal:

"DISPLAY SOFTWARE"

— An Entire Issue Devoted to Special Papers on this Timely Topic.

CHALLENGE: Select a display for today, tomorrow, and the 1980's.



Totalscope II displays. Lightweight subsystems in a single package. Ask about: internal processing, low-cost growth to multi-function, plasma displays, high MTBF, lower logistic support costs, 4000 flicker-free characters, off-the-shelf availability including computer interfaces... and a lot more.

You're looking ahead...and looking worried. Military display needs keep getting more complex and there's still more sophistication looming on the horizon like a fast moving thundercloud.

And your budget is tighter than ever.

It seems like a rotten choice; you can solve immediate problems within your budget by selecting a system that will be obsolete by the time it's uncrated or you can get one with psychedelic lights, guaranteed to glow in the dark. It'll look nice...as its inflexibility forces it to become obsolete.

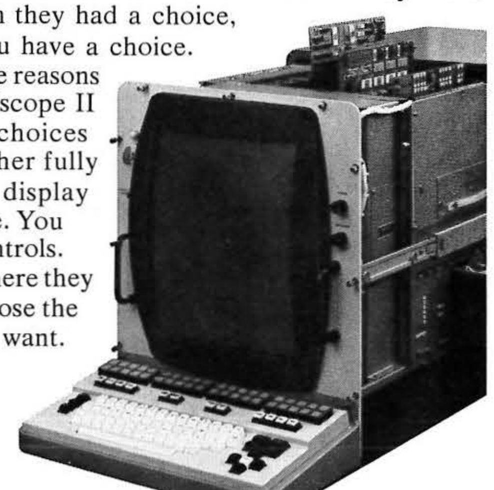
The Motorola solution to your dilemma:

Totalscope II, the off-the-shelf random position display that lets you pay for just what you need now. Without hurting your future because Totalscope's design utilizes time multiplexing and bus organization to allow additions whenever you wish.

So good our competitors recommend it to their customers.

Some of the biggest display manufacturers in the country—people we often bid against—have at one time or another recommended Totalscope II. You know what that's like for a salesman? But they did it even though they had a choice, just like you have a choice.

One of the reasons is that Totalscope II gives more choices than any other fully militarized display in existence. You pick the controls. You pick where they go. You choose the options you want.



Works-in-a-drawer Totalscope II is modular all the way through ...from plug-in functions, to CRT shape and size, to where you want the control knobs.

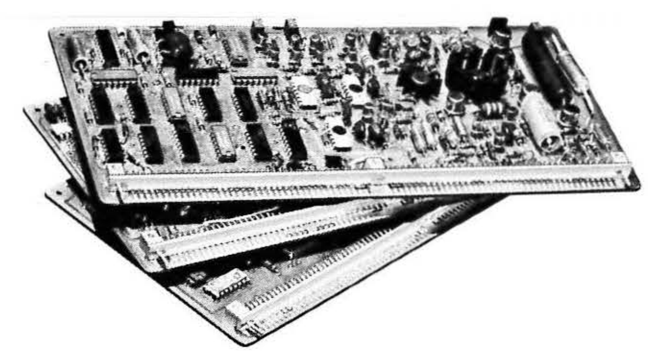
And even if you pick them all, you won't end up with a monster. Nor run up an outrageous price.

Reliability means 125 days and 125 nights.

The MTBF on Totalscope II, following MIL STD 756, is over 3,000 hours. That's 125 days of 24-hour operation. Self-test for hardware and software plus a BITE diagnostic module are immediately available. And since Totalscope II is far more than just a slave display, it can stay up when all else is going wrong. An optional keyboard lets you overlay real time sensor data with operator generated material. The light pen module lets you call out specific data on the spot. And all this won't get in the way of information flow because the unit's specific modules let you see hardware instead of wasting memory space and computer time with software.

Pick a card, any card.

Alphanumerics? We'll give you 4,000 flicker-free characters. Our engineers say it's the fastest response of any non-raster system. And since Totalscope isn't a raster system (unless you order a raster card) problems with the host computer compiler can't mess up every display in the house. Totalscope II can automatically refresh itself so one team can keep solving real time problems while another one tries to exterminate the bug.



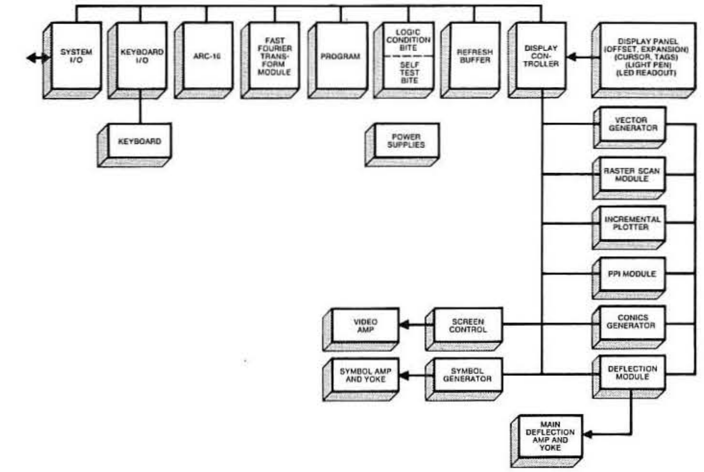
To add capability, change functions, or quickly troubleshoot your Totalscope II, just plug in a module.

Want to add graphics too? Just plug in a graphics module and appropriate memory.

You'll find similar simplicity with other cards that supply up to 127 radii offset in any direction, magnification of character/vector positions and vector length. Ditto for cursors and tags, an editor, a display buffer module, readout module, and even a module for drawing fine detail maps or geometrical patterns. Four color capability gets a bit more expensive.

How selecting options saves money.

If Totalscope II sounds expensive, remember that almost everything is an option, so you only have to get fancy when fancy is needed. And since you only buy what you need you save the weight of useless-to-you features. Weight is typically just 110 pounds. If you select a rack mount instead of a case, you can even save an extra 10 pounds.



Totalscope II's bus organization avoids problems by treating internal options as if they were peripherals.

People keep on selecting Totalscope. Because they face the problem you face; solving display problems for right now and the long run.

Enough. For a list of impressive statistics and programs for which the unit was purchased, drop a line to: Display Systems, Motorola Government Electronics Division, 8201 E. McDowell Rd., Scottsdale, Az. 85257. While you're at it, tell us your problem, or call William McCreary at (602) 949-3256. Outside the U.S.A. call any of our offices in Toronto, Paris, London, Bonn, Geneva, Amsterdam or Rome. Then you'll know all the reasons why our competitors recommend us. And exactly how little it costs to have Totalscope II help you meet the challenge of today, tomorrow, and the late 1980's.

MOTOROLA

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Social Implications

monkey around in display industry

Research in identifying a "natural" display language

■ Over the past quarter century or more, considerable emphasis and development effort have been expended to better define, and improve the so-called Man/Machine relationship, that unique interface through which man with his superior intellect has been able to communicate with, and to control his exanimate, but more versatile and powerful partner to successfully achieve functional cooperation. Now, a new dimension has been added to that complex equation—namely a highly successful and demonstrable, three-way Animal/Man/Machine interface.

In what must be considered an amazing breakthrough in both psycholinguistic and primate research, a team working at Emory University's Yerkes Primate Research Center in Atlanta, has combined a three year old female chimpanzee named Lana, a PDP-8E computer, IEE projection readout displays and a composite graphic language to conclusively demonstrate this simian's ability to effectively communicate via a new and unique visual technique. The team is headed by Dr. Duane M. Rumbaugh, Chairman of the Psychology Department at Georgia State University and is conducting its research under grants from both the National Institute of Child Health & Human Development; and The Animal Resources Branch of the National Institute of Health.

Lana at the keyboard.

During the past year of study, Lana has acquired a vocabulary of more than fifty nouns, verbs and articles which she retains and readily recognizes. Although sentence construction differs somewhat from English, she has learned to use these words properly to construct and punctuate syntactically-correct sentences and requests which she utilizes consistently throughout the day to communicate and to make her wants known, even when alone in the wee morning hours. In marked contrast with previous studies in animal response such as Pavlov's findings with dogs and their predictable and repeatable reactions, Lana is clearly able to discriminate among objects and actions, and to unilaterally express herself correctly and spontaneously, often without resort to rote or any programmed response, regardless of whether she is interrogated or simply wishes to express a desire of her own.

Symbols vs. Vocal Cords

Because of vocal chord limitations which make it impossible for primates to emulate the modulation and tonal variety necessary for human speech, the researchers decided to adopt a visual technique utilizing discrete graphic symbols for specific objects and actions. Known as "Yerkish" and developed by Professor Ernst von Glaserfeld, a psycholinguist from the University of Georgia, the language at the base level consists of nine symbols or single design elements (Figure 1). Through simultaneous projection which precisely superimposes two or more of these basic elements on the same screen, composite symbols called lexigrams are created. Unlike English or other human languages, each composite has only one specific meaning in order to avoid ambiquity, and to preclude confusing Lana. Three basic color backgrounds (yielding seven discrete, composite colors) are also used to assist in discrimination.

In developing Yerkish, Professor von Glaserfeld has utilized a conceptual and correlational approach to the relationship of word classes which differs from conventional "subject-verb" type of sentence construction. Instead, Yerkish relies more on an "actor-activity" method of expression with additional words serving as correlators, objects of an action, and as punctuators. Accordingly, Lana is able to construct meaningful sentences or expressions which, though they may sound somewhat grammatically stilted in English, are conceptually correct. On the other hand, the computer logic is so programmed that if she constructs an expression which, though syntactically correct in Yerkish, is functionally wrong, the computer rejects her input out of hand. Samples of Lana's Yerkish lexigrams are shown at Figure 2.

As mentioned above, the nucleus of the Emory University system is PDP-8E computer; and 14 each of Industrial Electronic Engineers' (IEE) Series 360 and Series 10 Rear Projection Displays. A modular, vertical keyboard panel of five banks of 25 keys each in a 5 x 5 matrix (until recently only three of the five were in use), and the associated interfact-logic, electronics and software were designed and developed at the Yerkes Center under the direction of Professor Harold Warner, a biomedical instrumentation systems specialist, and his associates.

Arrangement of Displays

The Series 360 displays with their 2" characters are arranged in two banks of 7 projectors each, one above the other directly over Lana's keyboard with the lower set directly connected to the output of her keyboard through the computer, and the upper set slaved to the output from an experimenter's console outside Lana's enclosure. The smaller Series 10 displays are located in similar but inverse fashion at the experimenter's station where they simultaneously display the messages which Lana composes, as well as information the researcher may wish to display on the upper bank of Lana's projectors. In this interrelated fashion, each input resulting from Lana's depression of a single lexigram key is fed into the computer and then simultaneously displayed on one of the feedback projectors inside the enclosure and at the researcher's station outside the chamber. Depression of any one of the keys at either keyboard activates the com-

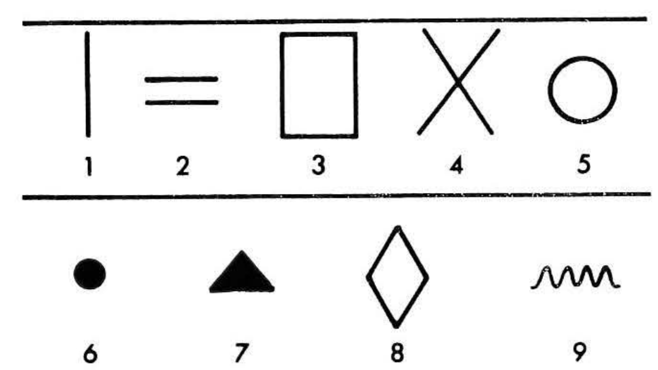


Figure 1. The great majority of the lexigrams which Lana uses are made up of the 9 single design elements shown here. (above)

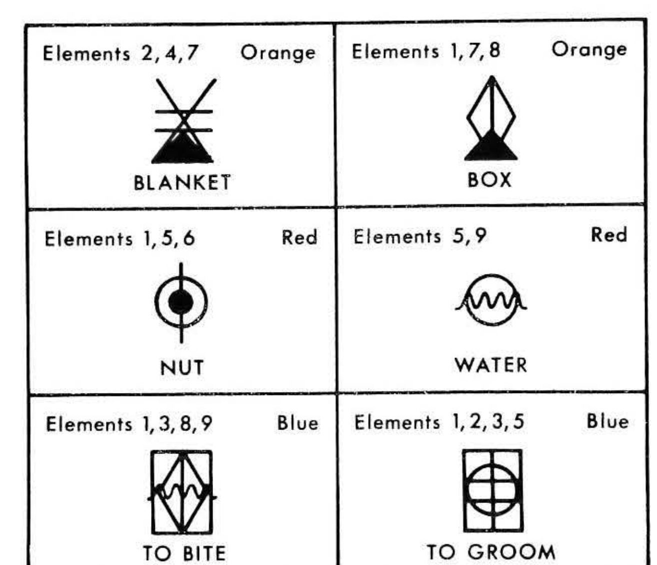


Figure 2. Samples of Lana's lexigrams. The numbers indicate the elements of the lexigram; the colour is indicated in the right-hand top corner, the "meaning" underneath. (at right)

puter memory which selects the correct elements of the corresponding lexigram in the computer's dictionary and transfers the composite representation to an internal parser, while at the same time transmitting the appropriately binary coded signal representing the basic elements of that particular word to an external decoder which drives the projection lamps of one of the 7 lower projectors, thus displaying the reconstructed lexigram on the face of its screen. The interface logic is such that the corresponding lexigram for the first key depressed is projected on the first display, and succeeding words are displayed on the other projectors from left to right in incremental step fashion.

In order to activate the system, Lana must first pull down or hang from an overhead bar above the keyboard. Having activated the system, she may then proceed to enter her request in proper sequential fashion and in a format that is conceptually correct. Finally she must terminate each sentence with the period symbol to signify completion. Should her message be a request and she fails to preface it with the "please" symbol, or should she insert a lexigram which is conceptually incorrect such as "PLEASE MACHINE *GIVE* WINDOW" (rather than with the symbol "OPEN WINDOW"), or should she fail to terminate with the period symbol, a buzzer sounds, the feedback projectors go blank, and she must start over. Conversely, if the sentence has been both procedurally and conceptually composed in correct fashion, a bell sounds to signal its correctness and the computer activates the appropriate action or reward such as opening the window or dispensing food. The computer is also programmed to maintain a continuous recorded printout of all events which transpire including the time and nature of all messages, incorrect sentences, nature of errors, restarts, and ultimate results. In this manner, experimenters have been able to monitor Lana's activities while she is alone during early morning hours, and have learned that she will frequently request music, activate the movie projector in order to entertain herself with the "late, late show", or open the window at daylight in order to watch early morning traffic outside the building. They have also been able to determine her distinct preferences for various types of music (jazz is her favorite) and foods such as M&M candies (for which she has developed a particular fondness).

The team of researchers has been delighted with Lana's rapid progress and her ability to readily learn and discriminate such a wide variety of objects and activities. To preclude any possibility of automatic reflex or positionally-related response, the physical positioning of the lexigram keys is frequently changed in random fashion, yet she invariably is able to locate and select the correct lexigram to express herself. Moreover she has shown additional aptitude to correctly complete partial sentences constructed by the researcher, and to detect conceptually incorrect sentences displayed to her. In the latter case, she has signaled her detection of the error by hitting the erasure button in over 90% of the time, and similarly when she errs in constructing her own sentences, she invariably catches her mistake and corrects it.

While overjoyed at Lana's progress, team members are reluctant to predict the ultimate results of such experimentation. Admittedly years ahead of schedule after only one year of work, delighted team members are theorizing that they may possibly progress to a point where direct interactive conversation between animal and researcher may be possible, or even in a more advanced concept, primate to primate conversation may ultimately be achieved.

The IEE's Series 10 and 360 Rear Projection Displays currently being used are both standard catalog items, each projector being capable of displaying one or more of 12 discrete messages stored on a film chip. The 360, which weighs less than 1½ pounds, is 7.8" x 2" x 4" overall and displays a 2" character, viewable at 40' through 160° with 40 F/L brightness at 6.3 VDC; the venerable Series 10, the first successful rear projection display ever demonstrated, weighs but 12 ounces, measures 1½" x 2¾" x 5½" and projects a .94" character, visible at 20' through 160° with 75 F/L brightness at 6.3 VDC. Both units utilize a 3 x 4 array of 12 lamps (6.3, 14 or 28 VDC) and a unique, patented light collecting lens and projection system with a radially curved, mylar film chip to project alphanumerics, whole messages, symbols, graphics, colors, or anything else photographically reproducible, essentially distortion-free on a non-glare, ground glass screen. While the many diverse applications for which these versatile units have been utilized are far too numerous to recount herein, their novel adaption to primate communication must rank as one of the most unique and unanticipated uses ever.

Aside from furthering man's knowledge and a better understanding of primates' linquistic potential and learning capacity, Dr. Rumbaugh and his team's investigative efforts may contain corollary, and perhaps more far-reaching implications, namely that the insight gained therein, into concept formulation and language acquisition may prove invaluable in the evolution of meaningful programs for the intellectual development of retarded children, and other handicapped individuals. The positive application of information display technology in ursuit of such a goal can only be most gratifying to all of us. ■

Optical Diodes' LED

Optical Diodes, LED maker set up recently with backing of Stanley Electric Co. of Japan, is moving into watch modules, opto isolators and 14-digit displays for scientific calculators at a plant in Palo Alto, California.

MULTICOLOR & MULTIPERSISTENCE PENETRATION CRTs

Color coding improves recognition and response time. However, most CRTs show only black-and-white pictures. Most color CRT development has been for color TV, rather than scientific or industrial applications. The penetration color tube is designed to rectify this.

By ANDRE MARTIN
Thomson-CSF
Grenoble, France

■ *Why Multicolor or Multipersistence Displays?*

The use of color for visual information is an unquestionable improvement since it enables one to display more and more complex information while maintaining an excellent discrimination of its contents. Studies about human factors have shown that color coding improves the accuracy of recognition and reduces the response time.

Thus it is surprising to consider that most cathode ray tubes designed for scientific or industrial applications show only black-and-white pictures. If we consider that a professional display must be looked at with close attention in order to recognize without hesitation the different parameters of the display and if we think that the retinal zone where the eye automatically focuses images when it peers at something is composed only of color sensitive cells, it seems absolutely abnormal to misuse the eye to such a point with monochrome displays.

The reason for the lag is that most color CRT development work to date has been for color television and the characteristics of a good color T.V. CRT such as a shadow-mask tube or Trinitron do not fit the requirements for a good information display tube.

A relatively new class of device, the penetration color tube, has now been developed to the point where it fulfills those requirements (high resolution, color uniformity and picture brightness).

Penetration C.R.T.

Operating principle: how does penetration CRT work?

The CRT has a multilayer screen consisting of two phosphors of different colors separated by a layer of transparent dielectric material (fig. 1). The two phosphors produce different colors when excited by an electron beam. A beam of too low a voltage to penetrate the dielectric barrier layer will excite only one phosphor. Higher voltage will excite both phosphors with predominance of the second phosphor color. Intermediate colors will be obtained from intermediate voltages. Several colors can then be produced by a single electron gun by simply switching the acceleration voltage.

For example, if the phosphor layers produce red and green light when excited individually, the tube can be made to produce four distinct colors: red, orange, yellow and green.

As the acceleration voltage is switched from one value to another to produce the different colors, the current through the magnetic deflection yoke must be adjusted to keep the magnetic deflection amplitude constant and the beam current must be modulated to keep the picture brightness constant.

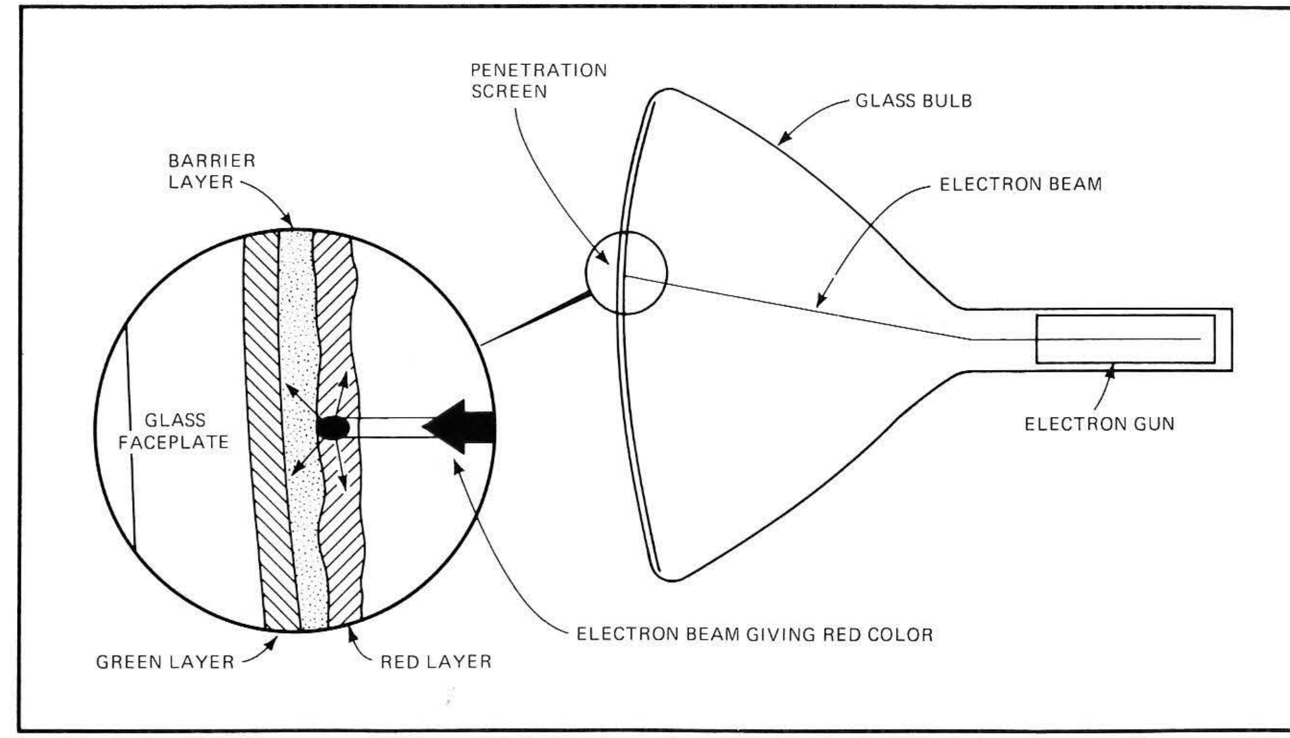


Figure 1. Color penetration tube principle.

For color, displays choice of basic colors

Besides the ability to display large amounts of meaningful information, the color characteristics of the penetration tube enable an operator to use it for long periods of time with minimum eye fatigue. Some of the reasons for this adaptability are related directly to the physiology of the human eye. When an observer wants to watch closely a display, without being rapidly tired, this display must contain only small amounts of the blue colors. Clearly, the best basic colors to use for accurate observation are green and red with their hues chosen to correspond exactly with the peaks of the spectral absorption curves of the cone pigments. By mixing red and green colors in the proper amounts, orange and yellow can be produced. These colors are not sufficient to reproduce all of the colors encountered in nature and therefore required for a home color T.V., but they are adequate for information displays where colors are used to code a great number of symbols, sketches, figures and so on and to give better recognition accuracy.

For multipurpose displays, choice of color and persistence

Many other types of phosphors may be used to make other penetration CRT's for a wide variety of applications. For example: red-to-white screen, monocolor or multicolor displays with variable persistence screen, adjustable anti-flicker screen. These are described following.

Main characteristics of penetration CRT

The penetration CRT is characterized by the absence of any internal mechanical device for the separation of colors and by its need for only one electron gun. Despite its simple construction the penetration CRT is the only one which allows the manufacture of bright, high resolution displays required for scientific or industrial graphics applications. Its main characteristics, therefore, are:

—good resolution, over 1500 T.V. lines,

By ANDRE MARTIN

—high brightness in the high voltage mode, good brightness in the low voltage mode,
—no convergence circuitry need to superimpose the elements of a picture (uses only one electron gun),
—deflection angle not limited by the color separation device since it is built into the screen.

In addition to the four preceding characteristics, the penetration tube has a quality that sometimes is an advantage and at other times is a disadvantage. This is the impossibility of producing more than one color at one time. Because it is a single-gun device, the penetration tube can only select colors in a sequential mode; the appearance of a simultaneous selection is accomplished by the persistence of the eye. The consoles must be constructed in order to take advantage of this property.

Different Types of Penetration Screens

Red-to-green screen

The console manufacturers need tubes having the following characteristics:

—the smallest voltage swing,
—very good color uniformity in intermediate colors, for instance orange and yellow, on the whole screen area,
—maximum color separation and brightness.

For instance, line brightness of 2500 cd/m² in the red color at 610 nm can now be achieved. Two years ago, such a level was unthinkable. Corresponding line brightness of 7500 cd/m² in green color (550 nm) makes possible THOMSON-CSF special penetration CRT to be used in airborne equipment, in fast writing speed display consoles, and so on.

To achieve these requirements, R & D has developed two new types of screens:

Screen E 20 (fig. 2) works at low voltages, from 7,5 kV for deep red (at 610 nm) to 12,5 kV for pure green (at 550 nm). Great care has been taken to obtain the best scale of colors, with the lowest voltage steps. As an example, four distinct

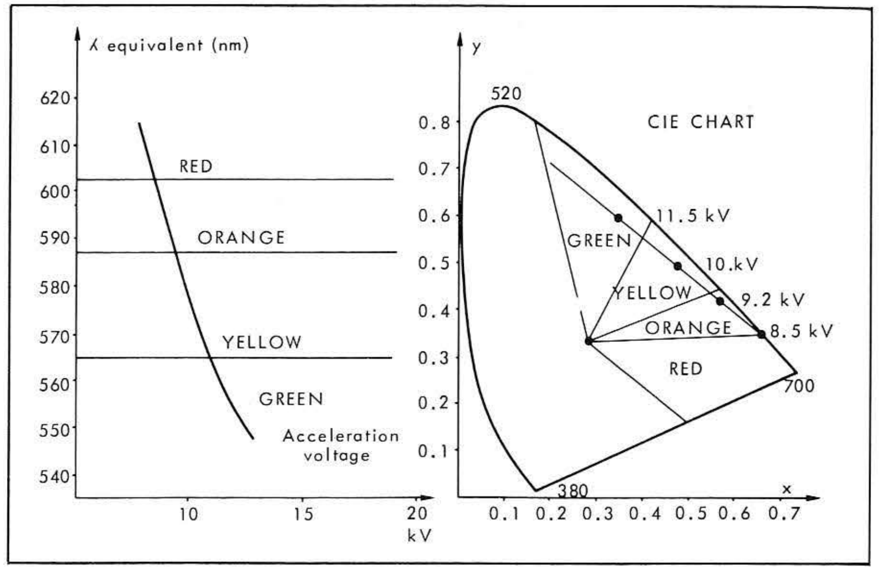


Figure 2. Characteristics of screen E20.

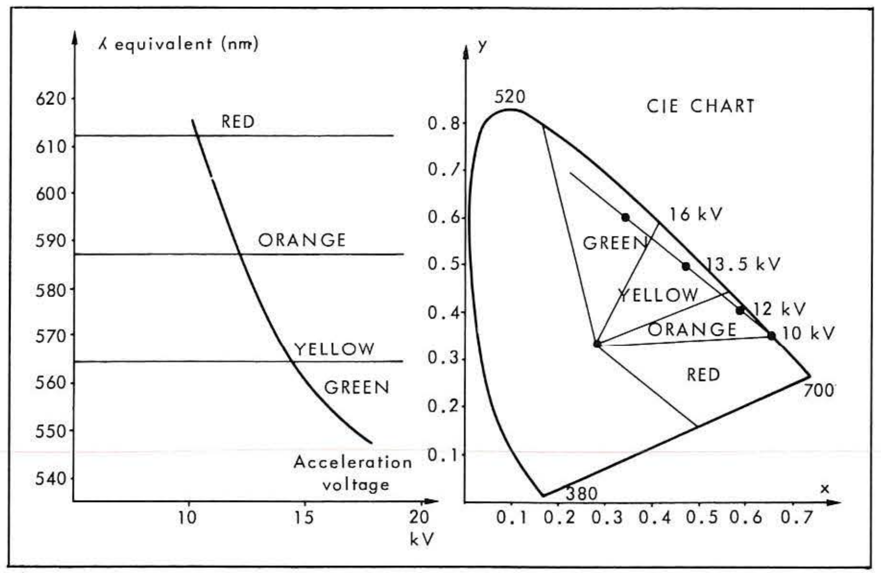


Figure 3. Characteristics of screen E21.

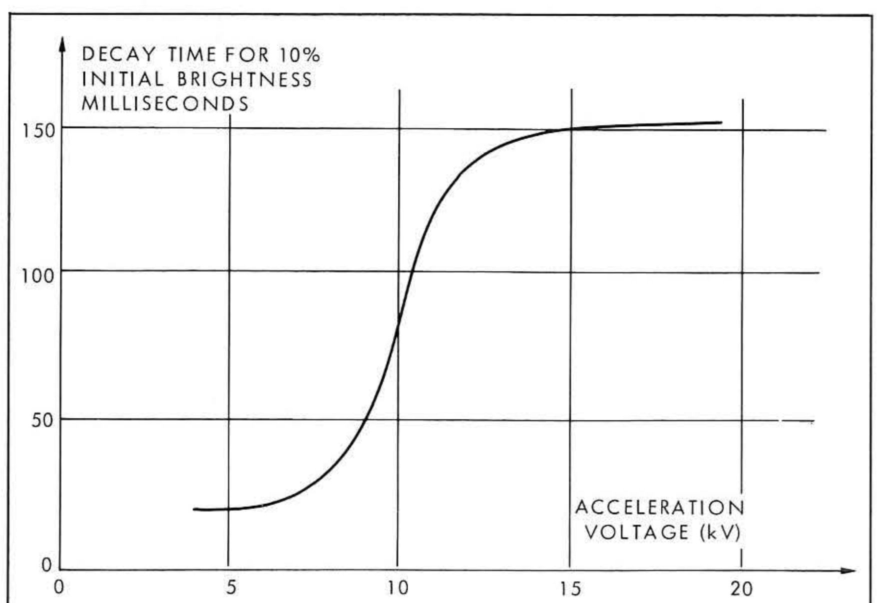


Figure 4. Variable persistence screen characteristics.

By ANDRE MARTIN

colors, red, orange, yellow and green can be obtained from 8,5 kV —red, 9,2 kV—orange, 10 kV—yellow, 11,5 kV—green, the total voltage swing being 3 kV. This screen, E 20, is recommended for tube sizes up to 9 inches screen diameter when used under heavy ambient illumination and up to 16 inches screen diameter when used in normal ambient illumination conditions.

When display consoles must be used under very high ambient illumination, or when the screen area is exceptionally large, for instance 22" radar CRT, with limited screen current density, screen E 21 can work from 10 kV for deep red to 16–17 kV in green (fig. 3). More screens are under development and intended for airborne displays, where ambient illumination up to 70,000 lux (*) can be experienced. Measurements with photometers have corroborated visual observations, and screen brightness has reached such levels which could not have been previously foreseen.

Red-to-white screen

This type of tube can produce ordinary monochrome T.V. pictures and the red color is used to underline or encircle areas of particular interest. Brightness and resolution are equivalent to a conventional black-and-white tube with in addition the red color ability.

Variable persistence and antiflicker screens

The dream of every radar manufacturer and user has always been a variable persistence tube that would allow the display of low-repetition rate information such as radar video on a long persistence screen, and, at the same time, allow the display of such rapidly moving information as labels and position symbols on a short-persistence screen.

For small size cockpit radar displays, the direct view storage tube has provided a realization of that aim. But until now, no solution has been available for larger displays of more than 10" diameter. Variable persistence screens can provide a solution for such displays.

In such applications as LLLTV or Radiological TV, signal fluctuation can severely limit the amount of information that the operator can glean from the display. A long-persistence phosphor can effectively integrate the signal, thus reducing the noise, but it can also cause smearing of the picture. A penetration CRT combining a medium-persistence phosphor with an anti-flicker phosphor of the same color provides a partial solution to this dilemma. Manual selection of the CRT's screen operating voltage allows the operator to make the optimum trade off between noise reduction and smearing for each individual situation.

Fig. 4 shows the decay variation to 10% of initial brightness for different high voltages of a variable persistence screen. ■

*(±) 1 lux=1 lumen m^{-2}=0,1 fc

Display Complex For Dutch Airport

N. V. Luchthaven Schiphol has awarded a $1.2 million contract to Conrac Corporation for installation of a comprehensive Flight Information Display System during Phase I of the airport's seven-year, three-phase expansion program.

The contract includes design and installation of a complete control system for presently existing flight information boards and extensive new equipment. Four new video controllers will provide 72 channels of video to more than 170 Conrac CRT monitors. In addition 59 split-flap display boards will be installed, ranging from four large arrival and departure hall boards through smaller single line, three line and eight line boards at pier entrances, exit gates, custom halls and baggage areas.

An interesting feature of the Schiphol design is the "gate-dedicated" video provision. In addition to the information on imminent departures displayed to the public on split-flap boards, each gate will have its own video channel that will show operations personnel future departures and gate change information.

Schiphol Airport presently handles over 7 million passengers.

4 TEST PATTERNS for VECTOR (line drawing) COMPUTER DISPLAYS

By ROBERT M. LEE
Lawrence Laboratory
Livermore, California

The author suggests users of computer graphics displays not rely entirely upon tests provided by the manufacturer; and provides test patterns designed to evaluate specific characteristics.

■ In evaluating computer graphic displays don't rely entirely upon demonstrations and tests provided by the manufacturer. Be prepared with two kinds of tests of your own: test patterns designed to test specific characteristics of the display and pictures representative of the work you intend to do on the display.

The four test patterns to be described here were written to test specific characteristics of a vector display, a Control Data Corporation DD80C, which is used in conjunction with a 35mm motion picture camera to produce pictures ranging from simple graphs to animated movies. These test patterns have also proved useful in testing storage tube displays and raster displays.

Hum Test

The test pattern shown in Figure 1, Hum Test, detects the effect of stray magnetic fields on the positioning accuracy of the display. A cathode ray tube is very sensitive to such fields that are provided in abundance by transformers and chokes.

The principle used in this test pattern is to write a cross on the screen and then, some time later,

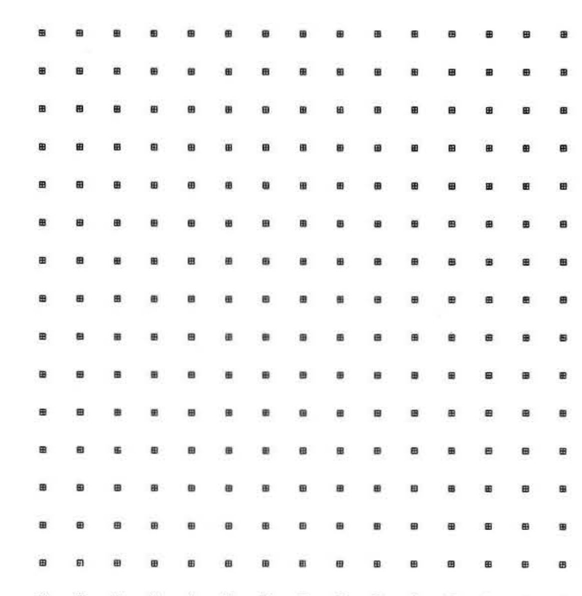


Figure 1. Hum Test.

By ROBERT M. LEE

attempt to write a square surrounding the cross. If they fit exactly, all is well and good; if not, you have detected a positioning error.

The complete test pattern is written by first drawing crosses (like plus signs) starting at the lower left corner of the display and going across. When the first line of crosses has been drawn, the beam is returned to the left edge of the display and raised to the next line. When the last cross has been drawn, the beam will be in the upper left corner of the display. Immediately start to backtrack, drawing squares around the crosses. The time delay between writing the cross and the square in the upper right hand corner will be a few microseconds on a typical display. The time between writing the cross and the square in the lower left hand corner can be as long as desired, depending upon the number of squares and crosses and the speed of the display. In some cases it may be desirable to artificially lengthen the total time by programming delays between the symbols.

Any change in the beam positioning during the writing of the test pattern will show up as a misalignment of one or more cross-square pairs. Furthermore the direction and magnitude will be shown. In our application we used squares, ten display divisions on a side, and crosses, with arms ten display divisions long. This makes it easy to estimate numerical values for the magnitudes of positioning errors. In a high resolution display, with high positioning accuracy, it might be desirable to use smaller symbols.

If you are looking for the effect of a.c. fields on the display, a time of 17 milliseconds (one cycle at 60 Hertz) is appropriate for writing the entire test pattern. As might be expected, positioning error will gradually change from maximum to minimum values as the test pattern is scanned. We have also seen random positioning errors using this program (only one cross pattern in the field misaligned with its enclosing square) and, to our surprise, we discovered that the camera was sometimes starting to advance the film before the picture had been completed. The time at which the motion of the film started was clearly visible and we could easily have calculated its rate of acceleration had we wished.

This test pattern is also useful as a test of focus over the entire face of the tube because of its small, evenly distributed, symbols.

Resolution Test

As contrasted to the simplicity of the Hum Test, the Resolution Test, shown in Figure 2, is very complex. It provides a quantitative measure of resolution for use in comparing displays with each other. In the course of time other useful features have been added.

The resolution patterns in each of the four corners of the Resolution Test are identical. They are not only useful for comparing one vector display with another, they can also be used to compare the resolution of a vector display with the resolution of a raster display.

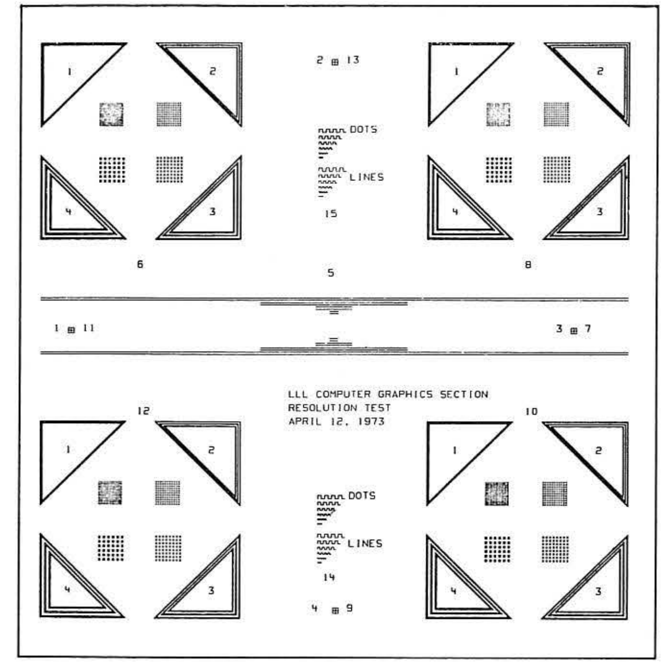


Figure 2. Resolution Test.

By ROBERT M. LEE

The triangles are drawn using lines, the squares are drawn using points (dots). The triangles with a "1" are drawn with one line, one space, one line, one space, one line. The adjacent squares are drawn with one point, one space, one point, one space, etc. The triangles with a "2" are drawn with two lines, two spaces, two lines, two spaces, and two lines. The adjacent squares are composed of clumps of four points (two x two), the clumps being separated by two spaces from the next clump in any direction. The triangles with a "3" are drawn with three lines, three spaces, and so on.

Another resolution test is provided by square waves that are composed, as labeled, of dots and lines. The largest square waves are six picture lines high, the next are five picture lines high, and so on.

In high speed displays, the power required by the deflection circuits can become a problem. We have included in the Resolution Test, a test to see whether the positioning accuracy of the display is affected when the beam is held in one part of the display for a while, and then quickly moved to another part of the display. We have already discussed the 1, 2, 3, and 4 within the triangles. The other numbers in the test show the order in which the parts of the test were written. The small squares at the edges of the test were written first, second, third, and fourth respectively. The horizontal lines were written fifth, and the resolution pattern in the upper left corner was written sixth. This complex pattern requires that the beam be deflected in the upper left quadrant for a long time.

By ROBERT M. LEE

immediately after that resolution pattern is completed, the cross is written at the extreme right edge of the test as the seventh symbol to be written. If the deflection circuits have been overheated in drawing the preceding pattern, they are likely to not properly center the cross in the square. If you follow through the rest of the numbers you can see that after each resolution pattern is drawn, a cross is drawn in a reference square. We have tested one display in which this proved to be a serious problem.

The sets of horizontal lines in the center of the screen are used to compare the relative brightness of lines of different lengths. In the DD80C long lines are drawn at higher writing speeds than short lines. This means that if short and long lines are to appear of the same intensity, some compensation must be provided. The horizontal lines show whether the intensity compensation has been adjusted correctly.

A last point. We have labeled this test pattern with its source, name, and the date of its last revision. This is most useful for people in an organization who may may find themselves using a test pattern about which they have questions. The label is included in three of the test patterns described here. It is not included in the first because it might interfere with the interpretation of the results obtained in using the test pattern.

Vector Joining Test

The test pattern shown in Figure 3 was written to test the accuracy with which the display joins lines together. It tests the joining of lines of differing lengths and the joining of lines at various angles.

The central pattern is drawn in one continuous line, starting at the right center. If you trace it, you will see that it starts with a very long line joined, at right angles, to a very short line. The short line in turn joins to a line not quite as long as the first line, and so on. The joints in this pattern are all at the outside edges so that they can be scanned readily. The three herringbone patterns, formed from "v"s whose sides are joined at varying angles, should appear identical, but they are drawn each differently from the other two. In the set at the left of the test pattern, each "v" is drawn in two sequential strokes.

The end of the first stroke is the beginning of the second. In the set at the top of the test pattern each "v" is drawn by a pair of lines, starting from the ends of the "v" and ending at the joint. In the set at the right of the test pattern, each "v" is drawn with the end of the first stroke joining the beginning of the second stroke, as was done in the set at the left of the test pattern. But, after the first stroke is drawn, the beam is turned off and positioned to the center of the screen and then returned to draw the second stroke.

Straight Test

The test pattern shown in Figure 4 was written to test the accuracy of the circuits used to calculate and draw straight lines between addressable points on the display screen. It also provides a test of the accuracy of the positioning circuits, and will show if there is a difference in line width or brightness as a function of the direction in which the line is drawn.

There are sixteen groups of four lines each. The order and relative direction of drawing the four lines within each group is important and is shown in the inset in Figure 4. The numbers, 1-4, show the starting point of each line and indicate the order in which they are drawn: Start at 1, draw the line, go to 2, draw the line, go to 3, draw the line, and go to 4, draw the line.

If the lines are not straight, this manner of drawing them will cause the curvature to show. If the lines are not parallel, that also will show. The criss-cross pattern at the center of the test pattern is another good test for resolution. ▪

Work performed under the auspices of the U.S. Atomic Energy Commission.

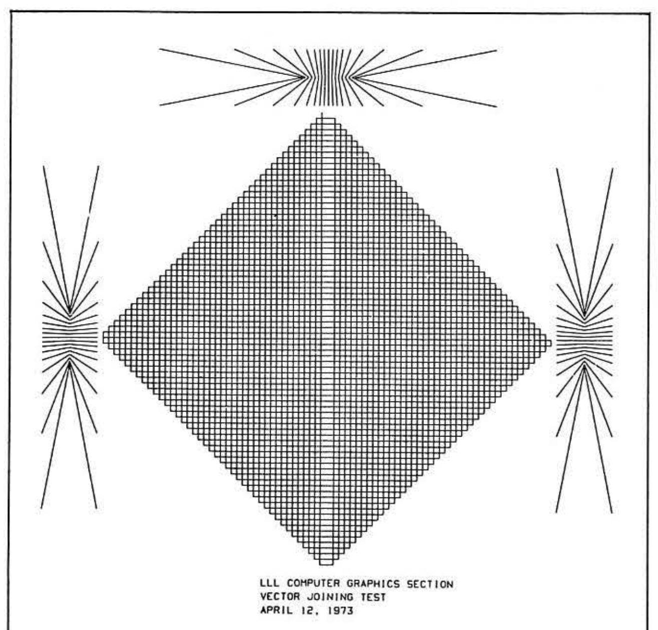


Figure 3. Vector Joining Test.

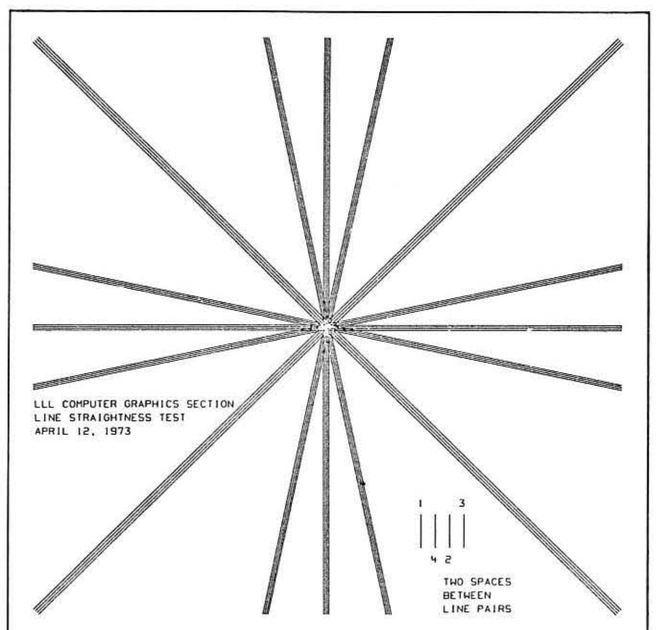


Figure 4. Line Straightness Test.

NEW PRODUCTS

SID SID SID SID

New Comtal Display

New COMTAL 8000 Series Digital Image Display System is second generation system, will be demonstrated for first time at National Computer Conference, May 6-10, Chicago. It will also be demonstrated at the SID Symposium, May 21-23, San Diego.

Versatile 8000 series will retain all the operating features of the earlier 5000 series (see attached descriptive literature sheet) but will incorporate many new user advantages: (1) Approximately 50% greater real-time processing capability; (2) Greatly increased image display facility; (3) Improved operator interaction, graphic overlay options and target/trackball options; (4) Field expandable—permits user to start with black and white digital image display and to easily convert system to full color as his applications may dictate. New features expected to substantially expand the applications potential of "true" image processing.

Circle #101 on Readers Service Card

Tiny Counter

World's "smallest digital panel meter," by Non-Linear Systems, Inc., now available in an Event Counter version, the PM-4 (C). An external 3-pole, double-throw switch allows the instrument to function as a computer of up to 9999 pulses from either a DTL or a TTL source, at a maximum rate of 200,000 pulses per second, or as a single range four-digit voltmeter

with full-scale values of ±1, ±10, ±100 or ±1000 VDC. The compact counter/voltmeter is less than one inch high, has "all of the characteristics of the PM-4": high reliability, low power drain (less than 0.5 watts at the standard supply voltage of 5 VDC) and an accuracy of ±0.02% when used as a voltmeter.

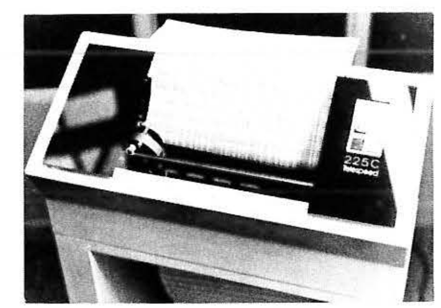
Circle #102 on Readers Service Card

35-mm Liquid Gate

A 35-mm liquid gate is offered by Space Optics Research Labs in its line of precision liquid gate holders. New model consists of 35-mm film holder designed for practical insertion into an X-Y micrometer stage which, in turn, provides two degrees of precision, calibrated motion through 1 in. of travel without obscuration to the 2.25 in. clear aperture. The assembly is mounted to an upright for direct application on an optical table or any standard carrier for optical bench use.

Circle #103 on Readers Service Card

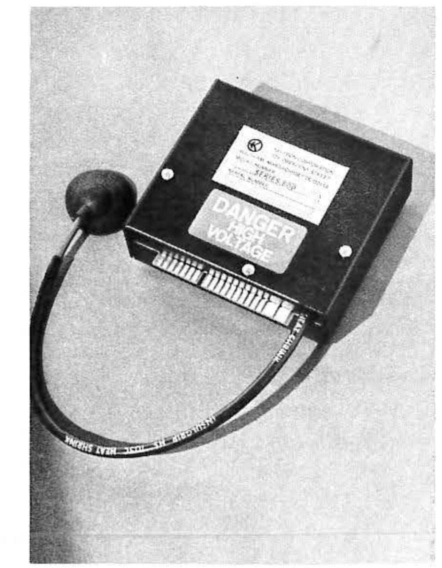
Fast Printer



The "World's fastest computer peripheral serial printer" is operating in a laboratory in Long Island City, New York. The inventor, Arthur Matschke, co-founder of Tele Speed Communications, has developed an impact printer capable of printing five carbon copies at over 225 characters per second. This dot matrix printer, using a new type of magnetic cell of extremely light weight, has increased the life expectancy of the printing mechanism beyond the known technology. Matschke, who holds patents in electronics, fiber optics and automation has been working on the invention for the last two years.

Circle #104 on Readers Service Card

Power Supply For CRT Display



Keltron's new Series 800 is a high voltage power supply specifically designed for use in CRT display systems. Up to 4 optional additional plus or minus output voltages can be added with the same line regulation as the high voltage output. Specifications:

Standard Output Voltages (KV): 10 to 20 at 10 watts maximum. *Line Plus Load Regulation:* 0.1%. *Input Power:* 115 VAC. *Ripple:* 0.05% peak to peak. *Full Load Transient Response:* 0.03% peak recovering in less than 2 milliseconds. *Size:* 6⅝" x 4⅜" x 15/16".

Series 800 features silent operation and the unit is fully protected from damage caused by arcing, overload, a short circuit. With automatic recovery upon removal of the fault. Completely enclosed in an aluminum case. This unit has all silicon semiconductors and is factory repairable.

Circle #105 on Readers Service Card

new products

Solid State Fetron

Teledyne Semiconductor now has FETRON kits available for solid state conversion of both the HP400 voltmeter and the Tektronix CA oscilloscope plug-in module. These are first of a series of kits designed for replacing vacuum tubes in electronic instruments with solid state FETRONs. The FETRON duplicates vacuum tube performance with a hybrid JFET circuit that plugs directly into the socket. Unlike vacuum tubes, however, the FETRON doesn't drift and doesn't require filament, screen grid or support power, company says.

Circle #106 on Readers Service Card

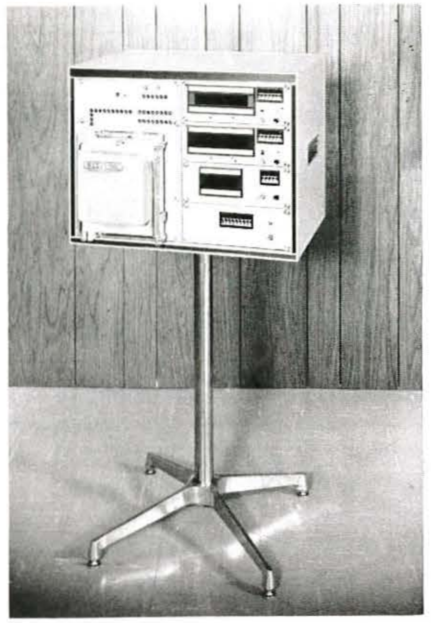
LED Mount Hardware

Industrial Electronics Engineers introduce unique universal LED mounting hardware package. Universal panel mount accepts any Dual-Inline LED display packaged with .3″ row spacing. Mounting hardware package consists of a one-piece nylon bezel, a circular polarizing window and a one piece behind-the-panel socket assembly *which eliminates all individual DIP sockets.* Dual-in-line displays with 14 or 16 pins can be accommodated in presentations from 2 to 8 units.

The one piece socket assembly has wire wrap-terminations that permit economical wiring of any display arrangements.

Circle #107 on Readers Service Card

Digit System



A new, low-cost digitizing system, Model D100, designed for high-speed data reduction applications, has been developed by Broomall Industries, Inc., for accurate digitizing of engineering drawings, circuit layouts, contouring, architectural drawings, and numerical control tape preparation.

These and other applications are performed by the D100 Digitizing System, which measures and automatically records sequentially-numbered points of X-Y coordinate data on card punch, tele-typewriter, paper tape punch, or on magnetic tape.

"The System has complete formatting flexibility, provided through a unique patchboard system that complements individual computer requirements and allows a variation in word length.

A standard 40 x 60 in. digitizing table is provided with each system. The precision table is adjustable from full horizontal to vertical positions and features power lift for height adjustments.

Circle #108 on Readers Service Card

James Transformers

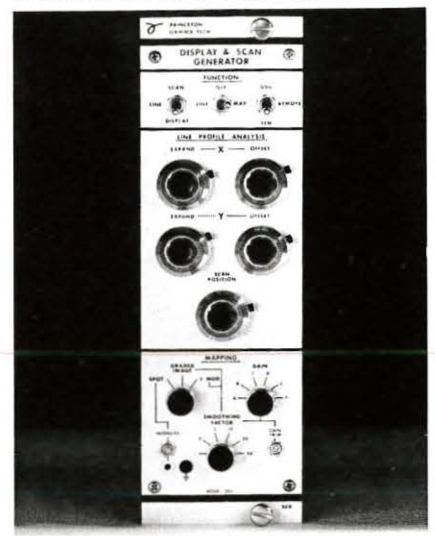
James Electronics introduces new line of communications and data transformers, featuring high performance cores, providing optimum performance for a wide variety of telephone, communications and data circuits.

Circle #109 on Readers Service Card

Scanner Can Map

For the first time a scanning electron microscope or microprobe can be used in elemental mapping for simultaneous visualization of element distribution and intensify information in a three-dimensional (isometric) presentation, using new Model 303 Display and Scan Generator, says Princeton Gamma-Tech. It is used in conjunction with a PGT X-Ray Analyzer System and an SEM or microprobe.

Model 303 also provides line analysis and display transfer. In line analysis, the SEM scans a single line while the counts of a selected single element are stored in the multichannel analyzer. Stored data may then be transferred to the CRT display of the SEM to produce a micrograph with the overlaid single line element distribution data and count.



In the display transfer mode an X-ray spectrum in the multichannel analyzer is transferred to the SEM display. This results in the combination of X-ray spectral data and a micrograph of the sample on a single photograph.

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New Disk Storage

Itel Corporation's Data Products Group announces new disk storage product, the 7330 Model II disk file, which is capable of storing 200 million bytes of information, or twice the capacity of their present 7330. The new file is said to be a direct, lower-cost replacement for the IBM 3330 Model II file.

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Display Readout

A 3½-digit data display readout, the AD2015, which can be used as a remote DPM slave display or as a visual readout for a counter, A/D converter, or any other source of BCD data, has been introduced by the Modular Instrumentation Division of Analog Devices, Inc. The AD2015 displays the data on 0.4-inch, bright RCA Numitron™ readouts, and accepts three digits of standard parallel, positive true BCD data inputs at DTL/TTL logic levels. The digital display module has other inputs to indicate a 1 for 100% overrange, all dashes for overload conditions, and the polarity sign.

The 5V DC power commonly used for logic circuits is all that is required to operate the AD2015. For the logic circuitry in the display, 200mA with ±5% regulation is required.

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Xebec Formatter

Disk-drive formatter that interfaces with all commercially available cartridge disk drives has been announced by Xebec Systems. Designated the XDF-20, the new formatter can be supplied with couplers to match the selected disk drive to most popular minicomputers. Says company: "The XDF-20 offers the OEM or end user a lower cost alternative to the disk systems provided by the mainframe manufacturers. In addition, it offers several important benefits.

Reliability said to be assured through use of a single board which minimizes connector problems and eliminates the need for a fan.

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Debugging Method

Binary Systems announces availability of a new program, BREAKPOINT, which allows online interactive symbolic debugging of FORTRAN programs at the source code level. BREAKPOINT is an easy to use program that allows interactive debugging of FORTRAN programs. On most small computers, programming in FORTRAN is simple, but the mechanics of compiling, assembling, and creating a load module are complex. Depending upon the computer configuration, it may take anywhere from 5 minutes with a disc system to 8 hours or longer on a paper tape system to create a FORTRAN load module. This load module must be recreated each time a correction is made to the program. BREAKPOINT allows the programmer to debug a FORTRAN program in an online interactive mode eliminating many of the time consuming recompiling and reloading operations.

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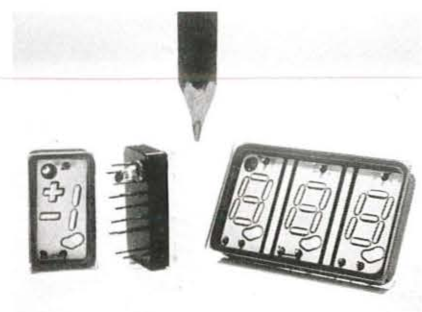
Flat Pack Readout



A new "flat pack" vacuum fluorescent readout—the Digivac 2000—has been developed by the Tung-Sol Division of Wagner Electric Corporation. Available in rectangular, low profile package, the Digivac 2000 incorporates the advantages of the Tung-Sol-developed cathodoluminescent readout (Digivac 1000) in a smaller package. The Digivac 2000 has a broad color spectrum which, with filters, can offer virtually any visible hue. Its low voltage, low current requirements make it directly compatible with all MOS IC logic packages.

Flexible language (alpha/numerical/symbolic) is a feature of this new product.

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Activities SID SID SID SID SID SID

If You Heard 'Em Lucky, If You Didn't, Too Bad

These notices summarize recent SID chapter meetings, and are representative of the types of programs offered to members of SID chapters throughout the U.S.

SAN DIEGO

January 8, 1974

Speaker: John Silva, Ph.D., Naval Electronics Laboratory Center, San Diego.

Topic: "Viewing Cardiac Performance Ultrasonically." A chemical equipment research effort to develop a non-invasive technique for diagnosing heart disease. Ultrasonic echocardiograms are recorded simultaneously with other types of cardiograms and pulse tracings, from patients. A computer program developed by NELC automatically derives key cardiac performance parameters from the recorded information. Parameters are a significant diagnostic aid and eliminate traumatic cardiac catharization.

February 12, 1974

Speaker: Keith Bromley, Naval Electronics Laboratory Center.

Topic: Mr. Bromley, a research physicist, discussed and analyzed real time, programmable optical signal processors: in particular, a portable unit designed at NELC utilizing light-emitting diodes and charge coupled devices. A demonstration was performed.

NEW YORK CITY

February 20, 1974

Speaker: Burt Masnick, Industrial Products Div., Hazeltine Corp.

Topic: "Microprocessors and CRT Displays." The logic design of an alphanumeric or mixed alphanumeric/graphics CRT display has traditionally been segmented along set lines. Various sections, such as keyboard control, memory, I/O handler, beam control and peripherals handler have been joined to form the total logic package. The availability of low cost large capacity Read-Only Memories has enabled the design to utilize microprocessors as CRT display system controllers.

The various aspects of microprocessor design and the practical effects of the design choices available on the performance and capabilities of the display are the focus of considerable current interest.

MINNEAPOLIS-ST. PAUL

January 11, 1974

Topic: Visit to Dynamic Information Systems, Inc., Lakeville, Minn. Description and demonstration of a mass memory bank involving microfilm vs. disc file equipment. The system also has editing-composing capabilities; copies; and serves as a computer terminal.

LOS ANGELES

January, 1974

Topic: Tour of Public Broadcasting Corp. TV Station KCET, Los Angeles.

How Computers Can Help Society

How computers can help solve the problems that plague society is the topic of a new 575-page hardcover book, Computers and the Problems of Society, published by the American Federation of Information Processing Societies, (AFIPS), with which Society for Information Display is affiliated. Copies of the $15.00 book can be ordered from AFIPS Press, 210 Summit Ave., Montvale, N.J. 07645.

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Calendar of Events

1974

April 1-6
17th International Electronic Components Exhibition. Exhibition Park, Paris, France

April 9-11
1974 International Optical Computing Conference (CompSoc). Zurich, Switzerland (Digests due February 1, 1974)

April 23-24
Workshop on Machine-Independent Graphics (ACM, NBS). NBS Headquarters, Gaithersburg, Md.

April 24-26
Fifth Annual Pittsburgh Conference on Modeling and Simulation (ISA, Univ. Pittsburgh, Pittsburgh Sect.) Pittsburgh, Pa. (Abstracts due February 4, 1974)

May 6-10
National Computer Conference and Exposition. McCormack Place, Chicago, Illinois

May 21-23
15th International SID Symposium. Town & Country Hotel, San Diego, California

June 10-11
Chicago Spring Conference on Broadcast and Television Receivers (G-BTR, Chicago Sect.). Marriott Motor Hotel, Chicago, Ill. (Summaries due March 6, 1974)

October 9-10
1974 Conference on Display Devices and Systems. Co-sponsored with Group on Electron Devices, IEEE. Statler Hilton Hotel, New York City

SID Proceedings: Computer Graphics

First Quarter Proceedings (Volume 15, No. 1) of the Society for Information Display, a special issue on Computer Graphics, includes articles on the following subjects:

The Technology and Characteristics of Computer Driven, Interactive, Graphic Display Systems; Computer Graphics Terminals—A Backward Look; Computer Graphics—The Present; Solid State Vertical Scale Instruments.

The issue may be ordered from SID National Office, 654 N. Sepulveda Blvd., Los Angeles, California 90049.

IEEE Display Devices' Call for Papers

The 1974 Conference on Display Devices and Systems will be held on October 9-10, 1974 at the Statler Hilton Hotel, Seventh Avenue and 33rd Street, New York City, sponsored by the Electron Devices Group of the IEEE, the Society for Information Display, and the Advisory Group on Electron Devices.

Previously Unpublished Papers —

The program will cover all of the disciplines relevant to research, development, and design of electronic display devices and systems. Previously unpublished papers describing significant new results of interest to active workers in the field are solicited. Among the areas of interest are: cathode-ray tubes, solid and liquid light emitters, gas-discharge devices, liquid crystals, electrochromics, light valves, projection displays, and utilization of IC technology. Related topics such as drive address and control techniques, phosphors, fiber optics, electron optics, photochromics, cathodochromics, image intensification and conversion, recording media directly applicable to displays, new phenomena, pertinent operational characteristics, measurement techniques, and new applications are to be included. Papers describing the interaction among display device performance, system requirements, and economic considerations relating to research, development, and design of displays are also invited.

The deadline for abstracts is June 24, 1974. The paper should be suitable for a 20-minute presentation, and authors are requested to submit both a 35-word abstract and a one-to-two-page draft summary. Since papers will be selected on the basis of the draft summary, this must include a concise statement of what new and significant results, differing from previous publications, have been obtained. Hand drawings and sketches may be included to aid in the selection of papers.

Specifications For Papers

The 35-word abstract, suitable for publication in an Advance Program, should be typed on a separate sheet, and include title of talk, author's name, affiliation, complete address, and telephone number. Twenty copies of the draft summary and abstract must be submitted. The author's name, affiliation, complete address and telephone number must appear on the first page, with the author's name and abbreviated paper title on each subsequent page. Authors of accepted papers will be asked to prepare a final one-to-two-page summary (including figures) for publication in the Conference Program. A text of the full paper, with figures, for publication in the Conference Proceedings will be required by the last day of the Conference.

A few post-deadline papers (for 10-minute presentation) reflecting important new projects, will be considered if 100-word abstracts and one-to-two-page summaries with any pertinent illustrations, suitable for publication in the Conference Program, are received by September 16, 1974.

Mail all material to Thomas Henion, Palisades Institute, 201 Varick Street, New York, N.Y. 10014. Telephone: (212) 620-3384. Overseas authors are encouraged to send a single additional copy of their material directly to a convenient overseas committee member. If you have any questions concerning this announcement, please contact any one of the committee members.

SID renewal volume at the National Office is up this year. Pictured here diligently processing your renewal application is SID National Office Manager Vi Puff and temporary assistant, her daughter, Jane. As usual, some members wait until the last moment to send in their checks. How about you? Is your renewal in this picture? If not, don't wait. Send your check today for 1974 dues and enjoy a full year of SID benefits.

Unique Liquid Crystal Patented by RCA

An unusual form of liquid crystal, described as "an electronic window shade," has been patented by RCA Laboratories. The device is opaque until current is applied, at which time it opens to reveal whatever visual element is underneath.

The new liquid crystal undergoes a field-induced phase change upon application of low-powered current from an integrated circuit. The liquid crystal host material has an optically active cholesteric component. The electric field alters the texture of the liquid from a light-scattering to a transparent state, thus revealing the visual element. When the current stops it resumes its opaque condition. The developers of the device, Edward F. Pasierb and Chan Soo On both were associated with RCA Laboratories in Princeton, N.J.

RCA plans to open a liquid crystal plant in Franklin Township, N.J. to produce the new devices.

Special Purpose Technology Corporation moves Cathode Ray Tube Operation into separate new, larger facilities. Company is set up to develop and manufacture complete line of CRTs from standard types to most sophisticated, including back ported, ultra high resolution, multi-neck, subscreen, and monoscopes. SPTC also designs, develops and manufactures display systems such as flying spot scanners, high-resolution monitors, fiber optic printers, computer terminals.

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Registration Form—Reader's Service Card—

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Waukegan, Illinois 60085

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Minato-ku, Tokyo, Japan

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Information Display Products
P.O. Box 500
Beaverton, Oregon 97005

THOMAS ELECTRONICS, INC.
100 Riverview Drive
Wayne, New Jersey 07470

THOMSON-CSF
Paris, France

XEROX DATA SYSTEMS
El Segundo, California 90245

Burroughs Now Making Displays in Mexico

In its first move to manufacture gas discharge display panels outside the U.S., Burroughs' Electronic Components Div. has begun production of Panaplex displays at its Guadalajara, Mexico plant, using half of a 200,000 sq. ft. complex for the present. At the start, only panels for calculators are being made, but this Fall Self-Scan alphanumeric panels also will be made. Observers said the move is expected to make Burroughs more competitive with LED and liquid crystal displays in the calculator and clock consumer markets.

Operational Amplifier

Model 9734, from stock from Optical Electronics, Inc., is a modular operational amplifier said to provide lower offset voltage and lower offset voltage drift than obtainable from low cost integrated circuits. The 9734 is termed "a high performance, low cost FET operational amplifier for analog circuit and system designers."

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