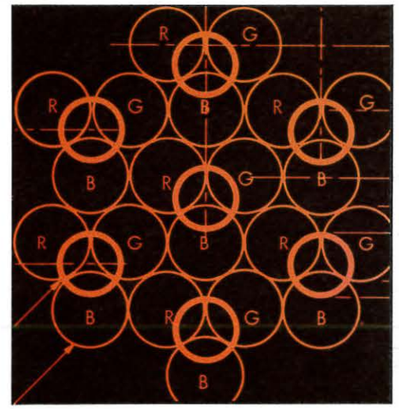
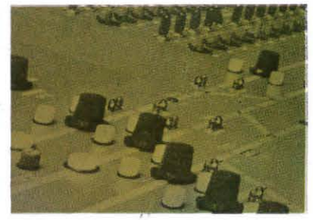
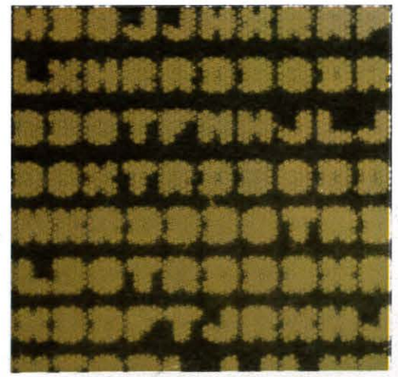
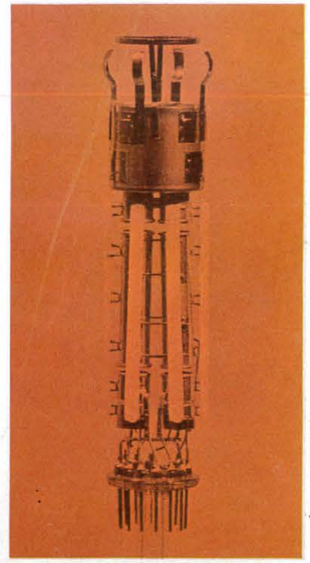
SID JOURNAL

The Official Journal of the Society For Information Display









SHADOW MASK

november/december 1972

vol. 1, number 4

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table of contents

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)ENT'S MESSAGE PRESIDENT'S ME

The Society for Information Display represents a unique amalgamation of scientific and technical interests in the total spectrum of professional organizations. There are other organizations that collectively offer audiences for each and every specialty with which our own Society might conceivably be concerned. Certainly, whether one is interested in the fundamental physical techniques underlying displays, or the engineering specifications and utilization of displays, there is little difficulty in finding a vehicle for either the presentation of papers or the publication of articles on any subject in our technical field.

And yet our Society is in fact unique, in that every member, be he listener or reader, author or presenter, can know that every other person in the Society is concerned with one fundamental problem —the methodology for the presentation of Information to observers. The explosion of information and knowledge represents one of the great challenges of our times. While the computer offers the potential for the processing and storing of information, without its availability to humans, the knowledge so treated will remain sterile and unoperated upon.

It has been said that as we now emerge from the final phases of the Industrial Revolution, we are about to enter into an era in which the manipulation and utilization of knowledge will assume ascending importance in our civilization. If such assertions are true, and I believe them to be, the importance of producing material products will demand less of our attention and will assume second place to our ability to treat with the economic, social and political issues of our times. I believe that the greater advances to be made in these "newer" scientific fields will occur because of the removal of man's inability to operate upon information previously beyond his "biological" capacity to retain. The advent of the computer offers him the potential for manipulating vast quantities of information and examining their interrelationships in ways that have been previously prohibited by the sheer labor of their study.

Such studies will depend upon the economical and effective presentation of Information to the user. This rather simply stated objective demands the harnessing of new device technologies, more effective software and hardware interfaces with computers, and the derivation of new principles of human factors engineering for displays. Anyone interested in such techologies and their interactions certainly can benefit from membership in our Society.

Dr. Carlo P. Crocetti
President

High Resolution SHADOW MASK

Description of mask resolution in a two-color system to 900 lines, with concurrent beam resolution of 900 lines; plus certain other revisions; with performance results/

By D. L. SAY
GTE Sylvania, Inc.
Seneca Falls, N.Y.

● Resolution of a shadow mask color CRT is normally limited by hole spacing in the mask to approximately 500 lines and further by beam diameter of the gun to 300-400 lines. Mask resolution in a 14″ two-color system has been increased to over 900 lines. To match the improved mask resolution, the beam resolution of the gun has also been increased to 900 lines. In addition, a revised two color phosphor system has been developed to reduce high brightness "flicker" at 30 cycle refresh rates. Performance results are discussed for the improved shadow mask CRT.

Introduction

Shadow mask cathode ray tubes are highly effective display devices for the presentation of entertainment color television. In spite of this wide usage in color television, shadow mask tubes have not been widely applied to the display of alphanumerics and/or graphics in color. The major reason has been the lack of adequate resolution in a shadow mask tube to effectively display large numbers of alphanumeric characters—1000 to 3000—in a single frame of data. As a result, the alphanumeric display field has been dominated by black and white CRT's even though the need

By D. L. SAY

for color is present in many display applications.

The limitation in resolution of shadow mask CRT's may be traced directly to two features of the tube. First, the hole pattern in the mask limits the resolving power of the display to an inverse function of the spacing between holes. Second, the relatively large electron beam diameter of typical entertainment shadow mask tubes further limits the resolving power of the display.

This report describes the results of a development program to improve these two problem areas. In addition, improvements have been made in the high brightness "flicker" problem at 30 cycle frame rates. Results to date have been successful to the following extent: More than three times the number of characers displayable on an entertainment three-color shadow mask tube may be effectively displayed on an improved two-color high resolution tube.

The report that follows is broken down into a review of: first, the mask resolution improvement; second, the electron beam resolution improvement; third, an improved phosphor system; and fourth, deflection and setup procedures: Performance results are reviewed using photographs of alphanumeric patterns from sample tubes.

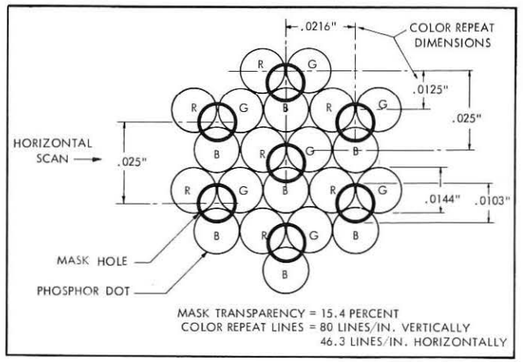


Figure 1. Non-Matrix, Conventional 14 V Shadowmask.

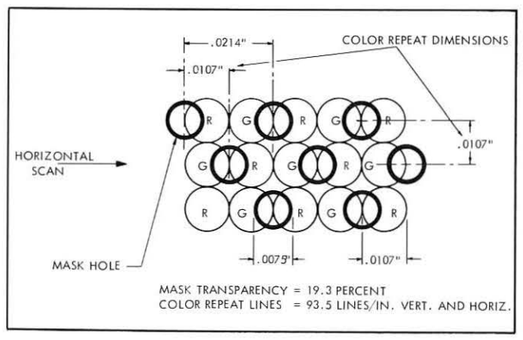


Figure 2. Two Color 14V Shadowmask.

Mask Resolution Improvement

The following section compares the geometry of the 14V conventional entertainment tube with the geometry of the two-color mask improved for resolution.

The conventional 14V color tube has a pattern of mask holes and phosphor dots shown in Figure 1. The "Color repeat dimension" horizontally (that is, the distance from a vertical column of dots of one color to the next vertical column of the same color) is .0216 inch or 43 lines/inch. The vertical spacing between horizontal rows of dots of one color at .0125 inch results in a vertical "color repeat dimension" of .0125 inch or 80 lines/inch.

The fact that these columns and rows of dots are not solid lines, but rather, circles spaced apart, should be noted since it causes the effective resolution capability of the system to be slightly lower than the number of lines per inch noted above. A closer examination also shows that the dots of one color in the rows of dots are spaced relatively further apart than in the columns by the ratio of 3 to 2. This feature causes the vertical resolution of the conventional system to be noticeably degraded from 80 lines/inch.

Mask transparency of the entertainment tube mask as noted in Figure 1 is 15.4%. (Mask transparency is directly related to screen brightness.)

To significantly improve the resolution of the mask, one set of phosphor dots has been removed, smaller mask holes are used, and the unique pattern of two-color dots seen in Figure 2 is applied. This design improves mask resolution in the following three ways. First, the color repeat dimension between vertical columns drops from .0216 inch to .0107 inch, thereby improving horizontal resolution of the mask by 102%. Second, spacing between horizontal rows of one color drops from .0125 inch to .0107 inch thereby improving vertical resolution by 17%. Third, the horizontal rows of dots that establish vertical resolution have their "solidness" increased by the ratio of 3 to 2 for a further improvement in vertical resolution of roughly 50%.

The net improvement in the resolving power of the improved two-color mask may be calculated as the

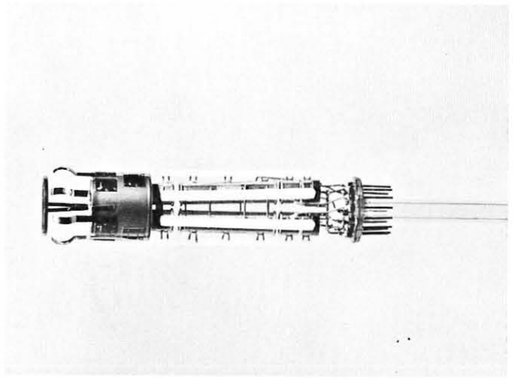


Figure 3. Structure of Electrostatically Focused Gun.

average of the improvement in horizontal and vertical resolutions, or approximately 84%. Further, the transparency of the two-color mask at 19.3% is significantly higher than the conventional mask at 15.4%.

Electron Beam Resolution Improvement

To match the resolution capability of the improved two-color shadow mask, it is necessary to provide an electron beam with a half-amplitude beam width in the size range of the color repeat dimension of the improved shadow mask, i.e., .0107 inch. Achieving this beam width at moderate current levels—300 to 500 μA—has been the goal of the second phase of this development effort.

As a reference, in the regular 14V color tube at moderate current levels, recently improved entertainment color guns have half-amplitude beam widths of .025 to .030 inch. This beam width is obviously still more than double the beam width needed to fully realize the resolution potential of the improved two-color mask. To reduce beam width by this needed factor of two a number of approaches have been investigated, including a magnetically focused two beam design and an electrostatically focused high resolution design.

Of the gun designs investigated the electrostatically focused high resoluion version has most effectively achieved the required beam width without undue complications of setup and circuitry requirements. The line width goal has been reached in the absence of restrictions normally imposed on focus voltage and overall length. This development has been successful in that half-amplitude line widths of .0120 inch have been consistently achieved with the gun design shown in the photograph of Figure 3.

This gun features a one-inch longer than normal overall length and increased prefocusing in the G2-G3 region. Focus voltage is significantly higher in this design than in a conventional color gun. Figure 4 indicates the increased focus voltage needed for the electrostatically focused high resolution color gun.

Additional features of this gun include a 900 ma total heater current at 6.3 volts, and basing identical to a regular trigun assembly except for the omission of

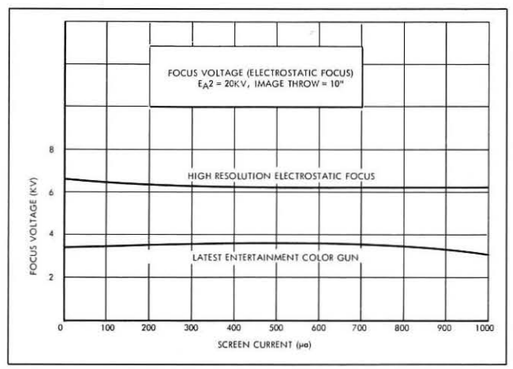


Figure 4. Curves of Focus Voltage for Entertainment Color Gun, Electrostatically Focused High Resolution Gun.

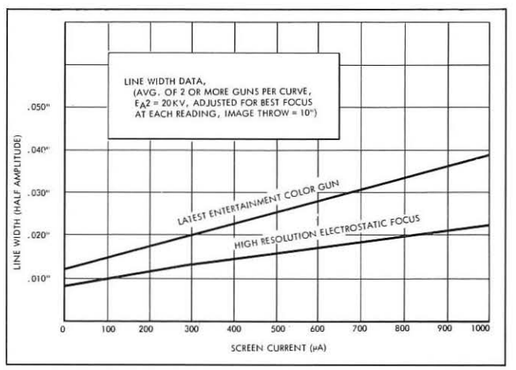


Figure 5. Curves of Line Width for Latest Entertainment Color Gun, and for Electrostatically Focused High Resolution Gun.

By D. L. SAY

certain pins normally connected to the blue gun.

Improved Phosphor System

The tube may be provided with any two of the three regular P22 shadow mask phosphors if desired (normally red and green phosphors are used). In addition a revised phosphor system has been developed for those applications where flicker in the display may be objectionable.

For instance, when alphanumerics are displayed on an interlaced TV scan system, alternate scan lines appear at a 30 cycle refresh rate. The medium fast phosphors normally used in color TV will then cause alternate lines of the characters to flicker slightly, particularly at high brightness levels. To alleviate this problem a two color phosphor system has been developed using somewhat slower phosphors. This system uses a P39 green, peaking at 5250 angstroms, decaying to 10% of initial brightness in over 33 milliseconds, eliminating objectionable flicker at 30 cycle refresh.

Deflection and Setup Procedures

Deflection of the two beam pattern is best accomplished using a low impedance toroidal yoke tailored for this CRT. This yoke, having impedances designed for use with solid-state driving circuitry, has a further significant advantage regarding convergence of the two beams. That is, with this yoke the two beams track convergencewise over the face of the tube within an accuracy of .040 inch or better. With this yoke, therefore, it is not necessary to provide dynamic convergence waveforms for most two color display applications.

An alternate deflection system uses a regular high impedance TV saddle yoke. It is then necessary to provide dynamic convergence waveforms for most two color displays.

Setup of the tube is similar to a regular shadow mask color tube with two exceptions. First, beam alignment magnets are provided near the grid 1-grid 2

Figure 6. Photo—Alphanumeric Pattern of Entertainment 14V CRT, 3000 Characters/Frame.

Figure 7. Alphanumeric Pattern of Electrostatically Focused High Resolution, 2-Color CRT, 3000 Characters/Frame.

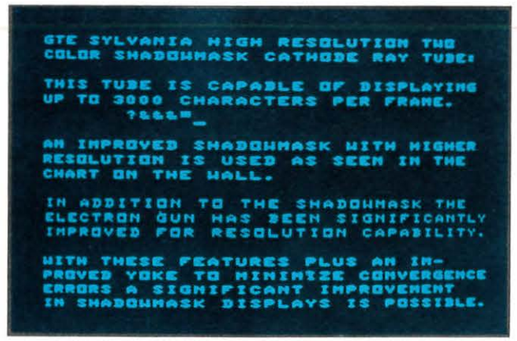


Figure 8. Alphanumeric Pattern of Electrostatically Focused High Resolution, 2-Color CRT, 2500 Characters/Frame.

gap of the electron guns, and second, the static convergence yoke is an "in-line" type with permanent magnets for statically converging the two beams. Also internal magnetic pole pieces are provided in the tube for those cases where dynamic convergence waveforms are applied to the convergence assembly.

The sequence of operations for setting up the tube, using the toroidal yoke, are similar to those for a normal shadow tube except for the following change. After initial setup the anode potential is reduced to focus potential (6KV) and the scan is removed. The two beams are then individually aligned in their limiting apertures. The tube is returned to normal operation and the initial setup adjustments are rechecked before operating the tube.

Performance Results

Figure 5 indicates the improvement in half-amplitude line width for the electrostatically focused high resolution design compared to the latest entertainment color design. The improved design reduces line width by approximately 40%, reaching .013 inch at the 300 μA level.

In the course of this investigation a number of two-color tubes have been built. Figures 6, 7 and 8 show alphanumeric patterns photographed from various sample tubes.

Figure 6 shows a two inch by three inch pattern of 200 characters from a conventional 14V color tube. This character density is equivalent to 3000 characters over the full 8 inch by 11 inch screen. Note that the alphanumeric pattern is fuzzy and indistinct for this conventional 14V color tube.

Figure 7 shows a similar pattern from the electrostatically focused high resolution two-color tube with the improved two-color mask, and Figure 8 shows a four inch by six inch word pattern at the 2500 character density level from the high resolution two-color tube.

Summary

The recently developed two-color shadow mask CRT has both its mask and electron gun improved for resolution. The net improvement in overall resolution is a factor of two better than the best available entertainment shadow mask tube. The number of characters displayable on a two-dimensional field is therefore increased by approximately a factor of four.

With this tube, up to 3000 readable characters may be displayed in two colors. The tube is capable of filling a long vacant role in the field of color alphanumeric and graphic displays. ●

about the author

Donald L. Say's work with Sylvania's cathode ray tube operation (where he is CRT Engineering Section Head) has included development of special purpose single-gun color tubes, low deflection power and low heater power cathode ray tubes, high resolution vidicon electron guns and high resolution multibeam cathode ray displays. He holds five patents in electron tube construction, with others pending. Mr. Say studied electrical engineering at Drexel Institute of Technology and Carnegie Technical Institute (B.S. 1950). He has been with Sylvania since 1950.

SID 5th Annual Conference "Update 73"

The SID 5th Annual One-Day Technical Conference, "Update 73," held in San Diego at Sheraton Inn-Airport, Friday, December 8, 1972. Gerald Chandler, Paper Selection, says response to the call for papers was excellent.

Richard Thoman was Conference Chairman.

Morning session papers: *Visual Perception and Illusion in Image Transmission Systems*, Harold Lasberg, Jet Propulsion Lab.

Imagery Storage Techniques, Robert D. Vernot/Joseph J. Frangipane, Philco-Ford/C&TS Division.

The Halftone Response of Electrical Recording Storage Tubes, R. A. Davidson, Litton Data Systems.

Flat Panel Displays, Who Needs One?, Frank C. Martin Jr., NELC.

Nematic Liquid Crystal Displays, Properties and Limitations, Ulrich Bonne / J. P. Cummings, Honeywell Corporate Research Center.

Afternoon session papers: *Which Flat Panel Display Technology—A Specific Example*, George Robert Kaelin, Litton Data Systems.

Improved Memory Tube for Alphanumeric and Graphics Applications, K. R. Hesse, Hughes Aircraft Industrial Products.

An Economical and Versatile Digital Display Unit, K. Kosman / L. P. Boivin/D. Paterson, Bell Northern Research; and S. Soos, Microsystems Intl. Ltd.

An Improved Image Converter Technique for a Portable Thermal Imaging System, R. P. Casper, Hughes Aircraft Industrial Products.

Analog 3-D Graphic Display Generation System, Richard C. Gerdes, Optical Electronics Inc.

Special Rates for AFIPS Papers

AFIPS Press has announced that Volumes 37, 38 and 39 of the Proceedings of the Joint Computer Conferences will be available to members of AFIPS Constituent Societies at the special price of $7.00 each instead of the regular member price of $13.00 (non-member prices remain at $26.00 per volume). Prepaid orders, including society membership number, should be sent to AFIPS Press, 210 Summit Avenue, Montvale, New Jersey 07645. Orders should be sent promptly.

Volume 37 contains the 70 papers given at the 1970 Fall Joint Computer Conference: Volume 38 contains the 67 papers given at the 1971 Spring Joint Computer Conference: Volume 39 contains the 69 papers given at the 1971 Fall Joint Computer Conference.

Also available from AFIPS Press at the regular member price of $15.00 (non-members $30.00) is Volume 40 which contains the 127 papers presented at the 1972 Spring Joint Computer Conference. This 1217 page volume covers almost every aspect of development in the computer field.

Standard for Graphic Symbols

The American National Standards Institute has proposed a standard for graphic symbols for logic diagrams (BSR Y32.14 Graphic Symbols for Logic Diagrams - IEEE 91), described as follows:

Establishes the graphic symbols for use in the preparation of logic diagrams representing logic functions implemented with two-state devices. The primary purpose of this standard is to enable a user to readily read and understand the function of the logic without requiring a specific knowledge of the constructional details of the device represented. Descriptions of logic functions, the graphic representation of these functions, and examples of their applications are given.

Copies should be ordered from IEEE, Draft Dept., Standards Office, 345 E. 47th St., New York 10017. Single copies, $6.00.

Please Pass the SID

We'd like this issue of SID JOURNAL to get as wide circulation as possible. So, let your co-workers, maybe even your boss, read this issue.

Tom Curran, SID Officer, Named

Thomas V. Curran, Western Regional Director of the Society for Information Display, has been appointed Western Regional Sales Manager for Information Displays, Inc., maker of computer-driven interactive display system and other equipment and systems. Prior to his new post, Mr. Curran had been Director of Planning, Stresskin Products, and before that had held marketing posts with RCA Data Systems, Litton Guidance & Controls and Lockheed Missiles & Space. He will headquarter at IDI offices, 15720 Ventura Blvd., Encino, Cal.

Library in SID's National Office

The SID national office at 654 North Sepulveda Boulevard in Los Angeles maintains a library of all back issues of the SID Proceedings, Information Display and many books, reports and periodicals on Displays. This library is for use by SID members. If you have a literature search to do, or need to research some aspect of Displays, make your first stop the SID National Office. Vi Puff, National Office Manager, will be happy to serve a cup of coffee and help you get started.

LA Firm Claims Highspeed Typeset

A "revolution" in the graphic arts industry based on dramatic decreases in composition time is taking place at the West Los Angeles firm of Data Dissemination Systems, Inc., DDS asserts. Firm has made the first commercial installation of a new computerized composition system, known as COMp 80. The new system "can compose pages up to 16 times faster than present computerized composition equipment" which rely on standard line printers, cold type setters and the like, according to DDS. The exceptionally high speed of the COMp 80 will be used for utility printing including illustrated catalogs, stock charts and other quick-reaction requirements.

The end product from the COMp 80 is film which can be used in the offset printing process.

Interactive CRT Terminal Selection

A discussion of factors to be taken into consideration in the selection of interactive CRT terminals for different applications.

By C. MACHOVER
Information Displays, Inc.
Mt. Kisco, N.Y.

● Published articles and papers over the last few years (typified by References 1 thru 14) describe how computer graphics are being used in a wide range of applications . . . computer-aided design, management information systems, simulation, process control, computer-aided education, graphic arts, computer generated movies. From such sources, an extensive list of applications for computer graphics . . . particularly for interactive CRT terminals . . . can be readily compiled. A representative list is given in Table 1.

There are currently more than 35 hardware and systems suppliers offering over 60 different models of graphic terminals (Reference 15).

It is unlikely that any one single device provides the best answer to all requirements. One invariably needs to match the terminal characteristics against the application requirements in order to make a meaningful choice. Price alone, for example, is seldom the best reason for making the decision.

This paper describes a systematic method for evaluating various terminal-types in terms of the application requirements. Briefly:

a. The various types of commercially avalable terminals are categorized.
b. Relevant performance characteristics are listed.
c. A numeric value is assigned to each of these characteristics for each of the terminal categories.

The user then decides:

1. Which of these performance characteristics are important for his application,
2. Whether additional factors should be evaluated for his application, and
3. Whether some of the factors should weigh more heavily in the final evaluation than others.

When finished, the user has developed a numerical rating for each of the categories, based on the terminal characteristics and the application requirements. The method has enough sensitivity that a fairly positive indication is given as to which category of terminal is probably best for the user's applications. The paper closes with several examples of how the method can be used.

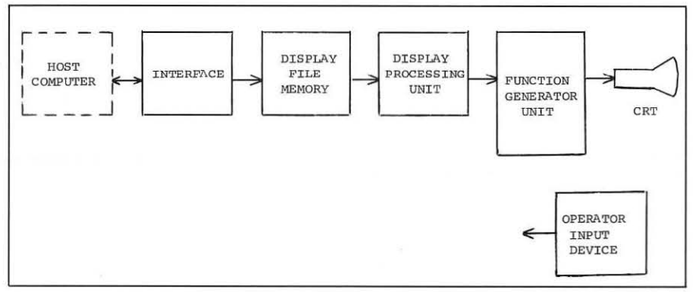


Figure 1. Generalized Interactive CRT Terminal

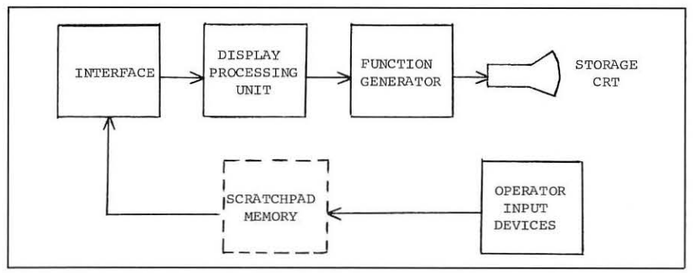


Figure 2. Storage Tube

Types of Terminals

Generally, any interactive CRT graphic system needs to include the functions shown in the simplified block diagram, Figure 1. The sequential relationship between the elements may not be the same for each terminal, and some terminals may not contain each element.

It is convenient to divide commercially available CRT terminals into eight categories. A brief description of each type, a simple block diagram, and a representative list of commercially available terminals which fit that category follows:

1. *Storage Tube* (Figure 2)

In a storage tube terminal, the display file memory and CRT are combined into a single element . . . the display itself. To provide for local editing, the terminal may have a small scratchpad memory which works in conjunction with the write-through (non-storage) mode of the tube.

Representative units in this category are:

Adage ARDS
Computek Model 400
Tektronix Model 4002

2. *Limited Graphics/Buffer* (Figure 3)

This configuration includes all of the elements of a typical interactive CRT terminal. However, to reduce cost, the performance of some of the function generators may be limited. For example, the line generator may be capable of drawing lines at only certain selected angles. Lines at other angles would be programmed as a series of connected line segments.

A representative unit in this category is Information Displays, Inc.

3. *Limited Graphics/CPU Buffer* (Figure 4)

In order to increase the free-standing capability of the terminal, some limited graphics terminals include a central processing capability as well as refresh buffer.

Representative units in this category are:

Conographic CON 14
IMLAC Model PDS-1
Systems Concepts DELTA 5

4. *Unlimited Graphics/No Buffer* (Figure 5)

In some display environments, the host computer has sufficient capacity to provide the display file memory function. Therefore, to reduce the unit cost, the terminal does not include a buffer memory. The term "unlimited graphics" implies that the function generators can draw straight lines between any two addressable locations on the screen.

Representative units in this category are:

Digital Equipment Graphics 15
Information Displays, Inc. E1
Vector General DD1

5. *Unlimited Graphics/Buffer* (Figure 6)

Similar to Unlimited Graphics/No Buffer, except that the display file memory has been included. Typically, the buffer will be a random-access core memory.

Representative units in this category are:

Honeywell 7420
IBM Model 2250 MOD 1

6. *Unlimited Graphics/CPU Buffer* Figure 7)

Similar to the Limited Graphics/CPU Buffer except that the system typically has complete line drawing capability. Also, the CPU and Display File Memory are combined and frequently a commercial minicomputer serves both functions.

Representative units in this category are:

Adage AGT Series
CDC Digigraphic
IBM Model 2250 MOD 4
Information Displays, Inc. IDIIOM
Monitor Systems 8100
Sanders ADDS 900

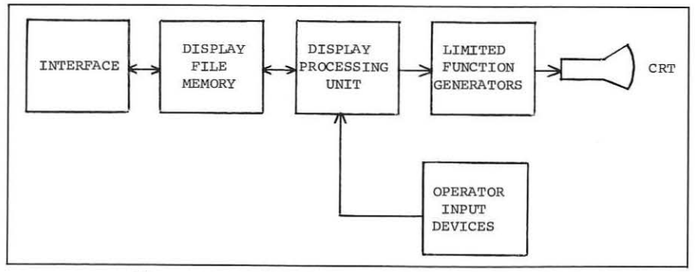


Figure 3. Buffer Refresh/Limited Graphics

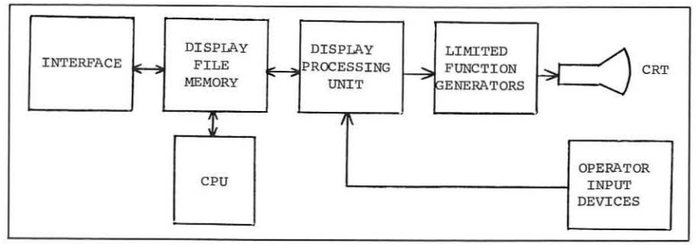


Figure 4. CPU/Buffer Refresh—Limited Graphics

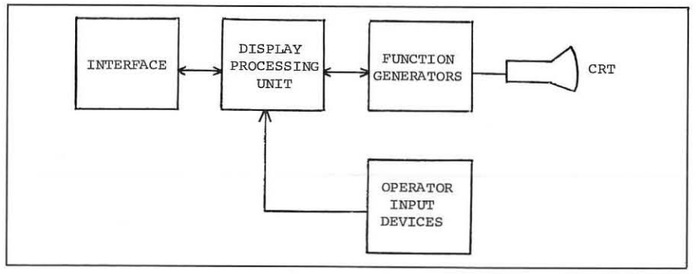


Figure 5. Unlimited Graphics/No Buffer

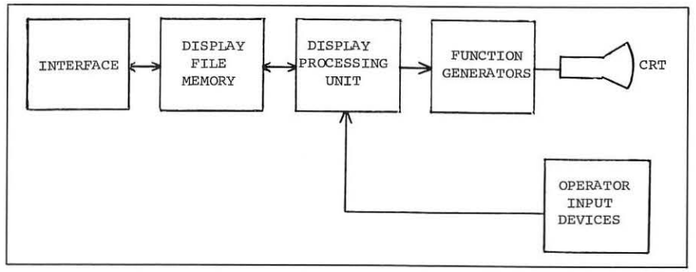


Figure 6. Unlimited Graphics/Buffer

Table 1. Representative Applications/for Computer Graphics

Advertising Design
Air Traffic Control
Aircraft Cockpit—Human Movement Analysis
Aircraft Seating Arrangement Development
Analysis of Dynamic Systems
Architectural Design
Architecture—Cost Analysis of Floor Plan
Automatic Wiring List Development from Logic Circuit
Bio-Medical
Cabinet and Panel Layout
Calculation of Volumes and Areas
Chemical Research—Molecular Structures
Circuit Analysis and Layout
Communications Analysis
Computer Generated Animation
Control of Blending Refinery—Simulation
Costume Design
Data Reduction
Data Retrieval
Data Scanning
Decision Tree Analysis
Display of Radar Data
Electrical Engineering
Engineering Drawing Retrieval
Engineering Drawing Preparation
Exception Reporting
Exploration Research—Petroleum
Flight Simulation
Forecasting
Geo-Physics
Groups of Linear or Non-Linear Differential Equations
Human Engineering Studies—Ability to Respond
Human Engineering Studies—Physiological Envelope
Human Factors in Driving Performance
Industrial Design
Integrated Circuit Design
Inventory and Production Charts
Laboratory Analysis
Management Information Needs
Maunfacturing and Material Cost Analysis
Math Function Visualization
Mechanical and Thermal Networks
Molecular Analysis and Structuring
Monitoring of Experiments on Satellites
Music and Voice Synthesis
N/C Tape Preparation Checkout
Nuclear Physics Environment
Ore Location Description
Pattern Recognition
Pattern Recognition in Medical Environment
Pattern Recognition of Nuclear Tracts
Pert Analysis of Resource Demand
Pharmacology—Geometric Arrangement of Atoms may be Predicted
Power System Monitoring (Flow and Breakdown)
Printed Circuit Boards
Processing and Display of Sonar Data
Process Control
Production Planning
Program Progress Monitoring
Programming and Debugging
Radiation Protection Analysis of Fallout Shelters
Sales Market Analysis
Seismographic Analysis—Oil
Sensitivity Analysis
Sheet Metal Layout Development
Simulation of Aircraft Panel Instruments
Simulation of Control Systems—Stability of Feedback
Simulation of Production Scheduling
Simulation of Torpedo Trajectories
Spectrometer Analysis
Statistical Analysis
Statistical Sales Data
Stock Market Analysis
Stress Diagram
Structure Analysis
Submarine Control Systems
Synthesizing of Electrical Waveforms
Text Editing—Composition, Manipulation, Browse or Query
Topographical Surveying
Trajectory Analysis
Underseas Weapons Research
Visual, Musical, and Plastic Arts Applications
War Gaming Simulation
Wind Tunnel Data Analysis

7. *TV/Scan Converter* (Figure 8)

This system substitutes a scan converter for the display file memory. The input to the scan converter is a conventional analog function generator, while the output is a conventional TV raster.

A representative unit in this category is Princeton Electronics Corporation 801.

8. *TV/Digital* (Figure 9)

These systems essentially create a map of the display area in a kind of mass memory, and then read-out the memory in a TV scan. The map may be created directly by the host computer or the unit may include function generators which accept end point definitions and convert that data into a TV map.

Representative units in this category are:

Computek 300
Data Disc 6500
Monitor Systems 8500

Note that Categories 3 (Limited Graphics/CPU Buffer), and 6 (Unlimited Graphics/CPU Buffer) are sometimes referred to as 'intelligent terminals" (Reference 16.

Performance Characteristics

Performance, host computer requirements, and cost are the principle factors which determine a terminal's suitability for a given application.

These primary factors can be further subdivided into at least 19 items, as shown in Table 2. In order to develop an objective evaluation method, a numerical value (1, 2 or 3) is assigned to each of these characteristics. For each characteristic, the "most favorable" range is assigned as 1, the "medium" range is assigned as 2, and the "least favorable" range is assigned as 3. While a wider range of values could be used, for preliminary evaluation purposes, the 1 to 3 range appears adequate, and is simpler to assign.

Numeric value assignment involves several judgments. Where an operating range can be established unambiguously, a choice must be made of how to divide within the range. For example, the screen size (available display area)

of commercially available terminals ranges from about 400 in.² (for a 23″ round CRT) down to about 48 in.² (6″ x 8″ CRT).

In developing the screen size (Item 1) numeric values shown in Table 2, I made the judgment that a large screen area is more favorable (hence value=1) than is a small screen area (hence value=3). The division among Large (>120 in.²), Medium (50 in.² to 120 in.²), and Small (<50 in.²) is arbitrary, but is based on an understanding of how the screen sizes tend to be grouped.

Some factors must be judged subjectively. For example, picture quality (Item 9, Table 2) is an important factor, but numeric values can have only qualitative, not quantitative significance. When such values are later assigned to the various terminal categories (Table 3), the designation is my subjective judgment.

Nineteen terminal characteristics, together with my range definition and ratings, are listed in Table 2. The terms are used in a general rather than rigorous sense and the range descriptions try to reflect the user's (rather than display experts) environment.

To use these ratings for meaningful evaluation, each characteristic should be essentially independent of the others, not merely a re-statement of another item.

Rating Chart

Using the characteristics and ratings shown in Table 2, the Graphic Display Rating Chart, Table 3, was prepared. Table 3 assigned a numeric rating to each of the 19 performance characteristics for each of the eight terminal categories. As discussed in the previous section, some ratings are quantitative (based on a specific range of values), while others are qualitative (subjective). These groupings are summarized below:

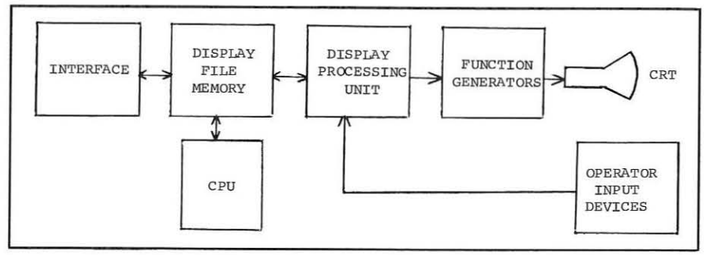


Figure 7. Unlimited Graphics/CPU Buffer

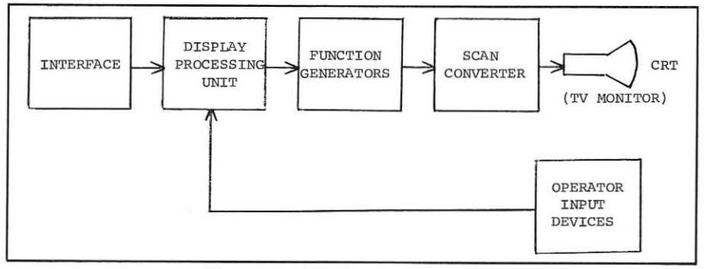


Figure 8. TV/Scan Converter

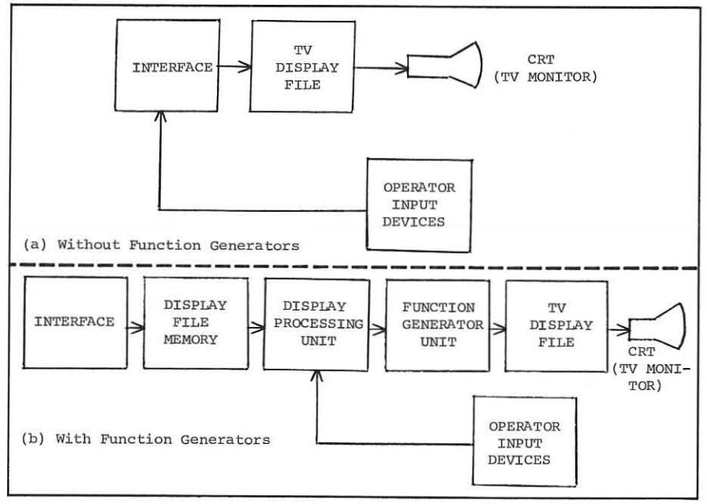


Figure 9. TV/Digital

about the author

As Vice President of Marketing for Information Displays, Inc., Mr. Machover has been concerned with the design and marketing of display systems and computer graphics. He has been with Information Displays, Inc., since 1960. Mr. Machover was Manager of Sales for Skiatron Electronics Television Corporation before joining Information Displays, Inc. During the prior eight years, he was with the Norden Division of United Aircraft Corporation, involved with engineering and marketing servo components, gyroscopes, displays, BOMB/NAV systems, and precision test equipment.

Mr. Machover has published numerous articles on displays, and has delivered lectures on the subject at technical conferences and universities in the United States, Europe and Australia. Mr. Machover is also the author of books on gyroscopes, and holds patents on gyroscope devices. Mr. Machover is a member of SID, ACM (SICGRAPH), IEEE, Sigma XI, Tau Beta Pi and Eta Kappa Nu. He is a Past President ('68-'70) of the Society for Information Display (SID), and a Fellow of that organization.

	RATINGS		
	1	2	3
1. Screen Size	Large (>120 in.²)	Medium (50 in.² - 120 in.²)	Small (<50 in.²)
2. Brightness / Contrast	Bright (>10 ft. lamb)	–	Dim (<10 ft. lamb)
3. Color Capability	True Color	Synthetic (Grey Level conversion to color)	None
4. Grey Level	Many (4 or more)	Limited (1 – 3)	None
5. Light Pen	Yes	Limited	None
6. Joystick / Trackball / Graphic Tablet	Yes	–	No
7. Line Drawing Capability	High (Random End Points; Random Length)	Medium (Selected Connected Strokes)	Low (Essentially orthagonal)
8. Selective Erase	Easy	Limited	None
9. Subjective Graphic Picture Quality	High	Medium	Low
10. Dynamic Picture Manipulation	Unlimited	Moderate	Very Limited
11. Data Content For Flicker Free Presentation	No Limit	High (>3000 char. >10000″ per line)	Low (<3000 char. <10000″ per line)
12. Multiple Diff. Display / Single Controller	Many (>6)	Some (3 – 6)	Few (1, 2)
13. Host Computer Load To Support Picture Refresh	Low Loading	Medium Loading	High Load
14. Suitability For (Remote Comm Line Interface	Suitable	Marginal	Unsuitable
15. Stand Alone Capability	Yes	Limited	No
16. Host Computer Load To Support Graphic Manipulation	Low	Medium	High
17. Host Computer Load To Support Application Program	Low	Medium	High
18. Price (Per Single Crt, No Mult)	Low (<$12,000)	Medium ($12,000 – $50,000)	High (>$50,000)
19. Cost Per Channel, Multiple Displays	Low (<$5000)	Medium ($5000 – $15,000)	High (>$15,000)

Data Sheet 280-572

Table 2. Performance Characteristics Detailed Key to Rating

QUANTITATIVE

1. Screen Size
2. Brightness
3. Color Capability
4. Grey Level
5. Light Pen
6. Other Input Devices
7. Line Drawing Capability
8. Selective Erase
11. Data Content for Flicker Free Presentation
12. Multiple Different Displays/ Single Controller
14. Suitability for (Remote) Communication Line Interface
15. Standing Alone Capabiilty
18. Price (per Single CRT, No Multiple CRT's)
19. Cost per Channel, Multiple Displays

QUALITATIVE

9. Subjective Graphic Picture Quality
10. Dynamic Picture Manipulation
13. Host Computer Load to Support Picture Refresh
16. Host Computer Load to Support Graphic Manipulation
17. Host Computer Load to Support Application Program

The numeric values are, of course, my judgment. Where several commercial terminals are available within a category, the rating represents my judgment of the composite characteristic of all terminals in that category.

The Rating Chart classification also anticipates that a user may be concerned about additional characteristics, not included among the 19. As a reminder to the evaluator, the category "D (Other)" is also included.

One systematic way of using the Rating Chart, Table 3, to make the preliminary evaluation is detailed in the following "step-by-step" pro-

By C. MACHOVER

cedure. Undoubtedly, other methods will occur to the reader.

To Evaluate Various Terminals for a Specific Application

1. *Draw a horizontal line through those factors of no interest to the user.* For example, if the terminal is to be used for information retrieval, the terminals capability for selective erase and dynamic picture manipulation may not be important. For cost factors, generally either cost per single tube or cost per channel (multiple display) will be important, but not both.
2. *Add other factors of interest and assign ratings.* For example, in evaluating a terminal that the user can conveniently carry or move to different locations, portability will be an important factor. Numeric values might be assigned based on weight divisions or subjective descriptions.
3. *Identify "Knock Out" factors. Draw vertical lines through display types which do not qualify.* For example, if the user decides he must have a color presentation, then any terminal with a 3 rating for Item 3, Color Capability, simply cannot be considered. Under these circumstances, a vertical line would be drawn through the storage tube terminal category.
4. *If desired, assign weighting factors to certain characteristics.* Frequently price is a more important consideration than many other specific characteristics. The evaluator could decide to weight price three times higher (for example) than any other feature. Accordingly, *all* ratings in the price category (either Item 18 or Item 19) would be multiplied by 3.
5. *Sum resulting ratings for each remaining terminal category and each remaining factor (weighted, where appropriate).* That terminal category, or categories, with the *lowest sum* is probably most suited for the evaluator's application.

PARAMETERS	WEIGHTING FACTOR	1 STORAGE TUBE LIMITED GRAPHICS	2 BUFFER REFRESH LIMITED GRAPHICS	3 CPU/BUFFER REFRESH LIMITED GRAPHICS	4 UNLIMITED GRAPHICS NO BUFFER	5 UNLIMITED GRAPHICS BUFFER	6 UNLIMITED GRAPHICS CPU BUFFER	7 TV SCAN CONV	8 TV DIGITAL
A. Performance Factors									
1. Screen Size		3	2	2	1	1	1	2	2
2. Brightness		3	1	1	1	1	1	3	1
3. Color Capability		3	1	1	1	1	1	2	1
4. Gray Level		3	1	1	1	1	1	2	2
5. Light Pen		3	1	1	1	1	1	2	1
6. Other Input Dev.		1	1	1	1	1	1	1	1
7. Line Dwg Capability		1	2	2	1	1	1	1	3
8. Selective Erase		3	1	1	1	1	1	2	1
9. Subjective Pict. Quality		1	2	2	1	1	1	3	2
10. Dynamic Picture		3	2	1	1	2	1	2	2
11. Flicker Free Data Content		1	3	3	2	2	2	1	1
12. Multiple Display/ Single Cont.		3	2	3	2	2	2	3	1
B. Host Computer Factors									
13. Host Load for Refresh		1	1	1	3	1	1	1	1
14. Remote Operation		1	1	1	3	1	1	1	2
15. Stand Alone Cap.		3	2	2	3	3	1	3	3
16. Host Load to Support Graphic Manipulation		3	2	1	3	2	1	3	3
17. Host Load to Support Add'l Packages		3	3	2	3	3	1	3	3
C. Cost Factors									
18. Single CRT Price		1	1	1	2	2	3	1	2
19. Cost/Channel Multiple Displays		2	1	2	3	3	3	2	1
D. Other 20. 21.									

KEY
1—Most favorable
2—Medium
3—Least favorable

Table 3. Graphics Display Rating Chart

PARAMETERS	WEIGHTING FACTOR	1 STORAGE TUBE LIMITED GRAPHICS	2 BUFFER REFRESH LIMITED GRAPHICS	3 CPU/BUFFER REFRESH LIMITED GRAPHICS	4 UNLIMITED GRAPHICS NO BUFFER	5 UNLIMITED GRAPHICS BUFFER	6 UNLIMITED GRAPHICS CPU BUFFER	7 TV SCAN CONV	8 TV DIGITAL
A. Performance Factors									
1. Screen Size	2	86	24	24	12	12	12	42	42
2. Brightness		3	1	1	1	1	1	3	1
~~3. Color Capability~~		~~3~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~2~~	~~1~~
~~4. Gray Level~~		~~3~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~2~~	~~2~~
5. Light Pen	2	86	12	12	12	12	12	42	23
6. Other Input Dev.		1	1	1	1	1	1	1	1
7. Line Dwg Capability	2	12	24	24	12	12	12	23	63
8. Selective Erase	2	86	12	12	12	12	12	42	23
9. Subjective Pict. Quality		1	2	2	1	1	1	3	2
10. Dynamic Picture		3	2	1	1	2	1	2	2
11. Flicker Free Data Content		1	3	3	2	2	2	1	1
12. Multiple Display/ Single Cont.		3	2	3	2	2	2	3	1
B. Host Computer Factors									
13. Host Load for Refresh		1	1	1	3	1	1	1	1
14. Remote Operation		1	1	1	3	1	1	1	2
15. Stand Alone Cap.	2	36	24	24	36	36	12	63	63
16. Host Load to Support Graphic Manipulation	2	36	24	12	36	24	12	63	63
17. Host Load to Support Add'l Packages	2	36	36	24	36	36	12	63	63
C. Cost Factors									
~~18. Single CRT Price~~		~~1~~	~~1~~	~~1~~	~~2~~	~~2~~	~~3~~	~~1~~	~~2~~
19. Cost/Channel Multiple Displays	3	26	13	26	39	39	39	62	31
		58	42	41	49	44	33	53	46
D. Other 20. 21.									

KEY
1—Most favorable
2—Medium
3—Least favorable

Figure 10. Engineering Drawing Preparation

Examples of Using the Rating Chart For Terminal Evaluation

To illustrate the evaluation method, three representative applications for computer graphics, chosen from Table 1, are discussed in this section.

Example 1. Engineering Drawings Preparation is shown in Figure 10. Evaluation favors *Category 6 Terminal, Unlimited Graphics/CPU Buffer,* by a substantial margin.

Example 2. Process Control is shown in Figure 11. Evaluation also favors the *Category 6 Terminal, Unlimited Graphics/CPU Buffer,* but there is only a small and probably not meaningful difference between the next four categories . . . Category 8, Digital TV; Category 2, Limited Graphics/Buffer; Category 5, Unlimited Graphics/Buffer; and Category 3, Limited Graphics/CPU Buffer.

Example 3. N/C Tapes Preparation Checkout is shown in Figure 12. Evaluation favors the *Category 1 Terminal, Storage Tube.*

In each example, factors of no interest, knockout factors, and weighting factors are indicated, together with the resulting sum for each category. It will be apparent that the results will be significantly affected by the users judgment factors. For example, with no weighting factors, and no "knockout" factors, the Category 6 Terminal, Unlimited Graphics/CPU Buffer, has the lowest numeric total, hence the best "rating," while the Category 1 Terminal, Storage Tube, has the highest numeric total, hence the poorest "rating." Yet, when appropriate judgmental factors are applied, there are clearly applications where each may be the preferred choice.

Summary

This paper describes a simple, but effective, way to choose the most suitable interactive CRT terminal type for a given application. To complete the process, a specific terminal must then be selected from among the several commercially available units in that category. Many of the same, as well as other, factors will be considered in the final selection, such as, reliability, the manufacturer's reputation,

turn to page 22

PARAMETERS	WEIGHTING FACTOR	1 STORAGE TUBE LIMITED GRAPHICS	2 BUFFER REFRESH LIMITED GRAPHICS	3 CPU/BUFFER REFRESH LIMITED GRAPHICS	4 UNLIMITED GRAPHICS NO BUFFER	5 UNLIMITED GRAPHICS BUFFER	6 UNLIMITED GRAPHICS CPU BUFFER	7 TV SCAN CONV	8 TV DIGITAL
A. Performance Factors									
1. Screen Size		3	2	2	1	1	1	2	2
2. Brightness		3	1	1	1	1	1	3	1
3. Color Capability	2	3	12	12	12	12	12	42	23
~~4. Gray Level~~		~~3~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~2~~	~~2~~
5. Light Pen		3	1	1	1	1	1	2	1
6. Other Input Dev.			1	1	1	1	1	1	1
7. Line Dwg Capability			2	2	1	1	1	1	3
8. Selective Erase		3	1	1	1	1	1	2	1
9. Subjective Pict. Quality	2		24	24	12	12	12	63	42
~~10. Dynamic Picture~~		~~3~~	~~2~~	~~1~~	~~1~~	~~2~~	~~1~~	~~2~~	~~2~~
11. Flicker Free Data Content			3	3	2	2	2	1	1
12. Multiple Display/ Single Cont.		3	2	3	2	2	2	3	1
B. Host Computer Factors									
13. Host Load for Refresh			1	1	3	1	1	1	1
~~14. Remote Operation~~		~~1~~	~~1~~	~~1~~	~~3~~	~~1~~	~~1~~	~~1~~	~~2~~
~~15. Stand Alone Cap.~~		~~3~~	~~2~~	~~2~~	~~3~~	~~3~~	~~1~~	~~3~~	~~3~~
16. Host Load to Support Graphic Manipulation		3	2	1	3	2	1	3	3
17. Host Load to Support Add'l Packages		3	3	2	3	3	1	3	3
C. Cost Factors									
~~18. Single CRT Price~~		~~1~~	~~1~~	~~1~~	~~2~~	~~2~~	~~3~~	~~1~~	~~2~~
19. Cost/Channel Multiple Displays	3	2	13	26	39	39	39	62	31
			28	30	32	29	26	38	27
D. Other 20. 21.									

KEY
1—Most favorable
2—Medium
3—Least favorable

Figure 11. Processing Control

PARAMETERS	WEIGHTING FACTOR	1 STORAGE TUBE LIMITED GRAPHICS	2 BUFFER REFRESH LIMITED GRAPHICS	3 CPU/BUFFER REFRESH LIMITED GRAPHICS	4 UNLIMITED GRAPHICS NO BUFFER	5 UNLIMITED GRAPHICS BUFFER	6 UNLIMITED GRAPHICS CPU BUFFER	7 TV SCAN CONV	8 TV DIGITAL
A. Performance Factors									
1. Screen Size		3	2	2	1	1	1	2	2
2. Brightness		3	1	1	1	1	1	3	1
~~3. Color Capability~~		~~3~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~2~~	~~1~~
~~4. Gray Level~~		~~3~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~2~~	~~2~~
~~5. Light Pen~~		~~3~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~2~~	~~1~~
~~6. Other Input Dev.~~		~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~
7. Line Dwg Capability	4	14	28	28	14	14	14	41	123
~~8. Selective Erase~~		~~3~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~2~~	~~1~~
9. Subjective Pict. Quality	3	13	26	26	13	13	13	93	62
~~10. Dynamic Picture~~		~~3~~	~~2~~	~~1~~	~~1~~	~~2~~	~~1~~	~~2~~	~~2~~
11. Flicker Free Data Content	2	12	36	36	24	24	24	23	23
~~12. Multiple Display/ Single Cont.~~		~~3~~	~~2~~	~~3~~	~~2~~	~~2~~	~~2~~	~~3~~	~~1~~
B. Host Computer Factors									
13. Host Load for Refresh			1	1	3	1	1	1	1
14. Remote Operation			1	1	3	1	1	1	2
15. Stand Alone Cap.		3	2	2	3	3	1	3	3
~~16. Host Load to Support Graphic Manipulation~~		~~3~~	~~2~~	~~1~~	~~3~~	~~2~~	~~1~~	~~3~~	~~3~~
17. Host Load to Support Add'l Packages		3	3	2	3	3	1	3	3
C. Cost Factors									
18. Single CRT Price	4	14	14	14	28	28	312	41	82
~~19. Cost/Channel Multiple Displays~~		~~2~~	~~1~~	~~2~~	~~3~~	~~3~~	~~3~~	~~2~~	~~1~~
		27	34	33	33	29	27	32	40
D. Other 20. 21.									

KEY
1—Most favorable
2—Medium
3—Least favorable

Figure 12. N/C Tape Preparation

Standards and Definitions Committee Report

1972

The main activity of this Committee has been through the EIA in particular JT6.16.10. A Glossary of Terms and Definitions for Industrial Cathode Ray Tubes was developed and has been submitted for letter ballot. This Glossary is printed here for comment, corrections or additions by interested readers. A Standard on Test Methods is next.

The Chairman has also participated in the IEEE Electron Devices Committee which has submitted several LED standards for letter ballot, and is conducting a review of "Methods of Testing Electron Tubes" for possible revision. In addition, contact was made with Mr. Charles Rosenthal, Chairman of the IEEE Computer Society Standards Committee. A number of proposals for joint action were sent to him but there has been no response to date. Further efforts will be made but it is suggested that IEEE Computer Society officers be contacted to expedite this action through some official SID Board resolution.—Sol Sherr, Chairman

Glossary of Terms and Definitions

astigmatism A focus defect in which electrons in different axial planes focus at different axial distances.

available line The portion of the scanning line which can be used specifically for picture signals.

barrel distortion A picture distortion that causes convex sides to appear on a symmetrically disposed rectangle.

beam current The electron current of the beam impinging upon the screen of a cathode-ray tube.

build-up (of luminance) The increase in luminance with time from the initiation of excitation to the point where equilibrium occurs or excitation ceases.

cathode-ray tube An electron beam tube in which the beam can be focused to a desired cross section on a surface and varied in position and intensity to produce a visible or otherwise detectable pattern. Unless otherwise stated the term cathode-ray tube is reserved for devices in which the screen is cathodoluminscent and in which the output information is presented in the form of a pattern of light.

chromatic aberration An enlargement of the focused spot caused by the velocity distribution of electrons throughout the beam.

color Color consists of the characteristics of light by which a human observer may distinguish between two structure-free patches of light of the same size and shape. *Note:* Also refer to JEDEC Publication No. 16B for specification or description of color.

coma A cathode-ray tube image defect that makes the spot on the screen appear comet-shaped when away from the center of the screen.

cone That part of the envelope, usually in the form of a truncated cone, which lies between the neck and faceplate.

deflecting electrodes (deflector plates) The electrods used to produce the electric field for deflection of the electron beam.

deflection Displacement of a beam by an electric or magnetic field.

deflection coefficient (deflection factor) The reciprocal of the deflection sensitivity.

deflection current The current in a deflector coil.

deflection defocusing An enlargement (usually non-uniform) of the spot caused by change of focus of the beam when deflected.

deflection linearity or deflection uniformity factor The factor expressing the linearity or uniformity in deflection.

deflection sensitivity (electric) The quotient of (1) the spot displacement by (2) the change in voltage between the deflector plates for a stated voltage on the final accelerator.

deflection sensitivity (magnetic) The quotient of deflection current in a stated magnetic deflecting system, and for a stated voltage on the final accelerator.

deflection voltage Voltage applied between a pair of deflector plates.

deflection yoke Coils usually mounted externally to the neck of the tube, used to produce the magnetic field for deflection of the electron beam.

deflector plates (deflecting electrodes) The electrodes used to produce the electric field for deflection of the electron beam.

electrical deflection uniformity factor The ratio of (1) the maximum variation in deflection sensitivity to (2) the maximum deflection sensitivity. *Note:* This in fact is a *non-uniformity* factor.

electrical spot displacement Displacement of the spot caused by self-bias resulting from a leakage current or a beam current passing through a resistor in the circuit of a deflector plate.

electric deflection Deflection by an electric field.

electromagnetic lens An electron lens in which the result is obtained by a magnetic field.

electron-beam tube or valve An electron tube or valve in which the performance depends on the formation and control of one or more electron beams.

electron gun A structure comprising a cathode and one or more electrodes for producing an electron beam.

electron lens A structure designed for controlling the cross section of an electron beam.

electrostatic lens An electron lens in which the result is obtained by an electrostatic field.

faceplate A glass plate carrying the luminescent screen and attached to the cone.

flicker The sensation of brightness or color variation, occurring when the frequency of the observed variation is between a few Hz and the flciker fusion frequency of the image.

flicker fusion frequency, fff Flicker fusion frequency is the frequency of intermittent stimulation of the eye at which flicker disappears. It also is called critical fusion frequency (cff) or critical flicker frequency (cff).

fly-back line (retrace line) The line traced by the electron beam in a cathode-ray tube in going from the end of one line or field to the start of the next line or field.

focusing coil A coil used to produce a magnetic field for focusing an electron beam.

focusing electrode An electrode designed to produce an electrostatic field for controlling the cross section of an electron beam.

footlambert, fL The footlambert is a unit of luminance (photometric brightness) equal to (1) the spot displacement by (2) the change in $1/\pi$ candela per square foot, or to the uniform luminance of a perfectly diffusing surface emitting or reflecting light at the rate of one lumen per square foot, or to the average luminance of any surface emitting or reflecting light at that rate. *Note:* The average luminance of any reflecting surface in footlamberts is, therefore, the product of the illumination in footcandles by the luminous reflectance of the surface.

glare Glare is the sensation produced by brightnesses within the visual field that are sufficiently greater than the luminance to which the eyes are adapted to cause annoyance, discomfort, or loss in visual performance and visibility. *Note:* The magnitude of the sensation of glare depends upon such factors as the size, position and luminance of a source, the number of sources and the luminance to which the eyes are adapted.

grid bias The grid bias required to produce a specified value of beam current.

grid cathode driving voltage (modulation voltage) The value of the alternating or pulse voltage which must be applied between the grid and the cathode to increase the beam current or spot luminance from the cut-off value to a stated value.

halation The presence of an illuminated annular area surrounding the spot, caused by reflection of light from the front and rear surfaces of the faceplate.

ion trap A device intended to remove ions from the beam.

luminance (photometric brightness), $L = d^2\Phi / dw(dA \cos \theta) = dI/dA \cos \theta$ Luminance (photometric brightness) in a direction, at a point of the surface of a source, of a receiver, or of any other real or virtual surface is the quotient of the luminous flux leaving, passing through, or arriving at an element of the surface surrounding the point, and propagated in directions defined by an elementary cone containing the given direction, by the product of the solid angle of the cone and the area of the orthogonal projection of the element of the surface on a plane perpendicular to the given direction; or it is the luminous intensity of any surface in a given direction per unit of projected area of the surface as viewed from that direction. *A single unit of luminance, the nit should be used and all others decried. The footlambert should be included as a temporary measure during the change of nomenclature. The test should specify whether a spot, line or raster is used as well as other test parameters.* *Note:* in the defiining equation θ is the angle between the direction of observation and the normal to the surface. In common usage the term brightness usually refers to the intensity of sensation which results from viewing surfaces or spaces from which light comes to the eye. This sensation is determined in part by the definitely measurable luminance (photometric brightness) defined above and in part by conditions of observation such as the state of adaptation of the eye. (See subjective brightness) In much of the literature the term brightness, used alone, refers to both luminance and sensation. The context usually indicates which meaning is intended.

luminance build-up The increase in luminance with time from the initiation of excitation to the point where equilibrium occurs or excitation ceases.

luminance contrast ratio The ratio of the total luminance at any information element to the background or surround luminance. It is given by

$$C_R = \frac{L_1}{L_2}$$

where

L_1 = Total luminance at information element

L_2 = Total background or surround luminance

Note: If the background luminance is greater than the luminance at the information element then L_1 and L_2 should be interchanged.

magnetic deflection Deflection by a magnetic field.

mechanical spot displacement Displacement of the spot with respect to a stated reference point on the screen, with all the deflector plates connected directly to the accelerating anode.

neck The narrow tubular part of the tube envelope near the base.

neck shadow A shadow on the screen caused by interception of all or part of the beam by the neck of the tube.

nit, nt The nit is the unit of luminance (photometric brightness) equal to one candela per square meter. (Conversion: nit x .2919 = fL). *Note:* Candela per square meter is the International System (SI) unit of luminance. The nit is the same recommended by the International Commission on Illumination.

persistence The continuation of luminance or radiance after the excitation has been reduced or removed.

persistence characteristic The relation, usually shown by a graph, between the luminance and the time elapsed after the removal of the excitation.

pin-cushion distortion A picture distortion that causes concave sides to appear on a symmetrically disposed rectangle.

post-deflection acceleration factor The ratio of (1) sensitivity in the presence of post-deflection acceleration to (2) that without post-deflection acceleration.

post-deflection acceleration ratio The ratio of (1) the screen potential to (2) the potential of the last accelerating electrode preceding the deflecting system.

post-deflection accelerator An electrode that accelerates the electrons of the beam after deflection.

radiance, $L = d^2\Phi / dw(dA \cos \theta) = dI/dA \cos \theta$). Radiance in a direction, at a point of the surface of a source, of a receiver, or of any other real or virtual surface is the quotient of the radiant flux leaving, passing through, or arriving at an element of the surface surrounding the point, and propagated in directions defined by an elementary cone containing the given direction, by the product of the solid angle of the cone and the area of the orthogonal projection of the element of the surface on a plane perpendicular to the given direction. *Radiance is the radiometric equivalent of luminance and is preferred for unambiguous measurement.* *Note:* In the defining equation θ is the angle between the normal to the element of the source and the direction of observation.

raster A predetermined pattern of scanning lines which provides substantially uniform coverage of an area.

resolution A measure of the ability to delineate picture detail; also, the smallest discernable or measurable detail in a visual presentation. *Note 1:* Resolution may be stated in terms of modulation transfer function, spot diameter, line width, raster lines, or television lines. *Note 2:* Modulation transfer function is the preferred method.

screen A layer, on the inside of an electron-beam tube, in which the luminescence is produced.

screen aging An area of reduced luminance resulting from the deterioration of the active material on the screen by electron or ion impact.

screen efficiency The ratio of (1) the light or other radiation intensity of an excited area on the screen to (2) the product of beam current and final accelerator voltage.

S-distortion A picture distortion that causes a straight line to take the form of a letter S.

spectral characteristic The relation, usually shown by a graph, between the emitted radiant power per wavelength interval and the wavelength.

spherical aberration A focus defect in which electrons at different radial distances from the axis focus as different axial distances.

spot That small luminescent area of the screen surface instantaneously excited by the impact of the electron beam.

spot distortion Undesirable asymmetry or defect in the spot shape, which may be caused by astigmatism, spherical abberation or coma.

stray emission Uncontrolled emission that causes undesirable luminance on the screen of a cathode-ray tube under cut-off conditions.

subjective brightness Subjective brightness is the subjective attribute of any light sensation giving rise to the percept of luminous intensity, including the whole scale of qualities of being bright, light, brilliant, dim or dark. *Note:* The term brightness often is used when referring to the measurable "photometric brightness." While the context usually makes it clear as to which meaning is intended, the preferable term for the photometric quality is luminance, thus reserving brightness for the objective sensation.

symmetrical deflection In a cathode-ray tube the application to a pair of deflector plates of a voltage in such a manner that at every instant the mean value of the voltage between the plates is equal to the final accelerator voltage.

time of persistence The time which elapses between the instant of removal or reduction of the excitation to the instant at which the luminance or radiance has dropped to a stated fraction of its initial value. Note: The 10% point is commonly used.

trace; line; scan The visible or recordable path traced on the screen by the moving spot.

trapezium distortion A picture distortion that causes a symmetrically disposed rectangle to take the form of a trapezium.

useable screen size The dimensions of the luminescent part of the screen accessible to the electron beam and visible when viewed in the direction perpendicular to the center of the faceplate. ●

Cathode Ray Storage Tube

Modulation Transfer Function of Electrical Output

● The technique described in the paper summarized here accurately determines the Modulation Transfer Function (MTF) of a storage tube as an element in a linear signal processing system. The measurement involves writing a vertical line on the storage target and reading it with a horizontal scan. It is shown that the Fourier transform of the output waveform is the MTF response, and a practical method is given to process the data either manually or through use of a simple computer routine.

by
R. J. Doyle[1]
F. P. Heiman[2]
M. Kerman[3]

This work was supported by Electronic Industries Association under U.S. Navy Contract N00039-69-C-1580

1. CBS Laboratories, Stamford, Connecticut
2. Princeton Electronic Products, North Brunswick, N.J. (Now with Mars Money Systems, Philadelphia, Pa.)
3. Display Systems Engineering, Leonia, N.J.

Introduction

Modulation Transfer Function (MTF) of a storage tube is the function which provides a quantitative measure of the ability of the device to transfer sine wave signal information from its input to its output as a function of spatial frequency. At each spatial frequency, the MTF value is the ratio of output sine wave amplitude to input sine wave amplitude. This function is defined only for linear systems; i.e., where output amplitude is proportional to input amplitude. By common practice the function is normalized to its d.c. or zero spatial frequency value.

When the line spread function technique is used to obtain the MTF, no input video system is required, a point measurement results, and only one simple mathematical conversion is required which can be easily, accurately, and reproducibly performed manually or with a simple computer routine.

Test Method

To obtain a valid MTF measurement, the device must be operated in the linear portion of its input-output transfer characteristic. To insure this condition, a background output signal corresponding to a level approximately half way between cutoff and saturation must be established. This may be achieved by uniformly charging the storage surface down from saturation. The input signal must be a constant amplitude level that produces an output signal which falls within the linear portion of the output characteristics.

In a single cycle, a pattern of one or more widely spaced parallel lines is written at the sweep rate desired.. Then, using an orthogonal read deflection system, the output signal from one line is expanded and displayed on an oscilloscope. From this presentation the following are recorded:

1. The output pulse waveform and the time base of the oscilloscope in microseconds.
2. The read scan length as a fraction of the storage surface reference dimension.
3. The active read scan-line duration in microseconds.

From this recorded data, a table of at least twenty amplitude points from the output pulse, spaced at regular time intervals, is prepared. The end points of the pulse must be zero amplitude but it is not necessary to center the pulse on the abscissa. A convenient time interval between data points (in microseconds), Δt, is selected for this purpose and also recorded on the table.

The MTF is obtained directly by taking the Fourier transform of this output (line spread function) signal.

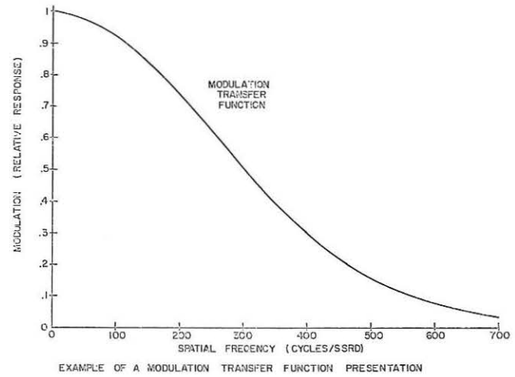
The MTF calculation is performed as follows:

$$MTF_p = \left[\left(\frac{\sum_i Y_i \cos 2\pi V_p X_i}{\sum_i Y_i} \right)^2 + \left(\frac{\sum_i Y_i \sin 2\pi V_p X_i}{\sum_i Y_i} \right)^2 \right]^{1/2}$$

Where:

- p = Spatial frequency in terms of cycles/SSRD for which the Modulation is determined.
- Y_i = The value of the line spread function at point X_i
- V_p = The frequency equivalent of p (cycles/Δt)
- Δt = Time increment between values of X
- X_i = The assigned abscissa interger values of the line spread function

The presentation of the Modulation Transfer Function may be in the form of computer printout or as shown in the Figure.



EXAMPLE OF A MODULATION TRANSFER FUNCTION PRESENTATION

Reference

The full text of the MTF measurement technique summarized here will be published in the 4th Quarter 1972 Proceedings of the SID. The paper includes diagrams and explicit directions on the equipment required and steps necessary to obtain a reliable and accurate measurement. It also includes a sample computer program for making the Fourier calculation as well as typical results. In addition, the paper presents the results of tests performed to establish the sensitivity and reproducibility of the method. ●

By C. MACHOVER
continued from page 17

price and delivery. Several listings of commercially available terminals and their characteristics (References 17-19) are available. Although that final selection procedure is not described in this paper, it is apparent that a method similar to the one discussed could be devised. ●

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Cockpit Displays

Cockpit-mounted display and control equipment for pilot use is part of a Navy contract awarded Philco-Ford, Newport Beach, Cal., for airborne laser target designators and tracking systems.

SC Electronics Inc.

SC Electronics, Inc. of New Brighton, Minn., announces appointment of Harry E. Hansen as Vice President for Manufacturing. The firm manufactures TV monitors and monitor/receivers.

Contributions Invited To The SID Journal

Information display professionals are invited to submit papers for consideration by the Editors and Editorial Board of the SID JOURNAL, the new official publication of the Society for Information Display. In submitting papers, authors should keep in mind the following:

Subject matter may include man-machine interfaces, information theory, operations research analysis, display system design, the physics of display devices and components, display optics, display electro-optics, display storage media, display circuit design, display software; and information processing.

Two copies of the manuscript should be submitted, including: (1) title, (2) author's name, (3) author's home and business address and telephone numbers, (4) abstract, (5) body of the paper including an introduction and conclusion, (6) list of footnotes and references, (7) list of figure captions, (8) figures on individual sheets, (9) tables on individual sheets, (10) author's photograph and biography.

Details of the above are as follows: The abstract should be limited to 150 words and should concisely express the major ideas of the paper. All written material should be typewritten in black, double-spaced on bond paper of letter size. All photographs should be black and white (color should be used only when absolutely necessary), glossy, and at least 4 x 5 inches with lettering that is at least ⅛-inch high (typewritten, Leroy-lettered or equivalent; no handwritten lettering should be used). Clean and clear photographic copies or originals of figures are requested; office copying machine reproductions are not considered adequate. Tables and figures should be adequately explained and understandable without reference to the text. The author's photograph should be black and white glossy. The author's biography should be limited to 150 words and include his education, present position, honors, professional societies, and S.I.D. activities.

Papers may be submitted to: Publications Chairman of S.I.D., 654 N. Sepulveda Blvd., Los Angeles, California 90049.

SID Book Review

Vol. 6 of the Annual Review of Information Science and Technology compiled by the American Society for Information Science, Carlos A. Cuadra, Editor.

To scientificate the collection, organization, storing and dissemination of information in an efficient and economic manner may provide the scientific community with the most challenging task of this century. The American Society for Information Science has accepted the goal to "——investigate the properties and behavior of information, the forces governing the transfer process, and the technology necessary to process information for optimum accessiblity and use." For a myriad of reasons, this young science presently lags far behind all other social and physical sciences.

The publication of this series of Annual Reviews is certainly a monumental step in the right direction. In Volume 6 alone can be found reference to over 1600 recent publications on theory and practice within the information sciences. From an impressive list of contributors comes opinions and conclusions relative to the progress made in their particular fields. Not a textbook, one does not find excessive detail on specific applications nor theoretical quantifiers. Rather, it is specifically oriented to assist those technocrats actively engaged along the frontiers of this young science. The dichotomy to resolve is to properly manage voluminous amounts of information on the subject so that the real problems of managing information can be tackled. This book may be purchased from: Encyclopaedia Britannica, Inc. Britannica Reviews, Dept. D-71, 425 North Michigan Ave., Chicago, Ill. 60611. Price: $17.50.

RON HUNTER

SID New Literature

Off-the-Shelf Lights Described

Off-the-shelf neon, incandescent, and solid-state pilot lights are detailed in a new brochure available from Industrial Devices, Inc. As well as describing stock pilot lights, the brochure explains the relative advantages and operating characteristics of the three types of light. These characteristics include the long life and low power drain of neon and solid state lights, compared with the wide range of voltages and colors for which incandescent lights can be supplied.

Circle #125 on Readers Service Card

Yoke Selection Kit

Deflection Yokes for cathode ray tubes are discussed in this new application and selection kit available from Syntronic Instruments, Inc. Included is an explanation of the most important interacting factors affecting the choice of a yoke and other elements in a display system. Typical Syntronic yokes, focus coils and positioning devices are illustrated. A Yoke Application Check List is supplied as a design aid to help the engineer faced with the problem of selecting the best type of yoke for his electronic display system.

Circle #126 on Readers Service Card

Picture Digitizer

Keyed by a new way to completely digitize continuous-tone grey scale pictures, film, objects (almost any input), the Model 108 Picture Digitizer is the latest picture-processor development from "image experts", Spatial Data Systems, Inc., Goleta, California. The compact, 3-model series is technically described in two new bulletins just published and announced as available upon request.

This new activity is stated to prove invaluable to those engaged in photometry, micrography, spectrography, digital television, pattern recognition, artificial intelligence and photographic densitometry.

Request the two new publications as "System 108/1-17 plus 4."

Circle #127 on Readers Service Card

Picture Processing Systems

The various computerized picture-processing systems on the proprietary products roster at Spatial Data Systems, Inc., Goleta, California, are comparatively presented—pictorially—in a new leaflet just released by this firm. The 2-sides, 1-page publication is available upon request.

The close-look comparison breakdown details Spatial Data's various color densitometers (12- and 32-color); data reduction and analysis system with picture processor and color display; edge enhancer and high-speed picture digitizer. Some are independent units. Others function in combination, for cost and performance advantages. All are depicted with latest "new concept" innovations and features.

Circle #128 on Readers Service Card

Archives Card System Working

The Selective Dissemination of Information Program from Institute for Scientific Information seems to be working out very well. At first I attempted to get copies reproduced and cross reference cards made of all the articles that appeared in our SDI lists, that were in my library collection, but that turned out to be quite a time-consuming job.

Now the procedure is as follows: The title and source of each entry is cut out and pasted on a 3 by 5 card. The subject category and author(s) is typed on the card and it is filed by subject category. The subject category is the computer retrieval term.

The same cards will be made for the earlier lists, so that we will have a complete file by subject of everything that has appeared on our SDI lists.

It would be helpful if someone were appointed in each chapter to forward material to the Archives Chairman as it's generated — Joe Ann Clifton. Archives Chairman.

ITT Display Terminal

Computer display terminal which is said to compare, pricewise, with teletypewriters, now offered by ITT Data Equipment & Systems Division. New unit, titled "Asciscope" Display Terminal, includes display, keyboard, buffer, modem, acoustic coupler, and maintenance, at monthly rate. ITT division points out asserted advantages for "small general-purpose user, district offices or outlying plants of corporations" who, up to now, have used teletypewriter to communicate with computer.

Circle #129 on Readers Service Card

"Spectra"® Pritchard™ Photometer

New "Spectra"® Model 1980 Pritchard™ Photometer is fully described and illustrated in Product Bulletin No. 520 available free from Photo Research, a division of Kollmorgen Corporation. Model is said to feature automatic computed direct digital readout for measurement of luminance, illuminance, radiance, tristimulus colorimetry, polarization, etc., from 0.001″ to infinity, Full-scale sensitivity from 0.00001 to 10,000,000 (10^{-5} to 10^{7}) foot-lamberts, and built-in apertures change the measuring field angle from 2 minutes to 3 degrees.

Circle #130 on Readers Service Card

NEW PRODUCTS

SID SID SID SID

High Resolution Storage Tube

New high resolution storage tube by Thomson-CSF offers resolution exceeding 4,000 lines, with same long storage and fast erasing capabilities of previous "minitubes." The TH 8803 storage tube is a single ended design in a two-inch-diameter Vidicon configuration, that provides a limiting resolution performance of 4300 TV lines per diameter. It can store 16 millions of bits in the digital form, or the equivalent in the full TV gray-scale image form, for more than 20 minutes under continuous readout scanning operation.

Unique feature of the TH 8803 is its fast erasing capability by means of a special gun design (THOMSON-CSF patent). Two TV frames are sufficient to erase the whole surface down to the noise level of a good amplifier. Because the display function is separated from the storage system, the user can selectively edit the stored image or, if he is interested in blow-up, zoom-in on any portion of the image.

The two-inch diameter structured silicon target of the TH 8803 permits a resolution of 2700 TV lines at 50% modulation level. It also permits operation with standard Vidicon hardware, and low voltage levels.

The high performance level reached is said to make the TH 8803 ideal for a number of applications such as buffer memory, high density data storage and retrieval, band-width compression or expansion, and scan conversion.

Circle #102 on Readers Service Card

GE Color Television Projector Unit

General Electric has expanded its line of large-screen video projectors with the addition of Model PJ625, a new high-performance, large screen color television projection unit. Like its counterpart, Model PJ600, the new projector provides color pictures that can be varied from 2 to 20 feet in width. The unit is designed to work from wide-band red, green and blue video signals.

The PJ625 was developed primarily for European and foreign markets and is designed to operate on RGB signal inputs at the frequency of 625 lines/50 fields per second, the European standard.

Both Model PJ625 and Model PJ710, a monochrome version designed to perform to the same European specifications, are the result of G.E.'s continuing response to the needs of its foreign customers.

General Electric's Visual Display Equipment Operation introduced earlier the PJ500 and PJ700 large-screen projectors to meet needs of customers in the United States.

Additional information on the new projectors is available from G.E.'s Visual Display Equipment

Circle #101 on Readers Service Card

Wang Programmable Calculator Told

Until now, according to Wang Laboratories, operating and programming language at the high level of "BASIC", has been available only at terminals of large computers or at terminals of costly mini-computers. Introduction of Model 2200 Advanced Programmable Calculator changes that, claims Wang.

Display via large and easily-read cathode ray tube, presents 16 lines of 64 characters each, enabling the user to view his data input, program steps, and resultant calculations in large and meaningful segments. In addition, when "End Program" is keyed into the system, the display screen instantly indicates the amount of unused memory still available to the user.

Primary elements of the system consist of the Display Unit, the Keyboard, and the Calculator or "Brain". The Keyboard, in addition to providing individual keys for each letter of the alphabet, provides Special Function Keys which can be customized by the user for whatever 32 application functions he desires. Numerically labeled keys are standard as are a complete set of trigonometric, exponential and mathematical functions providing a full 13 digits of accuracy within a broad spectrum of 10^{-99} to 10^{+99} at impressive speeds.

Circle #103 on Readers Service Card

new products

Corrects Flatscreen CRT Distortions

Intech Incorporated announces the A-740 pincushion correction module, a self-contained unit that performs all mathematical operations necessary to correct for pincushion effect seen on cathode ray tubes with flat or semiflat screens. It also is said to correct dynamic focus distortions and other distortions resulting from non-ideal deflection yoke and tube geometries. Correction accuracy is within 99.8 percent, bandwidth is 10MHz and slew rate 40 V/us in both horizontal and vertical axes. An undistorted image is smoothly synthesized throughout the dynamic range, making the A-740 ideal for display, document reproduction or document transmission systems. Typical applications include air traffic control radar displays, computer graphics and time-share terminals, phototypesetters and microfilm recorders.

The plug-in module measures 3.5 x 2.5 x 0.87 inches.

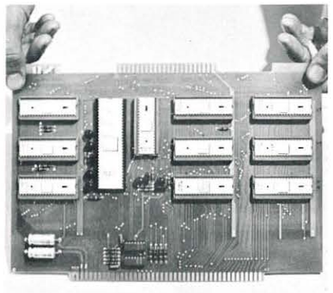
Circle #104 on Readers Service Card

CRT Readout Display

CRT "readout option" is offered users of Tektronix 7000-Series Oscilloscopes, giving alphanumeric display of test parameteres on CRT, along with measured waveform. Users are said to gain operating speed and accuracy in set up, measurement and in CRT photography. Large 8x10 div (1.22 cm/div) CRT has internal graticule, variable illumination, 15kV accelerating voltage. Optional maximum-brightness CRT, with smaller 8x10-cm display and 18 kV voltage, said to afford increased visual brightness and photographic writing speed.

Circle #105 on Readers Service Card

New Information System Told



Four-Phase Systems, the company that introduced the industry's first computer with a solid state memory and large scale integrated CPU, announces a new, more powerful computer in the System IV/70 series.

Intended for distributed processing applications in large organizations, the upward compatible Model 7002 combines up to thirty-two 1152-character video terminals with a general purpose computer having up to 98K bytes of memory. The new processor provides four times the memory and terminal capacity of the earlier Model 7001 and additionally features new high speed commands for decimal arithmetic and data string manipulation that result in a five-times improvement in byte processing speed.

The Model 7002 may be used in both on-line and stand-alone configurations with "savings up to 60% of current lease prices." These savings are made possible through extensive use of advanced semiconductor technology including the industry's first 2048-bit Random Access Memory chips and first 18,000-bit Read Only Memory chips.

The new peripheral family introduced with the Model 7002 includes a 50 million byte Disc File, 1600 bpi Magnetic Tape Drive, high speed Card Reader, Binary Synchronous Communications Controller, and a 1920-character Video Terminal with Selector Light Pen. The system additionally supports all peripherals offered previously by Four-Phase including a selection of printers and a Channel Adapter for local connection to IBM System/360 and 370 mainframes.

For shared processor data entry with magnetic tape output, the system can be operated with all editing and validation features at a moderate rate per terminal per month on a one-year lease. Even greater savings may be realized through the system's ability to combine multiterminal data entry with the functions of the IBM 2780 Remote Batch Terminal, the maker claims.

All lease prices include maintenance, software, systems engineering support, and systems education services.

Circle #106 on Readers Service Card

Compact Recorder

Orion Products Inc. has designed, developed and is delivering a very small tape recorder that is ideally suited for Oceanic and Avionic applications, e.g., low power requirements, small size and weight, long record time—analog and digital, high packing density, wide speed range, shock, vibration and spray resistant.

This recorder gives the project systems designer a definite *step-function advantage* in data acquisition, retrieval and processing that was never available before. Of special interest is the ability of the tape memory to time transform between real and process time, in addition to searching the real time data to a specific point in a few seconds.

Circle #107 on Readers Service Card

Ramtek Graphic Color System

Ramtek Corp. offers GX-200 color graphic display system which uses standard color TV monitors as output devices. GX-200 is completely solid state, raster display system which transforms computer-generated instructions into alphanumeric and graphic picture information. System can be configured in either single terminal 4-color channels or in a clustered configuration with up to sixteen 4-color channels being driven from a single controller with a single computer interface. System is also available in 8-color configurations with clusters up to 8 channels. Standard resolution is 256 elements by 256 lines with special resolutions available upon request. Programming instruction set consists of sixteen 16-bit words. Instruction format has been chosen to ensure ease of programming and minimum data manipulation within the CPU to display any complex picture. The instruction set contains a special color mask instruction that allows the computer to select any of up to 8 colors to be written, and the display device takes care of the considerations of writing the same information into storage for mixing of primary colors to create secondary colors. The system can also be configured using D/A converters on each primary color to create a complete color spectrum.

Circle #108 on Readers Service Card

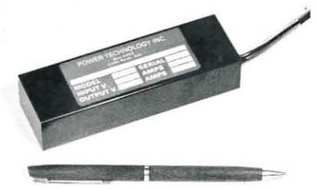
Core Memory System

A low-cost, plug-expandable core memory system with an enlarged word-length and vertical packaging technique has been introduced by Cambridge Memories, Inc.

The new Super ExpandaCore system can be expanded from a minimum of 8,192 words in plug-gable 8K modules up to a maximum of 72K words. Deliveries of the memory system are quoted at 30 days. Cambridge Memories, Inc. is a supplier of a broad range of memory products for the OEM and end-user markets. In addition to its ExpandaCore and Super ExpandaCore systems, the company also manufactures the UniCore-9 core memory system, the MOS-8S semiconductor memory.

Circle #109 on Readers Service Card

Helium Neon Gas Power Source



The Model L23 power supply is a compact, low cost, helium neon gas laser power supply. Switching mode regulation is employed to provide exceptionally high efficiency, while operating from battery voltages of 10 to 17V and supplying 2 to 7MA to the plasma tube with a regulation of $\pm$ 0.1MA. Starting voltage exceeds 10KV. Internal protection prevents damage if battery polarity is accidentally reversed.

Case size is $^{15}/_{16}$" x $1^{7}/_{16}$" x $4^{1}/_{2}$".

Applications include surveying and alignment devices, memory systems, holographic devices, and communication systems. A companion 110V/220V AC converter is available.

Circle #110 on Readers Service Card

Search Service

Plant Engineering Service (PES) rapid-access data storage and retrieval system has been added to the Visual Search Micro Film (VSMF) line by Information Handling Services. PES provides sources for tens-of-thousands of products, and with comprehensive indexing, leads you to the one manufacturer whose product best meets your design needs. It contains more than a half million data pages on such products as electrical, mechanical, safety, environmental, processing, and materials handling equipment.

Circle #111 on Readers Service Card

3D TV Systems

A new four-page illustrated technical paper from Stereotronics Television Co. surveys various three dimensional television systems and describes in particular the Stereotronics System, which optically converts normally flat closed-circuit television to 3D-TV.

Circle #112 on Readers Service Card

new products

Readout Assemblies

The new L-100 series of readout and decoder/driver assemblies by Luminetics are said to be efficient, versatile and cost effective. Readouts (incandescent or LED) and decoder/drivers are plugged into DIP sockets, allowing rapid interchange or repair. The entire P.C. board assembly simply plugs into an edge connector, providing both mounting base and electrical interface.

"Back-to-back" placement of the readouts and decoder/drivers permits a compact configuration. Readouts are mounted on 0.6" centers, while decoder/drivers occupy the same amount of space on the rear of the printed circuit board. Front-to-back dimension (including readout, decoder, two connectors and P.C. board) is less than one inch.

Circle #113 on Readers Service Card

EDP Trainer Kit

A new low-cost training kit for electronic data processing technical personnel has been introduced here by Edsco. The kit is designed to break the EDP training cost barrier.

The new kit, moderately priced, is composed of three audio cassettes and an illustrated text, housed in a vinyl case. The cassettes may be played in any standard equipment, or on a low cost device being offered by the company.

The kit is designed to give the student a competitive edge in today's tight job market. Employers will benefit, it is claimed, through higher staff skills leading to greater return on EDP investment.

Circle #114 on Readers Service Card

Activities SIDSIDSID SIDSIDSID

CALENDAR OF COMING EVENTS

1972

Dec. 5-7	Fall Joint Computer Conference Anaheim, California
Dec. 8	5th Annual SID Technical Conference "SID UPDATE '73" San Diego, Calif.

1973

May 15-17	14th International SID Symposium Statler-Hilton Hotel New York City
June	"National Computer Conference and Exposition" AFIPS New York City
Fall	6th Annual SID Technical Conference

1974

May 21-23	15th International SID Symposium Town & Country Hotel San Diego, Calif.
Fall	7th Annual SID Technical Conference

Advertisers Index

SID Operations Constitute A "Small Business"

Most members of the Society know that it is a largely volunteer and non-profit technical society which produces several publications and which runs two national and many technical meetings each year.

They do not know that it is in effect a small company, incorporated under the laws of the State of California, and that the Directors elected by the membership run the Society through periodic meetings and through an Executive Committee. The Treasurer administers a budget of approximately $50,000 per year. The Society on occasion retains lawyers, accountants, and other professionals to help its operation. The Society is currently engaged in several legal contests relating to earlier publication activities. Most of the work of the Board of Directors is relatively unsung and unappreciated by the average member.

— E. A. Ulbrich, Secretary

IDC Promotes Breyer

"Responding to the vastly increased information requirements of computer industry participants," International Data Corporation has promoted John P. Breyer to the newly-created position of Executive Vice President. Breyer will be responsible for directing IDC's overall activities relating to professional services for the computer industry, with particular emphasis on expanding the scope of IDC's business planning support services to meet the increased demands of our client base. These professional services will additionally include custom market research projects, product planning support, and other industry-oriented research projects. He will also direct the company's U.S. and International marketing operations.

SID Sustaining Members

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Lexington, Massachusetts 02173

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WEAPONS RESEARCH ESTABLISHMENT
Stores & Transport Branch
Department of Supply
Pennington, South Australia 5013

XEROX DATA SYSTEMS
El Segundo, California 90245

AFIPS Changes To One Annual Meet

This annual report will cover the last two Board of Directors Meetings of AFIPS. A number of significant items were debated and discussed during these meetings. They are: (a) location of the national headquarters: (b) a replacement of the Executive Director (Gilchrist); (c) the Spring and Fall Computer Conferences; and (d) membership application of AEDS, SIAM and ISA.

With respect to (a), since the computer industry is coming under closer scrutiny and possible control by the Government, it was felt that consideration should be given to the location of the headquarters in Washington (to be nearer the action). It was expected that moving the office from its present location in Montvale to Washington would involve approximately $100,000 and since the total dollar volume from the computer conferences (and thereby profits) has been continually declining, it was felt that this was not a judicious move at this time and that not enough was to be gained to offset the expenditure of $100,000. This item was left open for future discussions.

Regarding (b) above, under the terms of the contract with Dr. Gilchrist, a replacement will be required during 1973. A Screening Committee was set up to seek out a number of candidates for this position. Hopefully a candidate should be selected in early 1973 to allow at least three months overlap with Dr. Gilchrist. The activities of this group will be handled via mail channels to the Board members for their approval.

With respect to (c), as indicated earlier, the net income from the conferences has been declining. It was also apparent that the format of the conferences needed to be realigned to more adequately respond to the needs of a computer group. A special industry advisory committee was established and, working with the Executive Committee of AFIPS, has suggested that consideration be given to a single conference per year, supplemented by regional meetings throughout the country. A single conference would take on the guise of "National Computer Week," which would be oriented more to user problems and needs, and less to the gratification of academicians. Since the Board had not received complete data, the data must be supplied by mid-July (for timing purposes) to allow for the planning of the Spring and Fall Computer Conferences for 1973 (if they are to continue). A special meeting may be necessary to assess the effectiveness of this idea.

— William P. Bethke, Inter-Society Chairman

'Keys to Survival' In Alphanumerics

Mr. Glenn E. Dawson, President of Alltech Computer Systems, announced availability of the Alltech Industry Analysis "Keys to Survival, Alphanumeric (CRT) Display Field", a report which gives detailed forecasts of AN display shipments as well as analyses of the growing markets. "But the unique part of the report is that it discusses how companies can survive, grow and succeed in the AN display field as part of the computer industry", said Mr. Dawson. The 108 page report contains extensive discussions of markets, marketing strategies and business planning methods applicable to AN display suppliers.

The five-year forecasts begin with estimates of the present world-wide installed base of some 200,000 units subdivided by major suppliers and market segments. The forecasts conclude with a year-end 1976 installed base of some 1,000,000 units. These are subdivided by industries and applications, showing particular growth areas over the five years. The total five-year shipments are estimated to have a value of $1.7 billion.

The report is now available for a price from: Alltech Computer Systems, Inc., 5434 King Avenue, Pennsauken, New Jersey 08109.

Communications to the Editor, SID Journal, should be addressed to him, c/o SID Journal, 1605 Cahuenga Blvd., Los Angeles, Cal. 90028.

Rail Rapid Transit Control Console

Flashing lights represent gleaming rails and rolling stock as this computer console directs switching, inventory and communications at the newly opened Bay Area Rapid Transit (BART) District's principal train repair and storage facility. The fully-computerized control system for BART's Southern Alameda Yard at Hayward, Calif., was built by Philco-Ford Corporation's Western Development Laboratories Division in Palo Alto. With the flip of a switch, BART personnel can inform the computer of a desired route to guide a train between storage, repair barn or main line tracks. Designed for maximum safety as well as flexibility, the computer first checks to insure the route is unoccupied, then automatically performs the necessary switching and initiates safeguards to keep other trains off the route until it is again clear. In addition to guiding trains through the Yard's complex switch matrix, the system keeps track of all rolling stock in the Yard—moving or on numerous storage tracks—and displays locations on both the console and a separate monitor used for making up trains. It also governs the facility's entire communication system. Pictured are BART'S Richard J. Osanna (seated) and Philco-Ford program manager John W. Somers.

Prices Cut for Numeric Displays

Litronix, Inc., has cut prices sharply on its LED four digit numeric display, Data Lit 34 and on its LED 5 x 7 dot matrix alpha numeric display, Data Lit 57. The DL-34 is a four digit array of seven segment LED displays. The four digits are mounted in a standard 14 pin DIP package. It has 0.125 inch character height and exhibits four times the light emitting area as the MAN-A3. The DL-34 has a brightness of 200 foot Lamberts at 5mA.

Data Lit 57 now sells for $11.00 versus $13 in quantities of 100 to 999, a 15% reduction. For quantities of 1000 and up, the new price is $10.00 compared to $11.00.

The DL-57 is a 35-LED alpha-numeric display with a decimal point. It displays all 64 ASCII characters, mounted in a standard 14 pin DIP package. The diodes produce an output of 300 foot Lamberts at 10mA per diode on a 1.7 volt supply.

DL-57 applications include keyboard verifiers, film annotation and computer peripheral equipment. It is particularly suited for avionics because the solid state display is highly shock resistant and has a tested long life.

Both DL-34 and DL-57 are immediately available from all Litronix stocking distributors.

Litronix, 19000 Homestead Road, Cupertino, California 95014.

New Laboratory Opened:Datacom

Establishment of American DataCom laboratory, 1275 Bloomfield Ave., (Bldg. 27), Fairfield, N.J. 07006, has been announced by Ames F. Giordano, President. The laboratory will specialize in the design, development, and fabrication of electronic data processing and display, and communications equipment as required by the customer. A prime area of specialization is design and application of ministorage tube electronic scan converter systems.

American DataCom intends to serve the medical, scientific, industrial, computer, educational, and communications fields with ELECTRONIC SCAN CONVERTERS plus interfacing electronics for EKG display, X-ray imaging, ultrasonic scan display, TV microscope imaging, low-level video signal intergration, in-process product inspection and flow monitoring, computer graphics, computer gray-scale imaging, library information retrieval, cable-TV terminal, and slow-scan systems.

The new silicon targe ministorage tube memory is the heart of the Electronic Scan Converter which makes the above applications possible and others which are unfolding in this new field.

CALL FOR PAPERS

A call for papers for the 14th annual International SID Symposium has been issued. More details in next issue of SID Journal. Send abstracts to Society for Information Display, 654 N. Sepulveda Blvd., Los Angeles, Cal. 90049.