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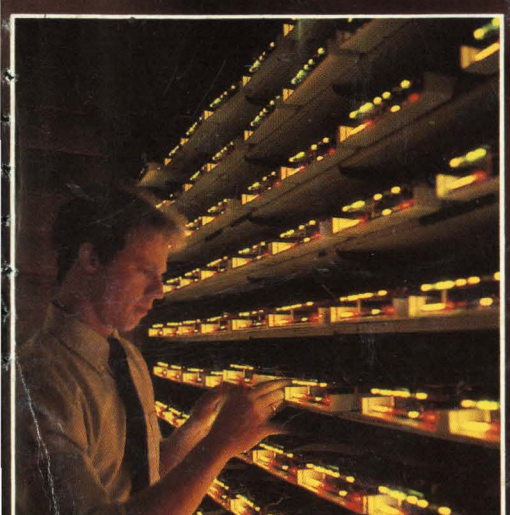
Digital Design



Modem Market Sparks Innovation

- Designers Guide - 488 Bus
- Software Strategies
- Graphics Labs
- Micros/CAD
- Disk Drives

COMPUTERS/SYSTEMS · PERIPHERALS · COMPONENTS · 1/84

VOL. 14
NO. 1

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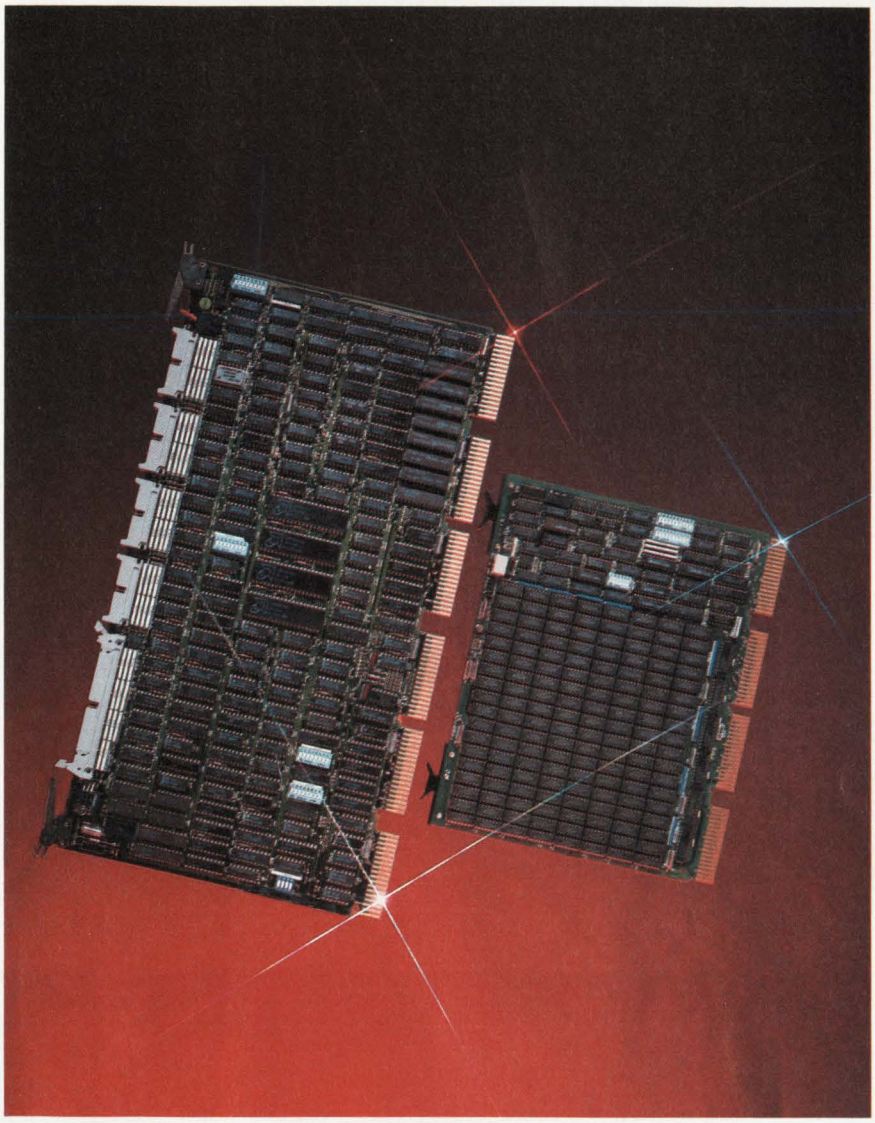

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*Based on U.S. Domestic Prices

Typical performance examples of geophysical, medical imaging and signal/image processing applications.

Application Example	AP-120B	FPS-5410	5420	5430
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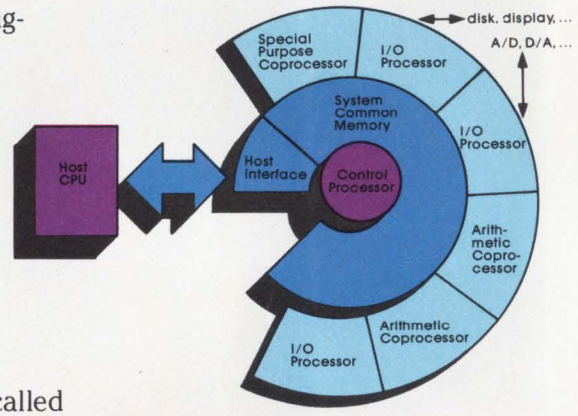
2. Tomography Preprocessing	60 sec.	25 sec.	16 sec.	12 sec.
3. Multispectral Image Classification (512 x 512 pixels 8 Bands, 4 classes)	49 sec.	25 sec.	13.3 sec.	10.5 sec.
4. 2D FFT (512 x 512 complex)	3.4 sec.	1.4 sec.	.7 sec.	.5 sec.
5. Matrix Multiply (100 x 100)	439 msec.	177 msec.	96 msec.	71 msec.

Based upon specifications subject to change.

Distributed processing architecture

The FPS-5000 Series is a distributed processing system that maximizes throughput by allocating the computational load to a set of high-performance, independent, floating-point processing elements called Arithmetic Coprocessors. Data flow is simultaneously managed

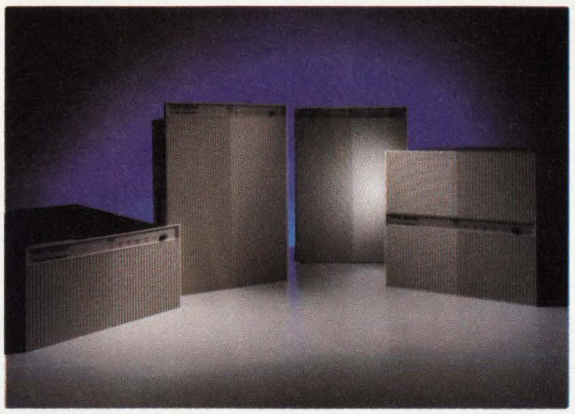
FPS-5000 Series Architecture



introduces the first the $2,000/MFLOP barrier.

by a combination of independent I/O Processors and the central Control Processor.

Each Arithmetic Coprocessor, with synchronous architecture to allow simple application debugging, functions as a self-contained unit.



The new Multiple Array Processor Execution Language (MAXL), based upon FORTRAN 77, allows the user to construct an integrated system environment which can be tuned to application requirements.

Increased performance can be achieved by adding Arithmetic Coprocessors as a field-installable upgrade as the user's requirements evolve.

Compatibility

The FPS-5000 Series maintains software compatibility with previous FPS 38-bit processors and is supported on a range of host computers. Thus, the extensive software support developed for FPS-100 and AP-120B products is maintained and users are able to move existing applications onto the FPS-5000 Series with minimal effort.

Quality and Reliability

The FPS-5000 Series was designed and built with the same quality standards inherent in all of the previous Floating Point Systems products—standards that have earned those products a reputation for unprecedented reliability and one of the best meantime between failure (MTBF) rates in the industry.

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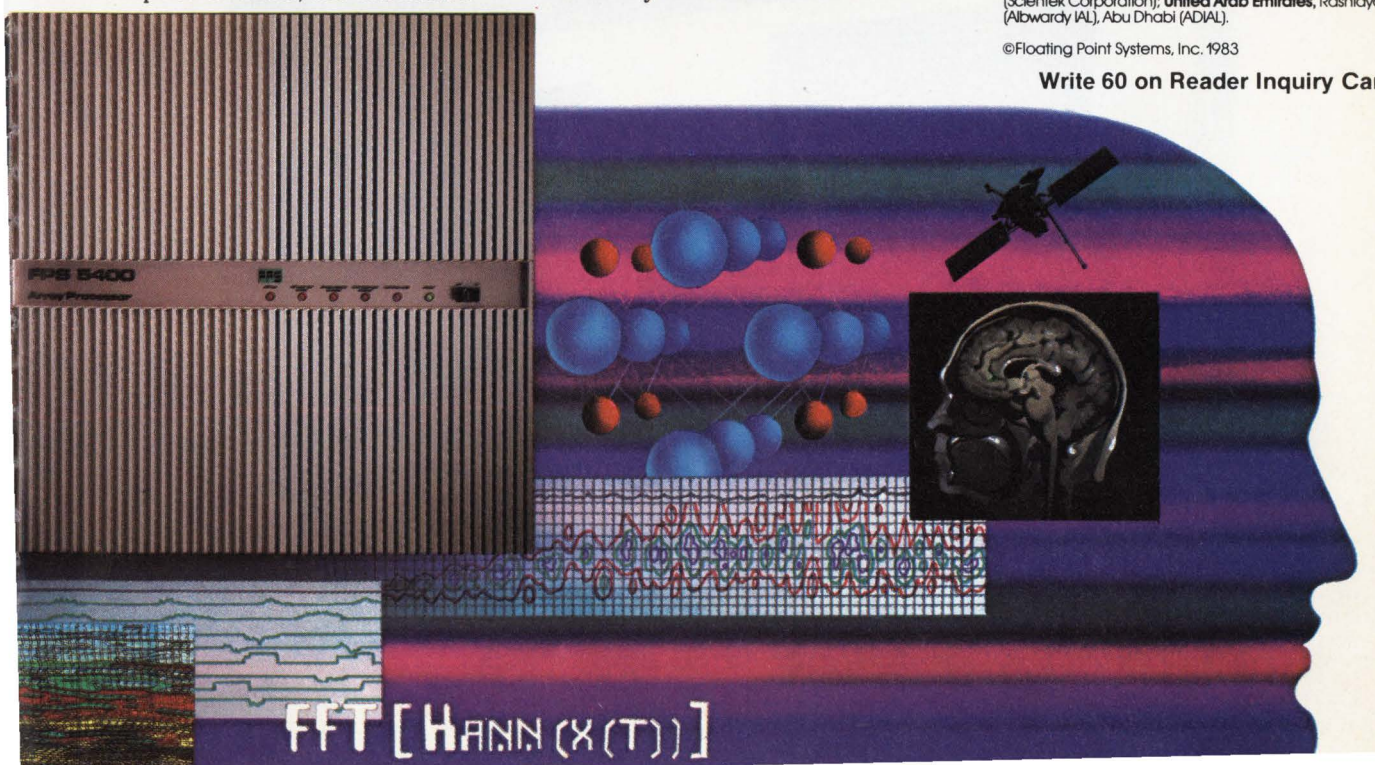

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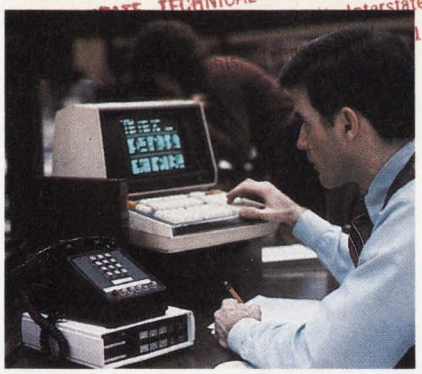

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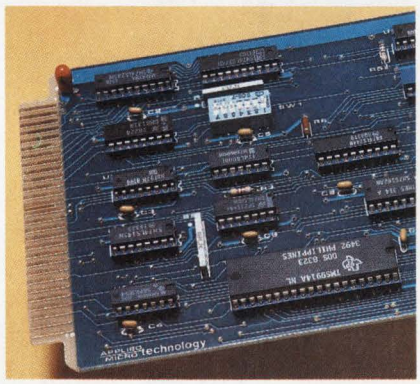

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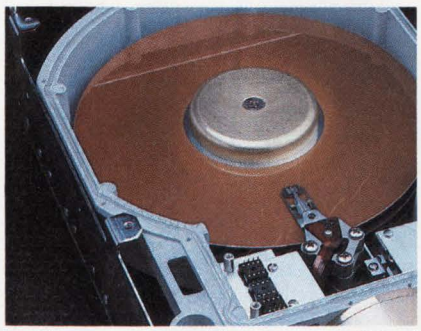

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Cover

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COMPUTERS/SYSTEMS

Designer's Guide To The IEEE 488 Bus: New Life For An Old Workhorse 53

The flexibility of the bus is no longer important solely for the test and instrumentation engineer, but has found wider applications that will also impact the systems integrator.

Graphics Research Points Toward Fifth Generation Systems 68

Different applications of graphics have individual requirements which create disparate design approaches.

Microcomputer-Based CAD Provides Low Cost Design Tools 74

As systems for computer support of engineering functions have become increasingly complex the efforts of small groups of engineers in developing new products and companies continues.

1982-1983 Index 82

A complete listing of articles published in *Digital Design* during 1982 and 1983.

Software Strategies Control Micro Market 90

Recent continuing developments strongly suggest that neither the products nor the technologies on which they're based are close to topping out.

Graphics System Design 36

Photo-Quality Graphics System For Engineering, Scientific Applications

PERIPHERALS

Industry Review: Widening Communications Environments Spark Innovation in Modems 40

This mature field is probably in for a shakeout, but the growth and good sales are that of a dynamic industry.

Mid-Size Winchesters Succeed Quietly 62

Despite the popularity of 5.25″ micro-Winchester disk drives, 8″ and 14″ drives continue to outsell 5.25″ drives.

Graphics System Design 39

Polaroid's Digital Photography Enhances Videoprinter Technology

Innovative Design 96

Hand-Held Terminal Provides Easy Maintenance

COMPONENTS

The Design Of A High Performance Multibus Memory Board 78

Fast logic circuitry and a discrete logic RAM controller contribute to speed.

Graphics System Design 38

Workstation's Tiling Engine Is Multibus-Based

Innovative Design 96

A Software Approach To Programming Memories And Logic

Application Notebook 105

16-Bit CMOS ADC Sidesteps Traditional Performance Trade-Off

Editor's Comment 14
News Update 20
Washington Report 24
Technology Trends 26
Market Trends 32
Product Index 98
Reader Service 99
Application Notebook 105
New Products 108
New Literature 116
Calendar 118
Advertiser Index 118

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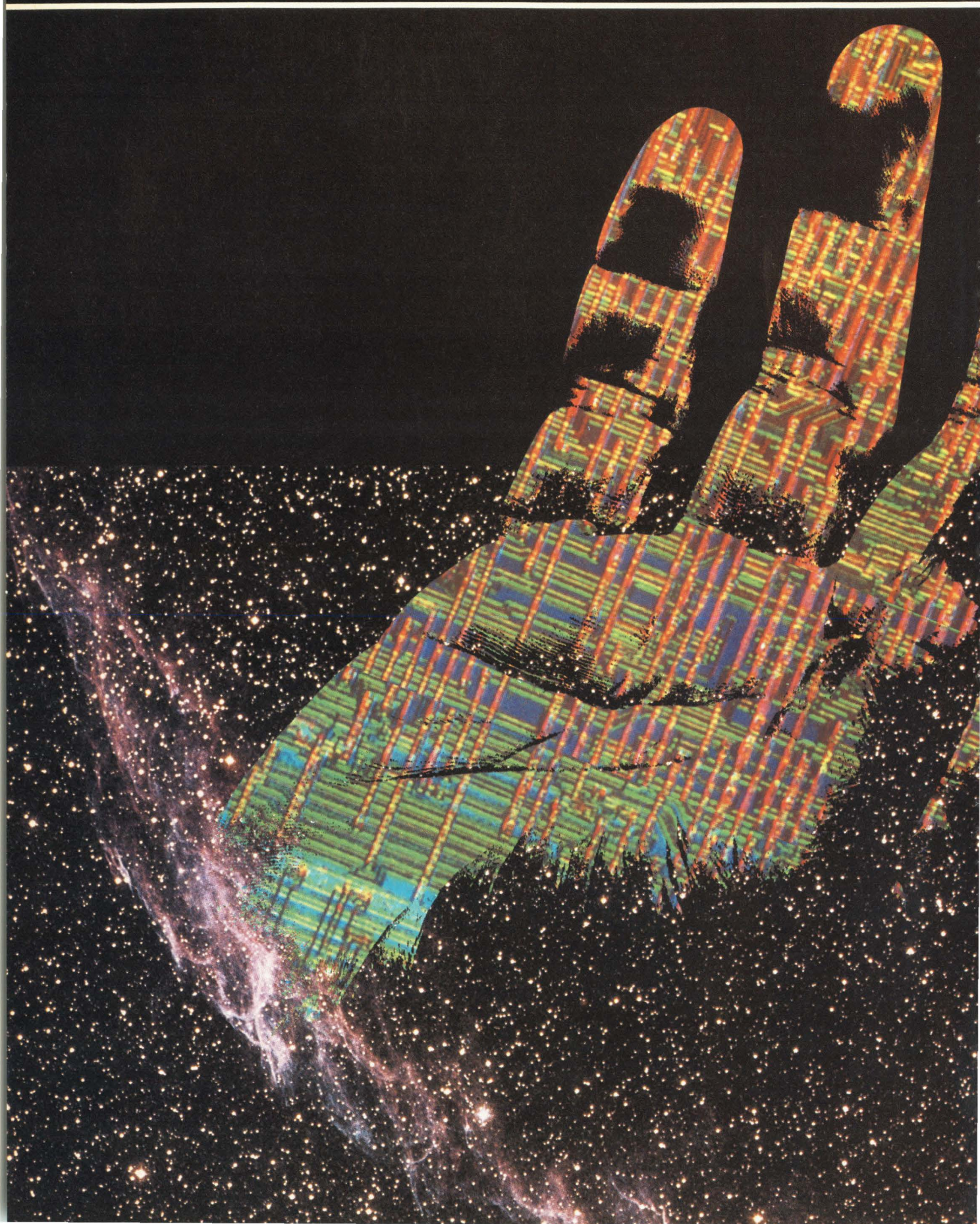
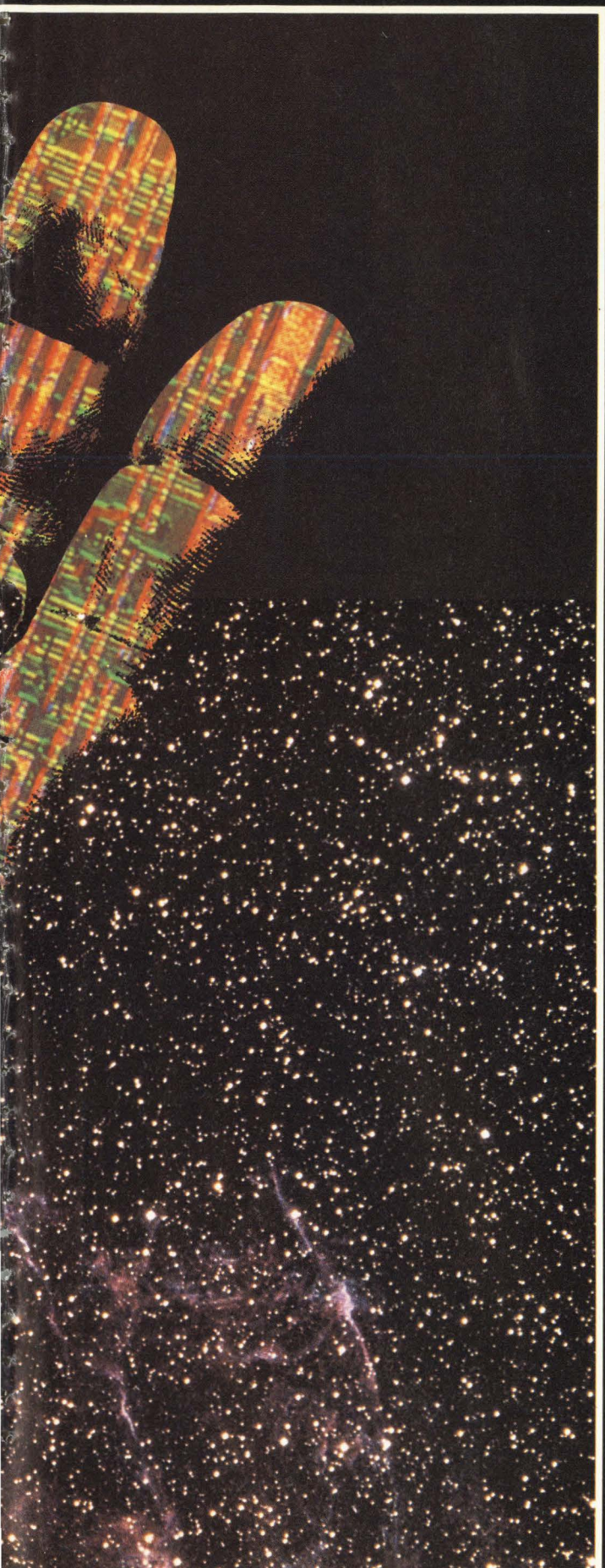


do we go from here?



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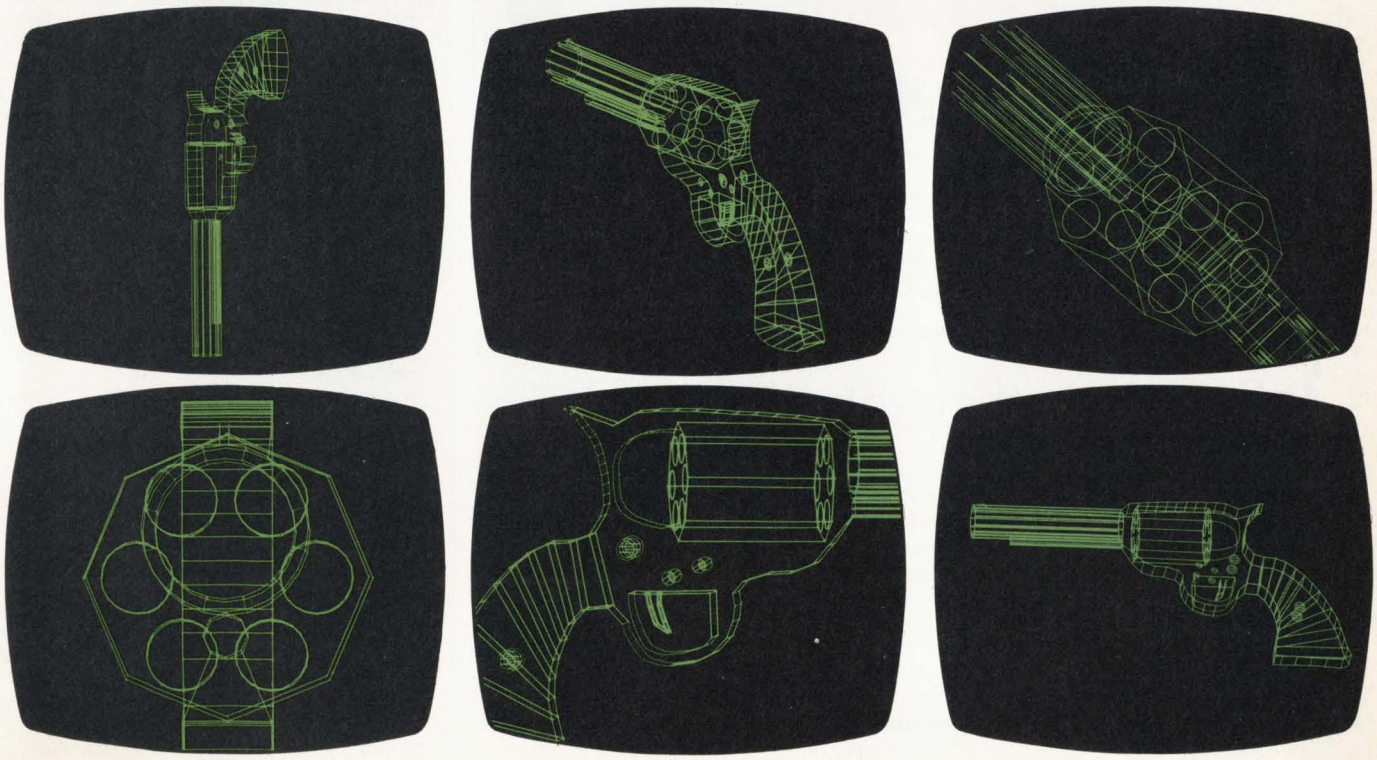

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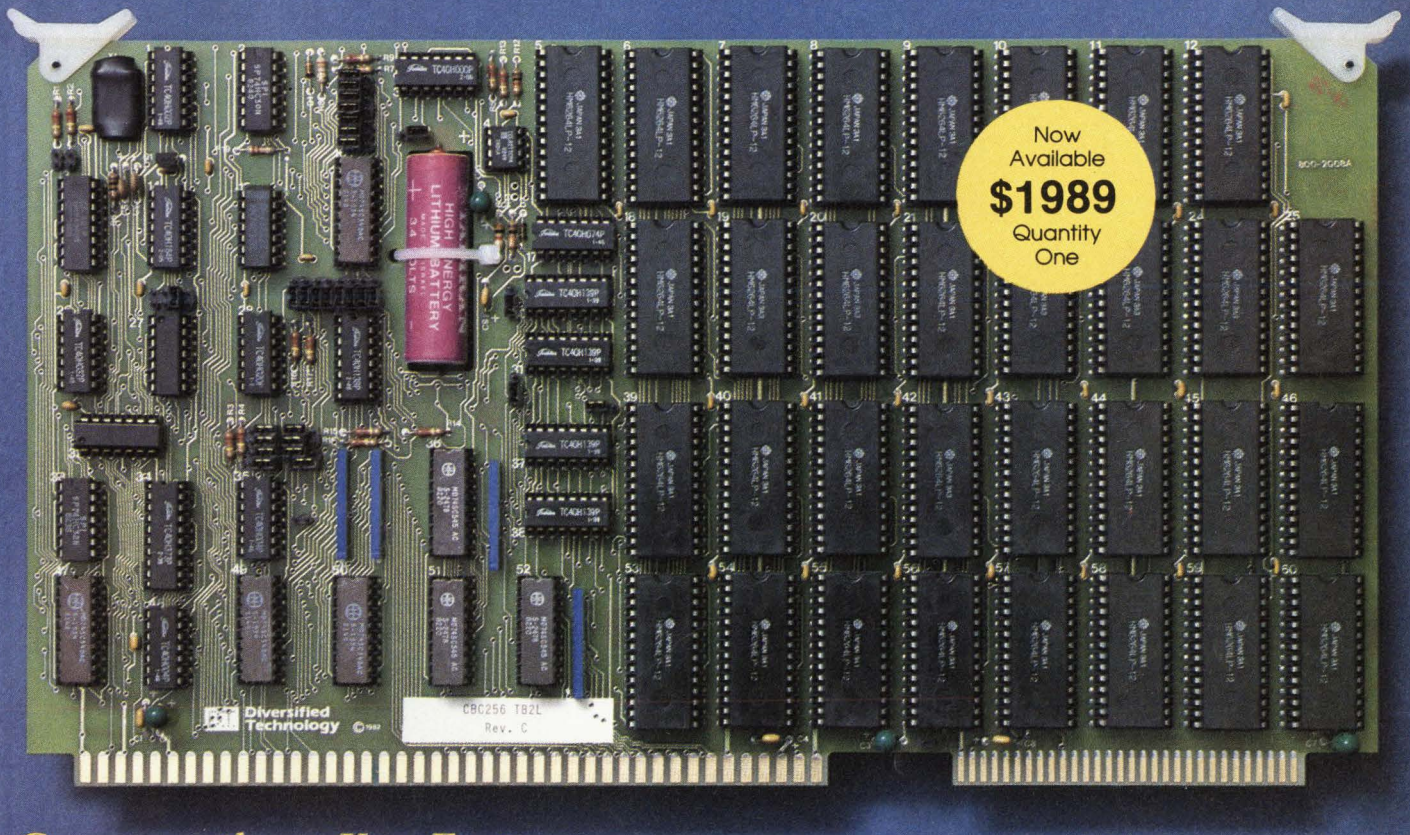

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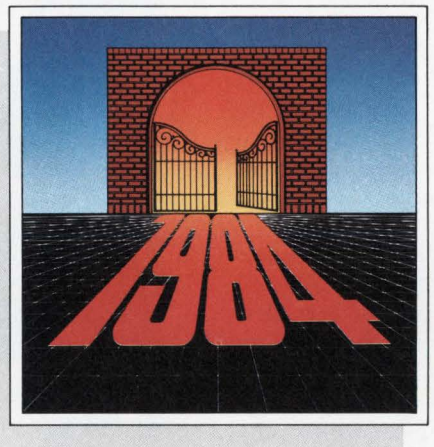
The Crowning of Miss Universal Semiconductor 1984 Launches a Banner Year For CMOS Gate Array Innovations!



Last year, we surprised the Industry by innovating the first annual beauty pageant sponsored by a semiconductor company. This year, Miss Universal Semiconductor's coronation marks 1984 as the year for unparalleled innovation in the field of high-performance CMOS gate arrays and CAD design techniques. Here's a preview of the current and planned innovations you can expect from Universal.

The UNICAD™-I Gate Array Design Station—With the UNICAD-I software system, your IBM personal computer becomes a fully functional interactive gate array design terminal. You'll design and capture your circuit using schematic graphics supported by our fully characterized CMOS macrocell library. Then, the system will generate a net list and you'll simulate your logic and verify your timing via a telecommunications link with our powerful mainframe "computer farm." Once verified, we'll take over and deliver tested prototypes of your circuit within four weeks. UNICAD-I is incredibly cost effective. For a capital investment of $12,000 or less, you can interface directly with a multimillion-dollar CAD and wafer fab facility. **Available now.**

The ISO 3/5I Mini-Array—The ISO 3/5I is 180 gates of high-speed performance. It's perfectly sized to consolidate the "glue" random logic that's consuming precious space on your printed circuit board. Also, it's an ideal array to convert the PALs you use for prototypes to cost-conscious, production-minded gate arrays. The ISO 3/5I gives you the cost advantages of a full custom IC with the fast response of a gate array. **Available now.**

The ISO 3/5H Maxi-Array—The ISO 3/5H is a performance blockbuster with 2400 gates and 100 bonding pads. Chances are you'll be able to consolidate an entire large circuit board of power-hungry TTL logic on this array. Think of the heat you'll eliminate by converting to cool silicon gate CMOS. And you won't sacrifice performance either. The ISO 3/5H is available on five micron technology for speeds up to 12 MHz and three micron technology for speeds beyond. **Available now.**

The ISO-2 Array Series—This is a continuation of our popular ISO 3/5 family of products. However, we've switched from a p-well to an n-well process and shrunk the polysilicon from three to two microns. The result? About 40% improved speed performance compared to the ISO-3 series. That means you'll be able to coolly and comfortably toggle up to frequencies of around 50 MHz. The ISO-2 series will be offered in nine configurations conveniently sized between 180 and 2400 gates. **Available March, 1984.**

UNICAD-II Software—Ever wish you had a Boolean conversion program to transform your truth tables, flow diagrams, logic equations, timing diagrams, or don't-care conditions directly to logic diagrams? Soon, if you have an IBM personal computer and the UNICAD-II software package, you'll be able to do it. Think of the time and drudgery you'll save. And, if you have UNICAD-I, you'll convert that logic diagram to tested silicon in record-breaking time. It's another innovation to help you hit those fast-breaking market windows. **Available June, 1984.**

UNICAD-III Software—PALs may be palatable in prototypes but they can be pesky in production. Of course, they're expensive. But some people feel they also lack long-term reliability, especially in high-volume production. Soon, if you have an IBM personal computer and UNICAD-III software, you'll be able to convert your PALs to reliable, cost-effective gate arrays and still meet your production deadlines. Maybe, in the long run, your best PAL will be Universal. **Available July, 1984.**

On Innovation—We're committed to CMOS gate arrays. We don't make ROMs, RAMs, microprocessors, or bubble memories. We're dedicated to expanding the applications for gate arrays through continuous innovation in products and design techniques. If there's something you want to do with an array and are currently unable to do it, give us a call. Chances are it's in our development plans.

Call for More Information—Give us a call at 408-279-2830 for more information on our latest innovations. We'll answer your questions and send complete technical specifications. Also, we'll send you a poster of Miss Universal Semiconductor 1984, suitable for mounting and framing.

UNIVERSAL SEMICONDUCTOR INC.

1925 Zanker Road, San Jose, California 95112. 408-279-2830

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EDITOR'S COMMENT

Among recent trade shows, last December's Comdex was the most demonstrative of the changes occurring in the computer and electronics industry. During the course of that event several supporters of this magazine raised the question of why *Digital Design* would attend a show ostensibly aimed at Independent Sales Organizations. The answer is twofold. First, while the conference portion of Comdex adheres to its organizers' ISO orientation, the conference exhibition has taken on a life of its own, as witnessed by attending vendors. On the exhibit floor are producers of peripheral controllers, card cages and assemblies, communications products, bus related products, peripherals, software, and systems. More than one attendee has noted the similarity between NCC and Comdex, but on the "small systems" level.

Secondly, the announcements released at Comdex relate to the central theme of this magazine — design. During the last 13 years *Digital Design* has sought to provide its readers with information about the design of some aspect of computer and electronic equipment. The focus of this approach has varied under different editorial philosophies, covering, for instance, peripherals, components, and more recently returning to a broad coverage of design.

Our editorial, however, has continued to examine issues important in engineering and design. At least part of this effort is directed towards innovative work by designers that covers the disparate application interests of our readers. Another aspect of our coverage has been examining how existing or new technology is integrated into systems.

During the last year and a half we have continued in all of this with one significant difference—the approach. Unlike in past years, we have made an effort to move towards an evaluative style of editorial as opposed to the contributed approach of most other magazines. We have done so in order to distinguish this magazine from a rapidly growing number of publications, but also because of several basic shifts in the process of design. We feel that this is at least partly reflected in the events of the last Comdex conference and exhibition which had over 80,000 attendees and several hundred exhibits.

A concise description of my perception of this shift is that the design of systems, peripherals, and components, which are a part of this magazine's coverage, is today more dependent upon how different components are integrated rather than how each part is designed. Recent activities in the marketplace, perhaps best illustrated by IBM's adoption of second party technology, have indicated that an increasingly complex range of components for systems require manufacturers to specialize. On the other hand, we see designers being given more design flexibility in silicon with new custom and semi-custom design techniques.

To the inevitable question of whether *Digital Design* will focus on the electrical or mechanical aspects of design, the answer is that the question is misdirected. To remain a magazine of design, we must deal with both. Furthermore, we must make a choice in order to successfully achieve editorial excellence: either becoming a journal of vertical specialization with the processes of design; or of remaining a forum for engineering management that provides a tool by performing not merely the collation of information, but analysis, in order to assist in the designer's day to day work.

James Warner, President, Precision Visuals and Jerry Borrell

You will for these reasons see articles in *Digital Design* that examine VLSI design techniques, the integration of peripherals into systems, and informal discussions about the growth of standards for various aspects of design.

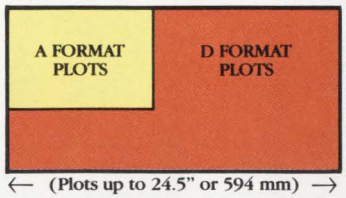
In all fairness, other trade journals also see this shift and are attempting to secure their market position through a vacillating editorial approach which differs with succeeding issues. Our efforts during this editorial calendar year will be to continue our work with industry to insure that our staff is aware of events impacting computers and electronics. The great difficulty is in remaining informed on a broad field of design issues and in retaining the above mentioned approach while providing our readers with an appreciation for the changes that we perceive. Towards this end, *Digital Design* will make several important announcements in the February issue.

Best Wishes for the New Year from all of us at *Digital Design.*

Jerry Borrell
Editor-in-Chief

At last. A plotter designed to run both cut sheet and roll media.

The most flexible "D" format 8-pen plotter ever.



↑ Plot lengths up to 170 feet using continuous feed roll media. ↓

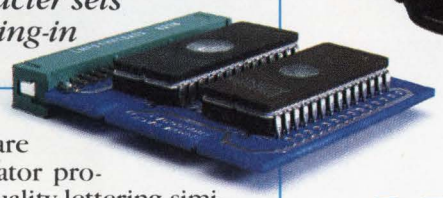
← (Plots up to 24.5" or 594 mm) →

Now you can create virtually any size plots you want up to 24.5" wide, including ANSI sizes A-D and ISO sizes A4-A1, on cut sheet or roll media. Use standard bond paper, glossy bond, vellum, clear film or mylar.

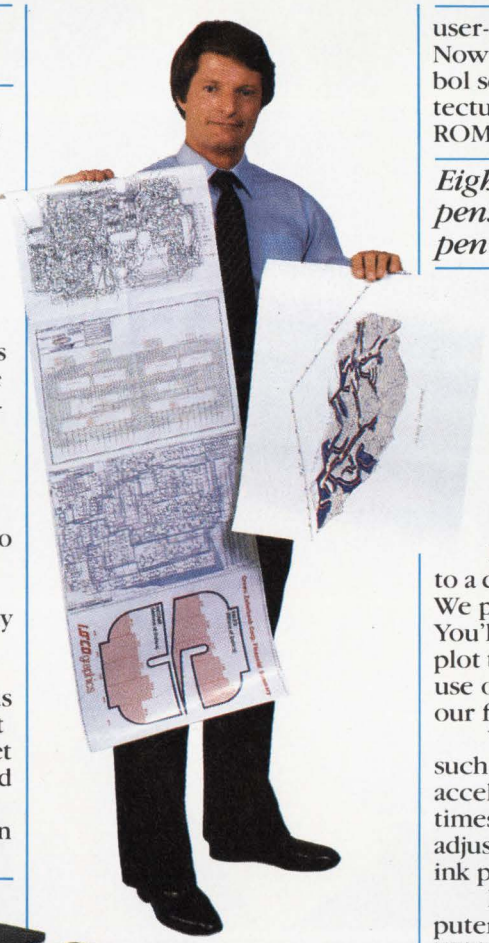
Run dozens of entirely different plots automatically thanks to a built-in microcomputer that can be pre-programmed to plot on roll media up to 170 feet. Then quickly switch to cut sheet plotting – great for your pre-printed forms. The ZETA 822 is the only plotter that can do both.

Best of all, we've got line quality and throughput at a price that makes us the cost-effective choice for just about anybody's plotter applications. You'll get vector independent speed of 25 ips. And 2 g acceleration insures the plotter reaches top speed fast. With resolution of one-one thousandth's of an inch.

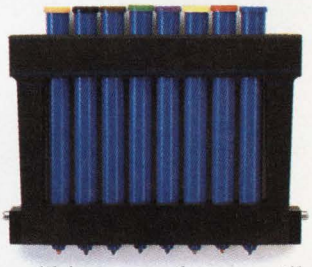
Change character sets just by plugging-in a ROM chip.



Our firmware character generator produces typeset quality lettering similar to the popular Helvetica font with user-controlled proportional spacing. Now you can add special character symbol sets for both engineering and architecture simply by plugging in a new ROM chip.



Eight color, carriage-mounted pens eliminate time-consuming pen changes.



Incredibly, some plotters still grind to a dead stop to change pens. Not ours. We put all eight pens on the carriage. You'll be amazed at what that does for plot throughput. And when you want to use our liquid ink option, just snap in our four-pen cartridge.

You have total user control over such variables as speed, pen pressure, acceleration and pen up/down delay times. Touch controls automatically adjust the ZETA 822 for perfect liquid ink plots.

Naturally, we support most computer protocols. And you can use the ZETA 822 on-line, off-line or remotely via RS 232C or IEEE 488 interfaces.

Call (415) 671-0600. Or write: Nicolet Zeta Corporation, 2300 Stanwell Drive, Concord, CA 94520 TWX 910-481-5951

Nicolet

See us at ADCON, Booth 510 - 512

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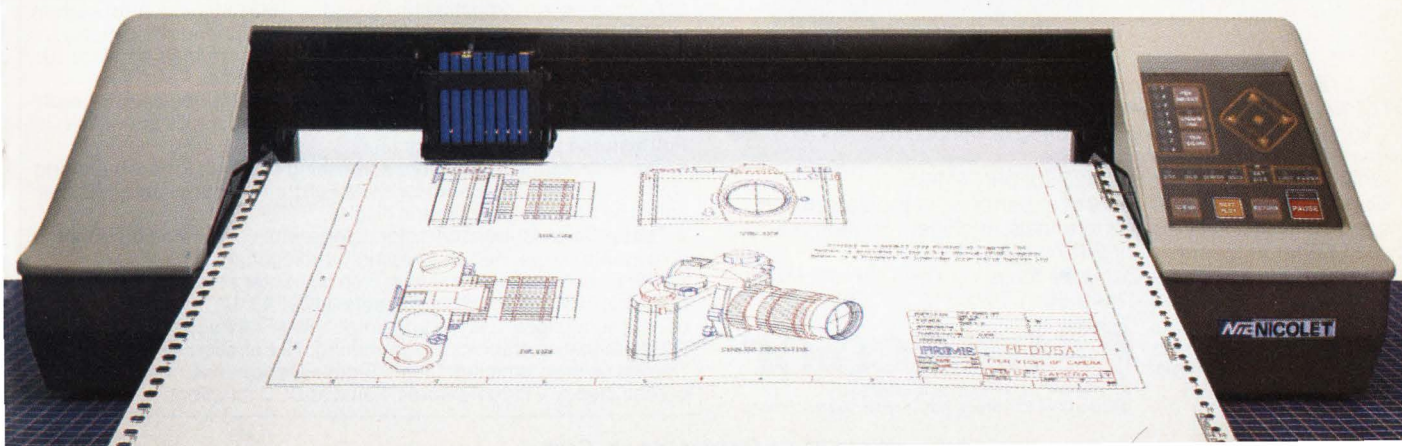


Do these tough demands blow your graphics apart?

1. Power & speed!

Dual processor power.
Rapid area fill and draw.

2. Simplicity & compatibility.

ANSI X3.64. TEK 4010, 4014 and 4027 compatible.

3. Full featured graphics.

Host graphics support and terminal primitives.

4. Dot addressability.

Vector drawing and point plotting.

5. Brilliant raster color.

64 color palette.

6. Affordability.

$1995*

PRICE/PERFORMANCE BREAKTHROUGH! The new Intecolor 2427 advanced graphics terminal puts the pieces together.

Even managers explode, evaluating terminals to satisfy *all these demands.* And at a reasonable price.

Solution: Try the Intecolor 2427, for only $1995.

Capitalizing on over 10 years of experience in the design and manufacture of color graphics terminals, Intelligent Systems has put it all together in the Intecolor 2427.

Check out the features. Compare the price. Then contact Marketing Communications at 404/449-5961. TWX 810 766 1581.

*Single-evaluation unit. U.S. domestic only. To evaluate the 2427 at this 100-piece price, your order must be received by 3/31/84. Single piece price is $2695.

Intecolor®

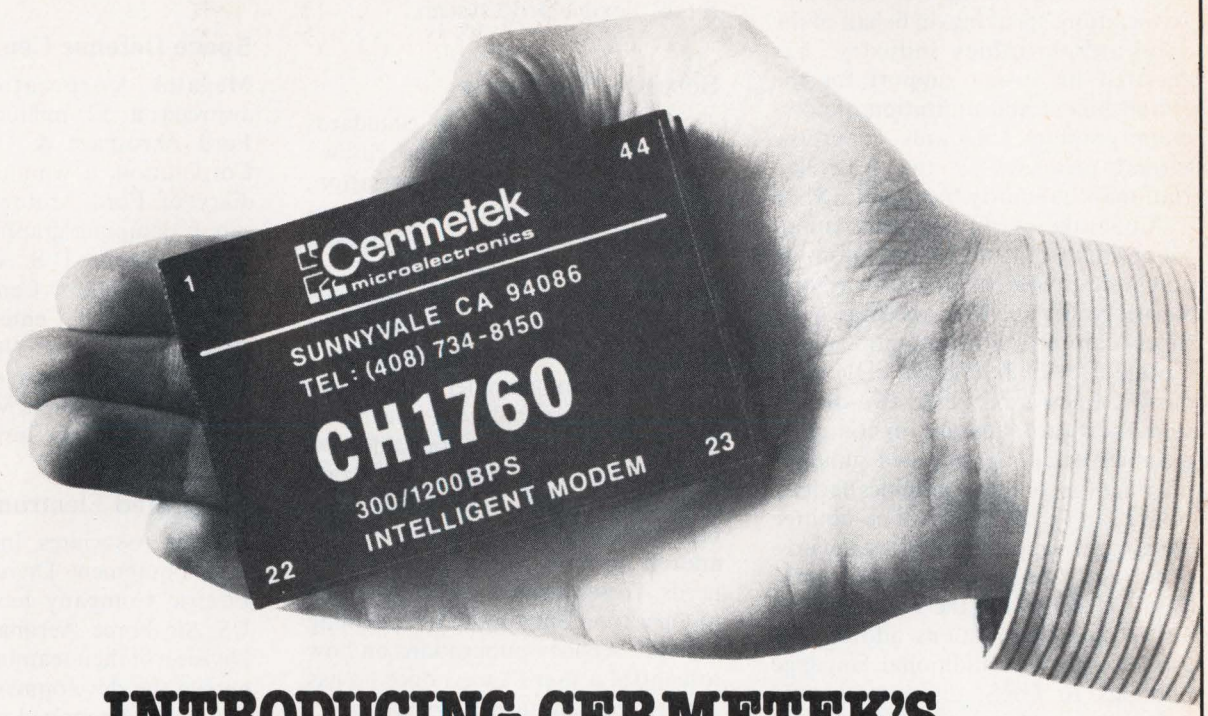
AN INTELLIGENT SYSTEMS COMPANY

Intecolor Drive, 225 Intecolor Park, Norcross, Georgia 30092

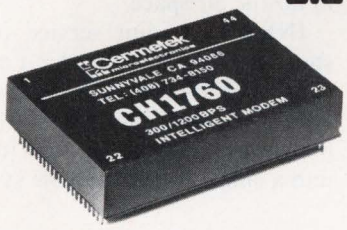
1. Dual Processor Power: 16-bit Z8002 graphics processor for rapid area fill and polygon drawing. 8-bit 8085 independent alphanumeric terminal functions processor. Plus independent keyboard processor.
2. Convenience/Compatibility: Extended ANSI X3.64 control system with VT100 features. Integrated graphics and alphanumeric menu set-up. Compatible with TEK 4010, 4014, 4027 terminals and Plot 10. Interactive color graphics. Easy conversion to color.
3. Complete Graphics Capabilities: Supported by popular host graphics packages. Terminal resident TEK 4027-like graphics primitives. Full featured bit-map graphics.
4. Dot Addressability: Absolute addressing of points for point plotting with complex graphics. 560H x 288V. Full three-bit pixel array. 80 characters by 24 line alphanumeric display.
5. Raster Color: Brilliant 64-color palette with color mapping. Eight displayable colors. Self converging, 13" diagonal CRT.
PLUS: Enhanced Text Features: Five character sets (two are user-definable). Two vector character sets. **ANSI X3.64:** Industry standard control sequences. Easy to implement. **Two Full Pages of Screen RAM:** Simplifies graphics programming. **72 Function Keys (optional):** Speeds up programming. **Clean, Simple Design:** Assures reliability, cost efficiency. **VT100 Features:** Familiar DEC functions.

Write 24 on Reader Inquiry Card

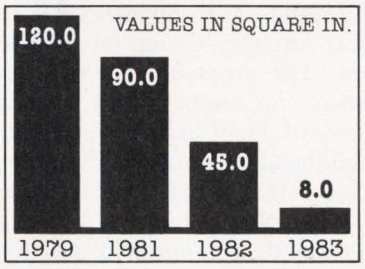
FROM THE SIZE OF THIS PAGE TO THE SIZE OF YOUR PALM.



INTRODUCING CERMETEK'S HIGHLY INTELLIGENT 212A-TYPE MODEM COMPONENT.



A complete integral 212A modem component. At Cermetek, modem technology has evolved to reduce the size of an integral 212A-type modem from a very large PCB down to the size of a component. In a space of 8 square inches, the CH1760 implements a fully featured 212A-type modem, including an FCC registered telephone line interface and advanced auto-dial capability.



No more custom PCBs. Since the CH1760 is a standard modem component and is fully featured, you no longer have to commit to a custom PCB to enjoy 212A-type modem integration. No NRE s or custom contracts to worry about.

If you still need custom, the CH1760's firmware can be reconfigured to meet your special needs. An EPROM version of the component, the CH1760E, enables custom features to be fully evaluated before committed to hard masks.

Features:
- Small size 2.4" × 3.6" × .65"
- 300/1200 BPS operation
- Bell 212A and 103 compatible
- Intelligent serial command interpreter
- Auto/Manual dialing — DTMF or PULSE
- Auto/Manual ANSWER
- Auto/Forced selection of DTMF or PULSE dialing
- Auto speed selection
- Auto parity selection
- Call progress tone detection (dial, busy, ring-back, modem answer tone and human voice)
- 32 digit last number dialed storage
- Memory expansion port (stores an additional 52 telephone numbers or log-on messages)
- TTL Host serial interface

Cermetek microelectronics

Advanced data systems through innovative components

Please rush me additional information on the CH1760 212A modem component. 1308 Borregas Ave., Sunnyvale, CA 94086.

NAME _____

COMPANY _____

ADDRESS _____

TELEPHONE ( ) _____

NEWS UPDATE

NCGA Supports Standards

The National Computer Graphics Association, speaking on behalf of the computer graphics industry, has declared its strong support for the establishment and utilization of computer graphics standards under the formal processes of the American National Standards Institute (ANSI).

Among the specific recommendations were: endorsing the formal adoption and widespread use of the Graphical Kernel System (GKS), and urging the timely completion and adoption of the Virtual Device Interface (VDI) standard. GKS is a proposed two-dimensional software standard for computer graphics. VDI is a proposed standard interface for computer graphics devices. X3H3, an ANSI technical committee working on computer graphics standards, is currently evaluating the GKS standard and developing the VDI standard. Other recommendations address the establishment of additional language bindings to GKS, dissemination of information on standards, and involvement in workplace regulatory and legislative activities.

H-P Uses Seagate Drives

Hewlett Packard Co. has selected Seagate to be the sole supplier of the 5-1/4" Winchester disk drives to be used in its recently announced HP 150 desktop personal computer. The Seagate 19 Mbyte ST419 (15 Mbyte formatted) and 6 Mbyte ST406 drives (5 Mbyte formatted) used exclusively in the new system will be supplied under a multi-million dollar extension to an existing two-year-old contract between the two companies.

Kodak Enters Drive Market

Eastman Kodak Company and Drivetec, Inc., jointly announced a licensing agreement that permits Kodak to manufacture a high capacity flexible disk drive, based on a Drivetec configuration. Kodak flexible disk drives will be commercially available beginning in the first quarter of 1984. The Kodak drive will use 600 Oe 5-1/4" flexible disks, offering an unformatted capacity of 3.33 MB of data storage and a formatted capacity of 2.62 MB. This will offer the largest single disk storage capacity of any commercially available 5-1/4" flexible drive system.

Security Standards

The National Bureau of Standards (NBS) testimony before the House Subcommittee on Transportation, Aviation and Materials on telecommunications security and privacy on October 17, 1983 stated that use of available administrative procedures and technology could prevent 80-90% of consumer problems. It was decided the major thrust in computer communications security should lie in integrating this technology into existing and new applications. They further stated that in working closely with ANSI, they have published standards that directly address telecommunications security needs. These include their "DES Modes of Operation Standard," an upcoming network security publications on how to control a user's access once he has entered the computer system.

Dual-Cable Broadband Standard

Wang Laboratories, Inc., and TRW Inc., announced a joint proposal for a dual-cable broadband local area network (LAN) standard designed to meet the information transfer needs of broadband network users. The proposal has been submitted to the IEEE 802 Standards Committee's RF Technical Advisory Group for consideration. The proposal cites two major reasons for establishing a dual-cable standard. First, large installed bases of broadband networks are experiencing a growing demand for such systems. As technology simplifies the integration and distribution of diverse forms of information, the demand is expected to increase even further, particularly among users requiring large information capacity applications. Second, single-cable standards are not readily adaptable to dual-cable networks because the requirements for the two are widely varied. The differences between single-cable and dual-cable media include transmission and reception on typically the same frequency for dual cable but on separate frequencies for single cable and elimination of the costly head-end translator with dual cable.

Space Defense Center

Megatek Corporation has been awarded a $2 million contract by Ford Aerospace & Communication Corporation, a wholly owned subsidiary of Ford Motor Company, to supply computer graphics systems and software for the U.S. Air Force Space Defense Operations Center (SPADOC) Phase 4A. The Center will be constructed within the North American Aerospace Defense Command (NORAD) Cheyenne Mountain Complex near Colorado Springs, Colorado.

Integrated Electronic Warfare

Sanders Associates, Inc. and the Aircraft Equipment Division of General Electric Company have notified the US Air Force Aeronautical Systems Division of their teaming agreement to pursue the development and production of the Integrated Electronic Warfare System (INEWS). INEWS will improve the ability of advanced fighter aircraft of the future to penetrate, survive and accomplish assigned missions in hostile air space.

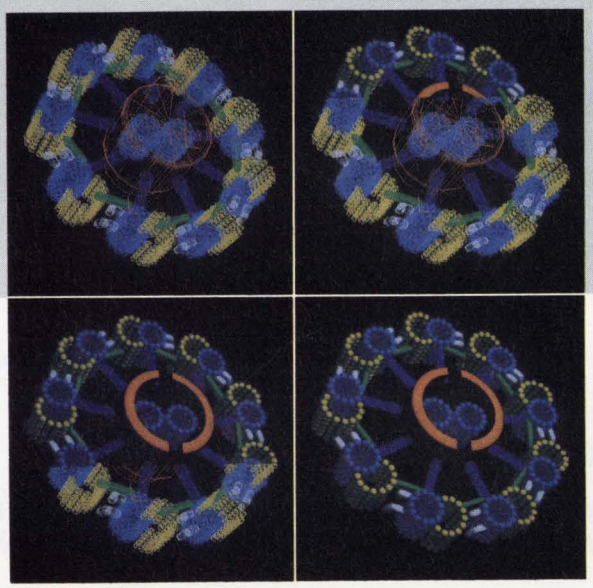
INEWS, a joint service program sponsored by the U.S. Air Force and supported by the U.S. Navy, is an advanced automated system which will integrate electronic warfare functions into a single programmable system.

Automated Microchip Assembly

Motorola has decided to add an $18.5 million automated microchip assembly line at the company's East Kilbride, Scotland facility to handle all production for Europe. The automated assembly unit is in addition to a $100 million investment to double capacity of its wafer fabrication and test facilities currently underway at the East Kilbride facility. The company claims that the plant will be the most advanced and first fully integrated semiconductor facility in Europe when it comes on stream in the third quarter of 1985. The Scottish investment represents over 25 percent of Motorola's total investment and is their biggest project outside the U.S.

Image manipulations in seconds, not hours.

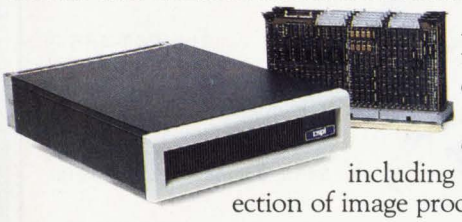
With Mini-MAP™...The Array Processor For The Graphics OEM



Courtesy of Al Barr, Raster Technologies, Inc.

For tough image processing problems like pixel rotation, image reconstruction, or hidden line removal from wire frame models, Mini-MAP gets results in seconds, not hours. Attach a Mini-MAP to a PDP-11 or VAX UNIBUS and you have an interactive number cruncher that is ideal for image processing, CAD/CAM, solid modeling, medical imaging, and animation.

Shared memory simplifies programming and provides the unprecedented throughput necessary for truly interactive image processing of complex algorithms. 32-bit DEC floating point arithmetic, along with 7 MFLOPS of number crunching power, ensures that accurate results are available quickly.



A scientific subroutine library of over 225 FORTRAN callable routines including an expanding selection of image processing algorithms is available for Mini-MAP. For optimum performance, high-level FORTRAN control languages are provided for both the host and Mini-MAP.

Memory is expandable up to 16 MBytes. Configurations include a four-board set with DEC-type backplane or fully packaged systems.

System integrators are finding Mini-MAP is the most cost-effective number crunching solution for image manipulation. Write for information or **call toll free 1 800 325-3110 for fast action.**

- 32-bit floating point precision
- Compiler/Assembler/Linker/Debugger
- 225 FORTRAN callable arithmetic routines
- Up to 16 MBytes of memory
- 1024 x 1024 2-D real FFT in 8.8 seconds
- 1280 x 1024 4-color image rotation (Raster Scan Storage Format) in 27.5 seconds.

DEC, PDP-11, VAX, and UNIBUS are trademarks of Digital Equipment Corp. Mini-MAP is a trademark of CSPI

cspi

THE ARRAY PROCESSORS

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NEWS UPDATE

Vertex Signs Seven Contracts

Vertex Peripherals, Inc., signed OEM agreements exceeding $12 million with seven firms to supply an undisclosed number of its family of 5-1/4 inch high-capacity, high-performance Winchester disk drives. The contracts with computer and computer-peripheral manufacturers reflect a range of applications, including Tallgrass Technology, (Overland, KS) a manufacturer of disk subsystems for the IBM PC; Cadmus, (Lowell, MA) a producer of multi-user CAE design systems; Computer Systems Dynamics, (Denver, CO) a supplier of turnkey multi-user small business computer systems; Microdisk, (Gardnerville, NV) a producer of disk add-on subsystems; Pacific Computer, (Beaverton, OR) provides disk expansion capability for Fortune 16:32 systems for commercial and business applications; Pixel, (Wilmington, MA) produces multi-user small business computer systems; and Quadram, a subsidiary of Intelligent Systems Corp. (Norcross, GA) manufacturers disk add-on subsystems.

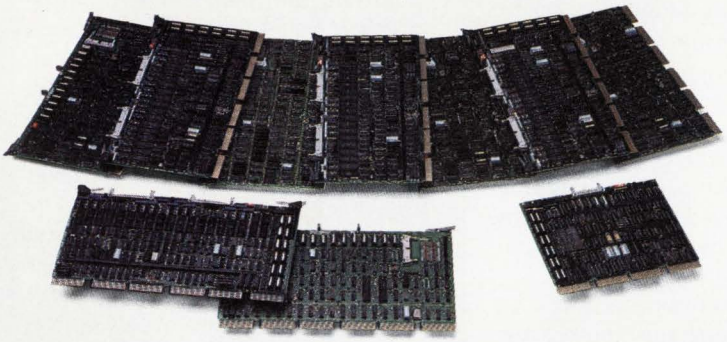
Atlanta's High Tech Growth

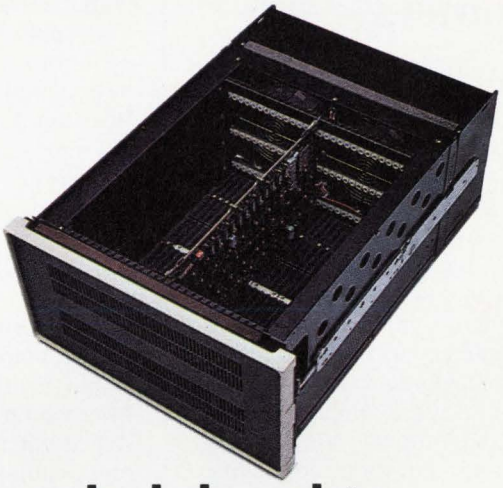
Venture capitalists are paying close attention to the Southeast as a location for future investment activity, according to the High Technology Capital Conference held recently in Atlanta. Delegates from 24 states and three foreign countries, representing nearly $700 million in potential capital, met at the fifth annual conference. Atlanta's high-tech growth is fueled by the research and educational facilities of Georgia Tech, particularly its Advanced Technology Development Center (ATDC). ATDC provides a variety of services to entrepreneurial high-tech firms and serves as an incubator for many developing companies. The ATDC supports start-up companies with sophisticated test equipment and facilities, access to the university's computer for software development, and consultation with scientists, researchers and technically trained personnel.

$83M FEMA Contract

Harris Corporation has been awarded a contract by the Federal Emergency Management Agency (FEMA) for a nationwide Direction Control and Warning Communications System (DCWCS). The initial contract award is for $83 million, with additional funding anticipated as options are exercised through 1989. The new system is being developed to provide protection of the nation's civilian population and resources in the event of national and technological emergencies. DCWCS will encompass local area, switch and access, and wide area communication networks deployed throughout the U.S. mainland, Alaska, Hawaii, Puerto Rico and the Virgin Islands. It will utilize satellite, UHF, VHF, HF, LF and meteor-burst communications media, as well as message/circuit switching equipment in each of the field mobile regional centers.

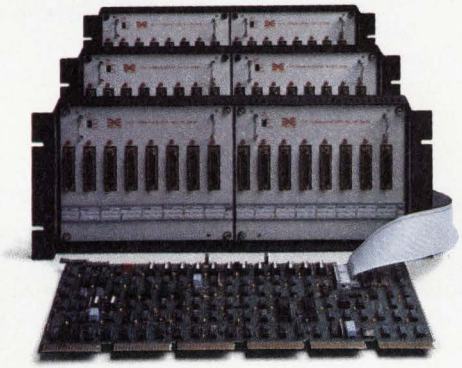
Five reasons why DEC users should buy Emulex communications controllers.





Broad product line featuring our new DMF-32 emulation.

Nobody covers LSI-11, PDP-11, and VAX-11 users' needs like Emulex. More than 15 software-transparent controllers emulating DH11, DZ11, DV11 and DMF-32. All deliver improved line-handling capabilities, in a smaller package, at lower costs.



More channels.

Emulex's new DMF-32 emulation is typical. One controller board handles up to 64 lines, vs. only eight per DEC module. And Emulex offers *all* lines with modem control, not just two. For even more lines, Emulex's Statcon Series is the answer. We simply add a low-cost port concentrator, so that with one controller board you can connect up to 256 remote *and* local terminals.

Easy growth path.

As your system grows, upgrading is simple with Emulex controllers. Just change PROM sets. Example: DH to DMF for $350. In addition, Emulex's advanced microprocessor architecture is consistent throughout the product line. Think of the inventory savings.

Fewer backplane slots.

Emulex communications controllers pack so much capability onto each board that fewer boards are needed. Take a 64-line DH11 emulation. Emulex does on one board what it takes DEC to do on 36. Think of the savings in rack space, to say nothing of price.

Lower prices.

For instance, a DEC DH11 controller lists at $8,950 per 16 lines, with expansion chassis costing $3,000 or more. Compare that to Emulex's CS11/H at $4,500 for the first 16 lines and $3,000 for each additional 16 lines. At 64 lines, you suddenly have savings of about $23,000 and a lot of extra slots to boot.

Don't speculate with your communications controller dollars. Invest in Emulex. Phone toll free: (800) 854-7112. In California: (714) 662-5600. Or write: Emulex Corporation, 3545 Harbor Blvd., P.O. Box 6725, Costa Mesa, CA 92626.

EMULEX

The genuine alternative.

GSA Contract #: GSOOK8401S5575

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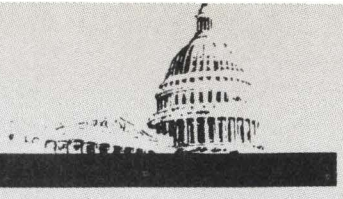
WASHINGTON REPORT



Tech Group To Study In-Flight Computers

by Anne A. Armstrong

A dramatic increase in the number of people using portable computers aboard aircraft has the airlines worried — so much so that half a dozen major carriers have banned the use of portable computers in flight.

The airlines are concerned that radio-frequency emissions from the small computers will interfere with sensitive electronic gear on newer aircraft. Not so, say the computer manufacturers; the computers are perfectly safe. Sorting out these conflicting concerns will be the job of the Radio Technical Commission for Aeronautics, a non-profit organization of nine government agencies and 125 private companies which provides technical support and assistance to the aviation industry.

RTCA was asked by Eastern Airlines to investigate the whole question of emissions from portable computers and to establish some guidelines for manufacturers and airlines. The last time RTCA looked at portable electronic devices was 1963. The results of its study at that time formed the basis of Federal Aviation Regulation 91.19 which says that no person may operate any portable electronic device on board U.S. civil aircraft except portable voice recorders, hearing aids, heart pacemakers, electric shavers, or any other device which the operator of the aircraft has determined will not interfere with the navigation or communication system of the aircraft.

The discretion and the responsibility inherent in the last section is what is bothering the airlines. "All we are asking for is certification that these portable devices will not interfere with automatic landing systems or navigational equipment," said an Eastern spokesman. "Newer aircraft rely so heavily upon electronic aids in critical situations that it is absolutely essential that the integrity of the automated systems be assured."

Modem Patent Forces Costs Up

A recent patent awarded to modem manufacturer, Bizcomp (Sunnyvale, CA), could drive manufacturing costs up for other companies since they will be required to pay licensing fees to Bizcomp. The patent, which is labeled "Modem Control Device Code Multiplexing," covers the switching mechanism used by intelligent modems to go back and forth from command and data states.

Industry analysts disagree on whether Bizcomp can enforce the patent, but at least one major player is not waiting to find out. Hayes Microcomputer Products has already signed what is described as a multi-million dollar licensing agreement to continue to use the techniques protected by the patent.

Bizcomp officials indicate that virtually all of the personal computer modems that connect with the serial interface use the patented technique.

USPS Awards $200M Contract

Electronic Data Systems Corp. has won a major contract from the U.S. Postal Service that calls for the company to build a network of minicomputers and micros to automate and control airborne mail. EDS will design and build a process control system to coordinate dispatching, planning, weighing and coding of small pieces of mail and the assignment of that mail to specific air carriers. EDS will also develop software for the newly mechanized system, and will act as coordinator for the systems provided by subcontractors, E-Systems of Dallas and Digital Equipment Corp. E-Systems is supplying materials-handling equipment such as belt and roller conveyers, laser scanners and Z-80 microcomputers, which will be used for process control. DEC's contribution is PDP 11/24 and PDP 11/23 Plus minicomputers and line printers.

The USPS sends some 1.6 billion pounds of mail by air each year and is planning to assume complete responsibility for airmail after the shutting down of the Civil Aeronautics Board.

The process of weighing and recording the mail and paying the airline for shipping is still largely a manual chore. Under the new system, 351 sites in the United States will have either a mini or a micro depending on the volume of mail processed, as well as a printer, some conveyer mechanism, and a laser scanner. The new system will also permit the Postal Service to keep closer tabs on carrier assignments, billing, and delivery schedules by automating data collection from the branch offices.

The first year of the contract is valued at $39 million; hardware and maintenance options in the next six years are expected to place the total value at some $200 million.

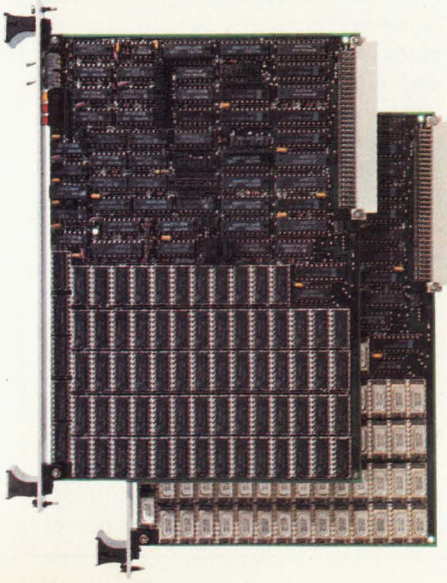
An EDS official said, "The Postal Service has massive plans to automate its services. Our task will be to help accomplish this goal by providing the system engineering, the equipment and the expertise to bring these elements together quickly and economically."

The Added Human Factor

At the recent annual meeting of the Human Factors Society in Norfolk, VA , the meeting organizers found themselves in the embarrassing position of having totally misestimated interest in the "Computer systems track." While large lecture halls were only partially filled, the small rooms assigned to computer screen design, rate of information presentation and visual information processing were packed past overflowing.

Interest was particularly high in visual display research — effects of flicker rate of a CRT on performance, readability of various fonts of dot-matrix displays, and effectiveness of LCD versus DC plasma display in various environments. Keyboard design, a staple of human factors research, was also well represented. Among the reported findings were a strong preference among users as to the placement of the return key and clear preferences about the shape and style of keycaps.

In the VME board race get the pole position with FORCE



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32-Bit Supermini Targeted To Industrial Automation

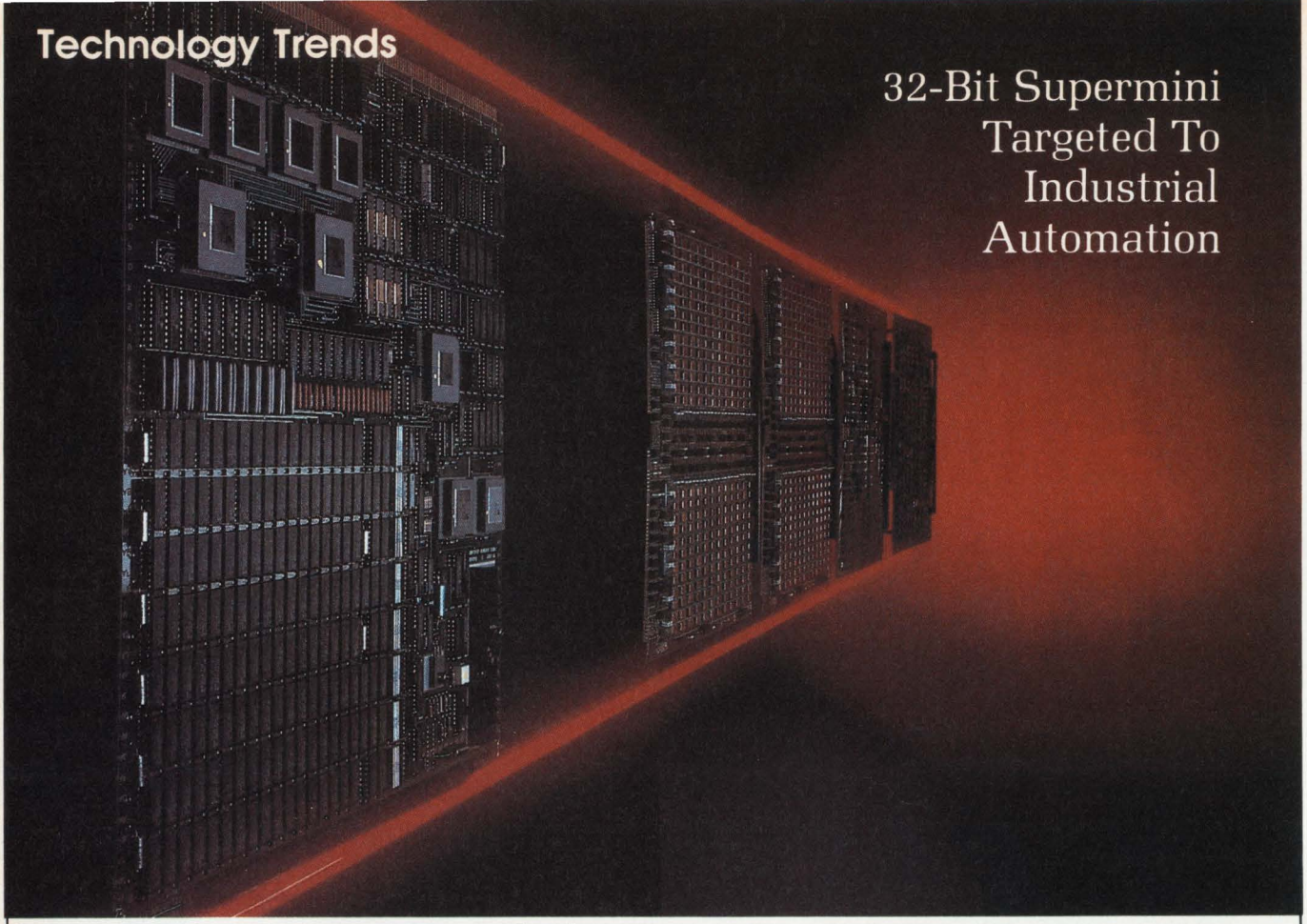

Figure 1: The 32-bit MV/8000 superminicomputer board.

A cooperative effort between engineering teams from Data General and its Japanese subsidiary, Nippon Data General has resulted in the industry's first 32-bit superminicomputer based on high density 256 Kbyte DRAM technology. Technical specifications for the ECLIPSE MV/8000 C were set in the U.S. to match market requirements as the technology developed, and the board was ultimately designed by Nippon Data General. The board then was integrated into the system in the U.S., and packaged and manufactured in Japan.

The new ECLIPSE MV/8000 C has the power of the company's larger MV/8000 II, but has been packaged as a compact 10 1/2"-high rack-mountable system for the OEM and system integrator market. The packaging was accomplished through the use of high density memory and 2000-gate logic gate arrays. The MV/8000 C is available with memory capacities of either 1 Mbyte or 4 Mbytes with a total storage of 5.6 gigabytes.

The system's most important characteristic is the use of state-of-the-art 256 Kbytes semiconductor memory components that, in the same amount of space, store four times as much data as conventional memories. It also uses integrated circuits or gate arrays, that put digital integrated circuits that once occupied dozens of square inches on a printed circuit board, into a single, 1" square silicon chip. The result is a very compact computer system capable of a computational power of 1.2 million instructions per second.

This combination of size and performance means the MV/8000 C can be used in applications such as CAD workstations, to monitor and control continuous industrial processes, in "hard" environments that call for special requirements, for high-speed data acquisition in industrial laboratory applications, and as a supervisory system in a computer hierarchy.

In an industrial research lab setting, analytical instrumentation such as atomic absorption, plasma emission spectrophotometers and nuclear magnetic resonance spectroscopes generate high volumes of data in short, very high speed bursts. The MV/8000 C, when equipped with the ArrayPlus 2000 block floating point processor, is able to gather, analyze and present the data to the scientist conducting the test. The MV/8000 C can be dedicated to a single instrument for very high volume data acquisition and analysis, or it can monitor a bank of instruments, storing the data for analysis later.

Many industrial applications use a computer hierarchy, where a group of microcomputers monitor processes and send the data to a series of supervisory systems, which control and monitor the micros while transferring selected management data to a central host system. Because supervisory systems are highly customized, they need many programming aids to get on-line quickly at a reasonable cost. The MV/8000 C's software development tools, inherent in the system's AOS/VS operating system, gives system implementers the productivity aids they need to meet their implementation schedules. In some applications, such as petroleum refining, chemical processing, and power

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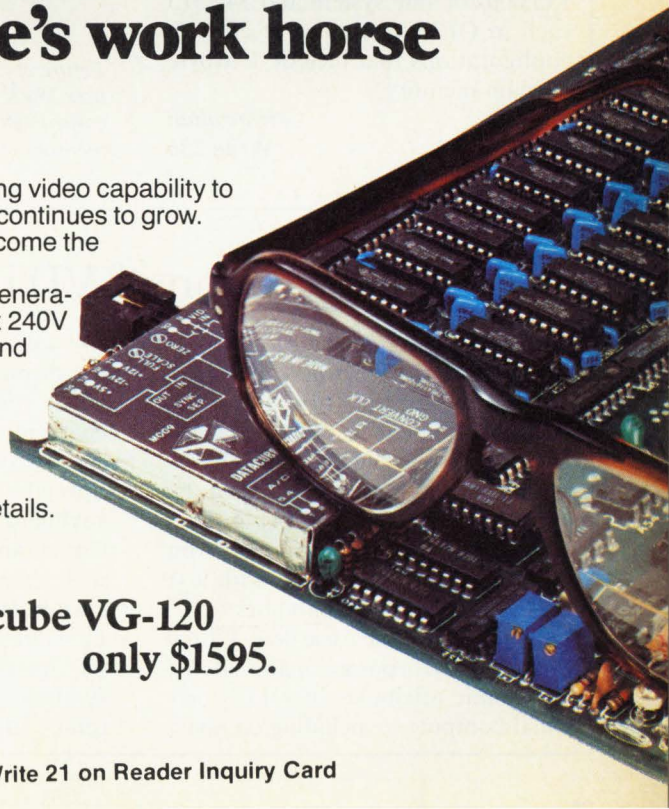

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generation, very large numbers of inputs come into the system simultaneously. The system must convert the input into digital format, analyze it, and trigger a response based on the input. Because there is no interruption in the process, the operations must be done quickly.

ArrayPlus

The block floating point array processor, the ArrayPlus 2000, brings 100 ns computational performance to all 32-bit MV/Family systems and most ECLIPSE systems. With a memory capacity of 512 Kbytes, the ArrayPlus 2000 uses a single, high-speed, 32-bit bus that permits internal data transfers at speeds up to 40 Mbytes per second. The new array processor is supported by Data General's AOS/VS, AOS/RT32, and AOS operating systems. Applications are written in ArrayPlus C, a structured programming language, and can be used with most of the standard languages including FORTRAN, PL/I and C. Users can develop special algorithms on the ArrayPlus 2000 using a full set of development tools. High speed devices can be interfaced directly to the system to optimize real-time processing performance.

The new 32-bit system is priced at $55,000 for one system and $40,515 each in OEM quantities of 20 with configurations that include 1 Mbyte of main memory.

—Hanrahan
Write 236

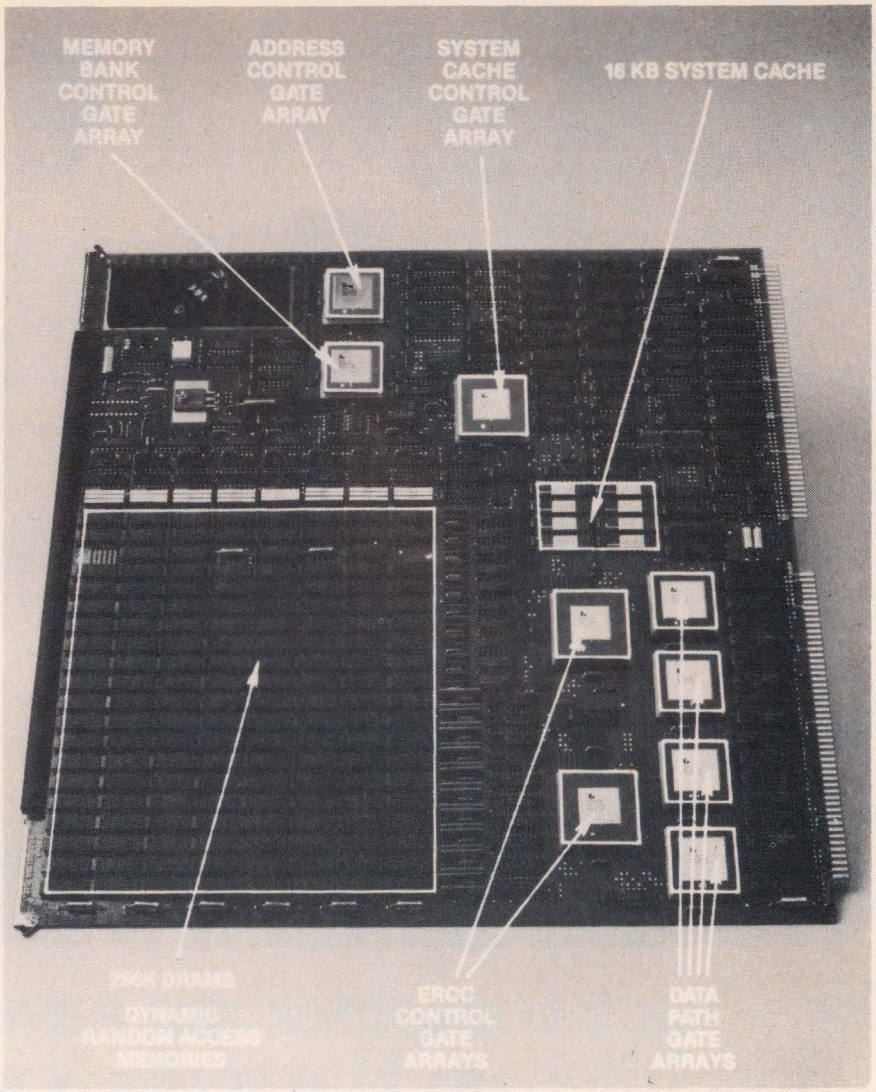

Figure 2: 256K-based memory control board for the MV/8000 supermini. The system uses 256 K DRAMS, five CMOS gate arrays serving as address, memory and data path controllers, and three 2000-gate bi-polar gate arrays for system cache control and memory error correction.

A New Generation of VDTs

Adding enhancements to features of the VT100 video display terminal, Digital Equipment Corporation has designed a new generation of video terminals — the VT200 family.

The VT200 family consists of the VT220, VT240 and VT241 models with applications ranging from advanced text handling to both text and color graphics capabilities.

In addition to new features, VT200 terminals incorporate many of the ergonomic attributes of DEC's personal computers, including compact size and advanced packaging. Monitor display features include reverse video and character highlighting; character brightness and screen contrast can be adjusted independently. Special function keys on the 103-key keyboard are host-programmable to define an operation or command with a single keystroke. Keys can be custom-labeled for each application. Downline-loadable special character sets for Greek letters, mathematical symbols, and other characters customize the terminal for operations such as APL programming.

If the same image is displayed for 30 minutes, a CRT "saver" blanks the screen to extend tube life. Any single keystroke recalls the blanked image.

Each model is available with a choice of 16 different language keyboards. Additionally, any of 256 multinational characters can be composed from any keyboard. All VT200 terminals have a printer port, EIA and 20mA communications interfaces, and a universal power supply.

The VT220, VT240 and VT241 models are priced at $1,295, $2,195 and $3,195, respectively.

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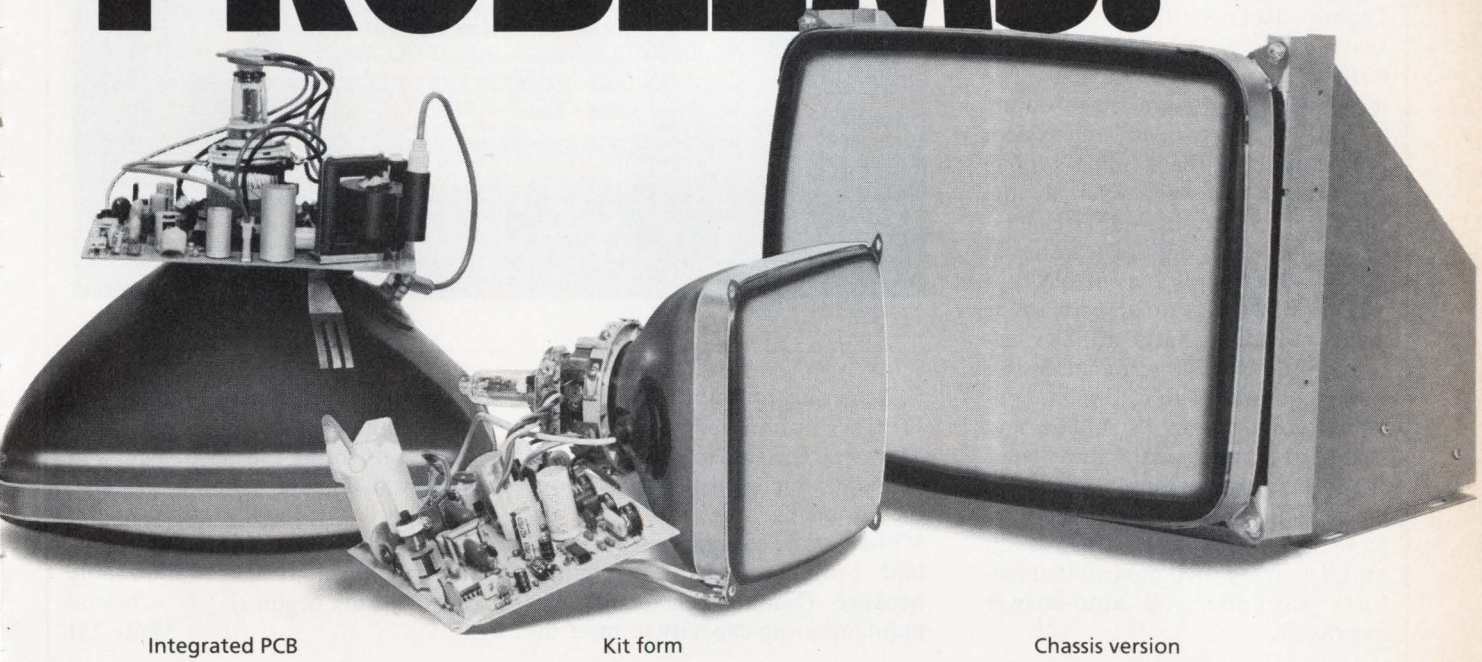

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The VT220 terminal, a two-piece monochromatic text unit, consists of an ergonomically styled keyboard and 12-inch, nonglare monitor. The compact, wedge-shaped video monitor is available with white, green or amber screens, and contains all logic circuitry.

The VT240 terminal has all the text features of the VT220 plus bit-map graphics capabilities for business graphics applications. The monochromatic terminal supports two high-level graphics instruction sets: Digital's ReGIS (Remote Graphics Instruction Set) and Tektronix' 4010/4014 graphic protocols. The terminal is a three-piece assembly with monitor, keyboard and system box containing the terminal's logic. Application software, such as the DECgraph and DECslide packages, to support the graphics features of the VT240 terminal is available.

The VT241 terminal adds color display to the text and graphics features of the VT240 terminal. It is a three-piece unit with a 13-inch, nonglare color monitor, system box, and keyboard. The terminal features color RGB (red/green/blue) output to devices such as a color camera or auxiliary color monitor. It also has an optional, integrated modem that features auto-dial and auto-answer capabilities.

The DEC VT240

According to Arthur T. Campbell, DEC's Terminals Product Group Manager, the series 200 are hard to emulate, which will alleviate some of the problems DEC faced with the VT100. Many competitive companies had built compatible terminals because Digital lacked sufficient manufacturing capacity to meet the huge demand for the VT100. Digital will continue production of the VT100 terminals for at least two years and longer if demand continues, added Campbell.

With expanded production facilities, shipments of the VT200 family have already begun. —*Rubino*

Write 231

Experimental 512K-Bit Memory Chip

An experimental computer memory chip that can store more than a half-million bits of information — nearly twice the capacity of any chip yet reported — is being developed by engineers from IBM's semiconductor facility in Essex Junction, VT.

The new component is a 512K-bit dynamic RAM chip, which actually holds 524,288 bits of information. It is the first complete chip ever to use an electronic technique called "plate pushing" to read data out of its storage cells. The plate pushing technique improves the chip's reliability. In particular, the stronger signal produced by plate pushing reduces the chip's vulnerability to "soft errors", or loss of charge from a cell caused by the passage of ionizing particles through the chip's silicon material. As chips become increasingly dense, their susceptibility to soft errors decreases.

The stronger signal created by pulsing the plate contributes to increased density in two ways. First, by allowing the use of a smaller capacitor, which reduces the size of the cells, and, second, by making possible a unique chip architecture featuring fewer "bitlines". Bitlines are the electrical pathways that connect individual cells to the circuitry that senses the amount of charge stored in the cells. The reduction in the number of bitlines means that less support circuitry is needed, leaving more space for storage cells. The area of the chip devoted to storage cells is 64% of the total chip area — nearly a third greater than industry average.

Other techniques for producing a stronger cell signal can result in undesirable consequences. For example, a signal level can be increased by storing more charge in the capacitor, either by using larger plates or a thinner insulator. Larger plates however, use up more area, which reduces density, while thinning the insulator requires extra precautions to insure high reliability. By pulsing the plates, signal strength can be gained without sacrificing either density or reliability.

In certain applications the chip can be operated at speeds even faster than 120 nanoseconds. For example, in

page-mode operation, an initial group of up to four bits can be read or written in 120 nanoseconds, but then subsequent groups of up to four bits of data having the same word address can be read or written at sixty-nanosecond intervals. The four bits of data are available simultaneously. This provides a greater range of potential applications than is available with chips limited to a single-bit output.

The new chip measures 7.96 millimeters by 8.6 millimeters (about 3/8" square). The smallest photolithographic images in the chip's circuit pattern are 1.5 micrometers wide; about 1/50 the diameter of a human hair. Several lots of wafer containing the new chip have been fabricated at the IBM laboratory. Testing of these chips has confirmed that all circuits function as intended.

Technical information about the 512K-bit chip was presented by IBM engineers Dr. Howard Kalter and Chris Miller at the 1983 Symposium on VLSI Technology held in September in Hawaii. The symposium was jointly sponsored by the Japan Society of Applied Physics and the Electron Devices Society of the IEEE.

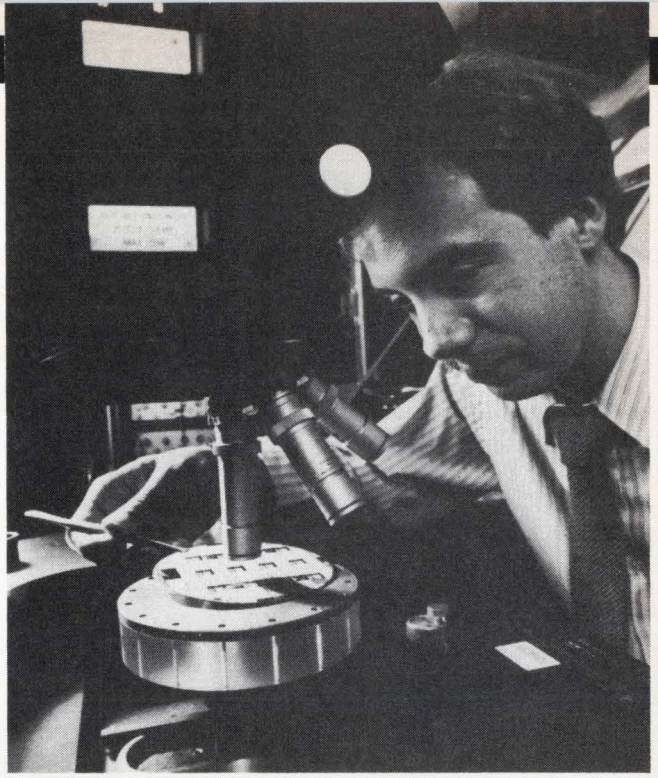

Figure 1: IBM's wafer containing experimental memory chips which are capable of storing more than half a million bits of information. An unusual technique for reading data out of the memory cells contributes to the chip's high density and reliability.

—Hanrahan

Write 235

Dynamic Growth Forecast For Disk Drive Industry

Accelerating growth for hard disk drives in all capacity ranges boosted 1982 worldwide revenues for hard disk drives to $7.4 billion according to the recently released 1983 DISK/TREND Report. The outlook continues upward, with a forecast of $16.9 billion for 1986, as computer users demand more data storage each year.

5¼" Winchester drives below 30 Mbytes are currently the industry's growth leader, climbing from 239,700 worldwide unit shipments in 1982 to 1,157,500 in 1983. But even though small drives in this group will continue rapid growth, drives with diameters less than 5¼" will provide a new challenge by 1986, gaining 48% of worldwide shipments. Although total OEM revenues from removable disk drives are expected to decline from 54.4% of the worldwide total in 1982 to 14.4% in 1986, sharp growth in unit shipments is expected from disk cartridge drives using 5¼" and smaller disks.

In 1982 large disk pack drives provided more worldwide OEM revenues than any other product group, but by 1986 these drives will produce less OEM revenues than any other product group. According to DISK/TREND, 14" disk drives are rapidly fading in importance in OEM markets. By 1985, 14" drives will retain their lead in units shipments only in large disk pack drives and in fixed disk drives over 300 Mbytes.

IBM's worldwide shipments of high capacity 3380 drives are estimated at a surprising 48,000 spindles for 1983, with severe impact on competitors in the plug compatible disk drive market. A double density version of the 3380 is expected in 1984, undercutting the market available to the manufacturers of PCM drives now initiating production shipments of drives equivalent to the standard 3380.

DISK/TRENDS cited Seagate Technology as the fastest rising manufacturer of OEM disk drives in 1982, with 40.5% of the worldwide unit shipments of 5¼" Winchesters. The overall lead in OEM revenues continues to be held by Control Data, with 45.2% of the worldwide total.

—DISK/TRENDS, Inc.

Write 237

Custom Chip Market Opens Up In New England

The regional custom chip market in New England would serve a potential 300 companies in Massachusetts, New Hampshire, and Connecticut. These companies comprise approximately 11% of the market for custom integrated chips — second only to California, which has 30%.

An example of a semiconductor start-up taking a risk in this untapped market is Custom Silicon, Inc. of Lowell, MA. CSi has completed a pact under which they will be the exclusive licensed design center for NCR Microelectronics Division in the New England States. Under the terms of the agreement, CSi will provide NCR with marketing and engineering support for the development of custom integrated circuits which can be manufactured in NCR's fabrication facility.

CSi has slated complete custom chip delivery in as little as six weeks versus three months from some California Foundries. The chips will be designed rapidly with two extensive families of standard cells. The cells range in complexity from simple gates to microprocessor core cells, and include both analog and digital functions. The license covers NCR's three micron CMOS standard cell technology and its three micron NMOS family. CMOS technology is used for applications that require high-speed performance with minimum power consumption. NMOS is used for applications that can benefit from lower cost but do not require the low heat dissipation of CMOS. In addition to providing design support to NCR customers, CSi will also use the technology to design custom chips for itself and its customers.

CSi was founded to provide other New England manufacturers with the advantages of proprietary components, which are available to their larger competitors from in-house "captive" semiconductor divisions. According to CSi president Dr. Albert P. Belle Isle, "We feel that to provide our customers with the advantages of a 'time-shared captive semiconductor division,' we must offer objectively both gate array and standard cell technologies. Our agreement with NCR provides CSi with access to high performance CMOS and low-cost NMOS standard cell families, and provides NCR with an additional distribution channel for their products."

CSi estimates that the New England market for rapidly-designed custom integrated circuits will exceed $150 million in 1986 and reach $0.5 billion by 1990. The company estimates that standard cell technology will account for up to one half of this market.

According to David W. Guinther, CSi's vice president of marketing and sales, "We believe that NCR has a clear lead over all other standard cell vendors. They have over a decade of experience as a captive supplier of custom components used in NCR system and peripheral products. NCR product development groups depend on the Microelectronics Division to design and prototype custom integrated circuits rapidly and produce them reliably.

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major investments in, and has extensively verified, a comprehensive CAD system, production-proven design building blocks, and three separate IC fabrication facilities," said Guinther. "Our sourcing agreement with NCR, combined with CSi's capabilities in the specification and design of custom ICs, will provide our customers with a number of benefits. These include fast turnaround for prototypes and guaranteed sourcing for production parts from a multi-billion-dollar company with both the means and motivation to keep up with advances in semiconductor and CAD technology."

CSi will offer the same services that a product development group in a large company can expect from their own captive semiconductor division: system partitioning and detail chip specification, text program development, logic and circuit design, design of manufacturing tooling, and fast turnaround prototyping. *-Hanrahan*

Write 242

Commercially Available 32-Bit Microprocessor

The highly advanced NS 32032 CPU from National Semiconductor is the first commercially available monolithic 32-bit microprocessor.

The NS32032 is designed for systems that need to manipulate large data bases at high speeds beyond the capabilities of 8- and 16-bit microprocessor. The NS32032 features true 32-bit internal and external architecture along with the ability to support high-level languages, advanced operating systems and large memory spaces through demand paged virtual memory capability.

Emerging microprocessor applications continue to encompass areas that formerly were dominated by minicomputers. Such applications for the NS32032 include engineering workstations, business and professional computers, integrated office systems, graphics systems, CAD/CAM systems, industrial process control, telecommunications, intelligent terminals and military systems.

All three CPUs in the NS16000 family — the NS08032, NS16032 and NS32032 — share the same internal 32-bit architecture, which assures complete compatibility both upward and downward for software and hardware migration. Additional devices currently in development will conform to this same architecture.

The 32-bit external data bus enhances performance of the NS32032 by increasing the amount of information that can be accessed from memory in a given amount of time. But, unlike competing designs (which provide only partial 32-bit implementation), the NS32032 not only provides this data-bus bandwidth, but also includes other 32-bit internal attributes such as 32-bit registers, a 32-bit arithmetic logic unit, 32-bit internal data paths and 32-bit displacements.

A complete set of support tools for the NS32032 is already in place, along with a family of software compatible slave processors and peripheral circuits. Full resident development system support for the entire 16000 family is provided by National's SYS16™ multi-user development system, based on the 16000 family chip set, and the powerful ISE/16™ in-system emulator. The NSX-16 cross-support package provides high-level language and assembly-level support, on VAX™ or Starplex II™, as well as a symbolic debugger and various support utilities. Resident support and the UNIX™ operating system also are available, along with National's GENIX™ and GCS16 support package.

By March 1984 the DB32000 development board will be available to provide evaluation and development capability for key 16000 family peripherals as well as all three CPUs (NS08032, NS16032, and NS32032). Additional future software support will include the ISE/32 in-system emulator.

In the peripheral chip area, the NS32032 is supported by the NS16081 Floating Point Unit (FPU), the NS16082 Memory Management Unit (MMU), the NS16201 Timing and Control Unit (TCU), the NS16202 Interrupt Control Unit (ICU), and the NS16450 Communications Interface (UART). These parts are all currently in production.

National also expects the NS16456 Multiple Protocol Communications Controller (MPCC) and the NS16203 Direct Memory Access (DMA) to be in production by mid-1984, followed by the NS16488 General Purpose Interface (GPIB) in the third quarter.

The company has begun sampling a terminal management processor chip (NS455), and is designing a hard disk controller to be introduced early in 1984. National said these 10 devices give the 16000 family broader peripheral support than currently available for any other 16- or 32-bit microprocessor.

The NS32032 initially is available in a 6MHz version, which is the first microprocessor in the industry to break the one-million instruction per second barrier. A 10MHz version will be available in the first quarter of 1984.

The NS32032 currently uses National's advanced 3.5-micrometer XMOS technology, which has been proven in high-volume production of the company's microprocessor families. This technology has the potential for increased operating frequency well in excess of 10MHz, through planned design shrinks and process improvements. Future CPU versions based on National's advanced microCMOS technology will offer even higher performance.

The NS32032 is packaged in the 68-pin JEDEC B ceramic leadless chip carrier (LCC). This package occupies approximately one square inch of PC board space, about 65 percent of the area required by an equivalent dual-in-line package. Sample pricing for the NS32032 in 100-up quantities is $220 each. By 1985 anticipated high-volume pricing is expected to be in the $20 to $60 range, depending on quantity, operating speed and timeframe.

Write 241

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Photo-Quality Graphics System For Engineering, Scientific Applications

Figure 1: The 5080 graphics system display provides detail close to that of photographs.

An advanced graphics system that can display computer-generated color drawings which have the realism and detail of quality photographs was recently introduced by IBM's Information Systems Group. The 5080 Graphics System provides scientists and engineers a high resolution, steady screen with up to 256 color hues or gray shades simultaneously for detailed graphics.

Many of the computations required to create 3-D drawings and perform high-speed manipulation of images can be done independently of the host computer due to the 5080's advanced graphic functions and memory of more than a million characters. At any stage in the design process, an engineer can use color and other features to isolate variables, identify components, highlight different shapes or parts and modify the work as needed. The processor offers the option of switching back and forth between a product design on the screen, for example, and a parts list contained in an IBM 3270 program in a host computer.

The 5080 is compatible with the IBM 3250 graphics display system and IBM and user-written CAD programs now running on a 3250 system can be run, with some limitations on the 5080 without reprogramming.

Applications

With the 5080, an engineer designing a new bridge, for example, can begin with CATIA (Computer-graphics Aided Three-Dimensional Interactive Application) to examine surfaces in detail. Then, moving to CADAM (Computer-graphics Augmented Design and Manufacturing), the engineer can highlight changes with color, and using the tablet and cursor control device to isolate one area at a time, change or modify the basic design. Then, the design can be displayed in CAEDS (Computer-Assisted Engineering Design System) for structural analysis. An electrical engineering application uses the 5080 and CBDS2 (Circuit Board Design System 2) to design circuit boards with highlighted logic gates in colors which differentiate between design and control data.

Performance

The 5085 graphics processor can perform a variety of graphics operations, including high speed vector-to-raster conversion, polygonal area fill, circle generation, and 2-D and 3-D transformations such as scaling, clipping, rotating and translating. For animation capability, a user can replace display images instantaneously, with no screen blanking between images. The 5088 channel controller, which operates as a shared high speed control unit between the host channel and the 5085 and/or the 3255 control units. It may be attached to a System/370, 43XX or 30XX channel with speeds up to 2.5 Mbytes per second in data streaming mode, and up to 1 Mbyte per second in conventional channel mode. The transfer rate between the 5088 channel controller and the 5085 graphics processor is up to 2 M-bits per second. The controller provides the ability to mix 3250 and 5080 components; up to 16 addressable displays can be attached to a 5088 Model 1, and up to 32 addressable displays can be attached to a 5088 Model 2 in any combination.

Peripherals include an alphanumeric keyboard, a lighted program function keyboard, a tablet with either stylus or cursor control device and a dial unit. All of these peripheral devices attach to the graphics processor through connections in the base of the display.

The purchase price for a 5081 monochrome display with 4 gray shades, keyboard, a 5083 tablet with a stylus, and a 5085 graphics processor is $19,750. With a color display and 16 colors, it is $24,750. Systems will be available in the first quarter of 1984.

—IBM Corp.

Write 234

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Workstation's Tiling Engine Is Multibus-Based

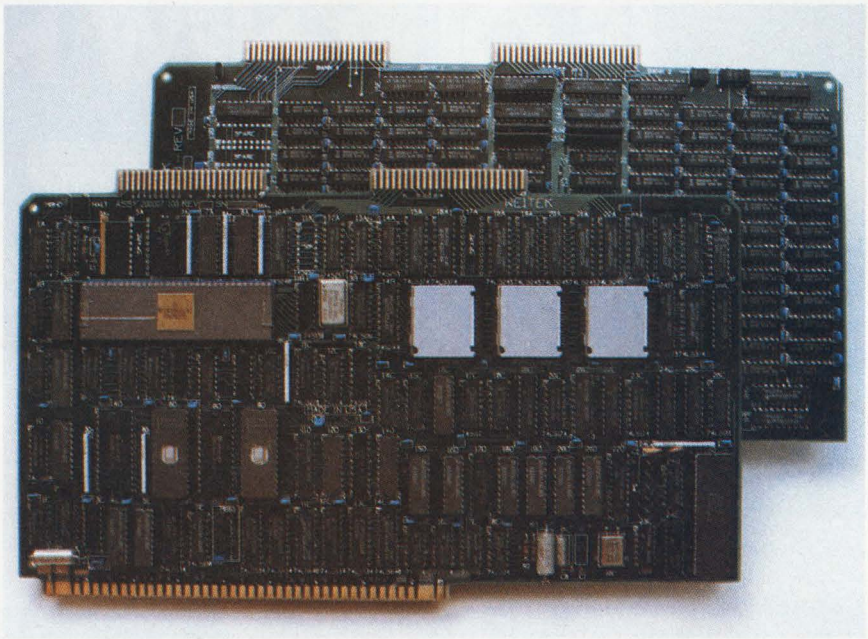
Getting a product to market quickly is becoming a difficult task for designers. Aware of the situation, many IC vendors including Intel, AMD, and SGS now offer Multibus hardware and software for the OEM both at the board and system level. Also recognizing this need, Weitek (Santa Clara, CA) has announced a two board Multibus implementation of its Tiling Engine that will allow the systems integrator to build a powerful stand alone workstation for the display of real-time shaded graphic images.

The first board of the Tiling Engine is called the Tiling board. Its main functions include interprocessor communication, polygon list downloading and tiling. The second board is called the Z-Buffer board which contains a Z-Buffer memory, an I-Buffer memory, bit conversion logic and upload DMA logic. The Tiling Engine accepts a boundary representation of a solid model consisting of planar polygons and produces a shaded image. The finished Z-Buffer can be unloaded to the frame buffer through a DMA channel plane by plane or pixel by pixel. These two boards communicate through two ribbon cables on top of the boards. The Multibus P2 connector is not used.

Figure 1 shows the block diagram of the Tiling Engine. Basically, the Tiling Engine performs three functions: 1) downloads a Polygon List from the system memory into the Tiling board local memory, 2) processes Polygon List commands by tiling the picture into the Z-Buffer and I-Buffer, and 3) uploads pixels to the system memory designated by the main processor. The first function is done by both the tiling and the Z-buffer boards. The third function is done in the Z-Buffer board.

The main processor transfers 'packets' of command and data information to the Tiling Engine through a Multibus DMA interface that is built into the Tiling board. These packets contain both control commands, which control various aspects of the imaging process, and data commands, which specify geometric image data.

A FORTRAN source-level Tiling Engine Standard Interface Library is provided which makes every Tiling Engine command available to the applications programmer through single subroutine calls. **Write 243**



The two board Multibus implementation of the Weitek Tiling Engine.

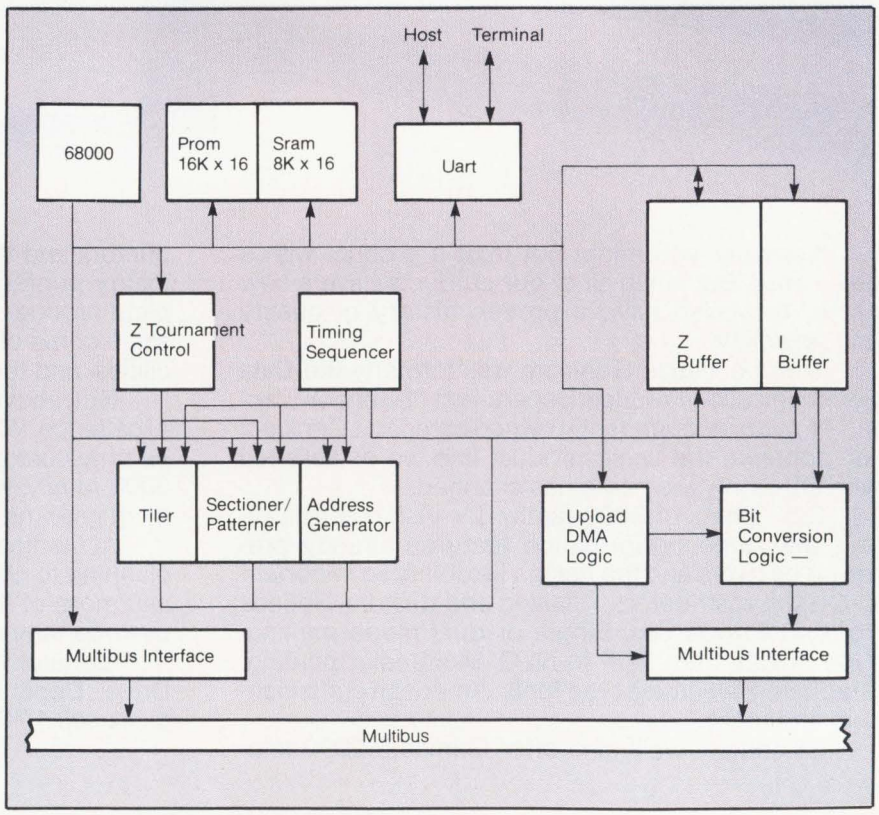


Figure 1: Multibus Tiling Engine block diagram.

Polaroid's Digital Photography Enhances Videoprinter Technology

Figure 1: Polaroid's Model 8 Videoprinter.

Polaroid has entered the videoprinter market, an area of the much larger arena of computer graphics, with their Model 8 Videoprinter. Polaroid's product is unique in that it uses a process based on an amplitude-measured exposure rather than a time-moduled exposure.

One of the problems with film, and the video recording process is that highlights, subtle shading and shadows are lost in the exposure process. This is essentially because the monitor emits phosphorus light which is a radically different reaction on film, compared to film's usual sensitivity to rays of daylight. Film does not respond to the phosphorus in a CRT in a linear fashion. By using amplitude measured exposure, Polaroid has circumvented this problem and retained accuracy in reproduction.

In essence, the digitizing process of the Model 8 produces a color transparency by using a digital image processor to neutralize the mismatch between the CRT and color response curves. The CRT's video signal is broken down into 256 gray scale levels, for which a specific exposure time is calculated. The Model 8's microprocessor sifts data and brings up the pixels which need the longest exposure time first and the shortest exposure time last. After this process is completed,the microprocessor moves onto the next color.

The 256 gray scale levels or digital levels are the result of the interpretation of analog signals which tell what the graphics display intends for the brightness of each color. The RS170 signal is received by the camera and then broken down into 256 digital images.

Special features of the Model 8 include tone control for tonal linearity and slide bar expansion of the light or dark areas. It is capable of image reversal, negative imaging, and can make color prints from black and white signals as well as black and white prints from color film.

The Model 8 accepts all computer graphics formats from 256 x 256 to 1400 x 1024. It accommodates RS170, RS330, RS412A and RS343 video standard interfaces. A NTSC composite video is optional. The videoprinter has a horizontal image resolution of 1400 lines and a 40 MHz digital video bandwith. It uses a power supply of 100, 120, 220 or 240 volts AC. Power consumption is 90 Watts.

Polaroid entered the market with the Model 8 in 1982 and has long supplied other manufacturers with the film necessary for digital recorders. According to Ron Klodenski, Senior Publicity Specialist, "Our marketing experience was in the field and the logical step was to contribute to the technology." *—Coville*

Write 239

Widening Communications Environments Spark Innovation in Modems

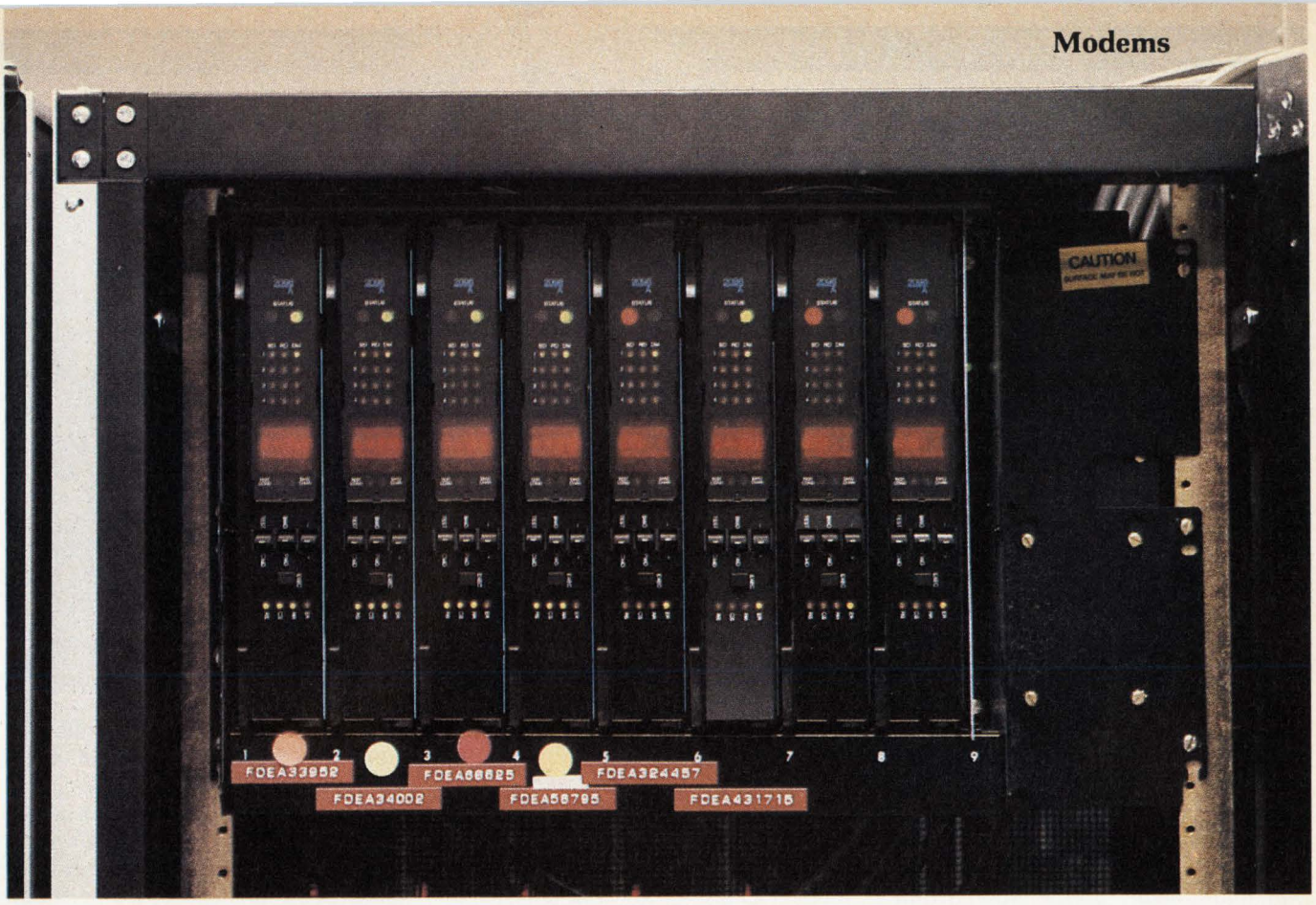
Until fairly recently, modem manufacturing looked like a dying industry . . . . This mature field is probably in for a shakeout, but the growth and good sales are that of a dynamic industry.

by Julie Pingry, Associate Editor

Current and forthcoming events are rapidly changing data communications. The breakup of AT&T, huge investments in private networks, the beginning of the changeover to an all-digital telephone network, and advances in LSI and VLSI chip technology for modulation and filtering are having a profound impact on the modem industry.

Until fairly recently, modem manufacturing looked like a dying industry. No one would say that now. This mature field is probably in for a shakeout, but the growth and good sales are that of a dynamic industry.

Growth in all areas of data communications, including modems, will no doubt be strong for some time. Because computing power has become increasingly distributed, the need for communications has increased. Expansion has been in many directions, to meet the needs of everyone from huge indus-



Left: The first 2400 bps full duplex autodial modems, from Concord Data Systems. Above: AT&T's Network controller for Data phone 2 commercial service.

trial, technical and commercial network users to the home personal computer users.

Modem chip sets for low speed modems are now available from several sources. This will certainly make OEM integration of modems into other products more attractive. Integral modems have long been a space-saving alternative to standalone modems, and are more attractive as they shrink in component count, and so in size and cost.

Board-level modems are not, however, making standalones obsolete. Many traditional OEM modem manufacturers are offering both products. Both box and board 300 bps modems have been a commodity for some time, and now 1200 bps modems are following suit. **Table 1** outlines Bell and CCITT standards for various speed modems.

Even 2400 bps modems are fairly standardized. As the push for higher speeds continues, 4800 and 9600 bps modems will fill a variety of feature and diagnostic requirements. The 9600 bps fast-poll and 14.4K bps modems, which allow combining of low and medium speed lines over one channel, now have a good field of competitors. Some modems for voiceband lines even operate at 16,000 bps.

Of course, at higher speeds, the trend is toward leased lines, but many new offerings have dial-up backup and fallback speeds to assure communications over whatever lines may be available. At the low to medium speeds, the choice between private and dial-up lines is not as clear, especially in light of the deregulation and tariff changes for both leased and dial-up lines.

Large users who have more than a few terminals to connect also need increased network control and monitoring capabilities. Diagnostic features, automatic testing and network management are areas stressed by Paradyne (Largo, FL), Codex (Mansfield, MA), Racal-Milgo (Miami, FL) and other large manufacturers with comprehensive product lines.

And, as in so many areas of technology, added features over the range of modem products — from auto-answer on 300 baud modems for PCs to network control on 14,400 bps modems in a large network — are feasible through advances in silicon LSI and VLSI technology.

Modems on Chips

The modem-on-a-chip is *nearly* here. Sets of two on up to a few chips, out from several vendors, perform nearly all of the functions needed for data communication over voiceband lines at 300 bps, with only a few additional UART, DAA and timing devices needed. Approaches to modem chip sets vary greatly, as do design requirements of the sets.

The chip sets, from National Semiconductor, Motorola, Exar, Cermetek, Signetics, Texas Instruments, American Micro Devices and Synertek, vary in silicon fabrication technique; many are CMOS, but several use NMOS, (Cermetek uses hybrid thick film), the analog and digital schemes in signal processing differ, and the degree of function integration also varies. Most sets presently available require additional logic, op amps, resistors and capacitors, as well as the chips for timing and interfacing to the microprocessor bus and telephone lines. In some sets, even the filters are separate.

With the advent of these standard 300 bps chip products, more PC, terminal and PBX makers are considering integration of modems. 1200 bps

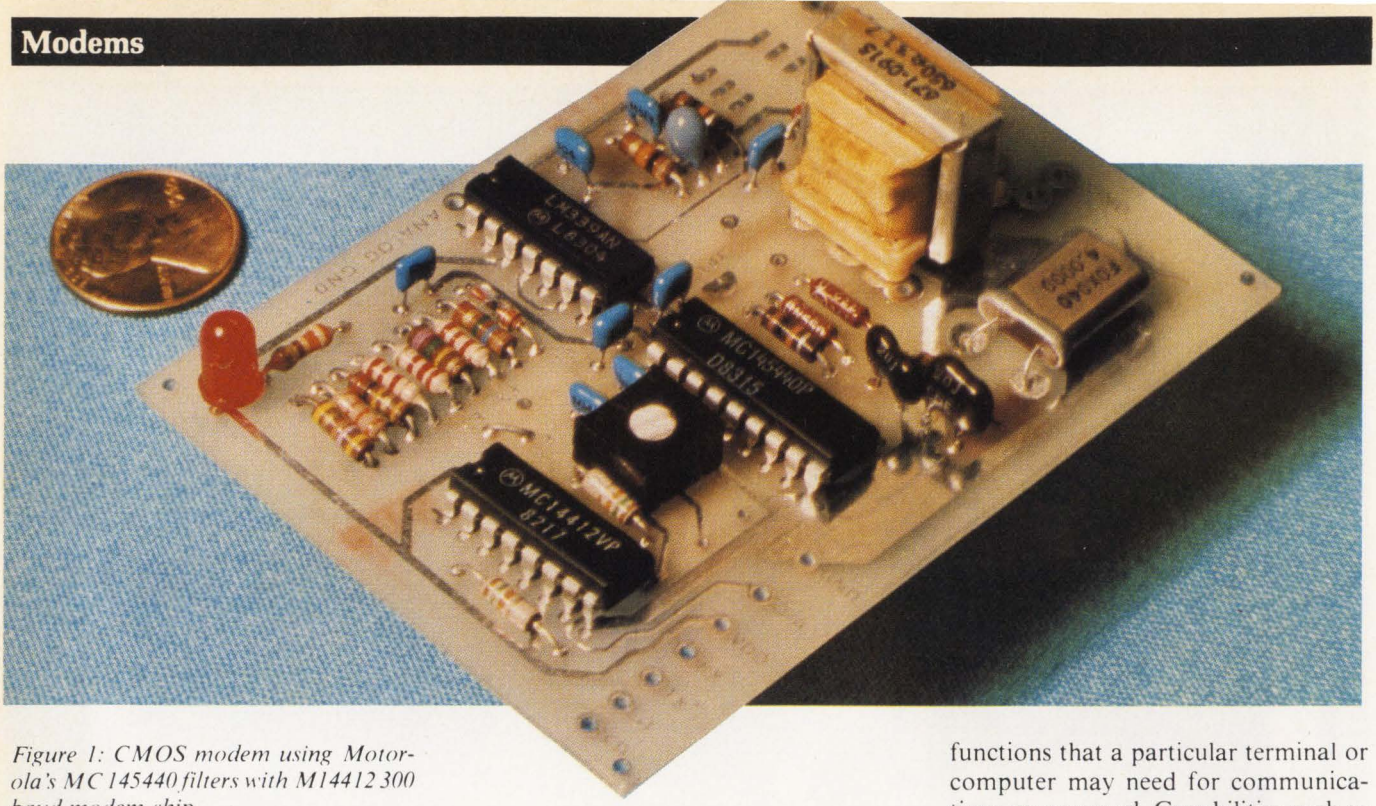


Figure 1: CMOS modem using Motorola's MC 145440 filters with M14412 300 baud modem chip.

Bell/CCITT standard chip sets from Exar and Cermetek, with those that will undoubtedly appear soon from other IC houses, are further impetus for integrating modems.

The advantages to using modem chip sets begin with size. Products can be placed on a board with other components, and even those that are packaged fit on a small board, as the Motorola (Austin, TX) 300 baud modem in **Figure 1**. Other suppliers' modem chips include the filters, for further part count reductions. With chip sets, modems can be designed to get their power from the device's main bus, as well.

One important thing that can be achieved by designing with modem chips is the addition of features and functions that a particular terminal or computer may need for communications on one card. Capabilities such as auto-answer, auto-dial and dial sequencing, which redials a number or alternate numbers until communications have been achieved, let terminal equipment communicate unattended.

In choosing chips to design a modem into a terminal or computer, preliminary considerations must include:

- Speed needed — is 300 bps sufficient, or would the device support 1200 bps or higher? Only 300 bps

Speed	300 bps	1200 bps	1200 bps	up to 300 and 1200 bps	2400 bps	2400 bps	4800 bps	4800 bps	9600 bps
Bell Standard	103J/113D	202S	202T	212A	201C	201B	208A	208B	209
CCITT Standard	V.21	V.23	V.23	V.22	V.26 bis	V.26	V.27 bis	V.27 ter	V.29
Transmission Mode	Full Duplex	Half Duplex	Full Duplex	Full Duplex	Full Duplex	Full Duplex	Full Duplex	Half Duplex	Full Duplex
Channel Type	2 wire	2 wire	4 wire	2 wire	2/4 wire	4 wire	4 wire	2 wire	4 wire
Switched or Private Lines	Switched	Switched	Private	Switched	Private or Switched	Private	Private	Switched	Private
Synchronization	Async	Async	Async	Async or Sync	Sync	Sync	Sync	Sync	Sync
Modulation Scheme	FSK	FSK	FSK	FSK	4-phase PSK	4-phase PSK	8-phase PSK	8-phase PSK	16-point QAM
Notes	Bell 113 is avail. as answer-only (C) or originate-only (A/D)	V.23 covers both half and full duplex; 202S has opt. 5 bps reverse channel	202T will operate up to 1800 bps with C2 line conditioning	async 0-300 bps; sync at 1200 bps; some use PSK for 1200 bps					requires D1 line conditioning

Table 1: Bell and CCITT standard modem types by speed. In the US, Bell standards predominate, but CCITT are the accepted standards throughout the rest of the world and are also more popular for higher speeds, even in the US.

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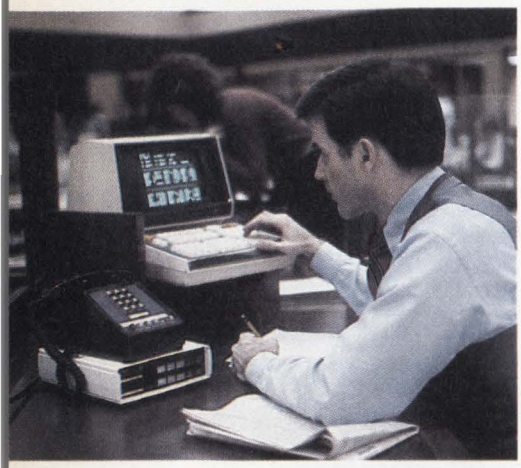


2400 bps switched line modems in environments like a stockbrokerage allow large file transfer, batch transfer such as disk to tape and printing over existing phone lines. Photo courtesy Concord Data Systems.

and a few 1200 bps chip sets are currently available off-the-shelf.

- Does the device need both answer and originate capability? Most chip sets allow both, and if both are not needed, a custom-designed board may be more cost-effective.
- Will the device need pulse (dial) or DTMF (touch-tone) dialing capability, or both? Most chip sets are designed for one or the other.
- Are automatic dialing and answering and telephone number storage important, or will the device generally be operated manually for communications?
- Is CMOS or NMOS more desirable, and how much space really can be used for modem functions?
- Should the modem be direct or acoustic coupled to the communication lines? Direct connect requires using an FCC-approved DAA (Direct Access Arrangement) device, and displaying the approval sticker on the outside of the final device. Acoustic coupling allows flexibility, but lower quality coupling demands a good bit of analog interface design.

Considerations for an actual design vary with each device, but include interfacing to the telephone line, and often to the microprocessor bus. By their very nature, a modem's analog and digital components require careful shielding and placement.

The extensive documentation offered by TI, Exar and other chip set makers is invaluable to digital designers who design these analog parts.

A complete modem using available chip sets requires many times the number of ICs in the set; **Figure 2** is a schematic of the 19 IC final configuration of the available Exar (Sunnyvale, CA) 212A-compatible 3-chip set.

But Exar and others are introducing chip sets with more and more analog functions on the chips of the set. Exar's newer 212A set will incorporate the same functions as the 19 IC configuration onto 4 chips, according to Jim Lange, and eliminate the need for the external logic, resistors and capacitors. This will not only allow drastic size and price reductions, but should make modem design far less intimidating, time consuming and design intensive. And as the year progresses, there will probably be similar introductions from several manufacturers.

Modem chip sets will enter not only the traditional OEM modem board markets, but also be a big factor in mobile applications. Portable computers and data collection and entry equipment that needs to be truly mobile will benefit from the great space savings of communications in a few chips.

Ready-to-Integrate Modems

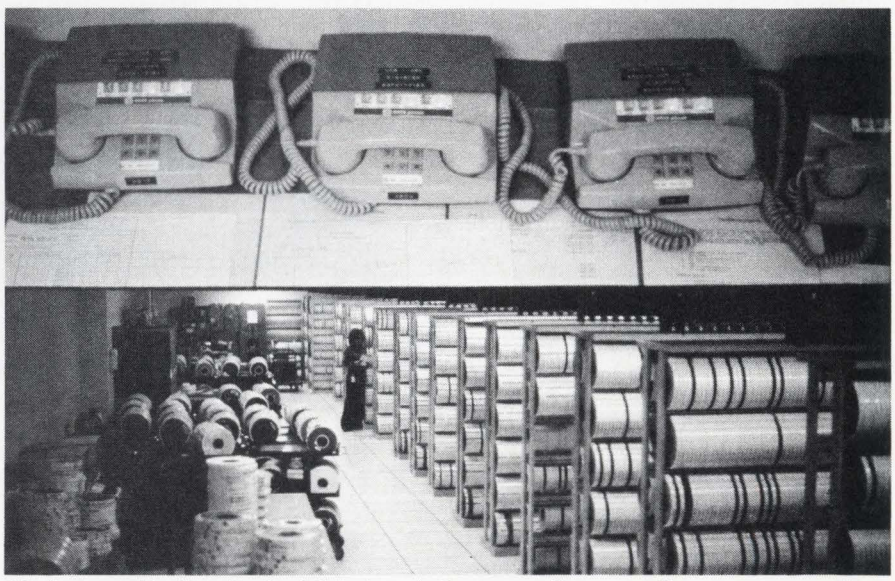
To receive the advantages of integral communications without designing the actual modem and analog circuitry, terminal, FAX, PBX and other data equipment manufacturers have relief on OEM board modems. Sources of board modems are proliferating, as traditional standalone manufacturers find that many of their products can successfully be sold as boards.

Space and packaging savings can be important, and OEM suppliers know that board-level modems must offer exactly the features a particular device will need. This requires working with the terminal equipment designers to optimize, and often to customize, the modem for each product.

Standing large OEM orders allow modem manufacturers to purchase parts in sufficient quantities so that prices are low. Companies such as Racal-Vadic offer standard low and medium speed modem lines that incorporate various features in both standalone and board configurations. Standard Bell 103/113 and 212A and CCITT spec modems assure devices of wide communication compatibility, generally for a nominal cost.

Companies such as Falco Data Systems (Sunnyvale, CA), who integrate their own modem into their terminal, say that the integral modem is a great boon to users, and thus to their sales. And, indeed, the use of integral modems in computer equipment is increasing.

The original markets for OEM modems—addressed by Rockwell (Newport Beach, CA), who offers only board modems and has done so for 30 years, and Universal Data Systems (Huntsville, AL), who has been offer-



Modems used in New England Telephone's Corporate Computer Center connect various databases. Photo courtesy AT&T.

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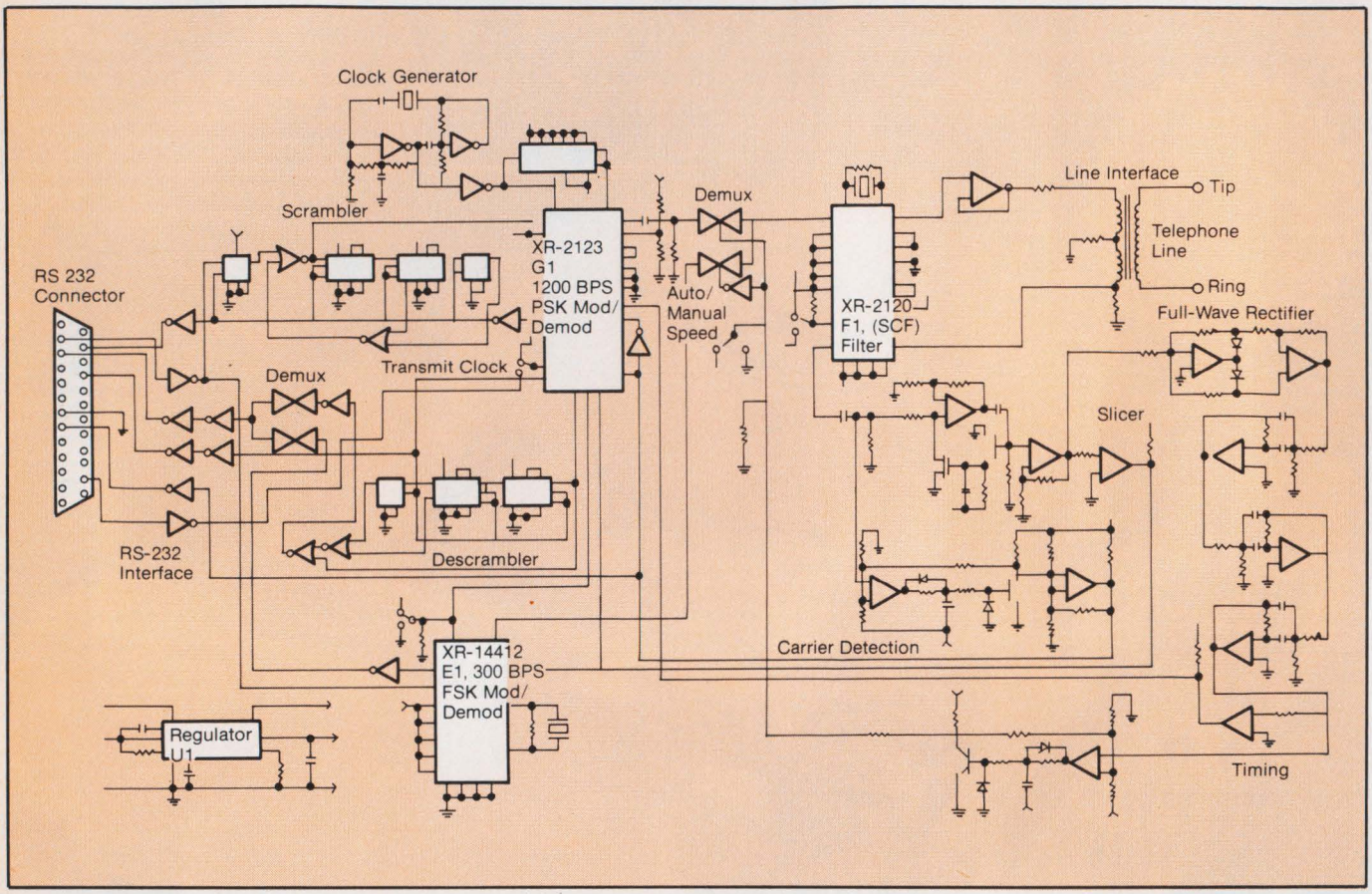

Figure 2: XR-212A Type Modem uses 16 ICs in addition to the Exar 3-chip set, to achieve 300/1200 bps modem functions. This is a typical chip set modem configuration until new chips integrate more functions.

ing OEM Modems for 13 years—were largely in facsimile and data communications. Even the standalone modem manufacturers who make some of the boards need backup supplies.

The newest and biggest impetus in integral modems seems to be the personal computer. Datec, (traditionally in the industrial market), Rixon, (an established modem maker), Hayes, (now an accepted standard for PC modems), and hosts of others including Ven-Tel and Bytcom are offering PC board modems. The phenomenal growth of Anchor Automation, who offer modems at the very low price range for PCs, is indicative of the force of that market for board-level modems. And since the PC has more intelligence and memory available to the modem than a dumb terminal, often very inexpensive modems can make use of the PC's power for adding functions and control.

Integral modems will be especially evident in devices designed for mobility. The portable computers, as well as hand-held data collection and entry devices will demand integrated modems with minimum board space.

Another relatively new and potentially large market for OEM modems is their incorporation with statistical multiplexers. Stat muxes have become a good line-saving device. With their use of idle time on one line to send signals from another on the same channel, stat muxes can send the signals from more than four 2400 bps modems down one channel at 9600 bps, and the available 9600 bps OEM modems from Rockwell and UDS make the stat mux even more useful. Many of the total network vendors offer such high speed OEM modems.

OEM 9600 bps modems have been around for some time, and some, such as UDS' original 4-wire full-duplex model, are unadorned workhorses. UDS' VP of Marketing George Grumbles says "It was the engine . . . It didn't have any fancy bells and whistles . . . It was a pump for someone that wanted a reasonably inexpensive 9600 bps modem." And therein lies the beauty of the OEM modem; it can be configured with only the features a device needs.

Rockwell's traditional OEM line is also one of medium speeds. For added reliability, their new OEM line uses the adaptive equalization techniques they pioneered for 9600 bps in all speeds of modems, from 1200 bps to 9600 bps. At 9600, modems need equalization to run over telephone circuits; at the slower speeds, it simply offers very low bit error rates. Rockwell has also been in the area of LSI for modems for some time, keeping part count down, and prices and size small.

The new modems mentioned above are hardware compatible, and can be used interchangeably in a design. Designers can thus offer different communication speed options on the same computer or terminal device without redesigning hardware. These modems use only 3 to 6 chips, for a total size of 100 x 65 to 100 x 160 millimeters, and include both the RS-

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232 and microprocessor bus interfaces.

Similar size and component count reductions are evident in the lower and medium speed OEM modems, as well. Using both custom and off-the-shelf ICs, suppliers such as Racal-Vadic and the host of PC board makers are churning out quantities of standard modems. And at the board level, modem and digital device designers can cooperate to create modems with just the features and specifications needed, with the benefit of a modem maker's experience in custom modulation and filtering LSI taking analog circuitry in hand.

But integral modems have not overtaken the market, as once was predicted. There are several reasons, including the fact that designers of digital equipment often do not want analog circuitry confusing their machine. There are some disadvantages of integral modems for certain users, as well.

Any call status or line monitoring included no longer has a front panel for display. Though some modem boards have LED indicators, they are not very accessible. And OEM modems are not as flexible in some ways, since more than an RS-232 cable connects modem to device.

But most of the disadvantages of integral modems are for multipoint or network environments one step short of totally centralized network control. Remote terminal and other devices, especially those that communicate at 300 or 1200 bps, will benefit from the inclusion of a modem. Between PC manufacturers and the new Teletype standards that specify a V.22 1200 bps full-duplex integral modem, quantities should be high enough for very competitive pricing.

Commodity Modems

Low speed standalone modems, from 200 to 1200 and even 2400 bps, have become standardized around the Bell specifications and are produced in such quantities so as to become truly commodity items. But there is much innovation afoot, as competition is hot.

Probably most important is the integration of components, as witnessed by the chip components. This reduction in part count has allowed smaller and smaller modem boxes, as well as plummeting costs. And for the PC and terminal markets that open large markets for low speed modems, these are prime features.

As more and more databases are available to small computer users, the desire for communication capabilities will continue to grow. Companies like U.S. Robotics, who use a patented digital signal processing scheme to keep part count low and costs down, have seen tremendous growth.

Other companies aiming at the "toy" end of the market have similarly seen great successes — Bizcomp, Anchor Automation and, of course, Hayes, to mention a few — are taking advantage of the growing base of sophisticated small computer users. Modem firms like Datec (Chapel Hill, NC) and Rixon (Silver Spring, MD) are also expanding into PC modems, and even AT&T Information Systems (Morristown, NJ) is offering new lines of 300 baud modems.

Though new 300 bps modems are appearing, standard 1200 baud modems are becoming inexpensive enough so that the line time savings pay off quickly. And most 1200 bps modems are Bell 212 compatible, which means they have a fallback speed of 0-300 bps, to remain compatible with the 300 baud equipment. (Note that bps or bits per second and baud are interchangeable at speeds of 1200 and below. Above that, generally more than 1 bit is packed into a baud by phase shift keyed (PSK) modulation, so speeds are given in bps. 2400 bps is achieved by packing 2 bits into a baud, 4800 by 4, and so on.) 300 and 1200 bps modems can use simple frequency shift keying, available in off-the-shelf silicon.

Standard modem chip components at 300 and 1200 bps are in great demand by all of the competing manufacturers. Some of the smaller houses are having trouble getting delivery on components like Intel's 8051, despite second sourcing. In this fierce competition, a range from all off-the-shelf, simple communications interfaces to auto-answer, auto-dial and re-dial and number memory modems offer choices. Codex flaunts integral software, for example, in a new model; others offer modems for well under $100. And these will all find buyers, though more and more low speed modems will be integrated into the equipment for user convenience and cost.

Innovations in Mid-Range

Some very big advances in modems, as well as very large volume sales are being made in the 2400 to 9600 bps speed range. Not only are sizes/parts counts/prices shrinking, as in the lower speed modems, but some very interesting features are being added.

Perhaps the most significant advance is a concentration on software-based products. A prime example of this trend is Racal-Milgo's Omnimode series **(Figure 3)**. These modems are software-strappable and even remotely strappable, so modem operating parameters can be changed if network reconfiguration requires it. Networking requires that parameters be available to both central sites and to the terminal user, and Paradyne and NEC also offer soft-strap modems. With the cost of EPROM dropping, more announcements can be expected, making installation and control of large networks possible from a main console.

There is a question of how much this

Figure 3: Racal-Milgo's Omnimode 9600 bps software strappable modem, whose operating parameters can be changed for network requirements.

soft-strapping saves the user. How the strapping information is entered is important. On the one hand, if new PROMs must be burned, or even if extensive keying is required, hard or firm straps could be more convenient. And if the modem command mode is too easily entered, normal data streams could stop communications. But for large networks, soft strapping does offer huge increases in flexibility. And software strapping will, no doubt, be more and more popular and valuable.

Network management and control systems, DNCS (Distributed Network Control Systems), and diagnostics are a big emphasis for the large firms offering complete modem lines. Paradyne with Access **(Figure 4)**, Codex and Racal-Milgo are all promoting complete network solutions, with control units and extensive monitoring and control on many types of modems. Such solutions are invaluable to large users, but they naturally commit users to one company's products.

A major issue for these modems is whether the switched network is feasible. The quality of the lines generally does allow dial-up use, but most users at the 4800 to 9600 bps level have their own lines. Nevertheless, with tariffs going up for leasing lines (after all, the new telephone operating companies must now make a profit somehow), especially with communication an essential, nearly all have fallback speeds and dial-up capability.

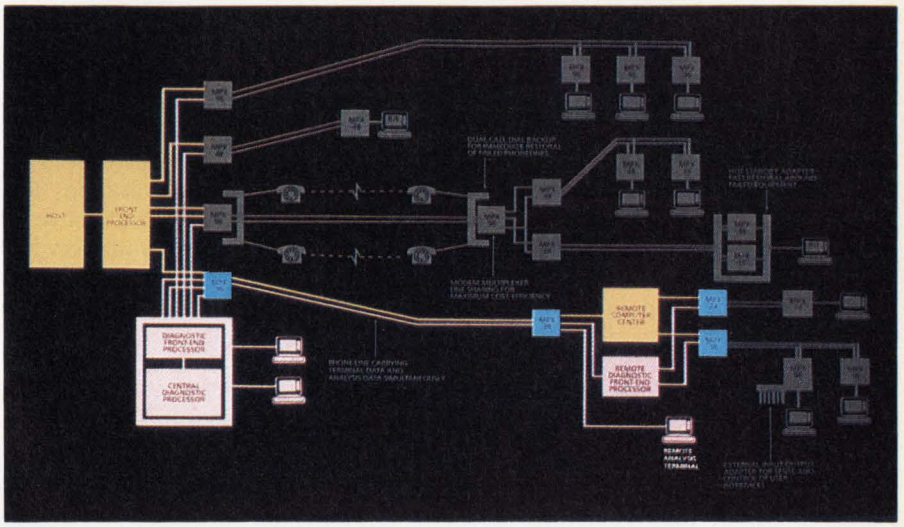
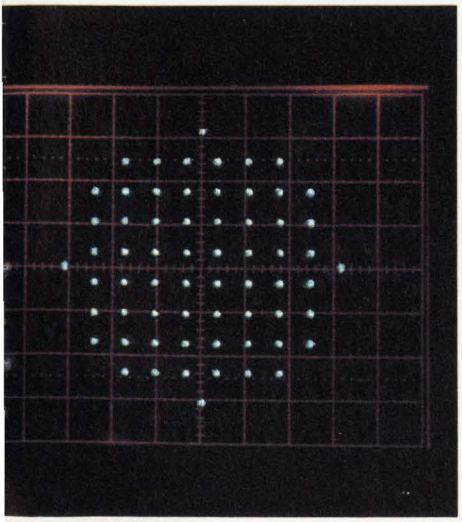


Figure 4: Paradyne's network scheme shows various types of lines. The pink highlights links with diagnostics. The grey indicates point to point and multidrop.

Figure 5: Actual signal constellation of a 14400 bps signal as received on a typical telephone circuit.



The 2400 bps full-duplex modem pioneered by Concord Data Systems (Waltham, MA) several years ago, is now very popular, since there is some standardization. CDS has now incorporated an auto dialing feature onto its full duplex 2400 bps modem. The acceptance of 2400 bps will likely move faster than the 1200 bps 212A did. And the CCITT is very near a 4800 bps full duplex dial-up standard, which should give Anderson-Jacobson (San Jose, CA) company in that field.

Here again, the advance of LSI microprocessors and components has allowed some drastic price cuts, as well as additional intelligence for network monitoring and control, and to some extent, diagnostics in consistent size boxes. Some component and parameter standardization is taking place for 4800 bps (Bell 208 standard) and 9600 (CCITT V.29).

It is interesting to note that the 9600 bps Bell standard, 209, is very rarely used. At the higher speeds, CCITT standards (V.29 for 9600 bps) dominate. This is in part because the large users that need that speed generally also need to communicate outside of the US and Canada, where only CCITT standard modems may be used on the telephone networks. But the main reason is that with deregulation, Bell will no longer necessarily be the source for telco modems.

A particularly interesting segment of the 9600 bps modem offerings are the "fast poll" modems. For some time, Codex has used a "gearshifting" technique for fast polling of modems, with a TRS-CTS delay of only 9 ms. General Datacom Industries uses a similar technique to better utilize the available 9600 bps speed. Paradyne has also achieved fast polling, but by using a memory technique to adjust speed.

The CCITT is currently working on a standard for "true" fast polling 9600 bps modems that would allow a 30 ms delay. The standardization of delay for fast polling equalization compares to a 253 ms delay under the V.29 9600 bps standard. Rixon, Kinex (Largo, FL) and others are making 9600 fast poll modems to the CCITT standards now.

Another big thrust for Kinex in the 9600 bps area, is data compression. Kinex's 9600 modem effectively operates even faster. Data compression gives a 9600 bps modem the ability to clock in and out at 14,400 bps. But this is achieved in a very different way than other speed gains.

The move from single bit baud (300 and 1200 bps) to multiple bit baud (2 bits per at 2400 bps and 4 bits per at 4800) to multiplexing of several lines by looking at the idle time on each channel and using the idle time of one modem to transmit from another has all been data transparent. But the use of data compression requires looking at the data and reducing it in any way possible.

The advantage is, of course, that

much more data can be sent in a shorter time at lower bit rates. This will allow the use of unconditioned 3002 lines (Bell designates its worst quality lines as 3002), an important fact in light of the fact that only 11% of Bell lines are estimated to be able to handle 14.4 Kbps speeds, while 70% can transmit at 9600 bps. Looking at the data itself, however, is difficult and really changes the face of modem parameters. The protocol insensitivity of modems is one of their greatest advantages.

But the need for fast transfers of information in many applications where conditioning of the line is not advantageous, and most especially where dial-up charges are burdensome, will push this ability to squeeze quantities of data into medium speed channels. Data compression is now available not only in Kinex modems, but also in multiplexers from Symplex and in Racal-Vadic standalone units. And by stripping start and stop bits from asynchronous data streams, Paradyne is also entering into data compression. The costs will likely remain high for some time, but for certain applications, the savings on line costs will make up for the initial investment.

lower speeds can use one channel at 14.4 to merge channels and save lines. These high speed modems are used on dedicated lines by large volume users. Mainframe-to-mainframe links, graphics links and similarly speed and data intensive communications lines need to operate at 14.4 and above.

Traditionally, most of the very high speed links were covered by limited distance modems, which could use much higher grade lines than those offered by the telephone network. But with the demand for communications between remote sites increasing in general and sophisticated equipment that requires high speed links becoming more widely distributed, schemes to make voicegrade lines accept high speed data have been developed.

Complex quadrature amplitude modulation techniques are stretched to achieve the 64 individual points that are needed to encode 8 bits of information per baud. **Figure 5** shows the signal constellation of the Paradyne 14400 as received on a typical telephone circuit. Because of the 64 points in the finite range of a telephone channel, the noise tolerance of 14.4 modems is very low; a small shift can cause a question

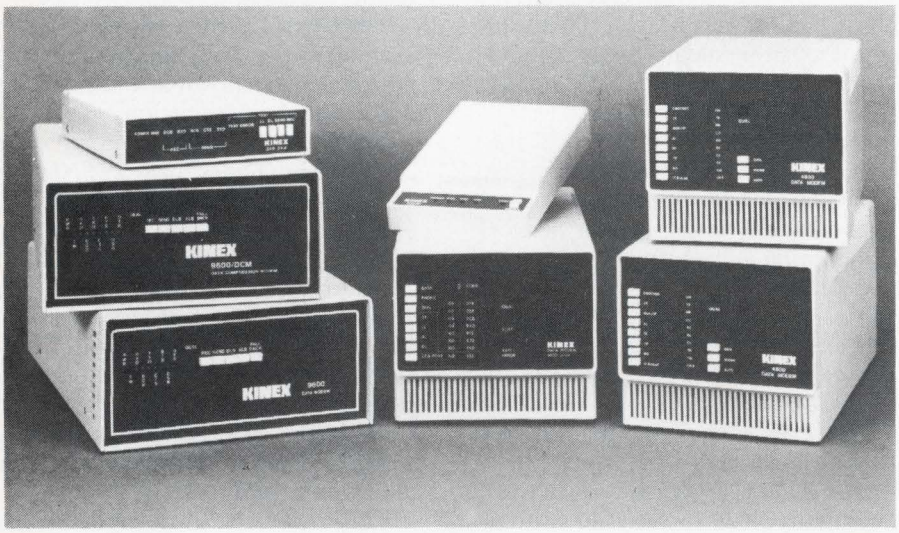


Figure 6: 4800 and 9600 bps modems from Kinex, including the 9600 with data compression, at center left.

High Speed Push

The number of modems that operate at 14,400 bps is growing rapidly, as is the market for such devices. Users with a large network operating at many of the

of which of the 64 states was meant by a given signal.

But that difficulty hasn't stopped Paradyne and General Datacomm Industries from coming up with an even faster, 16K bps, modem. These very fast modems will, no doubt, be joined by competitors at some point. But the gains are not as straightforward, and the penalties in sensitivity and reliability as well as the cost of such an engineering-intensive product will limit the applications of voiceband 16K bps and higher modems for some time.

The 16K modem is also only very useful in point-to-point links, as 16,000 bps does not break neatly into channels as does 14,400. And at this point, the higher speeds are simply not feasible over voice-grade lines. All of the high speed modems for use on the voiceband network may suffer somewhat from the lack of standards, as the 2400 full duplex once did and the 4800 bps full duplex is now. But vendors have seen significant orders for 14.4 modems. Many users need to transfer data at that speed or have many 2400, 4800, 7200 and 9600 bps lines that they can conveniently combine over one 14,400 channel.

As computers, terminals and workstations are operating faster, they also need to communicate faster. Even higher speeds will, no doubt, be achieved over voice-grade lines. And the new break between local and long distance telephone carriers could cause higher demand for diagnostics.

One area to look at if reliable diagnostics is important could be in-band test and diagnostic channels, instead of traditional sideband reverse channels. Especially important in protocol environments, in-band testing is not disturbed by the noise transients that creep in from the outside of communication channels.

Modems for Special Links

Traditionally, high speed lines were only needed for in-house links to the main host and provided for by limited distance modems. These products still have a very important place in the modem market. Since these lines are of shorter distance, the signal degrades less, and can be of much higher quality without telephone company restrictions. Consequently, limited distance modems can be less technically advanced to achieve high speed.

Limited distance modems are an established item that can be used to fulfill many of the functions that are

making local area networks (LANs) such a hot new commodity. With data rates from 0 to usually 19.2 Kbps and often much higher, to 64K and above, these modems allow huge speeds in a network up to several miles.

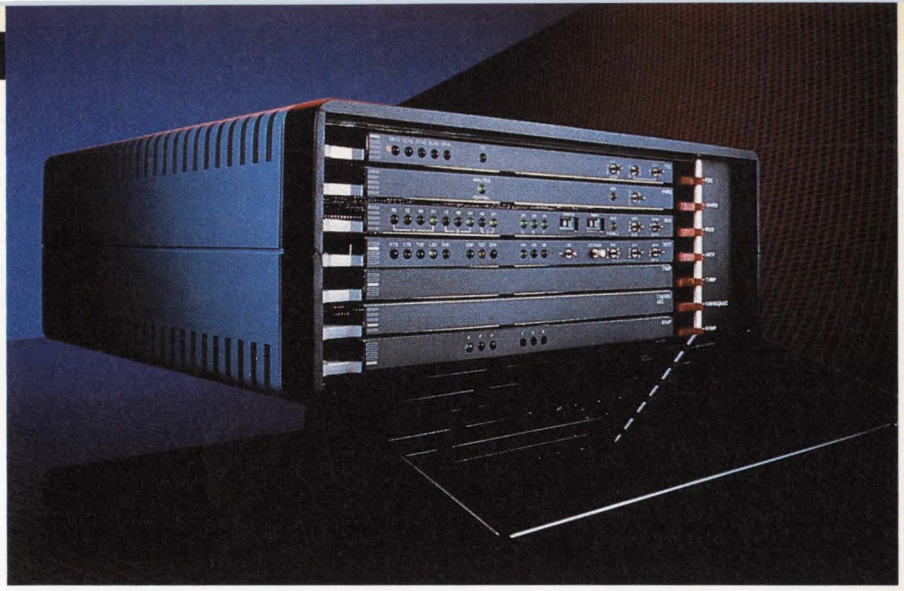
The increasing use of personal computers instead of dumb terminals will no doubt create additional demand for synchronous limited distance modems at lower speeds. Higher speeds are needed for remote front end processors and cluster controllers, important in industrial and office automation.

One interesting development is the use of existing lines for limited distance communications. Avanti, for example, has introduced the LDX 100 **(Figure 6)**, which uses PBX dial-up lines to run at 4800 or 9600, a great speed increase over, for example, Bell 212 1200 bps transmission. Since limited distance modems can often run on twisted pair or even installed lines, they have an advantage over complex LANs that need expensive, often bulky special cable. Several firms, including Astrocom, Remark, Bo-Sherrel and others, focus on limited distance modems. Many voiceband modem makers offer them to fill out product lines.

Though a network of modems may not necessarily offer all of the flexibility and functionality of a LAN, installation is much simpler. New installations will probably use complete networks, but limited distance modems allow even satellite data on a few models for a comparatively low cost.

The very highest speed communications requirements demand yet other special kinds of modems. Wideband modems, operating at speeds over 19.2K bps and modems for fiber optic lines, which have virtually unlimited bandwidth, as well as modem eliminators round out the upper end of the spectrum.

These devices are not yet very widely used, as the lines are not as common as voiceband telephone lines and not too many users need the speeds offered. At least not yet. These markets will, no doubt, grow as more and more sophisticated equipment is installed. Fiber optics are now being installed for many military applications and for long-haul telephone, but little of it actually gets past the telephone companies' central exchanges and to customer sites.



Products such a Paradyne's 14.4 SM modem include other features, in this case, an integrated statistical multiplexer, to increase performance and functionality.

In addition to these devices, traditional modems will begin to be integrated into other devices to meet needs. Multiplexer/modem combinations will be especially evident in the fairly near future, as line costs rise and the number of data terminal devices hooking into central sites grows. Multiplexers with integral modems provide great capabilities with maximized line savings.

Network management systems will continue to proliferate and grow more complete. Monitoring and diagnostic functions will expand well above the basic analog and digital loopback tests and call status indication. The increased memory and intelligence needed for these functions will pay for itself in very large installations, when problems will be easy to pinpoint and even, in some cases, to circumvent.

Market Expansion

One of the strongest messages of talks with modem manufacturers is that product lines are expanding in *all directions*. Traditional low-speed vendors are expanding into higher speeds and vice-versa. Offerings are expanding to include both standalone and board-level versions of all of the standard modems. Makers of very low end "toy" modems are expanding speed and functionality. There is a great movement among modem manufacturers to offer families of modems, and even accompanying network management products.

The market is demanding that everything from $75 modems for home use to tie into The Source to 16K bps high-performance engines be able to operate, at least in a fallback mode, over unconditioned telephone lines.

The breakup of AT&T bodes well for the modem industry. The local telephone companies are no longer bound to buy Bell equipment. The tariffs on leased lines will probably go up, and though it will be hard on users, this may make higher speed modems popular to multiplex medium-speed channels through one line. It remains to be seen exactly what will happen to the dial-up rates, but the predictions are that local rates will do down, making higher speed dial-up modems important products.

And whether the tariffs really do go up or not, the quantity of terminals, workstations and computers that most companies now want to connect is growing so rapidly that much new data communication equipment will be purchased over the next few years. Conditioned lines and private networks will accommodate the extremely high speed transfers and large volume users, but the ready-installed telephone network will carry more and more data communications.

Even the phasing-in of the all-digital (DDS) network will not spell doom and gloom for most of the modem industry. They are working on data communication processors that will be needed in that environment, as well. Engineering efforts are not only to expand modem lines, but to care for future communications needs, as well.

The modem industry is, indeed, changing today. And the competition is heating up to such an extent that an industry shakeout is likely. The companies that cannot keep up may not be those with insufficient technical exper-

tise because marketing and service are very important. Many of the more successful small firms are making standard 300 and 1200 bps modems, using off-the-shelf components and keeping overhead low. Still, for any of those firms lost in the shakeout, a demand for communications for hundreds of new terminals and computers will keep the growth of the modem industry reasonably steady for at least several years, — by which time much of the development of products to meet the needs of a digital network and new technologies will be done. □

Manufacturers of Board, Box and Chip Level Voiceband and Limited Distance Modems

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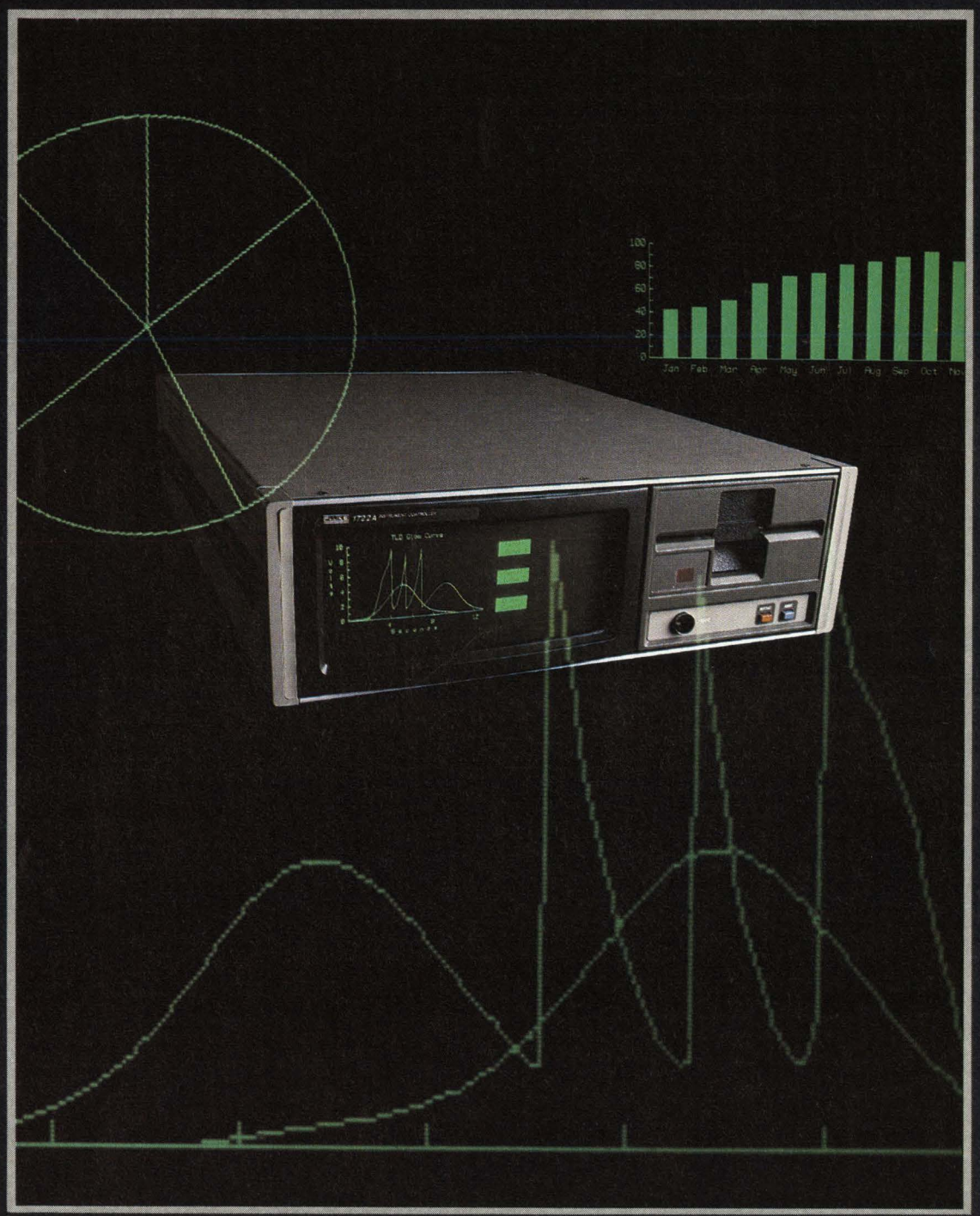


THE IEEE 488 BUS

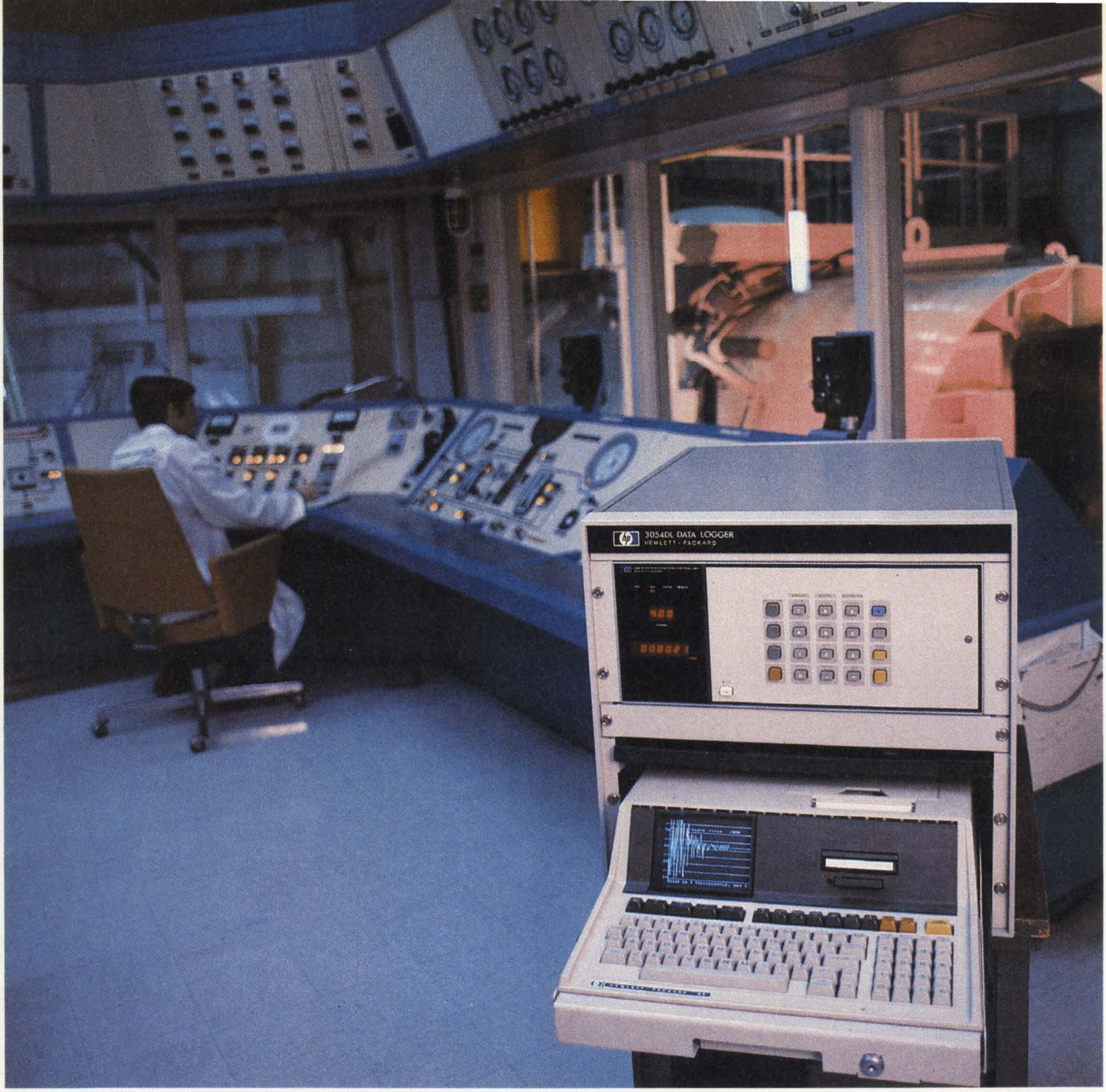


Photo courtesy Hewelett-Packard

Designer's Guide To The IEEE 488 Bus: New Life For An Old Workhorse

The GPIB is no longer important solely for the test engineer, but has found wider applications that will also impact the systems integrator.

by Dave Wilson, Senior Technical Editor

The first major step toward general compatibility in electronic instrumentation for system use came in 1975 with the publication of the IEEE 488-1975 standard that defined an interface and communications bus for programmable instruments. This bus is commonly called the GPIB — the General Purpose Interface Bus.

In 1978, the standard was further refined (IEEE-488-1978), defining an interfacing system that has become a widely accepted instrument industry standard. Tradition-

Fluke products compatible with the IEEE-488 range from DMMs to signal generators.

ally, the bus has had the image of being devoted to the area of instrumentation control and data acquisition. It has allowed test engineers to concentrate on solving their measurement problems instead of on computer instrument interfacing. With GPIB compatibility, measurement devices can be chosen off-the-shelf and simply cabled with standard bus cables in either a linear or a star configuration.

Today, the GPIB is finding a new application image, as a general purpose communications bus for computer to computer data links.

The flexibility of the bus is no longer important solely for the test and instrumentation engineer, but has found wider applications that will also impact the systems integrator. **Table 1** illustrates how the bus compares with other networking schemes currently available in the marketplace, and **Figure 1** shows its use in tying together some key areas in an industrial environment. Testifying to this new image are a wide variety of board related products that allow the designer to hook up computer systems from Digital Equipment, Intel, Pro-Log, etc., in a network environment that may also include test and development stations.

An automated test and measurement system usually consists of multiple instruments, controllers with software computer peripherals (such as disk and tape drives), a keyboard and a display. The multiple instruments included may consist of either stimulus instruments, such as function generators, pulse generators and power supplies or measurement instruments, such as counters, waveform digitizers and multimeters.

Controllers tell the instruments what to do, collect results and process them. The systems controller is generally a small computer. The software or firmware operating system must have a powerful, flexible I/O structure to handle GPIB bus traffic. It must also have processing power for waveform manipulation and graphics for display.

For smaller systems, a controller usually includes a keyboard display and peripherals. Larger, more powerful systems may be minicomputer based. Since the instrument houses, such as Fluke, Tektronix and Hewlett-Packard were instrumental in the early stages of the bus, many sophisticated controllers have been made available by those companies.

Today, the ubiquitous multi-purpose, low-cost IBM PC is going after a similar marketplace. When the product was introduced, an enormous number of third parties attempted to cash in on the IBM bandwagon. Not only is it now possible to configure the PC to be GPIB compatible (through boards from Ziatech and Applied Micro Technology), one can also buy PC compatible controllers (from companies like E-H International). Since this controller is software compatible with the IBM PC, it can also accept any PC program, as well as optional compilers for BASIC, COBOL, Fortran, and PASCAL. Couple these announcements with the wide range of test and measurement products available for the machine (Valley Data Sciences Software driven from programmer and Northwest Instruments Logic Analyzer), and the picture of an integrated test and measurement workstation on each designer's desk seems a step closer to reality each day.

Before the GPIB, most measurement systems were operated by controllers that required a separate connector for each instrument. With the GPIB, this is no longer a requirement; users can directly link as many as 14 instruments with the controller via the bus, and set up the systems in linear or star configurations (see **Figure 2**). Although the hardware characteristics of the bus specify cable lengths up to and not exceeding 20 meters (66 feet) with a device load required for every two meters of cable, products are available (like National Instruments' IEEE-488 bus extender boxes) that are transparent to the bus and can give up to 300 meter extension per pair. (See **Figure 1**).

Fundamental to the 488 standard is the partitioning of

HP's automatic Data Aquisition/Control System.

	Local Area Networks		
	Telephone Line Networks	Office Automation	Laboratory Automation
Examples	SNA X.25 BSC (3270, 3780)	Ethernet Omninet	NET 488
Characteristics	Low Speed 9600 bits/sec) Long Distance	High Speed (1-10 Mbits/sec) Within Building	High Speed (4 Mbits/sec) Within Building
Emphasis	Access to Mainframe Database Distributed Processing	Computer Periperal Sharing - File Server - Print Server - Gateway to Telephone Net	Interfacing Computers and Instruments
Hardware	Mainframes Minicomputers Modems	Workstations Professional Computers Large Discs Expensive Printers	Micro/Mini Computers Programmable Instruments CAD/CAM Stations

Table 1: IEEE-488 parameters as a local area network. (Courtesy National Instruments)

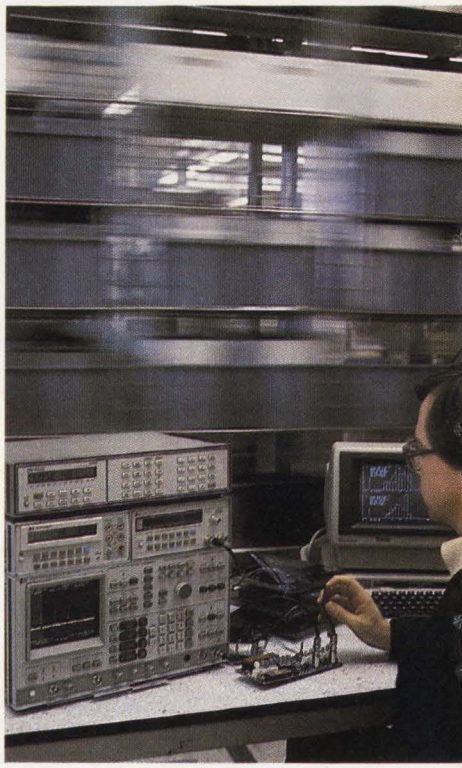


Photo courtesy Hewelett-Packard

GPIB operation into two logical functions: interface functions and device functions, as illustrated in **Figure 3**. This partitioning is analogous to the layering used in the design of networking systems. Logical communication between the device functions of different devices is accomplished by using the lower layer interface functions and from the interface functions back up to the device functions.

Physical communication occurs only between the interface functions of devices and is referred to as transferring remote messages (in contrast to the local messages between the layers within a device). Interface functions, remote messages, and local messages from the device functions down to the interface functions are the subject of the 488 standard, while device functions are specifically excluded and local

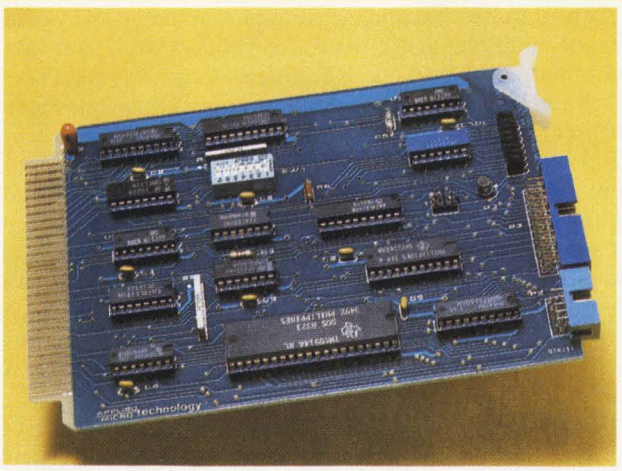
Controller Allows Designers To Network Computer Systems

Allowing designers to network their computer systems, the STD4311 IEEE General Purpose Interface Bus from Applied Micro Technology (Tucson, AZ) is designed to be compatible with most STD bus processors.

The unit, which is based upon the TMS9914, is software-programmable for the Talker, Listener, or Controller modes. Other user-definable options allow various interrupt or DMA operations to be implemented, with those inputs and outputs routed to the front edge of the circuit card.

A software support package is supplied with each unit. The package consists of a CP/M compatible diskette, which contains a driver program to allow the user to configure the systems in any of the modes. An interface cable (4311 to IEEE) is provided with the controller. *—Coville*

Write 468



The IEEE-488 bus can be used to hook together a variety of computer systems.

Put powerful instrument control at your fingertips.

IEEE-488

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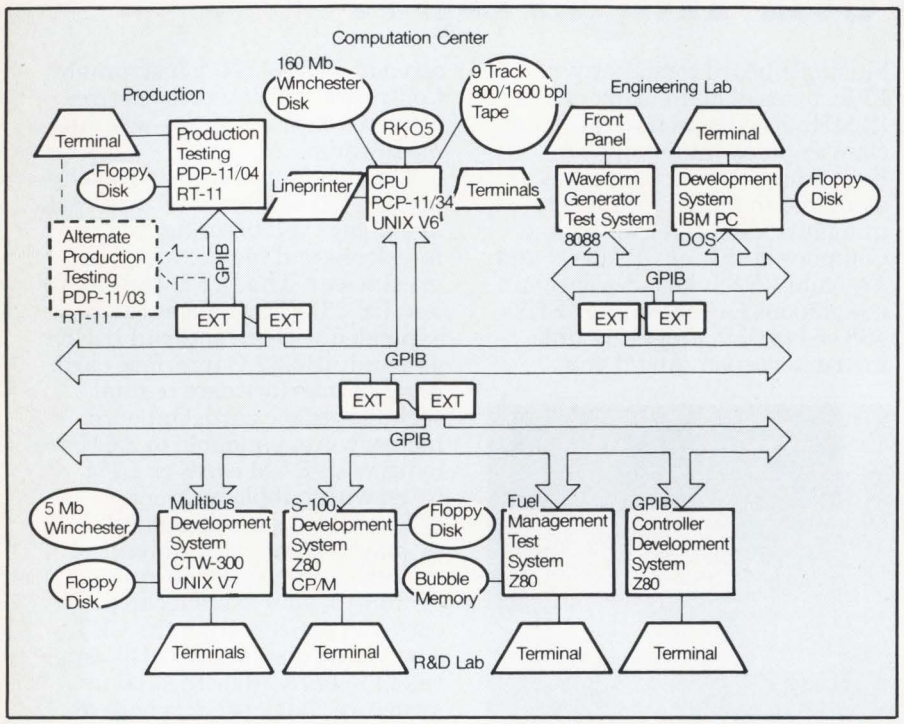


Photo courtesy Hewelett-Packard

◁ *Figure 1: The IEEE-488 GPIB as an industrial network bus.*

messages going to the device functions are only suggested.

The discussion of any interface can be divided into four areas: mechanical, electrical, functional, and operational. Although the IEEE-488 defines the first three areas, standardizing the fourth would involve standardizing such things as the functions that a voltmeter must provide. It is not desirable to standardize this, since it would not allow manufacturers to optimize their products for specific solutions.

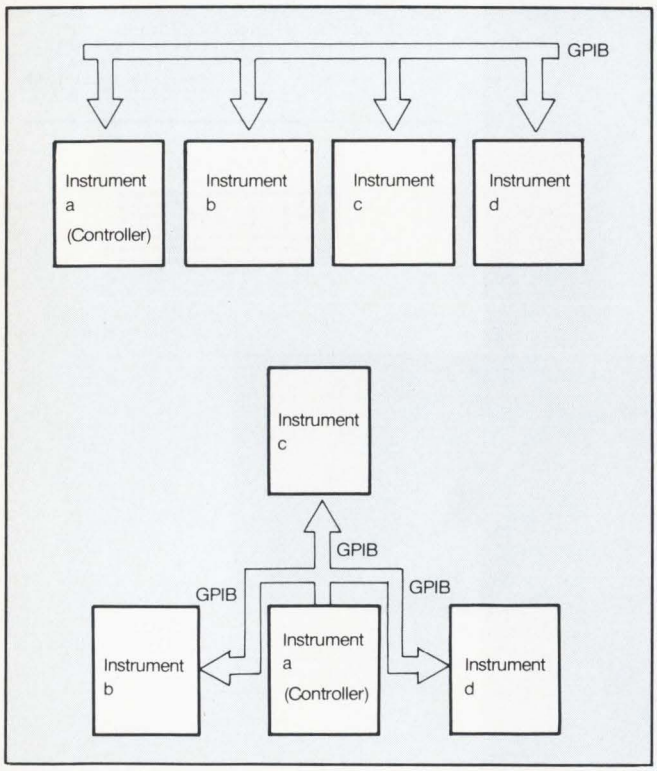


Figure 2: Linear and star configurations of the GPIB.

The mechanical standard specifies the interface connector and cable, the electrical standard, the logic signal levels and how the signals are sent and received. The functional standard outlines the tasks that an instrument's interface may perform, such as sending data, receiving data, triggering the instrument, etc., and the protocols to be used.

The GPIB contains 16 parallel digital signal lines, five of which are used for bus management, eight for data transfer, and three for supervising the data transfer or handshaking the data. The eight data lines are used for transferring "multi-line" messages in 8-bit parallel, byte serial fashion (see **Figure 4**).

Every GPIB device must be capable of performing one or more of the following roles. A listener is a device that is capable of receiving data over the interface when addressed. Up to 14 of these devices, such as printers or programmable power supplies may run simultaneously on the interface. A talker is a device capable of transmitting data over the interface when addressed. Examples of this type of device include tape readers and counters that can output data, etc. A controller is a device capable of specifying the talker and listener for an information transfer, including itself. A computer with an appropriate I/O card is an example of this type of device. There can only be one active controller on the interface at a time.

Interface functions are predefined capabilities which could be designed into a GPIB device. The designer is free to choose which are implemented in a device depending on the particular device's intended application. The total available set is summarized in **Table 2**.

The functional requirements of the GPIB are unambiguously specified in terms of 18 (or fewer) parallel interacting state diagrams. **Figure 5** presents a simplified version of two

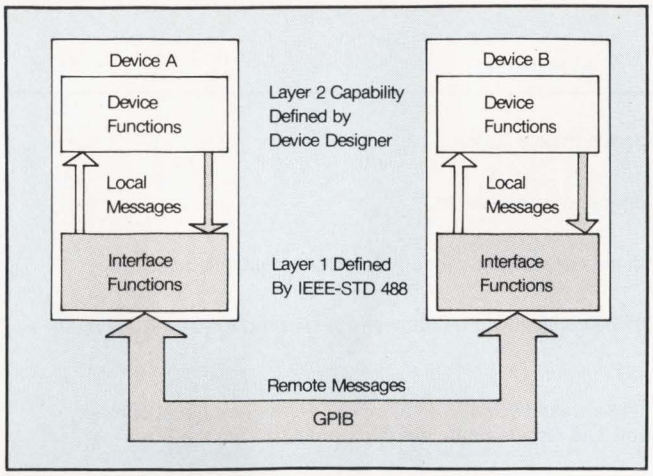


Figure 3: Layering architecture of the GPIB; shaded areas are the subject of the 488 standard.

principle interface function state diagrams of the 488 standard.

The Source Handshake (SH) and Acceptor Handshake (AH) functions are used to transmit and receive multiline messages. Each state that an interface can assume is represented as a circle and permissible transitions between the states are represented by arrows. The transitions of the SH and AH state diagrams define how the three handshake lines interlock the transfer of a byte. The three handshake lines

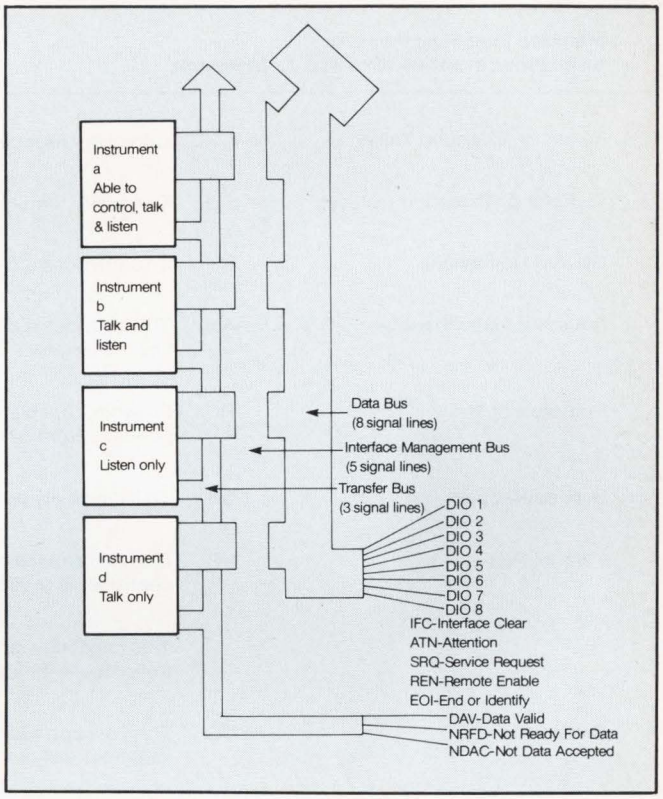


Figure 4: Functions of the 16 parallel lines of the GPIB; the lines are grouped for message status, device preparation and data.

New Bus Extender Increases Linking Distance Between Instrument And Controller

Whereas some users of IEEE STD 488-1978 compatible instruments may have been restricted to a maximum distance of 4m between instruments (with a total cabling distance of 20m), National Instruments (Austin, TX) has alleviated this drawback with their IEEE bus extender. With the GPIB-100 the user may locate instruments up to 300m from the controller or other instruments and increase the number of instruments on a single GPIB to 28.

Two GPIB-100 units, which connect to the GPIB with a standard bus connector, and an interconnecting transmission cable are required. The GPIB-100 detects the location of the System Controller, Active Controller, and active Source Handshake. Appropriate signals are transmitted and received from the identical remote unit to establish connection of the two busses.

The GPIB-100 link is transparent with respect to all GPIB functions except Parallel Poll, where the response lags by one poll. Each GPIB-100 unit represents one bus load to the GPIB. Since a total of 15 loads may be placed on each GPIB, the GPIB-100 also acts as an expander, enabling 28 devices to be connected together with a GPIB-100 system. Another advantage is that GPIB-100 systems may be connected together in series or star configurations.

Bus extenders allow the bus to be used in a network configuration.

-Coville

Write 467

Interface Functions that may be included in an HP-1B device.	Mnemonic	Comments
Talker or Extended Talker	T,TE	Capability required for a device to be a "talker."
Listener or Extended Listener	L,LE	Capability required for a device to be a "listener."
Source Handshake	SH	This provides a device with the capability to properly transfer a multiline message.
Acceptor Handshake	AH	This provides a device with the capability to guarantee proper reception of remote multiline messages.
Remote/Local	RL	Provides capability to select between two sources of input information. Local corresponds to front panel controls and remote to the input information from the bus.
Service Request	SR	This capability permits a device to asynchronously request service from the controller.
Parallel Poll	PP	Provides capability for a device to uniquely identify itself if it requires service when the controller is requesting a response.
		This capability differs from service request in that it requires a commitment of the controller to periodically conduct a parallel poll.
Device Clear	DC	This function allows a device to be initialized to a pre-defined state. A device with this capability will have the effect of this command described in its operating manual.
Device Trigger	DT	This function permits a device to have its basic operation initiated by the talker on the Bus.
Controller	C	This function permits a device to send addresses, universal commands and addressed commands to other devices on the /HP-IB/. It may also include the ability to conduct polling to determine devices requiring service.
Drivers	E	This code describes the type of electrical drivers used in a device.

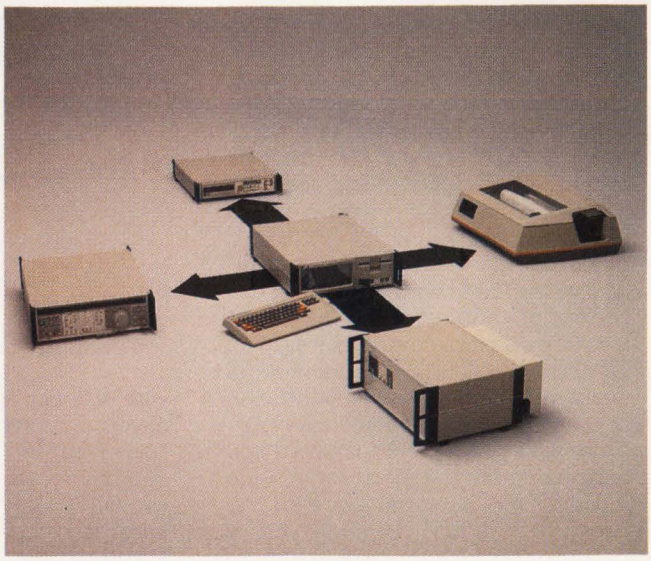
Table 2: GPIB interface functions that can be designed into a 488 compatible device.

are Data Valid (DAV), Ready-for-Data (RFD), Data Accepted (DAC).

When a byte is available to transmit and the SH detects that all AH functions are ready (by observing DAC) it returns to the idle state and stops asserting DAV. The handshake cycle can then be repeated for the next byte. The three handshake lines are used in an asynchronous interlocking sequence to guarantee to the transmitter, as well as all receivers, that a given byte has been accepted by all receiving devices. By "wire-ORing" the NRFD and NDAC bus signals, all AH functions are guaranteed to be interlocked with the SH regardless of the differences in speeds of the devices.

The IEEE Standard 488-1978 specifies the hardware interface and its basic functional protocol. It also specifies a set of codes called interface messages that control interface functions.

However, it does not specify the syntax or coding of the device-dependent messages that control the programmable features of the instrument. Since these are not specified, instruments that conform to the IEEE 488 standard may use



Illustrative photograph of the IEEE-488 interface.

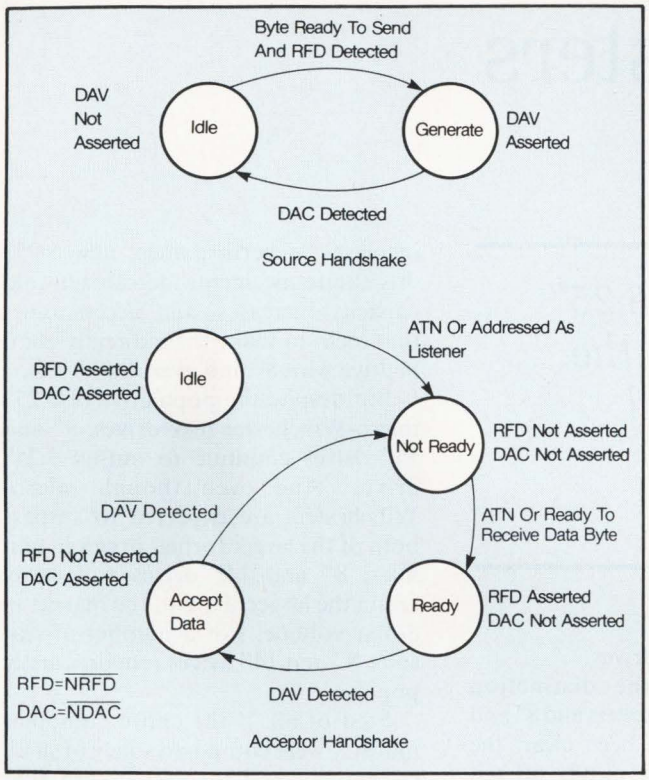


Figure 5: Simplified source and acceptor handshake state diagrams.

inconvenient or even incompatible message formats.

Fortunately, some guidance exists in the IEEE 728 "Code and Format Conventions for use with IEEE 488-1978 Digital Interface for Programmable Instrumentation." Because users are increasingly interacting with GPIB systems at the controller keyboard rather than at instrument panels, as witnessed by the increased use of BASIC at this level, GPIB systems must be as friendly as possible.

On the whole, the 488 standard is well written. If it has a weakness at all it is in some of the terminology. For example, the word "control" is probably overused. The similarity in the terminology belies the significant difference between the concepts "Active Controller" and "Systems Active Controller." And although "take control," (as in TCT) and "take control asynchronously" (as in tca/tcs) are similar sounding phrases, they have nothing to do with each other, and not recognizing the distinction may result in some confusion.

Although not within the scope of this talk, the designer should be aware of another interface known as HPIL. This is a bit serial interface designed for small, low cost, battery-operated field portable and simple benchtop systems that use highly portable controllers. □

ACKNOWLEDGEMENTS

I would like to express my thanks to the staff of Fluke, Tektronix, Hewlett-Packard and National Instruments for their help in the preparation of this article.

Bus Controller Has Powerful Computing Capabilities

The EH 7000, from E-H International (Oakland, CA), is an IBM PC-compatible instrument controller and personal workstation for research and development, electronic design, production testing and mathematical analysis. Its dual IEEE-488 ports comply with 1980 standards and have a 50 Kbyte programmed I/O data rate (One of the ports has a 256 Kbyte DMA data rate). The controller features a IEEE-software library for facility in programming.

The controller runs Microsoft MSDOS and Microsoft Advanced Disk BASIC interpreter with graphics support which is the same software used by the IBM PC. Optional hardware includes an 8087 floating point processor and an IEEE-488 GPIB bus-analyzer.

Based on the Hyperion Computer which has a display resolution of 640x250 pixels with a refresh rate of 60 Hz, the EH 7000 has a 7" CRT and alphanumeric screen format of 25 lines of 80 characters each.

Diskette drives provide 320 Kbytes of storage in a 5¼" format. The controller is capable of reading and writing IBM PC single- and double-sided diskettes and has an optional second drive. Also standard are 250 Kbytes of user RAM and 20 Kbytes of display RAM. In addition 8K ROM contains automatic power-up diagnostics, machine initialization and general I/O routines.

The continued growth in the popularity of the IBM PC has led to its use as a controller in IEEE-488 configurations.

— *Coville*

Write 469

Mid-Size Winchesters Succeed Quietly

Overshadowed by the success of 5.25" micro-Winchesters, disk drives in the 8"to14" category continue to fulfill the requirements of a large base of computer systems.

by Bob Hirshon, Contributing Editor

Judging by the sheer volume of articles written about 5.25" Winchester disk drives, and the number of ads selling them, one would think that 8" and 14" drives were rapidly headed for extinction. In addition, with announcements of micro-Winchesters with capacities of 300 Mbytes, there might seem little reason to buy larger drives.

Until recently, the distinction between micro-Winchesters and 8" and 14" Winchesters has been clear: the larger format drives typically offered two to ten times the capacity of the micros, with much faster access times and data transfer rates. But this has changed in the past year. While new 8" and 14" drives show substantial increases in performance, new 5.25" drive announcements indicate ten-fold capacity increases, and access times that seem to make them directly competitive with 8" and even 14" drives.

But despite the popularity of 5.25" micro-Winchester disk drives, 8" and 14" drives continue to outsell 5.25" drives. And even though micro-Winchesters are expected to surpass both of the larger format drives in unit sales, 8" and 14" drives will easily retain the larger share of the market in dollar volume. For a number of reasons, 8" and 14" drives remain quietly popular.

First of all, if the entire computer industry were composed solely of small systems — and it's easy to get that impression — the mid-size drives would indeed be on their way out. But for

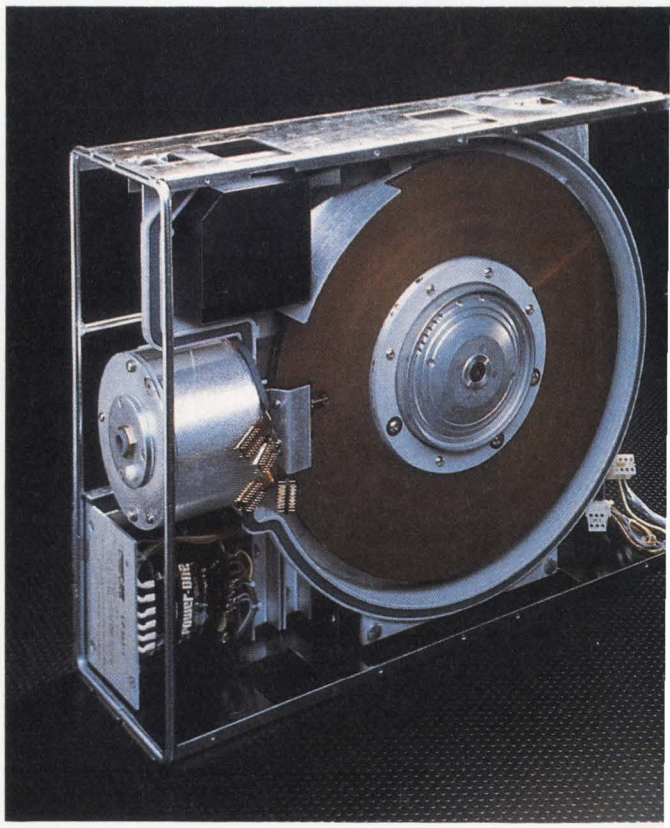


Figure 1: Priam's 8" and 14" Winchesters feature linear voice coil actuating systems.

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most systems, drive footprint is not the critical factor. This is especially true of systems in memory-intensive applications, such as medical imaging, image processing, and CAD/CAM. For these applications, the CPU and mass storage devices may occupy their own section of a room, or even a room of their own.

For applications in which a small footprint is not essential, larger disk drives have a number of inherent advantages. Despite gains made by micros, the bigger drives still have a significant edge in performance. In average access times, for example, micros are down to around 30 msecs, 8″ drives are under 25 msecs, and 14″ Winchesters are down as low as 16 msecs. The difference isn't as substantial as it was a year ago, but for many applications — multi-user environments, for example — every millisecond is critical.

Some of the advantages of a larger drive are less obvious. For instance, most 8″ and 14″ drives have a greater number of bytes per track than micros. For applications requiring the transfer of large blocks of data, these drives will use less seeks per Mbyte than micros. Consequently, they will transfer a large block of data faster than micros with otherwise identical specs.

Specs Misleading

Comparing the specification sheets of the latest micro-Winchesters with the latest 8″ and 14″ Winchesters can be dangerous because of basic differences in the markets and the technologies. The micro-Winchester market is highly competitive, immature, and dominated by a large number of smaller companies. The 8″ and 14″ Winchester drive market is more mature, and is comprised of far fewer manufacturers. Micro-Winchester technology is changing more rapidly, with each manufacturer trying to get a leg up on the competition.

Consequently, announcements of new micro-Winchesters typically occur far earlier in the product's life cycle than do announcements of 8″ and 14″ drives. Even when production schedules are the same, micro-Winchesters are more likely to undergo delays than are the larger drives. Therefore, although the micros introduced at the latest trade show may compare favorably with the 8″ and 14″ drives introduced at the same show, the larger drives will probably be available earlier. Similarly, comparisons of larger format disk drives with micros in the press are often slanted towards the micros because they compare tomorrow's micros with today's 8″ and 14″ drives.

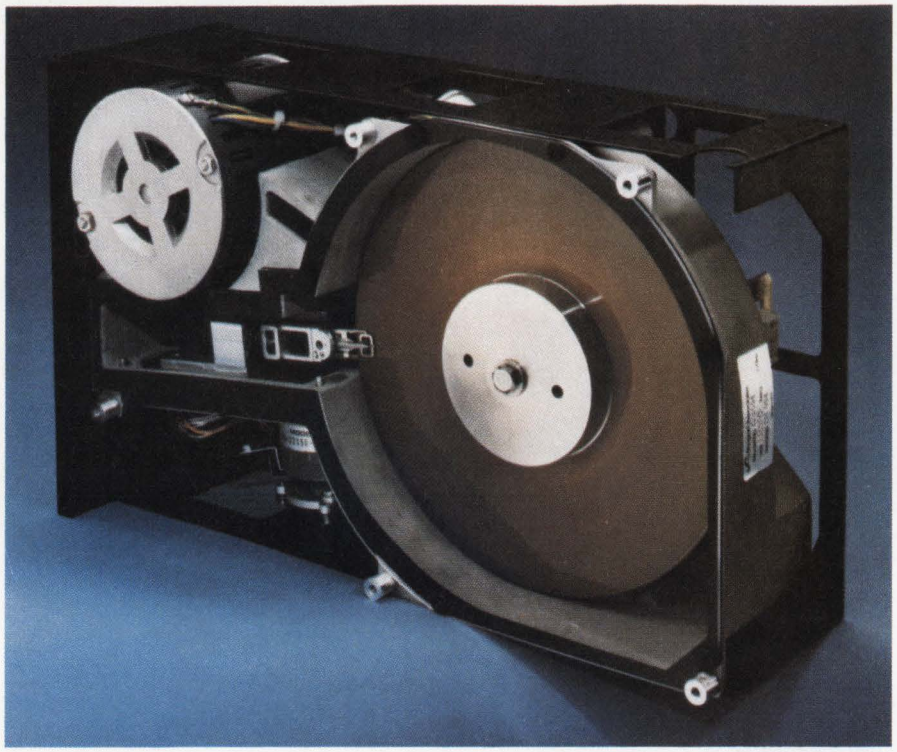

Figure 2: Despite technological advances in 8″ Winchesters from Shugart and other manufacturers, Shugart still receives orders for its original SA1000 8-Mbyte drive.

Head and Media Trends

Thin film heads have already been incorporated into many of the newest model drives. In these drives, the heads don't offer any substantial performance benefits, but they pave the way for future upgrades. As densities increase, media improves and head flying heights lessen, thin film heads will become a necessity. Many companies have opted to go with thin film now, in preparation for these changes.

As the process for making thin film heads is perfected at head manufacturing facilities, yields will improve, quality and consistency will increase, and costs will decrease. This is the biggest benefit of thin film heads, and this is why most drives will eventually use them, even if high performance isn't a design requirement.

Thin film media will find its way into 8″ and 14″ disks more slowly. Media manufacturers can't even supply sufficient quantities of 5.25″ platters; it will be a while before they turn to the more difficult to manufacture larger platters. Also, demand is greater for the smaller platters, because micro-Winchesters are more likely to benefit from thin film media. Micros need thin film media's greater bit packing potential, and, because micros are more likely to travel, they need thin film's abrasion-resistance. Not until this demand for 5.25″ platters is satisfied will thin film media move into 8″ and 14″ drives.

Positioning Systems

When it comes to positioning, 8″ and 14″ drives have an advantage over micros. Because they are less affected by space constraints, they can devote more space to their positioning systems. This allows them to use high-precision, space-consuming positioning systems, like linear voice-coil actuators, that are difficult to fit into a micro-Winchester footprint. Use of these fast, accurate positioners is one reason why larger format drives tend to have better data seek specifications

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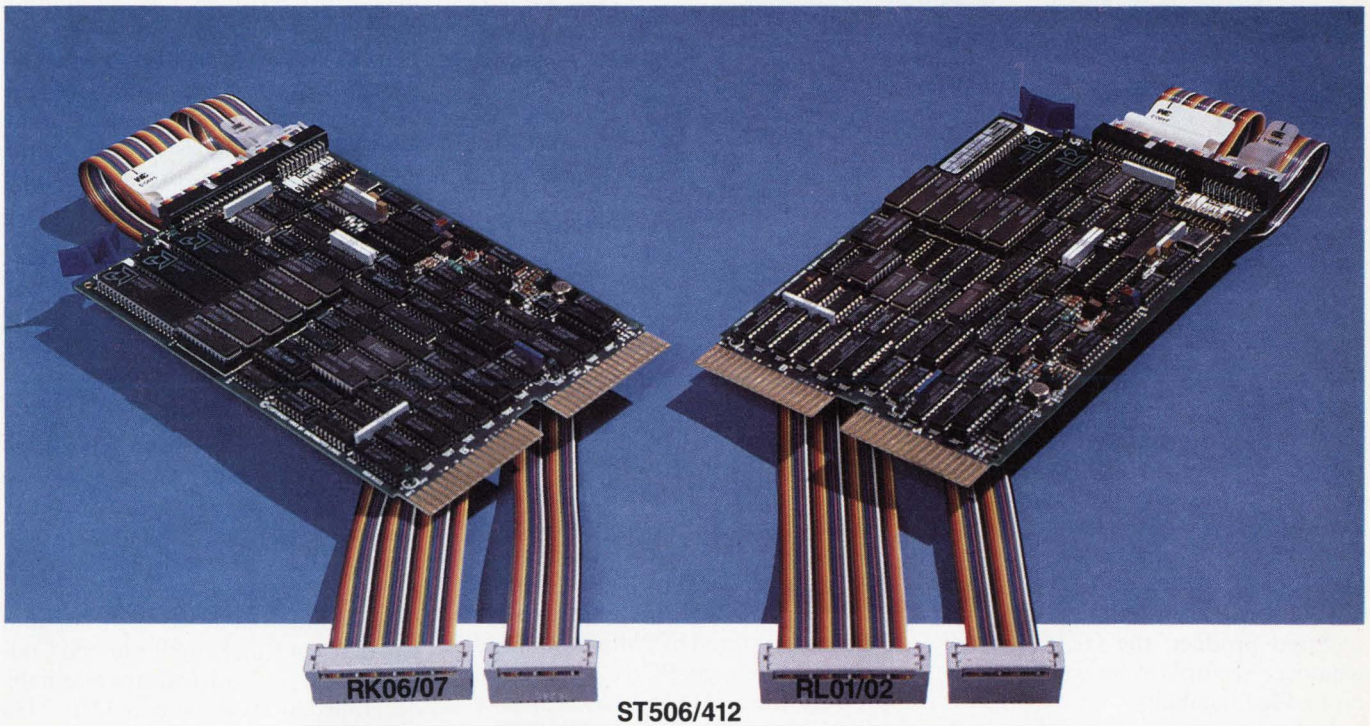

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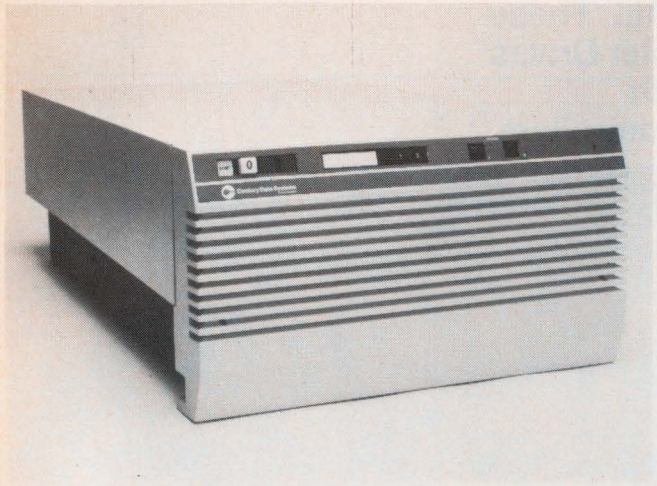

Figure 3: Using 19 thin-film data heads, the AMS 571 14" Winchester, from Century Data Systems, stores 571 Mbytes on five platters, has an average access time of 19 msecs., and has a data transfer rate of 1920 Kbytes per sec.

than do micros.

High performance 8" and 14" Winchesters use either a dedicated surface closed loop positioning system, or an embedded servo closed loop positioning system. With a dedicated surface system, one disk surface is reserved for positioning information. The advantage of this is that it allows for a soft-sectored product; the OEM can use whatever sector size he wants, giving him added flexibility.

Embedded servo, on the other hand, means that the positioning data is on the same surface as the data. For these drives, sector-size is pre-determined at the factory. The advantage of embedded servo is that its superior accuracy allows higher data density. In addition, because it needn't sacrifice one entire platter side for positioning information, it gains that surface for added data storage. Eventually, most drives will probably be forced to sacrifice the flexibility of dedicated servo for the greater capacities made possible by embedded servo.

LSI Reduces Real Estate

Increasingly, the use of LSI is reducing the number of PCBs, while simultaneously boosting subsystem reliability. For example, Control Data Corp.'s (Minneapolis, MN) last generation 14" Winchester stored 675 Mbytes and had approximately 20 PCBs. Their latest product, the XMD-800, has a capacity of 825 Mbytes and requires only four PCBs, plus a power supply board. Not only does this reduce electronics costs, but it lowers space requirements, greatly reduces the number of interconnects, and therefore increases reliability.

Another result of LSI is that drive electronics are moving more and more onto the drives themselves. In addition to cutting down on interconnects and space requirements, this has the added advantage of moving the drive electronics closer to the platter; with higher bit densities, and the resultant lower signals off the disk, the closer the electronics are to the heads, the better.

One consequence of these advances in control electronics, and the addition of greater intelligence on the drive is that the role of the sub-system integrator is changing. Hardware is now becoming a commodity, and is more readily available and easy to configure. As a result, the emphasis of the memory subsystem builder is shifting from hardware to software and service. Also, large OEMs are becoming more likely to buy directly from the drive manufacturers, and do their own subsystem design.

Large Disk Technology

Advances pioneered in large IBM drives are working their way down to mid-size 8" and 14" drives. The 8" Commanche, from Amcodyne (Longmont, CO) is an example of this trend. It boosts performance by using low mass Whitney-style R/W heads and two of seven Run Length Limited Coding (RLLC) — both features originally developed by IBM for their 3370/3380 drives.

The Whitney head suspension and low-mass slider allows lower head flying heights, greater head stability, better tracking accuracy and a higher signal-to-noise ratio. The assembly is lighter and stiffer than conventional Winchester head assemblies, is less affected by vibration, and is less prone to eccentricities from mechanical resonances.

Run Length Limited Code is a data encoding technique that uses a limited number of non-transition lengths, which permits self-clocking. Two of seven RLLC means that there are a minimum of two consecutive clock cells without a transition, and a maximum of seven consecutive clock cells without a transition. This encoding scheme allows a 50% increase in bits-per-inch over flux changes per inch.

Another feature of the Comanche drive is dynamic ramp-loading of

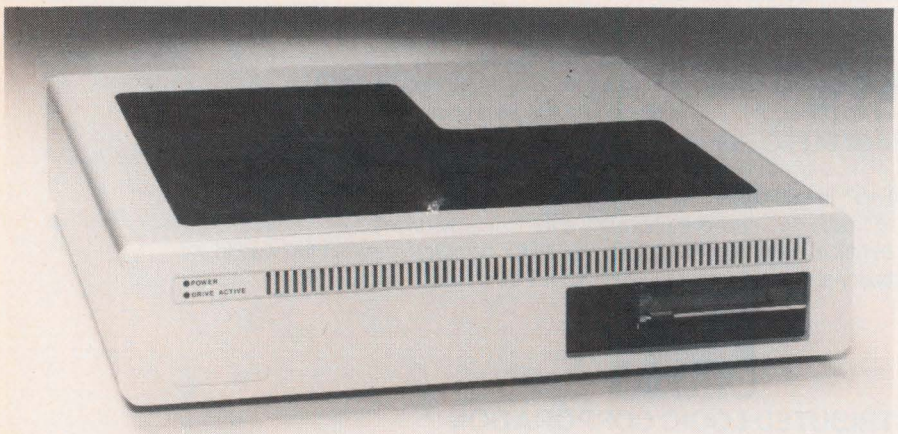

Figure 4: Technology's first offering in the field, the Seagate ST8100, is half the height of voncentional 8" Winchesters, stores over 100 Mbytes (unformatted) and has an average access time of 30 msecs.

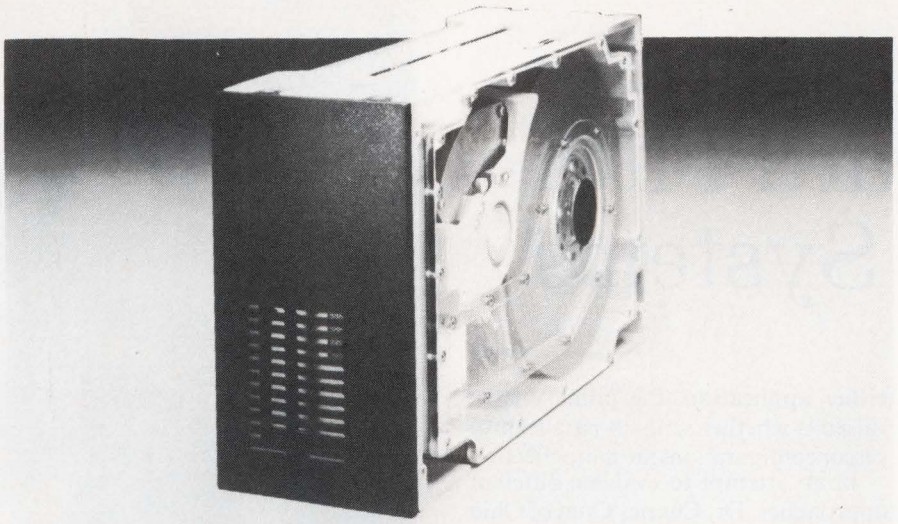

Figure 5: Micropolis' latest addition to the 1400 series is an 8" Winchester with 331.8 Mbytes of capacity, and a 20 msec aug. access time. Drives in this series are SMD compatible.

heads, eliminating head-disk contact. Since the heads are loaded only after the disk has reached its operational speed, they land on an air bearing, rather than on the disk surface. This greatly reduces media wear.

Other Technologies

For years, large format Winchesters' only competition was other Winchesters. There was simply no other technology that could match Winchesters' performance specs. But one technology that may soon have an impact on Winchesters is optical recording.

The current read-only removable optical disks will be used primarily for archival storage of data and will probably complement, rather than compete with, Winchesters. But future generations of read/write optical disks will compete directly. The extent of this competition is difficult to assess, because R/W optical memory is still under development. Its future, and its possible impact on Winchesters, is impossible to determine without further field studies.

Vertical or perpendicular recording greatly increases bit density by orienting the magnetized regions that define each bit down into the disk surface. Standing them side-by-side, rather than laying them end-to-end, boosts potential densities to over 100,000 bits per inch.

Perpendicular recording will be introduced to Winchesters initially in the 5.25" format. Like thin film media, perpendicular recording media is difficult to manufacture consistently in high yields. Not only are micro-size platters easier to manufacture than 8" or 14" platters, but demand for the 5.25" disks will be greater, since high bit density is more important for micro-Winchesters.

As with thin film media, perpendicular recording will work its way into every size format of Winchesters. But it would be unwise to predict that vertical recording, or any of the new technologies, will soon replace current technology. After nearly five years, and tremendous advances in Winchester technology, Shugart still receives orders for its SA1000, 8-Mbyte 8" drive.

Conclusion

The choice between a micro-Winchester and an 8" or 14" Winchester will continue to be system dependent. There are applications in which a large drive may seem the obvious choice, but for which micros may be preferred. For instance, a number of micros may replace one 14" drive in a system that would sacrifice over-all reliability for the advantages of drive redundancy — in the event of a head crash or other malfunction, a multiple-micro system offers the advantage of continued operation or a graceful failure. But in most cases, 8" and 14" will continue to be the formats of choice where high performance and capacity take precedence over lower power and smaller size. □

Graphics Research Points Toward Fifth Generation Systems

by Jerry Borrell, Editor-in-Chief

Computer graphics have become integral to computer applications. Several aspects of fifth generation computing are tied to visual databases, intelligent CAD, natural operator interfaces, and the use of picture processing. Because the processing, memory, and software demands of computer graphics are so great there is also a more influential, but perhaps less obvious influence that graphics systems and interaction have upon the development of computer systems for the future generation.

Architectures

Because the generation of computer displays are one of the applications that create the most intensive demands upon the CPU, it is not suprising that as more sophisticated displays are rendered, the demands for more powerful computer architectures are also required. However, different applications of graphics have individual requirements which create disparate design approaches.

For example, Mike Cyrus of Boeing Computers notes that the requirements for systems in flight simulation, which demand real time interaction and need very high performance processors, sacrifice some scene complexity. To provide real time capability, 50 to 100 ns pixel write time must be achieved. For this, Boeing has had to develop a "geometry engine" whose geometric primitive processing allows real time scenes (**Figure 1**) to be rendered. While existing TTL technology is used, the approach taken in the architecture is based upon multiple processors.

In other intense applications, such as the generation of animation, the speed at which scenes can be rendered is less important than scene complexity, which is crucial. In addressing either application, the primary issue raised is whether serial or parallel processor configurations are more effective.

In an attempt to evaluate different approaches, Dr. Charles Csuri of Ohio State University, and the members of the Computer Graphics Research Group, are implementing algorithms on a unique device. Professor Csuri has remarked that the current generation of array processors are insufficient because the data I/O channels cannot handle the volume of data. An example of such work is the application of the OSU multiprocessor in rendering several types of display algorithms simultaneously; rotations, scales, perspectives, and vector normals.

Beyond the question of how to organize processors to handle algorithms more efficiently, the issues of how to design and manufacture the processor arise. One of the most powerful architectures recently demonstrated is that of Silicon Graphics IRIS system. The heart of the IRIS system is multiple custom graphics processors developed by Clark at Stanford University.

This approach raises the real question of who will design the product, the IC house or the Systems Architect. Clark feels that the current rush toward semi-custom design indicates that the long term effect will be to give designers the dominant role, with the silicon foundaries supporting them with software and manufacturing.

Dan Wayland, of the California Institute of Technology is completing graduate work on the development of architectures for animation. As is the case with systems today, the effort is towards scene complexity and the speed of frame generation. In his work he has acertained that the use of custom logic would be the best avenue, quoting performance requirements of up to 100 times that of the Clark graphics engine. Wayland says that such a system could be built today, but that it would require the equivalent of 200,000 gates in a semi-custom product. Wayland feels that to support 1024 x 1024 60 Hz displays of the quality required, pixel write times will have to approach 30 ns. This indicates a single chip alternative to insure that data transfer time is minimal.

The basic factor contributing to the demand for high levels of performance in processing graphics is the amount of data required to render a display. Dr. Richard Shoup, founder of Aurora Systems, feels that one basic problem today is that RAM memories used in frame buffers are not built with the most efficiency for graphics processing. Typically RAMs have data I/O channels ideally suited to read out

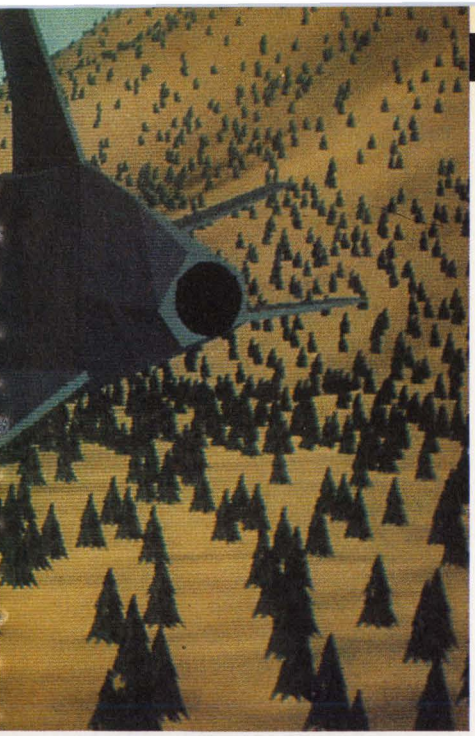

Figure 1: Boeing-generated computer simulation of a cruise missle flight demonstrating real time processing requirements. (Photo courtesy Boeing)

Figure 2: An entirely computer generated image, exemplifying the ability to create gaseous volumes and metallic surfaces using hard edge highlights. (Photo courtesy Digital Productions)

sequential values from memory. Graphics systems designers, however, would like to read out a minimum of 4 bits at once, and in color systems, 8 bits would prove invaluable. At present, says Shoup, only 4 x 16K RAMs are available, but 64K bit devices and newly available 256K RAMs lack this organization.

For those researchers more concerned with the development of future systems however, the resolution of such issues must be assumed and the next level of complexity addressed, i.e., how to process the data available from say, a 8 x 256K semiconductor memory source to support richly detailed scenes which make use of dynamics.

Wayland of Caltech likens the approach to building smart memory chips with the intent of providing a processor to either perform specific functions such as the rendering of geometric primitives, or arrays of such processors. Wayland cites near term economic prohibition to the application of such devices. If one considers the prototype frame buffers in use at OSU, 1024^2 and 32 bits of memory per pixel, or the 4000 x 4000 x 64K bit buffer at Lucasfilm, the costs are evident.

Given the complexity of some scenes, the dedication of up to one processor per pixil is envisioned! Demos's ideal is to provide the filmmaker with the interactive capability of setting up parameters for a scene (here used to indicate a series of factors such as motion, background, lighting, weather, characterization) and have the system respond with a series of questions, and then render the end product. His concern from the design point of view is whether or not the system can be made to utilize each processor or intelligent pixel to full potential. When issues such as these are raised the designer then has the tertiary consideration of even larger sources of memory which remain online, but which are too large for solid state memory.

Mass Storage

Of the current users of mass memory storage, the image processing applications are still leaders. While dynamics are not of immediate concern, the processing of image displays requires enormous power. Thus magnetic memories offer sufficient volume of memory.

As images and as computer graphics have become more sophisticated there are multi-Mbyte memory requirements for a single display. The primary limitation has become the speed with which information may be read from the magnetic storage. Ron Clouthier of Comtal is working with the development of proprietary controller interfaces with a 10 MHz bandwidth for

The generation of computer displays are one of the applications that create the most intensive demands upon the CPU.

512^2 displays. As companies with imaging applications in areas such as medicine begin to demand real time or video manipulation of displays, or higher resolution such as 1024^2 a 40 MHz interface becomes necessary. Clouthier notes that the technology is available to build transfer interfaces for the 1024 displays but the price is prohibitive at present.

In addition to this requirement for bandwidth/interface development, work is needed at disk level as well. Much like semiconductor memory, designers would like to read 8 bit values from the disk. Shoup of Aurora mentions the ability to have 8 sets of independent read/write drive electronics as a key issue. In working with the Cray generated pictures at Digital Productions, Demos must transfer over 22 Mbytes of information per second, making this consideration of transfer even more important than the amount of storage available.

As system designers look forward to higher rates of interactivity, the use of optical disk technology is universally recognized. Comtal already demands Gbytes of storage in its work with the Thematic Mapper which dramatically increases the amount of information to be processed for satellite analysis. Filmmakers are also faced with the lack of evasability with the four available optical disk systems, but prototype erasable optical disks are being demonstrated.

Communication

Another concern of graphics systems designers is communications needs, such as sharing complex scenes or graphic databases between different locations. In working with the million plus polygon scenes at Digital Pro-

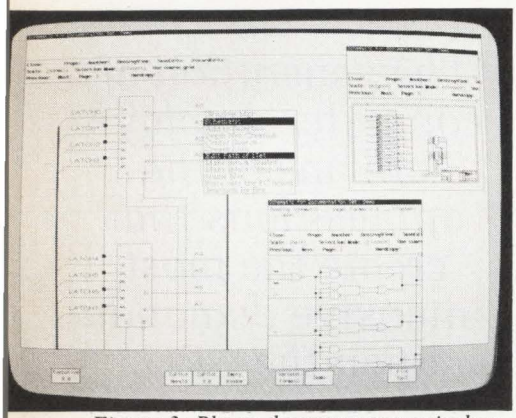

Figure 3: Photo demonstrates windowing research into operator interactions. (Photo courtesy Versatec)

ductions, Gary Demos has had to develop unique high speed interfaces to transfer data to their film printer at an economical rate (**Figure 2**). Demos calculates that given VAX bus limitations or the internal MASSBUS of the VAX 780 the realizable transfer rate of data given the system overhead is approximately 200 Kbytes per second. That would mean a single frame of animation requires two minutes to transfer, whereas economic production requires that about one frame per second must be recorded and generated. The Cray high speed channels have a capacity for 100 Mbytes per second, and a sustained rate of 33 Mbytes per second which supports 3 channels for picture processing and film recording.

Most graphics developers require lower transfer rates at present. Dr. Mike Wozny, Director of the Graphics Facility at Rennsalear Polytechnic Institute is concerned with sharing of large data bases between graphic workstations and feels that Local Area Networks in existence have inherent limitations. Jim Clark is similarly critical of current broadband implementations of co-axial networks and feels that the full capacity of 200 channels with the 600 Mbyte bandwidth should be used to provide a combination of graphics, text, video, and other sorts of information. Clark's appreciation of performance here is that 16 channels of broadband would allow transfer rates between disks equivalent to current backplane transfer rates making true "diskless" workstation networks possible.

Displays

Of all the issues being addressed by researchers it is somewhat ironic that display inadequacies remain one of the big headaches. Perhaps the most obvious shortage is for a color monitor that can display color graphics at or above 2000 x 2000 pixels. While recorders are available for much higher capacity, the system operator should ideally have the capability of viewing the scenes being rendered before recording. Dick Shoup is one of the few consulted that has hopes for large flat panel devices or at least the availability of rear projection formats with interactive capability.

Several experimental color monitors are being shown by manufacturers but their availability is speculative. Demos decries the lack of low cost, high quality full page, 66 line, text terminals. He is involved with local programming activity where productivity could be greatly increased if the terminals were both full screen and had sufficient local memory to allow the operator to independently scroll through several pages of information.

One former Xerox PARC researcher Jim Cucinitti, now at Versatec, has had insight into current and future display capabilities as affected by software design. Cucinitti feels that multiple windows, use of perspective rendering, and independent interaction can resolve many of the issues raised relevant to large screens and operator needs (**Figure 3**). That PARC has been able to attract Frank Crow into its research environment indicates the redoubling of graphic research.

Software

The area of research that ties many of the above discussed technologies together is that of software development. De Fanti and Shoup, the epitomy of the mathematicians who have been able to make a transition into graphics applications while maintaining design interest in systems, are currently involved in the development of better tools for system operator interaction. De Fanti feels that "applications programmers continue to do the majority of program development, but it is the applications users that must resolve their problems".

Shoup was one of the developers at Xerox PARC over a decade ago of the Ikonic/mnemonic interaction. The digital fine art system produced by his

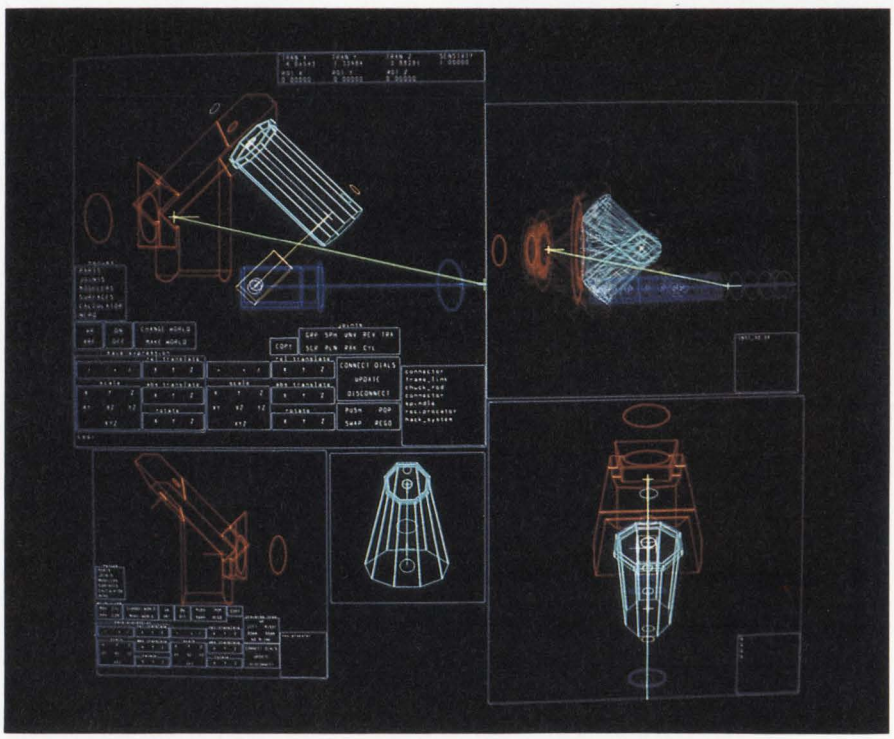

Figure 4: Solid geometric modeling allows computer analysis that would have been nearly impossible on the real part. Here, a water valve has been sectioned, revealing the internal channels. (Photo courtesy Perdue CADLAB)

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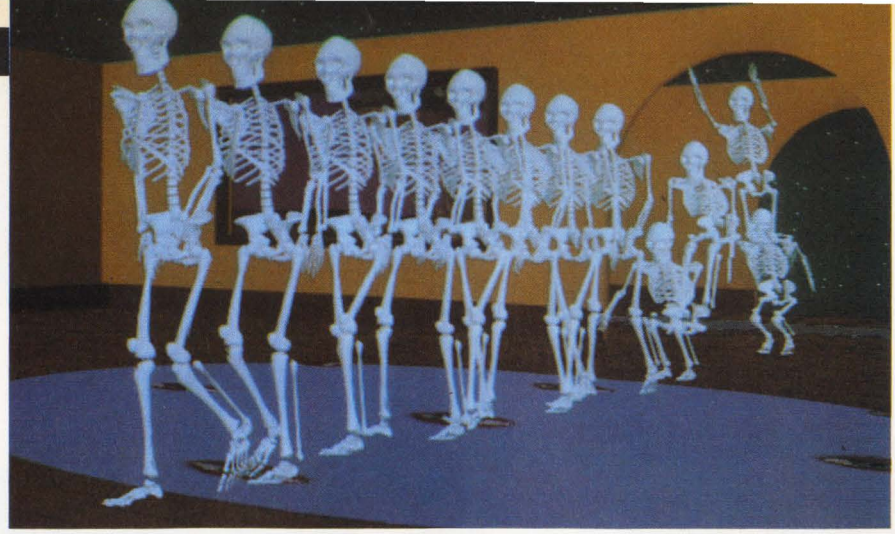


Figure 5: Sequence from a skeleton animation sytem, in which the model is animated against a background that is textured. (Photo courtesy Computer Graphics Research Group, Ohio State University)

company incorporates many such techniques as do many of the window based workstations. However, Shoup is working towards even more facile techniques of image communication and interaction. A related aspect of how to train or accustom system users to computer graphics systems is being considered by Wozny of RPI and Dr. James Foley of Geroge Washington University. Wozny justifiably points out that as systems become more accessible as a result of desktop systems there is not the need to train a broad group of users, but to keep them updated in the case of occasional users.

The sum of the efforts described above is that the community of graphics system designers must borrow from research into artificial intelligence and expert systems. From this perspective the esoteric theory regarding Fifth Generation computing, becomes recognizable in the distillization of "fuzzy set" theory, cognitive prompting structures and work that is now almost a decade old. The startling realization is that this work is being performed in what is ostensibly a broad field of graphics systems research.

Retaining this focus, Purdue University Graphics Laboratory under Dr. Mike Bailey and Dr. Dave Anderson (**Figure 4**). Bailey's research into software tools for computer aided manufacturing and engineering is based upon the need to visualize and predict the behavior of real objects. This work, according to Bailey falls into two main categories: solid modeling and surface design.

In both the data base must be complete enough to accurately predict behavior. For solid modeling, inertia, desnity, and mass properties are all intrinsic. Other properties such as kinematic information should also be available. In surface design the emphasis is on the geometry input and editing techniques. In this example the use of editing tools to perform functions such as surface manipulation are being implemented with support of PROLOG (the rule based AI software system).

Picture Rendering

The outstanding problem in rendering displays is represented by the need for large numbers of floating point calculations. As scene complexity and display time demands increase, so the number of floating point operations is increased. Mike Cyrus, in building the geometry engine at use in Boeing for flight simulation type displays, had to work with up to 1.2 billion operations per second. To successfully achieve constant performance levels of this nature, custom logic was used to develop a multiprocessing architecture. Furthermore, the system has to be made "failsoft" or "fault tolerant" to allow for failed components.

The need for fast calculations are present in relatively static images as well because of the complexity in rendering textures, light, natural phenomena, and the most difficult of all — motion. The most effective algorithms for achieving these effects at present, according to Dave Wayland are the ray tracing approaches. These are, however, extremely slow and primary effort has been towards writing more efficient algorithms.

Wayland envisions developing hardware with architectures specific to ray tracing. As the parameters of a scene are made more complicated, the longer the processing time becomes for accumulating the effects into a single scene. This is particularly problematic in the ongoing work in the simulation of natural phenomena.

Some of the most sophisticated work is that at Digital Productions where complex backgrounds and motion are under investigation. In some cases, such as fluid dynamics, actual physical models are applied. For other types of action interpolation effects may be applied for warping or related "tweening" scenes. The OSU illustration (**Figure 5**) shows efforts in these areas in which an anatomically detailed skeleton is animated against a background which is textured and held in proper perspective. Beyond this Csuri would like to work at the level of complexity so that two figures could be made to wrestle. Demos directs his work in developing a program for the creative director, John Whitney Jr., to provide tools that allow the director to "set a stage", withdrawing from systems memory not merely data locations but effects such as lighting, characterization, or models that leave the director free to work on aesthetic aspects of the scene.

Systems

In the face of issues such as these, integrating systems would hopefully be less problematic. Several sources have pointed out the need to work on standards other than those which receive popular attention. RPI's Wozny feels the ANSI's PHIGS, the committee for Programmable Heirarchical Interactive Graphics Standards, is one such area. This committee is considering topics such as data file structures, interactivity, and the relationships of data across several layers. In another important standards arena, the virtual device interface, Boeing's Cyrus has developed such an interface tht accepts protocols for a wide group of display devices.

Given the keen interest in graphics and the large amounts of data that must be manipulated, it is of little surprise that graphics systems design is becoming one of the most active areas of convergence for artificial intelligence, silicon research, memory and operator interface techniques. □

Rx FOR HEALTH

INSTALLMENT TWO

By Lawrence Lee, MD

Dr. Lee is a leading Southern California Internist, specializing in cardiology. He is a co-founder and board chairman of LH Research, Inc. This column is presented as a public service for better understanding of topical medical problems and possible solutions.

HERPES!

SIMPLEX TYPE 1 VIRUS

The Herpes virus most commonly recognized by laypeople is Herpes Simplex, which as we previously stated comes in two types; Simplex-1 (HSV-1) and Simplex-2 (HSV-2). These, along with another type of Herpes called Varicella Zoster, attack the human nervous system.

Herpes Simplex-1 is the virus which most commonly infects the mucous membranes of the mouth, the skin around the mouth and lips, the eyes, and other areas of the body *above the waist.* Other common names for this are "fever blisters", "cold sores", or Herpes Febrilis (occurring with fever in the area of the lips and nose).

HSV-1 can be acquired any time *during childhood.* It appears to be spread by close contact between infected and susceptible individuals, with a normal incubation period (time between contact and clinical signs of the disease) of from 2-20 days, with a mean of 6 days.

Latent infection then occurs, in which the virus remains dormant *within* the body without giving rise to signs of infection. When a *Trigger Mechanism* occurs (such as nutritional deficiency, fatigue, emotional strain, fever, infection, certain diseases, exposure to certain levels of sunlight and other unknown reasons), the virus emerges as an acute infection by migrating from the body of the nerve (Ganglion) in which it has been dormant down the nerve fiber (Axon) to the sensory organ (mouth, nose, eyes, etc.), causing the small blister-like lesions with which we are familiar.

HSV-1 apparently resides *only* within the sensory nerve cells, which conduct impulses *from* the sensory organs (nose, skin, etc.) *to* the brain or spinal cord. It does not affect motor nerves, which control or stimulate muscle contraction *from* the brain or spinal cord. The most common significant infection caused by HSV-1 is HERPES KERATITIS (inflammation of the cornea of the eye), which can lead to blindness. There are medicines available for its treatment.

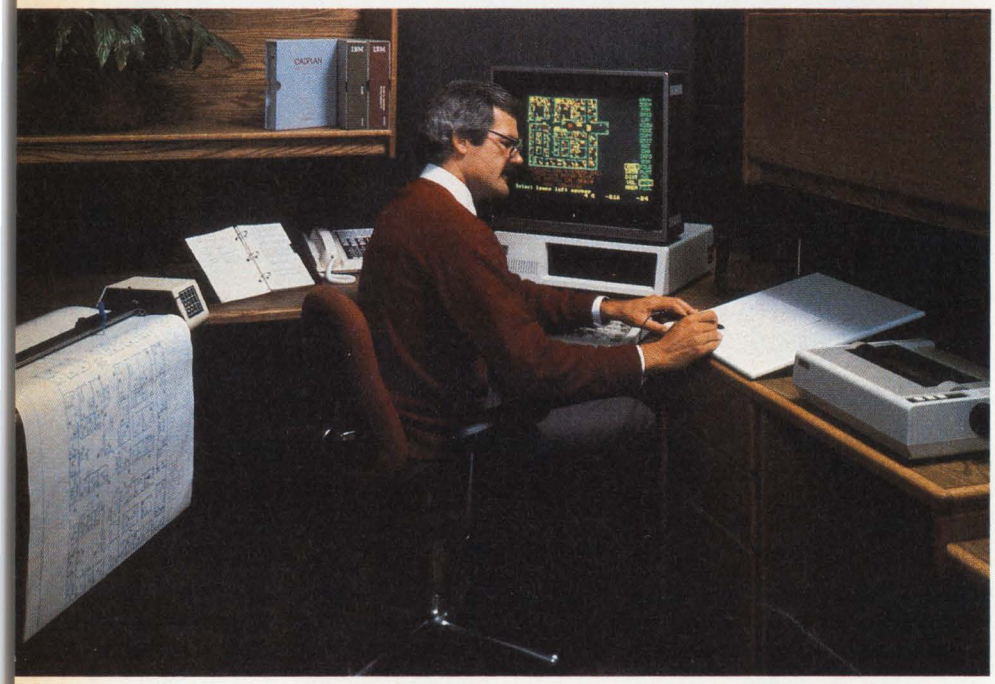
HSV-1 virus are commonly identified by the cluster of small blisters (vesicles), but can be verified by blood tests or fluorescent antibody staining of the tissues. Treatment depends on the site involved. While many different treatments have been tried for HSV-1, including polio and smallpox vaccinations and antibiotics, none have proven successful. One of the best deterrents, however is avoidance of known Trigger Mechanisms. We will cover further advances in treatment, and other types of Herpes virus, in subsequent columns.

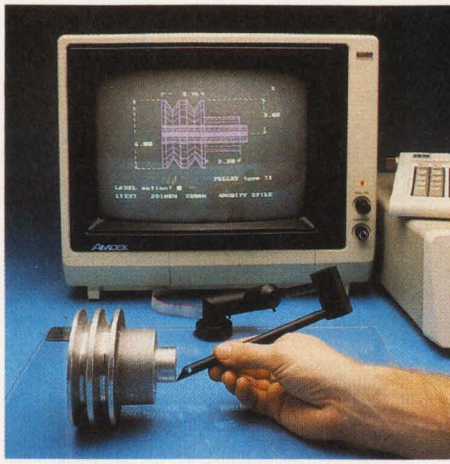
LH RESEARCH

The Power Supplier.

This is the second in a series of columns by Dr. Lee on medical subjects of current interest, although perhaps not fully understood, by the public. If you have a question, please write Dr. Lee at LH Research, Tustin, CA 92680.

Microcomputer-Based CAD Provides Low Cost Design Tools





Left: Photo courtesy photo CAD Systems. Right: Pulley design on IBM based CAD system.

Recent product developments and associated upgrade devices provide Micro-based CAD systems with performance levels rivaling those of more expensive dedicated systems.

by Jerry Borrell, Editor-in-Chief

The growing number of CAD systems based on microcomputers has numerous implications for the field of digital design. As systems for computer support of engineering functions have become increasingly complex, the efforts of small groups of engineers in developing new products and companies continues. Low-cost CAD tools can provide a competitive edge and many industry observers claim that there will be no more "garage shop" start-ups because of the need for substantial investment capital.

One of the most important events for the area of microcomputers and CAD over the last two years has been IBM's announcement of its personal computer. A significant portion of PC sales are within industry and the number of CAD products based on the PC alone has more than doubled in the last year. The rapidity of product announcements has been dramatic. As more recent announcements for the PC and its associated upgrade devices are made, the performance levels of software announced for the system begin to rival the operations of more expensive dedicated systems. The PC was primarily intended for office applications in engineering environments. This began to change as products for industrial applications began to appear, including PC boards for signal acquisition uses. Today the body of existing applications software means that the PC can play roles in engineering as diverse as providing a terminal interface to mainframe computers, to production of project support and technical documentation.

Apple And CAD

Two firms have worked over several years to provide high quality CAD on the Apple computer: Cascade Graphics Development and T&W systems. Recently joined by DITECHS, these firms offer products that address drafting applications where line drawing is the focus. The capabilities include

architectural, printed circuit, and mechanical design. The CADAPPLE from T&W Systems is configured with a floppy disk drive, hard disk drive, Houston Instrument's plotter and digitizer, 2D drafting package, and necessary expansion PC cards for about $12,000. Cascade has provided an additional Motorola 68000 processor in its 12.5 design workstation configuration of the Apple IIe.

The system uses the Apple's processor to handle all system work, and dedicates the 68000 to graphics displays. Included is a graphics tablet, joystick, 20 Mbyte disk, and a floppy disk; all for a total cost of approximately $30,000. In addition the system may be configured in networks of up to six workstations. While a plotter is not provided, an interface to Houston Instrument and Hewlett-Packard devices is available. As might be expected for the price, the system's software incorporates features of many more expensive systems: geometric input capabilities, editing functions, application-specific drawing functions, data base management functions, and user programmability in PASCAL. DITECHS has similarly based its 800 Design Drafting System on Houston Instrument plotters and tablets.

IBM Moves

As the Apple Computer began to gain support by manufacturers of graphics peripheral devices, IBM has made available a variety of options. GTCO Corporation, a manufacturer of digitizing tablets, developed an interface for its tablet and also offers VECTOR SKETCH line drawing graphics package and interface to the Hewlett-Packard 7000 Series Plotters. For only $3000 the package offers certain geometric input and editing features but was intended as a preview package rather than an application tool. As in the case of the Apple-supported packages, much of the inexpensive drafting software is greatly benefited by the high quality of today's low cost plotters.

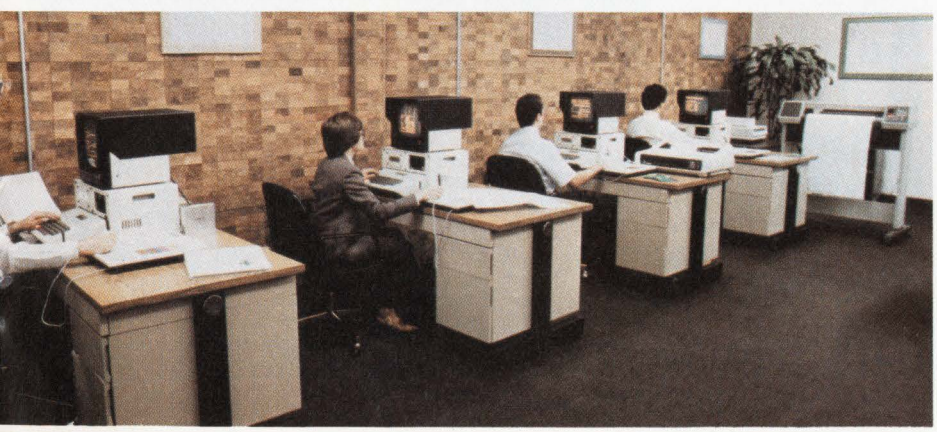
Computer Aided Design (San Francisco, CA) has written the MicroCAD 3D software package for the PC. MicroCAD offers users a readily displayed capability for 3D drawings at a cost of $500; included are functions for scaling, rotation, and translation. AutoDesk sells the AutoCAD package for the IBM PC and all CP/M 80 compatible computers for approximately $1500. AutoCAD offers text and line graphics for 2D capabilities in architectural and electronic applications. There is a surprisingly sophisticated group of graphics editing and input functions available with the package.

More recently CadCal has announced CadPro-2 on the PC/XT (hard disk version of the PC) with the 8087 coprocessor. The system supports 640 × 480 resolution color graphics displays and a selection of hardcopy devices more typical of mini-computer based systems such as plotters from CalComp, Hewlett-Packard, and Tektronix. The 2D mechanical software offers a nearly complete Core set of graphics functions as well as bill of material generation and interface to numeric control tape preparation. CadCal also offers a more powerful line of graphics workstations that retain 8086/8088 processors, but offer increased performance features such as 256 color display, 60 Hz refresh rate, and 1280 × 1024 display.

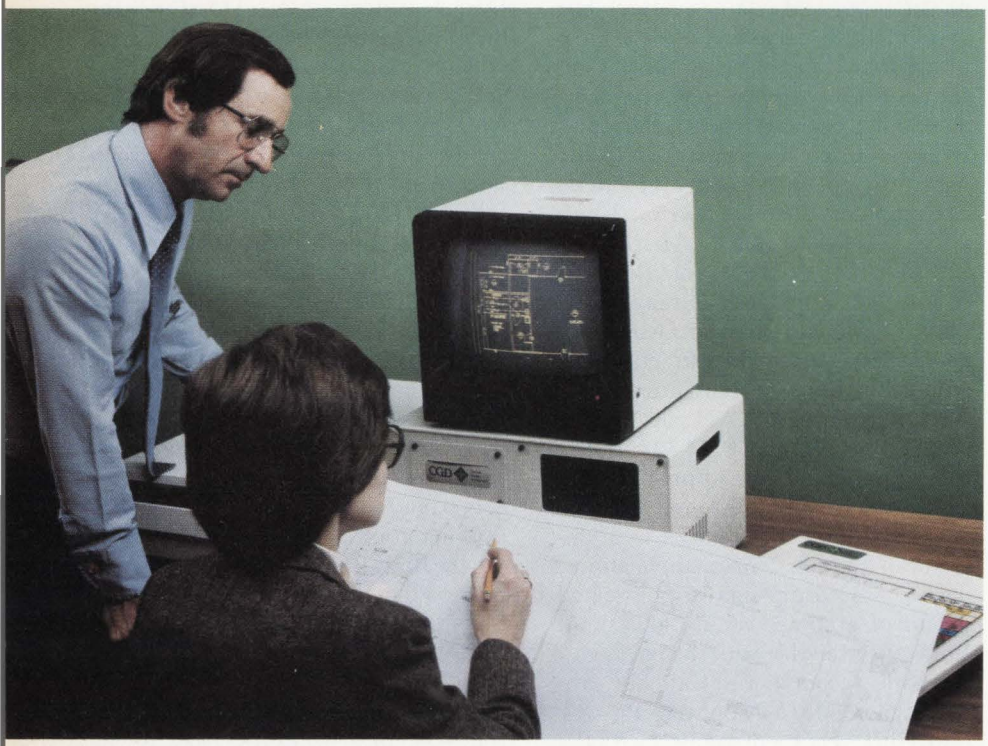
Extensive electronic applications packages for the PC have recently been developed by various manufacturers. Design Systems writes DASOFT for the PC, giving the designer use of schematic editors, compilers for netlist and wirelist, auto router, and an artwork generation. Futurenet's DASH-1 is also intended for printed circuit design and allows the PC to emulate a DEC VT-100 terminal for interface with DEC minicomputers. This is a detailed schematic design package costing $13,000, including the computer.

Of all recent announcements on the PC, Summit CAD's release on the IBM PC/XT has the most impact on the marketplace. The announcement combines the PC with a Motorola 68000, and the option of adding 68881 floating point co-processors. Expanding the body of software for the system beyond these packages is possible with the addition of co-processors such as the DEC J-11, Intel 80286, or National 16032/81. Offered with 2MB of RAM in 256K chips, it is not surprising that the system's graphics capabilities should rival dedicated graphics systems. Summit CAD's two current software packages include PATHFINDER for printed circuit design and AUTOPLACE & ROUTE. PATHFINDER allows for analog or digital board design, schematic design, auto-routing, net list, continuity, design rule checking, and extensive documentation capabilities. With AUTOPLACE the system offers additional functionality. These capabilities include NC tape generation, final film generation, and interface to several hardcopy devices. When the designer considers the already available IBM mainframe interface via SNA and terminal emulation of the 3250 series of displays, the potential of these workstations becomes apparent.

On the mechanical side, the CS-5 from Cubicomp provides a solid modeling package capable of smooth shading displays. The company developed both the 3D software and a display processor for the PC. Micro Control Systems has modified the Space Tablet, allowing it to offer a 3D digitizer for the PC. The supporting software includes Space Graphics and Advanced Space Graphics for digitization, editing, transformations, and system interaction.



Cascade Graphics Development System.



Cascade Graphics Development System.

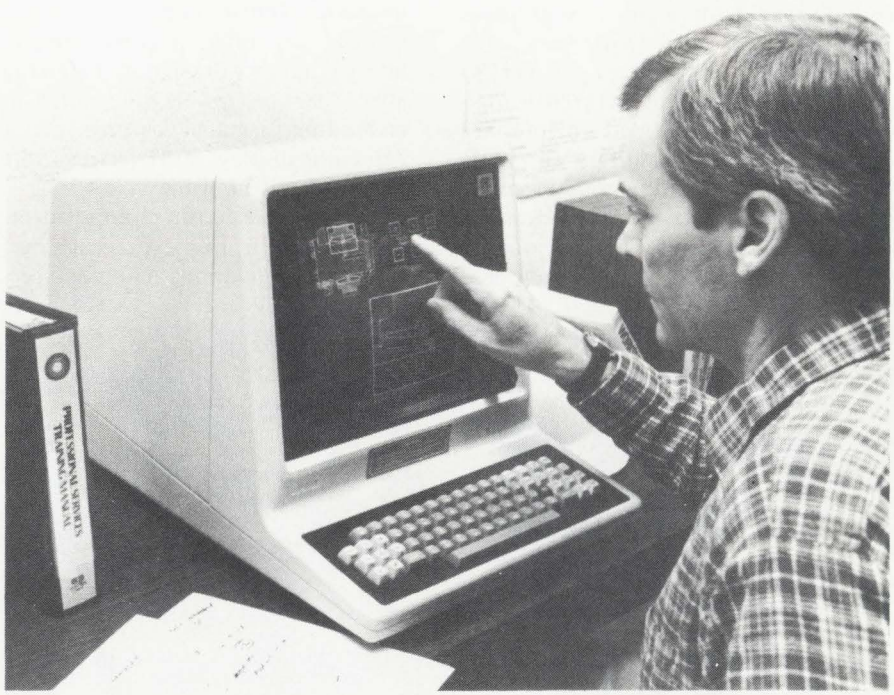
Processor Possibilities

As one of the first to have 16 bit microcomputers in the marketplace, Terak Corp. has numerous CAD applications packages available. The company offers three powerful CAD packages: Minn-Draft, an educational tool aimed at providing University students with exposure to the capabilities of high performance CAD packages, Design Graphix CAD, a 3D general application graphics design package, and CATSOFT, a constructive solid geometry based solid modeling package. In addition, the company offers documentation and project support software. Based upon the DEC 11/23 processor, the 16 bit system has been one of the most widely used microcomputer/CAD systems. DITECHS, for example, incorporates the Terak into its 3200 DG Design Drafting system. DITECH sells the 3200 system with 19" color monitor, 5MB hard disk, and mechanical design software for about $48,000.

The Motorola 68000, the first widely available 32-bit processor, has been the basis of many systems, and microcomputer-based CAD systems are no exception. Bruning CAD recently announced a 68000-based system with 19" color monitor, 14 MB hard disk, D size plotter, and EasyDraf 2 software. The system uses a Hewlett-Packard 32-bit microcomputer in the 200 series as the CPU, and incorporates its 3 1/2" microfloppy drives, mouse cursor controller, and tiltable screen. MicroCAD of Israel uses the Cromemco line of microcomputers with the 68000 CPU card for its MICROCAD/ME. The system costs $45,000 and includes a D size plotter, 3D modeling and drafting software, and 1280 × 1024 monochrome display. Intended for mechanical design, the system also offers a NC interface package. Paragon Technology Corporation sells a "Personal CAD" system for as low as $40,000 based on DEC's LSI-11 that includes a system monitor, 14" 580 × 430 color display, disk drive, tablet, interface to hardcopy peripherals, and printed circuit design software for boards with up to 14 layers.

Summary

There is confusion in the design tools marketplace, primarily as a result of misinterpretation of prices released from the manufacturers of workstations or graphics systems. Raster Technologies or Lexidata terminals, for example, can be purchased for well under $20,000. Apollo workstations are available with a 68000-based processor for similar cost. The systems discussed in this article, however, have included not only the processor but applications software and in many cases peripheral devices. These systems provide entrepreneurs or small groups



Plato Computer based training.

Bruning's 68000-based system.

few advantages left to providers of components and other products. Recent announcements such as IBM PC with secondary 32-bit processors have the potential to compete with systems being sold for nearly twice the cost. Further advantages go to the small design firm because of the additional software capabilities being provided. □

of designers with the capacity to reach the market faster. Given the increasing cost required to establish manufacturing and applications software, the use of low cost design tools is one of the

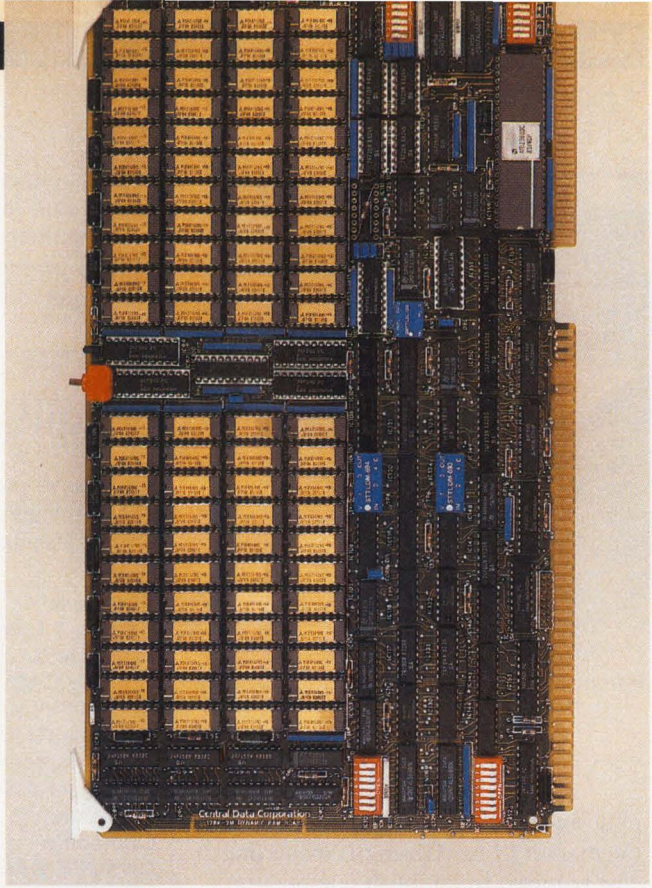
Manufacturers Listing

To receive more information on the following manufacturers of Micro/CAD systems, please write in the appropriate Write Number on the *Digital Design* Reader Inquiry Card.

AutoDesk ..... Write 300
Bausch & Lomb Interactive Graphics ..... Write 301
Bruning CAD ..... Write 302
CadCal Products Inc. .... Write 303
Cascade Graphics Development ..... Write 304
Computer Aided Design ..... Write 305
Cubicomp ..... Write 318
DASOFT, Design Systems Inc. ..... Write 306
DITECHS ..... Write 307
FutureNet Corporation ... Write 310
GTCO Corporation ..... Write 311
MicroCAD ..... Write 312
Micro Control Systems .. Write 313
Paragon Technology Corporation ..... Write 314
Personal CAD Systems Inc. ..... Write 315
Terak Corporation ..... Write 316
T&W Systems Inc. ..... Write 317
Summit CAD Corporation ..... Write 319

The Design Of A High Performance Multibus Memory Board

FAST logic circuitry and a discrete logic RAM controller contribute to speed.



Control Data Corp.'s high performance memory board for the Multibus.

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By Jeffrey J. Roloff

With high performance systems becoming a necessity in today's microcomputer world, the need for high speed dynamic RAM becomes evident. Central Data Corp. (Champaign, IL) embarked upon a project in early 1982 to design a fast and reliable memory board for the Multibus. A significant amount of worst-case AC analysis lead to the use of several high-precision delay lines and much 74F (FAST) logic circuitry. Further, for several reasons discussed below, a dynamic RAM controller chip was not chosen due to the inherent delays associated with such devices. The entire dynamic RAM controller was done with discrete logic, bucking industry trends to gain the maximum speed from the board.

Two Multibus memory boards, an EDC (Error Detecting and Correcting) and a parity-only version of the 512K memory were designed. It turns out that the control circuitry and general overhead for each board remains very similar, with only the data integrity section changing between the two boards.

To Use or Not To Use

One of the first design questions that needed to be answered for the board was whether to use a dynamic RAM controller chip. The advantages of such devices are numerous, since they contain internal refresh counters and multiplexers needed for dynamic RAM address sequencing. They also have high capacitance drivers on their outputs to allow direct driving of large RAM loads.

Unfortunately, most such devices have such general properties that they lose some of the speed advantages that they inherently have by being contained on one chip rather than distributed over several logic chips. Also, the drivers are designed to drive a full 88-chip RAM array, which causes even well designed drivers to operate fairly slowly.

Since this board was to be a very high performance one, we tried to get every possible ounce of speed from it. To do that, it was decided that the RAM controller had to be done with discrete TTL logic. Also, it was determined that drivers for address lines and the write enable should be split so that no one driver handled more than 22 RAM devices. This significantly reduces the propogation delay through the driver, since they are operating in closer to normal (50pf) regions. Further, the drivers for the RAS and CAS signals are divided so that they drive no more than eleven devices.

Since the RAS/CAS inputs to RAM devices have higher capacitance than the address/WE inputs, a porportionally higher number of drivers was used to adjust for the capacitance. In this way, when doing worst case analysis, the skew between all of the signals to the memory is minimized, and the inputs to switch such signals can therefore be brought closer together. **Figure 1** shows the RAM driver arrangement.

The driver selection was also an

Jeff Roloff is President of Central Data Corporation, located in Champaign, Illinois. The company designs and manufactures a complete line of Multibus board level products. Roloff started the company in 1975, and is now almost exclusively involved in the development of new products. His activities are split between the conceptualization of possible new products and reviewing the designs presented to him by his staff.

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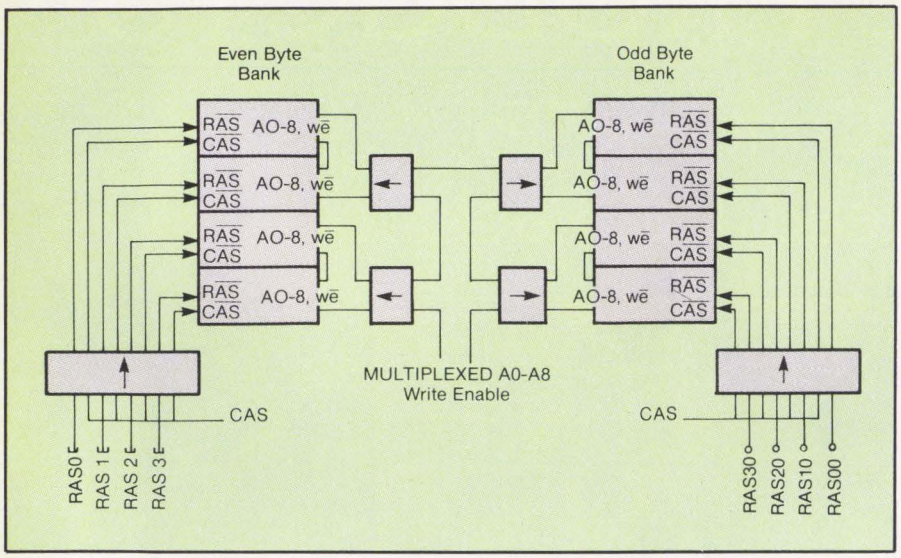

Figure 1: Ram Drive Array — This shows the large number of drives used to drive the inputs of the RAM array. Note that all signals have 15 Ω series resistors to decrease overshoot and undershoot. Most boards have only one driver for all RAMs in the array.

important factor because of the relatively fast switching speeds and high capacitances. The 74F series of drivers were chosen for all RAM driving circuitry, due to their very strong ability to drive capacitive loads and their high switching speeds. All of the lines driven by these drivers have 15ohm series resistors, to ensure that the signal waveforms have minimum overshoot and undershoot. Further, the 74F series drivers have both the minimum and maximum delay time specified over the full temperature and voltage range, allowing worst case analysis to calculate the skew between drivers. With standard 74LS/S devices, this maximum skew must be estimated, causing it to become much greater. Again, if the skew can be minimized, the input signals can be brought closer together, causing the board to operate faster.

Refresh Arbitration

Since the dynamic RAM board is operating in the Multibus environment, where all commands arrive asynchronously to any clock, the refresh arbitration problem becomes significant. In fact, many RAM board designers have found it to be the most difficult problem of any dynamic RAM board design.

Much effort was put into this area of the board (**Figure 2**), with the realization that it would be the most difficult to debug if a problem occurred, as well as one affecting the MTBF of the board. After studying several papers written on the asynchronous arbitration problem, it was determined that a 74F74 would be used to synchronize these asynchronous events. There is only one point on the board where any asynchronous operation occurs, and it is at that flip-flop. This localizes the problem so that it can be worked on in an intelligent manner.

Since the data and clock inputs into the 74F74 are asynchronous with respect to each other, the outputs can do strange things if the input data does not meet its set up or hold time (**Figure 3**). These strange things can include simply not operating right, missing the data, or (more seriously) oscillating or going into an invalid TTL state. The 74F74 was chosen since it has the smallest setup/hold window where such occurrences happen, and when they do happen their duration is short.

The general scheme of the arbiter circuit is not to look at the outputs of the device until a certain fixed delay has been reached. This delay is calculated to be a reasonable time for the circuit to settle down and become stable.

Unfortunately, due to the extremely important nature of the arbiter with respect to board reliability, the value chosen for the precision delay line needed to be sufficiently large to guarantee no-fault operation. For this reason, a major portion of the board's

(continued on p. 94)

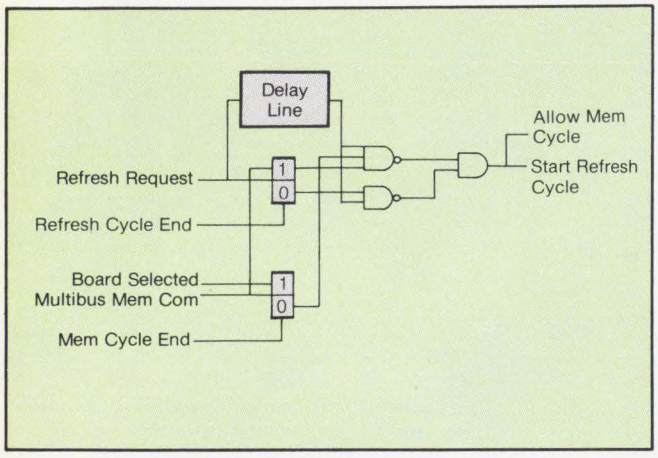

Figure 2: Refresh Arbitration — This circuit uses 74F74 flip-flops and a precision delay line to arbitrate between the asynchronous refresh request and the Multibus MEM COMD. The final output is a signal with no glitches or oscillations.

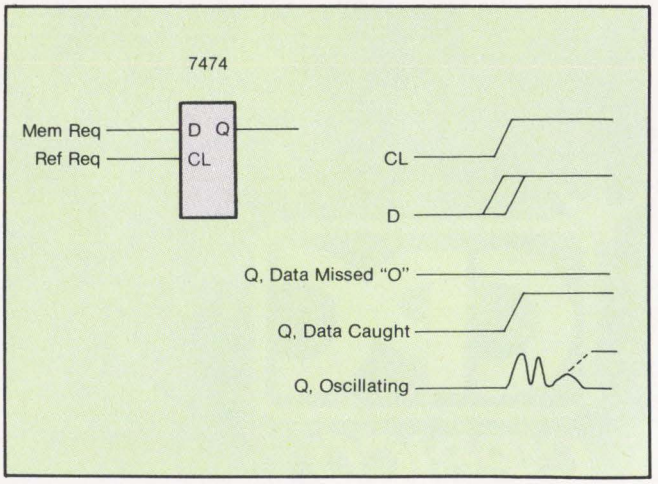

Figure 3: Asynchronous Flip-Flop Inputs — This shows the possible outcome of having asynchronous data and clock inputs to a flip-flop.

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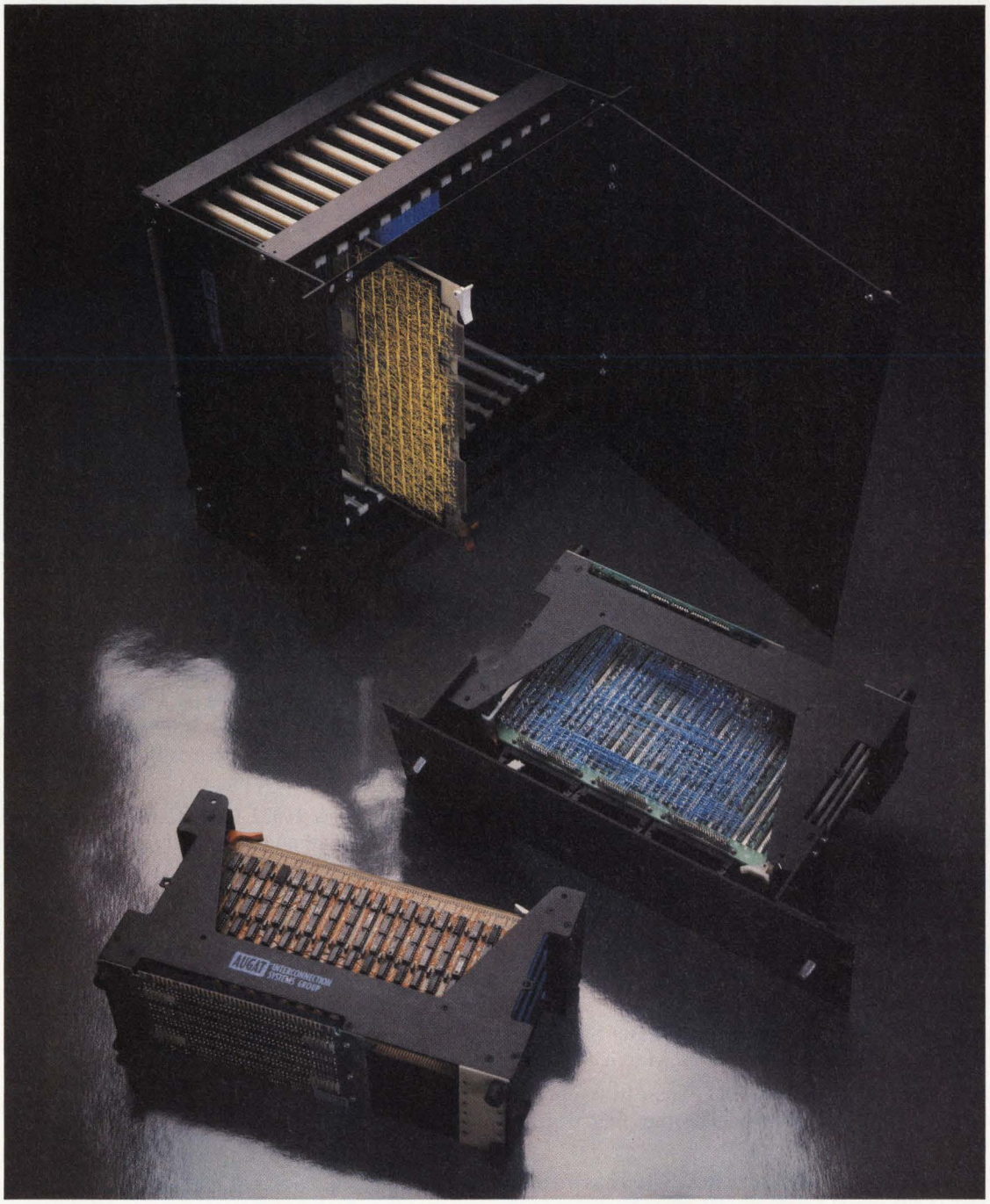

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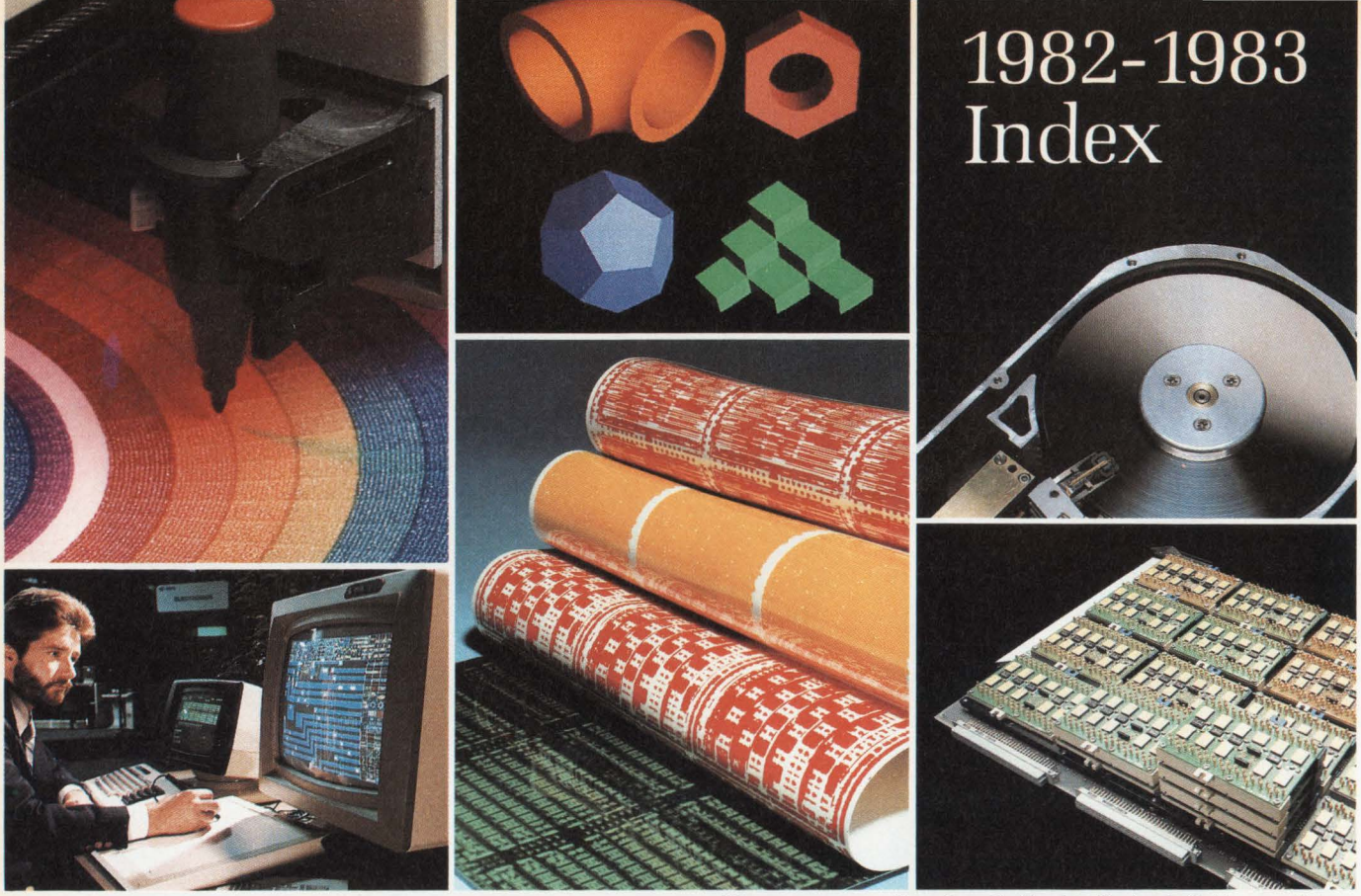

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Compiled by Winnie Jenkins Rubino

BUS RELATED PRODUCTS

A CP/M Processor For LSI-11 And PDP-11 Computers. PDP-11 and LSI-11 users gain access to CP/M software. March '83, pg. 60.

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Designers' Guide To The S-100 Bus. IEEE-696 standard may finally give the bus respectability. Sept. '83, pg. 41.

Designers' Guide To The STD Bus. The STD Bus is one of the fastest growing buses. April '82, pg. 62.

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Designer's Guide To The VME Bus—Silicon Simplifies Building Block Approach. The VME specification specifies what logic is on the boards by defining a set of functional modules. Dec. '83, pg. 39.

Designing A 16032 CPU Card For The S-100. The IEEE 696/S-100 Standard for permanent bus masters is well documented for all bus operations. Nov. '82, pg. 64.

Designing The CMOS NSC800 Onto The STD Bus. CMOS components overcome problems inherent in using the STD bus for μP control applications. April '82, pg. 70.

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Innovative Packaging Improves Color Graphics Boards' Resolution. Custom LSI devices and new packaging techniques solve PCB space constraints. Aug. '83, pg. 64.

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Multibus II—A Top Down Approach. The Multibus II bears a great deal of resemblence to its predecessor Multibus I. Dec. '83, pg. 71.

Peripheral Memory Controllers: Change And Growth In The '80s. Higher price-performance requirements and emerging standardization are forcing major changes. Jan. '83, pg. 44.

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introductions in the OEM market driven by competitive pressure. Nov. '83, pg. 82.

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STD System Cuts Software Costs. The system integrator may find his main expense is software development. April '83, pg. 74.

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VMEbus—A μP Bus For The Future. VMEbus uses the Eurocard format and offers some unique capabilities. Aug. '82, pg. 68.

32-Bit VMEbus Combines With Single Board Computer Architecture. The VMEbus has capabilities that current μPs are not utilizing. July '83, pg. 93.

COMMUNICATIONS

Communicating Data In A Multiprotocol DP Environment. Multiprotocol information systems ease the distributed processing confusion. Feb. '82, pg. 62.

Equipment Manufacturers Drive Data Communications Industry. Telecommunications dominated by computer-based equipment and its hardware/software. Jan. '82, pg. 46.

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New Advances In Modem Technology. IC technology, combined with the μP, is changing and improving its traditional role. Jan. '83, pg. 56.

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Sorting Through The LAN Morass. Local area networks allow sharing of systems aimed at automating product design cycles. Nov. '82, pg. 54.

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COMPUTER SYSTEMS

A New Concept In Workstation Design. Corvus introduces a personal computer workstation. June '82, pg. 70.

Array Processors: The New Crays? The symbiosis of the mini, mainframe and microcomputer with the array processor is expanding application environments. Dec. '82, pg. 22.

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manipulation processes that produce intelligent action. Dec. '83, pg. 82.

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Fault Tolerant Architectures. Demands for data integrity and system availability promote the design of new fault tolerant systems. Aug. '83, pg. 70.

FIFO Buffers Insure Continuous Array Processor Performance. Array processors achieve high performance through the use of multiple processing elements. April '83, pg. 56.

IBM Compatibility—The IBM PC Comes Of Age. There is an increased demand for IBM compatible products. May '83, pg. 47.

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Integration Issues For The First All Digital Commercial Aircraft. The need for quick and accurate diagnosis of potential problems prompted the move to digital systems. Dec. '83, pg. 101.

Medical Applications For Systems Designs. Products, specifications, obstacles and design approaches are discussed. Feb. '82, pg. 44.

Minicomputers Face Stiff Competition. Modification results in increased performance while maintaining hardware and software compatibility with earlier models. Aug. '83, pg. 48.

NCC '82: Enterprise Takes Off In Houston. Small and giant leaps in computer technology. May '82, pg. 80.

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Superminis Offer A Cost-Effective Solution For High Throughput. Various design improvements allow enhanced throughput. Dec. '83, pg. 94.

GRAPHICS

CAD/CAM: The Acronym Changes To CAE. CAD/CAM manufacturers offer a variety of systems aimed at automating product design cycles. Nov. '82, pg. 40.

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Display Processors—The Design Of Computer Graphics Systems. Enhanced semiconductor technology is forcing designers to improve display performance. Aug. '83, pg. 36.

Engineering Workstation Face Demands For Individual Design Needs. A single designer will become involved in a great portion of the entire design process. Dec. '83, pg. 87.

A Four-Phase Approach To Implementing A Graphics Tool Package. Graphics can be generated on a variety of hardware with the appropriate tools package. July '83, pg. 42.

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High Performance Shapes CRT/Monitor Systems Design. Design and availability of high performance color displays has become a key issue affecting graphics systems manufacturing. Oct. '83, pg. 52.

Industry Spotlight: New Horizons In CAD Technology. Decreased system costs and increased capabilities bring CAD/CAM into new environments and applications. June '83, pg. 27.

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Making A Good Printer A Better Graphic Printer. Enhancing an existing product by adding graphics demands a careful reliability analysis. Feb. '83, pg. 106.

New Architecture Improves Graphics Programming. A new

approach to workstation architecture provides superior development tools and facilities for graphics programmers. Jan '83, pg. 48.

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NCGA '82 Getting The Picture. A diverse assortment of computer graphics, tutorials and technical sessions offered for conference attendees. May '82, pg. 52.

Raster Monitor Evaluation And Selection. Application and environment are pivotal to monitor selection. Jan. '82, pg. 40.

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SIGGRAPH '82 Highlights. Computer graphics. July '82, pg. 62.

Solids Modeling Becomes The Driving Force Behind Automation. Developments in semiconductor memory and processing capabilities bring SM to forefront. Nov. '83, pg. 88.

HARDWARE/PACKAGING

Computing Power Boosts Speech Quality. Speech processing and speech synthesis units are taking advantage of recently-introduced IC's. May '82, pg. 44.

Designers' Guide To Keyswitches. Discussion of Keyswitches. May '82, pg. 70.

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INTEGRATED CIRCUITS

Alterable Microcomputers: Tailoring Chip Design To Meet Applications. Their basic elements are designed to tolerate modifications. Aug. '82, pg. 44.

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Interfacing The Z-bus Peripherals. Z-bus, multiplexed bus structure and techniques for interfacing the Z-bus peripherals are discussed, Nov. '83, pg. 71.

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New Concepts In Dynamic And Static Memory Cell Storage. Examines memory refresh options and their implementation. April '83, pg. 78.

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MASS STORAGE

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New Technology Promises A Bright Tape Future. Data

processing market increasingly turning to tape. June '82, pg. 36.

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POWER SUPPLIES

Diverse UPS Technologies Provide Design Alternatives. Recent advances in power systems technology demand an expansion of the definition of UPS. June '83, pg. 81.

External CML Reference Power Supply Offers Versatility, Economy. Advantages of external reference power supply. Nov. '82, pg. 30.

Power Supply Selection & Design. The selection process and some fundamental design decisions are outlined. Nov. '82, pg. 30.

Selecting A UPS? Follow These Six Criteria. Selection areas for selecting a UPS. May '82, pg. 78.

Select Conditioning Devices To Protect Your Systems. Protection of computer equipment from power disturbances can be accomplished through a variety of different devices. April '82, pg. 42.

Specifying Uninterruptible Power Systems. Protection against power outages requires use of a UPS. March '83, pg. 88.

Switching Power Supplies: Reliability Rises As More Functions Go On-Chip. Adding more critical functions on-chip is improving switcher reliability and repairability. April '82, pg. 78.

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What's Ahead In Power Supplies. OEM companies should be careful before committing to a given specification of power supply. Feb. '83, pg. 37.

PRINTERS/PLOTTERS

Character Generation Techniques For Dot-Matrix Printers. Their versatility allows these printers to be used in a variety of special applications. March '83, pg. 84.

Full Color From An Electrostatic Plotter. Precise dot registration proved the most difficult problem in the designing. March '83, pg. 48.

Ink Jet Modules Meet OEM Demands. Use of a state machine memory controller enables these printers to increase data throughput. Dec. '82, pg. 46.

Keeping Pace With Printers. Keeping up with the latest developments in printers is no small task. Sept. '83, pg. 80.

Looking At Plotters. Advances in plotter technology have been at a pace rivaling that of computer technology itself. Nov. '83, pg. 64.

The Micro-Floppy Race Tightens. Micro-floppy designs are receiving large support from a number of manufacturers. Dec. '83, pg. 78.

Printers: The Industry, Technology And Markets. Broader applications are providing more alternatives for systems designers. Dec. '82, pg. 36.

Putting Color Graphics On Paper. Research focuses on low-cost, compact, color hard copy devices for unsophisticated operators. July '83, pg. 48.

Putting The Lid On Printer Noise. Noise restrictions for dot matrix printers. March '82, pg. 44.

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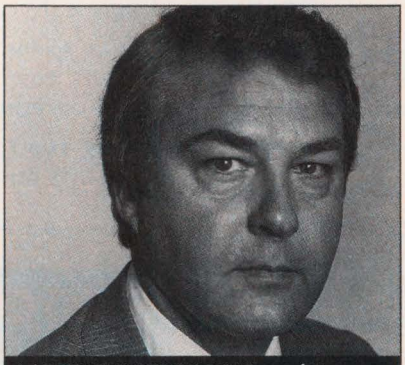

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Write 120 on Reader Inquiry Card

The Three Printing Modes Of Low-Cost Dot-Matrix Printers. Data processing, word processing and graphics are performed in single inexpensive machines. March '82, pg. 35.

SOFTWARE

ADA For Large-Scale Software Systems. Abstraction and information hiding are built into the language with contribution of ADA's package concept to software design. Nov. '83, pg. 114.

Boolean Resolver Operates As Combinational Or Sequential System. The algorithm outlined evaluates Boolean functions, allowing verifications of designs before they're mounted on a breadboard. Feb. '82, pg. 54.

CP/M '83 And UNICOM Highlights. A trend toward stability is good news for software developers. April '83, pg. 62.

CP/M-86 Vs. MS-DOS. Comparisons of two systems. July '82, pg. 52.

Embedded μP Applications Require A Real-Time Operating System. Embedded environments have a unique set of requirements that conventional operating systems are ill-suited to meet. Jan '83, pg. 50.

Forth From A To Z. A listing of Forth products and services. Jan. '82, pg. 12.

Software Simulator Streamlines Back-Up Performance. Simulator has been developed that allows the trial of a streaming back-up system before committing to hardware. April '82, pg. 52.

A System Architecture Approach To Microcomputer Benchmarking. Benchmarking is defined as a measure of total system performance. June '83, pg. 108.

Unix Leads To Greater Flexibility. Use of this system allows software development to expand easily. Aug. '83, pg. 92.

TERMINALS

Color Graphics Terminals: A Growth Market. Graphics terminal market is growing through advances in semiconductor devices. Feb. '83, pg. 46.

Dumb Terminals: Workhorse Of The Computer Industry. Rejuvenation in the popularity of dumb terminals created by popularity of superminicomputers and distributed processing. Jan. '83, pg. 26.

Ergonomics Of VDU Workplaces. VDUs must be designed to fit the capabilities and limitations of operators. Feb. '83, pg. 25.

High Intelligence Key To Printing Terminal Growth. Favorable outlooks for intelligent units and daisy wheels. Feb. '82, pg. 30.

Visual Ergonomics And VDT Standards. Emerging standards for VDTs combat poor design selection. Feb. '83, pg. 24.

TEST EQUIPMENT

Assessing The Latest In Logic Analyzers. The complexity of the latest logic analyzers makes their selection a difficult task. Dec. '82, pg. 53.

Development Tools Move Into High-Level Programming Environments. Automated programming tools are offering fully integrated high-level support to the entire software develpment cycle. July '83, pg. 90.

Industry Spotlight: The Changing Environment Of Automated Testing. Products being tested today are increasing in both speed and complexity. Oct. '83, pg. 40.

μP Development Systems: More Choices For The User. New strategies mean designers must analyze a variety of cost/performance trade-offs. Sept. '82, pg. 32.

Looking Ahead: A Forecast for the '80s. 1984 will be the key year when manufacturers will begin to examine issues for the fifth generation computer systems. Dec. '83, pg. 58.

1983 Salary Survey And Employment Trends. The demand is for a new emphasis on employee satisfaction. Dec. '83, pg. 66.

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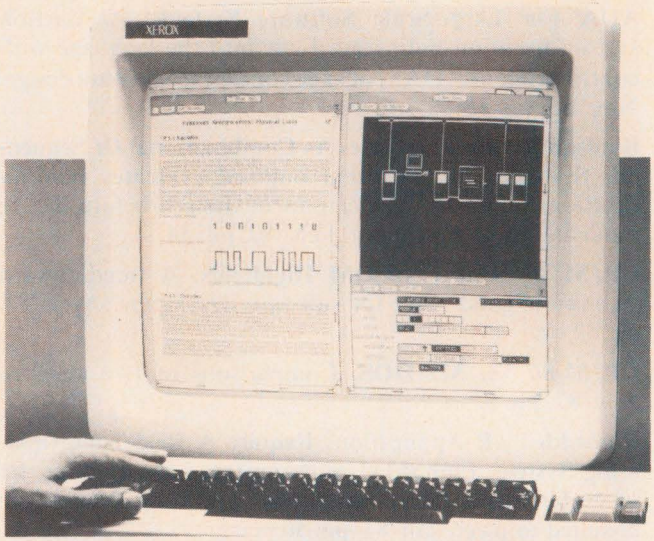
Software Strategies Control Micro Market

The vendor shakeout from nearly 200 sources will continue, but the principal issue separating the winners from the losers will be the quality of the software.



Wide range of text and graphic information can be created on two-page display screen of Xerox 8010 Star information system. (See box p. 93)

by Michael Cashman,
West Coast Technical Editor

One is hard pressed to find a sector of the computer industry that is more visible, active and exciting than microcomputers. Perhaps some believed the predictions made more than a decade ago that there would be 360/370 class machines on our desktops, and affordable on top of that. But did we really think it would be IBM supplying them?

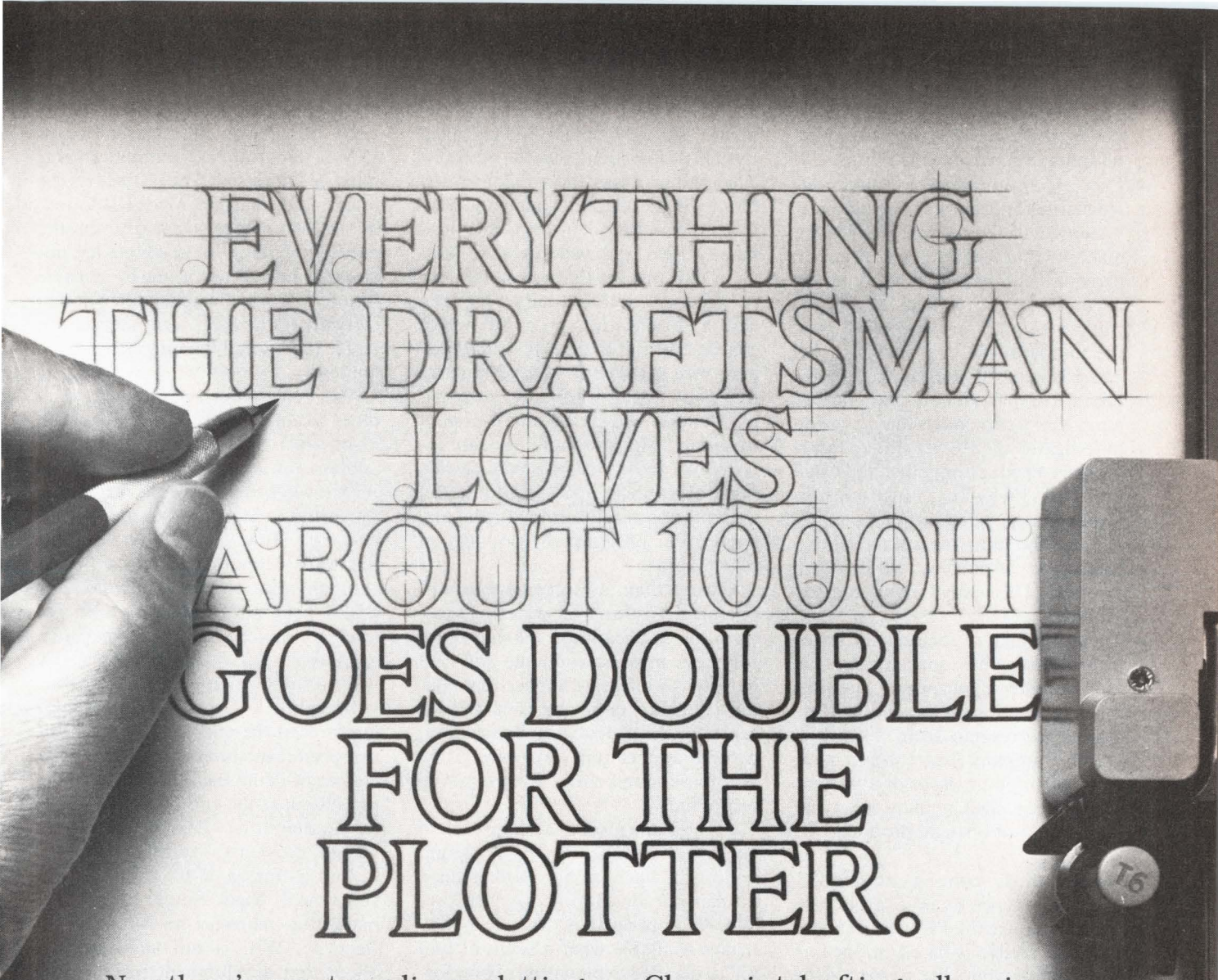
The personal computer has matured enormously since the middle 70's when companies like MITS in New Mexico, and a California company by the name of Apple Computer offered the first glimmer of affordable computers for the masses. Of course, one could only acquire an Apple motherboard; the keyboard and display had to be acquired separately at first. It seems so distant to those days, yet it's been only seven years.

Recent continuing developments strongly suggest that neither the products nor the technologies on which they're based are close to topping out. In typical fashion, IBM saw other companies prove the PC concept, and then aggressively moved into the market to protect deep inroads from being made into its user base.

While the PC has matured enormously, both in terms of markets and product definition, the market is still very much a dynamic one. Products and marketing strategies are being rushed through development in an attempt to gain control of the market, and much of this churning has to do with micro-level software. For example, if programming windows can be sold as the only way to handle the man/machine interface, then present and future products that aren't based on this technique may appear antiquated to prospective buyers.

In a number of interviews with many major and minor suppliers of micro-level software — including operating systems and applications programs — one movement was mentioned by virtually everyone queried. The nearly 200 assorted suppliers of personal computers are moving ambitiously to identify sources of effective software and to get that logic up and running on their respective machines as quickly as possible. What follows is a list of current problems identified in interviews with more than a dozen independent software suppliers.

- There exists a general inability to effectively explain what a particular software package does, what it buys the user.
- There exists a general lack of standards, particularly disk formatting standards. But it must be pointed out that this cry is always heard when new software markets are unfolding. If your company is a leader, you want your company's approach to be the standard. If you're not doing well against the competition, you'll accept almost any standard, for it will conserve your resources by enabling you to focus your product design efforts.
- The need for easy-to-use software on low-cost machines will force the incorporation of artificial intelligence to assist the body of users who will be essentially non-computerists.
- The classic problem of earlier computer generations of whether to program in assembler for performance, or higher level languages for maintenance and clarity is just as prominent as it ever was. Spreadsheet programs make tremendous performance demands on small systems. There can be large differences in how long it takes to run a given problem depending on how well the system is designed by its creators.
- The need for peripheral performance improvements will lead toward



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the incorporation of non-standard peripherals, such as video disks.

- User expansion needs are just now registering on vendors. The ultimate system will be a very low-cost machine that will sell the concept of personal computing, and then be expandable to multi-user systems while retaining programming and file compatibility.
- There is market hesitancy right now because of the shakeout that's beginning. Many companies that have not investigated the PC yet tend to lump vendors' products together and can't understand why Texas Instruments, Osborne, and others who appear to all be in the same market have been forced to withdraw, while IBM prospers. This fosters a wait-and-see attitude.
- There is a lack of focused software. The industry has concentrated on high-volume applications, leaving other application markets unfulfilled, says a spokesman from VisiCorp, whose company has focused well enough to sell upwards of a million VisiCalc packages, perhaps the greatest number of a single product ever sold.
- Resistance is coming from MIS director level personnel in large companies who see the PC used to make business decisions based on incomplete data, while the correct data existed in the corporate mainframe.

Short Term Software Strategies

"The single function program is dying in the corporate workstation environment," stated Context Management Systems' President David Saykelly. That thought was shared almost verbatim by C. Gerald Diamond, VisiCorp's Vice President for OEM business. "Users and vendors alike have come to realize that what is truly needed is a seamless interface between various application programs which enables the user to quickly switch back and forth between tasks, and to make that switching as transparent as possible," added Dave Davison, President of Iconix. His company has concentrated on the development of a wide range of graphics capabilities for screen presentation of data from almost any application program or combination of programs.

Clearly then, as software must cooperate across an ever widening spectrum of applications, the hardware suppliers must rely on the software industry to integrate applications. But most software companies tend to concentrate on a few, often non-competitive applications programs. How are these conflicting factors to be reconciled?

Perhaps the most likely approach to be taken will be the open system approach, such as the well defined mechanism developed by VisiCorp. Where appropriate, the company makes available what it terms a "tool kit", a detailed explanation of how foreign software products can be interfaced to VisiCorp products, how the protocols operate, etc. This is an example of marketing maturity that will doubtless save many a sleepless night for vendors and users alike.

At this point, the significance of IBM's elaborate PC announcements must be addressed. The problem is the 8-bit based machine. With IBM moving to center stage so rapidly, and the gut feeling that 8-bit machines are not going to be popular in the foreseeable future, why would you set out to design software for an 8-bit computer like an Apple II, especially if you were resource limited?

This observation is compounded by other factors. One is the spectre of the 32-bit micro. "There's quite a lot of anticipation and wonder about what AT&T will bring to the marketplace," according to Robert Bradford, executive Vice President of Westminster Software (Menlo Park, CA), a British company that offers the now familiar PERT program product on a micro-level computer. "A 32-bit machine, aggressively priced, and sporting UNIX will stir up this market all over again."

In reality, UNIX is seen as a steadying force at the micro level because of its portability. It has at least as good a chance of being the dominant operating system at the end of the decade as its competitors, Digital Research's CP/M, or Microsoft's MS DOS.

And as far as 32-bit machines are concerned, Nigel Smith, a product marketing manager at Microsoft in Bellevue, WA, is not as concerned about that development from a software standpoint as one might think he would be.

"Those machines are coming; they may well be in development, and I think they may well be what really launches desk-top computing and per-

UNIX Variance Strain

According to David Cloutier, Vice President of Marketing and Sales at Oregon Software (Portland, OR), the UNIX operating system is in a crisis at the micro level. "A lot of software companies have taken the system and modified it so that the object code isn't compatible. Then Bell did the same thing between System Versions III and V so that there is no confidence between various object codes compiled."

It might sound like Cloutier is anti UNIX, when he really is all for Bell Laboratories OS alternative. He simply fears that UNIX is becoming a tower of Babel. "The original intent of UNIX was to be the long sought after universal operating system. We do not have it, we are a lot closer, but we could have had it if the software vendors had built products within UNIX's original boundaries. Now it is beginning to look like just another painful step forward."

Oregon Software is a vendor of programming tools (with 40% of sales to foreign shores) that Cloutier says are vitally needed in order to broaden the range of applications micro's can tackle. Cloutier says software developers are badly in need of refined programming tools to make applications program creations as painless as possible. The company sells software development products including a librarian program which enables programming teams to work on separate modules of a common application and not interfere with each other. Much of the record keeping associated with file relationship management is performed for the team by this package. "Software development is really a craft, but we'd like to make it as close to a science as possible," says Cloutier.

Write 499

Window Orientation Becoming Standard Display Mode

The development of display "windows" that are software controlled is generally credited to Xerox and was made possible by ever cheaper memory costs. The technique first appeared in the late 70's on the Alto product, the forerunner of the 8010, or Star project. The technique was envisioned as an effective way of moving the desk-top office environment onto a display screen, but the graphics basis—and benefits of the technique—were soon applied by other manufacturers for non-OA applications. Numerous manufacturers, including Apple and IBM, as well as independent software suppliers, now offer window-based display interfaces.

haps even redefines the way computing will be done in the future. But the step from 16-bit to 32-bit machines will be a lot'less traumatic than the step from 8- to 16-bits was. That's simply because 32-bit architecture is a lot closer to 16-bit design than 16-bits was to 8-bit."

There's another point made by Donald Wanless, a member of the technical staff at Iconix. "Of course the smart software companies have written all the machine-dependent code into modules that can be pulled out and rewritten to allow for architecture changes."

Wanless and Context Management Systems' Saykelly also see some stability arising in programming languages, with the leaders being Pascal and C. Products that need to be developed to broaden the appeal of the PC should be written in one of these languages to be safe.

System Integrator Concerns

Many of the firms interviewed were willing to part with advice on what is necessary to ensure a successful product offering. Says VisiCorp's Diamond, "OEMs have to look at the total customer solution. The software needs to be integrated, instead of running one application stand-alone at a time. You need to build a system that can generate back-up storage diskettes. And a toll-free number would instill some confidence in your product offerings."

Now's the time to get started, if you haven't discovered the market already. Digital Research figures that less than 3% of the distributed processing market for personal computers within large corporations has been impacted by PC's, and little more than 5% of small businesses have acquired a system. If those numbers are even close, the PC market is going to get even more interesting during the rest of the 80's. □

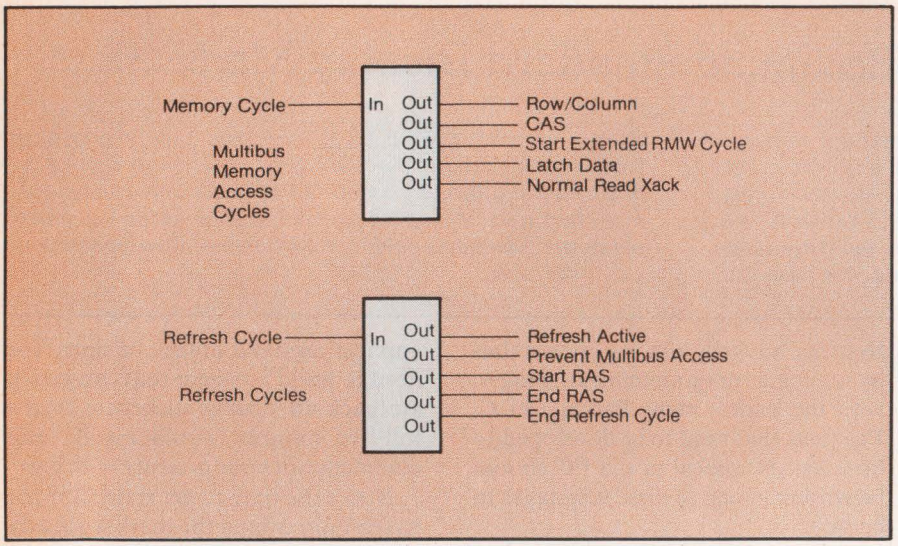

Figure 4: Control Circuitry — Timing for the board is controlled with two 5-Tap delay lines, the outputs of which turn on and off various signals on the board.

(continued from p. 80)

access time is used up in the arbitration circuit, with a possible 42.6ns delay from the start of a command to the START signal on the board which is used to begin a cycle.

But the design has proven to be very stable by extensive lab and field testing. Therefore, the delay is felt justified in order to satisfy the foremost goal of the board: reliability.

Control Circuitry

The control circuitry on the board, which determines timing for sending signals to the dynamic RAM array, is largely made up of two precision delay lines and 74F series circuitry (again, to reduce skew times) (**Figure 4**). One delay line is used for normal accesses to the board from the Multibus, while the other one is used for refresh cycles on the board.

The first delay line has five taps, which have the following significance:

- Tap 1 — Switches row/column addresses to the RAM array
- Tap 2 — Starts the CAS signals to the RAMs
- Tap 3 — Starts a second cycle if read-modified-write
- Tap 4 — Latches data to the output buffers
- Tap 5 — Causes an XACK to the Multibus on a normal read.

The read-modified-write cycle is only needed on the EDC board when a byte-write is done. This cycle is needed because the board's error correction circuitry operates in 16-bit mode only. Therefore, a byte-write must be done in several steps:

1. Read the old data (16-bits) from the memory and latch it into the EDC device.
2. Correct any errors on the old data.
3. Merge the new data in with the corrected old data.
4. Generate new check bits for the new 16-bit word.
5. Write the new word to memory.

Since the parity-only board does not require this type of cycle, only four taps are needed for it's delay line.

The refresh cycle's delay line also has five taps, used basically to turn on and off the RAS strobe to the memory array. The refresh addresses (being a discrete counter on the board) are clocked at the end of every refresh cycle.

XACK Generation

Cycles are all the same length on the parity-only memory board. This is because data is accessible in 8-bit or 16-bit increments, and any errors that

are detected cannot be corrected. However, with the EDC memory board, XACK can be generated at several different times, depending on the cycle (**Figure 5**). The different types of cycles, from fastest to slowest are:

1. Word write cycle: This type of cycle always operates without errors, since it is overwriting any current data in the memory. It operates with a 230ns maximum (200ns typical) access time.
2. Read cycles with no errors are the next fastest cycle, with a 265ns maximum XACK (240ns typical). Note that the data is available much earlier than the XACK, with the difference being in the error detection circuitry. The data is available within 210ns maximum, or 180ns typical.
3. The slowest type of cycle on the board is the byte-write, which is a read-modified-write cycle. This generates an XACK with in 660ns of the write strobe to the board with 600ns being a typical value.

It would have been much easier (and many other boards use the technique) to simply generate XACK at the latest possible time, or perhaps use only two values, normal and byte-write. Since performance is important for the board, it was determined that every cycle should acknowledge as quickly as it possibly could.

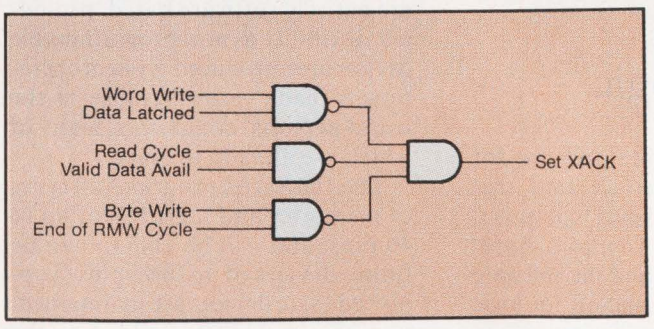

Figure 5: XACK Generation — XACK is generated at different times for each type of cycle. Most memory boards generate just one XACK, slowing the processor for otherwise fast cycles.

Error Detection and Notification

Both types of boards can detect errors, although only one can correct them. Even the EDC board cannot correct double-bit errors, although it can detect them.

Just as important as the fact that the board can detect/correct errors is *how it handles* the errors when they are found. Naturally, single bit errors on the EDC board are automatically corrected, and the XACK is stretched according to the cycle. For all other types of error cycles, however, the processor needs to be notified so that it can take appropriate action.

Both types of boards have ports which allow the processor to read the exact bank of memory devices which failed. This can provide the possibility of the processor continuing it's operation (assuming the error did not occur in system memory), and simply disabling that area of memory from use again. The process that was running in that area of memory would, of course, have to be deleted at that time.

Interrupts are optional for both boards on the occurrence of an error. The EDC board can even interrupt on a single bit, corrected error, so that the host can be notified of such errors (for logging purposes). Alternately, this option can be defeated.

Noise Reduction

A problem with many dynamic RAM boards in the past has been signal or power supply noise. This board solves these problems using a variety of methods.

First, multi-layer construction is used for both types of boards. The EDC board is six layers, with every other layer a ground/voltage layer. Likewise, the Parity-Only board is four layers, with the inner two layers the ground and voltage planes. This multi-layer design assures a constant impedence for all signals on the board, and guarantees that the peak heavy ground/power current requirements are satisfied.

Second, bypassing rules are followed very closely for the entire board so that almost every device on the board has a 0.1μF bypass capacitor. The sockets used to hold the dynamic RAM chips and the drivers for those chips contain integral bypass capacitors, directly from the +5V to the ground pins. Being part of the sockets themselves, these capacitors have a minimum lead length to the IC pins, and therefore minimum inductance. In effect, the design of the sockets maximizes the capacitance available to the chip.

Finally, the sockets used in various parts of the board (including the entire RAM array) are the highest quality made. Each pin consists of a swiss screw mechanism that holds the device in place even with severe vibration. Normal single/double wipe sockets have been a constant source of problems in digital designs of the past. They can lead to bad connections, another source of signal noise.

256K RAM Usage

The boards were designed throughout for the use of 256K dynamic RAM chips when they become available. This gives the user great flexibility for the future, since the 64K chips can be pulled from their sockets and 256K chips can be put in, to result in a 2M RAM board.

Conclusion

Although the design of dynamic memory boards in general has become much easier with the use of chips provided by semiconductor companies, a very high performance memory board still requires much discrete logic. Further, several design considerations that don't directly affect the operation of the memory are important for the reliability, servicability and expandability aspects of the board. □

Errata

In the article, "Q-Bus Line Offers Design Flexibility For The OEM" (*Digital Design,* November, 1983), we stated that the NCR Tower was based on the National Semiconductor 16000. To be correct, the NCR Tower is based on the Motorola 68000 and was introduced at the Fall Comdex show in 1982. We are sorry for the error.

Hand-Held Terminal Provides Easy Maintenance

The failure of conventional tape or disk drives necessitates the use of the host computer to isolate the fault. Normally, the host computer must be dedicated to this task, resulting in burdensome system downtime until the repair is complete. This also occurs when routine maintenance is performed.

Digital Equipment Corporation's TA 78 tape drive circumvents this situation. Built-in firmware (i.e., diagnostic programs designed to exercise the drive and isolate the error), run by an 8085 microprocessor (also incorporated into the tape drive), relieve the host computer of any involvement. During repair, the drive alone is down.

A hand-held 24 oz. control/display terminal, built by Termiflex Corp., Nashua, NH, permits easy communication between service engineer and microprocessor. Plugged into a 5V power source and RS 232 port, both located on the drive itself, the lightweight terminal lets the service engineer monitor all status registers and perform most subsystem functions (via slave drives) while the TA 78 is temporarily off-line.

Punching "Control C" on the terminal keyboard initializes communication. Typing in "HELP" calls up the available commands. These are listed on the terminal display. Based on problem location (indicated by a set of binary coded lights located on the drive's control console) and information supplied by the customer, the service engineer selects the appropriate command signal. If the operator types in "RUN", for instance, the microprocessor initiates that particular program. In the course of program execution, the terminal displays actual data vs. expected data (for fast fault isolation) as well as direct messages in English. If no errors are found, the engineer initiates another command, and so on. Possible problem areas include circuit board failure, adjustment changes, etc.

The terminal, Model HT/12, features a full alphanumeric, two line display, 16 characters each line. The 20 pad keyboard, with the help of three additional shift keys, will generate all 128 ASCII characters and codes. Furthermore, scroll capability and a 2000-character buffer allow message retrieval and review. Diagnostic programs may be placed on hold at any point during program execution. Designed for high-capacity disk-to-tape back-up, high-speed data acquisition, reduction of the number of tapes handled, maximum system uptime, and compatibility with foreign systems, the TA 78 tape drive with self-contained diagnostics permits convenient, economical archival storage and transport of large data bases. **Write 238**

The Termiflex hand-held 24oz. control/display terminal.

A Software Approach To Programming Memories And Logic

Using sophisticated software run on a personal computer, designers can now program all types of memory and logic ICs without different modules or adapters for each family of devices.

Valley Data Sciences Inc. (Mountain View, CA) has introduced the 160 Series universal programmer, employing software that runs on a personal computer instead of hardware to control the algorithms for programming PROMs, EPROMs, EEPROMs, EPROM-based microcomputers, PALs and IFLs. The complete system includes a programming station with two zero insertion force (ZIF) sockets—one for devices of up to 28 pins and one for 40-pin ICs, an interface card that plugs into the personal computer; either an IBM PC, Compaq, Apple IIe or Zenith Z-89, and the software on floppy disk — LogiSoft for logic and MemSoft for memories.

The market is dominated by conventional instrumentation, relying heavily on dedicated hardware solutions employing personality modules for both engineering and production applications. VDS has chosen a software solution tied to the growing base of personal computers as the vehicle for market leadership. Reflecting this current trend towards software, VDS' products are entirely software based, providing flexibility as new programmable devices are introduced. System operation is made easier because of the use of personal computers, many of which are already in place.

The 160 Series programs all types of memories and logic ICs of up to 40 pins, and will be able to handle future devices of up to 96 pins. Supported logic devices are maintained, and new devices are added to the data base, with convenient software updates on floppy disks. Test vector generation is supported by the personal computer through the use of software simulators available from the suppliers of fuse file development software. The test vectors can then be applied to programmed devices that are inserted into the programming console.

VDS has developed the "Smart

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Product Index

To help you find the products you need, we've compiled a subject index of the ads and new products that appear in this issue. Organized by general product area, the listings include the name of the manufacturer, the page on which the product appears and a write number for additional information on that product. Bold type indicates advertised products.

Mainframe Systems

	Page #	Write #
Cadmus	**47**	**48**
Canaan	108	141

Microprocessor Systems

Cambridge Digital	**31**	**70**
Cubicomp	**35**	**39**
Dy4 Systems	110	129
Inner Access	109	140
Innovative Electronics	110	146
Scientific Microsystems	110	128
Summagraphics	109	135
Sun Microsystems	109	145
Tandem	109	137
Wang	110	144
Wicat Systems	109	136

Integrated Circuits (μPs, A/D's, Multipliers)

Floating Point	**2, 3**	**60**
Marinco	**C4**	**4**
Universal Semiconductor	**12, 13**	**15**
GTE Microcircuits	114	188
Hybrid Packaging Technology	115	209

Operating System Software

Computervision	108	147
Mosaic Software	110	127
Stratus	108	139
Versatec	109	138

Test Equipment

Micromint	112	158
Orion Instruments	111	171

Hardware/Back Planes, Packaging, Electromechanical Components

Augat	**81**	**41**
Scambe	**10**	**14**

Keyboards

Summagraphics	**33**	**28**
Optomicronix	112	157

Power Supplies/UPS/ Line Conditioners

L.H. Research	**73**	**72,29**

Mass Storage/Drives

Century Data Systems	**63**	**35**
Control Data	**45**	**22**
Dylon Data Corp.	**93**	**38**
Kennedy	**C2**	**2**
Imperial Technology	**115**	**46**
Applied Data Communications	112	164
Hewlett-Packard	112	159
Maynard Electronics	113	160
Micropolis Corp.	113	167
Shugart	113	163
Sunol Systems	112	172
Vertex	112	173

Printers/Plotters

Clearprint	**91**	**56**
Genicom	**37**	**32**
Hecon	**86**	**47**
Nicolet-Zeta	**15**	**16**
Anderson Jacobson	113	162
Comrex	113	175
Datasouth	112	155
Storage Technology	111	166
United Micronics Corp.	111	177

Communications Equipment

Audiotronics	**29**	**26**
Complexx Systems	113	163
Welch Allyn	113	161

Add-In Memory Boards

Central Data	**77**	**34**
CSPI	**21**	**11**
Diversified Technology	**11**	**18, 19**
Plessey	**1**	**9**
Codar	116	201
SGS USA	114	190

Controllers/Interface Boards

Ciprico	**79**	**37**
Datacube	**27**	**21**
Emulex	**23**	**23**
Fluke	**57**	**12**
MDB	**4**	**5,6**
Standard Microsystems	**83, 85, 87,89**	**42,43, 44,45**
STD Microsystems	**67**	**36**
Adaptec	116	206
Burr-Brown	115	193
Computer Products	114	192
Cromemco	114	186
Dy-4 Systems	114	189
Octagon Systems	115	210

CPU Boards

Zilog	**6,7**	**8**
Advanced Digital Corp.	115	208
RCA	116	194

Color Graphics Terminals

Intecolor	**16**	**24**
Lundy	**9**	**7**
Modgraph	**43**	**33**
Aydin Controls	109	142

Data Terminals

Falco Data Products	109	130
Micro Touch	110	143
Monolithic Systems	110	126

Busses

Dilog	**65**	**30**
Erbtec	**31**	**1**
Force	**25**	**27**
Huerikon	**8**	**10**
Intersil Systems	114	187
Micro Memory	116	191
Micro/Sys.	115	207
Rmac	116	199

Displays (LED, Vacuum, Fluorescent)

Cermatec	**19**	**17**
Epson America	**C3**	**3**
Science Accessories Corp.	**111**	**50**
United Micronics	**113**	**73**

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Figure 1: The 160 Series programmable logic workstation.

Socket" concept for programming memories and logic in which a universal programmer is controlled by sophisticated, CP/M-based software. One hardware system programs all devices—there are no separate personality modules or adapters. All of the programming information is contained on floppy disks, and each disk is capable of storing the programming algorithms for almost 2,000 devices. Because logic design software for PALs is now available for use on PCs, one computer system can be used for developing the logic and programming the device. The computer then becomes a logic or memory workstation.

According to Martin Cohen, executive vice president at VDS, "there are two major trends taking shape in digital systems relating to programmable logic and memory. First, more and more products are coming to market with PROMs and EPROMs instead of ROMs—they give the designer more flexibility and eliminate the risk of outdated ROM inventory, and second, the use of PALs is growing rapidly, with new devices being introduced at a steady rate. When you combine these with the fact that PAL design software is now available for personal computers, it makes sense to have a PC-based memory and logic programmer." The 160 Series can also be used to program single-chip microcomputers that contain on-chip EPROMs.

The key to the ease of use of the 160 series lies both in its hardware and software. The software, called MemSoft for memories and microcomputers, and LogiSoft for PALs and IFLs, contains all of the necessary programming algorithms and device data bases on floppy disks. With a unique code packing scheme, it can store the information for almost 2,000 device types on a single floppy disk.

Several options for the 160 Series are planned for introduction during 1984. These include a 16-socket ganger for programming and an automatic IC handler interface for production programming. The 160 Series universal programmer is available with or without the computer. Without the computer, the 160 Series with MemSoft sells for $4,995, with LogiSoft it costs $4,495, and with both software packages, it sells for $5,495. The software updating service is $400 for five updates. A typical turn-key system including a Zenith Z-89 computer, the 160 Series console and both software packages sells for $7,195. A turn-key system with an IBM PC sells for $9,295.

—Valley Data Sciences

Write 233

Table 1: Software design tools for programmable logic.

Software	Supplier	Operating System	Logic Devices
PALASM	Monolithic Memories	MS DOS (IBM PC)	MMI PALs
PLAN	National Semiconductor Corporation	CP/M 80	NSC PALs
AMAZE	Signetics	MS DOS (IBM PC)	IFLs
AMPALASM	AMD	CP/M	AMD Advanced PALs
CUPL	Assisted Technology	MS DOS (IBM PC)	All PALs and IFLs

16-Bit CMOS ADC Sidesteps Traditional Performance Trade-Offs

A CMOS 15-bit plus sign analog to digital converter (ADC) offers performance, price, package and functionality benefits not found in previous monolithic, single chip ADCs. Teledyne Semiconductor's TSC800 offers a combination of user-desirable characteristics; maintaining that comparable single chip monolithic devices have only one-eighth the TSC800 resolution **(Figure 1)**.

Maximum linearity error is 2 LSB or four times better than the TSC7109/ICL7109 12 bit plus sign devices. Maximum differential linearity error is ±1/2 LSB. High resolution is complemented by a 100μV input sensitivity made possible by device input noise being 15 μVp-p typically.

Analog inputs are fully differential, unlike earlier two chip implementations. Input common mode range extends to within a volt of either supply. Typical common mode rejection is 86dB. The high impedance -$10^{12}\Omega$ - CMOS inputs feature a low 15 pA maximum input leakage current. Power supply requirements are ±5V at 3.5mA maximum current. The negative supply can be generated in a +5V only system with the inexpensive TSC7660 DC to DC converter. System costs are reduced by not requiring ±15 supplies.

The TSC800 uses a modified dual slope conversion technique **(Figure 2).** An auto-zero phase during each measurement cycle guarantees a zero voltage input and gives a zero code output without trim potentiometers. The zero scale error drift with temperature is also corrected to 0.8 μV/°C typically. Correcting voltages are stored on an external auto-zero capacitor. To guarantee the TSC800 recovers quickly from out of range input signals, the auto-zero capacitor is discharged and the integrator output set to zero before a new conversion cycle begins. This is an important feature in multiplexed systems where sensor failures can cause overloads.

The dual slope conversion method may offer several advantages over successive approximation (SAR) converters. A sample and hold amplifier is not required since the digital output depends on the average input signal over time rather than the signal at fixed times as in an SAR converter. The averaging feature can be used to eliminate repetitive waveforms such as 50/60 Hz line interference. A low-cost 2.45 Mhz crystal connected to the internal oscillator gives rejection of 50, 60, and 400 Hz signals. Integration period is 100msec. At 60 Hz the practically realizable attenuation is 55dB. The 400 msec conversion rate is more than adequate for many process control, data logging, and physical environment monitoring applications where "real time" is measured in seconds or minutes.

The TSC800 is packaged in a new compact 60 pin quad flat package as well as the conventional 40 pin DIP. Space requirements are about 30% of the DIP. The TSC800 is the first precision data acquisition component available in a compact 60 pin flat package.

Data transfer is facilitated by three-

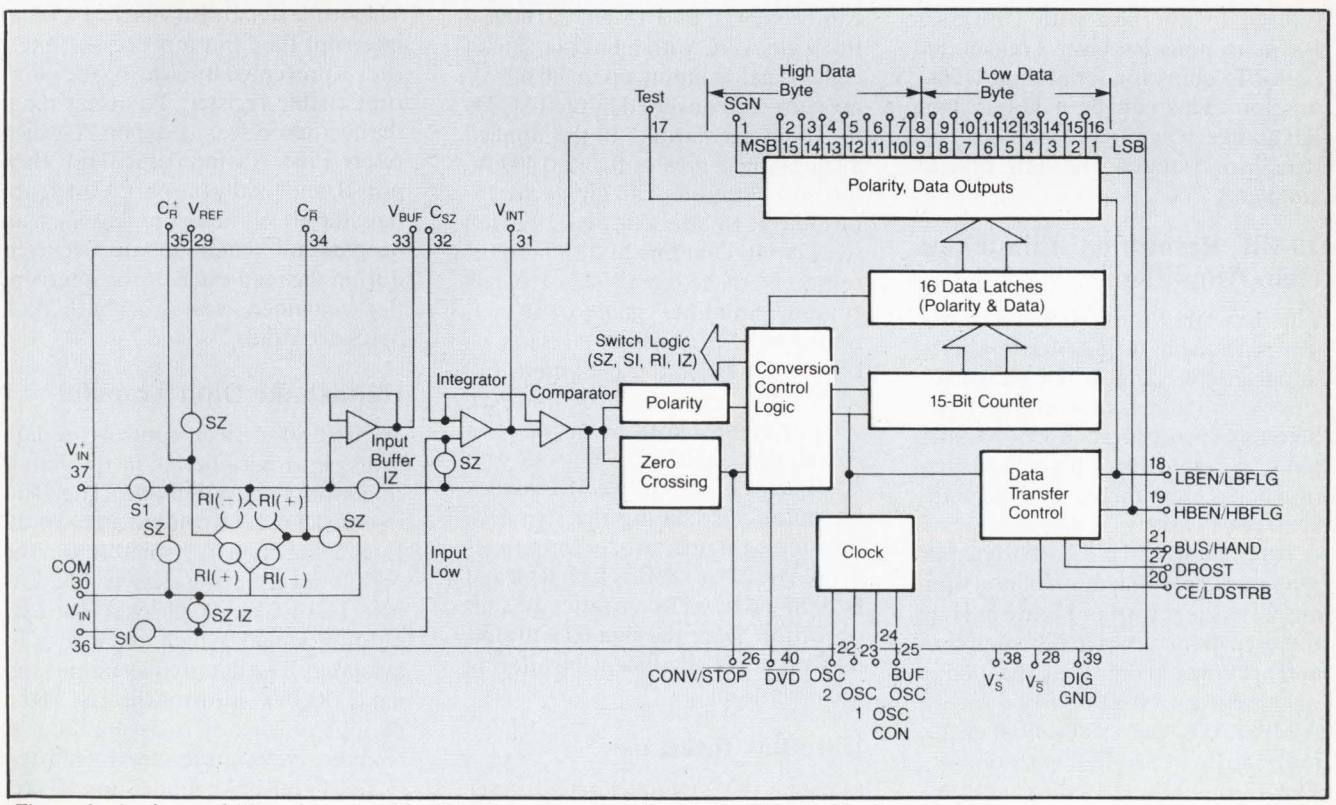


Figure 1: Analog and Digital compatible CMOS process provides Single Chip 16-Bit Converter.

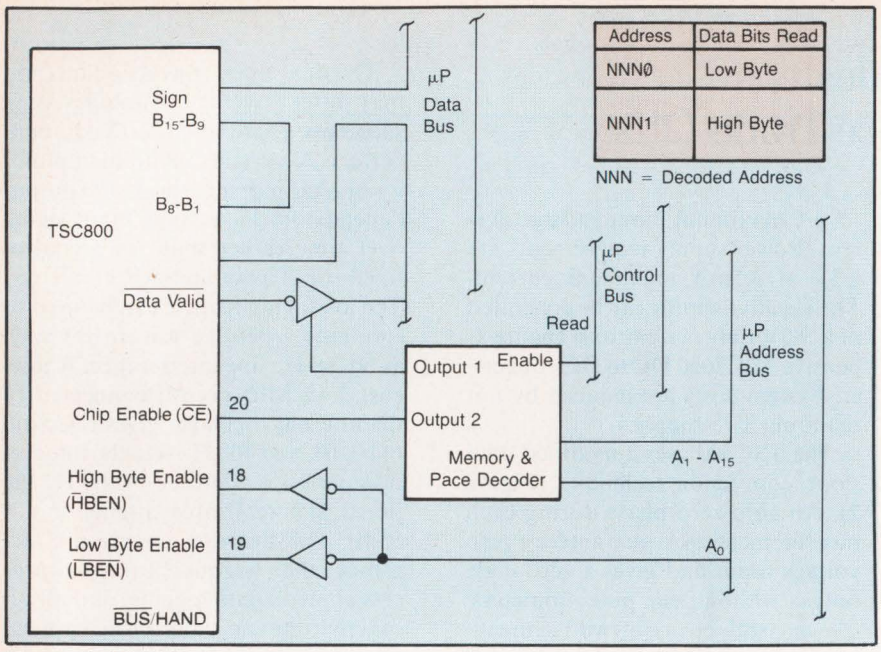


Figure 2: TSC800 Integrating Converter updates conventional dual slope conversion with system zero and integrator zero phase.

state data and sign bit outputs which interface to a data bus with two 8-bit bytes or as one 16-bit word. Continuous or convert on command operation is possible. A special "handshake" data transfer allows the TSC800 to actively participate in data transfers. The handshake mode is used to interface with Universal Asynchronous Receiver Transmitter (UART) chips for serial data transmission. This can be a key system advantage when, for example, systems are isolated through optical couplers.

15-Bit Resolution Eliminates Gain Amplifiers

The TSC800 96 dB dynamic range solves problems usually needing additional analog components. Since each analog component adds an error term, better system accuracy and lower system cost result. Error budget calculation and allocation for the designer is also made easier.

An example of the TSC800 dynamic range and the elimination of precision amplifiers is shown in **Figure 3**. Here the user desires twelve bit resolution and accuracy in digitizing the analog signal between ±0.4096V to ±3.2768V. A 12-bit ADC cannot accomodate this range without sacrificing resolution. The 12-bit ADC based system normally resolves the dilemma by using a programmable gain amplifier with gains of 1,2,4, and 8. This amplifier is, unfortunately, expensive and a system error source.

A 15-bit TSC800-based system can replace the programmable gain amplifier and, through a software routine, give full 12-bit resolution. The TSC800 can be viewed as a 15-bit, ±0.4096V full scale ADC with a built-in gain of eight. Analog inputs up to ±0.4095V are correctly converted by the TSC800 to 12-bit resolution. If the applied analog input is greater than ±0.4096V, the host computer can divide the 15-bit output to adjust for a 12-bit full scale input. Dividing by 2, 4, or 8 corresponds to reducing the TSC800 "internal amplifier" gain to 4, 2, or 1, respectively. The TSC800 gives full 12-bit resolution at the maximum full scale input, even with the non-zero starting point. The necessary division is easily accomplished by software with a simple right shift of the TSC800 15-bit output (excluding the sign bit). Shifting right one, two, or three times divides by 2, 4, or 8. Bits B15, B14, and B13 should be set to zero after the shift operation, since the sign bit will shift into the most significant bits during the operation.

Data Bus Interface

Data transfer is completely under user control with the TSC800. The bus interface mode allows a direct connection to a processor data bus. The dual function $\overline{\text{LBEN}}$ (Bits 1-8) and $\overline{\text{HBEN}}$ (Sign, Bits 9-15) inputs along with chip enable ($\overline{\text{CE}}$) activate the three state data outputs. A typical interface is seen in **Figure 4**.

Address bit A0 and A0 drive the byte select inputs. Additional decoded address bits enable the TSC800. A complete 16-bit data transfer requires two memory read operations, and all 16-bit data lines can be active for a 16-bit wide data bus. Monitoring the TSC800 data valid signal (DVD) allows the user to verify data that did not change during the two byte operation.

The bus data transfer mode supports interfaces using peripheral input/-output chips like the 6522 Versatile Interface Adapter and 8255 Programmable Peripheral Interface Device. Data access involves selecting and reading two I/O ports. A data error will result if data changes - because of a new conversion update - between the processor's high and low byte read cycles. An easy error detection scheme is implemented with the peripheral I/O chip programmed for strobed input operation. The DVD signal is used to strobe data into the I/O chip. The strobe signal also sets the I/O chip interrupt flag, but a processor interrupt is prevented by clearing the interrupt enable register. To access data, the microprocessor reads port A (which resets Port A's interrupt flag), then port B, and finally the port A interrupt flag. If port A's interrupt flag is set, an output data latch update occurred during the read cycle. If the interrupt flag remained clear, the both data bytes are valid.

Handshake Data Transfer

The TSC800 actively controls the data transfer to peripherals in the handshake data output mode. The load strobe (LDSTRB) output signal indicates valid data is available for the peripheral receiving device. The low byte (LBFLG) and high byte (HBFLG) outputs signal which data byte is available. The data request input signal (DRQST) informs the TSC800 a peripheral is ready to accept data. A complete cycle transfers two 8-bit bytes.

The handshake mode supports remote data acquisition systems using

serial data transmission through current loop, RS232 or fiber optic data links. Universal Asynchronous Receiver Transmitter (UART) communication ICs provide an inexpensive parallel to serial conversion. Start, stop, and parity bits, if required, are automatically inserted on transmission and removed on reception. Data transmission errors are automatically flagged. The TSC800 handshake mode exactly matches UART input and control requirements, making serial data transmission a practical reality. The UART relieves the system designer from designing a complex serial data transmission subsystem. The easy TSC800 to UART interface lets the design engineer focus on the data acquisition task, rather than chip interfacing details and serial interface protocols. UARTs are multi-sourced in a variety of technologies: CMOS, NMOS, and PMOS. Some devices lower system part count by including on-chip baud rate generators.

Serial data transfers, especially in high resolution systems, are often dictated on a cost basis whan the ADC distance from the digital processing unit exceeds several feet. Serial transmission greatly reduces the number of cables and line driver/receiver units. When system isolation through optical couplers is desired, cost savings are magnified.

The TSC800 handshake mode is set each time the UART receives a character. The TSC800 automatically transmits two parallel bytes to the UART for serial transmission. The converter's 2.4576 MHz clock serves double duty by driving 94702 baud rate generator. Serial data transmission rates between 50 and 19,2000 baud are selectable.

When the UART receives a word, the Data Received (DR) output goes high, forcing the TSC800 into the handshake data transfer mode. Once the handshake mode is entered by setting the TSC800 internal handshake flip-flop, the BUS/HAND input pin state is ignored.

The DATA REQUEST (DRQST) input is tested for a high UART TRANSMIT BUFFER REGISTER EMPTY (TBRE) signal that indicates the UART is able to accept data. With TBRE high, the High Byte Data Flag (HBFLG) goes low and the sign bit plus B15-B9 data bits become active. The Load Strobe (LDSTRB) pulse latches the data into the UART transmitter holding register and resets TBRE. The TSC800 tests DRQST again for an indication the UART has

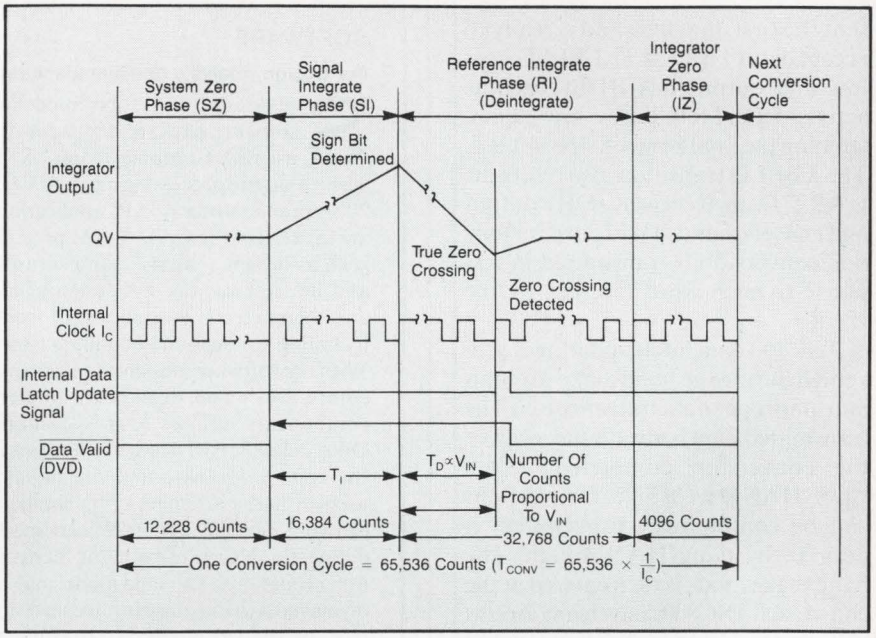


Figure 3: 15-Bit Dynamic Range Converter eliminates programmable gain amplifier.

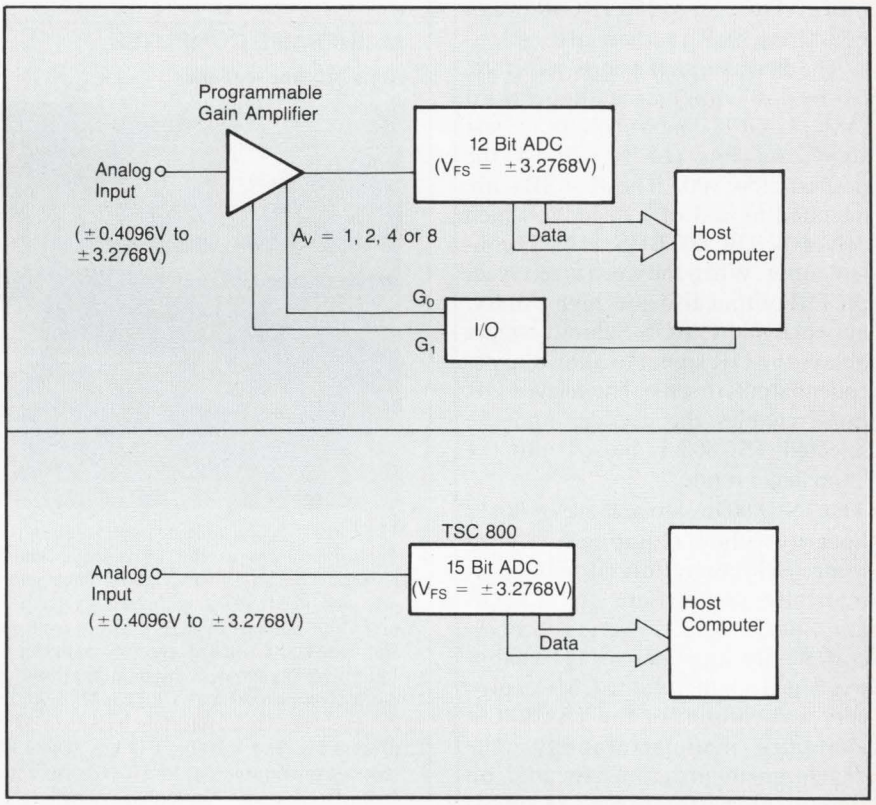


Figure 4: A low-cost interface results when you access the TSC800's 16 data bits directly by treating the converter as two memory locations.

Application Notebook

sent the first data byte and is ready to accept data (TBRE = 1). LBFLG goes low and output bits B1-B8 become active. LDSTRB puses low again, latching the final byte into the UART. The LBFLG transition also resets the UART Data Received (DR) output and ends the handshake transfer. Only one conversion is transmitted in response to each word received by the UART.

TSC800 data latch updating is prevented during the handshake to eliminate improper data transmission. The transmitted data is always the result of the conversion completed before BUS/HAND went high. Conversions can be continuously transmitted, if desired, by tying HAND high. The handshake mode is then entered at the end of each TSC800 conversion. Access to several converters can be achieved with only one UART. Two TSC800 converters give a two-channel link. Output decoding provides room for 6 more ADCs; up to 256 TSC800's can be addressed with additional decoders.

The data handshake starts, as before, by the host computer sending a word to the UART. The word's three least significant bits (LSB) address the desired TSC800. The 3 LSBs are decoded by a 3 of 8 decoder which drives the TSC800 BUS/HAND control input. When the word is received, the DR output also goes high. An RC network and CMOS Schmitt trigger delays the DR signal to allow the decoder outputs to settle. The delayed DR pulse enables the decoder and the selected TSC800 is pulsed into the handshake mode.

The TSC800 design achieves 0.006% linearity without requiring laser trimming. Self-correction circuits automatically compensate for CMOS amplifier errors, lowering process complexity and increasing reliability. A proven metal gate CMOS process was chosen for the TSC800 to guarantee manufacturability. The development programs focused on functional performance, technical specifications, and device producibility.

—Wes Freeman, Applications Engineer; David L. Gillooly, Product Marketing Manager; Teledyne Semiconductor, Mountain View, CA. **Write 232**

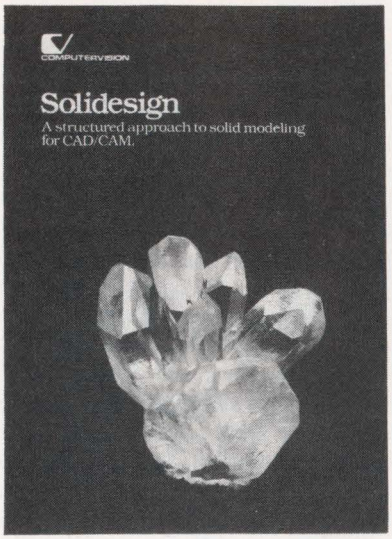
NEW PRODUCTS

COMPUTERS/SYSTEMS

SOFTWARE

For Design Analysis And Manufacturing

Solidesign is a solid modeling software package developed for use with Computervision's APU 32-bit analytic processing unit and CGP 20X graphics processor. Its applications are in areas of the CAD/CAM process, such as design analysis, manufacturing and documentation. Solidesign generates geometric descriptions of parts including surfaces and boundary edges. With the software, designers can change colors, tones and distinguish different components surfaces or cross-sections. Once defined, part geometry remains in the system database and can be later used to make an engineering standard drawing, generate a finite element mesh, define an NC tool-path, or perform other functions. The solid model may be displayed as a line drawing, meshed surface, or shaded picture. In drafting or technical illustration, dimensions and annotations can be combined with the



solid model and cross sections can be crosshatched in monochrome or color. Solid parts can be defined by sweeping a 2D figure to form a 3D solid. **Computervision,** Bedford, MA **Write 147**

MAINFRAME COMPUTER

Runs 370 Applications

The Canaan mainframe computer system runs 370 applications at the user's desk, sharing resources via an Ethernet LAN. Each system provides 1-4 Mbytes of main memory, has a 15" or 17" bit mapped display, graphics controller and detached keyboard. Options include a 35-140 Mbyte Winchester hard disk, 200 to 400 cps dot matrix printers and a 1/2" tape drive. The system's two-bus architecture includes a 32-bit process bus and a 16-bit I/O bus. There is a separate microprocessor for I/O, device control and network access. **Canaan,** Trumbull, CT **Write 141**

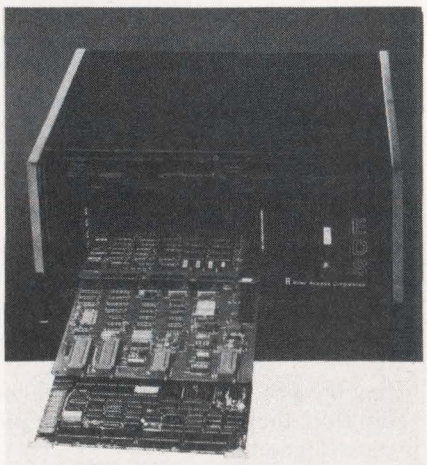
SOFTWARE

Fault Tolerant

The SOS software package connects IBM PCs IBM 3270s to the Stratus 32 Continuous Processing System, a 32-bit fault-tolerant computer. SOS allows PCs to exchange and convert data on Stratus/32 disks and IBM mainframes to the formats used by PC spreadsheets. SOS is based on fault-tolerant hardware, and supports PC software from different vendors. The software controls mainframe files and protects information by requiring users to identify themselves, ascertaining correct authorization. Licenses range from $150 per PC to $33,000 for a package license. **Stratus,** Natick, MA **Write 139**

DEVELOPMENT STATION

16 Mbyte RAM

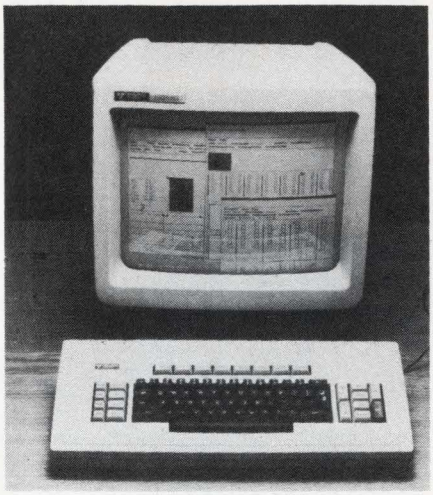


The IEEE-696/S-100 based engineering development station supports Inner Access' word/byte wide ROM simulator and PROM and microprocessor programmer. The EDS features two double sided, double density 8" drives with a 2 Mbyte capacity. Also included are 64K of RAM memory, two RS232 ports, a 16-bit parallel port and a 4MHz Z80 with memory management that allows 16 Mbytes of RAM memory to be

addressed. Price is $5,995. **Inner Access,** Belmont, CA **Write 140**

SOFTWARE

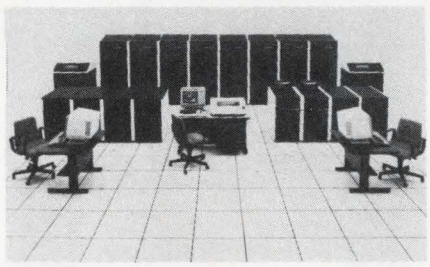
For Versatec Engineering Workstation



These software modules allow the Versatec Expert to be configured for electronic and electro-mechanical engineering, pcb design, or mechanical drafting. Workstations can be networked via Ethernet. The simulation module supports transistors, gates, RAMS, ROMS, and programmed logic arrays. It also supports MOS, TTL, and ECL technology, and provides control and debugging features. All software modules are available separately. Simulation requires the schematic design module. Printed circuit board design requires a mechanical drafting module. Standard workstation office software is necessary to implement equations, records processing, and advanced graphics. Price is $3,900. - 10,000. **Versatec,** Santa Clara, CA **Write 138**

PROCESSING COMPUTER

1 Gbyte Virtual Memory



The NonStop TXP is a 32-bit multiple processor based computer system. The system includes 32-bit native addressing, 64-bit memory access, and a 64 Kbyte cache memory. Each CPU can address one Gbyte of virtual memory/processor and architecture supports physical addressing of 16 Mbytes main memory/processor. In addition, each CPU accesses 64 bits from main memory, and manipulates 32 bits of data at a time via dual data paths and dual arithmetic logic units. CPU cycle is 83.33 nsecs. The system is expandable from a single system of two to a worldwide system with up to 4,080 processors, without reprogramming applications. Price is $328,550. **Tandem,** Cupertino, CA **Write 137**

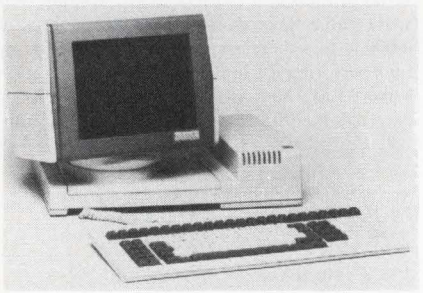
WORKSTATION

For CAD/CAM Manufacturing Applications

The Sun-2 family of workstations are designed for OEM applications such as software development, CAD design and CAD/CAM manufacturing. The Sunstation features local area network communications, a 32 bit CPU, bit mapped graphics display, and an optional hardware floating point processor. The system can be configured, as either a network node or a standalone system. The Sun System uses a Multibus backplane, a 10 Mhz MC68010 processor, supports 4 Mbytes of physical memory, and implements DMA for peripherals. A performance option equips the system with a hardware FPP that supports IEEE standard formats for 32-bit single and 64-bit double precision operations. Price starts at $16,900. **Sun Microsystems,** Mountain View, CA **Write 145**

TERMINAL

Supports Baud Rates of 19.2 Kbaud



The Fame II terminal features 22 user programmable function keys and a 900 character nonvolatile memory. Two ports support baud rates to 19.2 Kbaud for communication with the host and peripheral devices. The 24 line x 80 column has a 25th line for status information, as well as split screen, scrolling, underline and reverse video. The display screen comes on a 12" monitor, and a 14" model is optional. Price starts at $595. **Falco Data Products,** Sunnyvale, CA **Write 130**

CAD SYSTEM

For Architectual Applications

The Aycad 200 is an expandable color CAD system for mechanical and architectural applications. The system consists of a 19" color monitor, a 12 x 12" digitizing tablet, a 13" monochrome display, and a 21-Mbyte Winchester hard disk and a floppy disk drive. Software supplied includes the M/PM operating system and the Aycad software. Creation primitives are selected from the menu by a puck attached to the digitizing tablet, or commands can be entered from the keyboard. Users can create their own symbol libraries, and manipulate the libraries using menu and macro facilities. Optional hardware includes additional digitizing tablets and disk storage, plotting and hardcopy devices, and an alphanumeric terminal to handle word processing and non-graphic tasks. Price is $47,500. **Aydin Controls,** Ft. Washington, PA **Write 142**

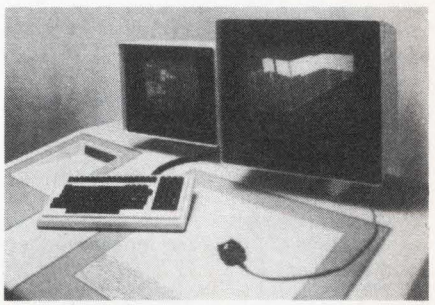
SUPERMICROCOMPUTER

With 512K RAM

The S-140 supermicrocomputer contains a 68000 processor, 512K of RAM and memory mapping registers. A CRT controller board interfaces to a 12" diagonal CRT with 25 lines of 80 characters each. The S-140 interfaces to a disk controller which supports 5¼" Winchester and Floppy disks. The interface is capable of interrupt driven or polled operation, DMA or non-DMA mode data transfers. The S-140 is capable of running all software available for use on Wicat systems with the exception of multi-user software, multi-bus operations, and software exceeding 512K memory requirements. Price is $7,995. **Wicat Systems,** Orem, UT **Write 136**

CAD SYSTEM

In Single And Dual User Configurations



ICON is a computer-aided design system for application architectural engineering, construction and printed circuit board design. The workstation is available in single and dual-user configurations and features a 19" raster graphics display with 1280 x 1024 resolution. The system is available with application packages for AEC and PCB professionals. Price is $37,250. **Summagraphics,** Fairfield, CT **Write 135**

COMPUTERS/SYSTEMS

STANDALONE COMPUTER

Can Be Used As Multiuser Workstation

The Tempest 75 PC-T can be used as a standalone personal computer and as a workstation on Wang's 7500T series of multi-user OIS and Alliance Systems. The 75 PC-T is based on the 16-bit Intel 8086 microprocessor, and includes a keyboard, monochrome display monitor, and electronics unit. Primary features are MS-DOS, 128 Kbytes RAM (expandable to 640 Kbytes), a CPU with eight expansion slots and a 5¼" diskette drive which stores 360 Kbytes of data. Also included are a character resolution card, DMA, programmable system clock, a keyboard, numeric keypad, and two self-diagnostic testing systems. Price is $4,900. - $5,585. **Wang,** Lowell, MA **Write 144**

DATA COLLECTION SYSTEM

Stand-Alone Configuration

The Innovative Data Collection System is a microcomputer based data acquisition/supervision system for inventory control, positive sample tracking, and quality control. The system operates in one of two configurations: either as a stand-alone or in conjunction with a host computer. Its hardware components include a 16-bit CPU, disk drive, microprocessor controlled terminals and application specific peripherals. Each terminal is separately addressable and has a 16 character alpha/numeric display, status lights, and 48 key keyboard. **Innovative Electronics,** Miami, FL **Write 146**

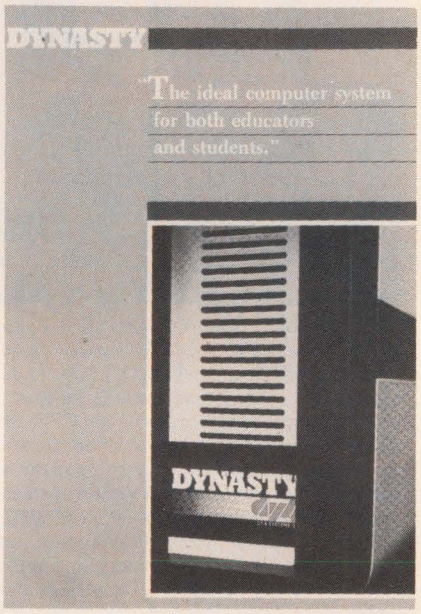
SOFTWARE PACKAGE

For IBM PC.

Integrated-6 is a software package designed for use with the IBM PC. The package combines a relational database, business graphics, spreadsheet, word processing, communications, and terminal emulation to link the PC with a mainframe. The package requires 256 Kbytes of memory. The disk based database stores 100,000 records/file. The graphics module includes 15 graphic styles and the spreadsheet can handle up to 256 columns and 2,000 rows. Price is $495. **Mosaic Software,** Cambridge, MA **Write 127**

MICROCOMPUTER

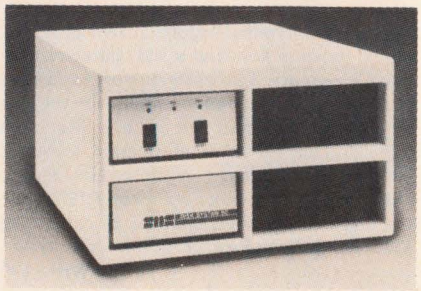
Supports 64 Workstations



The Dynasty is an Omninet compatible microcomputer which supports 64 workstations/per network with or without disk storage. It has a transfer rate of 1 Mbit/sec and network file servers include double sided/double density 1.2 Mbyte diskettes and a Winchester hard disk. Dynasty supports three operating systems, CP/M, MS-DOS and UNIX as well as multiple serial printers and plotters of 19.2 Kbaud. Network cable links workstations at distances of 4,000 ft. and there is an optional RAMDisk for high performance applications. Communication servers link the network to other networks or external mainframes. **Dy-4 Systems,** Campbell, CA **Write 129**

MULTIBUS MICROCOMPUTER SYSTEM

128 Kbyte RAM



Disk System 80 is a 16-bit hardware and software Multibus microcomputer system with 75.6 Mbytes of formatted 8" Shugart or Quantum Winchester disk storage and a Shugart SA850 1.2 Mbyte floppy drive. The standard system with CPU86/640 includes an 86/30 processor board with 128 Kbytes of RAM and an iSBC337 math co-processor, one additional 512Kbit RAM board, and one 4-port serial communications board. A single board SMS FWD8001 Winchester/floppy disk controller is used for high data integrity and software compatibility with iSBC215/iSBX218 two-board controller set. For smaller configurations, the CPU86/128 option may be specified. **Scientific Micro Systems,** Mountain View, CA **Write 128**

TOUCH SCREEN MONITOR

For IBM PC

The Point-I is a touch sensitive monitor for the IBM PC and other personal computers. Users can position the cursor, select from menus, and manipulate graphics by touching the CRT screen. The Point-I includes a CRT, a touch screen with a resolution of 1024 by 1024 points, and an RS-232C serial port for the communication of touch points. The Point-I works with the IBM monochrome and color graphics card and is available with a choice of amber or green phosphors. Other features include a built in microprocessor and a software development package. Price is $850. **MicroTouch,** Arlington, MA **Write 143**

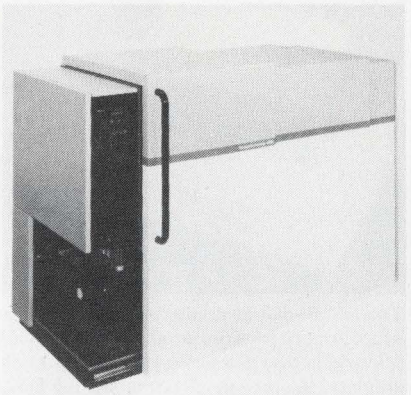
INDUSTRIAL COMPUTER

409 Kbyte Formatted Storage

The MSC 8807 Industrial Portable Computer is a forced-air cooled system which includes a CRT, two microfloppy disk drives, 100w power supply and a detachable keyboard. A single board computer with piggyback module and controller board reside in the six-slot multibus chassis. Concurrent CP/M-86 and iRMX-86 operating systems are available with the MSC. 8807 Multibus-compatible expansion memories, I/O controllers and high resolution graphics board can be added to the system without modification. **Monolithic Systems,** Englewood, CO **Write 126**

LASER PRINTING SUBSYSTEM

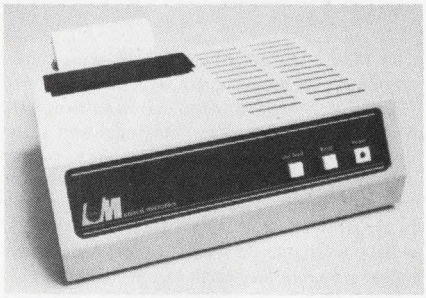
240 X 240 Resolution



The 6100 Printing Subsystem from Storage Technology Corp. is designed for users of high performance data processing systems. It prints forms, data and text at a speed of 103 pages/minute and uses an IBM 3800 interface to connect with IBM-compatible mainframes. Users can change font styles and character densities within one line and line density within a page. Densities of 6,8,10 and 12 lines/inch and 10, 12, and 15 characters/inch are user options. Paper feed rate is 14.6 in./sec. Resolution is 240 X 240 dots per inch. The printer can be set to copy 235 pages of original documents and has on-line status, sense byte information, and off-line diagnostic modes. Price is $195,000. **Storage Technology,** Louisville, CO **Write 166**

IMPACT PRINTER

Supports 110 To 9600 Baud Rates



The 400 Series is a dot matrix impact printer in 40 or 21 column sizes. It is microprocessor controlled with a parallel or RS-232C serial interface. Data is accepted during print cycle with automatic line wraparound, using the standard 1K or optional 2K buffer. Serial baud rates of 110 to 9600 are supported. It has a ASCII character set and controls including a programmable line feed and character pitch (40 characters/line or 32 characters/line), expanded character print, inverted character print, block graphics and self-test. **United Micronics Corp.,** Chevy Chase, MD **Write 177**

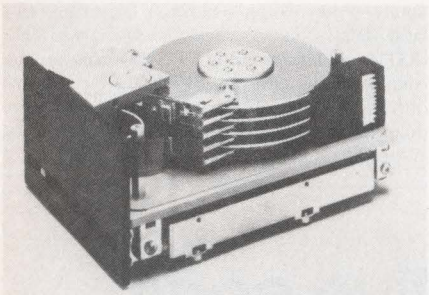
ANALYZER/EMULATOR

Emulates 128 Kbytes ROM

The single pod-sized box contains a 48-channel bus state analyzer, an 8/16-bit emulator, an EPROM programmer, and an input stimulus generator. A control program runs on the host computer and coordinates disk, printer and instrument resources into an integrated environment. The system can be used as a complete development system for any kind of target processor. Up to 128 Kbytes of 195 ns ROM can be emulated in either an 8 or a 16-bit mode. The analyzer has 4-step sequential triggering, pass and delay counters, and selective trace. The ROM emulator and the EPROM programmer share memory allowing EPROMs to be burned directly from emulation memory without downloading. Price is $2395. **Orion Instruments,** Woodside, CA **Write 171**

WINCHESTER DISK DRIVE

25 msec Access Time

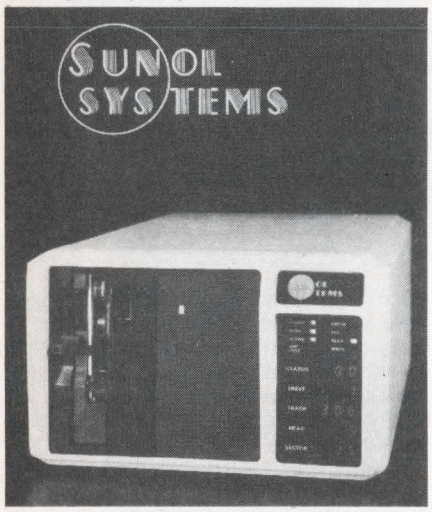


The V2100 is a 5¼" Winchester disk drive, with a 72 Mbyte capacity and 30 msec average access time. The drive uses thin film media and utilizes the Seagate ST412HP interface standard. Applications include multi-tasking, image processing and network applications. Other features include a dual-frequency closed loop servo system which allows continuous sampling and correction of head-to-track positioning as the disks rotate. Track density is 960 tpi. **Vertex,** San Jose, CA

Write 173

WINCHESTER DISK SYSTEM

51 Mbyte Capacity



The Universal Mass Storage system is a 51 Mbyte Winchester disk system compatible with Corvus systems. Host adapters are available for IBM, Texas Instruments, Apple, and Radio Shack. Four 51-Mbyte modules may be stacked together to achieve 204 Mbytes of storage. On line storage is provided by a removeable ¼" tape cartridge. The system utilizes Run Length Limited which causes a transfer rate of 7.5 mbits/sec. 64 users may share the mass storage unit. Price is $4,595. **Sunol Systems,** Pleasanton, CA

Write 172

STREAMING TAPE DRIVE

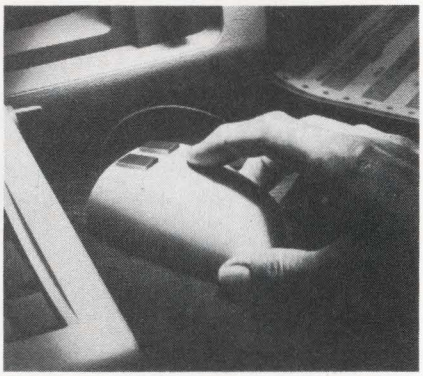
500 Mbytes Storage

The HP 7974A streaming-mode tape drive is designed for backup of midrange systems with 100 to 500 Mbytes of on-line disk storage. The HP 7974A is a 1/2" drive formatted with 1,600 c.p.i. per inch. Users may add 800-cpi NRZI if dual density is needed. The drive operates at 50 ips, 200 ips rewind, using tension-arm buffering. In the streaming mode, it operates at 100 ips and has an HP-IB IEEE-488 interface. Price is $12,500. **Hewlett Packard,** Palo Alto, CA

Write 159

MOUSE

For Graphic Display Applications



The Model RK280 Mouse is designed for OEM applications such as graphics, wordprocessing and business. The controller has a resolution of 160 logic states per inch of travel and is reliable at 1000 miles of Mouse travel. The RK280 has a modular construction and user removable ball which allows the Mouse to be used on any flat area. Price is $58 in quantities of 1000 units. **Optomicronix,** Mountain View, CA

Write 157

DISKETTE READER/WRITER

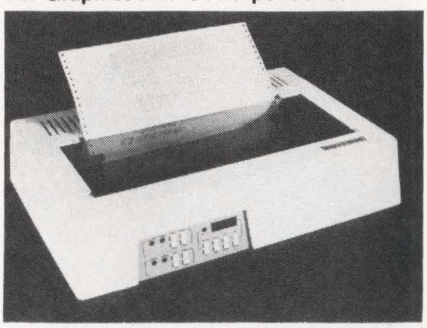
Unifies Data Formats

The Model TM-500 diskette reader/writer is a media translation system that accepts source computer data from floppy disks of any size, density and format. TM-500 transfers the data to an internal buffer memory, where overhead formatting data are stripped away. Data is then re-formatted in memory, and written back out to other floppies of different sizes and densities, allowing input to otherwise-incompatible computer systems. The TM-500 unifies data formats for I/O ports and magnetic tape. A X-on/X-off feature allows TM-500 to accept real time data communications input and bisync protocol option. Price is $15,800. **Applied Data Communications,** Tustin, CA

Write 164

MATRIX PRINTER

For Graphics And Correspondence

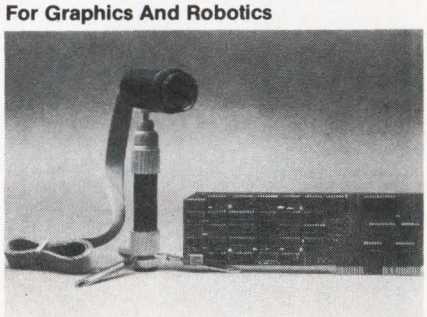


The DS220 matrix printer provides correspondence printing for word-processing, draft quality printing for data processing and dot-addressable graphics. In correspondence mode, the DS220 generates an 18 x 48 dot matrix and prints at 40 cps. Standard features include correspondence, memo and draft fonts and a micro-character set. For print intensive applications, the DS220 operates at 220 cps utilizing bidirectional logic-seeking printing and has a throughput of 450 lines/minute. When used for dot-addressable graphics the DS220 prints 217 columns for spreadsheets and then graphically outputs the results. The DS220 includes both serial and parallel interfaces and a 2000 character buffer. Price is $1,995. **Datasouth,** Charlotte, NC

Write 156

DIGITAL IMAGE SENSOR

For Graphics And Robotics



The Micro D-Cam digital image sensor gives computers the dimension of sight. Using a 256 by 128 silicon array and menu driven software, the Micro D-Cam interprets, enhances and stores images. Applications include graphics, pattern and character recognition, robotics, process control and security. The Micro D-Cam is available in an IBM PC and Apple II version (RS-232 version available on special order). The sensor includes an interface card, extension cable, IS32 optic RAM, lens, remote housing, operators manual and utility software. Price is $295. **Micromint,** Cedarhurst, NY **Write 158**

DISK DRIVE SYSTEMS

10 Mbyte Capacity

The Winchester hard disk drive systems are engineered to run on DOS 2.0 or other operating systems which use XT hard disk. They are equipped with a Maynard SandStar card, A SandStar Hard Disk Controller module, software and cable. They are available in three configurations with the following modules: Serial

Port, Parellel Port, Clock Calendar, Game Adaptor, SASI Host Adaptor and, Prototyping Module. The former can control two floppy drives mounted inside the IBM PC and two optional 5¼" and 8" drives mounted externally. With the Memory Card, the user can add 64 Kbytes to 576 Kbytes of memory. Price is $1,395. **Maynard Electronics,** Orlando, FL **Write 160**

NETWORK CONTROLLER

Buffering Capability

The HBD-NC Programmable Network Controller is compatible with all Welch Allyn E2 bar code products configured for RS-422 multidrop. The HBD-NC handles and combines data between 31 terminals and a host computer via full or half duplex communication. ACK/NAK protocol may be used. The HBD-NC can be configured from any on-line remote decoder or terminal by scanning a custom bar menu. Individual terminals can be located 4,000 ft. from the controller and messages received by the HBD-NC are buffered until the host computer can accept them. **Welch Allyn,** Skaneateles Falls, NY **Write 161**

PRINTER TERMINAL

Single-Pass APL Printing

The AJ 864A dot matrix printer terminal is designed for printing speeds of 180 character/sec. The AJ 864A uses a 9-wire head with a 5-dot wide character. Seven function keys can be programmed with multi-key sequences of up to 31 characters. The keyboard includes a 16K extended buffer memory, double-width characters, and automatic line centering. Price is $3,250. **Anderson Jacobson,** San Jose, CA **Write 162**

OPTICAL DRIVE

One Gbyte Storage

The Optimem 1000 laser-based optical disk drive stores one Gbyte of information on each side of its 12" disk. The drive writes and reads using non-erasable laser technology, has removable media and can be used as a backup device for Winchester disk drives in archival applications. Information is recorded and played back on a removable 12" disk which is protected by a hard shell cartridge. The Optimem media is pre-grooved for servo-tracking and pre-formatted with sector address information. The Optimem 1000 has a five Mbit/sec transfer rate and an average access time of 100 Msecs. An optional power supply fits within the drive. Price is $6,000 in quantities of 250. **Shugart,** Sunnyvale, CA **Write 163**

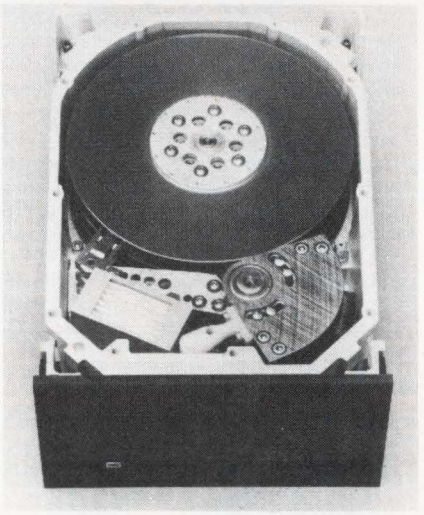
MODEM

For Limited Distances

The LVS 76.8 limited distance modem allows users to select eight synchronous speeds from 2400 bps to 76,800 bps. The LVS 76.8 can operate at any speed by using an outside clock. At 76.8K bps maximum speed the modem sends data 16,250 ft. The LVS 76.8 operates with either an EIA RS-232C digital interface or a V.35 interface and is programmed to provide line loopback testing. The unit has LED indicators for power, data transmit, data receive, carrier detect and testing. Price is $650. **Complexx Systems,** Huntsville, AL **Write 165**

WINCHESTER DISK DRIVE

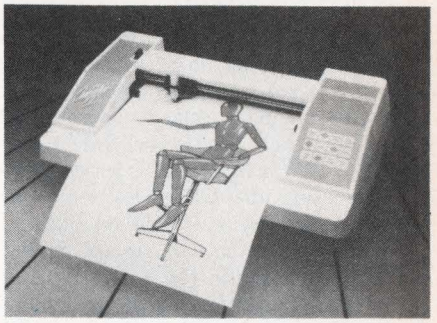
83 Mbyte Capacity



The model 1305 is a 5.25" Winchester disk drive which has a 83 Mbyte capacity and 25 Msec seek time. The 1305 supports the ST506/412 interface and has noise levels below 51 dBA. Standard features are an automatic positioner lock, disk brake, head retraction to a data free landing zone, and an electronic system. Price is $1,635. **Micropolis Corp.,** Chatsworth, CA **Write 167**

PLOTTER

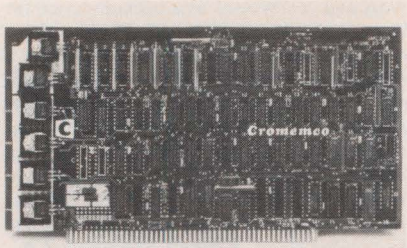
Six In/Sec Drawing Speed



The Model CR-1810 ComScriber I plotter includes pen, paper, interface cable, and tutorial software for the Epson, IBM and Apple Computers. The plotter draws at a speed of six in/sec and line segments are accurate to one four-thousandths of an inch. The basic plotting area of 8-1/2" X 11" can be extended up to 120" in length. The CR-1810 draws characters 1/8" to 20" high. Plotter movements are controlled by a 12-key keyboard and a self-test feature is included. Price is $695. **Comrex,** Torrance, CA **Write 175**

SMD HARD DISK CONTROLLER

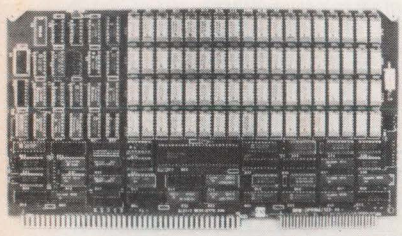
Supports 1200 Mbytes



The Model SMDI from Cromemco is a single-board disk controller that interfaces up to two hard disk drives ranging in capacity from 8 to 600 Mbytes each. The Model SMDI controller allows users of a Cromemco system using the CROMIX multi-user operating system to add on fixed or removable media with storage module drive interfaces. The increased disk capacity makes it suitable for applications such as database and information archival. Systems can be configured from a selection of vendors and models of disk drives. In addition, data transfers can be handled at a 6 to 10 mHz rate with on-board sector buffering and sector interleaving. Data integrity is achieved by automatic CRC generation and checking. Cromemco supports the controller with the SMDS software package for systems running CROMIX. Price is $795. **Cromemco,** Mountain View, CA **Write 186**

RAM MEMORY BOARD

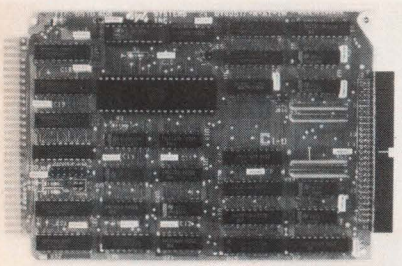
128 Kbyte To 2 Mbyte Capacity



The SAM/DPRAM is a dual port dynamic RAM board that is Multibus and Sam-Bus compatible. The SAM-DPRAM board has a typical access time of 250 nsecs and a maximum cycle time of 250 nsecs. It has memory capacity that ranges from 128 Kbytes to 2 Mbytes and uses parity checking. 24-bit addressing is provided on both buses and the board can be divided by 128 Kbyte sections and programmed for the assignment of the address range allowed by each bus. Price is $2,400. **SGS USA,** Phoenix, AZ **Write 190**

INTERFACE CARD

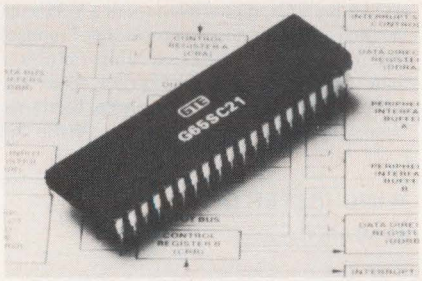
88 Kbyte Transfer Speed



The DSTD-408 is a high speed parallel interface card for the STD bus. It is configured to be compatible with the QIC-2 ¼" tape interface protocol. A Z80 DMA controller chip allows transfer speeds of 88 Kbytes/sec. The interface features an 8 bit data bus plus a 9th parity bit. Seven control signals plus 2 handshake signals are supported by the DSTD-408. When used with other Dy-4 STD modules the DMA on the DSTD-408 can co-reside with up to 3 other DMA devices on the same bus. Both 2.5 and 4 MHz versions are available. Price is $275. **Dy-4 Systems,** Ottawa, Ont. **Write 189**

CMOS PIA

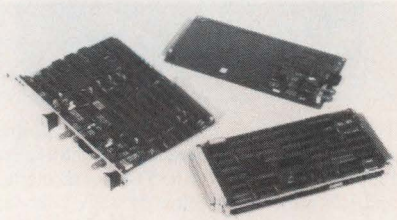
Handshaking Feature



The G65SC21 is a CMOS peripheral interface adapter for parallel I/O support of 6500/6800 series 8-bit microprocessors. The G65SC21 provides programmed microprocessor control of two peripherals through two 8-bit bidirectional I/O ports with individually assigned data direction registers. These registers allow selection of I/O at each respective I/O point. The four peripheral control lines have a handshaking interrupt feature. Price in quantities of 100 is $5.45. **GTE Mirocircuits,** Tempe, AZ **Write 188**

SERIAL LINK

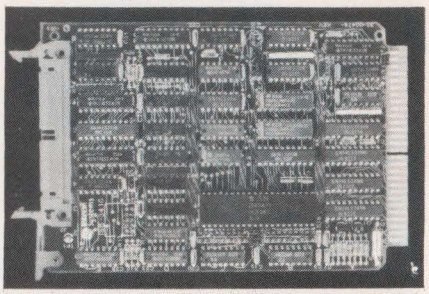
With Optical Modem



The serial link allows computers to communicate serially with data acquisition and control equipment. The link includes a host dual port serial card, an intelligent remote control unit and an optical modem. Data can be transferred between the host computer and processor in single words or blocks at a rate of one Mbaud, using RS-422 signal levels or fiber-optic cable. The control unit supports digital I/Os, analog I/Os, sequence-of-event time tagging and open transducer testing. The link provides data security and a positive response on all data transfers. It is available for the Motorola 68000 I/O. **Computer Products,** Ft. Lauderdale, FL **Write 192**

STD BUS BOARDS

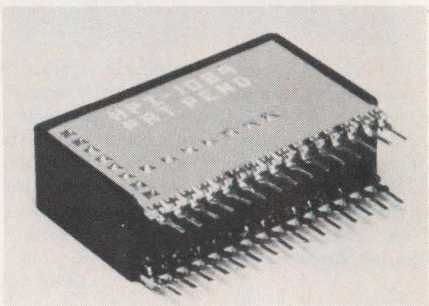
64 K Memory



The ISB-3250, ISB-3410, ISB-3430 and ISB-3711 are four STD bus boards with a memory capacity of 64 Kbytes. The ISB-3250 features eight 28-pin JEDEC sockets, each of which is selectable on 2K, 4K, 8K or 16K address boundaries. The ISB-3410 is a Winchester disk interface card that allows the user to adapt industry standard hard disk controllers for use with STD BUS systems. Data transfers can be initiated via DMA, as well as through polled operation and interrupt driven. The ISB-3430 is a CRT controller and keyboard/light pen interface card that has an 8-bit parallel input port and strobe to interface common keyboards. It provides the user with a 80 by 24 alphanumeric and character-graphics generator. The ISB-3711 serial I/O card has two duplex serial communications channels, each of which is independent and capable of asynchronous and bisynchronous operation. Prices are $250. (ISB-3250), $364. (ISB-3410), $364. (ISB-3430) and $271. (ISB-3711). **Intersil Systems,** Sunnyvale, CA **Write 187**

RAM MODULE

64 Kbytes Memory

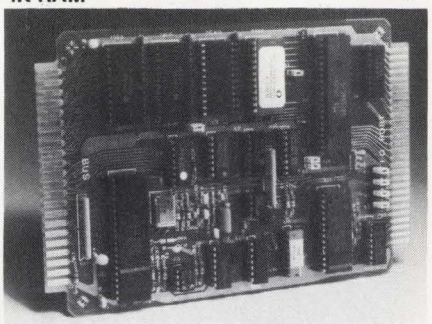


The HP1-6418V 64 Kbyte RAM module comes in a 1.60 ×1.05 inch package. The package size reduces printed circuit board space and results in shorter current carrying distances, distributed capacitance, higher speeds and fewer support components. The HP1-6418V requires +5 volts

in operation and is expandable in 64Kbyte increments. The HP1-6418V allows the utilization of a double-sided backplane, rather than four layer motherboard. Price is $125 to $150 in 100 piece lots. **Hybrid Packaging Technology,** Sunnyvale, CA **Write 209**

MICROCONTROLLER

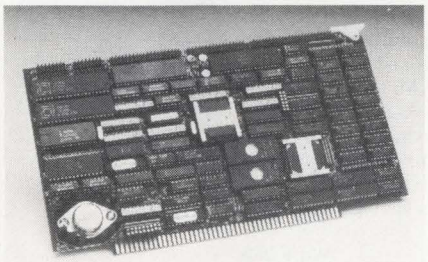
4K RAM



The SYS-3A Tiny BASIC microcontroller is a stand-alone controller with an on-board development system. Applications include energy control, robotics, management, data acquisition, instrumentation and industrial and process control. The SYS-3A features 4K of RAM, externally expandable to 28K, and 4K of EPROM or EEPROM space, externally expandable to 30K. It has 46 I/O lines plus bank decoding for 4096 external I/O lines, as well as a CRT terminal interface. Price starts at $295. **Octagon Systems,** Westminster, CO **Write 210**

SINGLE BOARD COMPUTER

256 Kbyte Memory



The Super 186 is a 16-bit S-100 single board computer built around the Intel 80186. The Super 186 can be configured as a stand-alone bus master or bus slave to serve both single or multiple users. The Super 186 features 256 Kbytes of memory, expandable to 1 Mbyte, and a floppy disk drive controller that simultaneously supports both 8" and 5¼" disk drives. It comes with four Serial RS232 and two Parallel I/O ports, DMA controller, parity and monitor EPROM. The board is compatible with CP/M-86, MP/M-86, TurboDOS and MS-DOS operating systems. Price is $1650. **Advanced Digital Corp.,** Huntington Beach, CA **Write 208**

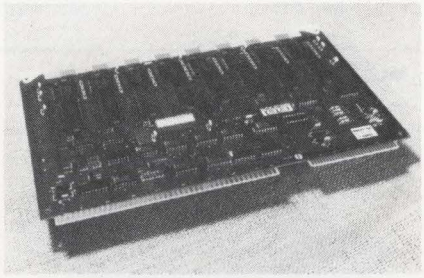
STD BUS BOARD

Contains Four RS-422 Channels

The SB8414 bus board is intended for Z80-based STD Bus systems requiring multiple, serial I/O ports. The SB8414 contains four RS-422 channels, and comes in two versions, which operate at 2.5 MHz and 4.0 MHz. Included with all four channels are asynchronous, byte-synchronous, and bit-synchronous protocols, such as SDLC and HDLC. The full-duplex channels support one modem handshake in each direction and provide RS-422 and RS-422 multi-drop interface levels. The SB8414's baud rate generators supply channel data rates from 50 to 19.2K in asynchronous modes and 800 to 307.2K in synchronous modes. Price in quantities of 10 is $300. **Micro/sys,** La Canada, CA **Write 207**

8-CHANNEL SERIAL I/O

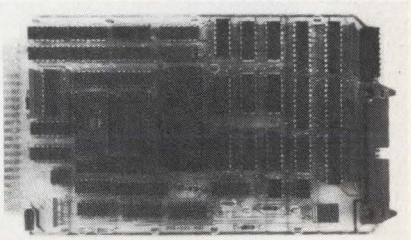
For Multibus Systems



The MP8518 I/O board has a 450 nsec max access time and allows eight EIA RS-232 interfaces to be connected to any Multibus system. Each interface is controlled by a USART which contains an on-chip baud rate generator. Baud rates available range from 50 to 19,200. The MP8518 requires 32 I/O ports and its base address can be on any 32-port boundary. Standard I/O addressing uses a 16-bit dip-switch. An 8-bit addressing option is strap selectable. A Signetics 2651 USART is provided and various combinations of interrupt servicing can be set by strap selection. Drivers and receivers used on the MP8518 are 1488 and 1489 types and provide compatible interfaces for TxD, RxD, DTR, RTS, CTS and DSR lines. Price in quantities of one to nine is $465. **Burr-Brown,** Tuscon, AZ **Write 193**

MICROBOARD SYSTEM

With CMOS CPU



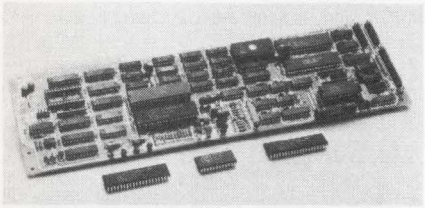
The Microboard Computer is a combination of a CMOS CPU and TPM operating system. The board contains one socket for a 4K ROM, 2K of RAM, a parallel interface, timing and control logic and I/O or special function Microboards. TPM is upward compatible with CP/M. The board provides 8-bit I/O ports, each having

COMPONENTS

strobe and read handshaking which can transfer data at 160 Kbytes/sec. The MB80 comes in two versions. Prices in quantities of 1 to 9 pieces are $249 and $269. **RCA,** Somerville, NJ **Write 194**

WINCHESTER CONTROLLERS

IBM Compatible



The ACB-2002 and ACB-2000 are two IBM PC/XT compatible controller boards and VLSI chip-sets. The ACB-2002 controller board is fully IBM compatible at the software, hardware and drive magnetic level. The ACB-2000 is also software compatible but features greater disk formatting and utilization. Other features include non-interleaved operation and a specific design for sectors of 256 to 2048 bytes. Price is $225. **Adaptec,** Milpitas, CA **Write 206**

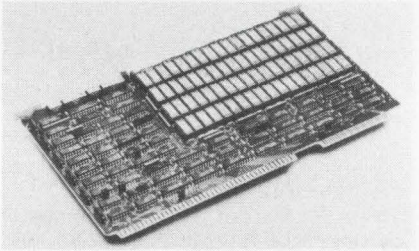
Q-TIMER BOARD

Rebooting Feature

The Q-Timer single-board system module is designed for integrators of real-time systems based on the DEC line of 16, 18, and 22-bit bus architectures. The watchdog timer is suitable for unattended or remote operations because it can re-boot the system if program execution stops. The Q-Timer has a CMOS calendar clock and uses a 32.768 KHz crystal oscillator for reference. An on-board CMOS RAM memory provides 2K × 16 bits of storage for data and/or programmed parameters. An EPROM software monitor is included which features self-diagnostics of on-board devices and bootstrap routines for RL01/02, RK05, RK06/07, RM02, TU58, and TM11 storage devices. The software will run CPU and memory diagnostics. **Codar,** Longmont, CO **Write 201**

MULTIBUS MEMORY

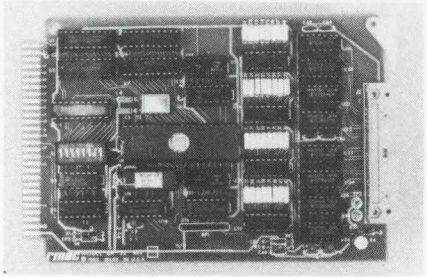
200 Nsec Access Time



The MM-7000D memory board features an access time of 200 nsec and cycle time of 325 nsec. The board is compatible with Multibus systems employing 68000, 8086, or Z8000 microprocessors. The MM-7000D uses either 256K or 64K dynamic RAMs in five capacities; 2M, 1M, 512K, 256K, or 128K bytes. 256K RAMs are used in the 2M and 1M versions, and 64K RAMs are used in the others. The MM7000D includes odd parity generation and checking and adjustable XACK/delays. Price is $995. **Micro Memory,** Chatsworth, CA **Write 191**

DIA STD BUS CARD

32 Channels



The DA-32 STD Bus card has 32 channels of D/A conversion with 8-bit resolution on a single card. Applications are in process control, test systems and instrumentation. The DA-32 has a self-contained microprocessor which updates each channel every 60 Msecs and requires no system software for D/A conversion. Price is $455. **Rmac,** Capitola, CA **Write 199**

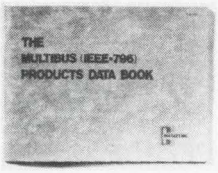
New Literature

Data Communications Casebook. This four-color guidebook from DEC presents a fun approach to solving problems in data communications in the form of cases, clues, and solutions. Digital's line of modems, acoustic couplers, and intelligent communication processors are featured, and are described in the closing section of the guidebook. The casebook proceeds from examples of simple data communication problems to the more complex. **DEC** **Write 253**

LED Indicator Brochure. This four color brochure from General Instrument features the StatusPak LED Circuit Board Indicator. The LED installation system permits mounting of one to twelve circuit board indicators as a single unit. StatusPak can be specified with any combination and sequence of right-angle, T1-3/4 LED colors for one to twelve positions in a single module. Open spaces can also be specified.
General Instrument **Write 254**

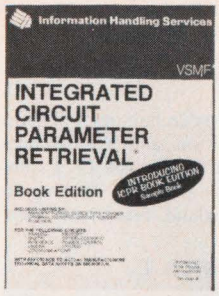
Linear Power Supplies Catalog. This four-page catalog from Electronic Measurements describes the ATR Series of linear controlled DC power supplies. The catalog contains a listing of key features, a general description of the series, ratings table, specifications, and drawings of the Model ATR-100 and Model ATR-250 linear power supplies.
Electronic Measurements **Write 255**

Multibus Products Data Book. This reference manual from C&C Marketing provides technical data and comparative information for board-level products and support hardware available on the Multibus/IEEE-796 Bus. The manual categorizes material into four categories: board-level products, hardware support, enclosures and subsystems, and operating systems. Each of these categories is further divided into product types having similar functions and characteristics.
C&C Marketing **Write 256**



Power Supply Information. Technical information from Triad-Utrad is available concerning their line of uninterruptible power supplies. The Power Right series features common and transverse mode noise attenuation, and the Power Master UPS units provide input and output protection along with an hour of battery back-up time.
Triad-Utrad **Write 257**

CMOS Data Book. This book from Motorola MOS Integrated Circuits Group's features their MC54/74HC High-Speed CMOS Logic family. The reference book includes a function selector guide, a military/hi-rel selector guide, a design considerations chapter, and data sheets. One hundred forty-seven devices and 71 circuit descriptions are covered including AC/DC parametrics and 76 parts with pinout and functional descriptions only.
Motorola **Write 259**

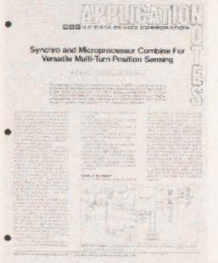


Integrated Circuit Service Index. This reference for design engineers from Information Handling Services is a book edition of their filmed Integrated Circuit Parameter Retrieval (ICPR) Service Index. Each listing includes cartridge and frame microfilm references to the manufacturer's technical data sheets. The ICPR edition contains 50,000 listings of circuits from 448 manufacturers, both domestic and foreign. The book and the microfilmed data sheets are updated every 30 days.
IHS **Write 260**

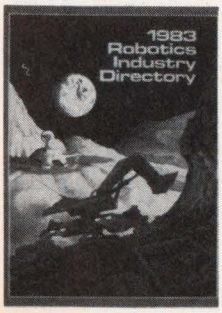
Logic Board Catalog. Fourteen standard, high density, bus compatible logic boards are described in this catalog from Methode Electronics. Highlighted are boards with single and dual 68-pin Jedec Type "A" leadless chip carrier sockets with wrappable pin-out. Formats included are Motorola Exorciser & Versabus, Intel Multibus, 160 & 220mm single and dual VME DEC Quad and dual, S-100 and S-100 voltage regulated, Prolog STD and Zilog Z-80.
Methode Electronics **Write 261**

Data Conversion Components Catalog. The 376 page data conversion component product catalog from Datel Intersil contains engineering data on monolithic, hybrid and modular products. These include A/D and D/A converters, data acquisition subsystems, sample-hold amplifiers, operational amplifiers, instrumentation amplifiers, isolation amplifiers, analog multiplexers, and special function circuits. Products are organized into selection tables arranged by function and performance.
Datel Intersil **Write 258**

System Brochure. Hewlett-Packard's color brochure details the HP 1980 oscilloscope measurement system and its role in automatic test systems. The brochure provides guidelines for developing a testing strategy based on a test system in an automatic environment. The HP 1980 system includes a programmable oscilloscope, gated universal counter, digitizer, programmable analog comparators, and application software.
Hewlett-Packard **Write 262**



Position Sensing Application Note. The four page application note from DDC explains how to use the combination of a synchro transducer, S/D converter and a microprocessor when positioning microprocessors. Design considerations cover the selection of an S/D converter, specification of parallel and serial data interfaces along with hardware and software design. Illustrations are included.
DDC **Write 263**



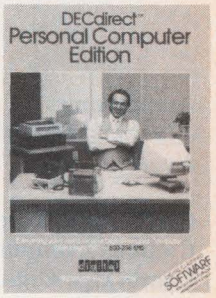
Robotics Industry Directory. The 1983 Robotics Industry Directory covers industrial robot models and components with emphasis on specification information. It features 213 computer-generated robot model listings. Each listing contains specifications such as accuracy, velocity, number of axis, load carrying capacity, robot weight, floor space required and type of control system.
Technical Database Corp. **Write 267**

Multiplexer Brochure. This brochure from General DataComm describes features of the LSI Time Division Multiplexer. The device is fully CCITT R.101 compliant, has alternative a and b framing and is synchronization switch selectable. The multiplexer has DC and VF channel interfaces and channel cards with monitor jacks and LED indicators. It is transparent to all forms of Telex signaling as well as Telex characters.
General DataComm **Write 266**

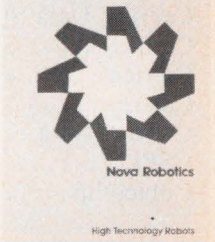
Fiber Optics Application Note. This four-page application note from Artel Communications describes the industry's first fiber optic system specifically designed to remote Computervision's Instaview workstations. The application note explains how the CV100 system transmits high resolution monochrome or color video and data from the Computervision processors to Instaview workstations two miles apart over optical fibers. System examples and a special section on set up and operation are included.
Artel **Write 251**

Product Selection Guide. This 20 page catalog from Burr-Brown covers their product line of data entry and display terminals, A/D converters, operational amplifiers, isolation products, and data acquisition and control systems. Tables are provided for each product which summarize resolution, linearity, conversion times, accuracy, input and temperature range. Complete descriptions and photographs accompany each product.
Burr-Brown **Write 252**

Computer Accessories Catalog. The 32 page accessories catalog from Digital Equipment Corp. features a 40 page pullout personal computer software supplement. The catalog covers fundamental information about personal computers and associated products and contains a dictionary of common computer terms. Products covered in the catalog include diskettes, paper, printers, furniture and electrical line filters.
DEC **Write 264**



Robotics Brochure. The Aries robot system is described in this brochure from Nova Robotics. The system is all-electric and modular, and characterized by a control system and user-friendly programming language called Astro. Illustrations and general specifications are included, as well as information concerning installation.
Nova Robotics **Write 265**



Dot Matrix Printer Catalog. This catalog by Eaton Printer Products features dot matrix impact printers, print mechanisms and printheads designed for a range of hard copy requirements in commercial industrial and instrumentation applications. Functional specifications, operating characteristics, dimensions, features and ordering information are provided.
Eaton **Write 268**

Calendar

January 31–February 2

Communication Networks Conference and Exposition. Washington, D.C. Contact: CN '84, Box 880, Framingham, MA 01701. (617) 879-0700.

February 2–4

1984 SCS Multiconference. San Diego, CA. Contact: Society for Computer Simulation, PO Box 2228C, La Jolla, CA 92038.

February 6–8

Software Process Workshop. Egham, England. Contact: M.M. Lehman, Dept. of Computing, Imperial College of Science and Technology, Huxley Bldg., 180 Queens Gate, London SW7 2AZ England. Tele. 01-589-5111.

February 6–9

CADCON West. San Francisco, CA. Contact: Morgan-Grampian Expositions Group, 2 Park Ave., New York, NY 10016. (212) 340-9780.

February 6–9

1984 International Symposium on Logic Programming. Bally's Park Place, Atlantic City, NJ. Contact: Dr. Joseph Urban, Computer Science Dept., University S.W. Louisiana, Box 44330, Lafayette, LA 70504. (318) 231-6304.

February 7–8

ATGP Workshop. Arlington, VA. Contact: Jerry Kunert, Naval Air Engineering Center, Code 92A3, Lakehurst, NJ 08433. (201) 323-2663.

February 11–17

1984 International Joint Alpine Symposium Medical Computer Graphics and Image Communications and Clinical Advances in Neuro CT/NMR. Contact: Alpine Medical Symposium, PO Box 639, Silver Spring, MD 20901. (301) 589-8142.

February 14–16

1984 Computer Science Conference. Philadelphia, PA. Contact: Frank Freidman, Dept. of Computer and Information Science, Rm. 303, Computer Center Bldg., Temple Univ., Philadelphia, PA 19122. (215) 787-1912.

February 16–17

ACM SIGCSE Technical Symposium. Philadelphia, PA. Contact: Richard H. Austing, Dept. of Computer Science, Univ. of Maryland, College Park, MD 20742. (301) 454-4145.

February 18–19

Third Annual Research Conference of the Office Systems Research Assoc. Los Angeles, CA. Contact: Joel D. Levy, OSRA Conference Chairman, 115 Maywood Dr., Rochester, NY 14618. (716) 461-2171.

February 18–22

Euroshop '84. Dusseldorf, W. Germany. Contact: Dusseldorf Trade Show, 500 Fifth Ave., New York, NY 10110. (212) 840-7744.

February 21–23

Softcon. New Orleans, LA. Contact: Northeast Exposition, 822 Boylston St., Chestnut Hill, MA 02167. (617) 739-2000.

February 21–24

INFO '84. (Information Technology and Office Automation Exhibition and Conference). London, England. Contact: B.E.D. Exhibitions Ltd., 44 Wallington Sq., Wallington, Surrey SM6 8RG England. Tele. 01-647-1001.

February 28–March 1

Compcon Spring '84. San Francisco, CA. Contact: Compcon Spring, PO Box 639, Silver Spring, MD 20901. (301) 589-8142.

March 6

Micro-Delcon '84. Newark, DE. Contact: John T. Lund, Conference Chairman, E.I. DuPont de Nemours Co., Nemours 3505, Wilmington, DE 19898. (301) 774-7006.

March 12–16

IEEE Computer Society International Conference on Robotics. Atlanta, GA. Contact: Robotics, PO Box 639, Silver Spring, MD 20901. (301) 589-8142.

March 12–15

Interface '84. Las Vegas, NV. Contact: 300 First Ave., Needham, MA 02194. (617) 449-6600.

Advertiser Index

Audiotronics 29
Auerbach Publishers 93
Augat 81

CAD CON West 84 97
Cadmus Computer 47
Cambridge Digital 31
Central Data 77
Century Data Systems 63
Cermetek 19
Ciprico 79
Clearprint 91
Control Data 45
CSPI 21
Cubicomp 35

Datacube 27
Dexpo East 84 103
DILOG 65
Diversified Technology 11
Dylon 93

Emulex 23
Epson America C3

Erbtec Engineering 31

Floating Point 2,3
Fluke 57
Force 25

Genicom 37
GTE Network 71

Hecon 86
Heurikon 8

Imperial Technology 115
Intecolor 16
Invitational Computer Conference 88

Kennedy C2

L.H. Research 73
Lundy 9

Marinco C4
MDB Systems 4
Modgraph 43

Nicolet Zeta 15

Pickles & Trout 22
Plessey 1

Scanbe 10
Science Accessories 111
Standard Microsystem 83,85,87,89
STD MicroSystem 67
Summagraphics 33

United Micronics 113
Universal Semiconductor ... 12,13

Zilog 6,7