APRIL 21, 1981

CUSTOM ICs BECOMING STANDARD/103

National Computer Conference zeroes in on productivity/172

Board-tester combines in-circuit and functional testing/189

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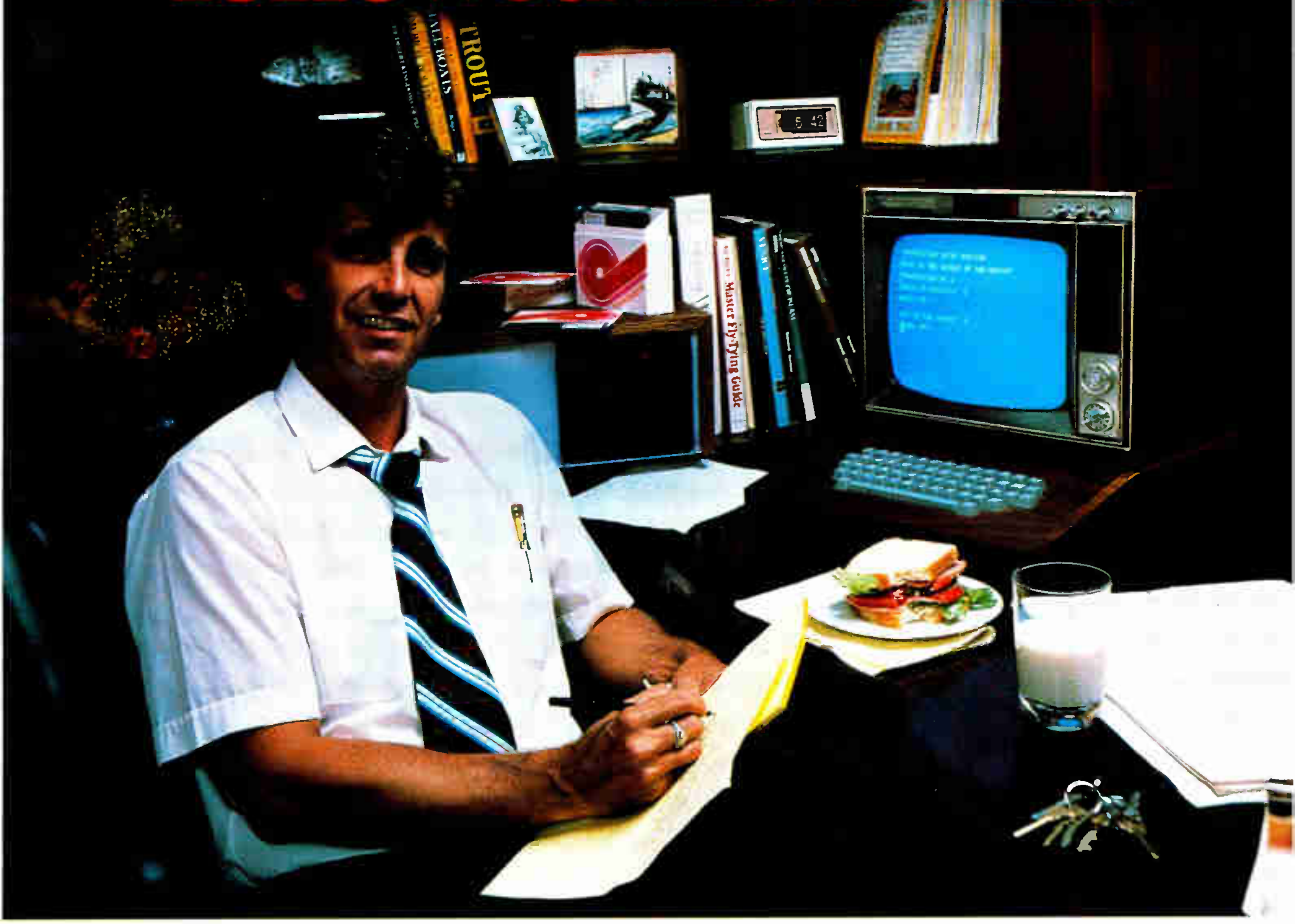

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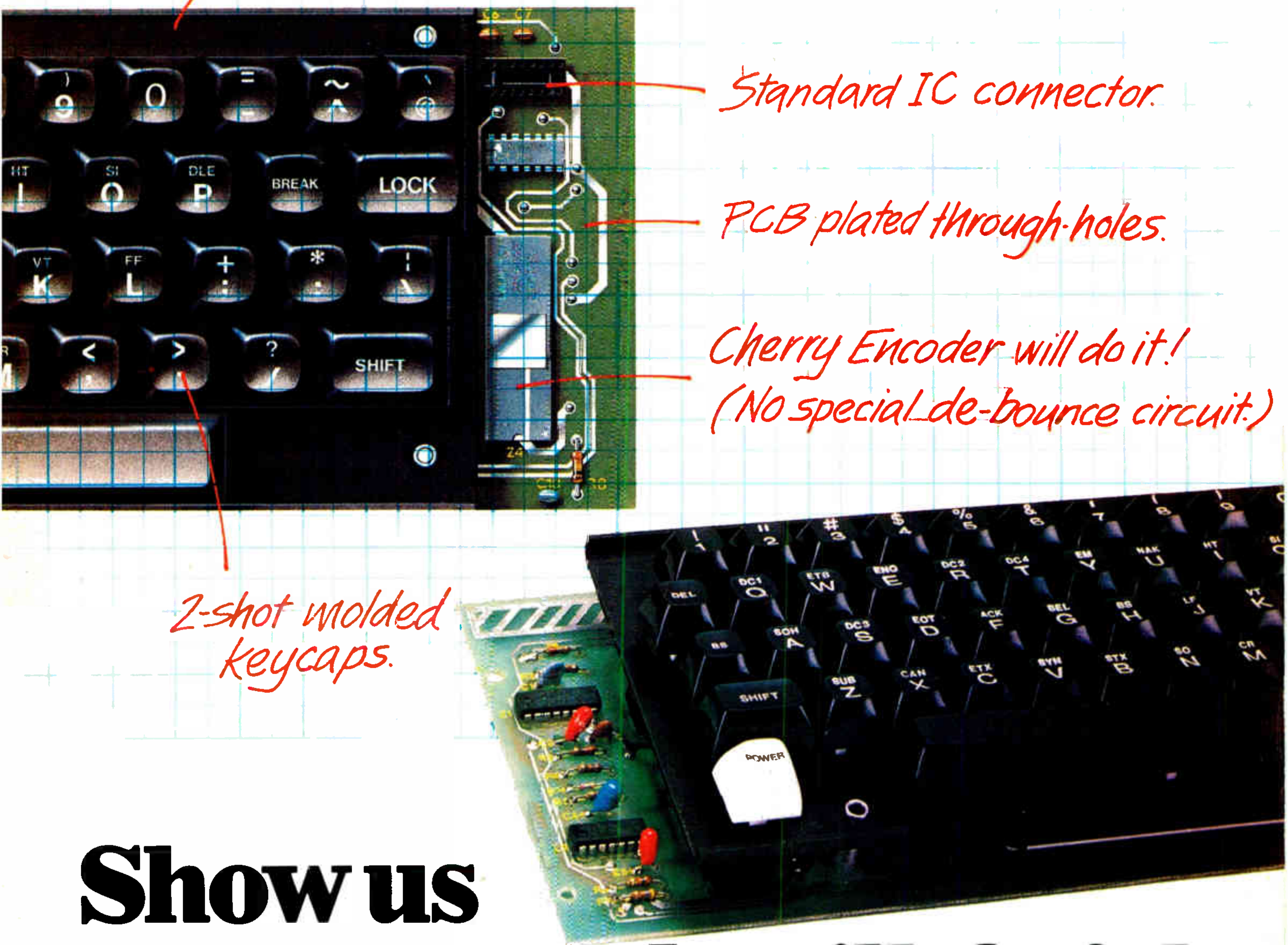

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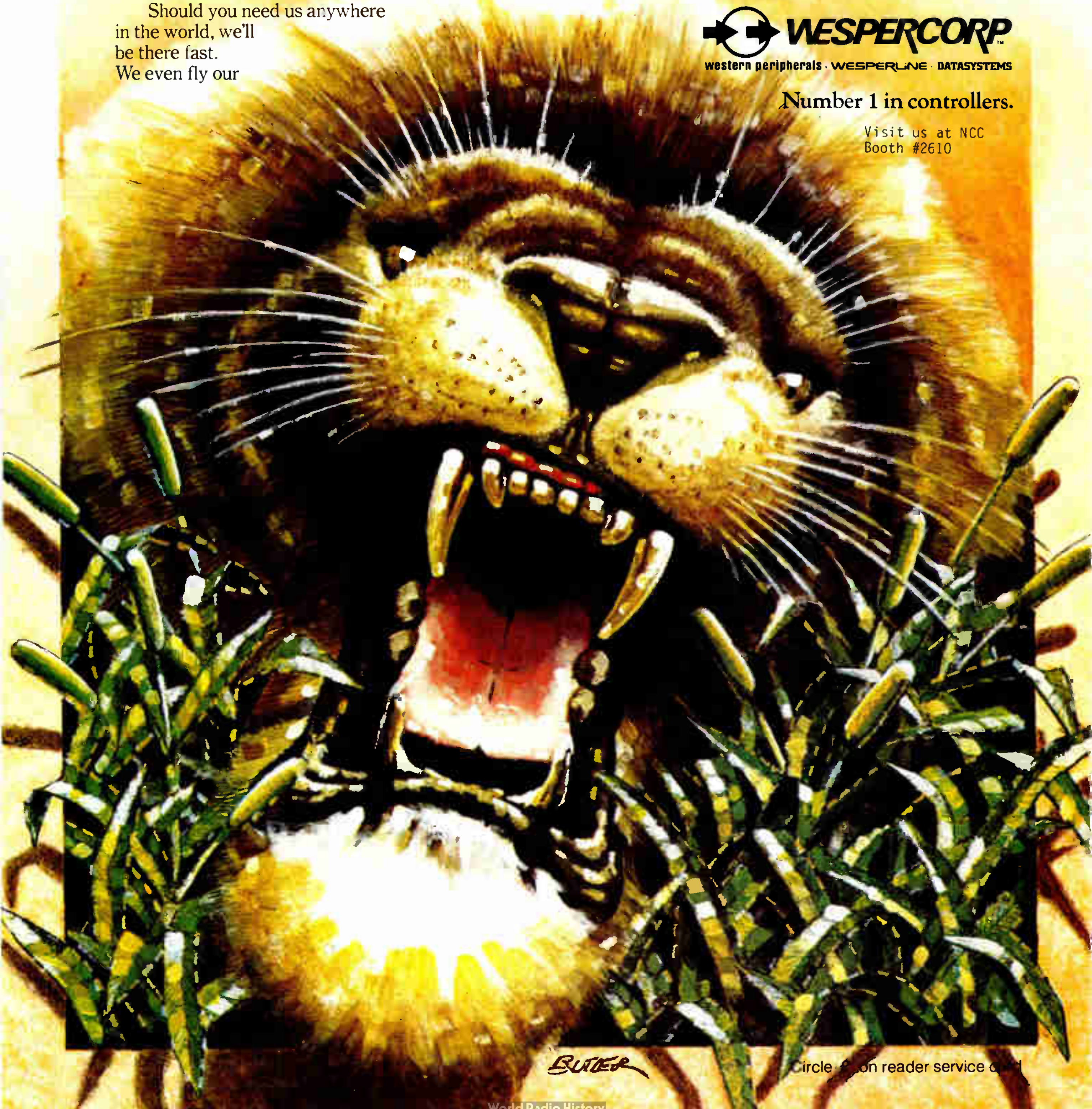

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Electronics

The International Magazine of Electronic Technology **Vol. 54, No. 8 • April 21, 1981**

World Radio History

Electronics

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Highlights

Cover: Clearing the software hurdle, 163

The computer may be central to increasing industrial productivity, but it suffers from its own productivity problem—that of its programmers, especially for microprocessor systems. However, standard operating systems like Unix and CP/M and highly portable high-level languages such as Ada are making microsystem programming easier. Even more importantly, they are making possible standard, widely available application packages from the fast-growing third-party software industry, as this special report documents.

The cover illustration is by Ron Chironna.

Custom ICs take novel routes, 103

The very complexity of large- and very large-scale integrated circuits brings with it a greater, not lesser, need for custom-designed chips. And these devices have their own high-level conference—the CICC, or Custom Integrated Circuits Conference, which will take place this year in Rochester, N. Y., on May 11–13. The circuits and processes to be discussed reveal possibilities for standard ICs as well, notes this Probing the News story.

16-bit processor heeds the call of modular languages, 175

Microprocessor designers are seeking to embrace the advantages of the latest high-level languages—increased software reliability and maintainability, as well as programming productivity—by embodying their modularity in the processors themselves. One such chip, the 16000, takes on the monitoring of the individual modules.

Functional, in-circuit testing combine for VLSI, 189

Whether essentially scaled-down or new designs, large-scale integrated circuits represent, in effect, a new level of test requirements, and that is only the beginning, for very large-scale integration will take those requirements even further. A new system joins comprehensive in-circuit testing with functional techniques so as to be up to the test demands of the 1980s.

Innovations mark 64-K RAM, 197

A 64-K dynamic random-access memory puts new architectural features and new circuit designs using multiple device thresholds to work for both excellent performance and ease of manufacturing. To boot, it takes collective advantage of the best aspects of earlier RAM designs.

And in the next issue . . .

A preview of the Electronic Components Conference . . . a new error-detection and -correction scheme . . . bubble memories come to removable cartridges . . . two electrically erasable programmable read-only memories made with n-channel metal-nitride-oxide-semiconductor technology.

April 21, 1981 Volume 54, Number 8
105,942 copies of this issue printed

Electronics (ISSN 0013-5070) Published every other Tuesday except the issue of Monday, Nov 30, by McGraw-Hill, Inc Founder: James H McGraw 1860-1948 Publication office 1221 Avenue of the Americas, N.Y., N.Y. 10020; second class postage paid at New York, N.Y. and additional mailing offices

Executive, editorial, circulation and advertising addresses: Electronics, McGraw-Hill Building, 1221 Avenue of the Americas, New York, N.Y 10020 Telephone (212) 997-1221 Teletype 12-7960 TWX 710-581-4879 Cable address M C G R A W H I L L N E W Y O R K.

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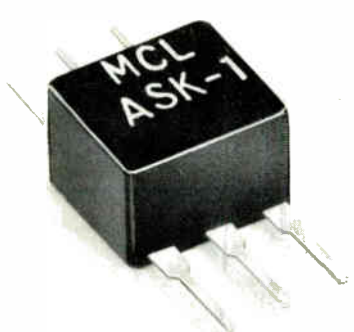

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Publisher's letter

A year ago at the annual National Computer Conference, the industry was concerned with the problem of generating software adequate for the demand. This year, as the NCC draws near, relief from the programmer crunch is in sight.

The special report on software productivity (p. 163) describes the third-party software market, representing one solution to the crunch, as well as tools to help programmers to be faster and more efficient, another far-reaching solution. Prepared by computer and peripherals editor Tom Manuel and microsystems and software editor Colin Johnson, it points out that programs are now often easier to buy than to write.

"The systems integrator can design machines knowing there's a whole spectrum of software available to the end user without the systems integrator having to write it. And the software is available when the machine is," Tom comments.

Many of the new software publishers are concentrating on programs for small-business machine manufacturers. But even large, well-established computer companies are seeing the advantage of using these outside service firms.

Among the productivity tools discussed are structured-programming techniques and the languages, such as Ada, that are geared to them. Also coming into play is automated program generation—that is, programs that generate programs. "It's the wave of the future in programming aids," comments Colin.

Speaking of the NCC, also in this issue is a special section of exclusive stories on new products to be introduced at the show May 4–7 at Chicago's McCormick Place (p. 215). This lineup was put together by new products editor Jeremy Young from reports filed by our news bureaus. And for a glimpse of the NCC program and exhibits, see the overview on pages 172 to 173.

Voice messaging is one of those trends that seems to heat up to big dollar expectations before equipment is even built. For example, Rob Lineback, Dallas bureau manager, who prepared the Probing the News story on this subject (p. 99), learned that manufacturers are expecting the voice-messaging market to be worth over $3 billion by the end of the decade.

Though few such systems are being delivered today, there's lots of activity, with several companies, including giants such as AT&T and IBM, revving up systems or planning products. Why all the excitement? "Voice messaging is the missing link in office automation," Rob explains. "At a recent conference on office automation, the sessions on voice messaging were packed."

Incidentally, note that Rob's full name is actually James Robert, giving him probably the most famous initials in Dallas these days, thanks to television.

As noted in the last issue, the Electronics Index for 1980 is available. For a copy, circle number 370 on the reader service card.

Paul W. Reiss

Wanted: a Business Trends editor

A newly established department of the New York editorial staff of *Electronics* offers a unique opportunity for a skilled communicator interested in the business side of technology. We seek an experienced business journalist with a good statistical or market research background in the electronics field. An EE or an MBA in market research or an economics degree would be eminently desirable. Send your résumé to the Editor-in-Chief, *Electronics*, 1221 Avenue of the Americas, New York, N. Y 10020.

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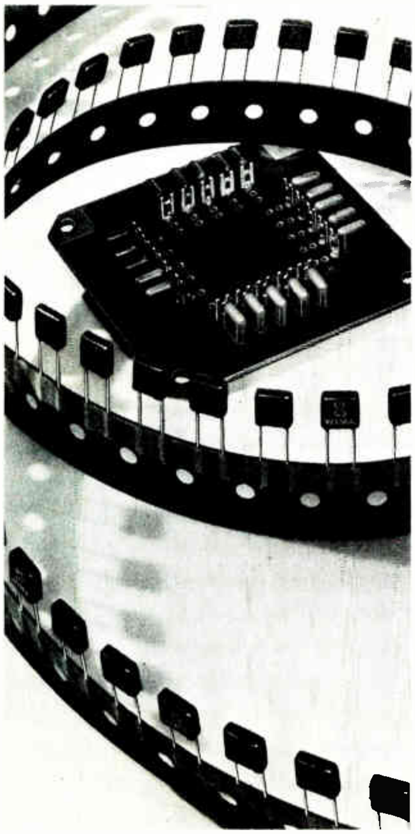

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Readers' comments

Ironic juxtaposition

To the Editor: The Jan. 27 Career Outlook [p. 174] states that the "demand for engineers graduating with a master's degree will grow 20% over 1980, and on average they will earn $25,000." Ironically, the left side of the same page carries an ad seeking a person with an MSME for all of $8.41 per hour, which comes to under $17,500 a year.

Two conclusions, both probably correct, are possible. The first is that engineering salary figures published by industry or college-affiliated organizations are inflated by the desire of both these groups to attract more people into engineering. The academics need to keep their classrooms full, and corporate groups desire the glut of engineers that lets them keep salaries down.

The second conclusion is that the ad was placed so that an alien can be hired for the job. An employer may not hire an alien unless it is first shown that no American could be found to fill the opening. And what better way than to advertise for a very low salary?

Irwin Feerst
Massapequa Park, N. Y.

Ada's portability

To the Editor: Your "Special report: Ada, the ultimate language" [Feb. 10, p. 127] may have been too generous in accepting the claims that have been made for this language. All programming languages tend to be at their best before their implementation and use.

A case in point is found in the grossly exaggerated claims made for the portability of Cobol-60, which have just not proven true. Ada differs in sophistication and detail from Cobol-60, but it does not differ in principle.

It is extremely difficult for different teams in different countries to write any programming language, much less a portable language. It would be nice if that were acknowledged and portability claims made with greater caution.

Alex d'Agapeyeff
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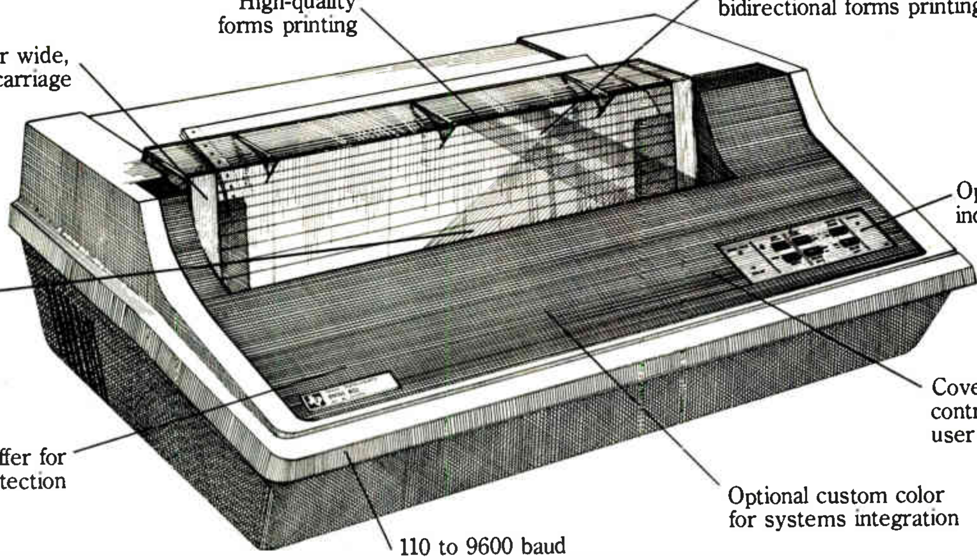

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Software should be eligible for tax credit

If the Reagan Administration is serious about stimulating the domestic economy in general, and high technology in particular because of its contribution to the export-import balance, it could well turn its attention to the inconsistent Federal and state attitudes toward taxation of software. The first big stumbling block to regulation is the lack of a decision about whether software can be classified as what accountants call tangible property. After all, argues the Federal government, it can't be weighed, felt, or seen, so how can it be put in the same class as hardware and taxed? Not so fast, say many of the states; software is as inherent a part of a hardware system as a printed-circuit board or a cabinet, so it must be taxable.

Reflecting this indecision, Massachusetts has just become the 27th state to slap a sales tax on software (5% in its case). And for their part, industry organizations like the Data Processing Management Association's software group vow to continue their fight throughout the nation against such levies.

But an overriding consideration may be that computer and communications hardware are eligible for the Federal 10% business-stimulating investment tax credit. However, since Washington says software is intangible property and untaxable, it is ineligible for the credit.

Government has a right and a necessity to tax, and the taxed have a right to object. But if software is seen by more than half the states as tangible and taxable, then it would to be time for the Federal government to reconsider its stand. Will the present Administration recognize the technical realities and change the rules?

Giving a break to R&D

On the subject of taxes and credits, another vital component of America's technology mosaic deserves some attention: research and development. Specifically, the subject is how to encourage business to make major investments in R&D.

One way, says Harry J. Gray, chairman and chief executive officer of United Technologies Corp., the Hartford, Conn., conglomerate, is to permit businesses to take accelerated depreciation allowances—a step proposed by the Reagan Administration—to recoup investment costs more quickly. But another aid, suggested Gray in his keynote address earlier this month at Electro/81, would be to permit businesses to choose the year in which to take the deduction.

"Depreciation allowances obviously are of no value unless they can be applied against taxable income," he said. "Such a measure would benefit these companies as well as the small, startup entrepreneurships that have been so important to our industry."

United Technologies' chairman hammered home his point when he stated that "it has been estimated that roughly two thirds of all advances in managerial and technical knowledge stems from R&D programs. And it is said that half the increases in U.S. productivity over the past 50 years have stemmed from advances in technology. R&D is what yields these advances."

R&D, in other words, keeps the progress pump going. And if permitting a movable deduction would strengthen the process, we're all for it.

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We're so proud of our high quality that we back it with a one-year parts and labor warranty.

That's why our customers ask us to build STD BUS cards they could get somewhere else. Because no one builds cards with Pro-Log's attention to quality and reliability.

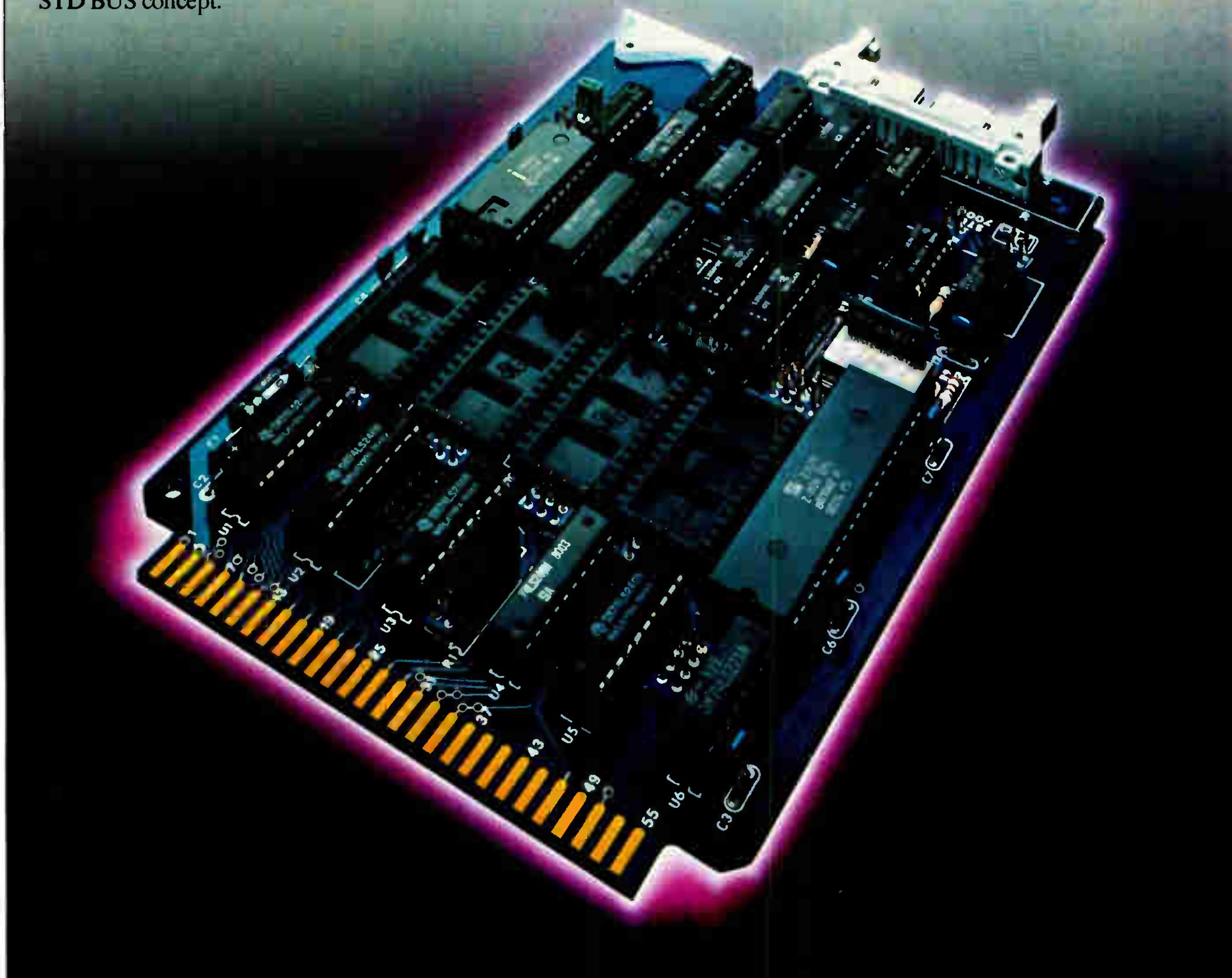
Ask our customers.

Find out what our customers say about using Pro-Log STD 7000 cards. Write or call for our STD BUS applications brochure, plus technical data on our new 7804 CPU card, its companion 7704 memory card, and our full line of STD BUS products.

Pro-Log Corporation, 2411 Garden Road, Monterey, CA 93940, phone (408) 372-4593.

STD BUS

PRO-LOG CORPORATION



World Radio History

Textool is your best "single source" for test *and* production sockets!

Now, Textool applies its years of experience as a leading supplier of zero insertion pressure (ZIP) and other test sockets to offer you the convenience of filling your test *and* production socket requirements from a single source.

Textool's expanding line of specialized ZIP DIP®, pin grid and chip carrier production sockets is designed with the durability and quality required for a test environment, yet in sizes and at low costs essential to production sockets.

As IC's become more complex and expensive, socket quality and design are of ever increasing importance. The value of one destroyed device well exceeds the total cost of buying several sockets. Considering this fact, Textool continues to design quality and reliability into all their sockets to help keep your test *and* production expenses at an absolute minimum.

Detailed information on Textool's complete line of sockets/carriers for test, burn-in and production applications is available on request.

Textool Products Department
Electronic Products Division/3M
1410 W. Pioneer Dr., Irving, TX 75061
214/259-2676

3M

Bonelli to provide expertise for St. Gobain's expansion into semiconductors, computers, and office automation

Top executives of France's huge St.-Gobain-Pont-à-Mousson industrial group make no bones about their inexperience in the fields of semiconductors, computers, and office automation. But in light of the company's recent push into those areas—it controls MOS newcomer Eurotechnique SA and Franco-American mainframe maker CII-Honeywell Bull and holds a 30% share in Italy's Ing. C. Olivetti & Co.—the group obviously needs some expertise in the front office.

That is why Pierre Bonelli, a 10-year veteran of Texas Instruments Inc., is now a group manager for the company, headquartered in Neuilly on the outskirts of Paris. "What attracted me is that the group is committed to an ambitious and courageous diversification—it is a fascinating endeavor," Bonelli says. "My most important responsibility is improving the internal coherence of the group," he explains, "to foster synergy and ensure the coordination of different activities."

Given the number and variety of St. Gobain's various partners, there is plenty of coordinating to be done. Some 47% of CII-HB belongs to Honeywell Inc. Then, 49% of Eurotechnique, the semiconductor manufacturer that started producing its first 4-K static random-access memories late last year, is held by National Semiconductor Corp., a joint venture that Bonelli helped form.

Providing the glue. Pierre Bonelli will try to improve coherence of St. Gobain group.

Finally, Olivetti is committed to IBM plug-compatible mainframes, furnished by Japan's Hitachi Ltd., and also is hoping to supply terminals for the French electronic telephone directory project. However, to further muddy the waters, Olivetti did not team up with CII-HB as originally planned, but with Thomson-CSF, a Eurotechnique semiconductor rival.

Eurotechnique is the youngest and weakest member of the St. Gobain family and will undoubtedly require extensive nurturing. But Bonelli, who has an engineering degree from France's Ecole Polytechnique and an MBA from the Harvard Business School, is convinced that, starting with National's technology and adding St. Gobain's financial support and commitment, the new company should be able to hold its own technically and commercially within five years.

Director of TI's Southern Europe division from 1970 to 1975, after starting with the company in 1966, and then manager of the digital circuits operation in Houston until 1977, Bonelli says Eurotechnique is plotting a course based on a Japanese map. "Learning how to mass-produce—without accident—that is how the Japanese began. They did not try to modify the processes or designs. Their 16-K memory? It is a U. S. design."

At GI, Gaur is point man for advance into speech ICs

Already a veteran in the nascent speech synthesis industry, Jai P. Gaur is now at General Instrument Corp. to lead its push into the talking IC market. Gaur, who played an important role in the development of

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	RL01 Controller	RX02 Controller	MSV11-DD 32KW Memory	MSV11-DD 32KW Memory
	RL01 Controller	DLV11-J Serial (4)	RL01 Controller	RX02 Controller
	DLV11-J Serial (4)	OPEN	RL01 Controller	DLV11-J Serial (4)
BACKPLANE	OPEN	OPEN	DLV11-J Serial (4)	OPEN
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Circle 15 on reader service card

World Radio History

thesis chip set for its Speak & Spell products, is in charge of strategic market planning for audio products at GI's Microelectronics division in Hicksville, N. Y.

Speech synthesis is no longer a technological problem, according to Gaur, who at 39 has earned credentials in both marketing and technology (he holds a Ph.D. in electrical engineering from the University of Minnesota and an MBA from Texas Tech University). Gaur sees much of the future development work going into improving quality, lowering prices, and educating potential customers on the implementation of speech chips in myriad consumer products in such areas as automobiles, computers, and telecommunications.

Talk leader. Jai Gaur sees job as improving quality, cutting prices, educating customers.

"Part of our job is to coach customers," he observes. "Microprocessors have been around for seven or eight years now, and there's been a lot of customer education during that time. In the case of a memory chip, the customer knows what its specifications are. But speech chips are very different from other integrated circuits."

For instance, the commas affecting speech have to be inserted by the user at the front end of the process, "and he has to learn to tweak the technology to have words said correctly," Gaur explains. He adds that many companies may delve into the art of code generation for speech to retain product confidentiality.

"The problem with speech is that so many of the issues are psychological and linguistic, rather than technical," he observes. "The technology is way ahead of the marketplace as far as the chips are concerned. But speech is a subjective issue, and that's why the market is reacting so slowly. After all, speech chips aren't just pieces of silicon, they represent a lot of overhead, and companies are going to take their time before making that investment." □

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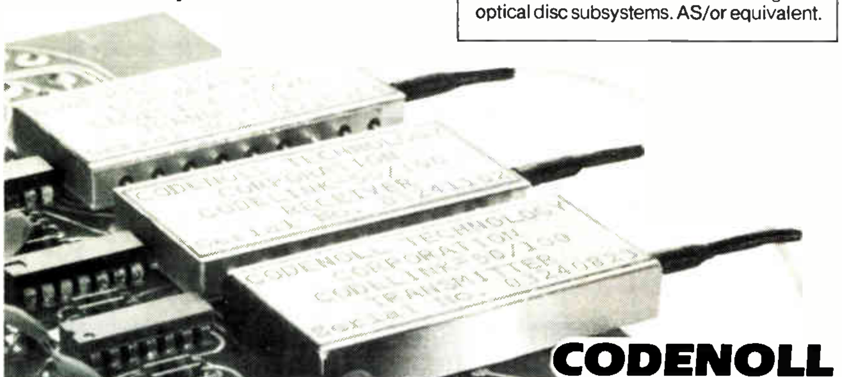

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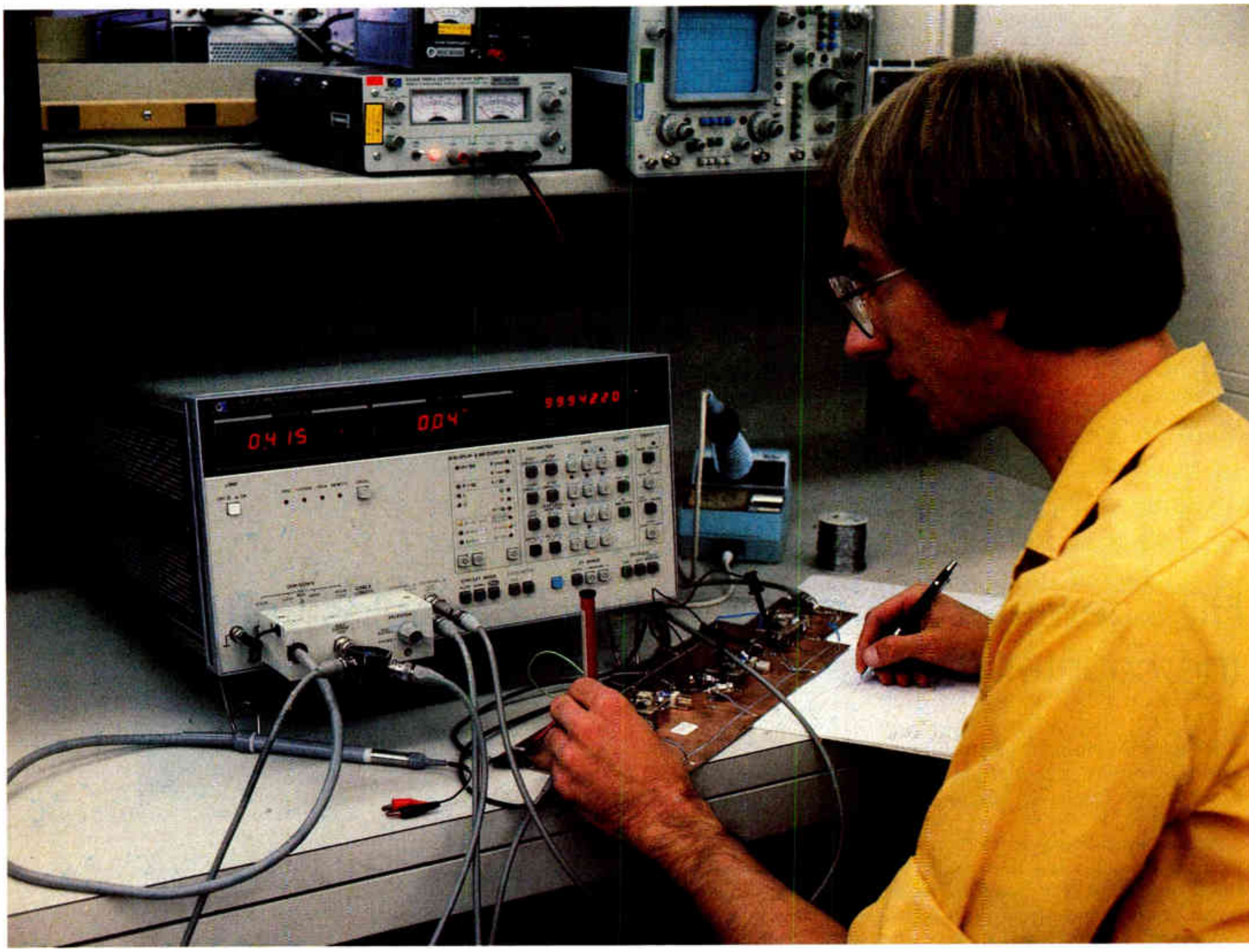
 Circle 16 on reader service card

World Radio History

MEASUREMENT COMPUTATION news

product advances from Hewlett·Packard

APRIL 1981



From 5.000 Hz to 13.000000 MHz, HP's new 4192A LF Impedance Analyzer measures impedance of components—also measures gain, phase shift, and delay of complete circuits such as filters and amplifiers.

Now—complete component and network analysis in one versatile new instrument. Meet HP's DESIGNED FOR HP-IB SYSTEMS 4192A.

The new HP 4192A is both a quality LCR meter and a highly accurate network analyzer—the first instrument to combine both capabilities in a single, compact, easy-to-use package. It's also about half the cost of buying two separate high-quality instruments.

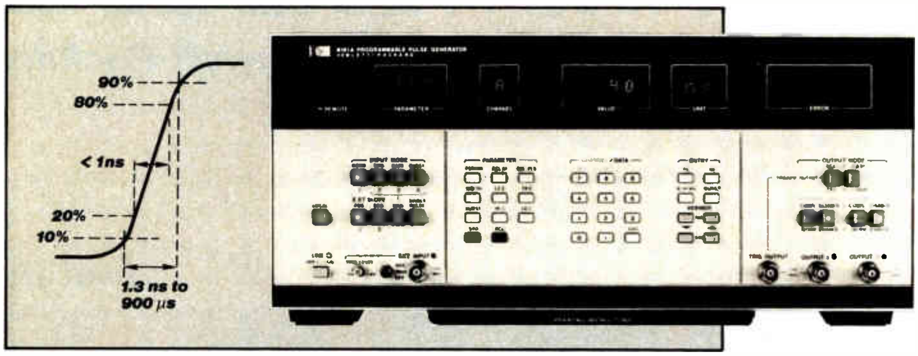
Comprehensive Testing—Fast

Tests that formerly required two instruments can now be performed by the new 4192A. Functioning as a network analyzer, the 4192A lets you measure amplitude gain or loss,

(continued on third page)

World Radio History

New HP-IB pulser—superb for today's fast logic circuits



This new HP 8161A Programmable Pulse Generator has reserve speed for ECL and other fast applications.

AC parametric tests for fast logic circuits such as ECL, advanced Schottky etc., can be performed now conveniently and accurately using the new HP 8161A 100 MHz Programmable Pulse Generator. With 1-5% basic timing accuracies, < 1.3 ns variable transition times and 0-50℃ specified temperature range, this high-speed stimulus makes testing more effective in production, R&D and incoming evaluation. The 8161A's variable transitions are **faster than 1 ns between 20% and 80% of amplitude**, and therefore give superb ECL capability.

Option 020's independent second channel is indispensable when two correctly-timed pulse signals are needed in, for example, set-up and hold-time measurements. Ideal for generating complex pulse shapes, *Channel Add* mode allows circuit response to glitches, spikes and ringing to be investigated.

In addition to the wide temperature range for accurate, reliable system operation, one-year recalibration and warranty periods save maintenance time and money. To help get started quickly, HPL and BASIC programming examples are included in the comprehensive user documentation.

Check **B** *on the HP Reply Card for a data sheet on the 8161A and a complimentary application note.*

HP's new electronic counter brochure helps you choose the counter for your needs

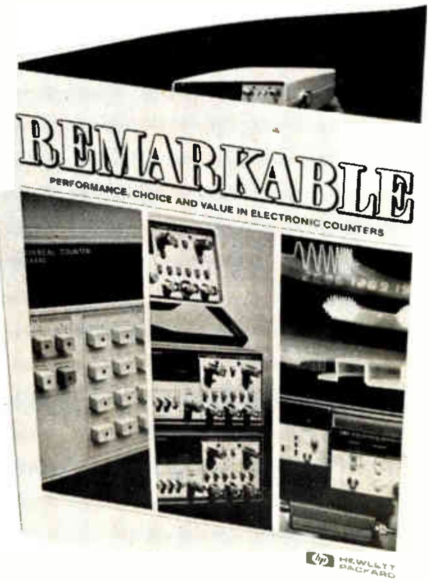
It's easy to select the electronic counters that best suit your application needs with HP's new electronic counter brochure, in English, German, French, Italian and Spanish editions.

You're most likely to find the counter you need in HP's product line, for it's the industry's broadest. Eleven, distinctly different, HP counter families span the range from basic, frequency-only models to universal and microwave-models with unmatched performance and versatility.

This new, eight-page, four-color publication summarizes the capabilities of all our electronic counters—including the newest ones and their accessories too. For example, you'll find models with ±20 ps time interval resolution or models that measure the frequency of carrier bursts as brief as 60 ns up to 40 GHz. Yet, you'll also find an exceptionally low-cost HP, lab-grade universal counter.

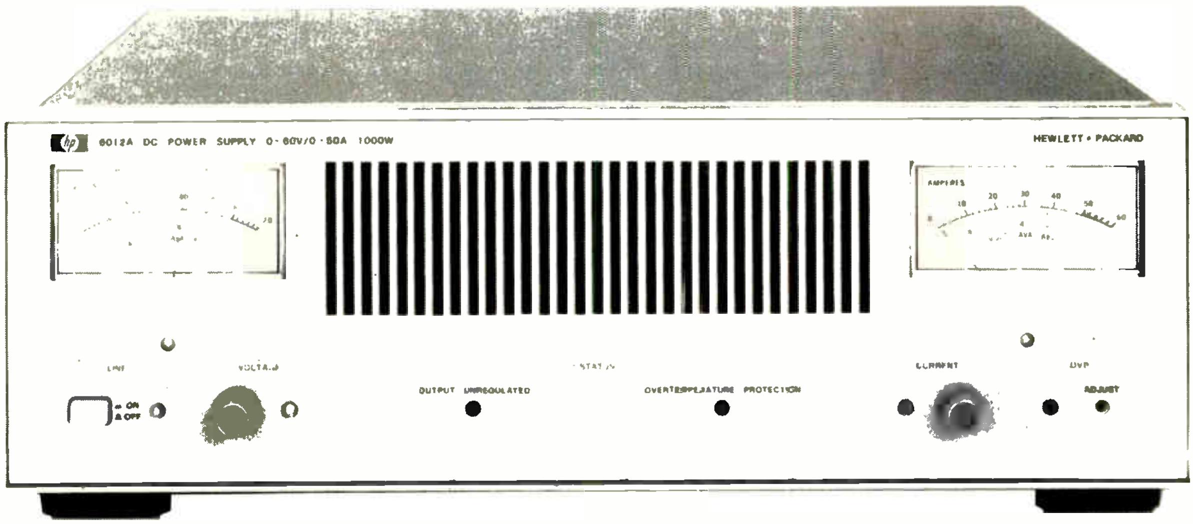
German, French, Italian and Spanish editions of the brochure are available in European countries where those languages are spoken. An English edition is available everywhere else.

Check **C** *on the HP Reply Card for your free copy.*



World Radio History

New 1000 watt power supply combines high frequency switching technology with autoranging



HP's 1000 W autoranging power supply uses high frequency switching technology to provide expanded capability in systems and laboratory applications. An interface option adds remote programming status feedback, remote shutdown and output bias supplies.

A new *autoranging* power supply with the high-performance characteristics and special design features useful in automatic test system applications have been added to HP's autoranging power supply family.

System designers who need a variety of fixed programmable power supplies get operating freedom and flexibility in the compact, lightweight and efficient HP 6012A Power Supply. In addition to filling the need for up to 1000 W of power in the lab, the 6012A has special interface and status feedback features for automatic test systems. Typical applications include semiconductor burn-in systems, PC board test systems, and automatic production processes. Option 002 provides a convenient low-cost means of integration using a 37-pin connector on the back of the power supply.

The 6012A also provides maximum output power over a wide and continuous range of voltage and current combinations without requiring manual selection of the proper output range. This feature, unlike conventional cv/cc power supplies which provide maximum output power at only one combination of output voltage and current, makes the 6012A convenient, cost-effective and capable of satisfying many different dc requirements. For example, an engineer would need a 20 V and 50 A supply, a 40 V and 30 A supply, as well as a 60 V and 17.5 A supply to cover a range similar to that of the 6012A.

The 6012A's versatility is further enhanced by a lab supply including mode and status indicators, adjustable overvoltage protection, two 10-turn potentiometers for high resolution control, amplified current monitor terminals, and voltage and current meters.

Check **D** *on the HP Reply Card for technical details.*

Two instruments in one save time, costs, bench space

(continued from first page)

phase shift and differential phase shift. Then, if your circuit does not operate properly, use the 4192A as an LCR meter to measure individual components. To assist you, eight optional test fixtures let you connect to your networks and components. All this can add up to savings in test time, bench space and instrument expense.

Excellent frequency resolution of 1 Hz at 13 MHz plus 7-digit frequency display set the 4192A apart from other LCR meters. Add those features to its 5 Hz-13 MHz frequency range, fully programmable voltage levels and the capability to measure grounded components, and you can see that it's an LCR meter and then some.

As a network analyzer, HP's new 4192A offers extremely high accuracy (0.02 to 0.09 dB) and high resolution (0.001 dB) in the top 20 dB. That's the kind of performance only higher priced network analyzers can offer.

In the lab or in manufacturing, you can use HP's new Impedance Analyzer to measure complex components, evaluate filters and hybrid IC's, design and evaluate circuits, semiconductors and electronic materials, plus much more. HP-IB is standard for high-speed, automated testing.

Obtain complete technical data by checking **E** *on the HP Reply Card.*

World Radio History

The new HP 1000 Model 5 Microsystem: DESIGNED FOR HP-IB SYSTEMS A low-cost computer system so modular you virtually design it yourself.

The modular design of the Model 5 gives system designers, automation OEM's, and industrial and laboratory end users exceptional flexibility in configuring a Microsystem to their specific needs.

The newly-announced HP 1000 Model 5 is the smallest and lowest-priced complete computer system in HP's family of real-time computers.

Integrated into an attractive benchtop microcomputer system package are an L-Series processor, twin flexible disc drives, CRT display and keyboard. The resulting Model 5 Microsystem can be put to work in a wide range of industrial and laboratory applications where an intelligent terminal isn't enough, but a typical computer system is either too expensive, performance "over-kill", or both.

You can start with either RTE-L or RTE-XL, our powerful multi-programming multi-user operating systems. Their modular construction lets you build the real-time computing environment your applications programs demand; programs you can develop in Assembler, FORTRAN 4X, BASIC, and PASCAL languages. Our IMAGE data base management package gives you a powerful tool for simple and efficient data management. Need graphics? Picture the possibilities offered by our GRAPHICS/1000 software. Like all other software packages, these are all upwardly compatible throughout the entire HP 1000 line.

But the modularity doesn't stop with software. To the standard 540k bytes of mini-floppy mass storage can be added hard discs with capacities ranging from 12M to 20M bytes. You optionally can replace the basic 64k bytes of main memory with a 128k or 512k byte memory board. You can also choose from two built-in terminal options—an HP 2621 or an HP 2624, each with or without a thermal printer. Standard boards on the base system include the CPU, memory, terminal interface, disc controller and HP-IB interface, leaving room for three more I/O or memory boards of your choice.

Check **F** *on the HP Reply Card for further details.*

HP's microwave counters now protected against severe input overloads

The chance that you'll cause costly damage to an HP microwave counter's input circuit is far less when you specify HP's Option 006, Input Limiter. This limiter extends the already excellent damage limit to inputs of up to 8 W (+39 dBm) CW, and of up to 100 W (+50 dBm) peak pulsed. For input protection up to 26.5 GHz, this new option is available for HP Models 5340A, 5342A and 5343A Microwave Counters, and for HP Models 5356A and 5356B Frequency Converter Heads. It is installed at the factory when the instruments are ordered with Option 006, and is also field installable in counters now in use.

For more information, check **G** *on the HP Reply Card.*

Shown here are two HP microwave counters that can, when equipped with HP's new Input Limiter Option, withstand more severe input overload than ever before.

World Radio History

New eight-pen DESIGNED FOR HP-IB SYSTEMS plotter family now colors your high-quality engineering and scientific graphics

Ten Pen Colors in Two Line Widths

HP's new eight-pen plotters now make it possible to use as many as eight different colors on a single plot—all without operator intervention.

The six new microprocessor-controlled plotters, Models 9872C/T, 7220C/T, and 7221C/T, are enhanced versions of the HP single-sheet, A3 (11 × 17"), flatbed, 4-color plotters. Available in a standard C-version or in an automatic paper advance T-version, they will totally replace the four-pen models at no increase in cost.

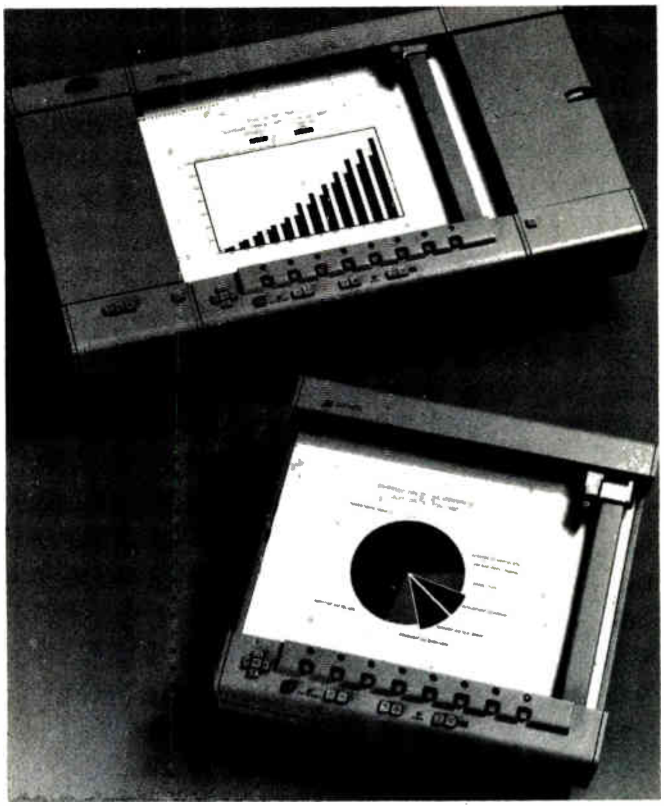
Extremely flexible, high-quality professional graphics are possible thanks to the 10 pen colors, each in two line widths. These colors include a variety of mid-range blending colors especially suited for business graphics and a series of bold colors for line differentiation. Currently available are red, green, blue, black, violet, turquoise, brown, gold, burnt orange and lime green.

To keep pens fresh, airtight caps protect the pen tips while they are stored in stables at the front of the plotter. The plotters automatically store pens and select new pens at the push of a button, or upon receipt of a program command.

The plotters also speak one of two programming languages to provide the most efficient communication method for your computer: Compacted Binary and Hewlett-Packard Graphics Language (HP-GL). HP-GL is a set of easy-to-understand, two-letter mnemonic instructions, while the compacted binary language is optimized for remote data communications at low baud rates. Both languages cover the full range of plotting needs, from vector plotting to enhanced graphic presentations.

All plotters internally generate character sets, dashed lines and handle other high-level functions with a resolution of 0.001" (0.025 mm). Graph limits and plot scaling can be programmed or controlled through the front panel.

Check **H** *on the HP Reply Card for full details.*



A variety of interfaces and programming languages enable these plotters to work with a host of Hewlett-Packard and non-HP computers, peripherals and controllers. Typical applications include: business and financial planning, computer-aided design, chemical analysis, measurement and test data recordings, manufacturing and engineering drawings, numerical control verification, cartography and more.

How to analyze the economics of using signature analysis for troubleshooting microprocessor-based products

Here's a new application note that helps you determine the cost and feasibility of using **Signature Analysis** for testing and servicing microprocessor-based products. It presents a detailed economic model useful to people involveld in product design, manufacturing, field service, cost control, or in the managment of any combination of these functions.

Eight assumptions, which usually affect the economic analysis for any product, are examined. Major emphasis is on simplified rules that aid in estimating incremental costs and savings, in addition to calculating return on investment.

The model is derived from experience with **Signature Analysis** in hundreds of products ranging from a $300 instrument to a $100,000 ATE system.

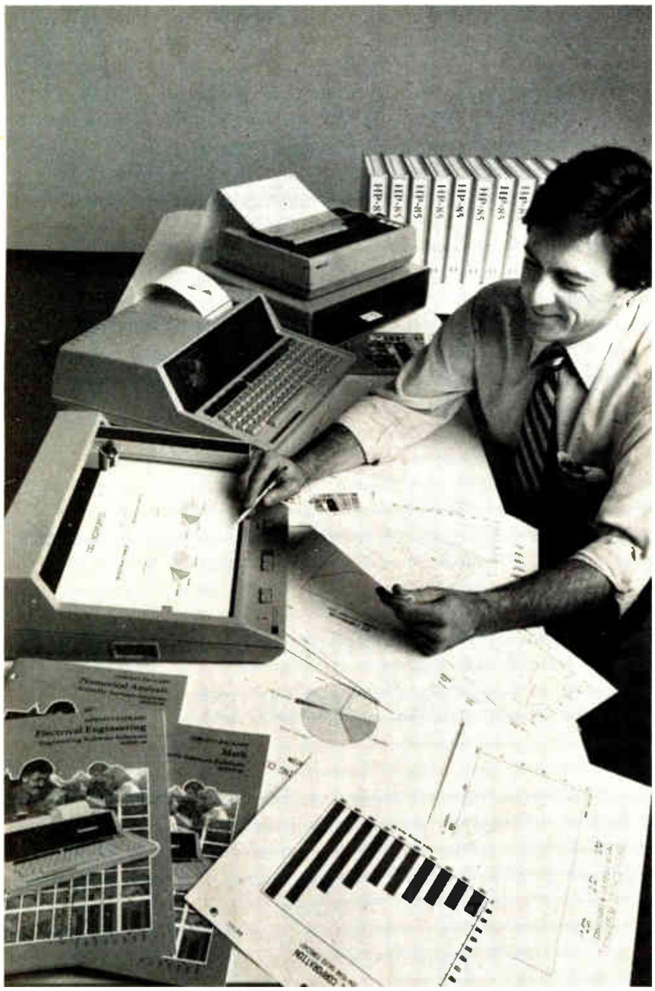
Application Note 222-3, "A Manager's Guide to Signature Analysis" is available free of charge. Check **I** *on the HP Reply Card.*

World Radio History

Two new software packages for the HP Series 80 personal computers now give you an all-purpose data base management system and "electronic worksheet"

HP Series 80 personal computers for professionals provide solutions for business and technical professionals. They feature integrated high-resolution CRT's, full keyboards, enhanced BASIC language and unusually powerful graphics capability in a rugged, portable package.

Two new software packages are now available for the Series 80 personal computer: Information Management Pac (IMPac) is a data base management tool for accessing, modifying, searching and sorting data; and VisiCalc™ PLUS which is an enhanced version of the award-winning "electronic worksheet" software.



Personal Information Management System

IMPac teamed with an HP Series 80 Personal Computer, and the 540K byte, random storage capacity of the HP 5¼" flexible disc dual-drive, becomes an all-purpose personal data management system for business and technical professionals. It helps you manage more information and perform complex analysis right at your desk.

The IMPac software has a friendly querying system to prompt the non-computer user; a report writer for organizing printout, sorting and statistic capabilities for comparison analyses; and graphic capabilities which enable you to create line, curve, bar and pie charts for clear impact in reports or presentations great for organizing data.

Great for Organizing Data

Any job that requires organization of data—clients' names, accounts, products, experimental data—into further categories can use the HP Information Management System. For example, information on a part number could include data ordered, date delivered and cost.

Possible applications include creating, updating and printing inventory records, customer mailing lists, catalogs or other data bases.

VisiCalc™ PLUS an electronic worksheet

HP's VisiCalc™ PLUS is a major new software tool. It's an electronic worksheet that instantly recalculates results as you change the variables. You can evaluate functional behavior, select variable alternatives, perform cost analyses and more, with greater accuracy and using more variables than you thought possible. You key in the what-if questions and immediately see their effects on your solution. No programming is necessary. You can become proficient with VisiCalc™ PLUS in a few hours. VisiCalc™ PLUS features many powerful tools, and the entire HP Series 80 BASIC math set, plus graphics. Create professional presentations with curve-fitting plots, stacked or clustered bar-graphs, exploded pie charts and line graphs, all in up to four colors, on paper or on transparencies.

Only From Hewlett-Packard

HP Series 80 personal computing systems are serviced by HP technicians and on-site service contracts are now available. We urge you to judge for yourself with a hands-on, one-on-one demonstration at your HP dealer.

Check **A** *on the HP Reply Card for complete details.*

World Radio History

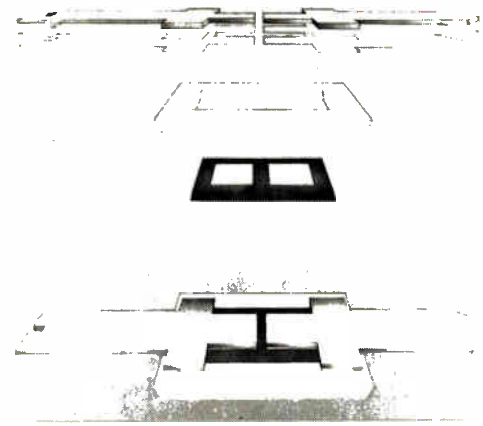
New low parasitic beam lead PIN diode for microwave frequencies

Hewlett-Packard's new HPND-4005 Beam Lead PIN Diodes are designed and manufactured to offer exceptional lead strength while achieving excellent electrical performance at microwave frequencies. These diodes are produced by a new HP planar process which captures a minimum amount of active silicon material in a dielectric frame. This process minimizes the amount of parasitic silicon and produces diodes with a very low resistance-capacitance product, while providing large beam anchor points which increase beam strength.

Typical electrical characteristics for the HPND-4005 are: series resistance of 4.5 Ω; capacitance of .017 pF; breakdown voltage of 120 V; and reverse recovery time of 20 ns.

Designed for use in stripline or microstrip circuits, the HPND-4005 diodes are also particularly well suited for circuits requiring high isolation in a series diode configuration.

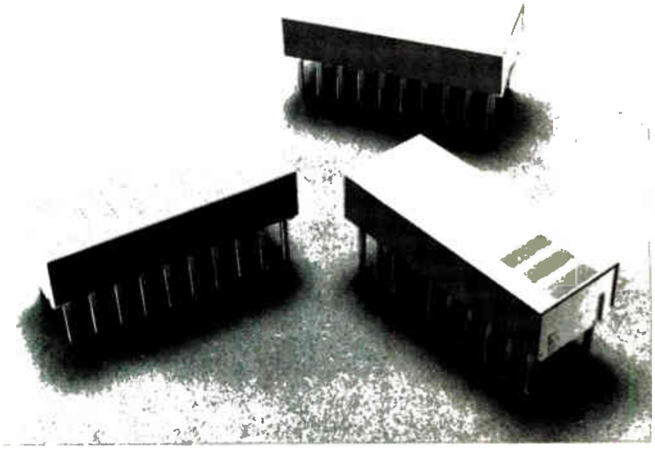
Check **J** *on the HP Reply Card for details.*



This new beam lead PIN diode combines extremely low capacitance, low series resistance, and rugged construction for applications in switching, attenuating, phase shifting, limiting and modulating at microwave frequencies.

HP introduces new, high-performance, ten-element bar graph array

With HP's new 10-Element Bar Graph Array, the HDSP-4820/30/40, displaying information in recognizable bar graph form is easy. A special package interlock feature facilitates end stacking alignment, while the low profile, only 6.10 mm (0.24"), streamlines design and is compatible with other HP front-panel products. Total package size is only 6.10 mm (0.24") by 10.16 mm (0.40") by 25.40 mm (1.0").



The Bar Graph Array is available in standard red (HDSP-4820), high-efficiency red (HDSP-4830), and yellow (HDSP-4840). High ambient problems can be solved by either the high-efficiency red version, which is brighter than any other presently on the market, or the yellow version. All of the colors are categorized and tube packed for luminous intensity. The yellow is also categorized for dominant wavelength.

Viewability is excellent with HP's Bar Graph Array as it exhibits superior segment-to-segment, on-off contrast. Segment size is also large, 1.52 mm (0.06") by 5.08 mm (0.20"), and provides a wide viewing angle.

To simplify your design, Hewlett-Packard offers Application Note #1007 featuring a description of the bar graph manufacturing process, a thorough explanation of the package and electrical characteristics, a discussion and summary of analog and digital interface techniques, available integrated circuits, plus a list of recommended filters.

All are available from authorized HP distributors.

For further information, check **K** *on the HP Reply Card. For a free copy of AN #1007, check* **L**.

World Radio History

Video waveforms brightly displayed with HP's new TV sync option

Hewlett-Packard now offers an optional TV sync capability for its 100 MHz Oscilloscopes (Models 1740A, 1741A, and 1742A). This Option 005, adds the circuits necessary for triggering on a composite video signal while maintaining standard measurement capabilities for design and troubleshooting.

Inputs supplied by Option 005 are compatible with video outputs, thus ensuring maximum stability and fidelity of video signals. Detailed examination of lines and test signals is also offered with the triggering and viewing features provided by this option.

Obtain further information by checking **M** *on the HP Reply Card.*

A modulated stairstep test signal and the elusive color burst are easily displayed with HP's new TV sync option.

New Optoelectronics/Fiber Optics Applications Manual

The HP Optoelectronics Division's understanding of the growing complexity of today's product applications and the problems associated with them has led to the creation of the second edition of the *Optoelectronics/Fiber Optics Applications Manual*, HPBK-2000. This hard-cover manual provides solutions to the most common problems that arise in the application of fiber optic systems, optocouplers, emitter/detector and digital bar code systems, as well as optoelectronic displays and lamps. In addition, such subjects as photometry/radiometry, contrast enhancement in visible displays, the reliability and the mechanical handling of optoelectronic components all are covered. Examples of circuitry and software for direct utilization in circuit designs are also given.

Each of the major sections covers the theory of a particular area of technology, the theory behind products designed to service needs in that area and the practical solutions to technical problems encountered in that area. Enough theory and technical analysis are provided for each application to easily extend the solution to other applications.

In a single handy source, this authoritative manual provides the full range of technical information that engineers need to design circuits, specify components and solve problems in optoelectronics/fiber optics engineering. The *Optoelectronics/Fiber Optics Applications Manual* can be ordered and purchased from an authorized Hewlett-Packard distributor.

Check **N** *on the HP Reply Card for more information.*

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March/April 1981

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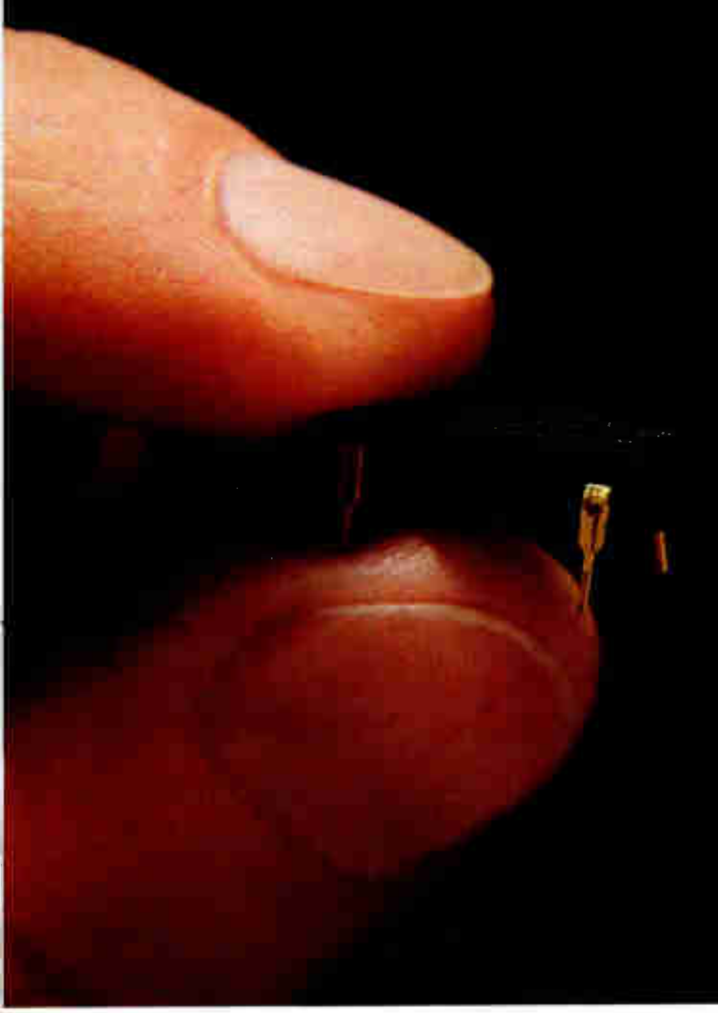

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Meetings

ISA Power Industry Division's National Symposium, Instrument Society of America (67 Alexander Drive, P. O. Box 12277, Research Triangle Park, N. C. 27709), Hyatt Pittsburgh Hotel, Pittsburgh, Pa., May 18–20.

1981 IEEE International Conference on Plasma Science, IEEE, Sweeney Convention Center, Santa Fe, N. M., May 18–20.

Automan 81—First European Automated Manufacturing Exhibition and Conference, British Robot Association and IFS Conferences Ltd. (35–39 High St., Kempston, Bedford MK42 7BT, England), Exhibition Centre, Brighton, England, May 18–21.

First European Conference on Cineradiography with Protons or Particles, L'Association Nationale de la Recherche Technique (ANRT, 109 Ave. Raymond Poincaré, 75116 Paris, France), Tour Olivier de Serres, Paris, May 19–21.

Naecon 81—National Aerospace and Electronics Conference, IEEE *et al.*, Dayton Convention Center, Dayton, Ohio, May 19–21.

Semicon/West 1981, Semiconductor Equipment and Materials Institute Inc. (625 Ellis St., Suite 212, Mountain View, Calif. 94043), San Mateo Fairgrounds and Bay Meadows Race Track, San Mateo, Calif., May 19–21.

Third European Conference on Hybrid Microelectronics, International Society for Hybrid Microelectronics (Conference and Technical Forum Secretariat, ISHM; 11 rue Hamelin, 75783 Paris Cedex 16, France), Palais des Papes, Avignon, France, May 20–22.

Videotex '81, Infomart (122 St. Patrick St., Toronto, Ont. M5T 2X8, Canada) and Online Conferences Ltd. (Argyle House, Northwood Hills, Middlesex HA6 1TS, England), Royal York Hotel, Toronto, May 20–22.

Ninth World Congress of the International Measurement Confederation (VDI/VDE Gesellschaft Messund Regelungstechnik, Graf-Recke-Strasse 84, P. O. Box 1139, D-4000 Düsseldorf 1, West Germany), International Congress Center, West Berlin, May 24–28.

Melecon 81—Mediterranean Electrotechnical Conference, IEEE and the Association of Engineers and Architects in Israel, Tel Aviv Hilton, Tel Aviv, May 25–28.

Fourth Biennial University/Government/Industry Microelectronics Symposium, IEEE, National Science Foundation, and International Society for Hybrid Microelectronics, Mississippi State University, Starkville, Miss., May 26–28.

16th Symposium on Electron, Ion, and Photon Beam Technology, IEEE Electron Devices Group and American Vacuum Society, Loews Anatole Dallas Hotel, Dallas, Texas, May 26–29.

35th Annual Frequency Control Symposium, U. S. Army Electronics Technology and Devices Laboratory Electronics Research and Development Command (Fort Monmouth, N. J. 07703), Marriott Hotel, Philadelphia, May 27–29.

Microcomputer Show '81, Japan Electric Industrial Development Association (3-5-8 Shiba Koen, Minato-ku, Tokyo 105, Japan), Tokyo Ryutsu Center, Ota-ku, Tokyo, May 27–30.

NCTA 30th Annual Convention, National Cable Television Association, (918 16th Street N. W., Washington, D. C. 20006), Los Angeles Convention Center, Los Angeles, May 29–31.

12th International Television Symposium, Swiss postal and telecommunications administration (Symposium Secretariat, P. O. Box 122, CH-1820, Montreux, Switzerland), Exhibition Center, Montreux, May 30–June 4.

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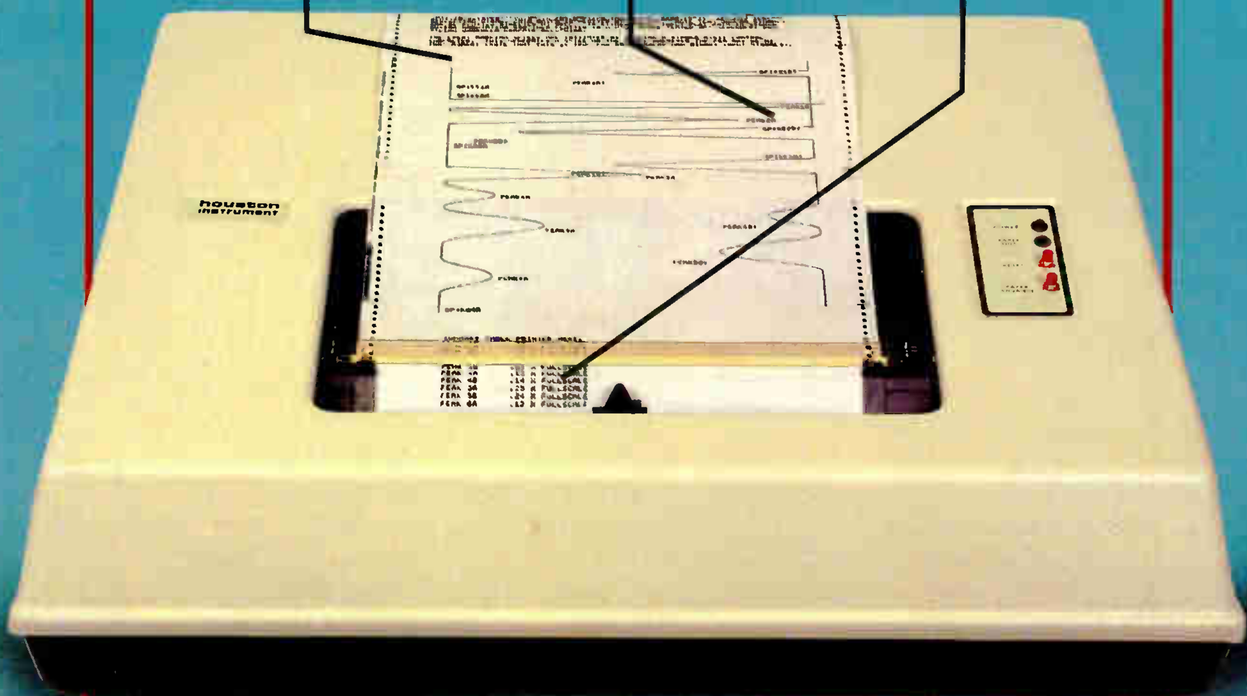

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Avionics engineers toughest to find

Companies with engineering openings are finding that the most elusive candidates are those with avionics experience, according to a just-compiled national survey. Demand for avionics talent is zooming because of contemplated step-ups in aircraft procurement and improvements in their electronic systems, reports Thomas-Mangum Co., a Los Angeles executive search and consulting firm, adding that **avionics replaces software as the hottest specialty.** Overall, the survey notes that, in general, industry hiring is strong but "not as hot and heavy" as last year, largely because of recessionary pressures.

Second generation of fault-tolerant computers unveiled

Tandem Computers Inc. of Cupertino, Calif., introduced its second generation of fault-tolerant interactive computer systems last week, four years after the introduction of its first generation. Dubbed the NonStop II system, it comes in practical configurations containing 2 to 16 processors. With peripherals, the cost ranges from $500,000 up to $4 million. The new system has a 16-bit data path like its predecessor, but it maps up to 23 bits per processor, or 16 megabytes, whereas its predecessor mapped to 20 bits, or 2 megabytes. In addition, **the NonStop II can address up to 1 gigabyte of virtual memory per processor,** which is unlikely to be exceeded by any application program. Input/output-channel memory is increased from 4-K bytes to 64-K bytes and the number of virtual circuits that can be established by the new system has also been increased from less than 50 terminals to 255. NonStop II is software-compatible with previous systems, but it uses loadable control storage rather than programmable read-only memory to hold the instruction set. The new system also provides for remote diagnostics and operation via a page-mode–oriented operations and service processor. Present NonStop systems are field-upgradable to the NonStop II.

Quick Connect prototyping system due by midsummer

The first automated Quick Connect backplane-interconnection system could emerge this summer from Computer Numerical Controls Corp. of Woburn, Mass. Aimed at prototyping and short production runs, the microprocessor-controlled system would be programmed manually by "walking it" through a set of backplane interconnections; afterward the unit would follow the same pattern automatically, recalling it from memory. The unit would be **the first to combine the advantages of Quick Connect, developed by Bell Laboratories** [*Electronics*, Sept. 13, 1979, p. 98]—low board profile and a single wire per pin—**with those of automated operation.** Its developers feel that it could signal the beginning of a shift away from 1948-vintage Wire-Wrap and thus possibly trigger development of a new generation of large backplane-interconnection machines. Already a maker of large Wire-Wrap systems, CNC will be watching the acceptance of the new machine closely, with an eye toward offering large, high-speed, totally automated Quick Connect units.

Textronix series seeks to blunt competitors' thrust

With foreign and domestic competitors pushing to make inroads into Tektronix domination of the oscilloscope market, the Beaverton, Ore., firm is introducing a new line of portable scopes. Called the 2300 family, **the compact units—5 by 12 by 17 in.—weigh only 17 lb., yet have dual-trace performance and specifications similar to those of the company's model 465 scope,** which has for years dominated the service market.

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Electronics newsletter

Extremely rugged and immune to electromagnetic interference, the 100-MHz scopes range in price from $2,775 to $3,350, depending on whether the purchaser wants a delta-time readout or a digital multimeter with it.

Multiuser systems to bow at NCC

TeleVideo Systems Inc., which in just two years has established itself as a leading supplier of smart terminals, is moving simultaneously into two new, fast-growing markets. At next month's National Computer Conference in Chicago, the Sunnyvale, Calif., firm will take the wraps off three low-cost, multiuser (up to 16) microcomputer systems, all based on Zilog's Z80A 8-bit microprocessor and aimed at small-business applications. **What's more, TeleVideo Systems is extending its line in the terminals market with the addition of a $699 cathode-ray-tube terminal** for end users and original-equipment manufacturers. Designated the model 910, this Z80A-based unit, also to be unveiled at the NCC, features switch-selectable compatibility for emulating the Lear Siegler ADM-3 or ADM-5 and the Hazeltine 1410 "dumb" terminals. This feature enables the model 910 to be used without modification in existing systems employing many of the most popular CRT terminals.

Interstate to make speech module for Lear Siegler unit

Two Anaheim, Calif., companies—Interstate Electronics Corp. and Lear Siegler Inc.'s Data Products division—have completed an agreement for Interstate to supply a speech-recognition module that can be added to Lear Siegler's ADM-3A and ADM-5 dumb terminals. The board, a variation of the firm's 100-word module, **can be added to existing units by distributors in a matter of minutes.** The price to the end user will be $2,100. Lear Siegler last year signed a similar agreement with Heuristics Corp. of Sunnyvale, Calif. [*Electronics*, May 22, 1980, p. 105], but Heuristics could not supply enough boards.

Addenda

Ford Aerospace & Communications Corp. in Charlotte, N. C., **has automated wafer inspection.** Its WIS-100 system uses a scanning laser and microprocessor-based analysis to find defects as small as 1 μm, with a claimed throughput of 600 wafers an hour—twice that of visual inspection. Also, an operator may run two machines simultaneously. . . . Oki Semiconductor of Santa Clara, Calif., having established a beachhead in the market for 4-bit single-chip microcomputers, **is about to begin shipping samples of a family of five 8-bit models,** the series 80. They run either Intel's Isis or Digital Research's CP/M software. . . . A new method of microprocessor software development is ready for market at Intermetrics Inc., Cambridge, Mass. **It allows routines to be developed very rapidly in a multiuser minicomputer environment with aid of high-level languages.** The new program is then transferred to a traditional development system for final testing and integration at a great savings in time. . . . Data Media Corp. of Pennsauken, N. J., will unveil what it bills as **the lowest-priced color graphics terminal—less than $4,000**—at the National Computer Conference. It displays 132 columns of alphanumerics, plus business graphics in eight colors. The 8085-based device is interchangeable with DEC's VT-100 display terminal and includes full keyboard, keypad, and refresh memory.

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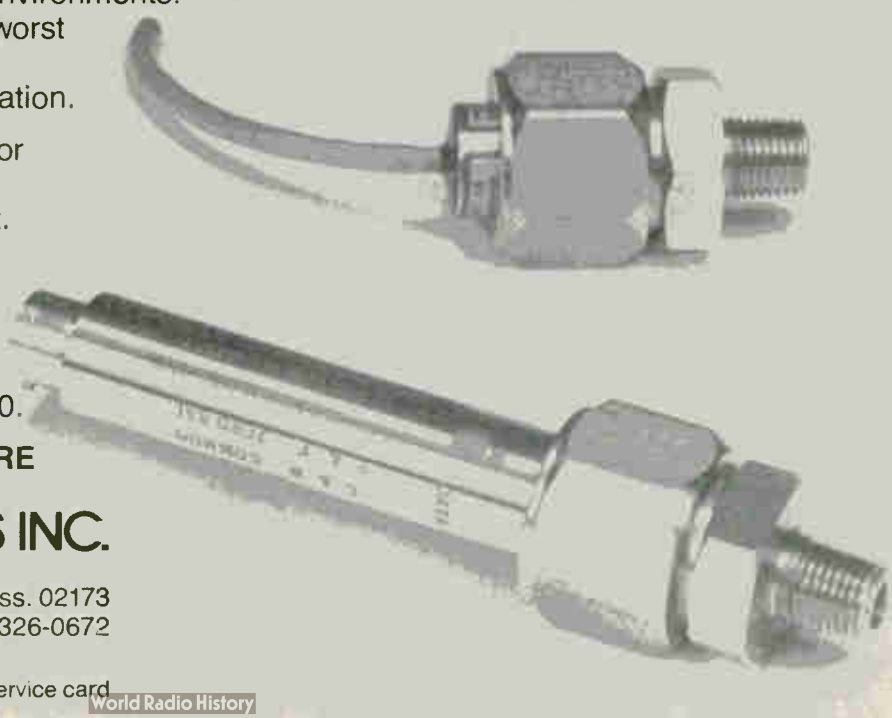

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Storage technique cuts flicker in plasma displays

by Raymond P. Capece, Managing Editor, Technical

Brighter, wider displays to compete with CRT units are due to second signal that sustains glow discharge

Flat-panel plasma displays are on the verge of head-to-head competition with cathode-ray tubes for graphics applications. Burroughs Corp.'s displays operation has evolved a technique that removes the limitations on display size and brightness, freeing the simple and rugged flat plasma units for applications other than cash registers.

The development from the Plainfield, N. J., operation of Burroughs OEM Corp. makes possible a screenful of picture elements, or pixels. As in other plasma displays, the pixels are produced by a dot-matrix addressing technique, but a new storage feature makes possible a bright, flicker-free picture.

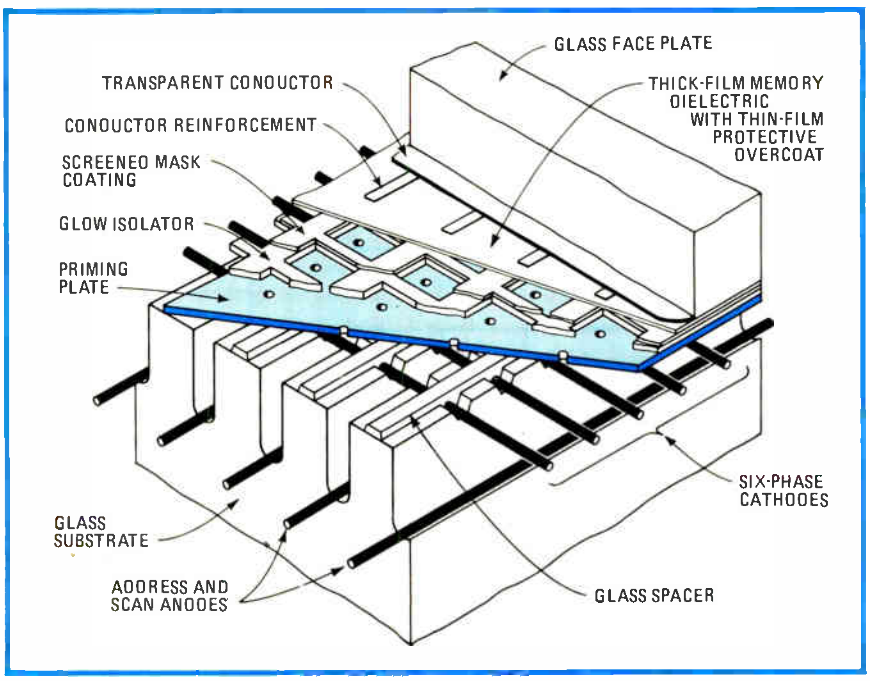
Limitations. For simplicity's sake, Burroughs designed its conventional dc Self-Scan plasma display to be activated by a multiplexed scanning signal along the rows and columns of the dot matrix. However, the scan is limited to about 30 hertz—a row cannot extend beyond 300 pixels or so before flicker becomes noticeable and the display dims.

Existing plasma displays are therefore limited to about 40 five-by-seven-dot characters per row. But the new approach puts the 96-character standard row found in CRT units within reach. "The width is limited only by the glass and metal fabrication process," claims Burroughs researcher James Ogle. He and coinventor George Holz will present a paper at next week's meeting of the Society for Information Display in New York.

The secret is the storage feature that allows a continuously applied ac sustainer signal zipping along at 16.7 kilohertz to pulse the dots at a far greater frequency than the slow address-scanning rate. The display configuration adds the priming plate shown in the figure to separate the anodes and cathodes of the scanning signal from the rectangular chambers that sit just on top of the plate.

In conventional plasma displays, the glow discharge for a given dot took place at the intersection of the anode and cathode. Now it is confined to the appropriate front chamber, which improves viewing angle.

Combo. The scan signal interacts with the sustaining signal, which alternately applies ±85-volt levels between the metal priming plate and



Storage display. 16.7-kHz current between priming plate and transparent conductor drives glow discharge, thereby giving a brighter, flicker-free plasma flat-panel display (above).

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the transparent conductive coating that has been added behind the faceplate. Together these two signals form a column of positively ionized gas through the appropriate small hole in the priming plate, depositing electrons on the wall of the chamber.

Many modes. The new display can operate in three modes: total refresh, in which each dot is rewritten with each scan; add dots only; or erase dots only. The scheme thus allows selective writing or erasing.

Burroughs says the new design uses a multiplexing scheme that reduces the number of address lines to about a tenth of those required to address each pixel—the approach taken by some high-performance flat-panel graphics displays where cost is no object. Despite its improved brightness, the new display actually uses less power than previous plasma devices—about 225 microwatts per pixel compared with about 700 μW for the typical dc flat-panel plasma display.

Burroughs' target is clearly the CRT market. Though first products will not have the screen height of CRT displays, tens of thousands of pixels can be expected, and 96-character widths seem almost certain.

Initial cost of the first units, to bow later this year, will be comparable to earlier multiline Burroughs displays. But the company is making a major commitment to the line.

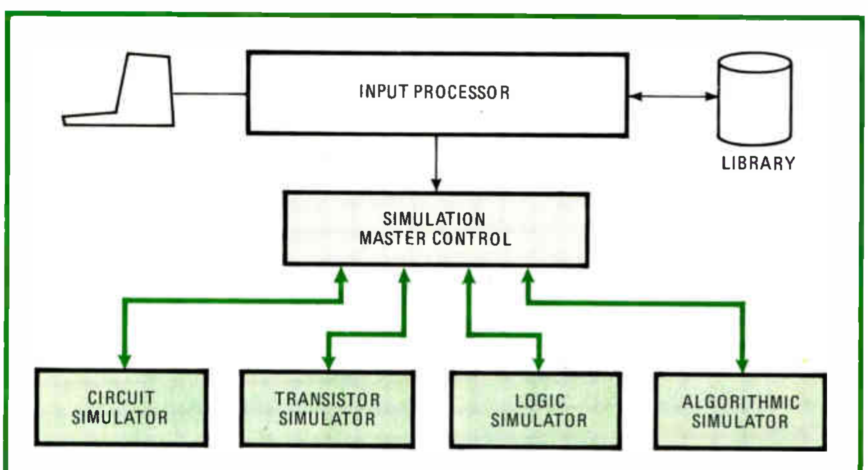
Computer-aided design

Single pass checks all hardware levels from gate to system on proposed VLSI chips

The Missile division of Hughes Aircraft Co. is putting finishing touches on a computer-aided design system that includes software capable of checking out in one pass all hardware levels of a proposed integrated circuit. In real time, the CAD module can check out a hardware simulation all the way up from its gates through transistors, circuits, logic cells, and chips to the system level.

The module can test the various circuit functions and timing parameters, and it also permits development and verification of system software and test algorithms along with the hardware checkout. In effect, the division's center for large-scale integrated design in Canoga Park, Calif., has combined the hierarchy of separate software checks on each level of hardware into one concurrent operation (see figure) and has eliminated the need for breadboards.

"The whole motivation of concurrency is to let an engineer focus at a specific level—say, a transistor's operation—and still observe a large entity, such as the entire chip or system," says Robert L. Gardner, who directs the simulation program. This approach will be essential for the coming highly complex VLSI circuits, he adds.



Multilevel simulation. Real-time CAD checks of all hardware of a proposed IC design are possible in one pass from gates to system level with a new Hughes Aircraft system.

Advance hailed. The Hughes module is a significant jump in CAD state of the art, in the opinion of Will Sherwood, who is consulting software engineer at Digital Equipment Corp.'s Semiconductor Products division in Hudson, Mass. "The goal is to have simulation that covers as many levels as possible," says Sherwood, whose division ranks among the leaders in design automation for integrated circuits.

The problem in devising a unified package has been the different simulation techniques required for each level, he says. Industry word has DEC poised to launch its own multilevel simulator later this year, but neither Sherwood nor a company spokesman would confirm it.

The root of the problem of differing techniques for differing levels has been the lack of a single programming language powerful enough to describe all levels of hardware, to say nothing of software. The Hughes LSI design center team thinks its major achievement is its development of just such a language.

New language. The team started with PL/1—a difficult language to work with, but strong on describing network relationships. It then wrote what amounts to a new common language for simulation.

Industry sources agree that Hughes' achievement is significant, saying that the proliferation of the many languages necessary to operate the different parts of a CAD system generally has been a knotty problem. Hughes expects to have the language far enough along by the end of the summer to be using it exclusively in its CAD system.

Already the three-year Hughes effort is paying off with some chips in prototype projects and more in the offing. These ICs incorporate thousands of gates, and smaller, faster versions are in sight.

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There is no inherent density limitation on chips the Hughes design automation program can produce, since computing power comes from the big Prime Computer 750 minicomputers. Design automation head Paul B. Weil says that as modules of the program reach completion they may be made available to outside users. -Larry Waller

Microsystems

Fairchild toughens processor strategy

Mostek hops on 68000 bandwagon

The ink was hardly dry on Motorola Corp.'s fourth second-source agreement on its 68000 microprocessor when the company signed up yet another source: Mostek Corp. The Carrollton, Texas, company joins Signetics, Hitachi, Rockwell, and France's EFCIS as an alternative source for the 16-bit processor. In moving to the 68000, Mostek dropped plans to make Intel Corp.'s competing 8086, leaving Intel without a U. S. second source, at least for the time being.

The Mostek-Motorola agreement signed early this month is much like the Signetics-Motorola pact [*Electronics*, March 24, p. 57] and the agreement with Hitachi. Each of these second sources will be developing peripheral chips in turn for full photomasks for the M68000 family and technical assistance from Motorola.

No arrangements have been made for any of the three to second-source any of the other's peripheral chips. So far only Motorola has the right to produce all the members of the 68000 family.

Since Intel currently dominates the 16-bit processor market, the loss of Mostek may be little more than an annoyance. However, the Santa Clara, Calif., firm has an ace up its sleeve. The recent Matra-Harris joint venture agreement with Intel [*Electronics*, April 7, p. 71] includes producing the 8086 in France, and that alternative sourcing may well extend to Harris Corp. in the U. S. At the moment, the only licensed 8086 second source in West Germany's Siemens AG; in Japan, Toshiba, Hitachi, and Nippon Electric are working on unlicensed copies.

Mostek switched for two reasons, says Robert Burckle, microsystems marketing manager. Producing a part for which masks will be made available will be much easier—the 8086 project was a complete redesign effort. The second reason, he says, is "the easier migration path to 32-bit machines offered by the 68000, since it is already a 32-bit machine internally." For example, bringing the internal 32-bit data paths off chip for the full 32-bit implementation would retain complete software compatibility with the 16-bit version. **-R. Colin Johnson**

Schlumberger money is mounting a long-term assault on the microprocessor market by its U. S. semiconductor subsidiary, Fairchild Camera & Instrument Corp. At a Paris components show presentation early this month, Gilbert F. Amelio, general manager of the recently reorganized Microprocessor Products division, spelled out a strategy spanning the low-cost single-chip 8-bit controller market, the high-speed 16-bit bipolar sector, and the general-purpose 8-, 16- and 32-bit markets.

The acquisition by Schlumberger Ltd. [*Electronics*, June 7, 1979, p. 42] has long been expected to light some fire under Fairchild's lagging operations. Amelio's disclosures show that is beginning to happen; among other points he made was the news that his company is ploughing around $100 million a year into basic microprocessor research and is talking of its first production plants in Europe within three years.

8 bits first. Though 32- and 16-bit machines are attracting much of the limelight, Amelio started by emphasizing the 8-bit sector. The trend there is away from bus-oriented circuits to true single-chip microcomputers that are input/output-intensive, he says.

To minimize chip size and hence cost, Fairchild plans a range of single-chip circuits around a standard processor offering different program- and scratchpad-memory and input/output options. The next step is to get customers to specify their own microprocessors from a range of standard building blocks within three years.

The starting point for this objective is a single-chip version of the F8 series of two-chip microcontrollers first introduced in 1974. The single-chip 3870 series is already launched, with more parts this year.

For the custom microchip objective, Amelio admits that the needed computer-aided design capability to stitch the different building blocks together has yet to be developed. Each of the constituent blocks is to be available in different form factors so that they fit together to create a compact, easily produced chip.

In the 16-bit bipolar processor market, Fairchild's marketing push has been stalled by litigation with Data General Corp. over its 9940 chip set emulating the DG Nova minicomputer [*Electronics*, March 27, 1980, p. 48]. However, Fairchild has salvaged something from the project in the form of the 9445 with an on-chip multiply-and-divide unit, to be launched in June.

The instruction set is a superset of the 9440, and the software has been developed by Fairchild, so it will not be the subject of litigation, the company claims. The clock rate for the pipelined part is 20 megahertz initially but is jumping to 30 MHz as the company moves its integrated-injection-logic Isoplanar process from 4- to 3-micrometer minumum design rules.

New family. In the longer term, Fairchild's plans are centered on the completely new family of software-compatible microprocessors being jointly developed with neighbouring National Semiconductor Inc. The 16000 series [*Electronics*, Sept. 27, 1979, p. 42], basically a 32-bit central processing unit with 8-, 16-, or 32-bit-wide buses, is being designed from the top down to retain software compatibility between

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parts. Apart from the CPUs, the two companies are splitting the development of the 14 peripheral support chips, including a memory management unit and slave processors transparent to the user. As integration allows, these will be brought on chip.

Are the two companies too late to launch yet another microprocessor family on a possibly resistant market? "We don't think we are too late for the 32-bit market," says Amelio, who sees it developing quite gradually. Furthermore, he sees software compatibility from top to bottom of the range as a very powerful weapon and notes that the two smaller parts will be able to emulate the 8080 instruction set. **-Kevin Smith**

Careers

IEEE urged to act on alien hiring

The employment by U. S. firms of alien engineers at what are presumed to be cut-rate salaries is generating an angry call for action on the part of members of the Institute of Electrical and Electronics Engineers. The Los Angeles council's professional activities committee (LAC/PAC) is starting a campaign to push the organization into an activist stance on the issue.

The committee has just launched two resolutions upwards through IEEE channels. One calls for barring from IEEE publications employment advertisements that violate accepted salary levels, and the other urges the IEEE to work for a strong advisory role to the U. S. Department of Labor, which must give its permission for each alien engineer's hiring.

Impetus. Triggering the resolutions was an advertisement in the January 1981 issue of IEEE Computer, says George A. Morris Jr., committee chairman. "The ad asked for a superman who doesn't exist, it had the wrong job title, and the salary was at least $10,000 too low."

The ad sought a systems programmer, with an MS and extensive background in many disciplines, plus detailed knowledge of graphics technology and software. The salary offered was $15,000 to $17,000.

Morris says he has seen similar ads elsewhere. "But this is the first we've noted in an IEEE publication offering a job at substandard pay," he adds.

LAC/PAC and many other groups suspect that such ads are ploys to mislead the Labor Department, which must certify that no U. S. engineers are available for a job before an alien can be brought in. The low salary advertised draws no U. S. applicants, permitting the company to successfully petition the department.

Furthermore, U. S. law requires that salaries for foreign nationals working in the U. S. be comparable to those being paid to working Americans with similar backgrounds. The petitioning company can point to its low advertised salary as the prevailing wage for the job.

The committee's initial resolution urges that employment ads in IEEE publications offer salaries consistent with those disclosed in the organization's own survey data. "We can't tell outside publications what to do, but we can our own," Morris says.

In the second resolution, it is proposed that the IEEE seek review of requests made to the Labor Department to certify aliens in order to inform it when salaries are out of line. The IEEE's data on salaries is a solid guideline here.

For the IEEE to sanction those resolutions requires discussion and formal approval by its U. S. Activities Board and other appropriate committees meeting over the next few months. "Action will take time to percolate up through the committees," points out an IEEE spokesman at New York headquarters.

Awaiting action. The 19-member activities board, the parent group of the regional professional activities committee, convenes in Chicago, June 3. Its seven-member operating committee met last week in Washington, but had not received the LAC/PAC resolutions. This means that action will have to await the June 3 USAB meeting.

The institute routinely makes available membership salary surveys, both national and local, to the U. S. Department of Labor. However, the Los Angeles proposals call for a more active advisory role, including the review of employment advertising that would likely involve

Apple coprocessor puts UCSD Pascal to work

Adding software power to its processor board that supercharges the Apple II computer, Stellation II is introducing the UCSD Pascal system for its add-on board with a 6809 microprocessor. The Santa Barbara, Calif., company introduced the Mill to add true coprocessor capability to the Apple's basic 6502 central processing unit [*Electronics*, Sept. 25, 1980, p. 42], but there has been little software available for the board.

In contrast, Microsoft's Softcard with a Z80 gives Apple II users access to the extensive CP/M software base. Stellation II is now offering a comparable software setup with its Pascal, which will run on Apples having that language option. Software-compatible with Apple Pascal, the new system affords an average twofold speed increase in program execution.

The Apple's 6502 still performs all input/output functions, with the 6809 brought in to execute the pseudocodes that do not involve I/O. The initial software release will also utilize the 6502 routines for executing floating-point arithmetic p-codes, but later releases will use the 6809 for everything but I/O. Speed increases using the 6809 for executing p-codes range from 30% to 350%, mostly the result of its additional registers and the more efficient instruction set.

Deliveries of the Mill will now include the UCSD Pascal system and will add about $100 to its price, bringing it to about $375 when the software becomes available late this month. Customers with earlier Mills can buy the Pascal system as an add-on. **-R. Colin Johnson**

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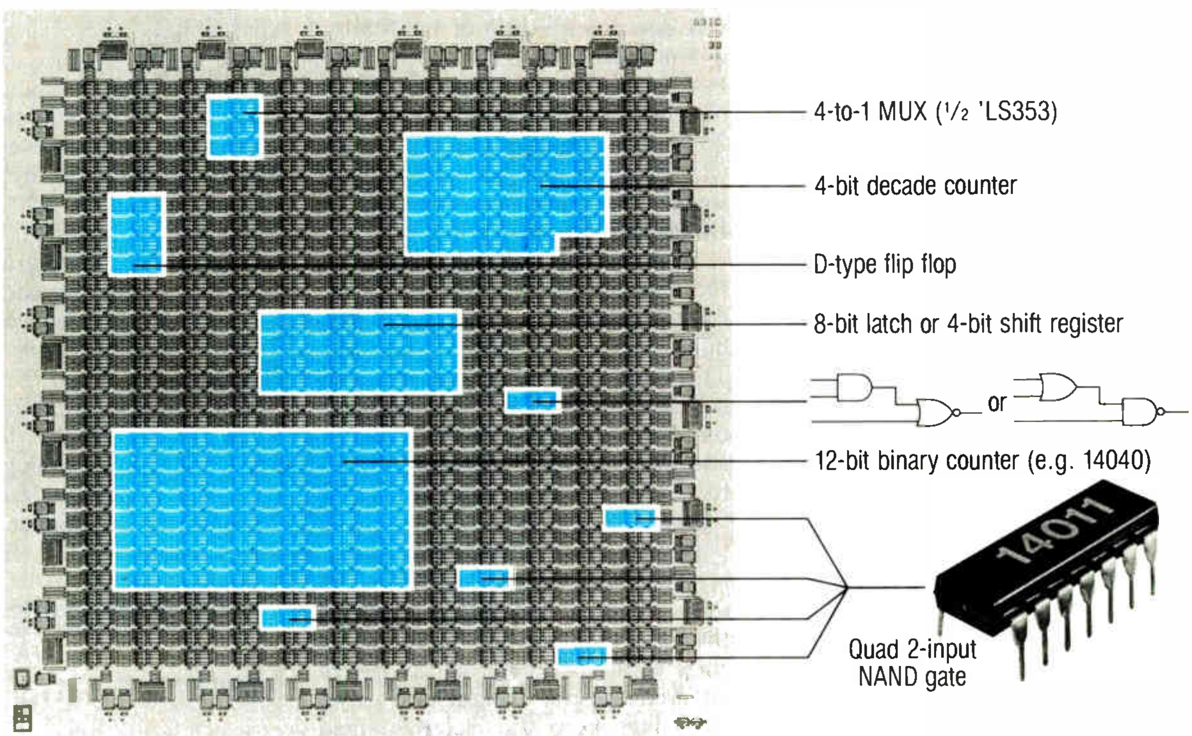

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the IEEE Publications Board.

That the first proposed IEEE action on foreign hiring should emerge from the Los Angeles council comes as little surprise because concern probably has reached a higher pitch in the West than elsewhere. Hiring foreign engineers perhaps has been more widespread here, because of its proximity to Asia where some countries have a surplus of low-priced talent. **-Larry Waller**

Components

Power transistors unite MOS, bipolar

Melding MOS and bipolar technologies to produce a power transistor with both their advantages is a route a number of semiconductor makers are taking. Several firms, including Supertex Inc., have developed structures that use a high-impedance, low-current MOS input device and a high-power bipolar output device with low on-resistance.

"The ideal power transistor is one that combines the input and fast switching characteristics of a vertical double-diffused MOS power transistor with the high-current and low-voltage-drop characteristics of a bipolar transistor," says Richard A. Blanchard, vice president of the Sunnyvale, Calif., affiliate of Exxon Enterprises Inc. In its new effort, Supertex is following in the tracks of Siemen AG, with its Sipmos [*Electronics*, March 10, p. 12].

The initial step in designing the new SuperFET was to apportion the chip real estate into MOS and bipolar sections for a minimum voltage drop. "Too small a MOS field-effect transistor will produce insufficient base drive for the bipolar transistor," Blanchard says, "while too large a MOS FET will decrease the current-handling capability of the combined transistor structure."

The first part, then, will be a 500-volt device with 40% of its 245-by-245-mil area devoted to the MOS FET, giving an on-resistance of 0.3 ohm or less and a current capacity of 20 amperes and more. Blanchard will describe the process at next week's Powercon 8 conference in Dallas [*Electronics*, April 7, p. 97].

With only a slight modification, the sequence of steps for fabricating D-MOS power transistors can also build bipolar transistors, he says. The cross section of the structure (see figure) shows a p-type diffusion that forms the body of the MOS FET and the base of the bipolar transistor. The n^+ diffusion forms the source of the D-MOS transistor and the emitter of the bipolar transistor.

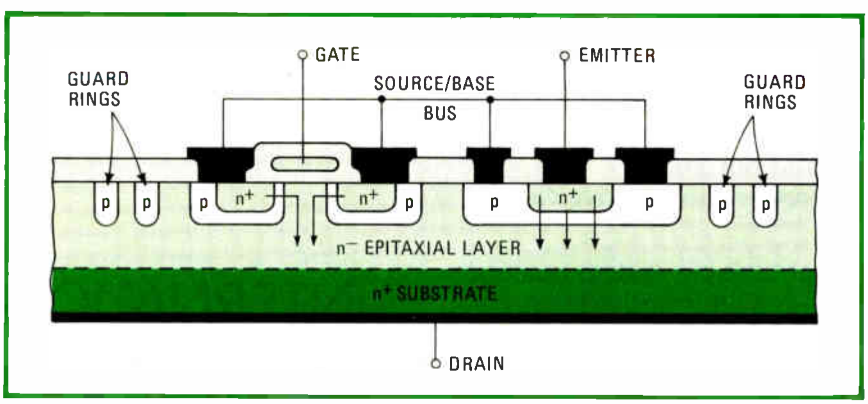
"The high-voltage capability of this combined structure is achieved through the use of field-limiting rings at the perimeter of the p-type diffused region," Blanchard says. The rings keep the electrical field associated with the base of the bipolar transistor and the drain of the MOS device below the critical level, increasing breakdown voltage.

In contrast to Sipmos, the SuperFET structure comprises one large MOS and one large bipolar device, whereas the Siemens part is composed of small cells connected in parallel, each merging FET and bipolar functions.

Blanchard says that SuperFET prototypes have reached breakdown voltages as high as 600 V; Siemens has 500- and 1,000-V parts catalogued—but the 500-V part has a 0.6-Ω on-resistance and 8.6-A current rating. In accordance with Ohm's law, simply increasing chip area would drop resistance and boost the current rating, Siemens says, but result in a more costly product.

Another two-technology structure has been developed by the Philips French subsidiary RTC–La Radiotechnique Compélec. Its version uses an MOS device driving a Darlington transistor. This approach, however, is useful only for low-voltage, intermediate-current parts, Blanchard claims.

With its fast switching characteristics, the SuperFET is likely to find applications in switching power supplies where operating frequencies of 20 kilohertz and higher are becoming common. **-Bruce LeBoss**



Combo. Supertex' new power transistor combines a high-speed MOS driver with a high-current bipolar output transistor, a tack other firms are taking, too.

Fiber optics

Mainframe makers pursue optical links

Computer makers are buckling down to serious work in the development of fiber-optic links for their systems. Several mainframe makers, notably the Sperry Univac division of Sperry Corp., are devising means for running light-wave lines between central processing units and peripherals.

Since the typical computer interface comprises control, handshaking, and data lines in parallel, the first step is a parallel-to-serial converter that will permit use of a single fiber-optic line. A parallel link would be too expensive and wasteful of the fiber's data capabilities.

Just such a converter has been built by R. Kirk Moulton, principal engineer at Sperry Univac in Blue Bell, Pa. The unit and the compan-

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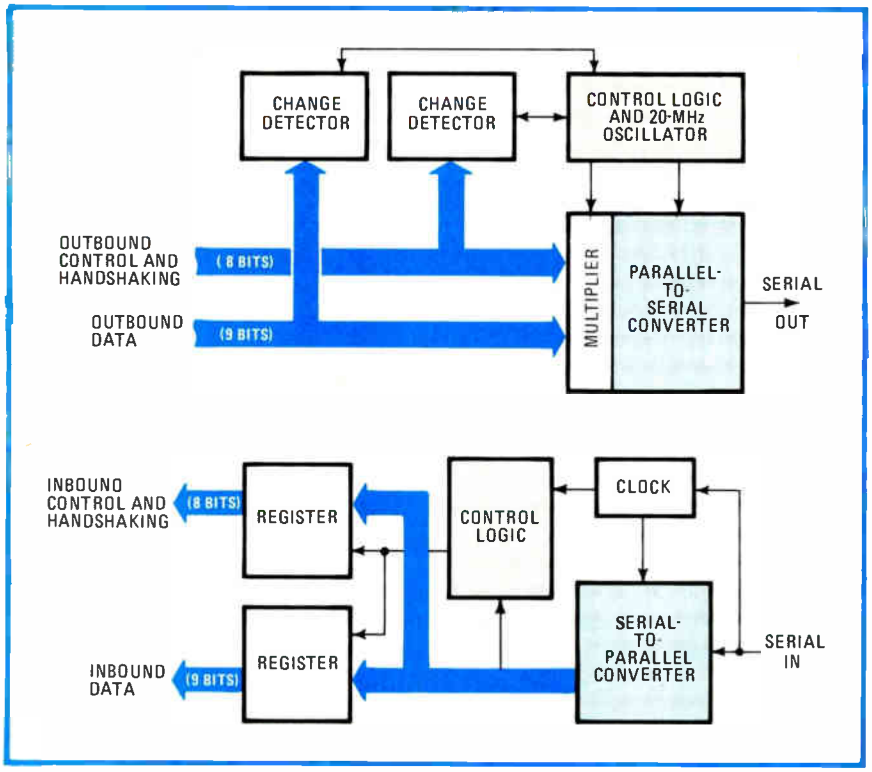

Byte converters. With these modules, Sperry Univac can send parallel computer data over serial fiber-optic cables linking the various elements in a system.

ion serial-to-parallel converter can handle transmission of up to 250 kilobytes a second, which is enough for such peripherals as printers but not fast enough for high-speed storage equipment like disks.

As the figure shows, the conversion and reconversion hardware is a straightforward implementation. The outgoing control logic appends start and stop bits to the serial stream and shifts it out at the 20-megahertz oscillator frequency. The electrical interface is characterized by long strings of 0s followed by short bursts of control and data bits in the nonreturn-to-zero format.

On receipt of the start bit, the receiving control logic starts a gated oscillator, which reinitializes with each burst. Storing the incoming bits in a control or data register allows recreation of the parallel interface.

Moulton's implementation uses 55 small- and medium-scale integrated circuits. "While even faster performance could be achieved using faster serialization rates, faster logic families, and a more efficient coding scheme, the [byte-acknowledgment] protocol limitations still would preclude use with disks," he says.

The protocol limitation has been the stumbling block that has held back the predicted explosion of fiber-optic computer communications links. The dominant input/output architecture in today's computers supports byte-acknowledgment protocols, which do not map well into serial lines.

In such a scheme, each byte is transferred through an interlock using request and acknowledgment control lines to maintain the handshaking. Thus four one-way protocol transmissions through the link are necessary for each byte.

What's more, transmission of each byte in a stream must await acknowledgment of receipt of the first, and cable delays and de-skewing times reduce data throughput even further. However, this inefficient architecture does require minimal support logic and permits asynchronous transfers, and it made sense in the 1960s when silicon costs were high relative to copper.

Computer makers, including Sperry Univac, IBM, and Hitachi, are looking seriously at message-acknowledge protocols, in which a block of bytes may be transmitted before an acknowledgment is required. Such a protocol is ideal for a serial transmission scheme because the maximum data-transfer rates are limited by the de-skewing time of the transmission medium, rather than by the cable or serialization propagation delays.

Step one. These protocols do require data buffers and interface logic that is complex enough to facilitate the interchange with minimal processor intervention. Such an architecture makes sense when silicon costs are low relative to the cost of the transmission medium, as is the case with fiber-optic cable.

Therefore, Moulton sees his adapters as only the first step in the spread of fiber optics in the computer world. "Only when such adapters are widely available and protocol translation is taken care of will we see fiber optics make inroads into computers—and not before," he says. **-Harvey J. Hindin**

Production

Direct-write E-beam goes on line at TI

Joining one of the more exclusive clubs in the world, Texas Instruments Inc. is beginning to use direct-writing electron-beam technology to scribe integrated-circuit patterns. The Dallas company was to tell stockholders at its annual meeting late last week that it will be using electron-beam lithography to make a new 16-bit microprocessor aimed at military applications.

The only other semiconductor maker known to be using similar equipment is International Business Machines Corp., which has four machines on its highly automated production line in East Fishkill, N.Y. [*Electronics*, Jan. 27, p. 121]. The random-logic master slices that IBM makes are solely for internal use; apparently that will also be true,

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Logo leads children to computers

At its annual meeting, Texas Instruments was scheduled to unveil its new TI Logo, a simple high-level language intended to teach young children the concepts of programming. It is based on the Logo concept created by Seymor Papert and developed at the Artificial Intelligence laboratory of the Massachusetts Institute of Technology.

The $300 TI Logo package runs on a standard 99/4 personal computer, albeit a well-equipped one. Starting from scratch, the 99/4 and the disk drive, 32-K random-access-memory expansion unit, and color video monitor necessary for Logo—plus the software—will cost $2,525. However, that is much cheaper than earlier versions of the software, which required the power of at least a small-business system.

TI is aiming the product at schools (see photograph) and has already conducted field tests in Dallas [*Electronics*, Oct. 11, 1979, p. 50] and in New York. The child can write simple procedures, create shapes, and draw figures. Papert's idea is that in teaching the computer what to do, the child learns some of the basics of computer operations and becomes familiar with computer logic almost painlessly. **-J. R. L.**

at least initially, for TI's new bipolar processor, a member of the SBP-9900 family.

Fine lines. Electron-beam direct writing is often thought to be the answer to the coming need for sub-micrometer design rules. Now TI can point to solid evidence of its value.

It will be selling another version of the processor, made with standard optical lithography, that achieves minimum design features of 4.5 micrometers. Fabricated with the electron-beam machine, the IC has minimum features of 1.25 μm.

What's more the electron-beam version has a speed-power product rating of 2.8 nanojoules, compared to 3.6 nJ for the standard part. The electron-beam processor has a speed of 10 megahertz and a power dissipation of 280 milliwatts, compared with the other IC's rating of 5.5 MHz and 600 mW. **-J. Robert Lineback**

Conferences

Technologists see Japanese closing gap

The knotty question of U. S. and Japanese conflict in the field of high-technology electronics came under scrutiny at an evening panel session

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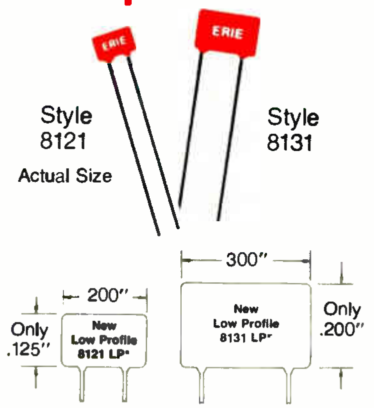

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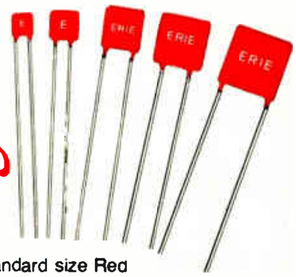

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News briefs

Profits drop sharply for IC makers

The anticipated bleak quarterly earnings reports from Silicon Valley are beginning to emerge. Advanced Micro Devices Inc. of Sunnyvale, Calif., has just announced results for its fourth quarter, ending March 29, that showed profits down 23% from last year's fourth quarter, from \$6.7 million to \$5.2 million, although sales rose 29%, from \$62.2 million to \$80.3 million. Earlier, Intel Corp. of Santa Clara announced that profits plunged 91% for its third quarter, from \$24.1 million to \$2.1 million, on a 9% sales decline, from \$203.9 million to \$184.6 million. Also, National Semiconductor Corp. of Santa Clara has reported a 41% third-quarter drop in net income, from \$12.4 million to \$7.3 million, on a 7.5% sales increase, from \$230 million to \$247.2 million. The companies attribute the drop in income to severe price competition in semiconductors, which has resulted in a decline in profit margins. On the bright side, National reports that U. S. semiconductor order rates are strengthening.

National signs Motorola as bubble-memory second source . . .

Bolstering its intentions to remain active in the commercial market for magnetic-bubble memories, National Semiconductor Corp. has signed an alternative-source agreement with Motorola Corp. The latter's Phoenix, Ariz.-based Semiconductor Group will manufacture and market the 256-K and 1-megabit bubble devices and large-scale integrated bubble-memory controllers developed by National over the last three years. Motorola had a second-source pact with Rockwell International Corp., which recently withdrew from the commercial market [*Electronics*, Feb. 24, p. 35]. National which, already has a second-source agreement with Sagem SA of Paris, will provide Motorola with full design data, including basic device architecture and test procedures.

. . . and sheds its calculator and watch business

National has also signed an agreement to sell all the assets of its calculator and watch operations to Novus Electronics Corp., a new firm formed on behalf of a joint-venture group headed by Sam Nassi, a Beverly Hills, Calif., businessman. The divestiture, for an estimated \$16 million, "is in accordance with our strategic plan to focus on semiconductors and on digital systems where our semiconductor capabilities provide us an advantage," says Charles E. Sporck, president of the Santa Clara, Calif., company

NCR beefs up its interactive processing line

Planting its flag even more firmly in the interactive-processing market for business systems, NCR Corp. is introducing four new systems to consolidate its I series. The new models range from the entry-level I-9010 desktop small-business computer to the I-9050, the largest interactive system introduced by the Dayton, Ohio, company to date. The I-9050 has a 32-bit bus architecture, a virtual memory system, and a 3-megabyte main memory. With a basic processor cycle time of 84 nanoseconds, or 56 ns with an optional performance-enhancement feature, it offers up to twice the performance of the discontinued NCR I-8400 systems. The low-end I-9010, with 64-K to 256-K bytes of memory and a cycle time of 600 ns, will replace the NCR I-8100 family of small-business systems. Two mid-range models—16-bit machines like the 9010—are the I-9020 (512-K bytes and 250 ns) and the I-9040 (2 megabytes and 112 ns) complete the series at this time.

at this month's Electro show in New York—and if there was no resolution, there was at least a clear demonstration that leading electronics research executives from the two countries see the problem in pretty much the same terms as do trade negotiators or company presidents.

Cochairman Bruce Hannay, vice president for research at Bell Laboratories, set the stage for the panel members' statements by noting that the key issue is Japan's move from its position as the perfector of elec-

World Radio History

NATIONAL ANTHEM®

SEMICONDUCTOR NEWS FROM THE PRACTICAL WIZARDS OF SILICON VALLEY.

The 10A MOOSE™ - another first from the linear leaders.

THE FIRST 10A ADJUSTABLE VOLTAGE REGULATOR THAT RADICALLY SIMPLIFIES POWER SUPPLY DESIGNS.

Reliable 16K bipolar PROMs

J-FETs for sensitive signals

Practical octal peripheral drivers

Phased-Locked Loops ease AM/FM design

COP400-PDS development system

New COPS double their memory

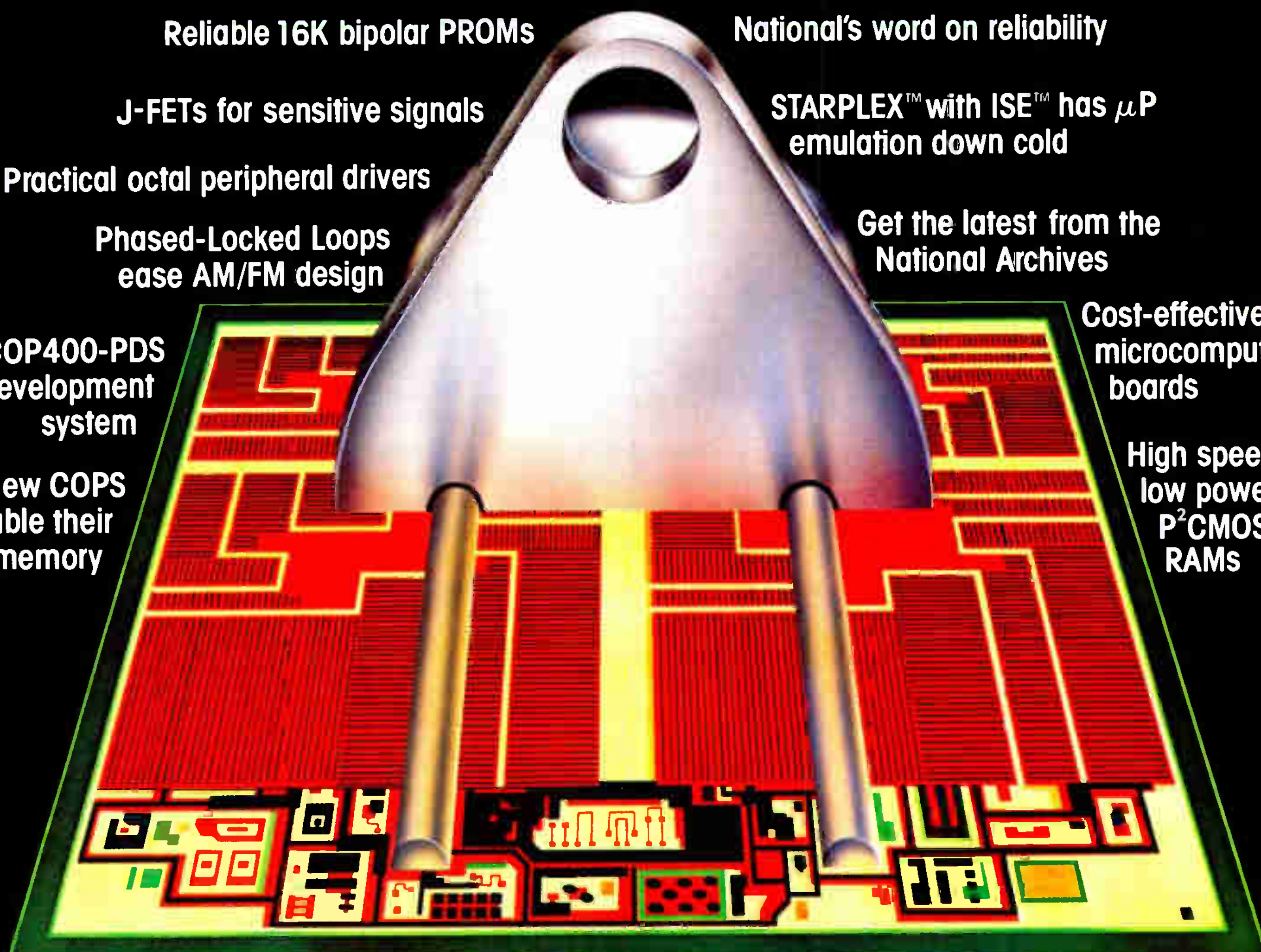
National's word on reliability

STARPLEX™ with ISE™ has μP emulation down cold

Get the latest from the National Archives

Cost-effective microcomputer boards

High speed, low power P^2CMOS RAMs

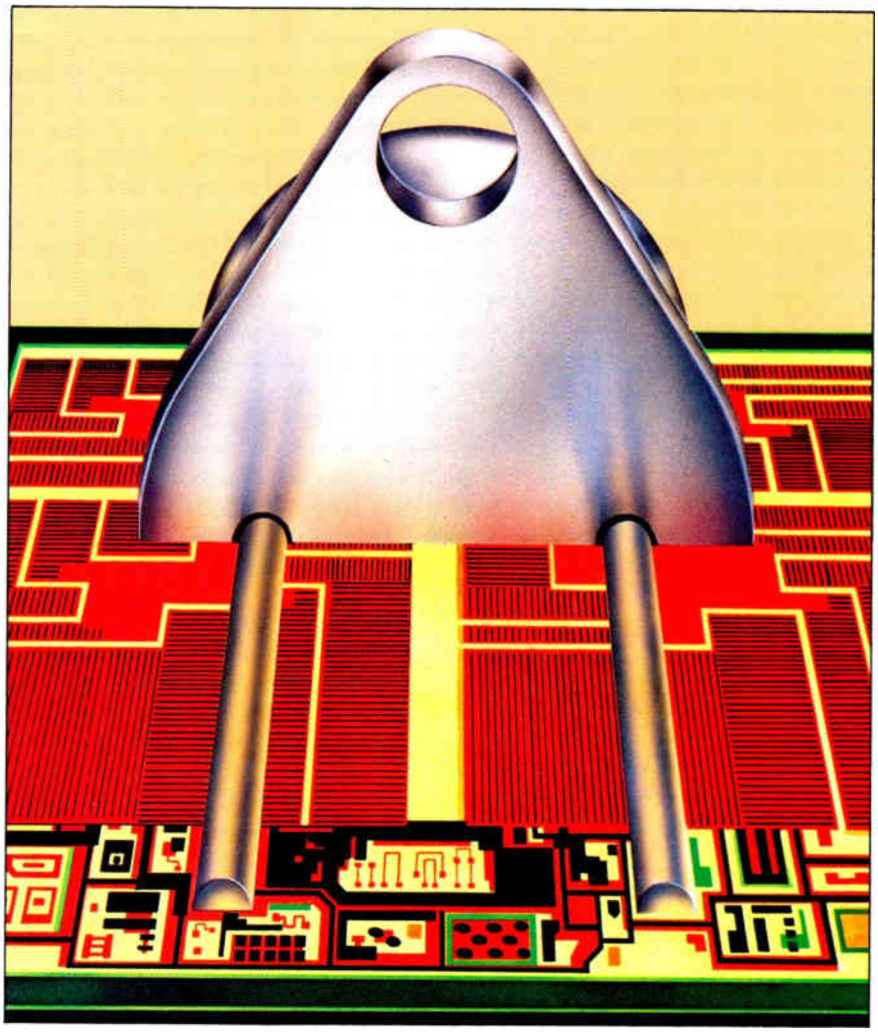


Digitalker COPS Data Acquisition Logic Transistors Hybrids Linear Interface
Bubble Memory RAMs/ROMs/PROMs Transducers Displays Custom Circuits Optoelectronics
Memory Boards Microprocessors Development Systems Microcomputers Modules

NATIONAL ANTHEM

National's 10 Amp MOOSE™ is five years ahead of the pack.

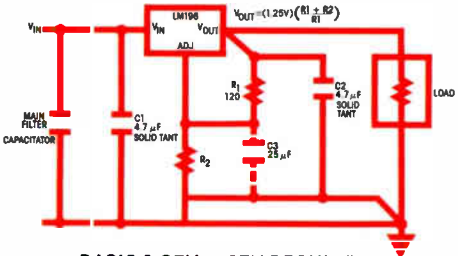
The linear leaders are the first to introduce a 10 Amp monolithic adjustable voltage regulator. It uses National's revolutionary new MOOSE fabrication process that leaves the rest of the industry far, far behind.



MOOSE combines discrete power transistor and modern monolithic linear technologies. By combining both processes, the linear leaders have developed the world's first 10 Amp monolithic adjustable voltage regulator.

That's far and away the highest output current available in any adjustable IC voltage regulator.

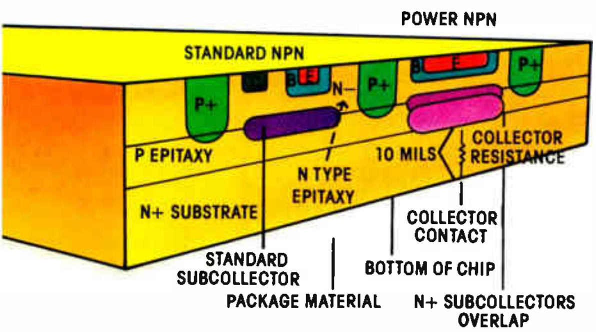
The LM396—available in the standard TO-3 package features on-chip trimming of reference voltages to ±0.5%, with simultaneous trimming of reference temperature drift to 30ppm/°C.



BASIC 1.25V to 15V REGULATOR

Strict attention to thermal interaction between the control circuitry and the pass transistor results in excellent line regulation (0.005%/V) and load regulation (0.07%/A).

It's continuously adjustable from 1.25V to 15V and can satisfy higher output voltages as long as the maximum input/output voltage differential (20V) is not exceeded.



MOOSE PROCESS

Even with high power dissipation, this high-performance monolithic regulator can handle 10 Amps with power levels up to 70 watts.

In addition, the LM396 is the first to allow operating temperatures up to 200°C while providing all the protection features of National's lower power 3-terminal adjustable regulators. Furthermore, 100% thermal limit burn-in guarantees these features under actual overload conditions.

High performance, low price. The advanced MOOSE process results in a 2:1 reduction in die size and significant leaps in operating efficiency. These advances, backed by National's manufacturing expertise, strict quality control procedures and large volume production, result in a low $12.35* unit price for the LM396 in 100 piece quantities.

MOOSE has left the competition to their own devices. With the advent of MOOSE, the linear leaders have overcome major limitations in die topology and inefficiencies that will plague the competition for years to come.

Meanwhile, National is constantly researching new applications for their new MOOSE technology, perhaps even a 30 Amp regulator. Other possibilities include switching regulators, buffer amplifiers, solenoid drivers and heaters for aluminum smelters.

You can expect to see a complete array of MOOSE-based devices from National in the future. But then, who would expect less from the linear leaders?

To get the full picture on MOOSE, check box number 069 on the National Anthem coupon in this issue.

*U.S. price only.

MOOSE is a trademark of National Semiconductor Corporation.

World Radio History

J-FETs – the time-proven solution to increased signal sensitivity demands.

The reliable back-to-basics solution to design overcomplexity.

National is known throughout the industry for their high performance line of J-FETs. They make over 500 standard products using 18 processes. And they're all available in quantity now.

The result is a J-FET for virtually any application problem.

The economics of plastic. No one offers plastic J-FETs with leakages as low as National's. Their PN4117A—normally used in smoke detector applications—has a leakage current of 1.0 pA max, 0.3 pA typical. Copper lead frames offer low thermal EMF voltages in ultra-low leakage switching applications such as digital voltmeter range switches.

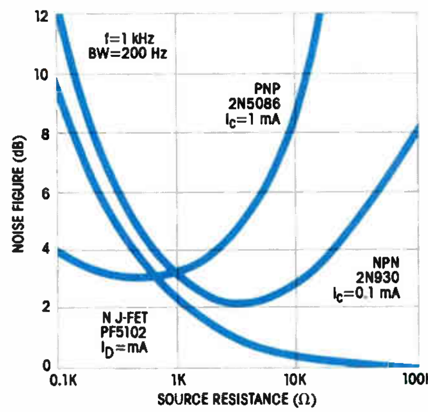
But the best news is National's plastic J-FETs offer leakages comparable to the metal can versions, with plastic devices costing 50% less. So now versatile plastic packages can be designed into applications requiring extremely tight specs.

High performance on the job. J-FETs offer outstanding performance in circuits that demand signal detection, selection and isolation without the undesirable transfer of noise or signal cross-modulation. Which makes a big difference in differential amplifiers used in pre-amps, operational amps and many instrumentation designs.

J-FET practicality is basic reliability. The J-FETs' versatility allows them to rescue designs wrought with overcomplexity. And National's broad line of both single and dual J-FETs offers a flexibility of design along with competitive pricing and solid reliability. Together they give engineers considerable freedom of choice.

Check box number 074 on this issue's National Archives coupon or contact your local distributor or NSC sales rep for additional information. For application assistance, call one of National's FET Wizards at (408) 737-5554.

And start getting back to basics with high performance J-FETs.



BIPOLAR AND J-FET TRANSISTOR NOISE COMPARISON

World Radio History

Titanium-tungsten fuses improve 16K PROMs.

The industry's largest bipolar PROMs from National guarantee an extra measure of reliability, thanks to titanium-tungsten fusing and today's high volume Schottky production processes.

National's technical expertise puts them out in front with significant bipolar advances that make practical sense.

Their 87S190 and 87S191 state-of-the-art 16K bipolar PROMs are an example. They're as fast and as large as any in the industry. And yet their titanium-tungsten fusing and high volume Schottky production process gives them rock-solid reliability.

These high-speed PROMs are Schottky-clamped for a typical address access of 40 ns and a typical enable access of 20 ns. In addition, they use PNP inputs to reduce input loading. And they incorporate TRI-SAFE™ for low voltage programming, with all DC and AC parameters guaranteed over temperature.

Fuses that last. National's titanium-tungsten fuses are made of a very stable and reproducible metal combination which resists oxidation.

National uses an on-chip Darlington programming circuit that "pulse shapes" the programmer's input and sends a very fast, high energy current pulse to the selected fuse.

This minimizes local heating and produces a wide gap in the fuse link. One free of residual conductors and without deteriorating hermeticity. It all results in a very reliable PROM.

Additionally, the titanium-tungsten fusing allows a low 10.5V programming voltage. And that eliminates the need for guard rings and wide spacings.

Reliable PROMs from proven processes. As an additional measure of practical reliability, this family of PROMs uses titanium-tungsten as a buffer between the aluminum interconnect and the platinum-silicide "barrier." They use the same basic production flow as for standard Schottky bipolar RAMs, ROMs and other logic circuits. It's a proven process that works time-after-time.

National's tight quality control and practical innovation pay off in highly reliable, high volume products. In the TRI-STATE® PROMs, for example, only 11 failures have been observed in 2.7 million hours of testing. And not one of the failures was fuse-related.

So you can't go wrong with National's 16K bipolar PROMs.

The product table in this article gives the part number, organization and T_{AA}. But, for more information on these and other long-lasting memories check box 043 on the National Anthem coupon.

PROM SUMMARY TABLE

PART NUMBER	T_{AA} (MAX COMM)	ORGANIZATION
DM74S188/288	35	32 x 8
DM72S287/387	50	256 x 4
DM74S570/571	55	512 x 4
DM74S472/473	60	512 x 8
DM74S474/475	65	512 x 8
DM74S572/573	60	1024 x 4
DM87S180/181	60	1024 x 8
DM87S184/185	55	2048 x 4
DM87S190/191	65	2048 x 8

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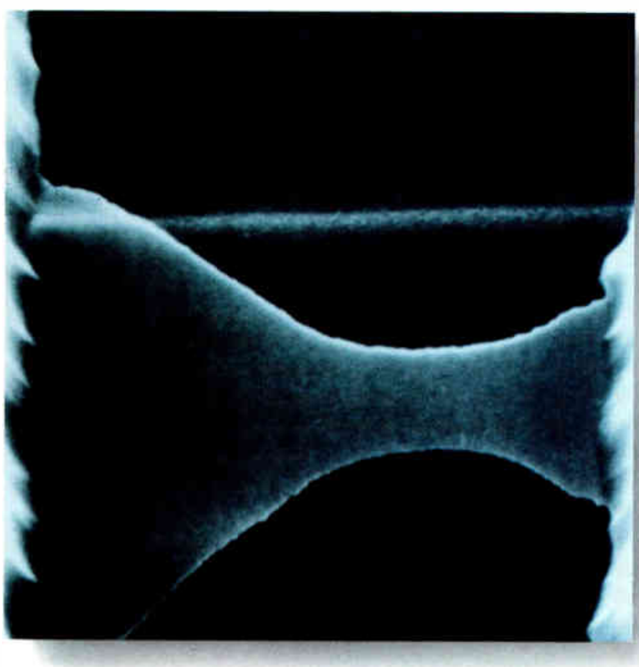
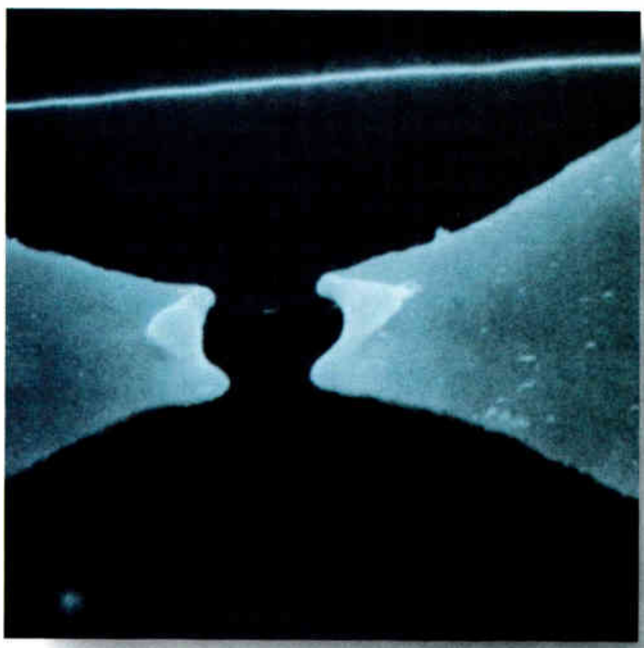




SCANNING ELECTRON MICROPHOTOGRAPHS OF NATIONAL'S TITANIUM-TUNGSTEN FUSES IN THE CLOSED AND OPEN STATE.

World Radio History

P²CMOS™: A new generation of low power high performance RAMs.

National leads the industry with their new P²CMOS memories.

P²CMOS, National's silicon-gate complimentary—MOS process, has made possible a whole new generation of static RAMs.

These high density RAMs employ two levels of polysilicon interconnect and one level of metal interconnect and the result is NMOS speed at CMOS power.

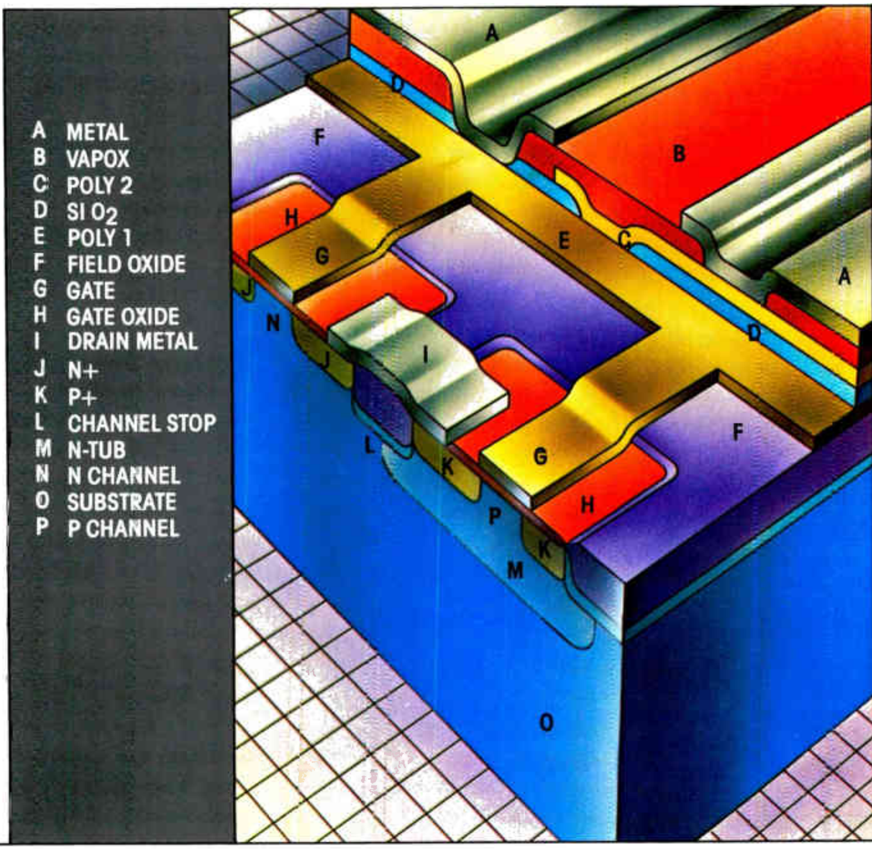
And these RAMs—available in military, commercial and industrial versions—take full advantage of P²CMOS: higher reliability, low power and heat dissipation, and improved immunity to system noise and alpha particles.

For data sheets and additional information check boxes 043 and 064 on the National Archives coupon.

P²CMOS STATIC RAM FAMILY

Part Number	T_{AA} (ns)	Organization
NMC 6508	180-300	1K x 1
NMC 6518	180-300	1K x 1
NMC 6551	220-350	256 x 4
NMC 6552	220-350	256 x 4
NMC 6503	300-350	2K x 1
NMC 6504	300-350	4K x 1
NMC 6513	300-350	512 x 4
NMC 6514	300-350	1K x 4

P²CMOS is a trademark of National Semiconductor Corporation.



National carries the broadest line of cost-effective microcomputer boards.

Save time and money with over 85 Series/80 board level computer products from the Practical Wizards.

When it comes to selecting board level computer products, it never pays to gamble on boards that don't easily lend themselves to practical application.

This is precisely why National offers over 85 MULTIBUS™-compatible Series/80 products. Because the Practical Wizards believe that no product should have to be forced into an application.

And although many customers come to National for plug-compatible replacements for Intel® SBC products, their Series/80 BLC line is hardly just a second source supply.

In fact, a full two-thirds of their Series/80 Family is made up of proprietary products, including CPUs, memories, analog and digital I/Os, peripheral controllers, rack-mounted systems, a full complement of card cages, power supplies, cables and other accessories.

And each one features high reliability, functionality of design, and the longest warranty coverage in the business.

Setting a good example. The depth and breadth of the Series/80 product line can best be illustrated by examining just a few of its members.

The BLC-8222 Double Density Floppy Disc Controller can handle up to four dual or single-sided drives (either standard or mini). It features CRC error checking with programmed re-try, user definable sector sizes and switch selectable base addresses that allow multiple controller systems.

The BLC-8737 Analog I/O board with 12-bit resolution makes each input and output channel appear to be a RAM address. On-board logic eliminates the need for the system CPU to drive the analog circuitry through its conversions. Its 16 single-ended (8 differential) input channels are easily expandable to twice that capacity.

The BLC-8715 Intelligent Analog I/O board was specifically designed for industrial and process control systems. This new product offloads all of the analog data processing and many of the control functions normally performed by the host CPU.

And in doing so, the CPU may then devote more of its valuable resources to the rest of the control system.

The BLC-8064 A/B Family offers parity or Error Checking and Correction (ECC) on 16K, 32K, 48K and 64K RAM boards. In all, they can deliver a dramatic improvement in reliability over conventional RAM boards. The kind of reliability only minicomputers could supply in the past.

Check box 035 on this issue's National Archives coupon for free literature on these and all of the practical Series/80 products from National Semiconductor.

With the strength of the industry's broadest selection to choose from, you can't go wrong.

Intel and MULTIBUS are trademarks of Intel Corporation.

World Radio History

NATIONAL ANTHEM

How to turn a μP bus into high current, high voltage peripheral drivers.

The new DP8310/11 octal peripheral drivers make interfacing easy.

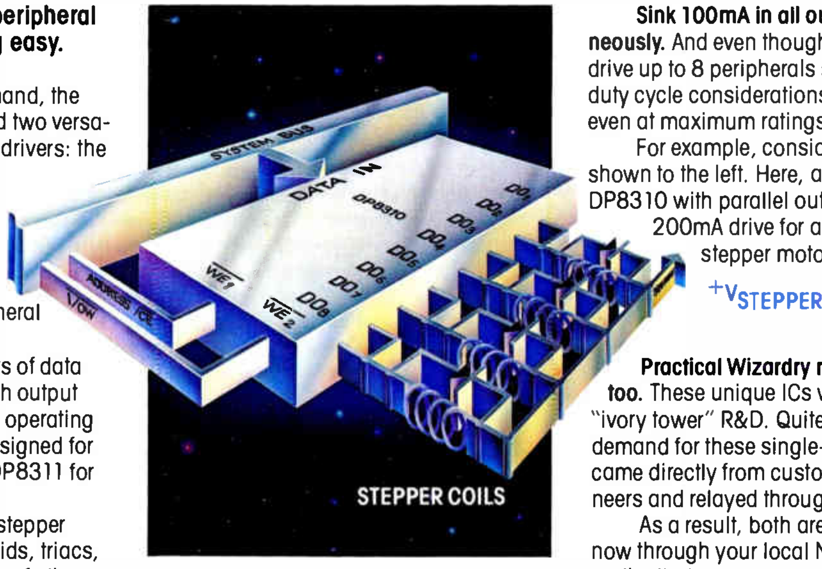
In response to popular demand, the Practical Wizards have produced two versatile new octal latched peripheral drivers: the DP8310 and DP8311.

Since they interface directly to any microprocessor bus, the DP8310/11s easily and economically turn the bus into high current, high voltage peripheral drivers.

Both devices latch eight bits of data with open collector outputs, each output driving up to 100mA DC with an operating range of 30V. The DP8310 is designed for positive edge latching and the DP8311 for fall through latching.

So they're ideal for driving stepper motors, fiber optic LEDs, solenoids, triacs, relays, displays and any number of other high current, high voltage peripherals.

Maximum design-in flexibility. These unique logic interface circuits provide truly maximized design-in flexibility. In addition to the open collector outputs, the DP8310/11s operate from a single 5V supply with ±10% tolerance.



They also feature internal "glitch free" power-up clear to enhance the integrity and safety of the application design.

Sink 100mA in all outputs simultaneously. And even though each device can drive up to 8 peripherals simultaneously, all duty cycle considerations are eliminated—even at maximum ratings.

For example, consider the application shown to the left. Here, a single 20-pin DP8310 with parallel outputs is providing 200mA drive for a four-phase bilfilar stepper motor.

Practical Wizardry means listening, too. These unique ICs were not born of "ivory tower" R&D. Quite the contrary, the demand for these single-chip functions came directly from customer design engineers and relayed through National's FAEs.

As a result, both are available right now through your local NSC sales office or distributor.

The DP8310/11. Because Practical Wizardry means listening, too.

For free data sheets, check box number 063 on this issue's National Archives coupon.

Universal PLLs simplify AM/FM design.

By combining ECL and I²L technologies, National designed the first single-chip AM/FM Phase-Locked Loops that did not require external prescalers.

National's DS8906 and DS8907 universal Phase-Locked Loops were the first to offer extremely low-noise operation with single-chip versatility.

Thanks to their simple serial data interface, these highly sensitive PLLs operate effectively with the COPS™ Family (or a wide range of other) microcontrollers. This universal approach makes the DS8906/07s ideal for any digital AM/FM radio design.

No prescalers required. The DS8906 and DS8907 were the first PLL frequency synthesizers to accept 120MHz directly. By reducing these functions to a single 20-pin chip, National can offer the double advantage of small size plus high performance and versatility.

In addition to their AM and FM frequency references (500Hz and 12.5kHz, respectively for the DS8906; 10kHz and 25kHz, respectively for the DS8907), both PLLs feature a 50Hz "time of day" reference for digital clock radio designs. All generated from an on-board 4MHz crystal controlled oscillator.

High volume production. National Semiconductor, a long-time leader in bipolar ECL/I²L technology, has their distributors well-stocked with both the DS8906 and DS8907 Phase-Locked Loops. And due to their current high volume production, these versatile PLLs are very competitively priced.

For complete information on National's low-noise Phase-Locked Loops, check box number 047 on this issue's National Archives coupon.

COPS is a trademark of the National Semiconductor Corporation.

World Radio History

New COPS microcontrollers double their memory capacity.

The new COP444L and COP445L microcontrollers pack 2K x 8 ROM and 128 x 4 RAM into the family's standard packages.

Two new high-end COPS™ Family microcontrollers, the COP444L and the COP445L, offer twice the on-chip memory as any other family member.

Both devices are compatible with the rest of the family in all respects—the architecture, instruction set, packages and options. But the COP444L (23 I/O lines; 28-pin DIP) and COP445L (19 I/O lines; 24-pin DIP) each carry 2K x 8 ROM and 128 x 4 RAM for the most advanced single-chip solutions for large microcontroller applications.

Another clear advantage of the two new COPS is their amazingly low power requirements: 55mW at 5V operation. In addition, they're available in two power range options, 4.5V to 9.5V or 4.5V to 6.3V.

The distribution of intelligence. The COPS Family represents a unique approach to microcontroller applications.

Every COPS peripheral device has enough intelligence designed into it to execute at least a few instructions on its own. By distributing the processing workload to each device on the MICROWIRE™, every COPS system is optimized for efficiency.

And because the COPS instruction set consists of simple task-oriented operations, they not only take up less memory space, they also accomplish each task in less time than other single-chip microcontrollers.

The benefits of this family approach are felt throughout the development phase as well. The entire family is supported by a single development system (the COP400-PDS). Real-time emulation of the COP444L and COP445L is performed by the COP-E04L board. The COP400-T01 functional tester is a development system option useful in testing any COPS device.

Freedom of choice. So now the design engineer can pick and choose from a wide variety of key specs: CPU size, fabrication technology (CMOS, low-power NMOS, high-speed NMOS), the temperature range, the voltage range, the speed, the I/O options and the package size and type.

In short, the COPS Family offers the freedom to choose from a broad range of compatible microcontrollers and peripherals to closely match the requirements of each design.

And now that the high-end COP444L and COP445L are readily available, there's all the more reason to exercise that freedom.

For more information on these devices and the entire COPS Family, check box number 044 on this issue's National Archives coupon.

COPS and MICROWIRE are trademarks of the National Semiconductor Corporation.

The low cost, easy-to-use development system for COPS™ microcontrollers.

It's the COP400-PDS, with a host of features for microcontroller software and hardware development.

The COP400-PDS product development system is the most cost-effective way to edit, assemble and debug hardware and software for COPS microcontrollers.

The COP (Controller Oriented Processor) family is National's complete line of single-chip microcontrollers. Each contains all the necessary system timing, internal logic, ROM, RAM and I/O to implement dedicated control functions in a variety of applications.

Disk storages eases the effort. The user interacts with the COP400 via a front panel keypad or an optional CRT and printer. Programs are edited and stored on the COP400's floppy disk.

Disk storage allows users to perform edit-assemble-test cycles much easier than on paper tape systems. And it's the most convenient means of providing National with the program data necessary for the mask-making process.

An important feature of the COP400-PDS is its debugging capability. It enables users to single step through a program, breakpoint to an address, trace program execution and dump out internal COP400 registers. The ability to execute these types of commands significantly reduces development time.

An emulator card attachment allows the execution of object code under the system's control. And an additional QUIKLOOK™ test module provides GO, NO GO inspection testing of incoming COPS devices.

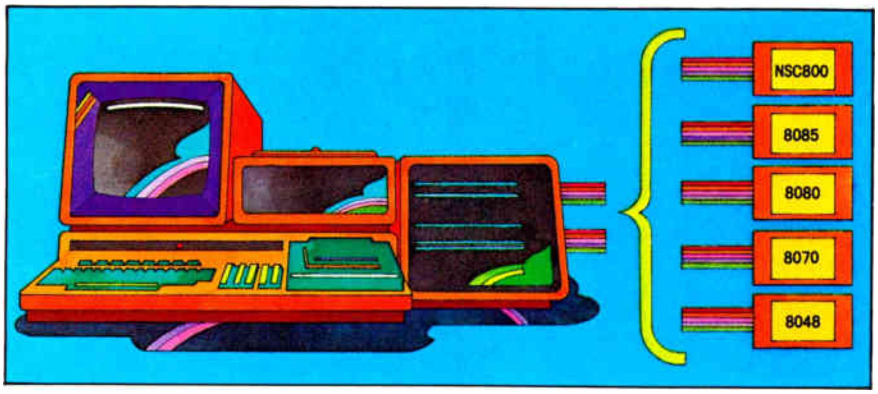
This is, after all, National's way of providing an integrated concept support for their line of COPS microcontrollers.

For more information on the COP400-PDS and QUIKLOOK tester check box number 070 on the National Archives coupon.

COPS and QUIKLOOK are trademarks of the National Semiconductor Corporation

World Radio History

ISE™ has microprocessor emulation down cold.



STARPLEX™ with ISE—National's fully developed development system.

The Practical Wizards have created an easy-to-use development tool that helps design engineers do their entire job on the STARPLEX development system. It's called ISE (In-System Emulation).

With ISE, engineers can now develop, test, analyze and debug prototype software/hardware for 8080, 8048, 8049, 8070, INS8050, Z80, COPS™ microcontrollers, 8085 and NSC800 microprocessors plus their Series/80 BLC boards.

ISE's powerful debugging capability allows simultaneous software and hardware debugging of single or multiple processors for faster, more efficient system integration.

And since the symbol table is available during emulation, the same symbols are used in debugging that are used in writing the program being examined.

STARPLEX's symbolic debugging capability provides not only the usual breakpoint conditions, but also a "coast" command which allows you to continue executing a program after the breakpoint combination has been satisfied.

Also, with ISE's in-line assembler and disassembler programmers can modify object code and display it in assembly language without having to leave the debug and emulation environment. And without editing and re-assembly of the entire source program, thus eliminating many tedious manual steps.

National's easy-to-learn ISE software comes completely integrated into the STARPLEX system, including the unique Automatic Testing mode called "In File."

In-File implements a predefined sequence of tests. ISE can also record those results to show exactly how each part of the system performs during the tests.

When you get right down to it, National's STARPLEX with ISE offers features not available in any other development system on the market today. Yet it costs substantially less to own and operate than any system on the market.

For complete information on STARPLEX and ISE, check box 037 on the National Archives coupon.

The Practical Wizards have μP emulation down cold.

STARPLEX, ISE and COPS are trademarks of National Semiconductor Corporation.

Get National's word on quality and reliability. In writing.

At National, the integrity of their quality continues to establish industry standards. And they publish a bimonthly newsletter that tells the story.

It features articles that give the full scoop on the immense amount of money, equipment and programs devoted to building the best and most reliable microcircuits in the world.

National calls it the Reliability Scanner. Subscribers call it thought-provoking, revealing, and relevant. What's more, it's free from National.

So now anyone can get the behind-the-scenes story on National's quality and reliability programs.

Just check box number 068 on this issue's coupon. And learn how National is making the best semiconductors in the business.

What's new from the National Archives?

035 ☐ Additional Series/80 Information
036 ☐ Optoelectronic Handbook ($3.00)
037 ☐ STARPLEX™ and ISE™ Information
043 ☐ Memory Data Book ($6.00)
044 ☐ MOS Data Book ($6.00)
047 ☐ DS8906/07 Data Sheets
052 ☐ Free Subscription to the Data Update
063 ☐ DP8310/11 Data Sheets
064 ☐ P²CMOS Memory Data Sheets
068 ☑ Rel Scanner Newsletter
069 ☐ MOOSE™ Brochure Data Sheet and Adjustable Regulator Brochure
070 ☐ COP400-PDS™ and QUIKLOOK™ Tester
074 ☐ Additional J-FET Information

Enclose check or money order based upon appropriate currency. Make checks payable to National Semiconductor. All prices shown are U.S. prices only. Add applicable state and local sales tax to your order. Allow 4-6 weeks for delivery. This coupon expires on July 31, 1981.

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Santa Clara, CA 95051

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Industriestrasse 10
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West Germany

National Semiconductor
The Practical Wizards of Silicon Valley

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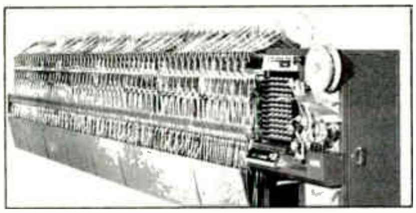
World Radio History

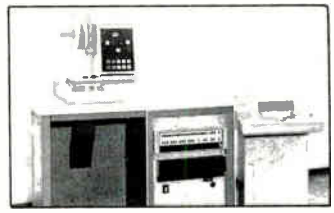
Universal Automation in Electronics

There's a labor-saving Universal Instruments machine or system for almost every electronic assembly manufacturing need. Not just one machine that will do the job for you better and faster, but a whole array of machines, systems and peripheral equipment. They range from table-top manual units that help the operator increase output, to complete production lines. Many of these systems are modular in design, so that you can increase production capability as your volume grows. Among them you'll find the perfect match for your particular need, whether your problem involves increasing productivity, improving quality, or reducing per unit cost.

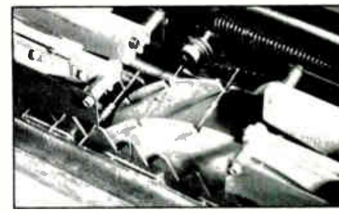
Model 2425/2315 Axial Lead Straightener-Taping Machine. Automatically straightens leads of axial components and tapes them at a rate of 15,000/hr



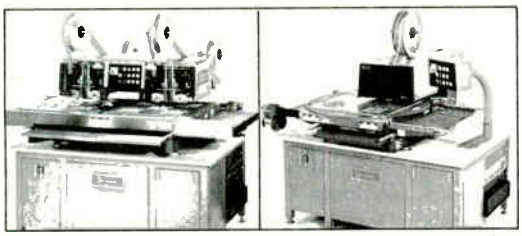
Model 2596 Expandable Component Sequencer. Sequences axial lead components, including jumper wires at rates up to 25,000 an hour for programmed insertion. Modules can expand from 20 to 160 input stations



Model 2863 Off-Line Tester. Can be used for inspection of incoming components, or sequenced components at up to 36,000 an hour

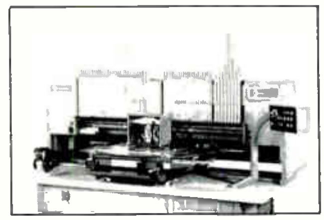


Model 2862 On-Line Sequence Tester. Mounts on Model 2596 Sequencer and detects missing, out-of-sequence and faulty components and stops machine cycle for correction of error at up to 22,500 components an hour

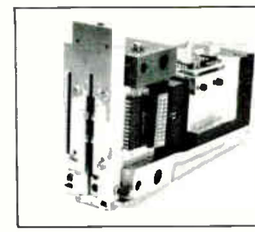


Model 6285/6295 High-Speed VCD Axial Lead Insertion Machines. The ultimate in automatic insertion of axial lead components. Cycle rates of 12,500 insertions an hour on single head Model 6285, 25,000 an hour with dual head Model 6295

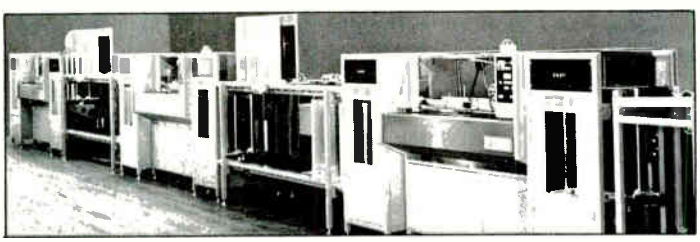
Model 6345 Radial Lead Sequencer/Inserter. Cycles at insertion rates of over 7,000/hr. Will insert a broad variety of radial lead devices, including capacitors, peaking coils, and "hairpin" axials



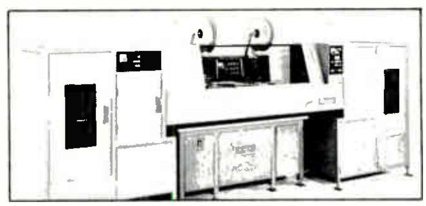
Model 6792 Multi-Module™ DIP Insertion Machine. High-speed automatic insertion of two different DIPs selected from 300", 400", 600" sizes, sockets, and small 2- and 4-lead 300", sizes



Model 2866 DIP Verifier. Verifies that each integrated circuit module is the correct type, functional and correctly oriented

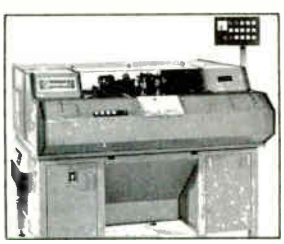


Pass-Thru™ Automatic Board Handling System eliminates manual board feeding and removal. System accepts boards in stack or magazine input, moves them through the machine and accumulates inserted boards in a magazine loader for automatic movement to the next machine

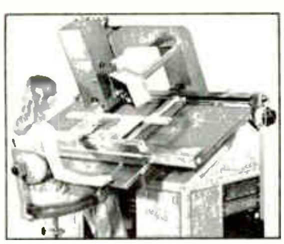


Model 6911 Auto Load™ Board Handler permits hands-free automatic circuit card loading and unloading of VCD type machines

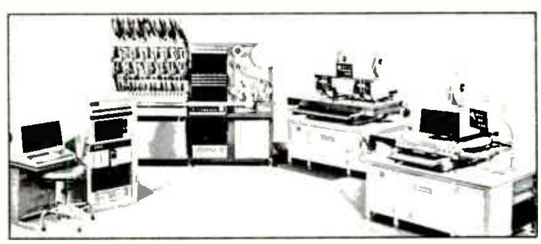
Model 6232 Man-U-Sert Manual Assembly Machine. Machine automatically positions board, shows operator exact location for each insertion, cuts and clinches leads after insertion



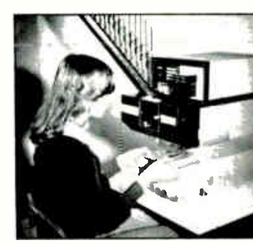
Model 4611 Hybrid Microelectronic Assembly Machine. Automatically places chip capacitors, integrated circuits and other microelectronic devices as small as .030" on substrates at cycle rates up to 3,600/hr



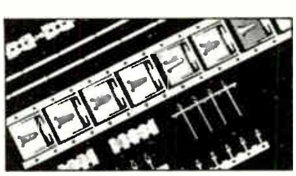
Model 3986/3991 Wire Termination Machines. Panels are positioned under termination gun and indicate wire to operator, for termination rates of 600 to 1200 wires/hr



Model 8212 Satellite Controller System. Multi-machine capability and centralized program generation and storage make this the world's most productive computer-based machine control system



Model 6731 Mod-U-Sert® Manual DIP Insertion Machine. Easily-programmed built-in memory automatically feeds 300", .400" or 600" DIPs from 12- or 16-magazine feed rack



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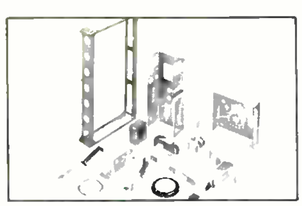

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tronics technology originating in the U. S. toward a position of leadership in innovation, thereby closing the gap with the U. S. No panelist disagreed with the assessment.

■ Michael L. Dertouzos, director of the laboratory for computer science at the Massachusetts Institute of Technology, put much of the blame for the U. S. decline squarely in the laps of American industry, which he criticized for failing to invest significantly in long-term research efforts, as have the Japanese. He strongly supported the free flow of information between the two countries, arguing that the U. S. should strengthen its strong suit of innovation and Japan its expertise in developing marketable products.

■ William C. Hittinger, executive vice president for research and engineering at RCA Corp., faulted Japan for its wide-ranging restraints on foreign competition. He did so diplomatically, and indeed the full force of his criticisms may not have sunk in at the panel.

■ Hiroshi Inose, a University of Tokyo researcher who has just resigned as head of the school's national computer center, maintained that the Japanese drive to develop original computer and communications technology is largely due to domestic pressures caused by the lack of natural resources and rising personal expectations. Technological competition between the two countries is vital, he said, for without it there will be no innovation.

■ Michiyuki Uenohara, associate senior vice president for Nippon Electric Co. and director of research at the NEC laboratory, urged a U. S. reassessment of Japanese competition, saying that although Japan's factory productivity and quality of goods is high, office productivity is low and the mercantile distribution system is inefficient. Like other panel members, he promoted the idea of vigorous but fair competition between the two countries.

Wrapping up the panel, cochairman Leo Esaki, an IBM researcher and a 1973 Nobel laureate in semiconductor physics, noted from his

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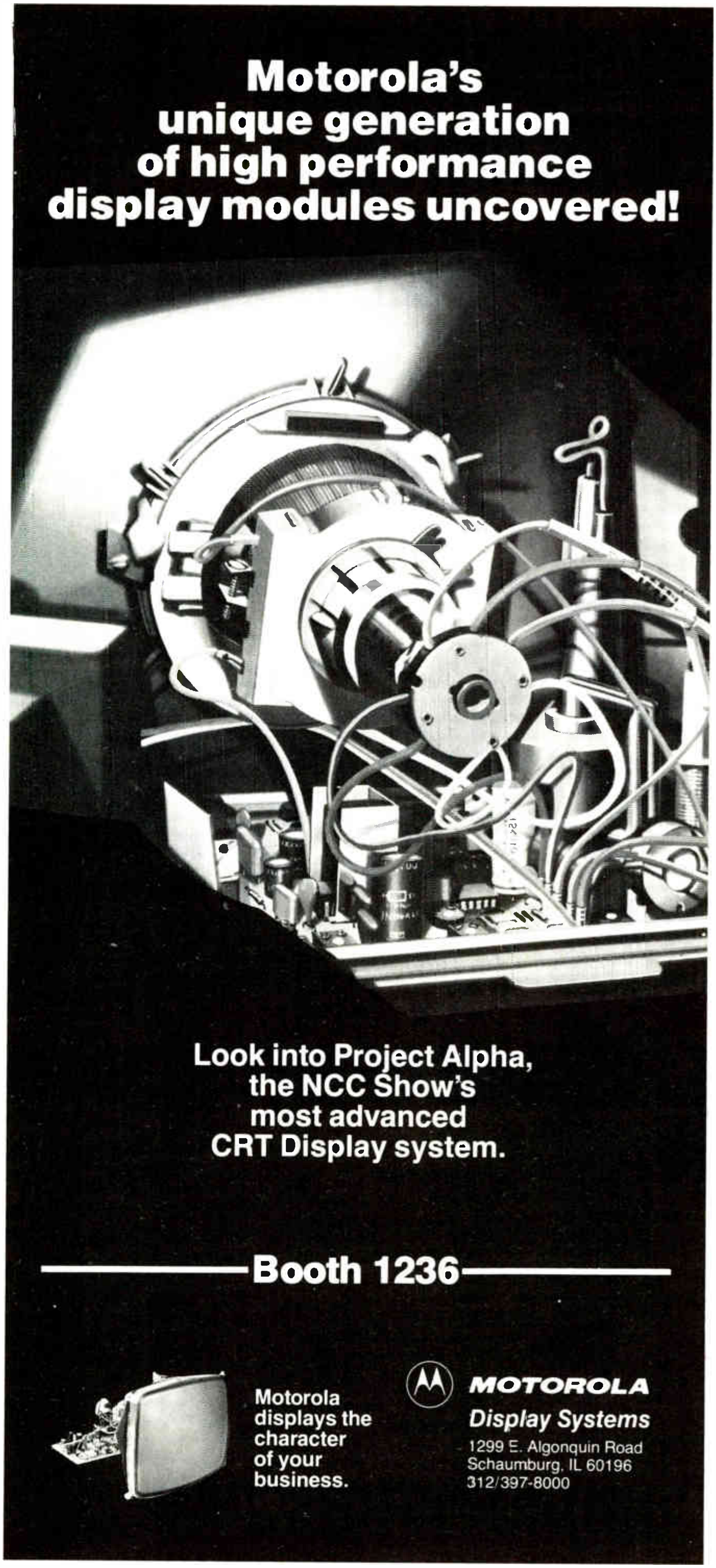

personal knowledge of the two countries' cultures that they have very different ground rules. For example, the goal of the U. S. educational system seems to be to turn out good officers, whereas Japan seems to emphasize turning out good soldiers.

The panel was one of many events at a crowded and busy Electro. Unaudited attendance was put at 42,900, up substantially from the 32,000 that came to the 1979 show in New York. There were 402 exhibitors occupying 834 booths, compared with 394 exhibitors and 690 booths in 1979 and with 352 exhibitors and 750 booths last year, when Electro was held at its alternate site, Boston. *-Electronics* staff

Peripheral equipment

Cache memories catch on for disks

Speeding up computer access to disk drives by applying traditional cache-memory techniques is gaining popularity. Minicomputer Technology last week announced the first in a new family of products that, like a similar offering from Computer Automation Inc., moves a cache from its usual application between the central processing unit and main memory to between main memory and the disk storage.

The Turbo-21, the first family member from Minicomputer Technology in Palo Alto, Calif., can improve disk throughput by as much as 80% on Digital Equipment Corp. PDP-11 and VAX systems. The unit, from Computer Automation's Commercial Systems division in Irvine, Calif., reduces average disk access time from 40 to 4 milliseconds [*Electronics*, April 7, p. 33]. A somewhat similar concept is also being applied to floppy-disk drives by an English company.

Like the classical main memory cache, the disk cache is a smaller, higher-speed memory to hold data currently in frequent use. MOS random-access memories are sufficient for the task because they are faster

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ACDC Salesman: Harnesses are a point of potential failure. There are possible cold solder joints vulnerable to everything including shipping vibration, not to mention noise considerations in how the harnesses are placed throughout. No one has ever successfully introduced a switching supply without hard wiring until our RS/RT Series.

Customer: When you say you test the daylights out of them, give me some details.

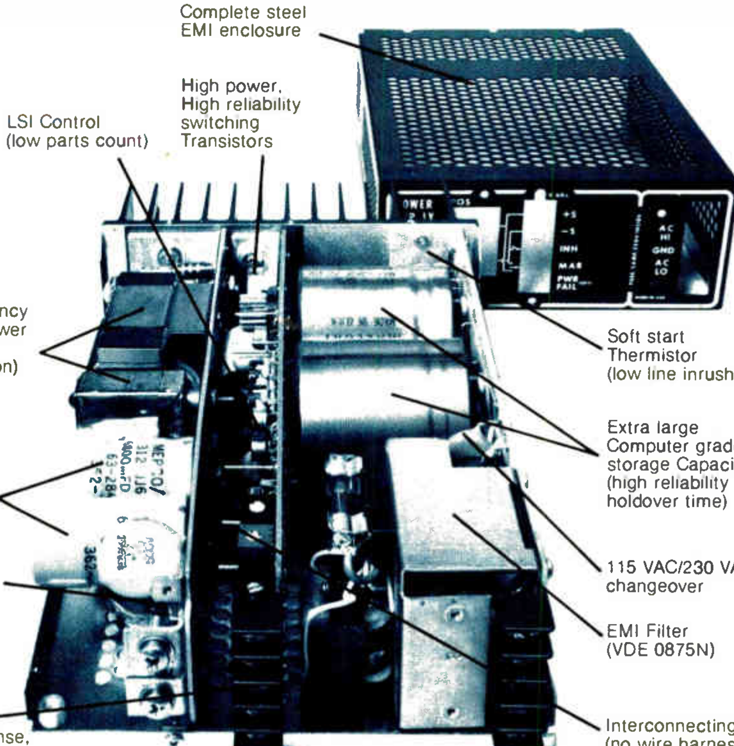
ACDC Salesman: O.K. First, all of our active devices are 100% screened. We stable bake, temperature cycle, and then 100% electrical test. All to MIL-STD-883B. The modules themselves are computer tested. When we assemble them into the final unit, we first Auto-Test, then burn-in for 48 hours at 50°C under full load, cycled, Auto-Test again with computer print out- serialized. You get one copy of the hard test data and we keep a copy. In other words we all know exactly what you're getting.

Customer: Everything sounds good, but what about the cost?

ACDC Salesman: Simple. We save you money because instead of building a hundred of these and fifty of those, etc., we continuously build thousands of the same modules each month. That saves us, and you, money. We test everything thoroughly and that eliminates warranty returns, reworks and all those costly problems. Believe me, if you've ever seen the production of power supplies, you'd know we have a uniquely superior product here...and, at a fantastically low price.

Customer: It sounds to me like you've brought power supply technology up to date.

ACDC Salesman: Thanks...we think our RS/RT Series are the switchers of the 80's.



RS Series/Single Output

SINGLE OUTPUT					
OUTPUT VOLTS	OUTPUT CURRENT				
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2	10.0	20.0	30.0	60.0	—
5	10.0	20.0	30.0	60.0	75
6	8.0	9.0	25.0	50.0	—
12	4.5	9.0	13.5	27.0	31
15	3.6	7.2	10.8	21.0	25
18	3.0	6.0	9.0	18.0	—
24	2.5	4.5	7.0	13.0	15
28	2.0	4.0	6.0	11.5	—

RT Series/Triple Output

MULTIPLE OUTPUT				
	TRIPLE			QUAD
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MAIN OUTPUT	5V 20A	5V 30A	5V 60A	5V 30A
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than any disk. A complex algorithm determines what data is most likely to be frequently used for the work in progress. It may be executed by the CPU or by a microprocessor that is part of the cache.

The Turbo-21 is a single board that holds 128-K bytes of dynamic RAM with transparent refreshing. All connections to the main processor are through Minicomputer Technology's EDC-21 disk controller, and as a result no changes to system software are necessary.

More planned. The single-unit price of the Turbo-21 is $6,750. Future releases of the line will work with the company's other disk controllers for Data General computers, Perkin-Elmer products, and DEC LSI-11s.

Computer Automation's disk cache for its business systems uses its semiconductor disk [*Electronics*, Sept. 11, 1980, p. 54]. The company modified the software for this product so that it can now serve as the cache in an alternative duty.

There are two proprietary 16-bit microprocessors, one a controller interfacing with the main processor and the other a controller for the disk cache. The list price is $30,000 for the basic cache with 256-K bytes of dynamic RAM and $15,000 for each additional 256-K bytes.

Floppy enhancement. Another cache approach to performance enhancement, one for floppy disks, is a software package that uses part of main memory for buffering disk data to reduce the number of disk accesses. The Turbocharger package from Equinox Computer Systems Ltd. of London runs on top of the CP/M operating system for the Equinox series 500 and 8000.

By using part of main memory as a level of buffering between the disk and program memory, the Turbocharger speeds up floppy-disk access by three or four times, also using optimizing techniques like storing the most frequently used sectors. The user can choose the buffer size in main memory to get the maximum performance improvement for his application mix. The software costs $325.

-Tom Manuel

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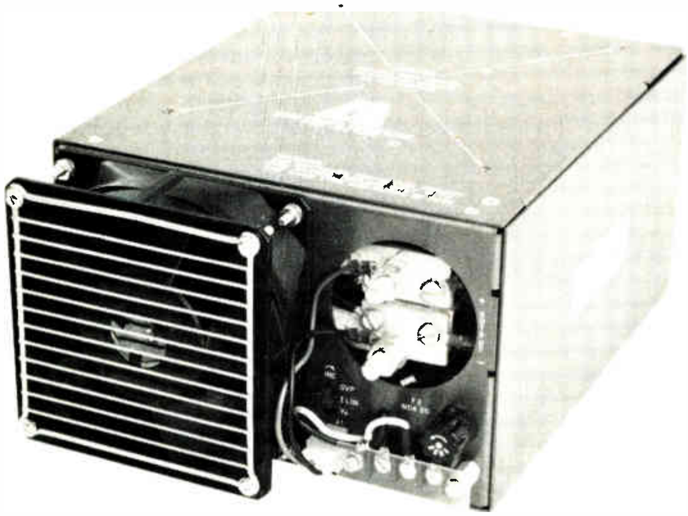

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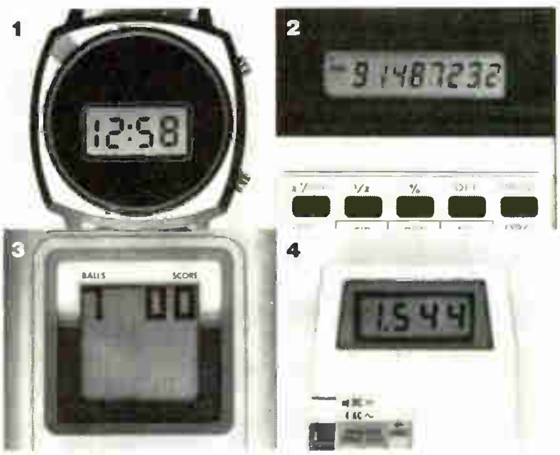

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Washington newsletter

Commerce to start own investigations of dumping activity . . .

In a new get-tough policy on trade, the Commerce Department plans to begin initiating within a month antidumping investigations without waiting for petitions from industry alleging injury, says Lionel H. Olmer, who is in the final stages of being confirmed by the Senate as under secretary for international trade. Formerly Motorola Inc.'s director for international programs, Olmer told the Electronic Industries Association's spring conference in Washington, D. C., that the department might, for example, initiate an antidumping investigation **"against some Latin American country" and use it "as a warning to the Japanese."** Olmer said he pledged to begin the program at the urging of Sen. John Heinz (R., Pa.) in the first round of confirmation hearings before the Senate.

. . . and seeks to speed export licenses

Olmer also told the EIA session that he has high hopes for getting a White House policy decision within six weeks that will speed U. S. decisions on granting export licenses. **The goal is to counter Europe's existing competitive edge in competing for high-technology markets in Third World countries.** Olmer also disclosed that the Departments of Justice and the Treasury actively support legislation to permit formation of export trading companies, similar to those in Japan, that will encourage and facilitate exports by small and medium-sized corporations. The legislation has already passed the Senate but faces opposition in the House, partly on grounds that it might violate existing corrupt-practices laws by permitting collaboration between companies. But the Commerce Department, Olmer says, already has the support of the Treasury Department and the promise of Justice Department support, too.

EIA to set antistatic package standard . . .

A new Electronic Industries Association unit will draft an antistatic-packaging standard to counter the old electrostatic discharge bugaboo. **The problem costs domestic components and equipment producers upwards of $10 billion annually** in products that either fail or must be reworked or serviced. EIA engineering vice president Allen M. Wilson says the antistatic-packaging task force will be headed by Charles Peer of RCA Corp.'s Consumer Electronics Group in Indianapolis, working with two other industry members and a Defense Department representative to be named. Consultant to the group will be Stephen A. Halperin, executive vice president of Analytical Chemical Laboratories, Elk Grove Village, Ill., specialists in static control.

. . . as industry losses mount

Halperin told a late-March meeting of the EIA's packaging committee that his company's survey of 111 facilities shows that electrostatic discharge causes estimated average dollar losses of 16% to 22% annually in components manufacturing, plus another 9% to 15% by subcontractors; 8% to 14% by equipment makers; and between 27% and 33% by users, based on field-service costs. Major component users are shifting to Japanese products because U. S. incoming quality levels are 0.1% to 1.3% worse than for their Far Eastern counterparts, Halperin told the EIA. RCA Corp.'s Consumer Electronics Group has reportedly confirmed that **many of these dropouts were due to static problems related to packaging.** Static control, Halperin contends, "is the single greatest profit opportunity that exists. One can easily project that our industry profits can be increased in excess of $5 billion after taxes with effective static control."

World Radio History

Another lesson for America from Japan

Going back as far as the early transistor radios, Japan's spectacular success in consumer electronics has been built on a strategy of copying or buying the rights to America's inventions and then improving upon them to produce highly competitive products for export, initially to the United States. No trend over the past two decades has had a more obvious effect on U. S. industry. And a similar strategy is apparent in semiconductor and in computer products.

Now Japan seems to be taking another American concept—professional public relations—and successfully adapting it to the needs of its electronics manufacturers. The strategy here seems to be to convince the American government, its legislators, and indeed some U.S. manufacturers that Japan is not an economic threat but a friend—a friend ready to share its technology and management techniques with the U. S. in order to help it resolve its economic troubles. It is certainly an example of what some Americans would call *chutzpah.*

Media mileage

Despite the fact that many U. S. manufacturers are convinced that imports from Japan are in large part one cause of their country's economic problems, a countercampaign by the Electronic Industries Association of Japan, using American PR talent, is getting much media mileage in the American consumer press.

Compare, for example, two events in the national capital on April 2. On that day, the EIA-J rented Georgetown's most expensive hotel to present a day-long seminar stressing the "interdependency" of the U. S. and Japanese electronics industries. Presentations by Japan's Kazuo Aichi, vice minister for foreign affairs, and Alan Greenspan, a Reagan Administration economic adviser and former head of the Council of Economic Advisers under President Ford, generated coverage by reporters from the largest newspapers in Washington, New York, and London, as well as the wire services and trade press. Those present also heard talks by two top U. S. electronics company executives who concurred with the EIA-J view that Japanese management and productivity techniques can be successfully applied to U. S. "reindustrialization"—a favorite Washington buzz word of late (see p. 106).

Concurrently with the seminar, five U. S. electronics manufacturers' organizations were making a strong, coordinated presentation to the House Ways and Means Committee for tax reforms to stimulate America's declining corporate and academic research and development base, as well as for modification of capital gains taxes to stimulate U. S. investment in enterprises involving new technology. Despite the fact that the success or failure of these internal tax reforms may be more critical to the future of America's technological leadership than anything Japan can offer, the testimony went unnoticed by the consumer press covering the capital. To them, it was no more than one more special-interest group pressing for its own protection, and there's little new about that.

The threat to entrepreneurs

The difference between the coverage of the two events by the press has less to do with the recent stream of Japanese leaders to Washington to discuss trade issues with U. S. government leaders than it does with EIA-J's effective advance promotion of its event and the comparative silence of the U. S. manufacturing associations prior to their presentation. In short, the difference was effective public relations.

That fact is distressing to America's new electronics ventures. And they cannot even take comfort in the knowledge that few, if any, innovators like the founders of Sony Corp. can be seen in Japan today, for they know that their Japanese counterparts with entrepreneurial ambitions prefer the security and financial backing their new ideas will get from their existing employers—the big Japanese multinationals.

The mobility of talent that characterizes the American electronics community is almost unknown in Japan. But its continuation is vital to the maintenance of U. S. technological leadership in increasingly competitive domestic and world markets. In a time when not enough American students are turning to engineering educations and when many consumers find the quality of foreign products more appealing, it is important for America's electronics leadership to do more than push for improved tax laws. They must also do a far better job in promoting the contribution of electronic technology to the national economy to larger audiences than the House Ways and Means Committee. That may be one of the most effective lessons that Americans can learn from the Japanese, who copied it from the Americans. **-Ray Connolly**

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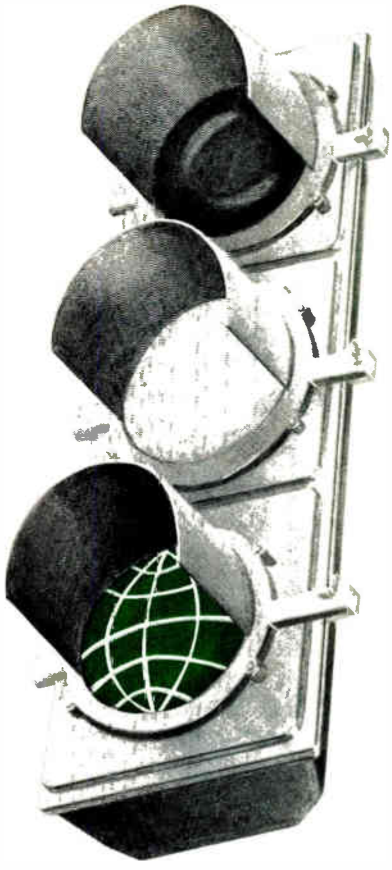

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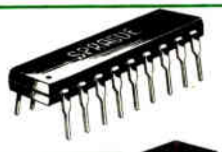
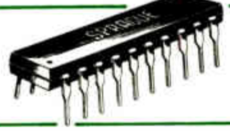
	DEVICE TYPES	CHANNELS/DIP	MIN BV (OUTPUT)	DIP
	UDN-6116A-2, 6126A-2 UDN-6116A, 6126A	6 6	+ 60 V + 80 V	16 lead 16 lead
	UDN-6118A-2, 6128A-2 UDN-6118A, 6128A UDN-6118A-1, 6128A-1 Anode driver, gas discharge displays	8 8 8	+ 60 V + 80 V +110 V	18 lead 18 lead 18 lead
	UDN-6138A-2, 6148A-2 Split supply (+20 V, −40 V) UDN-6138A, 6148A Split supply (+40 V, −40 V)	8 8	60 V* 80 V*	20 lead 20 lead

*Output BV referenced to V_{EE} Max. V_{EE} −40 V

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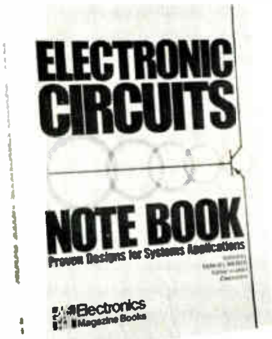

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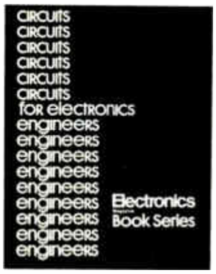

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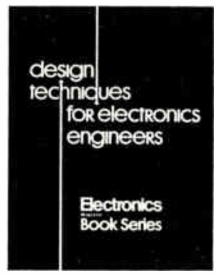

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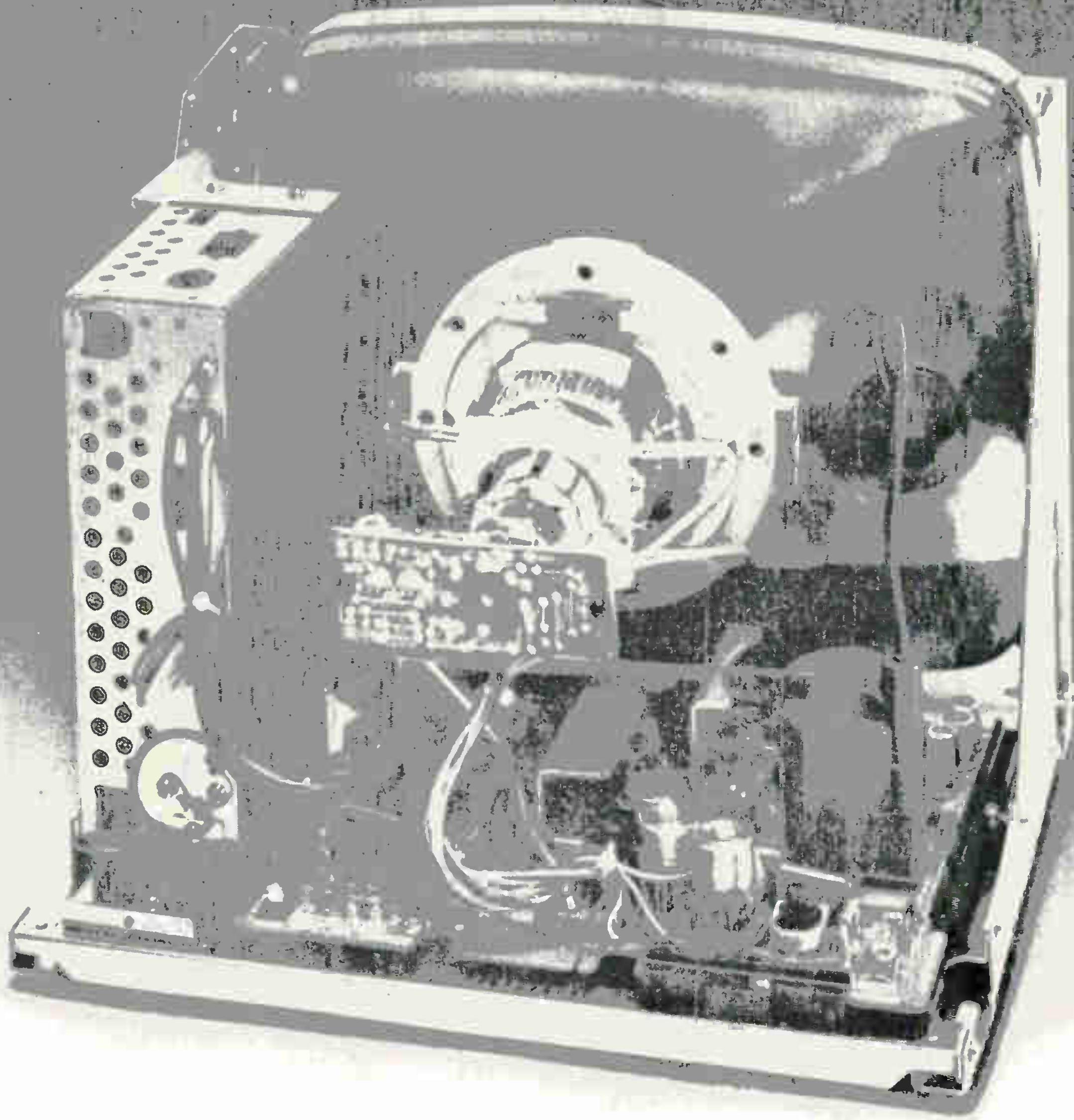

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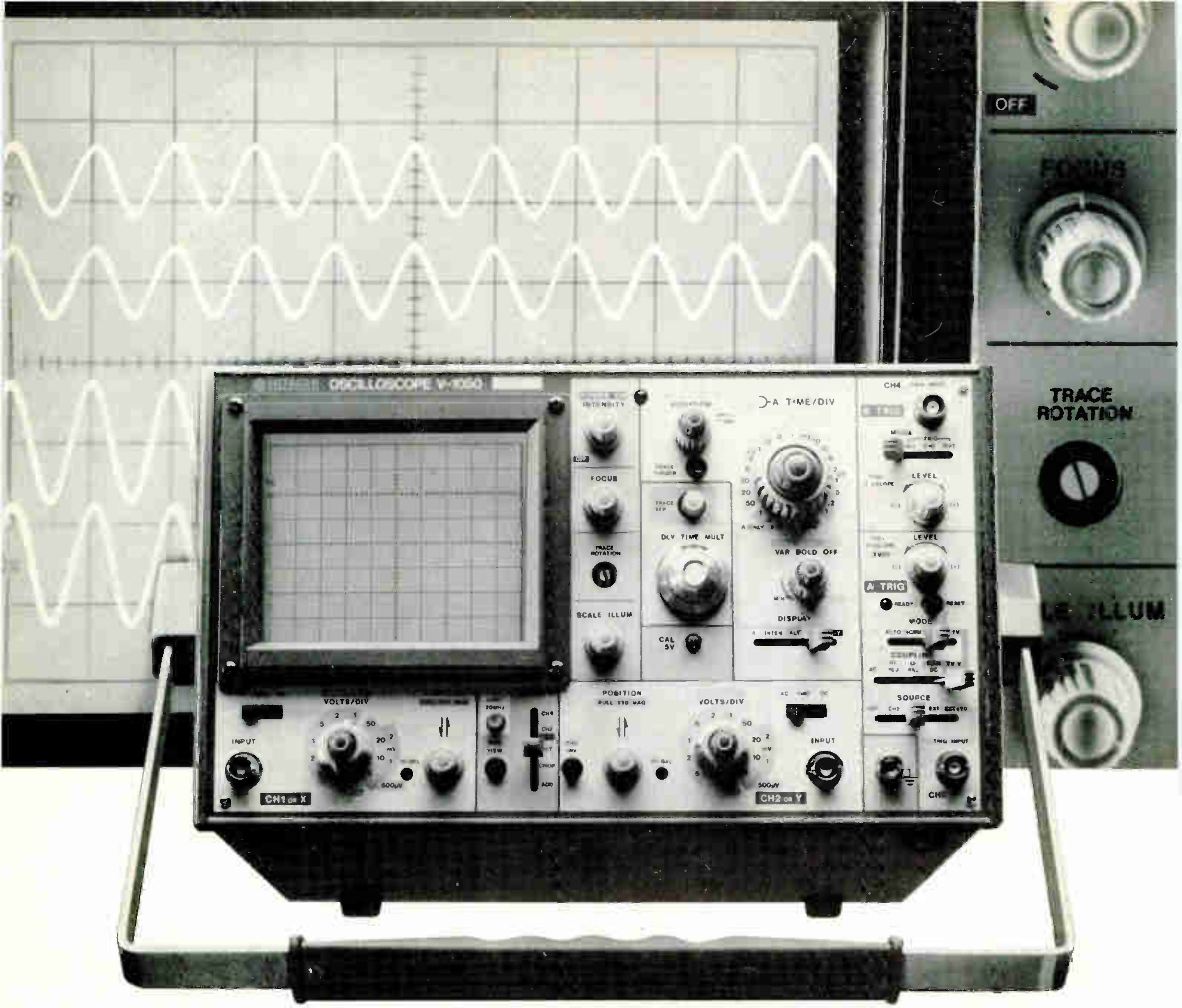

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World Radio History

International newsletter

Siemens, Grundig linkup likely

A financial linkup between two of West Germany's electronics giants—Siemens AG and Grundig AG—appears imminent. Speculation among industry watchers has it that Munich-based Siemens, the country's No. 1 electrical and electronics producer, is eyeing a 24.5% share in Fürth-based Grundig, the leading West German maker of entertainment electronics. That would give the latter a second powerful partner, since NV Philips Gloeilampenfabrieken of the Netherlands acquired the same share not long ago [*Electronics*, Aug. 30, 1979, p. 63]. **For Siemens, Grundig would be a big customer for its components.** For Grundig, on the other hand, Siemens would be a potent shareholder in helping the firm stand up to Far Eastern competition and pull out of the doldrums in which the country's entire entertainment electronics industry finds itself.

UK laser fine-tunes wavelengths

When the optical output of one single-mode laser diode is injected through its fiber-optic pigtail into a second such diode, the final wavelength can be tuned to an extremely fine spectral line width—to just ± 0.1 nm in the case of a laser operating at 843 nm. The use of the technique at a 1.55-μm wavelength—the optical window favored for upcoming long-haul fiber-optic systems—**would cut light dispersion within the fiber by more than 95%,** according to the developers of such an optically tuned laser at British Telecom's Martlesham Research Centre in Ipswich, Suffolk. They are presenting a paper on the device at the Third International Conference on Integrated Optics and Optical Fiber Communications in San Francisco, April 27–29. The tuning technique could also be applied in high-density wavelength-division-multiplexing schemes.

French lab improves fast-changing LCD

Catching visitors' attention at the Paris Components Show earlier this month was an improved version of Thomson-CSF's unusually fast-acting experimental liquid-crystal display [*Electronics*, April 26, 1979 p. 70]. The entire 10-by-10-cm display, consisting of a matrix of 240 by 250 points, can be changed in 5 seconds. That speed opens the door at least part way to **the use of LCDs in small computer system displays,** say researchers from the company's laboratory in Corbeville outside Paris. The display uses a liquid-crystal compound based on biphenylnitryl that, when heated to just under 40°C, enters the nematic phase, in which the molecules take on an ordered structure when an electrical field is applied. However, it takes 20 W to heat each row of points for the 20 ms needed to write it.

Japan to mass-produce solid-state lasers

Semiconductor lasers, one key to small and affordable digital audio disk players of the future, will be made and sold in quantity for the first time starting this July, according to Matsushita Electronics Corp. The Osaka-based joint venture of Japan's Matsushita Electric Industrial Co. and NV Philips Gloeilampenfabrieken of the Netherlands plans to start making 10,000 devices per month, **possibly rising to 100,000 a month by next year** if the demand should justify it. The price of samples will be \$165 to \$187 apiece but will fall to under \$47 with mass production. The "terraced-substrate" device, with five layers of n- and p-channel gallium arsenide and gallium aluminum arsenide, emits an almost-round laser beam. Its extremely low oscillating current of 30 mA obviates the kind of external modulators necessary with conventional gas laser pickups, but its 810-nm wavelength is too long for video disk use.

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U. S. renter invades Europe

United States Instrument Rentals Inc. of San Mateo, Calif., has acquired the largest supplier of electronic leasing equipment in the UK—Lab-Hire Ltd.—for $3.8 million, making it the first U. S. rental company to establish a European operation. Formerly a subsidiary of Hamilton Leasing Ltd., the West Drayton, Middlesex, firm will be known as Instrument Rentals (UK) Ltd. and will have its inventory bolstered by test equipment and data terminals from USIR's $50 million to $60 million inventory as well as additional purchases from British manufacturers. **Other U. S. leasing companies are also said to be considering subsidiaries serving the potentially lucrative European market.**

French videotex system starts trials

With no fanfare or publicity, the French telecommunications authority's videotex experiment is getting under way in the Paris suburb of Vélizy. The videotex service center opened there in late March, and this month the first households taking part in the experiment are having their home terminals linked to the service by regular switched telephone lines. The authority expects to have between 500 and 1,000 homes linked up by June and all 2,500 terminals on line by September. **More than 150 companies and public agencies have already signed up to supply videotex information and services,** among them several national and regional newspapers that plan to offer classified ads. Industry and government officials note that the government agency is keeping the Vélizy startup under wraps in order to prevent it from becoming an issue in the French presidential elections.

NEC markets very small business computer

Nippon Electric Co.'s first very small business computer is one of its series of five new business computers that extends to the large minicomputer size. More than half of the shipments of the new system will be the bottom-end system 20/25, which is **built around the firm's upcoming 16-bit n-MOS microprocessor.** It includes a personal-computer–like cathode-ray-tube console with 48-K bytes of user memory and two built-in 1-megabyte floppy-disk drives, together with a serial printer and operating system. The minimum price in Japan is $13,500. The top-of-the-line 150/55 has a user memory area of 1,024-K bytes and will sell for $66,700 in the minimum configuration.

Addenda

Researchers at the ITT affiliate, Standard Elektrik Lorenz AG in Stuttgart, West Germany, have put together an experimental optical transmission system that operates at a wavelength of 1.2 μm and sends data **at 34 Mb/s over a repeaterless optical-fiber line 36 km (22 miles) long**—a rate and distance somewhat below those achieved in a UK experiment last fall [*Electronics*, Sept. 25, 1980, p. 73]. . . . AEG-Telefunken of Frankfurt and MAN AG of Munich have developed what the two West German firms claim is **the world's largest trackable generator for converting solar power** directly into electrical energy. The generator, essentially a 40-square-meter array of silicon solar cells and movable about two axes, provides an output of 3.5 kW.

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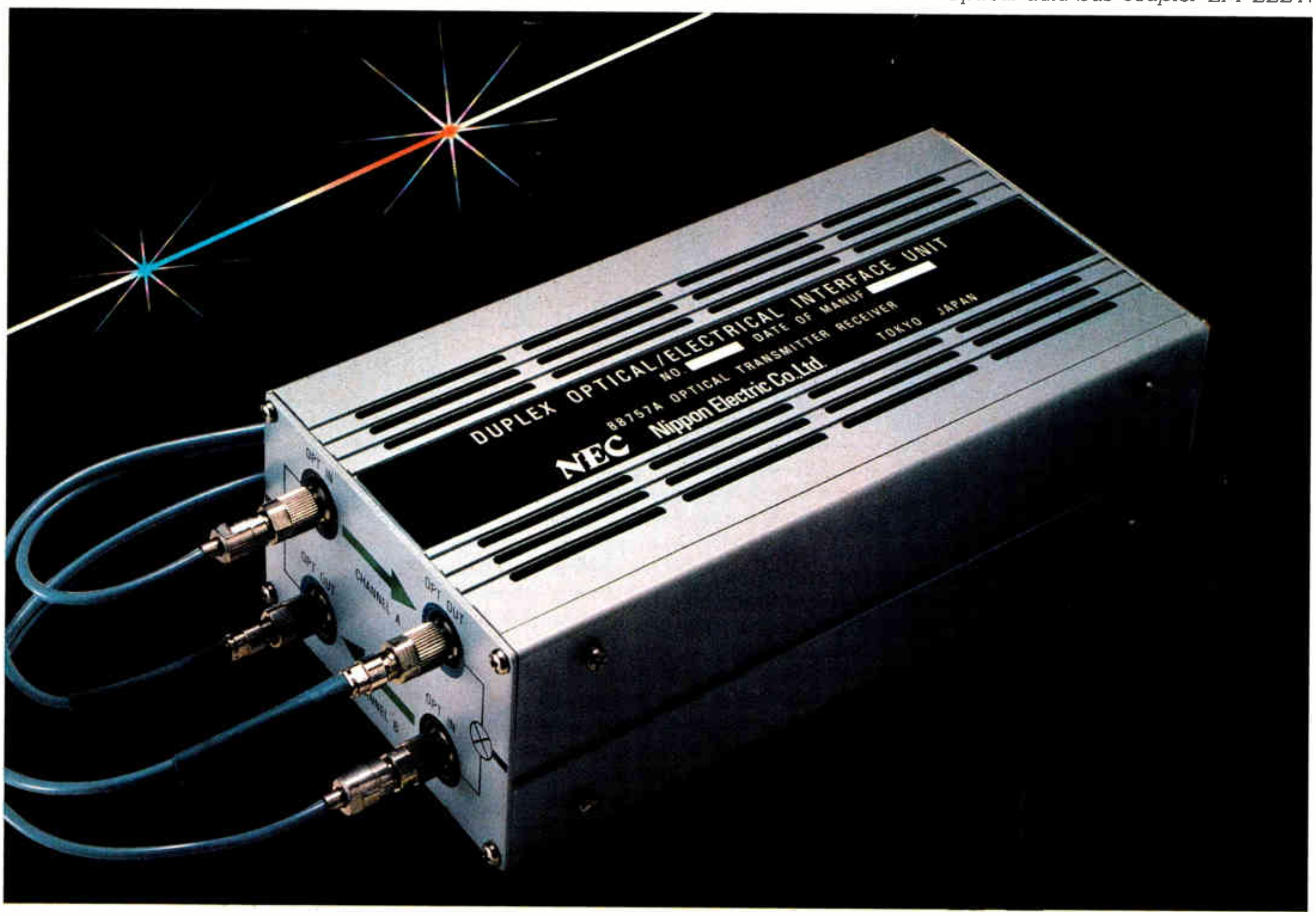
NEC NEWSCOPE

Optical data bus coupler LM-2221.



NEC BIDIRECTIONAL OPTIC SYSTEM USES SINGLE FIBER

Five nuclear power plants in the United States are set to use a new product in communications—the world's first bidirectional single-fiber-cable optic system to employ the same wavelength for data transmission both ways.

Developed by NEC, this system offers substantial savings in both initial and running costs when compared with dual-fiber-cable systems.

The five American systems are composed of 266 data bus couplers including 532 optical transmitter-receivers and about 50km of optical fiber cable.

Each system uses about 10km of cable, has about 50 data bus couplers, and transmits data at a rate of up to 100kb/s handling several thousand items of information. It operates in the full duplex mode normally and, in case of failure, in the simplex mode. Also, each system uses 4 data bus loops for data acquisition and control of power generating equipment, for recording the operation of power generating and communications equipment, for fire detection and alarm, and for security control. Each loop is capable of communicating and servicing up to 72 remote terminals with a maximum of 4.5km per loop.

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NUMBER 116

NATIONWIDE MICROWAVE LINK FOR LIBYA

The Socialist People's Libyan Arab Jamahiriya has completed a nationwide microwave communications network that covers all major cities and towns in the country.

Since 1978, NEC has been working to complete spur microwave links to blanket Libya's cities and towns off the trunk systems so as to form a nationwide microwave network for both telephone and television.

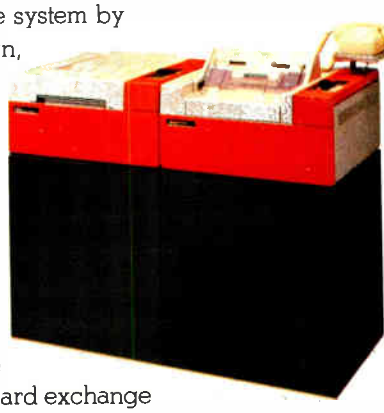
The spur links completed throughout the country include a total of 100 terminals and repeater stations extending over 53 hops. The links are equipped either with 7.5GHz or 4GHz microwave equipment, and can provide 300 or 960 telephone channels.

NEC completed the country's trunk microwave system in 1974. A trans-horizon tropo-scatter link was installed in 1975, and an inland microwave system across deserts was opened in 1978.

A microwave communication repeater station in operation at Mrassas, Libya.

SECURITIES COMPANY GETS C&C FACSIMILE NETWORK

The Daiwa Securities Co., Ltd. of Tokyo is to have a high-speed integrated facsimile system by June 1981. NEC will design, manufacture and install the system in a typical application of the company's "C&C" capability—full integration of computer and communications technologies.



Together with the existing data processing system, the new message switching, store, and forward exchange system will form an on-line network. This will consist of a host computer subsystem, a pattern processing subsystem and a multiple switching subsystem, with 3 transmitting stations and about 130 receiving stations throughout Japan.

Each receiving station can have the stock price information—stored in the host computer in the center—fed out on its high-speed facsimile receiver in the form of graphs and tables merely by keying on the data terminal at the station.

The facsimile transceiver to be used is the high-speed digital NEFAX-6200. This machine can transmit a typical business document in 40 seconds or less.

NEW LSIs TO DRIVE LCDs.

Now available from NEC are two types of new LSIs.

The μPD7502G is a CMOS 4-bit single-chip microcomputer with a built-in liquid crystal driver. The μPD7225G, also a CMOS LSI, is designed to be interfaced with a microcomputer requiring an external circuit for driving liquid crystal.

A liquid crystal driver is normally an independent circuit. In the past, a single-chip microcomputer like the μPD7502G was considered impractical because of the very intricate control circuit required.

The μPD7502G also features: (1) A standby mode to minimize power consumption; (2) Ability to use its program fully for control and operation. (3) A "serial interface" capable of transferring data in series; (4) General-purpose microcomputer capability.

The μPD7225G is designed to be used in conjunction with another microcomputer. Features of the μPD7225G include: (1) Low power consumption; (2) Ability to increase its display digits; (3) Built-in character generator to display a total of 48 alphanumerics; (4) Programmable blinking.

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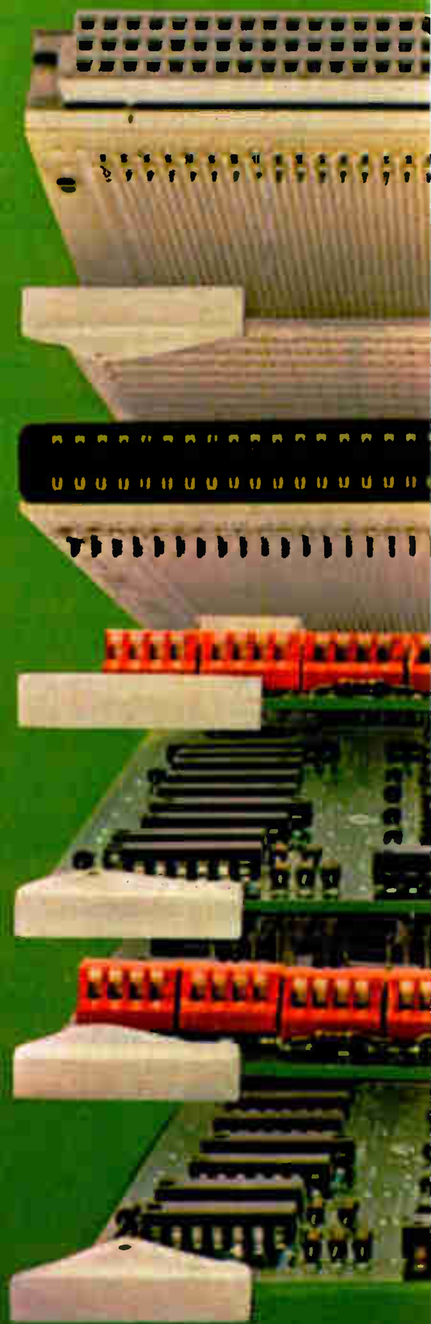

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Video Timer & Controller VTAC® / CRT 5037
This chip off the old block is almost identical to the CRT 5027 except it's the first CRT controller to add balanced beam current interlace for distortionless interlaced display.

Video Timer & Controller VTAC® / CRT 5027
Here's the father of all programmable CRT controllers. It was the first on the market and it's the industry standard. The CRT 5027 generates all the timing and control signals for a video display in a single chip. It's also manufactured by three other leading semi- conductor manufacturers under license from Standard Microsystems.

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For low cost systems, the CRT 5047 is the way to go. This close relative of the CRT 5037 has its display format fixed in ROM. Can we program one for you? The CRT 5047 is especially effective for low cost CRT terminals using an 80 x 24 display format with a 5 x 7 character matrix.

Video Timer & Controller VTAC® / CRT 5057
Need to synchronize your display to the frequency of a 50 Hz or 60 Hz AC line? The CRT 5057 adds "line lock" to the CRT5037 controller, thereby eliminating the so-called "swim" phenomenon. It's perfect for the international market.

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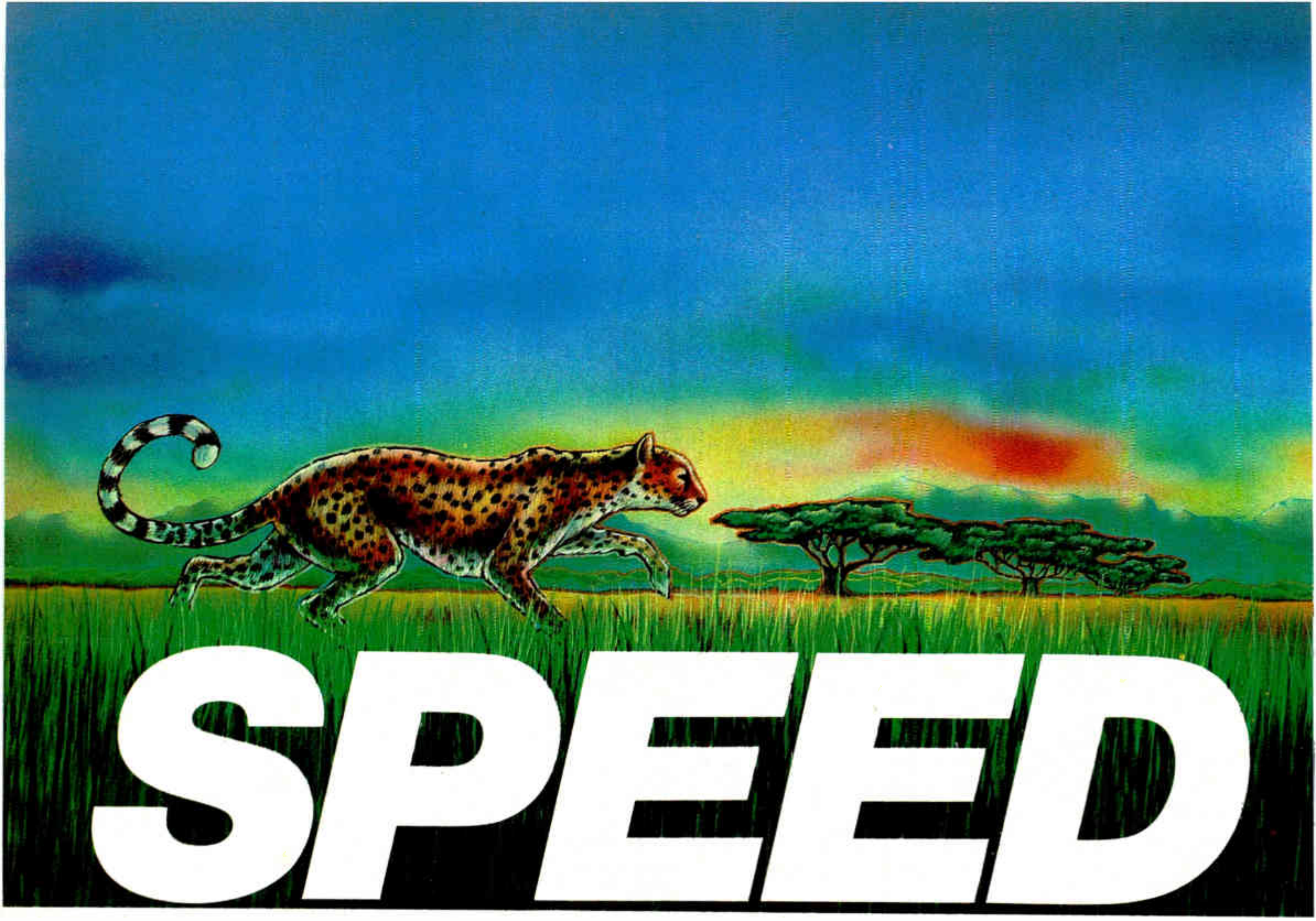

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Circle 82 on reader service card

World Radio History

Computer cuts the distance a waiter walks

by John Gosch, Frankfurt bureau manager

Orders punched in on a hand-held terminal show up on a computer in the restaurant's kitchen or bar

The waiter or waitress scurrying around in a restaurant and taking orders with a pen and pad is an anachronism in this digital age, as far as Siemens AG is concerned. So engineers at the company's Munich-based Components division are putting together an infrared-light–based transmission system that sends the order, keyed into a hand-held terminal, to a small computer in the kitchen where the order is registered, filled, and billed.

Bernd Schade, a sales manager in the Components division and one of the originators of the "waiter's electronic ordering system," says restaurant owners have already shown much interest in the setup. He is banking on its acceptance for several reasons. First, it helps alleviate the chronic shortage of restaurant personnel that exists in West Germany and elsewhere. The new system cuts the amount of walking a waiter or waitress must do, enabling them to serve many more customers as they could with the old pad-and-pencil method.

How much? What's more, for all it does, the system is not very expensive. A complete setup, consisting of a terminal, a small computer, and a few accessories, will sell for between \$5,000 and \$25,000, depending mainly on what type of computer is used. With the savings in labor costs it provides—about 25 U. S. cents per customer—the system "amortizes itself within a few months for a medium-sized restaurant with, say, 20 tables," Schade says. And then, of course, the system considerably shortens the time that customers must wait for their meals. A prototype setup is now being readied for trials in a restaurant in downtown Munich.

As for how it works, the waiter or waitress takes the hand-held battery-powered terminal, which is slightly larger than a pocket calculator (see photo), and keys in the numbers corresponding to the customer's order plus the number of the table. The order number may consist of up to nine digits to accommodate many kinds of meals, side dishes, extras, and drinks. These numbers are coded and modulated onto a carrier frequency that rides on an infrared light beam from the terminal's nine IR light-emitting diodes to a small relay station mounted on the ceiling of the restaurant. The nine diodes produce enough light power to bridge at most 10 meters—the maximum distance between the terminal and the relay.

Link. In the relay, a hemispheric transparent bulblike device about 20 centimeters in diameter, two receiving-diode-and-preamplifier-circuit packages convert the IR signals into electrical pulses and amplify them. The pulses are fed over wires to a modem and then to the interface of the computer in the kitchen.

At the computer, which may be a Siemens PC100 or similar low-cost

Faster food. The terminal on which the waiter is entering the customer's order sends the data on an infrared beam to a ceiling receptor that is linked by infrared light and wires to a computer in the kitchen.

World Radio History

personal computer, the order appears on a monitor or alphanumeric display for the chefs to fill. A second such computer may be at the restaurant bar to indicate and bill the drinks the customer has ordered. The computers keep tabs on what is consumed and print out two bills, one for the customer and the other for the restaurant's or the waiter's records. If the kitchen or bar has run out of a particular meal or drink, the waiter is told so on the alphanumeric display on his terminal.

The transmissions in both directions take place at either 2,400 or 4,800 bits per second—usually at the higher rate in restaurants with many waiters. The IR wavelength for the terminal-relay optical link is 950 nanometers and the carrier frequency onto which the IR signals are modulated is 90 kilohertz. A relay contains as many as 84 transmitting diodes, enough to cover a 20-meter-square dining room. The large number of light transmitters ensures that the waiters, no matter where they are in such a room, can pick up the data from the kitchen or bar.

The hand-held terminal is operated with a slotted key. This produces a code that is transmitted along with the order and table numbers and allows the computer to distinguish one waiter from another.

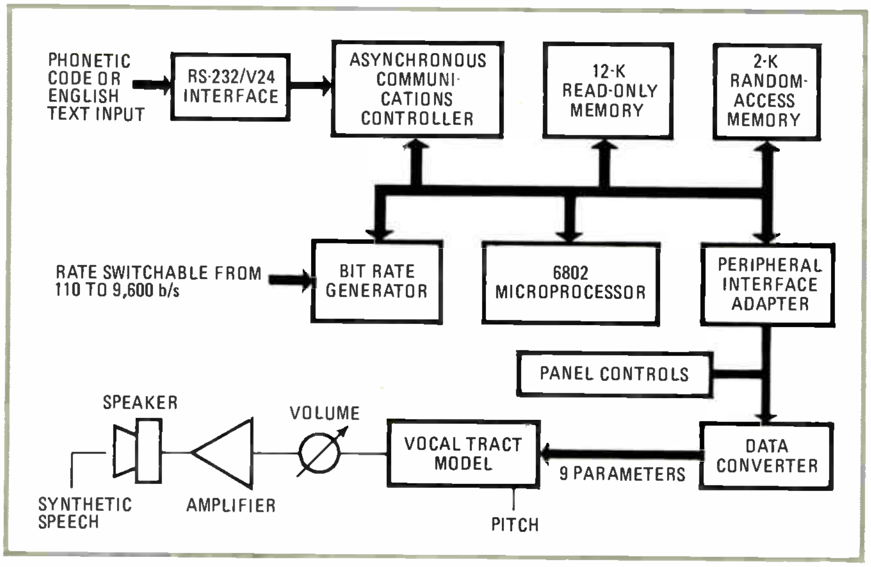
Quick service. At a 2,400-b/s rate it takes only 280 milliseconds for the unit to transmit seven different orders, the table number, and the waiter's identification code from the terminal to the computer and to receive an order acknowledgment signal from the computer.

As the terminal's IR transmitting range is only 10 meters, there is no interference with other communications services. Hence, no approval from either communications authorities or postal agencies is required.

Great Britain

$2,000 text-into-voice unit gives utterance to input almost immediately

The voice is machine-like and its pronunciation is often appalling, but nonetheless a voice-output terminal developed by two British consulting engineers does at least provide a means of converting text into speech just about as fast as it is keyed onto a cathode-ray-tube display.



Compact. A single 9-by-7½-inch board holds all the circuitry necessary for producing synthetic speech in real time from typed-in English text or phonetic code.

The speech quality would probably not be acceptable for public use. But for a highly motivated user such as a blind computer operator, for users who would regularly work with the system, and for companies investigating the potential of voice systems in their products, the Microspeech 2 is a very practical product.

Complete. Made by Costronics Electronics of Hillingdon, Middlesex, the stand-alone speech synthesizer has its own control microprocessor, power supply, and loudspeaker. It generates speech from either straight English text or a standardized form of phonetic spelling and stores about a minute's worth in its internal buffer store. It can run from just an ASCII keyboard accepting data at up to 9,600 bits per second and connected by a standard RS-232 interface. The unit's price is around $2,000.

The Microspeech 2 uses a synthesize-by-rule principle, assembling words from the phonemes basic to the English language. The approach was one of the first to be thoroughly investigated, but, says Tim Orr, who developed the terminal with Richard Monkhouse, it has become a practical proposition only with the availability of microprocessor power.

In the Microspeech 2 an electronic model of the vocal tract is driven by a set of control parameters—one set for each phoneme stored in the controlling microprocessor's read-only memory. In systems developed by Texas Instruments Inc. and General Instrument Microelectronics Ltd., for example, the ROM stores the phonetic parameters of every word to be used. The resulting speech quality is far higher, but the vocabulary is limited to the size of memory.

The Microspeech 2 is somewhat similar in concept to Votrax's CDS-II development system [*Electronics*, Feb. 10, p. 118], though instead of a single-chip synthesizer, it employs discrete complementary-MOS parts. In essence, it consists of three cascaded bandpass filters, each modeling a resonant vocal cavity, which are set at the frequencies 660, 1,720 and 2,410 hertz and energized with a 100-Hz sawtooth waveform. These

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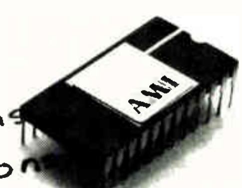
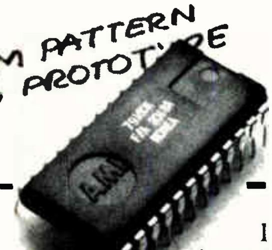
32K	S68332	2532	450ns
32K	S2333	2732	350ns
64K	S68A364	68A764	350ns
64K	S2364	2764	350ns
64K	S68B364*	68A764	250ns



DELIVERY: 5 WEEKS FROM PATTERN VERIFICATION TO PROTOTYPE



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filters plus the controlling microprocessor, a 6802, fit onto a single double-sided printed-circuit board measuring 9 by 7.5 inches. Data is entered into the system through an RS-232/V24 interface.

Apart from the difficulty of generating acceptable speech, one of the biggest problems in the way of text-into-speech translation is the oddity of English spelling. For every rule of pronunciation there is an even longer list of exceptions. The most realistic compromise, says Orr, is a rule-based spelling system together with an exception dictionary. They are available as an optional program for English text translation stored in an 8-K erasable programmable ROM. Also held in the E-PROM is the complete ASCII set so that each key can be named as it is pressed.

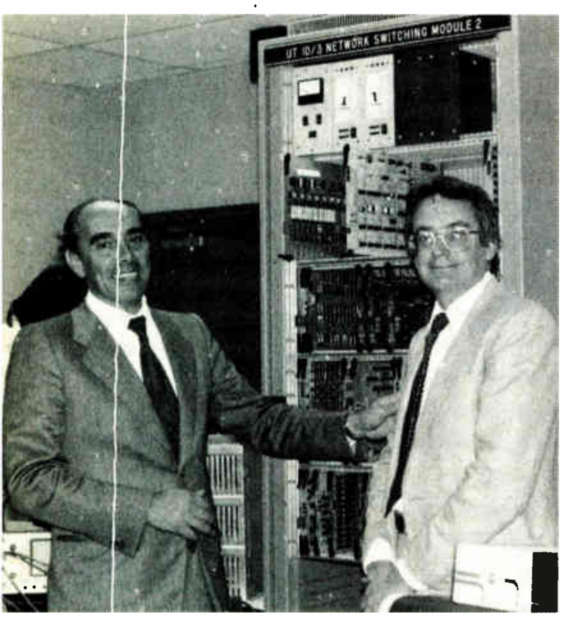
Without this E-PROM, the unit is operated in the phonetic mode in which the phonemes are represented by one or two letters. The variety of phonemes and their symbolic representation were chosen to make phonetic text readable. "Go," for example, is entered phonetically as "gow." A machine like this, says Orr, "is really for the dedicated user." Even so, since he launched the Microspeech a few months ago he has been selling the system at the rate of one or two a month. **-Kevin Smith**

Italy

Italian-American design team builds modular digital phone switch

In what could well be an indication of things to come, Italy's largest telecommunications equipment producer, Italtel SA of Milan, looked for a U. S. partner when it set out to build a truly up-to-the-minute modular, intelligent digital exchange for its country's telephone network.

The result—the UT 10/3—can be configured for anywhere from 200 to 10,000 subscriber lines and up to 3,000 trunks and consequently covers most of the urban switching needs of Italy. Perhaps more remarkable, the prototype hardware will go into trial service in Milan on schedule, just a little over two years after the design and development team got to work in Dallas.



Allies. Francesco Miccinelli of Italtel (left) will build the phone exchange module (center) designed with John Israel of Advanced Business Communication.

At the start. "We reviewed our switching business strategy in 1978 and decided there was an opportunity for a new generation of switches for the 1980s," explains Francesco Miccinelli, a deputy director general at Italtel, which like the phone company is a unit in the government-controlled telecommunications holding company Società Finanziara Telefònica PA (STET). And as "we wanted to get as close as we could to the source of advanced technology, that pointed to an American partner," he says.

He found that partner in John Israel, the former designer-founder of a Dallas manufacturer of private branch exchanges, Danray Co. "By February 1979," Miccinelli recalls, "we had the joint development started. By April we were writing specifications, and in June the actual design started." The team design averaged about 65 people, roughly 25 from Italtel and 40 from the joint venture, Advanced Business Communication Corp. of Dallas.

"We had a 10% share in ABC at the start, and we will eventually buy a controlling interest," notes Miccinelli. All told, the development of the UT 10/3 represents an $8 million investment.

The prototype. The switch destined for Milan's Volta exchange will have a capacity of 2,000 lines and uses two of the basic modules, each of which has 1,024 ports. Up to 16 of these modules can be connected by ribbon cables. Above that 14,000-line limit, additional hardware becomes necessary, and Italtel already has designed a custom chip that will serve as the building block for the autorouting network of a large exchange. It switches among eight incoming pulse-code-modulation lines and eight outgoing lines, each carrying up to 256 channels.

Though each module is autonomous as far as all the real-time switching functions go, each exchange will have an independent, sometimes remote service computer to take care of functions like man-machine dialog, data storage, and second-level diagnosis for all the modules. For the first exchange, this computer will be a Digital Equipment Corp. PDP-11/23 minicomputer. Later, Italtel expects to use an 11/23-like minicomputer of its own design—the 20-bit MIC20, built around a custom chip with special telephone functions.

As with the exchange as a whole, intelligence is widely distributed among the five major subsystems that make up the module. The control subsystem, for example, is built around two 16-bit LSI-11/23 microcomputers, paired with some 200-K bytes of memory, working in a master-slave arrangement. It controls all the call-processing required for subscriber lines or trunks terminated on the module. An internal end-to-end common-channel signaling system

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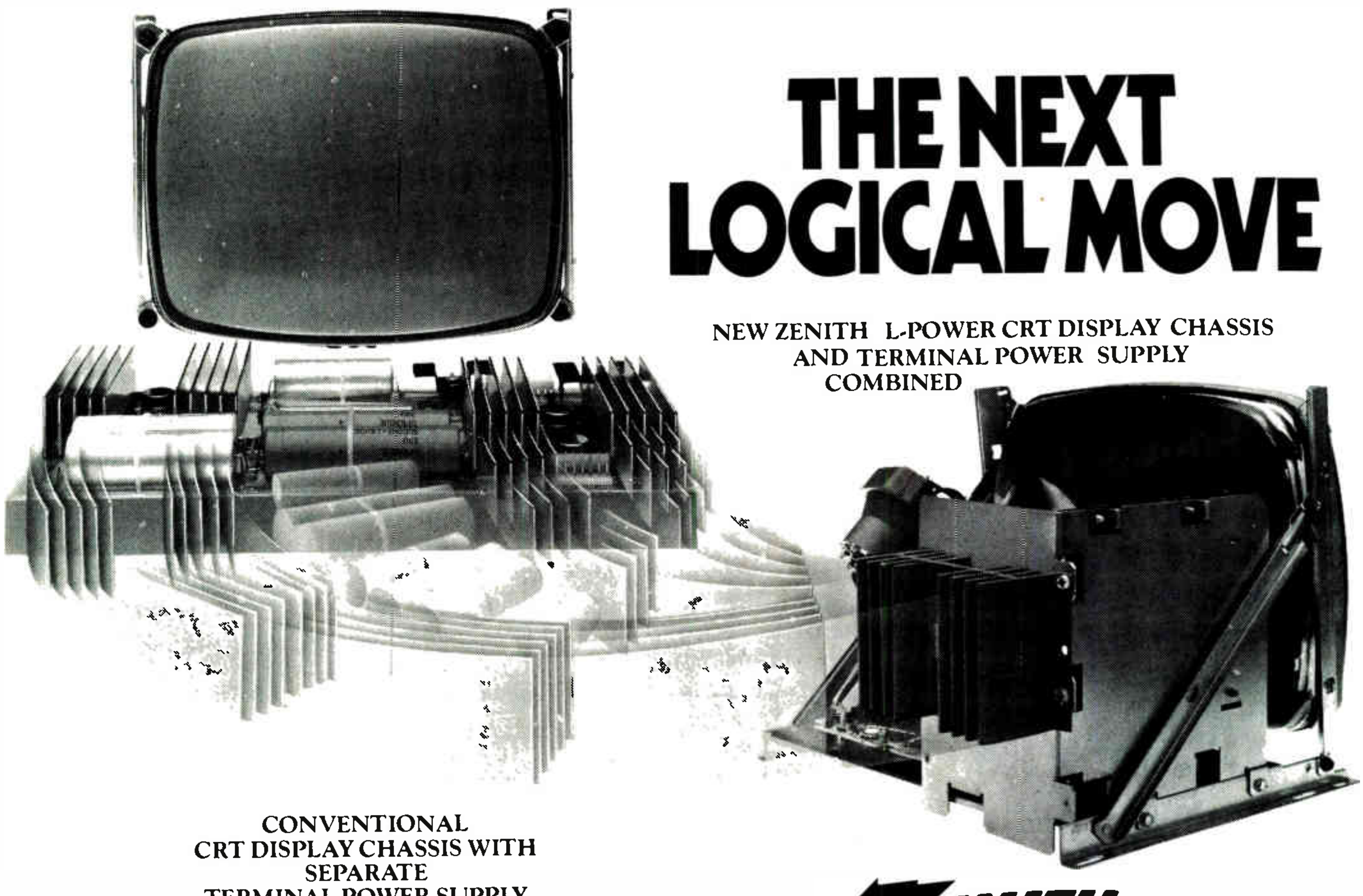

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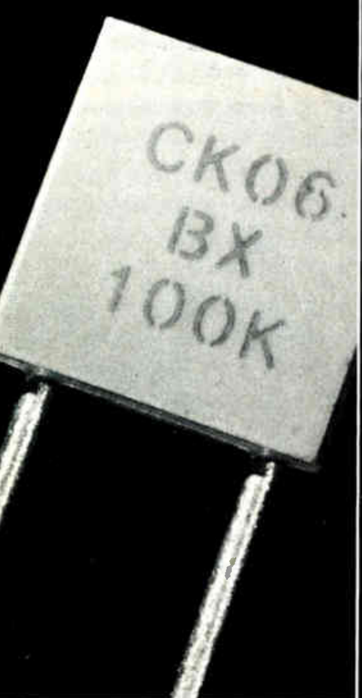

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takes care of the information exchanges needed to route calls between modules. As a result, no central common control is needed for the exchanges.

The switching subsystem handles 1,024 incoming digital time slots and 256 outgoing ones. As for the line interface, it can have up to 128 cards, one each for eight subscriber lines and each having its own Z80 8-bit microprocessor and some 8- to 10-K bytes of memory.

Currently, there are three species of line interface cards—one each for analog subscriber lines, digital lines, and trunks—and by next year, there will be a data-transmission line card, too. There is enough spare capacity in the LSI-11/23 for the module to work in an integrated voice and data network, Miccinelli points out.

Miccinelli maintains that the UT 10/3 will be very competitive in price but will not release precise figures. "Our production people worked closely with the designers in Dallas and we will have only 50 different kinds of different printed-circuit board for the exchanges," he explains. "There are only 500 different components involved," he goes on, "and that is bound to keep the production costs low." **-Arthur Erikson**

Japan

TRS-80 computers to be made in Japan

Tandy Corp., in planning to vastly expand its TRS-80 personal computer marketing network in Japan, is obviously attempting to bolster its sagging market share there. Under its agreement with Tokyo Electric Co. [*Electronics*, April 7, p. 48], the Toshiba affiliate will immediately start selling models 1 and 2 of the TRS-80 and begin making central processing units and keyboards for the TRS-80 model 1 this summer. Sales of model 3 will start in Japan this summer.

Tandy describes the tie-up as a way to meet the exploding demands for personal computers in Japan. But the move looks essentially defensive. Several years ago, when U. S. microcomputer makers had the world market to themselves, the TRS-80 enjoyed an estimated 40% market share in Japan, according to Hideo Muranushi, representative director of A&A Japan Ltd., a worldwide sourcing and trade division of Tandy. Today that share is under 10% and falling.

Meanwhile Sharp Corp. and Nippon Electric Co. have taken over the market. Observers say NEC sold about 50% and Sharp almost 30% of the more than 100,000 personal computers shipped in Japan in fiscal 1980. Sharp officials estimate that their domestic sales this year will soar to 70,000 to 80,000 units, while NEC expects shipments to more than double to at least 110,000 units.

Rationale. Japanese consumers prefer products made in Japan because they assume that both quality and service will be better. That has clearly worked in the favor of NEC, Sharp, and now Hitachi, which is coming on fast. Tandy's strategy is to gain the same advantage.

Other U. S. microcomputer makers are moving in the same direction. Commodore recently started making the latest model of its VIC 1000 series in Japan, and officials at Apple Computer Corp. have said they, too, will eventually start manufacturing there.

TEC seems a natural partner for Tandy, to which it has been supplying line printers for the TRS-80 for about two years through A&A. The Tokyo company, with sales of $342 million in fiscal 1979, enjoys a 40% to 45% share of Japan's electronic cash register market. Its share is even higher in the supermarket industry, which Muranushi says is Tandy's first main target for its computers in Japan.

Muranushi speaks glowingly of TEC's 23 domestic branch sales offices, its 100 service stations, and its "very, very aggressive salesmen." But Kensaburo Horai, manager of TEC's general administrative department, denies any current plans to sell TRS-80s through TEC's existing sales channels. Rather, TEC will sell

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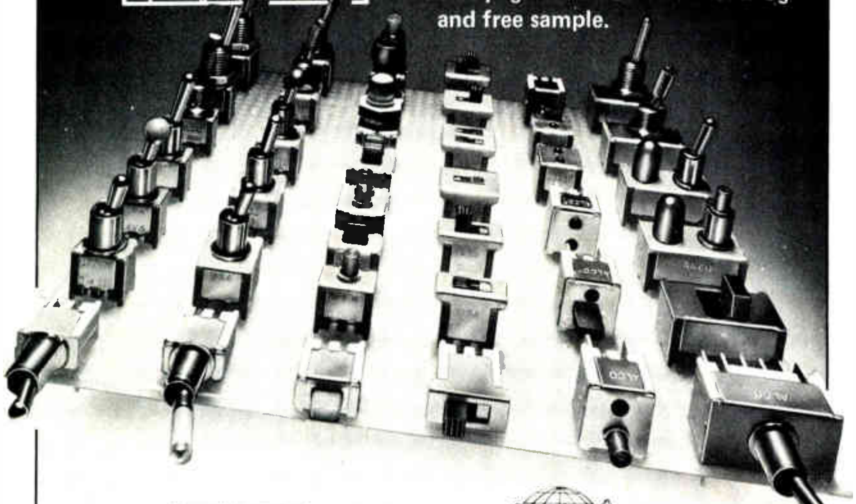

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Circle 90 on reader service card

them through a new small-business computer department it established in January with 25 salesmen. By early May TEC will complete an office computer center in central Tokyo to train TRS-80 users and will open similar operations in Naoya and Osaka by fall.

Unlike Sharp and NEC, which market largely through dealers and stores, TEC will sell TRS-80s directly to business customers. Although Horai does not say so, that would leave the company's existing sales network free to sell the low-priced personal computers soon to be launched by parent Toshiba, as well as any developed by TEC itself. Horai claims that since these models would address different market segments, there would be no cannibalization.

Present and future. Yet he hints that his company is looking beyond the TRS-80. "Tandy's product is so famous that we'd better start there," he says, adding that the initiative came from Tandy. Still, TEC seems intent for the time being on selling as many TRS-80s as possible. Its goal is to ship 2,000 units this fiscal year, though Horai will not say how many TEC will make. Even combined with the several hundred per month that Tandy hopes to sell through its present seven Radio Shack stores and 100 authorized dealers in Japan, the TRS-80 stands to cling to a meager share indeed of Japan's 200,000-plus market this year.

There are signs of a brighter future, however. An official at Sharp concedes that the new arrangement and production capacity will probably give Tandy greater market share eventually. The company is working hard to develop a kanji (or Chinese character) capability, essential for long-term success in Japan. And Muranushi claims that the TRS-80 enjoys far higher brand recognition than any other foreign microcomputer, with a recent survey showing that almost half of Japan's consumers know the name. What is more, Tandy can pursue further marketing and manufacturing options in Japan because the deal with TEC is nonexclusive.

-Robert Neff, McGraw-Hill World News

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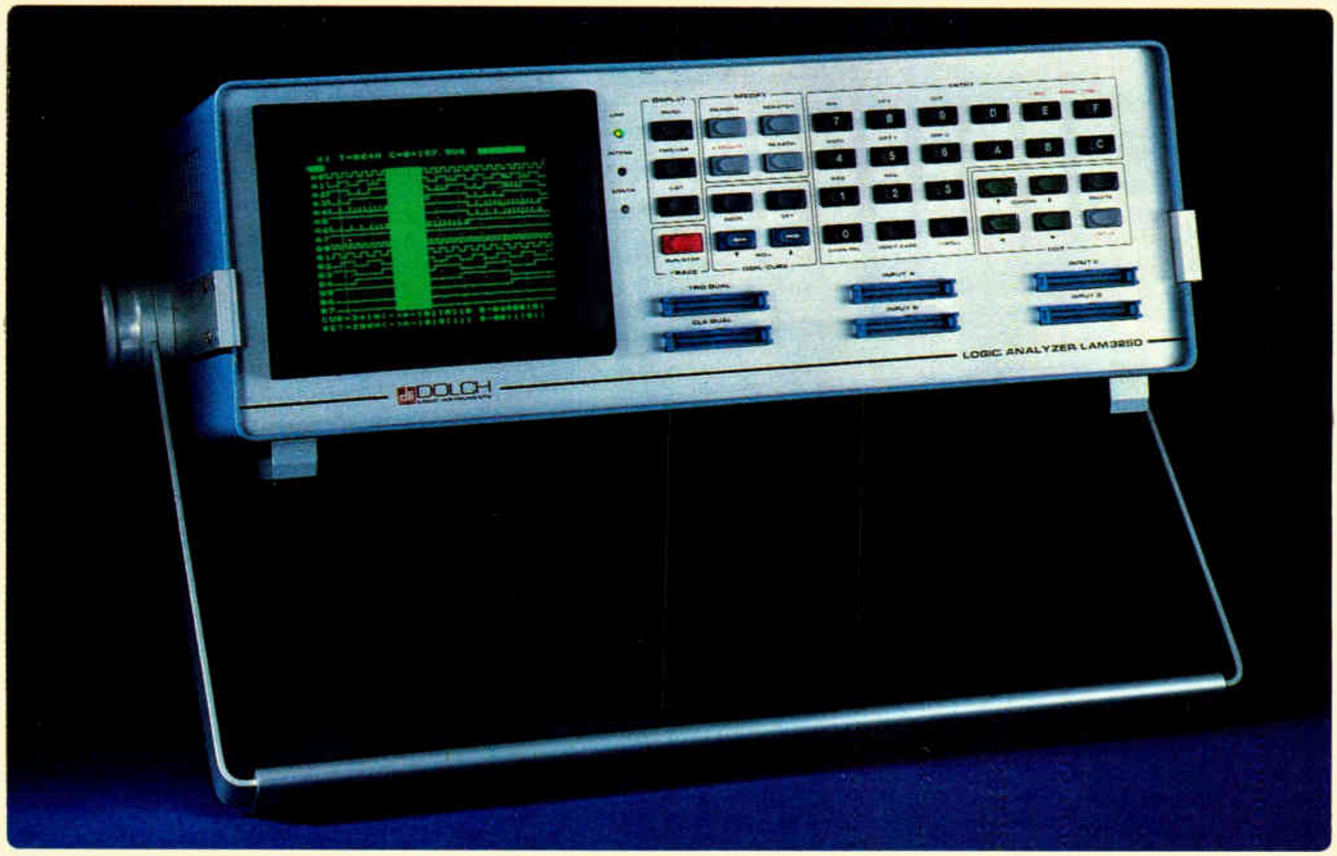

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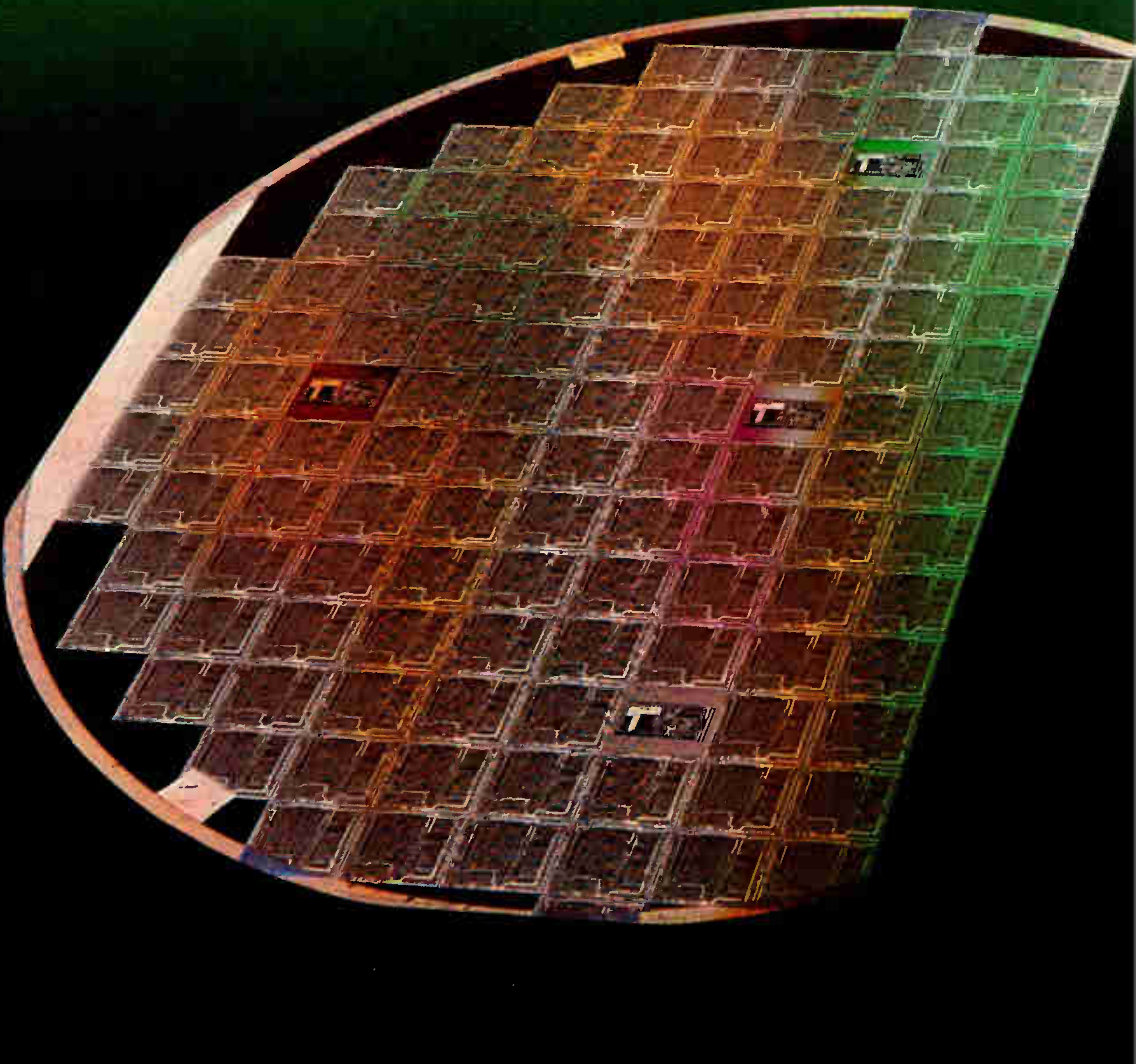

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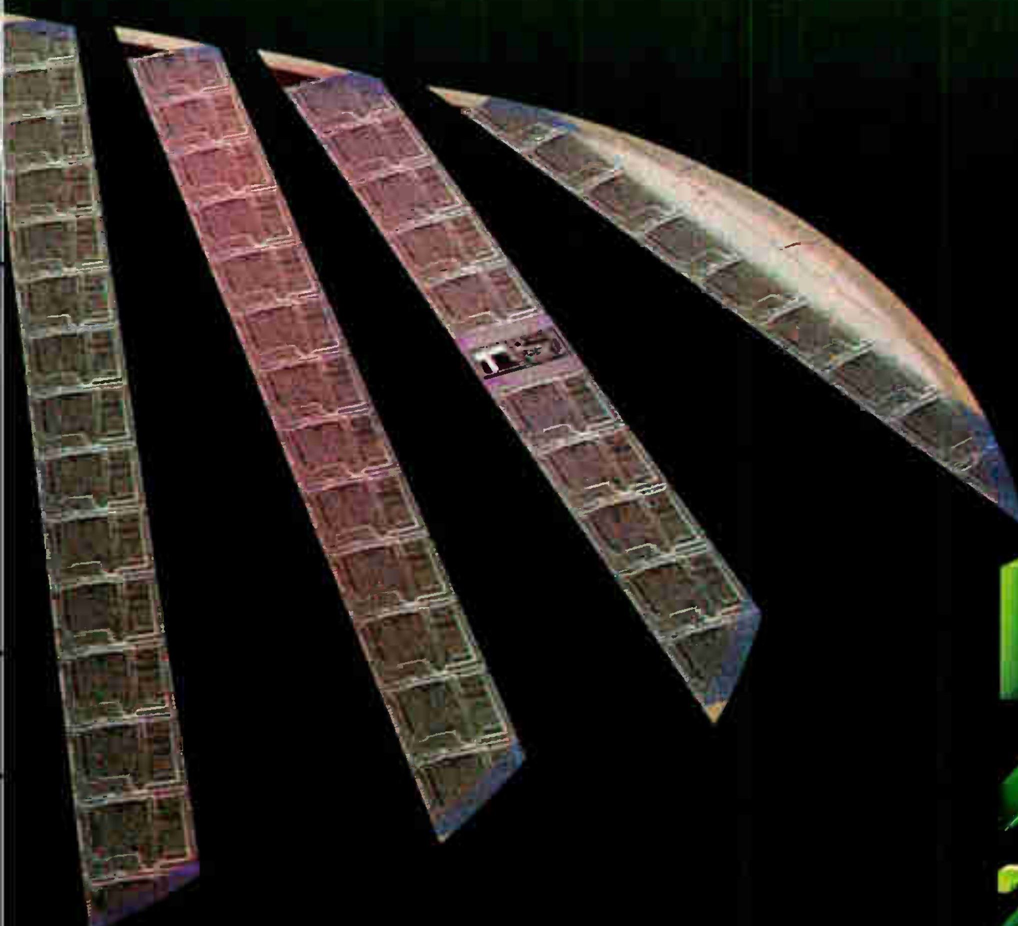

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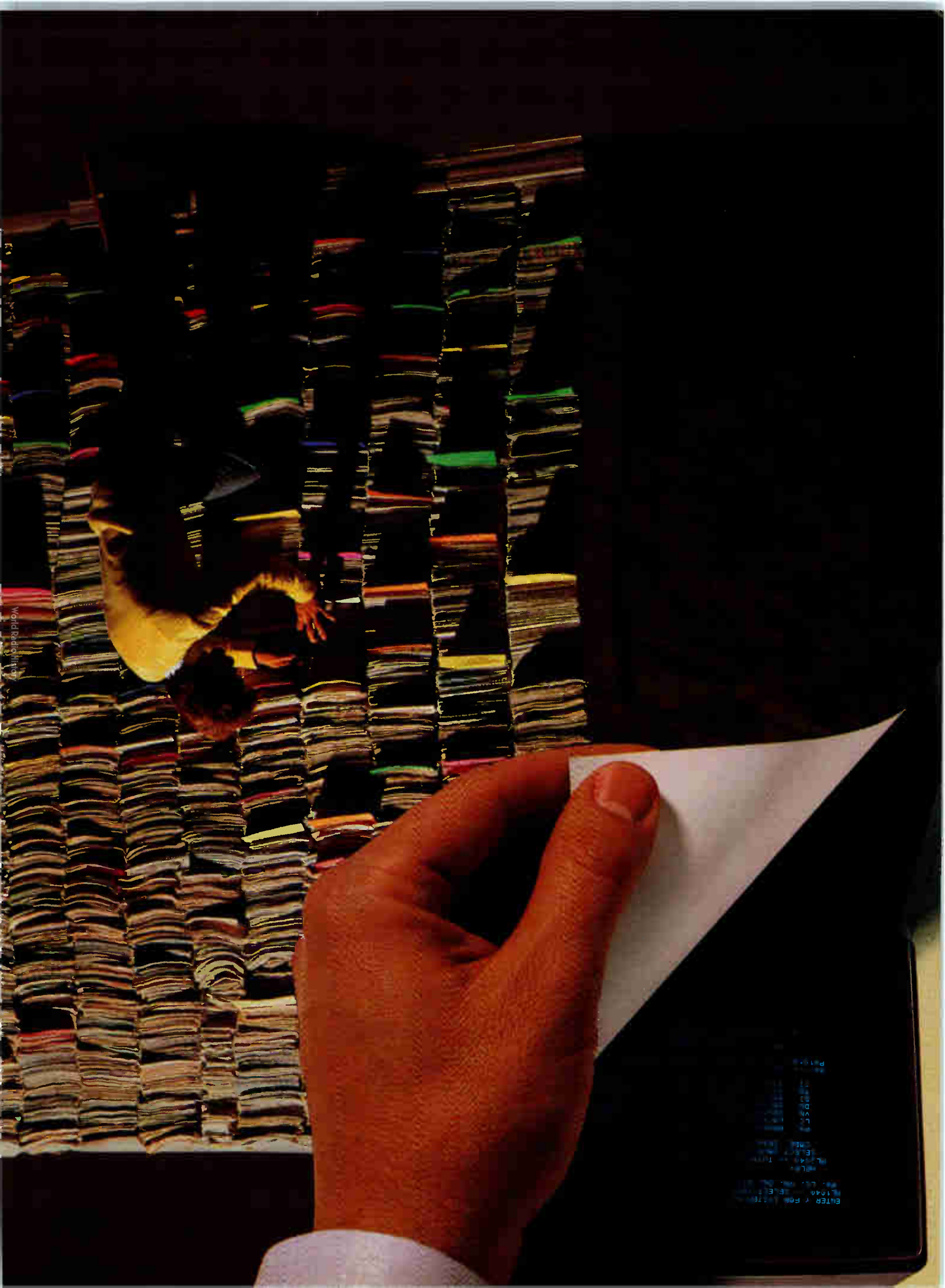

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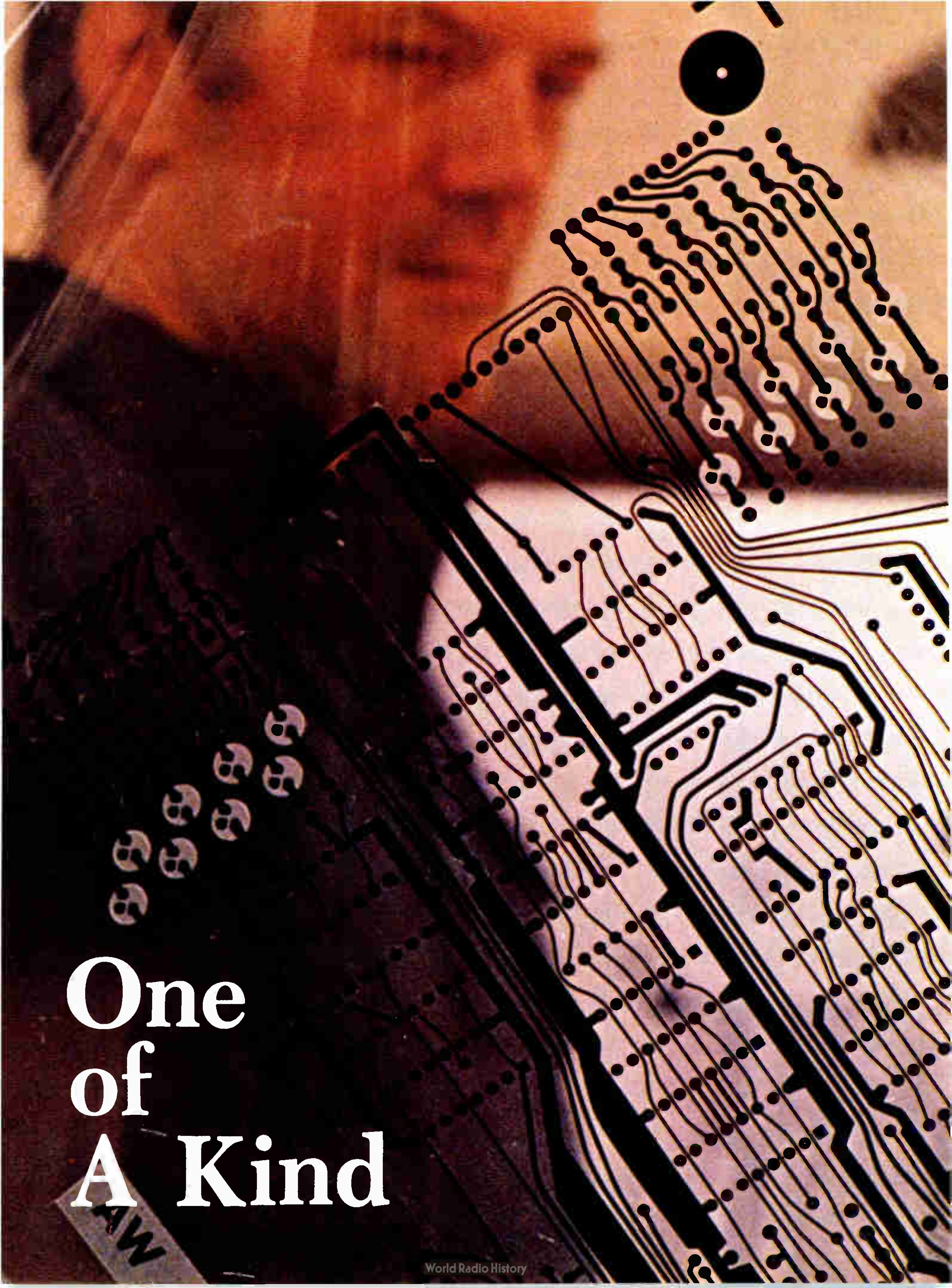

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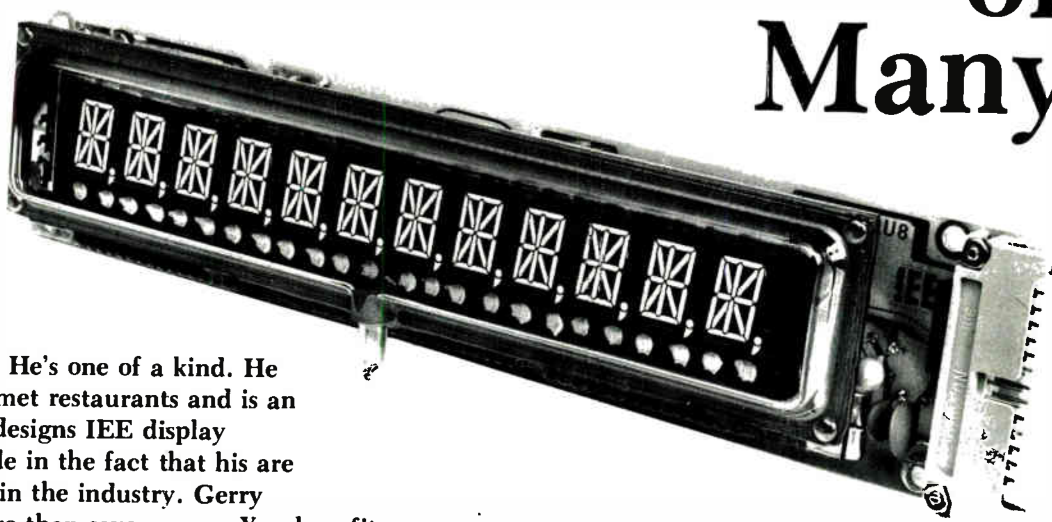
One of Many



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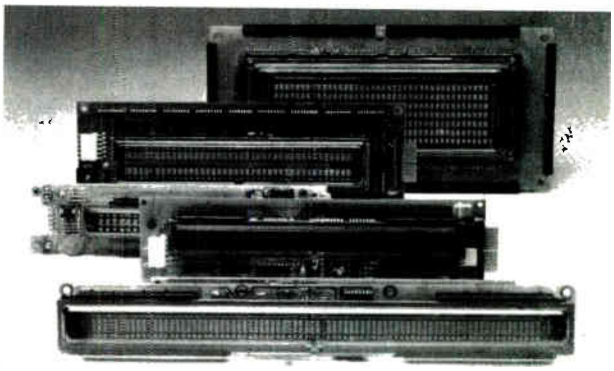

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Voice messaging: a future giant

Year-old industry could reach $3 billion by decade's end as store-and-forward systems find their way into the electronic office

by J. Robert Lineback, Dallas bureau manager

Electronic store-and-forward voice-messaging systems—often called missing links to higher office productivity—are fast becoming more than just talk. Barely a year old, the total market for so-called voice mail could hit $3.155 billion by the end of the decade, according to one estimate by International Resources Development Inc. In 1981, the number of market entries promises to double.

Meanwhile, companies with existing voice-messaging products plan additional software features in an attempt to stay on the crest of the wave. These computerized systems attack real-time problems of business communications, or what one pioneer in the field calls "telephone tag." Gordon Mathews, chairman and founder of ECS Telecommunications Inc. of Richardson, Texas, predicts that voice-mail service will improve white-collar productivity by reducing the time executives spend on the phone. "You call someone, and he or she is not in. So you leave a message with the secretary. Your call is returned, but you are unable to talk. Then you call again," says Mathews, whose firm first began selling voice-message exchange (VMX) systems a year ago.

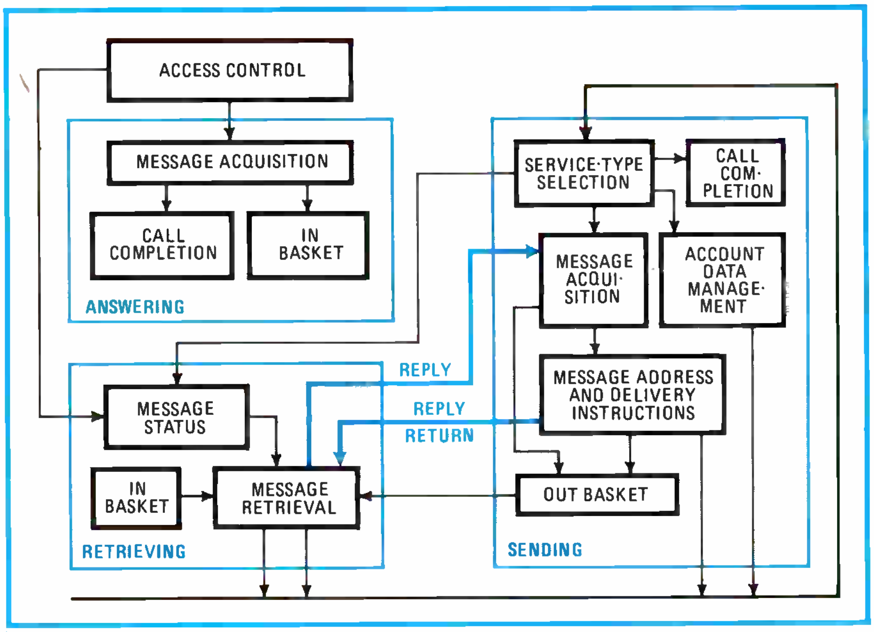
Use phone lines. To meet high-speed and mammoth memory requirements, messaging systems convert voice into digital form. Messages are then stored on disks and in high-speed buffer memories made up of random-access memory. In general, the systems operate over existing telephone lines and equipment. For business applications, they are often linked with a private automatic branch exchange to do both in-house and outside messaging. Some voice-mail firms also lease "voice mailboxes," which are tied directly to public telephone switching offices.

Customers operate voice systems over standard push-button phone units, using codes to activate log-on, record, send, retrieve, and playback modes. Most systems will also give reports on the number of incoming messages, which are kept on file until users delete them. Many products also feature automatic message delivery, which can be programmed to call any phone exchange any time of day. If messages are not delivered on the first try, systems can repeat calls until all the recordings are heard. In some systems, message senders also can receive status reports on delivery.

Despite general similarities, long-term voice-messaging strategies vary as much as the size and age of the companies themselves. Some firms see voice mail as part of an overall scheme to integrate all media into a single messaging network. Others have no plans beyond speech capability. Still others believe voice recognition and synthesis techniques must be further developed before such systems gain full acceptance.

Integrated system. For example, Delphi Communications Corp., a Los Angeles–based Exxon Communications Systems company, plans to introduce its Delphi–Voice Messaging System (D-VMS) in the second half of the year, with delivery scheduled for the first quarter of 1982. It will cost between $1.5 million and $3.2 million. D-VMS has been de-

Getting the message. The Delphi–Voice Messaging System, to be introduced later this year, consists of three subsystems that operate individually or collectively to provide service.



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Solid state

Innovations surface in custom ICs

Annual conference gives clues to circuits and processes that could find their way into standard devices

by John G. Posa, Solid State Editor

Even with compatible logic families and standard chips like memories and microprocessors, there will always be specialized applications requiring nonstandard devices. Indeed, with very large-scale integration putting entire systems on chips, and with original-equipment manufacturers cramming to acquire semiconductor know-how, the future promises more custom-built chips than ever.

Gaining a reputation as the forum for the latest in specially made chips is the annual Custom Integrated Circuits Conference—the CICC—scheduled for May 11–13 at the Americana Hotel in Rochester, N. Y. (see table). Though most of the chips were designed for internal consumption, they nonetheless define circuits and outline processes that could be applied, perhaps indirectly, to standard ICs.

A highlight of the conference is a 32-bit Schottky TTL microprocessor from the Musashino Electrical Communication Laboratory of the Nippon Telegraph & Telephone Public Corp. The 95-square-millimeter (146,564-square-mil) chip contains 12,000 0.6-nanosecond, 0.2-milliwatt gates made with the lab's super-self-aligned bipolar process. This process was used previously to build a 3-ns emitter-coupled-logic random-access memory [*Electronics*, Feb. 24, 1981, p. 145].

As impressive as the processor's cross section is the computer-aided design system that wired its 56,000 elements over some 18,000 paths in about one month. To facilitate placement and routing, the IC exploits a rectangular three-input NAND cell that can be stretched lengthwise to accommodate the second metallization layer without causing excessive delay (see figure, p. 104).

Some of the conference's most interesting chips are not fully custom at all, but rather semicustom master slices. To save processing steps, Japan's Fujitsu Ltd. customizes a new 770-gate complementary-MOS array—built on sapphire—by etching away epitaxial silicon lines. With this technique, Fujitsu can forgo a second metal layer and its mask yet retain a high packing density. So far, the firm has used the idea to build the controller for a charge-coupled-device video camera.

HIGHLIGHTS OF THE 1981 CUSTOM INTEGRATED CIRCUITS CONFERENCE

Monday, May 11	
Leadless chip-carriers	Sperry Univac
C-MOS pacemaker	Tadiran, Mennen Medical
High-power Bi-MOS	Sprague
Arinc interface chip	Harris
High-voltage array	Sprague
Mask design system	DMT Corp.
VLSI electron-beam lithography	Rensselear Polytechnic Institute
Modeling C-MOS VLSI	Westinghouse
Three-dimensional MOS models	University of Waterloo
Lookup table model for MOS	Toshiba
Tuesday, May 12	
ECL gate arrays	Siemens
Schottky logic arrays	Harris
I^2L arrays for peripherals	Control Data
Ultraversatile I^2L chip	University of Minnesota
Automated C-MOS/SOS array	RCA
32-bit VLSI processor	NTT Musashino Electrical Communication Lab
Moving-coil preamplifier	Delft University
Exposure control chip	Eastman Kodak
Spectrum analyzer preprocessor	Westinghouse
Fast video imager	Eastman Kodak
CCD a-d converter	Korea Advanced Institute
Analog telecommunications array	Thompson-CSF
Wednesday, May 13	
Epitaxial-layer customization	Fujitsu
Iso-C-MOS logic circuits	Mitel
1,000-V MOS process	Tektronix
Versatile n-well C-MOS	Honeywell
Self-aligned silicon MES FET	Tektronix
CCD signal processor	Westinghouse
Theoretic transformer	Mitre
C-MOS analog phase detector	University of Florida
Test chip standardization	National Bureau of Standards
High-reliability test chips	Caltech Jet Propulsion Laboratory
Ceramic moisture sensor	Shizuoka University

Source: *Electronics*

RCA Corp. in Camden, N. J., will discuss an SOS array containing 800 1- to 2-ns C-MOS gates and a layout program that regularly connects them with an efficiency beyond 90%. Mitel Semiconductor Inc. of Bromont, Ont., Canada, will describe its bulk Iso-C-MOS arrays, now built with 5-micrometer design rules, with scale-downs to 4- and 2-μm planned. At 2 μm, Mitel will switch to an n-well process [*Electronics*, Dec. 4, 1980, p. 39] for subnanosecond gate delays. Another paper, from Honeywell Inc., will reveal how a single n-well C-MOS IC can also support n-channel MOS, CCDs, and npn bipolar circuits.

Many uses. The University of Minnesota, collaborating with a company called Custom Integrated Circuits in Minneapolis has devised an integrated-injection-logic chip that it calls ultraversatile. The collectors, contacts, and metal layers of its 4,056 gates are programmable. The basic building block is an eight-gate cell that can be used for one flip-flop, one static RAM cell, or 40 read-only memory bits. Multiple cells can be combined for higher-level functions; for example, a 5-bit digital-to-analog converter requires

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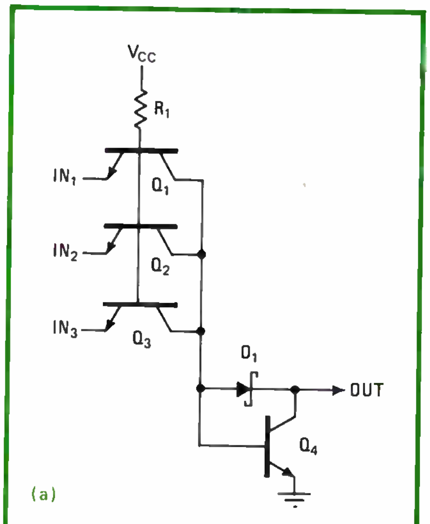
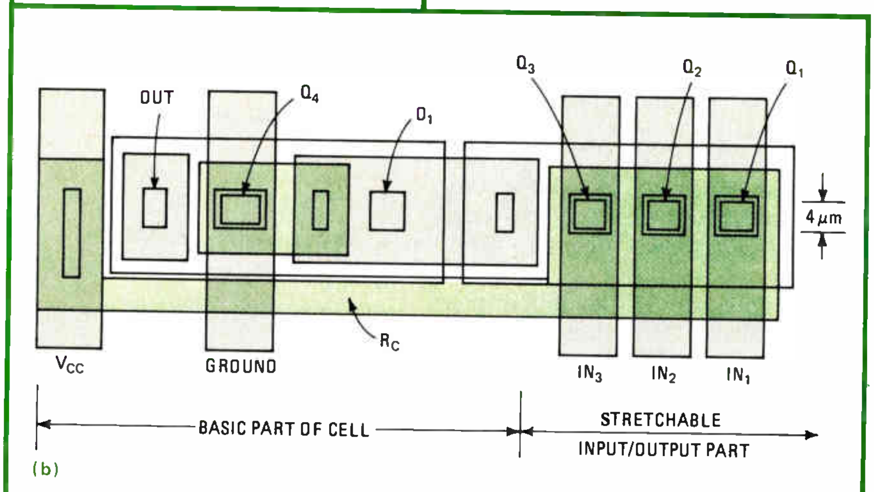
More proof that future arrays will come in all technologies, Control Data Corp. of Minneapolis will show how it uses 616- to 1,600-gate I^2L arrays in special 72- to 129-pin packages to control peripheral devices, Siemens AG of West Germany will describe the development sequence for its emitter-coupled-logic arrays, the Harris Semiconductor Group of Melbourne, Fla., will detail its Schottky-transistor-logic (STL) arrays, and Thomson-CSF of France will tell telecommunications users how to benefit from its 10-mm² analog master slice. In addition, Sprague Electric Co. of Worcester, Mass., will explain how the transistors in its arrays withstand 80 volts and the resistors more than 500 V.

Better yet, MOS power ICs from Tektronix Inc. of Beaverton, Ore., are able to handle 1,000 V. The company starts with a standard n-channel silicon-gate Isoplanar process, adding to the high-voltage transistors a lightly doped n-type drift layer and a source field plate that extends over the drift layer. The extended field plate helps to arrest surface avalanche injection in the channel region, and the drift layer determines the 400- to 1,000-ohm on-resistance.

Etching skill. The STL array and another chip from Harris—a custom interface for Aeronautical Research Inc.'s Arinc-429 specification for airborne digital information transfer—will demonstrate Harris's ability to anisotropically etch silicon for device isolation. For instance, in the array STL gates are separated with V grooves, oxidized, and backfilled with polysilicon. More impressive, in the Arinc chip, tubs with slanted sides are formed in a polysilicon substrate, oxidized, then filled in a proprietary step with n- and p-type single-crystal silicon.

For high speed, another paper from Tektronix will describe a self-aligned six-mask silicon metal-semiconductor FET, or MES FET, process responsible for subnanosecond gates that dissipate less than 100 microwatts. Indeed, the process is being used by Tektronix for a 30-ns 8-by-8-bit multiplier, a 40-ns 10-by-10-bit multiplier, a 500-megahertz





Expandable. Part of the cells (a) in 32-bit Schottky TTL microprocessor from NTT can be stretched to make room for interconnection paths (b). Rest of cell stays the same.

World Radio History

1,024-bit linear shift register, and a programmable IC that can compare two 4-bit words within 15 ns.

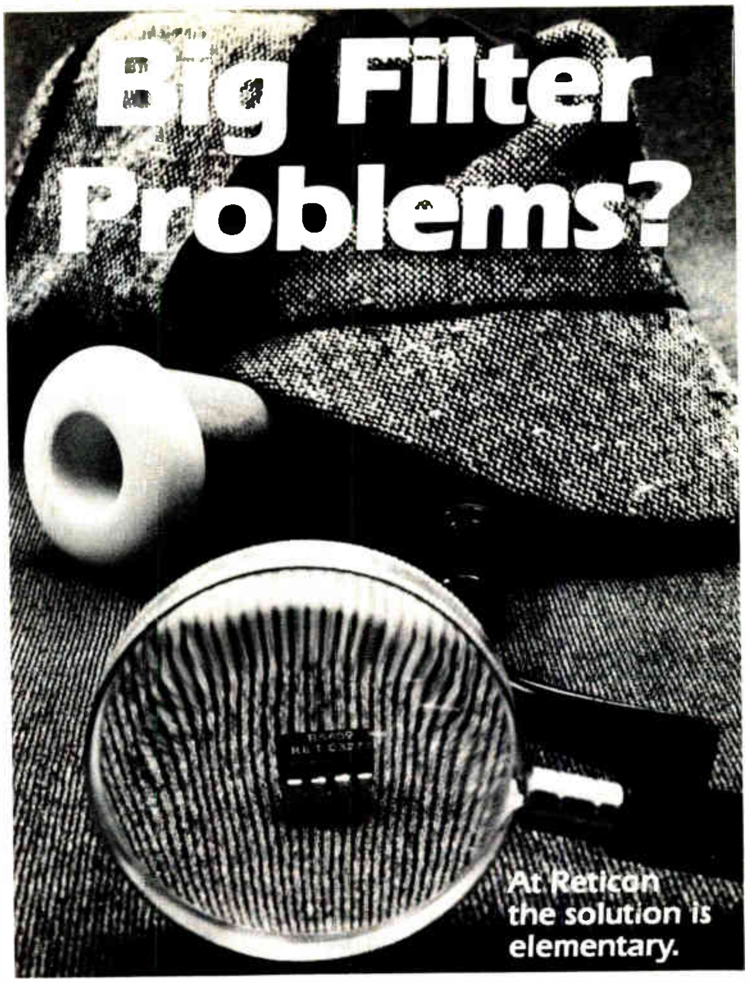
By breaking up its image sensor into six sectors, Eastman Kodak Co. of Rochester, N. Y., is able to squeeze 2,000 frames per second out of the 192-by-240-pixel (picture-element) MOS chip that it will unveil. Each block has 32 parallel outputs, reducing the effective analog rate internal to the chip to only 3 MHz. The imager is part of a super-fast motion analysis system sold by Spin Physics, a San Diego, Calif., company owned by Kodak. Kodak will also explain how the exposure control IC works in its recent instant cameras.

Processors and detectors. Some very sophisticated custom chips to be presented include an adaptive analog signal processor from Westinghouse Electric Corp.'s Advanced Technology Laboratory in Baltimore that combines an electrically reprogrammable CCD filter with C-MOS peripheral circuits, a C-MOS analog phase detector from the University of Florida for locked loops in communications and signal-processing applications, and an LSI chip proposed by Mitre Corp. of Bedford, Mass., that will perform Fourier-like, finite-field transforms of up to 255 4- to 8-bit symbols.

Westinghouse's Advanced Technology Lab will describe a detector and preprocessor chip for use with an acousto-optic spectrum analyzer. The smart sensor is part of a three-chip set, the other two being C-MOS-on-sapphire VLSI chips. Packing in technologies, the sensor combines high-speed CCDs, bipolar devices, C-MOS, and dielectrically groove-isolated photodiodes. Together, the chip set performs a recognition and sorting algorithm on high-speed, narrow-pulse signals.

Sensing also will be the topic of a presentation by the Research Institute of Electronics of the Shizuoka University in Hamamatsu, Japan. Seeking a moisture sensor that might be compatible with custom ICs, the institute's researchers settled on titanium oxide–tin oxide ceramic disks containing tantulum oxide as an n-type dopant.

For more information about the conference, call Constantine Anagnostopoulos at (716) 477-6768. □



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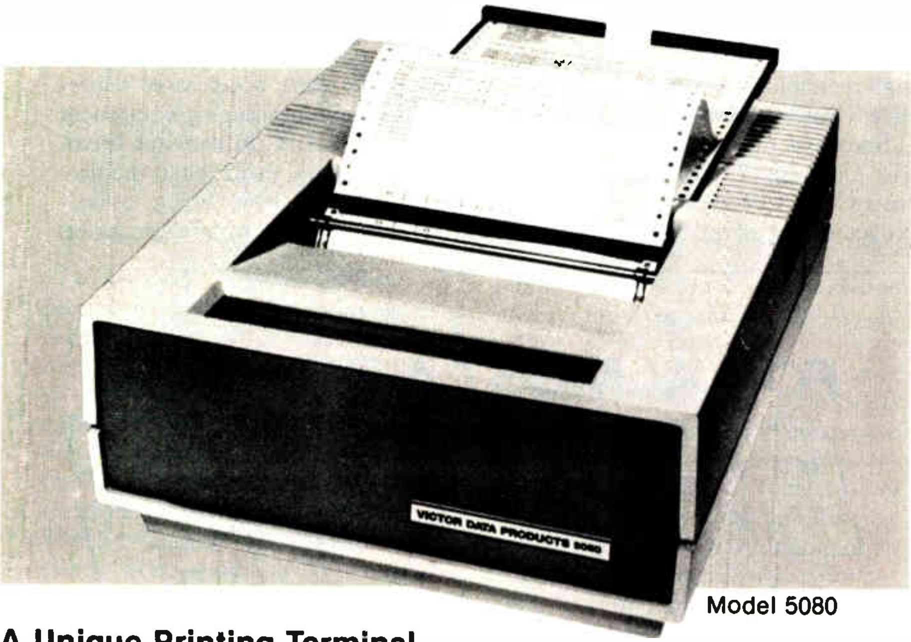

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of U. S. foreign branches and subsidiaries under the depreciation rules. Noyce spoke on behalf of the Electronic Industries Association, the American Electronics Association, the Semiconductor Industry Association, the Scientific Apparatus Makers Association, and the Computer and Business Equipment Manufacturers Association.

The Intel executive and cofounder highlighted the declining rate of U. S. R&D expenditures as a percentage of gross national product—compared to increases by Japan and West Germany in the 1964–76 time frame—by noting that the American R&D decline is worse than it appears. The reason, he said, was that "about 35% of U. S. R&D spending goes for defense and space, whereas Germany spends only 9% and Japan less than 3% in these areas.

U. S. trading partners like Japan, West Germany, France, Great Britain, Italy, and South Korea "bias results in favor of their national industries," Noyce told the committee, by "establishment of national goals, use of subsidies and incentives, special public support for universities, collaborative industrial research, and sheltered home markets."

Stock options. The American Electronics Association, in additional separate testimony by Spectra-Physics Inc.'s chairman and president, Herbert M. Dwight Jr., also called for restoration of restricted personnel stock options. This was seen as an incentive for attracting expertise to smaller innovative companies. Dwight also urged elimination of capital gain taxes on new investments.

The head of the Mountain View, Calif., laser manufacturer strongly supported the 25% tax credit for corporate R&D grants to universities, noting that the electronics industries "are facing a severe shortage of engineers and technical people." Dwight called it "a disgrace and a disturbing fact that Japan, with a population half as large as the U. S., trains four times as many scientists and engineers as we do" as a percentage of population. □

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Software Tools

In addition to the standard commands for manipulating processes, files, and the like, in its initial release COHERENT will include the following major software components: SHELL, the command interpreter; STDIO, a portable, standard i/o library plus run-time support routines; AS, an assembler for the host machine; CROSS, a number of cross-assemblers for other machines with compatible object format with 'AS' above; DB, a symbolic debugger for C, Pascal, Fortran, and assembler; ED, a context-oriented text editor with regular expression patterns; SED, a stream editor (used in filters) fashioned after 'ED'; GREP, a pattern matching filter; AWK, a pattern scanning and processing language; LEX, a lexical analyzer generator; YACC, an advanced parser generator language; NROFF, an Nroff-compatible text formatter; LEARN, computer-aided instruction about computers; DC, a desk calculator; QUOTA, a package of accounting programs to control filespace and processor use; and MAIL, an electronic personal message system.

Of course, COHERENT will have an ever-expanding number of programming and language tools and basic commands in future releases.

Language Support

The realm of language support is one of the major strengths of COHERENT. The following language processors will be supported initially.

- **C** — a portable compiler for the language C, including stricter type enforcement in the manner of LINT.
- **FORTRAN** — portable compiler supporting the full ANS Fortran 77 standard.
- **PASCAL** — portable implementation of the complete ISO standard Pascal.
- **XYBASIC™** — a state of the art Basic compiler with the interactive features of an interpreter.

The unified design philosophy underlying the implementation of these languages has contributed significantly to the ease of their portability. In particular, the existence of a generalized code generator is such that with a minimal effort (about one man-month) all of the above language processors can be made to run on a new machine. The net result is that the compilers running under COHERENT produce extremely tight code very closely rivaling that produced by an *experienced* assembler programmer. Finally, the unified coder and conformable calling sequences permit the intermixture of these languages in a single program.

Operating System

In part because of the language portability discussed above, and in part because of a substantial effort in achieving a greater degree of machine-independence in the design and implementation of the COHERENT operating system, only a small effort need be invested to port the whole system to a new machine. Because of this, an investment in COHERENT software is not tied to a single processor. Applications can move with the entire system to a new processor with about two man months of effort.

The initial version of COHERENT is available for the Digital Equipment Corporation PDP-11 computers with memory-mapping, such as the PDP 11/34. Machines which will be supported in the coming months are the Intel 8086, Zilog Z8000, and Motorola 68000. Machines for which ports are being considered are the DEC VAX 11/780 and the IBM 370, among others.

Because COHERENT has been developed independently, the pricing is exceptionally attractive. Of course COHERENT is completely supported by its developer. To get more information about COHERENT contact us today.

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World Radio History

Information processing

What electronic mail should deliver

Its cost-effectiveness and other questions come under scrutiny at the Ottawa Symposium on Computer Message Systems

by Harvey J. Hindin, Communications & Microwave Editor

"Humans," author Lewis Thomas says in his essay on computers in "The Lives of a Cell," spend "most of their time sending messages to each other, talking and trying to listen at the same time, exchanging information." And what people do in life they soon try to do with machines. Hence, last week's International Symposium on Computer Message Systems in Ottawa.

Although talking is more natural for man than writing, the opposite is true for computers. So those attending the meeting, sponsored by the International Federation for Information Processing, concentrated on what computers can do with electronic mail systems. Voice systems, a relatively new technology, have a way to go before they reach the degree of availability enjoyed by electronic mailboxes and messaging (see p. 99). But the U. S., Canada, England, France, Germany, Austria, Italy, Holland, Brazil, and other countries have electronic mail systems in place today.

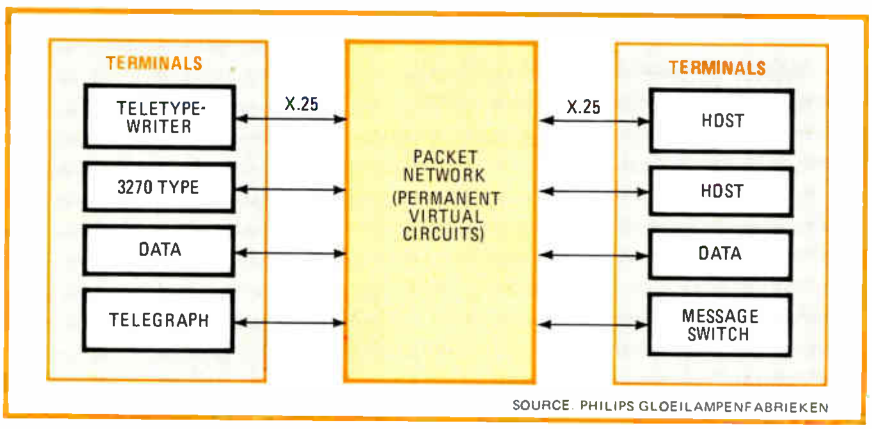
These systems, say J. Bruder, M. Moy, and A. Mueller of Hewlett-Packard Co. in Palo Alto, Calif., in their paper, offer the communicator the advantages of permanent records, asynchronous communication, freedom from interruption, release from geographic restrictions, and optimal use of the sender's and receiver's time. The freedom from geographic restrictions has been heralded as one of the major reasons for an electronic mail system. Yet, in practice, many systems are coming into place to serve narrowly defined local areas. Corporate management has—correctly—just not been willing to commit large resources to a computer-based message-switching system before its cost-effectiveness has been demonstrated without a doubt. Unfortunately, this has been difficult to do.

There are other problems besides cost-effectiveness. "Without the incentive provided by geographical dispersion, other factors become proportionately more important," say the HP researchers. These include the character of the user community, the nature of the messages, and the accessibility of the system. Like cost-effectiveness, these more or less psychological factors were on the minds of those at the meeting.

Custom design is one way to address the user suitability problem. For HP's internal electronic mail system, this means that messages are organized in separate data bases organized by receiver name rather than simply being stored as text files in a receiver's own filing space. One reason for this approach is that many potential users have more than one sign-on. Centralizing the data base allows them to access all their mail from any account. Another reason is the opposite phenomenon: different users sometimes sign on to the same account. Then the centralized approach affords privacy.

Many approaches. HP's system, known as Norman (for network routing of mail with automatic notification), has gone through several revisions and is typical of the electronic mail systems discussed at the conference. Other work is going on, for example, at Canada's Bell-Northern Research, where a pilot program has involved 19 workers at Bell-Northern Software Inc. in Toronto. For BNR researchers Don Tapscott and Morley Greenberg, the key to success is user-driven design.

The problem for vendors in supplying just what users of an electronic mail system need, they point out, is that there are no really good quantifiers of just what an electronic mail system does for productivity. "Product planners, system designers, market analysts, implementers, users, and choosers of systems are all forced to work in a vacuum," they



Worldwide. The Philips network, built over many years, houses a new data network for message switching called Codan. It is based on packet switching and the X.25 protocol.

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Probing the news

say. These difficulties are severe enough to make Tapscott and Greenberg state that "many systems have been inappropriate and failed. Others, lacking a clear and hard-dollar cost justification, have never made it out of the lab."

BNR is devoting a lot of effort to this necessary quantification. Unfortunately, there are so many limitations to the analysis that the company is hesitant to draw conclusions that are generally applicable.

The difficulties in performing office field studies, the uniqueness of the office environment, organizational changes, turnover, and changes in work content are other factors combining to make what is in essence a psychological-sociological study very difficult. Message use is being monitored, user satisfaction quantified, and learning curves analyzed. Furthermore, the variation of use as a function of the type of user and time on the system is being studied in an attempt to relate all the factors to some measure of cost-effectiveness. BNR's effort is one of several that are necessary, conferees said, if electronic mail is to be as ubiquitous as, say, Telex.

Not just local. Of course, electronic mail is not just limited to local networks; international systems exist that speed the transmission of messages over vast distances. They do best where the need for cooperation between geographically disparate communicators is foremost. Typical is the computerized message and teleconferencing system set up by the International Institute for Applied Systems Analysis in Laxenburg, Austria.

According to Istvan Sebestyen, the packet-switching–based service, which links Laxenburg with Budapest, Moscow, Prague, Vienna, and other cities, is still "experimental compared with services like Telex and the telephone," but developments are proceeding apace. For example, there are plans to use a West German distributed computer system known as Komex for a field experiment in text communication.

While the Laxenburg institute is looking into a specialized service, researchers at the Central Laboratories of the Siemens AG Communications Group in Munich are leaning toward Europe's Integrated Text and Data network for text communication. That 64-kilobit channel, currently being introduced into the public telephone network, "is a particularly attractive proposition," according to Peter Bocker and Peter R. Gerke of Siemens. The attraction, they say, is due to the network's message services being just as tailored to the needs of the user as they are in independent networks for the same purpose. Yet it will be a public, ubiquitous network.

The Siemens view supports the idea that electronic mail functions will not be revolutionary but will be just one more in a list of services provided by the communications industry. This is echoed by Cesac SpA of Lomazzo-Como in Italy. Researchers at that institution say that their new computer mail package on a local network of Univac 1100 computers was conceived as a logical extension of other, more traditional services offered by the center to its user. They, too, emphasize the need for what is clearly the major issue in electronic mail—utility for the user.

The popular Unix, the Bell Laboratories-derived computer operating system, was originally conceived as an ideal operating system for communications applications. It is no surprise, then, that it is making its appearance in computer messaging. At Laxenburg, Michael M. L. Pearson and James E. Kulp have developed an adaptive computer-mediated conferencing system based on Unix, called Telecenter.

The system was implemented in just one week, though months are usually required for such chores. Unix made this feat possible, but more important, it enabled the system to be shaped by user needs. According to Pearson and Kulp, Telecenter is written in the language of the standard Unix system command interpreter program. Hence they say, "its functions consist of easy-to-understand command interpreter scripts that can be implemented by anyone familiar with the operating system's standard interactive commands." □

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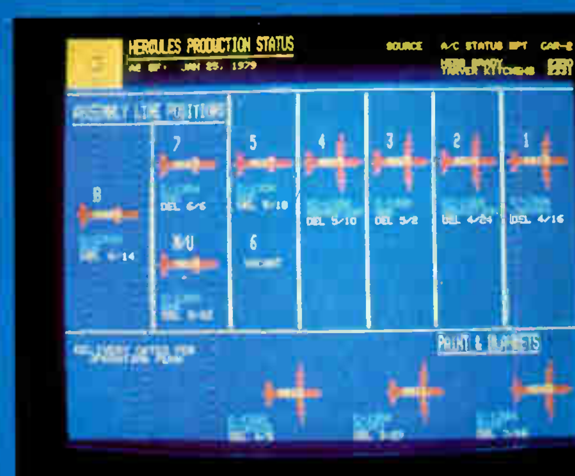
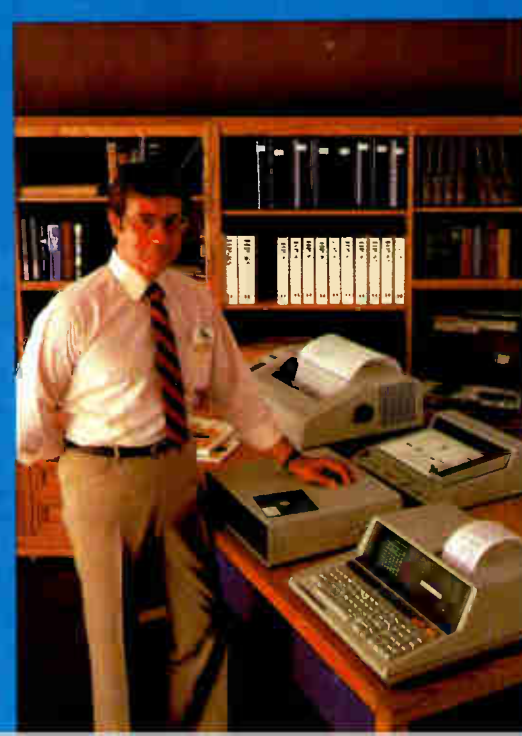
SPECIAL ADVERTISING SECTION

Personal Computers as the EE's Best Friend





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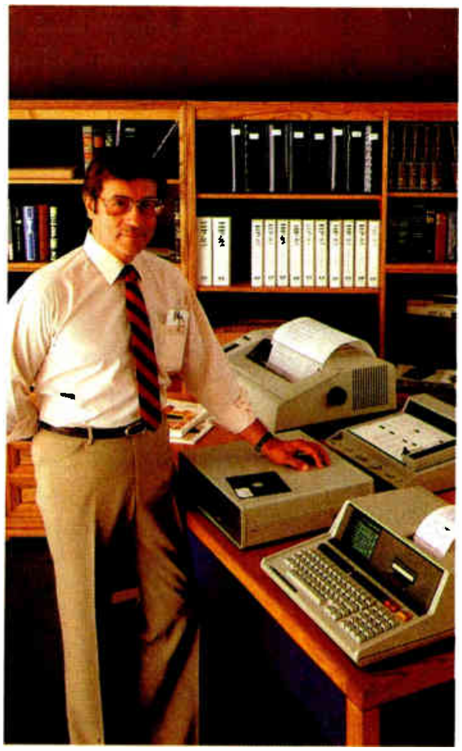
PERSONAL COMPUTERS: VERSATILITY PLUS

Engineers are finding them the solution to many problems

Maurice Zollner uses personal computers to tickle the brains of both the satellite power systems he builds and of his children, who used to be addicted to television. And he uses the same personal computer to do both.

Zollner, a Senior Design Engineer for McDonnell Douglas Astronautics Co., St. Louis, Mo., uses an Apple II Plus computer with special interfaces and a Houston Instruments' plotter to conduct half a dozen tests and quality control functions on what are known as modular par subsystems, each of which controls spacecraft power systems, altitude control systems, or data-handling networks. Six or seven engineers and technicians used to take days to do one of these tests by hand. Now, the ever-watchful and patient computer does it automatically in hours.

Before Zollner made a personal computer an invaluable measurement tool in his work, he discovered its power and versatility at home. "Every day, we find more and more uses for our home system," he says.



Personal computers have rapidly turned into vital tools for the working electrical engineer.

"One of my sons does his homework on it, has converted game programs from a book, and has written a graphics program for a math class; my 14-year-old daughter uses it for typing practice; I keep track of the billings and bookkeeping of my wife's business. But, of course, 75% of the time, we use it for Dungeons and Dragons and other games." An inveterate explorer of the computer's potential, he adds, "I find it the ultimate tinkering device."

This special advertising section on personal computers was written by Robert Perry, author of several books, including Owning Your Home Computer, and consulting editor for Mechanix Illustrated's "Personal Computers" annual.

Powerful Microcomputer Controls Cable TV System

Across the Appalachians, David R. Morrow, a young electrical engineer with C-CORR Electronics, in State College, Pa., also displays the ingenuity with which thousands of engineers are putting personal computers to work. He has designed a system, which can directly address up to 65,000 individual cable television installations, around an Altos ACS8000-6 microcomputer with a 64-K random-access memory and a 13.5-megabyte hard disk.

The Altos computer acts as the root of a system tree. Each of the 65,000 "leaves" is an addressable converter, called Scat-can, that resides on a telephone pole. A Scat-can contains a microprocessor that can control the type and number of channels each cable subscriber can receive.

Today, to allow a customer to add pay-TV or premium-pay services, most cable companies have to send out a serviceman to adjust the in-home converter or even install a new box with the additional channels. Morrow's system would eliminate the need for these service calls.

Although it would seem Morrow's knowledge is already blooming, he isn't resting on his laurels. He has built a Heathkit

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H-89 personal computer from a fairly simple kit ("It's tough to blow a Heathkit," he notes).

What does he use it for? "To learn, period. That was the whole reason I bought it. I am trying to learn everything I can—the system configurations, the different kinds of microprocessors, tricks of the keyboard and the inside of the terminal, Heath's HDOS operating system (which is much like CP/M)."

Input From All Corners

These two men, one an experienced, established professional and the other a young, aspiring, innovative electrical engineer, show how fundamentally personal computers are changing the electrical and electronics engineering industry. As you'll read later, EEs are finding imaginative ways to put computers to work and relieve people of boring, time-consuming tasks. They're also discovering new kinds of tests and measurements that personal computers can make that had never before been considered.

What's more, they're saving thousands of dollars and making real improvements in productivity. Zollner estimates, for example, that it would have cost $60,000 to buy another system to do the same work a $6,000 Apple system can do more easily.

When they take the computers home, the machines become new partners in creating a better family life. The kids become proficient programmers and sophisticated computer literates, giving them even greater advantages when they leave high school than the ones any well-educated, concerned parents would provide. The parents find that their family finances become more manageable, and information processing tasks—from small business bookkeeping to volunteer work—become easier and less time-consuming to accomplish.

Some people even find that personal computers give them a chance for a second or a new, more profitable career. Engineers have played a major part in establishing most of the 1,500 new computer retail stores, hundreds of software houses, and more than 2,000 systems houses and consultancies. And that doesn't include the dozens of small, new companies manufacturing motherboards, interfaces, disk drives, printers, terminals, and the thousands of parts that go into them.

Still, the new machine called a personal computer has only begun to influence the electronics industry and the nation as a whole. After all, there are only about 750,000 installed today (depending on whose estimate you read).

Personal Computers are on EEs' To-Buy List

Close to home, only 34% of all EEs say they either own or work with personal computers now. But more than half, 52%, say they plan to buy one by 1983. That means an enormous number of sales, hundreds of thousands, at least, just to engineers—and soon. Also, the consumer market for these devices has not been scratched.

The personal computer segment of the electronics and data-processing industries is growing very rapidly, and this growth raises many important concerns of which every engineer should be aware. This report will discuss many of these basic issues so you will have a fundamental grasp of what the personal computer will mean to you and your work now and in the future.

One section will review the birth and growing pains of the personal computer and how it gave rise to a new generation of entrepreneurs who become rich practically overnight. It will examine the current state-of-the-art in hardware. It will touch on the critical shortage of software, and how this shortage curbs the industry's growth.

The Engineer's Friend

As important, this report will show you how you can learn from people in your professions how to use personal computers to make dramatic and positive improvements in your work, your career, and your family life. in fact, this report is designed to help you use personal computers to unlock the doors to personal growth and professional productivity during the 1980s and beyond.

This decade will undoubtedly bring far-reach changes in the ways we work—more brain work and less drudgery; the ways we play—far more interaction with entertainment media and other people and much less passive "tubing out" with the TV; the ways we learn—more academic education in the homes and less emphasis on formal schooling; and the ways we view the world around us. And personal computers, from inexpensive game-playing devices, to powerful, but pocket-sized information processors, will help determine how these changes occur and how they influence your lives. The influence will extend to your families too, of course, for the personal computer is going to be everyone's friend. □

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Keyboard	Fixed	Programmable
Numeric Key Pad	Accessory	Built-in
Input/Output	8 expansion slots	4 expansion slots plus built-in: disk interface RS-232 interface Silentype™ printer interface
Disk Drives	Add-on one to six drives	One drive built-in, plus interface to support three more drives
Languages	BASIC Fortran 77 Pascal Assembly Pilot	Enhanced BASIC Fortran 77 Pascal Assembly
Typical Configuration Pricing	CPU, 48K RAM, single disk drive, B&W Monitor (9"), Silentype™ printer, and BASIC. $3250.00*	CPU, 96K RAM, integrated disk drive, B&W Monitor (12"), Silentype™ printer, SOS, Enhanced BASIC. **$4865.00***

*Suggested retail price.

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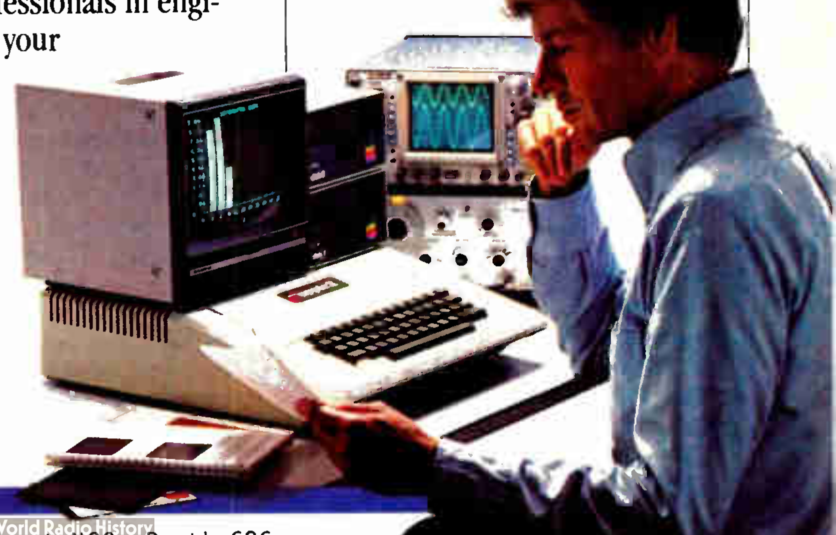

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World Radio History

PERSONAL COMPUTERS: A BRIEF HISTORY

Capitalizing on microprocessor technology, machines are growing in power

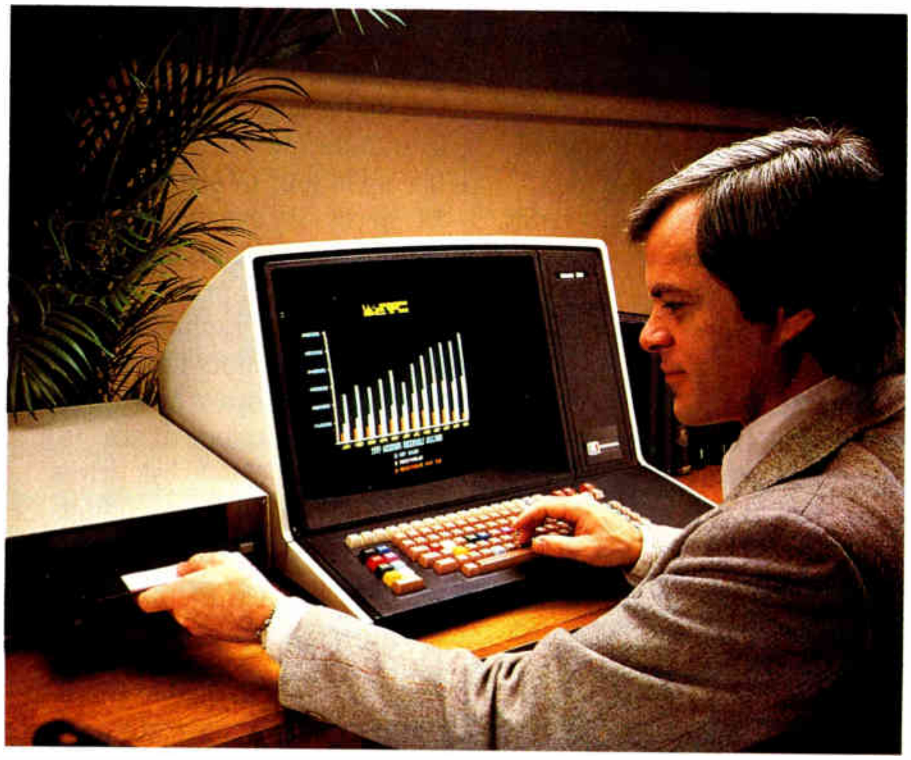
Minicomputers introduced the idea of a compact yet powerful computing system at a reasonable cost, and microprocessors helped lower the system price tag to the level that a wide range of would-be computer owners could afford on their own. The first stirrings of a new industry were evident as early as 1973, and by 1977 engineers and hobbyists owned about 50,000 truly personal computers, systems that they pieced together and programmed themselves.

The early personal computer mamufacturers offered what were essentially kits, needing such peripherals as a video monitor, a keyboard, and a mass storage device—to say nothing of a considerable amount of assembly by the proud purchaser. These offerings were enough to spawn the retail computer store, whose ranks grew to almost 1,500 outlets by the beginning of 1981. A new publishing business grew up, too, supplying news, how-to tips and software for the burgeoning market.

The First Home Computers

The watershed year for personal computers was 1977. The mainstays of the market—Radio Shack, Apple, Commodore, and Ohio Scientific—were introduced in an amazing rush. The simple TRS-80, the more advanced Apple II, the Commodore Pet, and the Ohio Scientific Challenger series are set apart from the products of the first two years: each is a completely assembled computer with all of its elements in one neat, usable package. All use simple high-level programming languages like Basic and common mass storage devices—cassette tape recorders or floppy-disk drives.

Between 1977 and 1980, the personal computer industry exploded like a new galaxy, with manufacturers and marketers of computers, peripherals, software, microprocessors, and all their attendant bits and pieces flying in a million different directions. But like the galactic dust, some major companies came to dominate the market like suns, with smaller support companies revolving around them like planets in successful orbits.



Powerful personal computers like the Intecolor 3651 have added such vital engineering functions as sophisticated graphics capabilities.

For electronics engineering applications, companies specialized in single-board microcomputers and

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development systems. Southwest Technical Products, Midwest Technical Products, Industrial Micro Systems, Ithaca Intersystems, Smoke Signal Broadcasting, Artec Electronics, Alpha Microsystems, North Star, Dynabyte, Tarbell Electronics, Thinker Toys, Vector Graphic and Cromemco were just a few of the first small companies that thrived in this field.

Many of them developed complete systems, incorporating dual floppy disk drives, intelligent terminals, and systems and applications software, and sold them by the thousands to small businesses and professionals. Others remained providers of motherboards and components to systems manufacturers.

Standards Emerged as the Marketplace Grew

Out of this chaos also emerged some *de facto* standards for communications and peripheral interfaces. All of the 8080- and Z80-based computers used the S-100 interface, and the IEEE has since based its microcomputer interface standard (the IEEE-696) on it. Practically every manufacturer also uses the RS-232-C communications interface for low-speed telecommunications with a modem. In software development, divergent languages and variations within the same language remain the rule, but more and more companies are using Digital Research's CP/M operating system (for all 8080- and Z80-based machines) and Microsoft Basic (and minor variations) as software standards.

By late 1978, it became clear that the TRS-80 series was sweeping the home market, and the Apple II was giving Radio Shack stiff competition in the small business market while dominating the professional, managerial and low-end desk-top engineering and research market. Commodore, the third most popular machine, was controlling the education market. As these companies and their small

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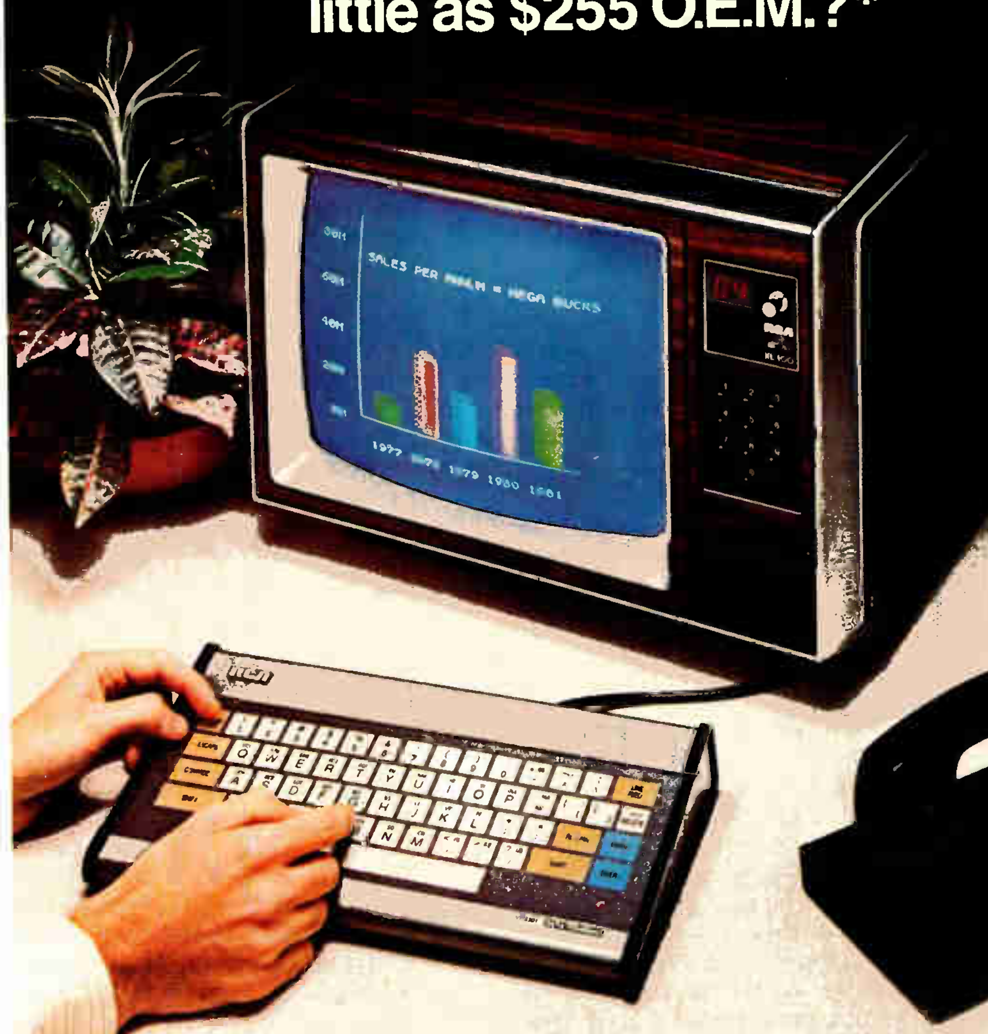

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competitors grew, and the weaker ones fell by the wayside, there was a sudden surge into the home market in 1979.

Atari Inc., the maker of the most popular video and electronic arcade games, and Texas Instruments introduced sophisticated, user-friendly home computers. They mistakenly tried to control all of the software for their machines while locking out outside software houses. But the public, led by an activist personal computing press, didn't take the bait, and demanded that a wide variety of applications software be made available for these home computers.

Enter the HP-85

While most people watched the battle in the home computer market, Hewlett-Packard introduced its sophisticated HP-85 personal computer in 1979. HP aimed this lightweight personal computer at the market it knew best—engineers, scientists and professionals. Ignoring the home and small business markets, HP proved that good things for engineers can come in small packages. In a box the size of an electric typewriter, HP packed in a big memory space, a powerful operating system and software that included full graphics capability, a 5-inch cathode-ray-tube display, and a dot-matrix printer.

With HP's reputation and marketing punch, this Series 80 personal computer quickly became very popular among engineers during 1980. But Apple remained very competitive in this field, and promised to remain important with the introduction of its Apple III in late 1980.

In 1979, Apple Computer, by then one of the fastest growing companies in the country, added extended Applesoft Basic as its standard language, nine-digit precision arithmetic. It is much easier to use than the earlier one, and appealed more to both novices and professionals, the latter because its high level languages were so much more versatile.

Adding Graphics

Apple was also the first to introduce a sophisticated Graphics Tablet, an 11-by-11-inch tablet with a resolution of 200 points per square inch. It became very useful to design engineers because it gave seven-color high resolution graphics, highly simplified the production of complex images, and eliminated time-consuming manual calculations of X-Y coordinates and dimensions.

The company is extending its line with the Apple III, which adds two more high level languages, Fortran and Pilot. It crams 143-K onto a single-sided single-density minifloppy disk and has a transparent operating system and an emulation option for use of Apple II software. The new model uses an upgraded MOS Technology 6502 and includes enhanced keyboard features and higher-resolution graphics.

Other popular computers in the engineering field include:

Cromemco System 3. In production for two years, the System 3 has dual double-density disk drives, comes with a 32-K RAM, expandable to 512-K, runs off of the fast Z80A CPU, and uses the S-100 bus and an RS-232-C interface. The company provides a range of other small computers and supports them with utility and systems development software.

Ohio Scientific Challenger C3C. This is the only personal computer that comes with three eight-bit processors, the 6502, 6800, and the Z80—in the same unit. It also combines a large-capacity hard disk, also a first in the industry, and a dual double-density 8-in. floppy drive. The company was acquired in late 1980 by telecommunications manufacturer M/A-Com Inc., and the combination promises many exciting things to come in the electronic office.

Vector Graphic System B. Using a Z80 CPU, this system includes two quadruple-density minifloppies, 56-K of RAM, a CP/M Version 2 operating system, and Microsoft Basic-80. It has a built-in terminal emulator, and the company offers four standard high level languages and a lot of systems development and utility software with advanced graphics.

North Star Horizon. The Horizon comes with a 64-K RAM, dual double-density minifloppies, and incorporates a Soroc Technology dumb terminal. The company has a new 18-megabit Winchester hard disk as an option and supports its computer with many development tools.

CPU power is growing

Since the heart of a personal computer is its microprocessor CPU, it's clear that the 16-bit processors and the forthcoming 32-bit mainframes in chip sets will have an enormous impact on these machines. As important as hardware, however, will be the software—and historically that lags the hardware introductions.

Perhaps more important in the long run is the IEEE's work on a standard bus for the 32-bit machines. A working committee will soon draft backplane bus standards for all 32-bit

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Multimodules represent a whole new family of plug-in expansion boards. They allow you to add a variety of special performance features to your existing iSBC system. Currently available add-ons are shown below. Soon you'll also be able to add other Multimodules for IEEE 488 GPIB control, communications, peripheral interfaces—and more.

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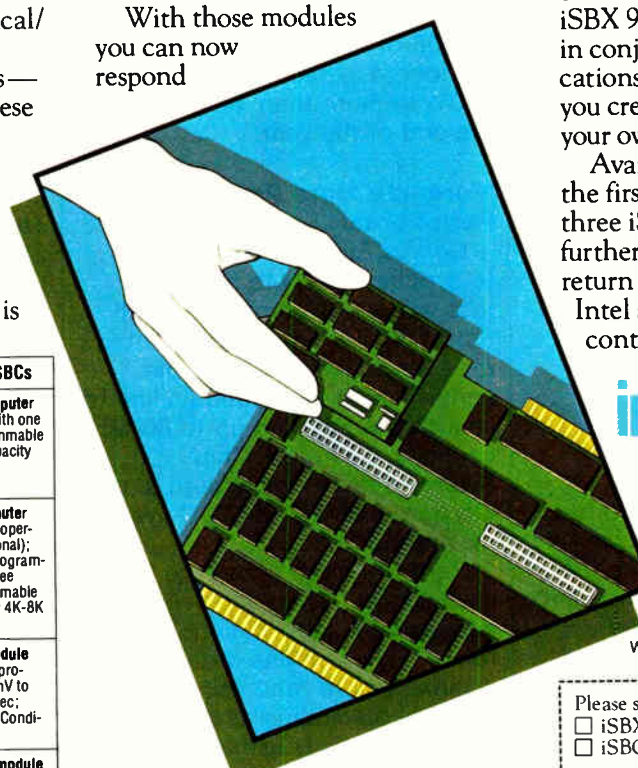

quickly to new applications opportunities. Examples? For data acquisition from thermocouples and strain gauges, simply plug in the iSBX 311. For 4-20 ma current loop control, use the iSBX 328. In laboratory control applications, instead of an independent math processor, now you can choose the more economical iSBX 331 or 332 math modules.

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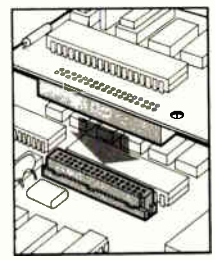

iSBX 960-5 Connector

Intel's 8-bit iSBC 80/10B, 80/24 and 88/40 single-board computers are the first of many iSBCs to offer iSBX Multimodule expansion capabilities. The first two are improved versions of widely used iSBC boards. (See table).

Custom tailoring, too

For users who want to design their own Multimodule boards, Intel offers iSBX 960-5 connectors. When used in conjunction with the iSBX specifications, this set of connectors lets you create modular boards that meet your own unique requirements.

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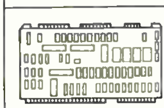
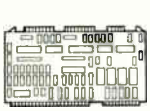
	**iSBC 80/10B Single Board Computer** 8080A-based microcomputer with one iSBX bus connector; 48 programmable I/O lines; one USART; timer; capacity for 1K-4K bytes RAM; up to 16K EPROM
	**iSBC 80/24 Single Board Computer** 8085A-2 based microcomputer operating at 4.8 MHz (2.4 MHz optional); two iSBX bus connectors; 48 programmable I/O lines; one USART; three programmable timers; programmable interrupt controller; capacity for 4K-8K bytes RAM; up to 16K EPROM
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microprocessors. Although little is known of its plans, the bus will be processor-independent and support up to 64 bus masters and clock rates of up to 20 megahertz.

This standard, dubbed P896, comes far earlier in the 32-bit development cycle than the IEEE-696 for 8-bit CPUs. If manufacturers cooperate, the bus will enable 32-bit CPUs to spread very rapidly with a very large number of compatible peripherals readily available. In short, another huge cottage industry will grow around the 32-bit CPU-based personal computers as soon as they appear.

Although Intel has taken the lead in the 32-bit race, no one should count out AT&T, IBM, Hewlett-Packard, National, Motorola, or MOS Technology, all of which are busily developing 32-bit CPUs, or micromainframes, as they have been dubbed. It has long been rumored that IBM would introduce a personal computer based on a 32-bit CPU that would have the power of its System 370.

The 32-bit CPUs will be to computing what Columbus' discovery of the New World has been to us, with hundreds of new horizons opening up during the next 10 years. New developments will range from inexpensive medical imaging devices to incredibly sophisticated signal-processing systems for the military. And all of them will be far more user-friendly than any microprocessor-based system on the market today.

As mass production of 32-bit CPUs begins in 1982, 64-K RAM chips will become important components of these new systems. The Japanese have leapfrogged American producers, and Fujitsu has already announced a production-model 64-K chip. Many major companies are also nearing production of 128-K RAMs: while bubble-memory capacities have soared past 1 million bytes.

However, small Winchester hard disks with capacities between 5 and 136 megabytes are arriving now, after many months of delay. In late 1980, low-performance 8-inch and 5.25-inch Winchesters (the IBM code name for its top secret project that introduced hard disks in 1973) became available, with industry-leader Shugart Associates (a new Xerox subsidiary) selling more than 15,000 of the 24,000 sold. That number is expected to increase 500% to more than 145,000 by the end of the year.

More and More Powerful Peripherals

Corvus Systems was the first to produce a 10-Mb hard disk that was easily compatible with the Apple II Plus, and accounted for a large percentage of the early sales. It expanded its line to include models with up to 80-Mb capacity. As noted, Ohio Scientific has incorporated a 14-Mb hard disk into its C3C system for more than a year.

Hard disks are certain to be vitally important in engineering and scientific applications that require large on-line data bases, or an ability to read and store enormous amounts of data. They will be especially useful in large data-logging applications and will enable an engineer to chain a number of personal computers to one hard disk drive for data storage, compilation and manipulation. They'll also allow engineering managers to maintain larger data bases of corporate information and will increase the usefulness of any in-house distributed data processing systems.

Similar advances are being made in the second most important type of peripherals, printers. Inexpensive dot-matrix printers have been available for many years, but printers that could plot graphics or provide letter-quality type were expensive. The latter, notably the NEC Spinwriter, the Xerox Diablo, the Qume and a few others, cost at least $3,000 in quantity.

However, significant price breaks occurred in printers during 1980 with the introduction of the Xymex and Howard Typrinter 221, veritable clones. (Sheldon Howard used to work for Xymex, but left and brought out his own version.) Both are letter-quality printers based on an Olivetti electronic typewriter. The machines, priced at less than $2,500 retail, incorporate a terminal keyboard, electronic typewriter and daisywheel printer.

Some Japanese manufacturers are said to be ready to introduce letter-quality printers that will retail for less than $1,000. The key to reduced printer costs lies in reducing the number of moving and mechanical parts; the established ones have more than 1,000 parts, while the newest ones have fewer than 100, making significant economies of scale possible in mass production.

Many manufacturers are incorporating controller and memory chips into more specialized peripherals like plotters to make them intelligent, freeing a personal computer's RAM from these tasks. This move toward intelligent peripherals will gain steam in engineering applications as the chips pack more transistors into smaller spaces. □

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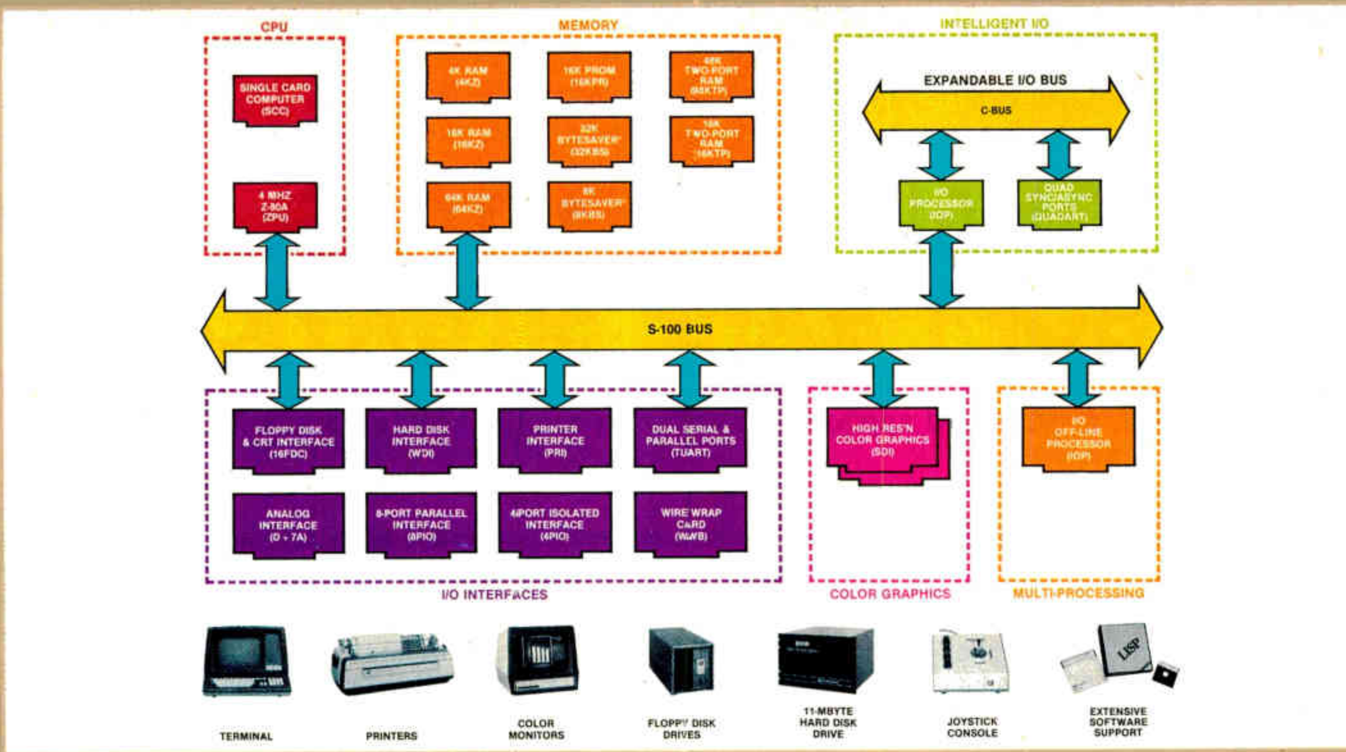

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PERSONAL COMPUTERS: THE SOFTWARE SITUATION

Programming languages and applications software are the key to popularity

In the race for success in the personal computer industry, high-level languages are the "jockeys" spurring the personal computer "horses" toward the finish line. Supporting these jockeys are operating-system "trainers," that teach the languages how to make their computers run more efficiently.

The most successful jockey in the personal computer race so far has been Basic, Beginner's All-Purpose Symbolic Instruction Code, because it uses English-like commands and statements. It is also more efficient in that its commands and statements require less memory than the standard version of Cobol (Common Business-Oriented Language). Thus, when the first hobbyist computers with very small RAMs were built, their makers incorporated the simplest language available, which, happily, most users could learn quickly.

Basic became popular for business-oriented minicomputers in the early 1970s when Management Assistance, Inc. developed Business Basic, and it grew in popularity in universities. In recent years, dozens of variations have been written to take advantage of or compensate for the shortcomings of many 8-bit central processing units. These versions range from Tiny Basic, a subset of Palo Alto Basic, to many Extended Basics, such as TI, H-P and Microsoft.

Long before Basic, Fortran (Formula Translator) was the most popular language among engineers and scientists. Today, because personal computer companies have increased their machines' RAMs, from 8- and 16-K, to 32-, 56-, 64-K and beyond, it is much easier to use well-known but long Fortran routines in personal software. The same generally holds true for Cobol, so important software houses, such as the largest language developer, Microsoft, Inc., have introduced Fortran and Cobol for personal computers.

Pascal draws users

Encouraged by Apple's example, however, many other houses are riding the Pascal jockey. A newer language named after the 17th century mathematician Blaise Pascal, it is highly structured and has many features that are very useful for writing sophisticated programs. With Pascal, a programmer can create complex data structures, such as an array, that can define tables including different data types; use a compiler that catches common consistency errors; and include program statements that replace Basic's common GO TO statement.

The standard on which all other versions are based is called the UCSD Pascal; Apple's version follows the standard, but extends its capabilities to include a fast, screen-oriented editor, an extended compiler with high-resolution graphics, disk files, strings and system programming, a relocatable assembler, and several utilities.

Applications Spread

Texas Instruments has also issued a Pascal development system based on the UCSD standard to encourage advanced programmers to write software for its 99/4 home computer. Sorcim, a growing software house, has introduced a full line of Pascal/M development tools, including a compiler, an object library, a pseudocode interpreter and a symbolic debugger for any CP/M-based system with an 8080, 8085, or Z80 CPU and 56-K RAM.

These four principal languages, however, are just a few of the dozens of high-level languages available for personal computers. Another relatively popular one is AP/L (A Programming Language), a very high level language that uses special notations for numerical and logical algorithms. It was written for the IBM 360 in 1968 and is available on the IBM small business systems, the 5110 and the 5120.

During the past year, two other languages, Forth and Flex, have received a lot of publicity as they entered the personal computer market. A version of Forth has even been introduced for the TRS-80 Model I by Miller

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While the Basic jockey leaves the pack in the 8-bit language race, the horses have just sprung from the starting gate in the race to dominate the 16-bit operating system market. The race pits two proven operating systems, Bell Laboratories' touted Unix—and many authorized variations—and Digital Research's CP/M-86, an enhanced version of CP/M, as the op sys for Intel's 8086.

During the past three years, more than a dozen Unix versions have been introduced, including Cromemco's Cromix, Whitesmith's Idris system, Software Labs' OS-1 Unix-like system, Microsoft's version for the Z8000, and Morrow Designs' version for the Z80.

Digital Research's CP/M-86 has the same facilities and file formats as its 8-bit op sys, CP/M version 2. The logic and hardware-dependent parts come in modules, so applications software can be easily customized, one of the most important reasons CP/M became so popular among software and systems houses. But so few 16-bit systems have been installed, it is still too early to tell which company will dominate.

The Grand Entrance of Lovely Ada

There could be only one language in the 32-bit race, and she is a powerful filly who could easily take on Secretariat in the Kentucky Derby. Her name is Ada, after Augusta Ada Byron, Countess of Lovelace and the daughter of poet Lord Byron, who is said to have been the first programmer because of her mathematical work on Babbidge's Difference Engine, the ancestor of the computer.

In fact, Ada has been under development for more than five years under U.S. Department of Defense contracts. Ada's designer, Jean Ichbiah, based it on the concept of the software component; analogous to hardware components, these software entities, according to Ichbiah, would be selected from a catalog and combined into any kind of program.

They would be compatible through a common bus, such as the one being developed by the IEEE. This bus will be controlled by an Ada compiler, into which the software modules would be plugged. Any program would operate as a bus controller; in hardware, a bus controller can use any module plugged into the bus.

Easy Use a Goal

The Defense Department wanted a language that could be used in business, scientific, educational, military, and engineering environments while establishing new standards in reliability, maintainability, and readability. In short, the military wants the common soldier to be able to use Ada very easily.

Judging by the initial draft standards and subsequent changes, the results combine the best features of Pascal, Algol, and PL/1 with real-time multitasking controlled by a software component. More importantly, the component concept allows Ada software to be customized, yet remain compatible and portable among many different versions. In short, Ada's creators and potential developers expect it to revolutionize the art of computer programming.

More than 25 companies and universities are developing Ada compilers, and Intel claims that the language will be its 32-bit microprocessor's primary language. But it will be two or three years before Ada is adopted as a standard according to the American National Standards Institute.

Lack of Applications Software

Engineers face a severe shortage of applications programs. Most software for electrical engineering tasks is produced by the end users themselves, often at home at night or during weekends. As you'll see, many thoroughly enjoy this part of their personal-computer involvement, but it may not be an adequate substitute when you perceive a good application for a personal computer that you can't implement because no software exists.

Most manufacturers that market directly to engineers, such as Hewlett-Packard, provide general applications packages, the "horizontal" software of engineers. These include waveform analysis, regression analysis, and so forth. Many other manufacturers provide a few similar programs but concentrate on software development tools, thinking that each engineering application will be too specialized for their attention. Few systems houses have been willing to produce vertical applications programs, especially when the company's proprietary processes or product development may be involved.

But engineers may not have to wait too much longer. In recent months, software houses have recognized how large and growing the engineering software market is. When all of these forces converge, as they inevitably will, electrical and electronics engineers will find that they are the winners in the software horse race. □

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CIS COBOL
COBOL-80
FORTRAN-80
KBASIC
muLISP
muSIMP
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PASCAL/M
PASCAL/MT
PASCAL/MT+
PASCAL/Z
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SMAL/80
S-BASIC
TINY C
TINY-C TWO
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FORMS 2 FOR CIS COBOL
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TEX
TEXTWRITER III
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ACCOUNTS PAYABLE (SSG)
ACCOUNTS RECEIVABLE (PTREE)
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PERSONAL COMPUTERS: AT HOME AT WORK

Engineers Use Them for a Multitude of Tasks

Design engineering manager Don Gay slashed the time-sharing costs of his section at Ampex Corp. in Santa Clara, Calif. by using an Apple II Plus to solve design and geometry problems. He also uses it as a management tool. W.J. Manthey at the University of Delaware Institute of Energy Conversion uses the Hewlett-Packard HP-85 for complex number crunching and for its graphics capabilities.

Alan Leff, project engineer for alternative energy resources, Standard Oil of Ohio (Sohio), uses five Ohio Scientific Challengers for mass spectrometer control and data acquisition, voltametry measurements, and heater control in a coal conversion reactor, to name only a few uses. Jeff Yagoda, an electrical engineer who became a microsystems consultant, designs small business and engineering systems around Industrial Micro Systems' 5000 machines.

Maurice Zollner at McDonnell Douglas has cut the number of staff members assigned to monitoring satellite power systems tests by bringing in an Apple II. Egil Juliussen takes work home: the paperwork overflow that comes his way as a top product planner for Texas Instruments Inc. is processed on his home personal computer.

Similarly Roger Schafer, a project leader at Grumman Aerospace's Training Systems Division, Bethpage, N.Y., uses an Apple for management tasks, running software he wrote himself. Personal computers also can be used as word processors, as Harold C. Kinne of the University of Texas at Dallas can attest. He also uses his Polymorphic 8813 to help maintain his students' records.

Personal computers are entering engineers' worklives by hook or by crook. Sometimes, an engineer will carry one into the office under his arm and start small, computerizing first one simple repetitive task, then a larger task. Before anyone really notices, a dozen computers are monitoring all of a lab's experiments and tests. Or the boss will buy a computer for his children, wanting them to become literate before they graduate from high school; instead, he finds he can think of more things to do with the machine at work than the kids can do at home.

Ampex engineer Don Gay used his Apple II to solve design and geometry problems and as a managerial tool.

In a few cases, an engineering manager perceives a problem—his payroll is way out of hand; it takes weeks too long to make accurate tests; the engineers are complaining because they have to come in on weekends to take test measurements; the test error rate has gone out of sight. Enter the personal computer; the manager doesn't have to go to corporate to authorize spending $3,000 for a machine.

Don Gay, Ampex

Don Gay had a serious problem: his time-sharing costs were averaging between $500 and $700 a day. He had to

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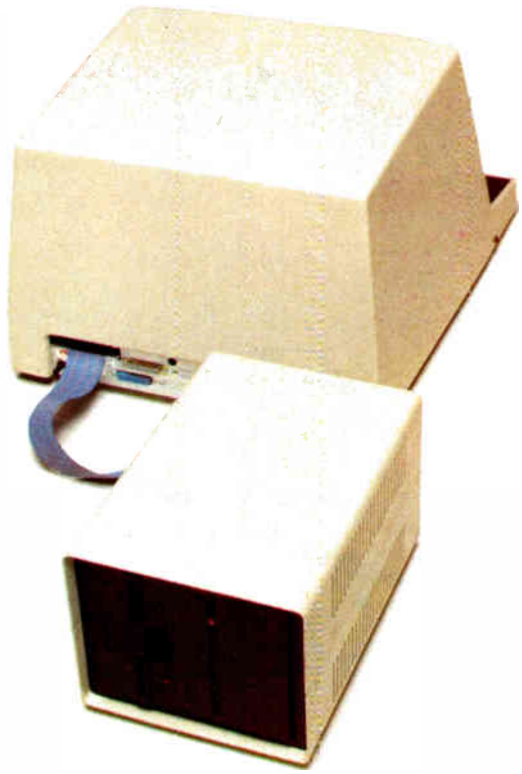

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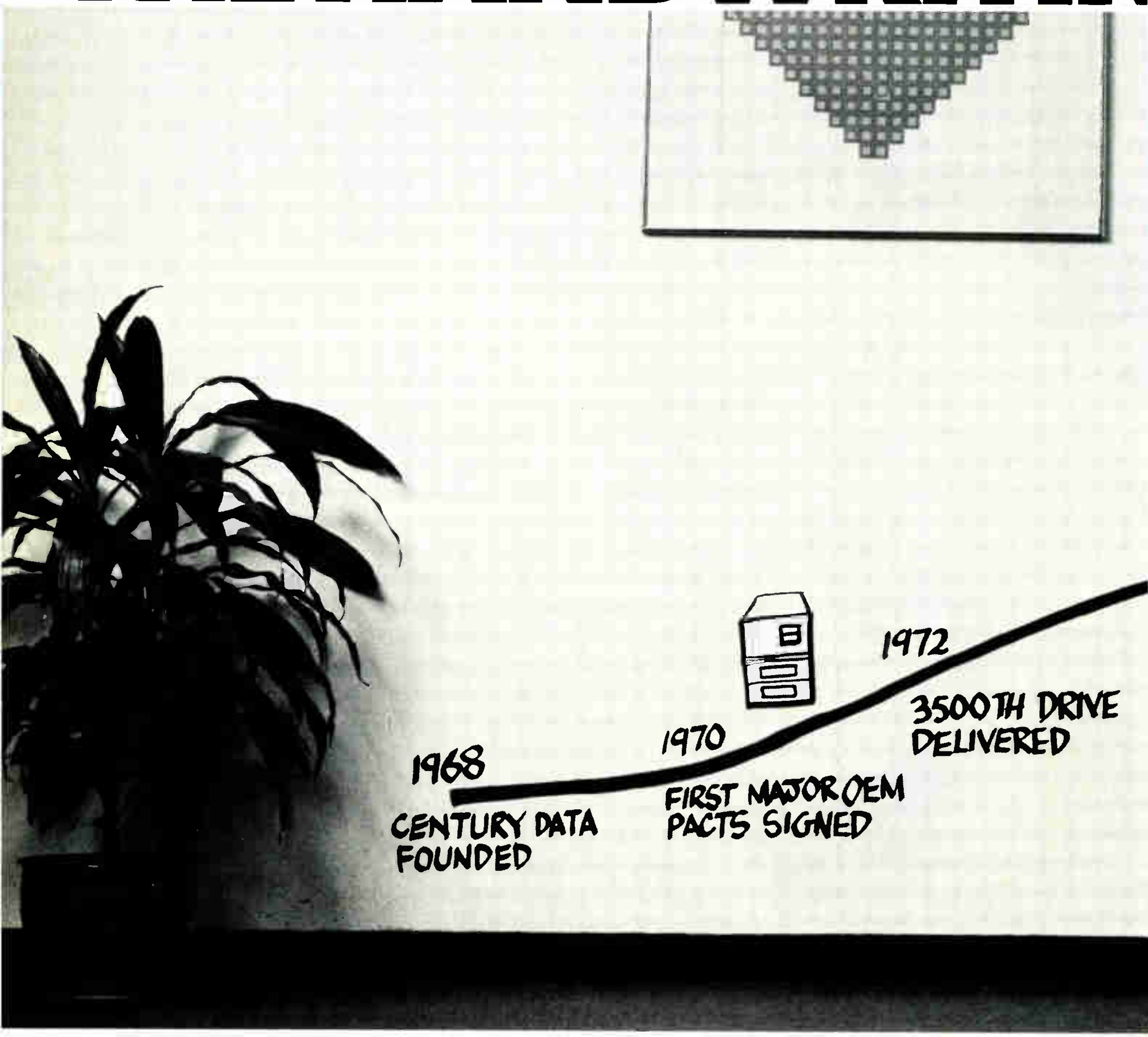

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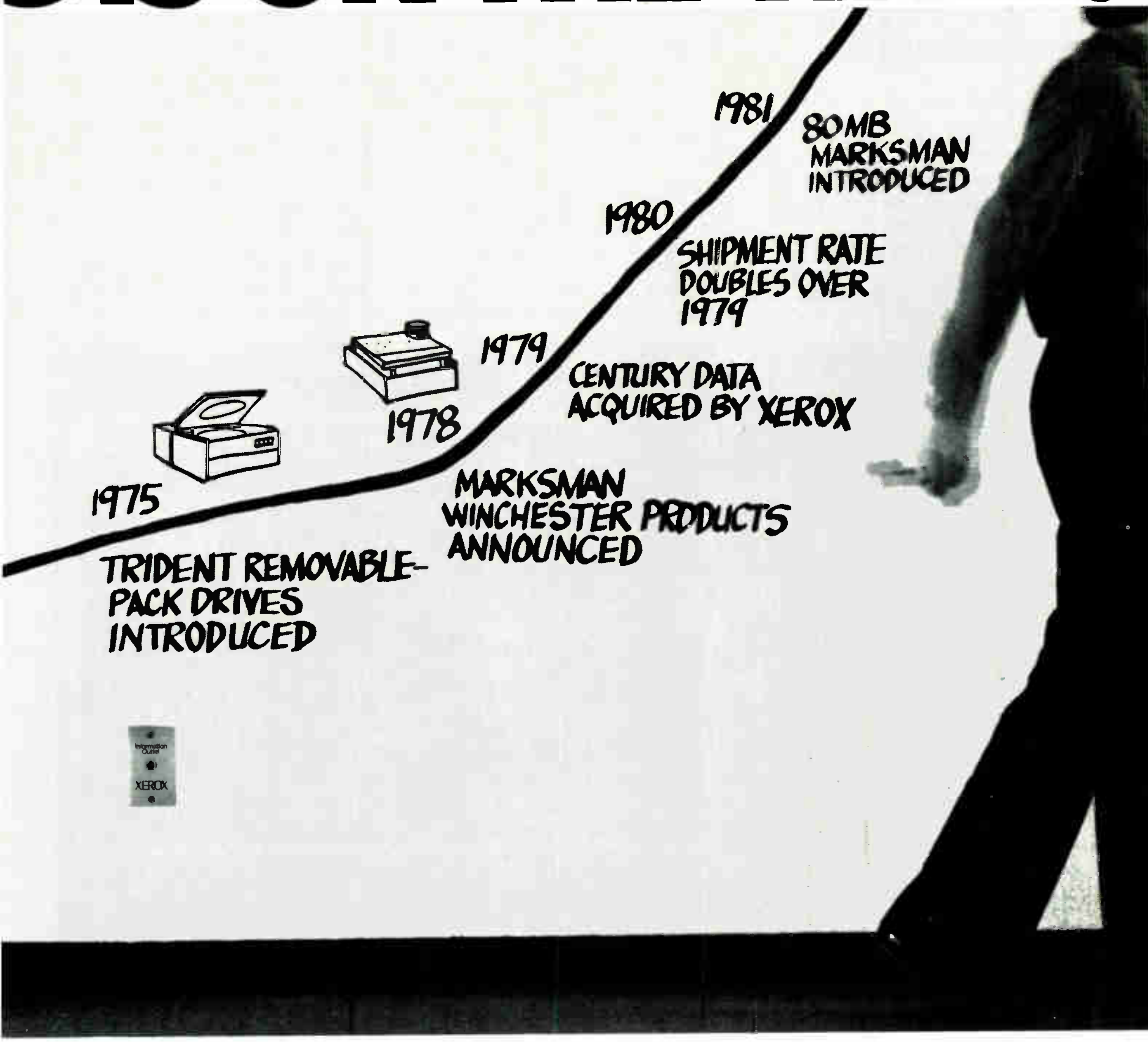

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decide whether to drop the service and force his design engineers to return to hand calculations for determining the geometry and circuitry for custom integrated circuits that they are planning.

He discovered his solution at home, an Apple II Plus computer that he used to develop a benchmark program against which to measure a time-sharing Basic program he wrote. He also knew the Apple had high-resolution graphics capabilities, so he brought one into his office to solve geometry and design problems, the most expensive of the time-shared functions.

"The Apple allows our design engineers to do in minutes what would take weeks of hand calculations," Gay says. "And they can try alternatives in semiconductor and IC design that were not possible before because they involved so much drudgery

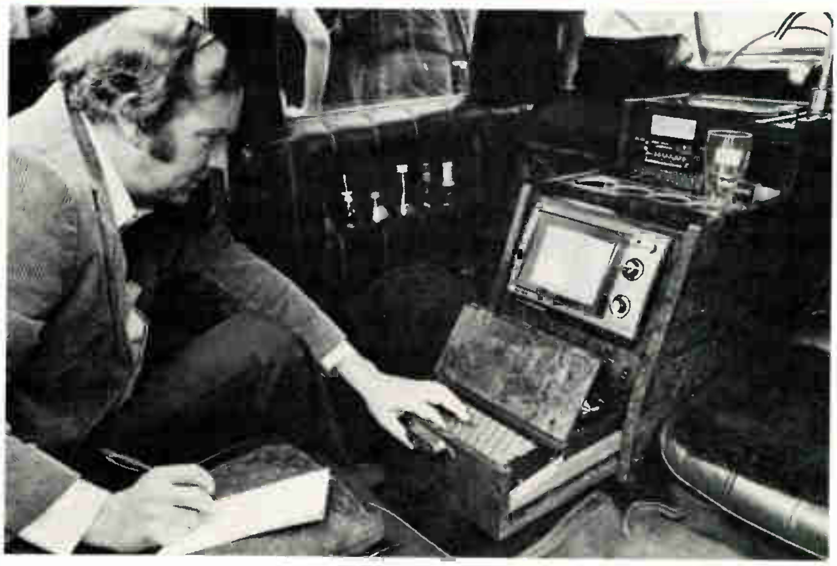
The Ultimate in Executive Productivity

William Kelly, a Long Island, N. Y., electronics executive, has found the ultimate tool to increase his productivity—a limousine that he has converted into a rolling computerized office. Kelly, who owns three companies and brokers electronic circuits, got tired of wasting his long commutes around Long Island. He felt he was wasting his time reading newspapers and reports when he could be conducting business.

Yet, if he wanted to do that, he needed hard facts—prices, supplies, and customer lists—in front of him. Of course, he couldn't put half a dozen filing cabinets in his limo, but he could take advantage of the latest technology.

So, working with Berliner Computer Center of New Hyde Park, N.Y., he had installed a Apple II Plus computer with dual floppy disk drives and a raft of other useful electronic gadgets in his stretched Cadillac. In a hurried week and a half, a Berliner team installed a stereo system, dual alarm systems—one keyless audible and one microwave silent—radar detectors, a 40-channel CB radio, and a 120-volt AC outlet.

Kelly can review his latest business meeting with a video cassette recorder on a Sony 8-inch color TV. (The TV set and



the ice box came with the car, the only two gadgets that did.) The set doubles as a computer monitor.

But Kelly does his serious business with the modified computer. Berliner built a standard Apple keyboard into a drawer underneath the TV and bar console. The team put a 48-K RAM Apple with a special operating system behind the keyboard, and hid two minifloppy drives, one under a jump seat and one behind the console.

All of the data-management software and data-base information is stored on dual 232-K floppies, one for software and one for data files, so Kelly doesn't have to move any seats around to change disks. He enters fresh information or deletes out-of-date data through the keyboard. This wasn't done only to prevent unnecessary inconvenience; the floppies would be susceptible to damage from the auto's magnetic fields if they were moved around frequently.

If this setup isn't fantastic enough, consider this: Kelly also has a roving telecommunications network. If he needs information from a computer at his office, he can plug in an acoustic coupler modem to his mobile telephone and down load data. However, he must stop the car so that data swap occurs without glitches.

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Compute Magazine, November/December 1980

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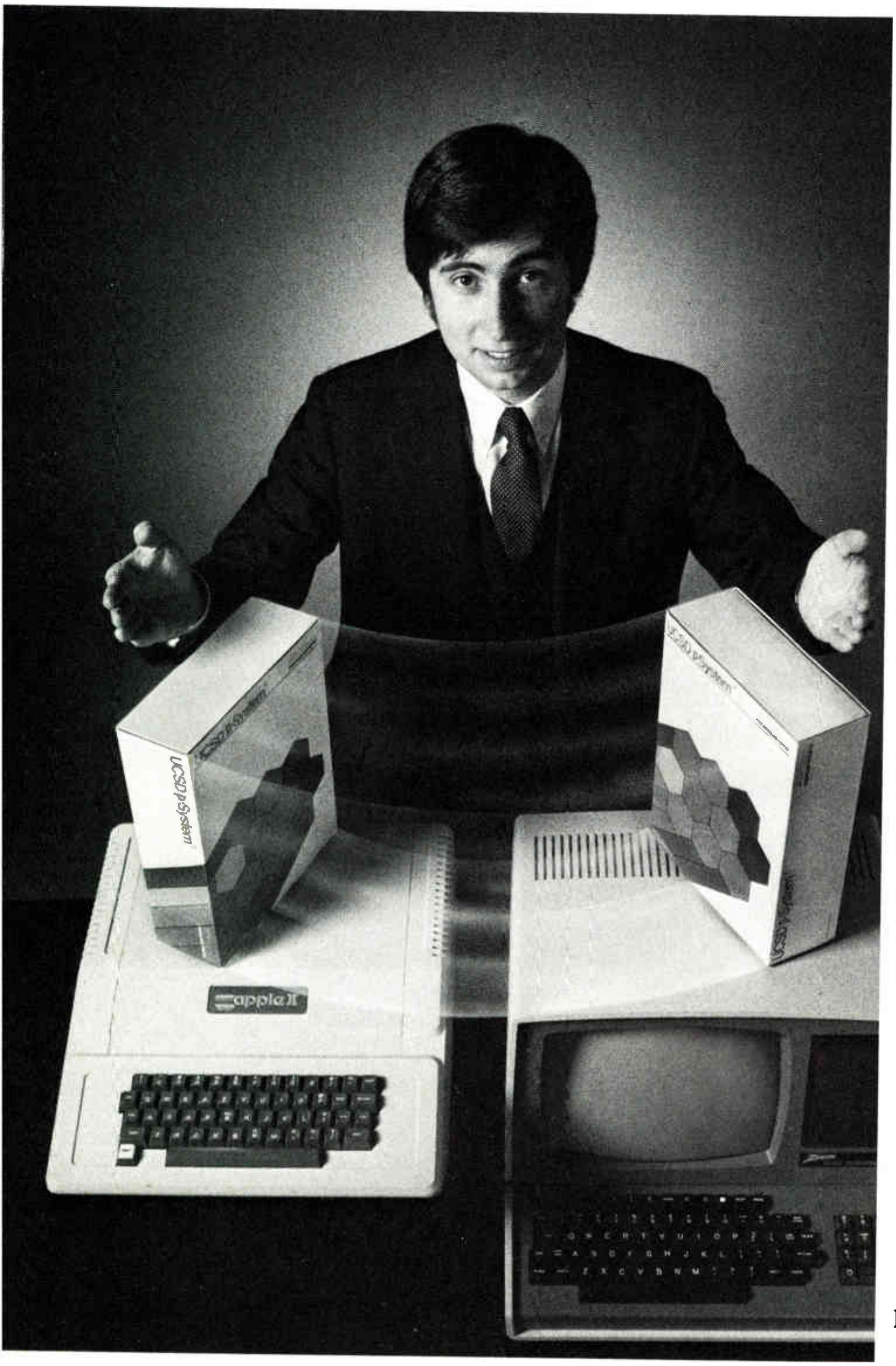

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and took so long. When we were pressed, we had to make do with the best we could do with a limited number of iterations. Now, we can do 10 or 15 iterations with variables in half an hour."

The Apple paid for itself in two and a half days, a trifling expense compared to the enormous cost of time sharing. The changeover from the time-shared software to the personal computer was easy, too. "All it took to change our other program to Apple was to restructure the output for the Apple screen," Gay says. "Otherwise, it's the same as the time-sharing program."

He has a simple configuration: a 48-K Apple II Plus with only one mini-floppy drive, Applesoft Basic, a black and white monitor, and an interface to a TI Silent 700 terminal with dual cassettes.

Gay still uses the time-sharing service's analysis of circuit design so he occasionally bounces back and forth between the Apple and the time share; he dumps data from the Apple to the Silent 700, and then to the time-share computer. The 700 acts as a printer, mass storage device, and a time-sharing terminal.

In addition to the geometry calculations, Gay has used the Apple as a data analyzer and plotter in several studies in which vast numbers of data points were involved. "We used the Apple to collect the data points and crunch them down into a usable form," he notes. The Apple is so easy to use that Gay can put a technician on the keyboard with little risk of damaging the work.

W. J. Manthey, University of Delaware

W. J. Manthey bought an HP-85 for one purpose, but has since discovered that it does a whole lot more just as well, if not better. He bought the Hewlett-Packard personal computer expressly to control an HP4274A LCR meter and produce plots and execute linear regressions on selected ranges of data in solar cell research at the university's Institute of Energy Conversion.

Bendix uses the HP-85 personal computer as the brains behind its coordinating measuring machines.

But, he adds, "the most impressive aspect of the HP-85 has come out in its graphics capabilities." Using MOVE, DRAW, BPLOT, and related commands, he has written several programs, one to display segments of selected crystal lattices and another to draw orthogonal curves on selected surfaces.

All of the programs allow for varying lattice structures and various perspectives, as if one were viewing them from various angles. Manthey uses these functions primarily to analyze the lattice of calcium sulfide used in solar cells.

He had no prior knowledge of Basic programming when he bought the HP-85. However, he says he "had no trouble making the programs interactive and satisfying."

Alan Leff, Sohio

As alternative energy resources project engineer, Alan Leff presides over five Ohio Scientific computers that have freed lots of engineers and technicians from a long tradition of pushing buttons and watching meters. The five computers—four C8P models, two with single floppies, and two with dual floppies, and one large C3 model—serve five primary functions.

One follows the kinetics of coal conversion to pyrolysis, gathering data through a mass spectrometer and controlling the scan rate with a residual gas analyzer. Another is tied to a coal conversion reactor and, using a board Leff designed, interfaces with a digital thermometer and controls the reactor's heater. A third C8P takes voltage measurements with analog-to-digital converters to measure the voltages going through the test converters, while a fourth machine uses an RS-232-C interface to control and log changes in reactor conditions in an enhanced or tertiary oil recovery process.

"Four professors and scientists and two secretaries use the big C3 computer as a word processor for editing rough drafts of technical papers and taking shortcuts in their writing," Leff says. "They also manage the other four computers' readings; they plug the figures into a data-base-management system so the figures can be recalled whenever they want them in whatever form they want them.

"Our next step is going to be to tie the micros with the C3 with a hard disk into a network, so we can build a large data base to

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which we would have rapid access," he adds. And then the Ohio Scientific C3 machine will be linked to a Sohio PDP-11/40 minicomputer.

Jeff Yagoda, Systems Consultant

A personal computer can not only serve as an exceptional professional tool, it can also bring EEs engineers new, exciting, and more profitable careers. Jeff Yagoda, a microcomputer systems consultant, began his career by working briefly to develop process-control machines and helping the huge Arthur Anderson accounting firm set up its IBM 370 mainframes. Then he obtained his Master's in Business Administration.

Consultant Jeff Yagoda puts together systems, working out the software at home.

But as the personal computer revolution began, he saw an excellent chance to put all of his skills to work. So, three years ago, he struck out on his own as a consultant.

Now, he builds microcomputer systems for corporations and small businesses and consults for his clients. He bases most of his systems on the Industrial Micro Systems 5000 with the CP/M operating system, an S-100 bus, a Hazeltine 1500 terminal, compatible mini floppy and floppy disk drives, and a Centronics printer.

"Based on my experience, I found that the IMS micro is very well designed, and adequate for most small business needs," Yagoda says. "Of course, there's a lot of software available with CP/M and a lot of hardware for the S-100 bus."

Mainly his work consists of designing a system—hardware and software—for a client's application. Then he modifies the program code to match the customer's exact requirements. But those are easy.

"Most of it is fine-tuning the software and holding their hands," he notes. "In the micro field, practically everyone lacks expertise, so they all need as much training and help as you can give them, and the system must be more functional and reliable than a mainframe." He usually tests and debugs his customized systems on his IMS at home, and transfers them on floppy disks to his client's location when they are ready.

Maurice Zollner, McDonnell Douglas Astronautics

Maurice Zollner, Senior Design Engineer, once needed seven engineers and technicians to keep tabs on extensive tests of satellite subsystems. They couldn't keep "nth degree" accuracy, watch constantly, or prepare reports at the same time. But his personal computer can.

"Now, two men monitor the computer," Zollner says. "They tear test reports off the printer and stick them in a binder, and keep the plotter fed with paper. The Apple does all the work."

That's not all the Apple II does. It is programmed to emulate a satellite's power module during tests and collect data about the module's performance. "It not only reports data. It also takes necessary outputs, calculations, and time integrations of certain parameters; graphs the data on a Houston Instruments' plotter; and prepares reports," he notes.

It also tests the input power the module receives from the satellite's solar array and the output power the module distributes to the system. Then, when the batteries recharge, it measures external loads and the current flowing into the batteries and determines the ampere hour measurements.

Zollner uses it to conduct quality tests as well. "These are dynamic, rapidly moving events, and only a computer could determine what's happening and keep track of things if they go out of whack," he says.

But Zollner stretches the machine's capabilities even more. The Apple measures the resistance versus temperature characteristics of the spacecraft's thermistors to the tenth of a degree. With high resolution

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graphics, it portrays the shape of components and creates a thermal map of what's going on inside the module.

"These are not short, one-shot tests. The Apple is used in a thermal vacuum chamber for two continuous weeks of tests, so it must be very reliable to withstand the constant operation," Zollner says. "And the computer does all of our tough work for us, because we've programmed it to know what's supposed to happen, and it tells us if the module isn't doing it."

The Apple is of no special configuration either. It is a 48-K with two minifloppies, a Mountain Hardware clock card, a serial interface card for the plotter, a prototype board to interface with the STCCC (standard telemetry and command component computer), and a Centronics printer.

The difference is in the software; Zollner has written many machine-language routines, including an exceptional one. It uses an 8-bit word to transmit data, but each bit carries one parameter of module performance; most programmers would have a hard time getting one 8-bit word to carry one parameter.

There's just one more thing the Apple does when it's not busy. It tests upwards of 100 special nickel cadmium batteries according to very strict specifications to find four or five matches. It used to take two people a week to do this simple, but crucial chore; it takes the Apple half an hour. "It's nothing fancy; it's just a brute strength program," Zollner says. But the computer doesn't mind.

J. Egil Juliussen, TI

A key product planner, Egil Juliussen is deeply involved in directing TI's work in minicomputers, microprocessors, memory technologies, and distributed computing. Does he, like other managers, have time to do his budgets and financial analyses at work?

Hardly. Like many engineering managers still do, he used to do the figuring at home on weekends engulfed in paper, pens, and calculators; and this despite the use of TI's fantastic world-wide distributed data processing network. But now Juliussen uses a personal computer with Visicalc software at home and breezes through the work.

He is not in the least unusual. Thousands of electronics and engineering managers are turning to personal computers as they try to cope with what's unfondly known as "information overload." This occurs when a manager must cope with too many reports and too many tasks in too little time.

Personal computers are crunching numbers, digesting report data, and masticating managerial memoranda into forms managers can get their teeth into. In addition, some personal computers have been configured to give professionals fingertip access to up-to-the-minute financial data, while others actually enable managers to delegate more authority better.

Roger Schaefer, Grumman Aerospace

For example, project leader Roger Schaefer uses an Apple in his office and in his home to maintain personnel accountability files, group budgeting, job scheduling, and word processing (with the new Programma Pie text formatter) three times as fast as he did those tasks before. He wrote the software for these applications by himself.

"I could have used Visicalc, but it's no fun to buy software when I can do it myself," he says. In fact, he bought the computer to keep his hand in his group's work of designing microprocessor-based flight simulators and trainers. He supervises 28 people, and, he says, "it's easy to get away from what's going on, so I keep the computer around to practice programming, so I'll continue to stay fresh with what's happening in my outfit."

Gay at Ampex has turned his computer into a tool to delegate authority. "We maintain a 'things to do list,' in effect a job schedule, that keeps track of who is doing what for whom to what," he says.

"Each project and its status are described in detail, so everyone knows what everyone else is working on. In turn, they can gauge their own actions to the department's needs. That procedure is in line with our corporate policy of pushing decision-making to the lowest possible level. At a more practical level, it works far better than when all decisions must be made by a manager."

Harold C. Kinne, University of Texas

Many managers, however, don't require sophisticated scheduling or task tracking systems, but they do spend a lot of time writing, editing, and rewriting their reports and proposals. Researchers and scientists feel the excruciating pressures of technical writing even more acutely. But they no longer have to pore over their indecipherable handwriting or correct secretaries' typos.

In increasing numbers, they are using personal computers as word processors. One of them is

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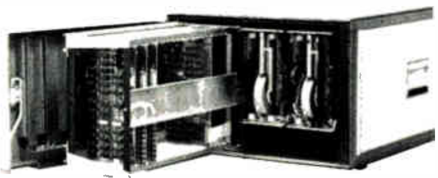

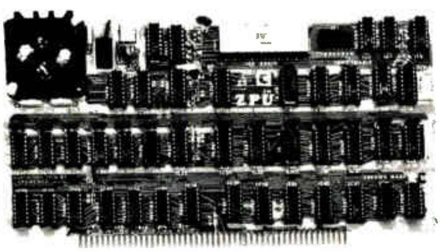

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Professional papers and classroom data are both grist for the mill of Harold Kinne's Polymorphic 8813.

Harold C. Kinne, who teaches a variety of management information science courses and consults on small computer systems for his own company and Future Computing Inc.

"I do all of my writing on a Polymorphic 8813 with a 48-K RAM, three mini-floppies, a new NEC green-character display terminal, and a Xymec-Olivetti 221 terminal," he says. "In fact, I wrote my dissertation on it, and I maintain all of my manuscripts with Word-Master software.

"I also have written some simple Basic programs that create a data base of all my students' records, class rosters, address lists, and the like."

Good Software Makes Good Managers

But enginering managers can really only work more efficiently with personal computers if they use well-written business software. Of course, the most popular software tool today is the oft-mentioned Visicalc, which comes from Personal Software.

Visicalc is an electronic spreadsheet that creates a malleable and intelligible grid of rows and columns—up to 250 rows and 60 columns. Any square, or grid intersection, can be defined as a label, a value, or a function. The operator can give one square a value, perform a mathematical operation on that square and another square, and the result will be placed in a third square.

A Program for Many Personal Computers

The program was first available for the Apple II Plus, but is now available for the Atari 800, the Commodore 32-K CBM, and the Radio Shack TRS-80 Model II. Two enhanced versions have been introduced, Visicalc III for the Apple III, and Visicalc Plus for the Hewlett-Packard HP-85.

Although it was the first and remains one of the best and least expensive, Visicalc is not the only financial modeling tool available. Others range from Exec-U-Plan for the Vector Graphic System B, which carries the same price but offers a few more features, to FPL (Financial Planning Language) from Lifeboat Associates, to RCS from Ferox Microsystems and Addison-Wesley technical publishers. The latter two are costly and require sophisticated financial planning and modeling experience.

Dozens of word processing packages litter the software landscape, but about half a dozen have most of the features anyone who does a lot of writing requires. However, these general-purpose packages may not have the scientific notations and graphics features an engineer might require.

Data-Base Management Software Flourishes

Also a wide range of data-base management system software is rapidly coming on line for stand-alone and multi-terminal personal computers. DBMS software can be a convenient way to create an electronic personal secretary (although there is a program called The Electric Secretary for the TRS-80 Model II), your own job scheduling, or informal personnel management files.

Most DBMS programs let you define the applications and set the parameters of the files, records, and fields within certain limits. You manipulate the information with a series of sort and search routines. The best advantage of much of this software is that it makes nonfinancial report-writing very easy. Of course, it must be remembered that the capacity, sophistication, and response speeds of DBMS vary widely. □

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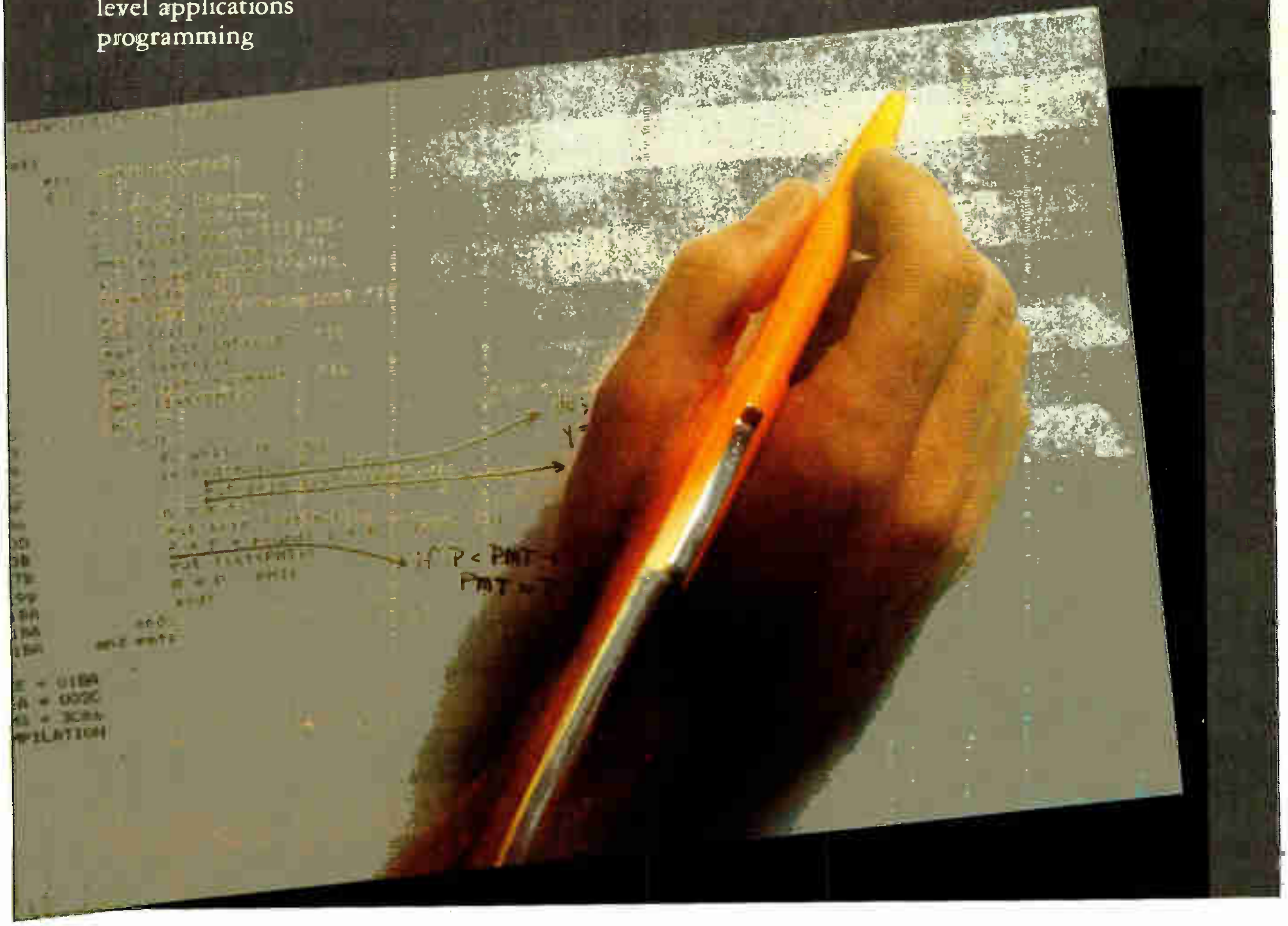

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PERSONAL COMPUTERS: WORKING HARD AT HOME

EEs and their families find many uses for a variety of machines

Many EEs sidle into personal computing as something for their kids. They may start out with a basic cassette-based machine, or they may spend $2,000 for a disk-based system and rationalize the cost, thinking that they need color graphics and tons of software so their children can become computer-aware.

However, it soon becomes clear, as in the old model train days, just *who* is playing with the computer. The EEs soon find that, while they're discovering dozens of worthwhile things to do with the computer in their work, their families are waiting impatiently for their turns at the keyboard.

That is the beauty of a personal computer. One minute, it's a sophisticated machine-language programmer for a computer-aided-design graphics package; the next, it's a learning tool for a seven-year-old; later, it's a small business accounting system; later still, it's an exciting family entertainment machine. All the while, the same computer is monitoring the home's heating and cooling system.

Thousands of families in which one or both parents are involved in electronics are using personal computers in these and dozens of other ways. Portia Isaacson, one of the best known consultants in the personal computer field and head of Future Computing, Inc., of Dallas, evaluates the machines and software in her work. (She is married to Egil Juliussen of TI, mentioned earlier.)

Keeping track of home finances is one of the uses to which TI's 99/4 personal computer may be put.

Her family is intimately involved in the day-to-day development of personal computers, and how they use the machines portends how the rest of us will some day use them. Obviously, Isaacson works with a variety of machines each day as she prepares reports for clients and keeps current on new developments. At home, both she and her husband use an Apple for financial decision-making, and she prepares most of her reports at home with word processing software.

Their children are going even further. They are learning programming on a variety of machines, using educational tutorials, playing every conceivable game, and even teaching every child in their neighborhood how to use a personal computer.

The End of Cowboys and Indians

Like the old games of cowboys and Indians, when the boys were always the heroic cowboys and the girls were the slaughtered Indians—if they played at all—the first years of personal computing seemed like a repeat of this pattern. But, more and more, girls and teenaged women are picking up where Augusta Ada Byron began. Several of the engineers interviewed for this special section said they have daughters, aged from 7 to 16 years old, who were fascinated by their personal computers and were learning to program very quickly.

The seven-year-old daughter of Don Gay enjoys the new Princess and the Wizard Adventure game and learns with a three-level spelling educational program that her father wrote. But, "she's more enthralled by the TI Speak 'n Spell and L'il Professor learning toys," he says. And he does have a little trouble getting her to stop playing Space Invaders.

His daughter's preference for the TI units is a strong clue to the personal computer of the future: portable, easy to handle, easy to use, and needing no programming. Moreover, it appears that women will play an increasingly important role in the personal computing industry. There are the noted shortages of programmers and systems analysts and another in the hardware engineering side for EEs and technicians. Only by encouraging more women will many of these problems be solved.

Children's Probing Curiosity

While children mostly play games with the computer, that's just a first step. Many quickly get interested in how the computer works, how logical operations occur, and how programs are formulated and control the machine. They often find that a personal computer can whet their inherent thirst for knowledge.

For example, Roger Schaefer's 12-year-old son rarely uses his personal computer for game-playing; the family has an Atari Video Computer System for that, says Schaefer. Instead, the boy started with printed software and began typing the coding into the computer so he could use the program. He learned how easy it is to make syntax errors, but also how to correct them.

He's also started experimenting; he changes the variables in the printed programs to see what happens. And he's learning programming and the tangible results he gets when he instructs the computer.

Maurice Zollner has two teenaged sons who are even more involved with the computer's potential. One writes math programs for school and converts Basic game programs to Apple Basic. The other, Zollner says, "never goes outside. He's always in front of the screen from after school until dinnertime."

Money in the Bank

Personal computers also are powerful home budgeting, investment tracking, and financial decision-making tools. You can even use some of the same tools you use at work, such as financial models, word processing, and data-base managers, at home—although on a much easier and simpler level.

Or you can turn to a dozen varieties of programs for the simpler home budgeting uses. Personal software houses such as Creative Computing sell these programs on tape or disk for less than $30, often half that much.

On the other hand, many professionals have investments in stocks and bonds, real estate, or tax shelters. Although software to handle this sort of finance is more expensive, it's also very powerful. Texas Instruments offers a Solid State Module for stocks that is very attractive; Creative Computing also offers an attractive program. Or you can use the Apple-Dow Jones Portfolio Evaluator tied to the Dow Jones News and Stock Quote Reporter telecommunication service for instant access to stock data.

What About Mom?

While personal computers are great work-at-home, financial and educational tools, and great toys, what are they doing for Mom? Unfortunately, with exceptions such as Dr. Isaacson, not very much. That's because few programs have been written that apply to housekeeping tasks. It's pretty foolish to try to convince homemakers the best program for them stores recipes or determines menus.

However, many women are self-employed and they can find many uses for computers in their work. Zollner maintains the books and billings for his wife's small business for income tax purposes, and Schaefer's wife keeps files of the people with whom she must deal in her charity and church work.

Many women who are teachers or are involved in medical professions could use personal computers for the same administrative tasks as their spouses. For example, Jeff Yagoda's wife is a teacher on sabbatical to complete her master's thesis. She uses a word processing package because it makes revisions and academic formatting like footnotes very easy.

Home Controls and Hobbies

Every family member can enjoy the benefits of home control systems run by personal computers. Several systems exist that allow a home computer to run appliances, control security devices, and operate home lighting.

Mountain Computer, Inc., sells an interface for an Apple II with a clock/calendar card that uses the BSR X-10 device for automatic control of up to 16 lights or appliances. Ohio Scientific introduced its C8P eight-port system in 1980 that includes the BSR device, a built-in control interface, two microwave security devices and several BSR plug-in modules.

Schaefer, for example, uses the Mountain Computer Introl X-10 to automatically control lights and stereos for security purposes. However, until microprocessor-based home control devices are built into the walls of modern homes, most people will wisely choose to buy the inexpensive, manually controlled home control

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devices, such as BSR's new programmable control device.

If all of these home applications weren't enough to whet your interest, they're really only the beginning. Hobbyists hook up personal computers to ham radio outfits and transmit information and program data over ham radio networks. They use personal computers to control amateur astronomical observatories.

They make music with computers. They use speech synthesizers to teach their computers to talk and voice recognition devices to teach them to listen. (Zollner has a MicroMusic interface, and the Heuristics SpeechLab 2000, and the Computalker SuperTalker for these functions.) And yes, they even use personal computers to control Lionel trains.

Inexpensive Home Computers

Most hobbyists, who happen to be electrical engineers in their "spare" time, have purchased sophisticated systems with 48-K RAM, two disk drives, a small printer and some special interfaces, at a relatively high cost. But, you don't have to spend two months' salary or hock the family car to get involved in personal computing.

What you can spend depends on what you want to do. And you can invariably start with an inexpensive, simple system and add to it as interests and finances permit.

Here are brief descriptions of four inexpensive personal computers that act as excellent "starter" systems. All can be expanded from the basic cassette-based system to one with floppy disks, printers, modems and up to 48-K RAMs:

Atari 400 and 800. Priced at $640 and $1,080 respectively, the Atari personal computers use 6502 CPUs, provide upper and lower case letters on an 80-column screen, and are the most easily expanded computers. They differ in that the 400 has a plastic touch-pad keyboard, while the 800 has a standard typewriter-like keyboard. Both can be expanded with 8- or 16-K plug-in modules up to 48-K RAM. They operate with either plug-in program cartridges, cassette tapes, or mini-floppies. Atari offers a full line of peripherals.

Texas Instruments 99/4. Undoubtedly, the 99/4 has the most built-in power of any personal computer priced at less than $1,000. TI's model comes with 26-K ROM, used for very good graphics and sound capabilities, and 16-K RAM. TI provides a range of software in its Solid State Modules for home and educational applications. It can be expanded to 32-K RAM, and also comes with a full line of peripherals, including TI's touted Speech Synthesizer with which the 99/4 becomes a sophisticated talking computer.

Commodore VIC-20. The newest personal computer, this color computer breaks the $300 price barrier for a basic unit. It comes with music and color capabilities, and 4-K RAM and ROM. It is expandable to 32-K RAM, and best of all, is fully compatible with Commodore's line of peripherals for its Pet and CBM series, and the thousands of existing progams written for all of its computers. It works with cassette, plug-in cartridge, or disk software.

Radio Shack TRS-80 Model III and Color Computer. Radio Shack introduced a $699 4-K RAM Model III and discontinued production of its successful Model I computers. The Model III is cassette-based, and still has a black and white screen. It comes in a console with room for optional disk drives, and accepts up to 32-K RAM. The Color Computer is a $399 home entertainment machine that uses plug-in modules; however, with a modem, it can double as a Viewdata-type terminal.

As hardware prices for home computers inevitably fall, and new developments put microprocessors for energy conservation tasks into the walls, American family life will undergo rapid and unpredictable changes. Many seers predict that working at home with personal computers will bring families, now divided because their members fly in a dozen directions every morning and visit occasionally in the evening, closer together. Parents working at home will, they foresee, use a personal computer on the kitchen table while their Johnnies and Janes play in playpens next to them.

Other optimists believe these changes will enable parents to become more involved in their community affairs. Suburbanites who commute to a city today rarely get involved with community affairs unless their children's education is threatened; working at home, say the experts, will make parents more concerned about the quality of community life. Pessimists say that these changes will isolate people who work at home from their fellows, create more difficult, if not intolerable, strains in already strained family ties, and make community life more contentious.

Whatever the results, probably some combination of these views, personal computers are in our homes to stay. And more than anyone else, EEs will know how to capitalize on their advantages and to minimize their drawbacks. □

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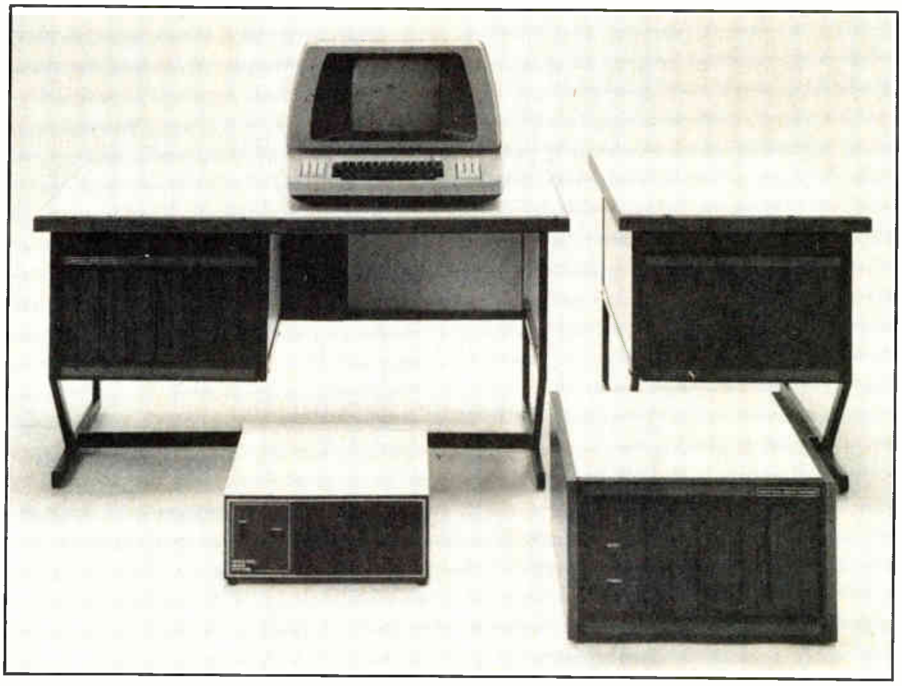
PERSONAL COMPUTERS: THE FUTURE

Sophistication will grow, size will shrink, capabilities will expand.

A famous science fiction writer has predicted that a personal computer in the year 2035 will be a hand-held terminal, without a keyboard, that will hear and reply in conversational English or other languages, while communicating with world-wide information networks through satellites. This device will be personal secretary, administrative assistant, corporate staff, lab technician, information network, electronic post office, and telephone.

The only problem with this prediction is the date. A personal computer with this sophistication will be feasible before 1990, and will probably be in mass production before the turn of the century. Advances in speech synthesis, voice recognition, very large-scale integration of electronic circuitry, satellite communications and information-network development are occurring so rapidly that this hand-held Jeeves is around the corner.

Before we reach that happy day, however, the personal computer will evolve first into a computer-cum-terminal that links everyone to what MIT's Michael L. Dertouzos has called the information marketplace. Just as today's marketplace buys and sells products, the information marketplace will buy and sell information in thousands of forms, from personal electronic newspapers to narrow data bases appealing to specialized interests.



Today it takes a hefty amount of hardware for a small computing system; tomorrow these boxes will hold the equivalent of a full mainframe.

The first information networks, CompuServe Information Service and The Source, give clues about how the future will take shape. Subscribers use electronic mail to send and receive messages at their own convenience, but they also seek to make contact with people of similar interests. They only use services that are clearly either less expensive than another method or unavailable from other sources, *i.e.*, instant access to large data bases on stocks and bonds and on commodities.

Long before it was supposed to happen, they have established "reverse advertising," as Dertouzos calls a new marketing phenomenon. CompuServe has a Community Bulletin Board service on which any subscriber can post a message. Subscribers ask for help (a nurse wants to telecommunicate with other nurses to share professional information, say), seek specific types of information, and sell things, from software to used computers and peripherals to other subscribers.

CompuServe also has The

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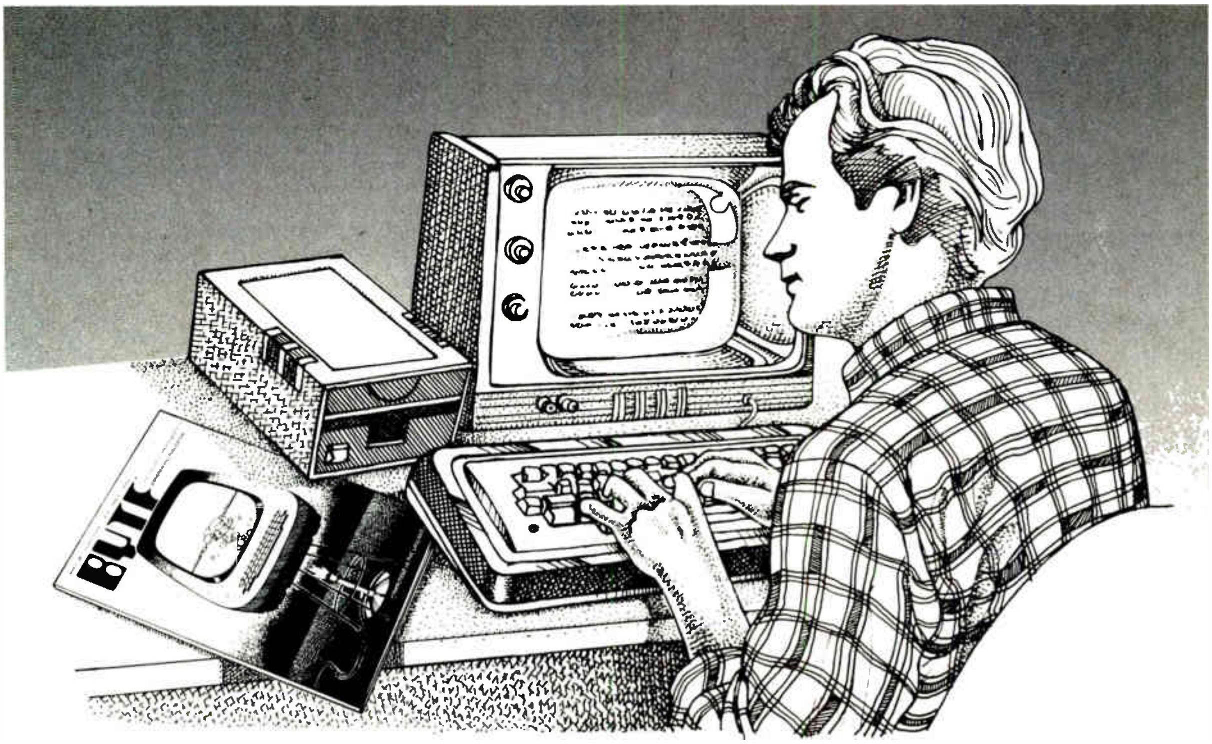

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Software Exchange, through which subscribers with software to sell can advertise the programs. Buyers can purchase the software, charge it to their time-sharing account and download the program through the system, or contact the seller directly. Another popular feature is its CB, or citizen's band, function that allows between 3 and 12 subscribers to create a private group through which to do anything they can do over an information network that is legal.

The day when personal computers will be as ubiquitous as TV sets is not far off. As costs fall and software catches up, home computers will proliferate at fantastic rates. Many predict the personal computer boom of the late 1980s will surpass the booms of the auto in 20s, the radio in the 30s and 40s, and the TV in the 50s and 60s.

Converging to cause this boom will be a number of key developments, all of which have already begun happening. First, the public will become familiar with personal computers. Unless one is a hermit, one has at least heard about these devices in the past two years. It's likely that most children have been exposed to electronic games, arcade games, video games, and personal computers in their schools. Also, the pace with which small businesses, professionals, and just folks are buying computers is quickening.

Software is Growing

Next, with a lot of fits and starts, software is reaching a mass market through computer stores, department stores, book stores, electronic boutiques, even a few office supply stores. Moreover, software quality and utility is slowly improving.

More importantly, the corporate giants, American Telephone & Telegraph Inc. most notably, are preparing the fundamental information networks. AT&T has begun soliciting press coverage for its home terminal, and it goes without saying that Bell's Viewdata test with the Knight-Ridder newspaper chain in Coral Gables, Fla., was a success.

At the same time, AT&T is launching a second major experiment, this one in Charlotte, N.C., with Duke Power, Piedmont Natural Gas, and Southern Bell. More than 1,000 homes will test such features as a customer's ability to manage his own energy consumption, the utility's ability to manage one home's energy consumption, and a combination of the two. The AT&T equipment will allow remote control of heating and cooling systems and appliances, automatic monitoring and control of energy usage, and remote gas and electric meter reading.

Watch Ma Bell

You can easily sense that AT&T will soon make a move into interactive information network so big and far-reaching that it will dwarf the efforts of any competitors. There are inherent limitations to using the telephone network for interactive communications, but as the first services are introduced, these limitations will not hamper the networks. As they grow, AT&T will transmit information by satellite and directly compete with Satellite Business Systems.

Dozens of information providers, companies that offer continuously updated data bases through such networks, have already signed up or are actively exploring how to join the networks. The publishing arms of the major TV networks, newspaper and communications conglomerates, federal agencies, and so forth are all jumping on the information bandwagon.

But these large networks will hardly be limited to passive information retrieval. People will interact with them, extending the power but reducing the cost of the telephone through electronic shopping, electronic mail, and uses no one has considered yet.

Into the 1990s

With these rapid advances, the dream of a personal computer in every home is not far away. But what will the industry do for an encore in the 1990s? If Texas Instruments Inc., General Instrument Corp., and a host of smaller companies have a say (which they do), the personal computer of the 1990s will speak thousands of words, understand a hundred or more spoken in any English accent, and respond to the human touch.

So, by the end of the decade, as the touch technology is perfected and the software to drive it becomes available, personal computers will lose their keyboards. A talking, listening, touch-sensitive personal computer will necessarily be very easy to use, and will become more important to a 1990 home than the telephone is in a 1981 home.

In the engineering lab, these capabilities will be added to intelligent equipment and robots, continuing to eliminate pencil-pushing manual labor but demanding more creative thinking. Long before the last tech is replaced by a robot, however, every engineer will have a personal computer at his desk, or within reach of his work station.

This work station will act as an intelligent associate in the words

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Helping Others with a Personal Computer

A few engineers are taking their personal computers a step beyond the norm and exploring ways they can help their fellow man. Richard Washburn, engineering unit supervisor for Chrysler Corp., Detroit, Mich., is such a person. Not only does he use several Ohio Scientific machines for important engineering management tasks and a simple Ohio Scientific CP1 system to teach his daughter programming; he also uses a sophisticated "homebrew" machine based on a Motorola 6800 microprocessor to develop software used in neurological research for Reyes Syndrome patients and stroke victims. (Reyes Syndrome is a brain disease, probably caused by a virus, which afflicts children and teenagers. It is usually fatal.)

While many professionals would patent or copyright similar and potentially important research, Washburn says he does all of it for free. "I'm one of those people who believes that they should leave the world a little better off than when they appear here," he says.

Washburn's accomplishments in his two dozen years of medical electronic research include the first automated heart and lung machine with solid-state controls, developed with Rice University. His latest work—his "hobby," as he calls it—uses the 6800-based system to monitor 10 bodily functions and automatically feed medication and nutrients to stroke or Reyes Syndrome patients. It constantly measures the type and amount of medication and gauges the patient's bodily responses according to certain parameters. When a patient's response gets out of range, the computer automatically compensates and signals an alarm. "It responds much faster than any nurse or doctor," Washburn says.

He adds that the machine allows Reyes Syndrome patients to build up their own defense mechanisms. In the past, patients continued to lose the battle against the syndrome for several days after they entered hospitals because testing and monitoring took that long to develop the proper treatments.

Washburn's system helps stroke victims in an even more important way. Using the system's monitoring functions, doctors can run special diagnostic programs that rapidly identify the area where brain damage has occurred. It shows the doctors, in minutes, where they should operate to bypass the brain damage. "In the past, stroke patients lost a lot of motor functions because accurate diagnosis took so long, often hours or days. Now, the doctors will be able to get to the affected areas very quickly," he says.

When he's not "relaxing," Washburn directs all of the engineering work on a new $150 million Chrysler plant expansion. "We use an Ohio Scientific C3C in three applications: manipulating manufacturing management data; measuring raw engineering data, such as electrical load distribution and energy management; and working out development systems," he comments.

In the latter, his staff of 20 uses the Ohio Scientific C3C. They write, debug, and test development programs (in machine language) before they fix the software into programmable read-only memories. These PROMs go into Chrysler's self-analyzing and testing products and equipment that check the tooling and tolerances on auto engine blocks.

"The C3C feeds back data on the tolerances, and tells us whether a purchased part comes within the high or low end of the required tolerances," he notes. "The data gives us clues as to what to expect to happen to that part when it is installed on a Chrysler car." It allows for easy changes to the PROMs when new engines are developed.

Before the C3C, Washburn says, he had two alternatives: buying three different development systems and hiring three specialists to run them, or farming the work out to separate vendors to do on their own equipment. A similar system purchased from a vendor would have cost at least $20,000 and wouldn't have done exactly what he wanted; the C3C hardware cost $5,700 and his people write the software.

As a manager, Washburn uses the C3C as a graphics tool to give Chrysler executives updates on engineering and manufacturing progress. "Our management is big on graphics analysis, and they prefer we make up statistical analyses and charts to present our reports," he says. "In the past, such reports would have taken us days or weeks to prepare, but now, with all of the data stored on board, we simply call up the program, do a statistical analysis and print out our charts in about a half an hour."

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of J. Thomas Markley of Raytheon Data Systems. In fact, Texas Instruments and a few other high-tech companies have already put such stations to work all over the world.

TI's international computer and communications network, using satellites, already transmits 200,000 messages per day sent by 50,000 employees world-wide at a cost of only a few cents per message. The interactive system can handle digital data as well as printed information.

Markley's intelligent associate takes the TI concept a couple of steps farther. Among its most important characteristics:

- ☐ It will perform data entry, inquiry response, program development, and electronic mail functions.
- ☐ It will be compatible with all other work stations in its company or however widespread a network its developers decide on.
- ☐ It will have standard interfaces that will support easily upgradable peripherals of all kinds.
- ☐ It will work with a wide variety of operating systems and software and execute any application.

As TI has more than adequately proven, the intelligent associate is already economical. It only remains for an innovative company to bring all of the pieces together. Xerox's Ethernet digital communications network standard and SBS' satellite communications network take two important steps toward giving every engineer an intelligent associate.

Whether personal computers evolve into computerized listeners and conversationalists held in the palm of one's hand or become sophisticated home terminals that give one access to the wisdom and wiles of the world through a huge video screen, one prediction will come true. What is here now in personal computing will not be the same tomorrow. ☐

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NEW PRODUCTS

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Mannesmann Tally has introduced a dual-function serial printer that produces letter-quality characters via a 40-by-18 dot-matrix-array technique. The

T-1805 printer's two modes are: a 50-character-per-second word-processing mode for high-quality printing, using the full dot matrix; and a 200-cps data-processing mode, using a standard single-pass 7-by-9 matrix array and optimized bidirectional printing.

The company says the new printer is priced below 50-cps daisy wheel printers while offering the added advantage of 200-cps printing. Single unit price is $2,495.

Mannesmann Tally Canada, Attn: Melle Zegel, 703 Petrolia Rd., Downsview, Ontario, M3J 2N6, Canada. (381)

Rack-mounted cages for S-100 cards

For packaging microcomputer systems, a new EIA-standard rack-mounted cage from Vector Electronic Co. holds 21 S-100 cards on ¾-in. centers. The model CCK100 cage has adjustable struts for mounting screw-down card-edge connectors or the Vector model 8803 S-100 motherboard.

The CCK100 card cage with 21 pairs of card guides is shipped unassembled and is priced at $49.80 each. Assembly typically takes 10 min., and Vector manufactures a complete line of cage accessories.

Vector Electronic Co., 12460 Gladstone Ave., Sylmar, Calif. 91342. (382)

Portable program loader

The latest Instant Peripheral from Electronic Processors Inc. is the STR-Link III portable program loader that uses a DC100A minicartridge. The self-contained microprocessor-based unit can be used with computers, controllers, or other machines requiring temporary or permanent storage of digital

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Features include read-after-

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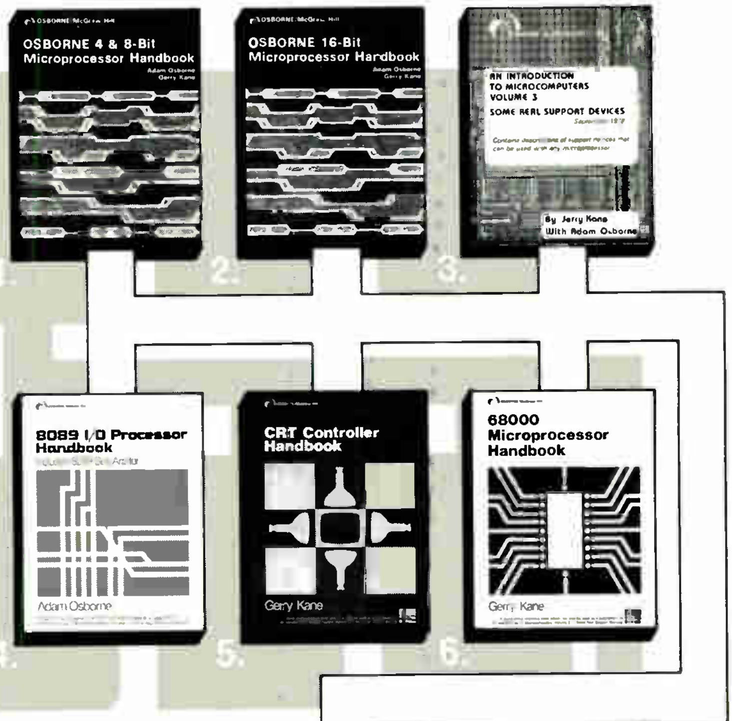

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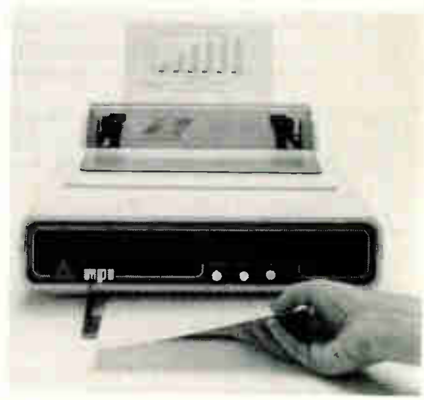

The model 99 Omni printer, complete with graphics capability, single-sheet feeder, and QT sound shield lists for $899, with substantial discounts

see EMM pp 1071-1081

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NEW PRODUCTS (continued)

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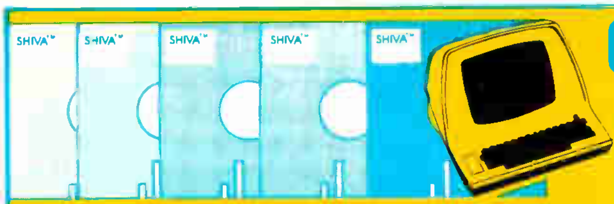

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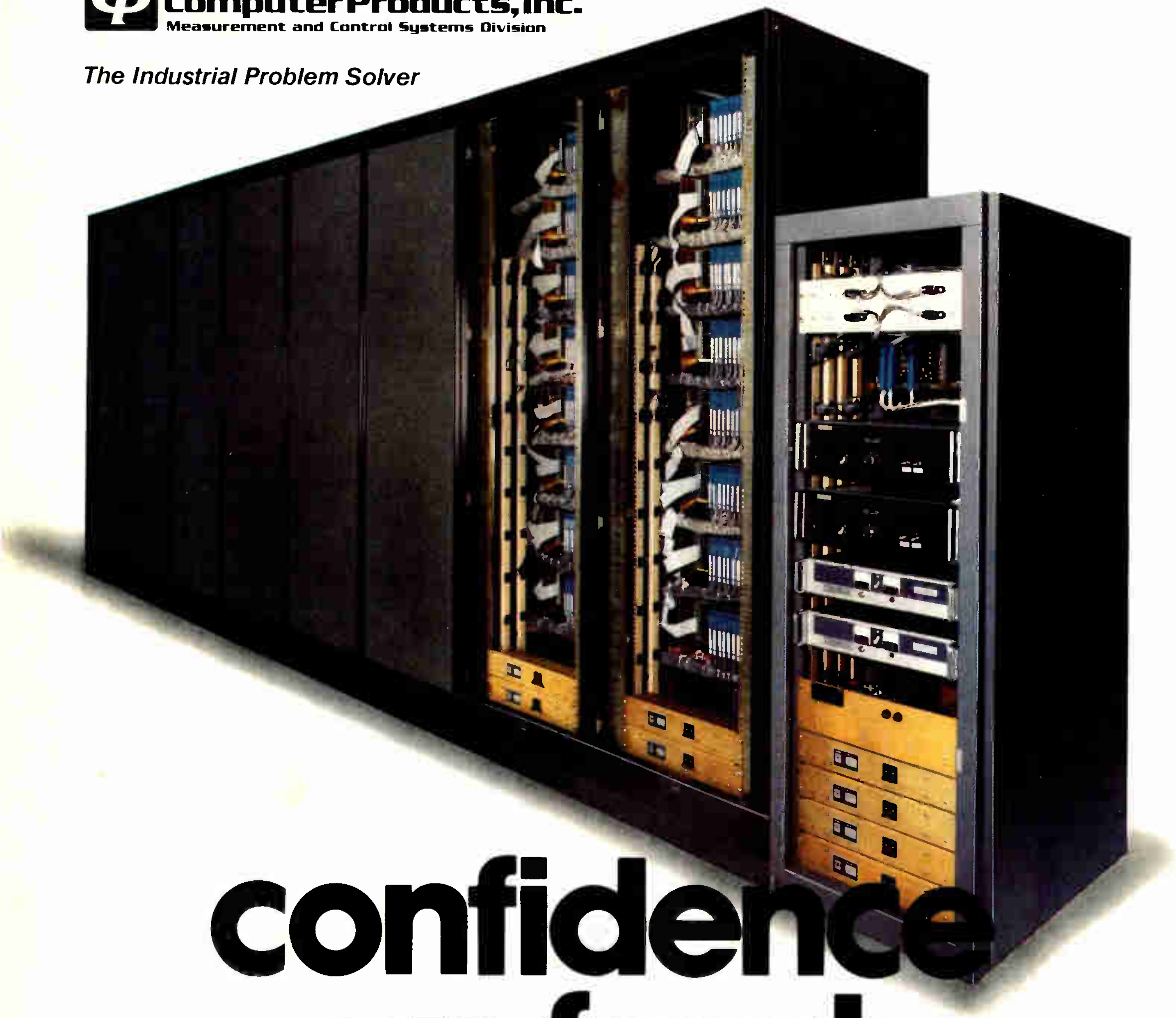

confidence up front

World Radio History

Buying software gets systems to market sooner: a special report

While better tools and techniques make each programmer more productive, third-party software houses distribute standard application packages widely

by Tom Manuel
Computers & Peripherals Editor
and R. Colin Johnson
Microsystems & Software Editor

☐ An important key to increased industrial productivity is the computer. That is the theme of this year's National Computer Conference, to be held in Chicago in early May. But a major hindrance to the use of the computer for industrial and other purposes is the lack of software.

Nowhere is this truer than among microprocessor-based systems. At their current rate of growth, it would be many years before they could take over all the applications of which they potentially could take charge.

But the situation is changing. With the emergence of standard operating systems like Unix and CP/M and with the still more recent arrival of Ada and other standard high-level programming languages that can run on almost any hardware or operating system, it has become easier to program microprocessor systems. And the proliferation of program development aids like editors and debuggers is further improving the individual programmer's output.

Far more significantly, however, because software has now become transportable among different computer types, the same program can now serve a vastly greater number of users. This development has given an enormous boost to the computer-related firms known as the third-party software industry.

Some companies in this area actually write the software of which they supply copies to their customers. But

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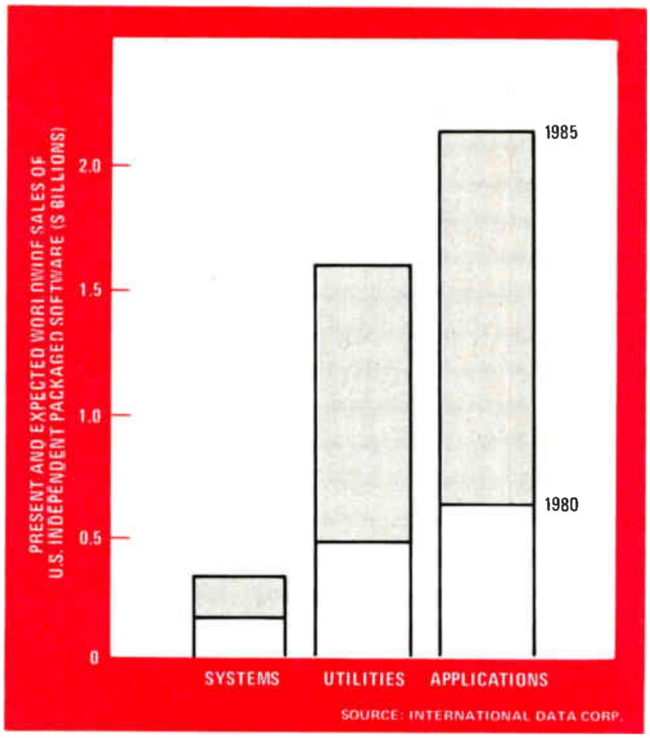

1. Applications rising. The fastest-growing segment of the independent packaged software market will be applications packages. The annual sales will more than triple in the next five years. Close behind will be programming languages and software development tools.

others are middlemen who define the requirements of a variety of microcomputer and computer makers and mesh them with the marketing needs of hundreds of independent software producers—often small firms consisting of just a few people. In effect, the latter are software publishing houses that serve to multiply the value of each programmer's work and thus add to the world's software resources.

They are the ideal answer to many a vendor's needs. The system integrator or builder of microprocessor-based small-business computers, personal computers for professional use, and office automation systems cannot succeed by just selling a hardware system and hoping the customer will do the programming. But no longer need he hire programmers to write his software for him—rather, by buying it, he cuts down on his product development time and costs and can thus get to market sooner with a lower-cost product.

Some best sellers

This approach is gaining rapidly in popularity. For instance, the CP/M operating system developed for 8-bit microcomputers by Digital Research Inc. of Pacific Grove, Calif., has over 200,000 licensed users. Three-year-old Lifeboat Associates in New York has a catalog of over 200 items and is a successful seller of the full spectrum of software packages (see "Gold, a software publishing pioneer," p. 166). Other best sellers are Microsoft Basic, a high-level programming language from Microsoft of Bellevue, Wash., and VisiCalc, an application program for numerical model building and the manipulation of charts of numbers from Personal Software Inc. of Sunnyvale, Calif.

In addition, the microprocessor houses like Intel are actively encouraging outside programming efforts. Technical assistance is being made available to those with good ideas, as well as free promotion and even subcontracts for software development.

The prices of microcomputer software packages have tended to remain stable. In general, they are a relatively inexpensive few hundred dollars. CP/M costs $150, the median price of VisiCalc is $200, the rest of Personal Software's business products range from $100 to $260, and Lifeboat's median price is $300.

(It is worth noting that this software grows in value as the computer hardware improves. For example, the reliability and high performance of the hard disks now available for microcomputer systems have made the latter viable for the first time as small-business accounting systems.)

As for the overall market in independently packaged software—that sold by other than computer manufacturers—*Electronics* estimates on the basis of several industry sources and reports that about 25% in 1980 was for systems costing less than $100,000 and 10% for very small systems costing from $5,000 to $25,000. However, this last market segment also appears to be the fastest-growing one. Because of the expected continued rapid growth of microcomputer-based systems, it is reasonable to predict that their software market will expand faster than the overall one—perhaps at an annual rate of 40% or 50% or even more.

These percentages may be viewed in the context of a survey recently made by International Data Corp. of Waltham, Mass. It concluded that U. S. producers of independent software packages sold $1.21 billion worth worldwide in 1980 and could expect this figure to rise at an annually compounded rate of 28% to $4.1 billion in 1985 (Fig. 1).

Of this 1980 total, the survey indicates that 22% was sold outside the U. S.—and indeed, the European market in packaged software is still 90% U. S.-dominated, according to Peter Reichert, managing director of the West German office of the consulting firm Mackintosh International in Darmstadt. Most of the programs of U. S. origin in Europe are system software and are marketed out of European offices run by local managers and staff. In the remaining 10% of the market, most of the software is from England, some from France, and a little from West Germany. For instance, Software AG of Darmstadt sells its Adabas data-management system with considerable success in the U. S. as well as Europe.

Nevertheless, "where the source of computer innovation is, that's where the innovative power for software development will reside," observes Reichert. "That source has been and is now the U. S. If the computer source migrates—to Japan, for instance—then the software source will follow."

The spread of CP/M

At any rate, no source besides the U. S. has so far produced the software publisher. Its emergence is being encouraged in particular by the interest of well-established computer companies in the very small business

World Radio History

2. Software power. The new Datapoint 1550 small business computer was designed to run the CP/M operating system and can therefore make use of all the software written for CP/M systems while maintaining compatibility with Datapoint software.

system selling for $5,000 to $25,000 and by their recognition that the independent third-party software vendor is a very good source for programs. Their approach is to develop a small system with an architecture for which a lot of software is already available.

A prime example of a computer planned around third-party software is the Z80-A–based model 1550 (Fig. 2), the newest small-business computer from Datapoint Corp. of San Antonio, Texas. It runs a version of the CP/M operating system from Lifeboat Associates in addition to supporting Datapoint software.

This is the first commercial-grade computer with maintenance support to run CP/M. All the fairly inexpensive software now available for CP/M can be used on it. The 1550 with 32-K bytes of memory and a 0.5-megabyte floppy disk has a base price of $7,075.

In the words of Gerry Cullen, Datapoint vice president of market planning, "I had bought and used small computers such as Apple and TRS-80 and noticed all the software that was available to them. Then one day, when I was walking by one of our model 1500 computers, it suddenly dawned on me that we could probably get it to run CP/M. Instead, we décided to see if we could get CP/M on our new model, the 1550 then being planned. I needed CP/M right away and we also wanted a legal relationship that was easily workable. We turned to Lifeboat Associates, which has a license to sell CP/M and a whole bunch of programs."

Datapoint and Lifeboat started working together at the beginning of the design of the 1550 to make sure CP/M would operate efficiently. Because CP/M was originally developed for the 8080 and Z80 type of microprocessor, Datapoint had to make only minor design changes to accommodate CP/M, says Cullen. Rather than write the software itself, the firm decided to rely on Lifeboat. Perhaps even more important, Cullen felt he could rely on Lifeboat's support and maintenance organization, saving Datapoint the cost and effort of setting up its own. Lifeboat will soon have a catalog of the 1550 software ready for Datapoint distributors. This publication will include almost all of the 200 or so CP/M application programs Lifeboat has available—"a wonderful way to begin life with a new computer system," Cullen declares.

There are several ways to go for the manufacturer of a small computer who decides to use an architecture for which a whole lot of software is available. Datapoint's way was to have an independent software marketing house develop a large catalog of compatible software so that a set of supported software is available to its customers when the system is announced. In the words of Anthony R. Gold, president of Lifeboat Associates, "It is essential to begin the relationship between the computer company and the software marketing house when the design of the computer system starts. Then, a cooperative, sympathetic relationship can develop. Changes for complete compatibility can be made to either the hardware or the software and tested early in the development cycle. When the machine is ready, the software is ready."

Zenith Data Systems adopted CP/M for many of the same reasons as Datapoint. But it was specifically to boost sales that the subsidiary of Zenith Radio Corp., Glenview, Ill., recently introduced the standard CP/M operating system for its Z-89 personal computer for business and professional users. CP/M is included in an expansion module containing dual 8-inch floppy disk drives plus the 16-K bytes of memory necessary to bring the system up to a full 64 K. In this way Zenith can offer a computer that is supported by all CP/M-compatible software without having to write it itself.

The company is now concentrating on purchasing software from the outside. In addition to testing and debugging it, the software group may modify some of it to meet their requirements and rewrite the documentation with the first-time computer user in mind. "There are a lot of good CP/M software sources out there. Picking up CP/M and buying applications software is a good bet for computer companies", says one Zenith Data Systems spokesman.

Another satisfied customer

Like Zenith, Ray Atkinson, product specialist at Pertec Computer Corp.'s Peripherals division in Woodland Hills, Calif., counts heavily on the third-party software houses. "It's easier for us to buy software from people who know software than to assemble a group to do it," he says. Pertec buys CP/M from Lifeboat in what Atkin-

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Gold, a software publishing pioneer

The world's largest software publisher, Lifeboat Associates, got its start in life in a theater. Anthony R. Gold, cofounder and president, while trying to use microcomputers in a banking application a few years ago, became painfully aware of the need for software for these potentially very powerful tools. He first began a users' group to enable CP/M users to share software and discuss problems. Then in 1977, with Larry Alkoff as partner, he began a part-time business distributing nonproprietary (nonroyalty) software. Next they started distributing proprietary software, and "it just grew into a business," says Gold.

It became a full-time operation in the spring of 1978. From having just three part-time employees in a grubby office backstage of an abandoned theater on Broadway in New York, it has grown to a $5 million business with over 50 employees—and no longer inhabits the theater.

Tony Gold, a graduate in electrical engineering from the University of Newcastle in England, first worked for International Telephone & Telegraph Corp. in the UK in digital equipment sales and then at the corporate level. He then came to the U. S. to obtain an MBA from the Harvard Graduate School of Business and followed that up with a job with Citicorp in New York as a credit officer before starting Lifeboat Associates.

Gold's plans for Lifeboat include adding new types of programs and expanding the coverage of 16-bit microcomputers and minicomputers. The company currently has offices in Switzerland and Japan and a joint venture in West Germany, as well as plans for opening other U. S. offices on the West and East Coasts.

When asked about the problems he faced in this new business area, Gold said, "Our major difficulty is that we have no one to copy—no role model. We are breaking new ground all the time." **-Tom Manuel**

son calls kit form—in a programmable read-only memory accompanied by a manual—plus the Microsoft languages on disks. It resells the unmodified software together with its 3712 dual disk-drive subsystems for hooking up to various computers.

"If you are a hardware company like Pertec and you have a good software vendor, it's an ideal situation. It frees us to make more and better hardware. We don't have to spend money and time on software development and can concentrate on what we're good at. CP/M is so versatile and has so many good programs available that we are glad we went with it. Also, a vendor of software like Lifeboat takes care of the acquisition and ongoing support. It's an advantage for all concerned: the hardware company, its customers, and the software vendor, too, of course," Atkinson comments.

System integrators are also taking advantage of the third-party software market. "We didn't want the time and expense of writing our own package so we sent out a request for proposals to several software companies," says John Hoppe, president of Applied Solutions Inc. in Houston, Texas. Applied Solutions is a system integrator, doing packaged turnkey and custom applications. For one system it recently designed to evaluate the possibilities of drilling for oil and gas on various properties, the company needed a data-base management package. Eventually, it selected a package proposal from Westico Inc. of Norwalk, Conn.

"Software publishers give OEMs like us a new source of software. We like the idea. Buying software is a much better solution for a system integrator than trying to develop it. You get a better package at a lower cost and in less time than the cost of developing what could be a substandard package of your own," says Hoppe.

That kind of attitude is of relatively recent genesis. In fact, CP/M came into being because Gary Kildall, now president of Digital Research, had a proposal turned down by Intel Corp.

Like so many other microprocessor manufacturers, Intel Corp. had no operating system for its 8080 microprocessor when it introduced it in 1973. Kildall approached Intel, which rejected his proposal to write one, whereupon he decided to write CP/M on his own. What he started, Digital Research Inc., Pacific Grove, Calif., is now a $3-million-a-year company and Kildall's program, CP/M, has become the *de facto* standard operating system for 8080- and Z80-type processors.

Eight years later, the big firms like Intel—and Motorola, National Semiconductor, Texas Instruments, and Zilog—are not turning down proposals from men like Kildall. They are going out of their way to find people like him, committed as they have become to supplying a whole line of operating systems, languages, and applications software with their microprocessors.

Unix catches on

Still, though CP/M has become a standard operating system in the 8-bit arena, it will shortly feel the challenge of Unix, the popular operating system invented at Bell Laboratories [*Electronics*, March 24, p. 126]. Author Kenneth Thompson feels that "since it started out on a small machine [a PDP-7 with 8-K bytes of random-access memory], it fits in small processors but offers facilities that cannot be found elsewhere, even on most mainframes."

But the big battle will be between rivals for a standard

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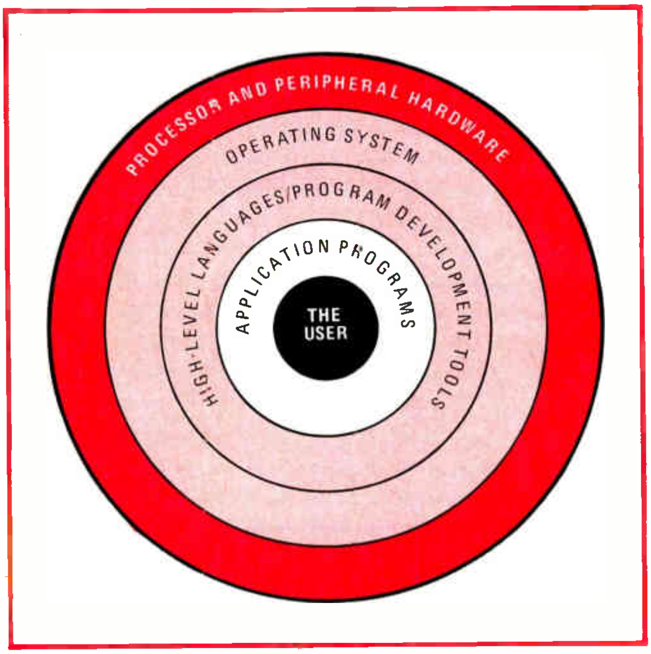
for the emerging microsystems based on 16-bit microprocessors. Here Digital Research is pitting MP/M against Unix and its derivatives by including what it feels are the most important features of Unix in the 16-bit versions of MP/M. In addition, the company will maintain compatibility with CP/M-3.0 by using the same file structure and by allowing 8- and 16-bit systems to interact over the CP/NET local network. Frank Holsworth, manager of the MP/M-86 project at the company, is confident of success on the grounds that its software is "designed expressly for microsystems that use more than one central processing unit, not for older, single-CPU minicomputers."

Stiff competition is already surfacing, however, with Microsoft, which has announced the availability of Xenix, its version of Unix, to original-equipment manufacturers using the Z8000; it has still other versions coming out later this year for the 8086 and the 68000. In fact president Bill Gates (see "Gates, a microprocessor language millionaire," p. 169) is making a very aggressive attempt to penetrate the market, trying to establish Xenix "as the CP/M of operating systems for 16-bit machines." Various other versions are available, too, not only for microsystems but also for minicomputers and mainframes [*Electronics*, April 7, 1981, p. 108].



3. Center of attention. The computer user can exploit a machine most fully when it is supported by good, easy-to-use application programs. The other layers of software support the applications and isolate the user from details of machine operations.

An addiction

The plain fact of the matter is that once programmers are exposed to the convenience of Unix's program development environment, they do not want to use anything else. For example, Amdahl Corp. of Sunnyvale, Calif., now offers a version of Unix on its IBM-compatible mainframe computers largely because programmers in its development group wanted to use it. Moreover, the responsiveness of Unix's software development environment is becoming well-known, partly because of the exposure to the system that many programmers receive in university courses. The extensive set of single-stroke operators that can be strung together in complex and efficient sequences are the hallmark of the Unix shell—a command-line interpreter that responds to user's terminals. Also listed as popular features are forks—the duplication of each program before it is executed—and pipes—the ability to send data from one program to another from the console. Finally, the language in which the original Unix is written, C, is one of the most respected structured languages around [*Electronics*, May 8, 1980, p. 129].

With the numbers of users and vendors of compatible operating systems and software development tools based on Bell Labs' Unix or similar proprietary designs growing every day, it is not surprising to learn that a Unix Association has been formed. The new association, headquartered in Walnut Creek, Calif., is call Uni-ops. One of the first acts of the association was to coin a new term to refer to the growing family of Unix, Unix-based and Unix-like products without having to use the name, a trademark of Bell Labs. The new term is Unitory, and Uni-ops is an association of vendors and users of the Unitory family of compatible operating systems and development tools.

The new association hopes "to act as a forum for the members to discuss their needs, plans and progress," says Walter Zintz, executive director.

Also, a communications software package is now available that enables Unix systems to communicate using standard Defense Department protocols. Unet is available from 3 Com Corp. in Menlo Park, Calif.

The sellers of software

It used to be the lack of system-level programming—the outer two layers in Fig. 3—that limited the use of microcomputers. But now that every major microprocessor is supported by a disk-based operating system like CP/M or Unix and can employ one or more modern, structured programming languages like Pascal, PL/1 or C, the biggest job begins—the writing of application programs.

Companies such as Lifeboat Associates, Westico, and Personal Software Inc., the software publishers, are one source of application software. Rather than developing all the software they sell, these firms in essence seek out and obtain the rights to programs; modify, test, and learn how to support them; market and distribute them to system developers and users; and, like book publishers, pay royalties to their authors. Capabilities critical to their success in this business include applications expertise or access to it, after-sale customer support, documentation good enough not to require special training of its users, adequate duplication facilities, and effective distribution. Personal Software is a purely application software publisher, whereas Lifeboat Associates and Westico offer products over the full range from operating systems to applications.

On the other hand, for example, Digital Research, SofTech Microsystems, and Microsoft began in the systems software business—developing operating systems

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The NCC and productivity

The National Computer Conference being held May 4-7 at the mammoth McCormick Place in Chicago will be one of the biggest ever, from the point of view of the number of exhibitors. *Electronics'* preview of the conference, whose theme is "Keys to Productivity," describes how the new breed of third-party software houses is helping original equipment manufacturers work with microprocessors to get products out the door faster. Highlights of the technical program at NCC and its allied Personal Computer Conference begin on page 172, and a roundup of new products being shown starts on page 215. Finally, striking the software note again, the article that begins on page 175 describes how modular high-level languages are supported by a 16-bit microprocessor.

and adapting programming languages for use on microcomputers. They are now turning to applications packages and are either encouraging and assisting program developers to write for their systems software, as are Digital Research and Microsoft, or like SofTech Microsystems, actively seeking application packages that will put them in the software publishing business [*Electronics*, March 24, 1981, p. 41].

The table lists the disk-based operating systems and structured programming languages offered by seven software marketing companies and notes whether or not they sell application programs. Those that do sell such programs typically have more than 100 listed in their catalogs.

All of these companies plan to expand their activities in three directions. They will extend coverage to more machines—moving from 8-bit microcomputers to 16- and 32-bit microcomputers and to minicomputers. They will increase their marketing coverage geographically. And they will add to the types of software and the kinds of applications they handle. Of importance in this last area of expansion will be their policies for the acquisition of software.

Author relations

Most of the new software publishers, including Lifeboat, Personal Software, and Westico, do not intend to write new software. Instead, they will encourage others to bring programs to them. However, they hedge a little and say that they may write or commission some small packages to fill specific needs if these programs are not otherwise available. They believe in a continuing relationship with the program suppliers in a form of a responsive, long-term royalty agreement with the authors. Tony Gold of Lifeboat Associates put it this way: "It is best for all concerned, the buyer, the seller, and the producer, for there to be a continuing interest on the part of the producer in the success of the product."

As for advertising or otherwise soliciting programs, Phil Woellhof, vice president of Westico, says, "We are encouraging the program sources we know as well as advertising for new ones in selected publications." Advertisements soliciting software are also part of the picture at Lifeboat, says Gold, though "at first we thought it wasn't necessary."

Not missing out on a good thing is also a problem. Personal Software is interested in evaluating every package that comes in. "There may be some gems among the 100 or so programs or ideas that come in over the transom each month," says president Terry Opdendyk. "We are looking for those packages or ideas that have the promise to serve our target market—the executive or professional person with a desktop computer."

Apparently VisiCalc has been enough of a hit for Personal Software to feel it unnecessary to advertise for programs. Enough material is coming in spontaneously to keep it busy, according to Opdendyk.

Digital Research and Microsoft do not intend to sell application programs but will continue to concentrate on developing systems software. However, they plan to stimulate the market for their products by encouraging application software firms to develop programs using their languages and operating systems. The form of the encouragement will differ between companies, of course, but a common theme emerges—give the applications house technical assistance and promotion but do not compete with it.

Digital Research is providing encouragement by fostering a group, referred to as the Independent Software Vendors group, to assist applications programmers [*Electronics*, March 24, 1981, p. 41]. This organization restricts its activities to support of the language PL/1–subset G which runs on any CP/M system, as well as on minicomputers from Data General, Wang, Prime, and Digital Equipment Corp. What Digital Research gives the applications house is educational seminars on the language itself, as well as tips on how to protect the software, technical assistance, consistent-looking documentation preparation, and free promotion. It is also helping to set up an independent company that will evaluate new software packages for possible inclusion in an Independent Software Vendor catalog. Digital Research has pledged not to sell any application software, thereby eliminating competition between itself and its independent software vendors.

One of the services provided by these new sellers of software is fast delivery either by rapid turnaround on mail and telephone orders or by off-the-shelf availability in retail outlets. Indeed, in the belief that its customers may want to acquire or add software very quickly, Westico offers 24-hour delivery, which it calls the Software Express Service. It also supplies 24-hour computer dial-up service that displays the current catalog with prices, program descriptions, and ordering information—its customers may order items through their computers and request 24-hour delivery.

One good result of a competitive market in software is its creation of an environment that promotes higher software reliability. To build a reputation and remain competitive, the software publishers must try to sell absolutely bulletproof software and foolproof documentation. The programs must be thoroughly tested and debugged both by the original author and by the publisher. They should be tested not only by people who know computers and the application but also by users who are

World Radio History

Gates, a microprocessor language millionaire

As one of the youngest presidents of a multimillion-dollar house, Bill Gates's is a success story that is short but sweet. He began his programming career at a private high school in his home town of Seattle where his software company, Microsoft, is also located. His school wanted to emphasize the impact that computers are having on society by offering computer time to students on the same system that handled its own internal data-processing chores.

At that time, however, no comprehensive programming course was offered—which is probably just as well since Gates taught himself programming and became an addict in the process. When the school's class schedule programmer died suddenly, Gates got one of his first real chances to cash in on what he had learned. "I lived in the computer room the summer we rewrote the class schedule system, and I got $4,200 plus all the computer time I could use," he recalls.

He got still more experience when the Computer Center Corp. gave students free time to help it debug some of its software. "I went crazy with that project and spent night and day there." The company eventually went bankrupt, but by then he had landed his first major free-lance contract for a traffic data-gathering system. It delivered reports on remote traffic conditions, replacing a system that required someone to pick up paper-tape records from every set of traffic lights. In his short free-lance career he also worked for Digital Equipment Corp. and TRW Inc.

From high school Gates went on to Harvard but failed to finish since he became just too involved in trying to do something useful with the new 8080 microprocessor. His first project was to write an 8080 simulator that ran on a Digital Equipment Corp. minicomputer, and with this system he developed what is now the most widely used 8080 language around—Microsoft Basic.

Since then his company has skyrocketed, growing at just under 50% annually to $7.5 million this year with $13 million expected next. It offers Basic for the 8086, Z8000, 6800, and 6809, as well as Cobol, Pascal, and Lisp. Microsoft employs 64 people including the newest addition, the Consumer Product division, that is aimed at the mass market of Apple and TRS-80 machines. This division is gearing up to make many more offerings soon. One of its first excursions into hardware—and a pioneering one at that—is the Softcard that allows CP/M-compatible software to be run on an Apple under the jurisdiction of a resident Z80.

At the age of 25 Gates has already come a long way, but his ideas are as forward-looking as ever. "I want to get in on the ground floor of the 16-bit market now with our Xenix operating system and follow it up with a whole lot of support software," comments Gates, who may just be beginning as a software entrepreneur. **-R. Colin Johnson**

like the expected end-user in experience and expertise. Even the documentation should be tested by someone who does not know the program.

If a program cannot be immune to every possible case that could cause a malfunction—and complex software may not be completely testable—then the software publisher must be able to make a quick fix. Establishing an ongoing relationship with customers providing full support after purchase is necessary in software publishing. This is the main difference between it and a traditional publishing business, whose products are usually sold on a take-it-or-leave-it basis.

Better tools and techniques

Another way to make the software producers more efficient is to provide them with tools that make the same amount of effort yield a much larger output. Crucial here is the notion of reliability. Time is saved in the long run if the code written contains fewer errors and needs less correction; so the focus of some tools is to make the code produced by programmers more reliable. Time is also saved if a program written by one programmer can be readily understood by another programmer, so that any changes that have to be made in it can be made quickly. Of importance here is a whole range of new techniques generally referred to as structured programming. Finally, there are ways of simply multiplying a programmer's output automatically by a factor of as much as 10. This is done by a new breed of programming software, called automatic program generators. Each line of code written in them yields as many as 10 lines in a high-level language like Cobol.

The wave upon wave of text editors, debugging packages, and macro-assemblers and disassemblers, all of which improve the reliability of a program, are being offered by computer manufacturers and private software houses alike. Many of these tools were demonstrated at the Tool Fair annex to the recent International Software Engineering Conference [*Electronics*, March 24, 1981, p. 39]. Screen-oriented text editors like Intel's Credit and Edward from American Microsystems Inc. of Santa Clara, Calif., allow corrections and alterations made on a video display to be automatically inserted into the code within the program. Debugging packages make it easier to identify and correct programming errors; some even simulate and simultaneously debug the execution of programs intended for processors other than the host.

One advanced tool is the compiler-compiler. This odd phrase denotes a compiler that accepts as input a description of a high-level language and produces as its output a compiler for that same language. A good example is YACC (Yet Another Compiler-Compiler), a part of

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MAJOR OFFERINGS FROM REPRESENTATIVE SOFTWARE SUPPLIERS			
Company	**Disk-based operating systems for specific machines**	**Structured languages**	**Application programs**
Digital Research, Pacific Grove, Calif.	CP/M for more than 250 computers MP/M for the 8080	PL/1-80	none
Lifeboat Associates, New York	CP/M for 92 machines MP/M for Intel MDS	PL/1-80, C, Pascal, SBasic	many
Microsoft, Bellevue, Wash.	Xenix for 16-bit microprocessors (Unix version 7)	MS-Pascal, C	none
Personal Software, Sunnyvale, Calif.	none	none	VisiCalc and more for 10 computers
SofTech Microsystems, San Diego, Calif.	none	UCSD Pascal	coming soon
Westico, Norwalk, Conn.	CP/M for many machines	PL/1-80, Pascal	many
Whitesmiths, New York	Idris (like Unix) for the PDP-11 and LSI-11	C and Pascal for the 8080, Z80, MC68000, VAX-11, and PDP-11	none

Source: *Electronics*

the Unix utility package from Bell Labs. It generates a compiler for a custom language in much less time than a programmer could. Of course, such a compiler runs much more slowly than one that has been optimized by hand, but that is less of a drawback in these days of higher-speed computers. Also, it is more than offset by the increase in programmer productivity—one researcher claims it makes the job of writing such a compiler a matter of man-months instead of one of man-years.

Structure helps

Going hand in hand with better tools are more refined techniques for producing code that is not only more reliable but also easier to maintain. Structured programming is foremost among these new methodologies. It differs from conventional programming in three ways.

First, it restricts the programmer to using only three control structures rather than the dozens of variations that can be created by liberal use of the GO TO statement. This constraint makes it possible to break up the program into individual, self-contained modules that can more easily be checked for accuracy. Second, in order to define these modules, the approach demands the development of a complete pencil-and-paper, top-down, modular analysis of the problem the program is to solve before a single line of code is written. Third, it requires extensive documentation of the program on the basis of this analysis, again before any code is written.

Between them, these techniques produce code that is more likely to be correct and can be easily translated into other languages thanks to the guidance supplied by the paper-and-pencil outline. Above all, it is more easily maintained since the control structures do not have to be orally explained to new programmers and the documentation is self-explanatory.

This structured approach is in very wide use today. It is taught in all university programming courses and has been incorporated into all the new programming languages as well as several older ones. The newest structured-programming language is Ada, which in addition is designed for easy implementation of real-time concurrent process management, or multitasking.

Pascal is another, structured language and, unlike Ada, is already available on almost every system configuration. Besides the three standard control structures, Pascal has strong data-typing facilities that help to preserve within the code the conceptual boundaries outlined in the pencil-and-paper analysis.

One disadvantage of standard Pascal is that the entire program has to be compiled at one time. This means that programs cannot take full advantage of the modularity of the pencil-and-paper solution since modules cannot be coded and debugged separately. For this reason practically all implementations of Pascal have had extensions added to them to handle the separate compilation of modules—notably Texas Instruments' implementation, which also adds real-time concurrent facilities similar to Ada's.

The language C also makes it easy to write structured programs and in addition is adept at system-level chores of the kind that require bit manipulation. Even such standard high-level languages as Basic and Fortran are being adapted for use in writing structured programs. SBasic can now be obtained from Cogitronix in Portland, Ore., for use on Tektronix and GenRad universal development systems. For Fortran, structured front ends are now available that produce standard Fortran as their output. A version called Ratfor can be obtained from Cromemco of Mountain View, Calif., for use with its Z80-based microcomputers and another called Iftran comes from General Research Corp.

Automatic code generation

Perhaps the last frontier in computer programming [*Electronics*, April 7, 1981, p. 39] is automatic code generation by very high-level languages that enable the nonprogrammer to write programs. Usually he or she simply uses a fill-in-the-blanks–style manual to complete the program's specifications. These are then passed through a very high-level–language compiler to emerge as a high-level–language program that meets the original specifications.

Naturally, such programs run much more slowly than those that are hand-coded, but the savings in man-hours can often offset this disadvantage. Also, as these methods become more refined, the lack of speed can probably be overcome at least in part through optimization routines within the very high-level compiler. □

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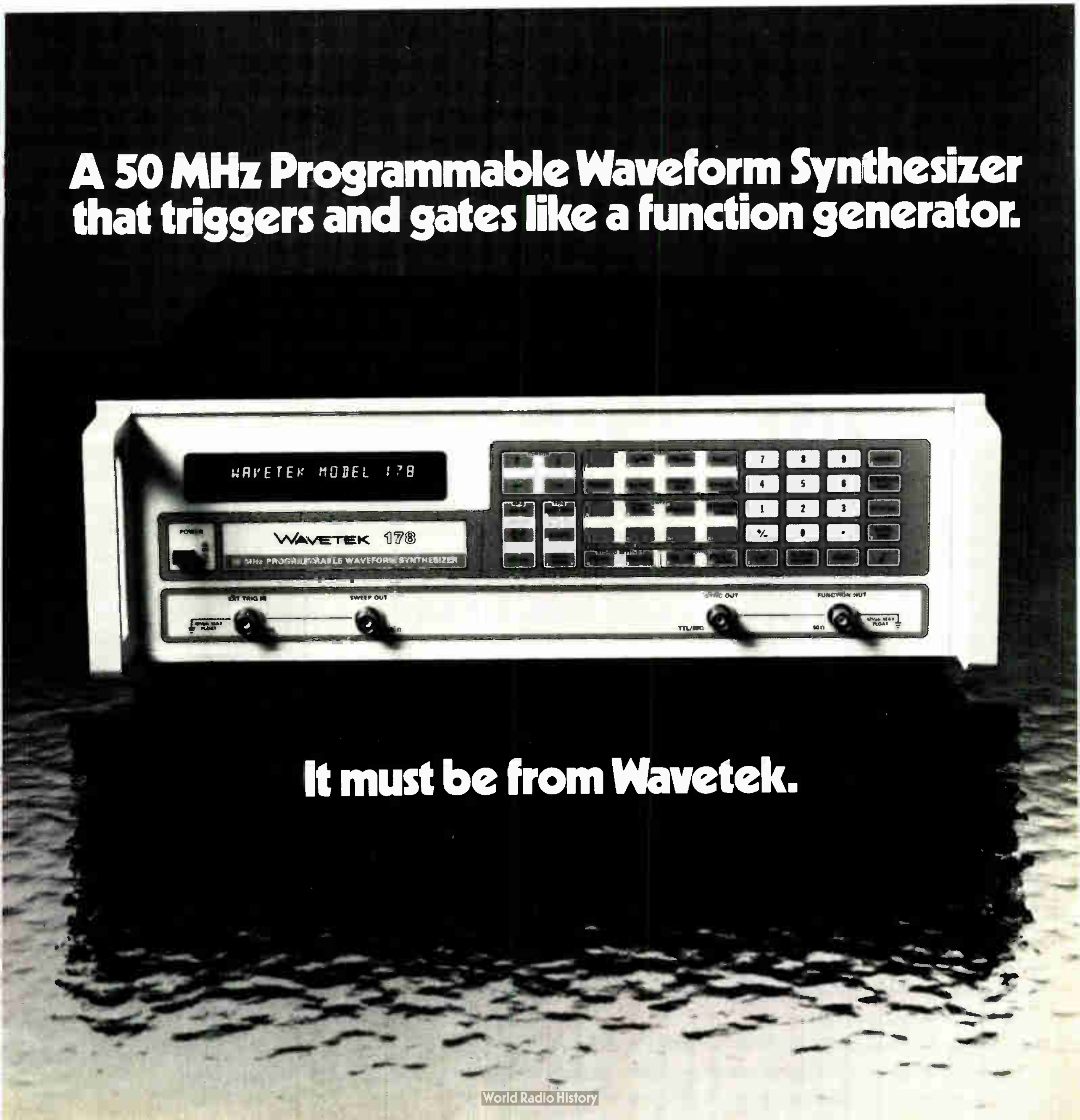

World Radio History

NCC to set exhibitor record in roomy McCormick Place

by Howard Wolff
Assistant Managing Editor

☐ For its four-day stay in the Windy City, starting on May 4, the National Computer Conference will be checking into Chicago's cavernous McCormick Place—a setting worthy of its ambitious plans for this year's show.

For one thing, the annual fling sponsored by the American Federation of Information Processing Societies will chalk up a record number of exhibitors: 544 companies have signed on, some 100 more than ever before. They will occupy more than 230,000 square feet, or more than 8 acres, so that the prospective visitor to the NCC would do well to start training now for the miles he or she will log among the exhibitions. But there is one consolation; in what must be an innovation in conference scheduling, people interested in a particular field will be able to attend all the sessions on that subject by staying in the same room for four days and will not have to wander about a hotel looking for the Stonehenge Lounge or whatever. "Of course," conference chairman Albert Hawkes is quick to point out, "you would have to make

	MONDAY 1:30 – 3:00	MONDAY 3:15 – 4:45	TUESDAY 8:30 – 10:00	TUESDAY 10:15 – 11:45	TUESDAY 1:30 – 3:00	TUESDAY 3:15 – 4:45
Hardware and Architecture	Design tools for system architectures	Innovative architecture and commercial computers	Microprocessor architectures – what next?	Perspectives on the history of computing	Fault-tolerant computing	——
Network Technology and Capacity and Performance Analysis	Transport and session protocols in the context of the ISO reference model	Packet speech	Local networks and the Ethernet in particular	——	Management of capacity planning	Network capacity planning
Software	Programming languages for small systems	Software development tools	Functional capabilities of dictionary systems	Operating systems	Software reliability in real-time systems	Pascal: standardization and extension
Information Processing Management	System implementation strategy	Audit and control in a data-base environment	Technology transfer: management issues	Planning for technology transfer	Implementing technology transfer	Systems assurance: a step beyond EDP audit
Education and Societal Issues	Survey and comparison of model curricula for information systems education	Joint business-university professional development and research programs	Computers and the future of literacy	Issues concerning national computer literacy in 1985	Effects of computers on personal life	Where is the story? a journalists' panel on trends in computing
Automating the Office and Computers at work	Integrated word- and data-processing systems	Office automation technology: futures	Word processing in litigation and information retrieval	Computer applications in law firm management	Simulation of natural systems	Future office systems
Data-Base Systems and Computers at Work	Distributed data-base management systems – transaction environment	Data-base machines	Distributed data-base architecture	Data-base practicum	Research and development data-base systems	Data-base systems advances in medical systems
Visuals, Natural Language Processing and Artificial Intelligence	Image analysis	Pictorial data-base models and query languages	Intelligent computer-aided instruction	Computer-based educational aids	Communicating with computers in natural language – current capacities	Communicating with computers in natural language – future promises

PERSONAL COMPUTING FESTIVAL

9:00 – 10:00	10:15 – 11:45	1:30 – 3:00	3:15 – 5:15
	Medical and dental uses	University research and administration	College classroom applications
	Sales management	Financial management uses	Production management use
Keynote session: a new direction in personal computing	CBasic 2	PL/1	UCSD Pascal

There will be three plenary sessions:
Monday from 10 to 11 a.m.,
Tuesday, noon to 1 p.m.,
Wednesday, noon to 1 p.m.

World Radio History

arrangements to eat and sleep elsewhere." There are 10 specialty fields at the NCC, which calls them "principal tracks," plus three more in the concurrent Personal Computing Festival.

Hawkes, supervisor of the engineering applications section at Sargent and Lundy Engineers in Chicago, notes another 1981 first for the NCC. This year the show will feature its first female keynote speaker, Marisa Bellisario of Italtel SA, the Western Electric of Italy, who is billed by the NCC as the top woman executive in the computer and communications industry. She is also a former president of Olivetti Corp. of America. Joining her, as the other plenary session speaker, will be W. Michael Blumenthal, chairman of Burroughs Corp. of Detroit and a former Secretary of the Treasury.

In all, grouped under the umbrella theme of productivity, there will be 112 technical sessions, up from the 95 offered last year in Anaheim, Calif. In addition, the concurrent Personal Computing Festival is holding 33 sessions, and there will be the usual series of professional development seminars running from Monday afternoon through Thursday morning. Once again, software is covered in 20% of the sessions, and office automation topics are covered in a good number of discussions. And a relatively new subject area, one that will undoubtedly grow in popularity in coming years, is called in the program "visuals, natural language processing, and artificial intelligence." ☐

WEDNESDAY

8:30 – 10:00	10:15 – 11:45	1:30 – 3:00	3:15 – 5:15
Microprogramming – the challenge of the 1980 s	—	Higher-level microprogramming languages and optimization	—
Capacity planning in a production environment	Simulation of computer systems: software and hardware	Special session: pioneer day – Univac I	—
Software maintenance	Quantitative measures for the quality of systems and programs	Maintenance of programs and systems	Software development facilities
Production process in the '80s	Business communications: security and vulnerability	Data-entry productivity	Special project management
Protection of proprietary interests in software	Planning agenda for a national health information system	Private sector policy issues on the use of computer technology in the healthcare industry	Alternative data-processing strategies for hospital information systems
Combining office automation and data processing – its technology and usefulness	Form processing in the office environment	Definition and measurement of application software productivity	Electronic mail: current developments
The impact of computing on the handicapped in the '80s	Simulation: a tool for business decision-making	Computer-assisted analysis in energy/economic models	Large-scale data-base applications
Artificial intelligence applications to electronic circuit design	Prospects for artificial intelligence application in industry	Imaging and computers	Educational uses of personal computers

8:30 – 10:00	10:15 – 11:45	1:30 – 3:00	3:15 – 4:45
Educational uses in Grades K-12	Panel discussion on teacher experiences	Authoring systems	Program design and selection
Audio/visual communication	Conferencing management	Robotics and artificial intelligence	
Star data base	Xenix operating system	Pearl – a data-base creation	Standards and implementations of programs

THURSDAY

8:30 – 10:00	10:15 – 12:15	1:30 – 3:00	3:15 – 4:45
Adaptable architectures	Architecture of specialized hardware systems	Single-chip computers – where are they headed?	The application of peripheral array processors
Implementations of experimental local networks	Local networks: the fundamental technology of office automation	Use of models in capacity planning	—
Quality assurance – an emerging technology	The user interface	The public release of Smalltalk-80	Computer-based tools for software and systems engineering
Motivation of computer personnel	Recruitment, retention, and certification of data-processing professionals	User requirements analysis	A survey of project management software packages
Computer professional as an expert witness	Library and business computer use: what's the difference?	Developing software engineers in industry	Developing software engineers in the universities
The electronic office: a futuristic forecast	Office automation: the Federal experience	Choosing a computer language for a first problem-solving course	—
Computing and energy technology assessment	Automated testing for increased productivity	Computing applications in magnetic-fusion energy research	Computational methods in inertial-confinement nuclear fusion
Recent computer advances in legislative reapportionment	Applications of artificial intelligence	Expert systems and knowledge engineering	—

8:30 – 10:00	10:15 – 11:45	1:30 – 3:00	3:15 – 4:45
Software sources for teachers	User reactions to software sources	Noncurricular uses	Federally funded applications
Programmer problem solving	PC graphics	Data acquisition and display	Special session panel on disk operating systems
Selector IV multikey data base	Pascal MT+	Future of bar-code technology	Turn Basic to Pascal

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Hardware comes to the aid of modular high-level languages

By defining a clean interface between separately compiled modules, 16-bit microprocessor architecture supports languages like Ada and Pascal

by David Ashkenazi, *National Semiconductor Corp., Santa Clara, Calif.*

☐ As advanced high-level programming languages emerge as a primary tool in achieving greater software reliability and maintainability, microprocessor architects are studying them carefully, looking to incorporate some of their modularity into hardware in order to cut software development costs. One result of such effort is National Semiconductor's 16-bit 16000 microprocessor chip, which efficiently supports modular languages like Pascal and Ada by taking over from software the task of monitoring individual modules.

In contrast to natural languages, which are continually evolving in order to adapt themselves to the changing environment, artificial or computer languages are defined and are therefore inert—they are highly impractical to change or adapt. This phenomenon explains why new software concepts lead generally to new languages defined specifically to include them. Nevertheless, there is a general trend in the direction of language specifications that include two features found to be essential to reliable, maintainable program development—namely, type checking and modularity (see table).

Type checking, which has been popularized by Pascal,

MODULAR LANGUAGES: A COMPARISON OF TWO PROGRAMS

		Pascal	Ada
Interface		UNIT SYMBOL_TABLE; INTERFACE	PACKAGE SYMBOL_TABLE IS
	Declarations	TYPE SYMBOL = RECORD ⋮ END PROCEDURE INSERT (S : SYMBOL) ; PROCEDURE RETRIEVE (S : SYMBOL);	TYPE SYMBOL IS RECORD ⋮ END RECORD; PROCEDURE INSERT (S : SYMBOL); PROCEDURE RETRIEVE (S : SYMBOL); END;
Implementation		IMPLEMENTATION	PACKAGE BODY SYMBOL_TABLE IS
	Private declarations	TYPE VAR HIDDENVARIABLE: SYMBOL; ⋮	⋮ HIDDENVARIABLE: SYMBOL; ⋮

	Procedure 1	PROCEDURE INSERT (S : SYMBOL);
		BEGIN
		⋮
		END;
			PROCEDURE INSERT (S : SYMBOL) IS
			BEGIN
			⋮
			END INSERT;

	Procedure 2	PROCEDURE RETRIEVE (S : SYMBOL);
		BEGIN
		⋮
		END;
		END.
			PROCEDURE RETRIEVE (S : SYMBOL) IS
			BEGIN
			⋮
			END RETRIEVE;
			END;

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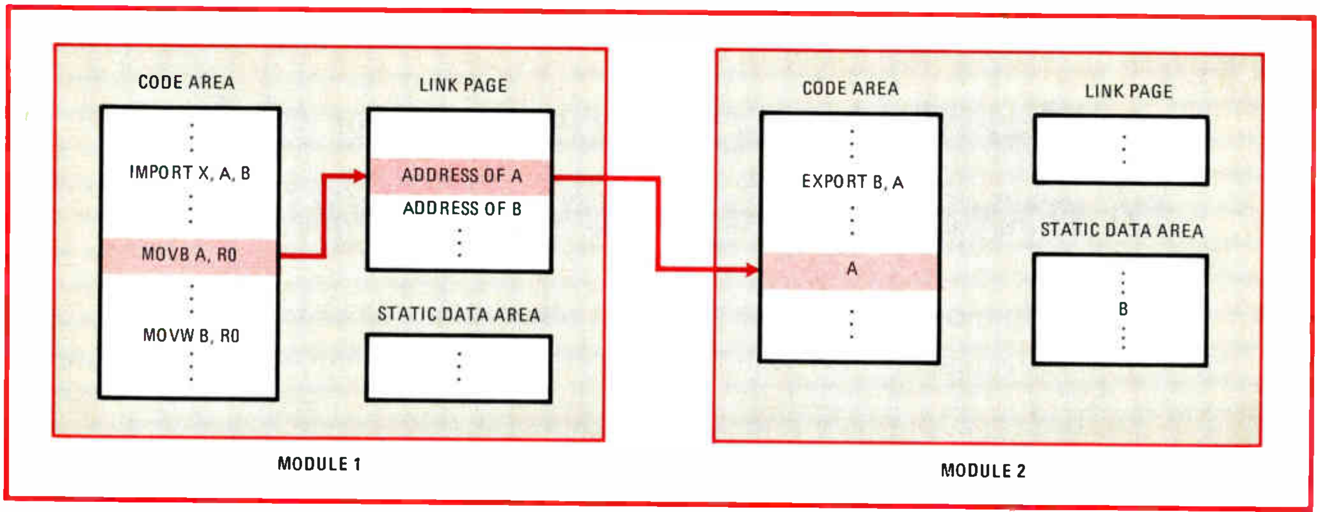

1. Modularity in hardware. The 16000 supports separate code and data areas as well as a link page holding the addresses of all variable references outside the module currently in use. This hardware speeds modular program development in an efficient execution environment.

attempts to trap as many errors as possible during compilation. Every variable must be declared to be of some type or other, and a type declaration constrains it to a set of possible values and legal operations. The compiler can then check for the wrong use of a variable and can trap errors such as operations between variables of incompatible types and subroutine calls with wrong parameters.

The other feature, modularity, is an attempt to make the flow of control more orderly and to establish visibility rules for data. The flow of control in a program is almost unlimited in Fortran and in assembly language, and as a consequence those programs tend toward a spaghettilike structure that is difficult to debug and extremely sensitive to modifications. To remedy this problem, a program is divided into free-standing segments, or modules, each of which has a single entrance and exit point. This greatly simplifies debugging a program, since errors are more easily located when isolated in a single module.

Making the most of modules

In order fully to exploit program modularization, the language has to allow separate compilation of modules without sacrificing type checking. It must also isolate modules properly to prevent changes in one module as it is updated from affecting another. And finally, it must define a clean interface between separately compiled modules for tight control of information passing.

Standard Pascal has no facilities for modularity and separate compilation. Designed as a teaching tool, it was not meant for use in developing large modular programs. Consequently, many incompatible extensions have been added by its various suppliers to increase its modularity. The most successful extension that incorporates its modularity into the language is UCSD Pascal, designed at the University of California at San Diego.

In UCSD Pascal, a module (called a unit) has two parts. The first, the interface, defines all variables, constants, procedures, and data types accessible to the user. It restricts communication between the user and the module to items clearly delineated in the interface. The programmer is free to include any item in that interface, eliminating the problem of having variables and functions accessible to a given piece of code determined solely by the physical layout of the program.

The second part, which is called the implementation, includes declarations of data objects that are hidden outside the module as well as the actual code that performs the desired function. This kind of partitioning is truly modular and gives the programmer complete freedom to pass or hide information, preserving type checking across separate compilation. Complete encapsulation also makes a module insensitive to changes in its physical location in the program.

The unit reduces debugging time, since a module can be tested independently of where it will be used. It also reduces system integration time; after debugging, the module's integration into a software system will not affect its proper functioning because the information-hiding mechanism guarantees the user will not tamper with it. And it simplifies maintenance since changes in the implementation portion are transparent to the user.

In Ada these principles of modularity are even more accentuated, giving still better control of information hiding to the programmer. A full range of hiding capabilities is available, including a mechanism that prevents the user even from making assignments to variables of the private or hidden types.

But a language is only a tool serving as an interface between the programmer and a real machine. To implement a language efficiently on a computer, a correlation must exist between the high-level constructs of the language and the low-level architectural features of the computer.

Hardware helps out

With this objective, the modularity concept was designed into the 16000 by means of a special addressing mode, special on-chip hardware and instructions, and a definition for the interface between modules.

In the microprocessor, a program consists of a set of modules. Each module is created by compilation or assembly and is identified by a number kept in a special register, MOD, which shows the one currently running. A

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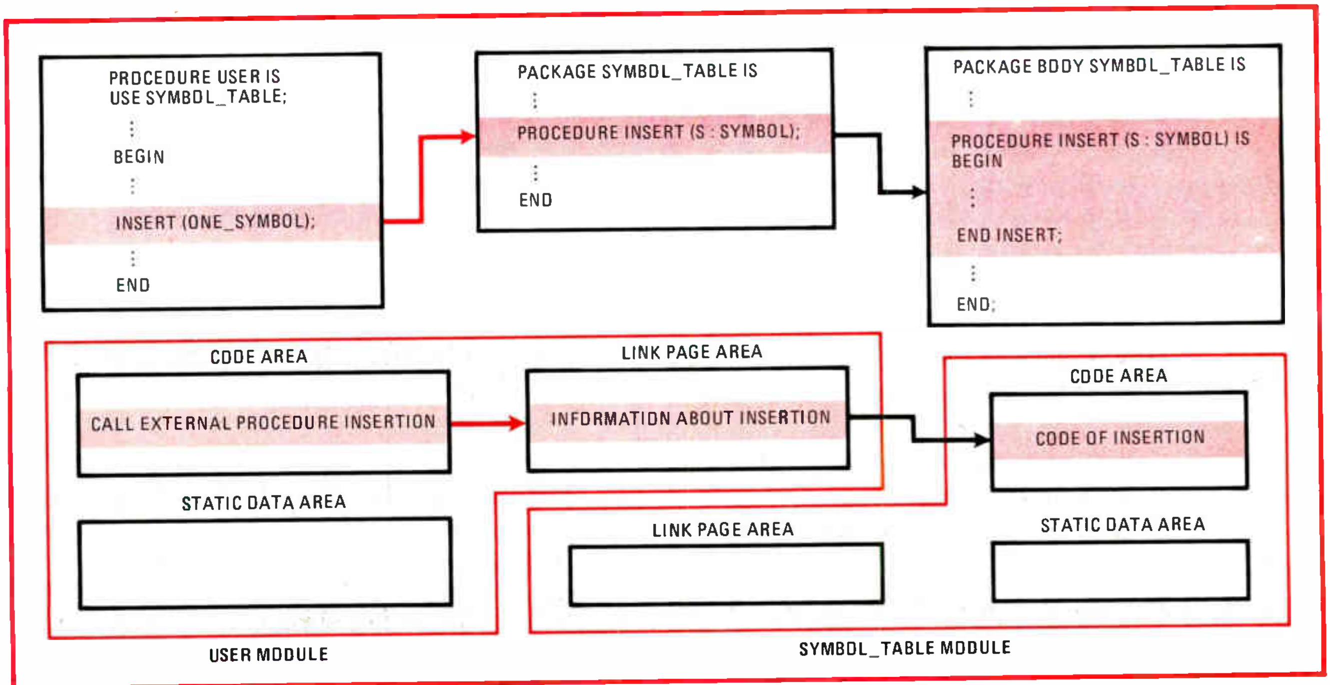


2. Support for Ada. This Ada program shows how the link page on the 16000 mirrors the way references are made to procedures external to the one executing. The package body contains the algorithms that perform the task in the code section of a 16000 module.

module directory or table, including the set of all the user-accessible modules, is maintained in memory.

A module consists of a code section, a static-data section, and a link-page section. The code section normally contains the instructions and the constants and in typical microprocessor applications is located in read-only memory. The static-data section normally contains variables that exist through the entire execution time of the program. Dynamic variables used to implement recursive procedures will normally be allocated on the stack. In the link-page section are the mechanisms for accessing variables (or procedures) in other modules. This section is normally in random-access memory and is built at link time, when the locations of all the modules are known.

A special external addressing mode uses the link page to realize the interface portion of modules. For example (Fig. 1), if A is the second external variable referenced in module 1 (imported from some other module), the instruction "MOVB A, R5" will use the external addressing mode by referring to the second entry in the link page. In this way, the linker will take care of inserting the right address, which means that the code section of the module is final and will never have to be changed even if the externally referenced module is modified or placed at another address.

The final steps

Two special instructions, "call external procedure" and "return from external procedure," complete the implementation of this hardware support of modularity. The first allows access via the link page to procedures in an external module. It also permits the static section, code section, and link-page section to be updated to correspond to those of a new module. The "return from external procedure" restores the old environment, leaving only the link page affected. In this way, changes in modules do not affect its user, who is isolated from it by a clean interface.

Figure 2 illustrates the parallelism that exists between modularity in high-level languages like Ada and in the architecture of the 16000 microprocessor. That parallelism means that languages such as Ada and some extensions of Pascal are well suited to the 16000. The possibility of supporting these powerful languages naturally will speed the development of trouble-free programs and ultimately reduce software cost.

Other effects of modularity

The 16000's modular architecture is also beneficial in that it makes possible a program library that can be put into ROM—a module's compilation is complete as far as the code section is concerned and needs no modification even if a referenced external module is altered. In particular, a given module makes no assumptions about the location of externally referenced modules, so any module may be relocated at any time. The position-independent code feature generally found in other microprocessors is insufficient to build such a silicon library.

Lastly, the design of the linker is simplicity itself. In most cases, a linker modifies the code at link time in order to generate addresses of variables that are externally referenced, since it is the only time these addresses are known. This process of code editing is very time-consuming and very complex. In fact, in many systems the linker is more complex than the compiler itself.

With the 16000 microprocessor architecture, it is not necessary to modify the code in any way because all the information about externally addressed variables is located in the link page, so that the linker simply needs to create that page alone. As a result, the linker becomes simpler, faster, and very small. □

World Radio History

Bringing the benefits of C-MOS to a Multibus-compatible computer

More immune to noise and temperature than its n-MOS counterparts, this new single-board machine has a bright future in industrial control

by Donald E. Lambert and Kester Rice, *Diversified Technology Inc., Ridgeland, Miss.*

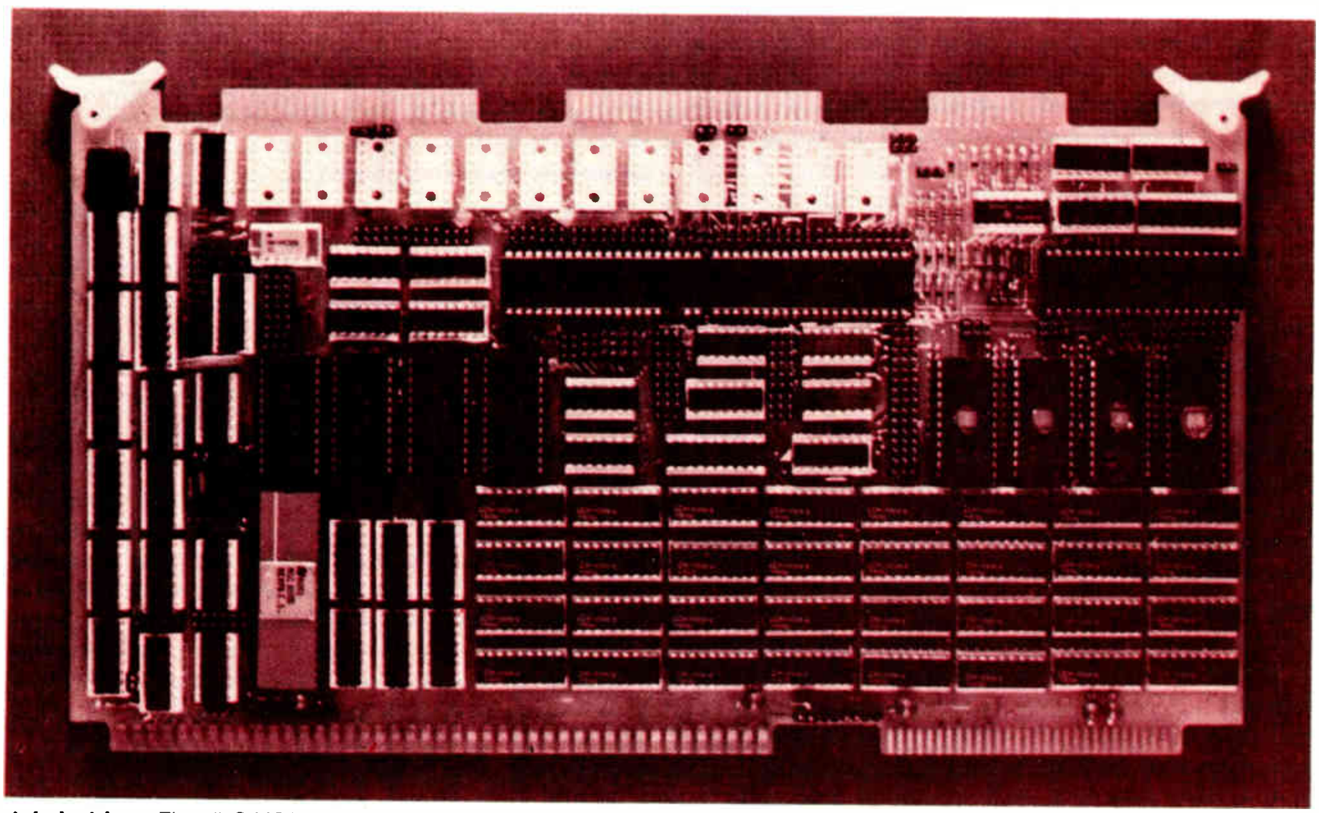
☐ As a standard building block that also does away with the expense of numerous board interconnections, the single-board computer is highly cost-effective for microprocessor applications. And where the sharing of a processing load is called for, multiple-computer systems frequently turn to the sophistication of the popular Multibus architecture. However, for want of a sufficiently powerful complementary-MOS microprocessor, these applications have all but ignored C-MOS logic, despite its inherent advantages.

When National Semiconductor Corp. announced the NSC800 C-MOS microprocessor, Diversified Technology designed an all–C-MOS Multibus-compatible one-board computer around it (Fig. 1). The CBC 800/216 offers speed and software compatible with existing n-channel MOS single-board computers while maintaining the high noise immunity and wide temperature range of C-MOS. Furthermore, it reduces power consumption to approximately 5% that of comparable n-MOS designs.

In most real-time applications of process control and instrumentation systems, a device being monitored or controlled is subject to electrical noise or severe temperatures—as in a paper or pulp mill, out of doors, or in a hazardous environment like an explosive atmosphere. A C-MOS computer is a logical answer to these problems. In addition, without the heat generated and the power required by n-MOS designs, many present single-board computer systems could be simplified and made more reliable by eliminating the need for external cooling.

As can be seen in the block diagram in Fig. 2, the CBC 800/216 offers:

- Bus arbitration logic and interfacing.



1. Industrious. The all–C-MOS strategy taken with the CBC 800/216 single-board computer makes it a natural for industrial applications. High noise immunity and a wide operating temperature range characterize the design, which also features Multibus compatibility.

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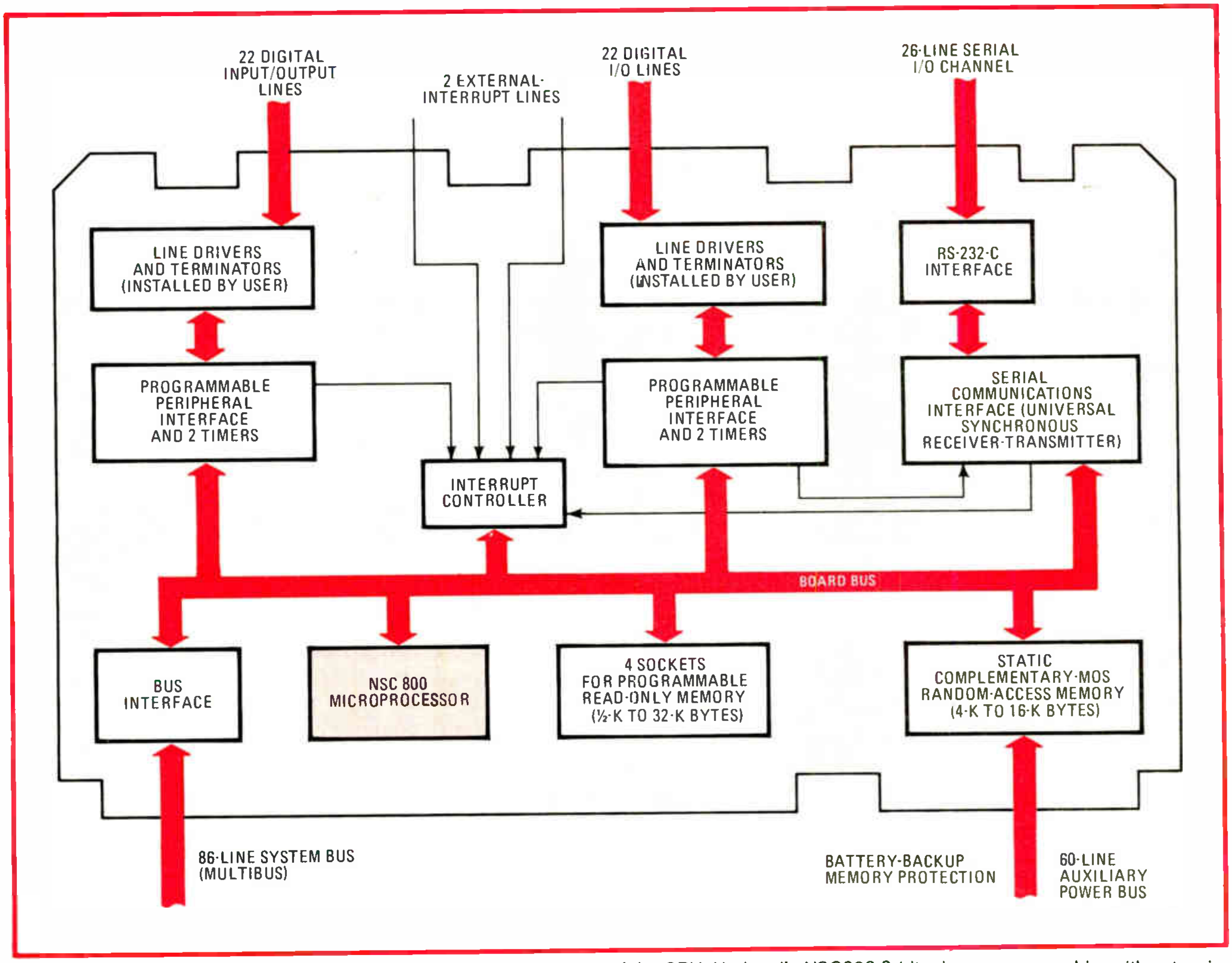

2. Blockbuster. The components of the 800/216 expand the power of the CPU, National's NSC800 8-bit microprocessor chip, with extensive I/O capacity. The full capability includes 44 programmable I/O lines, an asynchronous serial port, and 20 levels of prioritized interrupts.

- 16-K bytes of static random-access memory.
- Four sockets for erasable programmable read-only memory.
- 44 programmable parallel input/output lines.
- Four general-purpose binary counter-timers.
- An asynchronous RS-232-C port.
- 20 prioritized interrupts.

Table 1 compares these features with those of popular n-MOS single-board computers. The significant performance improvements are the operating temperature range, which extends from $-40°$ to $+85°C$, and power consumption, which is a maximum of 1 watt. Note that the power savings is achieved for essentially the same operating speed. This figure can be made even lower by reducing the operating speed or by duty-cycling the microprocessor.

An additional power savings is possible by increasing the value of the termination resistors usually associated with the Multibus. These resistors, which suppress ringing when the lines are driven by n-MOS or TTL circuits, are not necessary in an all–C-MOS system.

The NSC800 microprocessor combines many features of the 8080 and the Z80 but uses C-MOS technology. For instance, it executes the Z80 instruction set, which is a superset of the 8080 and the 8085 sets. In addition, the internal architecture of the central processing unit is the same as the Z80's, whereas the bus interface is multiplexed like that of the 8085. Table 2 shows the hardware and software differences between the NSC800, the Z80, and the 8085.

RAM capacity

The 800/216 has an on-board RAM capacity of up to 16-K bytes. The RAM is configured in banks of 4-K bytes, with each bank consisting of eight 6504 C-MOS static 4-K RAM chips. The address-decoding network allows a user to map the RAM at any location from 0000_{16} to $FFFF_{16}$ on 4-K-byte boundaries. This is done by populating the RAM bank or banks corresponding to the chosen address range and using movable plug-on shunts, or jumpers, to select the address lines.

If the full 16-K-byte RAM capacity is not needed, the unpopulated RAM sockets may be deselected by the same shunts, in which case the address occupied by the deselected RAM may be used for on-board ROM, off-board memory, or memory-mapped I/O devices.

Plug-on shunts are also used to disable the on-board RAM with the Multibus's RAM-inhibit signal ($\overline{INH1}$) or

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TABLE 1: COMPARING THE CBC 800/216 WITH n-MOS MULTIBUS-COMPATIBLE SINGLE-BOARD COMPUTERS

Manufacturer	Model	Central processing unit	Maximum clock frequency (MHz)	Minimum instruction execution time (μs)	Maximum power dissipation (W)	Operating temperature range (°C)	Number of parallel I/O lines	Interrupt levels
Diversified technology	CBC 800/216	NSC 800	2.5	1.6	1.0*	−40/+85	44	20
Intel	ISBC 80/20–4	8080A	2.15	1.86	21.3	0/55	48	8
Intel	ISBC 80/30	8085A	2.75	1.45	20.7	0/55	24/42	12
Monolithic Systems	MSC 8001	Z80 A	4	1.0	22.5	0/50	24	9
Advanced Micro Computers	95/4000 4	9080 A	4	1.0	19.9	0/55	48	8

Note: *Preliminary. All data is taken from the manufacturer's published data sheet.

from one of the on-board I/O lines. The latter method permits the selection of either on-board RAM or ROM, which are located at identical addresses, by means of software. With this feature, ROM and RAM addresses may overlap for an application where infrequently used ROM, such as for a lookup table or a bootstrap routine, occupies needed RAM addresses.

ROM options

The network for ROM-address decoding and the circuits for memory-chip selection were developed to maximize flexibility and minimize power consumption. The ROM section may be configured with plug-on shunts or wire-wrapped to accept any one of six types of popular E-PROM. This configuration ensures that only one ROM is active during a memory access.

ROM capacity on the 800/216 ranges from 2-K to 32-K bytes, depending on which E-PROM is used. The ROM section may be configured for the six E-PROM types listed in Table 3 or for compatible ROMs.

All address and chip-select decoding is configured with plug-on shunts that are set for each type of E-PROM, and a programmable ROM-circuit-disable signal exists to complement the RAM-inhibit signal mentioned earlier. For software control, these two signals are wired to 2 output bits of I/O port 21. An option is also available to use the Multibus's ROM-inhibit signal ($\overline{\text{INH2}}$) so that other boards have the ability to disable the ROM on the computer's board.

I/O capability

The 800/216 can communicate via parallel and serial peripheral interfaces. Handshake options are available for both.

There are also four programmable timers on board that may be configured for various tasks. One timer is normally dedicated to controlling the baud rate for the serial I/O port. The other three are available for use as period or event counters, as real-time clock generators, and for various other tasks.

The parallel I/O section of the 800/216 consists of four 8-bit ports and two 6-bit ports, for a total of 44 individual I/O points. The parallel interface is handled by two NSC810 I/O chips. Since all internal functions of the NSC810 are accessible through software, the function or mode can be changed without any hardware changes.

In the standard I/O mode of operation, each NSC810 has two 8-bit ports and one 6-bit port, each serving as an input or an output. The user selects a base address for the on-board I/O as one of four possible locations in the I/O address space. Control words written into a data-direction register (DDR) govern the direction of data (input or output) for each bit in the port, and each port may contain both input and output bits.

Each port also has a set and clear register defined in the address space. Control words written into the proper register will clear or set any combination of bits in either of the three ports.

Shaking hands

The NSC810 readily lends itself to parallel interfaces that require handshaking capability. In the three strobed modes, port 0 functions as a data-transfer port and the 3 least significant bits of port 3 are dedicated to handshake functions. These modes are strobed input, strobed output for an active peripheral bus, and strobed output for a three-state peripheral bus.

Three handshake signals are provided for interfacing the CPU with peripheral devices. These signals are an output strobe, a buffer-full status, and a CPU interrupt.

Serial data transfer is accomplished on the 800/216 through a C-MOS universal asynchronous receiver-transmitter (UART) and is designed to be fully compatible

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with the RS-232-C standard. The bit rate for the serial data interface is chosen by means of software through one of the four general-purpose timers in the two NSC810 interface chips. It is selectable in standard values of 110 to 9,600 bits per second with no change in hardware. Each timer may also be used as an event counter, a cumulative timer, a restartable timer, a one-shot, a square-wave generator, or a pulse generator.

Interrupt structure

The 800/216 has 20 levels of prioritized interrupt requests, of which 19 are maskable and 1 is nonmaskable. The interrupt structure is set up so that any of three interrupt modes can be specified by software. In mode 0, 16 of the interrupt lines are used to generate one of eight 1-byte restart instructions from the NSC800 instruction set. In mode 1, the INTR line is used as a restart with a dedicated restart address of $0038H_{16}$.

Mode 2 uses eight interrupt request lines on the Multibus, designated $\overline{INT0}$ through $\overline{INT7}$. These interrupt lines are prioritized, with $\overline{INT0}$ having the highest priority, and all eight may be masked by writing a control byte to the selected I/O address space. With mode 2 interrupts, a register supplies a page location and the lower byte of the interrupt vector is generated by hardware.

There are also eight maskable on-board interrupt sources that are prioritized and treated the same as Multibus interrupts but are given priority over them. The two highest priorities of the eight belong to two external interrupts, one per parallel I/O connector. The next four priorities are dedicated to the four general-purpose timer outputs from the NSC810s. The last two priorities of the eight are the interrupt signals generated by the NSC810s while operating in the strobed data-transfer mode.

In addition to these interrupts, three more interrupt sources may be tied to three restart inputs of the NSC800. Two of the restarts may be driven from two UART signals, transmitter register empty and data received. A third restart may be generated by the address-line-enable (ALE) signal from the CPU for a watchdog timer option. As long as instruction execution occurs, the reset input is held inactive by the toggling of ALE. If for any reason instruction execution stops, a reset is generated to restart program execution.

The 800/216 masks interrupts by two methods. The first consists of controlling the state of the two interrupt flip-flops (IFF1 and IFF2) within the NSC800. By clearing them, maskable interrupts can be selectively enabled or disabled. The interrupts are enabled as a group by an enable-interrupt (EI) instruction. A 4-bit interrupt-control register (ICR) is used for a second level of control over the four maskable interrupts built into the NSC800: reset A, B, and C and INTR. Before a request for one of the four may be acknowledged, its corresponding bit in the ICR must be set.

The second method of masking interrupts involves mask latches associated with the 16 grouped interrupt requests. Any combination of these 16 interrupt lines may be enabled or disabled with a write instruction to the proper I/O address.

With the 800/216, the nonmaskable-interrupt (NMI) input of the NSC800 can be tied to a power-failure detection input. The NMI is given the highest priority in the interrupt scheme and is used for an externally generated input to indicate power failure.

When the CPU addresses a memory or I/O location that is not assigned to the computer, the Multibus control logic will request access to the bus and take control of the bus according to the Multibus's master priority protocol. A time-out device is used to prevent the computer from waiting for an acknowledgment from a nonexistent slave board.

TABLE 2: COMPARING MICROPROCESSOR PERFORMANCE

	NSC800	8085	Z80
Voltage range (V)	3 to 12	5	5
Current (mA at 5 V)	50	850	750
Bus drive	1 standard TTL (100 pF)	1 standard TTL (100 pF)	1 standard TTL
Automatic wait state on I/O	yes	no	yes
Number of instruction types	158	80	158
Block I/O search	yes	no	yes
Number of on-chip vectored interrupts	5	5	2

TABLE 3: ERASABLE PROGRAMMABLE ROMs THAT CAN BE USED IN THE CBC 800/216

	Maximum on-board capacity (K bytes)
Intel 2716	8
Intel 2732	16
Intel 2764	32
Intersil 6654	2
Texas Instruments 2516	8
Texas Instruments 2532	16

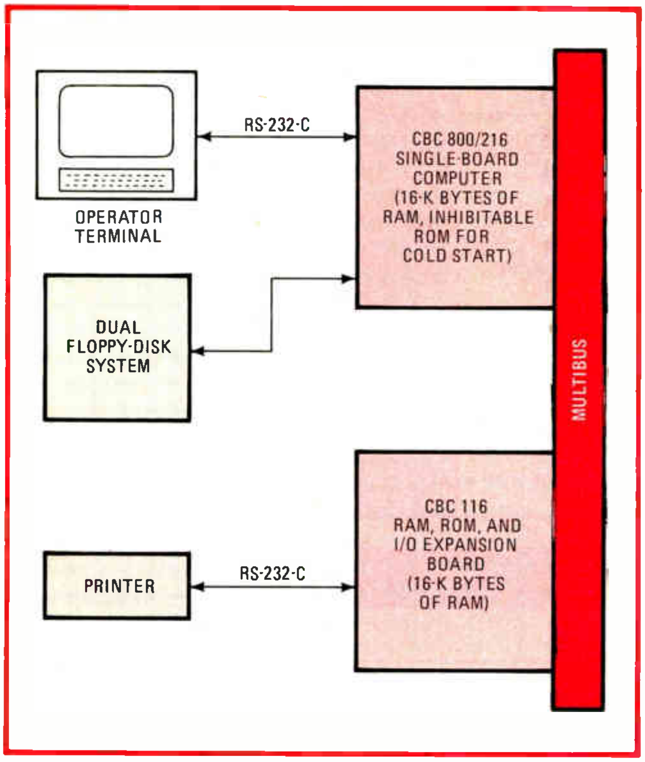
Multibus control

When the Multibus control circuit determines that the memory address is not on the computer, the control logic asks the CPU to wait. This request causes the CPU to suspend the current machine cycle until the external memory or I/O board responds with an acknowledgment or until a time-out cancels the wait.

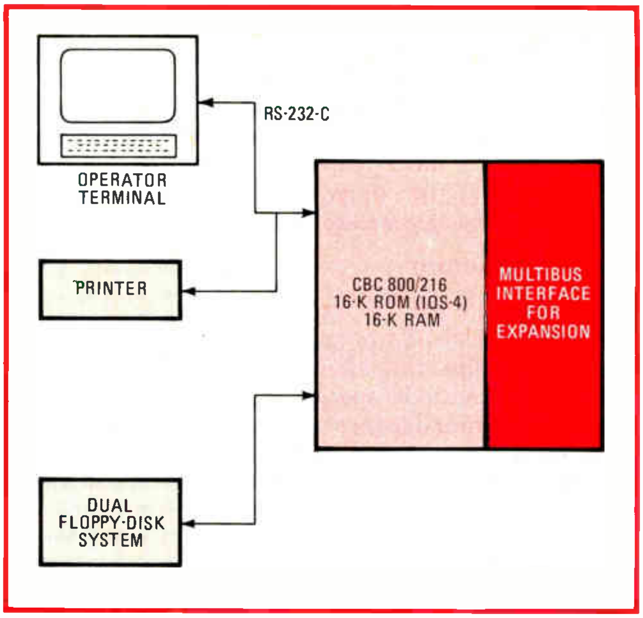
A hardware option allows a parallel I/O line to request and maintain access to the Multibus rather than transfer data a byte at a time between requests. This provides faster operation for multiple off-board accesses.

Concurrent with its work on the 800/216, Diversified Technology designed an expansion board, the CBC 116, which provides an additional 16-K bytes of C-MOS RAM, eight unfilled E-PROM sockets, 44 parallel I/O lines, an RS-232-C serial I/O port, four programmable timers, and 10 interrupt sources, any 8 of which are maskable.

Even without the expansion board, the 800/216's



3. Slipped-in disk. A separate memory and I/O expansion board raise the 800/216's capacity to where it will support a dual floppy-disk drive under a CP/M operating system. A terminal and printer complete the requirements for designing a development system.



4. On-board development. Unlike most single-board computers, which use a separate development system, the 800/216 allows development capability to reside in the target system, thanks to the IOS-4 operating system, written in a language based on Forth.

hardware provides sufficient memory, I/O facilities, and expansion capability for a good many applications. A number of other applications, however, such as those requiring a development capability, call for the use of the expansion board.

Such a system, shown in Fig. 3, contains a total of 32-K bytes of RAM, using both the 800/216 and the 116. The mass storage for this system is provided by a dual floppy-disk drive and controller interfaced by the parallel I/O ports of the 800/216. Interfacing with an operator is accomplished through a cathode-ray-tube terminal connected through the RS-232-C–compatible interface of the 800/216. A printer for hard-copy listings or a second terminal in multiple-user systems can be interfaced by the RS-232-C port of the 116.

Most if not all development systems require program testing of the target system through some sort of in-circuit microprocessor emulation. The emulator is usually connected to the target system through the microprocessor socket and uses the target memory for program and I/O testing.

All of the testing and emulation occur under development system control. This requires that the development system be near the target system, which is not always convenient. In those cases, it would be better to have a development capability within the target system and have the target system hardware double as the development hardware.

When the target system is composed of single-board computers and expansion boards, the hardware overhead of the disk interface is minimal, as shown.

The only component missing from this system is an operating system. For that purpose, Diversified Technology has developed a ROM-based high-level language utilizing international Forth standards. Called IOS-4, the resultant operating system has been applied in several systems where its operator interface and extensibility have proved its value during on-site system integration. This operating system will be offered for the 800/216.

The development system with IOS-4 is an 800/216 equipped with 16-K bytes of ROM, 16-K bytes of RAM, an operator interface through the RS-232-C port, and a dual floppy-disk drive and controller interfaced by the parallel I/O ports of the 800/216 (Fig. 4). Hard-copy listings are obtained through a software UART and an optional driver using a parallel I/O line. Twenty-two of the I/O lines are unused and therefore available for target system functions.

Controlling machines

A typical application of the 800/216 is as a machine controller. For this application, it might require an interface, available from several manufacturers, having eight optically isolated outputs and eight optically isolated inputs. The hardware includes development capabilities. After the software is written, the application software and as much of IOS-4 as desired can be compiled and placed in ROM. Removing the assembler and disk editor modules further compresses the target system, allowing interactive operation.

A comprehensive design and development plan calls for the release of several new boards over the next year. These boards will include optically isolated I/O, analog I/O, communications expansion, and an interface for a resistance temperature device. Additional support will be provided by a ROM monitor and an emulator, as well as other items. □

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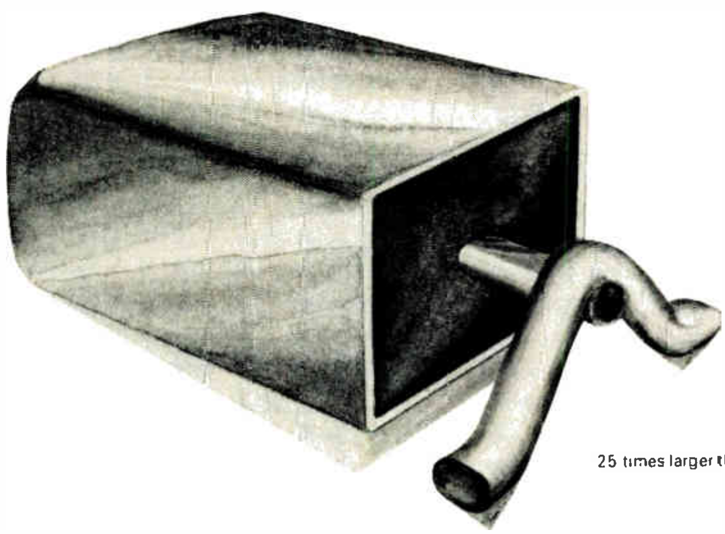

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Bi-FET op amps simplify AGC threshold design

by John H. Davis
Warm Springs, Ga.

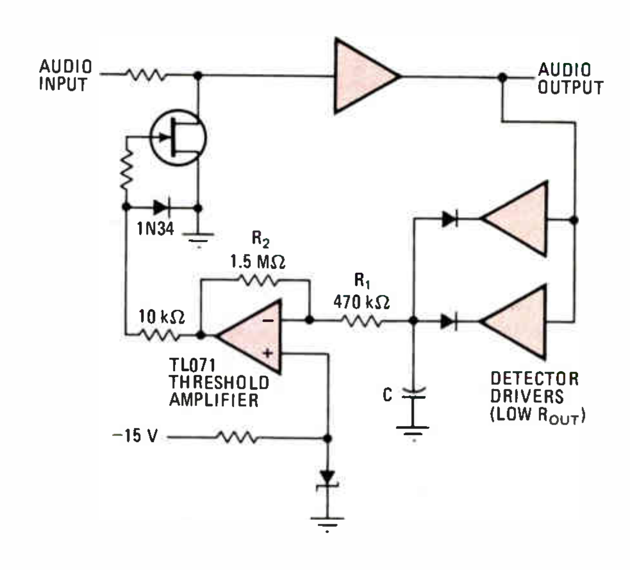
Operational amplifiers with the bandwidth and input impedance available using bipolar–field-effect-transistor (bi-FET) technology are well suited for integrating the threshold detection and automatic-gain-control amplification functions in audio limiters or receiver AGC circuits. Generally, such circuits are implemented with discrete components. But this often entails component selection and critical trimming adjustments, or both. An op amp approach makes an AGC design more predictable, stable, and easier to troubleshoot.

The circuit of Fig. 1 requires only one adjustment, to zero the output of the TL071 op amp under no-signal conditions. In this circuit, a control voltage is required over the range from zero (at full gain) to the negative value corresponding to the FET's cutoff voltage. A zener diode supplies the reference voltage. It is connected in a way that makes use of the common-mode rejection properties of the op amp; thus, R_3 nulls the static output, which thereafter is quite stable.

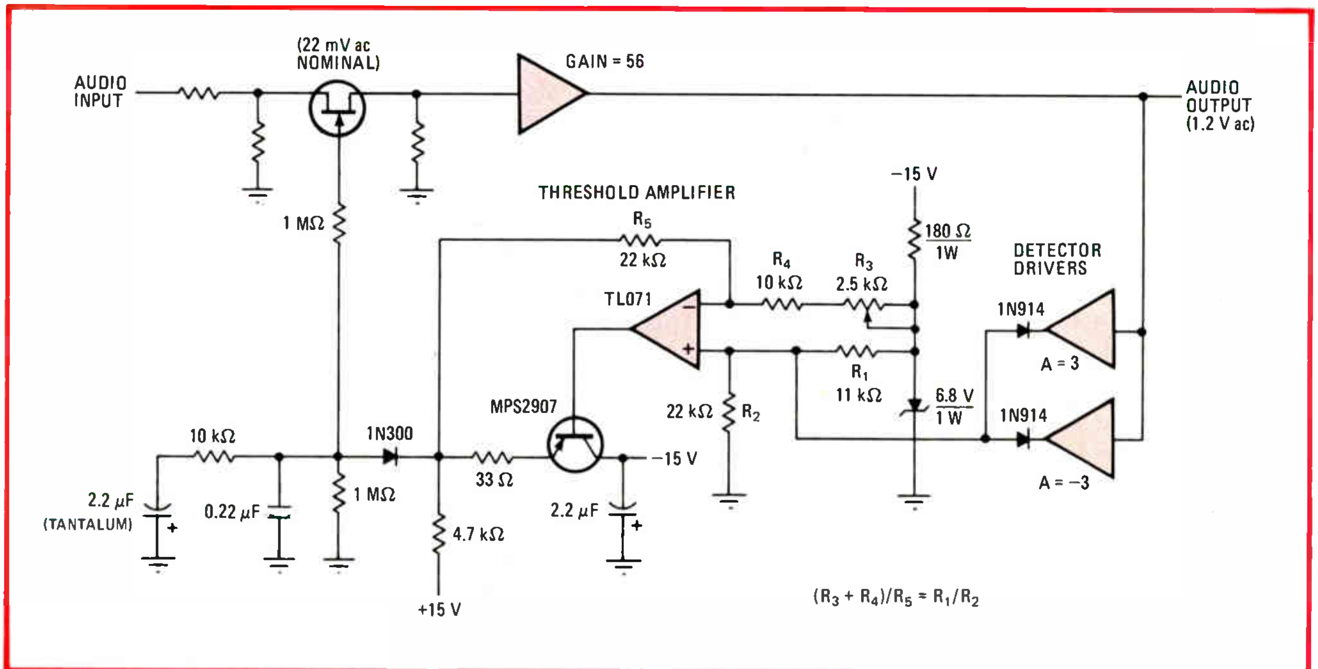
The threshold is the voltage appearing at the junction of R_1 and R_2, plus the forward drop of the detector diodes, and can be readily computed for any desired limiting level. For the detected peaks, the threshold detector has a voltage gain of:

$$A_{det} = (R_1 + R_2)/R_1$$

Not much gain is ordinarily required; too much imposes tighter tolerances on driver gain, diode properties, and



2. Simpler. Threshold detection, time constants, and amplification are consolidated in this single stage. For a receiver's i-f strip, an emitter follower is recommended, however. The control voltage here varies from a fixed negative value toward zero.



1. Easy play. Only one adjustment to zero the output of the TL071 op amp under no-signal conditions is needed in this AGC threshold amp. Good performance is achieved by using the amp's common-mode properties. The control voltage must vary from zero to a negative value.

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trimmer adjustment. Driver gain can be adjusted, within output swing limits, to tailor limiting slopes.

The emitter follower improves the attack time of the time constant network. The dual set of time constants shown prevents short-duration peaks from depressing system gain longer than necessary.

Further simplification (Fig. 2) is possible if the driver amplifiers have low output impedance. Here the threshold detection, time constants, and amplification are consolidated in a single stage. This consolidation around one op amp means that little additional circuitry is needed when an FET is the voltage-controlled element.

The circuit assumes the control voltage must vary from a fixed negative value toward zero as gain reduction is needed. With no signal, the threshold op amp is referenced to the desired voltage by the zener diode. As long as no signal peaks are applied to time constant capacitor, C, the op amp acts as a voltage follower. Detected peaks charge C more negative than the reference, and the difference is amplified by a gain of $R_3 \div R_1$. This shifts the control voltage toward zero.

The release time constant is determined by C and R_1 and R_2. (Although only a single capacitor is shown, a dual arrangement as in Fig. 1 can be used.) The simplified circuit shown in Fig. 2 can also provide a fixed positive voltage that ranges toward zero for gain reduction if all the diodes and the reference-voltage polarity are reversed. □

Feedback reduces offset in wideband video amplifiers

by Alan Cocconi
California Institute of Technology, Pasadena, Calif.

Wideband video amplifiers such as the LM733 generally have large input offset voltages that, when multiplied by their gain, can result in unacceptably high dc offset at the output. This undesirable effect can be reduced by feedback by means of a low–input-offset integrator.

As shown in (a), summing resistors R_1 and R_2 are selected so that the input to the integrator is proportional to the video amplifier's input offset voltage. The integral feedback drives the video amp's input offset to zero, leaving only the low offset of the integrator (which can be trimmed to zero) to appear at the amplifier output.

A practical implementation of the approach is given in (b). The integrating operational amplifier, a CA3140, was chosen for its low input offset voltage. Here, the 1N4371 zener diode and the 2N2222 transistor, in an emitter-follower configuration, are required to ensure that the output can go down to 0 volt, since the 733 video amp suffers from the restriction of a minimum positive output voltage. □

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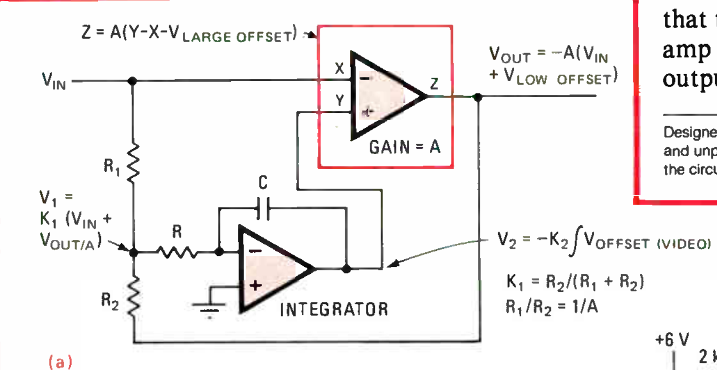

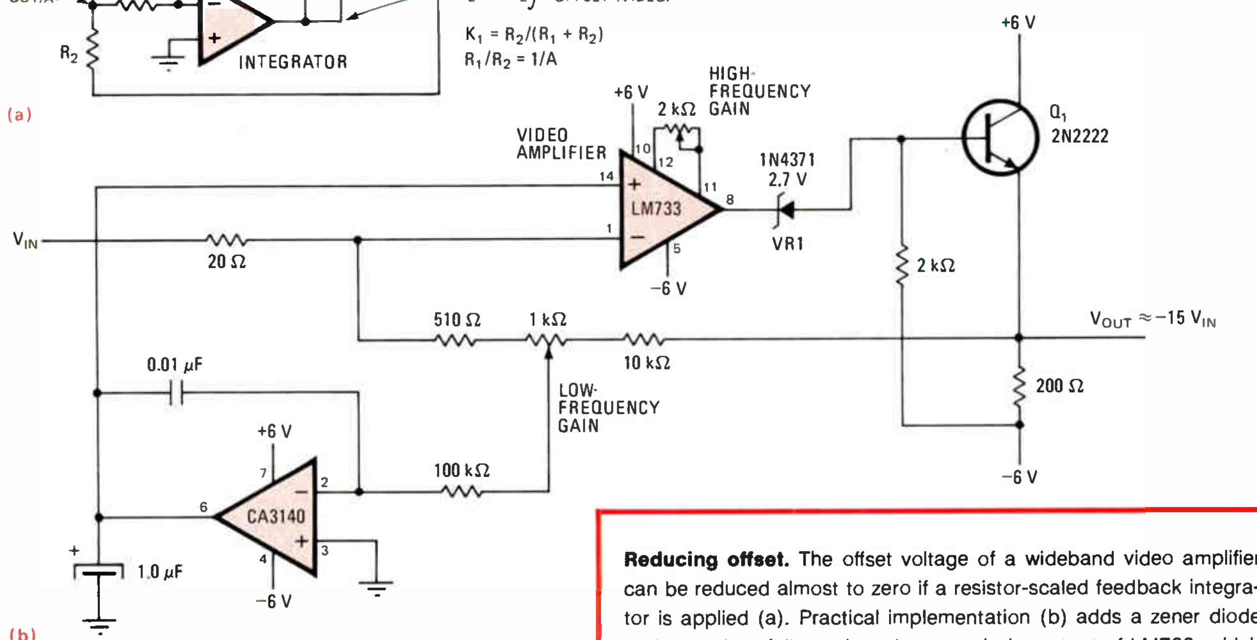

Reducing offset. The offset voltage of a wideband video amplifier can be reduced almost to zero if a resistor-scaled feedback integrator is applied (a). Practical implementation (b) adds a zener diode and an emitter follower in order to push the output of LM733, which has a minimum positive output voltage, down to zero.

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Time-slot assigner chip cuts multiplexer parts count

by Henry Wurzburg
Motorola Inc., Semiconductor Group, Phoenix, Ariz.

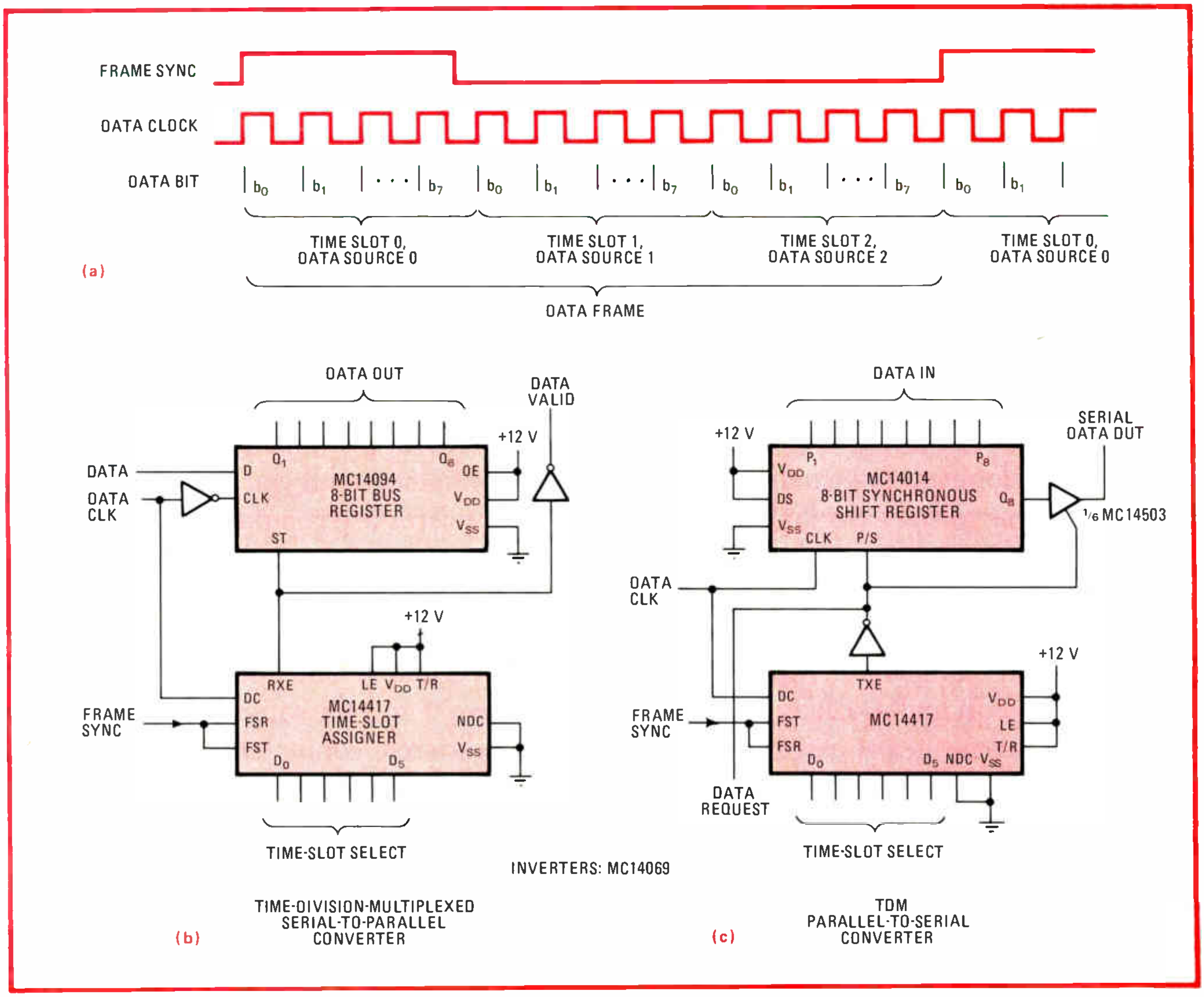
In some communications systems, particularly digital telephony equipment, it is hard to examine the data from a given source after it has been time-division–multiplexed with other data for serial transmission over a common data line. Capturing the data from its time slot and converting it into parallel form for examination usually requires many integrated circuits, since the slot must be programmable.

A special-purpose IC, the MC14417 time-slot assigner carries out this serial-to-parallel function with the aid of only a few inverters and one other IC. What's more, the cost of implementing the circuit is only a few dollars.

The timing of a simple three-slot TDM system is shown in (a). In digital telephone systems, a data frame may consist of anywhere from 24 to 40 time slots, each containing 8 bits of data transmitted at rates of up to 2.56 megabits per second.

In the all–complementary-MOS capture circuit of (b), the MC14094 shift register acts as a serial-to-parallel converter, while the 14417 computes when the data is to be captured and converted. Just which time slot it captures is determined by the binary data present at inputs D_0–D_5 of the 14417. The circuit also provides a valid-data output signal. As for speed, the circuit works for clock rates of up to 2.56 MHz with systems having up to 40 time slots.

Implementing a parallel-to-serial converter for multiplexing data onto the TDM data line is equally simple if the 14417 is used as shown in (c). Here, a three-state buffer prevents the serial data bus from being loaded during idle time-slot periods. The frequency limitations of this second circuit are the same as for the capture circuit. □



The right slot. Time-domain multiplexing (a) assigns to data from several sources specific time slots in a serial data stream. Capturing data from a specific slot is made easy with the MC14417 time-slot assigner (b), which works with the MC14094 shift register to provide data from the source dictated by the select inputs of the 14417. The versatile chip can also provide parallel-to-serial multiplexing (c).

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Functional and in-circuit testing team up to tackle VLSI in the '80s

The combination of techniques speeds checkout and fault isolation on high-density boards while cutting software development effort

by Peter Hansen, *Teradyne Inc., Boston, Mass.*

☐ Large- and very large-scale integration is totally changing the requirements for board test systems. In Teradyne's L200 test system, comprehensive in-circuit and functional test techniques have been combined in the same board-test system architecture for the first time. Optimized for performance and flexibility, the tester will enable board manufacturers to keep pace with rapidly evolving technology throughout this decade without seeing their investment in hardware and software become obsolete.

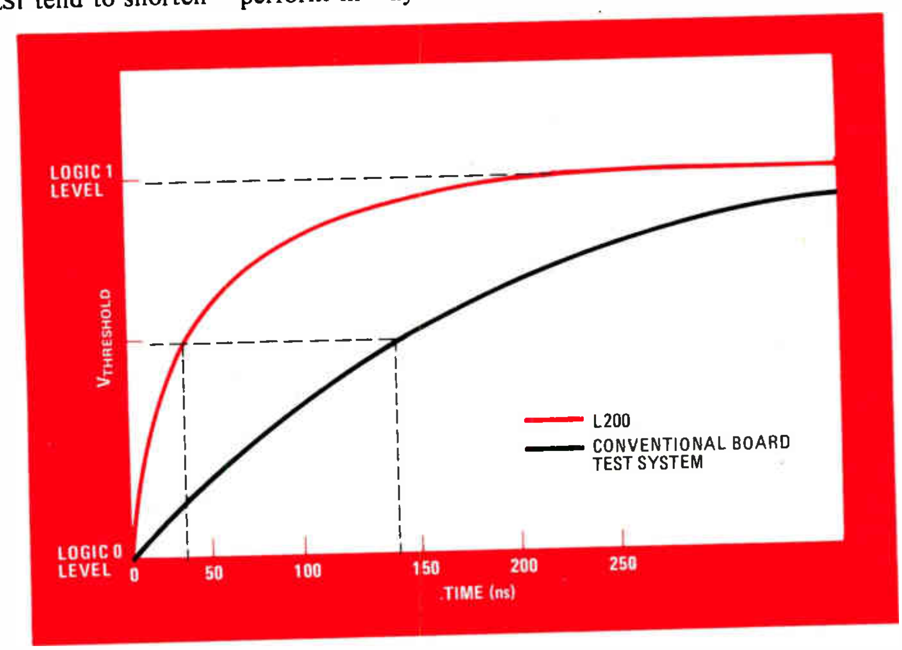
Today's components generally function in a highly sequential fashion and thus require long digital patterns to exercise them thoroughly. On bus-structured boards, faulty devices can present both static and dynamic contention problems that are difficult to diagnose. Likewise, the large amounts of memory both within chips and on the board are difficult to test because they are buried deep and access to them is limited.

The increasing consolidation of analog and digital functions on boards, as well as chips, makes generating test programs and diagnostics increasingly difficult. With gate arrays, the advantages of LSI density generally are accompanied by a lack of obvious functional partitioning. Furthermore, LSI and VLSI tend to shorten product life-cycles and, consequently, development times, making changes in hardware and firmware more frequent. These developments are at odds with the increasingly lengthy process of test-program generation.

Most commercially available board testers are based on system architectures of the early 1970s that have been enhanced to deal with the technology changes of the mid- and late 1970s. Now, they are often overtaxed by the added requirements for testing the coming wave of microcircuitry.

Typically, such systems have shortcomings in each of the three major areas that affect the cost of board testing: throughput, test quality, and startup time and cost. The throughput of test systems is generally limited by their inability to deal with long digital pattern sets in a reasonable amount of time. The quality of testing is usually limited by poor timing control, including insufficient data rates, edge control, and imprecise or poorly controlled driver transitions. Startup time and cost are typically high because of complex program generation and cumbersome, batch-oriented software—the result of using generally outdated test languages.

By using a new architecture, the L200 is able to perform in ways that could not be achieved by retrofit-



1. Full speed ahead. Compared with conventional board test systems, the L200 can deliver a signal to a board under test three times faster. Thus it will be capable of checking the performance of the very fast logic that will be used throughout the 1980s.

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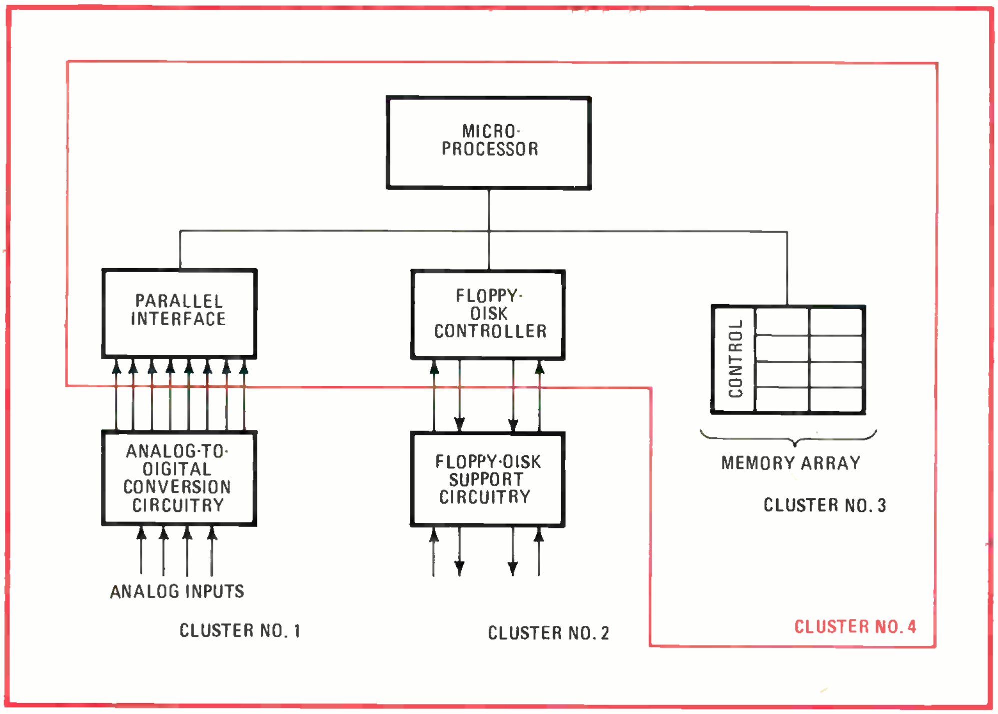

2. Clustered functions. Increasingly, test engineers are faced with checking boards that perform a number of functions, as shown on the left. With overdriving, those functions can be broken into clusters for which it is much easier to create individual test programs.

ting earlier systems. The L200, which consists of three major functional groups—the computer group, the instrumentation group, and the test station—employs a distributed processing architecture in which specialized processors in each of the three major functional blocks help maximize system efficiency and throughput.

Based on a Digital Equipment Corp. PDP 11/34, the computer group acts as the system supervisor, overseeing general system operation; managing the peripherals; and controlling the editing, compiling, and execution of test programs.

Reporting to the central computer group are the instrumentation group and the test station. The instrumentation group, which is responsible for the high-accuracy forcing and measuring functions, employs its own processor to directly control its analog hardware, freeing the supervisory processor to perform other tasks during relatively long analog test measurements. The test station also contains its own control processor, the digital command processor (DCP), which serves as both the interface between the PDP 11/44 and the test station electronics and as an intelligent direct memory-access (DMA) processor.

The hardware and software capabilities of the L200 can help solve LSI and VLSI test problems using performance in-circuit or functional testing, as well as functional testing of board segments using the in-circuit technique of digital overdrive.

Performance in-circuit testing

In-circuit testing of digital components involves forcing an on-board device's inputs to a desired state while sensing its outputs. This operation can be performed only for controlled periods of time, or the junctions of overdriven outputs will overheat.

Historically, this test technique has been employed solely to detect elementary structural faults such as stuck pins. The L200 lets this technique be extended considerably to thoroughly test a component's internal structure and external performance and to test complex components without cumbersome so-called work-arounds such as single-step circuits for dynamic parts.

In-circuit testing of complex LSI devices requires that the test system be able to apply a stimulus and observe a response in synchronization with the component. To do this, the test system should be able to generate patterns at rates above the device's keep-alive frequency—the minimum frequency at which it is specified to function. If the pattern or clock rate of the system can keep up with this frequency, special work-arounds can be avoided, and programming and debugging are simplified.

Typical keep-alive frequencies are 0.5 megahertz for the 8085, 2 MHz for the 8086, and 1 MHz for 8048/8041 series. The L200 can perform component tests at rates equal to or well beyond these keep-alive rates.

Keep-alive testing is not limited to a single microprocessor on a board. As multiprocessing and coprocessing become commonplace, the technique must be extended to dynamic peripheral chips which are often microcomputers themselves.

Data formatting

The L200's control over time-related parameters improves the effectiveness of testing procedures. With such data formatting schemes as return-to-zero and return-to-one, clock signals can be generated within a single tester pattern, rather than within the two needed to generate one clock period with a simple nonreturn format. As a result, any L200 pin can provide a clock signal twice as fast as with nonreturn formats.

The L200 performs in-circuit testing with patterns stored in each channel's memory. When the patterns are burst onto the board, the duration of overdriving is short and controlled. One thousand patterns at 5 MHz, for

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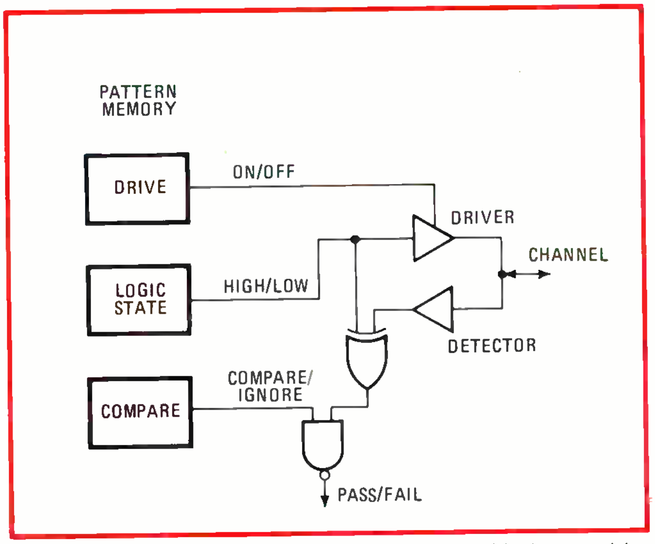
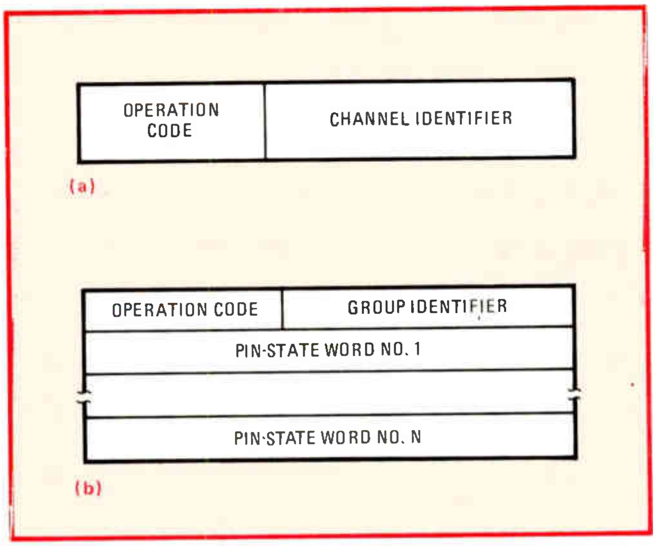


3. Channel state. At any time, the state of an individual channel (or pin) is determined by a 3-bit word loaded into the pattern memory. Each bit determines a particular aspect of the state—whether the pin drives or detects, is high or low, or compares or not.



4. Tester's choice. The test specifies the state of each channel using the format in (a); only the channel states that change must be updated in each cycle. The format in (b) specifies the states of channel groups that drive or detect simultaneously.

example, result in a pulse train only 200 microseconds in duration. In addition, the stimulus applied and the response expected can be written as a series of uninterrupted sequential test patterns—1s and 0s—just as if the device alone were connected directly to the test system. These test patterns may come from a library of routines or from a logic simulator or be generated from a manual functional test of the device.

The location of the stimulus edges can be accurately controlled through the system's 1-nanosecond timing resolution and the fast edges delivered to the device inputs. This edge speed is a function of the drivers used in the system and of short, low-inductance fixture wiring. The inductance of the wiring and the on-resistance of the overdriven device act as a filter, limiting the rate of voltage change. Conventional in-circuit testers have relatively slow transitions and often 1 microhenry or more of wiring inductance; the L200 drivers have 20-ns transition times and typically less than 300 nanohenries of inductance. The resulting overdriven waveforms are faster and more precise with the L200 (Fig. 1).

Performance functional testing

Functional testing detects failures resulting from the inability of a collection of components to work together as intended. To detect these faults, the test system must exercise the board in a manner that succeeds in emulating real conditions.

Performance functional testing may entail the strenuous exercising of various parameters and the application of an extensive collection of patterns to comprehensively test critical combinations of board functions. Variations in board power-supply voltages and the timing of control-signal placement can test for a parametric margin of safety and determine whether the board will operate properly under less than nominal conditions. Current-loading the output voltages can verify whether or not the board will properly drive the fanout of the target system.

By nominally and marginally emulating the final system, the L200 can supply the appropriate environment to achieve high-performance testing. Long, exhaustive pattern sequences are made practical by the system's high effective-test rate. Accurate control over power-supply voltages, driver logic levels, detector threshold voltages, and current loading all contribute to proper dc test conditions. Precise control over cycle time, edge placement for drive phases and test windows, format selection, and on-the-fly timing variation make possible realistic time-domain emulation.

Locating the faults

When a functional test fails, diagnostic tools in the system help to locate the fault. Guided probing can isolate the problem to the failing node. By tracking back from the failing board output, the probe will locate a node with an improper logic state, despite the fact that all controlling inputs for the node receive the proper data at the appropriate time.

The L200 automatically performs this operation in the presence of complex buses under the state-sensitive-trace (SST) diagnostic routine, which has an inherent understanding of three-state devices. Using information defining the proper on/off state of device outputs, the SST is able to optimize the order in which it probes, avoiding the confusion normally associated with bidirectional device pins.

Where static testing can be performed, the L200 electronic knife can go beyond the nodal diagnostic level and seek out the failing dual in-line package. By measuring the actual ratio of internal versus external impedance at each device on the failing node, the electronic knife locates the failing component, which will be the first device encountered with less than a unity ratio.

Combined in-circuit and functional testing

While in-circuit testing isolates most structural faults, it does not exercise the board as a whole. Functional

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L200 OPERATION CODES				
Operation code		Pattern memory		
		Logic state	Drive	Compare
Channel	Input low	0	1	0
	Input high	1	1	0
	Monitor low	0	1	1
	Monitor high	1	1	1
	Output low	0	0	1
	Output high	1	0	1
	Null	X	0	0
Group	Drive	*	1	0
	Expect	*	0	1

*Defined by bits of group pin state word

testing can increase the thoroughness of system testing by detecting and diagnosing the remaining performance faults. Yet, as board complexity increases, it becomes difficult to perform traditional functional testing solely from the edge connector. At this point, accessing internal nodes usually helps simplify testing.

To aid in this process, both test visibility and controllability can be achieved with test points designed into the board, clips connected during testing, or a bed-of-nails fixture for unlimited selection. Test visibility eases pattern generation by shortening the path through which a potential fault must propagate before detection; test controllability means that an internal node can be placed in a state directly, without requiring exceedingly complex combinations of sequences from the normal board inputs. The overdrive capability of the L200's channels can momentarily force and sense the logic state on a node and, therefore, add a measure of controllability to a functional test.

The functional programming of a board can often be simplified by segmenting it. In this way, each section can be considered as an independent functional unit. Boards are rarely designed to make this test division easy. Therefore, it is useful to effect segmentation of the device under test by connecting the digital functional channels that will supply the overdrive capability needed through a bed-of-nails fixture.

Clustering components

These channel cards combine high-quality functional characteristics with the 300-mA current capability required for overdriving, and they operate at a 5-MHz pattern rate. The resulting test program will then treat the board as functional clusters of components, where a performance fault within a cluster can be diagnosed using guided probing.

In designing a functional test, clusters should be chosen to include areas prone to performance problems. For example, improper communication between chips is most common along a data bus, so it might be entirely contained within a cluster. Other examples of typical clusters are:

- An array of memory and its control circuitry buried deep within a board.
- Peripheral support circuitry for a floppy disk, a cathode-ray tube display, or a tape drive.
- Digital sections that feed analog circuitry.

The test system can emulate I/O devices during test of clusters, such as those in Fig. 2, with full timing control, stimulus formatting, and a high cycle rate in order to simulate a worst-case peripheral for margin testing. Since all of these capabilities are under software control, emulation routines can be readily transported from board to board.

Getting into sync

Diagnostic testing using guided probing is generally complicated by asynchronous board activity, where no relationship exists between the timing of a specific stimulus needed to evaluate a response and that response. Generally, the most straightforward technique is to force the activities into some form of synchronization by the test system.

Again, proper control can be achieved by overdriving the channels while accessing the nodes internally. Boards with multiple clocks are prime candidates for this technique. The activity at each point in time can be synchronized by overdriving the appropriate points.

The quality of in-circuit testing for individual components is significantly below that of functional testing, which is able to diagnose more complex performance faults. On the other hand, functional test programming is considerably harder to achieve.

Many programming problems can be overcome by combining functional testing techniques with the control and visibility of an in-circuit approach. By design, the L200 permits this strategy; precision digital channels result in a high test rate, and short-path-length fixturing permits the accuracy needed for high-speed testing.

Improving effective test rates

With the long complex programs typical of LSI and VLSI boards, the effective test rate is an important factor in determining the real throughput of a functional, in-circuit, or combined-approach test system. The effective test rate of a system is the sum of the loading time for local channel memory, the burst time during which data is exchanged between system and board, and the measurement time in which results are compared.

Changing hundreds of channels synchronously at megahertz rates during testing demands that each driver/detector pair be backed by its own memory. This local channel memory is loaded from computer memory and then burst onto the board under test at far greater speeds. The burst time is a function of the data rate and the number of patterns being transferred. Compared with the load time, the burst time is so small that it generally can be ignored.

The measurement time, on the other hand, depends on whether responses from the board are compared by the computer's software or by hardware behind each channel's detector. If each channel's hardware knows what logic state is expected, all can simultaneously compare results, rather than being delayed by the time it takes for the computer to analyze the response after the burst. In the hardware, measurement takes place immediately after the board response becomes valid at the full burst data rate, thus eliminating that rate as a factor in the effective test rate.

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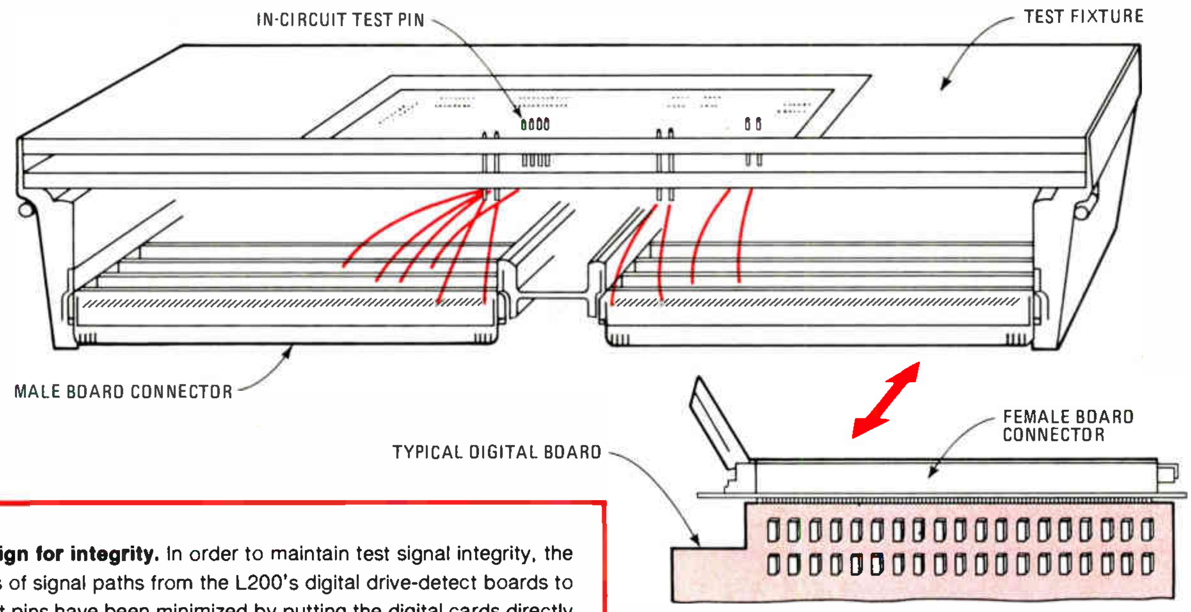

5. Design for integrity. In order to maintain test signal integrity, the lengths of signal paths from the L200's digital drive-detect boards to the test pins have been minimized by putting the digital cards directly under the test station's bed-of-nails fixture.

With a system that tests in hardware, the load time is the most significant factor. Testing in software, on the other hand, suffers from both load and computer test-rate overhead. In order to optimize the effective test rate, the L200 performs all digital tests in hardware.

The primary factors influencing the load time are the manner in which the test data is stored and the method of transferring it from computer memory to the rest of the system. Data is usually stored in the computer memory as high-level object code that is interpreted at test time. To maximize speed, the most frequently executed digital instructions are compacted into an efficiently interpreted format.

Taking the best of both

The most commonly used technique for executing object code has been software interpretation of the code, which affords great flexibility. Code may represent analog or digital test instructions, as well as general language elements such as control, input/output, or mathematical operations. The interpreter directly decodes the information and acts upon it. Software-based interpretation, however, generally suffers from a slow execution rate. Typically it takes from 100 μs to several milliseconds to execute an individual instruction.

On the other hand, by transferring code directly from the computer memory to digital-channel electronics, interpretation time can approach DMA rates, which can be hundred times faster or more than through software. To achieve this, the DMA hardware must be able to interpret the object code as the data passes through it. This approach, however, requires relatively complex hardware and makes it difficult to mix digital, analog, and general language code.

The L200 takes advantage of both the speed of hardware object-code interpretation and the flexibility of the software-based approach. Execution is first attempted by the DCP, a 16-bit intelligent DMA processor constructed from 2900 bit-slice components. The DCP can examine an object code instruction and determine whether or not it is a digital-channel command. If it is, the DCP interprets it and transfers it directly to the test hardware. If the DCP cannot directly interpret an instruction, it flags the supervisory processor for help, and the software interpreter comes to its aid. In this manner, digital commands are executed at rates in excess of 500 kHz, and other instructions can be randomly interspersed without affecting that digital rate.

The method of storing digital-channel information, which is critical to the loading rate, may be either absolute or incremental. The absolute method transfers from memory the state of every channel for every digital pattern. The incremental approach transfers only the changes that occur from pattern to pattern.

Each channel, or pin, of the L200 (Fig. 3) is designed so that it can be changed independently and thus patterns can be handled incrementally. Each pin change is defined by a 16-bit instruction which contains an operating code, or op code, and a channel identifier (Fig. 4a). The op code indicates the action to be applied to the pin specified by the contents of the identifier field. It also defines the 3 bits needed to control all digital functions, which signify the logic high or low state, whether the driver should be on or off, and whether the comparator should be considered or ignored during a test (see table). Since in most test programs only a small percentage of channels actually change state from one pattern to another on the average, incremental storage is by far the most effective.

Exceptional efficiency

Highly active buses can be a problem since the state of each bus bit often exhibits little constancy from pattern to pattern. The L200 deals with high bus-activity rates by encoding incremental bus-state changes in a highly efficient manner. The first word of the test instruction

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The economics of combined testers

Performing both in-circuit and functional testing on a single machine or family of machines results in some obvious savings in hardware, fixturing, training, and maintenance. Also, in volume production, it is more economical to perform in-circuit and functional testing during the same insertion, thereby minimizing board and handling costs. Most importantly, however, the combined tester lets the user obtain an appropriate level of fault coverage from a reasonable investment in programming resources during the entire life cycle of a product.

Using in-circuit test techniques, the combined tester can certainly obtain a high level of structural-fault coverage with a minimal investment of programming time. This may be all that is possible when boards for a new product must be brought quickly into production. However, as board-production volume builds, greater yields are needed than those attainable with in-circuit testing only. The combined tester enables the user to improve the fault coverage by adding performance fault tests, without reprogramming all tests from scratch.

The combined tester's additional ability to use any internal node for increased visibility and control results in greater testability, as well as the opportunity to partition a board into small, understandable clusters of components for greater precision in isolating faults. The failure of any specific segment can be diagnosed with the diagnostic tools of functional board tester, including guided probing, to the failed node.

The availability of a tester that combines in-circuit and functional test techniques, then, enables the user to trade off programming time and fault coverage to achieve the optimum level of fault coverage during the entire life of a product. The productivity advantages such a machine offers more than offsets its initial cost.

contains an op code and group identifier. The op code specifies what is to be done (drive or expect) to a specific group of channels (Fig. 4b). Subsequent words of storage use individual bits to specify the state (high or low) for each channel in the group.

Codes for pins with little activity are transferred one at a time, and groups of pins such as LSI buses are transferred as units. Op codes associated with pin or group changes also totally define the 3 bits of information required to define test status (I/O state, drive, compare), permitting a pin or bus to change from drive to detect as needed in bidirectional situations within the space of in a single instruction.

The L200 places no restriction on the choice of physical channels for pins within a group. The actual channels referenced by a group identifier are indirectly identified through a translation memory in the DCP, rather than being arbitrarily chosen by a hardware-dictated sequence.

Using this approach, the L200 can perform tests at rates up to 100,000 tests per second when driven by a PDP 11/44 memory. With more than half a megabyte of memory available for the program, the configuration can represent a program of over 50,000 patterns. The typical speed improvement achieved over software interpreters or less efficient data-storage schemes is 10 to 100 times. Digital programs that require minutes to execute using conventional approaches can usually be performed in seconds on the L200, yielding a dramatic improvement in productivity.

Making the connection

A key requirement for fixture wiring in a test system is that it maintain the integrity of signals flowing in both directions between the system and the board under test. Excessive ringing, noise, crosstalk, and poor edge control typically result from an excessive path length between board and channels, close proximity of the test wiring, and inadequate ground returns.

Ideally, all signal sources drive matching transmission lines with proper termination. Under these conditions, waveforms would be propagated without distortion, and edge transitions would remain intact—without significant ringing, overshoot, or undershoot. Termination matching is not a solution, however, for board nodes that must both drive and detect during functional testing of bidirectional buses and during in-circuit testing using overdriven nodes.

The most reasonable approach to this problem, therefore, is to minimize the wiring length, thereby shortening the duration of or altogether eliminating the reflections. Another alternative is to control ringing by slowing the system-driver edges, but if this is done to excess, edge control becomes imprecise and noise-induced clocking problems are exacerbated as the edge passes slowly through a logic device's threshold voltage.

Cutting the crosstalk

Shortening the wires has other benefits as well. Crosstalk typically results from coupling between wires connecting the test system to the board under test, and the longer and more closely packed the wiring, the more profound the crosstalk problem will be. Ground noise, usually a function of insufficient ground return lines between the board and system channels, is often another severe problem during digital in-circuit testing. Inductance in those lines results in spikes at the board ground, which reduce or eliminate device noise margins. The only solution to this problem is having many short paths to system ground.

The L200 attacks these traditional fixturing problems by minimizing the wiring length between digital channels and the board under test. The digital-channel cards are mounted vertically and directly under the board (Fig. 5). The bottom of the fixture frame has printed-circuit cards that mate with zero-insertion-force connectors on the digital-channel cards.

Wiring runs directly from these cards either to the spring-loaded pins of a vacuum head or to the appropriate edge connectors. Thus, it is possible to limit wiring distance to less than 6 inches for any critical interconnection, which, when compared with typical paths of 2 to

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3 feet, gives the L200 dramatically better signal integrity. In addition, every digital-channel card has a ground connection so that many ground returns can be distributed over the area of the board under test—again with short and therefore low-inductance paths.

Testing on-board memory

LSI technology is continually increasing the amount of memory on most boards with digital logic. Usually, this memory is in the form of random-access or read-only memory arrays that provide instructions to on-board processors or store data for off-board applications. Unlike boards whose sole function is memory, however, general-purpose boards may not provide simple edge-connector access to the memory array on the board, making testing more difficult. In addition, sizable quantities of memory are becoming common within multi-function peripheral chips and single-chip microprocessors and microcomputers.

Thorough testing of all these memory arrays is highly desirable. And, where reliability of these elements is critical, functional performance testing with worst-case voltage, timing, and patterns may be necessary.

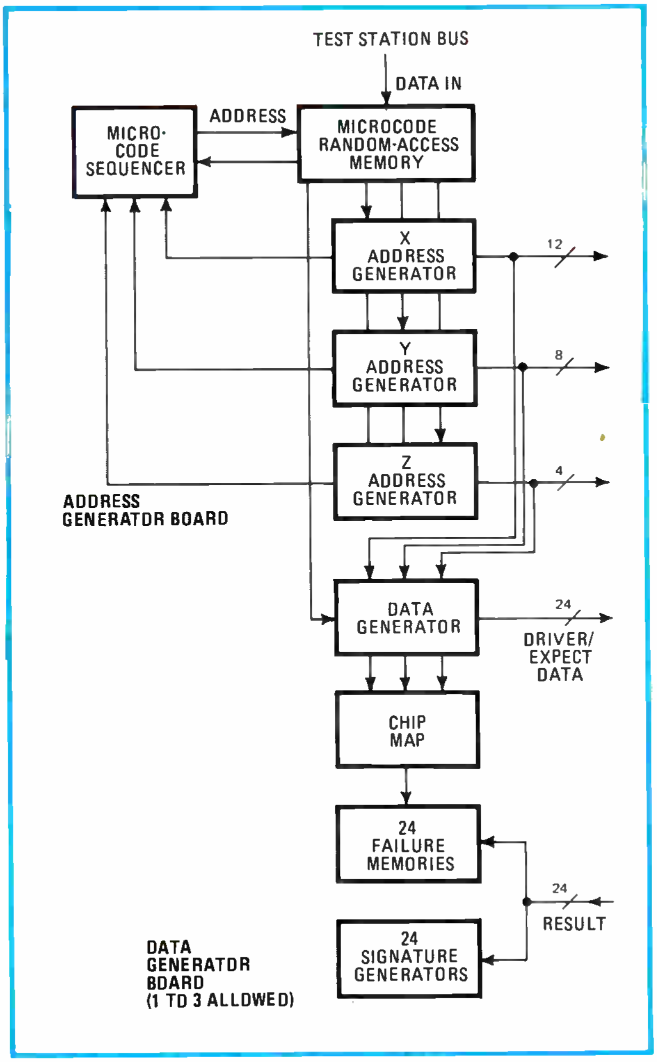
It is possible to write an ordinary digital program that accesses each location of a RAM, writes something into it, and then reads it back. Likewise, a ROM can be tested by examining every location to verify its contents. The growing size of on-board memory, however, makes even these simple scenarios cumbersome, since they require considerable storage or test time or both. In addition, a thorough memory test involves more than the sequential writing and reading of locations. Testing for faults induced by address and data pattern sensitivity and board-induced noise requires specialized sequences of considerable complexity.

Algorithmic addresses

To test on-board memory, the L200 uses the approach that has long been employed in memory-device and board testing—algorithmic generation of a stimulus and its expected response by hardware (Fig. 6). The algorithmic pattern processor executes this technique with the flexibility and diagnostic capability of a logic-board tester. In addition, the special memory-testing needs of LSI and VLSI logic are met with new approaches.

The L200 algorithmically generates addresses of up to 24 bits, which is sufficient to address 16 million memory locations. Because the unit has three independently programmable address generators, different algorithms can be applied simultaneously to subdivisions of the overall address space, an approach often used to differentiate intradevice rows, intradevice columns, and rows of device packages. Up to 72 bits of data can be derived from various registers or from the current addresses, and patterns can be shifted or rotated about the programmable width of the bus.

If failures occur during the algorithmic RAM-array test, programmable failure-mapping memories would pinpoint the devices being addressed at the time the problems occurred. ROM data is quickly tested using signature analysis, where an algorithm is simultaneously performed on the address bus and the hardware asso-



6. Patterns for the board. Together, two microcode-controlled boards—the address and the data generators—provide the algorithmic pattern processing for testing imbedded memory. The data generator board also captures failures and generates signatures.

ciated with each data bit generates 16-bit signatures that are then compared with previously learned or with calculated signatures.

Algorithmic addresses and data are routed to the board under test through digital channels otherwise under normal program control. This makes the full range of driver phases and formats, detector windows, and dc parameters available. In addition, channels may be switched back and forth from normal stored programming to algorithmic programming at speeds that can reach 10 MHz.

To penetrate buried memory, stored patterns might generate a microprocessor op code that is immediately followed by an algorithmic operand representing address or data.

For high quality, lengthy test sequences on boards with substantial RAM and ROM, hardware-generated test sequences are required. In executing these sequences, the L200 fully and synergistically integrates the strength of a logic-board tester with the algorithmic capability of a device tester. □

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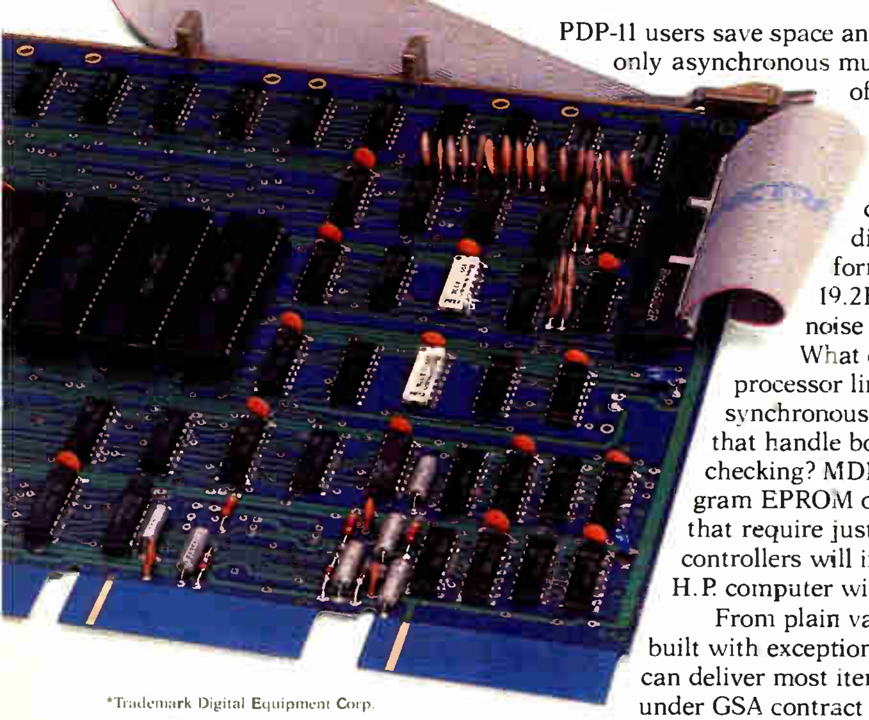

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Maximizing a 64-K RAM's operating margins

Circuit innovations double the sensed signal's amplitude and sharpen clock edges; processing enhancements reduce parasitics

by John Y. Chan, David A. Maxwell, John E. Muschinske, and John J. Barnes

Fairchild Camera & Instrument Corp., Research and Development Laboratory, Palo Alto, Calif.

☐ This will be the year that the leading semiconductor houses actually produce the long-awaited 64-K dynamic random-access memory. To compete in this market, a RAM must combine superior performance with the ease of manufacture that keeps costs reasonable. To that end, the F4164 employs new architectural features and new circuit designs based on multiple device thresholds, along with efficient manufacturing techniques that are already in place.

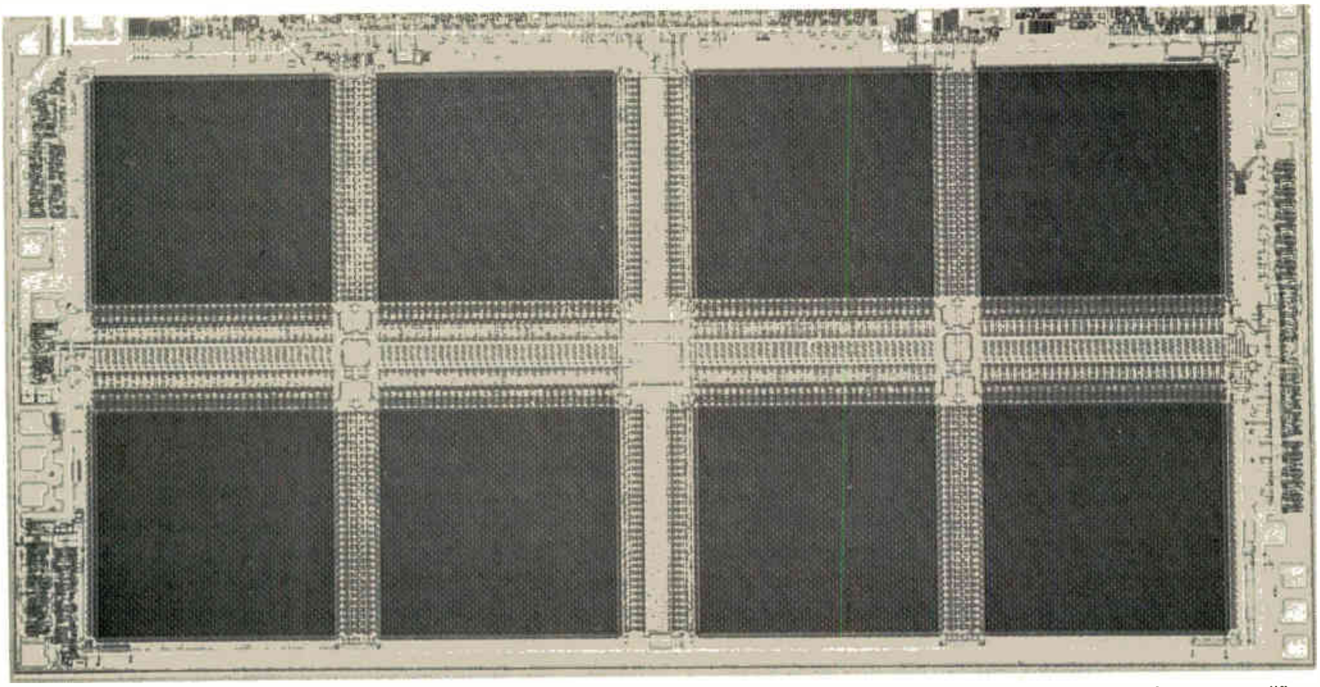
In addition, it collects onto one chip the advantages of earlier, smaller RAM designs. Unlike other RAMs, it combines metal bit lines, cells with enhanced capacitor noise immunity and storage margins, circuits with high-performance enhancement- and depletion-mode devices, a signal-doubling shared–sense-amplifier scheme, and standard scaled-down n-channel MOS processing.

Transistors in the F4164 exhibit an effective channel length of 2.5 micrometers, a gate-oxide thickness of 400 angstroms, shallow (0.35 μm) source-drain implants, and boron channel implants to control threshold voltage and punch-through. Additional process characterization has been performed to ensure the reliability of the oxides under long-term voltage stresses, and larger devices are used for high-voltage nodes to minimize problems with hot-electron injection.

Processing versus manufacturing

Given its importance, ease of manufacture was of course a key consideration during the development of the process technology and the choice of layout rules. Feature sizes of 3 to 4 μm and their associated alignment tolerances were adopted so that 1:1 projection alignment could be used. The reason is that proven projection aligners—rather than first-generation wafer steppers—afford much higher manufacturing productivity and lower wafer-processing costs.

Other state-of-the-art manufacturing techniques were, however, combined with the projection printing to attain the required line-width and geometry tolerances. Masks are generated by electron beam to achieve precise



1. Logical. Column decoders run vertically up the middle of the F4164 64-K RAM; the other two vertical stripes make up 128 sense amplifiers apiece. Dividing the chip horizontally are the row decoders. The logic at the far left generates strobes and the substrate bias.

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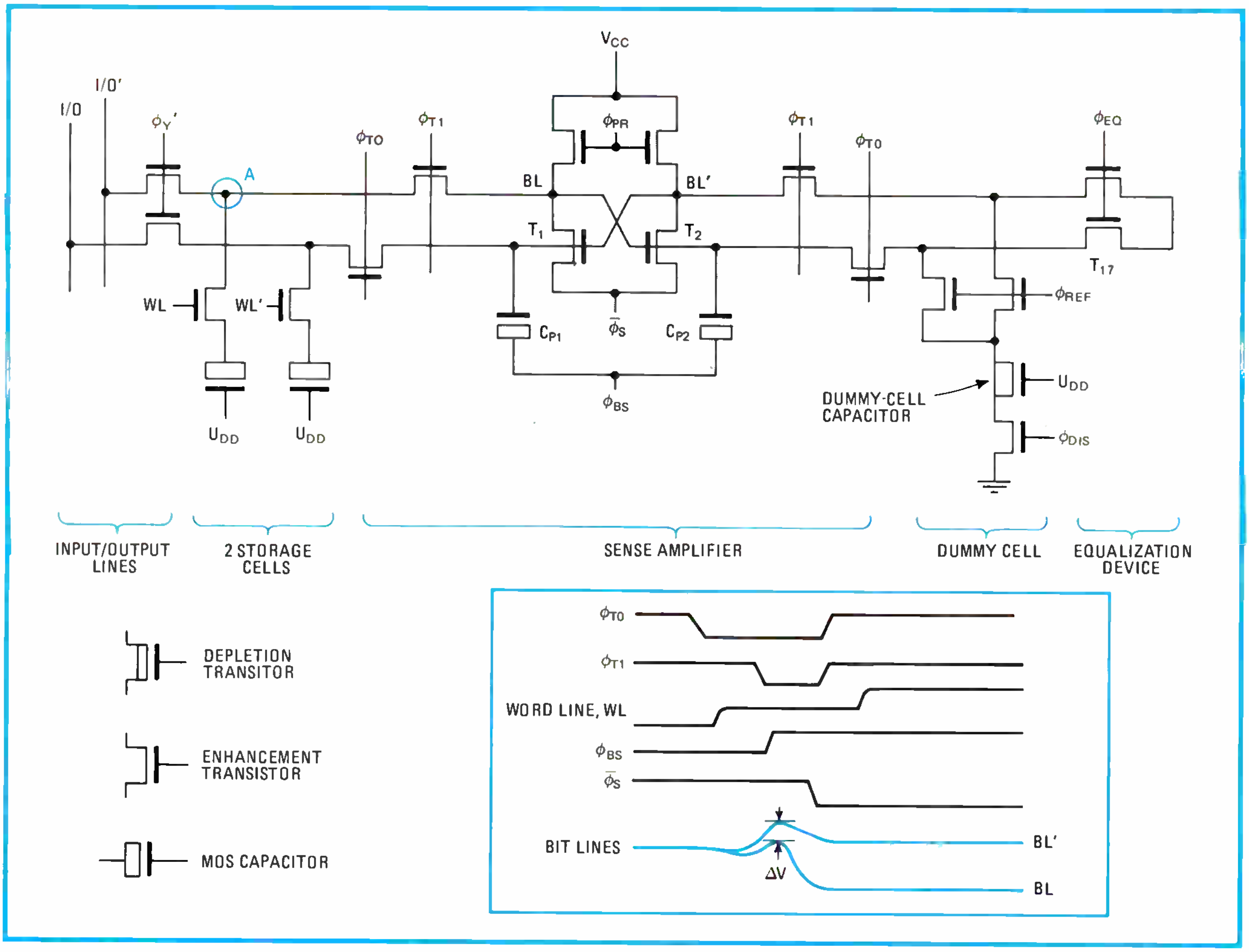

2. Sensible. Four identical bit lines converge onto a symmetrical sense amplifier. Control clocks connect only two of the lines—in open-ended fashion—during initial data sensing. Later, the bit lines are reconfigured into twisted pairs for writing or refreshing.

dimensions and to eliminate mask runout. An all-positive photoresist process, to allow a high degree of control over resolution and delineation, was joined with extensive dry etching for maximum control over line widths.

The F4164's process, with its double polysilicon structure and depletion- and enhancement-mode transistors, is similar to many of those used to build modern microprocessors and static RAMs. Because of both the resulting small die size of 37,000 square mils (24 square millimeters) and the known lithography, no redundancy was employed (see Fig. 1).

The number of threshold-adjusting implants in the design is minimized for better manufacturability but not restricted to the point where performance is compromised. There is only one critical depletion device, and its threshold voltage (V_T) is set with an arsenic implant. Owing to the relatively low diffusivity of arsenic at the low processing temperature, this implant is virtually undisturbed and V_T therefore remains unchanged during the process.

Lower temperatures in general characterize several of the process steps when compared with the production of 16-K RAMs. In particular, oxidation and reflow operations were significantly improved for the larger memory.

When bit lines emanate in opposite directions from a sense amplifier, they are said to be open-ended; when they are adjacent, they are called folded or twisted. Other 64-K RAM designs have employed one or the other approach, and there is reason to believe that both can be made to work properly.

The F4164 uses 256 ultrasensitive multiplexed sense amplifiers that are responsible for two pairs of cross-connected bit lines—instead of a single pair—so that each bit line connects to 64 cells instead of 128. Thus the bit-line–to–cell-capacitance ratio of 12 is as high as in designs based on double the number of sense amps.

Bit line ingenuity

During a read, write, or refresh operation, two open bit lines are initially selected but subsequently reconnected as one metal bit line. This scheme allows a totally dynamic sense amplifier yet avoids the need to place the word-line, or Y, decoder in the center or along two sides of the memory arrays to obtain a double-ended write operation. A device is also used both to equalize signals and to balance the capacitance of the sense amplifier.

Accordingly, this chip architecture minimizes the polysilicon word-line delay, the number of sense amplifiers, and the number of Y decoders. Yet it provides the maximum cell signal to the sense amplifier as well as a

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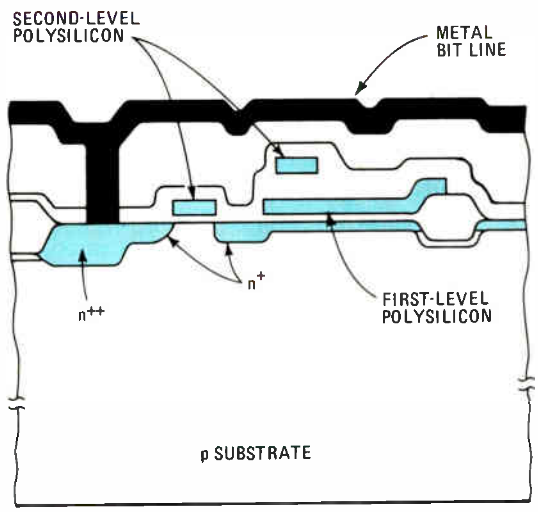
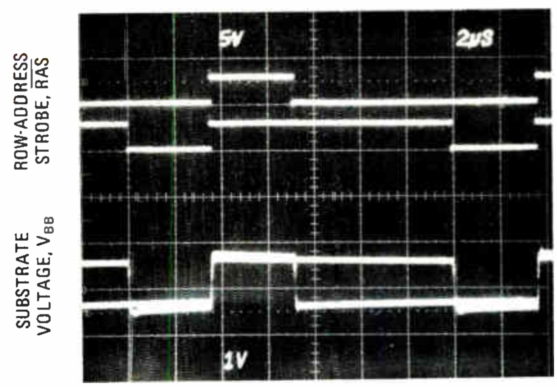


3. Substantial. The F4164's cells use a double-polysilicon structure, but bit lines are metal to maximize the storage capacitor's area and guard against soft errors from alpha radiation. Note that the second polysilicon level allows for a self-aligned transfer device.



4. Stable. The memory employs a two-level substrate voltage generator to account for the chip's active and inactive states. The top traces show long and short row-address-strobe $\overline{RAS}$ duty cycles. The bottom traces illustrate the constancy of the bias potential, V_{BB}.

desirable ratio of storage-cell area to chip area.

Figure 2 is a circuit schematic for the sense amplifier, with transistor and node numbers called out. A pair of bootstrap capacitors, C_{P1} and C_{P2}, is used in conjunction with transistors T_1 and T_2 to preamplify the initial signal and to ensure that the power supply voltage (V_{DD}) will be restored to the memory cell as a logic 1 level. Preamplification means that the voltage of the signal is boosted by the capacitors before—and not after—the normal latching of the $\overline{\phi}_S$ node.

The layout

As shown, each pair of bit lines is subdivided into four identical sections and connected by four couplers onto a symmetrical central sense amplifier. The control clocks, ϕ_{T0} and ϕ_{T1}, connect only two of the four sections to the sense amplifier during initial data sensing. Later, when all the couplers are turned on, a twisted bit-line pair exists during the restoration, or write, phase. The conveniently located equalization device ensures bit-line balance with a minimum precharge time.

Instead of using a conventional half-sized reference capacitor, a proper reference level is obtained by sharing a full-sized capacitor between two bit-line halves. A half charge taken from two unrelated bit lines is equivalent to having a half-sized dummy capacitor.

This approach eases the layout and matching difficulties associated with the half-sized reference capacitor design and its requirement for maximum-geometry devices. The folded metal bit-line arrangement means that the sense amplifier can be laid out in the pitch of two bit lines. The extra space needed to perfectly balance the sense amplifier and add the capacitors C_{P1} and C_{P2} was therefore provided.

The timing of the sense amplifier is as follows: during the precharge time, the row-precharge clock, ϕ_{PR}, rises to about 7 volts, charging the bit lines to V_{CC}, since clocks ϕ_{T0} and ϕ_{T1} are also at V_{CC} at this time. Equalization device T_{17} has the job of further equalizing the bit lines.

Assuming that the cell on bit-line node A is to be interrogated and that a 1 is stored in the cell, ϕ_{PR} and ϕ_{T0} go low and the selected word line rises along with the dummy word line, ϕ_{REF}. The similar waveforms for cell and dummy transfer devices preserve signal margins. The charge-sharing now occurs.

Clock ϕ_{T1} goes low to temporarily isolate nodes BL and BL′ for preamplification. Then the bootstrap-sense clock, ϕ_{BS}, rises. Preamplification now occurs, since T_1 can hold nodes $\overline{\phi}_S$ (with its large loading capacitance) and BL′ to approximately the same level while node BL is capacitively kicked upward.

Clock ϕ_{S2} rises as latch node $\overline{\phi}_S$ starts to fall. The signal is then amplified and the restoration phase begins. Clocks ϕ_{T0} and ϕ_{T1} rise to restore to the cell either V_{DD} if a 1 is being read from it or 0 V if the stored data is a 0 logic level.

Next, the word line is bootstrapped to about 7 V. Finally, precharge clock ϕ_{PR} comes on and the precharge cycle begins again. The preamplified signal eases the timing requirements of $\overline{\phi}_S$ and minimizes voltage loss on the high side of the sense amplifier.

Better cell control

Figure 3 shows the F4164's double polysilicon cell. The use of metal bit lines and polysilicon word lines gives about a 30% ratio of storage capacitor to cell area. This structure also makes the minimum channel length of the access transistor insensitive to misalignment of the polysilicon masking, unlike cells in a scaled-down 4116 16-K RAM. Arsenic and boron implants are added to the cell to improve its charge-storage capacity. With this method, the typical 50-femtofarad capacitance to the 171-square-micrometer cell includes about a 15% contribution from the cell's pn^+ junction capacitance.

In addition to the high cell capacitance, other factors help guard against soft errors from external noise like that induced by alpha particles. The metal bit lines limit

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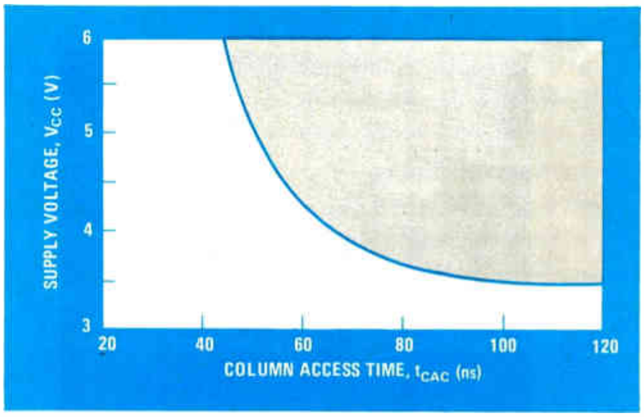


5. Functional. In this simplified Schmoo plot, proper circuit operation occurs in the shaded area. The device is good with a supply voltage reduced to 3.45 volts at a column access time of 86 nanoseconds. A column access time of 50 ns is achieved easily.

the amount of diffused area in the cells, in contrast to n^+ bit-line approaches, which are more susceptible. The word line is bootstrapped to overcome the threshold voltage of the cell's selection transistor. Thus, a full V_{DD} level is written into the storage capacitors. Typically over 250 femtocoulombs of charge can be stored in the cell. A die coating is also used to reduce device sensitivity to alpha radiation.

An interpolysilicon oxide

With a metal–bit-line cell, it is important to minimize capacitive coupling between the polysilicon word lines and any noise sources. A new interpolysilicon oxidation technique separates the first and second polysilicon levels by more than 250 nanometers (0.25 μm) of oxide, at the same time providing an oxide of only 55 nm (550 Å) under the second polysilicon for the gates of active devices. Improvements in vapor deposition and contact etching allow the use of unscaled passivation between metal and other areas while easing problems with topological definition.

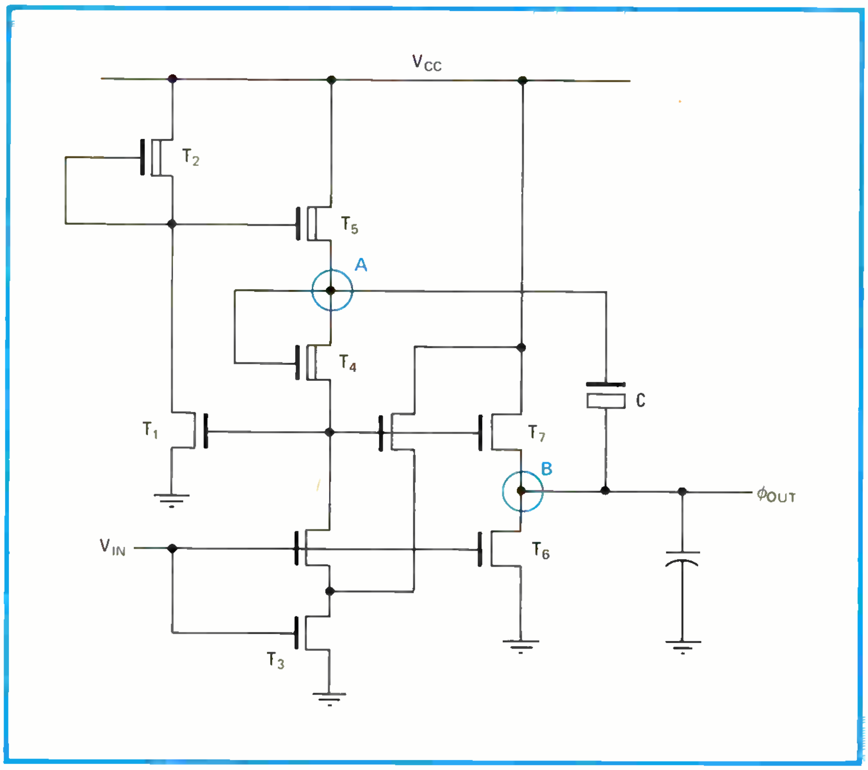
A major source of noise in dynamic RAMs is the power supply. When the storage capacitor's upper plate is tied to V_{CC}, it stands to lose more than 20% of its charge with a $\pm 10\%$ variation in the supply. Tying the cell plate to ground (V_{SS}) is one solution, but extra processes are then required to make deep depletion-mode bottom plates in the cells. The F4164 employs an internally generated constant-bias voltage supply, U_{DD}, for the upper memory-cell plate.

Away with the bump test

With the U_{DD} supply well-regulated internally, V_{DD} noise is minimized or avoided. Moreover, since U_{DD} is larger than V_{CC}, the full V_{CC} level can be stored in the cell without a depletion implant. Furthermore, U_{DD} can be varied with an external voltage source during wafer sorting to monitor sense-amplifier margins. Thus, a margin-test capability—for controlling product uniformity—can be achieved without resorting to other complex circuits.

Other features, such as a quiet word-line circuit, were used to reduce data-pattern sensitivity. This circuit ensures that unselected word lines are actively held down during the time that the selected word line is capacitively kicked to about $1.5V_{CC}$.

The purpose of a substrate bias is to improve data-storage time, to help control threshold voltages, to provide a better signal to the sense amplifiers, and to improve circuit speed by reducing pn-junction capacitance. However, the substrate voltage (V_{BB}) is affected



6. Dynamic. Dynamic depletion-mode circuits are used for clean internal clock signals. Older designs rely on enhancement transistors that must be pumped above the supply voltage, V_{DD}. The improved circuit makes use of positive feedback in order to save power as well as time.

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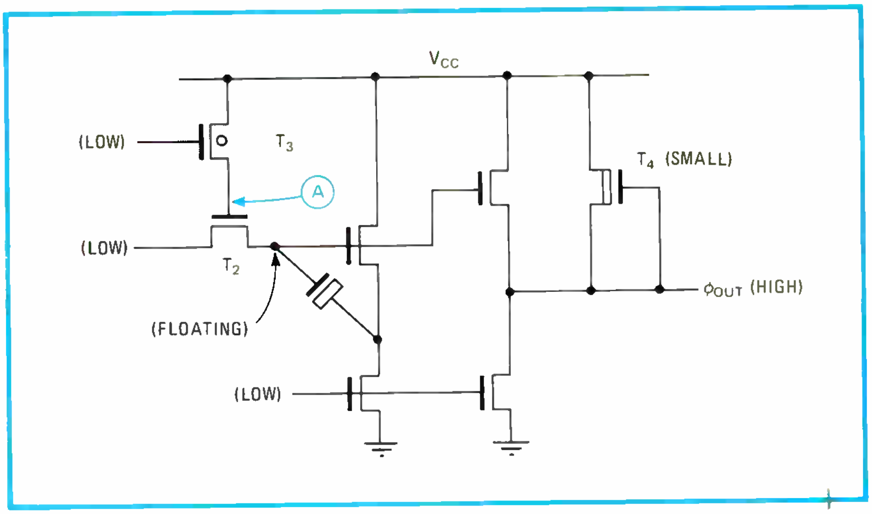
7. Natural. Since dynamic circuits are based on nodes that must be precharged to near V_{DD}, the F4164 adds low-threshold, or natural, devices that allow node voltages to be set to V_{DD} minus a single threshold-voltage drop. They make good low-current switches.



by the duty cycle of the chip-enable clocks. The F4164 uses a dual-level V_{BB} generator to bias the chip's active and inactive states independently. This method minimizes any variation in chip performance with respect to the input duty cycle.

Figure 4 illustrates the performance of the dual-level substrate generator. The two upper traces apply to long and short row-address-strobe ($\overline{RAS}$) duty cycles, respectively. The bottom traces show corresponding V_{BB} waveforms. The constant levels, when $\overline{RAS}$ is low or high, ensure stable performance under varying duty cycles of the control clock. In fact, the bottom trace—which uses a 1-V scale—proves that the bias voltage varies little more than 1 V, regardless of $\overline{RAS}$ length.

The low body-factor process guarantees proper operation even when the V_{BB} level swings 1 V from its active to its inactive cycle, because the generator has been designed to ease startup problems. Body factor refers to the change in a transistor's threshold voltage as the reverse bias applied to its source-substrate junction is varied. In some older designs, the threshold voltage could shift as much as 3 V; but in the F4164, this variation is kept well under 1 V.

The V_{BB} generator was also designed to start up quickly. The goal here was to prevent destructive breakdown of the chip when the V_{CC} power supply is first applied.

A speedy design

The active power consumption of the F4164 is typically 120 milliwatts at a 330-nanosecond cycle time, and standby power consumption is 11 mW. Row access can be as fast as 100 ns, and this speed has been achieved without resorting to metal silicides. Internal waveforms show considerable speed improvement over the 4116-type circuits. Delay times of 3 ns per stage are typical, compared with about 7 ns in older circuits—even though the latter include a 12-V V_{DD} supply that drives the clocks.

Figure 5 shows a Schmoo plot of the column access time (t_{CAC}) for varying values of V_{CC}. Proper circuit operation occurs in the shaded areas. The part functions with V_{DD} as low as 3.45 V, with t_{CAC} equal to 86 ns. For a typical 5-V value of V_{CC}, a column access time of less than 50 ns is easily achieved. And, as the curve additionally indicates, as the supply voltage is further increased toward a level of 6 V, the column access time decreases further, approaching 40 ns.

No opportunity was overlooked to speed up access time, improve device operating margins, and lower power dissipation. Beginning with an active $\overline{RAS}$ or $\overline{CAS}$ transition, a sharp V_{CC}-level clock is developed by means of the dynamic depletion-mode circuit shown in Fig 6. In the 4116, this circuit uses only enhancement-mode transistors, and the clock must be pumped above the V_{DD} rail. However, such an approach is not only cumbersome but also subject to variations in cycle-time characteristics of the memory.

The new circuit stores V_{DD} across the capacitor when V_{IN} is high, and a maximum voltage drop appears across T_4. As V_{IN} goes to a low TTL level, the charge stored in the capacitor is shared with node A through T_4. The positive feedback from node B further enhances node A's voltage until V_{OUT} reaches the maximum V_{DD}, thus allowing the capacitor-plate voltage to be bootstrapped above V_{DD}. Because devices T_7 and T_6 do not dissipate dc power, it is possible to design T_7 to drive a higher capacitance load.

Since dynamic circuits rely on precharged nodes that are bootstrapped upward to provide fast V_{DD}-level outputs, it is desirable to set this precharged level as close to V_{DD} as possible. Low-threshold devices allow the nodes to be set to $V_{DD} - V_T$—almost V_{DD}; thus margin can be made available to the individual clocks in the circuit (Fig. 7). In addition, low-current depletion-mode "keep-up" devices can be provided for the V_{DD}-level clock so that no degradation in voltage swing occurs in the course of a long cycle time.

Scaled-down memories to follow

The F4164 is only the first in a family of high-performance dynamic RAMs, static RAMs, erasable programmable read-only memories, and electrically erasable PROMs. Mastering the circuit design and fine-line lithographic processing of the 64-K dynamic RAM will allow 16-K static RAMs, 64-K E-PROMs, and 16-K EE-PROMs to be developed with a confidence in the basic technology and circuit concepts that were first proven on the F4164. □

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Engineer's notebook

Reading a dual-trace scope with a ±0.025% accuracy

by Leonard Sherman
National Semiconductor Corp., Santa Clara, Calif.

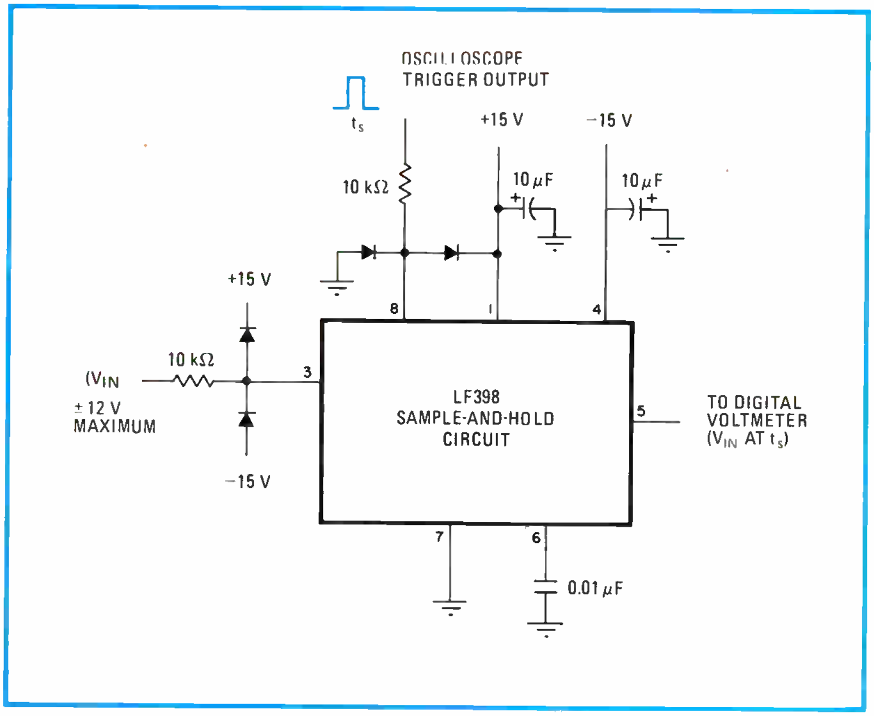
Reading a voltage from an oscilloscope display by eye yields an accuracy to within about ±2% at best. But with the aid of a single, inexpensive integrated circuit and an ordinary 5½-digit voltmeter, a typical dual-trace scope with a delayed-sweep mode can be used to obtain readings accurate to within ±0.025% or better.

In the circuit shown, the LF398 sample-and-hold circuit is used to sample the voltage at the test point V_{in}, at a time determined by a gating signal from the oscilloscope. The retained voltage can then be read by taking a DVM input from pin 5. The circuit does not use input prescaling or offset trimming, so the LF398 input can vary between plus and minus 12 volts and the reading will typically be accurate to within ±3 millivolts. Prescaling or trimming can be added for a wider input range or greater measurement precision, respectively.

To gate the measurement, the scope is set up so that it provides a gating signal at a time determined by the delayed sweep signal. In the case of the Tektronix 453A, for example, the scope is set to operate in the A-intensified-during-B mode and the B gate output is used to trigger the sample-and-hold circuit. Any point along the A channel's displayed waveform can then be measured by simply adjusting the delay time multiplier.

Even at high sweep speeds or with short sample windows, the periodic nature of most measurements permits measurement accuracy to be maintained down to 200-nanosecond gate widths with the circuit. Typical applications would include precise rise-time determinations and peak readings. □

Engineer's notebook is a regular feature in Electronics. We invite readers to submit original design shortcuts, calculation aids, measurement and test techniques, and other ideas for saving engineering time or cost. We'll pay $75 for each item published.



Sample, hold, and read. Based on an LF 398 sample-and-hold IC, the circuit above can be used to obtain precision measurements from a dual-channel scope with a delayed sweep that gates the measurement. V_{in} serves to drive the A channel input. All diodes shown are 1N4148s.

Computer notes

'Surgical' program speeds 6909 debugging process

by Ralph Tenny
George Goode & Associates Inc., Dallas, Texas

Without a precise move program, the traditional fix for many problems that arise during debugging is to jump to a patch area elsewhere in memory, do the missing operation, and jump back to the instruction that follows the jump's takeoff point. But the ideal solution is to insert one or two instructions inline in the program. With this routine, a gap can be opened in the existing program by means of a simple keyboard entry to three locations and

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6809 DEBUG PATCH PROGRAM

```
               0D30   TEMP1    EQU     $D30       REGISTER Y STORAGE
               0D32   TEMP2    EQU     $D32       REGISTER U STORAGE
               0D34   TEMP3    EQU     $D34       REGISTER D STORAGE

                      *THIS ROUTINE WILL MOVE A BLOCK OF DATA TO ANOTHER
                      *LOCATION.  PASS THE BLOCK LENGTH (BYTES) IN TEMP3,
                      *THE SOURCE ADDRESS IN TEMP1, AND THE DESTINATION
                      *ADDRESS IN TEMP2.  ALLOWANCE MADE FOR BUFFER OVERLAP.

0000 34    76         MVBLK    PSHS    D,X,Y,U    SAVE REGISTERS

                      *ALLOW FOR POSSIBLE BUFFER OVERLAP

0002 FC    0D30                LDD     TEMP1      GET START ADDRESS
0005 B3    0D32                SUBD    TEMP2      GET DISTANCE BETWEEN BLOCKS
0008 27    15                  BEQ     EXIT2      SAME ADDRESS, WHY BOTHER?
000A 2D    16                  BLT     REV        MOVE CODE FROM BOTTOM FIRST

                      *NOTE: THIS MOVE ALLOWS UNWANTED CODE TO BE
                      *OVERWRITTEN.  USE WITH CARE!

000C FC    0D34                LDD     TEMP3      GET NUMBER OF BYTES TO MOVE
000F 10BE  0D30                LDY     TEMP1      ALSO START ADDRESS
0013 FE    0D32                LDU     TEMP2      AND DESTINATION START
0016 AE    A1         B1       LDX     ,Y++       LOAD TWO BYTES
0018 AF    C1                  STX     ,U++       AND PUT THEM DOWN
001A 83    0002                SUBD    #2         COUNT THE OPERATIONS
001D 24    F7                  BHS     B1         LOOP UNTIL DONE
001F 35    76         EXIT2    PULS    D,X,Y,U    RESTORE REGISTERS
0021 39                        RTS                AND GO HOME

                      *THIS MOVE ALLOWS CODE TO BE OPENED UP TO INSERT
                      *ONE OR MORE OP CODES FOR A PATCH.

0022 FC    0D34       REV      LDD     TEMP3      GET NUMBER OF BYTES TO MOVE
0025 F3    0D30                ADDD    TEMP1      AND POINT TO BOTTOM OF BUFFER
0028 1F    02                  TFR     D,Y        LOAD SOURCE POINTER
002A FC    0D34                LDD     TEMP3      GET BYTE COUNT AGAIN, THEN
002D F3    0D32                ADDD    TEMP2      FIND END OF TARGET BUFFER
0030 1F    03                  TFR     D,U        LOAD DESTINATION POINTER
0032 FC    0D34                LDD     TEMP3      ONE MORE TIME!
0035 AE    A4         B2       LDX     0,Y        LOAD TWO BYTES AND
0037 31    3E                  LEAY    -2,Y       POINT TO NEXT LOAD
0039 AF    C4                  STX     0,U        STUFF THE DATA AND
003B 33    5E                  LEAU    -2,U       POINT TO NEXT TARGET
003D 83    0002                SUBD    #2         COUNT THE PASSES
0040 24    F3                  BHS     B2         LOOP UNTIL DONE
0042 20    DB                  BRA     EXIT2      THEN BLOW THE JOINT

0 ERROR(S) DETECTED
```

a simple jump statement elsewhere in memory. The missing instructions can then be keyed in and tested. The new code still has to be recompiled, but the recompilation is one that matches code that has been verified.

A normal block-move program would scramble the last part of the program, since these routines almost always move the top byte first. Thus, the first byte to be moved would land on the fourth byte downstream of the patch, thereby obliterating part of the program. To overcome this problem, this routine tests the addresses in buffers TEMP1 and TEMP2. If the code is to be moved down, the program jumps to its last section. This section peels off code from the bottom of the section being moved, so that there is just enough space to open the required gap. Thus the last byte to be moved will be the byte at the start of the patch.

The program is used by entering the address of the first byte to be moved in TEMP1, the address of the last byte to be moved in TEMP2, and the number of bytes from the address in TEMP2 to the end of the program in

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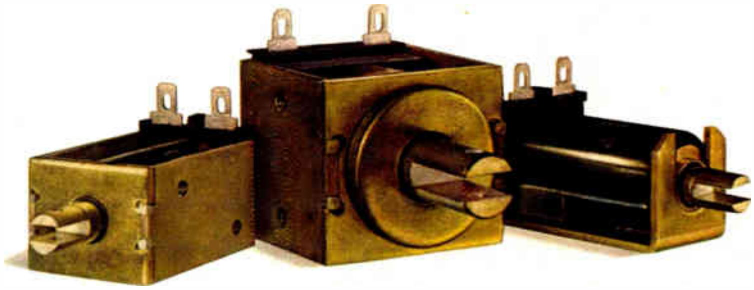

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TEMP3. Then the program is run. Inspection of memory will show that the code that resided between the specified addresses has been duplicated and that the rest of the program has been moved down in memory accordingly.

For the reverse problem, unwanted code that must be deleted, the usual debugging method is to replace an offending instruction with a no-op code. Instead, this program takes the first byte after the unwanted code and replaces the first byte to be deleted with it.

Note that if either operation happens to change the distance between the start and end of a relative branch, the branch displacement must be recomputed. □

Mobile-phone abbreviations demand explanation

by Noel Boutin
University of Sherbrooke, Quebec, Canada

The cellular mobile-telephone system is becoming a reality [*Electronics*, May 24, 1979, p. 158]. As with most areas of specialized technology, this one possesses its own technical jargon—an amalgam of telephone, data-transmission, and computer vocabularies. The following list of 80 widely used abbreviations and acronyms covers the ones most likely to be encountered by the increasing number of engineers who will either need to be familiar with or will be directly engaged in work on such a cellular phone system.

AMA	automatic message accounting
AMPS	Advanced Mobile Phone Service (Bell System)
AWC	additional word coming
BCH	Bose-Chandhuri-Hocquenghem error-correcting code
CCIS	common-channel interoffice signaling
CCITT	International Consultative Committee on Telegraphy and Telephony
CCM	central control and monitoring
CCS	customer calling service
CIR	carrier-to-interference ratio
CMAX	number of setup channels to scan
CNR	carrier-to-noise ratio
CPA	common paging and access
CTB	cellular test bed
CU	control unit
D	distance between the centers of nearest cochannel cells
DDT	display, debugging, and test unit
DF	data frame
DM	data memory
DMU	data-manipulation unit
DPLMRS	domestic public land mobile-radio service
D/R	cochannel reuse ratio
DRS	data-retrieval system
DT	down time
ESS	electronic switching system
ETSL	extended telephone simulation language
f^2_{RMS}	mean-squared frequency deviation
HCMTS	high-capacity mobile telecommunications system
HF	hands free
$\bar{I}$	mean value of interfering signal
IMTS	improved mobile telephone system
LRI	locating receiver interface
LRR	locating radio receiver
LSF	line-supervision frame
MATS	maintenance and traffic simulator
MCL	mobile communications laboratory
MCG	mobile call generator
MCU	monitor and control unit
MERT	multienvironment real time
modem	modulator-demodulator
Moses	mobile-office simulated environment system
MPSC	mobile phone service center
MRT	mean recovery time
MSA	mobile service area
MTBF	mean time between failures
MTF	maintenance test frame
MTFC	maintenance test-frame controller
MTL	mobile telephone laboratory
MTSO	mobile telecommunications switching office
MUT	mean up time
MW	message waiting
N	Number of cells per cluster
$\bar{N}$	mean value of environmental noise
$\bar{N}_p$	mean value of weighted peak noise
NAM	number assignment module
No SVC	no service
NRZ	nonreturn to zero
PA/C	power amplifier and combiner
Procon	programmable controller
PSU	program storage unit
R	cell radius
R-BPF	receiving bandpass filter
RCC	radio common carrier
RCS	Rayleigh channel simulator
RSSI	received signal strength indicator
SAT	supervisory audio tone
Sinad	(Signal + noise + distortion) ÷ (noise + distortion)
$\bar{S}m$	mean value of maximum signal
S/I	rf signal-to-interface ratio
$\bar{S}s$	mean value of serving signal
ST	signaling tone
TAC	terminal access circuit
T-BPF	transmitting-bandpass filter
TM	telemetry site
T-R	transmit-receive
TR	transceiver
TSU	trunk switching unit
VRD	voice receive data
VTDI	voice-transmitter data interface
WB	wideband
WSU	writable store unit

□

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Engineer's newsletter

Kit lets engineers try programmed logic

By combining the functions of several TTL circuits, a programmable logic array circuit can reduce the total chip count on a printed-circuit board by 90% or more, thus saving board space and reducing costs. To allow engineers to familiarize themselves with the parts, which are now available from Monolithic Memories, National Semiconductor, and Texas Instruments, the first of these companies has developed a PAL Kit. **Besides one preprogrammed "master" and seven unprogrammed logic array circuits,** the kit includes programming instructions, data sheets, a paper tape, and an engineering reference card. The PAL Kit is available nationwide from Monolithic Memories Inc.'s distributors for $99.95.

Where to learn about emi, rfi, and emc

Addressing the growing problems of electromagnetic interference, radio-frequency interference, and electromagnetic compatibility, Don White Consultants Inc. of Gainesville, Va., will hold **a wide-ranging series of seminars nationwide** to aid engineers in solving their design woes. The titles include: "Emc—Design and Measurement for Control of Emi," which will be held in Ottawa, June 1–5; "Grounding and Shielding," which will be presented in Boulder, Colo., on May 19–21, in Toronto, Aug. 11–13, and in San Diego, Sept. 15–17; "Introduction to Emi/rfi/emc," in Seattle, May 26–28; and "Emi Control in Electronic Data Processing Equipment," in San Francisco, May 11–15.

In addition, there are four sessions that deal with Government and military requirements, not to mention the telephone system's: "FCC and VDE/CISPR Requirements, Testing and Emi Control," to be held in Los Angeles, July 14–16; "MIL-STD-462/462B and System Level Emi Testing and Procedures," June 8–12, in Washington, D.C.; and "Emi Control in Telecommunications Systems," Los Angeles, July 7–9. The cost of the emc design course and the one which discusses military standards is $845; the others are $585 each. For additional information, contact Royce White at (703) 347-0030, or write to the International Training Centre, State Route 625, P. O. Box D, Gainesville, Va. 22065.

Addendum to EIA standards covers testing of switches

A new addendum to the Electronic Industries Association standards for testing electromechanical switches covers their endurance of standard logic levels. RS-448-4 describes test methods for measuring this parameter at both logic 1—a signal with a voltage greater than 2.4 V and less than 5.5 V; and logic 0—a voltage between 0 and 0.9 V.

The method for logic 1, formally called the logic-level endurance test, measures the ability of a switch to control electrical loads in which the applied voltage exceeds the melting voltage of the switch contact material and is less than the arcing voltage and arcing current. The method for logic 0—the low-level endurance test—measures the ability of a switch to control loads that have **insufficient energy to cause any physical change in the switch contacts.**

RS-448-4 was developed by the EIA Engineering department's P-5.9 working group on nonsensitive and push-button keyboard switches under the chairmanship of John Kitka of Grayhill Inc. Copies of RS-448-4 are available at $4.00 each from the Standards Sales Office, EIA, 2001 Eye St. N. W., Washington, D. C. 20006. **-Vincent Biancomano**

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Panasonic CRT's— not just another pretty face.

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Whether you build monitors, terminals or entire computer systems, a Panasonic CRT can be a key factor in your competitive strategy. Choose from five color tube screen sizes, from 5" to 25", and eight monochrome sizes from 1½" to 15", plus special phosphors in both monochrome and color. Our wide selection is your design advantage. Our Direct Etch screen, an option available on most models, ensures non-glare viewing and contrast enhancement while saving you the cost of a separate faceplate. Our consistent quality and features are your selling points. And our reliable delivery and stock of the most popular sizes, models and options are all the back-up you need.

So whether you're buying or building a CRT display, look for something more than just another pretty face. Look for the best in CRT's: Panasonic. Panasonic Company, Electronics Components Division/Electron Tube Marketing, One Panasonic Way, Secaucus, NJ 07094; (201) 348-5278

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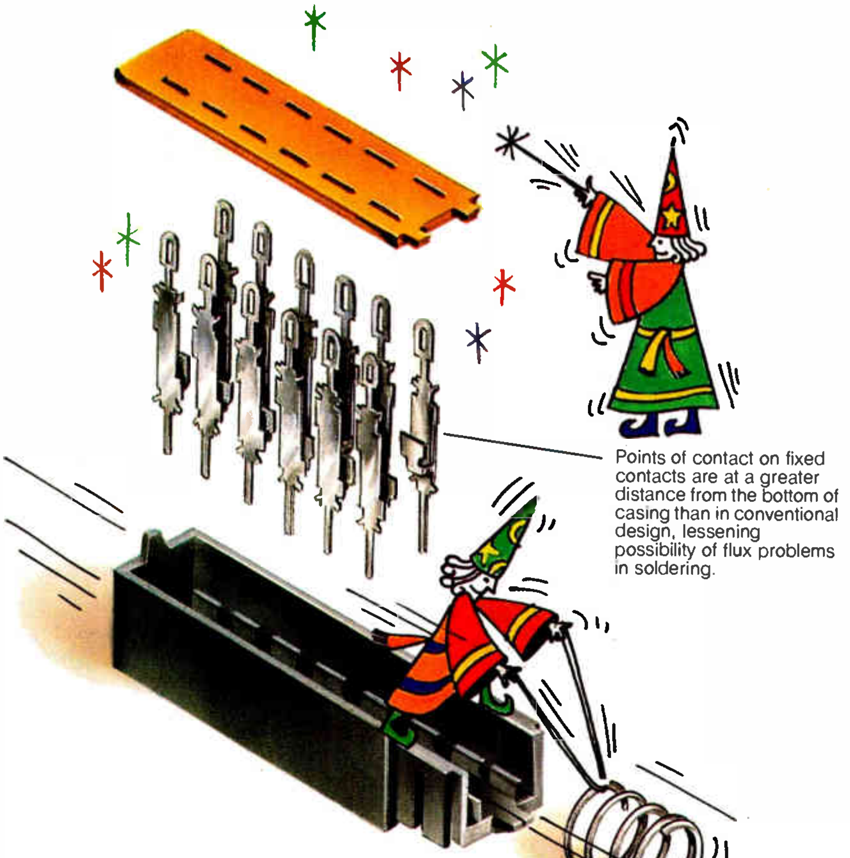
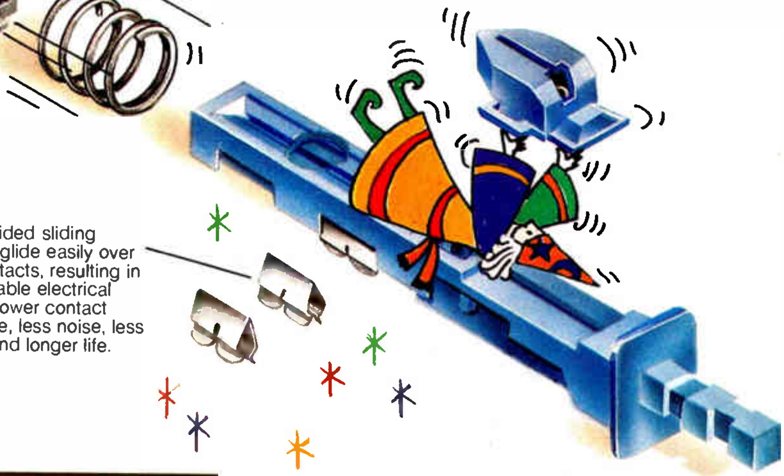
Circle 207 on reader service card

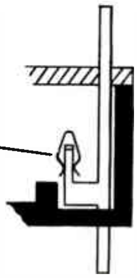
World Radio History

The Wizards of ALPS

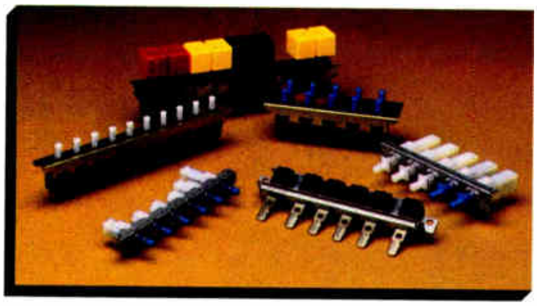


Points of contact on fixed contacts are at a greater distance from the bottom of casing than in conventional design, lessening possibility of flux problems in soldering.





Double-sided sliding contacts glide easily over fixed contacts, resulting in more reliable electrical contact, lower contact resistance, less noise, less friction, and longer life.



Shown here is our 4-pole SUE switch. Also available in the SUE Series are switches with 0, 2, 6, 8, and 10 poles. They are available individually, or in groups of 2-10, for operation in linked, independent (self-lock), non-lock (momentary), or reset modes.

Alps also manufactures seven other series of push switches (SUF, SUH, SUT, SUS, SPJ, SPS, and SPA) for various applications in audio and VTR equipment, as well as other home and industrial electrical equipment.

Alps® **ALPS ELECTRIC (U.S.A.) INC.,** 100 N. Centre Ave., Rockville Centre, NY 11570 / 516-766-3636 / TLX (23) 014-4508

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make pushbutton switches that push more softly and make more reliable contact than any others you can find.

The whole secret is in the exclusive double-sided sliding contacts our Wizards have conjured up. They act like clips, and grip the fixed contacts gently but firmly. The result is not only more reliable electrical contact than you get in a conventional, single-sided push switch, but less contact resistance and less noise. In the conventional design, too, the sliding contacts have to be pressed hard against the fixed contacts. This makes for considerable friction, and to overcome it there has to be a heavy spring to push the slide back when it's released. Our double-sided contacts slide so easily over the fixed contacts that the spring can be much lighter. For example, the SUE switch that our Wizards are assembling on the opposite page needs only 300 grams of finger pressure, while a comparable conventional switch needs 900 grams!

Another noteworthy benefit of our unconventional design is longer life and higher reliability, which makes it typical of all Alps products. Long life and reliability are designed into everything we make, and are further ensured by the total in-house control we exercise over every manufacturing step. That control starts with the selection of raw materials, and continues through tooling, punching and molding. It includes the building of a special machine to make every part of every switch, *and* a special machine to assemble the finished switch. As a result of this control, the number of failures in the 20 million push switches we make every month is astonishingly small.

It is this kind of reliability, combined with constant innovation, that has helped Alps, in the 33 years of its existence, become one of Japan's largest manufacturers of electro-mechanical and electronic equipment and components from television tuners to variable capacitors and variable resistors, from digital impact printers to cassette mechanisms. From our nine factories we meet the stringent demand of OEMs throughout the world.

You will certainly want to know more about us, about our push switches, and about our other products. To make it easier for you to do so, we've provided a coupon which we invite you to fill out and mail today.

☐ Call me to discuss my application

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■ My project volume is:

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Circle 209 on reader service card

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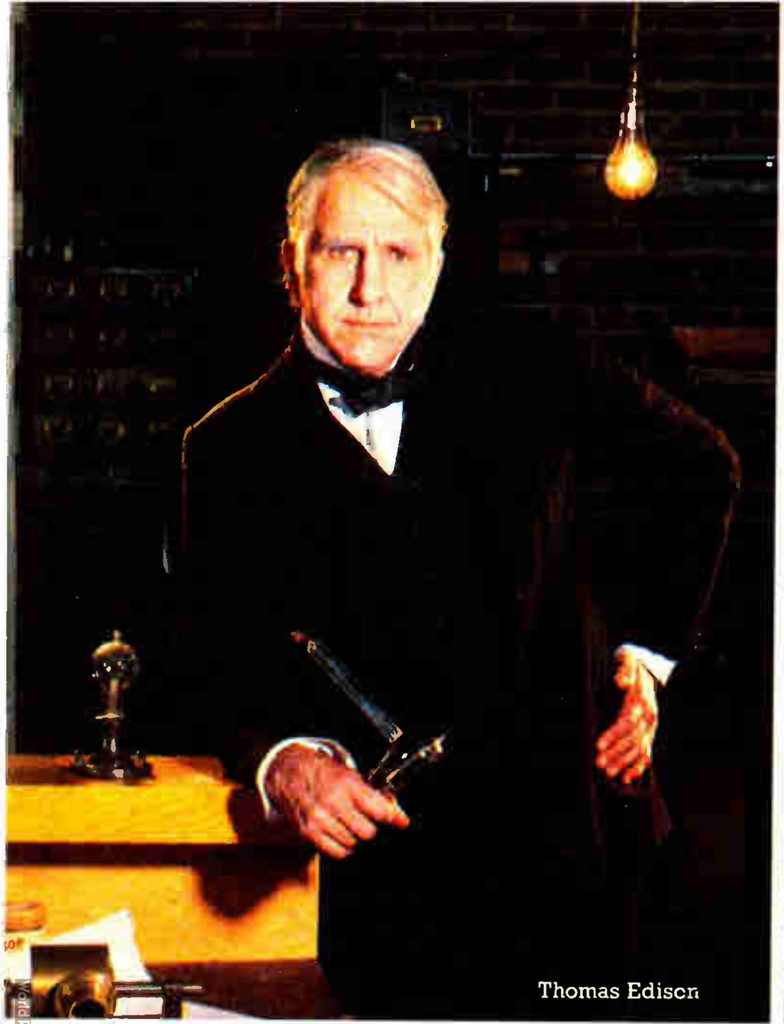
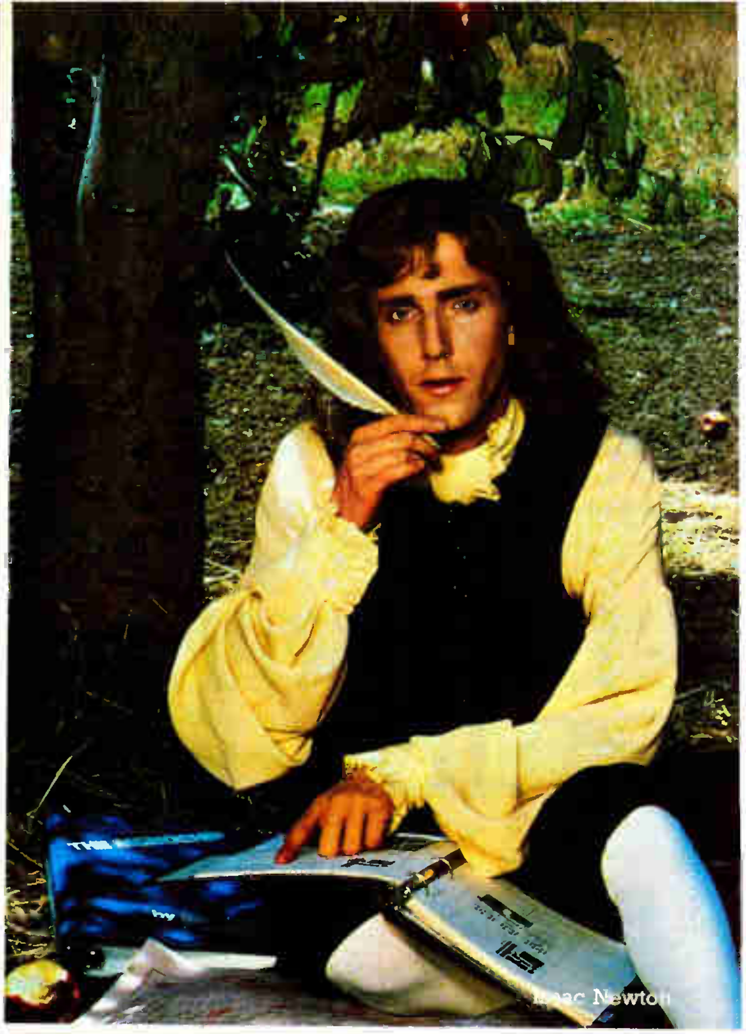
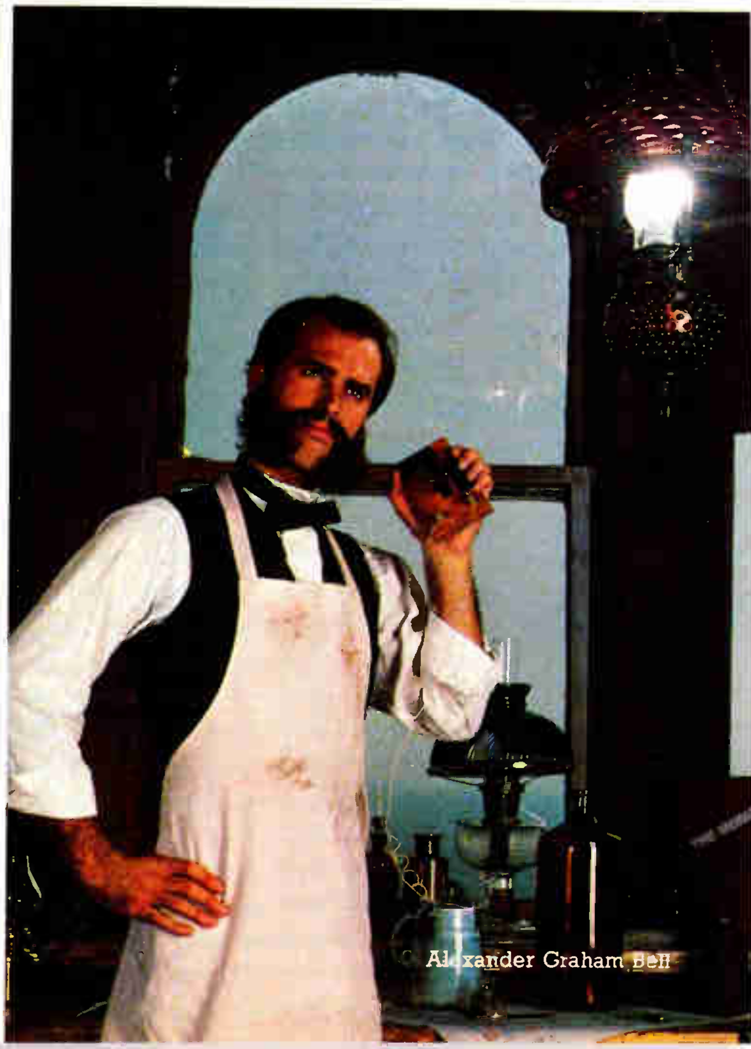

Thomas Edison


Isaac Newton

Leonardo da Vinci


Alexander Graham Bell

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Circle 211 on reader service card

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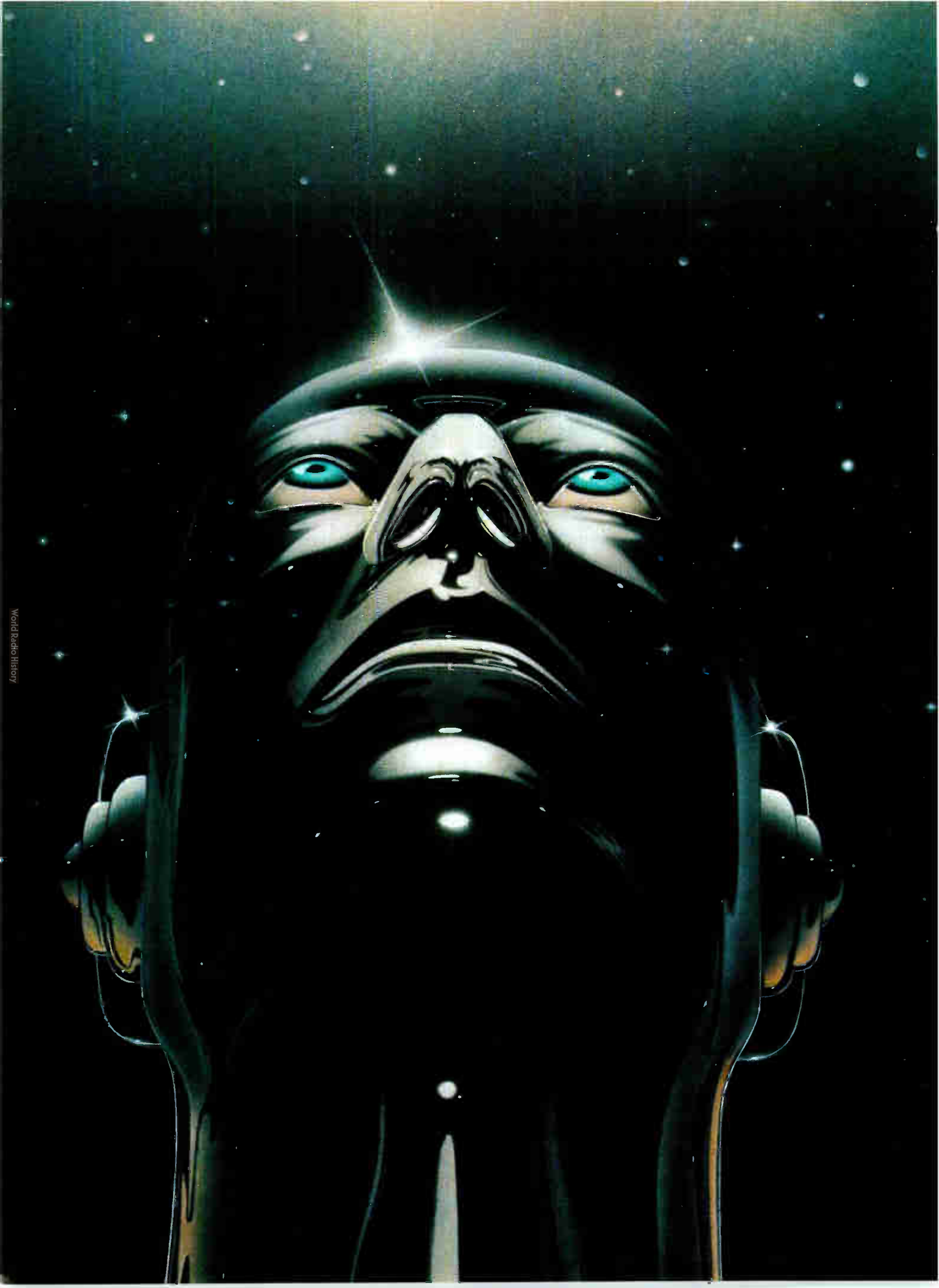

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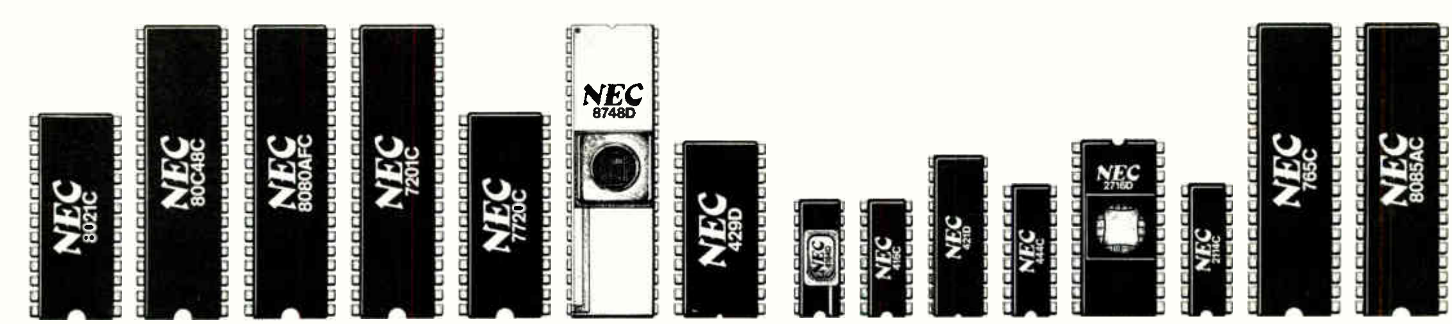

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NCC New products

$20,000 system puts 68000 on Multibus, runs large Fortran 77 programs

In the eyes of many, nothing would be more desirable than a combination of Motorola's 68000 microprocessor with Intel's Multibus (IEEE-P796). A number of Multibus-compatible boards are available to augment the functions of the microcomputer, whereas the 68000 is a powerful 16-bit processor. The use of 64-K random-access memories, subsidiary processors, a 5¼-in. Winchester disk drive, and several software and interface features further enhance the design of the CTS-300 integrated microcomputer system from Codata Systems Corp.

The CTS-300 crams 256-K bytes of RAM onto the same board as the central processing unit, so that the 68000 can take full advantage of the memory's 200-ns access time by using the RAM as a cache. In fact, the 8-MHz version of the 68000 employed can operate at full speed with no wait states at all when using the cache. The processor can directly address up to 2 megabytes of RAM on other Multibus cards. All RAM has parity checking, but not all has error checking and correction.

Compiler. Since so much main memory is directly addressable by the 68000, the CTS-300 can fully implement Fortran 77 with a compiler that costs $450 per copy. The compiler occupies about 100-K bytes of memory and works at speeds of about 7,000 lines per minute. When it becomes available in August, it will be possible to off-load into the CTS-300 from a mainframe any programs coded in Fortran 77, such as those translated from Fortran 4 into Fortran 77 by the compiler released this month for the IBM 370 series. Notes Codata director of marketing Beau Vrolyk, "For the first time, we are offering the user a personal computer capable of running large Fortran programs—and at a very reasonable cost."

A Pascal compiler (also $450 per copy) has been written in the native code of the 68000, and it can be run on the CTS-300. It occupies about 96-K bytes of memory and handles a superset, not subset, of the International Standards Organization's Pascal. Deliveries of the Pascal compiler will begin in June. The CTS-300 can also run a monitor program written in Pascal. "To the user, this monitor looks like Unix," notes Vrolyk. "It has directed I/O and subprocesses, but not concurrent processes."

The 68000 is aided by a series of controllers, each of which has its own 8085 microprocessor. One is a cathode-ray-tube and keyboard controller, with features including inverted video, blinking, underlining, and full cursor addressing. Another is a floppy-disk controller, including direct memory access, multiple-master mode, and a 4-K-byte data buffer for consecutive sector transfers. A separate controller for the Winchester disk drive has features similar to the floppy-disk controller's. The Winchester controller uses the faster Signetics 8X300 controller chip instead of an 8085. Also, there is a

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serial input/output controller that can handle four channels, each of which is a concurrent-interrupt-driven RS-232-C port.

Tape interface. There is also an interface for a nine-track magnetic-tape storage system that can interface with either an Intephase- or Comark-type tape unit, which has a capacity over 10 megabytes using an IBM 45-in./s format.

The CTS-300 comes as an integrated microcomputer system, and the company has yet to decide whether it will make the 68000 CPU board available as a separate product. The system is packaged similarly to Codata's previous products, the CTS-100 and CTS-200, which are Multibus-oriented integrated systems using a Z80A under CP/M and a Z8000 under Xenix, respectively. The system includes a detachable keyboard with 18 programmable function keys, a 9-in. CRT displaying 80 characters by 25 lines, and two 5¼-in. disk drives. Depending upon the configuration ordered, the disk drives may be two double-sided, double-density floppy-disk units containing a total of 696-K bytes or one floppy-disk drive and one Winchester drive. The Winchester drive is the Seagate Technology ST 506 drive, which stores about 6 (unformatted) megabytes. When the Seagate ST 512 drive, with a capacity of about 12 megabytes, becomes available, it will be offered as an alternative to the ST 506.

The Multibus architecture allows multiple processors to be used in a master-slave arrangement, although the CTS-300 is initially configured as a single-user system. The Multibus card cage has nine slots, giving the user the option of adding four Multibus cards of his own for system expansion. The price of the CTS-300 system, with 68000 card and Winchester and floppy-disk drives, is about $20,000. First deliveries will take place this month.

Codata Systems Corp., 285 N. Wolfe Rd., Sunnyvale, Calif. 94086. Phone (408) 735-1744 [421]

1-Mb/s twisted-pair network connects up to 64 devices

Using RS-422 twisted-pair connections rather than coaxial cable, the Corvus Omninet is a low-cost way for 64 devices to share a local network. The types of hardware that may initially be interconnected include Apple 2 and 3, LSI-11, and Onyx computers, as well as any of Corvus's disk drives. Connection of Tandy's TRS-80– and S-100–based computers, as well as the most popular types of printers, will be added in the third quarter. The network will operate at a 1-Mb/s data rate, and each device will gain entry to the network through an interface device called a Transporter.

Appropriately enough, the Transporter operates at the fourth, or transport, level of the International Standards Organization's seven-layered networking highway. The Transporter units are designed around a Motorola 6801 processor and a custom gate array and are priced at $450 for the Apple computers, $600 for Onyx computers, and $750 for Digital Equipment Corp.'s LSI-11s. For the Corvus 5¼- and 8-in. Winchester disk drives, the Transporter unit is integrated into a disk server card, which costs $1,000 and adds security features; first in, first out communication channeling (which Corvus calls "pipes"); and disk spooling to the network. The entire Omninet can also serve as a base for the company's Constellation networking applications software, which operates at ISO levels five through seven.

The Transporters also include a unique structure for dismantling packets and demultiplexing. Using a direct-memory-access transfer technique and operating on the fly, the Transporter can separate a received data packet into two portions, such as status information and data, and transfer it directly into the main memory of the attached computer. It does this with only one small buffer, a 3-byte FIFO.

Almost virtual. Like other local network offerings such as those by Nestar, Ungermann-Bass, Zilog, and Xerox, Omninet is a carrier-sensing multiple-access system. It is different, however, in that it does not use collision-detection routines. The Corvus Omninet uses a DMA-transfer architecture based on "microvirtual circuits," a new term coined by Corvus. Notes Omninet project manager Phil Belanger, "This is more than a datagram, yet not quite a real virtual circuit." The difference is that the Omninet does not weed out extraneous packets, and it does not have all the security features of a true virtual circuit.

What it does have is a system of low-level acknowledgments, which are different types of packets from those that carry data. The network specification calls for a maximum interval of 15 μs between the time a data packet is put onto the net and the time an acknowledgment of that packet must start back to the sender. If it does not arrive within the time window, the data packet is retransmitted. The acknowledgment packet is given a higher priority than a data packet, unlike other packet schemes in which all packets are treated equally. "With our method, we can guarantee the arrival order of the data packets without requiring extensive packet-tracking overhead," adds engineering vice president Mark Hahn.

Although it does not maintain extensive collision-detection circuitry, Omninet has two methods for avoiding collisions. The first is a method that Corvus calls a "software level of randomness," which enters data packets into the net according to random numbers assigned to and based on the number (from 1 to 64) of the sending network member. The Transporters keep track of the number of collisions that have occurred recently on

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468 Portable Oscilloscope

A new standard in digital storage.

10 MHz storage in a 100 MHz oscilloscope.

The powerful, portable 468.

Storage that's easy to use. Check the front panel. Controls are familiar, comfortable: VOLTS/DIV, TIME/DIV, VERT MODE... But the 468 gives you digital storage — with displays that don't fade, bright traces of single-shot events, unlimited storage time — digital storage at the touch of a button.

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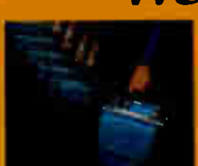

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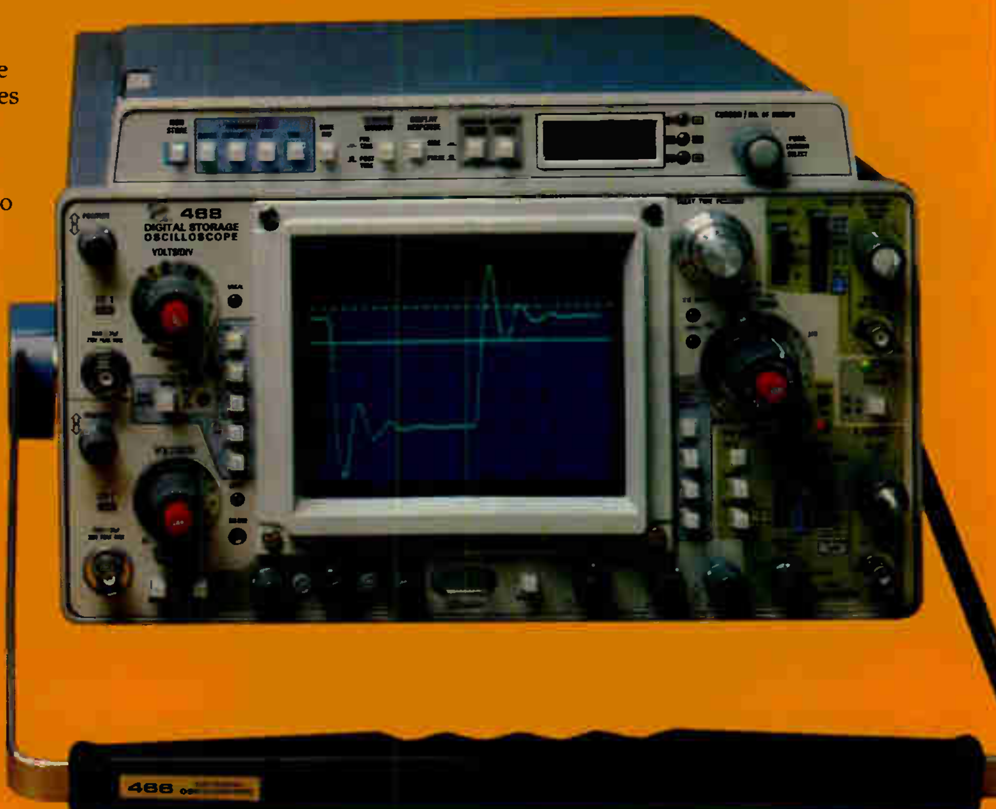

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World Radio History

the net, and when the collision rate grows larger, the randomness factor is increased to a longer interval.

The second method is implemented in the carrier-sensing hardware in the Transporter units, which makes decisions about bus traffic within a 100-ns time frame. The overall reduction in collision-avoidance circuitry allows the Transporter to implement the physical link and the data link of an RS-422 connection using only two chips—the SN75174 and SN75175 transceivers from Texas Instruments.

The data packets used in the Corvus network are also different in that they are of variable length. "The actual limit in length of a data packet is 2-K bytes, but as a matter of policy we are starting out using only up to 600 bytes," notes Hahn. He adds that, as Xerox has done with Ethernet, Corvus is willing to license Omninet at a very reasonable cost.

Corvus Systems Inc., 2020 O'Toole Ave., San Jose, Calif. 95131. Phone (408) 946-7700 [427]

10-megabyte 5¼-in. Winchester accesses in 25 milliseconds

The first 5¼-in. Winchester disk drives started to roll out in quantity as recently as late last year. But already the microcomputer market gives signs of demanding more performance and added features from the inrush of new entries.

One such is the initial Winchester family from floppy specialist Micro Peripherals Inc., which is slotting what it calls its Super Micro Winchester into desktop microsystems, where multitasking applications increasingly call the play. "Multitasking requires a 10-megabyte capacity and faster access than is yet available on other 5¼-in. Winchesters," says company president P. S. Sidhu.

The MPI model 10 has a 10-megabyte formatted capacity (12.06 megabytes unformatted) and an average access time of 25 ms. Its data-transfer rate, another key speed measurement, is 5 Mb/s. Sidhu claims the model 10 operates up to three times faster than other announced 5¼-in. Winchesters.

Higher densities are achieved through the proprietary design of an on-board microcontroller for open-loop track reading and head positioning, Sidhu claims. Track-to-track access time for the drive is 3 ms. Additionally, the microcontroller directs the thermal-compensation and air-filtration system that makes use possible in most environments.

MPI's drive is compatible with Shugart SA-1000 and Seagate ST-506 interfaces. It has a track density of 371 tracks/in. and a bit density of 8,000 b/in. The small Winchester is rated at a 10,000-h mean time between failures, with a mean time for repair of 30 min. The hard (uncorrectable) read error rate is given as 10^{-12}, and the soft read error rate is 10^{-10}. The unit is shock-mounted and uses only 30 W.

Future members of the MPI family will have 20 and 40 megabytes of formatted capacity (24 and 48 unformatted), and each drive will fit the slot of a standard 5¼-in. floppy-disk drive. The model 10 will sell for less than $1,000 in quantity, with evaluation units expected to be ready in September.

Micro Peripherals Inc., 9754 Deering Ave., Chatsworth, Calif. 91311 [430]

Terminal recognizes voice, keyed inputs

Interstate Electronics Corp. is tying its established voice-recognition board to a terminal to make a unit

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We've extended the capacitance ranges of our NPO Ceramic Capacitors

(And reduced the prices)

Vitramon, Incorporated has taken a bold step to curb inflation and lower your component costs.

We've increased the capacitance ranges of our NPO monolithic ceramic chip and "VP" Radial-lead Capacitors — and reduced prices below 1980 levels. (So you'll receive more capacitance for your money.)

A new, high-quality dielectric system has enabled us to increase the capacitance ranges from 50% to 160% on our 11 body sizes of "VEE JEM" NPO Chip Capacitors. The versatile "VP" Ceramic Capacitor series is also available with similar capacitance increases.

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The NPO is the most stable dielectric used in monolithic ceramic capacitors: a 0 ± 30 ppm / °C T.C., a maximum dissipation factor of 0.1% — virtually no capacitance change when subjected to voltage, frequency, temperature or time.

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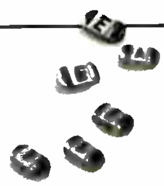
You'll find it hard to beat our combination of extremely high quality, increased capacitance and lower pricing.

Type	Part No.	Vdc	Old Range (pF)	New Range (pF)
"VP" Radial-Lead	VP12	100	1-1800	1-3900
	VP12	50	2000-3900	100-4700
	VP22	100	180-1800	10-3900
	VP22	50	2400-3900	180-5600
	VP23	100	2400-10,000	4700-15,000
	VP23	50	11,000-15,000	4700-22,000
CHIP	VJ0504		10-150	1-390
	VJ0805		1-680	1-1000
	VJ0905		10-680	1-1200
	VJ0907		620-1100	10-1800
	VJ1505		680-1300	47-2200
	VJ1805		620-1600	180-2700
	VJ1210		1300-3900	220-4700
	VJ1808		1500-3900	680-5600
	VJ1812		1500-6800	470-.01 μF
	VJ2321		6200-15,000	1200-.022 μF
	VJ2224		6800-18,000	1200-.027 μF



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Circle 219 on reader service card

World Radio History

that responds to both keyboard and voice inputs. According to the firm, it makes only one mistake per 100 words of voice input, on average, once trained to a speaker's voice.

The intelligent terminal, dubbed the VRT 101, will have a speaker-dependent vocabulary with a maximum of 100 words at any given time, or for each menu function. Total vocabulary is limited by disk-storage capacity.

The Z80-based terminal has a 48-K-byte main memory. A 100-K-byte, 5¼-in. floppy-disk drive is standard, and up to four floppy drives can be added. The terminal screen displays 24 80-character lines, and two RS-232-C ports provide 9,600-b/s serial communication.

The unit uses the CP/M operating system, so a wide range of applications software is available. The standard system also includes voice-utility software, for uploading and downloading patterns and training the system to each speaker's voice. The program displays each word on the screen, and the user repeats it until the system determines it has the necessary pattern to recognize that person's voice for future uses. The utility program also handles editing and generates ASCII strings from voice input.

The VRT 101 uses either a handheld or headset microphone; a noise-cancellation microphone is available for noisy environments. The system also has a four-level volume control, so that the user can vary his or her distance from the microphone. Inputs from the microphone or keyboard are handled by the system in the same manner.

The firm sees the market opening up for the voice-recognition products this year and expects the VRT 101 to find use as a voice-recognition evaluation system and in end-user applications such as computer-aided design and manufacture, word processing, and data entry. Firm pricing is not yet set but is said to be approximately $5,000. Delivery is set for the third quarter.

Interstate Electronics Corp., 1001 E. Ball Rd., Anaheim, Calif. 92803. Phone (714) 635-7210 [423]

1-MHz, 8-bit merged-MOS microcomputer runs on 15 mW, comes in chip-carrier

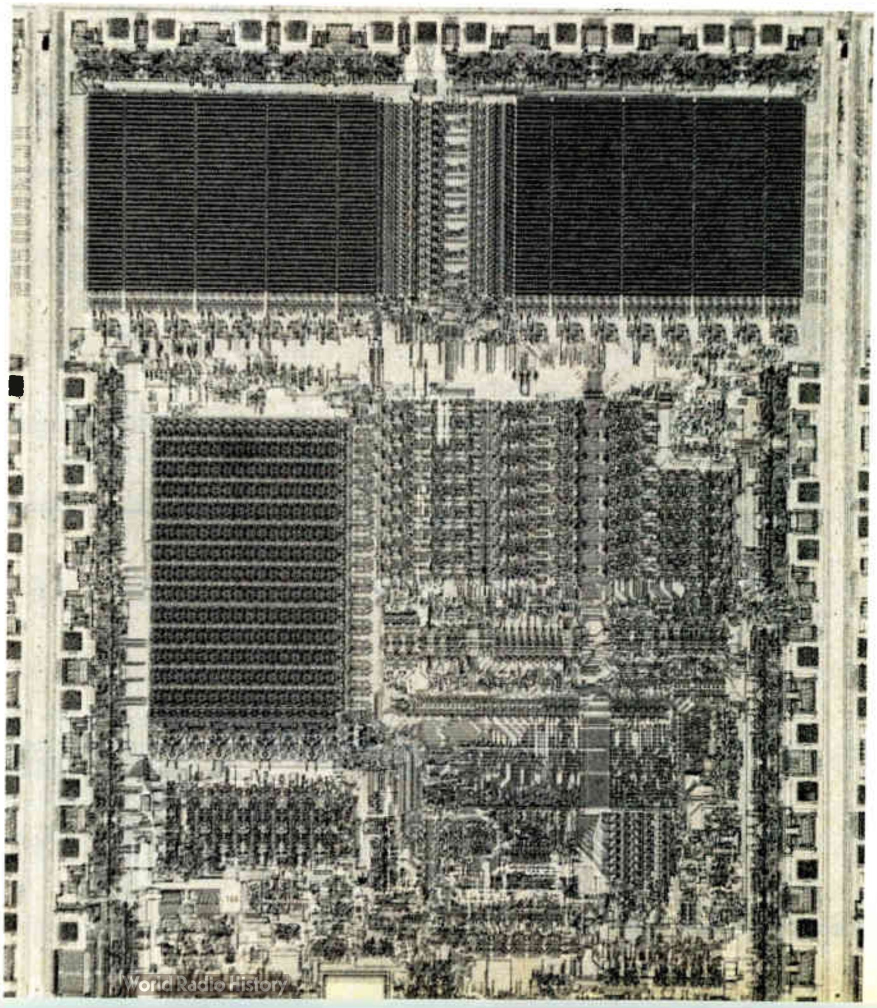
Motorola is calling the 8-bit MC146805G2 microcomputer a complementary-MOS device even though only about 30% of it is actually C-MOS. The merged-MOS approach in this case has yielded a balance between n-channel and p-channel MOS that is "not the 50-50 proportion that you often see," says G. Wesly Patterson, head of the firm's 8-bit microprocessor operation in Austin, Texas.

"For example, in the memory area, we are using predominantly n-MOS. The proportion of p-channel devices is very low. And in the control logic section we are using conventional C-MOS design almost entirely because we want it to have very low static power—or very low power, period."

The G2 microcomputer, which is priced at $22.25 each in lots of 1,000, combines the firm's MC146805E2 C-MOS microprocessor with 2.2-K bytes of read-only memory. The E2 is a bus-oriented device that misses single-chip computer status only because of the absence of ROM.

Capitalizing on merged-MOS's density and low-power advantages, Motorola plans to use the G2 microcomputer to spearhead a drive to market C-MOS processors in leadless chip-carriers. This is part of a thrust into portable applications.

To keep the chip small, the decimal adjustment module and the B accumulator were omitted on the G2. Aside from the B accumulator instructions, the G2's instruction set



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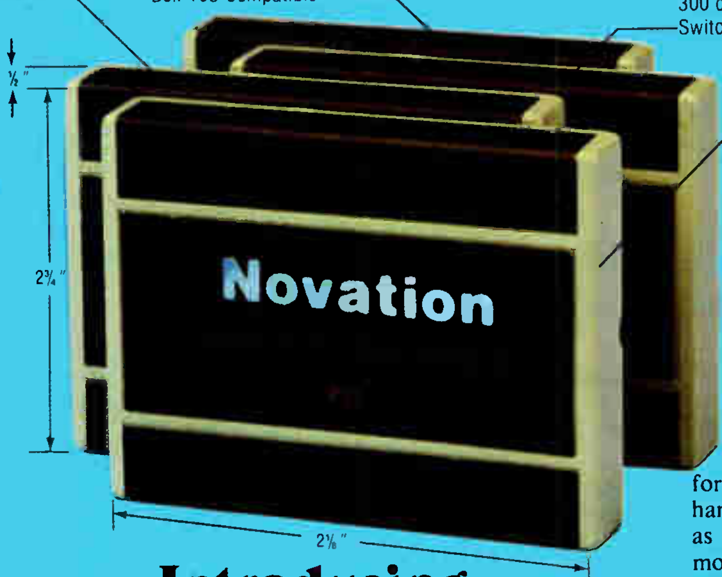

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is the same as the 6800's. Patterson says the accumulator was not needed in the G2's applications.

The 40-pin device runs at dc to 1.0 MHz using a 3- to 6-V supply. With a 5-V supply, typical operating power consumption is 15 mW. In its low-power modes, the device has a range of 0.1 to 3 mW.

The single-chip system is truly static and contains 112 bytes of random-access memory. It will branch on condition on any RAM bit or input/output pin, of which there are 32. Of the I/O lines, 4 drive 10 mA for light-emitting-diode displays, 12 drive 2 mA, and 16 drive two low-power Schottky TTL loads. The timer has an 8-bit programmable counter, a 7-bit programmable prescaler, and three input modes: external, internal, and gated-clock. Other G2 features include a 6-bit stack pointer, an 8-bit index regulator, a 13-bit program counter, and a 5-bit condition-code register. The G2's self-testing checks all addressing modes, most of the instructions, and the basic operation of RAM, ROM, ports, and timer.

The MC14685G2 will be available right after the NCC.

Motorola Inc., 3501 Ed Bluestein Blvd., Austin, Texas 72721 [422]

Portable data-entry terminal has full alphanumeric keyboard

With a typewriterlike keyboard, a built-in 40-column dot-matrix printer, a two-line liquid-crystal display, and prompting software, the portable series 400 Alpha-verter from the Digitronics division of Comtec Information Systems Inc. is almost a communicating small computer. But the Cumberland, R. I., firm calls it a data-entry terminal and is pricing it accordingly: in original-equipment-manufacturer lots, the 400 would cost $2,995.

The Alpha-verter is an extension of Digitronics' numeric-only Portaverter data-entry line and offers users a growth path of more capabilities as their applications become more complex. It also offers communications at 1,200 b/s in batch mode or 300 b/s in interactive situations. The unit uses either its built-in acoustic coupler or an RS-232–compatible direct-wire connection.

The 400 has a standard typewriter keyboard layout with an additional embedded calculator keyboard. It also stores data on tape through a removable 97,000-character cartridge.

The system is built around an Intel 8085 microprocessor, firmware stored in programmable read-only memory, and about 4-K bytes of random-access memory, the latter being partially used by 16 separate accumulators.

Options include optical-character-recognition and bar-code scanners, a ticket punch and reader, check-digit verification, a variety of form printers, and a tape-storage enhancement allowing up to 150,000 characters to be stored.

Digitronics' Glenn F. Bowgren, vice president and director of marketing, expects the unit to fill applications in remote data entry, data manipulation, and communications. "The 400 is almost ideal for go-anywhere data input/output," he says. Its array of accumulators and function keys aids the capture of various data types and their quick characterization.

Routines. The 400's programming is simple, but can branch, prompt the operator as to the field to be entered, control whether numeric or alphabetic data is required, sequence entries, control field size, carry data from record to record, and perform several other routines.

Bowgren notes that the 400's keyboard design and software suit it to use by non–data-processing personnel—accounting clerks, salesmen, typists, and shop employees. Its environmental specifications suit it to field operation: it operates over a humidity range of 20% to 80% and over a temperature range of 10° to 43°C. Delivery takes 30 days.

Digitronics Division, Comtec Information Systems Inc., 53 John St., Cumberland, R. I. 02864. Phone (401) 724-8500 [424]

8-in. floppy drive has linear positioner

As its entry into the high-density 8-in. floppy disk-drive market, Decitek Corp. is announcing a 1.6-megabyte 8-in. drive compatible with Shugart systems. The new model 8302 is a double-sided, double-density unit with 37% fewer parts than its Shugart competition, according to Decitek—a reduction that the firm claims results in a 50% increase in mean time between failures to 12,000 h.

The unit also has linear-stepper head positioning, microprocessor-driven control and diagnostics, and a price of only $670 in 100 unit lots.

The 8302 is aimed at original-equipment manufacturers and Decitek is gearing its production proportionately. The company plans to build 8,000 drives between now and June and conservatively plans to produce more than 24,000 of them annually. The latter figure will probably grow with the drive market, which is itself expanding at about 45% yearly.

Simple design. To position its read/write heads, Decitek uses a mechanically simple linear stepping motor rather than the more complex rotary stepper. The linear design is said to eliminate much of the mechanical wear caused by head movement during seek operations and as much as 50% of the noise produced by competing units. Decitek claims to have been the first in this market to apply stepper technology to a single-sided floppy-disk drive introduced about one year ago.

The stepper approach allows the company to retain about 95% parts

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The first personal computer for under $200.

The Sinclair ZX80. A complete computer— only $199.95 *plus $5.00 shipping.*

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We've packed the conventional computer onto fewer, more powerful LSI chips—including the Z80A microprocessor, the faster version of the famous Z80. This makes the ZX80 the world's first truly portable computer (6½" x 8½" x 1½" and a mere 12 oz.). The ZX80 also features a touch sensitive, wipe-clean keyboard and a 32-character by 24-line display.

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Your course in computing.

The ZX80 comes complete with its own 128-page guide to computing. The manual is perfect for both novice and expert. For every chapter of theory, there's a chapter of practice. So you learn by doing—not just by reading. It makes learning easy, exciting and enjoyable.

You'll also receive a catalog packed with items that can make your ZX80 even more useful. Including 27 program cassettes, from games and home budgeting for just $6.95, to Sinclair's unique Computer Learning Lab (a workbook, six cassettes with 100 lessons, and two cassettes for storing programs).

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Sinclair's BASIC places no arbitrary restrictions on you—with many other flexible features, such as variable names of any length.

And the computer that can do so much for you now will do even more in the future. Options will include expansion of 1K user memory to 16K, a plug-in 8K floating-point BASIC chip, applications software, and other peripherals.

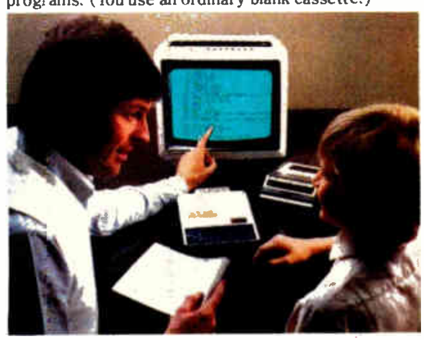
Order your ZX80 now!

The ZX80 is available only by mail from Sinclair, a leading manufacturer of consumer electronics worldwide.

To order by mail, use the coupon below. But for fastest delivery, order by phone and charge to your Master Charge or VISA. The ZX80 is backed by a 10-day money-back guarantee, and a 90-day limited warranty which can be extended by 12 months under Sinclair's extended service program for $25.00.

Price includes TV and cassette connectors, AC adaptor, and 128-page manual.

All you need to use your ZX80 is a standard TV (color or black and white). The ZX80 comes complete with connectors that easily hook up to the antenna terminals of your TV. Also included is a connector for a portable cassette recorder, if you choose to store programs. (You use an ordinary blank cassette.)



The ZX80 is a family learning aid. Children 10 and above will quickly understand the principles of computing—and have fun learning.

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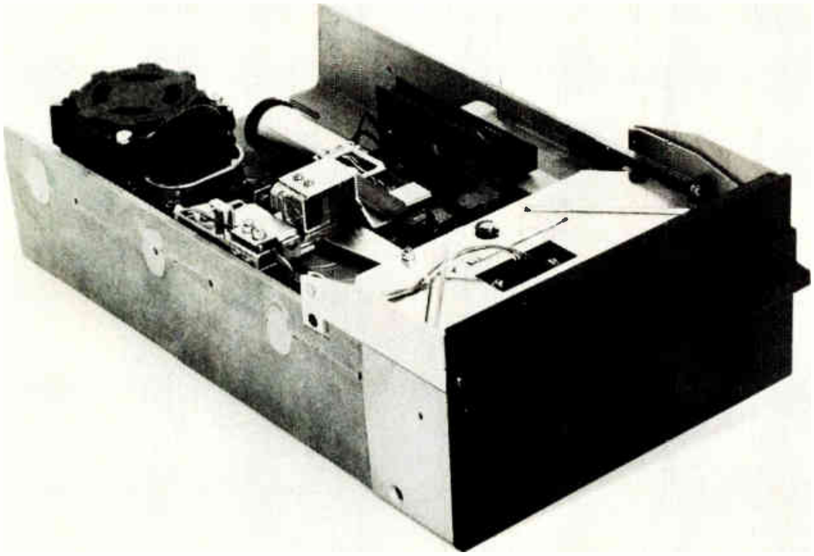

commonality with its earlier drive, thus helping push costs down. A one-piece positioning mechanism is said to eliminate ajustments of head azimuth and penetration.

The entire positioning subassembly may be removed by unscrewing a single screw. This cuts repair time to as little as one-half hour.

All major functions within the drive are microprocessor-controlled, including seek, control, and index or sector mark generation. Diagnostic routines also wring out the drive's mechanism, with faults indicated by a light-emitting diode. The diagnostic package can be run independently of the drive's controller, with the drive in or out of the system.

According to the maker, the 8302 is jumper-compatible with almost all other double-sided, double-density floppy disks now available. With a total of 154 tracks, it reaches its designed storage density of 1.6 megabytes in hard-sectored format. The data-transfer rate reaches 500 kb/s; seek time is about 3 ms, track to track, with a settling time of about 15 ms. Latency time is about 83 ms and average access time about 174 ms. Delivery is immediate.

Decitek Corp., 129 Flanders Rd., Westboro, Mass. 01581. Phone (617) 366-8334 [431]

Floppy disk stores up to 2 megabytes

The 1117 family of 5¼-in. floppy-disk drives from Micropolis uses special disks made by Dysan Corp. of Santa Clara, Calif., and a narrow head gap to double the standard "quad" density to up to 2 megabytes. The 100-μin. head gap used in other Micropolis drives has been reduced to a proprietary length of from 50 to 70 μin. The gap width remains at 6,200 μin. Capacity of the doubled-sided 96-track/in. model is 2 megabytes; the 100-track/in. drive stores 1.92 megabytes.

The drives' heads are supplied by Nortronics Inc. of Minneapolis. The Dysan medium used achieves 12,000 flux changes per inch and comes in single- and double-sided versions.

In order to ruggedize the system and provide the necessary speed, temperature, and alignment stability to double storage density, the firm is going from stamped-steel construc-

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FEATURES:
- Miniature sealed "DIP" package.
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- Wide range of operating voltages.
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- Isolation: 1000 vrms.
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Four basic types of relays come with a variety of coil ratings and features:
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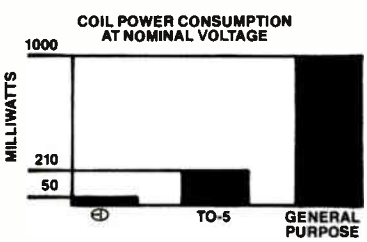
Applications include interfaces with TTL and CMOS logic and power circuits, telecommunication-loop sensors, transreceivers, attenuators and test equipment.



For complete information, contact Electrodyne, the people who pioneered the first balanced armature electromechanical "DIP" relay.

ELECTRODYNE, INC.
11200 S.E. 21st Street, Milwaukie, Oregon 97222
Phone (503) 654-0711

tion to die casting. Two Micropolis standards are retained, however: lead-screw positioners are used rather than the widely applied band positioners, and the stepper motor still makes a 30°-per-step movement to access the tracks. Some changes were made in the electronics that handle reading and writing.

The mounting form factor is Shugart-compatible. In 100-unit lots, both drives sell for $342 (single-sided) and $376 (doubled-sided).

Delivery is set for the first quarter of 1982.

Micropolis Corp., 21329 Nordhoff St., Chatsworth, Calif. 91311. Phone (213) 709-3300 [432]

Control and display unit is suited to harsh environments

A low-cost control and display unit features simplified data entry for monitoring, control, and data-acquisition system applications that do not require a full ASCII keyboard. The CD/20 from Termiflex has a 24-key, tactile-response membrane pad that suits the unit particularly to harsh operating environments. Weighing in at only 10 oz, the CD/20 can act as a hand-held terminal as well as mount on a control panel or desk. In 500-unit lots, it costs $245.

The unit permits single-stroke entry of numerical data, as well as special function codes whose identity system designers can customize by means of software modifications and lookup tables at a host computer. As an option, Termiflex will customize the unit's keypad to show the symbols that are most familiar for a particular application.

The CD/20 communicates with a host computer in bit-serial asynchronous ASCII format at rates of 300, 1,200, or 9,600 b/s. The unit comes with a standard RS-232-C interface; RS-422 20-mA current-loop or TTL interfaces are optional. Full-duplex communication is standard on the unit, half-duplex is optional.

Light-emitting diodes display a single 16-character line of alphanumeric data using a standard 96-character ASCII set. In addition, four light-emitting diodes indicate operating status. Both display forms can be shown in flashing lights to indicate special status conditions. The CD/20 control device also contains a 16-character display buffer.

The unit measures approximately 7 by 4 by 1.5 in. It has an operating temperature range of −18° to +50°C, operates from a single +5-V dc power supply using a maximum of 500 mA, and comes with a standard connector and 6-ft cable. Delivery takes 60 days.

Termiflex Corp., 17 Airport Rd., Nashua, N. H. 03063. NCC booth 1350 [425]

Protocol converter runs at 50 kb/s

The BAC 2780SR series 2 bisynchronous-to-asynchronous protocol converter allows users to emulate IBM equipment. KMW Systems Corp., which has primarily addressed end-user needs for protocol converters in graphics applications, has recently redesigned its converters, packing onto a single board circuitry

Cortron announces a solid state keyboard at "bare bones" prices.

Solid state intelligent keyboard for only $45

If you are considering a low cost type keyboard, have we got an offer for you. The Cortron® CP-4550 Keyboard is a high quality, solid state, intelligent keyboard with full microprocessor capabilities.

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Long-life, highly reliable keyswitch

We've designed a keyswitch with an exceptional, true linear feel. It's also environmentally superior to foam pad design approaches. The keyswitch uses the full line of impressive Cortron keytops. All of this with a life test rating in excess of 100 million cycles.

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that handles the same load as an earlier eight-board configuration from the firm.

The older box-level product is 9 by 21 by 15 in. in size, weighs 40 lb, and costs $3,950; the new version is priced at $1,495 in single units and is smaller, at 6 by 12 by 15 in. and 8 lb. The new converter uses piggyback interface modules and a Z80 microprocessor; it operates at 50 kb/s, compared with a maximum 19.2 kb/s for the 8080-based older unit.

KMW had been buying the boards for its protocol converter but will manufacture the new board itself. According to Fred Klingensmith, vice president of marketing for the firm, a board-level product will be offered separately as well as boxed.

The company plans to expand the board line beyond the IBM emulator to include similar protocol converters for customers using Sperry Univac, Honeywell, and Control Data Corp. equipment. The BAC 2780SR series 2 boxed protocol converter will be available in June. The company has not yet established prices for the new board, but it plans to start delivery in July.

KMW Systems Corp., 8307 Highway 71 West, Austin, Texas 78735. Phone (512) 288-1453 [426]

Band printer puts out 1,500 lines per minute

For its first band printer, Dataproducts Corp. has pushed printing speeds to higher rates—a maximum of 1,500 lines/min—than normally reached by such units. The BP-1500 operates at this rate with a 48-character set, 1,200 lines/min with 64 characters, and 900 lines/min with 96 characters.

"At 1,500 lines per minute, the BP-1500 prints an average page in 1.5 seconds," says Robert J. Pieper, marketing vice president. "This speed makes the printer ideal for medium- and large-system builders seeking high-volume output devices," he adds. Dataproducts is targeting such users who previously had to pass up inherently very reliable band-type devices that work mostly in the 300-to-900-line/min range.

With fewer moving parts than drum-based printers (although both employ impact hammers), band devices operate longer without repair and are less expensive. The Dataproducts unit has an increased duty cycle of 60% to 75%, up from 25% for volume printing requirements. It will be useful in data-processing centers, remote batch-terminal applications, and in large distributed-processing modules, Pieper notes.

Other BP-1500 specifications include a paper slewing speed of 50 in./s and 14 ms to advance a single line. The company's parallel interface has a full-line (optionally expandable) buffer.

The BP-1500 can make five copies of a form in addition to the original. Fan-folded edge-perforated continuous forms can range from 3.5 to 18.75 in. wide. Character spacing is 10 to the inch and line spacing is either 6 or 8 lines/in., switch-selectable. The printer runs on seven voltage levels from 100 to 240 V (+10%, −15%) at a frequency of 47 to 63 Hz. It uses a maximum of 1,100 W.

The printer has features also

Call one of our design engineers. They're idea men—the men who helped create what is now the largest and best line of P/C connectors around. That's a lot of connectors. More important, that's a lot of experience. And it's experience that's yours for the asking. Do ask.

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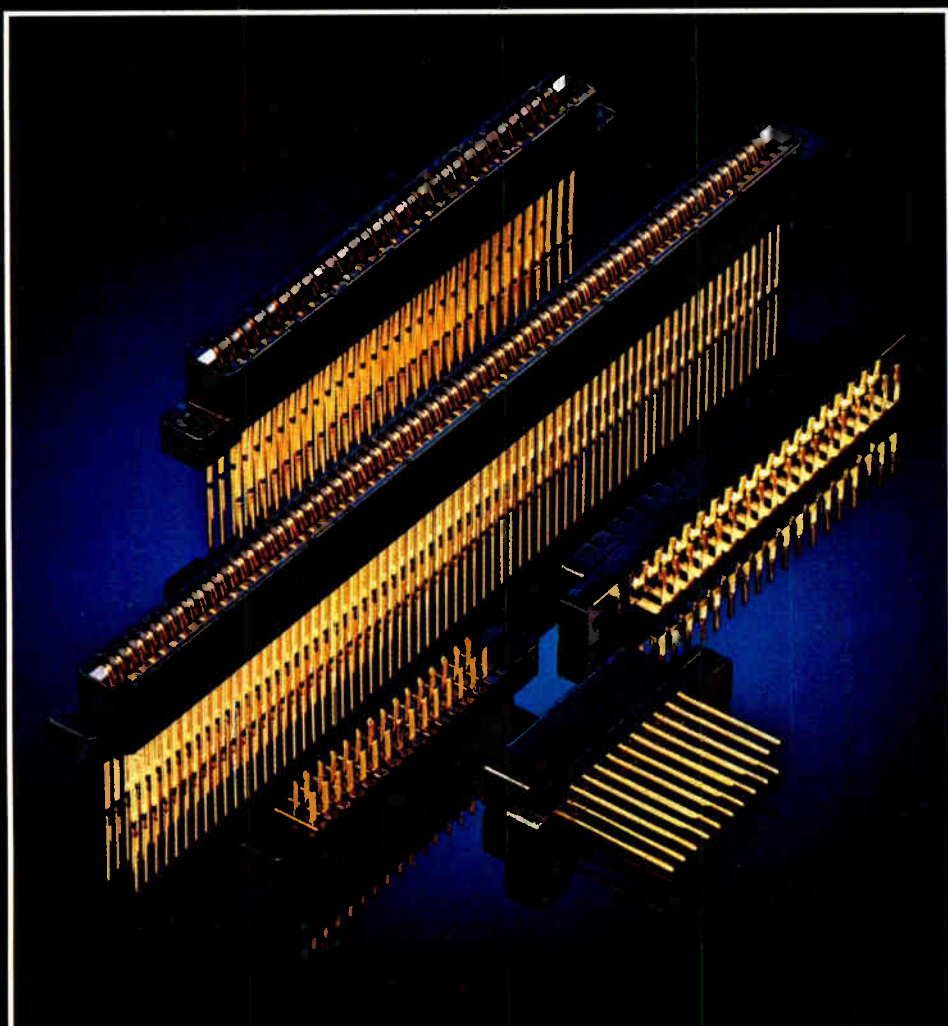

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KeyTek systems include everything necessary—energy source, pulse-forming networks, operating controls, digital readout of peak surge values, complete safety interlocking and fully-engineered surge coupling to active 15A and 30A ac and dc power lines.

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- **Systems can be expanded to meet most industry specs, including CCITT, IEC, FCC, UL, SAE and others.**

KeyTek offers a broad range of equipment, from basic, low-cost "kickers" to sophisticated automated systems. Modular design permits limited initial investment, future expansion with your testing needs.

Write or call for complete data on KeyTek's new 711 Series.

KeyTek
INSTRUMENT CORPORATION
12 Cambridge St. • Burlington, MA 01803
(617) 272-5170

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incorporated in the company's established B series medium-speed printer line, among them diagnostic and status indicators that help cut downtime by giving detailed reports about the microprocessor and system interlocks that control overall operation. The control panel has a built-in tester with switching to 80- or 132-column multiple test patterns.

Two sensors that monitor paper supply and paper and ribbon motion make possible operation without continuous overseeing by an operator. Servicing has been simplified by self-contained hammer-flight timing circuitry that tolerates a lower level of skill in maintenance technicians, the company says. The hammer system is the 132 mark V type.

As standard features, it has forms-thickness adjustments, a paper puller, four forms tractors, single-cycle print control, and a universal power supply. Available as options are a power stacker, a quieting cabinet, a forms-length–selection switch, and a 12-channel paper-tape punch.

The BP-1500's dimensions are: height, 49 in.; width, 35.5 in.; and depth, 29.5 in. with paper puller removed, 38.5 in. with attached pullers. It weighs 440 lb. First of a new family of Dataproducts band printers, it sells for $16.700 singly.

Dataproducts Corp., 6200 Canoga Ave., Woodland Hills, Calif. 91365. Phone (213) 887-8451 [433]

600-line/min band printer performs complete self-testing

Centronics Data Computer Corp.'s new LP-series band printers are said to be plug-compatible with most Digital Equipment Corp. and Data General computers, plus IBM's Series/1 system. The 600-line-per-minute devices include operator-activated self-testing and built-in micro-

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Now, Racal-Vadic has invisible dual and triple modems.

They're packaged inside TEXAS INSTRUMENTS' *Silent 700** 780 Series Data Terminals.

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When Texas Instruments designed the 780 Series of 120 character-per-second data terminals, Racal-Vadic was asked to solve a difficult engineering and packaging problem.

The requirement was for modems on a PC card that would operate full duplex at both 1200 & 300 bps; be compatible with Racal-Vadic's VA3400 and Bell 212A & 103 type modems; operate as a direct-connect modem or as an acoustic coupler; yet be small enough to fit inside TI's portable data terminals. An incredibly tough problem. But Racal-Vadic solved it.

Today...

Texas Instruments' Model 785 Portable Data Terminal includes a micro-processor controlled DUAL originate-only, acoustically coupled modem that operates at 1200 & 300 bps full duplex, and is compatible with Racal-Vadic's VA3400 & Bell's 103.

The modem for the TI Model 787 Portable Communications Data Terminal presented an even tougher challenge. The result is a full originate/answer TRIPLE modem that is direct-connect to the switched network (with an acoustic coupler option), and is compatible with Bell's 212A, 103, and Racal-Vadic's 3400 Series.

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processor electronics to aid both operation and diagnostics. Yet they sell for about the same as printers only half as fast, says the company.

One attractive feature should be self-testing at turn-on: by throwing a switch, an operator can generate a test pattern that originates in the printer controller and loops through the entire subsystem, verifying the condition of the printer's electromechanical system, of the controller, and even of the connecting cable.

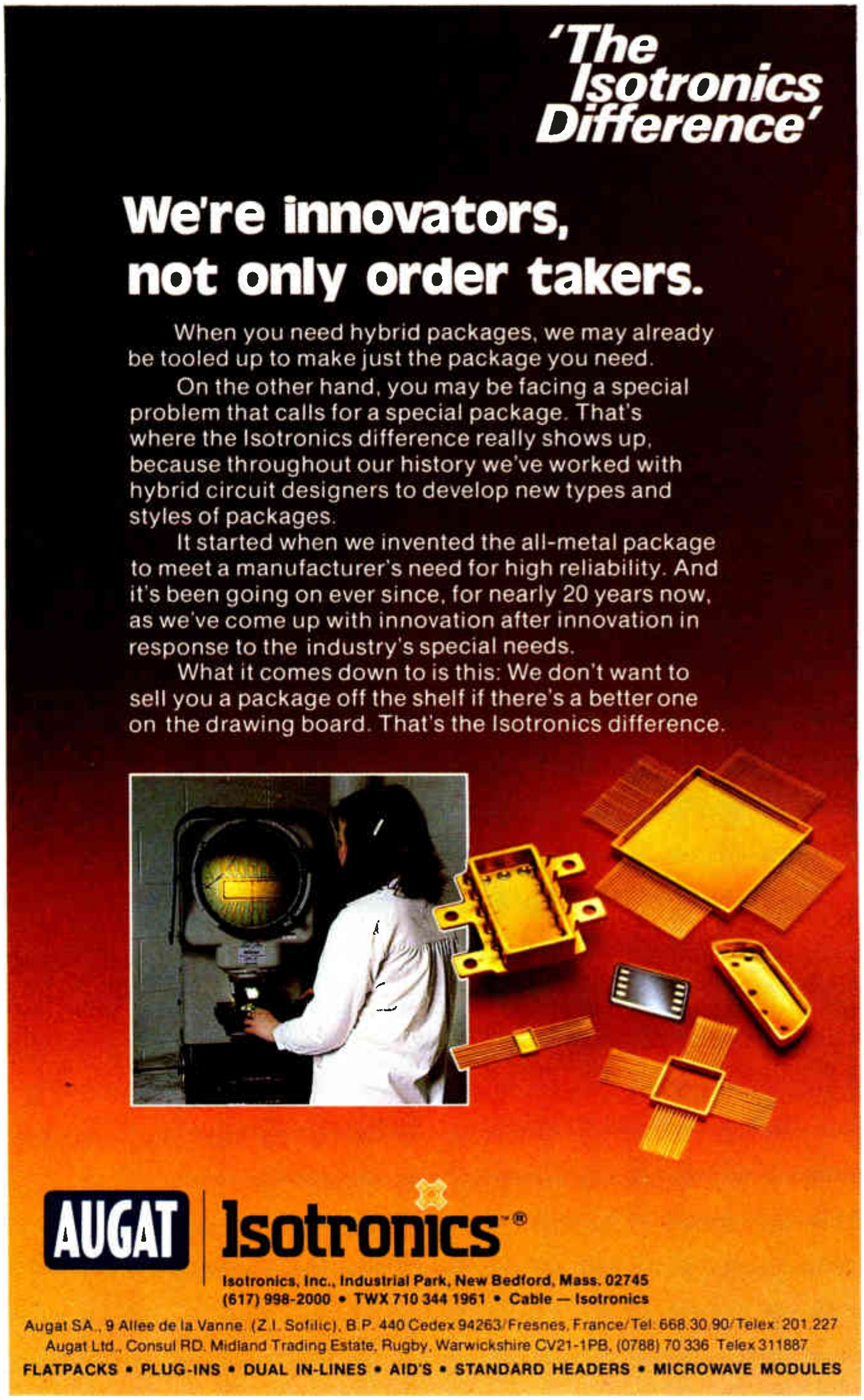
The LP series printers offer a choice of four print bands with 48, 64, 96, and 128 characters. The units have a basic 132-column format with a 10-character/in. pitch and six- or eight-line/in. vertical spacing.

In addition to a pedestal-mount model (LPS) with an open paper path, the company also will offer an acoustically isolated version, the LPQ, said to be capable of reducing ambient noise below 60 dBA in the workplace.

The LP line currently includes interfaces for DEC's PDP- and LSI-11 systems, as well as its VAX-11/780. Units are ready for Data General's Nova and Eclipse systems and for IBM's Series/1 computers.

Prices vary with the interface required and the noise-dampening feature. For example, the single unit price for the least costly LP printer, the pedestal-mounted LPS designed for use with DEC's LSI-11, is $7,525. Prices for units operable with other DEC computers, including the quiet LPQ versions, are within about $1,200 of that figure. Delivery of these units is immediate. IBM-compatible models range in price from $7,950 to $8,900.

Centronics Data Printer Corp., One Wall St., Hudson, N. H. 03041. Phone (603) 883-0111 [434]



Printer has high resolution

Among three dot-matrix printers from Anadex is a dual-mode unit said to produce near–letter-quality output intended for text-processing equipment. Two are aimed at small business systems, and all will be available in 1981's second half.

The top model, WP-6000, prints at its best quality at 150 characters/s and 250/s for data processing. It owes its high resolution to an 18-needle head having two vertical rows of 9 needles each. As the rows are slightly offset from each other in the vertical dimension, 18 dots can be printed vertically in a single horizontal pass, appearing as a single straight line.

For graphics, it provides a 144-dot/in. resolution. Paper for the WP-6000 may be either tractor- or

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For instance, our ultra-precision MAR series does all of the above with absolute TC's and tolerances to ±5 ppm/°C, ±.01%. Our smallest discrete uses <.016 in². of PCB space. Complex sets and networks include 16 Bit Binary Ladders, input attenuators and others up to 28 pins.

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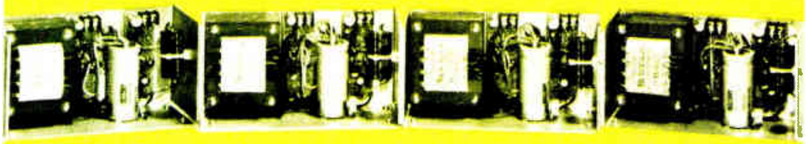

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Electronics Magazine

friction-fed, or a commercially available dual- or single-sheet automatic feeder may be used. The price will be under $1,500 in quantity.

The DP-9600 RO has a conventional seven-by-nine-dot matrix head that makes it capable of 200 characters/s at 10/in. Compressed-print capability ranges from 10 to 16.7/in. The price to original-equipment manufacturers is under $1,300. The DP09600 KSR has the same printing system as the DP-9600 RO, but includes an 80-key alphanumeric keyboard, a separate 10-key numeric keyboard, and editing keys for insertion, deletion, and scrolling of data, as well as moving a cursor.

Display. A 40-character, single line, dot-matrix vacuum fluorescent display and a 4,600-character random-access memory allow the user to compose a message prior to transmitting it. The display can be scrolled in both directions. Integral, nonvolatile memory stores commands for tab, page width and length, and a 30-character "answer-back" message transmitted whenever the printer is interrogated by a computer or remote printer.

All three printers have RS-232-C, current-loop, and parallel interfaces as standard features and provide bidirectional logic-seeking.

Anadex Inc., 9825 DeSoto Ave., Chatsworth, Calif. 91311. Phone (213) 998-8010 [436]

Dot-matrix printer is smart and fast

The model IPS-5000-C dot-matrix printer from Dataroyal will debut at the NCC as the third—and high-end—member of the firm's IPS-5000 series of small-business printers aimed at original-equipment manufacturers. Smarter, faster, and more capable than its predecessors, it "has the flexibility and ruggedness to run and run hard in any small-business or commercial printing application," asserts Dataroyal president Ronald O. Huch.

The printer uses a nine-by-nine-

100MHz, quad-input and dual time base... and that's just for openers!

B&K-PRECISION introduces the new standard for comparison in 100MHz lab scopes. With quadruple-input, *eight-trace display* and dual-time base operation, the 1500 is a no-compromise instrument. Moreover, this "new generation" scope utilizes a combination of new techniques never before applied to oscilloscope design.

The quad-input capability itself sets the 1500 apart from other scopes in its price class. The most common application for quad display is to use channels 3 and 4 as a "trigger view" for channels 1 and 2. Most competitive scopes offer only a single-channel trigger view. Another useful four-trace application is to display four digital signals, as found in microprocessor-based circuits.

Dual time base circuits permit independent operation of the A and B sweep circuits, allowing the 1500 to act like two 100MHz scopes. Signals unrelated in time can be applied to a combination of inputs.

Full delayed-sweep capability is built-in. The delayed signal from any input can be viewed as a second trace or superimposed on the non-delayed signal. Separate intensity controls are provided for the delayed and main time-base signals.

To speed and simplify operation, all function switching on the 1500 is performed by soft-touch lighted push buttons. When one of the function buttons is pressed, an LED illuminates the button confirming the change in scope operation. A non-volatile RAM retains the last function switch setting—even when power is removed.

A significant weight reduction was achieved by designing in a high efficiency switching power supply. Weighing only 16.5 pounds the 1500 is much lighter than other portable lab scopes. In fact, the most nearly comparable scope weighs 50% more!

Like other B&K-PRECISION products, the 1500 is available for delivery at local distributors. For the name of your nearest distributor or complete product specs, call 800/621-4627 toll-free.

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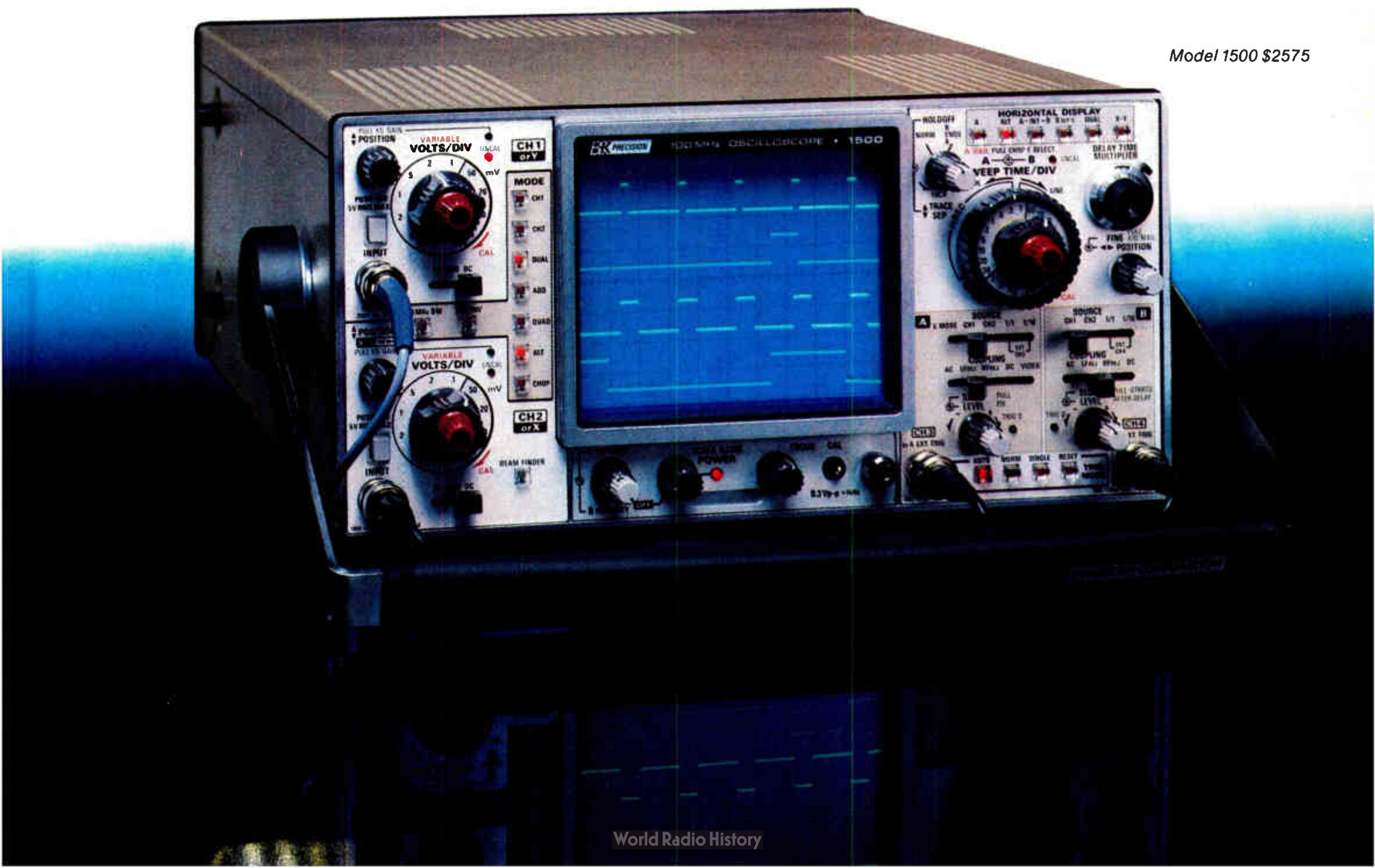

Model 1500 $2575

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Home grown

Opcoa is very picky when it comes to LED lamps.

Opcoa grows their own Gallium Phosphide LED lamp material from seed . . . processes, tests, matches and temperature cycles *all* their LED lamps. In fact, all Opcoa lamps are subjected to the toughest five-cycle temperature test (−40°C to +100°C) in the business before they're measured for electro-optical specifications.

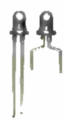
No matter which LED lamp you need, Opcoa can assure you of the best quality and reliability; highest intensity and efficiency; lowest power requirements . . . in a variety of colors, packages and viewing angle types—all at competitive prices.

T 1-3/4 LST Series with rugged epoxy lenses provides high brightness in orange, red, green or yellow. Choose long or short dome sizes. Well-suited for wide angle and high-intensity applications.

Bi-Color T 1-3/4 & T 1 Series offered in red/red, green/red, green/green, green/orange, green/yellow, orange/orange & yellow/yellow combinations. Ideal for stop/go, up/down, right/left and other dual status indications.

Solid State T1 OPL Series offered in four colors with flange or flangeless designs, long or short dome sizes. These high-efficiency lamps are just right for pc board mounting (clips available).

Mini T 3/4 LLL Series in four colors features fully-illuminated .090" diameter lens, .150" overall height and .120" base flange diameter. These are the smallest illuminators or indicators available for pc board mounting.



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dot matrix and comes in both 80- and 136-column versions. It bidirectionally prints a full 96-character ASCII set at 165 characters per second; for condensed printing, it speeds up to 285 characters/s. It features seven different print styles that are selectable from front-panel switches. Optionally available are seven selectable foreign-language character sets. The printer also has a standard graphics package that uses full-pin dots and full-dot definition; graphics printing is unidirectional.

Expandable memory. The IPS-5000-C has up to 12-K bytes of erasable programmable read-only memory and 4-K bytes of random-access memory. The printer's 500-character first-in, first-out buffer optionally expands to a maximum of 2,000 characters. A direct-memory-access architecture makes the IPS-5000-C an upwardly mobile unit with the potential for unlimited memory expansion, Huch says. This potential, he points out, enables the printer to take on additional print features and character sets or to handle complex communications protocols.

The unit uses a continuous-feed tractor and can handle up to five copies plus an original on paper or business forms. It boasts a high degree of reliability, with a mean time between failures of 1,500 h at 100% duty cycles.

Standard features on the IPS-5000-C include analysis that points out transmission errors, a self-test program, selectable line spacing of 6 or 8 lines/in., and programmable printing for paper lengths of up to 18 in. The printer also comes with both a parallel interface and an RS-232-C serial interface, which accepts data at 110 to 9,600 b/s.

The IPS-5000-C operates off a standard 115-V ac line; a multitap transformer option runs the printer from several other voltage levels, including European 230-V ac lines. The 80-column version of the printer measures 7 by 14 by 18.3, in., and the 136-column model 7 by 14 by 24 in. The operating temperature range is 5° to 40°C.

Price in 100-unit lots is $1,010 for the 80-column and $1,110 for the

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THE CALLAN™ INTEGRATED WORK STATION IS THE PERFECT PACKAGE FOR OEM USERS OF MULTIBUS™ OR LSI-11 COMPATIBLE CARDS.

1 INTELLIGENT TERMINAL
12-inch CRT display, non-glare glass, 7 by 9 character, 5 character attributes, powerful edit commands, split screen, separate scroll region, smooth scrolling. High strength structural foam case.

2 200 WATT SWITCHING POWER SUPPLY
Enough power to handle virtually any system configuration. Fan cooling. Rear cover removable for CPU access. Will operate with cover removed.

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82 keys including keypad, auto repeat function keys, applications modes, typewriter pairing. LED indicators show On Line/Local, KB locked, keypad in application mode (3 LEDs are user accessible through RS232 commands).

4 BUILT-IN CPU CARD CAGE
Holds up to 6 Multibus cards or 7 quad/14 double height LSI-11 modules so user can configure system using these card families, including microprocessor, memory, peripherals, input/output, communications...

5 FRONT PANEL SWITCHES & LEDs
CPU reset and interrupt switches (Multibus)
CPU halt/enable and LTC switches (LSI-11). 8 CPU LEDs addressable through RS232 commands.

6 DUAL 5¼ INCH MINI FLOPPIES (OPTIONAL)
Or one mini floppy and one Winchester rigid disk. Disk controller (user selected) is located in rear card cage.

7 RS232 SERIAL INTERFACE
Connects CPU and terminal. Option switches select: 115/230V, baud rate, 7/8 data bits, parity, auto wrap, auto LF, local/self test/on line, other modes.

At last, the perfect packaging solution for OEMs and large volume end-users who are using Multibus or LSI-11 compatible cards.

It's the Callan CD100 — a compact, desk top Integrated Work Station, which combines a versatile intelligent terminal with advanced video features, an integral card cage which holds up to 6 Multibus or 7 quad/14 double height LSI-11 modules, a high capacity switching power supply, and, as an option, two 5¼ inch mini floppies, or one floppy and one mini Winchester rigid disk.

Now you can design your complete system into this single low cost package, rather than interconnecting 3 or 4 separate boxes, or investing $500,000 or more to develop your own integrated work station.

The Callan CD100 makes the "Make or Buy" decision easy, since unit prices are as low as $3195 with substantial OEM discounts available.

The CD100 is fully compatible with all Multibus and LSI-11 family cards, and software as well, including DEC's RT-11 and RSX-11, CP/M and CP/M86 from Digital Research, and Intel's RMX-80 and 86.

For the whole story, phone or write Callan Data Systems today.

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World Radio History

136-column version. Delivery takes 60 days.

Dataroyal Inc., 235 Main Dunstable Rd., Nashua, N. H. 03061 [435]

Software links S-100 units to IBM world

Cromemco will demonstrate at the NCC some software packages that considerably augment the power of its existing systems. One of these is the IOP development software package (IDS), which is intended to make it easier to develop software for Cromemco's input/output processor card (IOP).

The IDS package ($595) provides the tools necessary to upload and download programs from the host central processing unit to the IOP. This makes a high-level language on the host CPU and the Cromemco macro-assembler available to the IOP. Also included in the package is a sophisticated IOP debugging program that allows a programmer to trace the execution of an IOP program, set breakpoints, and display and modify register contents. IDS also supports asynchronous communications by way of a modem, using either 110-, 300-, or 1,200-b/s rates and standard Bell 113C, 103J, or 212A modems, or their equivalents. It requires the use of a Quadart, Cromemco's four-channel, multiprotocol line interface.

A second communications package links Cromemco computers to the IBM environment. Called the remote batch-terminal emulator (RBTE), this package supports IBM's Binary Synchronous Communication protocol. It also allows Cromemco systems to communicate at rates of up to 9,600 b/s. Like the IDS, the RBTE costs $595 and comes on diskette.

Cromemco will also demonstrate its recently announced Cromix operating system and the C language.

Cromemco Inc., 280 Bernardo Ave., Mountain View, Calif. 94043. [428]

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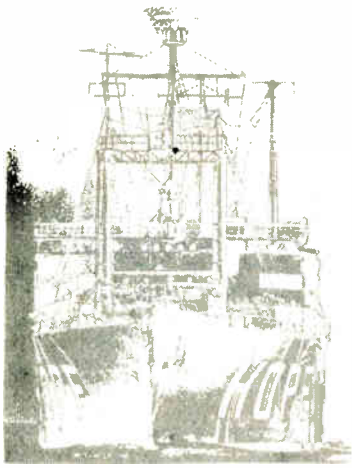

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Either Blinking or Continuous: CQX 22 The new LED Idea.

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Now, for example, we have extended our blinking LED (CQX 21) to yet another component.

Up to now the CQX 21 had two "legs" and blinked red.

The new LED – **called the CQX 22** – still blinks red.

But the blinking function can now be turned off – and the LED shines continuously!

That is important for applications where the diode, as a warning signal, is continuously turned on.

For example, the gasoline-meter in a car. When the gasoline reaches a certain level then the diode starts to blink. As a further critical level is passed then the diode is turned on continuously.

But that is, of course, only one example of the many possible applications of the CQX 22.

Finally some technical details

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- Wide viewing angle of 80 °C
- Axial terminals
- Long life compared with filament lamps
- Vibration resistant
- Built-in IC for the flashing function, f = 3 Hz
- Blinking starts with a bright phase
- **Blinking function can be deactivated**
- Supply voltage $V_S = 5$ V

Further questions? Please contact

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Somerville, NJ 08876
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Tlx.: 833409

Just call us up – If you wish, you can contact one of our nearest agent.

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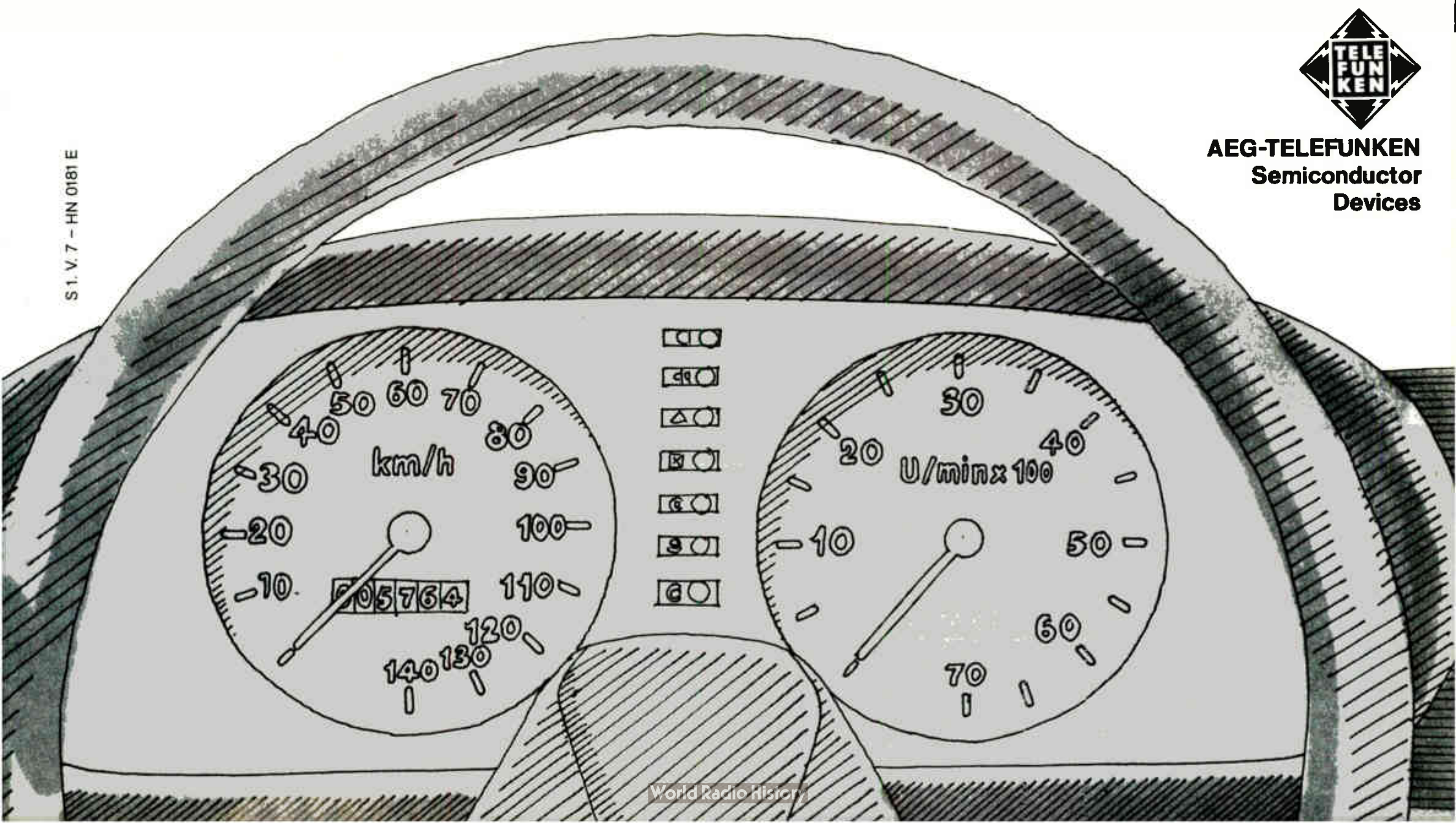

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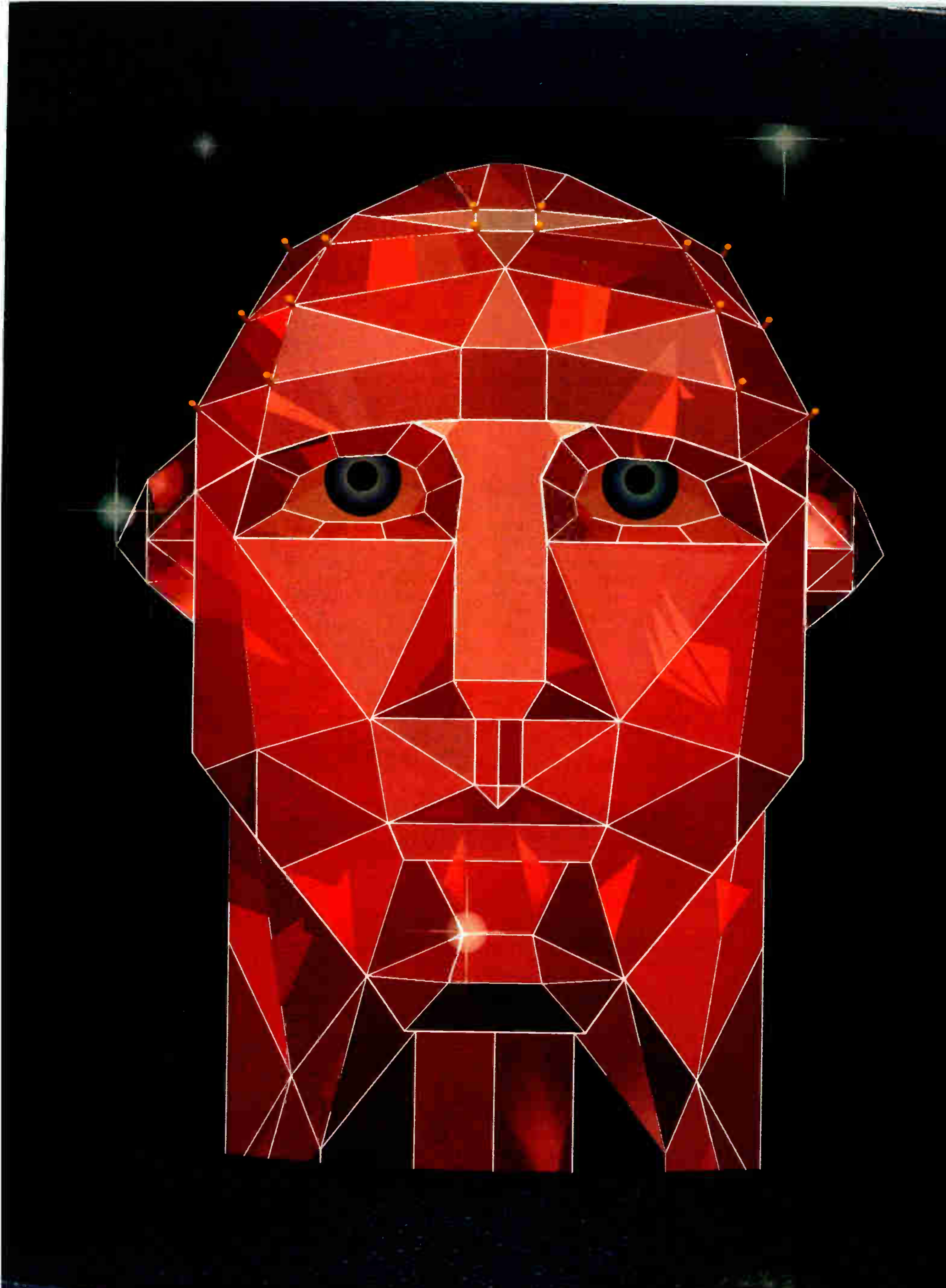

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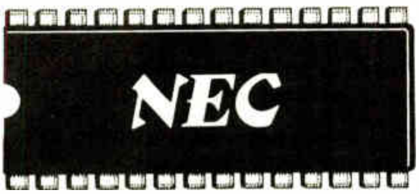
A graphic masterpiece.



NEC Microcomputers, introduces sophisticated computer graphics control in a single IC.

Now you can control complex color graphics with a single chip, NEC's μPD7220 Graphics Display Controller (GDC).

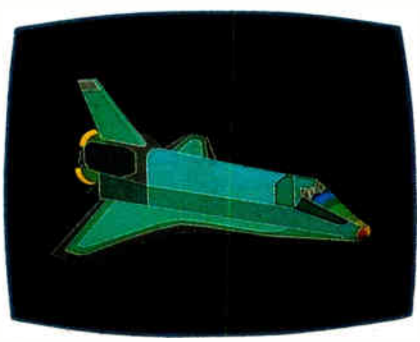
The μPD7220 is so powerful and technically advanced it can actually reduce your chip count from hundreds to just a few. This remarkable chip will save you thousands of dollars, dramatically reduce design time and hardware costs, and help you get your product to market faster.

The GDC generates timing for the raster scan display and manages display memory. It provides full color at 1024 by 1024 pixels per frame and allows you to perform both graphic figure drawings and place graphics and characters on the screen simultaneously.

NEC's μPD7220 also gives you these powerful capabilities:

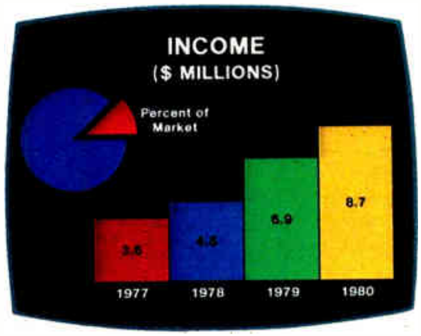
Graphics Display Capabilities:

- Bit mapped display memory is supported up to 256K 16 bit words (2048 by 2048 pixels maximum).
- Hardware figure drawings including lines, arcs, circles, rectangles and bit mapped graphics characters, all performed faster than 800ns per pixel.
- Two partitioned display areas are independently pannable.
- Display up to 1024 lines.



Character Display Capabilities:

- Display memory up to 64K characters is controlled and provides 16 bits for each character code and its attributes.
- Auto-advance cursor can be programmed to blink.
- Four partitioned display areas can be independently scrolled.
- Display up to 256 characters per row, or 100 rows per screen.



Additional Capabilities:

- RMW display memory operations include set, clear, complement, and replace.
- Display zoom factors up to 16X are program selectable.
- Multiple GDC's can be synchronized for expansion flexibility.
- Light pen input.
- 8-bit interface to popular microcomputers includes 16 byte FIFO command buffering, plus interfacing to popular DMA contollers.
- You get all this in a 40 pin DIP.

If you design computer graphics, find out more about the NEC Microcomputers Graphics Display Controller. It makes your design work graphically easier.

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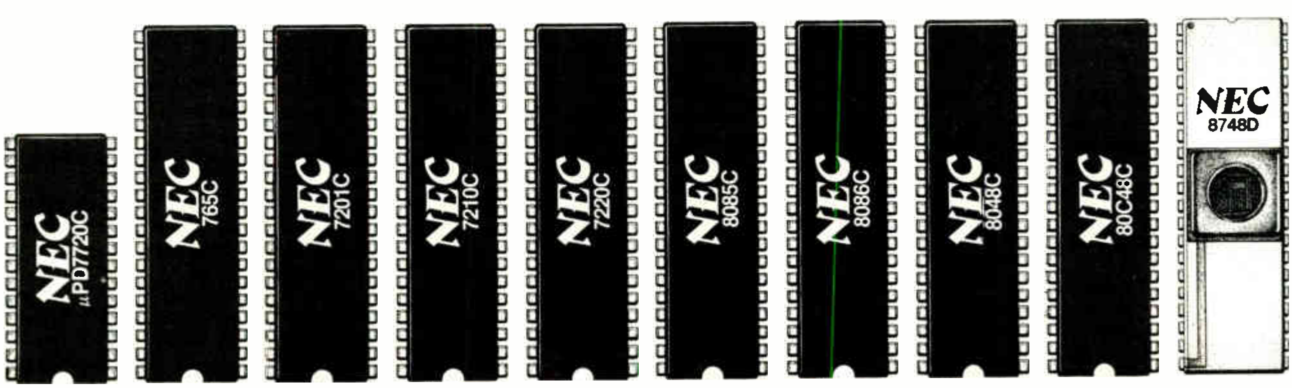

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The first choice in functional PCB testers is Fairchild.

Over the years, Fairchild has earned the reputation of being the First Family of ATE. Not only because of our products. But because of our product philosophy, too.

For starters, our functional test systems give you the most accurate diagnostics in the industry. A guided probe is standard equipment, and operates at a full 5MHz, allowing you to test most boards at full data and clock rates. If you're testing denser, more complicated boards, we offer two highly specialized options that can reduce diagnostic time substantially—by as much as 80%. First, our Flo-Tracer operates at high speeds, but isolates faults beyond the node level all the way down to the component level, saving you precious testing time. And if you're testing boards with LSI, VLSI, microprocessors, RAMs and ROMs, our Live Data Compression option can handle all the high speed data you'll generate.

And the choice is now better than ever.

SERIES 70

You'll also like the philosophy behind all of our products. Every Series 70 system we sell is totally compatible, based on Mediator—our own structured, high level language that makes programming fast and simple. Family compatibility and modularity means your system can grow as fast as you do. And you'll never lose your original software investment.

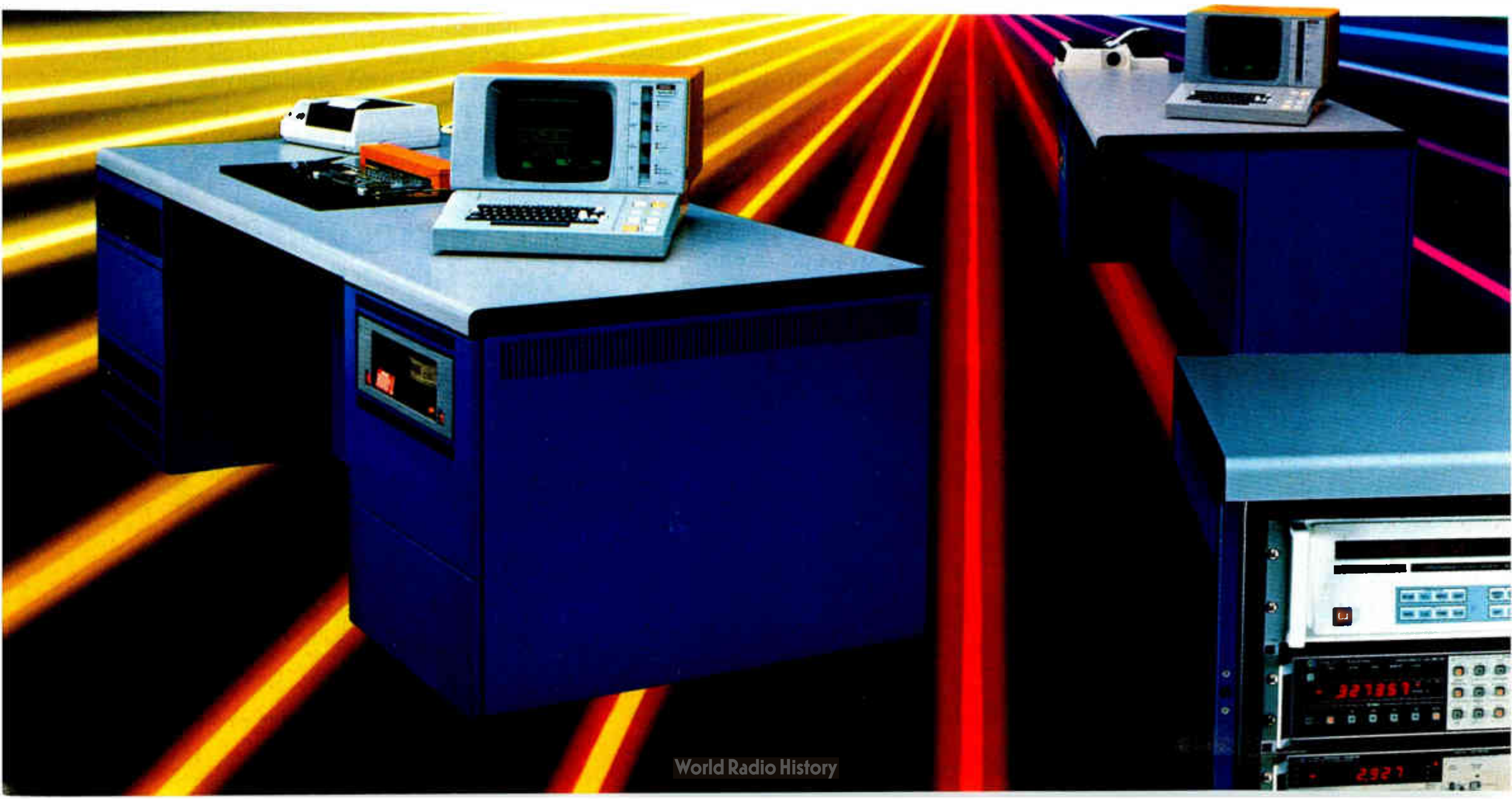
And now, our functional test system line is broader than ever. So you'll never have to settle for less than a Fairchild again.

Series 70/Model 76 functional hybrid tester.

If you're looking for a functional analog/digital tester that can test at a full 5MHz, our 70/76 gives you unprecedented flexibility.

It's compact enough for use in both manufacturing applications and field depots. It can test boards as well as exercise modules, subassemblies and multiboard systems. It lets you choose standard edge connectors or Fairchild's optional Thinline™ bed-of-nails fixturing. And, like all Fairchild systems, the 70/76 can be expanded to meet your future testing requirements.

The analog section provides complete software control of all signal switching paths and instruments through a standard IEEE 488 Bus. The digital section uses a stored program



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technique for real time testing of all microprocessors, RAMs, ROMs and dynamic devices. And each pin is backed by 4K RAM for high-speed parallel patterns up to 512 pins.

For more complicated boards, our automatic Live Data Compression option can handle LSIs and VLSIs at full speed. And our optional Flo-Tracer isolates faults to the component level at high speed, saving 80% of diagnostic time.

The 70/76 provides state-of-the-art technology today. And the ability to expand tomorrow.

Series 70/Model 60 functional, in-circuit test system.

For both functional and in-circuit testing, all you need is the 70/60.

The 70/60 comes with 512 points standard, expandable to 1920, for in-circuit testing. It's perfect for quick screening of passive components, diodes, transistors, continuity and IC orientation. Developing programs is fast and easy with our automatic test generator, and incremental editing saves rerunning entire programs to make changes. In addition to the full complement of in-circuit pins, the 70/60 can functionally test up to 256 digital pins at 5MHz, or analog circuits through a standard IEEE 488 Bus.

The 70/60 is both an in-circuit tester and a functional tester. At one low price.

Series 70/Model 30 functional digital test system.

For digital boards, you can get all the speed and accuracy of our 70/76 in our economical 70/30.

The 70/30 is one of the most efficient ways available for testing digital subassemblies and modules up to 512 pins. It uses a guided probe to test at 5MHz, and an optional high-speed section to test microprocessors, RAMs, ROMs and dynamic devices in real time. Add our optional Flo-Tracer and automatic Live Data Compression module, and you've got a fast, highly accurate system for complicated boards.

The 70/30 gives you all the sophistication of our larger system. At a fraction of the price.

Series 70/Model 90 programming station.

The 70/90 programming station is the most economical way you'll find to offload programming functions and circuit simulation to keep your test system working full time on the production line.

The 70/90 gives you the same logic simulation software as our other Series 70 systems for independent program development. It not only produces a complete test program, including nodal activity, but a fault dictionary that diagnoses device and assembly faults, too.

Let your systems test full time. Program on the 70/90.

Of course, all Fairchild systems have been designed to make expansion as simple as possible. Any of our Series 70 systems can be upgraded with plug-in modules, add-on options and software packages. So you can buy the capabilities you need now, and upgrade as you grow. And the Series 70 systems are all backed by the industry's largest service and support organization.

So no matter what kind of functional test system you're looking for, Fairchild is your first choice. And your best.

For more information on Series 70 test systems, write or call Fairchild Test Systems Group, Fairchild Technical Center, 3 Suburban Park Drive, Billerica, MA 01821; (617) 663-6562, TWX: 710-349-7580.

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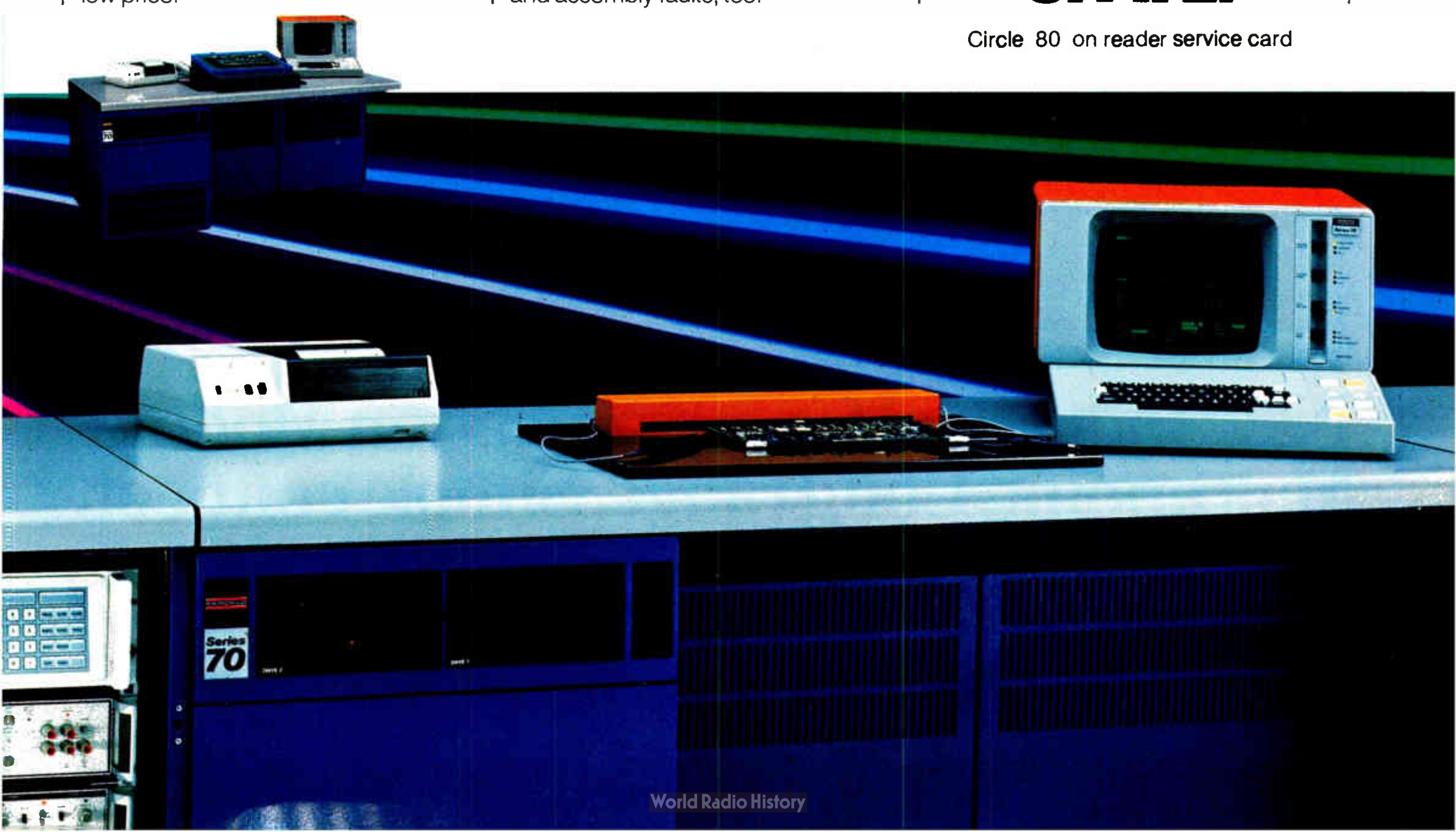
Circle 80 on reader service card



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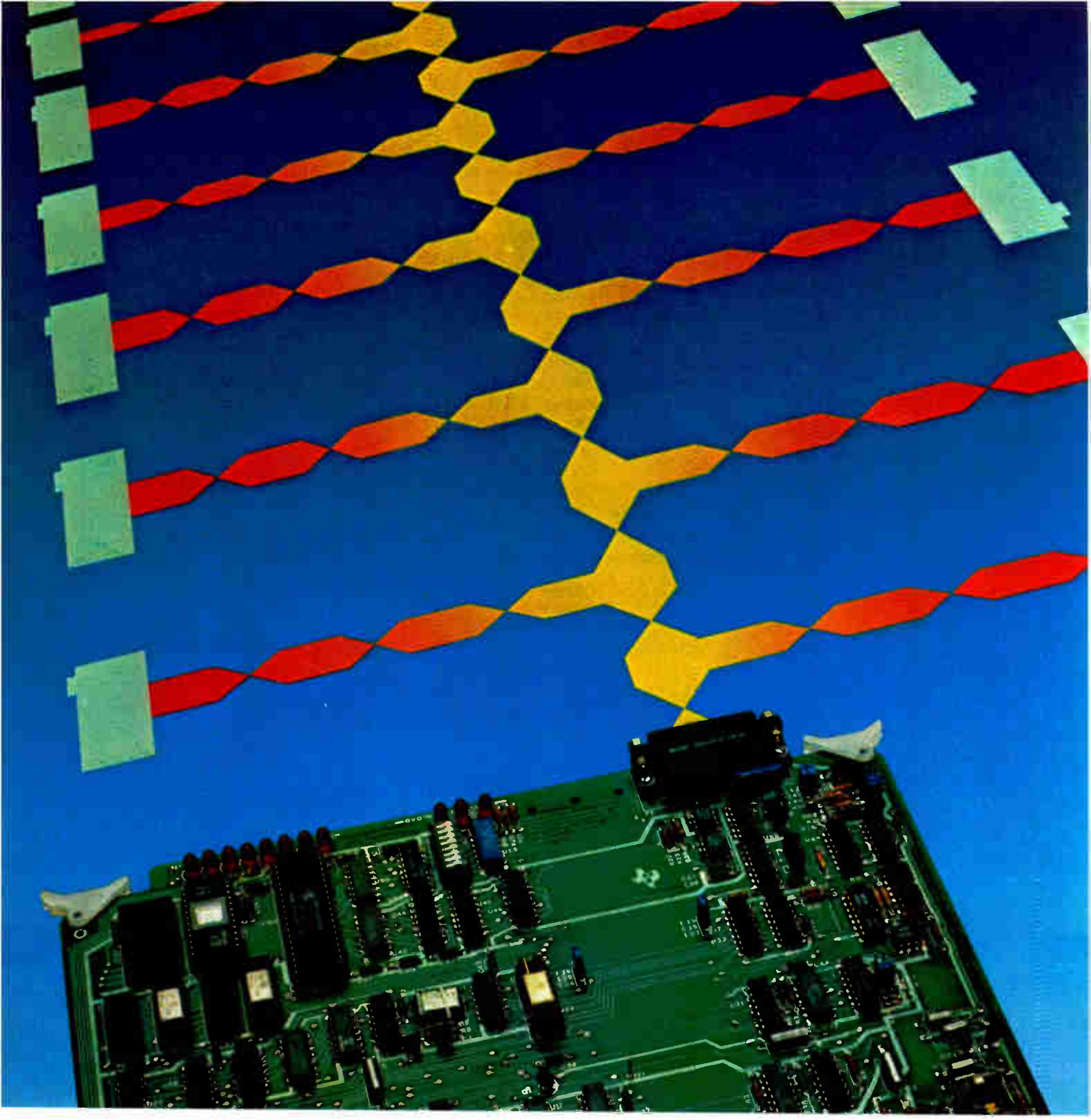


New Industrial Communication Module: Multi-point. Long range. Simple connect. From Texas Instruments.

A new development from TI extends industrial communication to more points. Over greater distances. At less cost.

The unique, new TM990/308 Industrial Communications Module relieves a host CPU of most of the time-consuming processing associated with synchronous, multi-drop communication port. Communication, in the multi-drop mode, can be with as many as 31 other compatible TM990 systems. Over

World Radio History

a range as great as 10,000 feet. Over twisted-pair lines which substantially simplify interconnects and reduce installation costs. The interface is optically isolated (1500 V RMS).

Point-to-point communication over an even longer distance is achieved using Bell 208 type synchronous modems.

Either way, the 308 module is an intelligent interface, with processing handled by an on-board TMS9980 microprocessor. Firmware supports address decode, down-load command decoding, self test and other primitive functions.

New Communication Expander Module

A second new TI module — the TM990/307 — allows communication with up to four devices such as terminals or modems (see diagram at right). It provides four RS 232C EIA ports using standard RS232 connectors, and one port can be RS422. A Bell 801 automatic calling unit interface is on board. Optionally, four channels of synchronous communication are possible by changing on-board devices to synchronous controllers. A loopback permits self-testing.

Demonstration Software

Demonstration software for the new communication modules enables the user to check for proper operation quickly and easily. The software listings will also facilitate application programming.

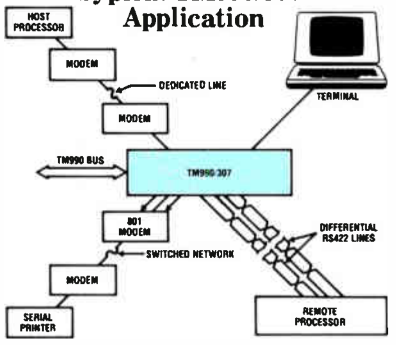
Software Support

Coming soon for the new TM990/308 module: two new software packages.

One of TI's new Component Software Series, the Software Data Communication package supports point-to-point and multi-point communications. Operating with TI's Realtime Executive, the SDC package will reduce software costs substantially by providing a library of statements common to most programs. It provides networking capabilities by interprocess communication. TM990 systems, 990 minicomputers, and PM550 controller systems may be interconnected.

The EIA Software Communication package offers programmable features like character width, parity, start stop bits, and baud rate. Each port can be programmed independently to a particular priority level, special control character set, etc.

Typical TM990/307 Application



TM990 Series Microcomputer Modules

Microcomputer Modules:
TM990/100MA
TM990/101M
TM990/180M
TM990/1481

Memory Modules:
TM990/201 EPROM/RAM
TM990/203 Dynamic RAM
TM990/206 Static RAM

Mass Storage:
TM990/210 Bubble Memory
TM990/303A Floppy Disk Controller

Digital I/O Modules:
TM990/305
TM990/310

Analog I/O Modules:
TM990/1240
TM990/1241
TM990/1243

Communication Modules:
TM990/307
TM990/308

Speech Module:
TM990/306

Industrial AC and DC I/O Modules:
TM990/5MT Series

Data Entry and Display Microterminal:
TM990/301

University Module:
TM990/189M

Software Development Module:
TM990/302

TM990 Modules: The efficient, economical solution

For the designer who needs to get to market quickly — at least cost — TI's TM990 modules are his best choice.

As a glance at the listing shows, the selection is broad enough to implement most any system design. And it's a growing selection — the two new communication modules are just the latest additions. The Series will continue to grow in response to industry needs and technological changes.

Faster design: The modules come off the shelf from distributor stocks ready to use. Bringing with them the precision performance of TI's 16-bit 9900 Family microprocessors.

Hardware design. Board layout. Manufacturing. Assembly. Testing. All are done in advance to shorten the design cycle.

All modules interface directly to the versatile, flexible TM990 bus which helps simplify system integration.

Faster software development: Support includes complete assembler, editor, linker and PROM programming utilities, as well as the TIBUG* interactive debug monitor, TI Microprocessor Pascal and Power Basic* high-level languages. Hardware development tools range from a software development module to the multi-user AMPL* prototyping lab.

Fast fit: The modules are based on the memory-to-memory architecture common throughout TI's pioneering 16-bit 9900 Family. This advanced architecture, in combination with the rich 9900 instruction set, is particularly well-suited to industrial control applications, simplifying both hardware and software.

Fast help: Demonstrations of the TM990 modules can be arranged at local TI distributor Systems Centers.

In-depth instruction courses on the modules and the 9900 Family are available at TI Regional Technology Centers. TI distributors and TI field sales offices can tell you dates, locations and course fees.

From a standpoint of time and money saved, reliability and performance gained, TI's TM990 Series modules are an extremely efficient and economical solution to design problems. For full particulars, get a copy of the TM990 Series brochure. Call your TI distributor, or write Texas Instruments, P. O. Box 1443, M/S 6404, Houston, Texas 77001.

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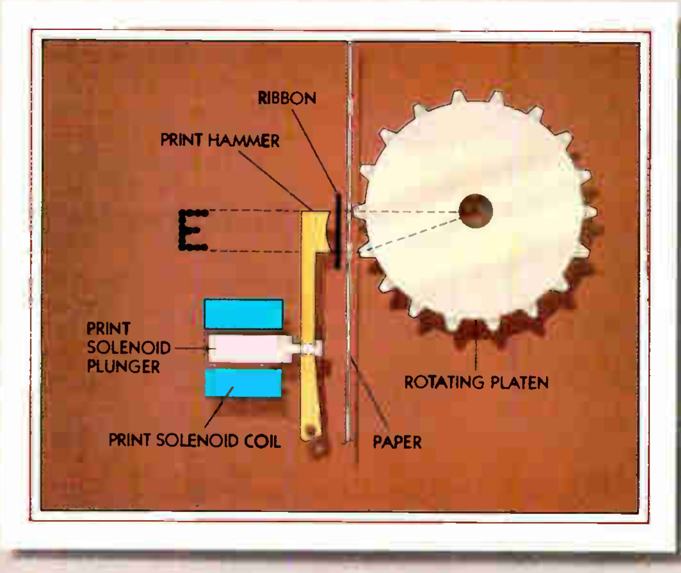
INTRODUCING A REVOLUTIONARY DOT MATRIX PRINTER WITH JUST ONE HAMMER. AT AN INCREDIBLE PRICE – JUST $399.

The Uni-Hammer Replaces Seven... or More.

Revolutionary? We don't know what else to call it. An impact printer with a single rugged hammer, rather than the seven or more individual solenoids and print wires found in conventional dot matrix printers.

At an incredible unit price of $399!

Because of the unique Uni-Hammer design, the GP-80M is smaller and simpler than other dot matrix printers yet costs considerably less. Which makes it a natural for OEMs needing compact, reliable, low cost printers for system use, and also for the personal or small business user who wants a quality impact printer at the lowest possible price.



A Product of the Seiko Group

The GP-80M is manufactured by Seikosha and exclusively distributed in the USA by Axiom. It took a company such as the Seiko group, world's largest watch manufacturer, with vast experience in the design of small, intricate, precision products, to come up with a totally new concept in dot matrix printing.

Circle 246 on reader service card

How the Uni-Hammer Works

The GP-80M, which prints both graphics and alphanumerics, uses a rotating platen with protruding splines positioned behind the paper (see diagram). The character or graphics image is created by multiple hammer strikes in rapid succession as the print head advances across the paper. The precision gear train assures exact positioning of the print hammer relative to the splines on the platen, to provide excellent print quality.

A Complete Printer

The GP-80M has features comparable to printers selling for thousands of dollars. These include upper/lower ASCII character sets, ribbon cartridge, 80 columns at 12 characters per inch, adjustable tractor feed, original and 2 copies, 30 characters per second, and full graphics with a resolution of better than 60 dots per inch in both horizontal and vertical axes.

Plenty of Interfaces

Interfaces include Centronics parallel, RS232C, serial TTL, 20mA current loop, IEEE-488, Apple, TRS-80, PET, HP-85... and more.

See the GP-80M in action at your local computer store, or write for the distributor in your area.

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World Radio History

32-bit machine flexes ECL muscle

Multiple-bus architecture and stackable CPUs give computer performance of 4 to 5 million instructions/s

by James B. Brinton, Boston bureau manager

What has been called the most powerful 32-bit superminicomputer yet is about to emerge from Systems Engineering Laboratories Inc., Fort Lauderdale, Fla. The Gould Inc. subsidiary says its new machine is the first such machine to be based on emitter-coupled logic, and its throughput reflects the fact.

The Concept 32/87 processes 4 million to 5 million instructions per second, achieving at least 3,604 Whetstones on the Whetstone I test and at least 2,249 on the double-precision Whetstone II exercise.

Both numbers are several times greater than for other 32-bit superminicomputers, say Systems spokesmen. The nearest competition in terms of throughput are mainframes from IBM and others. So the firm expects the 32/87 to sell well for large-scale simulation and industrial control applications, as well as for scientific data-processing and program-development slots.

Extras. If the machine is too slow for an application, Systems will eventually offer additional ECL central processing units, which can be installed to achieve the desired throughput. For number crunching, the 32/87's shared memory and high-speed bus allow the graceful addition of array processors.

Comparing its former top-of-the-line computer, the 32/77, with the 32/87 in a single-CPU configuration, the 32/87 is five to six times faster. A slightly derated version of the 32/87 using a half-size, 16-K-byte cache is still three to four times faster than the 32/77, even when the latter is equipped with a high-speed floating-point arithmetic unit.

The 32/87 uses multiple buses and processors to divide the work load and speed the passage of data through the machine. The computer's backbone is its 32-bit selBUS with a data-transfer rate of 26.67 megabytes/s. To it are appended from one to eight CPUs, up to 16 megabytes of main memory in 256-K-byte integrated memory modules (IMMs), and high-speed peripheral processors for tape and disk stores.

The system's second bus is the 1.5-megabyte/s multipurpose (MP) bus. It is reserved for any operations that would cause excess overhead on the selBUS and thus slow the CPUs. An input/output processor (IOP) bridges the gap between the two buses and also serves the 32/87's control console. Riding the multipurpose bus are a Z80-based diagnostic processor, floppy-disk and line-printer control subsystems, and an eight-line asynchronous communications multiplexer.

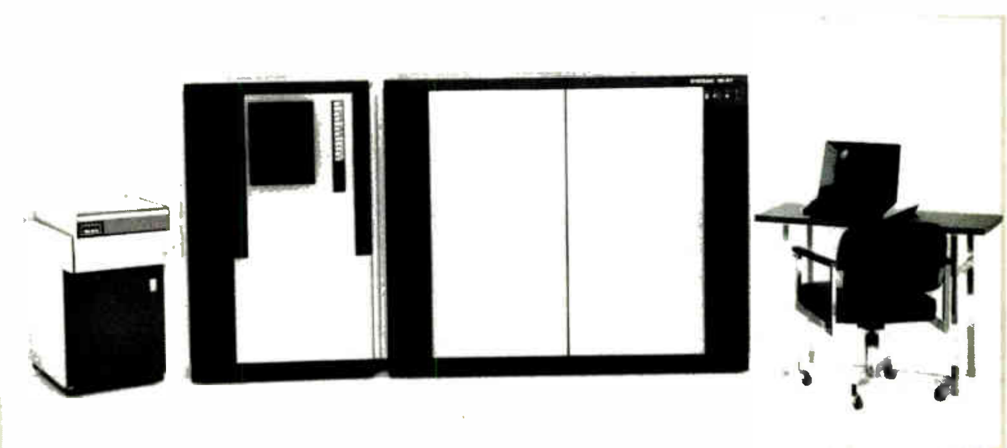
The 32/87 uses a hierarchical memory system. At the bottom of the hierarchy is bulk storage—tape and disk—with lengthy access times. Next is main memory, whose overlapped, interleaved read or write time is 150 ns. Above main memory is a 16-K- or 32-K-byte ECL cache capable of 75-ns read operations. Not only is the cache two- or four-way set-associative, but also its controller can fetch 64-bit double words from main memory in 300 ns.

The 32-K-byte cache and a sophisticated cache-control algorithm raise the probability above 90% that the proper data or instruction will be in cache, according to company specifications. But insiders hint that the real hit rate may be nearer 98%.

Size plus. Size counts, but the cache control algorithm may be as important. Instead of using a first-in, first-out approach, the cache controller writes over least recently used instructions, retaining those most likely to be addressed.

Data is transferred between cache and the CPU's arithmetic and logic unit via a 64-bit-wide bus, and the ALU can pipeline as many as four instructions in a queue.

The 32/87's CPU combines cache, cache controller, alterable control store, ALU, and a floating-point pro-



Mounting Ideas from Weckesser

6 Ways To Mount Cable Ties

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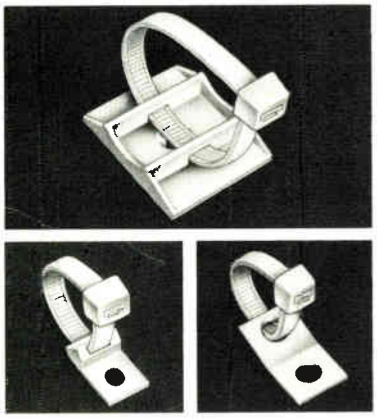

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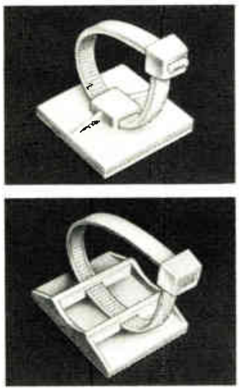

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cessor (FPP)—all interconnected by a 64-bit-wide, 75-ns bus. Putting cache and FPP in close proximity to the ALU also helps to maintain CPU speed.

Like the rest of the CPU, the FPP uses internal 64-bit-wide data paths to speed computation, and in the 32/87, out of a set of 201 instructions, 20 are reserved for, or related to, floating-point operations, thus easing programming.

The 32/87's I/O processor makes possible a low-cost, low-speed I/O subsystem without sacrificing computer throughput or foreclosing the use of the selBUS for high-speed I/O. The processor controls the 1.5-megabyte/s multipurpose bus and communicates with various device controllers through it. Since all device controllers share the processor's logic, there is no need for fast, costly, and redundant selBUS-interface logic on the controllers.

Each I/O processor runs as many as 16 device controllers, which can in turn support up to a total of 124 peripherals. Since large systems can use multiple I/O processors, growth potential is great. And the bus architecture does not preclude use of peripherals with high data-transfer rates on the selBUS itself, such as high-speed disk and tape.

The heart of the processor is a firmware-controlled, bit-slice–based microengine interfacing with console ports, the multipurpose bus, an interval timer, a real-time clock, and interrupt lines. A FIFO data buffer prevents the IOP from monopolizing the selBUS while allowing the MP bus to run at its full rated speed.

Memory integration. Main memory also rides the selBUS. It comes in integrated memory modules (IMMs) each holding 256-K bytes. The IMMs are based on 16-K complementary-MOS dynamic random-access memories capable of 600-ns read and 300-ns write operations but, as organized, capable of initiating write cycles every 150 ns. With multiple IMMs and two- or four-way interleaving, transfers between CPU and main memory run at the full speed of the 26.67-megabyte/s selBUS.

Each IMM includes fast TTL control logic, refresh logic, and error-correction–code logic. The error-correction logic automatically corrects single-bit errors without a read-time penalty; multibit errors are flagged.

As organized, the 32/87 can support up to 16 megabytes of physical main memory (it is not a virtual machine), although to reach this size another cabinet must be used.

The 32/87 uses the MPX-32 operating system and a mapped executive and addresses memory in two fashions: mapped addressing within the unit's primary address space and mapped extended addressing of an additional 1.5 megabytes. Extended address spaces can be located anywhere within the 16-megabyte physical memory possible with the 32/87.

A Z80-based diagnostic processor loads the CPU's control store at power-up and tests the processor as well. Diagnostic routines are stored on a dedicated floppy disk and loaded into control store RAM. The CPU is then put through its paces before its operating microcode is loaded and the system is initialized.

The 32/87's MPX-32 operating system supports Fortran 77+, an in-house version of Fortran conforming to ANSI standards, plus Cobol and Pascal. There is also a ready library of subroutines that can be called from application programs.

Basic. A basic version of the system, the model 32/8720, would include one ECL-based CPU with 32-K-byte cache; 1 megabyte of main memory; an I/O processor; a diagnostic processor; a line printer and floppy-disk controller; two floppy-disk drives; a cathode-ray-tube control console; a 38-card-slot chassis with 17 selBUS slots, 21 CPU slots, and power supplies; an 8-slot multipurpose bus chassis with power supplies; a 55-in.-high dual-width cabinet; ac distribution panel; firmware and diagnostic software on floppy disk; and documentation.

The price for such a configuration would be approximately $265,000. Deliveries should begin by June and take 90 to 120 days.

Systems Engineering Laboratories Inc., a subsidiary of Gould Inc., 6901 West Sunrise Blvd., Fort Lauderdale, Fla. 33313 [338]

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MACSYM 20 can operate even in rugged environments because no movable mass storage devices are used. You have your choice of downline loading programs from your host computer into RAM memory on MACSYM 20, or burning the programs into PROM.

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Circle 249 on reader service card

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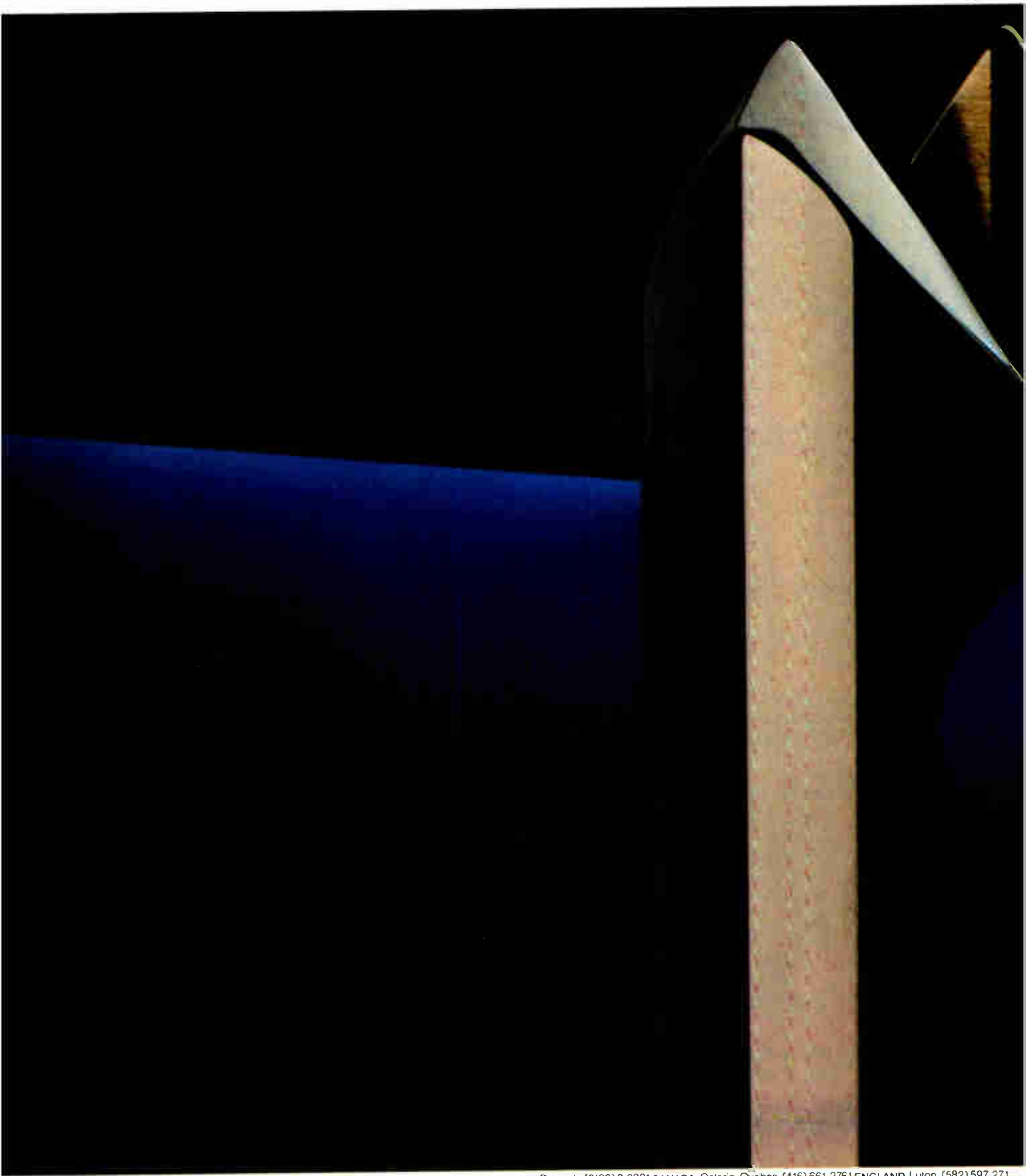

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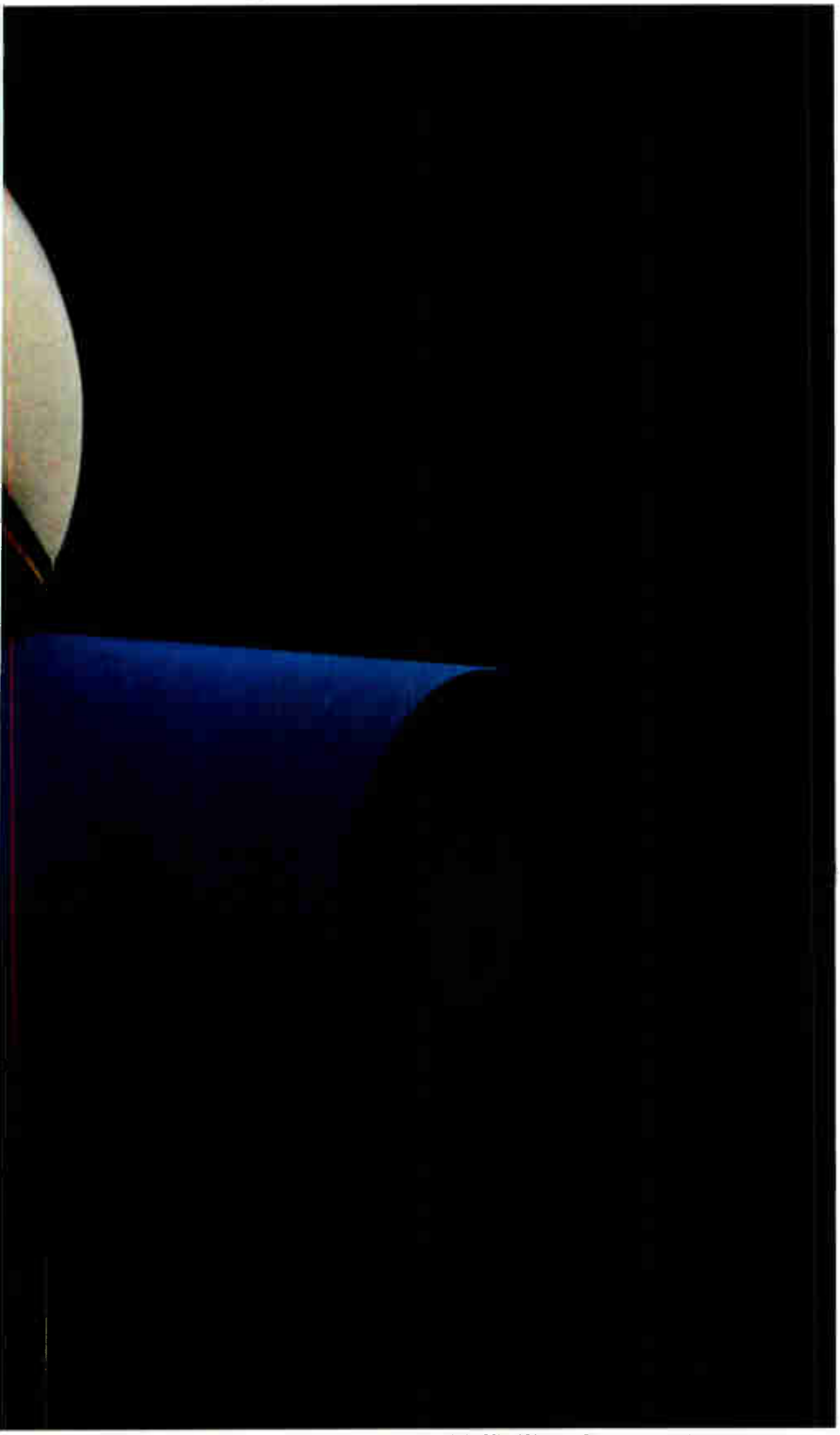

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Circle 251 on reader service card

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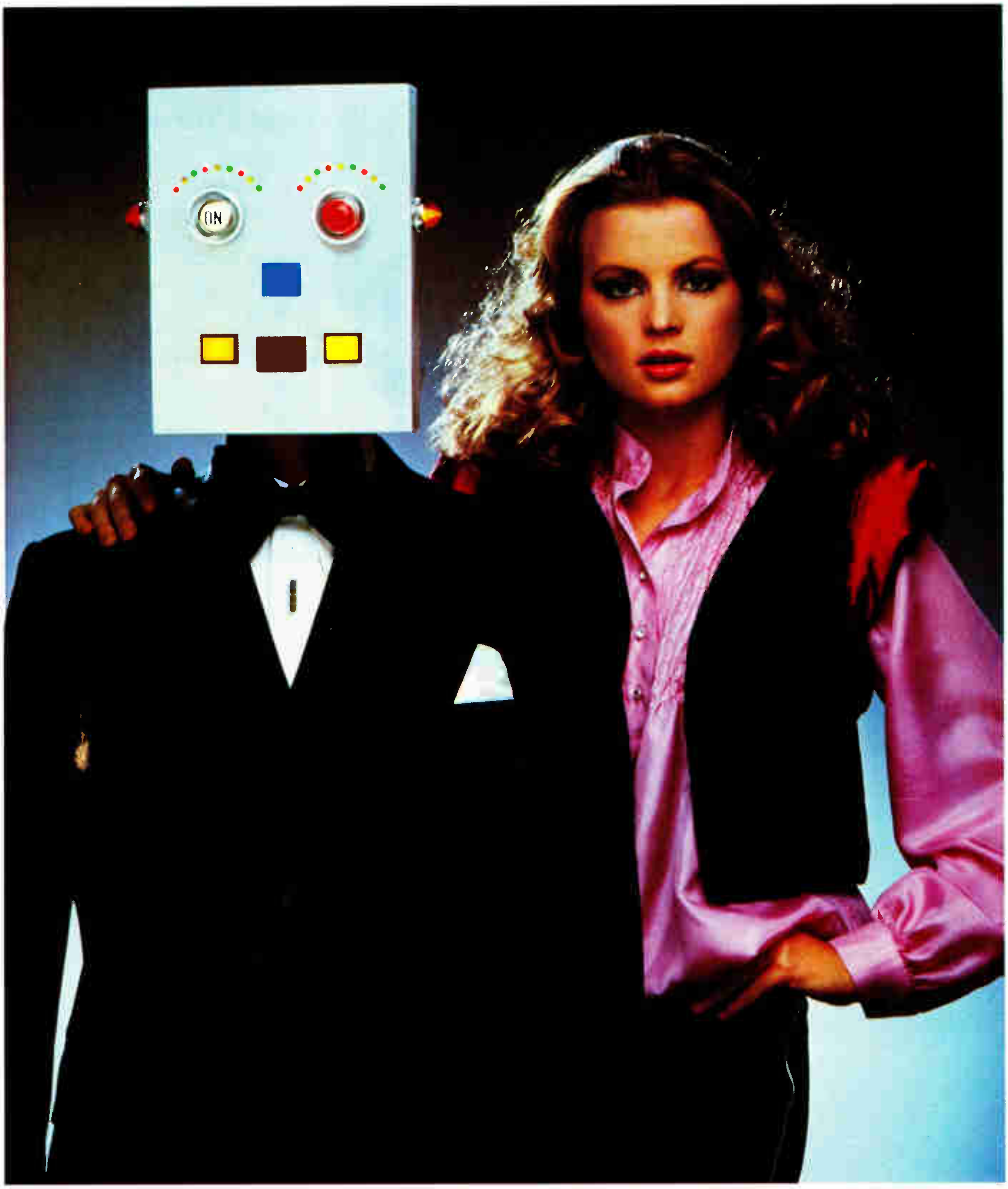

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Even the most demanding industrial designer or design engineer will occasionally take switches, indicators and optoelectronics for granted. That's a mistake. Because they are often the first components people see and the ones they use most frequently.

That's why so many designers insist on Dialight standard products and custom designs. They know that precision Dialight products will give their computer, machine or instrument the look and feel of quality.

Choose from over 1,500,000 indicator lights.

Dialight is the world's largest manufacturer of incandescent, neon and LED indicator lights. For over 40 years we've introduced new sizes, styles and colors.

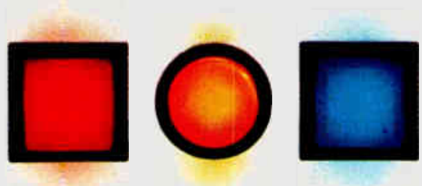
So there's a good chance our collection includes exactly the light you need. If it doesn't, we'll be happy to work with you on an original. After all, we didn't create over a million different designs by refusing special orders.

Rockers and toggles for panel and PC board mounting.

Dialight meets your needs for miniature switches with thousands of different designs in rockers, toggles and levers. All are 100% tested and made in the U.S.A.

Our rocker and toggle line contains a wide selection of actuators, terminations, mountings and contact ratings. Included are dozens of styles for mounting on front panels and sub-panels as well as styles for snap-in and printed circuit board applications.

If our catalog doesn't show exactly the switch you need, we'll design and build it to order. All it takes is a call to our Applications Engineering department.



100% testing of every illuminated switch.

Dialight offers a complete line of computer-grade illuminated switches at reasonable cost. And to make sure they all work perfectly, we test every switch both electrically and mechanically before it's shipped.

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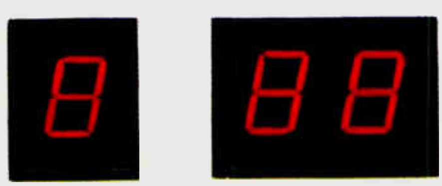

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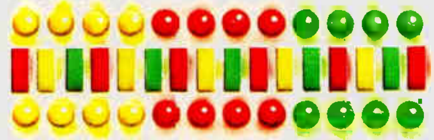

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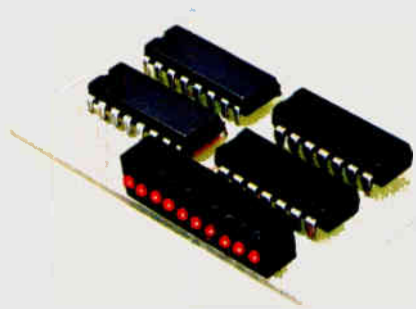

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World Radio History

One-board system handles images fast

Single large Nova-compatible board analyzes video input, converting and storing 18.4 megabits per second

by James B. Brinton, Boston bureau manager

"Visual inspection is the least automated aspect of modern manufacturing," says John E. Trombly, president of Octek Inc. The Octek 4200 robot vision module, he feels, could help change this. "Many manufacturers would like to use 100% inspection rather than the sampling approach they are forced to today by personnel costs," he notes. "Now, using video processing and minicomputers, it is possible to inspect, say, every stamping coming out of a machine. Thus if there is a die failure, the stamper can be shut down immediately; this not only prevents bad parts from being incorporated into larger assemblies, but saves raw materials, too."

Today, vision systems are being used or tried out in applications ranging from the inspection of automotive engine timing chains, razor blades, integrated circuits, and circuit boards to aircraft parts. Octek's system is being considered for graphic but nonvisual inspection approaches, too—ultrasonic or X-ray inspection techniques also can be implemented with the 4200.

But whereas inspection is sure to be an early application for the 4200, robotic vision is expected to be a major market as U.S. industry retools. "We are in contact with almost all of the 20-odd major robotics firms," says Trombly, "and they agree that the 75% of industrial robots that do not have 'eyes' need or could use them, and the 25% that do could use improved systems." Some tasks, he notes, can be done more rapidly with vision than with the more typical pseudotactile sensing used by today's industrial robots.

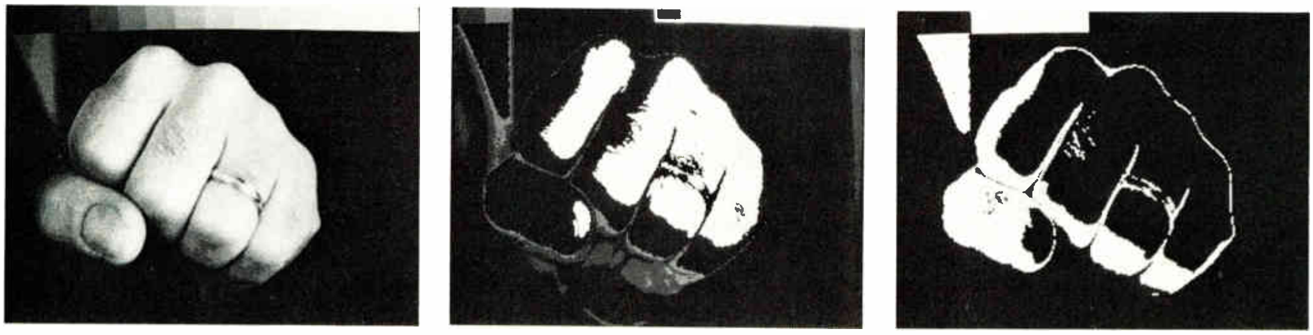
The 4200 consists of a model 2000 video image analyzer and an Octek 1000 Fortran-based software package. The 2000 fits a single large printed-circuit board compatible with Data General Nova computers. It performs high-speed video-image analysis, image processing, and graphics and is built to do so without tying up its host minicomputer.

The board's hardware complement includes a Signetics 8X300 microcontroller with a 320-ns cycle time. The 8X300 controls the board's basic functions—input/output selection, video digitization, pixel manipulation, and so on. It combines these functions to perform image analysis tasks at high speed—vector generation, for example, plus edge detection and other operations. The 8X300 also handles interaction between itself and the host.

Also on board is a dual-ported image memory organized into four planes, each capable of storing 240 by 320 picture elements (pixels) of image data. This memory can be used to drive up to four monochrome displays independently or can be combined to drive either a 16-color display or a monochrome display with a gray scale of 16.

Managing this memory is an image memory controller, which offloads the 8X300. The controller's tasks include storing video inputs (at about 160 ns per pixel), displaying them from memory at the same rate, and handling direct-memory-access requests from the host and the random pixel requests of the 8X300.

The 4200's video inputs are RS-170–compatible. Thus the unit can accept video data from almost any standard television camera or similar equipment. Analog input signals are converted into digital form using a high-speed, 4-bit converter with each 4-bit word representing the intensity at a certain spot in the video field. The analog-to-digital converter is



Shades of gray. The Octek robot-vision module accepts video input from a standard television camera; its memory can drive a 16-color or 16-shade monochrome display.

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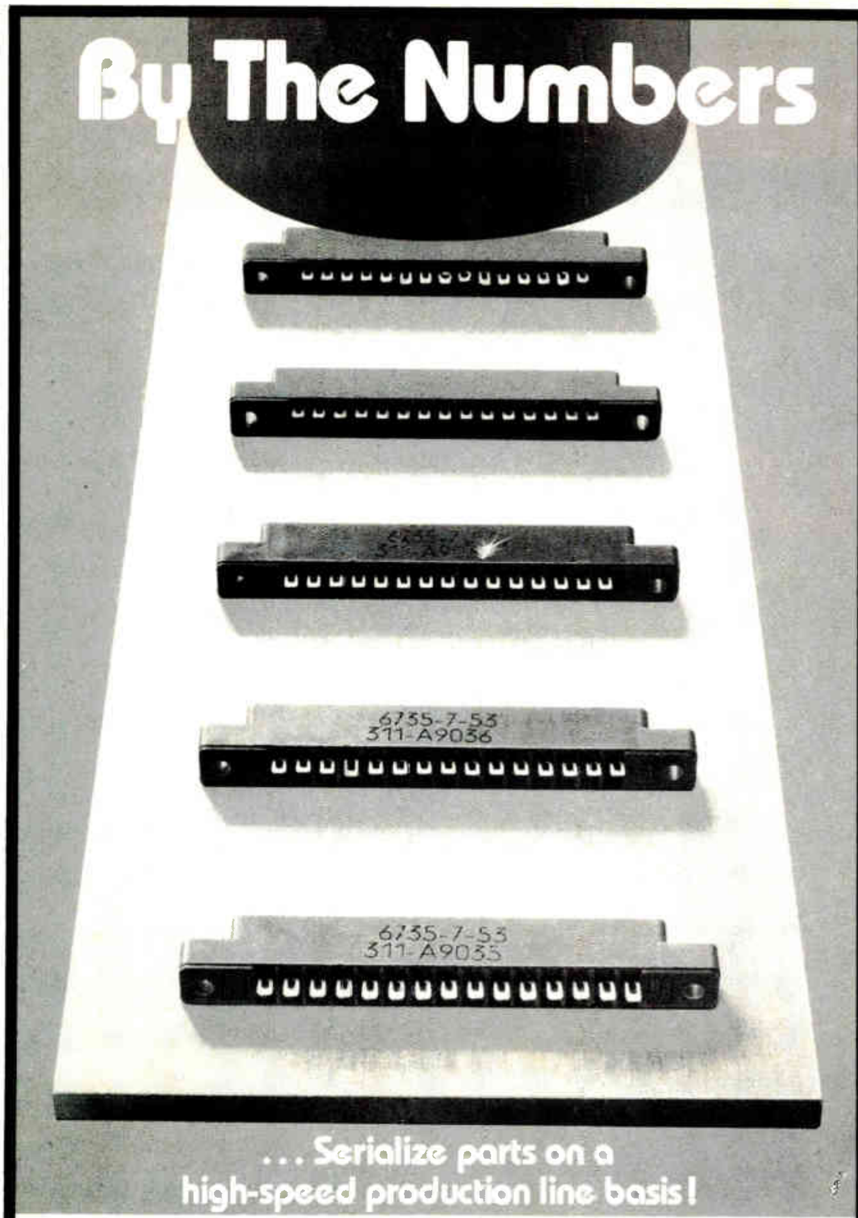

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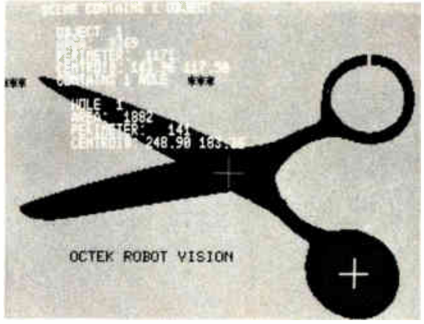


synchronized with the video input for image stability. Thus, every sixtieth of a second, 307,200 bits of video data can be converted and stored by the 4200.

After conversion, the data is passed through a digital translation table and stored in the dual-port image memory. The system is designed to allow the host minicomputer to access stored data during the same memory cycle as video input or output.

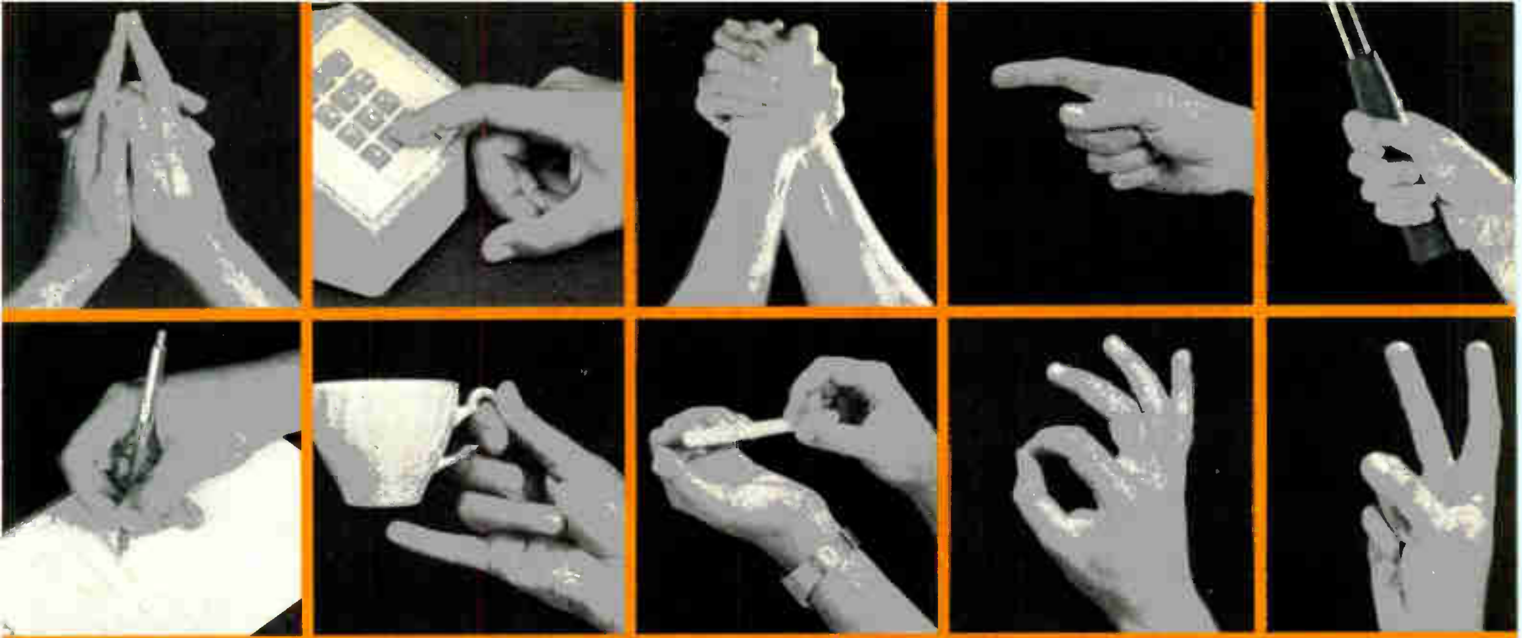
The process is reversed for video output. Acquired data can be either displayed or not displayed on screen, depending on whether the operator or the computer is running the show. In video-output applications, the unit might also be called upon to display alphanumerics in conjunction with image data and in a variety of fonts. In fact, one expected use of the 4200 is font generation and translation for typesetters and printers.

In practice. In low-speed inspection applications, an operator might view a series of freeze-frame displays. The 4200 is capable of defining the edges of bodies, the number and shape of holes in them, geometrical orientations, major and minor axes, and so on. This data can be displayed with or without an alphanumeric caption. Color or captions can be used to call the operator's attention to flaws. If the operator could keep up, this could be done repeatedly in fractions of a second. The 4200 would therefore be at its most efficient in totally computerized applications.

Price for the 4200 ranges from \$9,900 in single units, to \$6,000 in 100-unit lots. Delivery takes 90 days.

Octek Inc., 7 Corporate Pl., South Bedford St., Burlington, Mass. [339]

World Radio History



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Takeda's Advanced Test Strategy — ADVANTEST — is the newest, most efficient concept in LSI/VLSI testing. A concept that led not only to guaranteed overall timing accuracy — far surpassing the comparatively limited timing accuracy capabilities of current testing systems — but also to a wide range of major technological advantages for Takeda's systems. The ADVANTEST concept helped raise data crunching speed in Takeda's T3380 VLSI Test System to 100 MHz, for example. And its timing resolution to 100 ps. It also led to expansion of pins to 192 I/O maximum (384 pins). To real time I/O switching capability. To a 100 million vector-per-second logic testing vector generation — with built-in major loop/minor loop capabilities. ADVANTEST generated significant innovations in Takeda's T3370 as well as its T3380. Result: greater speed, reliability, and better-than-ever fault detection for both. The T3370, with its algorithmic pattern generator, is a specialized memory-test instrument. The T3380 carries a logic pattern generator but can, if you wish, accept an algorithmic pattern generator, too — to test both logic and memory. And now, both these systems deliver unique 9X, 9Y and 9Z address vectors to allow partitioned testing. That cuts test time drastically. Takeda's T3331 40MHz Memory Test System reflects the ADVANTEST concept, too. Its enhanced capabilities raise memory testing to a highly-developed state — with X, Y and Z address vectors plus 100ps timing resolution.

(ADVANTEST was developed in cooperation with N.T.&T. Musashino Electrical Communication Lab.)

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Computers & peripherals

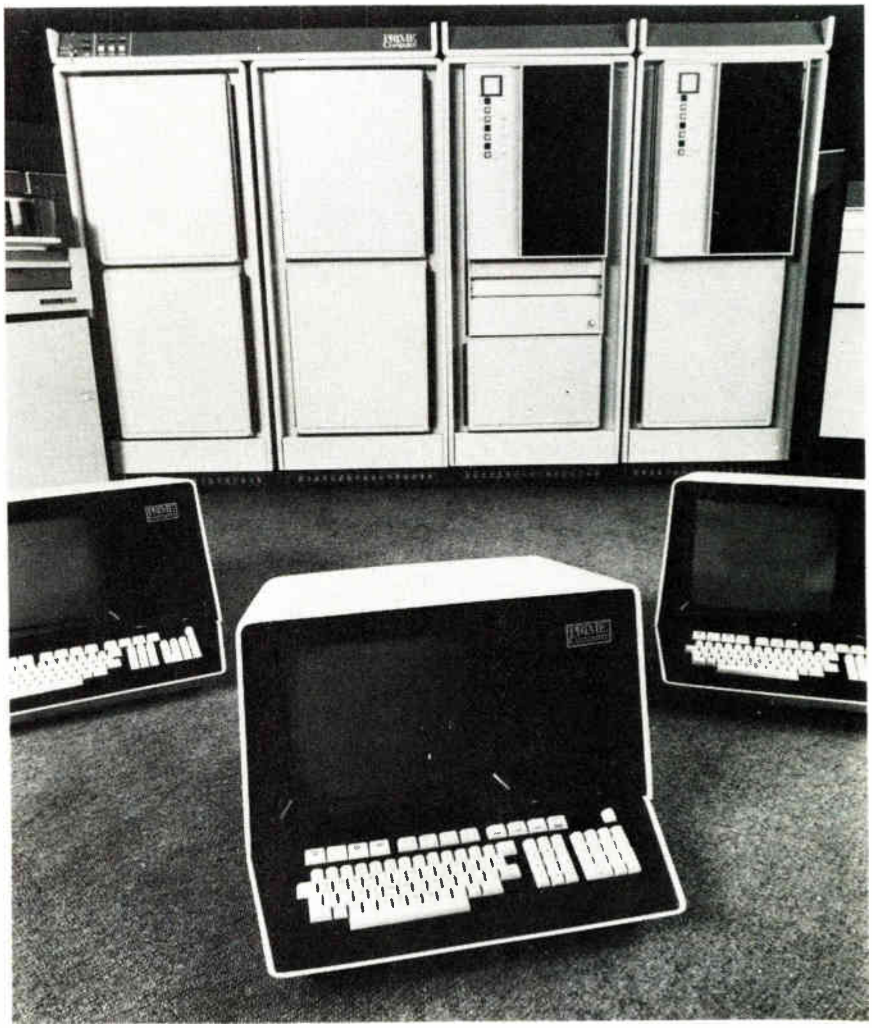
Unit executes two streams of code

Computer has performance between mini and mainframe, suits multiuser climate

A virtual-memory superminicomputer from Prime Computer Inc. processes two parallel instruction streams simultaneously for enhanced performance in multiuser, multifunction applications. The 32-bit Prime 850 system, representing the new high end of the firm's 50 series of computers [*Electronics*, Jan. 18, 1979, p. 174], claims a throughput up to 50% better than most superminis, including Digital Equipment Corp.'s VAX-11/780.

Prime attributes the 850's performance to what it calls its multistream system architecture. Designed to support the full interactive, multiuser capabilities of Prime's Primos operating system, the multistream approach teams two execution units—heavily modified versions of Prime's earlier 750 central processing unit—in an integrated system, says Stuart P. Silverman, group product manager for CPU products. The two execution units, called instruction-stream units (ISUs), access the same main memory, share a single memory and input/output bus, and operate under the same Primos operating system.

A single-board stream-synchronization unit (SSU) coordinates the



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Sets up shop. Makes housecalls. The state-of-the-art MS-230 is at home anywhere there's a need to accurately test or measure electronics equipment.

TV repairmen find it works wonders in the field. Tuck it in the tool kit, sling it over a shoulder or slip it on a belt, and it's ready to make a quick on-site diagnosis.

It's a great benchmate in the shop, too. Checks distortion, compares circuit inputs and outputs, finds faulty components. All with equal ease. And the MS-230 is so compact it doesn't clutter up the work area.

What's more, the versatile MS-230 is perfect for servicing microcomputer systems, maintaining avionics equipment and diagnosing sophisticated medical equipment.

A trio to pick from. If your work demands an oscilloscope that handles virtually all normal applications with unblinking accuracy, we've got your number. The MS-230. A superb value at $649.00.

We also make miniscopes to match other budgets and needs. Take the MS-215, for example. It's a 15 MHz, dual-trace scope priced at $497.00. Or the MS-15, 15 MHz, single-trace at $389.00.

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When it comes to portable, affordable, accurate miniscopes Non-Linear Systems leads the way.

MS-230 at a glance

Vertical Bandwidth:	30 MHz
Deflection Factor:	10 mV/div to 50 V/div, 12 calibrated ranges
Input Impedance:	1 megohm in parallel with 50 pF
Time Base:	0.05 nSec/div to 0.2 Sec/div, 21 calibrated ranges
Horizontal Bandwidth:	200 kHz
Trigger Modes:	Automatic, Internal, External and Line
Power Sources:	
Internal:	Rechargeable lead acid batteries
External:	115 VAC or 230 VAC, 50-60 Hz via plug-in transformer
Size:	2.9" H x 6.4" W x 8.6" D (74 mm x 163 mm x 218 mm)
Weight:	3 lbs. 10 oz. (1.65 Kg)

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ISUs' operations. Since each ISU contains its own 16-K-byte bipolar cache memory, the SSU's major task is cache validation; the SSU updates one ISU's cache memory whenever the other changes a shared memory reference. It also acts as a central clock to simplify bus arbitration, handles communications between ISUs, and runs internal diagnostics.

The cache memory access time is 80 ns and the hit rate, or likelihood that instructions and data will be present in the cache when needed, is 95%, says Jeffrey C. Flowers, product manager for operating systems at the firm. Each ISU also contains an instruction preprocessing unit, which minimizes execution time by prefetching four instructions from cache memory ahead of the program counter. This unit performs instruction decoding, sequential instruction queuing, and address translation in advance of execution.

Main memory on the 850 expands from 2 to 8 megabytes. Prime, says Flowers, is the first computer vendor to use 1-megabyte memory boards in a system; the boards contain 64-K MOS random-access memories. All memory logic is error-checking and -correcting. Consecutive memory addresses are located on separate boards, allowing two-way interleaving to speed sequential memory access, Flowers adds.

Data bursts. The 850 uses burst-mode I/O for very high data-transfer rates of 8 megabytes/s at 64 bits per burst request. With up to 2.4 gigabytes of auxiliary disk storage, the system supports a maximum of 128 direct-connection terminals and up to 128 user processes simultaneously. Firmware instructions for context switching automatically introduce new processes to either ISU in less than 35 μs.

Multistream operation boosts the 850's throughput into the entry-level mainframe category, where it is comparable to that of IBM Corp.'s 4341 model 2 and DEC's Decsystem-2060, says Prime's Silverman. "The 850 fills the gap between these and most high-end superminicomputers currently available, and it does so in the supermini price range," he

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Non-Linear Systems' Touch Test 20. The 2 lb. 4 oz. test lab.

The Touch Test 20 DMM weighs only 2 lbs. 4 oz. Yet it puts twenty key test functions at your fingertips. Plus exclusive light pressure touch function selection. Shown from above on leather shoulder sling (optional).

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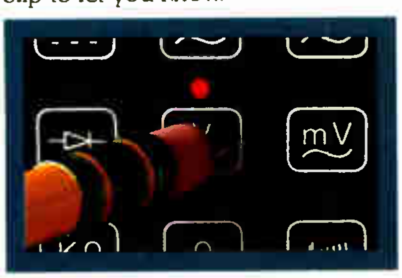
Another bright idea. The Touch Test 20 is the only DMM with light pressure touch function selection. No more dials to fiddle with. Instead, an LED shows the function you choose. And when you switch, you get an audible bleep and a visual blip to let you know.



Operation's a snap. A light touch chooses the function. An LED shows it.

Functional. Not gimmicky. We believe that in DMM design, form should follow function. For example, it's rare that a DMM is used hand-held. Usually it's placed so the operator's hands are free to manipulate the test leads and the equipment being tested. That's why we developed the Touch Test 20 — to fit where and how it would be used. The result is the most innovative portable/bench-type multimeter in the industry today.

Small wonder. The Touch Test 20 is designed specifically for mainline electronics measurement and testing. It checks AC and DC voltage, AC and DC current as well as resistance. Analyzes temperature in Celsius and Fahrenheit. Measures conductance and capacitance. It also performs diode/transistor and continuity tests. All with the accuracy that's synonymous with the name Non-Linear Systems.

Shop-proven. Field-proven. The Touch Test 20 is ideal for benchtop use. The large, 0.55-inch LED numbers make it easy to read. And its dial-free, light touch selection system prevents the unit from skittering across the tabletop. Light and versatile, it's the perfect, portable road lab, too.

The Touch Test 20 comes with test leads, temperature probe and resistor/capacitor test adapter. It features automatic polarity and overload indication plus in-circuit test capabilities. The Touch Test 20 is available in two models — rechargeable battery or line operated. All parts and labor are guaranteed for a full year. And each model is available with optional accessories like a leather carrying case with shoulder strap and belt loop, to help you get the job done.

Touch Test 20 at a glance

Measurements	
AC Voltage	10 μV to 750 VRMS, 6 ranges.
DC Voltage	10 μV to 1000 VDC, 6 ranges.
AC Current	10 μA to 10 A, 4 ranges.
DC Current	0.01 μA to 10 A, 7 ranges.
Resistance	10 milli Ω to 20 meg Ω, 7 ranges.
Temperature	−40°C to 150°C, −40°F to 302°F; 2 ranges.
Conductance	0.01 nS to 200 nS (equivalent to 5 megohms to 100,000 megohms) 2 ranges.
Capacitance	1 pF to 200μF, 6 ranges.
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Diode	Diode and transistor junctions in conducting and non-conducting directions.
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Price	$467.00 with batteries $435.00 without batteries

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asserts. He notes the 850's throughput is an average of 65% higher than that of Prime's 750 system.

Silverman expects the 850 to compete in scientific, computational, and commercial markets. The system can handle applications as varied as simulation, modeling, computer-aided design and manufacture, circuit analysis, manufacturing control, schedule planning, and office automation, he says. Both hardware- and software-compatible with Prime's other 50 series systems, the 850 also supports the company's Primenet networking software for distributed applications.

Silverman estimates the 850 will range in price from about $380,000 to $700,000. A typical configuration will cost $525,000 and will include the 850 CPU with 4 megabytes of main memory, one 300-megabyte disk drive, one tape drive, one 600-line/min printer, networking hardware and software, 20 terminals, Fortran 77 and Cobol, a data-base management system, and Primos.

Deliveries of the 850 begin in July, Delivery will take 30 to 90 days.

Prime Computer Inc., Prime Park, Natick, Mass. 01760. Phone (617) 655-8000 [361]

2- and 3-pass matrix printers do 150 to 600 lines/min.

The OSP/120 and OSP/130 two- and three-pass Office Systems Printers for word-processing, data-processing, and communications applications operate in the 300-to-600-line/min. range. The matrix printers supply graphics and incorporate an automatic cut-sheet feeding mechanism; manual and tractor feed are also offered. The OSP serial printers provide multiple-font storage, fully formed characters, and optical-character-recognition printing and labeling. The fonts are electronic, so they are stored either in read-only memory or are down-line–loaded into random-access memory, eliminating the need to change print wheels, print ball, or bands.

The printer can operate at 2,400 b/s or higher, speeds that are unusu-

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Introducing PANDUIT™ *HI-CON*™ Connectors

Interconnection is finally catching up with packaging density

While increased packaging density has been making giant strides in recent years, ordinary card edge connectors have lagged behind. Now Panduit offers you a way to catch up with package density with HI-CON two-piece PC board connectors that offer you up to 96 contacts in three rows.

PANDUIT HI-CON connectors are precision made to IEC 48B and DIN 41612 specifications and are fully intermateable with all components produced to these standards.

Utmost reliability

Unique female contact with torsion spring design provides dual wipe, coined surfaces with strict mating tolerances that drastically reduce mating/unmating contact abrasion and permit use of low gold thicknesses to help you reduce interconnecting costs.

PANDUIT HI-CON maintains low contact resistance after hundreds of mating cycles, assuring you of excellent electrical characteristics, even under adverse conditions.

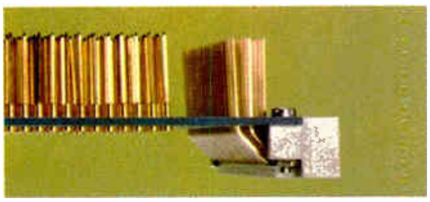
Maximum versatility

HI-CON connectors are available in types B, C, Half C, D and E, in standard, compact envelope sizes providing 16, 32, 48, 64 or 96 contacts in hundreds of pin arrangements and configurations. One, two or three rows of contacts let you match the connector to the specific requirements of your application.

Choose from three gold-over-nickel plating options: 30, 50 and 80 microinches.

Special female angle pin connectors mounted on card edge permit daughter board mating in the same plane.

All HI-CON connectors are available for either wire wrapping, hand or wave solder termination. And the precise, uniform 0.1″ grid lends itself perfectly to automated processes.



Male connectors with long angle pins permit direct connection to wire wrapped boards—reducing parts and installation time.

Reduce board cost

Reliable HI-CON termination pins adapt to varying board thicknesses, and the connectors maintain strict mating tolerances regardless of board quality. Also, the elimination of heavily gold plated fingers needed for edge connectors reduces board costs considerably.

At last, PANDUIT HI-CON, two-piece connectors give you the density plus reliability you've been looking for. And all at a price competitive with gold plated boards and card edge connectors.

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* 21 CHARACTERS/LINE
32 OPTIONAL

* SERIAL/PARALLEL
INPUT

DIGITEC'S
6450 & 6460
THERMAL ALPHANUMERIC
PRINTERS
* 64 CHARACTERS

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IJKLMNOPQRSTUVWXYZ@
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!'~[]()

* 21 CHARACTERS/LINE

* SERIAL/PARALLEL
INPUT

DigiTec's popular 6400 Series Printers now offer you a choice!

DigiTec has added two new thermal models to the tried and proven 6400 Series Alphanumeric Printers. You can now choose thermal or electrosensitive printing and get all the DigiTec benefits with either. Fewer moving parts than impact printers guarantee increased reliability. Plus, non-impact means no hammers to clatter or wear out and no messy ribbons to change. A built-in microprocessor provides the simplest possible interfacing.

Input configurations satisfy all the popular data communication interfaces. The serial models are programmable for either RS-232-C or 20 mA current loop at either 110 or 300 baud while parallel input models accept data at rates up to 1000 characters per second (higher rates optional).

These features combined with compact size, quiet operation and designer-styled good-looks produce dependable printers that are perfect for your application.

Choose either thermal or electrosensitive . . . if it's DigiTec, you've made the right choice.

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New products

al for a serial printer. For draft or data-processing output (a single pass), the printers can operate at 600 characters/s, and for letter-quality output (two and three passes), they work at speeds no lower than 150 characters/s. For an average text, this runs to about three to six pages per minute with automatic collating.

The OSP printers' print-head life exceeds 1 billion characters, and all operator control is with push buttons. RS-232-C interfaces are standard, and Centronics, Dataproducts, parallel ASCII, current loop, and other communications protocols are optional. Delivery is in 60 days. The list price for the model OSP/120 two-pass printer is $3,900 and for the OSP/130 three-pass printer it is $4,100.

Florida Data Corp., 600D John Rodes Blvd., Melbourne, Fla. 32935. Phone (305) 259-4700 [362]

$7,800 printer runs at 1,200 lines/min

What could be the lowest priced 1,200-line-per-minute printer yet sells at an original-equipment-manufacturer price of $7,800. The model 3121 is priced about 40% below its competition, according to John G. Henry, vice president of marketing and sales at Data Printer Corp.

Though nominally a 132-column printer, the 3121 can accommodate

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Excellence Starts in Design and Continues in Performance

For 32-Bit Performance, CONCEPT 32/2750.

Some products are synonymous with excellence– Mercedes-Benz, Nikon, Rolex, Lear... They developed their reputations not only on innovative design but on continued improvements and refinements. They have imitators, but nothing can match their quality.

SYSTEMS has been the innovator for more than a decade, from the first true 32-bit minicomputer to CONCEPT 32/27, with the first single-slot 32-bit CPU. Our imitators are the most prominent minicomputer manufacturers in the world. But, no one has matched our quality.

CONCEPT 32/27 was designed from the ground up to be the most functional, reliable lowest-priced 32-bit minicomputer available to the OEM. Now, the CONCEPT 32/2750 maintains this leadership by increasing capacity and enhancing performance. Integral memory expansion up to 4 Mbytes. Floating point performance higher than any mini in its price range. Up to 36 SelBUS slots. A minimum of eight additional slots on the Multipurpose Bus. At a cost-per-slot that's less than you'd expect.

SYSTEMS unique, layered software makes it easier to optimize your system. The MPX-32 real-time operating system supports multi-user interactive program development. A variety of high-level languages, utilities and support libraries can be selected. And, you can order the full SOFTOOL 80™ package of software development tools to increase programmer productivity and provide management with greater visibility and control.

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SOMETHING NEW FROM ITT JENNINGS:

A SMALL, RELIABLE VACUUM RELAY TO 20 KV? YES.

Small wonder. That's what you can call this new series of vacuum relays from ITT Jennings.

There are presently 8 models in this series and they offer test voltage ranges from 4 to 20KV. They also offer low contact resistance (less than .020 ohms), high current handling (10 amps @ 2.5 MHz, for example), frequency ranges from DC to 76 MHz, and they are available in both latching and non-latching versions.

Are they reliable? Typically you can expect 1,000,000 cycles without a failure.

All of this in a small package that can prove to be the most cost efficient relay you ever purchased.

You will find a wide range of applications, too. Antenna couplers, antenna switching, transceivers, safety grounding, and pulse forming networks for radar to name a few. You will also find MIL-R-83725 "slash" versions available.

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DIVISION OF INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

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136 columns. Other features are ribbon re-inking, a forms-length selector and an 8-to-12-channel electronic vertical-format tape reader, 6-to-8-line/in. vertical line spacing, numerous font options, a digital line counter, and an elapsed-time indicator. Many of these features are user-programmable through the 3121's plastic keyboard, which addresses the built-in microprocessor.

The unit can run at up to 1,350 lines/min with a 48-character font, falling back to its rated 1,200 lines/min with a 64-character font. A speed of 600 lines/min is user-selectable and results in somewhat higher print quality.

Finally, the machine is quiet. Its enclosure is sonically damped so that the noise perceived in the vicinity of the unit is less than 65 dBA. That is near the perceived noise level of most offices and far quieter than the best printers of only a few years ago. Delivery is immediate.

Data Printer Corp., 99 Middlesex St., Malden, Mass. 02149. Phone (617) 321-2400 [363]

Faster intelligent graphics terminals cut host overhead

The 4110 series of computer display terminals combine local intelligence features with increased line speed and throughput, as well as increased ability to interact with the user and a reduction in host overhead. The 4110 series consists of the 4114, a 19-in. high-resolution direct-view storage tube with refresh and fast local-redraw capabilities; the 4114 Option 31, a variation of the 4114 with color-enhanced refresh for more contrast; and the 4112, a moderate-resolution 15-in. raster-scan

The way this connector mates 600 volts, anyone can handle it safely.

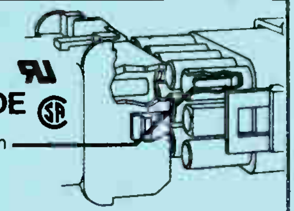
That's why the AMP Universal MATE-N-LOK connector has UL component recognition for 600 volts—and CSA and VDE for worldwide applications. Its silo cavity design provides complete shock hazard protection. Housings are flame resistant 94V-0 material.

For high or low voltage and current applications, there's no connector like it for safety and performance.

But it's versatile, too. You can use the Universal MATE-N-LOK connector wire-to-board with our wide range of pc board headers. Mounted on a panel or hanging free, you can intermix pins and sockets. And you'll always get excellent contact retention and strain relief.

Handle the high voltage with the connector that handles it safely.

AMP Facts



Wire Size:	30-10 AWG
Contact Plating:	Tin or Accu-plate selective gold
Housings:	2-15 position
Housing Material:	94V-2 or 94V-0 rated material
Insulation Resistance:	1000 megohms
Mating Forces (per circuit):	Split pin—1.5 lb. average
Separation Forces (per circuit):	Split pin—1.0 lb. average
Current Rating:	Dry circuit to 25 amperes (dependent on individual application)
Operating Temperature:	−55°C to +105°C
Durability:	50 cycles, mating and unmating
Approvals:	Underwriters Laboratories, Component Recognized, File #28476; CSA certified—File #LR 16455; VDE—tested under Report #4751-800-2/A

For a free sample, call the AMP MATE-N-LOK Connector Information Desk at (717) 780-8400.

AMP Incorporated, Harrisburg, PA 17105.

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E-3

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New products

model featuring the high addressability of the storage tube.

The terminals contain random-access memory expandable up to 800-K bytes in the 4114 and up to 600-K bytes in the 4112. In addition, integral single or dual flexible-disk mass storage is available as an option on the 4114 and a single disk drive on the 4112, with 512-K bytes of capacity per disk. The 4114 has a data-communications speed of up to 19,200 b/s; transmission speed is 9,600 b/s on the 4112. Block-mode asynchronous transmission will also be available as an option. The 4112, though a raster-graphics terminal, is equal to the storage tube of the 4114 in its addressable resolution: 4,096 by 4,096 addressable points.

The 4110 series will be supported by Tektronix PLOT 10 IGL software and existing applications programs for the 4010 series will also run on the 4110. An optional three-port RS-232-C peripheral interface enables local control of plotters and printers.

Base price for the terminals is $9,000 for the 4112; $17,500 for the 4114; and $19,500 for the 4114 with Option 31. They become available this month.

Tektronix Inc., P.O. Box 500, Beaverton, Oreg. 97077. Phone (503) 685-3043 [364]

14-in. Winchester disk drives are easy to repair

The microprocessor-controlled Capricorn series of 14-in rack-mountable Winchester disk drives have modular subassemblies that are easily replaced and comprehensive self-diagnostics for added reliability. Two models are available: the 165 with a capacity for 165.9 megabytes of storage and the 330 with 330.3-megabyte capacity. The drives use the standard storage-module drive (SMD) interface and offer an average access time of 30 ms. Pricing for the 165 is $5,900 and $7,100 for the 330 in OEM quantities. Shipments begin in September.

Ampex Corp., 200 N. Nash St., El Segundo, Calif. 90245. Phone (213) 640-0150 [367]

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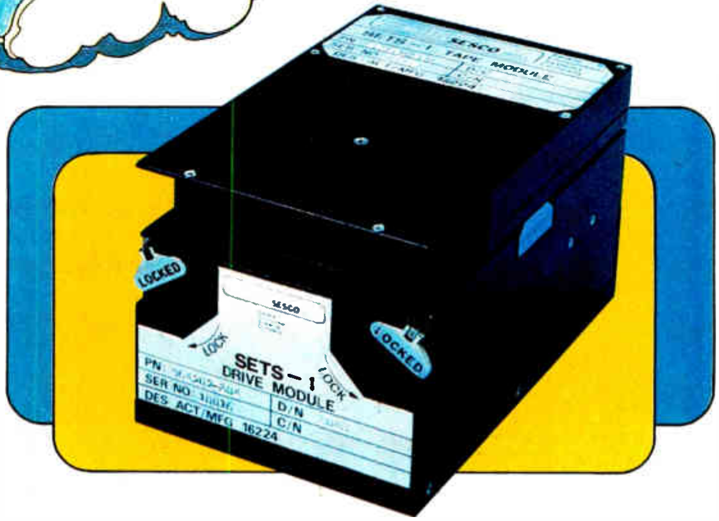
TOUGH

TOUGHER!



SETS-1: A 23-megabit digital tape system for severe environments

The soaring eagle is tough. Our SETS-1 digital tape system is tougher… on the ground as well as in the air.

Built Tough for Tough Jobs

Whatever the application — industrial, military or aerospace — this rugged recorder is built to take on the most hostile environments. It meets MIL-E-5400, 4158, 16400… and more.

Right now SETS-1 is being used by the Army and Air Force for bulk storage and data gathering from tanks, aircraft and remote sites. Also for mission loaders, communications and fire control systems. Its wide operating temperature range of −55°C to +71°C makes it perfect for a growing number of industrial requirements, too.

A Top Performer

As for performance, there is none higher. A removable, hermetically sealed tape cartridge stores 23 megabits of data at 1600 bits-per-inch on 300 feet of 1/4-inch magnetic tape. Plus it offers bidirectional read/write on 4 tracks with a 192K bit-per-second transfer rate.

Small, Light, Dependable

Solid throughout, SETS-1 features an all-aluminum case that measures a compact 4" by 6" by 3.6". Quick, easy maintenance is assured by plug-in modularity. The drive module holds a reliable brushless D.C. motor and all electronics while the magnetic tape, head, sensors and capstan drive are contained in a separate tape module. All together, the entire package weighs in at under 5 pounds!

See What Tough Really Means

Phone or write for complete details today. You'll soon know why our SETS-1 tape system deserves to be called the "tough one"!

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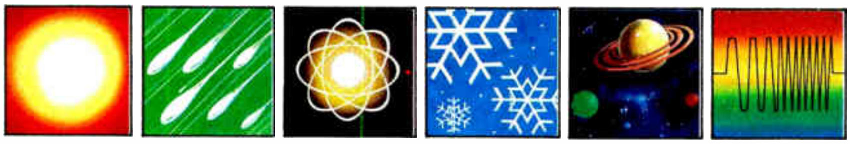

COMPUTER PRODUCTS FOR SEVERE ENVIRONMENTS

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Winning performance down to the wire. Multiwire.®

Jim Hill, Vice President Products and Services,
Systems Engineering Laboratories,
Fort Lauderdale, Florida

Reporting the results of a test of three circuit board technologies, Jim Hill of Systems Engineering says, "We're a big winner with Multiwire."

In this test, identical technical assignments were initiated with Multiwire, multilayer and wirewrap to produce two new double floating point processing boards for Systems' 32 bit scientific minicomputers. The 15" x 17" boards were to contain an average of 300 IC's.

Multiwire was the victor hands down. For good reason.

High Speed Electrical Performance

"Multiwire allows us to build high performance systems without sacrificing noise margin," says Hill. The copper circuitry of Multiwire provides consistent and controllable electrical characteristics so important to high speed logic.

Custom Design

Even the most difficult high density board configurations and specifications are achieved through Multiwire design technology.

Fast Turnaround

Multiwire delivered boards four to six months faster than multilayer.

Performance. Design. Delivery. Multiwire gives you all to make you a big winner, too. Challenge us with your next assignment.

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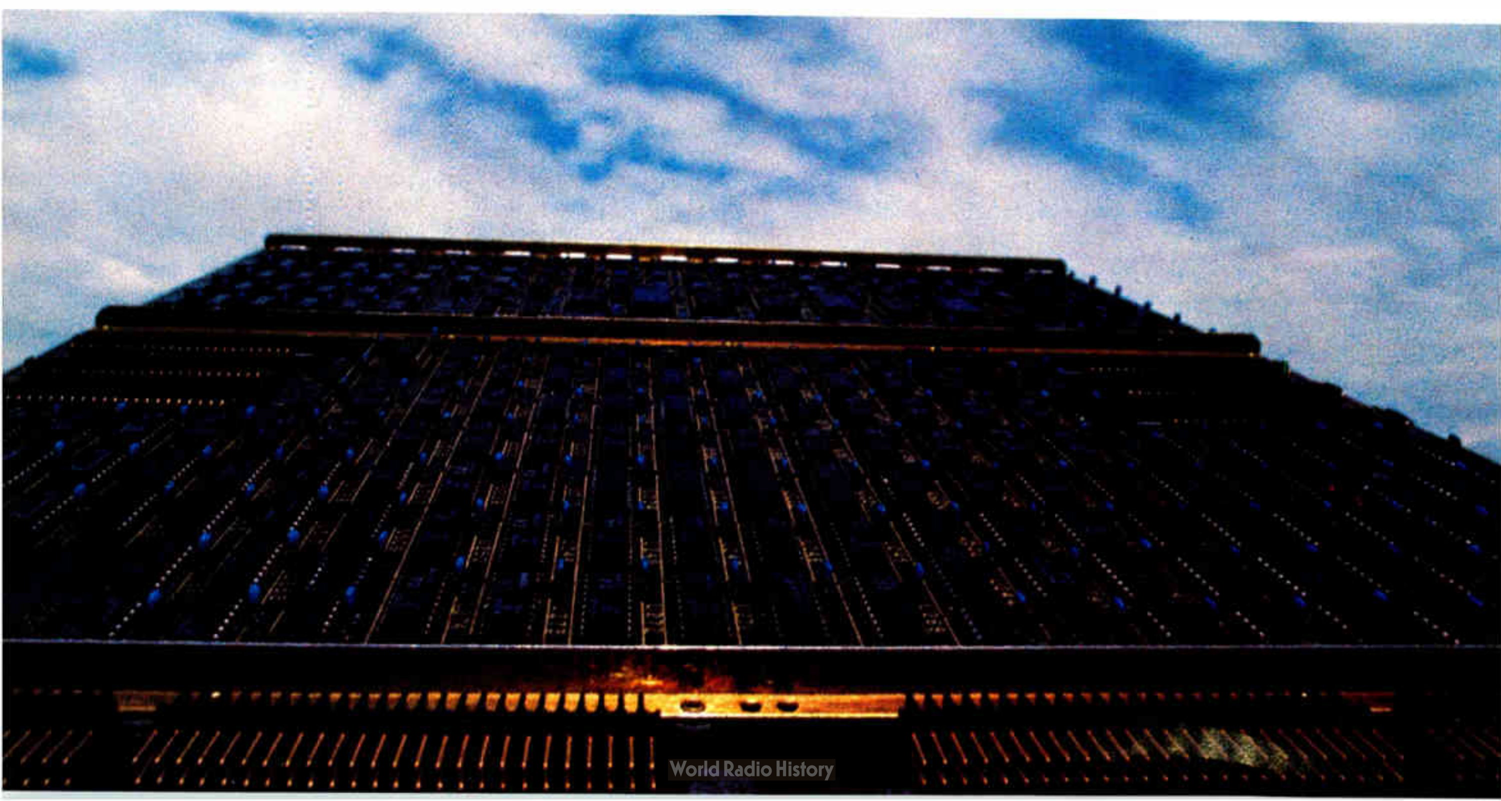


World Radio History

Software

Apple gets down to business

VisiCalc-related software plots, forecasts trends, links computers of any size

Four new business software packages have been introduced by Personal Software Inc., the supplier of the popular VisiCalc numerical model-building program. The new programs, which have the same easily used program style as VisiCalc, are: VisiPlot, a high-resolution plotting and graphics package; VisiDex, a flexible personal information system; VisiTrend/VisiPlot, a combination of a program for time-series manipulation, trend forecasting, descriptive statistics, and VisiPlot graphics; and VisiTerm, for easy communication between a personal computer and anything from mainframes to microcomputers, including other personal computers.

All four new programs operate on the Apple II and Apple II Plus computers with at least 48-K bytes of memory and 16-sector disk formatting. They function with or without Apple's language system. VisiDex and VisiTerm require one disk drive. VisiPlot and VisiTrend require two disk drives and Applesoft Basic.

The version of VisiCalc for the Apple II series of computers has been enhanced at the same time to include a full implementation of the Data Interchange Format, for information exchange among the Visi line of programs. Seventeen new commands have been added.

Data exchange. An example of the data interchange is the way VisiPlot can use data from the new version of VisiCalc, as well as that entered directly, to produce graphs and charts in six different formats and six different colors automatically, without programming. It produces bar graphs, time-series line plots, pie charts, area charts, high-low charts, and scatter charts.

With VisiTerm, the Apple personal business computer becomes an online terminal able to access time-sharing services, news wires, data bases, stock reports, and other personal computers to exchange VisiCalc work sheets or VisiPlot graphs, for example. VisiTerm works in ASCII upper- and lower-case characters with proportional spacing for easy reading. It is easily configured to match the requirements of various host computers. Such details as bit rate, parity, stop bit, and other features may be quickly changed and saved for future use.

The new features in VisiCalc include an editing command for editing a formula without retyping it; the ability to choose a particular element within a list on the basis of the result of another calculation; and the Boolean functions TRUE, FALSE, NOT, AND, OR, and IF. Also added are the mathematical symbols for "greater than," "less than," "greater than or equal to," "less than or equal to," and "not equal to."

The suggested retail prices are: VisiPlot, $179.95; VisiDex, $199.95; VisiTrend/VisiPlot, $259.95; VisiTerm, $149.95; and VisiCalc, $199.95.

Personal Software Inc., 1330 Bordeaux Dr., Sunnyvale, Calif. 94086. Phone (408) 745-7841 [351]

Package projects and calculates

Software is useful in science, engineering, and business; it runs on DG minicomputers

"Supercomp is so powerful that it gives small-computer users the capabilities of large-computer timesharing systems," says Allen Z. Kluchman, president of Access Technology Inc., publishers of the software package. The package is compatible with most Data General computers.

Access Technology's first offering, Supercomp is an electronic work sheet for businessmen, managers, engineers, and other technologists. As such, it is conceptually similar to packages developed for some microcomputers—VisiCalc, for example—but with the power and features appropriate to larger, more capable minicomputers.

Supercomp would seem better suited than VisiCalc to engineering calculations. Kluchman notes that Supercomp arithmetic uses a four-word binary floating-point format rather than VisiCalc's three-word decimal approach. This offers 15- rather than 12-digit precision and increased dynamic range; Supercomp can deal with numbers between 10^{75} and 10^{-75}.

Supercomp also uses row- or column-value references—an aid in dealing with replication of formulas. Also, its replicate command deals in full rectangles, not just row or column segments.

The storage command of the package is simplified: the user need only specify a file name rather than add a command. Other commands also allow incorporation of Supercomp into other resident programs, or, alternatively, extraction of a Supercomp work sheet, part of that work sheet, or appendages to it, in order to build a library of predefined work sheets. If users have trouble, they need only press a "help" key to see the options available to them and relevant to the problem displayed.

Kluchman expects businessmen to use Supercomp for tasks ranging

World Radio History

from simple job-cost estimation to complex production scheduling. Technical personnel will use Supercomp's work sheet matrix and more than 20 mathematical functions and logical operators for scientific and engineering calculations and simulation (see photo).

Business uses. Supercomp is said to permit managers to construct a detailed business plan with ease, turning the work of days into hours, according to Kluchman. And once a plan has been created, it can be easily altered to incorporate changes or try out alternative scenarios.

Supercomp also allows users to call information already filed on disk or tape into these plans—perhaps a unique feature, according to Kluchman. The files may be written in almost any language. Users can thus recall historical data to compare it with past projections and to determine if historical trends justify trend lines projected from current data.

One of Supercomp's strong points is its self-instruction package consisting of a text and prerecorded computer models. The text and business models used were prepared by a major accounting firm, Laventhol & Horwath.

There is a self-instruction package for users just learning to operate their computers. For advanced users there is a Supercomp handbook and a Supercomp pocket guide; experienced programmers and most engineers and engineering managers will be able to use these two aids to hit the ground running.

A license for the first release of Supercomp costs $950. This fee includes a year's worth of updates and enhancements, a service that can be extended indefinitely for a small fee. Delivery is immediate.

Access Technology Inc., 103 Central St., Wellesley, Mass. 02181 [352]

Interactive syntax generator eases reports from data base

Intel's latest productivity tool, an interactive syntax generator called Genius, enables nontechnical users to command sophisticated reports from system 2000/80 data bases. The program is a conversational report generator that can be used by both programmers developing application packages and end users who require prompting and error-detection facilities. Genius will be demonstrated at the NCC, as will be TAPS/80, an on-line application development aid operating under IBM's CICS, and QueX, a menu-driven interactive end-user aid.

TAPS/80 manages the entire application-development and -production process, reducing development work by an average of 55%, says Intel, because it lets programmers build data bases interactively. QueX, which stands for query-update by example, allows inexperienced users to make use of a data-base management system (DBMS) without knowing the system's syntax or computer language.

Intel Corp., Commercial Systems Division, 12675 Research Blvd., P. O. Box 9968, Austin, Texas 78766. Phone (512) 258-5171 [353]

Software prompts user through data management

The Hewlett-Packard Personal Information Management System can create, access, modify, search, and sort data; maintain up to 1,000 records of information; and perform complex analyses. The system can manage all this because it includes—in addition to a Series 80 personal computer, a mass-storage read-only memory, and a dual floppy-disk drive—the new Information Management Pac software (IMPac). The software features easy-to-follow prompts for the inexperienced computer user, a report generator, a sorting and statistical capability for comparison analyses, and advanced graphics capability to create line, curve, bar, and pie charts. Possible applications include creating, updating and printing inventories, customer lists, and catalogs.

For the complete system, prices are as follows: the HP series 80 personal computers range in price from $2,250 to $3,250; the HP 82901M dual-disk drive (which provides a total of 540-K bytes of random-access storage) sells for $2,500; the IMPac software costs $200; and the ROM costs $145. If the disk drive is purchased before May 15, the software and ROM will be supplied free of charge.

Hewlett-Packard Co., 1507 Page Mill Rd., Palo Alto, Calif. 94304 [354]

Exorcisor II can expand to cover new microprocesors

American Microsystems now supplies cross-support software that expands the capability of the popular Motorola Exorcisor II development system so that programs for the Intel 802X, 803X, and 804X microprocessor families as well as for the 8080, 8085, and Zilog Z80 microprocessors can be developed on the Motorola machine.

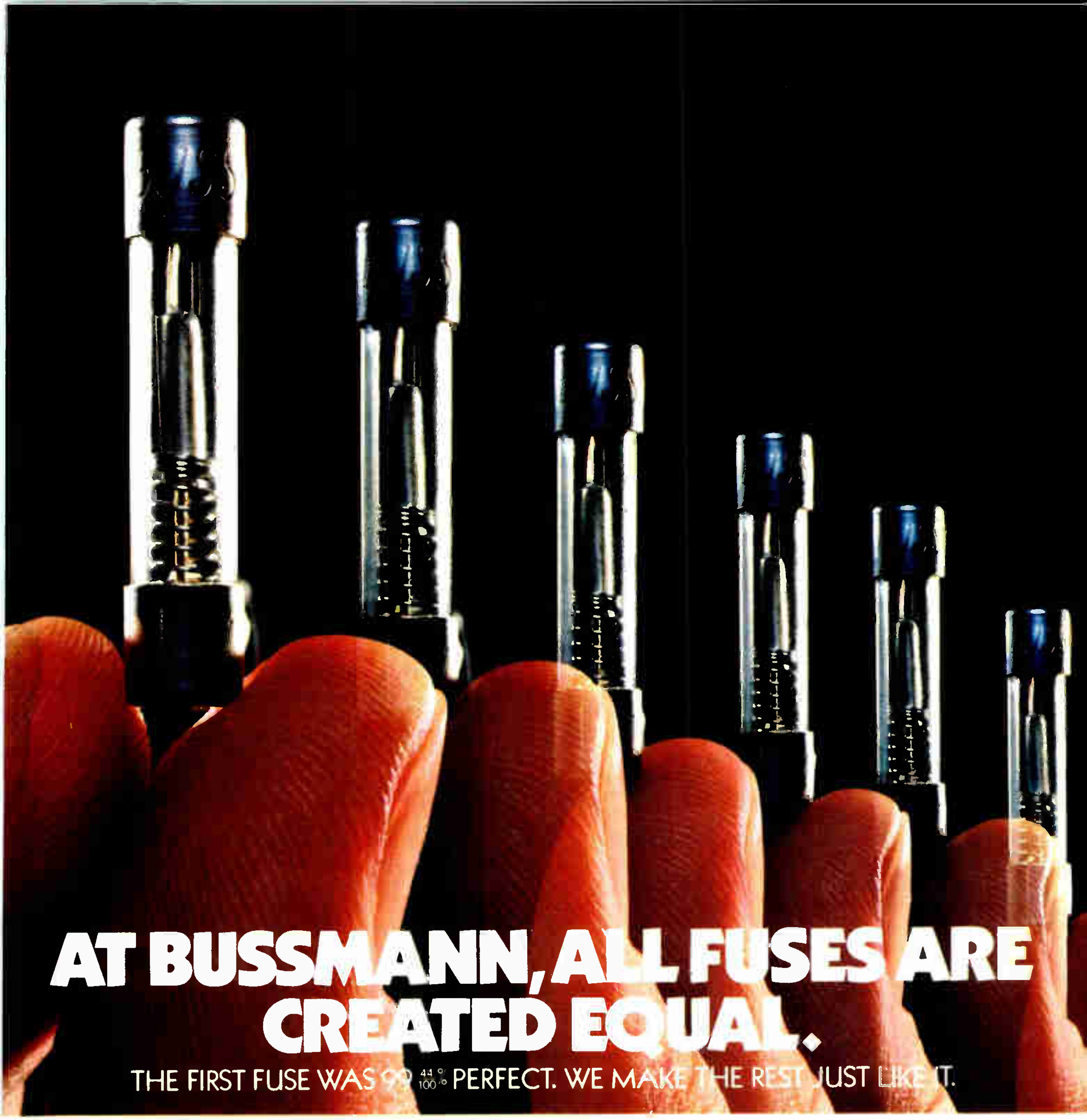
Using a screen-oriented editor with menu selection, programmers can scan 23 lines of code and make desired program changes by positioning a cursor to write over existing code or by selecting commands from a menu. This, says AMI, should speed the editing of programs. The software also includes error-recovery features to prevent accidental deletions from occurring.

Several full macro assemblers for the families mentioned above are available and include such features usually found only on larger development systems as 1's complement and exclusive-OR. All the macroassemblers support both local and global labels.

The cross-support software and one assembler cost $675 in North America. Each additional assembler is $125. These prices include a six-month software subscription service. An extended subscription to the software service is available for an additional fee.

American Microsystems, 3800 Homestead Rd., Santa Clara, Calif. 95051. Phone Nancy Hartsoch at (408) 246-0330, extension 604 [357]

World Radio History



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ELECTRONICS PROTECTOR NUMBER ONE.

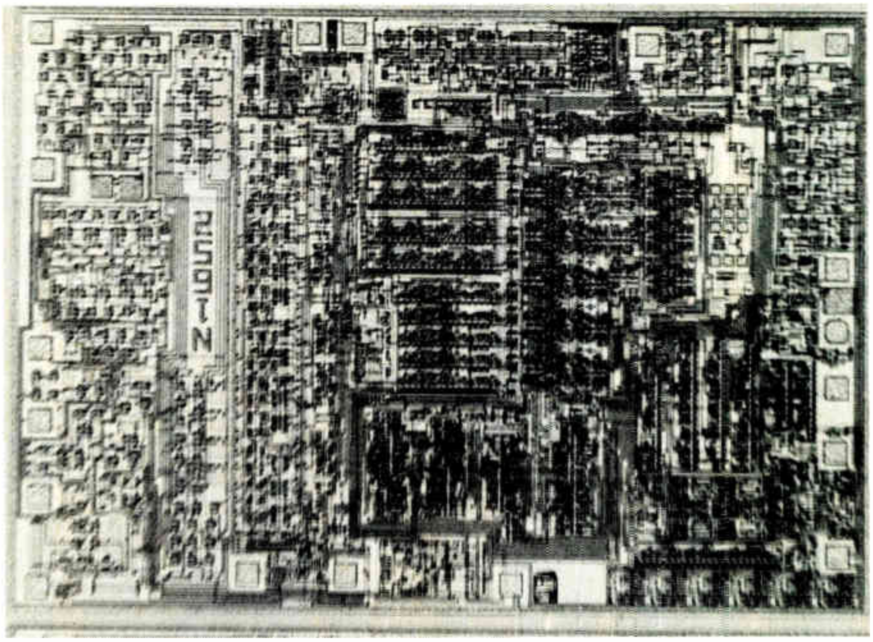
Circle 10 on reader service card

World Radio History

Components

Chip ups radio integration level

For portable, car, and hi-fi radios, chip keeps signals apart from control, display



No one yet has seriously proposed a single-chip radio. But Philips' Gloeilampenfabrieken of the Netherlands keeps moving consistently in that direction. In tandem-harness with the company's radio-set designers, the Elcoma parts-making division has developed a coherent range of integrated circuits that handles receiver functions all the way from the radio-frequency front end on through to the audio amplifier. And as IC technology advances, Philips packs more functions onto single chips when that makes sense, cutting the number of packages set makers need for new designs.

The trend is admirably illustrated by Philips' latest radio chip, the SAA 1057, which takes care of all the signal-handling essentials for digital tuning of a-m and fm radios. Because it combines analog circuitry like sample-and-hold, input preamplifers, and the loop-filter amplifier with injection logic for the digital portions of a phase-lock synthesizer, the SAA 1057 does a job that up to now took three chips.

Fewer extras. What is more, the number of outboard components needed to implement a digital tuning module has been slashed from 67 to 16. Just as important for cost-conscious set makers, "the SAA 1057 makes possible complete synthesizer-system modules that cut costs and save space," insists Rach Caduri, the international marketing manager for bipolar consumer circuits, based at Nijmegen in southern Holland.

The circuit works for car radios, high-fidelity radios, and portables. It was conceived, Caduri points out, to give set designers a free hand when it comes to the "gimmicks" associated with tuning. "We partitioned our digital tuning system to keep the signal essentials separate from the control and display functions," he explains. As a result, the SAA 1057 develops its output-tuning voltage in response to signals applied via a three-wire control bus. All sorts of tuning and display features—keyboard dialing, remote control, search tuning, and the like—can be implemented easily by using a microcomputer and hanging a display driver, a station memory and the synthesizer chip on the bus. An added advantage of the partitioning, Caduri adds, is that radiation is kept to a minimum because it is restricted to the "signal essentials" part of the chip.

Car radios, hi-fi radios, and portables have different design imperatives, but Jan Van Straaten and Henk Pruim, the two main circuit designers involved, managed to cover them all in a single chip without compromises in performance. A-m radios, for example, need fast lock-in and that means a high-speed digital phase detector. Hi-fi radios, on the other hand, need very high signal purity, and that implies a fairly slow sample-and-hold device. The Nijmegen pair resolved the conflict by using a 32-kHz sampling circuit when the system is out of lock and a separate 1-kHz circuit for the in-lock condition. The system locks on to the ordered tuning frequency in less than 4.5 ms yet manages a very high signal-to-noise ratio.

Tuner-loop gain. A versatile chip must cope with a variety of tuner-loop parameters. That is taken care of by a programmable loop-gain amplifier with a range of 1 to 100 and an integrated loop-filter amplifier. The combination makes possible a very simple loop filter and puts out tuning voltages as high as 30 V.

For portable radios, a wide range of supply voltages is a must, and the SAA 1057 functions over a range of 3.6 to 12 V. Equally important is current consumption, which has been held to less than 20 mA. A key factor here is a clocked traveling-wave divider and routing of current to different sectors of the chip only when they are clocked on. Stacked logic also contributes to low power drain. "Current is used at least twice," explains Van Straaten. "Almost every logic circuit acts as a current source for another."

The chip has a single reference frequency for both a-m and fm, but a programmable counter gives a choice of two tuning steps—1 or 1.25 kHz on a-m over a frequency range of 0.5 to 32 MHz and 10 or 12.5 kHz on fm over a range of 60 to 120 MHz.

Philips Nijmegen packs all this

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Circle 11 on reader service card

World Radio History

circuitry, plus a reference voltage stabilizer and some test features, on a chip 14.5 mm^2 in area. About 20% of the chip area is analog circuitry. The fabrication technology utilizes 4-in. wafers and a positive-resist process that employs 10 masking steps to achieve a gate density of 250/mm^2. The technology is noteworthy in that it makes possible two full aluminum interconnection layers, separated by one layer of silicon nitride and topped by another. The integrated circuit is housed in a plastic 18-pin dual in-line package.

Philips' own set-making division has designed the chip into prototypes of car radios and hi-fi gear, Caduri reports, and mass production will start in the second half of 1982. At the outset, the chip will be priced in Europe at about $4; as always with consumer chips, prices are highly negotiable for quantity orders.

Philips, of course, will continue with more chips for set makers. First to come, reports Udo Schillhof of the radio-circuits group at the Philips-Valvo Applications Laboratory in Hamburg, will be an 8048 single-chip microcomputer programmed for car radios. "We will sell the software as well as the chip," says Schillhof. A complementary-MOS driver for up to 60 segments of liquid-crystal display is also on the way.

NV Philips Gloeilampenfabrieken, Gerstweg 2, 6534 AE, Nijmegen, The Netherlands [395]

Signetics Corp., P. O. Box 9052, 811 E. Arqes Ave., Sunnyvale, Calif. 94806 [342]

Buffer's error is under 0.001%

In the worst case, 24-V/μs buffer/voltage follower has tested 1.5-mV output error

Because they are used to shield high-impedance sources from low-impedance loads while accurately reproducing input signals, the most important feature of analog buffers is that they introduce minimal error between input and output signals. Performing a worst-case error analysis of these devices is not only "a tedious chore," it is an unnecessary one, according to engineers at Precision Monolithics Inc., who have developed what they claim is the first high-speed buffer/voltage follower tested and guaranteed with a maximum output specification.

Designated the BUF-02, the new analog buffer device has a low output impedance of 0.03 Ω, typical; a minimum gain of 0.9999; a power-supply rejection ratio of 100 dB, typical; and a very low input bias current—0.3 nA, maximum. More importantly, the maximum output error—a 100%-tested specification composed of a wide range of input and output loads and input-voltage test conditions—assures that the BUF-02 will drive a 10-kΩ load over a ±10-V output voltage range, with a less than 1.5-mV error referred to the input.

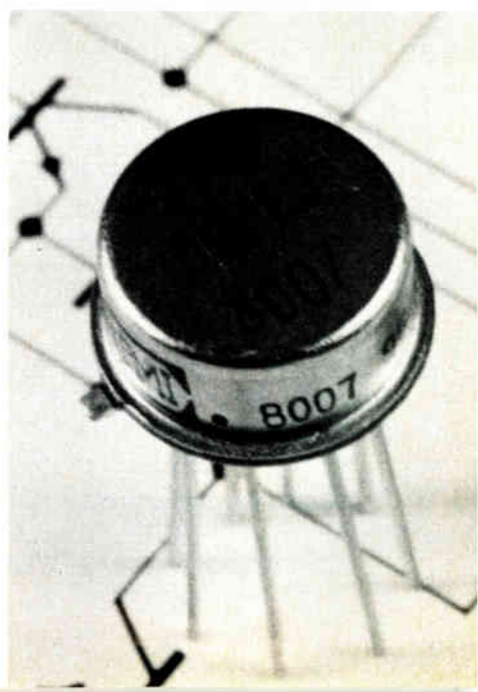
To perform a worst-case analysis of standard buffers, according to staff product marketing engineer David L. Gillooly, it is necessary to consider the inaccuracies that might be introduced from a variety of error sources, such as those due to offset voltage, to input bias current, and to the common-mode rejection ratio, as well as to the finite gain from the buffer itself. "Even if all error sources are considered, the designer doesn't know if some of them cancel out others until he puts the device in the system and measures its performance," Gillooly says.

What's more, performing a worst-case analysis of standard buffer devices yields a large error figure that the designer ignores at his peril. If he chooses to assume the cancelation of the effects of one error source by another, "it may haunt him later on in production."

Unlike PMI's previous BUF-01 precision buffer and voltage follower, which stresses accuracy (250-μV output error) and is suitable in low-speed (0.25-V/μs) applications, the BUF-02 provides better than average accuracy (1.5-mV output error) and far better than average speed (24 V/μs) and bandwidth. Also, the BUF-02 is pin-compatible with the LM110 buffer/voltage followers made by National Semiconductor, Intersil, and Advanced Micro Devices, for example. In contrast, these analog buffers have a typical output error of about 17 mV, though they are slightly faster with a slew rate of 30-V/μs, he notes.

Fabricated with PMI's technology combining bipolar and field-effect-transistors, the BUF-02's current-cancelation technique doubles the input bias current with every 18°-to-20°C increase in temperature. In most competitive offerings, the input bias current doubles with every 10°C increase. Also, with a typical input offset voltage of 0.5 V and a 1.0-V maximum one, power consumption is 150 mW typically and 210 mW maximum.

Because of its high gain and low voltage gain error (0.001%), the BUF-02 suits such applications as buffering an input signal that is going into an analog-to-digital converter. In this application, "you want to buffer the signal but you don't want to amplify it," Gillooly says. "The high accuracy of the BUF-02 is needed so that errors aren't added to the signal." For a 10-bit a-d conversion system having a 10-V full



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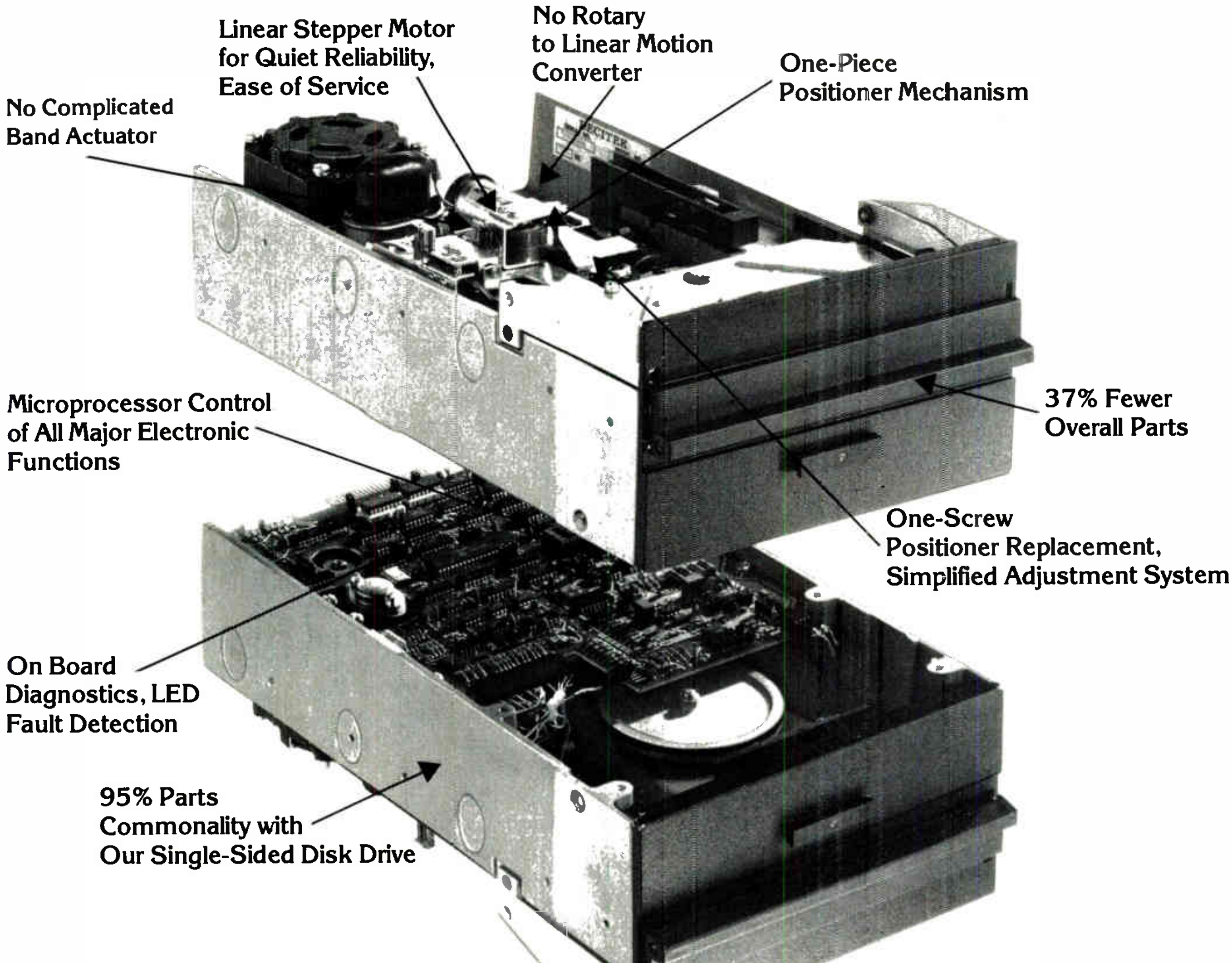

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Circle 12 on reader service card

World Radio History

scale, the worst-case error of the BUF-02 is one sixth of a least significant bit.

Among other applications that need voltage followers having a gain essentially of 1 there are: second-order high-pass active filters; bilateral current sources; high-speed single-supply ac buffers; and differential input instrumentation amplifiers. "There are also times when one wants to distribute signals to many places. The BUF-02 can be used right after multiplexer devices, for example, in a signal distribution network," Gillooly states.

Available in TO-99 (J-suffix) packages, devices with an A or E suffix are specified for a maximum output error of 1.5 mv, while devices with either B or F suffixes are of lower accuracy (4 mv). The A and B units are specified for use in the military temperature range of −25°C to +125°C and are available with or without MIL-STD-883 class B processing. The E and F devices are designed to cover the commercial temperature range of 0° to 70°C.

In quantities of 100, the BUF-02AJ is priced at $14.50 each, while the BUF-02AJ/883 costs $17.40 each. In like quantities, the BUF-02BJ lists for $8.00 or $9.60 each with 883 processing. The commercial devices, BUF-02EJ and BUF-02FJ are priced at $6.50 and $3.50 each, respectively, at the 100-piece level. Availability is from stock to 30 days after receipt of order.

Precision Monolithics Inc., 1500 Space Park Dr., Santa Clara, Calif. 95050. [342]

Power Darlington handles 200 A

500-W npn device series runs from 50 A at 850 V to 200 A at 250 V

A series of transistors for motor control and other high-power applications from the Motorola Semiconductor Group will be shown at Powercon 8, the international power electronic conference and exhibit. Of the npn Darlington type, they operate at collector currents of 50, 100, and 200 A and are housed in a new package the firm says was requested by designers of controls and industrial equipment.

Members of a high-current series, the MJ10050, MJ10100, and MJ10200 have collector-emitter on-voltage ratings (V_{ceo}) of 850, 450, and 250 V, respectively. They are capable of dissipating 500 W, the company says, and are targeted for use in six-step ac motors, speed-torque controls, and low-frequency inverters. Maximum fall times specified at room temperature for the three devices are 35 μs at 50 A, 5 μs at 100 A, and 8 μs at 200 A. Saturation voltage for these Darlington transitors is 2 V; they are rated to operate from 120-, 220-, and 440-V lines.

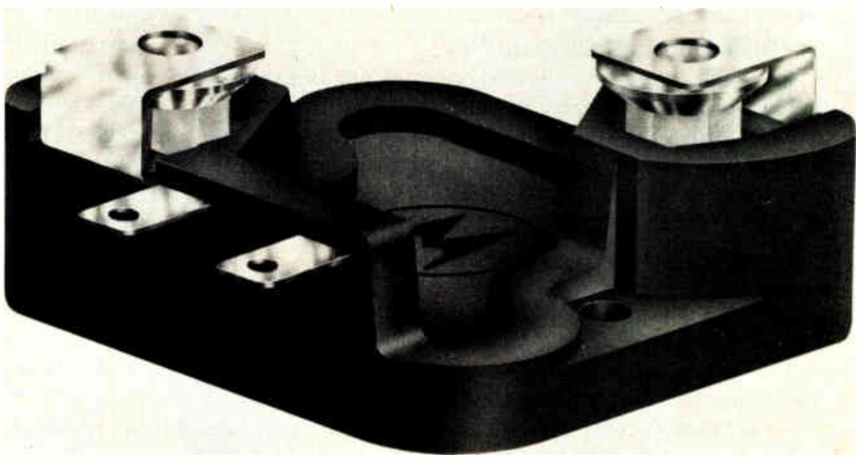
Motorola calls its new housing a user-designed package that incorporates many requested features. These include a single-sided mounting with isolated mounting holes, "bussable" terminals that have a ¼-inch bolt with captured nut, separate drive terminals capable of accepting a No. 6 bolt, a large heat-sink contact area, and a hybrid free-wheeling diode. The firm plans to introduce high-speed Darlingtons and TMOS power field-effect transistors for pulse-width–modulated controllers and high-frequency power inverters in this package later in the year. TMOS is a vertical MOS structure with a T-shaped current flow.

20-A series. Companion devices also set for unveiling are Darlington transistors housed in TO-3 cans for power control from 440-V lines. For switching in inductive circuits where resistive fall time is critical, the units are specified at 1.8 μs maximum fall time at 10 A. The two transistors, MJ10024 and -25, are rated at a continuous collector current of 20 A with voltage breakdown at 750 and 850 V. They are capable of blocking 1,000 and 1,200 V, respectively.

The devices have internal diodes running from collector to emitter that clamp inductive loads. A diode across the drive transistor's input enhances switching speeds when reverse bias is applied, according to the company.

For the high-current series, the price in quantities of 100 to 999 is $30.60 each. The switching MJ100-24 and -25 cost $8.25 and $9.75.

Motorola Semiconductor Group, Power Products Division, P. O. Box 20912, Phoenix, Ariz. 85035. Phone (602) 244-4911 [343]



Push-button toggle switches have long lives

A line of push-button switches have longer life-cycle ratings than available competitive products. TEC Inc.,

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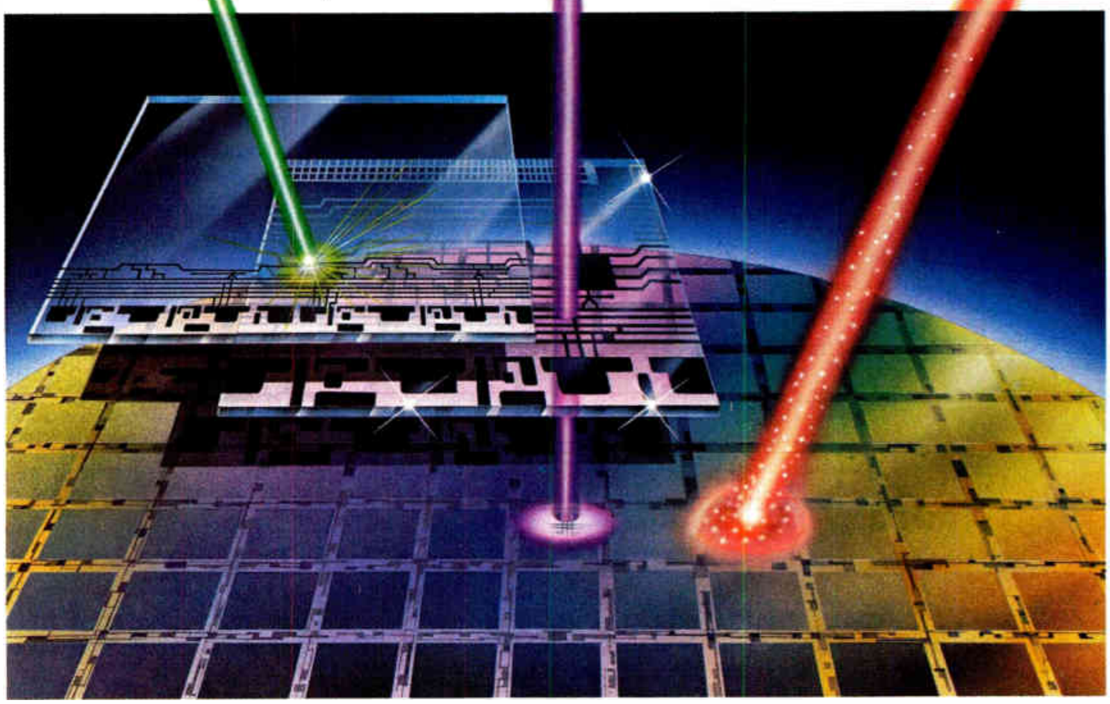
For information, write Perkin-Elmer, Semiconductor Operations, 50 Danbury Road, Wilton, Connecticut 06897.



PERKIN-ELMER

Responsive Technology

Circle 17 on reader service card

World Radio History

their manufacturer, says the new switches can last up to three times longer than competitive parts, though they are priced about the same.

The new snap-action push-button units, which are an expansion of TEC's miniature toggle-switch line, are available in single- and double-pole varieties, with from low-level to 5-A switching capacities. At the low level, each switch is rated at 250,000 cycles; at 1 A it is rated at 150,000 cycles, and at 5 A, at 25,000 cycles. A new switching mechanism developed by TEC had upgraded product life, says a company official.

The switches are designed to be mounted in a ¼-in. hole and are pin-compatible with existing push-button models. A variety of actuator shapes are offered in 10 colors. They can be supplied with several methods of termination: solder lugs, straight and angular solder tails for printed-circuit applications, and two types of wrapped-wire terminals. In 1,000-unit quantities, prices of the single-pole type are $2.15 apiece and $2.98 for the double-pole variety.

TEC Inc., 2727 North Fairview Ave., Tucson, Ariz. 85705. Phone (602) 792-2230 [344]

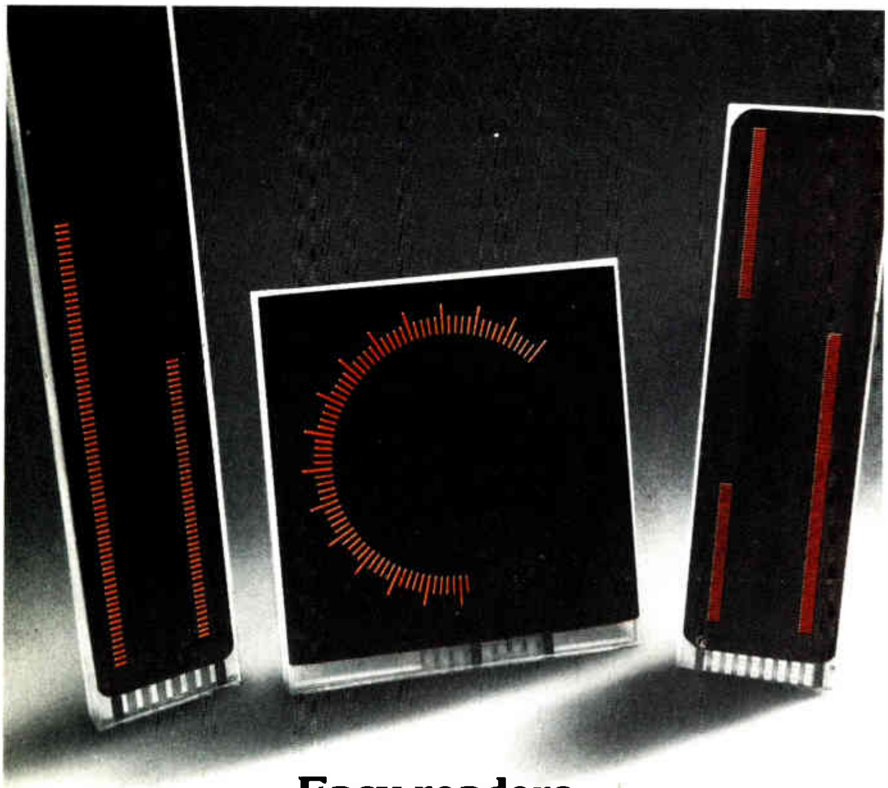
Green, yellow LED indicators save circuit-board space

Single- and four-element arrays of green and yellow light-emitting diodes have been added to the 555 series of circuit-board indicators. Typically used as logic-status and position indicators, the LED units can be stacked. Their elements and leads fit on 0.100-in. centers, and the package may be seated on the board surface for easier mounting and wave soldering. The single- and quad-LEDs come with or without current-limiting resistors for 5-V, 6-mA operation. The indicators are TTL-compatible, resist vibration and shock, and are housed in a black case for greater contrast. The single-LED indicators are priced at 62¢ each in quantities of 1,000; four-element arrays in the same quantities are $1.95 each.

Dialight, a North American Philips Co., 203 Harrison Place, Brooklyn, N. Y. 11237. Phone (212) 497-7600 [345]

Solid-state relays take TTL, C-MOS logic commands

For activating ac loads directly from the commands developed by TTL and complementary-MOS logic and microprocessors, two series of solid-state ac relays maintain a high degree of isolation between the low- and high-level circuits. The SA series is rated at 0.7 A and comes in an 8-lead dual in-line package, and the



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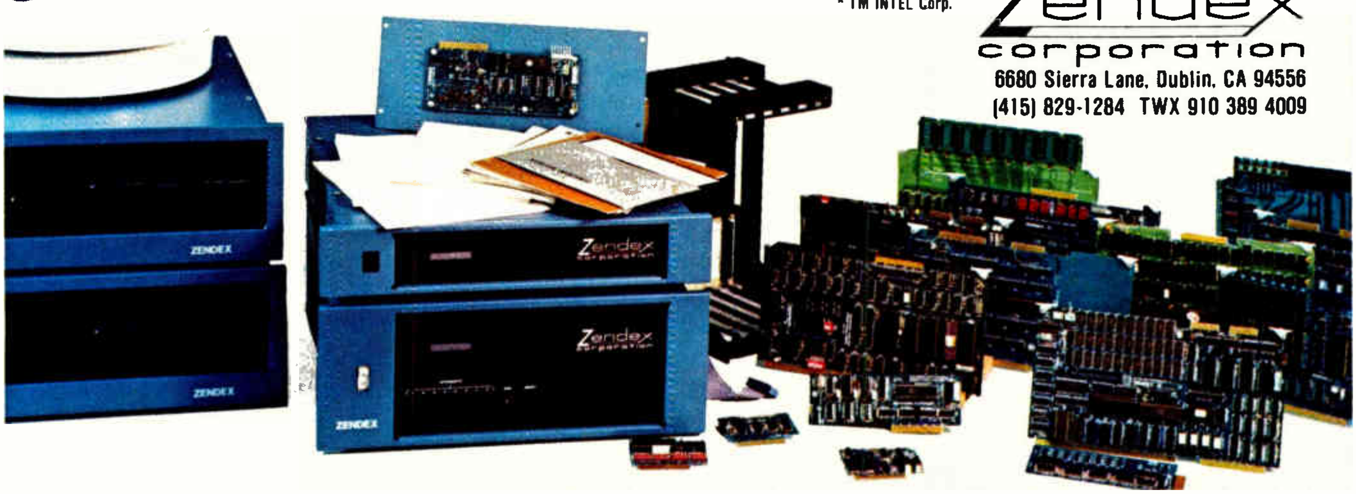

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Data Communications Books.

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Presents all 89 user-relevant data communications standards promulgated by CCITT, ISO, ANSI, EIA, and U.S. FTSC. Also includes descriptions of the standards organizations, plus relational charts of similar interfacing standards produced by different groups. Edited by Harold C. Folts and Harry R. Karp. 1133 pp., clothbound, $165.

Practical Applications of Data Communications: A User's Guide
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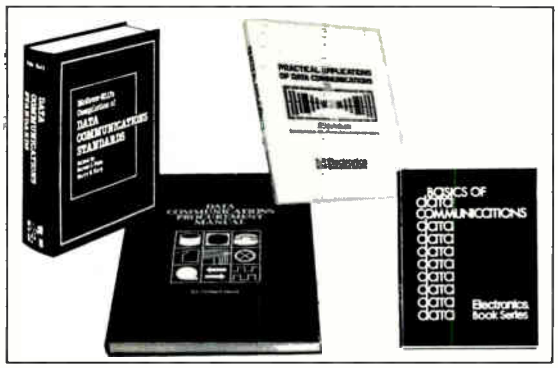

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RCA

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New products

1-A SB series comes in a standard 16-lead DIP. The SB offers higher continuous-current capability than the SA series and is available in several different footprints.

The optically coupled relays' input consists of a light-emitting diode, and the output consists of a pair of back-to-back silicon controlled rectifiers controlled by a proprietary chip. This arrangement makes the units more resistant than conventional circuits to line-borne transients and eliminates the need for an ac rectifier bridge. In 1,000-unit quantities, the SA units sell for $4.90 each, and the SB relays are $5.50 each. Deliveries are from stock to six weeks.

Power Switch, Elec-Trol Inc., 26477 N. Golden Valley Rd., Saugus, Calif. 91350. Phone (213) 788-7292 [346]

Resistor networks in SIPs have low, 0.200-in. profiles

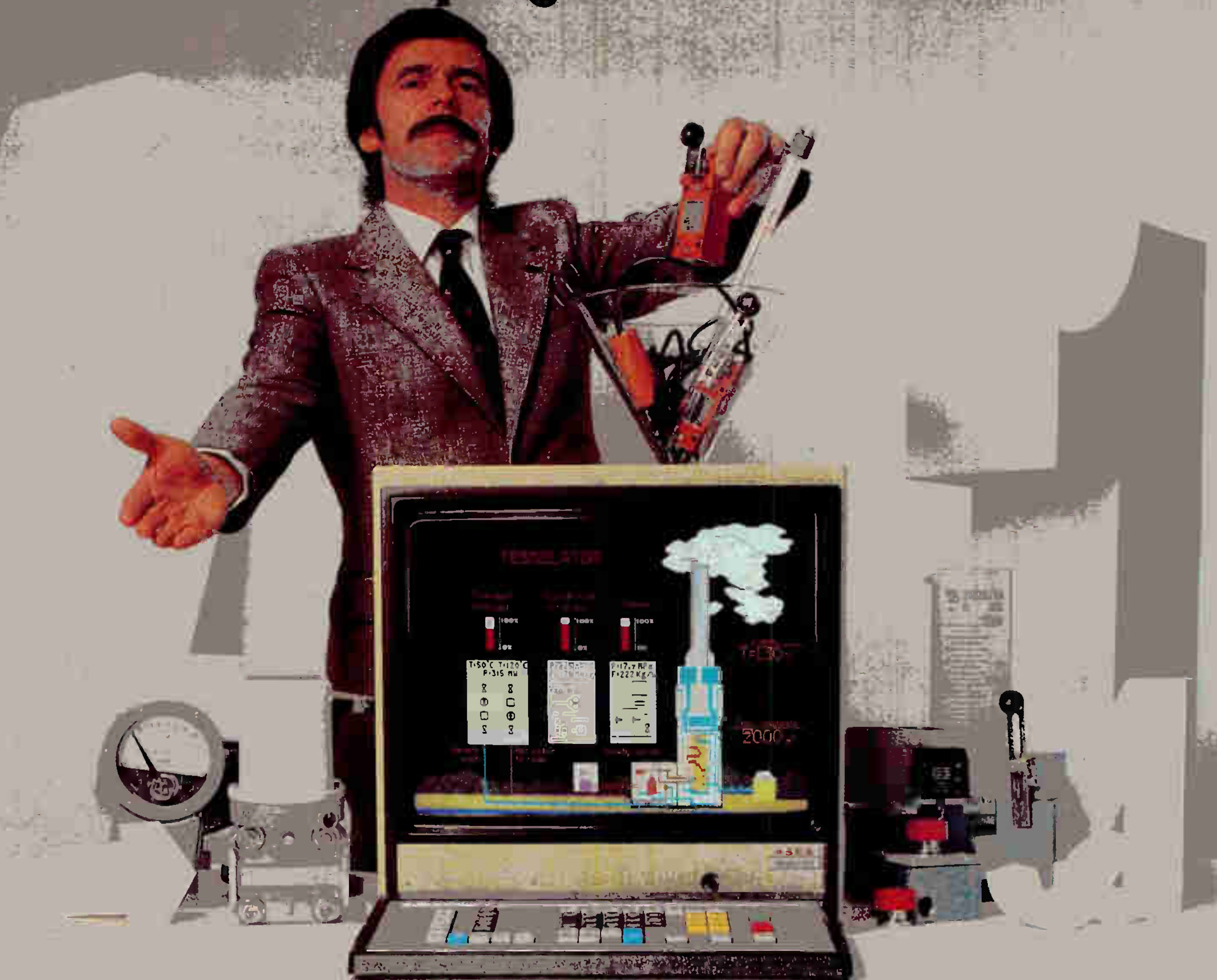
The maximum seated height of the HC2 series of 150 standard low-profile resistor networks in conformally coated single in-line packages is 0.200 in. The units come in 6-, 8-, and 10-pin versions with resistance ranges from 47 Ω to 1 MΩ and a ±2% tolerance.

They can be used for MOS memory, pull-up and pull-down functions, emitter-coupled-logic terminators current-limiting resistors, and other applications. The typical cost for an eight-pin, seven-resistor network in quantities of 1,000 is 39¢ each. Availability is from stock.

Centralab Inc., a North American Philips Company, P. O. Box 2032, Milwaukee, Wisc. 53201 [391]

World Radio History

A Display of Distinction



The Symbolizing Process made easy using ASEA's new TESSELATOR™ colour system

The TESSELATOR concept means you can represent just about any item or situation on your computer generated process display and be confident of optimum readability. All graphics are composed rapidly and easily – straight from the keyboard.

You can arbitrarily mix character sizes too, thanks to ASEA's revolutionary new character generator. Together with the high resolution monitor and perfectly uniform light intensity over the characters this makes the TESSELATOR display arguably the clearest and most distinct on the market.

So what's the secret? Well, Man has an amazing ability to pick out patterns and interpret symbolic structures. We at ASEA have seized upon this phenomenon. Vital facts and figures can now be highlighted without sacrificing space. High priority material is distinguished at a glance. And there is much less risk of eye-strain, backache, etc., due to over-concentrating.

Further, communication with the host computer is fast, due to the simplified coding format.

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TESSELATOR – the distinctive display

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Electronics Division
S-721 83 Västerås
Sweden

In the U.S.:
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See you later TESSELATOR – at NCC Booth 918

ASEA

Circle 21 on reader service card

World Radio History

Communications

Connectors cut fiber-optic costs

Plastic connectors for short-haul links can be mounted quickly and easily

A new fiber-optic interconnection system from Amp Inc. is aimed at the low-cost portion of the data-transmission market characterized by 10-Mb/s rates and link lengths in the 10-to-30-m range. The plastic-connector system is based on the use of any all-plastic 1,000-μm fiber with a 2.2-mm jacket diameter such as DuPont Crofon or Eska SH 4001, manufactured by Mitsubishi Rayon of Tokyo. Light emitters and detectors to be integrated into the system consist of Motorola's and Spectronics' TO-92 and TO-18 plastic-capped light-emitting diodes and detectors.

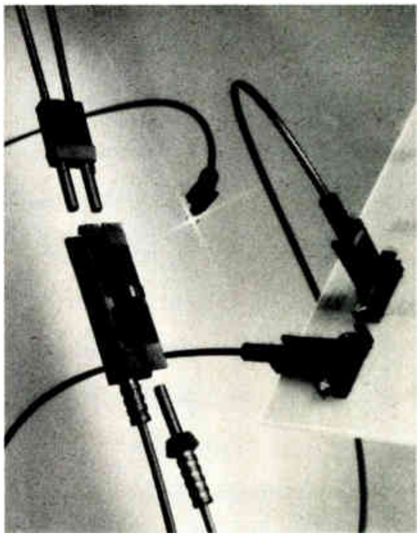
Amp's new fiber-optic connectors require no epoxy, polishing steps, or special tools to apply. To attach a plug, the fiber's protective jacket is stripped and the cable is inserted from the rear of the plug body until the jacket bottoms inside the plug cavity. Then the protruding fiber is cut off flush with the tip of the plug with a razor or hot knife.

The entire process takes about 15 seconds. A brass retention clip inside the body of the plug anchors the cable in place to withstand an 8-lb axial pull.

Specifically designed for use with the all-plastic fibers, the connector's performance depends largely on the end-surface finish of the fiber. Cutting the fiber with a razor results in insertion losses under 4 dB; cutting it with a hot knife produces a surface finish that yields insertion losses less than 2 dB. Application of an index-matching liquid reduces insertion losses by more than 50%.

Currently available components of the new connector system include a single-position plug, a dual-position plug, a single-position bulkhead receptacle, a dual-position bulkhead receptacle, a splice housing, a single-position active-device mount for TO-92 packages, and one for plastic-capped TO-18 packages. Each of these components is priced at approximately 25 cents. These components are aimed at the automotive, point-of-sale terminal, and small-computer markets.

An Amp analysis shows that its new fiber-optic system radically cuts system costs in comparison with



alternative methods. For instance, when compared with a system using currently available connectors, glass fiber, and low-cost emitters and detectors, the new Amp system reduces overall cost by about a factor of about 8.

Amp Inc., Harrisburg, Pa. 17105. Phone (717) 780 8851 [401]

Modules tailor custom modems

Choice of parts determines compatibility, functions of built-in modem circuitry

Although modems have been widely used to transmit data between computers, their design and construction are still basically analog problems, an environment that most digital systems designers prefer to avoid. Often, digital systems are designed, and then an off-the-shelf modem board or a self-contained modem is acquired, usually at a premium.

Cermetek has met the problem head on. "We have come up with a low-cost alternative—modem component sets—that will allow a digital designer, with little or no prior experience, to build a low-cost modem adequate for communication between microprocessor-based systems, teleprinters, and teletypewriters and for data acquisition and collection," states Howard A. Raphael, president of the Timplex Inc. subsidiary.

Based on integrated component modules fabricated in Cermetek's monolithic and hybrid circuit technologies, the component sets allow the easy design of a variety of 300- and 1,200-b/s modems, compatible with Bell System and CCITT formats. The kits come complete with tip and ring telephone interface on one port and a microprocessor-compatible interface on the other.

Cermetek is making available kits for the three popular low-speed modems, and it is also giving the modem designer the option of providing various types of interfaces to the modem modules for applications such as microprocessor bus, Multibus, S-100, IEEE-488, RS-232-C, and STD bus. The three series of modem kits are the CH1200, for Bell 103 or CCITT V-21 modems that use 300-b/s full-duplex formats; the CH1600, for Bell 202 or CCITT V-23 units that are 1,200-b/s half-duplex modems; and the CH1700 for Bell 212 or CCITT V-22 1,200-b/s full-duplex modems.

With the kit approach, Raphael notes, "it's possible to adapt a modem design to a specific data-communications equipment requirement." By the proper selection of a matrix of modules, the options also include high levels of integration and economy circuits for dedicated leased lines

World Radio History

The new Spectra-Strip 817 is the IDC D-Subminiature connector for those of you who have become disenchanted with D-Sub's.

With our D-Sub, you can now mass terminate your flat cables without separating each and every strand. Without stocking up on weird-pitched cable. Without a mechanical kluge tacked onto the back of the connector to go from .054-pitch pins to .050-pitch cable.

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Spectra-Strip, 7100 Lampson Ave., Garden Grove, CA 92642, telephone (714) 892-3361 and 720 Sherman Ave., Hamden, CT 06514, telephone (203) 281-3200.

In Europe, Spectra-Strip, Ltd., Romsey, Hampshire, England, telephone (0794) 517575.

D-Suberior.

World Radio History

Circle 22 on reader service card

or proprietary communications links. Within each modem selected, options are available for simplex or duplex transmission and originate-only, answer-only, originate-or-answer, automatic-answer, and automatic-dial operation.

Flexible or targeted. The modem designer can either design a board dedicated to a very specific communications requirement or make it more general-purpose, so that through the addition, subtraction, or replacement of modem components it can satisfy a range of system characteristics.

For the telephone port, Raphael explains, the designer can select a leased-line network interface, a switched line on the telephone network interface, and an acoustic coupler—"all of which can be easily adapted to the basic design." For example, a kit for a 103-type answer-or-originate modem has been partitioned into six basic monolithic and hybrid modules—a modulator, a mode selector, a demodulator, a transmit filter and line-interface hybrid, a receive filter, and a carrier detector. In addition, the component set includes a number of components needed for proper operation but not made by Cermetek.

According to Raphael, modem capability in kit form "can be incorporated into a product for under $100" in large volumes of about 10,000 units. "With the advent of modem modules," he says, "it can be done with no prior modem design experience, introducing the digital designer to the world beyond the RS-232-C interface." Availability of the CH1200, CH1600, and CH1700 kits is from stock to 30 days after receipt of order.

Cermetek Inc., 1308 Borregas Ave., Sunnyvale, Calif. 94086. Phone (408) 734-8150 [402]

Fiber-optic system operates at up to 100 kV/m

A broadband telemetry system, consisting of a transmitter unit with an input sensitivity of 200 mV, interconnecting fiber-optic links up to 500 meters long, and a receiver and control unit with an optional IEEE-488 interface, is designed for electromagnetic-pulse, -interference, and -compatibility testing, antenna mapping, and noise-free nonradiated transmission of analog and digital information. It has a return fiber-optic link to control input attenuation, calibration, and standby functions at the transmitter.

The telemetry system has a system gain of 28 dB, a harmonic distortion of less than 2%, and passband flatness to within ±0.5 dB. It can operate at up to 100 kV/m and is available in two models: one ranging from 1 kHz to 200 MHz and one from 10 kHz to 500 MHz. Prices go from $13,000 to $19,000. Delivery is within 90 days after receipt of order.

Amplifier Research, 160 School House Rd., Souderton, Pa. 18964. Phone (215) 723-8181 [403]

Microwave mixer comes in a TO-8 package

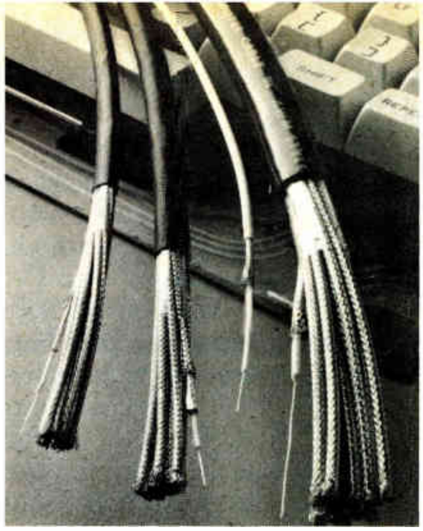
According to its manufacturer, the MC24T is the first double-balanced microwave mixer to be packaged in a small, highly reliable TO-8 package. It operates in the 3.7-to-4.2-GHz satellite communication band and features a 4.5-dB conversion loss, L-R isolation of 33 dB, L-I isolation of 20 dB, and a voltage standing-wave ratio of 1.6:1.

The MC24T mixer is available at $39.75 apiece in quantities of 100. Delivery is in two to three weeks.

Magnum Microwave Corp., 1080 East Duane Ave., Suite D, Sunnyvale, Calif. 94086. Phone (408) 738-0600 [404]

Coaxial cable offers fast data transmission

A line of miniature coaxial cables has been designed for electronic switching, computer interconnection, and data-communications applications. Their irradiated cross-linked inner-foam core allows propagation



velocities of from 85% to 87%, whereas typical velocities of propagation for other coaxials range from 65% to 70%. A process for extruding the foam core reduces the cable's diameter 25% over air-space coaxials and 35% over solid-dielectric cores.

The cables are available in single- and multiple-cable constructions with conductor sizes ranging from 26 down to 32 American Wire Gauge (AWG). They are priced between 10¢ and 25¢ per foot. Delivery is in 8 to 12 weeks.

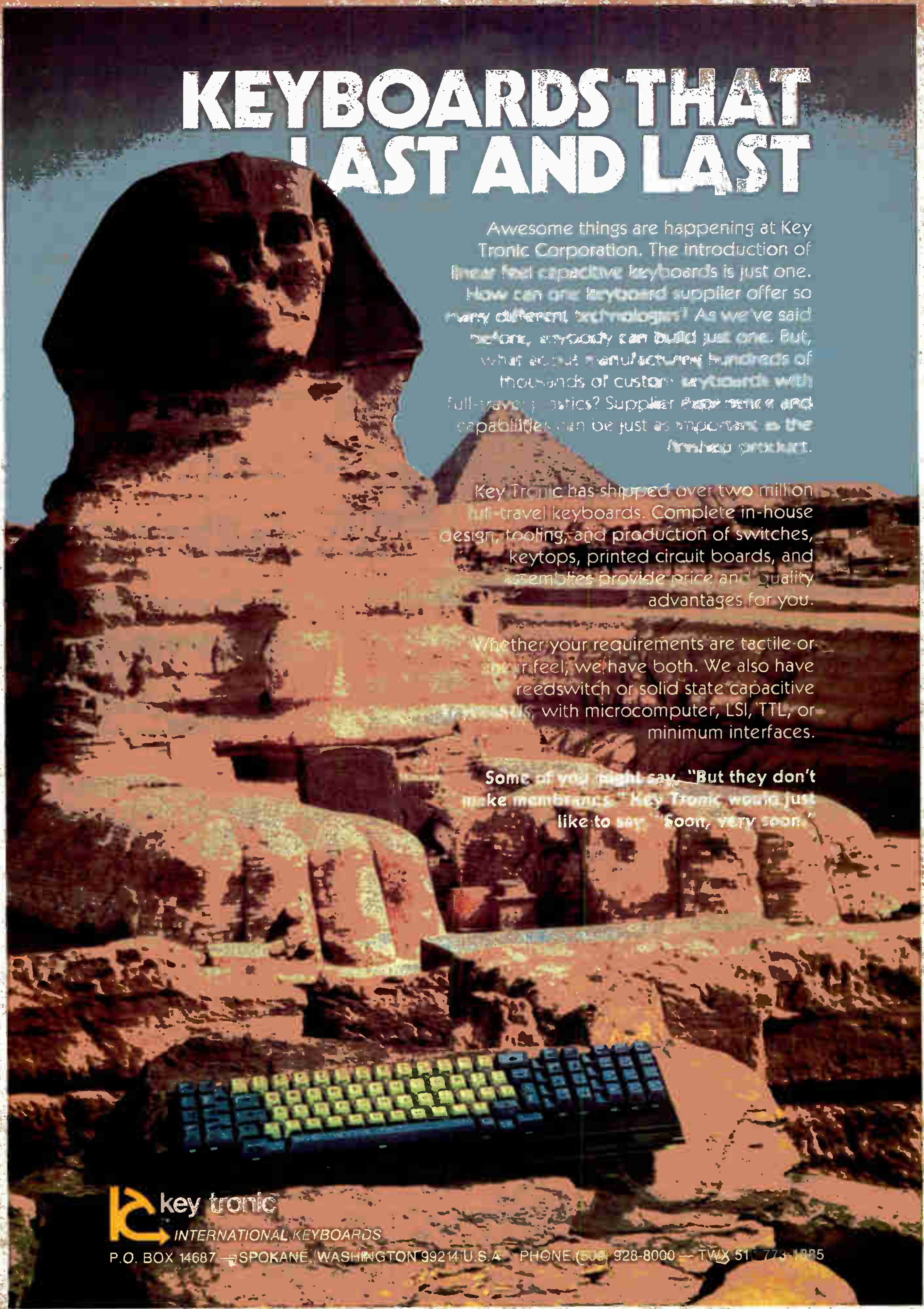
Telecom OEM Market, Electronic & Industrial Cable Division, Brand-Rex Co., Willimantic, Conn. 06226. Phone (203) 423-7771 [405]

Intelligent network processors work for small-system user

The models 60110 and 60120 have been added to the 6000 series of intelligent network processors to satisfy the needs of the minicomputer and small-system user. The 6001 INPs handle data traffic for clusters of up to eight asynchronous terminals for efficient transmission by statistically multiplexing data. Data integrity is ensured through error protection, and the processors are easy to operate via programmed parameter configurations. The light-emitting-diode displays on the units' front panels give information on data traffic and operation and allow self-testing at power-up or reset.

The two new models of the 6000 INP series support from four to eight channels and come with a 4,800- or 9,600-b/s integral modem to reduce cost. Prices begin at $1,975; one-to five-year leases are available. Shipments will begin in the third quarter

World Radio History



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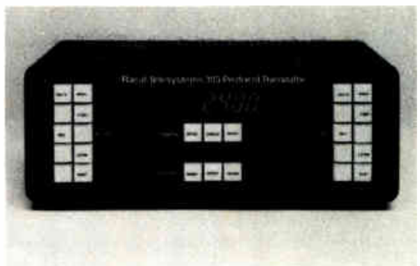
Codex Corp., a subsidiary of Motorola Inc., 20 Cabot Blvd., Mansfield, Mass. 02048. Phone (617) 364-2000 [406]

Translators let data and word processors communicate

Six protocol options, for cross communication among data- and word-processing equipment with different protocols and formats, have been added to the model 303 protocol translator. Eleven software options can be selected that enable word processors to originate and exchange information with mainframe computers, minicomputers, other word processors, and intelligent printers over hardwired or telecommunication lines.



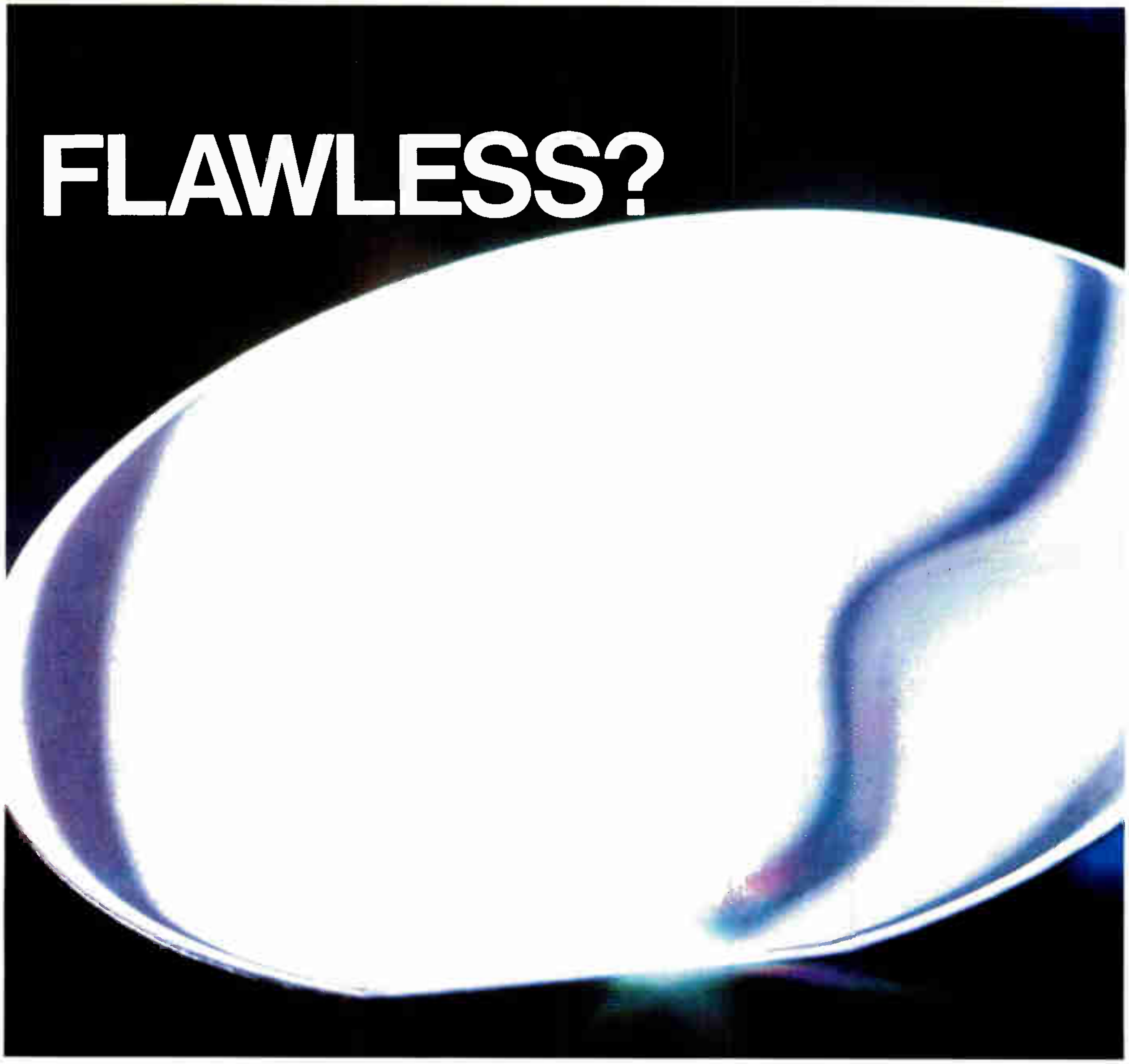
Not only is the 303 protocol translator compatible with DEC, Lexitron, Vydec, and Wang and IBM's OS/6 equipment, but it is also now compatible with the IBM 6670 laser printer systems and systems using Dictaphone 2000, CPT 8000, AM Jaquard, asynchronous ASCII, and bisynchronous EBCDIC protocols.

It can operate over unconditioned voice-grade telephone lines in a half- or full-duplex mode and transfers data at selectable rates ranging from 50 to 9,600 b/s. In dial-up applications, data from the translator can be transmitted by means of modems over virtually any distance.

The 303 protocol translator's price starts at $8,350 for two word-processor protocols. Each additional protocol option costs $500 more.

Racal-Telesystems Inc., a subsidiary of Racal-Milgo Inc., 410 North Michigan Ave., Chicago, Ill. Phone (312) 329-0700 [407]

World Radio History



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Ford Aerospace & Communications Corporation

World Radio History

Industrial

C-MOS memory keeps data 64 h

Nickel cadmium batteries back 16-K-, 8-K-by-16-bit cards for DEC systems

A competitor for magnetic-core memory in severe industrial applications using Digital Equipment Corp.'s LSI-11 systems is a static complementary-MOS random-access-memory board equipped with its own battery backup. Adac Corp.'s model 1816CMOS is an add-in memory whose two on-board nickel cadmium batteries protect against data loss for a minimum of 64 hours when power goes down.

That kind of reassurance should make the 1816CMOS an attractive alternative to bulky, power-hungry core memories. The maker will aim the unit primarily at industrial data acquisition and control, where system users contend with frequent brownouts and power failures and where lost data is irretrievable.

The RAM comes in two versions: the 1816CMOS-8 has an 8-K-word–by–16-bit capacity; and the 1816CMOS-16 holds 16-K 16-bit words. In either form the card is compatible with DEC's LSI-11/2, LSI-11/23, and PDP-11/03 systems, as well as with Adac's own models 1000 and 2000 computer-controlled data-acquisition systems. The 1816CMOS uses 450-ns RAM chips and can cycle in 95% the time it takes a host system's bus to cycle.

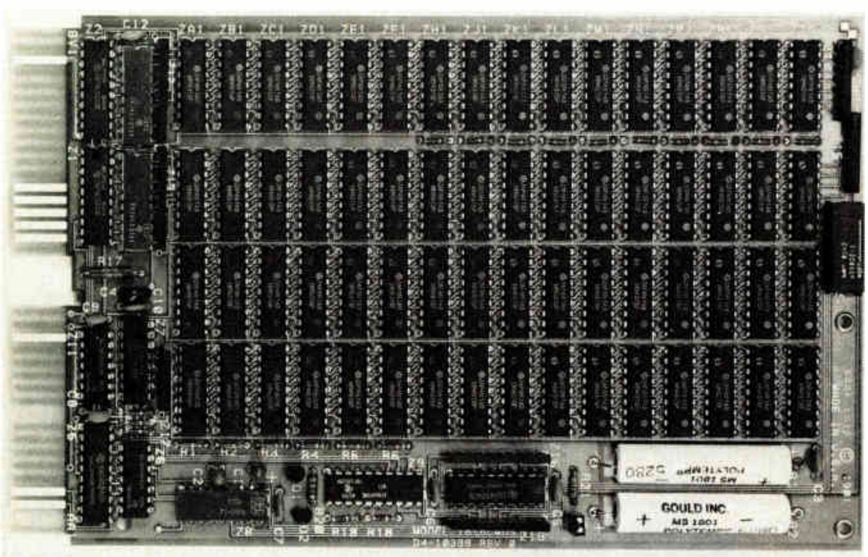
The 1816CMOS card decodes any 18-bit address, and its 8-K or 16-K words can start on any 4-K boundary within the address space. The 4-K-word blocks can be write-protected by means of configuration switches accessible while the card is in place.

Requiring only 25% of the space taken up by a 16-K-word core memory, the 1816CMOS fits into one dual-height position in the system backplane, according to Adac president James V. DiRocco. Unlike core memories, the RAM needs no 12-V power supply and typically consumes only 5 W, he adds. A built-in recharging circuit keeps the 1816CMOS's batteries at near peak efficiency for three years; recharging is automatic when +5 V is applied. The power-off drain rate, typically only 0.5 mA, is 2.5 mA maximum.

The 1816CMOS board measures 8.5 by 5.0 by 0.375 in. Operating temperature ranges from 0° to 55°C.

The price of the 16-K-word 1816CMOS-16 is $1,995 each. The 8-K-word 1816CMOS-8 costs $1,795. Delivery takes 60 days.

Adac Corp., 70 Tower Office Park, Woburn, Mass. 01801. Phone (617) 935-6668 [371]



Programmable unit controls 50 or fewer I/O functions

The SYSMAC-MO miniature programmable controller combines an integral keyboard programmer, display, and programmable read-only memory loader in a single compact package for logic or ladder-diagram programming with read-only memory or ultraviolet-light–erasable PROM. It is the smallest miniature programmable controller, according to the company, designed for applications using fewer than 50 inputs and/or outputs.

The list price for original-equipment manufacturers is $350.

Omron Electronics Inc., Control Components Division, 650 Woodfield, Schaumburg, Ill. 60195. Phone (312) 843-7900 [373]

Monitor displays data at up to 19.2 kb/s

Halcyon's 801 Mini Fox data monitor is easy to operate; the user simply plugs it into an RS-232-C interface and turns on the power. It automatically determines the line configuration (speed, code, and protocol) even

when the speeds of data-communications and data terminal equipment are different. It then displays full-duplex data of 50 b/s to 19.2 kb/s in real time.

The Mini Fox features, as standard, a 512-character, 5-in. cathode-ray-tube display; normal, reverse, and dim video capabilities; a 16-K capture buffer; status indicators for Electronics Industries Association leads; start and stop trappings; and automatic error flagging. It can han-

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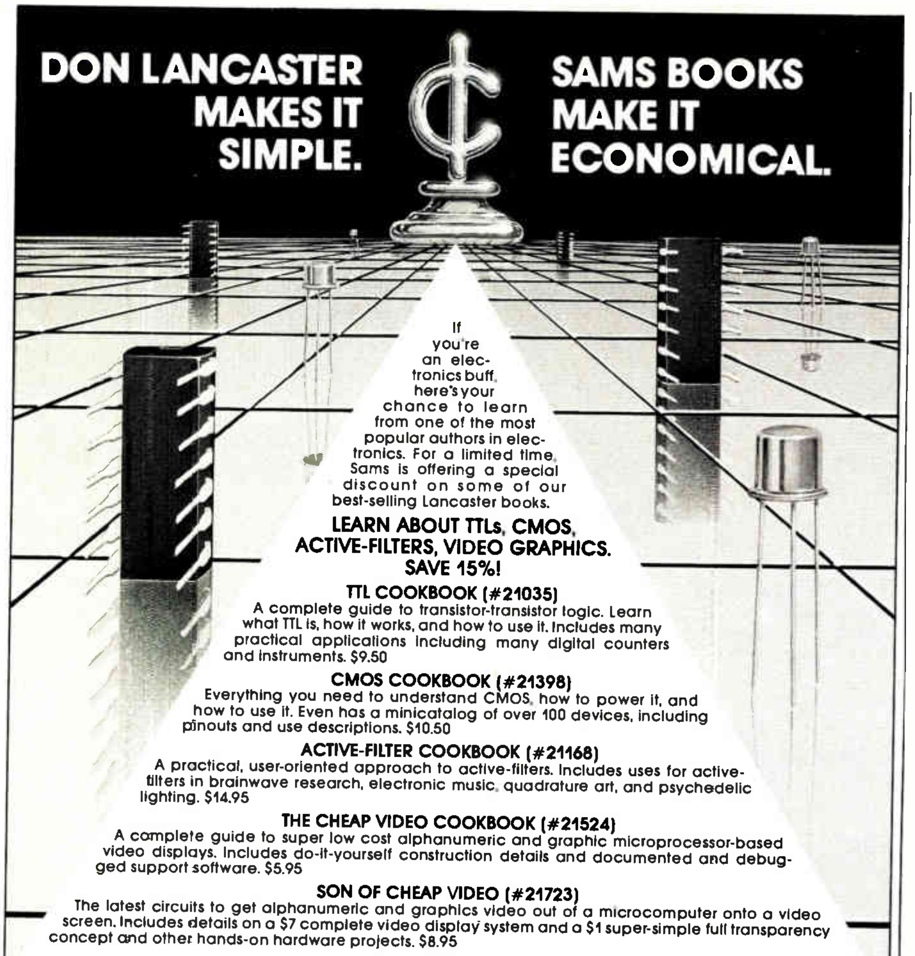

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Halcyon, 1 Halcyon Plaza, 2121 Zanker Rd., San Jose, Calif. 95131. Phone (408) 293-9970 [374]

Motion controller offers computer-generated profile

The Profiler II programmable motion controller is the first system capable of profiling computer-generated motion and controlling dc servomotors digitally via a closed loop. It is programmed from the front-

panel keyboard and interactive 32-character alphanumeric display.

The controller's priority profiling allows the use of more than one positioning sequence. Other features include complete motion control capabilities, stand-alone single-axis control, light-emitting-diode indicators, and minimum analog circuit calibration.

The Profiler II ensures reliable operation even in noisy environments and is designed to interface with a programmable logic controller or computer with either a parallel or serial interface. It sells for $3,200.

Kiowa Corp., 7685 Corporate Way, Eden Prairie, Minn. 55344. Phone (612) 934-0564 [375]

Remote data-acquisition unit cuts the cost of wiring

Designed to reduce the wiring costs of such distributed monitoring and control applications as energy man-

Add in Reliability. Then Relax.

Our LSI-11* compatible memory systems come with built-in ECC (Error Checking and Correction) circuitry. So you don't have to worry about expensive service calls, or strained relations with customers. Our 2,500 ECC systems in the field have a proven MTBF *in excess of 15 years.*

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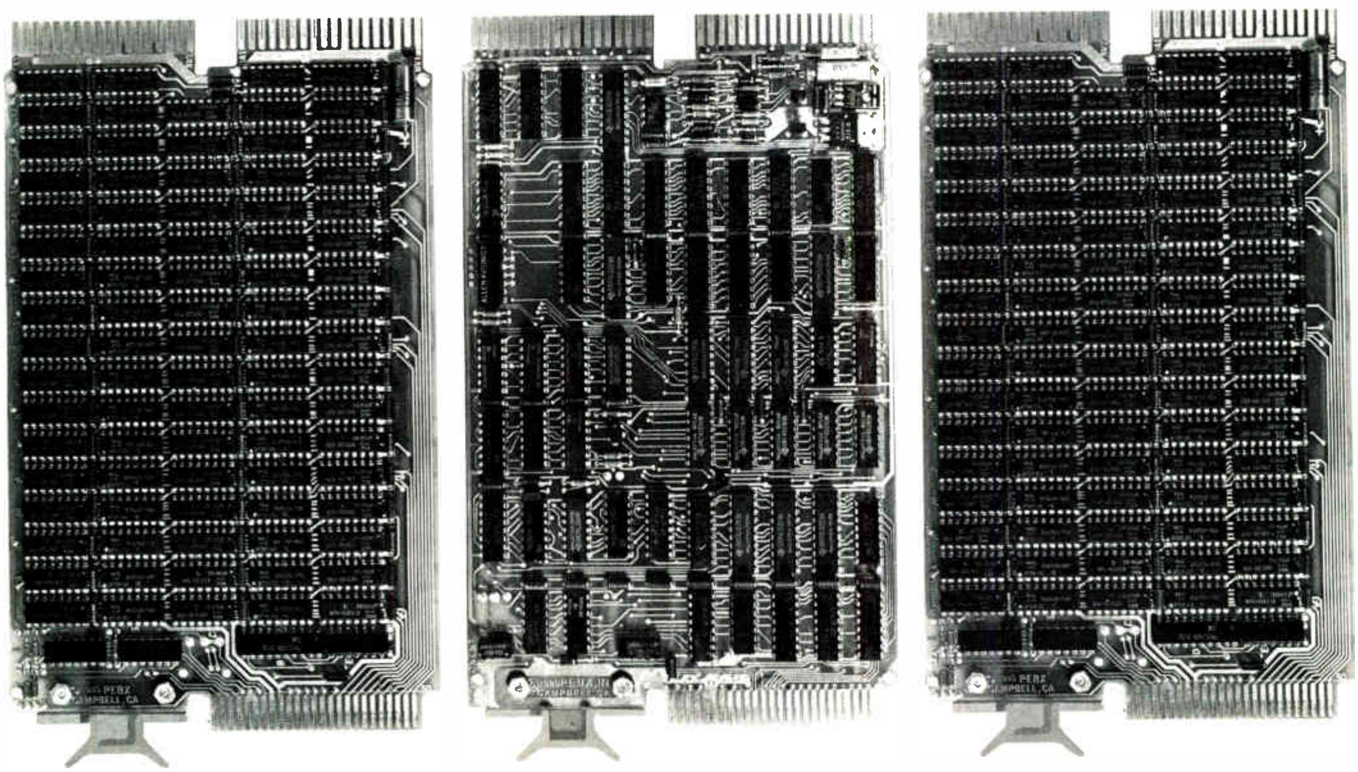

*LSI-11 is a registered trademark of Digital Equipment Corporation.

World Radio History

DYNAMIC RAM TIMING MODULES

The increasing size and density of dynamic RAM memories require that timing signals be accurate and repeatable. Precise signals allow more events to be timed in a given time period.

Catalog 812 for standard digital delay modules now includes a new series of:

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- ☐ Providing ten precision timing edges derived from one input pulse
- ☐ With total delays from 25ns to 500ns
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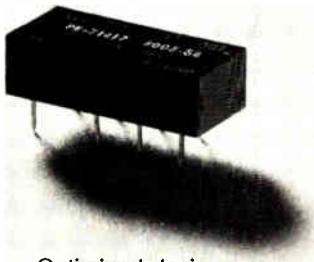

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Navy

agement systems, the IQ-25 remote data-acquisition and -control unit comes equipped with two photoisolated contact inputs, two Form C relay outputs, an RS-232/423 communications interface, and ac- or dc-input power. One of the standard contact inputs can be converted into a meter input by adding a push-on jumper. Other jumper-selectable features include remote addressing, bit rate, latching or momentary outputs, and a select-check-operate command sequence.

Measuring only 8 by 5 in., the single-board remote-control unit can fit into a small timer box or electrical jumper box. Original-equipment manufacturer prices for the IQ-25 start at under $500.

Quantum Technology Corp., 652 Papworth Ave., Metairie, La. 70005. Phone (504) 835-2598 [376]

Graphics system displays signals from 30 data channels

The Vitec 2205 graphics display system for machine protection systems displays the signal levels of as many as 30 channels of data (vibration, temperature, pressure) and allows them to be read simultaneously on a 15-in. cathode-ray tube. It also shows the alarm and trip levels of each channel.

The model 2205 is for use with the Vitec Modularm series of vibration monitors.

Vitec Inc., Machinery Protection Instrumentation, 23645 Mercantile Rd., Cleveland, Ohio 44122. Phone (216) 464-4670 [379]

Transducers handle pressure levels of up to 3,000 lb/in.^{2}

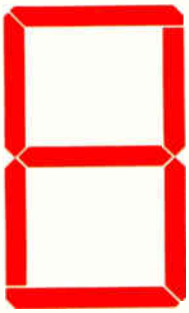
Two new monolithic series of absolute-pressure transducers operate at levels of up to 3,000 lb/in.^{2} with an overpressure rating to 5,000 lb/in.^{2} and can withstand millions of cycles of high pressure.

Both the LX04XXA and the LX05XXA/0 devices are for use in machine tools, engine diagnostic sys-

World Radio History

A DRIVER EDUCATION COURSE FOR DESIGNERS USING LARGE AND BRIGHT DISPLAYS.

Today's bigger, brighter displays need high voltage drivers.



Are you designing a medical instrument that must catch the eye of a busy nurse from across a hospital ward? Or a critical cockpit readout that pilots must read in direct sunlight? Or a control panel for a nuclear power plant where one display must out-shine all others? Or perhaps a digital scale, taxi meter, cash register or gas pump?

If you are one of the growing number of engineers facing these challenges, it's time you got to know a company named Dionics; and learned more about our monolithic high voltage drivers. They are the most reliable, straightforward way to take a TTL or MOS signal and drive a large and/or bright display.

Dionics: high voltage and high reliability.

Dionics has sold literally millions of high voltage drivers for every kind of display: gas or plasma discharge, vacuum fluorescent and electroluminescent up to 3 inches high. They drive digital and alphanumeric readouts, dot matrix panels, bar graph displays and more, with voltages to 280V. And they have earned the highest praise for quality and dependability from the industry's leading manufacturers.

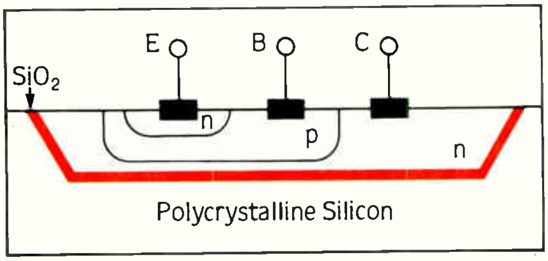
The trouble with junction isolation.

Other manufacturers attempt to use a conventional technique called junction isolation to make their drivers. This method — while quite simple and relatively inexpensive — has an unavoidable shortcoming. As voltages approach 100V, the isolation between separated components begins to break down.

There are possible solutions to this problem, but they are all less than ideal. They tend to be technically or economically impractical at the manufacturing level. And at the design and application level, they clutter up board layouts, run up assembly costs and double or triple the chances of a component failure.

Dionics' bright idea: dielectric isolation.

At Dionics, we manufacture our high voltage drivers using a technique called dielectric isolation. The various components within the monolithic circuit are isolated from each other in silicon dioxide (SiO_2); a form of quartz with all the electrical insulating properties of glass. You can use much higher voltage levels and eliminate the potential failure points created by the second "P" level found in junction isolation.

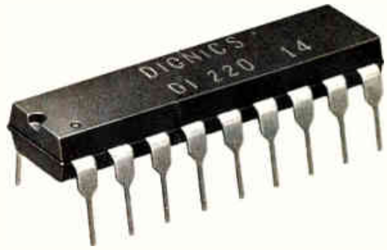


With dielectric isolation, circuit design proceeds as with totally discrete devices. There is no worry about interaction between components.

The breakdown voltage with dielectric isolation is typically greater than 500V. So designs, even those requiring outputs above 250V, remain simple, uncluttered, elegant. Lower parts counts, reduced production costs and dramatically improved reliability result.

Dionics drivers pay for themselves.

The advantages of Dionics high voltage

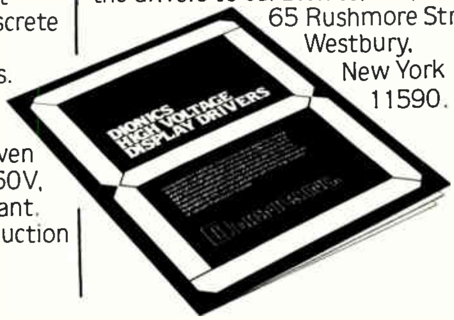


drivers do not come free. Manufacturing with dielectric isolation does cost a bit more than conventional techniques.

But consider the advantages of a clean, simple design — and the cost of even one service call to track down and replace a failed driver — and the conclusion is inescapable. A small initial investment in Dionics drivers pays for itself many times over.

Send for our enlightening new catalog.

If you are now, or may soon be, designing products with large or bright displays, you should have a copy of our new High Voltage Drivers Catalog. Use the reader service card, drop us a line or call, right now, (516) 997-7474. Then go ahead and make the displays as big and bright as you like. And leave the drivers to us. Dionics, Inc., 65 Rushmore Street, Westbury, New York 11590.



DIONICS

DIONICS INC., 65 RUSHMORE STREET, WESTBURY, NEW YORK 11590. (516) 997-7474 TWX 510-222-0974

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World Radio History

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The QUADRI Core Memory System is rugged, non-volatile, reliable, economical . . . meets military severe environment requirements.

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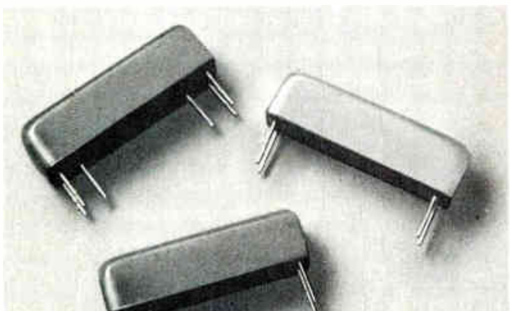
QUADRI CORPORATION
P.O. Drawer 2H
1725 W. 17th St.
TEMPE, AZ. 85282

Circle 36 on reader service card

MICRO-MINIATURE RELAYS FOR MAXIMUM PERFORMANCE



(Shown larger than actual size.)

Maximum performance micro-miniature relays from COTO handle fast digital pulses without degradation of pulse edges. Size — ⅓ smaller than a DIP, yet offering the same switching capabilities as miniature relays, plus high frequency handling.

Available in a variety of contacts and coil resistances, COTO micro-miniature relays are ideal for use in ATE devices, digital switching matrixes, computer interfacing and many other applications. Contact: Coto Corporation, 65 Pavilion Avenue, Providence, RI 02905. Tel: (401) 467-4777. TWX: 710-381-8016.

COTO CORPORATION

In Europe contact: Rhopoint Limited, Oxted, Surrey RH8 OHG, England Tel (08833) 7988 Telex: 957094

Circle 39 on reader service card

TEXT TO SPEECH

The Speech Machine Converts Arbitrary English Text To Natural, Audible Speech

Many current products could be enhanced by incorporating speech. Voice opens the door to new applications possible only when machines enter the powerful realm of human language. Previous attempts at text-to-speech conversion have been not only cumbersome and costly, but unintelligible and unintelligent. We believe the Speech Machine's performance and comprehensibility meet demanding instrumentation, computing, communications, and control requirements. Low cost and ease of use make it suitable for consumer products; your ideas for bridging the gap between everyday pursuits and sophisticated computer power may now be realized.

Yahara can assist you in the design and implementation of products and systems that talk. *Evaluation units are available for $800. Prices in quantity range below $400. Write for full information: Yahara, Box 479 Centerville, Ma. 02632.*

YAHARA

Circle 40 on reader service card

tems, pressurized tanks and lines, and automatic hydraulic and pneumatic equipment. Each series is available in four versions with operating-pressure-range ceilings of 100, 300, 1,000, and 3,000 lb/in.^{2} respectively. Each device guarantees a stability of 1.2% of full span and is usable with nonionic and noncorrosive working fluids. The LX04XXA has a temperature range of $-40°$ to $+85°C$; the LX05XXA/0's range is from $-40°$ to $+105°C$.

The LX04XXA is priced under $25 apiece and the LX05XXA/0 sells for under $15 each in high volumes.

National Semiconductor, 2900 Semiconductor Dr., Santa Clara, Calif. 95051. Phone (408) 737-5000 [377]

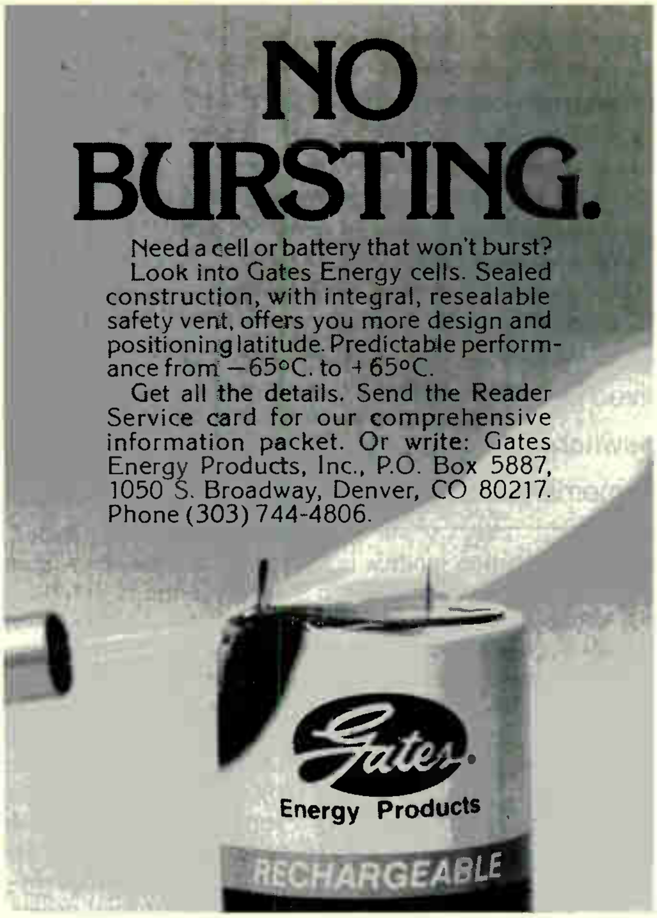
Batch controller serves remote and local computers

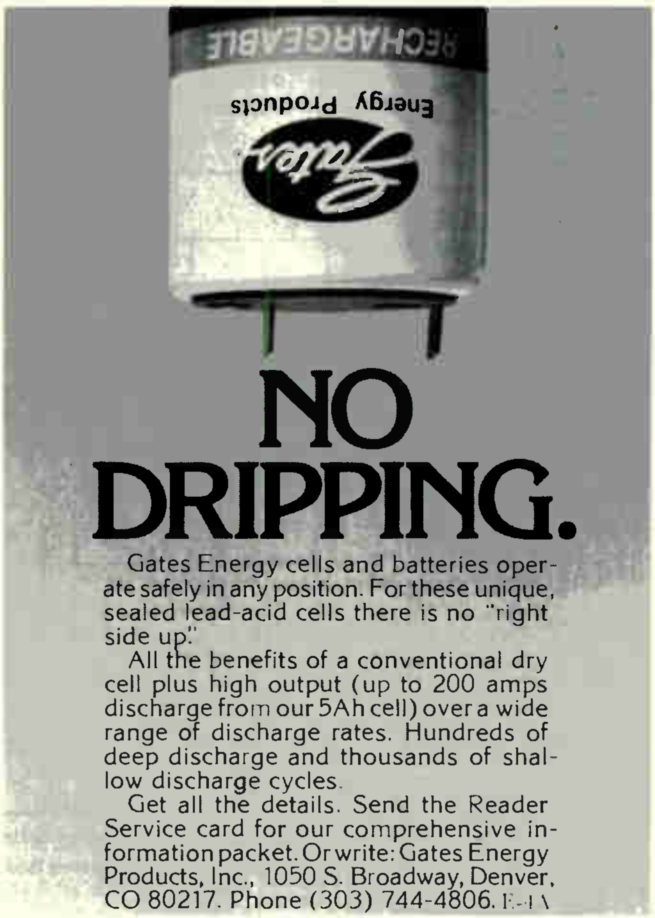
The series 1040 modular liquid-batch controller now offers remote or computer control for liquid batching. For local control by computers or programmable controllers, up to 16 controllers may share a single computer input/output port using a microprocessor-compatible bit-parallel, binary-coded decimal serial data bus. For remote data links, RS-232-C or 20-mA current-loop systems in half- or full-duplex configurations are offered with data transfer rates of up to 9,600 b/s.

The batch controller has been designed for use with Fluidyne positive-displacement flow transducers and the turbine flow-meters of other manufacturers. Its two-stage (dribble) shutoff control improves accuracy, and a battery backup system takes care of power failures. Optional features include linear and nonlinear temperature compensation, a 3½-digit flow-rate indicator with 0 to 5 V or 4-to-20mA outputs, and a wide range of inputs.

The 1040 controller is custom-designed to meet the various buyers' needs.

Fluidyne Instrumentation, 2930 Lakeshore Ave., Oakland, Calif. 94610. Phone (415) 444-2376 [378]





Circle 41 on reader service card

World Radio History

Semiconductors

Power module saves data

Long-lived LiI battery and power-switching logic keep C-MOS memories alive

The DRM data-retention module is a self-contained power source with switching capability that can pass external power, when available, to an output load and so make most complementary-MOS random-access memories retain data during the power-up and power-down transitions. The module offers continuous data retention for over 10 years; it is rated at 0.4 A-h at 5 μA and 25°C. Other capacities are available, according to the manufacturer. The battery operates at 2.7 V typically, putting out 10 μA typically, 50 μA maximum.

The 2.0-in.-square module, which is 0.400 in. high, includes a lithium iodide battery, a logic-level monitor, and a voltage monitor. It has the switching devices and control interface needed to choose between external power or data-retention power to the load.

For example, the DRM has a precision voltage detector that monitors the external power supply so that when that supply reaches 3.1 V (3.50 V is the minimum operating voltage), the DRM switches the external power supply on. This prevents the accidental draining of the data-retention power supply and also prevents system logic levels from exceeding the data-retention power-supply voltage by 0.5 V or more. When the power supply voltage drops from 3.1 V or greater to 2.9 V, the module then switches back to data-retention power.

To facilitate the module's use with the popular 5-V dc microcomputers, DRM includes a second precision voltage detector. This detector generates a logic signal—the dc-supply-on signal in the figure—that is high when the external power-supply voltage rises above 4.6 V and that goes low when the external supply falls below 4.5 V.

The DRM has a shelf life equal to or better than that of any RAM it operates with. It has 14 pins, 12 of which are on one side of a standard 24-pin dual in-line pattern. It can be mounted on a printed-circuit board and wave-soldered in place.

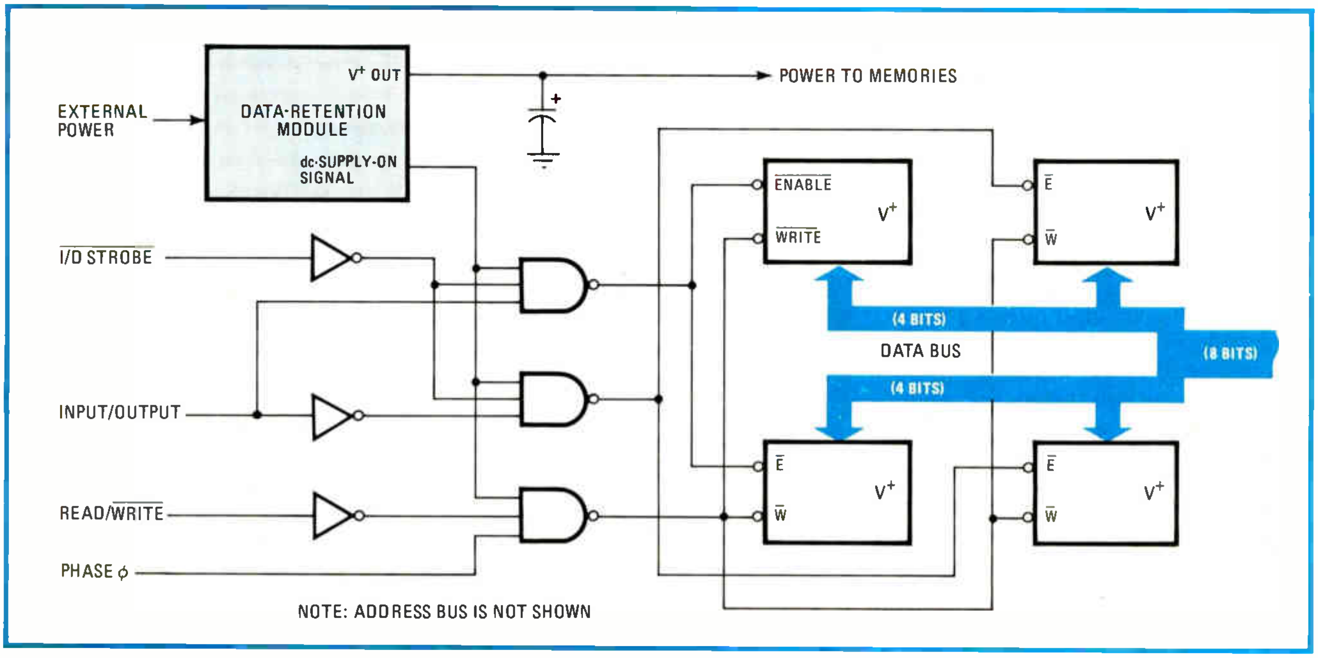
In single units, the DRM sells for $35, but for orders over 1,000 units, it is priced at $29 apiece. Delivery takes three to four weeks.

Catalyst Research Corp., 1421 Clarkview Rd., Baltimore, Md. 21209. Phone (301) 296-7000 [413]

Complimentary-MOS power FETs switch fast

Claiming low input capacitance and fast switching speeds for the ZVN02 and ZVP02 series of complementary n- and p-channel power MOS field-effect transistors, Ferranti Electric suggests such applications for the power devices as driving microprocessor and integrated-circuit logic interfaces, controlling motors, and amplification. The devices can replace or serve as an alternative to the Supertex VN02 and VP02 series. The power MOS FETs use a vertical double-diffused MOS structure with compact interdigitated geometries, can be easily paralleled, and do not exhibit thermal runaway.

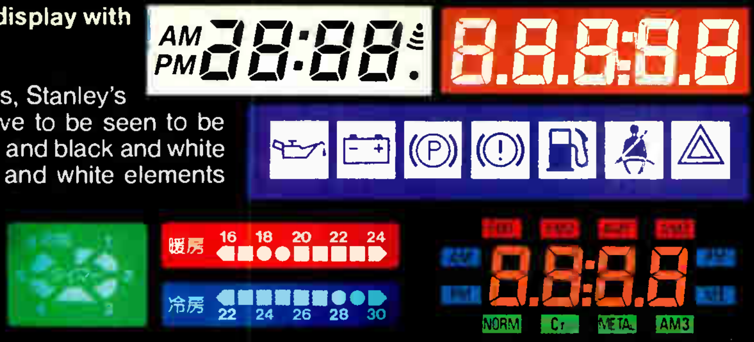
Each of the two series consists of devices with voltages ranging from



Staying alive. The DRM data-retention module contains a lithium iodide battery and logic circuits that can sense when primary power fails. When it does, the module automatically kicks in the battery back-up power and deselects the random-access memories.

World Radio History

Stanley has a colorful and super-bright liquid crystal display with your name on it.



Color LCD Samples

Based on technology derived from Guest-Host type LCDs, Stanley's new displays outshine all existing types. The colors have to be seen to be believed: clear blue, vivid green, bright yellow, vibrant red, and black and white combinations. Or, for even more variety in color, black and white elements with color filter patterns.
The Stanley LCD is neither influenced by variation in temperature nor fluctuation in voltage.
The brilliant color, high contrast and wide angle of view are all engineered-in to stay.
You specify the design and the function, we deliver. . . . transmissive, reflective or transflective type. . . . and meet your need to the letter.
For more information, write to Stanley Electric Co. at the address below:

Stanley shines.
In bold bright colors, wide angles, eye-easy contrast and any pattern you want.

Stanley now for shine and rich variety in equipment applications:
Automobile equipment, aircraft equipment, consumer electric appliances, audio equipment, digital clocks, multi-testers, optical instruments, calculators, computer terminals, automatic control machinery, emergency equipment and other uses.

STANLEY

STANLEY ELECTRIC CO., LTD.
LCD Sales Section:
2-9-13, Nakameguro, Meguro-ku, Tokyo 153, Japan
Tel. Tokyo 03-710-2531 Telex. 2466623

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World Radio History

Circle 43 on reader service card

Silicone-free PQ Heat Sink Compound. Prevents creeping in electronic assemblies and circuit applications where excessive heat can reduce service life. Available in 4 oz. applicator tube, 1 lb. can, 40 lb. pail, and 250 lb. drum. Distributor inquiries invited.

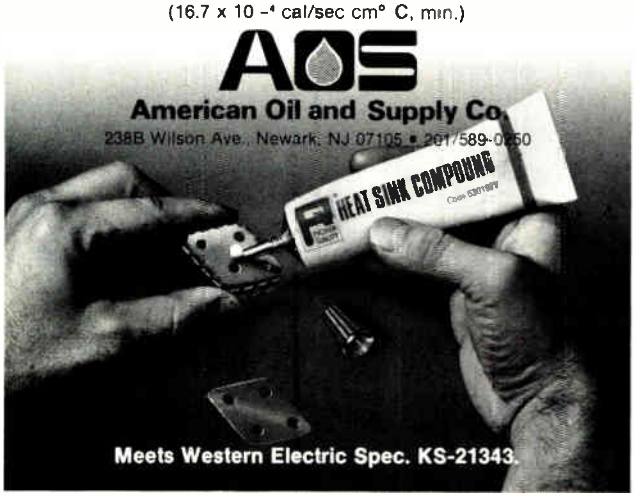
- **NON-SILICONE BASE FLUID**
- **NO SOLDER BATH CONTAMINATION**
- **EXCEPTIONALLY LOW BLEED** and evaporation characteristics
- **USE WITH METAL OR PLASTIC-CAPPED TRANSISTORS**

NO CREEP

PQ Heat Sink Compound

with HIGH THERMAL CONDUCTIVITY

(16.7 x 10 -4 cal/sec cm° C, min.)



Circle 44 on reader service card

New products

20 to 200 V and drain-current ratings of up to 6 A. Each is available in TO-3, TO-39, or TO-220 packages and as arrays in 14-pin dual in-line packages or in chip form. In quantities of 100, for example, the ZVN0209L is $2.00 and the ZVP0209L is $2.50. Delivery is from stock to 10 weeks, depending on voltage requirements.

Ferranti Electric Inc., Semiconductor Products, 87 Modular Ave., Commack, N.Y. 11725. Phone (516) 543-0200 [414]

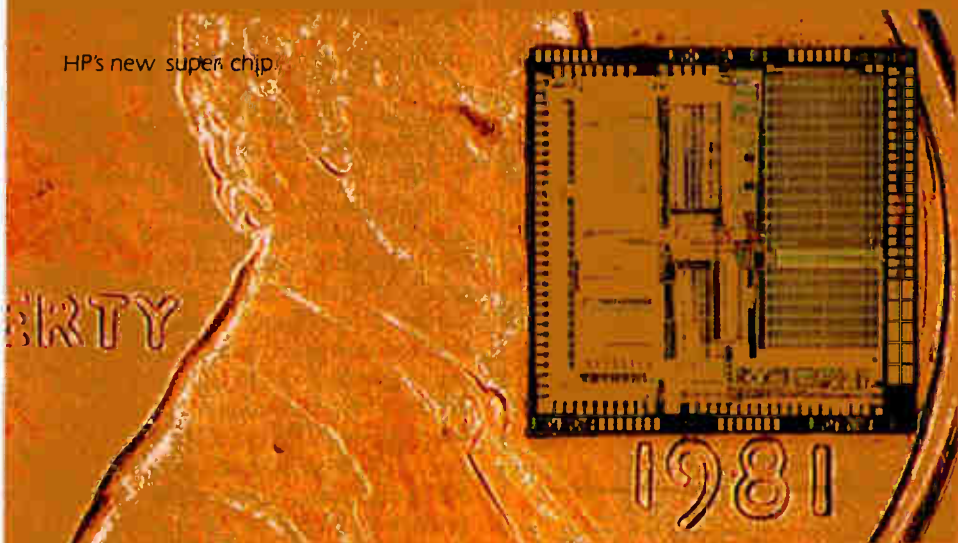
Thyristors come in molded plastic quick-connect package

Although traditionally semiconductor packages are designed for direct soldering to printed-circuit boards, Motorola has a line of thyristors in a plastic-molded quick-connect package that mounts anywhere on equipment. The power semiconductors are aimed at applications in appliances and power modules, so the package terminals duplicate those of other power devices normally used in such applications. They can be interconnected with driving circuits by the cables and connectors usually used in the appliance and control industries.

The new package can be used with any semiconductor device housed in the TO-220 package, fitting on it as an overmold. The first units to be available include the 15- and 25-A MAC515 and -525 triac series, the 25-A MCR525 silicon controlled rectifier series, and the 12- and 25-A MCR568 and -569 SCR devices recommended for crowbar applications. In quantities of 100 to 999, prices range from $1.33 to $5.30, depending on the product. To date, in an on-going power-cycling test, 100 overmolded devices have undergone

Surprise! The most powerful CPU computer on a chip—a Hewlett-Packard development. Capable of processing 32 bits simultaneously, this 450,000 transistor chip is faster and more powerful than many mainframes.

No Surprise! Because at Hewlett-Packard performance is measured by results. You can help create products that will be tomorrow's breakthroughs. Take the first step by contacting any of the HP Divisions listed below.



HP's new super chip.

Colorado Springs Division's IC facility designs and manufactures many solid state devices including high frequency analog ICs, high complexity digital bipolar ICs, and thick film and hybrid microcircuits. We're looking for the following people to contribute to our development and production of high-speed, high-complexity bipolar processes:

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THICK FILM HYBRID PROCESS ENGINEERS

Send your resume in confidence to: Hewlett-Packard Company, 1900 Garden of the Gods Rd., Colorado Springs, CO 80901.

Desktop Computer Division is in Fort Collins, Colorado, just 65 miles north of Denver, in the shadow of the Front Range of the Rocky Mountains. Our in-house IC facility designs and manufactures N-Channel (NMOS) processors, ROM and LSI random logic chips and various thin film products including thermal print heads and hybrid circuits. We're looking for:

IC PROCESS ENGINEERS
IC DESIGNERS
MECHANICAL ENGINEERS
ELECTRICAL ENGINEERS

Send your resume in confidence to Gale Hamelwright, Desktop Computer Division, Dept. 20, Hewlett-Packard Company, 3400 East Harmony Road, Fort Collins, CO 80525.

Cupertino Integrated Circuit Operation currently manufactures its ICs in CMOS-SOS technology. We produce more than twenty different products, including microprocessors, memories and interface circuits. We are also currently installing a state-of-the-art IC processing facility for bulk NMOS technology geared for the production of random logic and memory circuits for HP computer systems and peripherals. We are looking for:

TEST ENGINEERS
PROCESS ENGINEERS
DESIGN ENGINEERS
FACILITIES ENGINEERS
PRODUCT ENGINEERS
TECHNICIANS

Send resume in confidence to Eileen Collins, Hewlett-Packard Company, 10900 Wolfe Rd., Cupertino, CA 95014.

HP Laboratories (the corporate research division) has contributed to the success of Hewlett-Packard through early, state-of-the-art work in solid state materials, devices, circuit design, and applications. This contribution continues with our current work on LS and VLSI. We work in all of the technologies used by HP, which includes Bipolar, CMOS, NMOS, and GaAs, as well as others. We're looking for engineers to work in:

IC DESIGN
DEVICE PHYSICS RESEARCH
SEMICONDUCTOR PROCESSING RESEARCH

Send your resume in confidence to Brent G. Thompson, Dept. 900, Hewlett-Packard Laboratories, 3500 Deer Creek Road, Palo Alto, CA 94304.

Corvallis Division is located in the scenic Willamette Valley just 50 miles from the Pacific Coast and the Cascade Mountains. Help us to develop and support advanced LSI, VLSI and thin film technologies to include:

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CIRCUIT DESIGN
CAA/CAD
TESTING SYSTEMS AND METHODOLOGY

Send your resume in confidence to Hewlett-Packard Company, Dept. 1210-CRI, 1000 NE Circle Blvd., Corvallis, OR 97330.

Loveland Instrument Division, located in Loveland, Colorado, resides in a semi-rural setting within easy reach of major cultural and educational activities. The technologies range from high-speed LSI chips to precision analog processing chips utilizing NMOS, CMOS, bipolar and JFET technologies. Additional processes include thin film LSI resistor network chips produced on sapphire wafers, multi-chip hybrid processes, and advanced efforts in CAA/CAD and testing technologies. We're looking for:

BS/MS ELECTRICAL ENGINEERS
BS/MS MECHANICAL ENGINEERS
MS MATERIALS SCIENCE

Send your resume in confidence to Hewlett-Packard Company, Loveland Instrument Division, Professional Employment Manager, Box 301, Loveland, CO 80537.

Microwave Semiconductor Division's major products include power MOS transistors, RF and microwave Schottky diodes, bipolar transitors, GaAs Fets, and integrated components based on these devices. We presently have openings for engineers in the following technical areas:

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POWER MOS DEVICE/PROCESS PROJECT MANAGEMENT
MICROWAVE DIODE PROCESS/DEVICE DEVELOPMENT
SEMICONDUCTOR DEVICE PACKAGING AND ASSEMBLY DESIGN

Candidates should have an MS or Phd in relevant disciplines. Send your resume in confidence to Shelly M. Okuno, Hewlett-Packard Company, 350 West Trimble Rd., San Jose, CA 95131.

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00135

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INTERNATIONAL

OE CRYSTAL OSCILLATOR ELEMENTS

International's OE Series of Crystal Oscillator Elements provide a complete crystal controlled signal source. The OE units cover the range 2000 KHz to 160 MHz. The standard OE unit is designed to mount direct on a printed circuit board. Also available is printed circuit board plug-in type.

The various OE units are divided into groups by frequency and by temperature stability. Models OE-20 and OE-30 are temperature compensated units. The listed "Overall Accuracy" includes room temperature or 25°C tolerance and may be considered a maximum value rather than nominal.

All OE units are designed for 9.5 to 15 volts dc operation. The OE-20 and OE-30 require a regulated source to maintain the listed tolerance with input supply less than 12 vdc.

Prices listed include oscillator and crystal. For the plug-in type add the suffix "P" after the OE number; eg OE-1P.

OE-1, 5 and 10 can be supplied to operate at 5 vdc with reduced rf output. Specify 5 vdc. when ordering.

Output — 10 dbm min. All oscillators over 66 MHz do not have frequency adjust trimmers.

Catalog	Oscillator Element Type	2000 KHz to 66 MHz	67 MHz to 139 MHz	140 MHz to 160 MHz	Overall Accuracy	25°C Tolerance
035213	OE-1	$17.23				
035214	OE-1		$19.79		±.01%	±.005%
035215	OE-1			$24.89	−30° to +60°C	
035216	OE-5	$21.38			±.002%	±.0005% 2 −66MHz
035217	OE-5		$25.20		−10° to +60°C	±.001% 67 to 139 MHz
035218	OE-5			$33.19		±.0025% 140 to 160 MHz

Catalog Number	Oscillator Element Type	4000 KHz to 20000 KHz	Overall Accuracy	25°C Tolerance
035219	OE-10	$25.20	±.0005% −10° to +60°C	Zero trimmer
035220	OE-20	$37.02	±.0005% −30° to +60°C	Zero trimmer
035221	OE-30	$76.59	±.0002% −30° to +60°C	Zero trimmer

INTERNATIONAL CRYSTAL MFG. CO., INC.

10 North Lee
Oklahoma City, OK 73102
405/236-3741

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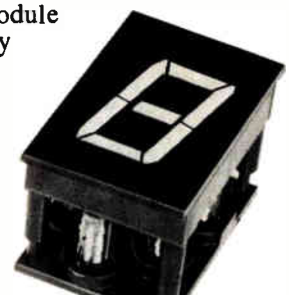
When Clear Displays Count



You can count on Ferranti-Packard's electromagnetic 7-Segment display module to give you the electronic compatibility you need plus the reliability and visibility your customers demand.

Performance-proven for over 5 years, the simple design and construction, backed by Ferranti-Packard research and engineering, gives you the combination of reliability, visibility and flexibility that no other read-out component can match.

When you design an electronic read-out system, Ferranti-Packard display modules will help you do it better. It's clearly the display module you should consider. See the difference for yourself, write or call us and we'll prove it.

When clear displays count – Specify Ferranti-Packard.

Ferranti-Packard Electronics Ltd.

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6030 Ambler Drive, Mississauga
Ontario, Canada L4W 2P1
Telephone: (416) 624-3020
Telex: 06-961437

more than 40,000 100% power cycles at junction temperatures of 100°C without a single failure, says the manufacturer.

Motorola Semiconductor Products Inc., P. O. Box 20912, Phoenix, Ariz. 85036. Phone (602) 244-6437 [416]

Bipolar semicustom IC arrays yield special designs faster

A series of 20 basic bipolar semicustom integrated-circuit arrays come in 13 analog, 5 digital, and 2 analog-to-digital converter designs, and design engineers need only to define the interconnection paths of the standard components to achieve a custom circuit function. Called Uniray, for universal array, the circuits are equipped with a number of design aids, including a catalog, a development library, a development and evaluation system, printed layout worksheets, a breadboard, and evaluation-kit parts.

Micro-Circuit Engineering Inc., 111 Fairfield Dr., West Palm Beach, Fla. 33407. Phone (305) 845-2837 [411]

In Europe, Pirckheimer Str. 124, D8500 Nuremberg, West Germany [415]

16-K bipolar PROM has 32-ns maximum read access time

The 3636B, a 16-K bipolar fuse-link programmable read-only memory, has a maximum read access time of 35 ns and a typical one of 25 ns. Organized as 2-K by 8 bits, the PROM is intended for use as a high-density microprogram-store medium in bit-slice equipment, central-processing-unit boards, minicomputers, and mainframes. The device consumes only 800 mW—0.05 mW per bit—from a single 5-V supply and uses the same programming algorithm as the earlier Intel part, the 3636, but the 3636B die measures 140 mils on a side—40% of the area of the 3636. The PROM is $50 each in quantities of 100.

Intel Corp., 3065 Bowers Ave., Santa Clara, Calif. 95051. Phone (408) 987-6742 [417]

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World Radio History

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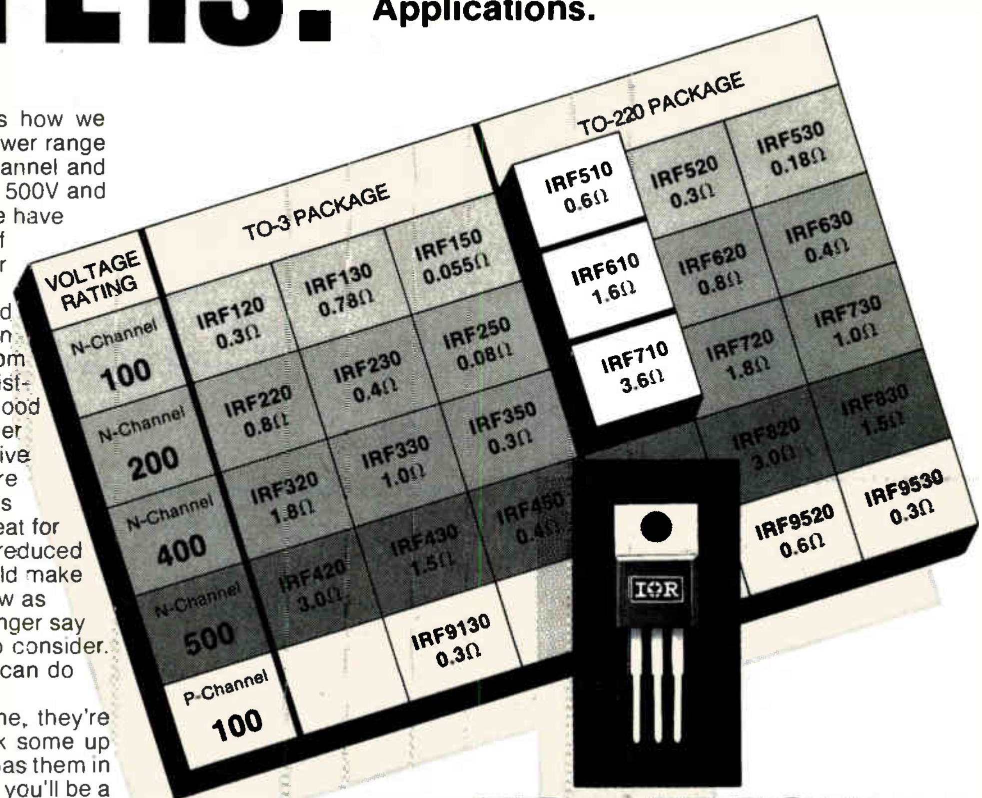

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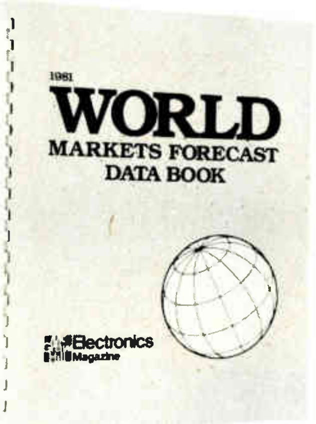

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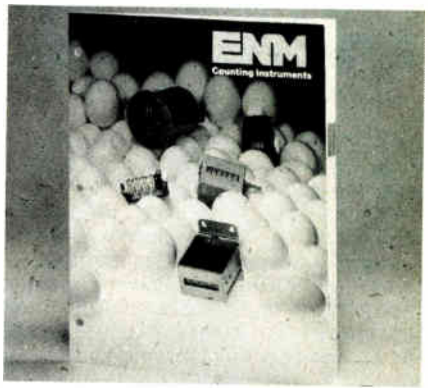
New literature

Scanning calorimeter. Available from Perkin-Elmer is a 43-page book entitled "Differential Scanning Calorimetry" by J. L. McNaughton and C. T. Mortimer. The book describes the theory and operation of the scanning calorimeter and such applications as the thermal analysis of a material's purity, kinetics, melting points, and chemical and physical reactions. A brochure that discusses the features of the DSC-2C scanning calorimeter and includes an outline of applications for the various industries is also available from the company. Free copies of the book and brochure can be obtained by writing to the Perkin-Elmer Corp., Main Avenue, Mail Station 12, Norwalk, Conn. 06856 or calling (203) 762-6853. The order numbers are L-604 for the book and L-653 for the brochure. Circle reader service number 440.

Rotor and stator components. A binder entitled "Precision Rotating Components Catalog" contains diagrams of 81 synchro-servo rotor and stator laminations and 10 stepper-motor stator and rotor laminations. The shape of each component is shown along with its part number, outer and inner diameter, and number of slots. Magnetic Metals Corp., Hayes Avenue at 21st St., P. O. Box 351, Camden, N. J. 08101. Phone (609) 964-7842 [476]

Component mounting. "Guidelines for Printed Board Component Mounting" illustrates the proper techniques used for mounting everything from discrete components to the latest large-scale integrated leadless components. The 116-page document discusses the various types and shapes of components that are commonly used with printed-wiring boards. Some of the sections covered include: manual mounting of discrete components; manual mounting of microelectronic packages such as dual in-line packages, flatpacks, and Jedec types; mounting of connectors and integrated-circuit sockets; automatic insertion and attachment; solder-joint reliability considerations; and shock aspects of component-mounting techniques. A copy of the IPC-CM-770B can be obtained from the Institute for Interconnecting and Packaging Electronic Circuits, 3451 Church St., Evanston, Ill. 60203 for $20 ($10 to IPC members). [477]

Counting instruments. Catalog 810 describes the standard counting devices from ENM Co. that are specified for original-equipment applications. It covers 152 electrical, mechanical, and electronic counters and hour meters. A description of each instrument, along with photographs, dimensional diagrams, and OEM model numbers, is provided for each instrument. For a free copy contact ENM Co., 5150 Northwest Highway, Chicago, Ill. 60630. [478]



Environmental connectors. "Cannon Connectors for Hostile Environments" contains data on connectors used by the aerospace, military, seismic, marine, and nuclear industries. Catalog HEC-2 contains photographs, drawings, diagrams, and tables for hermetic, high-temperature connectors; the LRN series of nuclear connectors; the MR and the W series of waterproof connectors; FRF/FVR/FRA/FVA, MSK, and CA-KE firewall general-purpose connectors; geophysical connectors; and the DRA series of general connectors. Assembly instructions for five connectors, information on how to order, explanations of part numbers, and diagrams of contact arrangements are included in the catalog. ITT Cannon Electric Canada, Four Cannon Court, Whitby, Ont. L1N 4V8, Canada [479]

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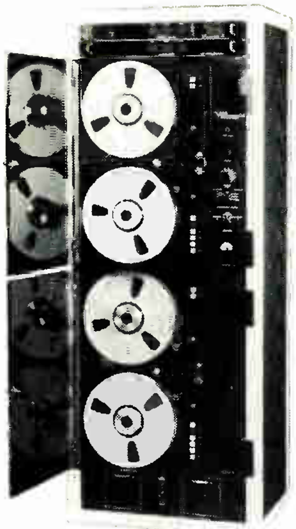

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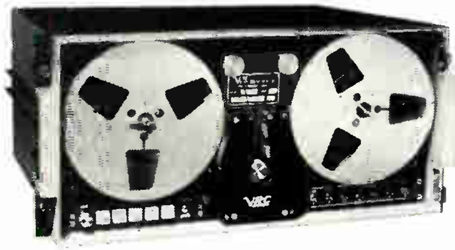

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7-CHANNEL
VOICE LOGGING

IDC-4
6-SPEED CASSETTE
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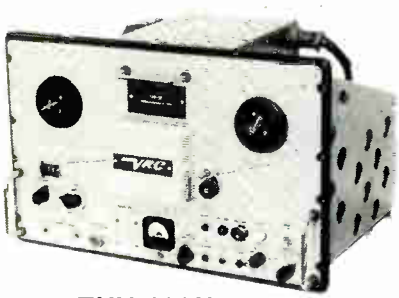

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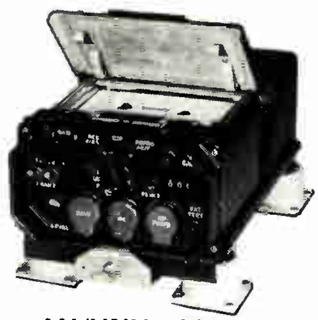

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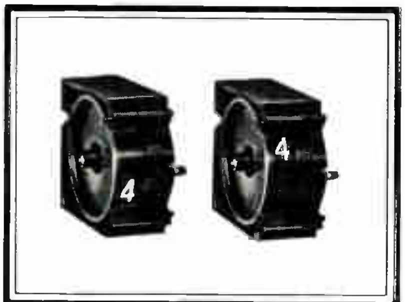

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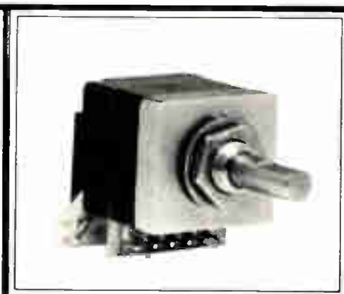
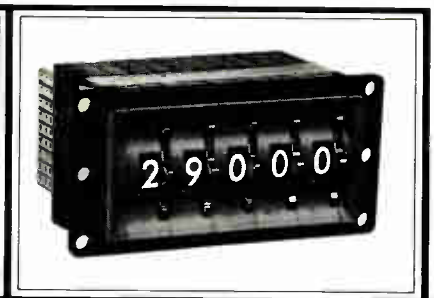

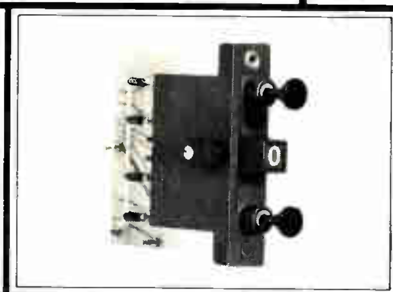
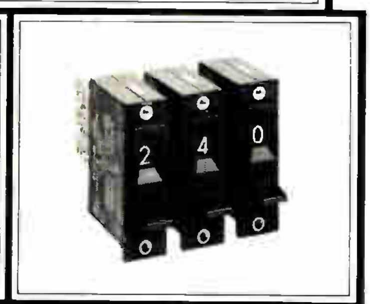
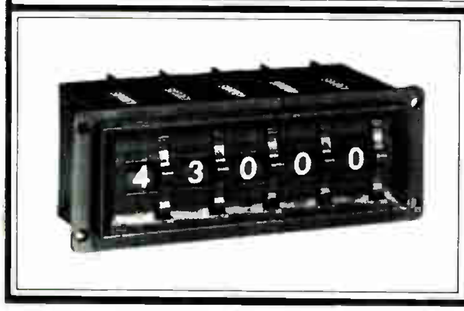
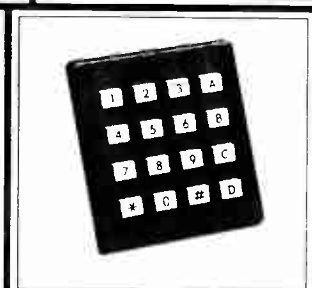
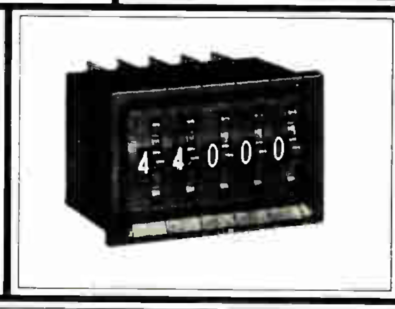

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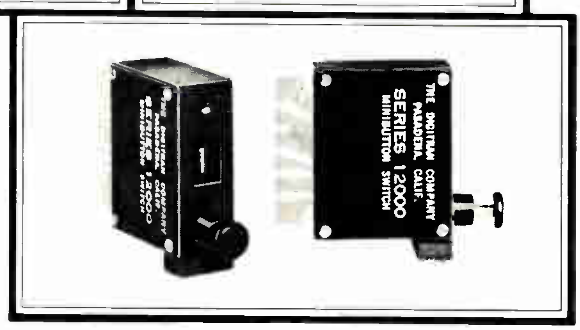

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Products newsletter

Protocol converter links IBM terminals with non-IBM peripherals

What is being called the first **microprocessor-based protocol converter to fully support IBM's Binary Synchronous Communications (BSC) system as well as its Systems Network Architecture** (SNA) will soon bow at Industrial Computer Controls Inc., Cambridge, Mass. The CA12-TCP supports IBM cluster controllers plus asynchronous terminals, on the one hand, and on the other, interfaces with inexpensive peripherals from other vendors to reduce network cost. Based on a Z80 microprocessor, the protocol converter supports terminal equipment from Digital Equipment, IBM, Lear Siegler, Hewlett-Packard, Televideo, and others. Unit prices range from $4,300 to $8,100 depending on the number of terminals supported (eight is the maximum).

Software for Z8000 allows real-time multitasking

Now the Z8000 16-bit microprocessor can manage real-time multitasking applications, thanks to a software package from Zilog. The Cupertino, Calif., firm's real-time software called ZRTS 8000 **consists of modules that permit efficient implementation of customized operating systems** for Zilog's segmented and nonsegmented (Z8001 and Z8002, respectively) central processing units. Company sources say the package should suit low-cost, high-volume products like games and intelligent terminals. The program on diskette costs $3,500.

Chip off TI 8-bit microcomputer family has 4-K-byte ROM

By the end of next quarter, Texas Instruments Inc. will be **adding a third member to its still-new TMS 7000 family of 8-bit, single-chip microcomputers**—the yet-to-be-announced 7040. The Dallas firm originally entered the 8-bit microcomputer area with the introduction of the n-channel MOS TMS 7020 [*Electronics*, Jan. 27, p. 107] with 2-K bytes of read-only memory, and of the TMS 7000 ROM-less version. The latest chip, the 7040, will offer 4-K bytes of ROM. In quantities of 1,000, the 7020 costs $7.50 each and the 7000 is $6.70.

Eclipse computers run in IBM network

Data General Corp.'s Eclipse computer systems will be able to operate as part of a network using IBM Corp.'s Systems Network Architecture (SNA), thanks to **a software interface package that allows transparent communications between the SNA and Data General's Xodiac network management system.** The DG/SNA software package enables a DG machine simultaneously to run both Xodiac, which is based on the international X.25 protocol, and IBM's SNA and Binary Synchronous Communications (BSC), says DG. Scheduled for introduction by the firm's information management division in Westboro, Mass., DG/SNA will cost about $10,000 and run on the AOS/VS Eclipse MV/8000 as well as on other Eclipse advanced operating systems.

Price changes

- **Augat Inc., Attleboro, Mass.,** has dropped the price of its family of 40-Mb/s fiber-optic data-link products by 42%, to $299 for a transmitter/receiver combination.
- To make user-programmable single-chip microcomputers an alternative to ROM-based versions, **Intel Corp.'s microcontroller operation in Chandler, Ariz.,** has reduced prices over 50% on its 8748 8-bit microcontrollers based on erasable programmable read-only memory.

World Radio History

Association initiates self-help program for industry

To meet the escalating manpower requirements of the electronics industries, the American Electronics Association is initiating a program of self-help for its members. The AEA's three-point action plan, started late last year, is well under way, and some results are expected within the next few months.

Pivotal to the plan is an action committee composed of both industry leaders and influential academicians who will look at the industry's needs for skilled workers over the next five years and try to outline a course of action to meet those needs. Chaired by William J. Perry, formerly an under secretary of defense and at present a partner with Hambrecht & Quist Co. of San Francisco, the Blue Ribbon Committee on Engineering Education has six industry executives and three university administrators as members: John M. Fluke, chairman of the John Fluke Manufacturing Co.; C. Lester Hogan, director of and consultant to Fairchild Camera & Instrument Corp.; Robert N. Noyce, vice chairman of Intel Corp.; Allen E. Puckett, chairman of Hughes Aircraft Co.; Ray Stata, chairman and president of Analog Devices Inc.; Dean A. Watkins, chairman of Watkins-Johnson Co.; Richard Atkinson, chancellor of the University of California at San Diego; Joseph Pettit, president of the Georgia Institute of Technology; and Karl Willenbrock, the Green professor of engineering at Southern Methodist University.

"Over the next three to six months, we'll be assessing the extent to which there is a long-term [engineering] shortage," notes chairman Perry. "We'll be looking at particular areas where the shortage will be most acute—computer scientists, circuit architecture designers, and programmers of machine and higher-order languages.

"We'll be trying to identify specifics as well as overall trends. The unique function of this committee will be to formulate a plan of action for industry."

The second part of the AEA's plan is a survey being conducted among 1,200 member companies on their manpower needs through 1985. About half of the questionnaires sent out have been returned, and results of the survey are scheduled to be published sometime next month. The survey is looking at two main job areas: technical professionals who have at least a four-year degree or equivalent work experience and paraprofessionals or technicians with a two-year degree or equivalent experience. The results will include geographic breakouts as well as U. S. totals.

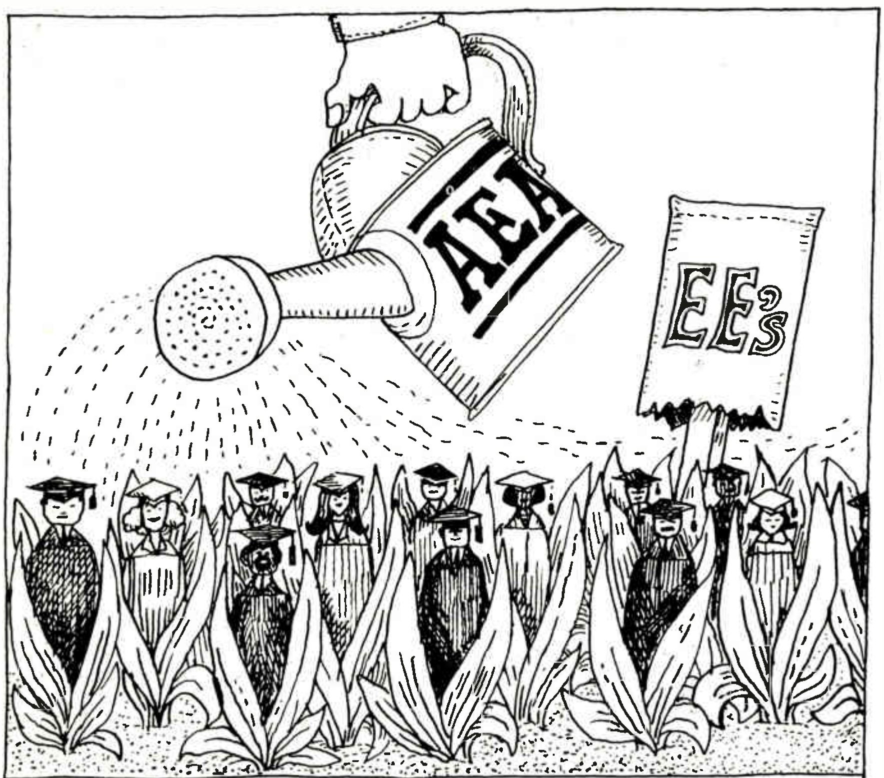
"This information should help state and local educational planners by giving them enough lead time to allocate the resources required to expand their programs so that they begin to meet our industries' needs," explains Patricia Hill Hubbard, manager of technology training and careers at AEA headquarters in Palo Alto, Calif. The data from the survey should also help individual companies to predict future technical personnel trends in their particular regions.

The third key point in the plan, according to Hubbard, is identifying materials with which companies could start up their own in-house training programs. During the second quarter of this year the AEA should have many of these materials needed for such a program and will begin to disseminate them to industry.

In stepping up its efforts in careers and technical training, the AEA is attempting to have industry lead the way in looking for solutions to the manpower questions, according to Hubbard. "We believe the shortages of technical people not only are extensive, but also they are worsening. We are concerned that Government prognosticians may inadvertently create complacency within the nation that the shortage problem will in time take care of itself," she recently stated before the Senate Select Committee on Small Business.

"The focus of the Blue Ribbon committee will be on engineering education," she emphasizes. "The reality we're facing is that there isn't going to be a letup in the need for engineers any time soon."

-Pamela Hamilton



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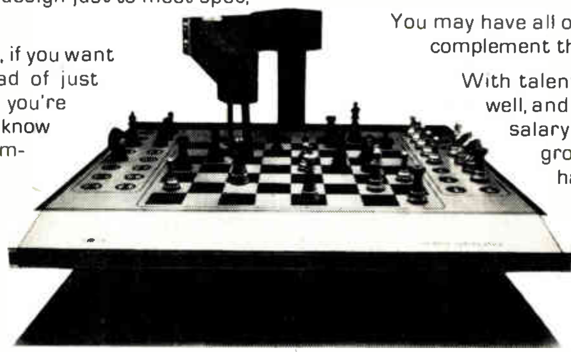

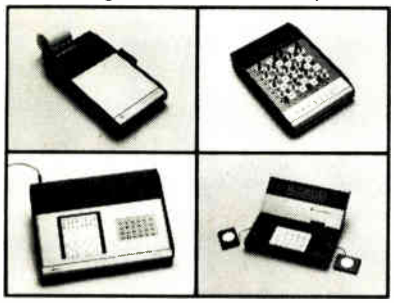

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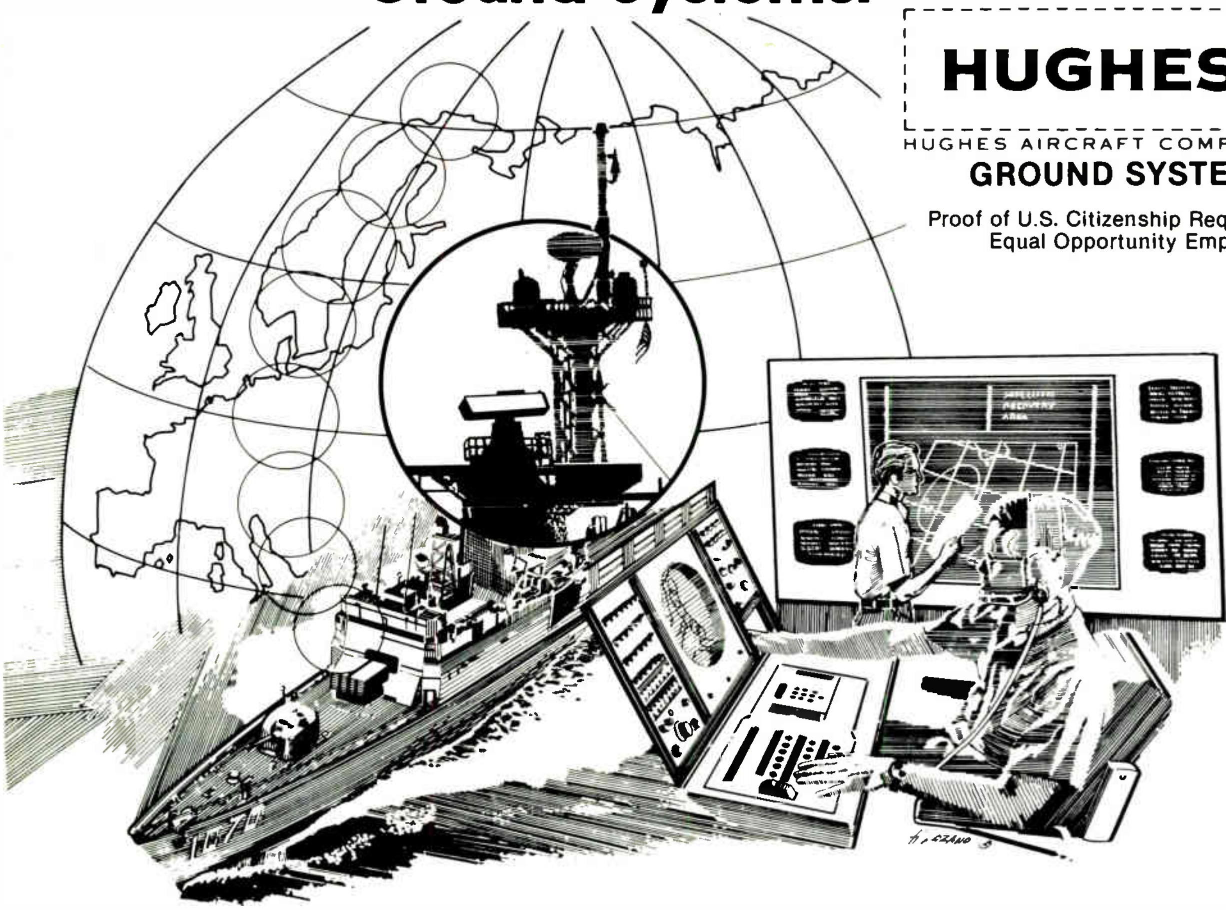

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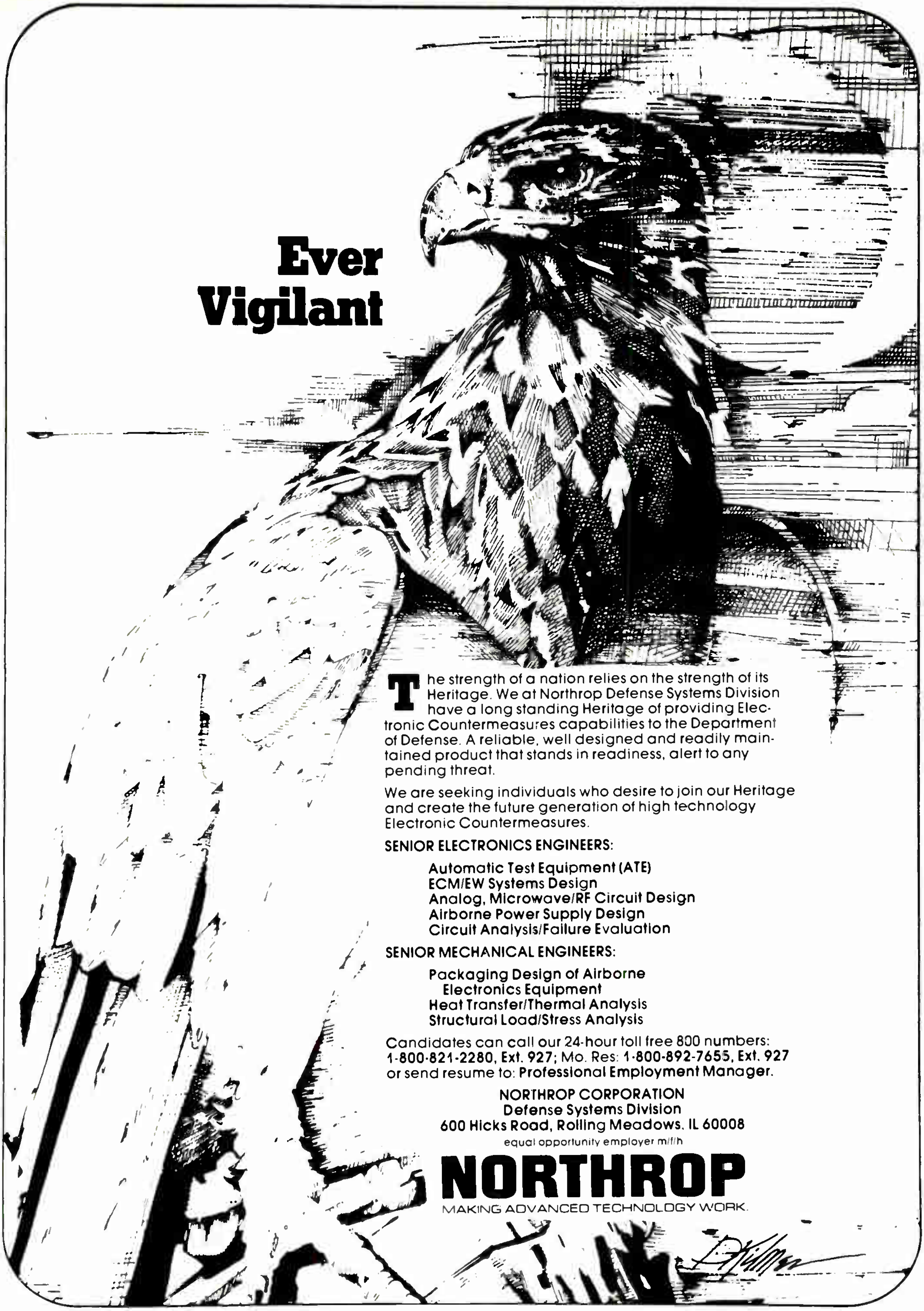

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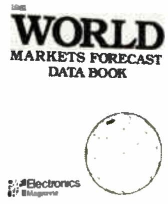

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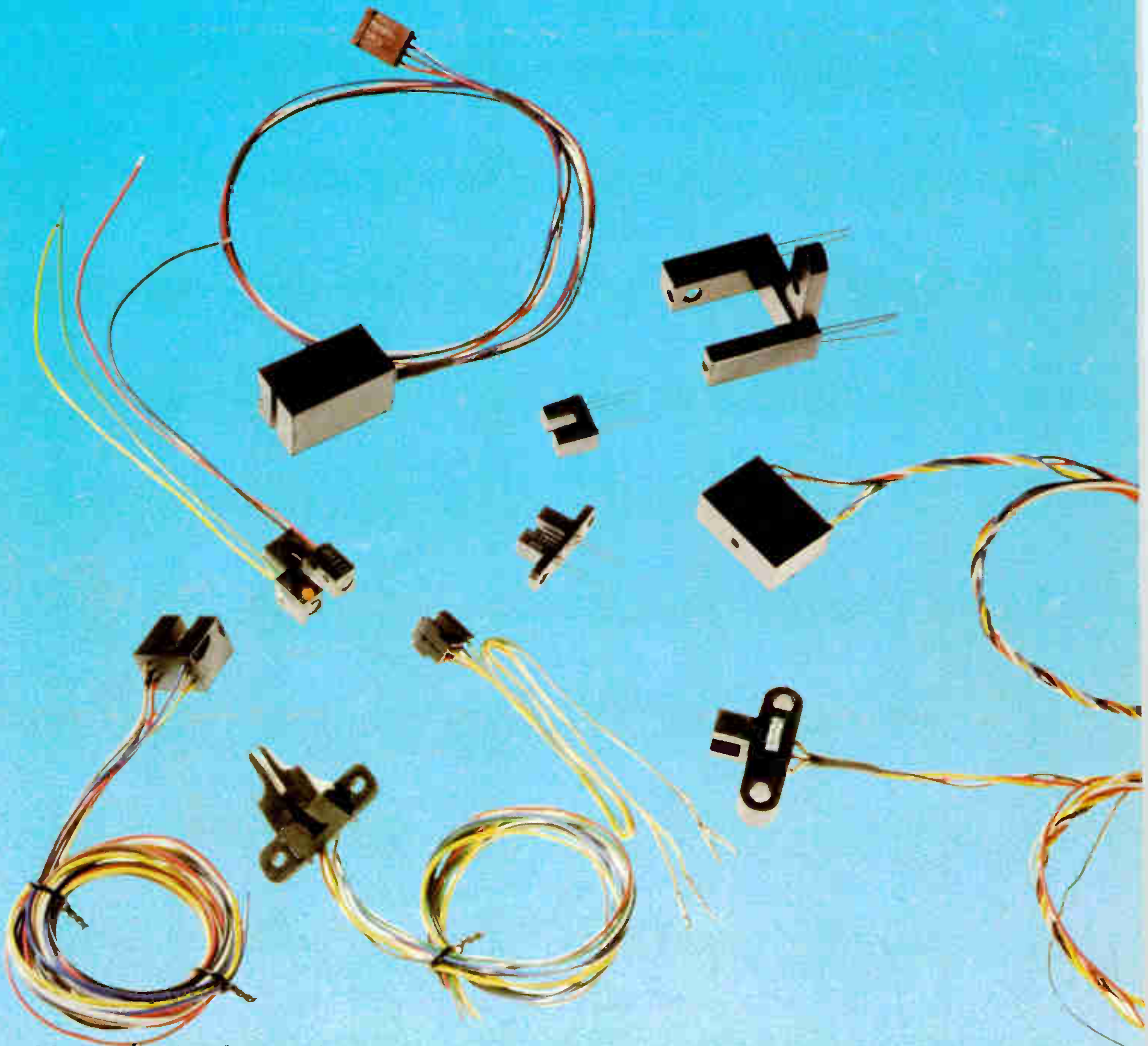

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