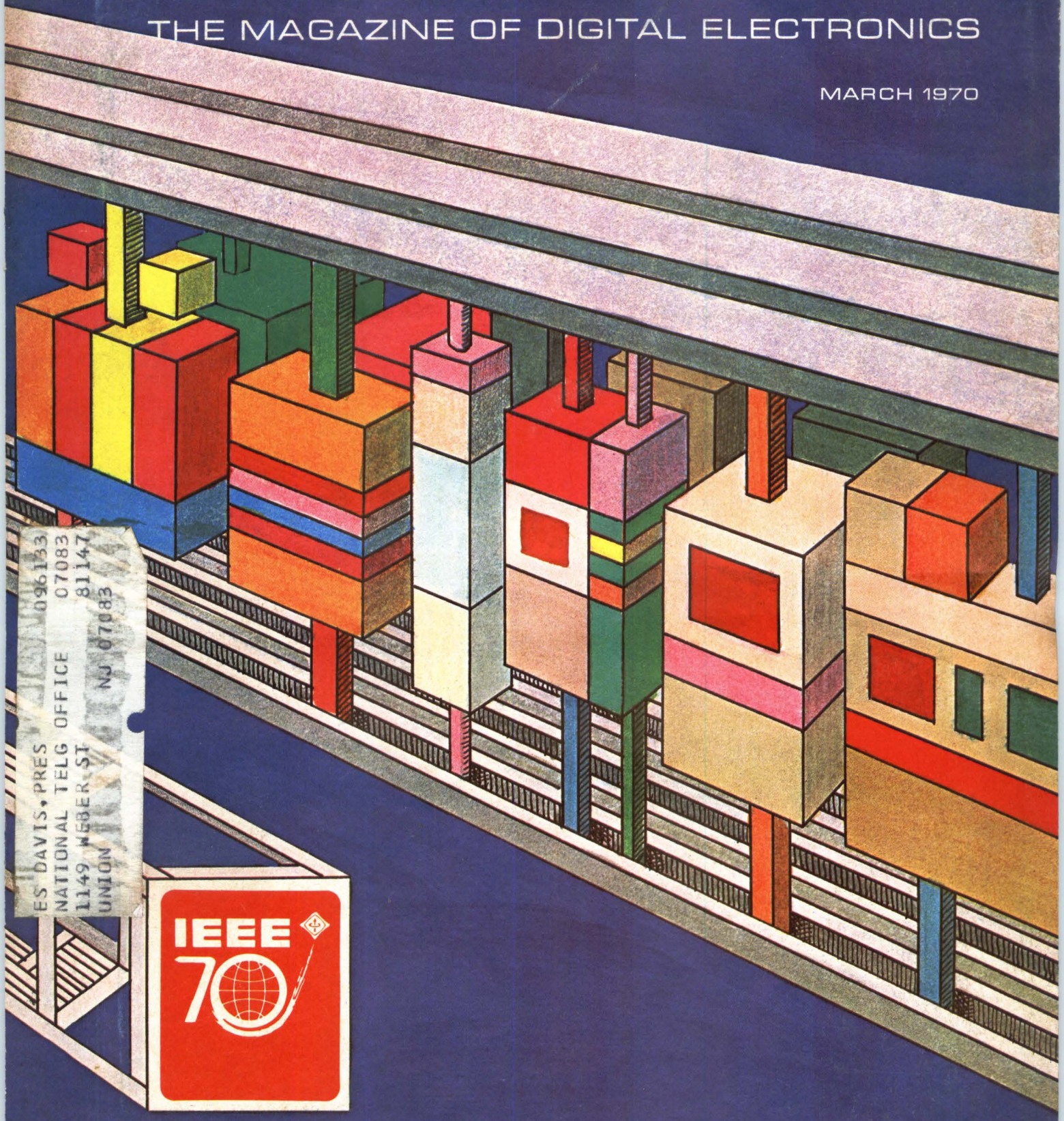
COMPUTER DESIGN

THE MAGAZINE OF DIGITAL ELECTRONICS

MARCH 1970



THE DIRECT FUNCTION PROCESSOR CONCEPT FOR SYSTEM CONTROL

AN ENGINEERING TOOL FOR FIELD SERVICING DATA COMMUNICATION SYSTEMS

A SERIAL INPUT/OUTPUT SCHEME FOR SMALL COMPUTERS

1970 IEEE INTERNATIONAL CONVENTION AND EXHIBIT

Try dropping this in your computer!

Antienvironment is the name of Varian's latest computer game. We call it the R-620/i, a ruggedized version of the popular 620/i (over 1000 sold worldwide).

The new R-620/i is a systems-oriented, general-purpose computer that offers highly reliable operation in the most severe environments. It is specifically designed to withstand vibration, shock, humidity, dust and corrosion. Ideal for mobile or permanent facilities in both military and industrial applications.

With ceramic integrated-circuit reliability, the computer features easy interfacing, compactness, choice of 16- or 18-bit precision and a high-temperature memory that can be expanded up to 32K words.

A large library of software, field-proven on the functionally identical 620/i, is available to you for the R-620/i. As well as one of the largest service and maintenance organizations in the small-computer field. The price is only $16,900. The R-620/i, a good new reason for you to talk to the big company in small computers.

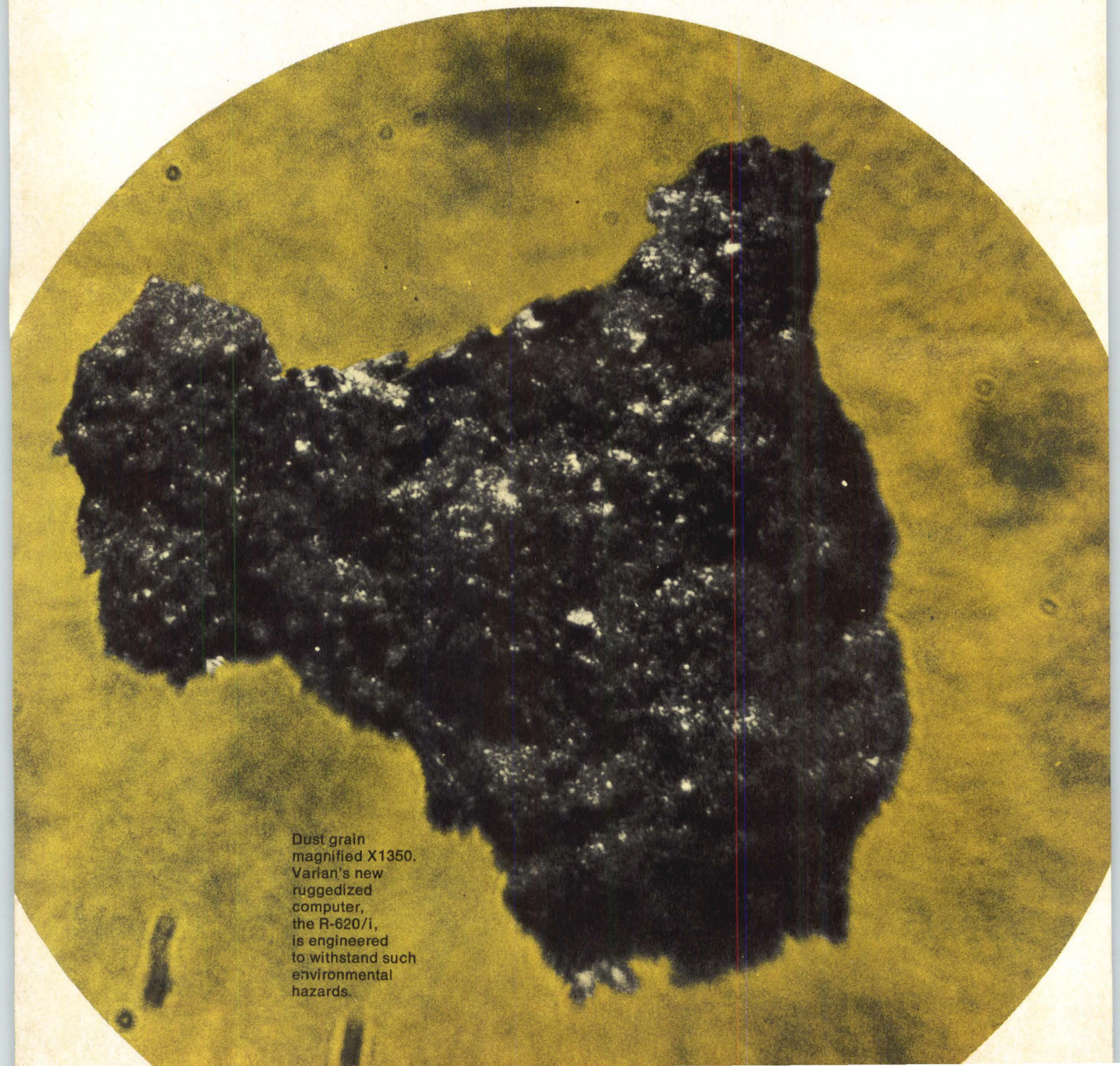
U.S. Sales Offices: Downey, San Diego, San Francisco, Calif.; Washington, D.C.; Atlanta, Ga.; Chicago, Ill.; Waltham, Mass.; Ann Arbor, Mich.; New Rochelle, Syracuse, N.Y.; Fort Washington, Pa.; Dallas, Houston, Tex. Other offices worldwide.

Varian Data Machines, a Varian subsidiary, 2722 Michelson Dr., Irvine, Calif. 92664. Telephone: 714/833-2400.

varian data machines

The Big Company in Small Computers

CIRCLE 1 ON INQUIRY CARD



Dust grain magnified X1350. Varian's new ruggedized computer, the R-620/i, is engineered to withstand such environmental hazards.

Ferroxcube's new mini-cost stack for mini-computers

Now solving your cost/speed/delivery problem is child's play

Ferroxcube's new Series 200 memory stacks plug right into your computer equipment. No special wiring expense. And they deliver speeds to 750 nanoseconds, capacities of 4K, 8K or 16K words with up to 40 bits.

The remarkable thing is that they do all this at such low cost. The secret? We built them around our 18 mil cores that sell at 20 mil prices.

If you want to save still more money and don't require 750 nanosecond speed, we also make 20 mil versions.

Both types have 3D, 3-wire organization with high-density packaging using double-matted planes. Now you can get more memory into smaller computer equipment.

The fundamental reason for Series 200's mini-prices is the same one that assures you of mini-time delivery. It's this: Ferroxcube is the largest independent supplier of stacks to computer equipment manufacturers...particularly so in 3D, 3-wire technology.

That means unmatched experience. We've learned how to give you the best combination of quality, delivery and price. Result: the lowest total cost to you.

Our Pluggable Mini-Cost Stacks can solve a maxi-problem...your cost/speed/delivery trade-off. To learn all the reasons, write us for the Series 200 bulletin today.

Ferroxcube
Saugerties, New York
A NORTH AMERICAN PHILIPS COMPANY

Annapolis, Md.—(301) 932-7660; **Burbank, Calif.**—(213) 849-6631; **Chicago**—(312) 832-0450; **Dallas**—Data Marketing Assoc., (214) 231-1406; **Denver**—Wm. J. Purdy Corp., (303) 794-4283; **Houston**—Data Marketing Assoc., (713) 686-9627; **Minneapolis**—(612) 920-1830; **Needham Heights, Mass.**—(617) 449-1406; **Orlando, Fla.**—W. A. Brown & Assoc., (305) 425-5505; **Philadelphia**—(215) 643-4117; **Phoenix**—(602) 264-3129; **San Francisco**—Wm. J. Purdy, Corp., (415) 347-7701; **Saugerties, N.Y.**—(914) 246-2811; **Union, N.J.**—(201) 964-1844; **Toronto, Ontario**—Philips Electron Devices, Ltd. (416) 425-5161.

CIRCLE 2 ON INQUIRY CARD

If you've been wanting someone to build a low-cost digital tape drive with Hewlett-Packard quality, HP just did.

We've taken the OEM experience we've gained from putting almost 4000 digital tape systems in the field. Added what you've told us you'd like to see in a low-cost tape drive for small computers and off-line applications. And produced the HP 7970.

It has all the features you're looking for in a digital transport: IBM and ASCII compatibility, 25 ips speed without program restrictions, DTL/TTL compatible interface. Seven or nine track capability with simple field conversion. Standard 10½ inch reels. Plus handsome appearance, fingertip push-button controls, backlit indicators for quick operational status checks, dual gap head for read-after-write error checking capability.

It also has HP's exclusive trouble-free design and rugged construction, with cast aluminum frame, automatically milled to precise reference planes. The tape transport components are mounted to this frame on precisely indexed bosses to assure that tape path tolerances are routine. The HP 7970 also has electronic deskewing, direct drive motors, single capstan, and dynamic braking that eliminates mechanical adjustments. Plus the back-up capability of 141 Hewlett-Packard sales and service offices around the world.

So if you want a low cost digital tape drive with HP quality, call your Hewlett-Packard field engineer for more information on our new 7970. Or write Hewlett-Packard, Palo Alto, California 94304; Europe: 1217 Meyrin-Geneva, Switzerland.

HEWLETT hp PACKARD

MAGNETIC RECORDERS

42907

THE MAGAZINE OF DIGITAL ELECTRONICS

COMPUTER DESIGN

MARCH, 1970 • VOLUME 9 • NUMBER 3

DEPARTMENTS

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BPA CIRCULATION OVER 45,000

FEATURES

W. Jerry Sanders III took eight years getting from sales engineer to chief marketing executive of a $100 million semiconductor company. Along the way he managed to learn the business from the men who invented it. He's Advanced Micro Devices' President and Chairman of the Board.

Jack F. Gifford led the linear circuit business into the industrial, computer peripheral and instrumentation markets. He's specialized in product definition and planning. That's why he's Director of Marketing and Business Development.

Sven E. Simonsen has more than four years in the development of monolithic complex digital circuits. He designed and developed the 9300 MSI sequential circuit family. He is Director of Engineering, Complex Digital Operations.

D. John Carey was responsible for the development and manufacture of 26 monolithic complex digital circuits in 12 months, including the 9300 MSI family. He's Managing Director of Complex Digital Operations.

"Why don't we get together and start a business?"

ADVANCED MICRO DEVICES, INC.
901 Thompson Place, Sunnyvale, California 94086 **Established May 1, 1969.**

Advanced Micro Devices has perfected the production technology of complex, mainstream digital and linear monolithic circuits.

James N. Giles collaborated with R. Widlar on the design and frequency-compensation of the first monolithic op amps. He wrote the *Fairchild Linear Circuit Handbook*, the industry's standard reference. He's Director of Engineering, Analog Operations.

Edwin J. Turney has ten years' sales management experience in the semiconductor industry. He's been involved in the growth and service needs of customers like XDS, Burroughs, NCR and many more. That's given him special credentials for his job as Director of Sales and Administration.

R. Lawrence Stenger increased the reproducibility of the UA 709 from 6,000 circuits per month to 400,000! His department produced 22 second-generation LICs in two years. He's Managing Director, Analog Operations.

Frank T. Botte worked on the industry's first linear I.C.s. He developed the first production-reliable MOS monolithic capacitor, making possible the UA741—the industry's first frequency-compensated op amp. Now he's Director of Development, Analog Operations.

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GaAsLITE Update

Solid state displays

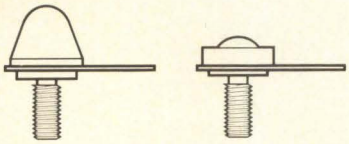
The MAN 1 is a seven-segment light-emitting all-semiconductor alpha-numeric readout.

Put the attention-demanding red light from electrically excited GaAsP to work in your digital displays for industry, computer peripherals, or avionic/marine instrumentation. Our MAN 1 is shock-resistant and long-lived. Offers styling advantages because it's flat, parallax-free and visible within 150°. Reads out all numbers plus A, C, E, F, H, J. O, P and U. Available now. Any quantity.

Brightness: 200 ft-lamberts @ $I_F = 20$ ma, 3.4V, per segment

Compatibility: directly interfaces with off-the-shelf IC decoder/drivers

Price: ~~1-9, $48; 1,000 or more, $25~~ *contact distributors for new prices!*



12 mW @1A IR emitters

New high power low cost 9000 Å GaAsLITEs give you extra mW for your $.

Design these powerful infrared sources into your next card or tape readers, intrusion alarms, or calibration units. Anything that uses silicon detectors wants our ME 2 and ME 5 GaAs infrared emitters. They give you a 2500-mil² emitting area with either lambertian (ME 2) or collimated (ME 5) radiation patterns. Guaranteed minimum output: 10 milliwatts at 1 amp. (Less expensive ME 2A and 5A versions radiate 7.5 mW.)

Peak forward current: (1μs pulse width, 300 pps) 25 amps

Forward voltage: 1.3 V typ ($I_F = 1.0$ A)

Rise time: 10 nanoseconds

Prices: ME 2, 5: 1-9, $30; 1,000, $12.50
ME 2A, 5A: 1-9, $14.75; 1,000, $8.00

GaAsLITEs by the millions

Bright red solid state lights are here. And affordable!

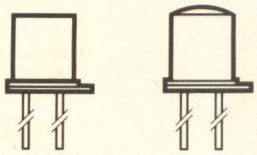
Want high performance and low price? Immediately? Order our new MV 50:

750 ft-lamberts @ 20ma; thousands ready to be shipped from your Monsanto distributor at $1.50 each.

Finally, a price that lets you justify GaAsLITEs for high volume applications. MV 50s can replace miniature and subminiature lamps down to the T3/4 size. Their solid-state reliability makes them ideal for indicator lights in computer systems, data processing equipment, communications systems, and as diagnostic lights on pc boards. And just think what you could do with them in large arrays and in optical logic systems. . . .

Size: 0.10" diameter
Output: 750 ft-lamberts (6500 Å) @ 1.6V, 20 ma
Switching time: 1 nanosecond
Price: 1-9, $2.30; 1,000, $1.50

Prices quoted are manufacturer's suggested resale price.



The superfast detector

Our 500-picosecond silicon PIN photodiodes, MD 1 and MD 2, complement our light-emitting diodes.

High speed optical switching has all kinds of sexy uses today: Laser detecting, for instance, and optical encoding. Even simple burglar alarms can use it.

Their half-a-nanosecond response cycle makes them perfect mates for Monsanto GaAsLITEs. And they work with other sources, too. Packaged in standard transistor cans, they're easy to handle and mount. Available with either flat lens or built-in optics.

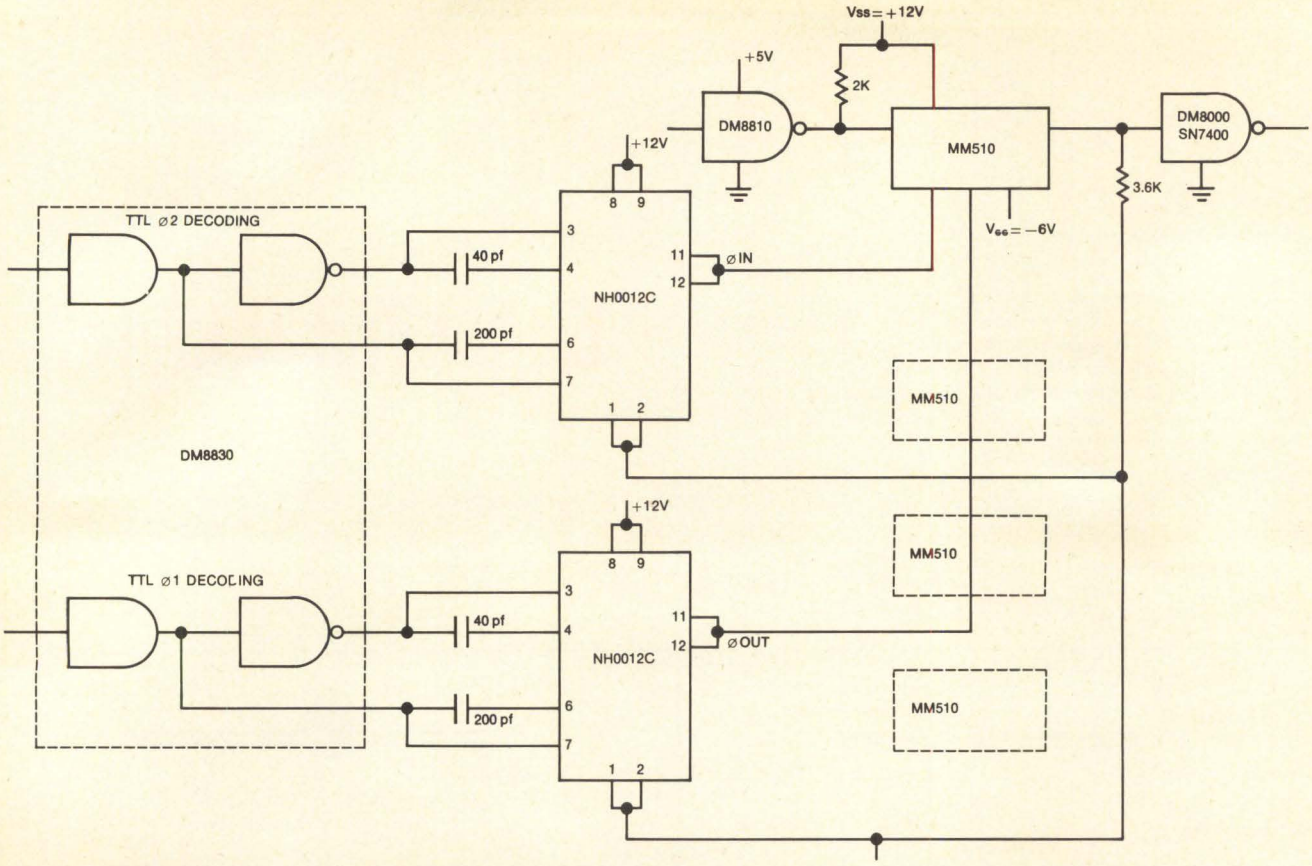
Rise time: .5 nanoseconds ($V_R = 20$V; $R_L = 50\Omega$)
Breakdown voltage: 50V ($I_R = 10\mu$A)

Sensitivity: MD 1 1.5 μA/mW/cm² (min) (.9 microns, $V_R = 20$ volts)
MD 2 3.0 μA/mW cm² (min) (.9 microns, $V_R = 20$ volts)

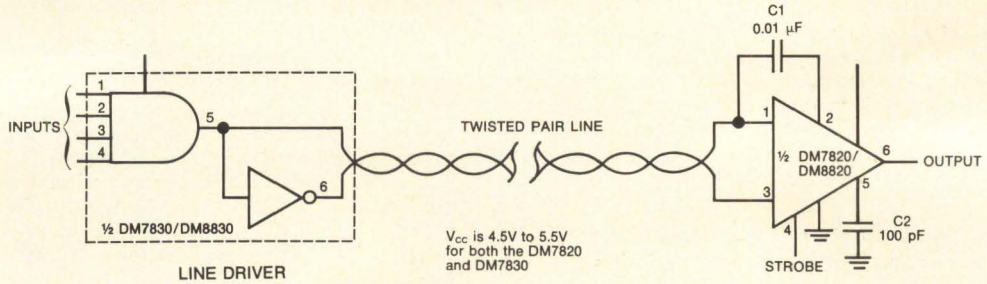
Price: 1-9, $6.25: 1,000, $3.40

Monsanto

All available through Schweber, Semiconductor Specialists, Kierulff or K-tronics. For additional technical information and world-wide distributor list, write Monsanto Electronic Special Products, 10131 Bubb Road, Cupertino, California 95014. (408) 257-2140

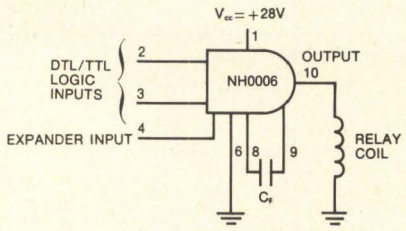


HIGH SPEED MOS CLOCK DRIVER

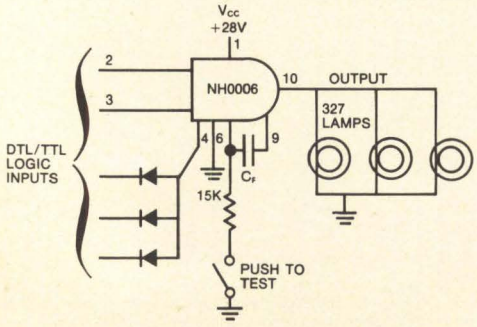


LINE DRIVER

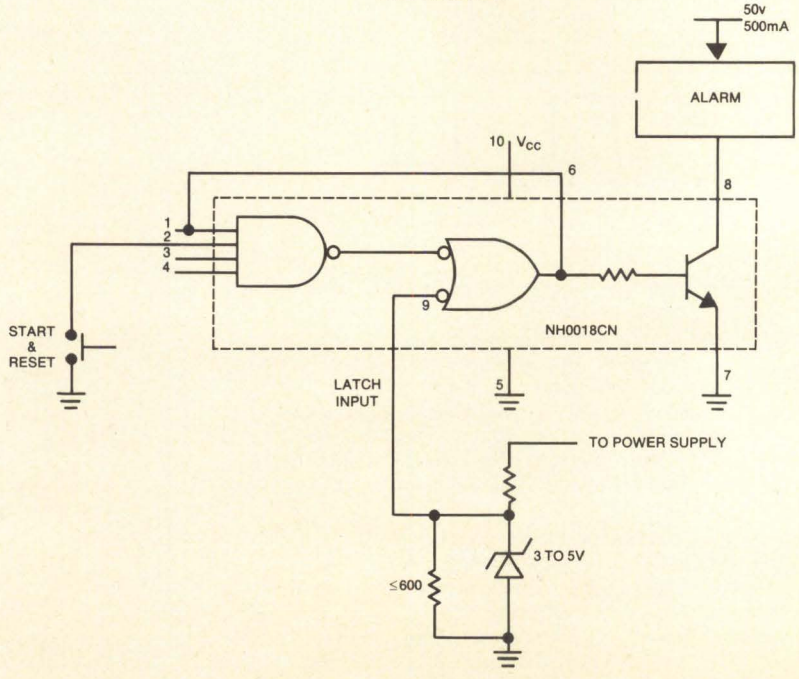
LINE RECEIVER



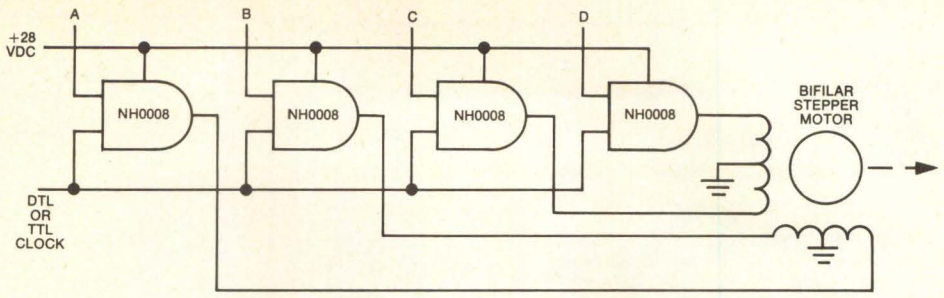
RELAY DRIVER



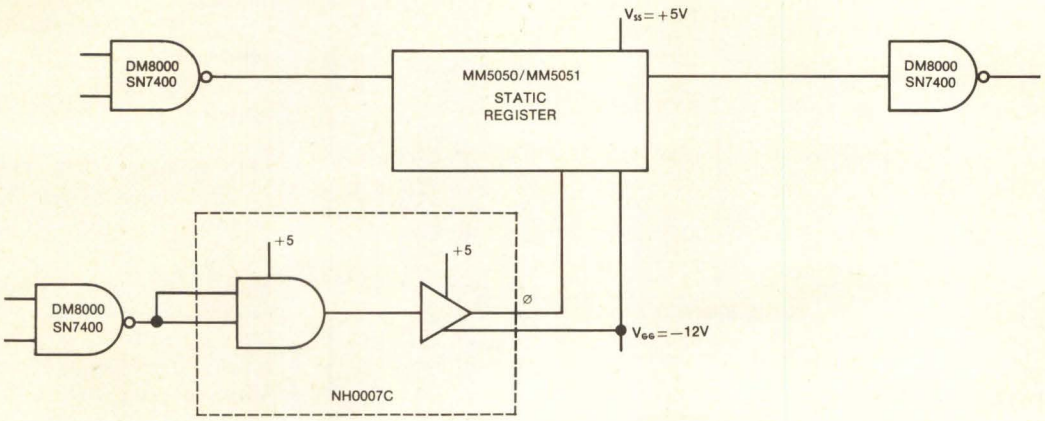
LAMP DRIVER WITH EXPANDED INPUTS



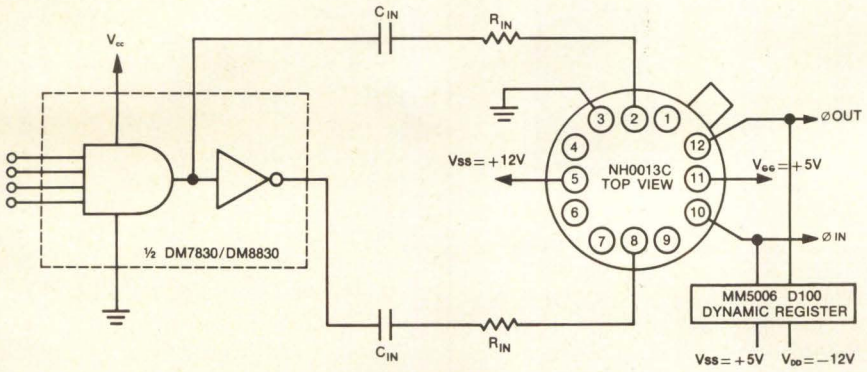
POWER SUPPLY MONITOR



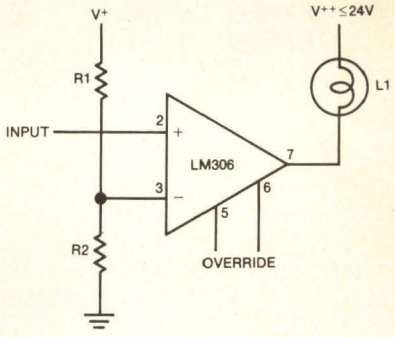
CONTROLLER FOR CLOSED LOOP STEPPER MOTOR



DRIVING STATIC MOS REGISTERS



DRIVING DYNAMIC MOS REGISTERS



LEVEL DETECTOR AND LAMP DRIVER

Leave the driving to us.

Interface at the output of a TTL system calls for circuits capable of handling up to 1 amp or 100 volts. From there, you can drive a line, trigger a relay, control a motor or light your lamps. Similarly, your MOS memory requires MOS clock drivers to deliver precision pulses to registers for a completely compatible TTL system (our registers are already TTL compatible at data input/output).

For total digital systems—DTL, TTL or MOS, National drivers come in TO-5s or molded silicone dual in-lines. They're part of the National scene, low cost and ready to go from distributors' stocks.

Call, write, TWX or honk for our drivers guide with charts, specs and applications notes. National Semiconductor, 2900 Semiconductor Drive, Santa Clara, California 95051 (408) 732-5000 TWX: 910-339-9240 Telex: 346-353 Cables: NATSEMICON.

National/Digital

CIRCLE 7 ON INQUIRY CARD

CONFERENCE CALENDAR

April 21-24—Int'l Magnetics Conf. (INTERMAG), Statler Hilton Hotel, Wash., D. C. **Sponsor:** G-MAG. **Information:** D. S. Shull, Bell Telephone Labs., 3300 Lexington Ave., Winston-Salem, N.C. 27102.

May 4-6—IEEE Transducer Conf., Governor's House, NBS, Gaithersburg, Md. **Sponsor:** G-IECI. **Information:** H. P. Kalmus, Harry Diamond Labs, Dept. of the Army, Wash., D.C. 20438

May 5-7—Spring Joint Computer Conf., Convention Hall, Atlantic City, N.J. **Sponsors:** G-C AFIPS. **Information:** AFIPS Hdqs., 210 Summit Ave., Montvale, N.J. 07645.

May 11-13—Aerospace Instr. Sym., Wash. Plaza Hotel, Seattle, Wash. **Sponsor:** Instr. Soc. of Amer., Aerospace Div. **Information:** L. J. Mertz, The Boeing Co., MS 55-04, Box 3707, Seattle, Wash. 98124

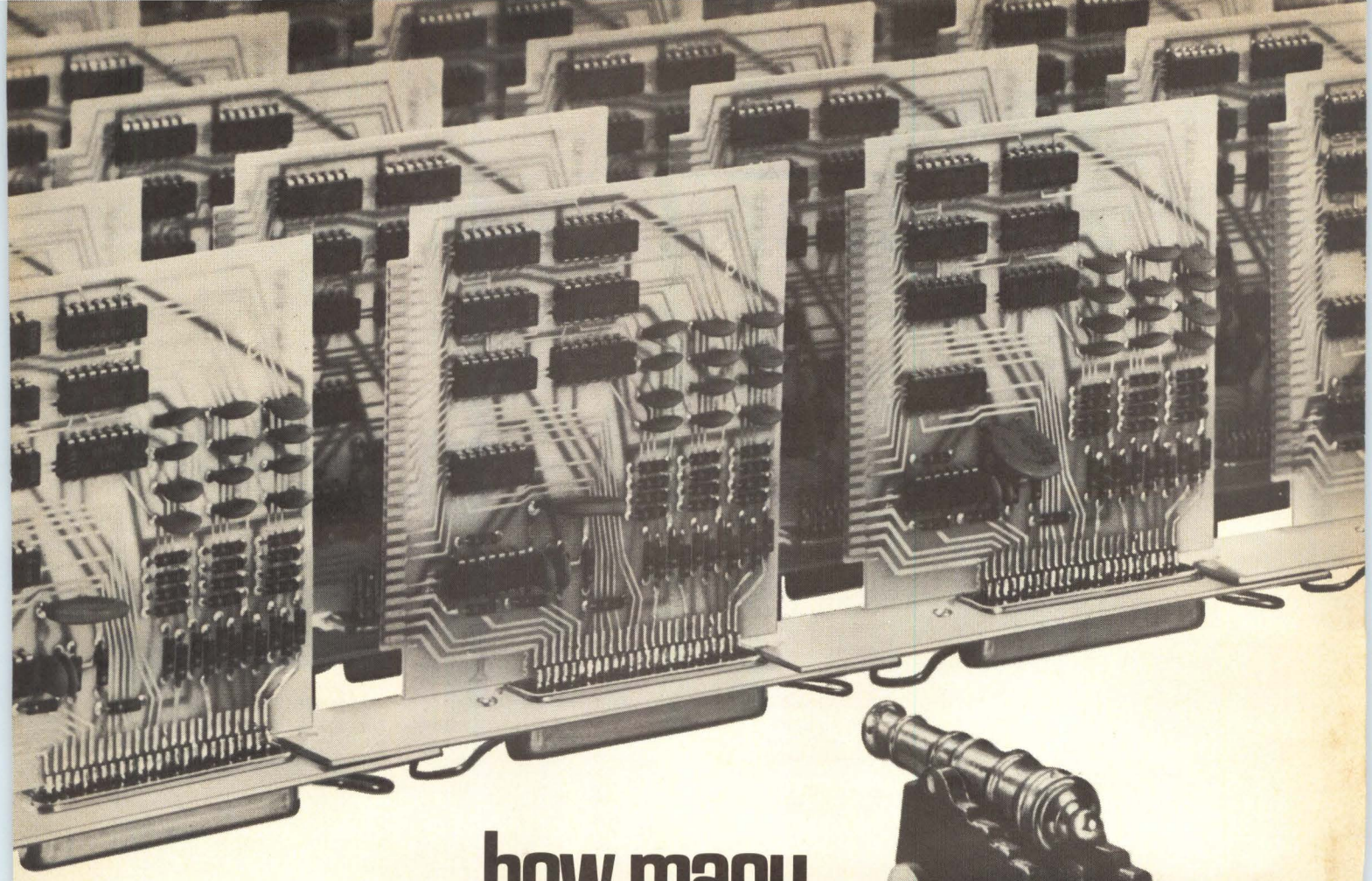
May 25-27—Analysis Instr. Sym., Chatham Center, Pittsburgh, Pa. **Sponsor:** Instr. Soc. of Amer.'s Pittsburgh Sec. **Information:** W. V. Daily, Nine Safety Appliances Co., 201 N. Braddock Ave., Pittsburgh, Pa. 15208

May 26-28—Ann. Sym. & Exhibit. **Sponsor:** Soc. for Info. Display. **Information:** W. M. Hornish, Western Union, 82 McKee Dr., Mahwah, N.J.

June 8-10—Int'l Conf. on Comm., San Francisco Hilton Hotel, San Fran., Calif. **Sponsor:** IEEE G-Comm Tech., San Fran., Sec. G-IT. **Information:** A. M. Peterson, Stanford Res. Inst., Menlo Park, Calif. 94025

June 9-10—Workshop on Microprogramming, Université de Grenoble, France. **Sponsors:** ACM, AFCET, & the University. **Information:** Prof. Jean Kuntzmann, Mathématiques Appliquées, Cedex 53, 38-Grenoble-Gare, France

June 16-18—IEEE Int'l Comp. Conf., Wash. Hilton Hotel, Wash., D.C. **Sponsor:** G-C. **Information:** D. E. Doll, IBM Corp., 18100 Frederick Pike, Gaithersburg, Md. 20760



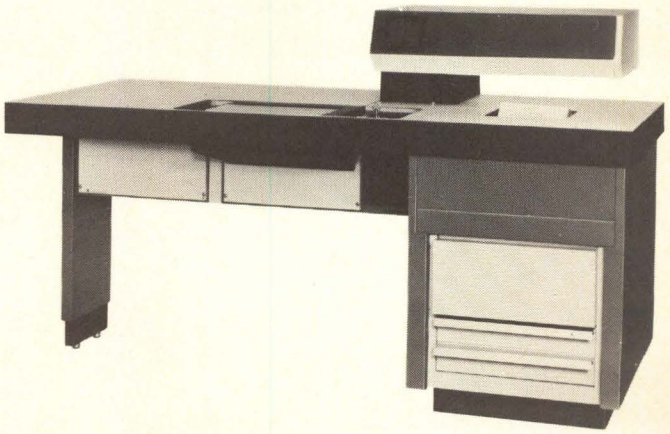
how many will fall today?

Shoot down your defective printed circuit boards in the early rounds of the manufacturing process and win the battle of the ledger with GR's 1790 Logic Circuit Analyzer!

Put the 1790 into your battle plan and get the very best weapon available to check your logic circuits quickly and economically. The 1790 combines a capacity to handle almost any board configuration (up to 96 input pins and 144 outputs) with a simplified test language (technicians can learn it in only a few days) and computer speed (up to 4000 tests per second). The end product is a GO indication, or a scope-displayed or typewritten error message (or diagnostic instructions included in the test program) to give you the most powerful logic-circuit analyzer on the market. (A simpler GO/NO-GO test mode can also be used.)

Base price of the 1790 is $32,500 (a strategic advantage for you), including installation and training. Additional computer memory and programmable logic levels are available as options. If you'd like more information for your strategy meetings, write General Radio Company, West Concord, Mass. 01781 or telephone (617) 369-4400. In Europe write Postfach 124, CH 8034 Zurich, Switzerland.

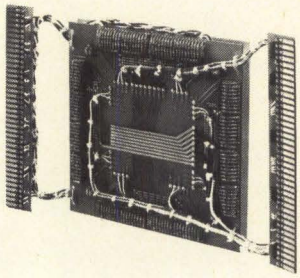
Price applies in U.S.A.



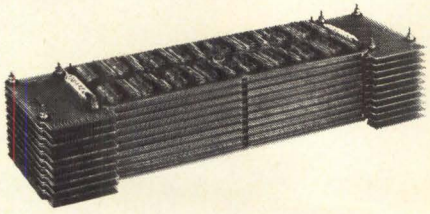
GENERAL RADIO

CIRCLE 9 ON INQUIRY CARD

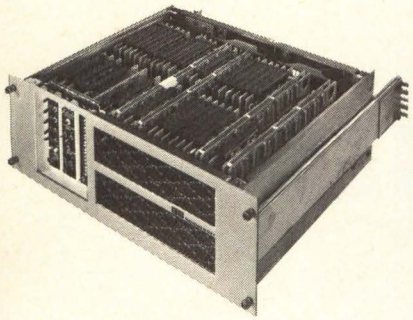
Who else but Electronic Memories



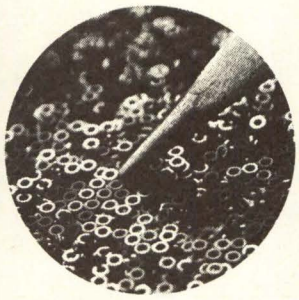
Rugged design for ground based mobile equipment, **NANOSTAK 020** commercial memory stack. High speed 850-nanosecond full cycle time for 4K memories. Features 3W, 3D organization with word capacities to 16K by 40. Built-in reliability and dependability. Available with wide temperature range cores for operation in severe environments.



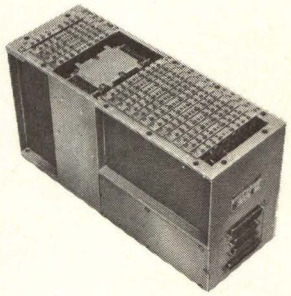
Perfect for high speed, large capacity mainframe memory systems... **NANOSTAK 3020**...technology breakthrough in 3W, 2-1/2D stacks. Stackable, compact size is an amazing 25% of competitive planar stacks and offers a significant advantage in form factor for system packaging. Extremely fast 650 nanosecond cycle time for 8K or 16K by 40, or 32K by 20 word memories.



High speed commercial memory system —**NANOMEMORY 2600**. Full cycle time of 600 nanoseconds, and word capacities of 16K by 18 or 8K by 36. It's all done with a second-generation 2-1/2D drive system with efficient circuit and logic design, for reduced component count and high MTBF, and wide operating margins—the real feature of the 2-1/2D configuration. It is easily expandable in the field, and comes in a standard 19″ rack.



Five new memory cores for your next stack or system. All are medium or high drive, all coincident current, and all are fast switching for your high speed applications. Four new cores available in 18 mil, 20 mil, and two types of 30 mil sizes for use from 0° to 70°C. Also, a new wide temperature range 18 mil core for severe environments of −55° to +100°C.



Compact, ATR compatible memory system **SEMS-6** for use in military and rugged commercial aircraft applications. Reliable performer is optimized around 8K or 16K with maximum capacities of 8K by 40 or 16K by 20. Full cycle time of 2 microseconds, with access time of 700 nanoseconds. Meets MIL-E-5400, low power consumption and lightweight.

could introduce five brand spanking new memories–at once

Only Electronic Memories, the technology leader, could introduce five important new memories at once. Each one offers significant advances to provide you with faster, more reliable, and lower cost memories. Each one is loaded with outstanding new design features to give you faster access, larger capacity, and more economical operation. From cores and stacks to megabit memories, Electronic Memories has the memory products for your next, faster, more powerful computer system. For more facts and figures, just write.

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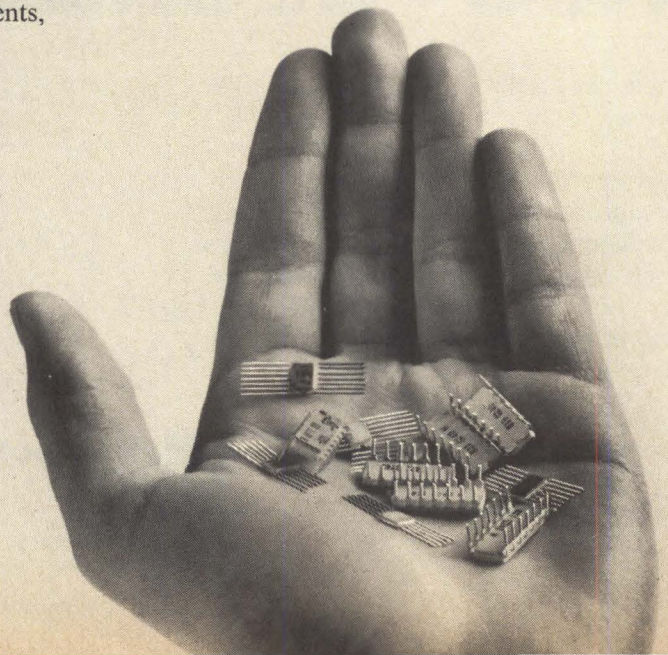
CIRCLE 10 ON INQUIRY CARD

Sylvania introduces the MSI supermarket.

FUNCTIONAL ARRAYS, TYPICAL CHARACTERISTICS (+25°C, +5.0 Volts)

Function	Type Nos.	t_{pd} (nsec)	Avg. Power (mW)	Noise Immunity +(Volts)–		Fanout
Full Adder	SM10 Series	Sum 22 Carry 10	90	1.0	1.0	These arrays are available in fanouts up to 15 and are completely compatible with SUHL I and SUHL II integrated circuits.
Dependent Carry Fast Adder	SM20 Series	Sum 22 Carry 10	125	1.0	1.0	
Independent Carry Fast Adder	SM30 Series	Sum 22 Carry 10	125	1.0	1.0	
Carry Decoder	SM40 Series	2	25	1.0	1.0	
4-Bit Storage Register	SM60 Series	20	30/bit	1.0	1.0	
Bus Transfer Output 4-Bit Storage Register	SM70 Series	20	30/bit	1.0	1.0	
Cascade Pullup Output 16-Bit Scratch Pad Memory	SM80 Series	25	250	1.0	1.0	
Decade Frequency Divider	SM90/92 Series SM91/93 Series	35MHz 30MHz	125 85	1.0	1.0	
4-Bit Shift Register	SM110 Series	25MHz	120	1.0	1.0	
Parity Generator/Checker	SM120 Series	22	125	1.0	1.0	
Comparator	SM130 Series	17	120	1.0	1.0	
Programmable Binary Divider	SM140 Series	25MHz	150	1.0	1.0	
Programmable Decade Divider	SM150 Series	25MHz	150	1.0	1.0	
Binary Counter	SM160 Series	25MHz	135	1.0	1.0	
Decade Counter	SM170 Series	25MHz	135	1.0	1.0	
Binary Up/Down Counter	SM180 Series	25MHz	205	1.0	1.0	
Decade Up/Down Counter	SM190 Series	25MHz	205	1.0	1.0	
BCD to 7-Segment Translator	SM200 Series	85	280	1.0	1.0	
Dual 4-Bit Multiplexer	SM210 Series	10-20	130	1.0	1.0	
Demultiplexer	SM220 Series	9-14	225	1.0	1.0	

Sylvania Electronic Components,
Semiconductor Division,
Woburn, Mass. 01801



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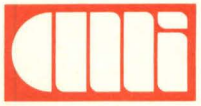
If memory is your thing, you need Computer Microtechnology memories. The first one is ready, the CM 2100 64 bit bipolar read/write memory. It features the best minimum write pulse width in the industry, 12 nsec typ. This combined with the other specifications gives you superior units for your applications. All decoding, driving and sensing circuitry is on the chip of this self-contained memory. You can achieve memory expansion simply through chip select input and wired-OR capability of outputs. □ The CM 2100 is ideally suited for high speed scratchpad or buffer memories. Do your thing. Check the specs and then order your CM 2100 memories today. □ PRODUCT LINE: 64 BIT, 256 BIT, 4096 BIT MEMORIES.

CM 2100 64 BIT BIPOLAR READ/WRITE MEMORY:

Organization	16 words by 4 bits
Read Access Time	40 nsec typ. 60 nsec max.
Minimum Write Pulse Width	12 nsec typ. 25 nsec max.
Compatibility	DTL and TTL
Packaging	16 lead dual-in-line
Price	$40.00, 1–24
Delivery	Stock



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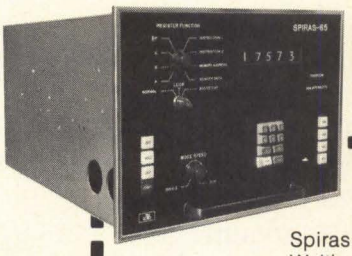
At this price, there are no options.

$9,950.

Buy two Spiras-65 computers at this new low price (per unit) and put away your wallet. We aren't going to put the bite on you for any major options. Because all major high-performance features are already built into the Spiras-65:

● 4K 16 bit memory expandable to 65K ● Hardware arithmetic with double precision and floating point ● Block transfer DMC ● Direct memory access ● Hardware priority interrupt ● 200 + instruction set cast in expandable ROM ● Indirect addressing to 32K ● Page free relative addressing ±512 words ● Fully commented software ● Software supported peripherals ● Nationwide service ● 3 week customer training course

All these powerful capabilities are standards with Spiras. So whether you buy one unit at the new low single-purchase price of 12,400, 2 units at 9950 each, 30 units at 8500 each, or 100 units at 7000 each, you get all the versatility and expandability you're ever likely to need. And no options.



Spiras Systems, Inc.
Affiliate of
USM Corporation

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Send to R. Frederickson,
Vice-President/Marketing
Spiras Systems, Inc., 332 Second Avenue
Waltham, Mass. Telephone: 617-891-7300

Name_____

Title_____

Company_____

Address_____

City_____ State_____ Zip_____

Quantity_____ Peripheral Requirements_____

USM is a world-wide 400 million dollar designer and manufacturer of systems aimed at improving the productivity of manufacturing and service industries.

LINEAR

Linear Integrated Circuit technology is happening so fast, it's difficult to determine which development to advertise first. So, we've decided to advertise everything at once. As it happens.

Every month, you'll see this weird-shaped ad in the trade press. It will include new product announcements, applications, marketing decisions, assorted breakthroughs, a design contest, what-have-you. Sort of a something-for-everybody compendium of LIC information. If you see something you like, write us and we'll tell you more about it.

New Product Digest

In addition to the μA715 and μA725, Fairchild is introducing the following new Linears:

μA731 Dual Channel Sense Amplifier
2mV Threshold Accuracy
5nSec Strobe Time Variation
Internal Memory Data Register
Reader Service Number 102

μA735 Micro Power Amplifier
100μW Power Consumption
2nA Offset Current
±3V to ±18V Supply Voltage
10MΩ Input Resistance
Reader Service Number 103

μA739 Dual Low Noise Op Amp
$1\mu V_{rms}$ Noise (20Hz to 150KHz)
50μA Offset Current
20,000 V/V Voltage Gain
Reader Service Number 104

μA742 Zero Crossing AC Trigger
Operates from AC or DC Supply
2 Amps Peak Output Current
Time Proportioning Operation
Adjustable Hysteresis
Reader Service Number 105

μA747 Dual Internally Compensated Op Amp
Short Circuit Protected
Latch-up Proof
Offset Voltage Null Capability
± 30V Differential Input Voltage
200,000 V/V Voltage Gain
Reader Service Number 106

μA748 High Performance Op Amp
Short Circuit Protected
Latch-up Proof
±30V Differential Input Voltage
200,000 V/V Voltage Gain
Reader Service Number 107

μA749 Dual Op Amp
92dB Voltage Gain
20MHz Bandwidth
Latch-up Proof
Short Circuit Protected
Reader Service Number 108

EDITORIAL

If We Can't Sell You Ours, We'll Sell You Theirs.

For a long time, Fairchild built only linears designed by Fairchild engineers. We didn't think anything else was worth the effort. People said we had an NIH (Not Invented Here) complex. And, they were right.

However, it's been brought forcefully to our attention that a couple other guys in this business know what they're doing. The competition is coming out with some pretty worthwhile linears. Our customers have noticed too, because they're talking to other manufacturers about linears we don't make. They're even talking to sole sourcers!

To keep things even, we've decided to give our wandering customers something they're going to need if they start dealing with a sole source linear maker: A second source. Us. (Just in case the original supplier's factory blows up or they lose the formula or whatever it is that happens when you can't get delivery.)

Starting now, Fairchild is introducing a new line of linears. We call them IT circuits (Invented There). The first two are available today: The LM101 and the MC1495. Soon we'll add the LM101A, MC1496 and the SN7524. Of course, we've given them Fairchild part numbers. Here's a conversion chart:

μA795	Analog Multiplier	MC1495
μA796	Modulator	MC1496
μA748	Operational Amplifier	LM101
μA777	Operational Amplifier	LM101A
μA761	Sense Amplifier	SN7524

There will be other additions to the IT line soon. So be sure you contact your local Fairchild Sales Engineer before you drop a design for lack of a reliable alternate source. Just give him the part number you want and ask him to check the IT line. Farewell NIH.

Reader Service Number 109

Contest

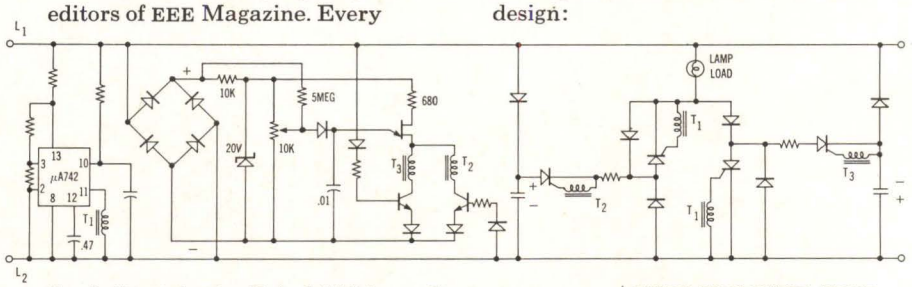
Last year, Fairchild gave a series of seminars on Linear Integrated Circuits in which we introduced 12 new products. One device, the μA742 TRIGAC Zero-Crossing A.C. Trigger, was so significant we offered a free sample to anyone who came up with an original application for it. We got hundreds of replies. The most ingenious was sent in by Richard M. Burkhart, a graduate student at the University of Illinois. We liked Richard's application so much, we decided to give him $100. Then, we liked the $100 idea so much, we decided to make it a contest.

Here's how it works:

1) Get all the facts on a Fairchild Linear IC.
2) Design the world's greatest application for it.
3) Send the application to us.

All entries will be judged by the editors of EEE Magazine. Every month, they will select the most fantastic application and give us the designer's name. We'll publish the winning design here and give the winner $100 upon publication.

To give you an idea of what we're looking for, here's Richard Burkhart's design:



REVERSE PHASE CONTROL CIRCUIT

Send all entries to: Fairchild Linear Contest
P.O. Box 880A, Mountain View, California 94040

New Op Amp has Gain of 3,000,000.

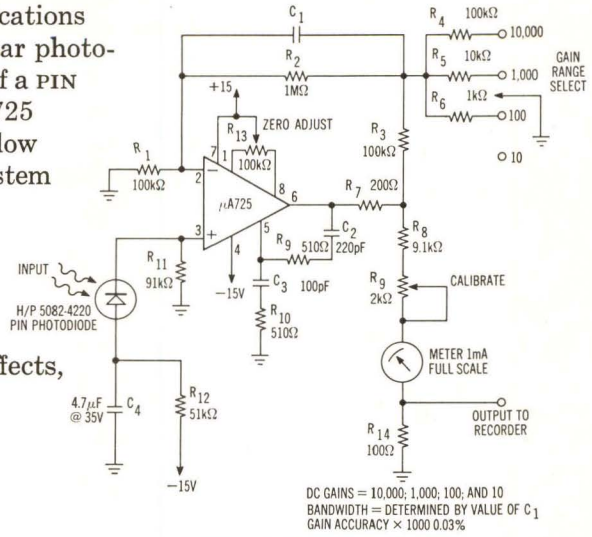
Fairchild's new μA725 Instrumentation Operational Amplifier can do the same jobs that used to require expensive chopper-stabilized or complex discrete component amplifiers. The μA725 is ideally suited for use in Low Level Signal Conditioners, Instrumentation Amplifiers, Precision Measuring Equipment, Process Control Systems and Data Acquisition Equipment.

Electrical Performance/Features

Low Input Noise Current. . . 0.6pA/ Hz
High Open Loop Gain 3,000,000
Low Input Offset Current 3nA
Low Input Offset
Voltage Drift . . . . . 0.5μV/°C
High Common Mode Rejection . 120dB

One of the many applications for the μA725 is in Linear photodetection systems. Use of a PIN Photodiode with the μA725 provides the user with a low noise linear detection system which operates from low voltage supplies and has none of the inherent disadvantages of photomultiplier tubes (high voltage supplies, aging effects, large physical size, high power dissipation).

Reader Service Number 100



μA725 PIN PHOTODIODE AMPLIFIER

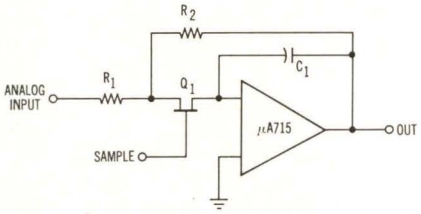
μA715 Basis of Fast Sample/Hold Circuit.

Many data acquisition systems require a sample and hold circuit to improve analog-to-digital conversion accuracy. The requirements of a good S/H circuit are:

1. minimum droop during the hold period
2. high open loop gain for good closed loop gain accuracy
3. high speed
4. minimum temperature drift

A basic sample and hold circuit configuration looks like this:

In the sample mode, the sampling switch Q_1 is turned on and



BASIC OPERATIONAL SAMPLE AND HOLD CIRCUIT

the circuit functions as an inverting operational amplifier.

When Q_1 is switched off, the circuit functions as an integrator, holding the output voltage constant at the sampled value.

The acquisition time when going from the hold mode to the sample mode is a function of the time constant R_2C_1 and the required accuracy, and is given by:

$$t_a = R_2C_1 \ln\left(\frac{100}{\%\ \text{accuracy}}\right)$$

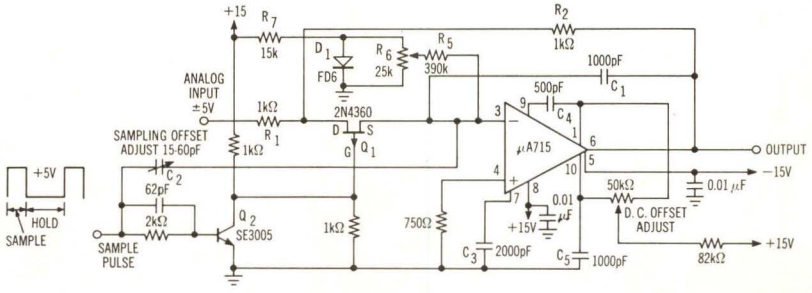
A complete sample and hold circuit is shown below. It includes the components necessary to compensate for the DC and AC errors inherent to the basic configuration. The DC offset is adjusted to zero by a 50k potentiometer (R_4). C_3, C_4, and C_5 provide unity gain frequency compensation.

A junction field effect transistor is used as the sampling switch Q_1. Because there is some capacity from the gate to the source of Q_1, a portion of the gate signal to the switch is coupled through the device onto the holding capacitor C_1 causing an offset error which is bucked out by an opposing signal, coupled by C_2, from the sample pulse input onto the holding capacitor.

Holding Accuracy. During the hold time the output voltage will tend to drift as the holding capacitor integrates the input bias current of the amplifier. This drift is compensated by supplying temperature compensated bias current from a separate source, R_5, R_6, R_7 and D_1.

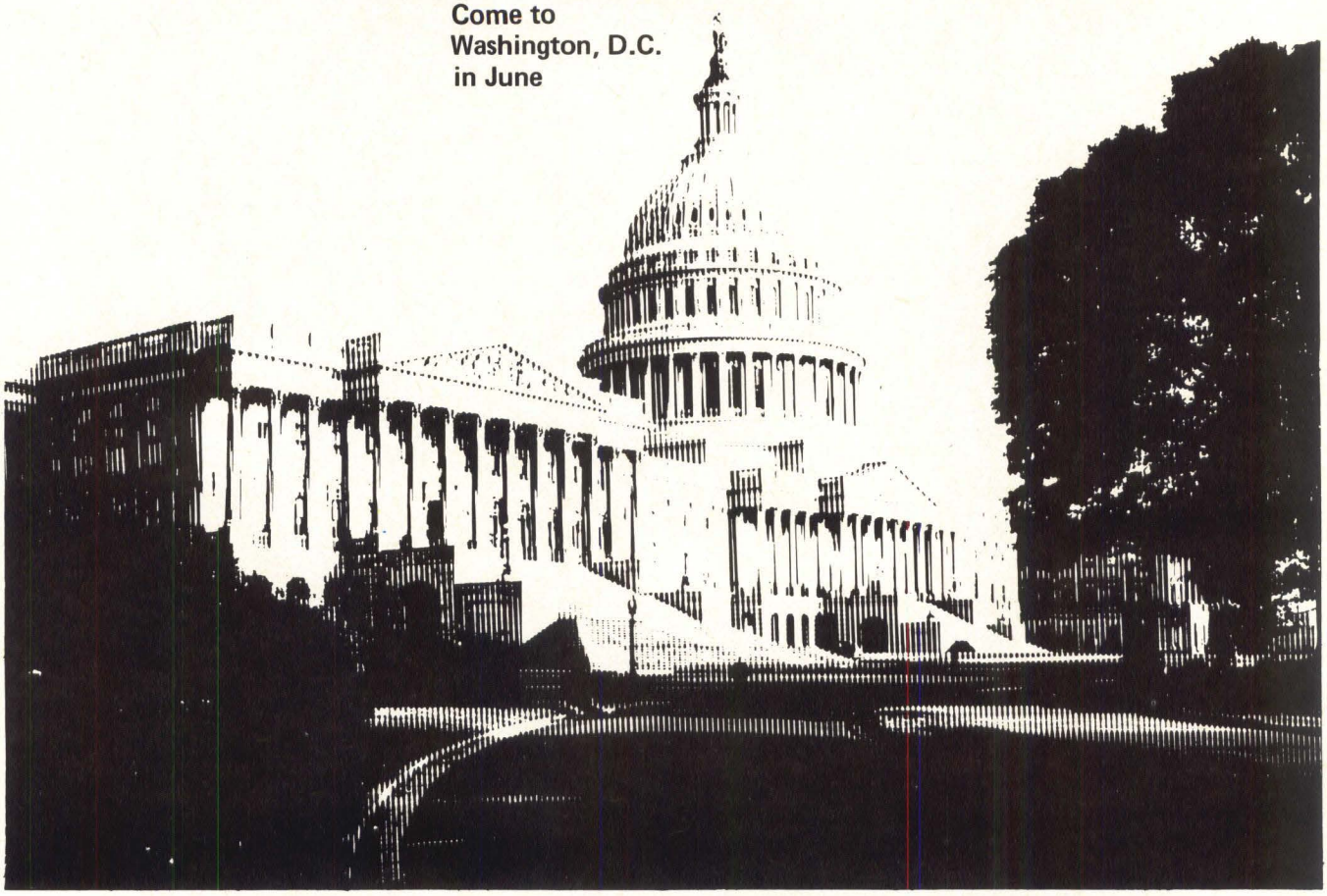
With a 10 volt step input (±5 volts to ∓5 volts) the settling time to ±0.05% is 10μsec. This is slightly longer than that given by equation 1 due to the finite "on-resistance" of the sampling switch Q_1. If C_1 is decreased to 100pF the settling time is about 1μsec. Temperature drift of the output in the hold mode is approximately 0.001% per degree Centigrade for a hold time of 100μsec.

Reader Service Number 101



μA715 SAMPLE AND HOLD CIRCUIT

Come to Washington, D.C. in June



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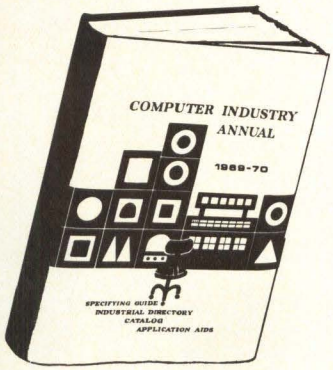

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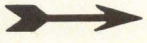

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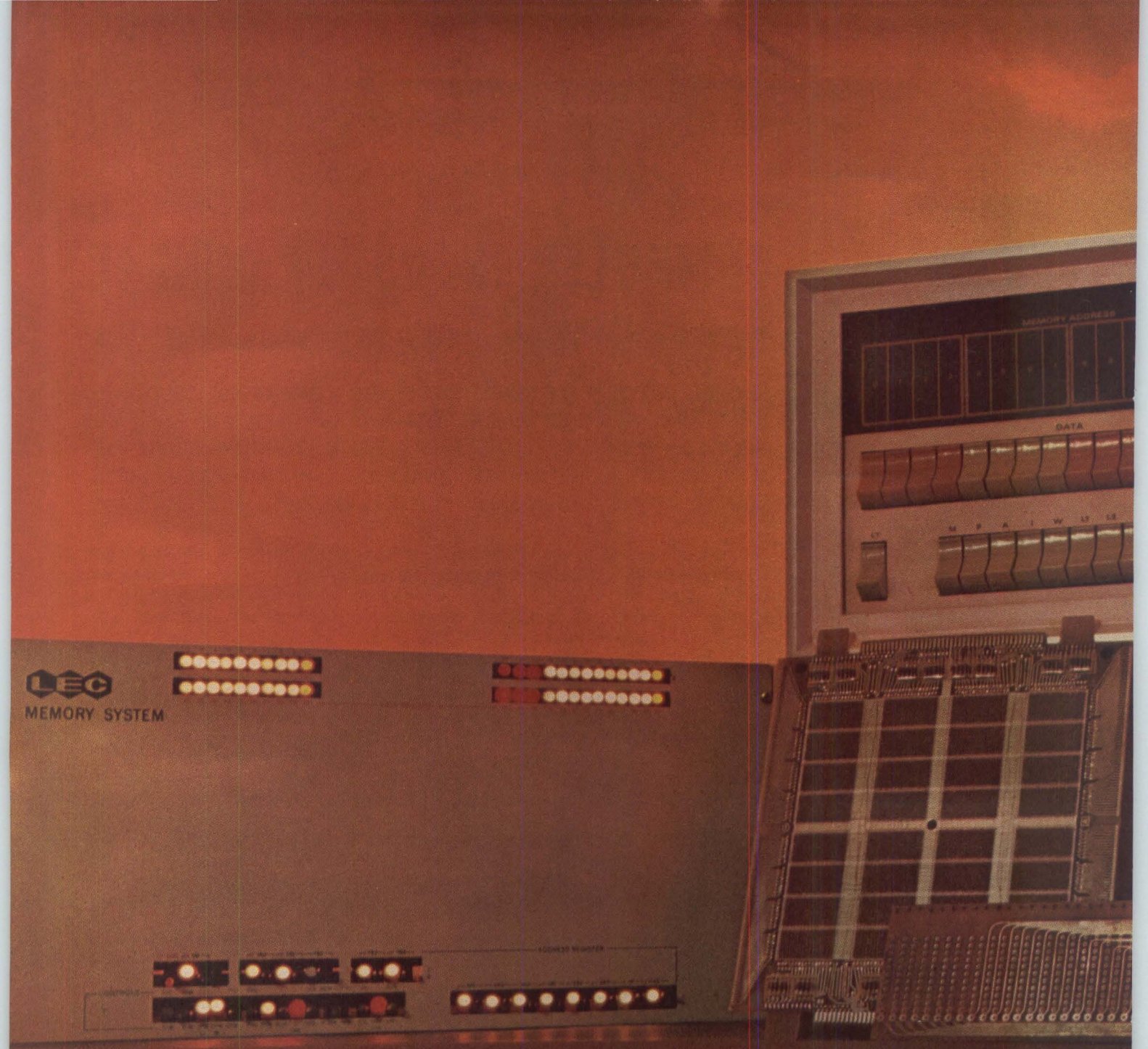

Funny, it doesn't look

Almost everyone knows our first name. Lockheed. The confusion starts when they get to the Electronics part.

Even though we've been in business for over ten years, some people can't get used to seeing the Lockheed name on memories, computers, and printed circuits.

Fortunately for us, a lot of people who buy electronics have gotten used to Lockheed Data Products. We've shipped more bits of high speed—one microsecond or faster—core memory than all other independent manufacturers combined.

We're pretty sure that we're the largest manufacturer of complex printed circuitry in the world.

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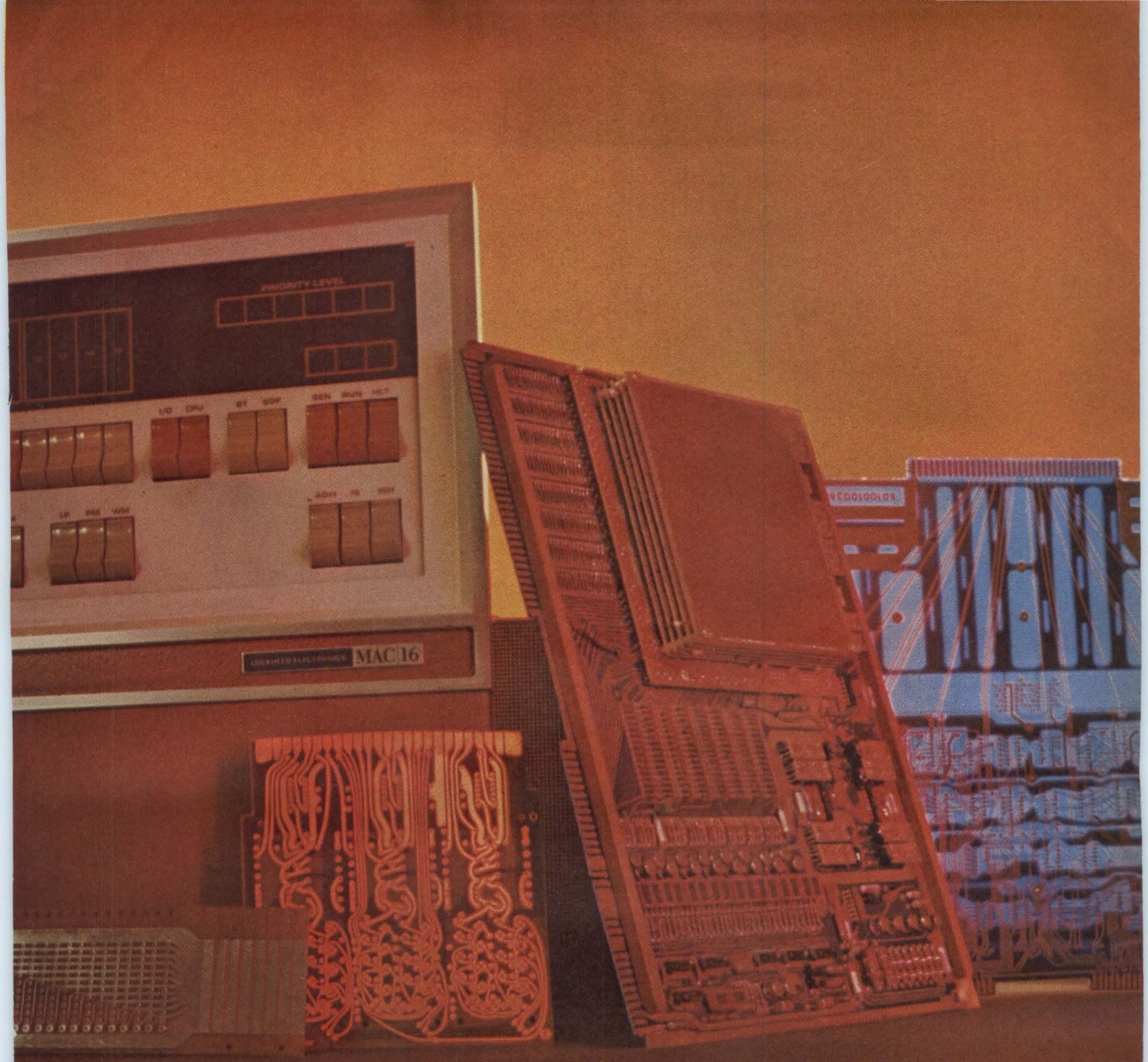

like a Lockheed.

parts, ourselves. There's not another manufacturer of mini computers who can say that.

We're producing plated wire memory systems and flexible circuits. We have a habit of being right there at the head of the line in new product breakthroughs.

Our products don't have wings. Or nosecones. So we may not look like a Lockheed to you. But we're flying high all the same.

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Lockheed Electronics

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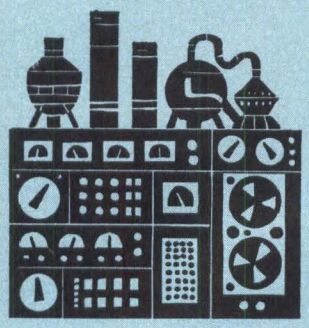

INDUSTRY NEWS

IEEE COMPUTER GROUP CONFERENCE AND EXHIBITION TO FEATURE MEMORIES AND PERIPHERALS—With the peripheral market predicted to be twice that of the computer mainframe in the '70s, the IEEE Computer Group has designed its international conference to examine these projections. The technical sessions will investigate the peripheral hardware, software and systems architecture expected to develop in the next decade, with emphasis equally divided between impact on the computer market and technological innovation in terminals, peripherals and memories.

The conference, to be held in Washington, D.C. this June, is among the first of its kind exclusively for designers and manufacturers of peripheral equipment. Over 60 exhibitors, both foreign and domestic, have confirmed space at this time. Many of the exhibitors will be new companies displaying products for the first time.

Planning and organization of the conference is under the chairmanship of Bob O. Evans, president of IBM's Systems Development Division, with assistance from Dr. Gardiner Tucker, assistant secretary of Defense Systems Analysis; Dr. Martin Greenberger of Johns Hopkins University and Henry S. Forrest of Control Data Corp. International coordination is being handled by Maurice Allegre, director of electronics in the Office of the Prime Minister of France. Each of the technical sessions, many including panel discussions, will be highlighted by a paper solicited from a senior scientist in the field. The program has been rounded out with papers presented by European, Asian and American technologists.

The combination of the hottest technical topic of the year, the most important people in the computer peripheral field and a carefully balanced technical program could result in this year's meeting being the sleeper conference of the year.

Registration is $25 for IEEE members and $30 for non-members in advance, and $30 and $35 at the door. Admission to the exhibits is free.

CONSIDINE WINNER OF "BEST PRESENTATION" AT FJCC—Eugene M. Grabbe, chairman of the 1969 Fall Joint Computer Conference technical program committee, has announced that James P. Considine, IBM, Yorktown Heights, N.Y. has been selected as winner of the Best Presentation Award for his talk on "Establishment and Maintenance of a Storage Hierarchy for an On-Line Data Base Under TSS/360." The Award Committee judged the speech to be an outstanding contribution to speaker/audience communications in the computer field.

Judging was based on review of video tape recordings of all conference speakers. Considine will receive a plaque at the 1970 SJCC banquet in Atlantic City.

Cited for honorable mention was A. H. Bobeck, Bell Telephone Laboratories, Murray Hill, N.J. Bobeck spoke on "A new Approach to Memory and Logic—Cylindrical Domain Devices."

According to Dr. Grabbe of TRW Systems, Los Angeles, the '69 FJCC is believed to be the first major conference to video tape all speakers for use in judging of a Best Presentation Award. Assistance to speakers was provided through preconference presentation seminars organized by the program committee.

PROFESSIONALISM IN COMPUTER FIELD EVALUATED—Present and projected needs for professional competence and ethical behavior in the computer field were analyzed in a recent meeting of a special, high-level interdisciplinary study group. Under the chairmanship of Willard Wirtz, former Secretary of the Department of Labor, the group devoted the major portion of its study to ethical conduct, job requirements in the information processing field, measurement of individual proficiency, accreditation procedures for vocational institutions, statistical research covering employment, and the needs for information programs directed to the general public.

According to Dr. Richard I. Tanaka, president of The American Federation of Information Processing Societies, "The meeting marks a major step in an ongoing study by AFIPS of the overall needs for professionalism in the computer field. Conclusions and recommendations are currently being formulated based on the various viewpoints expressed during this working session. AFIPS plans to publish a comprehensive summary of the meeting by late spring or early summer of this year."

Considerable attention was given to the types of persons working with computing systems, as well as to the particular needs and activities of such organizations as software firms, service organizations, and educational institutions.

Discussions covered sensitive systems having direct impact on the public, including such areas of public safety as air traffic control; various billing systems; dossier-type systems, such as credit bureau files; commercial time sharing systems; and systems storing data of critical value.

Two sound reasons for buying our keyboard.

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First, the keyboard. It's all solid state. The world's first use of an integrated circuit as a keyboard switching element.

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INDUSTRY NEWS

DR. BRICK RECEIVES IEEE APPOINTMENT—Dr. Donald B. Brick has been appointed Systems Science and Cybernetics chairman for 1970 by the IEEE.

Dr. Brick is president and technical director of Infoton, Inc., of Burlington, Mass.

He is a senior member of the IEEE, a member of Sigma Xi, the Harvard Society of Engineers and Scientists, the American Physical Society, the New York Academy of Science, the American Society for the Advancement of Science, the Society for General Systems Research and the Association for Computing Machinery.

Dr. Brick has performed research and directed projects in information processing and theory, bionics, electronic warfare, automatic recognition and perception theory, communications, anti-submarine warfare statistical decision theory, radar systems and control theory.

COMPUTER GRAPHICS CONFERENCE TO BE HELD IN GREAT BRITAIN—One of the most spectacular arrays of experts in the computer field ever gathered to speak at a single symposium has been lined up by Brunel University for its CG. 70 Computer Graphics event to take place April 14-16 on the university campus at Uxbridge, Middlesex, England.

The conference will comprise a major exhibition and a symposium, which has been organized into 20 sessions, four running parallel at any one time, so that delegates can choose the most relevant for their field of interest. In the event of any two clashing, however, delegates may attend video-recorded repeats to be shown mid-day and evening.

Of the 100 speakers, approximately 50 are from the U.S., 35 from UK and others are from USSR, Canada, Australia, France and Hungary.

Papers will include "Fundamental Problems Facing Growth of Man-Computer Graphics," "Supporting Multiple Interactive Graphic Consoles in a Productive Environment," and "Computer Graphics—Lessons From the '60s."

In addition to those on technique, there are sessions on specialist applications such as in the design of electrical circuits, the design and construction of civil engineering projects, architecture, hospital administration and text processing for printing. A complete session is being devoted to management information systems.

The largest exhibition of its kind will be run in conjunction with the technical sessions. A block of eight lecture theatres is being used for manufacturers' lecture-demonstrations and three special-purpose hemispherical domes are being erected on the University campus to house the main body of the exhibition. The equipment on show will range from data transmission equipment to full-scale working interactive computer graphics systems. It is expected that several companies will be showing equipment for the first time.

MAJOR PRICE REDUCTION ANNOUNCED ON LSI MEMORIES—Intel Corp., of Mountain View, Calif., has announced price reductions of from 38 to 73% on LSI memories employing MOS and bipolar technologies. According to Robert Noyce, president, the reductions stem from production yields far higher than those typical of the industry.

The reductions now apply to two fully-decoded random-access memories: Model 1101, a 256-bit silicon gate MOS memory with 1-μs maximum access, and Model 3101, a 64-bit Schottky-process bipolar memory with 60-ns maximum access.

In quantities of less than 10, the 1101 sold for $150, the 3101 for $99.50—they are both now available at $40; in quantities of from 10 to 24, the 1101 was $110, the 3101 $74—they also now sell for $40; from 25-99, the 1101 was $80, the 3101 $53—they are now available at $32.50; 100-249, the 1101 was $65, the 3101 $43—the price is now $26.50; quantities of from 250 to 999 are $26.50, and from 1,000 to 2,000 are $23.50 each.

Since the high yields are due to successful application of the silicon gate for MOS devices and the Schottky process for bipolars, lower prices may be anticipated for all the company's circuits employing these techniques.

SPEECH LEVEL STUDIES AIDED BY COMPUTER—To assist in their studies of speech level measurements, scientists and engineers at Bell Telephone Laboratories, Holmdel, N.J., are using a small computer instead of a more conventional meter. In studies of the "equivalent peak level" (epl), a measurement that was pioneered by Bell, the small computer, a Digital Equipment Corp. (Maynard, Mass.) PDP-8/L is used to record and display the actual epl measurements. Unlike previous measures of speech level, the epl is an objective measurement rather than a measurement calling for judgment by a human observer; this can permit new relationships to be derived in speech level studies.

Although a specialized meter could have been constructed to make these measurements, because of the unique nature of what was to be measured, the cost of producing such a meter would have been between $8,000 and $9,000. Unlike a meter, the small computer proved its value by being "modified" to take different measurements by altering its programming instructions. The alteration was performed in only a few hours. To achieve this with a meter would have entailed a redesign of the meter itself and its rebuilding.

AMPEX DELIVERS PLANAR STACKS TO DEC—Ampex Corp., of Redwood City, Calif., has begun delivery of radically simplified core memory stacks under a $500,000 contract from Digital Equipment Corp., Maynard, Mass.

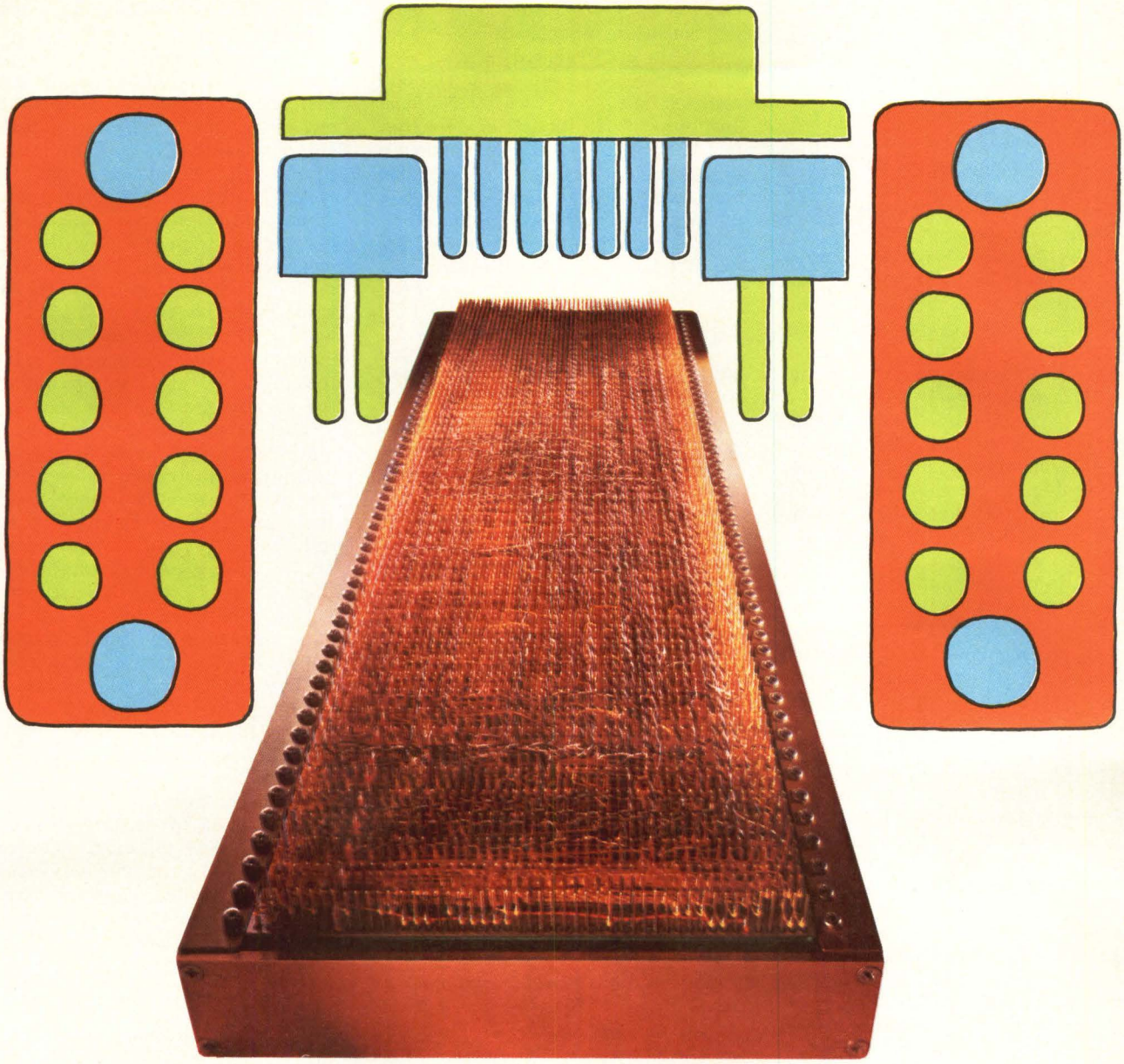
Eugene E. Prince, Ampex vice president-general manager, computer products division, says the Ampex planar pluggable stacks, designed to DEC specifications, will be incorporated in the core memories of various DEC computer product lines.

The stacks use a design that eliminates all cabling, connectors, stack hardware and hundreds of operations previously necessary in producing and using core stacks.

SOFTWARE PROGRAM DEVELOPED FOR TESTING—A program to assist IBM 360/DOS users in preparing test data and performing file processing activities has been announced by Raytheon Service Co., of Burlington, Mass.

Called FORMAT 70, the program requires a minimum computer configuration of 32,768 bytes of memory, a disc drive, and a card reader. It is designed specifically as a "LOAD AND GO" utility program.

Developed basically for testing applications, FORMAT 70 is also suitable for selected phases of production because of its quick reaction time. The program is parameter driven and flexible, resulting in the reduction of test data preparation and generation time.



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And this fact proves the point: Of the various types of wire terminating connectors, only the HW Series by Winchester Electronics, positioned in AccurFrame, consistently meets the contact true position tolerances required by automatic wire terminating machines.

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CIRCLE 17 ON INQUIRY CARD

INDUSTRY NEWS

COMPUTER SYSTEM INSTRUCTED BY SIMPLE ENGLISH SENTENCES–A complete computer data acquisition system, COMPAS, that uses a programming system named COIL, enabling engineers to instruct the computer in simple English, has been designed specifically for real-time applications where at the same instant that signals and events are being measured information is being processed. In many cases, this information is then instantaneously used for control. Non-programmers–engineers, laboratory technicians, and supervisory personnel–use simple declarative sentences to communicate directly with the system which can include a broad range of analog and digital peripheral products.

The system, demonstrated by Systems Engineering Laboratories, Inc., of Fort Lauderdale, Fla., monitors and sequences many test stands simultaneously, solving the user's measurement and control problems to assure meeting exacting quality standards. Besides improving the consistency of the tests over manual methods, the standard computer system also speeds statistical information to management. Rejection causes and trends can be automatically plotted so corrections can be made early in the manufacturing process.

COIL enables simple sentences to be the means of communication between the operator and the computer system. Once the operator is familiar with the language, he can use a form of shorthand that consists of the first two letters of each command. Both the simple declarative sentences and the shorthand version sharply reduce programming costs and can be intermixed.

MINICOMPUTER IS HEART OF BIOMEDICAL DATA SYSTEM – A biomedical data system organized around a Lockheed Electronics MAC 16 computer was introduced at the recent Conference on Electronics in Medicine in San Francisco. Designed for ease of use and adaptive modularity, the SP5000 system will support a wide variety of data collection and processing functions. It is also used as a portable analog signal processor in clinical and research environments.

The system is particularly well suited for real-time patient surveillance or controlled experimental projects requiring on-line data processing and fast response. Data reduction and analysis can be performed, often making the use of a large-scale computer unnecessary. Developed by Civil Systems, Inc., of Anaheim, Calif., through research under contract by National Institutes of Health (HEW), the system has ability to accept simultaneous analog signals at combined effective conversion rates of from 50 to over 400 kHz. Results can be displayed on a CRT, recorded on magnetic or paper tape, or output to a printer.

FAIRCHILD BECOMES A MAJOR SUPPLIER OF 7400 TTL SERIES–Fairchild Semiconductor, of Mountain View, Calif., has entered the market as a major supplier of 7400 series integrated circuits.

For its first penetration into this general-purpose TTL market, the company is offering 24 ceramic dual-in-line products, which include the entire 7400 family of digital gates and flip-flops, at prices as low as 77 and 85¢ in quantities of 100.

The company is geared for a production rate of two million circuits per month, and distributors already have large inventories of the devices.

In function and pin configuration, the circuits are exactly equivalent to the originals and can be plugged into existing sockets without system or interchangeability problems. Identical electrically to the originals and having the same parameter distributions, the devices operate in the 0 to 74°C temperature range.

This second source series consists of 17 gates, 6 flip-flops, and a BCD-to-decimal decoder/driver. Included in the series are the quad 2-input AND gate and the triple 3-input AND gate, which are the only AND gates offered at regular speeds by a major 7400 supplier.

The circuits will be followed by a succession of MSI elements, at least two every month.

COMPUTER MAINTENANCE COMPANY ESTABLISHED – Comma Corp., New York City, the first nationwide, independent computer maintenance company, has just been established by three former IBM field engineering executives.

The firm is headed by Richard K. Puder, chairman of the board and chief executive officer; George O. Harmon, president and chief operating officer; and Arthur H. Eickhoff, executive vice president.

The company, with corporate headquarters at 1250 Broadway, is establishing service locations in all major cities across the country.

Puder estimates the maintenance market at $100 million annually for the growing number of computers owned by users or leasing companies. He expects this market to increase substantially during the next few years. According to Puder, the reconfiguration market–modifying an existing system to meet the needs of the new user–will reach $60 million annually by the end of 1971. He forecasts that the current $2.5 billion worth of computer equipment now owned by leasing companies will be reconfigurated at least 1.5 times on the average between now and 1975.

The company offers the computer industry the first major, independent, nationwide alternative to the manufacturer's own maintenance service. It is available to those who own, rather than rent, their systems. One of the most important advantages is that Comma Corp., whose only business will be to render the full range of maintenance services to computer users, will dedicate itself to excellence in performance and tailer its services to the customer's requirements. The service for mixed computer systems (computer systems composed of units from more than one manufacturer) will also be offered.

In addition to performing maintenance services, Comma will offer maintenance consulting services designed to assure computer users a continuing, high-level performance from their equipment.

XDS REDUCES PRICES OF SYSTEM INTERFACE UNITS–Price reductions averaging 20 percent have been announced by Xerox Data Systems in El Segundo, Calif., for its family of system interface units (SIUs).

SIUs are standard XDS-designed electronic subassemblies used to connect XDS computers with such analog and digital input and output devices as transducers, converters, multiplexes, recorders, etc. The devices permit XDS computers to be adapted to virtually any task and eliminate requirements for costly custom-designed interfacing instrumentation.

Over 25 subassemblies comprise the family of SIUs. They provide for the computer's interconnection with A/D and D/A converters, analog multiplexers, direct-to-memory data channels, frequency-dependent controllers and other devices that permit the computer to communicate efficiently with data generating and reporting sources.

EVEN SQUINTING WON'T HELP.

No use, fellas. You need a microscope to see the world's most densely packed LSI circuit.

That's what Electronic Arrays has done this time.

4692 transistors (4096 bits of memory) on a single 88 x 94 mil chip.

Since that kind of density is not available elsewhere, may we take this hallowed moment to proudly proclaim our EA 3300 (a 512 word, 8 bit/word ROM) the champion of the LSI world.

We didn't, however, design the EA 3300 this way just to show off.

EA 3300 has the most functional complexity of any product available today in a 24 pin package.

That reduces cost.

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Our entire line of Registers, ROM's, Read/Write RAM's and Logic circuits is made in *production quantities* with the same close-tolerance MOS technology as the EA 3300.

And all products are available *immediately* from 24 distributors nationwide, and 6 international distributors.

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Proven MOS products delivered in volume.

Forms for your specialized bit patterns are available from any of our representative offices or directly from the factory. The EA 3307, which is an EA 3300 already programmed to be an EBCDIC to ASCII and ASCII to EBCDIC code converter, is available from distributor and factory stock. Features include two output inhibit controls that give 1024 4/bit words; nine input addresses; all decoding on the chip; power requirements less than 100 milliwatts; synchronous 2-phase clock, 24 pin hermetic dual-in-line package.

CIRCLE 18 ON INQUIRY CARD

INDUSTRY NEWS

IEEE HONORS—The Institute of Electrical and Electronics Engineers has named three persons prominent in the computer technology field to receive awards.

Dr. William L. Rubin, director of research for the Sperry Gyroscope Division of Sperry Rand Corporation, was named an IEEE Fellow for his contributions to the performance of radar systems by signal-processing techniques.

Dr. Rubin joined Sperry in 1957 as a research engineer and was assigned to the Advanced Studies Department. He was promoted to research section head in 1960, senior research section head in 1963, research department head in 1964, and in 1967 was named assistant chief engineer for research. He was appointed director of research in 1968. In this capacity he is responsible for research in radar, ASW/sonar, inertial, digital and information systems.

A 1948 graduate of Columbia University with a B.S. in electrical engineering, Dr. Rubin did his graduate work at the Polytechnic Institute of Brooklyn. He received his M.S. in 1953 and his Ph.D. in 1960, both in electrical engineering. He is in the honor societies of Eta Kappa Nu and Sigma Xi.

Dr. Rubin holds three patents in the field of radar signal processing, and in 1963 received the IEEE M. Barry Carlton Award for the best technical paper published in the IEEE Transactions on military electronics. He is a member of the IEEE and American Association for the Advancement of Science.

E. Gary Clark, vice president of Burroughs Corp., has been named an IEEE Fellow for contributions in the fields of television receiver design, computer circuits, and advances in electronic data processing. Mr. Clark is vice president and group executive of Burroughs Defense, Space and Special Systems Group operations, headquartered in Paoli, Pa. The Group conducts research and manufacturing programs on a wide range of custom-designed computer systems, air traffic control equipment, and special-purpose electronic devices at nine facilities in the U.S.

Mr. Clark joined Burroughs in 1955 as a development engineer. He served in several managerial positions before being appointed manager of the company's research division in 1960.

When Burroughs Defense, Space and Special Systems Group was organized in 1963, Mr. Clark was named vice president in charge of the group's marketing activities. In 1967, he was named manager of planning for large computer systems, on the corporate management staff, where he served until appointed vice president and group executive in June of 1968.

Mr. Clark holds 15 patents in the areas of solid-state computer technology and television receiver design. He has served on several Joint Computer Conference committees and is a member of a number of professional societies including the Association for Computing Machinery, the Institute of Radio Engineers and the Research Society of America. He is also a member of the Professional Group on Electronic Computers.

Dr. Dennis Gabor, Professor Emeritus, Department of Electrical Engineering in the Imperial College of the University of London, London, England, was awarded the IEEE Medal of Honor for his discovery and verification of the principles of holography. Dr. Gabor, who is known throughout the world for his achievement provided the mathematical basis for the beginning of holography twenty years ago with his discovery of how to reconstruct objects from their light wave interference patterns. The interference principle was used by Dr. Gabor to construct the first hologram in 1948.

Dr. Gabor, as a consultant to CBS Laboratories in Stamford, Conn., is a member of the scientific team which developed Electronic Video Recording. He is the recipient of several scientific honors including the distinguished Rumford Medal awarded by Britain's Royal Society, 1968 Michelson Medal for scientific achievement from the Franklin Institute, and the International Christopher Columbus Prize for communication theory.

He is a Fellow of the Royal Society, which was founded in 1660 and is Britain's oldest scientific institution. He also is a Fellow of the Institute of Physics, a Fellow of the Institution of Electrical Engineers (IEE), and an honorary member of the Hungarian Academy of Science.

SIGNETICS MEMORY SYSTEMS ESTABLISHED—The formation of a Corning-Signetics subsidiary devoted to the manufacture of memory systems has been announced by James F. Riley, Signetics president.

Orville Baker and David Allison will be principal officers of the corporation—Signetics Memory Systems, Inc., in Sunnyvale, Calif. In addition to his new role, Baker will remain as a vice president and director of Signetics Corp. Allison, formerly vice president of Signetics, will devote full time to his new responsibilities.

Riley emphasizes that the new corporation will benefit greatly from an interchange of ideas and talent with Signetics in much the same manner that Signetics Corp. has benefited from such an exchange with Corning Glass Works, its parent company.

CALL FOR PAPERS—The Fourth Conference on Applications of Simulation will be held December 9-11, 1970 at the Waldorf-Astoria in New York. Only papers concerned with *discrete* simulation (using languages such as GPSS and SIMSCRIPT, but not limited to them) will be considered. Areas of interest include: statistical considerations, recent language developments, corporate and financial models, transportation and distribution models, computer system models and languages for modeling computer systems, manufacturing and aerospace applications, social system models, gaming, job shop scheduling, urban system applications, and simulations of large-scale systems. Only papers which have not been presented or published previously should be submitted. Complete papers will be published in the Conference Proceedings.

Those planning to present a paper should submit three copies of a 50-100 word abstract, together with a working title, no later than March 31. Five draft copies of the paper, including illustrations to be used in the presentation, must be submitted by July 6. Final manuscripts for publication in the Conference Proceedings must be available by September 30. Authors will receive detailed instructions on the format to be observed in preparing the paper and in typing the final copy. Papers will be judged on the basis of relevance to the Conference, excellence of technical presentation, and soundness of simulation methodology. Authors will be notified of acceptance of their submitted papers by August 7. At the Conference, authors will be asked to summarize their papers.

All material relating to the technical program should be forwarded to Michel Araten, program committee chairman, Celanese Chemical Co., 245 Park Ave., New York, N. Y. 10017.

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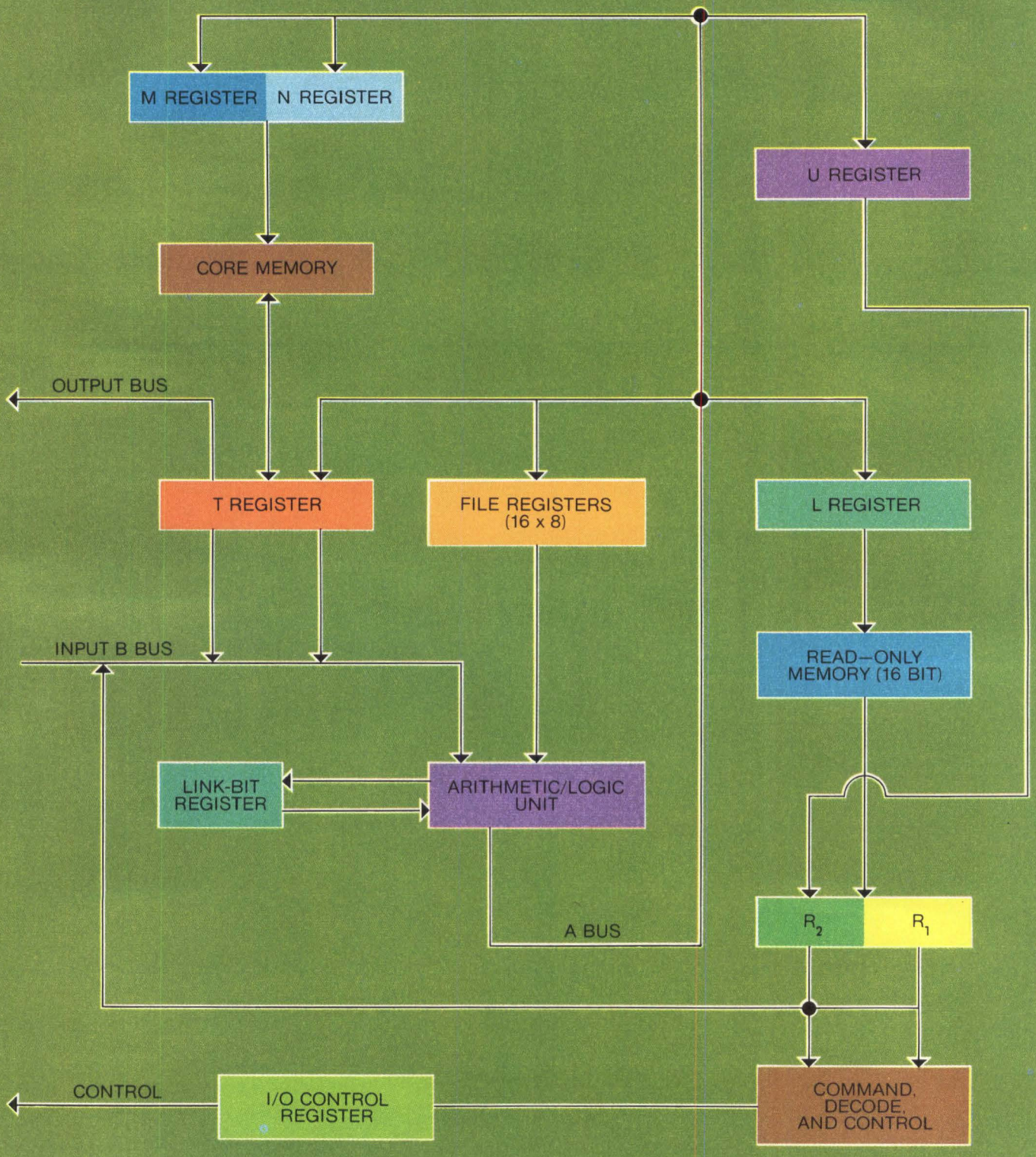
what would it look like?

Like this.



THE CIP/2000 FROM CINCINNATI

A new, low cost, microprogrammable digital computer
for dedicated and general purpose applications.

Now what will it do?

The CIP/2000 operates fastest and most efficiently when specifically produced for a dedicated application. By exploiting its micro-programming capability, you can integrate it into any of your systems for control and/or data processing.

Use it to acquire data, to concentrate and/or perform computations on the data, to monitor operations and processes, to perform continuous automatic testing, to control automated production lines, for in-house time-sharing systems, for medical monitoring, or for laboratory data acquisition and experimentation control. In short, the CIP/2000 offers a low-cost, ultra-reliable method to apply computer techniques where the high costs of larger computers made such use prohibitive in the past.

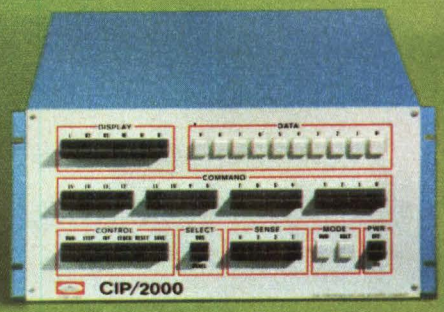
For less than $3,100 you get a computer with 15 general-purpose, 8-bit file registers; 7 dedicated working registers; microprogram control; 16 powerful microinstructions, including logical arithmetic, control and literal data. Its speed is outstanding, with 1.1 microsec memory cycle time and 220 nanosec micro-instruction execution time. The unit has read-only memory space up to 1,024 instructions.

Many optional features and arrangements are available, including a variety of I/O devices, core memory up to 32K, Direct Memory Access, as well as assembler and simulation software.

One application is our model CIP/2100, in which the microprogram converts the basic system into a software-programmable, general-purpose computer. Support software is available for both units, as well as strong program in training, maintenance, and field service.

The Cincinnati Milling Machine Co. has been actively engaged in the electronics field for over 15 years, manufacturing dependable control systems for real-time hostile environments. CINCINNATI controls operate sophisticated machines producing critical components for aircraft and space vehicles. The production of the new CIP/2000 computer is a natural outgrowth of this activity.

For full specifications for both the CIP/2000 and CIP/2100 computers, contact The Cincinnati Milling Machine Co., Dept. R-11, Lebanon, Ohio 45036, phone (513) 494-5444.



The CIP/2000

CINCINNATI

The Cincinnati Milling Machine Co.

CIRCLE 19 ON INQUIRY CARD

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First, you get a 16-bit parallel word computer with a repertoire of 72 hardware instructions. A basic 4K memory. A programmed data channel, handling up to 255 devices. And MAC's four priority interrupts in hardware—with automatic store/restore.

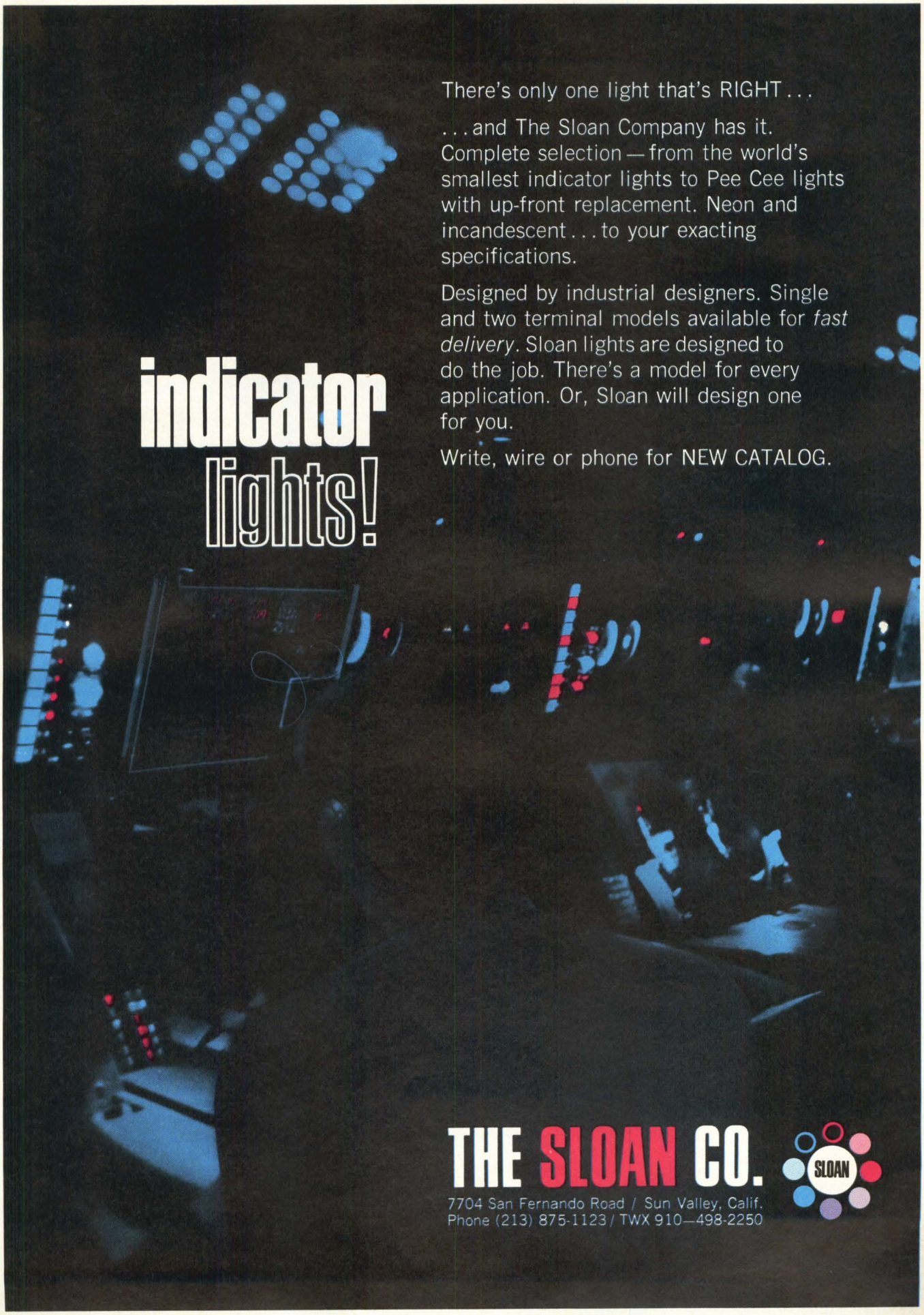
Another big MAC feature is its raft of options. Like up to 64 interrupt levels. Memory expansion to 64K. Multiply/divide hardware. Memory parity. Power fail and restart. Remote control panel. Automatic bootstrap loader. Multiplexed or direct memory access data channels. Plus a complete array of peripheral equipment.

So get the features you need and still save money with MAC. Buy one now and we'll give you an option on the other 1½.

Write to MAC, Lockheed Electronics Company, Data Products Division, 6201 East Randolph Street, Los Angeles, California 90022.

LOCKHEED ELECTRONICS
A Division of Lockheed Aircraft Corporation

CIRCLE 20 ON INQUIRY CARD



CIRCLE 21 ON INQUIRY CARD

DEVELOPMENTS

Foam Reduces Printer's Noise Level Drastically

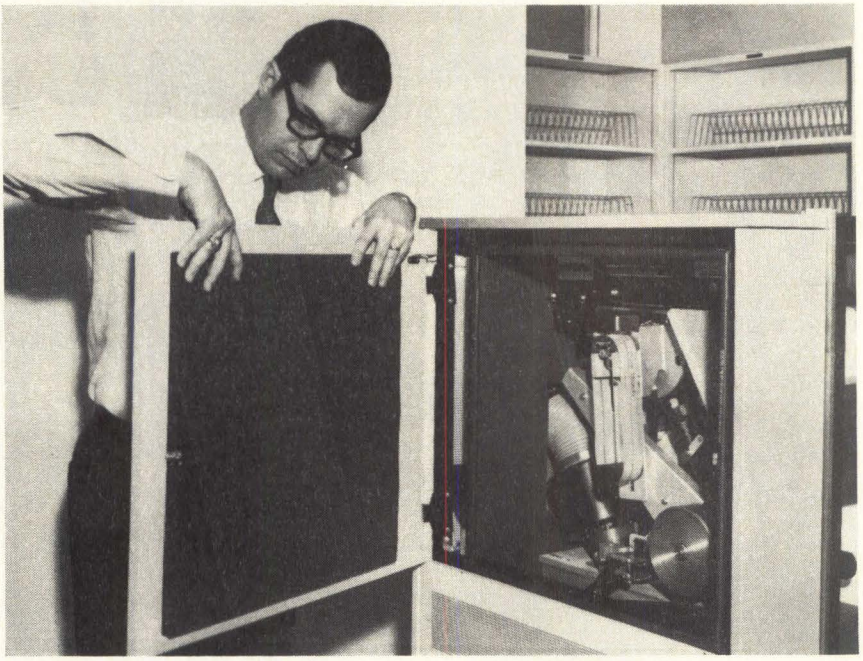
Engineers at RCA Computer Systems Division have lowered the speech interference level from 80 to 55 db in the company's latest model high-speed printers with the help of a sound insulator made of a special compressed polyurethane foam.

The insulator consists of "open-pore," or fully reticulated compressed foam which lines the interior metal surfaces of the printer. Inside the printer is the major source of noise: a battery of 132 or more rapid-firing hammers that print out up to 1250 lines per minute on paper that moves through the same enclosure.

The compressed foam—called SCOTTFELT—is being used exclusively by RCA on its new Models 70/243-30 and 70/242-30 printers. Developed by the Foam Division of Scott Paper Co., Chester, Pa., the foam is made by applying heat and pressure to a block of the material until it is squeezed to the desired thickness. The compression radically changes the structure of the foam and makes it an excellent sound-absorbing material. It has also been used as a noise reducer in stationary and aircraft gas turbine power plants, in tractor engine compartments, anechoic chambers, and numerous other sound attenuating applications.

In the RCA printer application, the SCOTTFELT is compressed to one-third of its original thickness of three inches, then cut into the desired shapes, and fastened by an adhesive to the interior metal surfaces of the printers.

To achieve the quietest printer possible, RCA engineers first built a masonite enclosure around the printer mechanism and took readings with a noise and vibration analyzer with the printer operating at its maximum rate or "worst case" condition. Then the enclosure was insulated with various types of sound-absorbing materials, and comparative readings taken. Fiberglass, closed-cell foam, and several other materials were tested before RCA engineers selected SCOTTFELT as the most effective and practical sound-absorbing medium.



Rear-door view of RCA printer shows one-inch-thick SCOTTFELT on inside of door panel and on interior surfaces, where it forms a barrier to escape of noise from inside printer mechanism. The compressed polyurethane foam material, developed by the Foam Division of Scott Paper Co., is also used on air intake and exhaust sections of the printer to help achieve a 25-decibel reduction in the speech interference level

The one-inch thick foam is used in three principal areas of the printer. All internal surfaces of the sound box are covered with the material, which deadens the noise of the printer hammers. It is also used to line a sound baffle installed at the point where cooling air enters the printer.

The sound pressure level lp in decibels, corresponding to a sound pressure p, is defined by $lp = 20 \log \frac{p}{po}$ db. The "po" is a reference pressure usually taken as .002 microbars which is equal to one dyne per sq. cm.

Recording Paper is Heat-Sensitive

Computer Graphics System Corp., of Sun Valley, Calif., has announced the development of a heat-sensitive recording paper. According to company president Dr. John Gelb, the paper is coated with a proprietary compound which is normally a neutral white in color. A servo-controlled contactless heat pen traces a high-contrast black line on the paper. No post-exposure development is necessary, and no laser system is involved.

The technique is claimed to have several advantages over present high-speed recording techniques. Unlike ink systems, the line trace has uniform width without blots or interruptions. Initial applications are anticipated primarily in strip chart recorders and graphic plotting machines. Production quantities will be available in the near future.

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DRUM AND DISK MEMORIES – CONTROLLERS

CIRCLE 22 ON INQUIRY CARD

DEVELOPMENTS

Spacerays Marries Lasers to Computers

Spacerays, Inc., Burlington, Mass., a manufacturer of industrial laser equipment, announces completion of the first computer-controlled industrial laser system. The unit was developed under a leasing contract for the production adjustment of thick film resistors. The Model YT60c, a computer-controlled YAG laser resistor trimmer system, can trim integrated circuit resistor components to less than 1% tolerance in approximately one second.

This most unique system is able to make a complete parameter analysis of the circuit element to be adjusted simultaneously with the trimming process. Through the computer's ability to associate the amount of out-of-tolerance to the circuit element's configuration, the adjustment or trimming of the element can be made to a degree of accuracy never before attainable. This configuration analysis was developed by Spacerays to adapt the system to the rigid trimming specification required by the military. To accomplish the precision toleranicing and maintain the maximum cross-sectional area of the remaining resistor portion, the system includes an L-shaped trimming cut. The reduction of the cross section of each resistor is determined and controlled by the computer for each individual resistor. For precision tolerances the unit features a single-shot shutdown capability. The YT60c is the only unit available with these features.

The system has a fully automated XY numerically-controlled component positioning table. The positioning equipment locates a complete tray of small ceramic substrates under the beam automatically. Each substrate may contain many resistor elements on it, and each element may be adjusted to a different value. With the computer, a relatively unskilled operator can feed information into memory banks through the system's teletypewriter such that all variety of trimming requirements can be made by the equipment without further operative adjustments.

The YT60c also has the ability to "actively" trim circuits, which means adjusting a resistor element of a circuit while the circuit is functioning and controlling the laser trimming process through a functional measurement of voltage, frequency, comparison voltages, etc. Any measurement in which the readout can be made digitally for the computer is suited to the unit.

NASA Develops Device to Operate at Wide Temperature Range

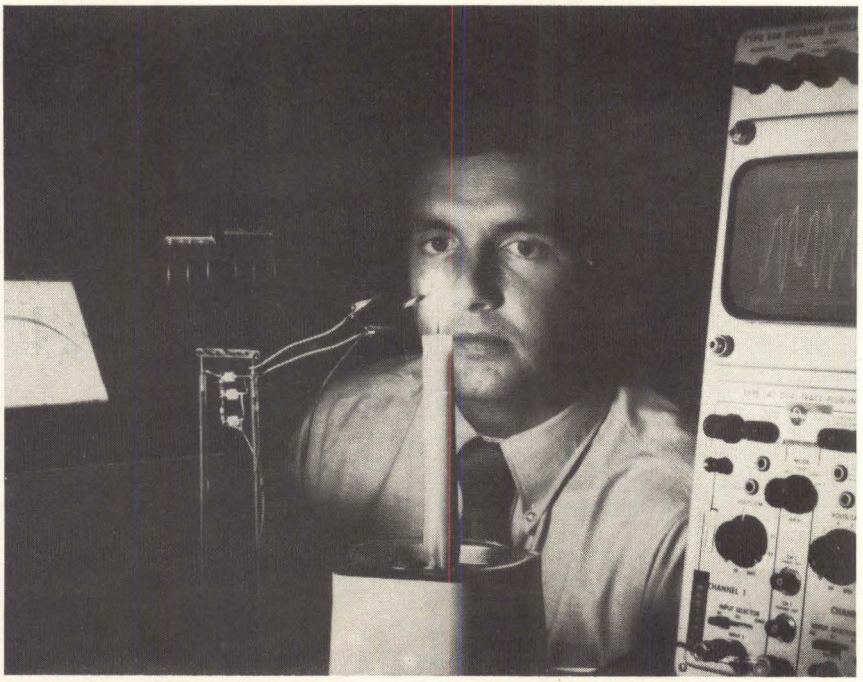
NASA's Electronics Research Center in Cambridge, Mass. has developed an electronic device that can operate in both the extremes of heat and cold in deep outer space.

The device is a diode composed of silicon carbide, a material long known to scientists for its ability to withstand high temperatures. In laboratory tests, the diode has survived and functioned over a temperature range of 1,600°F—from 1,300° above to 300° below zero. The device would be operable, for example, at the surface temperature of Venus, about 800°.

The diode is believed to be the first of its kind to withstand extremely high temperatures while performing effectively at the same time as a detector at frequencies of up to 10 billion cycles per second.

Developed by Richard Farrell in the ERC's Device Research Branch, the diode serves as a detector of high-frequency radiation. In the presence of a signal the device will allow current to flow in one direction only and thereby extract the information content of the signal.

Its temperature tolerance not only increases its efficiency in space but makes it potentially valuable in a number of applications. Its effectiveness at extremes of temperature promises higher reliability than that of similar devices designed only for earth temperatures.



High-frequency radiation detection diode operates at extreme temperatures

MODEM 2200/24

1200 bps
2400 bps

MODEM 3300/36

3600 bps

MODEM 4433/20H

2000 bps

MODEM 4400/48

4800 bps

MODEM 4433/20L

2000 bps

MODEM 5500/96

9600 bps

MODEM 4400/24PB

2400 bps

MODEM 1100

4800 bps to
1,000,000 bps

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CIRCLE 23 ON INQUIRY CARD

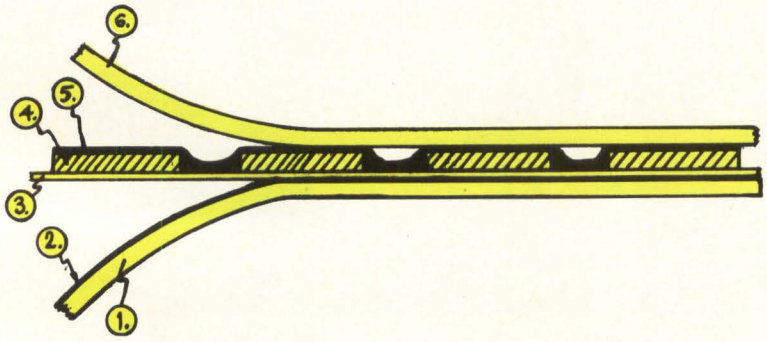
DEVELOPMENTS

IDS Deposits Thick-Film Circuits with Thin-Film Precision

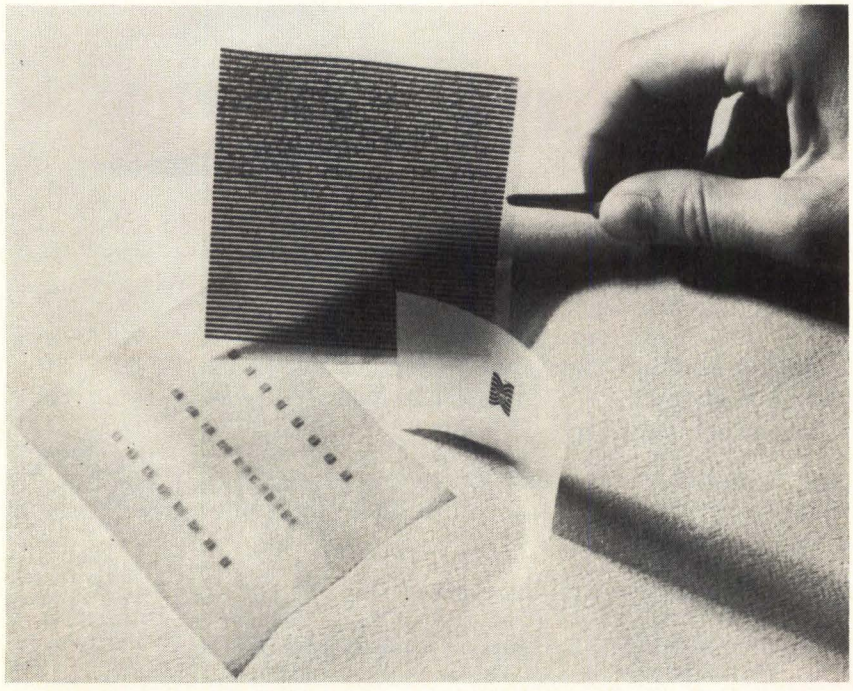
A tape decal system, known as TDS, has been developed by Vitta Corp., Wilton, Conn., which deposits thick-film circuits and patterns on a variety of substrate shapes. A wide range of conductive, resistor and insulator compositions can be deposited on ceramics, metals or plastics.

After application of the tape decals, burn-off of the organic materials and sintering of the circuit layer are performed simultaneously. In addition to coating patterns on flat surfaces, the system permits the coating of recessed areas, around corners and irregular shapes with precision tolerances to 3-mil lines and 3-mil spacings.

TDS is adaptable to both prototype and production applications where precision and quality of circuit patterns are required.



Cutaway view of the tape decal system



A wide variety of patterns may be produced with the TDS, including a strip pattern composed of a ferrite material for a computer memory stack

High-Performance Insulation Combines Ruggedness with Easy Fabrication

A developmental resin, "Tefzel" ETFE fluoropolymer, is being manufactured by the Du Pont Co.'s Plastics Department, in Parkersburg, W. Va., to meet the need for a high-performance wire and cable insulation with mechanical ruggedness plus the electrical, chemical, and thermal properties characteristic of fluorocarbons.

"Tefzel" is a copolymer of ethylene and tetrafluoroethylene (TFE). By weight, the resin is more than three-fourths TFE, making it a close analog of "Teflon" fluorocarbon resins. Its balance of properties is particularly suited for wire and cable insulation, heat shrinkable and spaghetti tubing, and electronic components.

This fluoropolymer can be fabricated by melt extrusion and injection molding. In laboratory tests, it has been extruded into long, flaw-free lengths of wire insulation over both tin- and silver-plated conductors.

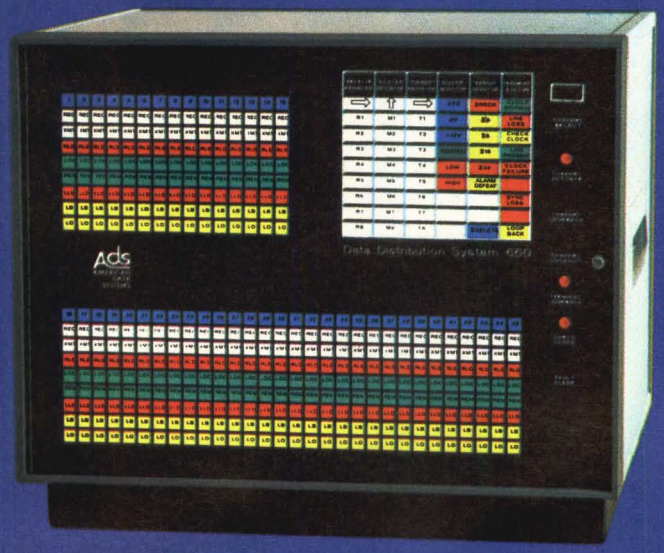
Designed for ruggedness, Tefzel combines cut-through resistance and abrasion resistance with high flex life and impact strength. Its notched Izod impact strength is over 20-foot-pounds-per-inch from room temperature to −54°C. The low-temperature embrittlement is below −100°C.

With a broad operating temperature range—extended-period upper use temperature is 180°C, satisfactory short-term service up to 230°C—Tefzel is rated either "nonflammable" or "self-extinguishing" in various flammability tests. It passes vertical and horizontal tests in insulated wire as a single wire and in bundles. In ASTM D635, it is rated "nonburning."

The resin's electrical characteristics include a dielectric constant of 2.6, which remains constant with frequency and temperature. The dielectric strength is 2,000 volts per mil for 10-mil film. The volume resistivity is greater than 10^{16} ohm-cm, while surface resistivity is greater than 10^{14} ohm per square.

2 new data multiplexers

FOR COMPUTER TIME-SHARE, ETC.*



FULL CONTENTION is the big feature of the compact ADS-630, the new **economical** bit type time-division multiplexer. With it, you can expand your real-time telephone/computer network — pyramid data terminals and utilize **all** low speed computer ports on a first-come/first-served dial-up basis. ADS-630 will increase system efficiency; reduce costs dramatically.

45 CHANNEL CAPACITY is the strong feature of big brother ADS-660. This time-division byte type multiplexer continuously displays—up front in lights—all you want to know about each of the remote terminal lines and the telephone line.

MIX BAUD RATES on either of these new solid state multiplexers. Also add remote terminals without fuss as your system grows. Multi-drop, automatic self analysis, product and data integrity—all part of the new generation of data system modules from American Data Systems. Send for details.

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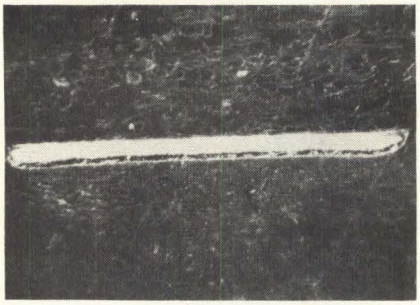
CIRCLE 24 ON INQUIRY CARD

DEVELOPMENTS

Significant Advance Made in PC Board Production

An advanced system for producing printed circuit boards which integrates a newly developed board material and a new additive circuit process, has been announced by The Richardson Co., of Baltimore, Md. "New design concepts in printed circuits with important savings in processing time and materials are possible with the RICO PC+ system," W. B. Basile, president, says.

The process utilizes new laminated paper and glass boards based on the company's RICON resins, which have outstanding dielectric properties. Richardson's thermosetting polybutadiene RICON resin base provides improved electrical, thermal, moisture-resistant and processing properties.

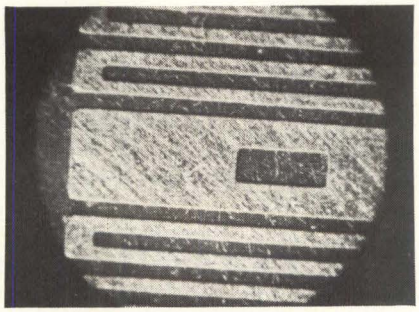


Cross section of a line 1 mil thick and 20 mils wide, illustrating the minimal undercut achieved with RICO PC+

On the conventional printed circuit approximately 90% of the laminated copper foil is etched away and the remaining copper is left as the circuit. The system deposits the copper circuit only on the pattern desired and does not require a copper clad board. Simultaneous plating of the circuit on the board and through holes is a feature of the process.

As a result, the number of steps and time required to produce the circuit are reduced. The amount of copper removed is markedly reduced as is the time required for etching. The life of the etch is extended, which reduces the problem of disposing of spent etching solutions. There are substantial cost savings on board materials, processing steps and etching operations.

Both pilot plant runs and production of prototypes of Bartlett Manufacturing Co., Elk Grove Village, Ill., have been highly successful.



Magnification of the demonstrated circuit mounted on display card. Note the sharpness of lines, which allows thinner lines and closer spacing than current circuitry methods

The RICO PC+ system is expected to be particularly attractive for high reliability applications where low drift, thermal stability, low moisture absorption and low dielectric characteristics are required. Typical uses would include circuits for communications equipment, computers and telemetry. From a design viewpoint, the system has advantages in applying narrower than conventional circuit lines with narrower spacing; thickness can also be controlled, allowing greater flexibility in design, higher circuit densities and possibilities for miniaturization.

Design and Test Automation Service Established

Telpar, Inc., of Dallas, Texas, a new design and test automation service company, has opened offices on the West Coast.

Design of digital two-sided circuit boards begins at Telpar with the client providing logic diagrams and physical characteristics of his board. This information is translated into computer readable form and a program checks the logic for correct transcription. Physical characteristics are graphically displayed for visual comparison to engineering drawings.

The Telpar system can then assign circuits to packages, based on package families and costs provided by the designer, or the client can input this information.

After packaging, the system assigns packages to locations on the board for routing. If the client desires, he may input part or all of the package placement. Once packaging and placement are completed, the system routes the board, making improvement passes for removal of feedthroughs and optimization of wire length. The routing is checked for completion against the client's input data. Any irregularities noted, such as missing lines, are flagged and appropriate data is output for manual completion prior to artwork generation. The original data, plus corrections, are then checked by the system. Artwork tape for mask generation is prepared, along with the appropriate reports to facilitate the generation.

If the client desires, numerical control tapes or the actual artwork itself, can also be generated by the Telpar system. The test design service is also generated from the client's logic diagram. This computer-aided service utilizes fault simulation techniques to select patterns for check-out or functional testing.

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The SSU with its capacity to store operating systems, application programs and compilers will increase your throughput, upgrade your present installation to fourth generation performance, and extend the life of your system.

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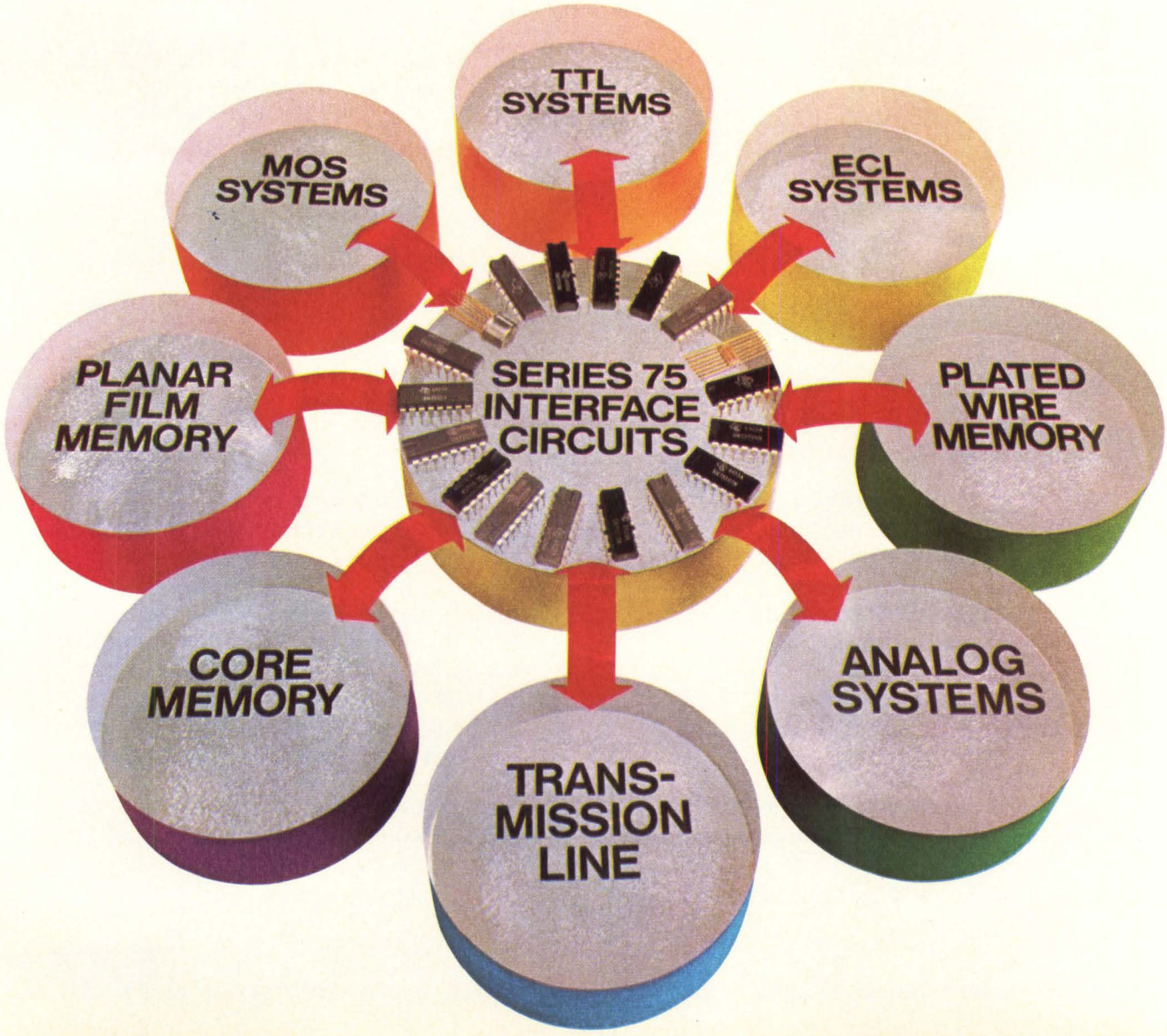
CIRCLE 25 ON INQUIRY CARD

TI's quiet revolution in Linear ICs



Here's your biggest choice for system interface design—10 sense amps, 2 memory drivers, 6 line circuits.

System interface designers have long needed an IC line big enough to work with. TI's quiet revolution in Computer Interface has provided the answer—the biggest family now available. Choose from 18 proven functions—all in stock.

The 10 sense amps (Series 7520N) offer you a selection of three basic circuit designs—three versions of dual preamplifiers driving common—output circuits, or two complete sense amps in a single package. You gain low propagation delay, fast overload recovery, high d-c noise margin, individual channel strobing, TTL compatible outputs—and substantial cost savings.

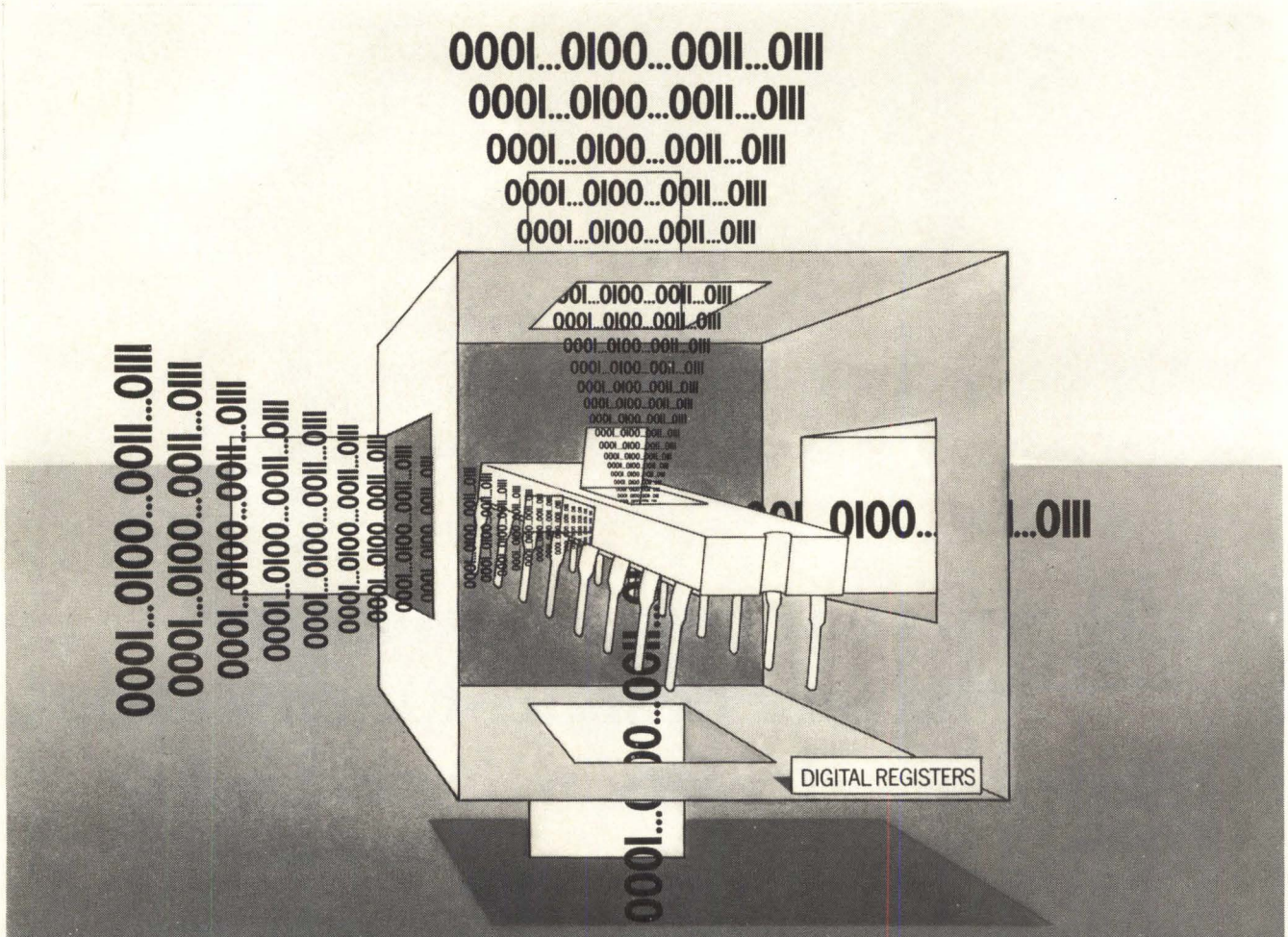
From the group of six drivers and receivers, you can pick dual line receivers which translate transmission line signals to logic signals or perform level shifting operations (SN75107/SN75108). Or receivers which can be applied as differential or single-ended receivers or as comparators (SN75100/SN75120). Or pick dual channel line drivers useful in balanced, unbalanced and party line systems (SN75109/SN75110).

Of the two memory drivers, the SN75303—a 150 mA transistor array—interfaces between bipolar logic levels and magnetic memory systems. The SN75324 replaces traditional discrete high-current transistor-transformer circuits in magnetic memory systems.

If you're ready to whip interface problems the IC way, we'll send you our new brochure on our Computer System Interface Circuits. Circle 288 on the Reader Service Card or write Texas Instruments Incorporated, P.O. Box 5012, M.S. 308, Dallas, Texas 75222. That's where the quiet revolution is going on. Or call your authorized TI Distributor.

TEXAS INSTRUMENTS
INCORPORATED

RCA COS/MOS makes MSI also mean multiple-saving integration

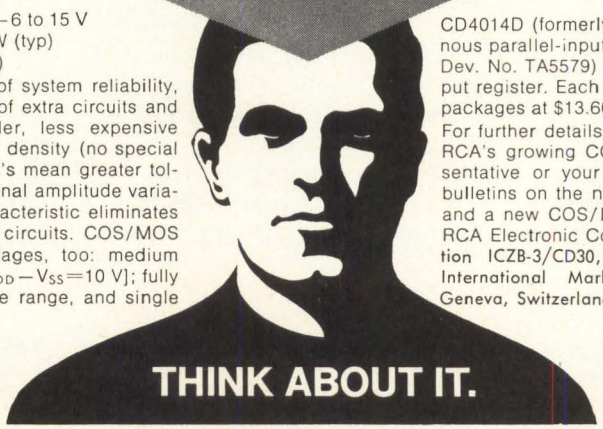


New CD4014D and CD4015D COS/MOS Registers provide cost-saving benefits of MSI

RCA COS/MOS digital IC's provide:

- ☐ Operation from a single power supply—6 to 15 V
- ☐ Low quiescent power dissipation—5 μW (typ)
- ☐ High noise immunity—45% of V_{DD} (typ)

Think of these characteristics in terms of system reliability, minimum package size and elimination of extra circuits and components. Low power means simpler, less expensive power supply circuits; tighter packaging density (no special cooling devices required). COS/MOS IC's mean greater tolerances to power-supply voltage and signal amplitude variations. And the high noise-immunity characteristic eliminates the need for special noise-suppressing circuits. COS/MOS has other logic system design advantages, too: medium speed operation [f_{CL}=2.5 MHz (typ) at $V_{DD}-V_{SS}$=10 V]; fully static operation; full military temperature range, and single phase clocking.



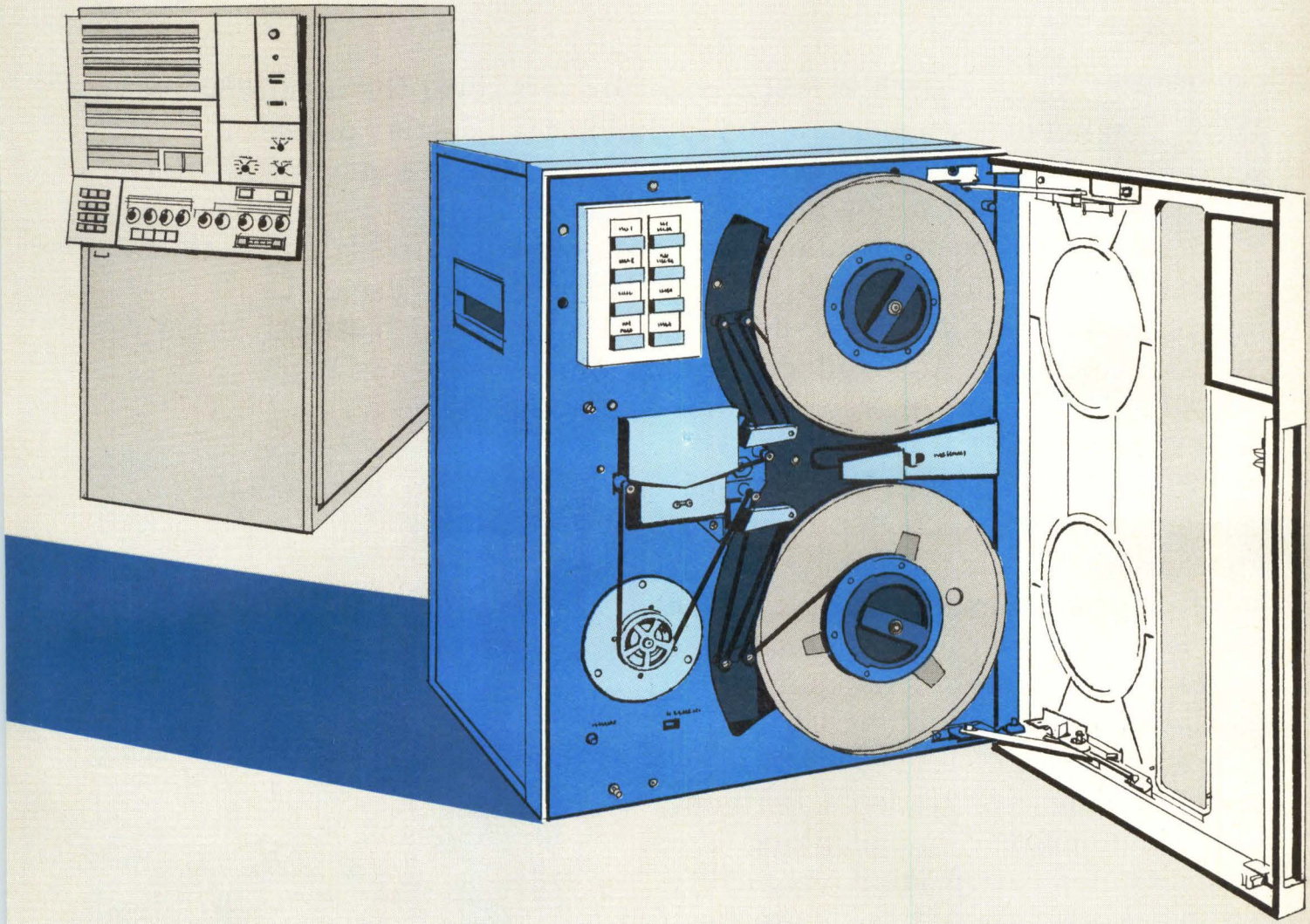
CD4014D (formerly Dev. No. TA5578) is an 8-stage synchronous parallel-input/serial-output register; CD4015D (formerly Dev. No. TA5579) is a dual 4-stage serial-input/parallel-output register. Each device is available in 16-lead DIL ceramic packages at $13.60 (1000 or more units).

For further details on the two new COS/MOS Registers and RCA's growing COS/MOS line, see your local RCA Representative or your RCA Distributor. For the technical data bulletins on the new Registers (File Numbers 415 and 416) and a new COS/MOS Reliability Report (RIC-101), write to RCA Electronic Components, Commercial Engineering, Section ICZB-3/CD30, Harrison, N. J. 07029. In Europe: RCA International Marketing S.A., 2-4 rue de Lièvre, 1227 Geneva, Switzerland.

RCA Integrated Circuits

CIRCLE 26 ON INQUIRY CARD

Computer's little helper.



Ampex TMZ adds a total tape memory to your system for $3500*.

Complete with data electronics and read-after-write capability. It meets 7- and 9-track IBM modes at 24 ips without program restrictions. Adding the 37½ ips option increases data transfer rate at minimal cost. Interfacing is easy. Just plug in. For data density there's 200, 556, and 800 bpi.

Thousands of TMZ's sold are proof of its wide industry acceptance. Here's why:

Time-proven design for longer MTBF.

Modular packaging for more uptime, reduced spares logistics, faster field servicing. And all this in a 19"x 24" package that makes it the biggest little helper you ever had.

For more information, contact: Ampex Corporation. Computer Products Division, 9937 W. Jefferson Blvd., Culver City, California 90230, a leading world source for tape memories, core memories, stacks, arrays and cores. Telephone (213) 836-5000.

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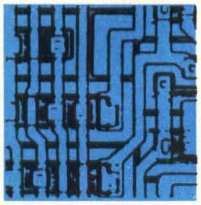
*In quantity order

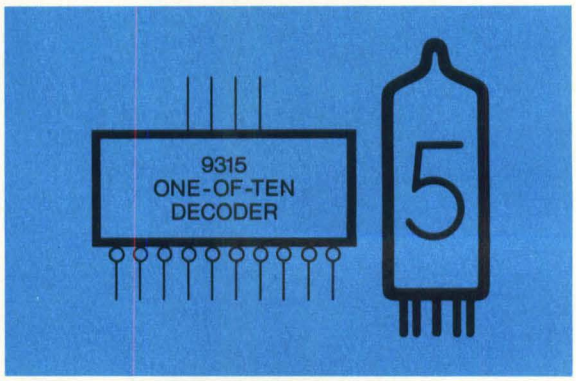
To make Decoders that can drive every major display device,

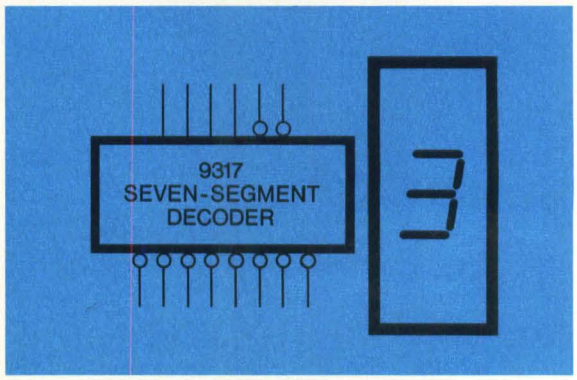


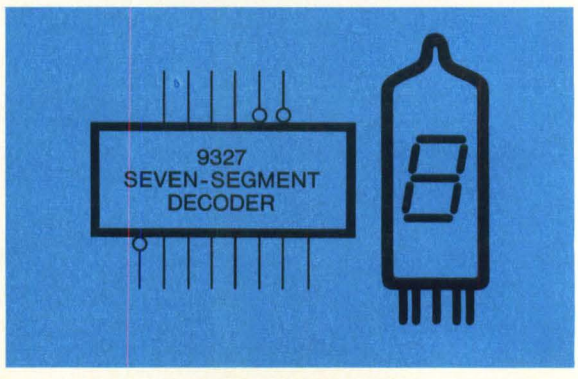
Three Fairchild MSI decoder/drivers cover the requirements of every major military and industrial display device on the market. The 9315. The 9317. And the brand new 9327. Each device has a built-in driver stage—an important feature that means smaller, lower-cost systems with higher reliability.

NIXIE—The 9315 One-of-Ten Decoder/Driver accepts decimal inputs and provides ten mutually exclusive outputs which directly drive NIXIE* tubes. Stable high-voltage output characteristics also make the 9315 ideal for driving relays, lamps and similar devices.

SEVEN-SEGMENT—Fairchild's 9317 and 9327 Seven-Segment Decoder/Drivers convert 4 inputs in 8421 BCD code into appropriate outputs for driving seven-segment numerical displays. The 9317 is designed for use with incandescent lamps, neon, electroluminescent and CRT displays, as well as light emitting diode indicators. The 9327 is used for DIGIVAC S/G** vacuum fluorescent readouts. Both devices feature automatic ripple blanking, lamp intensity modulation, lamp test facility, and blanking output. Outputs are disabled by codes in excess of binary 9. Flags are removed on the 6 and 9, which reduces the number of ambiguous states.







*NIXIE is a registered Trademark of Burroughs Corporation.
**DIGIVAC S/G is a registered Trademark of Wagner Electric Corporation.

To order these Decoder/Drivers, call your Fairchild Distributor or ask for:

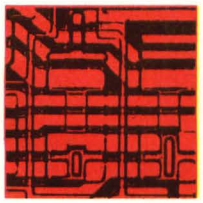
PART NUMBER	PACKAGE	TEMPERATURE RANGE	PRICE (1-24)	(25-99)	(100-999)
U4L931551X	Flat	−55°C to +125°C	$22.00	$17.60	$14.65
U4L931559X	Flat	0°C to + 75°C	11.00	8.80	7.30
U6B931551X	DIP	−55°C to +125°C	20.00	16.00	13.30
U6B931559X	DIP	0°C to + 75°C	10.00	8.00	6.65
U4L9317513	Flat	−55°C to +125°C	28.00	22.40	18.70
U4L9317593	Flat	0°C to + 75°C	14.00	11.20	9.35
U7B9317513	DIP	−55°C to +125°C	25.40	20.30	17.00
U7B9317593	DIP	0°C to + 75°C	12.70	10.15	8.50
U4L9327591	Flat	0°C to + 75°C	13.05	10.50	8.80
U7B9327591	DIP	0°C to + 75°C	11.90	9.55	8.00

you have to get serious about MSI family planning.

We put together a family plan by taking systems apart. All kinds of digital systems. Thousands of them.

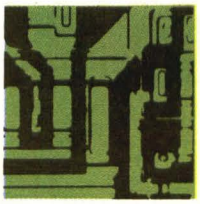
First we looked for functional categories. We found them. Time after time, in a clear and recurrent pattern, seven basic categories popped up: Registers. Decoders and demultiplexers. Counters. Multiplexers. Encoders. Operators. Latches.

Inside each of the seven categories, we sifted by application. We wanted to design the minimum number of devices that could do the maximum number of things. That's why, for example, Fairchild MSI registers can be used in storage, in shifting, in counting and in conversion applications. And you'll find this sort of versatility throughout our entire MSI line.

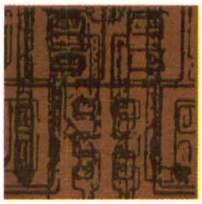


OPERATORS
9304 – Dual Full Adder/Parity Generator

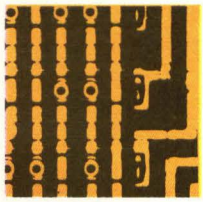
Finally, we studied ancillary logic requirements and packed, wherever possible, our MSI devices with input and output decoding, buffering and complementing functions. That's why Fairchild MSI reduces – in many cases eliminates – the need for additional logic packages.



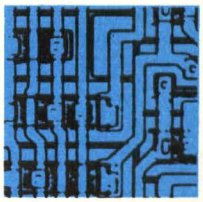
LATCHES
9308 – Dual 4-Bit Latch
9314 – Quad Latch



REGISTERS
9300 – 4-Bit Shift Register
9328 – Dual 8-Bit Shift Register

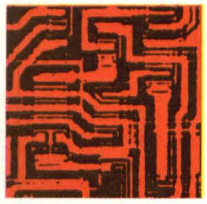


MULTIPLEXERS
9309 – Dual 4-Input Digital Multiplexer
9312 – 8-Input Digital Multiplexer

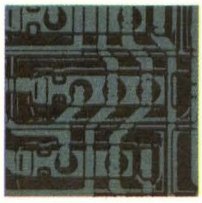


DECODERS AND DEMULTIPLEXERS
9301 – One-Of-Ten Decoder
9315 – One-Of-Ten Decoder/Driver
9307 – Seven-Segment Decoder
9311 – One-Of-16 Decoder
9317 – Seven-Segment Decoder/Driver
9327 – Seven-Segment Decoder/Driver

The Fairchild MSI family plan. A new approach to MSI that's as old as the industrial revolution. It started with functional simplicity, extended through multi-use component parts, and concluded with a sharp reduction in add-ons. Simplicity. Versatility. Compatibility. Available now. In military or industrial temperature ranges. In hermetic DIPs and Flatpaks. From any Fairchild Distributor.



COUNTERS
9306 – Decade Up/Down Counter
9310 – Decade Counter
9316 – Hexidecimal Counter



ENCODERS
9318 – Priority 8-Input Encoder

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Editor's Note: This monthly column discusses and analyzes significant developments which are occurring in the data communications field. Our primary objective is to provide you with a continuous source of technical and regulatory information and discussions to help you understand communications in a data processing environment. CD Communication Channel is prepared by John E. Buckley and the staff of Computer Group, Inc., of King of Prussia, Pa.

Communication Pollution

There can be no doubt that the communication network that spans our country is a required yet limited national resource. Like many other resources in this country, this network has unfortunately been taken for granted by most users. Inefficient use of this network during the recent unprecedented growth of communications has resulted in what can be termed "communication pollution." Virtually every communication user, voice or data, is aware of the most publicized example of this pollution—the communication system breakdown in the New York City area during the summer and fall of 1969.

The telephone company management has implied that the situation in New York City is an isolated incident. However, in spite of the various reasons offered as explanations the fact remains that New York City is really an indicator of similar problems developing in other parts of the communication network. What happened in New York City can and, in some cases, is happening in other American cities. Users of this resource should be aware of the symptoms which preceded the New York City collapse and, more importantly, consider what steps they can employ to relieve this potential "pollution."

New York City users were aware of indications of a growing system pollution. During the early stages there were increasing delays in obtaining dial tones from the central office as well as a growing number of local calls ending in busy conditions. When more and more telephone company personnel were sidetracked from routine maintenance assignments in an attempt to relieve the congestion problems, the overall problem was compounded. Evidence of poor maintenance was exemplified by correctly dialed telephone numbers being incorrectly connected by the telephone central office equipment.

As the situation continued to deteriorate, satisfactory usage of the network became increasingly difficult. In addition the user was faced with longer time commitments from the telephone company for installation and repair service and the deterioration began to accelerate, creating a true snowball effect. Finally, a major failure occurred which forced the local telephone management to institute restrictive measures and, in effect, significantly limit service to their communication users. Such steps could have been avoided if the users had recognized this evolving pollution and had implemented measures to conserve this limited yet necessary resource.

The primary measure companies can take is to insure that their use of this resource does not contribute to the pollution. Both administrative voice communications and data communications should be efficiently planned and operated. As companies grow, their communications needs also grow. While detailed planning is applied for the company's operational expansion, communications services evolve without the guidance of such a master plan.

An organization dependent upon communications should consider the following basic steps.

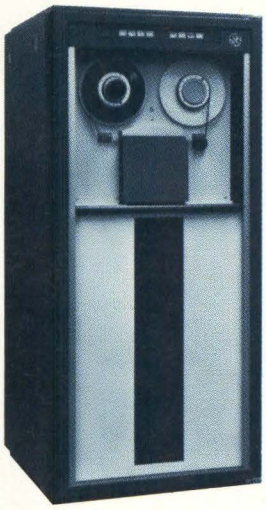
First, determine from the local communication common carrier the true status of the communication system in your area and the area for each of your major locations. Keep in mind that the failure in New York City only in-

This month's column was written by Mr. Jack B. Fairbaugh, Senior Staff Consultant. Mr. Fairbaugh suggests that the current dilemma in telephone communication services is not necessarily the exclusive fault of the telephone companies. The inefficient use of telephone services has created what he terms "communication pollution!" There are, however, specific steps the communication user can follow to protect his telephone capability and relieve the present "polluted" communication environment.

Once, computer peripherals like the GE1600 were sold only with GE computer systems.

Not any more! *Thanks to an ever-increasing demand, Original Equipment Manufacturers now have access to one of the finest, most competitive selections of data handling devices in the industry . . .by General Electric.*

GE1600 Removable Disc Storage Units represent a major advancement in data storage equipment. Now available at low OEM prices, the GE1600 offers field proven reliability. 24-hour emergency spare parts service is provided and trained field maintenance support is also available. The GE1600 is compatible with the IBM 2311 and permits direct exchange of units without software or hardware modification.
For increased storage, an 11-high system is also available in single or multiple spindle configurations.



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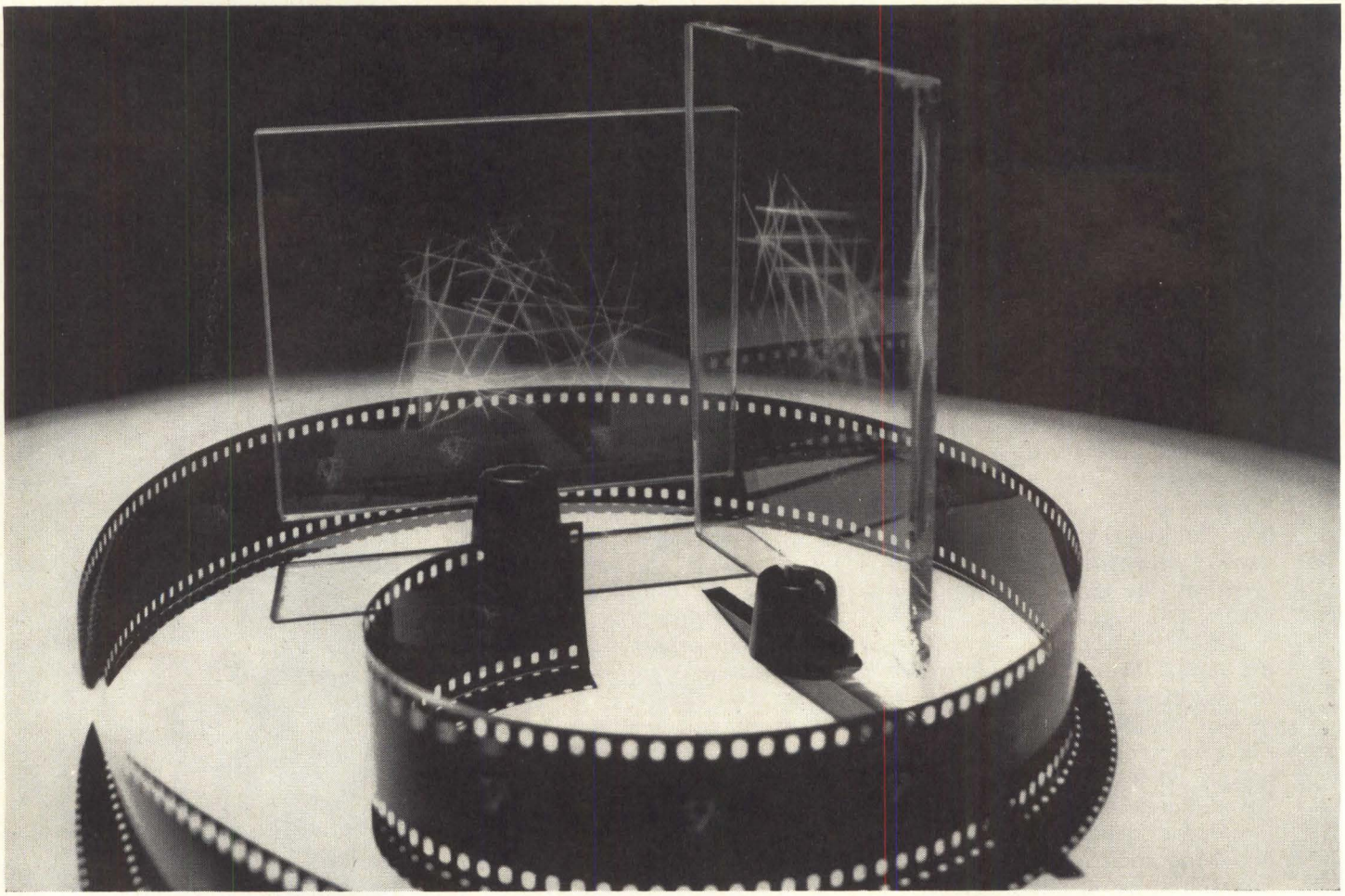
volved a limited number of overloaded central offices. Although the local common carrier representative will be inclined to initially assure you that such worries are unfounded, this assurance, if based on fact, can be quickly substantiated. The communication common carrier should be able to inform you of the type and utilization of the end offices that serve your major locations. Second, if a reasonable probability exists that an end office may be subject to a serious traffic congestion or possible failure, alternate access may be warranted. Foreign Exchanges Services to less congested end offices would provide you with the necessary alternate access in the event of the primary end office failure or congestion. Since originating dial calls create the greatest utilization at an end office the foreign exchange service may also be used for all outgoing calls while the more congested end office can be limited to incoming calls only. An optimum mode of operation must be developed jointly by the telephone company representative and your qualified representative. Third, having insured your continued communication capability through the first two steps, you must make sure that you are not contributing to this communication pollution. A complete analysis should be performed of your organization's voice and data communication services. Such an analysis of these services may reveal gross inefficiencies in the use of the network and excessive communication costs. The results however will allow your organization to optimize the existing system and allow for its orderly expansion in the future. With available definition of the administrative voice system, realistic plans can be made to integrate the data and voice networks into a single efficient operating system. It is highly probable that with such an analysis communication costs can be reduced while at the same time available communication capacity increased. By developing a more efficient communication system, the associated congestion or pollution of this limited resource is reduced.

In addition to permitting inefficiencies to develop in voice communication some companies operate data applications in a manner detrimental to the network. Not considering the fact that many data applications are placed on line with no thought of integrating their use with existing voice facilities, very often little attention is given to their operational impact on the network. For example, some computers collect data from remote locations by constantly dialing each location in sequence. The result is unnecessary use of central office equipment and lines. A much more efficient use of the network would be to have outlying stations call the computer when data is available. While it may be impractical to change an existing system in this manner, modification during the design stages may be feasible if the operational impact on the network is considered.

A communication user can and must be aware of potential loss of service. Although the communication common carrier may be reluctant to openly discuss local situations, a user should know the load and activity characteristics of the local telephone exchange. The failure in New York City was not deterioration of the entire company but the overload (pollution) of certain telephone offices. The communication user should also evaluate the necessity for alternate backup circuits in the event of a primary exchange failure. These alternate circuits may be foreign exchange services at light traffic offices or even toll or tandem office access for some of the incoming lines which would help diversify the load and permit the network to provide limited service even if the primary exchange should fail. Every large communication user should analyze the current cost and method of operation and implement as many efficiencies as possible. The communication common carriers in the United States are striving to improve the current situation. Communication users must realize that the major reason for the current communication problems is the inefficient use of this limited resource. All reasonable steps should be taken by users to optimize their methods of communication to prevent further communication pollution.



Holography—quickly—by computer

One of the most startling things about a hologram is that it produces images with parallax... that the appearance of the image varies according to the angle of view, just as in the real world. That's why we see the subject in 3-D, even though each eye, looking along its axis through a separate small area of the hologram, sees only two dimensions. Bell Labs scientists M. C. King, A. M. Noll, and D. H. Berry took advantage of this to generate holograms of nonexistent objects (such as 3-D mathematical graphs) with a few seconds of computer time.

Normally, a hologram is made by photographically recording wavefronts of laser light reflected from a real object. (Holograms have also been generated by calculating such wavefronts and recording their pattern on a photographic plate, but this takes many hours of computer time, even for simple subjects.)

A King-Noll-Berry hologram, however, is actually a series of holograms, each about 1mm wide and 100mm high, on a single holographic plate. These individual holograms are made, one by one, from a series of two-dimensional computer-generated pictures (film strip above), showing the hypothetical object from a range of viewing angles, in 0.3° steps. (Because of a hologram's high information capacity, each 1-mm vertical strip can contain—and project—a full-width picture.) And since each of the viewer's eyes looks through a different vertical strip, the viewer sees the object binocularly, in 3-D.

Like most holograms, these should be viewed with a laser; this limits their usefulness for many scientists, engineers, and students. But, because the "strip"-hologram images are two dimensional, placing a holographic plate with a special emulsion in the plane of the projected real image yields a copy hologram (glass plates above). Viewable under an ordinary incandescent bulb, this hologram can be studied wherever and whenever the user wishes.

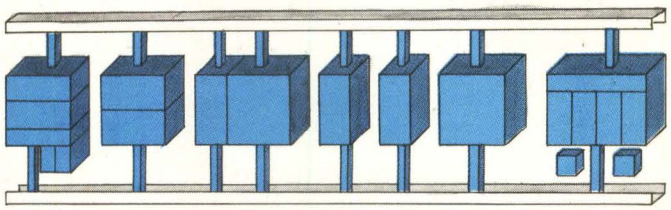
This technique is the first way to make "hard copy" holograms of imaginary solid objects with little computer time... a fast and inexpensive way of converting abstract data into three-dimensional pictures and graphs. It opens another avenue of fluent communication between man and machine, for possible use in communications technology, science, finance, architecture, statistics, and other fields in which the computer has become necessary.

From the Research and Development Unit of the Bell System—

Bell Labs

Here is an inexpensive approach to system control when arithmetic manipulation is not a prime factor. The direct function processor is a functionally oriented machine having true modularity and expandability

The Direct Function Processor Concept for System Control



Saul B. Dinman

GRI Computer Corporation
Newton, Massachusetts

At the present time, many small general purpose computers are being used as systems controllers. However, the fundamental concept of computers is that the computer is primarily a calculating device. It was never conceived in terms of controlling and sequencing activities that might not involve mathematics. The systems designer is forced to program his system functions in arithmetic terms understood by the computer but which might bear little direct relationship to its functional use.

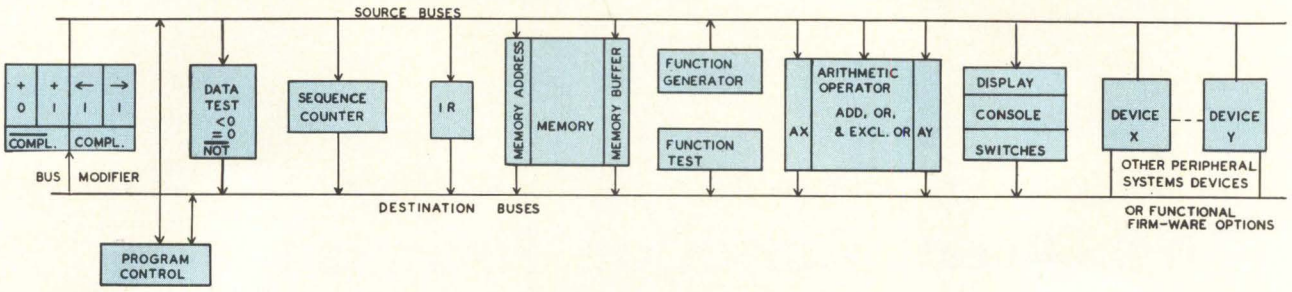
A fact generally overlooked about general purpose computer-controllers is that they are arithmetically, not functionally, oriented. All have a central processing unit (CPU) that is designed to accumulate information from a system or subsystem, perform arithmetic calculations on it, and return the computed data to the outside world, where it can be used to instruct, adjust, correct, regulate, or protect the system that is being controlled.

The cost and capability of these machines depend on how clever the computer manufacturer has been in designing and interconnecting his accumulators, core memories, arithmetic units, instruction and index registers, and other key elements. In general, all the computers that have been developed to date differ only in the design and organization of these elements. The concept has been that of calculating devices, not of control and sequencing devices, and, obviously, the objective is to obtain the most computing power per dollar that is possible.

The arithmetic concept requires either that the computer be required to perform a very specific function or that it be a general purpose machine with some predetermined capability-to-cost ratio based on what the computer manufacturer believes a group of users will require in terms of power and on what peripheral equipment they will connect to the input/output lines. Since the obvious engineering/sales decision is to aim for the broadest market, the systems designer usually ends up paying more for his machine than is warranted. In short, the progression has been from a single purpose computer-controller to a general general computer-controller—indeed, one that is often so general that it can be justified only if it is applied for multiple purposes, such a production control and accounting, as well as systems control.

Furthermore, every time there is a breakthrough that provides more power per dollar (which of course is associated not only with improved arrangements of the components inside the computer, but with advances in solid state devices, integrated circuits, packaging, component design, and the like) the industry moves to a different magnitude of capability and to

***Saul B. Dinman** is company founder and vice-president of engineering. Concepts developed by him and implemented in the direct function processor are the result of many years of experience in logic design, programming, and computer controlled systems. Mr. Dinman received a BSEE degree from Pennsylvania State University and is a professional engineer.*



Typical configuration of direct function processor

the so-called next generation machine that makes obsolete the user's current machine. To put it mildly, the systems designer is not an enthusiastic supporter of this cycle. It forces him to redesign his control system in order to remain competitive and puts him on an economic treadmill that can jeopardize his very existence. In existing general purpose computers there is neither true functional modularity, expandability, nor upward or downward software compatability between family members—despite what the industry claims.

Another disadvantage of this arithmetic concept is that the input data must be programmed in terms that the computer can understand, and the output data, in terms that the system can understand. Thus the systems designer is forced to program his system functions in arithmetic terms understood by the computer, and these unfortunately bear little direct relationship to its functional use. In fact, in most cases the actual systems programming is turned over to a programmer who must try to relate the systems requirements to equivalent terms that can be translated as instructions to the computer. Frequently, the programmer does not fully comprehend the total aspects of the system he is programming. In a sense the systems designer in turning the programming responsibility over to the programmer loses control of the design of his own system.

As a result, programming services have risen sharply in cost as the demand has increased. A new industry has grown up providing programming services to systems people because the demand far exceeds the supply—and the situation is worsening rapidly.

Another serious drawback of most of the current computer-controller systems is that in many cases—perhaps the majority—neither the computer manufacturer nor the system's producer is capable of maintaining the other's equipment. And while the user understands and can maintain the functional system, he does not have the same competence when it comes to the computer. So the computer manufacturer must support an expensive group of trouble-shooting and maintenance specialists that duplicates the field staff of the OEM supplier. In the final analysis, it's the customer who pays.

THE DIRECT FUNCTION PROCESSOR CONCEPT

The GRI-909 computer, or direct function processor, differs from the conventional computer-controller in that it extends into the computer the bus system across which the control devices are normally connected. To put it more accurately, the elements of the computer are brought outside the central processor, and all computer devices such as the instruction register, sequence counter, arithmetic unit, and memory, are connected across the same bus structure as the devices in the equipment to be controlled.

Thus, all internal and external elements are directly addressable by use of a compiler-like functional language rather than a mathematically oriented language. The programmer does not have to develop the involved command sequences that will translate process data into a language that the computer can understand and then back again into instructions that the equipment or process can react to. The unimpeded flow of data from device to device saves temporary storage locations for "bookeeping" purposes and provides the designer with modularity and flexibility to adapt the computer to specific system requirements.

The key to the concept of the direct function processor is a block of logic that provides a programmable path between the source and destination buses in the computer. It is termed a bus modifier and is designed to take information from any input device and move it to any output device, performing operations on the data as it passes from one device to the other.

Since the path connection is programmable, data can be transmitted from one device to another in one of the following conditions: unchanged, incremented, shifted left one bit, shifted right one bit, "ones" complemented, or "ones" not complemented. A "twos" complement, or negative number, can be obtained on the fly by combining the "ones" complement capability with the increment capability.

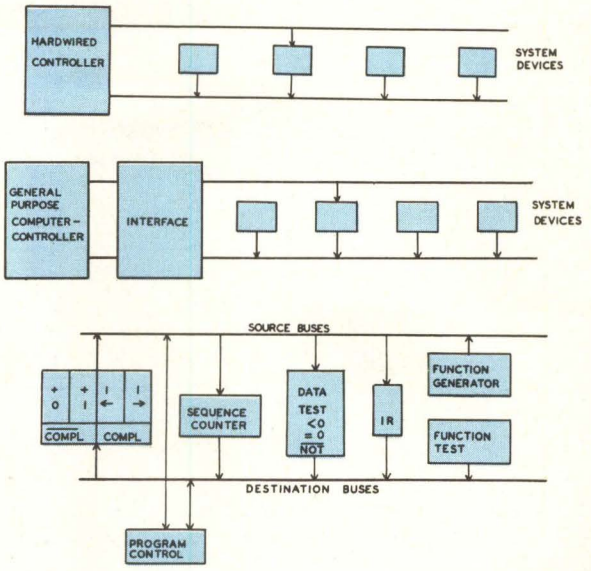
A link bit, through which data can be shifted for testing one bit at a time, and an overflow bit for tests involving incrementing data are provided with the bus modifier. Thus the systems designer has the ability to count and control data, although restricted to simple, repetitive operations, on a bit-by-bit basis.

INSTRUCTION FORMAT

The GRI-909 is a 16-bit, parallel machine. Six of the bits are used for source addresses, six for destination addresses, and four to control the transfer of data throughout the system. The latter can be microprogrammed to modify data or control their transfer.

Each device in the system is equipped with a decoder that enables it to recognize an instruction to supply, receive, modify, or otherwise manipulate data. Thus, in effect, the control logic is spread throughout the machine and is tailored to the particular requirements of the equipment to be controlled, since it is only added to the system when another device is added.

Program control provides the signals that indicate when a source device is to give up data, sets up the route the data are to follow, and tells the source device that is to receive them. It also must be capable of subsystem manipulation: incrementing the sequence counter or changing its contents when a jump occurs. A read-only memory, whose instructions are in the same format and therefore indistinguishable from those coming from the instruction register, is used to enable program control to perform such manipulations over the same data and control structure as used for the movement of system data.



Circuit arrangements for typical controller, general purpose computer, and tie-in system

BASIC COMPUTER DEVICES

The devices connected between source and destination buses in the basic computer configuration are, in addition to the bus modifier, the following.

Sequence Counter: This device is provided to keep track of the program information. It is common to all computers and indicates the address of the next instruction. In this application, the sequence counter is connected across the buses, as are all other elements in the system, providing direct access from device to device. An external device can cause the program to go to some special subroutine in memory by transmitting an address word directly to the sequence counter.

Instruction Register: The instruction register contains the instruction in the computer to be executed at a given moment. Like other elements in this system organization, it is connected across the source and destination buses.

Data Test: A computer decides on the program paths it will follow on the basis of the value of the data that resides in the arithmetic structure. In this machine, data test determines whether the value of the information it receives from any source is less than zero, equal to zero, or any combination thereof (including the negation). This tester is connected between the source and destination buses and is programmed to accept data directly from any source. A positive response to a data test results in a jump instruction. The contents of the sequence counter are automatically stored in a trap register associated with data test when a jump is executed.

Function Generator: Most peripheral devices require control pulses to perform such functions as start, stop, clear, and the like. Up to 16 different control commands can be issued to each system device by generating the address of the device and the control pulses on four control lines provided for this purpose. A typical instruction to be issued by the function generator might be START READER.

Function Test: Some devices produce status signals which indicate certain conditions to the computer. The function test operator looks at these status signals and acts upon them. Three control lines are provided for this purpose, plus a fourth which provides logical negation of the other three. A positive response by the function test operator to the sense lines results in a skip instruction.

Console: If a peripheral device is added to a system, a set of lights may be required to indicate what is going on within the device. When the switches on the console are set to a device address, any data delivered to that device will be displayed. This is useful for maintenance and debugging purposes. In some systems this can eliminate the development of large display panels and their attendant cost. The contents of any source register in the system can also be displayed on the computer console.

A programmer's console is optionally available which simultaneously displays major internal registers in the computer in addition to the selectable data display. Both consoles are equipped with plugs and are interchangeable.

Data may also be transmitted to any device in the system from the console switches by selecting its address and activating the transmit key. Control switches on the console are: start, continue, read, write, display, transmit, single step, and stop.

Minimum Configuration: The system described so far is the minimum configuration for the computer. With the addition of some kind of stored program, it can provide all the control capabilities of a general purpose computer. It can test data, transmit and receive control signals, and perform arithmetic and logic op-

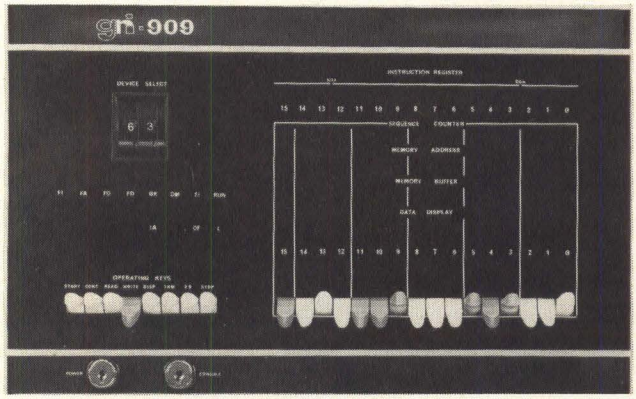
erations one bit at a time as data pass through the bus modifier. Although limited in the execution times of its arithmetic operations, it can be used as a special purpose controller with read-only memory or a general purpose controller with random access memory for those applications requiring little or no arithmetic or when the execution times of arithmetic are not a critical factor. This provides a very inexpensive approach to system control, with the capacity for expansion to full computer capability if required.

Core Memory: The memory is a 16-bit random access, ferrite core memory in 1024- and 4096-word plug-in modules. It can be expanded to 8192 in the basic processor frame without additional wiring. The total expansion capability is 32,768 directly addressed words.

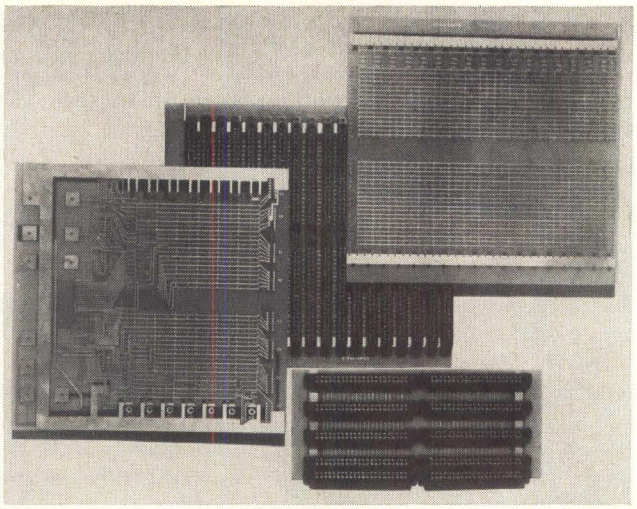
There is a multiple-channel, single-cycle, direct memory access system in the basic processor that permits direct, single-word access to the memory by a system function. The difficulty of multiplexing several devices on many different data channels is eased by a simple priority allocation system. Similarly, a range of complexity in implementation is available to the system designer. The data channels may be used to transfer data in or out of memory or simply to increment a specified memory location.

Arithmetic Operator: The arithmetic and logic manipulations that can be performed in the functional arithmetic operator are "add," "and," "or," "and/or," and "exclusive or." This arithmetic operator works somewhat differently from that of a typical computer. Instructions are not issued that say "add," which in a conventional computer says, "one number is in the accumulator and the other number is in memory. Pull the number out of memory, add the two together, and put the sum back into the accumulator."

In the direct function processor, the function generator is used to generate the "add" function. The instruction looks like "Function output 'add' to the arithmetic operator." This element will always perform the "add" function between the current value of X and Y accumulators until the user issues another command changing the state. When either one of those registers is changed, a new sum appears, immediately available for transfer to any point in the system. New values can be presented from a system register with a new result obtained in a single cycle time of 1.76 microseconds. The result, available as a separate source, always reflects the instantaneous output generated by the contents of the X and Y accumulators as controlled by the function selected. It can be stored in memory by a single instruction. The introduction of new values to one accumulator does not alter the contents of either accumulator, unless the instruction "arithmetic operator to X (or Y) accumulator" is issued.



The GRI-909 computer



Computer internal wiring

FIRMWARE OPERATORS

Computer capabilities can be expanded by adding firmware operators to the system. A firmware operator generally presents at least one register to the bus system. Each functional operator added to the computer systems adds one or more hardware instructions to the computer plus the variations provided by the bus modifier. Examples of some of the firmware options are the following:

Multipler: A "multiply" can be executed either through subroutine instructions or by the multiply operator, a firmware option. The subroutine for "multiply" has a maximum execution time of 360 microseconds for a full 31-bit signed product and occupies 42 memory locations.

The multiply operator performs a 16-bit unsigned multiplication. It uses the arithmetic operator and issues external instruction requests to the processor. It uses a single address for the 16-bit register (MPR) housed in the operator, which may also be used as a temporary storage register.

The 31-bit product is available in the X-accumulator of the arithmetic operator (most significant) and MPR (least significant) 56.32 microseconds after starting the operator.

The execution time might be extended if direct memory access requests arrive during the processing of this instruction. A higher-speed multiply operator is also available with an execution time of under 10 microseconds.

Byte Swap: The byte swap subroutine requires 20 memory locations and executes in 124 microseconds.

The byte swap operator is a 16-bit register (SWAP) used to interchange the halves of a computer word. It executes the interchange in a single cycle time of 1.76 microseconds, exchanging bits 15 to 8 with bits 7 to 0. A byte pack operator is also available to form a 16-bit word from two 8-bit characters that are loaded sequentially.

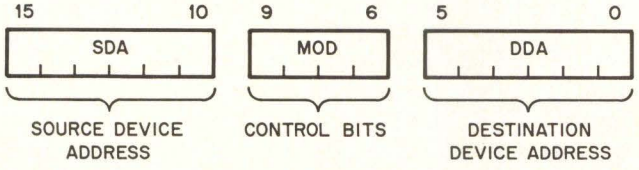
These two examples are indicative of the flexibility built into the computer. The ability is intrinsic to the direct function processing technique, permitting virtually any operation to be incorporated in the instruction repertoire of the machine. Other standard options include: square root, BCD/binary conversion, and general purpose registers.

DEVICE OPERATORS

Device operators provide the interface circuitry between system devices and the computer. Direct memory access and priority interrupt circuitry are provided for each device, as required, in the device operator. The high-speed signals related to the internal operation of the computer are terminated at the device operators so that external devices see only relatively slow signals that can be cabled to the device. In some cases, if the device is simple, the entire device can be provided on the device operator plug-in module. This module is approximately 4 inches by 9 inches and provides an output cable connection.

PROGRAMMING

Instructions are of the general form DEVICE X TO DEVICE Y, and are described by a single machine format:

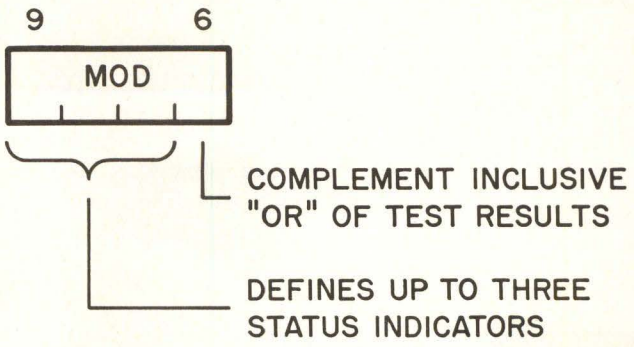


The actual operation performed by an instruction is dependent upon the unique combination of SDA, MOD, and DDA.

The four functional instruction classes are outlined below. Each class is described with examples of machine and corresponding functional language instructions in the following paragraphs. In machine language SDA and DDA are represented as two octal digits each, and MOD is represented as four binary digits.

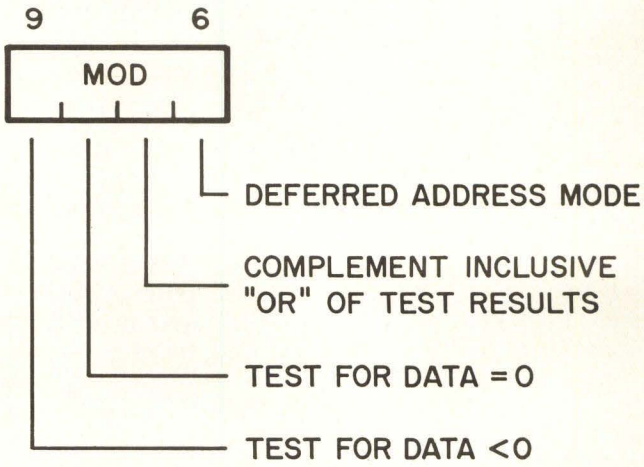
Function Generator: The source address of the function generator is 02. It causes control signals (rather than data) to be transmitted to any system device specified by the DDA. The modifier defines up to four pulses in combination to be transmitted in parallel. Examples of FAST instructions are: START HSR START TTI.

Function Test: The destination address of function test is 02. It senses up to three status indicators associated with any system device as specified by the source address. If the status test defined by the modifier is true, a SKIP instruction is performed. The format for the modifier is



Examples of FAST instruction: SKIP IF ADC RDY SKIP IF TTI NOT RDY

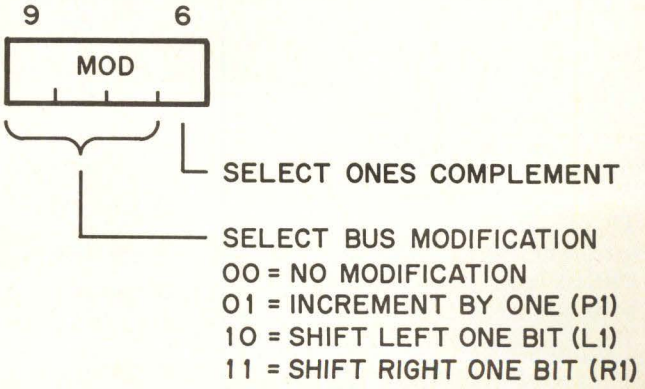
Data Test: The destination address of data test is 03. It can test data from any source address for less than zero, equal to zero or any combination thereof. If the test defined by the modifier is true, the next word is taken as a jump address; otherwise, the next word is skipped. The format for the modifier is



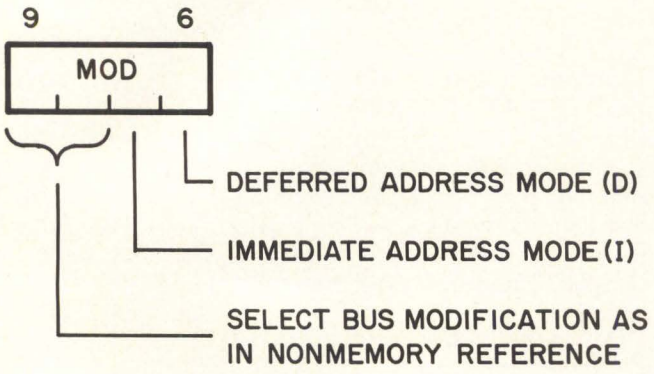
If a jump is performed, the current value of the sequence counter is automatically stored in a trap register associated with the data test. If the jump is to a subroutine, the trap register provides the link back to the calling program.

Examples of FAST instructions: IF ADC ETZ GO TO ALARM. IF TTI NETZ GO TO PROCESS

Data Transmission: Any instruction not in one of the classes defined above implies the transmission of data from a source device to a destination device as specified by their addresses. The source and destination may be the same device. Data transmission instructions are of two forms. For nonmemory reference the modifier format is



Examples: AO P1 TO DAC. C ADC P1 TO AY
For memory reference a memory reference instruction is designated if the source or destination address is the memory buffer register (06). The next word is taken as a memory address or an operand. The format for the modifier is



Examples: I-27 TO AX. LIMIT TO AY. D LIST-1 TO DAC

The contents of any register connected to the computer bus structure can be transferred to any other register in the system by a single instruction. The registers can be any devices in the computer or in the system, including memory. The computer recognizes and services interrupt requests and direct memory requests generated by system devices. Devices may, however, cause traps to unique memory locations. The cost of generating a unique address is borne by the device interface itself. In a multilevel interrupt environment, priority is enforced by manipulations of an interrupt status register by the respective interrupt routines. Each device that is interfaced to operate in an interrupt mode contributes a bit to the interrupt status register so that it may be selectively enabled and disabled. Interrupts may cause a trap to memory location zero. If two or more devices trap to the same memory location, a standard SKIP sequence is used by the interrupt executive routine to enforce priorities and isolate the device, or the devices may generate two unique addresses.

Input/output devices may be driven in a programmed synchronized mode, normal interrupt mode, or direct memory access mode. The permissible mode(s) for a device is determined by its interface with the system, but all data connections are made via the same bus structure used for programmed transfer.

A device to be operated in the direct memory mode presents at least two registers to the bus system (memory starting address and data buffer). A typical direct access device interface will appear to the user as follows:
Three addresses—DSKA: starting address on disc (prime register); DSKM: starting address in memory; DSKL: block length to be transferred.
Example: read from disc
TRACK TO DSKA : SET DISK ADDRESS
BUFFA TO DSKM : SET CORE ADDRESS
LENG TO DSKL : SET LENGTH
READ TO DSKA : INITIATE READ

The device will steal one machine cycle (1.76 microseconds) for transfer of each data word. When the block transfer is completed, the device generates an end-of-range interrupt on the priority interrupt channel. In addition, the disc contributes one bit to the machine status word to indicate its active state and sense flags to indicate parity error and up-to-speed.

Another interrupt mode, external instruction request, is provided. This interrupt mode is used to exercise the computer with hardware diagnostic modules. It can also be used in conjunction with read-only memory to extend the instruction repertoire to include complex instructions. When read-only memory is used in this interrupt mode, an instruction is executed in 880 nanoseconds.

SUMMARY

The computer is both modular and expandable. It need not have a main memory since other functions can be added later. Or it may have a minimal amount of memory and arithmetic capability, these functions being substantially expanded for different control system models. Thus the system designer can evaluate his system requirements with regard to the trade-offs between speed and economy. If he is looking for economy, he can strip down his hardware and perform his system functions through program subroutines. If it is speed he is looking for, he can substitute hardware with an increased cost.

The firmware capability is intrinsic to the computer. It therefore provides the flexibility of adding the firmware option at any time. If requirements change after a system has gone into operation, it is possible to expand the computer capability. So a decision made at one time does not necessarily commit the system designer for all time or require substitution of a different, more powerful processor.

Certain special hard-wired instructions that cannot be found in any other small computer or, indeed, in any other computer, small or large, can be provided or added by the customer as his own proprietary functions. For example, in a system monitoring fluid flow, the square root of the output of the flow-meters might be necessary for normalizing the results. A hard-wired square root instruction is possible. This is not an instruction capability normally found in small computers.

Another example might be a machine tool numerical control system. The system manufacturer might develop some special interpolation technique. By incorporating this within the computer he has a proprietary and unique computing capability. No other computer will be able to exactly duplicate that capability. In fact, this is an excellent way for the system manufacturer to maintain his identity and image where there is a growing tendency for one computer system to resemble another. In short, virtually any type of system dependent upon automated control can be enhanced by direct function processing.

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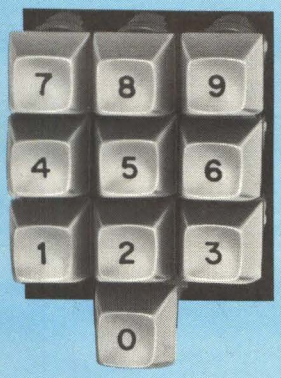

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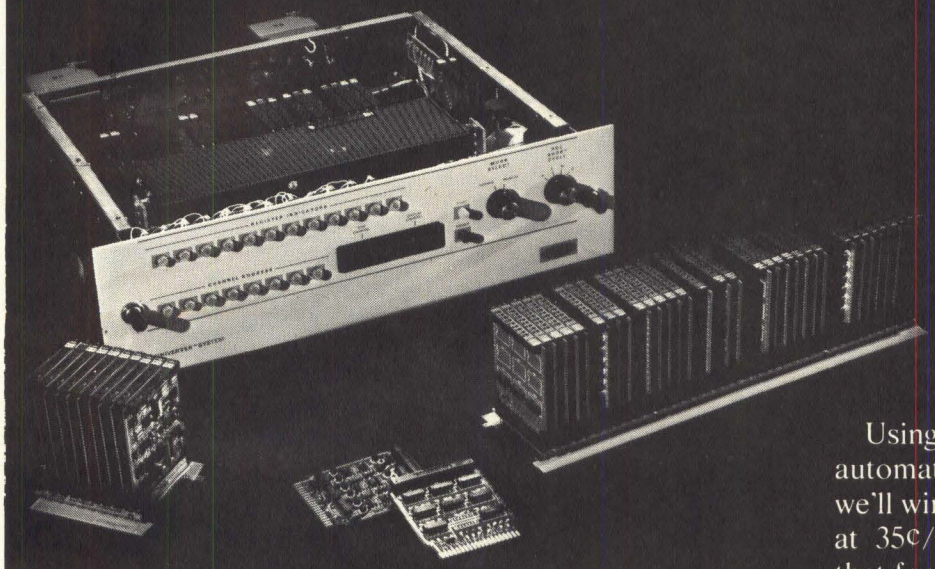

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Portable and easily set up, the data communication monitor is a powerful tool in diagnosing trouble anywhere in a system

An Engineering Tool for Field Servicing Data Communication Systems

Omer C. King
Dennis J. Toolan

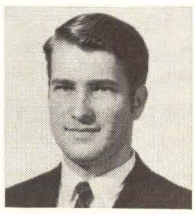
IBM Corporation
Systems Development Division
Research Triangle Park, North Carolina

When a customer's thruput is less than expected and his data communication system is spread over many miles, diagnosis of the problem can be very difficult. Not only does speed of transmission up to 600 bits per second make it difficult to isolate an offending bit, but examination of a single bit or character is seldom sufficient to pinpoint the problem. For such intermittent, fleeting trouble, standard test equipment such as oscilloscopes is usually inadequate.

To cope with these formidable problems, special tools and techniques are being developed. One of these is the data communication monitor, also known as an "error trap," built into an attaché-like case which can be easily carried into a customer's office. The monitor can be attached to a system by a single cable in less than a minute; all power and signals are received from the host machine.

The monitor traps and displays an error character and the three preceding characters, or identifies and counts various types of errors while unattended. The monitor does not in any way affect the operation of the machine to which it has been attached.

Omer C. King is a project engineer in Terminals Product Engineering. He has been involved for the past seven years in providing product engineering support of transmission control units and terminal systems. He has a BSEE degree from Purdue University.



Dennis J. Toolan is a technician in Terminals Product Engineering, where he has been the department technician with responsibility for model machine testing for the past three years. He has an AAS degree from the University of Hartford.

Before the monitor was developed, the service engineer had to rely entirely upon the oscilloscope and his knowledge of the program—which he also had to assume was correct. The monitor gives the engineer an open window to the flow of control and data sequences between the computer and numerous multiplexers, terminals and other components (Figs. 1 and 2). A trained operator can tell whether information is being transmitted or received and what is being polled or addressed, as well as collect error data. An analysis may indicate a trend toward losing or gaining bits which may point to an intermittent machine failure, a line problem, a program "bug" or an operator error. By viewing a series of lights and four counters on the monitor, an engineer can trace a problem to its source, determining its cause and best solution. If thruput seems low, the monitor can be used to count the number of characters and errors, showing the frequency of retransmission and the amount of time wasted in the system.

The monitor serves as a backup to normal error-checking circuitry. More important, it can associate an error with a particular set of circumstances—a particular type of transmission, time of day, or operator—to help identify an error. Over 20 data communication monitors have been built and are being used by IBM service locations throughout the United States. They have been used successfully to identify such operator errors as putting a tape in backwards and leaving a previously read tape in a machine until the computer timed out.

The monitor is used with start-stop systems transmitting in binary-coded decimal. In addition to its two rows of SMS (Standard Module System) cards—easily removed and serviced—the monitor's carrying case has storage space for tools and interchangeable cards and cables (Fig. 3). These allow the monitor to be quickly adapted to any machine with an EIA (Electronic Industry Association Standard) or modern interface, a 134- or 600-baud rate, and transmission

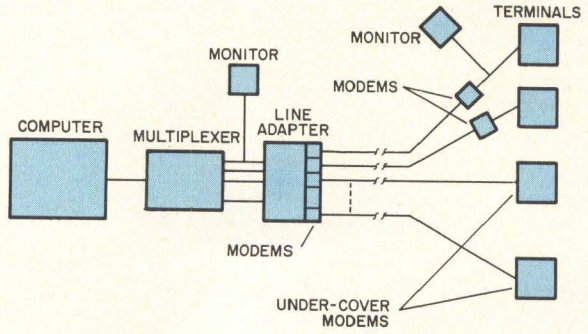


Fig. 1 Monitoring a teleprocessing system

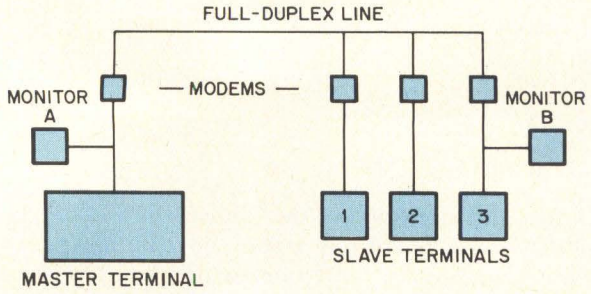


Fig. 2 Optimum location of the monitor A can monitor only transmissions to and from terminal 3, while monitor B can "look" at all data transmissions

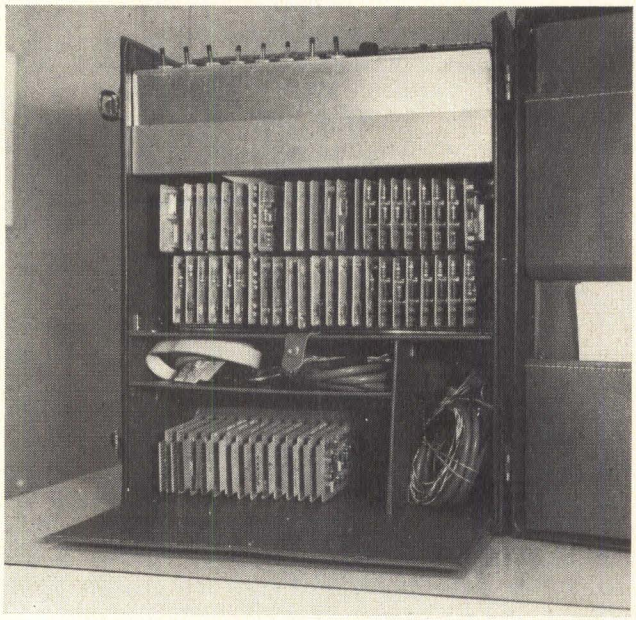


Fig. 3

codes compatible with a six-bit-plus-parity (BCD) code. This includes the NAND, SMAL (Small-Level), SMS and SLT (Solid Logic Technology) logic families, with voltages ranging from +12 volts to −12 volts. Switches, indicators and counters are easily accessible by lifting the cover of the carrying case (Fig. 4).

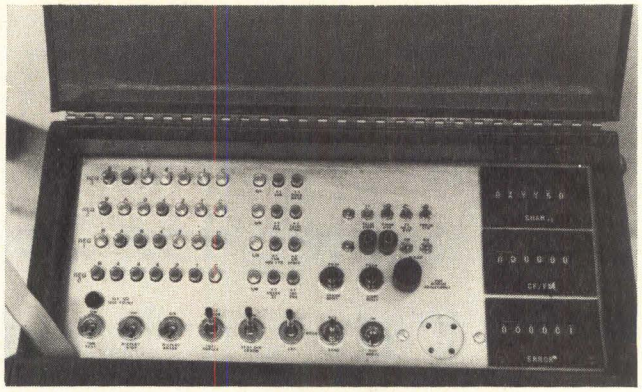


Fig. 4

FUNCTIONS

The data communication monitor performs a variety of functions to aid the engineer servicing data communication systems. Some can be provided simultaneously; others are options selected through switches. The functions, in brief, are:

- Monitors all data received or sent on the line
- Stops on any character and displays character and three preceding characters, when switch is thrown
- Stops on answerback characters from remote terminal or computer and displays character and three preceding characters. Stops on answerback of local machine one character late and displays character and two preceding characters
- Checks for "false starts." False starts, caused by transmission or line distortion or noise bursts, cause a space-to-mark line transition before the completion of an oscillator pulse in the monitor. False starts are indicated/counted by an electro-mechanical counter
- Checks for interruption of carrier ("carrier detect") caused by electrical noise or failure of communication facility or of machine at either end of line. Indicated by light/counter
- Counts characters, when switch is thrown, to indicate amount of usage
- Indicates end of block (EOB), signaling end of message and notifying engineer that longitudinal redundancy check (LRC), and answerback code (Y or N) should follow
- Monitors the terminal or computer for any attempts to transmit before the line has stabilized and a "clear-to-send" signal has been received back from the modem
- Checks for vertical redundancy check (VRC) parity and stops on or counts all errors, depending on switch position
- Transmits an alternate bit pattern to exercise an undercover modem for easier evaluation of mark-to-space ratio, distortion, and jitter

DATA FLOW

Fig. 5 is a block diagram of the monitor, which contains: a line-sampling oscillator; deserializing register (Register 0); three additional display registers (Registers 1-3); vertical-redundancy-checking circuit; error

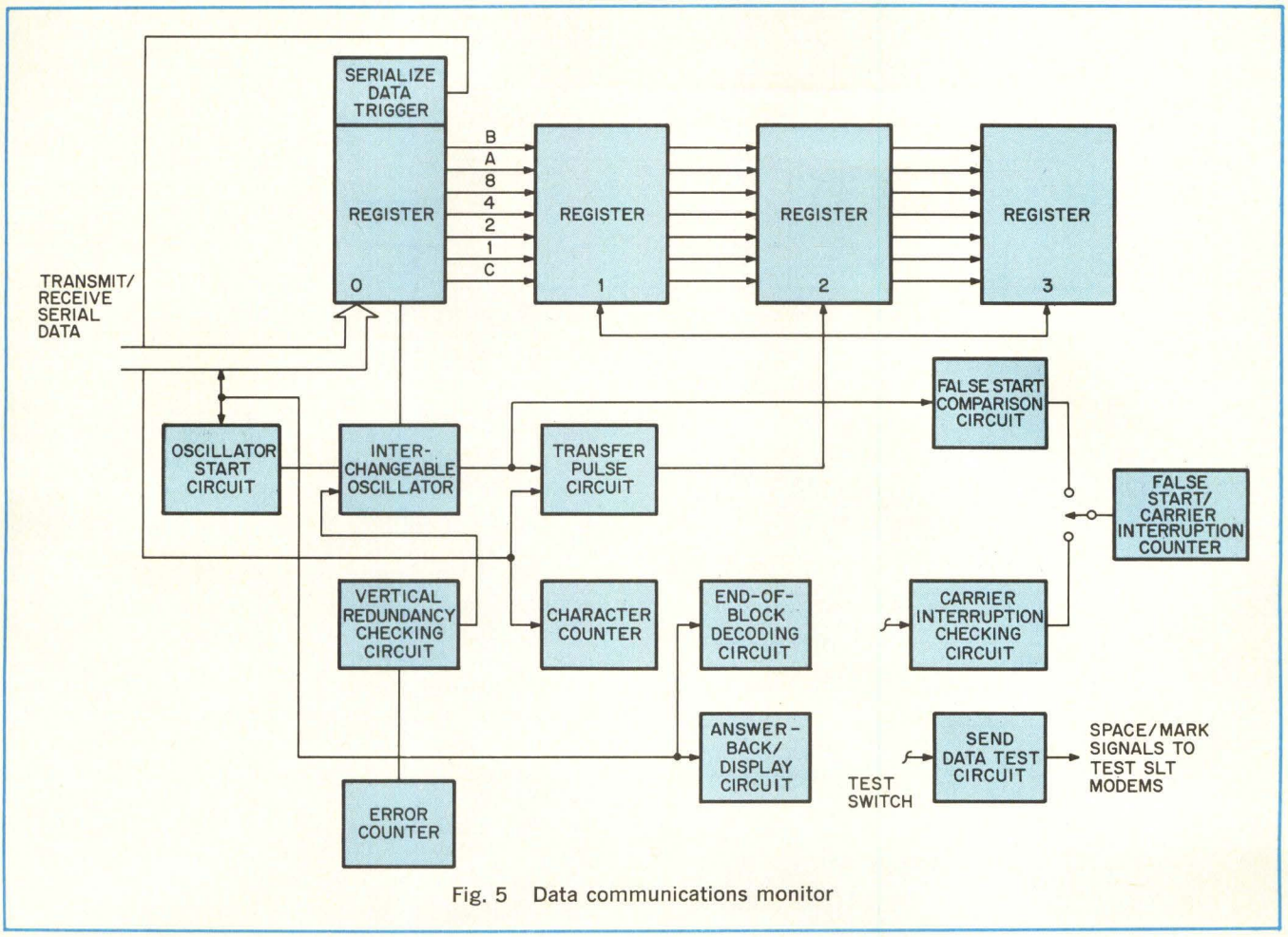


Fig. 5 Data communications monitor

counter; character counter; false-start comparison circuit; carrier interruption detection circuit; end-of-block decoding circuit; answerback-display circuit, and associated control circuitry, switches and indicator lights.

The signals monitored and required for control are shown in Fig. 6. Characters are transmitted serially from the transmit and receive data leads to deserializing Register 0. The character is displayed in Register 0 until the next character starts to come in, at which time the character is transferred in parallel to Register 1. At the same time, the character already in Register 1 is transferred to Register 2, and the one in Register 2 to Register 3. (The character in Register 3 is "flushed out.") Deserialization and transfer of these characters continue until the stop condition selected by the operator (error or answerback) occurs, or until the operator throws the display switch "freezing" the display and stopping further action by the monitor.

The steady-state or quiescent state of the transmit and receive data leads is the mark level. A mark level represents a bit or logical "1" and a space level represents the absence of a bit or logical "0" (Fig. 7). The transition from mark to space level initiated by the start bit of the first incoming character activates the control circuitry of the line-sample oscillator, gating the oscillator on. The first off-to-on transition of the oscillator is used to test the state of the transmit or receive data line for a true start bit.

If the data line is at a mark level, the condition is called a "false start" and the oscillator control circuitry will reset to the off condition, halting the deserialize operation. The number of false starts can be counted on an electromechanical counter located on the monitor box.

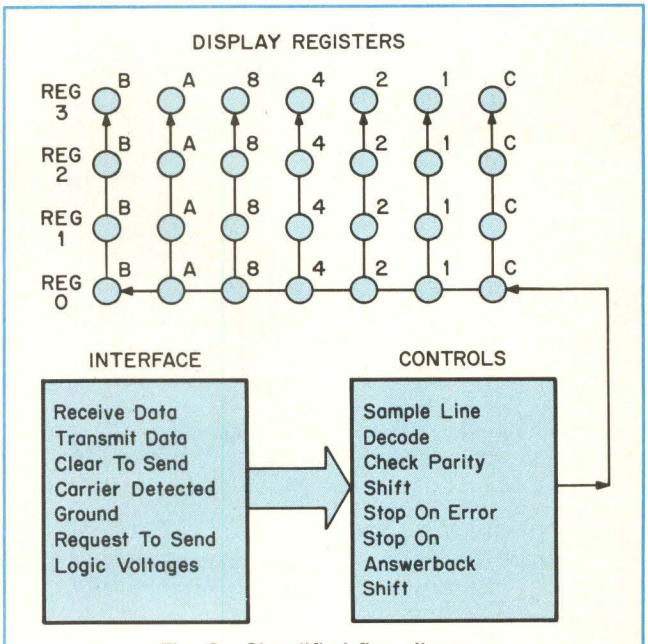


Fig. 6 Simplified flow diagram

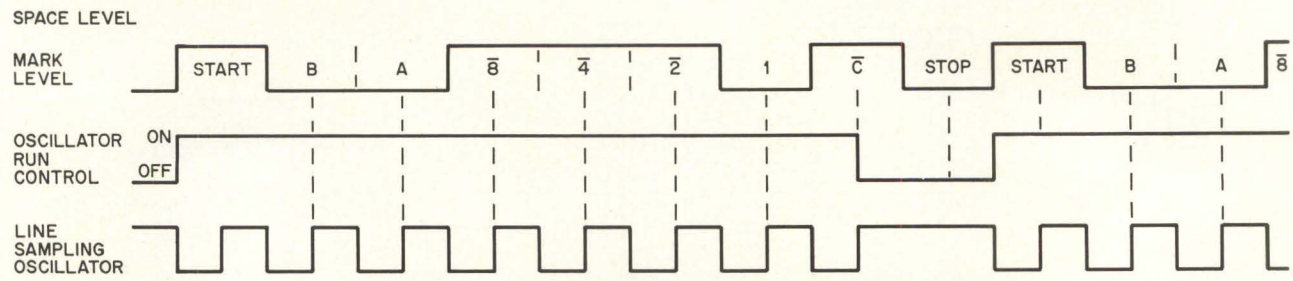


Fig. 7 Serial-by-bit deserialization of the alphabetic character "A" in the BCD code

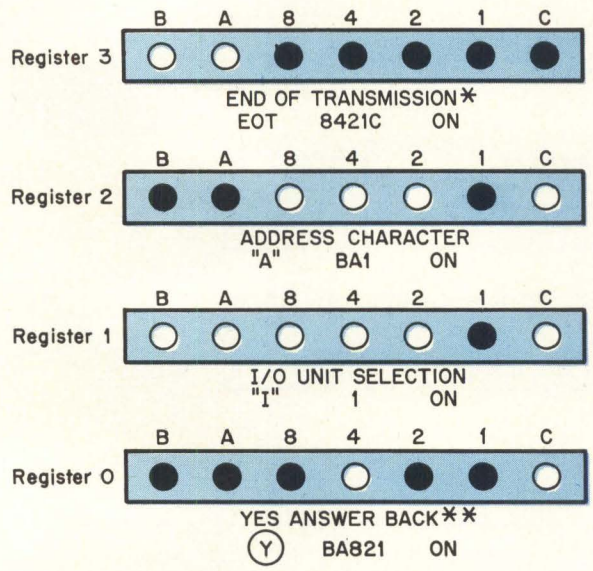


Fig. 8 Typical addressing sequence

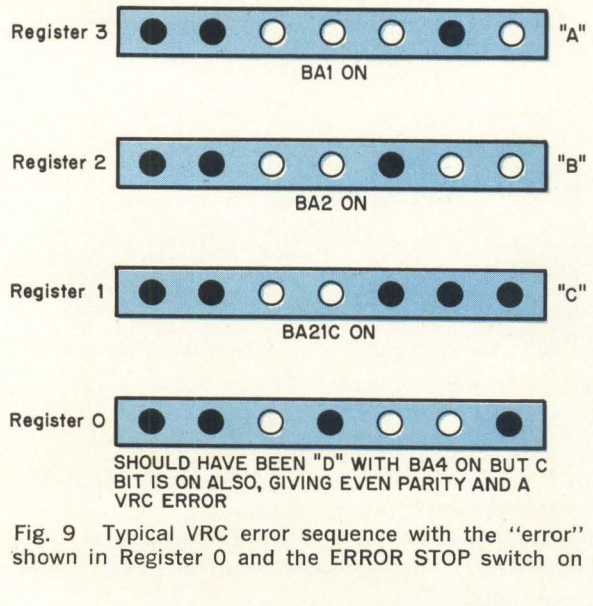


Fig. 9 Typical VRC error sequence with the "error" shown in Register 0 and the ERROR STOP switch on

If the data line is at a space level on the first transition of the line-sampling oscillator, a "0" space is set into the "C"-bit position of the deserializer/display register (Register 0), and the register contents are simultaneously shifted. Since all the register-bit positions are set on at the start of each character, the first sample and shift pulse turns the "C" bit trigger off and all other bit triggers on.

The next off-to-on transition of the oscillator pulse occurs at the middle of "B" bit time on the data lead (Fig. 7). Since the mark level is gated to the "C"-bit trigger, the "C"-bit trigger will turn on, while the previous no-bit condition of the "C"-bit trigger will shift to the "1"-bit trigger in the deserializer. This sample and shift technique continues until the "0" that was initially set into the "C"-bit trigger is shifted up through the deserializer into the serializer data trigger. This transition initiates the serialized data signal and resets the oscillator-control circuitry, stopping the oscillator.

ERROR CHECKING

The parity of the deserialized character is checked by (VRC) vertical redundancy circuitry. For any character, an odd number of "1" bits should be deserialized. The VRC consists of a binary trigger that is reset off at the beginning of each character.

The binary-set pulse is the same oscillator pulse that sets and shifts the deserializer. The VRC trigger counts "ones" by gating to its opposite state (on or off), whenever a mark level is sampled. As a result, the VRC trigger is always in the on state at the end of a deserializing operation if an odd number of bits has been received.

There is no error indication if the VRC trigger is on during the time that the serialize data trigger is on and being sampled. If the VRC and end-of-block triggers are off, the error counter is advanced. In addition, an oscillator stop signal is generated if the error-stop switch is in the on position. The oscillator-stop signal will not allow the deserialize operation to continue regardless of the state of the transmit/receive line until the operator has reviewed the error character displayed by Register "0" 's indicator lights and reset either the error latch or the entire monitor. The operator may record the error-character bits and the bit configuration of the three previously deserialized characters for analysis of what the error-character-bit configuration should have been (Figs. 8 and 9).

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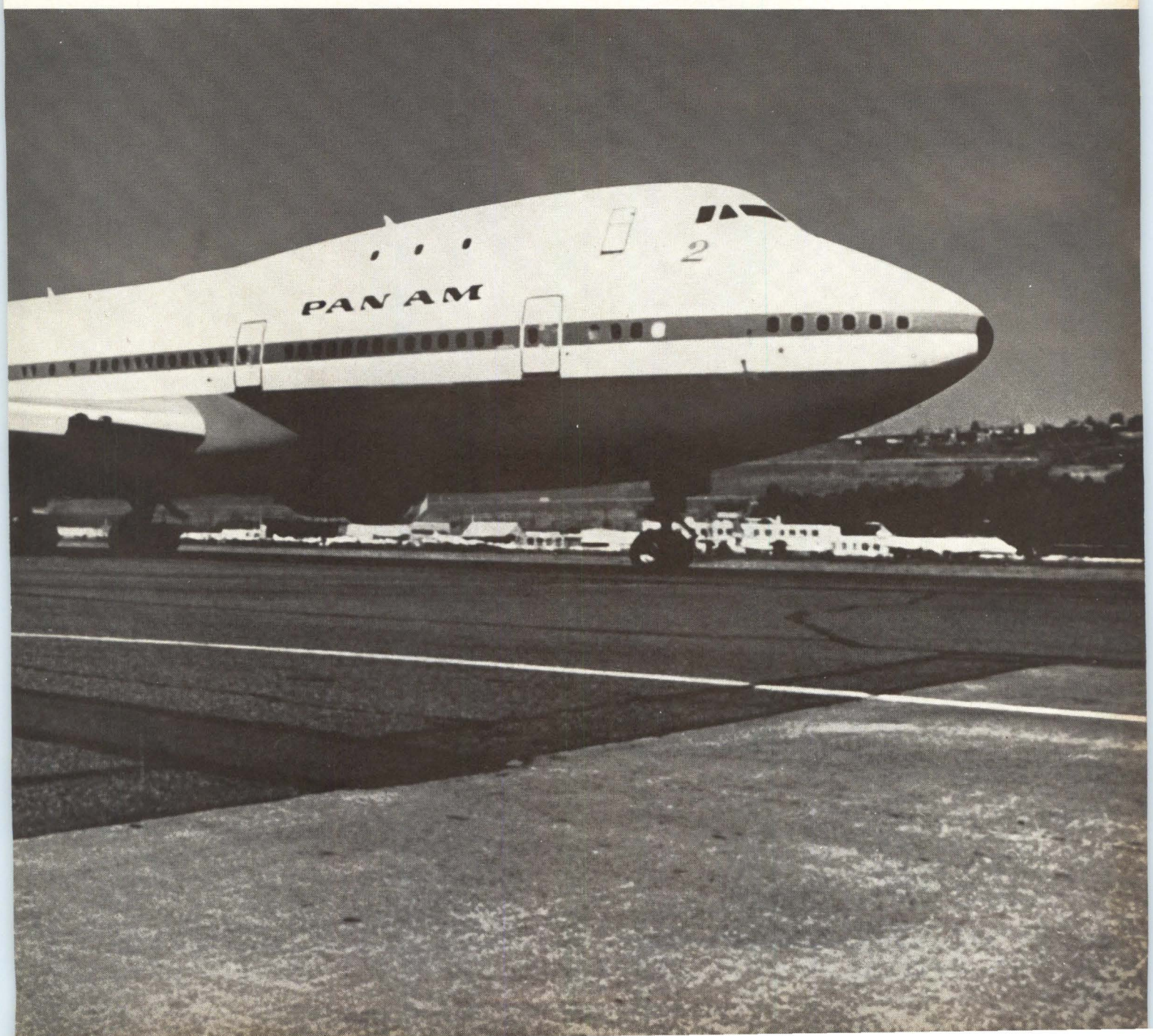


Serial data transmission to and from a computer has the great advantage of using only four coaxial cables, plus one for each terminal. Inexpensive and relatively fast shift registers make it easy and practical

A Serial Input/Output Scheme For Small Computers*

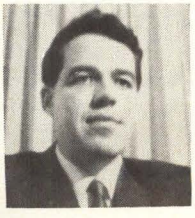
John D. Meng

Lawrence Radiation Laboratory
University of California
Berkeley, California

Five years ago Lawrence Radiation Laboratory installed a small computer for simple data analysis in a cyclotron environment. This was a 12-bit machine, very small by most standards, but the wiring and cabling problems were formidable since typical installations in such an environment involve many peripherals—a plotter, tape machine, a disc and many in-house produced input/output devices.[1]

Next a larger machine was acquired—one with 18-bit words, and with the larger machine naturally came more complicated input/output.[2,3] The back sides of the equipment racks began to look like solid cables. The circuit cards couldn't be found for the cables running up and down the back of the computer. Finally, a 24-bit machine was installed. The crew gazed for a few solemn moments at the cabling problems and settled into black despair.

A 20-MHz shift register became available about this time[4], however, and it was apparent that a 24-bit input/output could be handled over just five coaxial cables, as opposed to the 200 or so individual wires that would be required in a straightforward parallel installation.



Mr. Meng graduated from MIT with a B.S. Degree in 1960. While with the General Electric Co. for five years, he was an electronics engineer in the Computer Department. He is currently with the University of California, where he is active in developing systems using small computers for on-line data taking and analysis.

CONTRAST CALCULATIONS

Some simple arithmetic demonstrated the practicality of the scheme. Memory cycle time on the 24-bit machine is 1.75 μs. Transmission of a 29-bit word serially at 20 MHz requires 29 × 50 ns or 1.45 μs, less than one memory cycle time. A 4-bit shift register costs about $5.00. A 32-bit shift register costs 8 × 5 = $40.00. One is required at each remote point, and at the computer. Cabling costs would easily exceed this figure.

The accompanying table which compares serial and parallel data transfers, weights the argument heavily in favor of serial data communication. The practicality in any system is determined by the transmission time of a word of data. Until very recently, this was prohibitively long. Indeed, in some applications it may still be marginally too long. It is possible, of course, to trade off number-of-cables and transmission time. By using two data coaxes instead of one, and half the number of clock pulses per burst, one can halve the transmission time.

As a limit, the number of data cables could be increased to one per bit and the number of clock pulses decreased to one. This is the fully paralleled case. For any system, an optimum data-transmission scheme may be something between these end points. Fully parallel transmission is expensive but fast. Fully serial transmission is inexpensive but slower. Today, when 20-MHz clock rates are practical, the scale for measuring optimum performance per dollar is tilted in the serial direction.

*Work done under the auspices of the U.S. Atomic Energy Commission.

HOW IT WORKS

The basic transmission scheme is shown in Fig. 1. It consists of a gated oscillator, a 5-bit counter and decoding gate, and the shift registers. The technological developments which have made this practical are:

- Availability of a 20-MHz, 4-bit TTL shift register in a single can. This shift register may be loaded or unloaded either serially or in parallel and in fact has gating on the parallel inputs, reducing in many cases the number of external gates required. The current price of these shift registers is not prohibitive, being in the range of $5.00 to $10.00. A 29-bit register (4 bits per can) costs about $50.00.
- Availability of inexpensive TTL micrologic that is compatable with the shift registers. The standard TTL output is 130 Ω in the collector of a saturated emitter-follower. This is nearly a perfect match to a 125-Ω coaxial cable, a standard, readily available coax. Twenty-nine-bit registers are used to transmit 24 bits of data to allow for transmission error-checking, and also to allow three bits for sending an identifying tag with the 24-bit data word.

The computer has two basic input/output routes. One is via the central processor (which supplies the memory address), and the other is directly into or out of memory (the external station must supply both an address and the data). The same cables are used for both routes. The entire system is shown in Fig. 2. There are two cables returning with data and the shift clock. Then there is one cable required to connect each remote station to the daisy-chain multiplexer at the computer. The total number of cables from the computer equals 4 + n, where n is the number of remote stations.

The critical part of the system, of course, is the relative delay in the signal and clock channels. Gross inequalities in cable lengths must be avoided, as well as gross differences in signal paths through amplifiers.

The amplifiers at the remote stations are TTL gates, making them simple and inexpensive. The input-gate boxes, similarly, are TTL circuits. Gates driving the data coax must be discrete since it is necessary to drive data from any of the station points (including the computer), and when a station is not transmitting, it must not load the line.

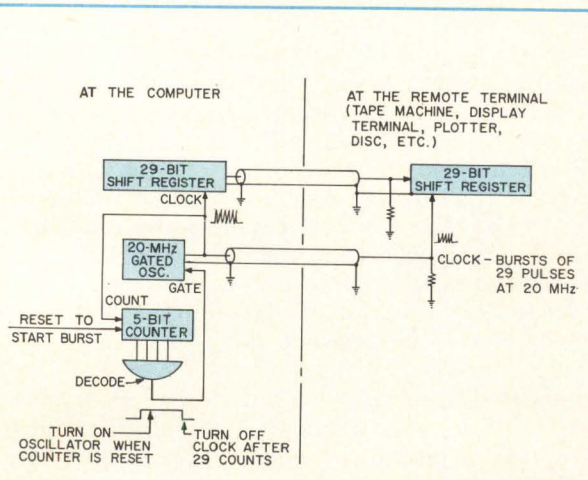


Fig. 1 Basic serial data transmission scheme

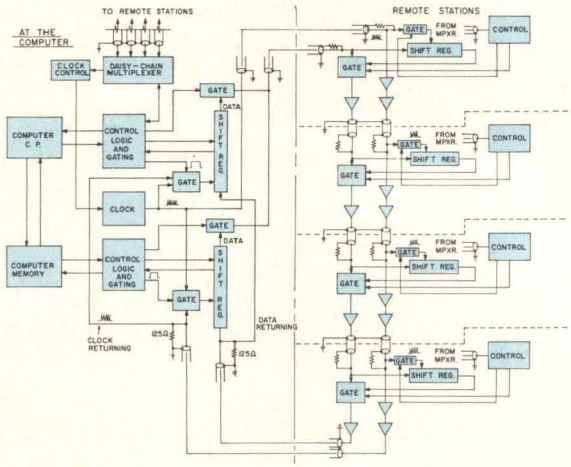


Fig. 2 Computer input/output scheme

Any defective station in the chain can shut the system down by preventing the flow of data or clock. However, bypassing such a station is simply a matter of disconnecting and joining four coaxial cables—a very trivial operation! Debugging at any station is simplified by having to worry about only five coaxial cables when pulling a unit out of its rack for troubleshooting.

FURTHER ADVANTAGES

More detailed considerations will reveal more advantages. The normal sequence of operation is for the central processor to send a word (or several words) to a device to initiate an operation. The word structure is depicted in Fig. 3. To initialize a device, the programmer might give an ACTIVATE command which will specify which station, followed immediately by a memory-location word, and then followed by a word-count/command word. Each station (unless it were in the midst of an operation) would receive these words in its shift register, decode them, and either ignore them or act, depending on the results of the decoding. The station addressed would then periodically require access to the core memory. It would gate off the input to its shift register, load a memory address into the shift register with the proper tag in the three function bits, and then request service from the multiplexer.

The multiplexer waits until it is not busy and then responds with a burst of clock pulses, preceded by a return signal on the direct connection to the remote terminal. The clock shifts the 29-bit word from the remote station into the 29-bit registers at the computer. The three function bits with the word are decoded after being received, and the desired computer operation is then initialized.

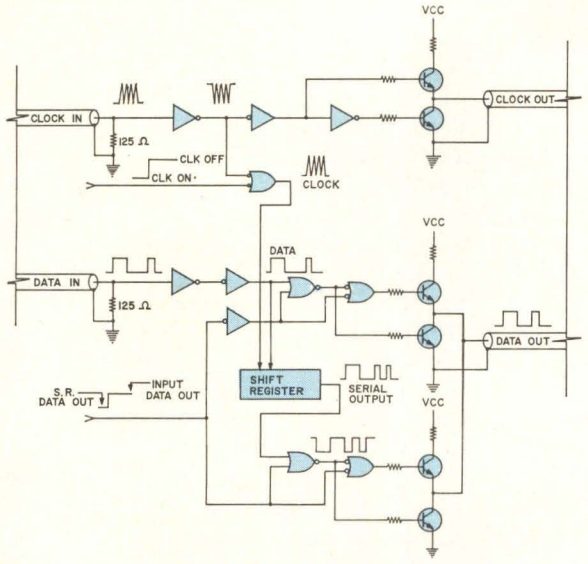


Fig. 3 Remote station in-line data/clock amplifiers

At the completion of the operation required by the command sequence, the remote station signals the computer by putting the interrupt code into its shift register (bits 2-4, Fig. 3) and asking the multiplexer for control. The computer responds with a clock burst when control is granted and interprets the word which reaches it as an interrupt request. The remote station is identified from the multiplexer (not from coding in the data word), and the 24-bit data word may be read by the computer to determine the specifics of the interrupt request (such as Ready, End of File, End of Tape, etc.).

COMPUTER ISOLATION

The point here is that the computer communicates directly *only with shift registers, which are located at the computer!* The advantage is the relative impossibility of fouling the computer from cable ends at a remote terminal. Wires that can easily foul normal computer operation are all terminated at the computer shift register in a carefully designed common interface which prevents such interference.

In other words, all peripherals now deal with only a single box which in turn must deal with the computer. The extra level of isolation adds protection to the operating central processor. Direct connections to a particular machine in general use today can set bits in the accumulator at any time with the simplest sort of malfunction. Such gross interference is very effectively prevented using this serial scheme.

In addition to the other features of the serial data transmission scheme, the multiplexer is interesting in that a single cable connection is used to request service from the computer interface by the remote station, return an answer to the remote station, and also signal the computer from the remote station when a data transfer is required. This is all done with the circuits shown in Fig. 4. The request is made by the remote terminal clamping the voltage down on the line. The request is acknowledged by having the computer end sink current from the remote-terminal transmitter. The computer then releases the line, and the remote station signals data-ready by removing the request.

ERROR CHECKING

Some comments should be made concerning the error-checking scheme tentatively adopted. A parity tree at each shift register was considered, but this involved too much hardware to be practical—particularly since the data motions were all serial. A straightforward scheme of using data-signal transitions to toggle a flip-flop as the shifting occurred was also considered. This is equivalent to a parity check, but on serial data. This technique does not involve much extra hardware, and in fact provisions have been made for using it should the present scheme prove inadequate. It was decided to use two bits which are always preset to (0, 1) at the initiation of a transmission (Fig. 5). They are checked at the end of each transmission for the same code.

The two bits are passed completely through the transmitting shift register at each transmission. The assumption is, of course, that failures will be caused by other than random noise, and the use of coax for all interconnections minimizes this possibility.

A detected error at the computer sets a flag which can be sensed by program. At the remote station the technique for the handling of errors is chosen by the station designer. The tape station, for example, sends back to the computer an error-flag message with the interrupt request.

One last point for consideration is the counter decoder which determines the number of shift pulses (Fig. 1). The gated oscillator produces one pulse after the gate has been lowered. Consequently, the decoder must not turn the pulser back on when this extra count occurs and must detect a $\geq$ condition rather

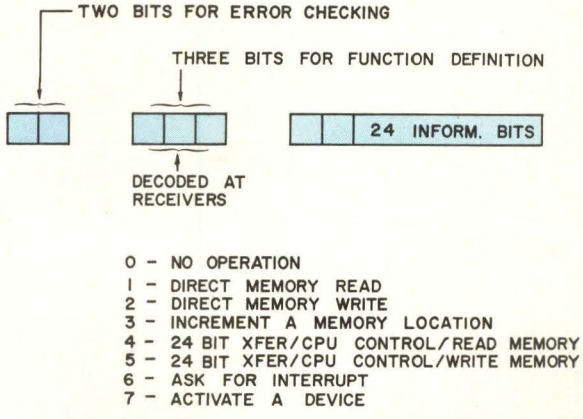


Fig. 4 Shift register word structure

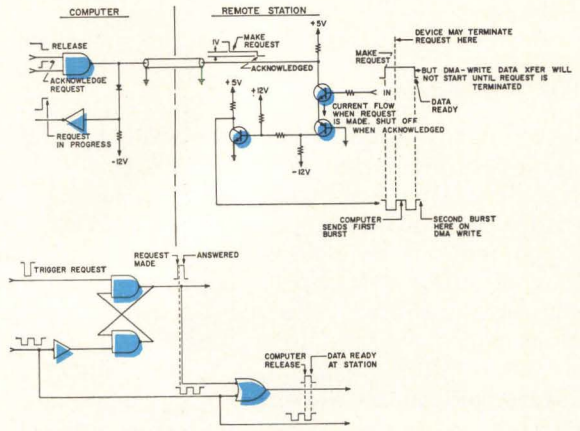


Fig. 5 Multiplexer-remote station communication

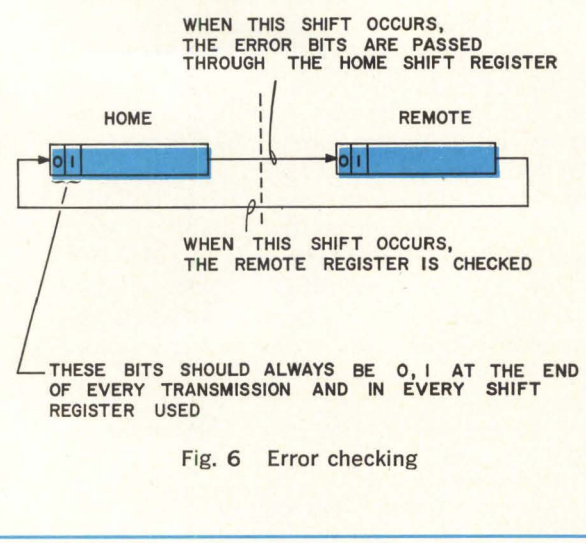


Fig. 6 Error checking

than just an = condition. This was accomplished by simply using 28 + 1 pulses:

$$28_{10} = 34_8 = 011100_2.$$

Our decoder detects the 0111 and ignores the least significant two bits.

This has been an overview of the system rather than a detailed description or analysis. It was first considered because of its inherent elegance and simplicity, and at this point it has paid substantial dividends. A general interface is now being developed for use with the CAMAC standard (formerly called IANUS) for nuclear instrumentation.[5]

THE CAMAC STANDARD

The features of the CAMAC standard are covered fairly completely in the Hooton article.[5] Consequently, a detailed scheme will not be given. Generally, though, it is a bin containing 25 slots and a well-defined set of busses and interconnections. It is designed so that the modules in the end position can multiplex operations on the busses and can also control bin interactions with any computer. The bin is becoming a nuclear instrumentation standard, having already won acceptance in Europe. The need for such a standard is, of course, dictated by the wide variety of special-purpose equipment developed in various laboratories which could be used by others. By defining the interface, which can be driven by any commercial computer, such special-purpose equipment becomes instantly operable in all laboratories using the standard.

In typical small-computer operations where the variety of special peripheral connections may be very large, such a standard interface has substantial value. If, for example, a particular disc or a particular tape machine were interfaced to a standard rather than being interfaced to some individual computer's idiosyncrosies, the controller for the peripheral could be used unchanged with any computer which was interfaced to the standard.

Thus, the number of computer interfaces necessarily designed for each different computer type is reduced to one rather than one per peripheral. From the user's standpoint, this is an ideal situation. He is free to choose the best available computer instead of merely the one with the best peripheral complement. He is freed from the tedium of redesigning all his individual interfaces everytime he changes computer types. He is also able to use interface designs from a larger group of users—not just those who by chance have the same type of computer he has. Of course, computer manufacturers might be expected to vehemently oppose such a user-dictated standard, since they clearly would like to have their particular input/output scheme adopted as a standard, with the accompanying competitive advantage when such a user goes out to purchase his next machine.

DESIGNING FOR ADAPTABILITY

Defining a standard for use in interfacing peripherals poses more problems than defining a standard for use just with nuclear instruments. However, CAMAC has been designed with enough care that it is easily adaptable to peripheral interfaces.

First, peripherals are not always located close enough to each other to make it desirable for controllers for each device to be in very close proximity to each other. Second, the computer must be interfaced to the bin standard, and the bin controller multiplexes the contents of its bin. For high-data transfer-rate devices (such as a disc), and where multiple bins must be themselves multiplexed at the com-

COMPARISON OF SERIAL AND PARALLEL DATA TRANSFERS

Criterion	Parallel	Serial
Number of wires	Approximately 200 n	4 + n coaxial cables, n being number of remote terminals
	Increases Linearly with word size	Constant with word size change
Transmission time	Typically 0.5 μs for any number of bits*	1.45 μs for 24-bit word with 20-MHz clock. Increases linearly with word size*
Crosstalk and noise	Major problem. Severely limits transmission distances	Not a problem for any practical transmission distance. Delay of clock relative to data is fairly critical
Flexibility in physical location of remote stations (for trouble shooting or to accommodate changing environments)	Extremely cumbersome to move any remote station. Requires special cables and connectors	Trivial since the number of cables is very small and the cables and connectors are standard items
Cost of making connection	Substantial labor involved in making cables. Special drivers and receivers often required because of crosstalk and noise	Very little labor involved in cable construction. No need for special receivers since noise and crosstalk are negligible. Special cable drivers may be required but very few are needed. A shift register is required at the computer and at each remote terminal

*For typical distances to peripheral devices, transit time will not be significant

puter (in addition to multiplexing within each bin), the multiplexing time build-up may get prohibitive. If a device requests computer service from a position within a bin and must wait (1) for the bin to be free, (2) for the bin to request service from the computer and (3) for the computer to be free, the time interval from the initial request to securing computer service may get too long for the device to tolerate. The obvious solution to these problems is the use of "single-device bins." These need not be bins at all, but merely device controllers containing standard CAMAC connectors for connection to the computer-CAMAC interface. Thus, the multiple advantages of standardization are retained without sacrificing flexibility or response time.

THE PROBLEM OF WORD LENGTH

Another problem is that generated by differing word length of different computers: How is it possible to build a peripheral controller to a standard interface without first knowing the word length required?

The answer is that two boxes are built—one for register functions and one for device-control functions. Register functions are word-length oriented rather than computer oriented and may include a word counter, computer-address counter, and word buffer. This box may be common to most of the devices in a system. The device-control functions form the interface of the particular device to the CAMAC standard.

Thus far this discussion has been hypothetical and might seem little related to the serial input/output scheme; it is very much related, however, because in the system under consideration a single interface was developed—serial to CAMAC—then device controllers were produced to CAMAC standards.

This practical application of the CAMAC standard has proven itself quite workable. Indeed, progressively greater advantages are anticipated as CAMAC becomes more familiar as a design standard.

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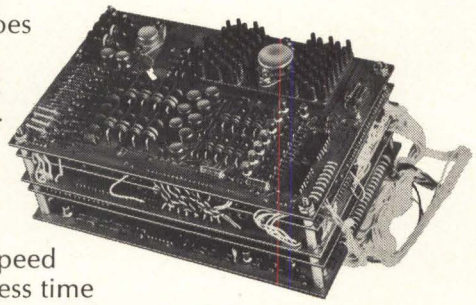
Ugly is only skin deep.



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Use of augmented flip-flop transition tables and octal numbers provides a fast, systematic procedure for transferring synchronous sequential data from a state table to Karnaugh maps

An Efficient Way of Transferring Synchronous Sequential Data

Julian S. Loui

Codex Corporation
Watertown, Massachusetts

Fast and reliable, systematic transference of data from the state table to Karnaugh maps in synchronous sequential-circuit design may be accomplished simply by augmenting with an initial-state column the excitation or transition table of the selected type of memory element and by using octal numbers to code the states and cells in the transition table and maps, respectively.

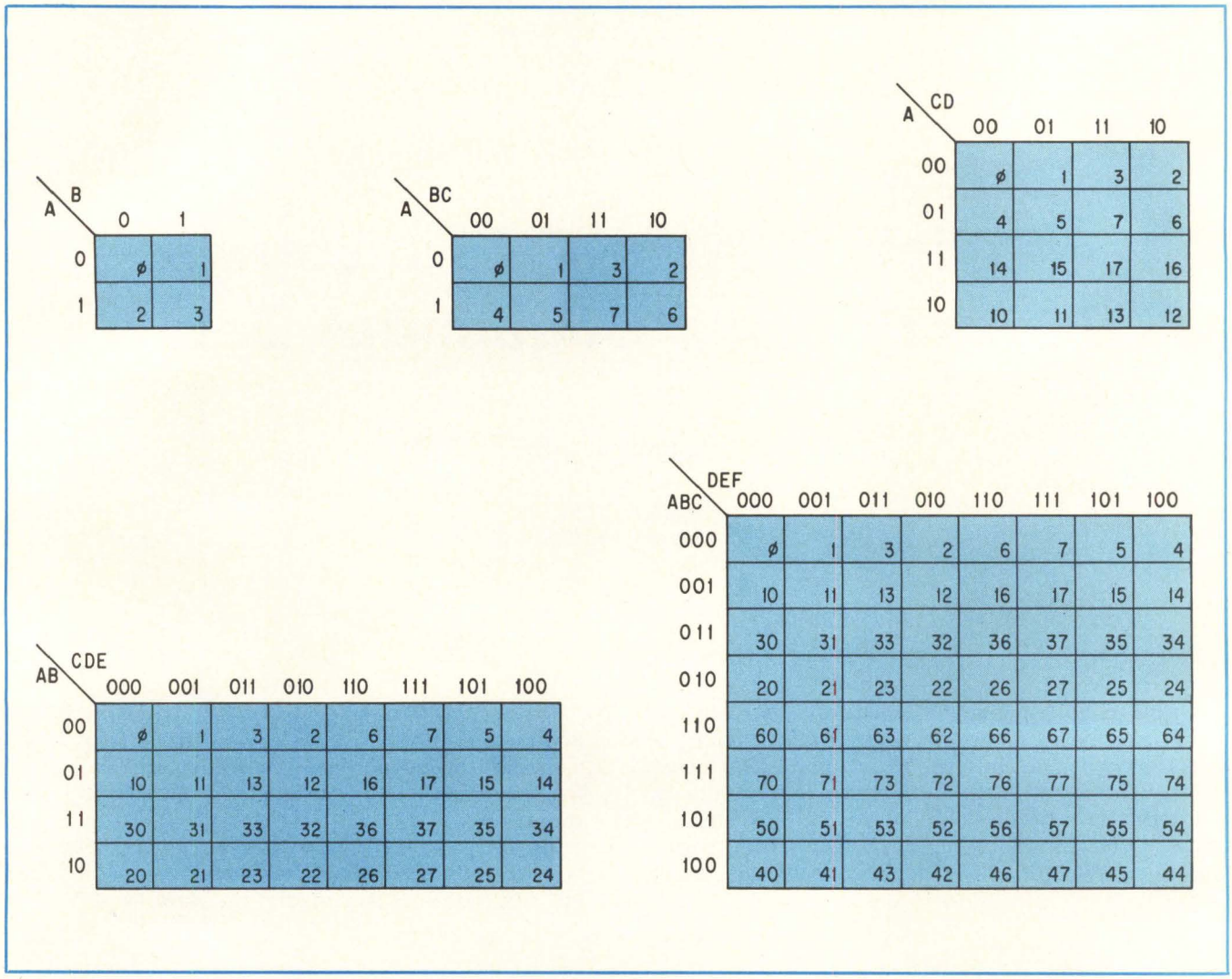
Reference to the augmented J-K, S-R, and D flip-flop transition tables shows that all states from which a flip-flop makes the same transition can be entered together in the appropriate row of the flip-flop's transition table and that once the table is filled, rapid data transfer to the maps can be made. The use of octal numbers greatly facilitates the coding and identification of states in the state table and cells in

TRANSITION	INITIAL STATE(S)	J	K
0 → 0		0	d
0 → 1		1	d
1 → 0		d	1
1 → 1		d	0

TRANSITION	INITIAL STATE(S)	S	R
0 → 0		0	d
0 → 1		1	0
1 → 0		0	1
1 → 1		d	0

TRANSITION	INITIAL STATE(S)	D
0 → 0		0
0 → 1		1
1 → 0		0
1 → 1		1

***Julian S. Loui** is a project engineer and member of the technical staff. He specializes in high-speed data modem circuit design. Mr. Loui received a BEE from the City College of New York and an MSEE from Northeastern University.*



the maps. The augmented excitation table acts as a rapid vehicle between the state table and the maps and provides a useful record for checking purposes.

The procedure offered here consists of:

- first setting up the design's state table with the entry states identified with appropriate equivalent octal numbers
- next deciding on the type of flip-flop to use
- then filling each flip-flop stages augmented transition table
- finally, collectively transferring the data from the transition tables to their respective input-logic Karnaugh maps.

Three complete simple design examples using current TTL J-K elements are provided below for illustration. J-K flip-flops have been selected mainly for their versatility.

EXAMPLE 1. A self-correcting divide-by-3 counter

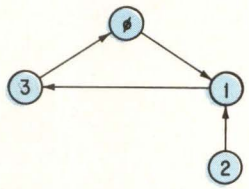
Begin with the counter's state table. The left-hand column designated t_n defines the initial state whereas the right-hand column designated t_{n+1} defines the corresponding subsequent next state. Each state is identified with an equivalent octal number. Also, a state diagram is provided as a pictorial description of the circuit's behavior. Though both are regarded as equivalent, the state table is, from the synthesis standpoint, more convenient to use than the state diagram.

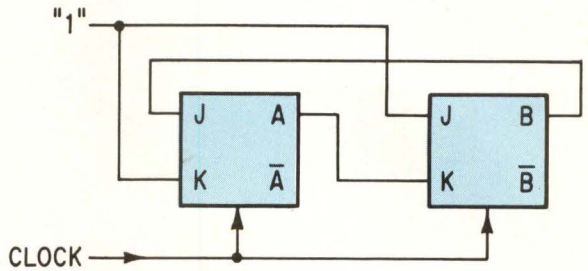
Next select the J-K flip-flop as the basic memory element.

Two augmented J-K transition tables are to be filled, one for A and the other for B. Examination of the state table reveals that A undergoes a 0-to-0 change from state ∅, to 0-to-1 change from state 1, a

EXAMPLE 1

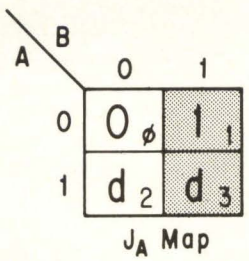
t_n		t_{n+1}		
A	B	A	B	
∅	0	0	0	1	1
1	0	1	1	1	3
3	1	1	0	0	∅
2	1	0	0	1	1



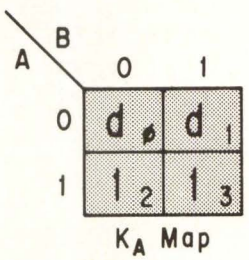


TRANSITION	INITIAL STATE(S)	J_A	K_A
0 → 0	4	0	d
0 → 1	∅, 1, 5	1	d
1 → 0	2, 6	d	1
1 → 1	3, 7	d	0

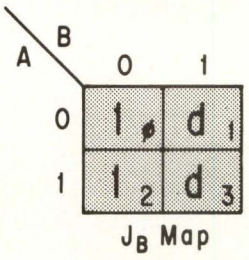
TRANSITION	INITIAL STATE(S)	J_B	K_B
0 → 0	—	0	d
0 → 1	∅, 2	1	0
1 → 0	3	0	1
1 → 1	1	d	0



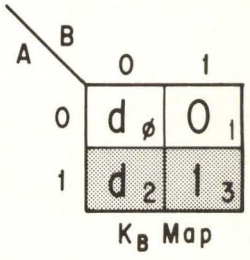
J_A Map



K_A Map



J_B Map



K_B Map

1-to-0 change from states 2 and 3, but no 1-to-1 change; B undergoes no 0-to-0 change, but a 0-to-1 change from states ∅ and 2, a 1-to-0 change from state 3, and a 1-to-1 change from state 1. Regard this information in the appropriate transition tables.

In accordance with the J and K columns of the A transition table, fill in the J_A and K_A Karnaugh maps, respectively, as follows:

J_A MAP

0 in cell ∅ corresponding to initial state ∅
1 in cell 1 corresponding to initial state 1
d (i.e., don't care) in cells 2, 3 corresponding to initial states 2 and 3

K_A MAP

d in cells ∅, 1 corresponding to states ∅ and 1
1 in cells 2, 3 corresponding to states 2 and 3

Similarly, fill in the J_B and K_B maps according to J and K columns of the B transition table.

Now that the maps are completed, finish the design by selecting a simple set of J and K logic equations from them (out of many equally satisfactory sets, needless to say). Arbitrarily the following were chosen:

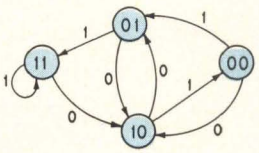
$$J_A = B, \qquad K_A = 1$$
$$J_B = 1, \qquad K_B = A$$

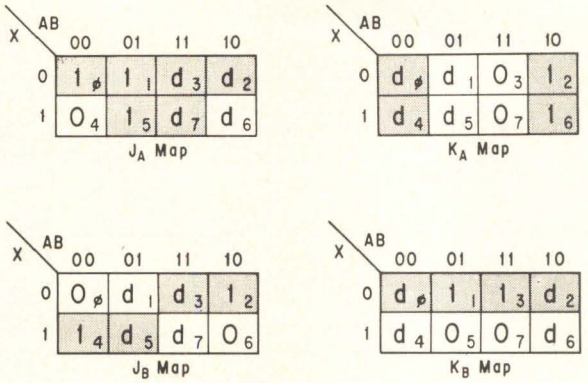
However, for example, the following set could be used just as well:

$$J_A = B, \qquad K_A = A$$
$$J_B = B, \qquad K_B = A$$

EXAMPLE 2

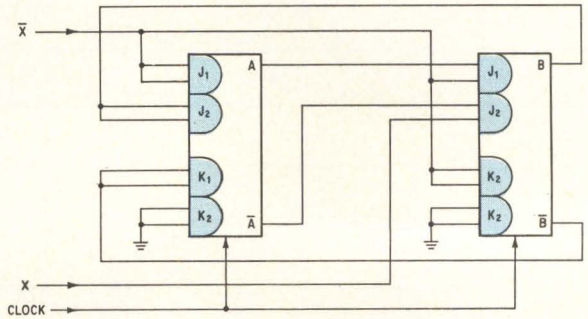
CODED INITIAL STATE	t_n X	A	B	t_{n+1} A	B
ø	0	0	0	1	0
1	0	0	1	1	0
2	0	1	0	0	1
3	0	1	1	1	0
4	1	0	0	0	1
5	1	0	1	1	1
6	1	1	0	0	0
7	1	1	1	1	1





TRANSITION	INITIAL STATE(S)	J_A	K_A
0 → 0	0	0	d
0 → 1	1	1	d
1 → 0	3,2	d	1
1 → 1	—	d	0

TRANSITION	INITIAL STATE(S)	J_B	K_B
0 → 0	ø, 6	0	d
0 → 1	2, 4	1	0
1 → 0	1, 3	0	1
1 → 1	5, 7	d	0



EXAMPLE 2. A 4-state sequential machine with a single input

The single input to the machine is designated X in the state table and the flip-flops are represented by A and B. In order to reduce the number of maps to be used in this problem (from 8 two-variable maps to 4 three-variable maps), the input has been artificially coded into the internal state. Thus, state 2 actually means "if X = 0 when the internal state AB = 10." In the state diagram, which again is intended only to render a pictorial interpretation of the machine's behavior, each directional link is described with a value of X.

Once again select the J-K flip-flop.

Note that A undergoes a 0-to-0 change from 'state' 4, a 0-to-1 change from 'states' ø, 1, and 5, a 1-to-0 change from 'states' 2 and 6, a 1-to-1 change from 'states' 3 and 7. Hence, the A transition table is seen to list (4), (ø, 1, 5), (2, 6), and (3, 7) on its first, second, third, and fourth row, respectively. The B transition table is arrived at similarly.

Now fill the J_A, K_A, J_B, K_B maps each in three collective steps as below.

J_A MAP	K_A MAP
0 in cell 4	0 in cells 3, 7
1 in cells ø, 1, 5	1 in cells 2, 6
d in cells 2, 6, 3, 7	d in cells 4, ø, 1, 5
J_B MAP	**K_B MAP**
0 in cells ø, 6	0 in cells 5, 7
1 in cells 2, 4	1 in cells 1, 3
d in cells 1, 3, 5, 7	d in cells ø, 6, 2, 4

It becomes apparent then that the following can be selected as a simple set of design equations:

$$J_A = \overline{X} + B, \qquad K_A = \overline{B}$$

$$J_B = X\overline{A} + \overline{X}A, \qquad K_B = \overline{X}$$

EXAMPLE 3. A modulo-16 gray-code counter

For simplicity, the state table of this problem is presented as a state sequence which lists the states of the counter sequentially. If any state (row) is considered as an initial state, then the state appearing immediately below is the corresponding next state.

As before, choose the J-K flip-flop.

From the state sequence note that flip-flop A undergoes a 0-to-0 change from states Ø, 1, 3, 2, 6, 7, and 5, a 0-to-1 change from state 4, a 1-to-0 change from state 10, and a 1-to-1 change from states 14, 15, 17, 16, 12, 13, and 11. Enter these four groups of states into the appropriate rows of the augmented J-K transition table for flip-flop A. Treat the other three flip-flops' data in the same manner.

Referring to the A, B, C, and D transition tables, fill in their J and K maps each in three collective steps as below.

J_A MAP	K_A MAP
0 in cells Ø, 1, 3, 2, 6, 7, 5	0 in cells 14, 15, 17, 16, 12, 13, 11
1 in cell 4	1 in cell 10
d in cells 10, 14, 15, 17, 16, 12, 13, 11	d in cells Ø, 1, 3, 2, 6, 7, 5, 4

EXAMPLE 3

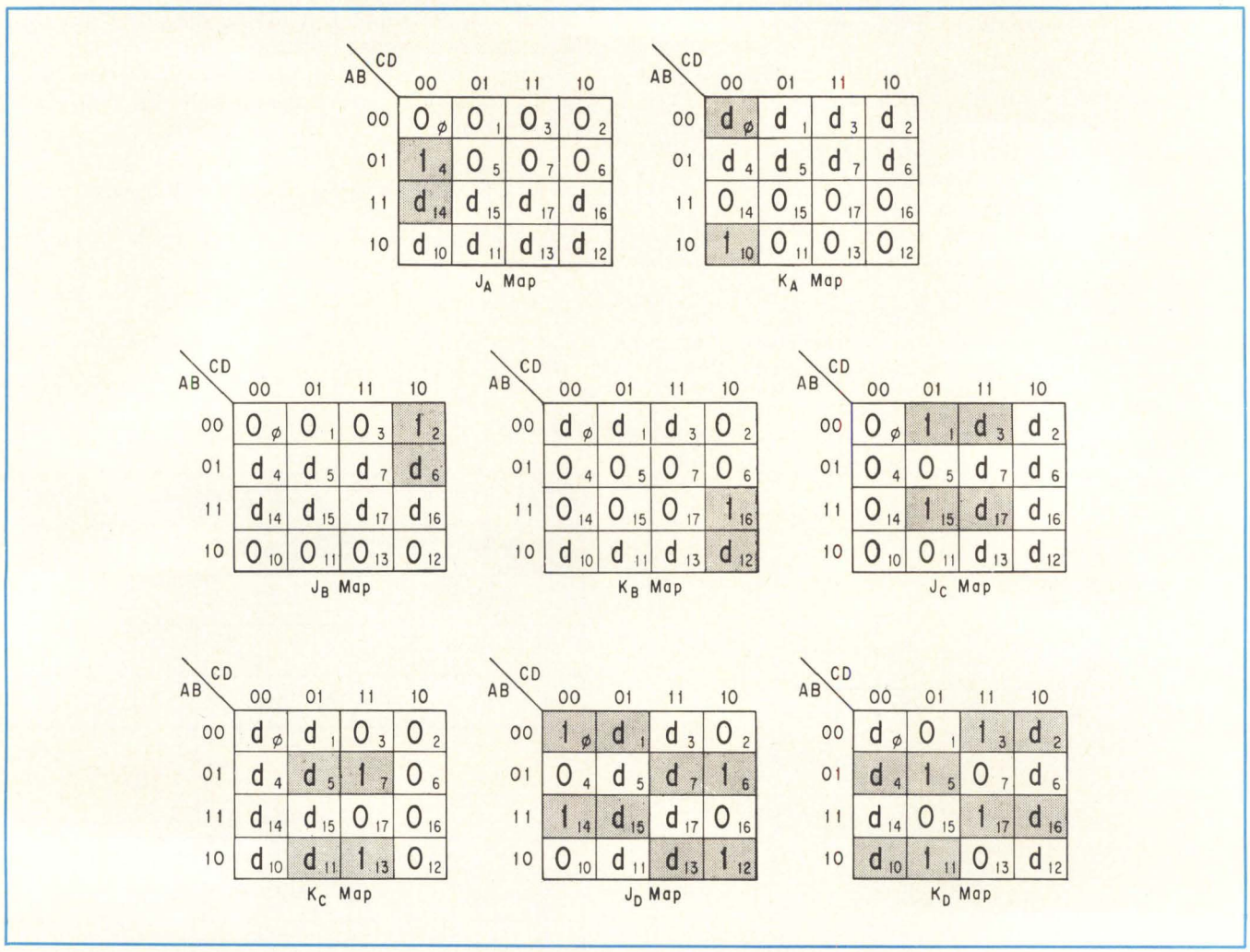
STATE IN OCTAL CODE	A	B	C	D
ø	0	0	0	0
1	0	0	0	1
3	0	0	1	1
2	0	0	1	0
6	0	1	1	0
7	0	1	1	1
5	0	1	0	1
4	0	1	0	0
14	1	1	0	0
15	1	1	0	1
17	1	1	1	1
16	1	1	1	0
12	1	0	1	0
13	1	0	1	1
11	1	0	0	1
10	1	0	0	0
ø	0	0	0	0

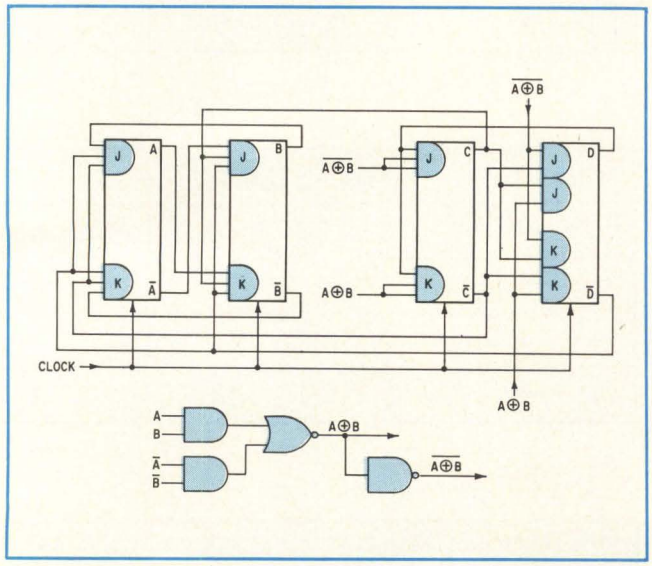
TRANSITION	INITIAL STATE(S)	J_A	K_A
0 → 0	Ø,1,3,2,6,7,5	0	d
0 → 1	4	1	d
1 → 0	10	d	1
1 → 1	14,15,17,16,12,13,11	d	0

TRANSITION	INITIAL STATE(S)	J_B	K_B
0 → 0	Ø,1,3,12,13,11,10	0	d
0 → 1	2	1	0
1 → 0	16	d	1
1 → 1	6,7,5,4,14,15,17	d	0

TRANSITION	INITIAL STATE(S)	J_C	K_C
0 → 0	Ø,5,4,14,11,10	0	d
0 → 1	1,15	1	d
1 → 0	7,13	d	1
1 → 1	3,2,6,17,16,12	d	0

TRANSITION	INITIAL STATE(S)	J_D	K_D
0 → 0	2,4,16,10	0	d
0 → 1	Ø,6,14,12	1	0
1 → 0	3,5,17,11	d	1
1 → 1	1,7,15,13	d	0





J_B MAP

0 in cells Ø, 1, 3, 12, 13, 11, 10

1 in cell 2

d in cells 16, 6, 7, 5, 4, 14, 15, 17

K_B MAP

0 in cells 6, 7, 5, 4, 14, 15, 17

1 in cell 16

d in cells Ø, 1, 3, 12, 13, 11, 10, 2

J_C MAP

0 in cells Ø, 5, 4, 14, 11, 10

1 in cells 1, 15

d in cells 7, 13, 3, 2, 6, 17, 16, 12

K_C MAP

0 in cells 3, 2, 6, 17, 16, 12

1 in cells 7, 13

d in cells Ø, 5, 4, 14, 11, 10, 1, 15

J_D MAP

0 in cells 2, 4, 16, 10

1 in cells Ø, 6, 14, 12

d in cells 3, 5, 7, 11, 1, 7, 15, 13

K_D MAP

0 in cells 1, 7, 15, 13

1 in cells 3, 5, 17, 11

d in cells 2, 4, 16, 10, Ø, 6, 14, 12

It is clear from inspecting the maps that one possible set of J-K equations consists of:

$$J_A = B\,\overline{C}\,D, \qquad K_A = \overline{B}\,\overline{C}\,\overline{D}$$
$$J_B = \overline{A}\,C\,\overline{D}, \qquad K_B = A\,C\,\overline{D}$$
$$J_C = D \cdot \overline{A \oplus B}, \qquad K_C = D \cdot A \oplus B$$
$$J_D = \overline{C} \cdot \overline{A \oplus B} + C \cdot A \oplus B$$
$$K_D = \overline{C} \cdot A \oplus B + C \cdot \overline{A \oplus B}$$

CONCLUSION

This data-transfer method can be applied to incompletely specified state tables also. A state table is said to be incompletely specified if it contains states whose subsequent next states are not given. These unused initial states generally fall into two classes, namely (1) impossible (hence don't care) states and (2) unwanted (or forbidden) states. Impossible states may be due to automatic initialization or resetting via asynchronous inputs and/or unique input conditions. All forbidden states must eventually lead back to the used (specified) states. Once the used-state data have been recorded in the maps, cells related to unused states can be filled in as follows. Cells corresponding to impossible states can arbitrarily be assigned logic values with a view to attaining an overall optimum solution. However, as for forbidden states, it is possible, as in normal practice, to tentatively assign logic values to their associated cells in the maps so as to achieve a best solution. This (logic-equation) solution is next tested to insure that each unwanted state leads eventually back to the used states. Otherwise, a new (and probably less simple) solution must be assumed by reassigning values to the unwanted states' cells and tested until a valid solution is obtained. If a table involves only a few forbidden states, it is always possible to circumvent the problem by arbitrarily returning the unwanted states to the used states with the likely consequence of using extra hardware. The table is therefore completely specified.

APPENDIX: Input Conversion Equations for Synchronous Memory Elements

Frequently it is useful to have available a set of input conversion equations between the common types of flip-flops operated in the synchronous mode. In general, input logic equations converted from one type of flip-flop to another may not yield as simple a solution as if they had been derived directly. Nevertheless, this drawback does not completely negate the value of input conversion equations.

A set of conversion equations between the common flip-flop types has been obtained by a straightforward application of the method presented in the preceding article. It has been assumed that the condition $R = S = 1$ is forbidden.

CONVERSION TABLE

Conversion from J-K Type with known J,K Inputs:

$$S = J\overline{Q} \qquad R = KQ \tag{1}$$
$$D = J\overline{Q} + \overline{K}Q \tag{2}$$
$$T = J\overline{Q} + KQ \tag{3}$$

Conversion from R-S Type with known R,S Inputs:

$$D = S + \overline{R}Q \tag{4-a}$$
$$D = \overline{R}S + \overline{R}Q = \overline{R}(S + Q) \tag{4-b}$$
$$T = S\overline{Q} + RQ \tag{5-a}$$
$$T = \overline{R}S\overline{Q} + R\overline{S}Q \tag{5-b}$$
$$J = S \qquad K = R \tag{6-a}$$
$$J = S\overline{Q} \qquad K = RQ \tag{6-b}$$

Conversion from D Type with known D Input:

$$S = D \qquad R = \overline{D} \tag{7-a}$$
$$S = D\overline{Q} \qquad R = \overline{D}Q \tag{7-b}$$
$$J = D \qquad K = \overline{D} \tag{8-a}$$
$$J = D\overline{Q} \qquad K = \overline{D}Q \tag{8-b}$$
$$T = D \oplus Q = D\overline{Q} + \overline{D}Q \tag{9}$$

Conversion from T Type with known T Input:

$$S = T\overline{Q} \qquad R = TQ \tag{10-a}$$
$$S = T \oplus Q = T\overline{Q} + \overline{T}Q \qquad R = \overline{T \oplus Q} = TQ + \overline{T}\,\overline{Q} \tag{10-b}$$
$$D = T \oplus Q = T\overline{Q} + \overline{T}Q \tag{11}$$
$$J = T \qquad K = T \tag{12-a}$$
$$J = T\overline{Q} \qquad K = TQ \tag{12-b}$$

Q is flip-flop's output

ILLUSTRATION

Implement a 4-bit maximum-length shift-register counter W X Y Z whose input equations are $D_w = W \oplus Z$, $D_x = W$, $D_y = X$ and $D_z = Y$, using J-K flip-flops.

Essentially D_w, D_x, D_y and D_z are D-type equations and the problem here is one of writing J_w, K_w, J_x, K_x, J_y, K_y, J_z and K_z in terms of D_w, D_x, D_y and D_z.

Clearly from equations (8-a) or experience

$$J_x = D_x = W, \qquad K_x = \overline{D}_x = \overline{W}$$
$$J_y = D_y = X, \qquad K_y = \overline{D}_y = \overline{X}$$
$$J_z = D_z = Y, \qquad K_z = \overline{D}_z = \overline{Y}$$

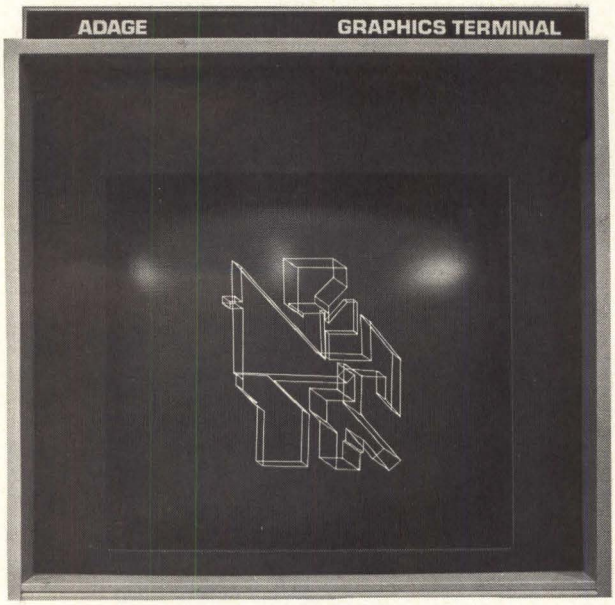
However, it is more advantageous to express J_w and K_w in terms of equations (8-b) instead of equations (8-a) in order to obtain a simpler solution.

$$J_w = D_w\,\overline{W} = (W \oplus Z)\,\overline{W} = Z\overline{W}$$
$$K_w = \overline{D}_w\,W = (\overline{W \oplus Z})\,W = ZW$$

Since equations (12-b) are identical to $J_w = \overline{W}Z$, $K_w = WZ$ with $Z = T$ and are equivalent to equations (12-a), it follows that

$$J_w = K_w = Z$$

Comparison between $D_w = Z \oplus W$ and equation (11) also reveals Z as a toggle function and therefore leads to the same conclusion $J_w = K_w = Z$.



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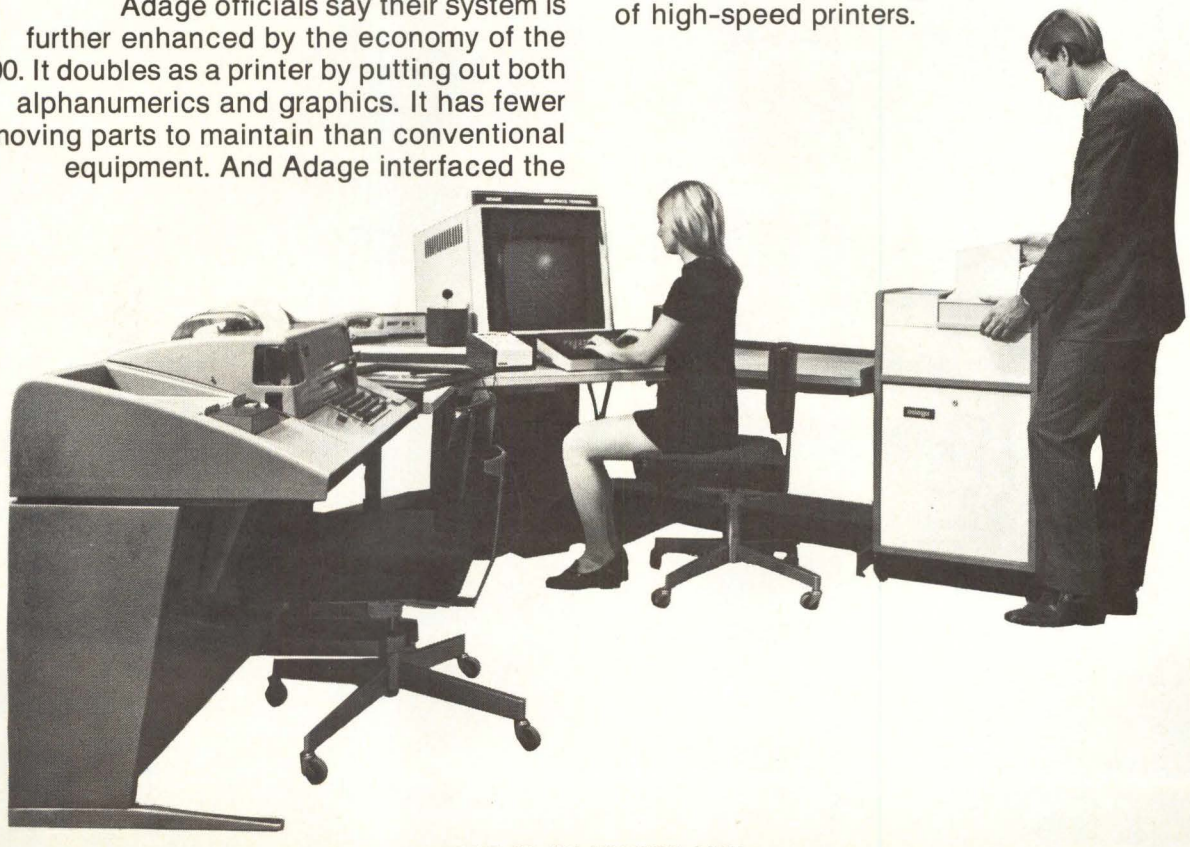
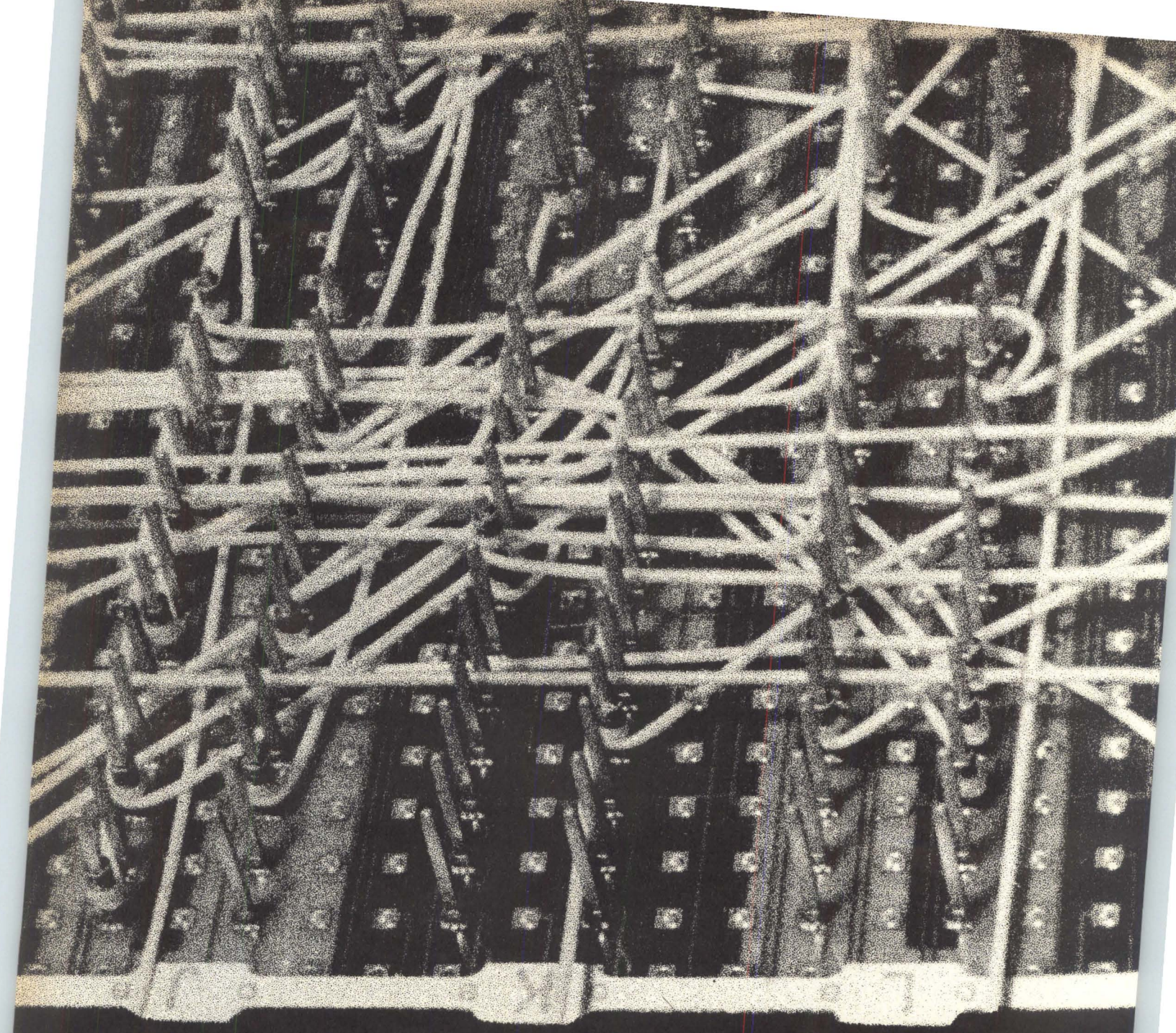


CIRCLE 38 ON INQUIRY CARD



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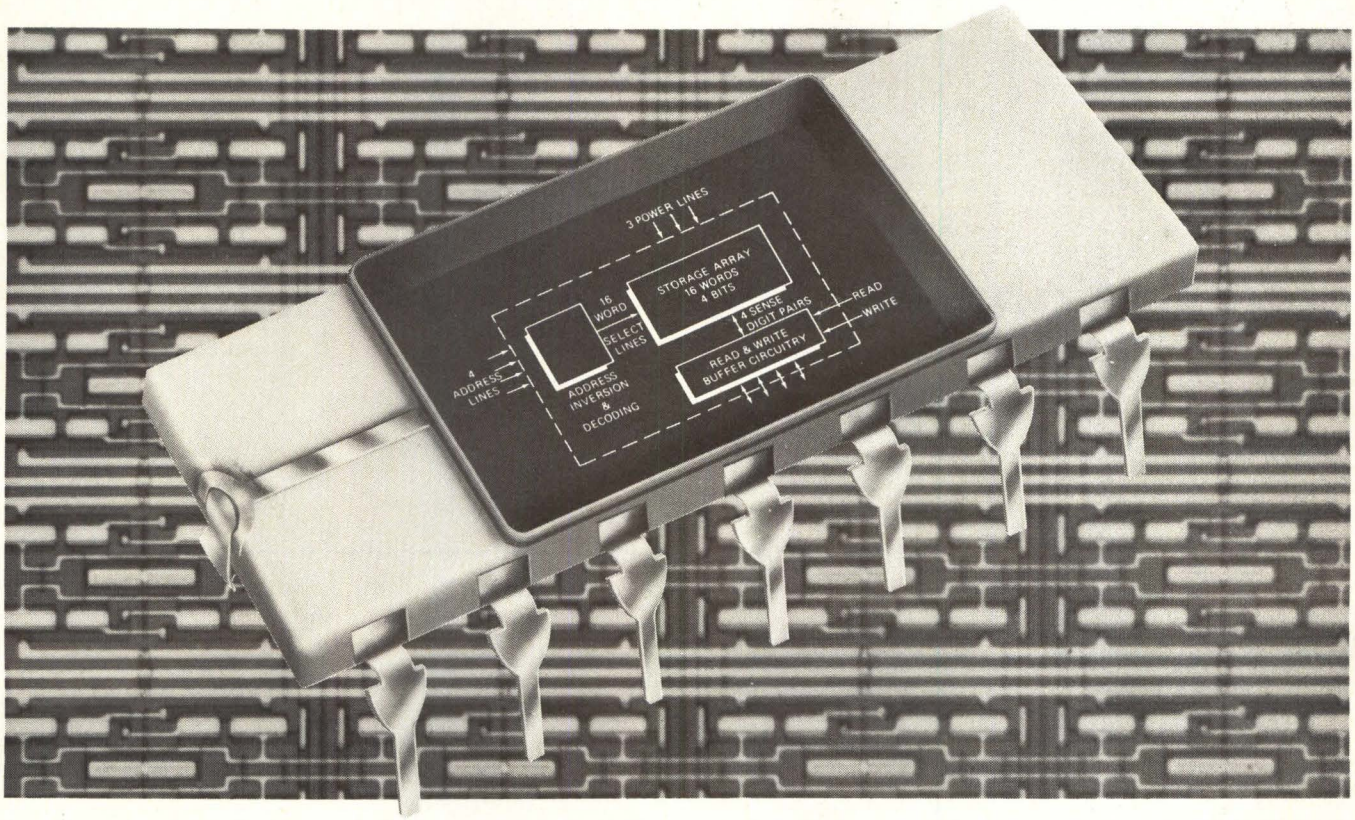

The MC1170L – Fastest MOS Memory Available

High performance and low cost neatly sum up the characteristics of Motorola's MC1170L 64-Bit MOS Random Access Memory. Designed for use in 500 ns or less access time systems, the memory is organized as 16 words of 4 bits each and features a typical access time of 250 ns. Decoding, Read, Write and Storage circuitry are all contained on the 80-mil square chip, thereby minimizing interconnection requirements and fabrication costs. And when cost is a prime consideration the MC1170's production quantity low bit cost overshadows higher 50¢/bit costs for 16-bit bipolar memories and 25-to 50¢/bit costs for magnetic memories (4,000-bit systems).

A word in the memory is addressed by applying the appropriate binary code to the four address lines. Separate read and write inputs control the mode of operation. During operation, four bit lines insert data into the memory in the write mode and sense the stored information in the read mode.

The MC1170L is flexible for expansion to larger memory systems. The binary addressing characteristic, the bit line wired OR capability and the availability of the enable input all aid in expanding the MC1170L to meet larger system requirements.

Use the MC1170L anywhere that low speeds and low data rates are required. Since the readout is nondestructive the MC1170L offers advantages over magnetostrictive delay lines. And, its comparative low-cost/high performance/small-size ratio suggests applications in digital instrumentation, miniaturized data processing equipment and advanced office machines.

Now's the time to start thinking of your system. To help you out we have a new application note (AN-501) which explains the MC-1170L in detail. It's yours for the asking — just write to P.O. Box 20912, Phoenix, Arizona 85036. And for immediate evaluation units call your local Motorola distributor. Make this a day you'll remember with fond memories.

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← CIRCLE 39 ON INQUIRY CARD

CIRCLE 40 ON INQUIRY CARD

1970 IEEE International Convention and Exhibition

New York Coliseum and New York Hilton Hotel
March 23-26

"Launching the Spectacular '70s in Electrical and Electronic Engineering" is the theme of this year's IEEE major electronics convention.

Fifty-one technical sessions will be held at the Hilton Hotel from 9:30 a.m. to 12:00 noon and from 2:00 to 4:30 p.m. Monday through Thursday. Technical application sessions will also take place daily on the fourth floor of the Coliseum from 10:30 a.m. to 1:00 p.m. and from 2:30 to 5:30 p.m. In addition play/panel discussions will be held Monday and Tuesday and special group-sponsored sessions will be held on Wednesday and Thursday in the Hilton at varied times.

The highlight session, "Planning for Change," will be held Monday evening from 8:00 to 10:30 in the Trianon Ballroom of the Hilton and the keynote session, "The Emerging Seventies," will be held Tuesday evening from 8:00 to 10:30 in the Hilton's Grand Ballroom.

The IEEE exhibition at the Coliseum will be open from 10:00 a.m. to 8:00 p.m. daily, Monday through Thursday. The first floor will be set aside for production equipment and such service organizations as publishers and consultants. The second floor will be restricted to systems and instruments. The third and fourth floors will be devoted to components, with all microwave components included in the third floor exhibits. There will be a free shuttle bus service between the Coliseum and the Hilton.

You may register at either the Hilton or the Coliseum. Registration hours at the Hilton are from 2:00 to 8:00 p.m. on Sunday, March 22, and from 9:00 a.m. to 5:00 p.m. daily during the convention, except for Monday and Tuesday when the registration period is extended to 8:00 p.m. because the highlight and keynote sessions are held those evenings. Registration hours at the Coliseum are from 9:00 a.m. to 8:00 p.m., Monday through Thursday. Registration fees are $4 for all IEEE members and group affiliates and members of the military services including civilian employees of government establishments. Non-members may register for $8 and women accompanied by a registered guest may register for $2.

A Convention Digest will be available at special booths at both the Coliseum and the Hilton. During the convention, one copy of the digest will be available to IEEE members at $3; additional copies will be $5 per copy. Non-members may purchase copies at $5 each at the convention. After the convention, copies for members will be $5 each and for non-members, $7.

TECHNICAL PROGRAM EXCERPTS

Monday Morning, March 23 9:30-12:00

Session 1A — Trianon Ballroom

Electro-Acousto-Opto-Magneto-Elasto-Interactions

Chairman and Organizer: A. Rose, RCA, Princeton, N.J.

"Properties of Magnetic 'Bubble' Domains," A. H. Bobeck, BTL, Murray Hill, N.J.

"Applications of Non-Linear Optics," I. P. Kaminow, BTL, Holmdel, N.J.

"Upconversion: A New Technique for Infrared to Visible Image Conversion," A. H. Firester, RCA, Princeton, N.J.

"Acousto-Electric Interactions," A. R. Moore, RCA, Princeton, N.J.

Session 1C — Sutton Ballroom North

Computer Techniques in Urban Management

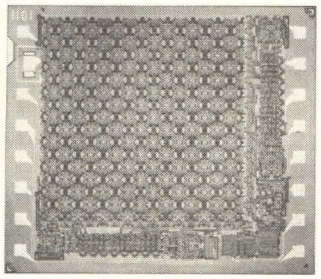
Chairman and Organizer: E. S. Savas, Office of the Mayor, New York, N.Y.

"Computer Techniques in Urban Government," S. Simich, Touche Ross Co., New York, N.Y.

"The Chicago Story," R. Golden, Civic Center Building, Chicago, Ill.

"The New York Story," H. B. Lipton, Office of the Mayor, New York, N.Y.

INTEL BOMBS THE PRICES ON LSI MEMORIES



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Quantity	Model 1101 (256-bit MOS) Old	Model 3101 (64-bit bipolar) Old	Both New
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10 - 24	$110	$74.00	$40.00
25 - 99	$ 80	$53.00	$32.50
100 - 249	$ 65	$43.00	$26.50
250 - 999	—	—	$26.50
1000 - 2000	—	—	$23.50

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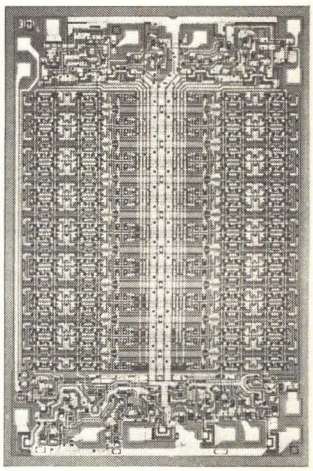

Model 3101, a 64-bit bipolar RAM with 60 ns maximum access, drops in price by 38% to 60%.

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CIRCLE 41 ON INQUIRY CARD

Session 1G — Gramercy Suite

Computer-Controlled Testing of LSI

Chairman and Organizer: M. R. Barber, BTL, Murray Hill, N.J.

"Techniques and Equipment for LSI Testing," G. C. Padwick, Fairchild Instrumentation, Sunnyvale, Calif.

"Systems Consideration for Dynamic Testing of LSI," J. G. Salvador, Teradyne Dynamic Systems, Inc., Encino, Calif.

"Computer Controlled Test Systems for IC Memory," C. W. Green, BTL, Allentown, Pa.

"Dynamic Test Systems for LSI Arrays," Conrad J. Boisvert, Jr., Cogar Corp., Wappingers Falls, N.Y.

Monday Afternoon, March 23 — 2:00-4:30

Session 2A — Trianon Ballroom

Optoelectronics: New Advances in Light Emitting Diodes and Other Display Devices

Chairman and Organizer: J. H. Rowen, BTL, Murray Hill, N.J.

"The Evolution in Gallium Arsenide Phosphide Injection Electroluminescent Displays," J. C. Barrett, Hewlett-Packard Co., Palo Alto, Calif.

"Red and Green Light Emission from Gallium Phosphide Diodes," W. Rosenzweig, BTL, Murray Hill, N.J.

"Visible Light Emission from Gallium Aluminum Arsenide," M. R. Lorenz, IBM, Yorktown Heights, N.Y.

"Efficient Infrared-Excited Visible Luminescence in Rare Earth Systems," R. A. Hewes, GE, Nela Park, Cleveland, Ohio

"DC Gas Discharge Panel Display," W. J. Harman, Jr., Burroughs Corp., Plainfield, N.J.

Session 2C — Sutton Ballroom North

Artwork Generation for Integrated Circuits

Chairman and Organizer: H. H. Loar, Western Electric, New York, N.Y.

"Integrated Circuit Design Automation," J. Narud, Motorola, Inc., Phoenix, Ariz.

"A Rotating Mirror Pattern Generator," K. M. Poole, BTL, Murray Hill, N.J.

"An Electron Beam Pattern Generator," W. R. Samaroo, J. Raamot, and P. D. Parry, Western Electric, Princeton, N.J.

"A Precision Computer Controlled Step and Repeat Camera," J. W. Elek, BTL, Allentown, Pa.

Session 2G — Gramercy Suite

Software for the '70s

Chairman and Organizer: W. R. Beam, Data Plus, Inc., White Plains, N.Y.

"Operating Systems: Present and Future," P. Denning, Princeton University, Princeton, N.J.

"The Implementation of Operating Systems," R. A. Creech, Burroughs Corp., Pasadena, Calif.

"Time-Sharing and Its Influence on Computer Software," A. S. Lett, IBM, Yorktown Heights, N.Y.

"Recent Developments in Programming Languages," P. Wegner, Brown University, Providence, R.I.

Monday Evening, March 23 — 8:00-10:30

Highlight Session — Trianon Ballroom

Planning for Change

Moderator: J. A. Morton, Vice President, BTL

Organizer: D. G. Marquis, Director of Sloan School, MIT

"An Industrial View," M. Shepherd, Jr., President, Texas Instruments, Inc.

"A Government View," The Honorable R. C. Seamans, Jr., Secretary of the Air Force

"A University View," K. S. Pitzer, President, Stanford University

Tuesday Morning, March 24 — 9:30-12:00

Session 3A — Trianon Ballroom

Achieving MOS-Bipolar Compatibility

Chairman and Organizer: R. M. Warner, Jr., Union Carbide, San Diego, Calif.

"Bipolar-MOS Trade-Offs in Memory Design," E. Alexander, BTL, Allentown, Pa.

"Current Directions in MOS-Bipolar Interfacing," R. H. Crawford, MOSTEK, Dallas, Tex.

"A Bipolar-Compatible MOS Read-Only Memory, R. Goldin, Union Carbide, San Diego, Calif.

"MOS-Bipolar LSI Memory," W. R. Raisanen, Motorola, Phoenix, Ariz.

"Circuit and System Aspects of Variable-Threshold FETs," L. J. Ragonese, GE, Syracuse, N.Y.

Session 3D — Sutton Ballroom South

What's New In Video Displays

Chairman and Organizer: R. D. Ketchpel, Electro Vision Industries, Inc., El Segundo, Calif.

"Performance Characteristics of the New Single-Gun-Light Valve Color TV Video Projector," W. E. Good and T. True, GE, Syracuse, N.Y.

"Flat Panel Display," G. R. Kaelin, Litton Data Systems, Van Nuys, Calif.

"High Contrast Cathode Ray Tube," G. Steele, Sigmatron, Inc., Santa Barbara, Calif.

"The Lithocon Silicon Storage Tube," F. P. Heiman, S. R. Hofstein, and A. Waxman, Princeton Electronic Products, Princeton Junction, N.J.

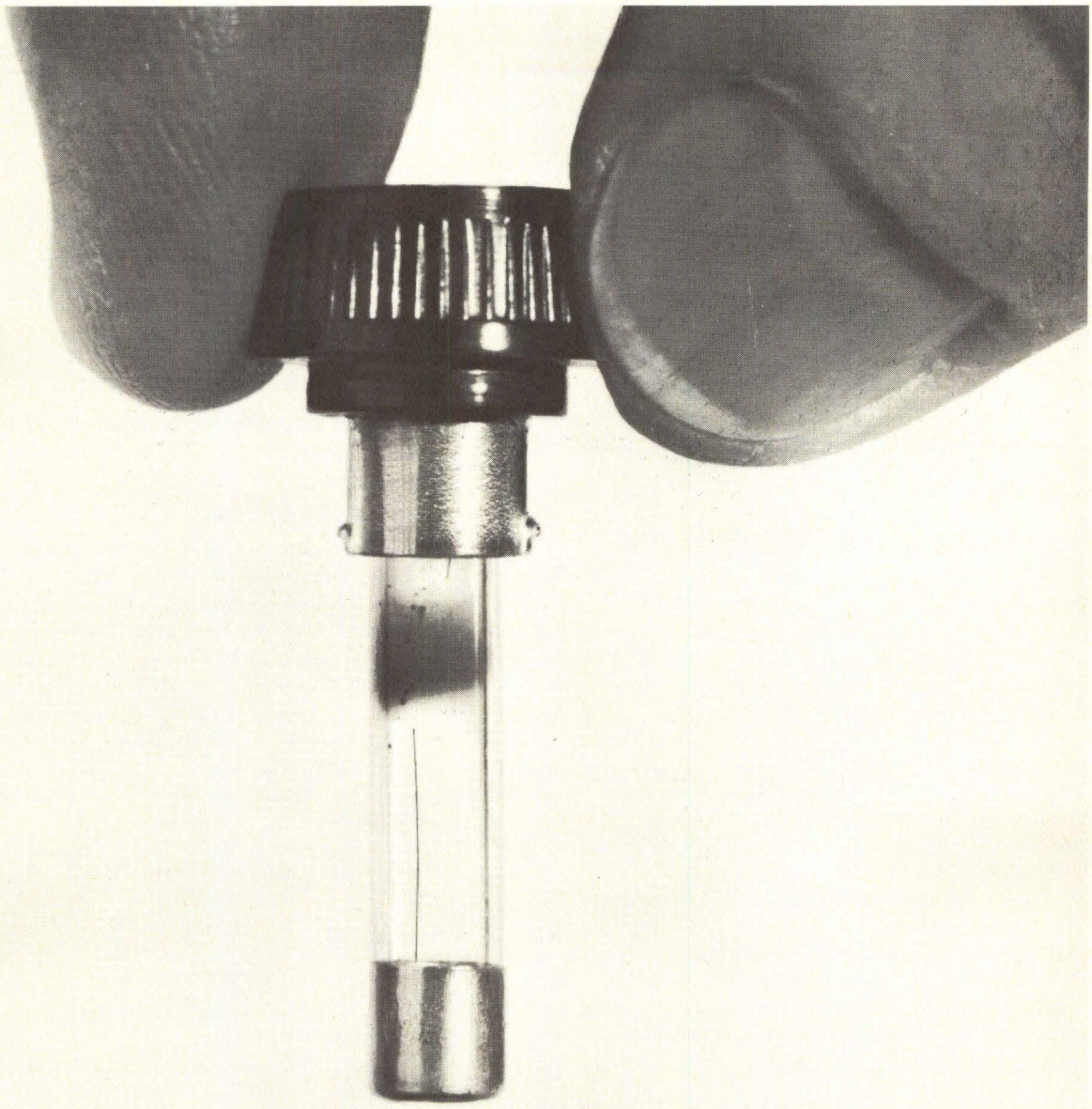
Session 3F — Murray Hill Suite

Systems Engineering—How Can We Use It Effectively

Organizers: H. Manoogian, Grumman Aerospace Corp., Bethpage, N.Y. and J. Reitman, Norden Div., United Aircraft Corp., Norwalk, Conn.

Moderator: The Honorable R. A. Frosch, Assistant Secretary of the Navy (R&D)

Panelists: E. Fubini, Consultant, New Canaan, Conn.; H. Chestnut, GE, Schenectady, N.Y.; R. E. O'Donohue, Defense Dept. R&E, Washington, D.C.; and J. A. Baird, BTL, Holmdel, N.J.



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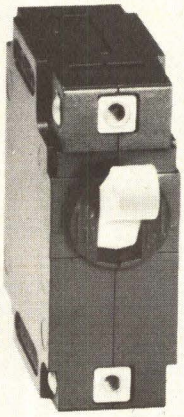

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CIRCLE 42 ON INQUIRY CARD

Session 3G — Gramercy Suite

Interactive Terminals—The Search for Cost and Performance

Chairman and Organizer: J. E. Ward, MIT, Cambridge, Mass.

"Standard Touch-Tone Telephone as an Interactive Computer Terminal," F. H. Westervelt and D. B. Smith, University of Michigan, Ann Arbor

"A Magnetic Tape Device for Use with Teletypewriter Terminals," I. S. King, Teletype Corp., Skokie, Ill.

"A New Computer Driven Display," C. K. Megla, Corning Glass Works, Raleigh, N.C.

"Design Trade-Offs in a Low-Cost Programmable Graphic Display," E. W. Pugh, Jr. and J. E. Cunningham, Imlac Corp., Waltham, Mass.

Tuesday Afternoon, March 24 — 2:00-4:30

Session 4A — Trianon Ballroom

Integrated Silicon Devices—A Projection Through the '70s

Moderator: J. D. Meindl, Stanford University, Stanford, Calif.

Organizer: J. A. A. Raper, GE, Syracuse, N.Y.

Panelists: R. N. Noyce, Intel Corp., Mountain View, Calif.; J. S. Kilby, Texas Instruments, Dallas, Texas; E. Blanchette, Fairchild Semiconductor Div., Mountain View, Calif.; and W. S. Boyle, BTL, Murray Hill, N.J.

Session 4B — Mercury Ballroom

Digital Processing of Analog Signals

Chairman and Organizer: C. M. Rader, MIT Lincoln Lab, Lexington, Mass.

"A Digital Frequency Synthesizer," J. Tierney, MIT Lincoln Lab, Lexington, Mass.

"A Design Technique for Nonrecursive Digital Filters," L. R. Rabinar and B. Gold, BTL, Murray Hill, N.J.

"A Method of Generating Gaussian Random Numbers by Computer," C. M. Rader, MIT Lincoln Lab, Lexington, Mass.

"Applications of Digital Waveform Processing in Radar," H. D. Helms, BTL, Whippany, N.J.

"Digital Filter Building Blocks from LSI Technology," W. A. Clapp, RCA, Camden, N.J.

Session 4G — Gramercy Suite

Computer Graphics in Action

Chairman and Organizer: C. Machover, Information Displays, Inc., Mt. Kisco, N.Y.

"Computer Graphics at a Small Diversified Research Center," J. B. MacDonald, Western Electric, Princeton, N.J.

"Application of Interactive Graphics at Ford Motor Co.," G. Partington, Ford Motor Co., Dearborn, Mich.

"Interactive Display Systems for Management Planning," T. M. Albert and W. E. Workman, Westinghouse Elec. Corp., Pittsburgh, Pa.

"Use of Computer Graphics in Computer Aided Design of LSI Equipment," A. Spitalny, Solid State Data Sciences Corp., Hauppage, N.Y.

Tuesday Evening, March 24 — 8:00-10:30

Keynote Session — Grand Ballroom

The Emerging '70s

Moderator: H. H. Heffner, Deputy Director of the Office of Science and Technology, Executive Office of the President

Organizer: W. O. Fleckenstein, General Manager, Research and Development, Western Electric Co.

"Materials and Device Technology," Dr. C. L. Hogan, President, Fairchild Camera and Instrument Corp.

"Computers," B. O. Evans, President, Systems Development Division, IBM

"Communications," Dr. J. P. Molnar, Executive Vice President, BTL

"Technology and Society," The Honorable E. Q. Daddario, Chairman, Subcommittee on Science Research and Development, U.S. House of Representatives

Wednesday Morning, March 25 — 9:30-12:00

Session 5C — Sutton Ballroom North

Gigabit Digital Circuits

Chairman and Organizer: L. W. Cotten, National Security Agency, Fort George G. Meade, Md.

"Feedback Current Switching Circuits—General Concepts," L. Weiss and K. F. Mathews, IBM, Poughkeepsie, N.Y.

"Interconnection of ECL Circuits for Maximum Gate Density," C. Garth, Texas Instruments, Dallas, Tex.

"Packaging Aspects of Gigabit Digital Circuits," W. T. Rhoades, Hughes Aircraft, Fullerton, Calif.

"A/D and Multiplexers for Hundreds of Megabits," R. V. Cotton, R. D. Vernot, and J. R. Galbraith, Philco-Ford, Willow Grove, Pa.

"Ultra High-Speed Digital Array Testing," J. B. Connolly and Yohn Cho, Tau-Tron, Lowell, Mass.

Session 5G — Gramercy Suite

The Minicomputer Phenomenon

Chairman and Organizer: L. C. Hobbs, Hobbs Associates, Inc., Corona del Mar, Calif.

"System Architecture for Minicomputers," G. C. Hendrie, Honeywell, Framingham, Mass.

"The Softwhere and Softwhen of Minicomputers," D. E. Ferguson, Programmatics, Inc., Los Angeles, Calif.

"Peripheral Equipments for Minicomputers," L. W. Vincent, Lockheed Electronics Corp., Los Angeles, Calif.

"Advanced Applications for Minicomputers," W. H. Davidow, Hewlett-Packard Co., Palo Alto, Calif.

"Impact of LSI on Future Minicomputers," M. E. Hoff, Jr., Intel Corp., Mountain View, Calif.

Wednesday Afternon, March 25 — 2:00-4:30

Session 6A — Trianon Ballroom

Optic-Magnetic-Semiconductor-Memory

Chairman and Organizer: H. E. D. Scovil, BTL, Murray Hill, N.J.

"Magnet Memories of the '70s," P. A. Harding, Electronic Memories, Inc., Hawthorne, Calif.

"Semiconductor Memory," R. Rice, Fairchild Semiconductor Research, Palo Alto, Calif.

"Disk Files," A. W. O'Sullivan, Digital Development Corp., San Diego, Calif.

"Optical Memory," J. A. Rajchman, RCA, Princeton, N.J.

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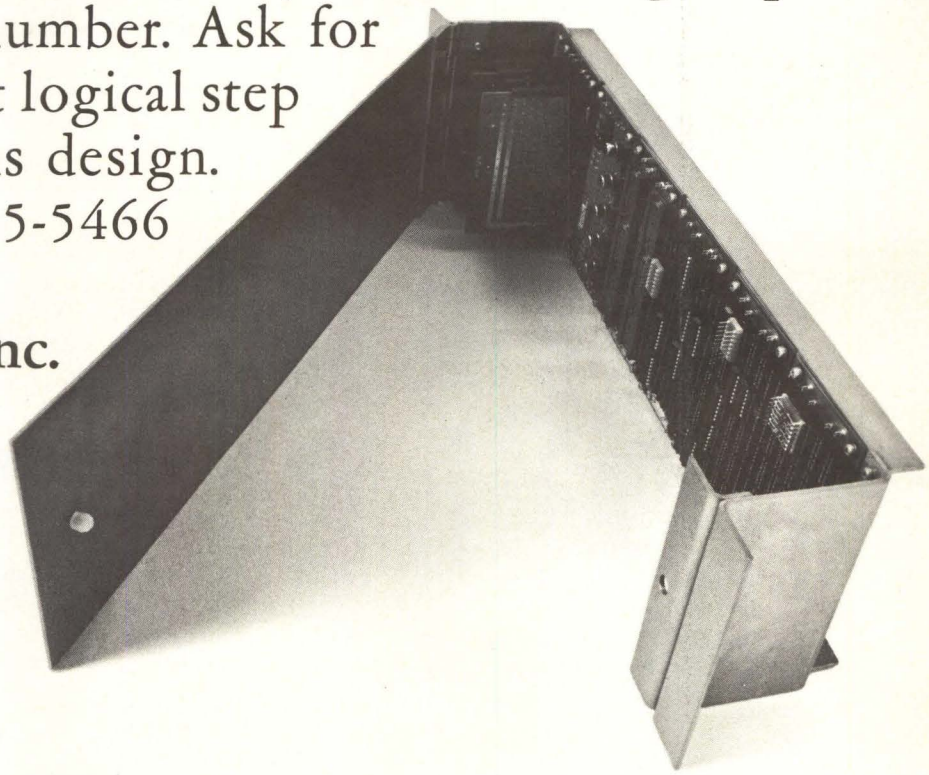

CIRCLE 43 ON INQUIRY CARD

Session 6B — Mercury Ballroom

The Digital Mating Call of Computers and Communications

Chairman and Organizer: V. N. Vaughan, Jr., AT&T, New York, N.Y.

Panelists: R. Grosch, National Bureau of Standards, Gaithersburg, Md.; R. R. Johnson, Burroughs Corp., Detroit, Mich.; J. D. Keuhler, IBM, Research Triangle Park, N.C.; C. S. Margach, Addressógraph Multigraph, Cleveland, Ohio; T. J. O'Rourke, Tymeshare Corp., Palo Alto, Calif.; F. D. Reese, Automatic Labs, Northlake, Ill.; and V. M. Wolontis, BTL, Holmdel, N.J.

Session 6G — Gramercy Suite

Prospects for Timesharing in the '70s

Chairman and Organizer: T. D. Truitt, Prime Information, Inc., Princeton, N.J.

Panelists: W. R. Beam, Data Plus, Inc., White Plains, N.Y.; J. I. Elkind, Bolt, Barenek, Newman, Inc., Cambridge, Mass.; J. P. Collins, Applied Geodata Systems, Cambridge, Mass.; and R. L. Rosenfeld, Applied Logic Corp., Princeton, N.J.

Thursday Morning, March 26 — 9:30-12:00

Session 7A — Trianon Ballroom

Integrated Systems—Interconnection Problems

Chairman and Organizer: J. J. Suran, GE, Syracuse, N.Y.

"The Problems and Promises of Micro-Electronic Interconnection Processes," A. S. Rose, RCA, Somerville, N.J.

"Beam Lead Chip Interconnection Systems," M. P. Eleftherion, Western Electric, Inc., Princeton, N.J.

"The STD Interconnection System," J. P. Dietz, GE, Syracuse, N.Y.

"Flip Chip Interconnection Systems," L. F. Miller, IBM, Hopewell Junction, N.Y.

Session 7B — Mercury Ballroom

Holography

Chairman and Organizer: W. E. Kock, The Bendix Corp., Southfield, Mich.

"Holograms as Recorded Interference Patterns," W. E. Kock, The Bendix Corp., Southfield, Mich.

"Holographic Optical Memories for Data Storage," L. K. Anderson, BTL, Murray Hill, N.J.

"Acoustic Holography," R. M. Mueller, Bendix Research Labs, Southfield, Mich.

"Validating Credit Cards by Holography," E. H. Christy, Radiation Lab, Tulane University, New Orleans, La. and K. K. Sutherlin, ICV California, Inc., San Jose, Calif.

"A Holographic Video Playback System," W. J. Hannan, RCA, Princeton, N.J.

Session 7F — Murray Hill Suite

Trends In Computer Applications for the '70s

Chairman: J. N. DiMarino, RCA, Cherry Hill, N.J.

Organizer: H. C. Plant, RCA, Cherry Hill, N.J.

"Banking Operations in the Last Three Decades of the 20th Century," J. V. Vergari, Federal Reserve Bank of Philadelphia, Pa.

"The Evolution of Medical Computing—Now a Revolution," M. Kessler, Hospital-Shared Computer Center, Towson, Md.

"Computer Communication Cooperation CLEAR," A. O. Atkinson, Computer Center for Cincinnati, Ohio

"Trends in Transportation Computer Application for the '70s," W. P. Ollman, Chicago and North-Western Railway, Chicago, Ill.

Thursday Afternoon, March 26 — 2:00-4:30

Session 8D — Sutton Ballroom South

Modern Network Techniques for Device, Circuit, and System Design

Chairman and Organizer: G. H. Danielson, GE, Syracuse, N.Y.

"State Variables: What Are They and Why Use Them?" T. A. Bickart, Syracuse University, Syracuse, N.Y.

"State Variables: Modern Computerized Network Analysis," C. Pottle, Cornell University, Ithaca, N.Y.

"The Scattering Matrix from DC to Microwave," H. V. Carlin, Cornell University, Ithaca, N.Y.

"The Application of Scattering Parameters to High Frequency Circuit Design," G. E. Bodway and J. J. Dupre, Hewlett-Packard Co., Palo Alto, Calif.

Group-Sponsored Meetings

Friday Afternoon, March 27 — 2:00-4:30

G-Comtech — Sutton South Ballroom

Advances in Data Communication

Chairman and Organizer: K. D. Young, New England Telephone and Telegraph Co., Boston, Mass.

"Yearly Advances in Facsimile Hardware," K. H. Fischbeck and D. A. Ross, RCA, Princeton, N. J.

"Yearly Advances in Display Devices," C. R. Fisher, Eeco, Santa Ana, Calif.

"Yearly Advances in Print Telegraph Machines," W. Y. Lang, Boonton, N. J.

Educational Seminars

March 23-26 — 8:00-9:30 A.M.

Programming for Industrial Process Computers — East Ballroom

An introduction to the problems encountered in programming computers for real-time control of industrial processes will be provided. The sessions describe typical system functions and summarize their distinctive requirements. Special-purpose languages for particular applications, scanning, alarming, control operating guides, start-up and shutdown will be discussed.

Characteristics of high-level proprietary problem-oriented languages—Prospro, Fortran, Biceps, Machine languages and Decision Table Coding—will be detailed with a current trend summary.

March 25-26 — 9:00-5:00

Monolithic Integrated Circuits — Rhinelander North

This eight-session seminar is aimed primarily toward design and systems engineers, many of whom are new to the field, but eager to use this expanding technology to their best advantage. Thirteen experts have been brought together to present both the basic and more advanced concepts required by design engineers who wish to benefit from what has come to be called "the micro-electronics revolution." Starting with terminology and semiconductor fundamentals, the seminar faculty will progress rapidly toward the latest applied logic-technology, digital design, optimization methods, and linear amplifier circuit analysis. Also included are sessions covering the processing and materials knowledge required by design and product engineers.

do your own thing!

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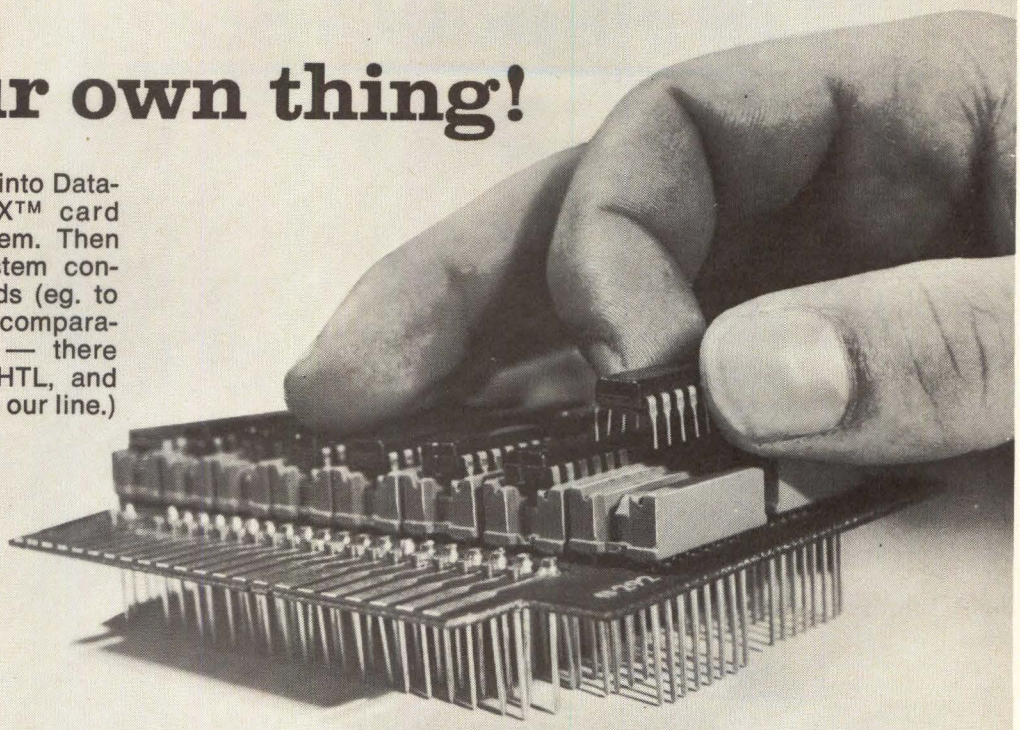

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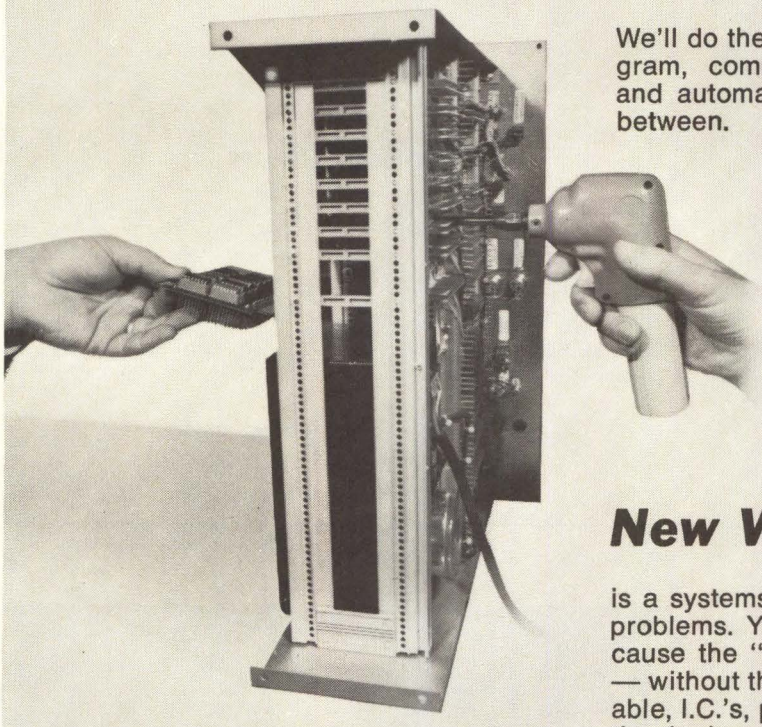

We'll do the job from your schematic or block diagram, complete it with computer-aided design and automatic wire wrapping — or anywhere in between.

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is a systems approach to solving your packaging problems. You save time, money and trouble because the "X" factor is now part of your system — without the cost of customizing. Standard, available, I.C.'s, plus Datascan Wrap-X cards and function logic cards are all interconnected to give you one-company responsibility for completely wired and tested hardware, at lower installed costs.

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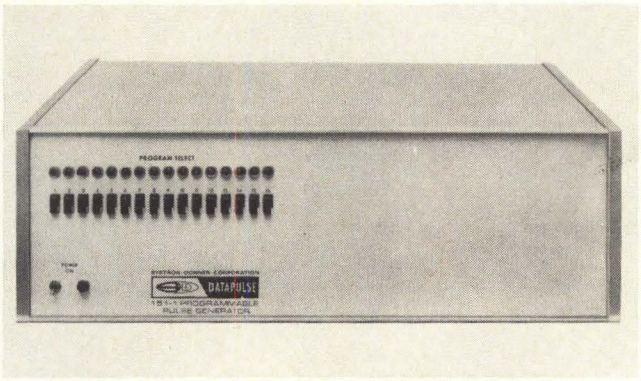
CIRCLE 44 ON INQUIRY CARD

IEEE PRODUCTS

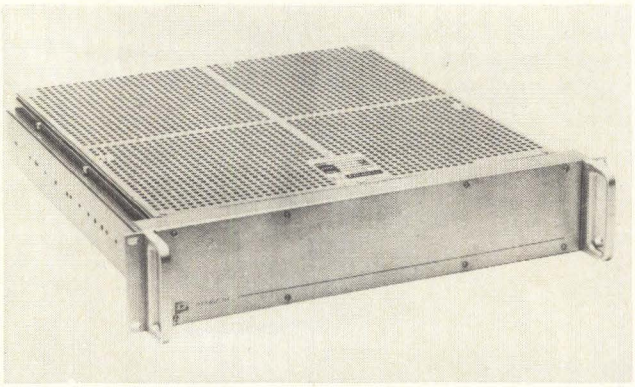
PULSE GENERATORS

Models 151 or 152 pulse generators allow simultaneous setting of all pulse parameters with a single pushbutton, thereby eliminating costly operator set-up time and improving parameter accuracy and repeatability. These generators automate the time consuming pulse generator operation without affecting the cost of easier-to-operate system elements and with no requirement for peripheral programming equipment. Models 153 and 154 generators feature the same basic pulse generating capabilities but are programmed by digital information from automatic or semi-automatic test systems. Characteristics of the pulses generated by this series meet exacting pulse test requirements. Repetition rate is 10 to 50 MHz, delay and duration is 10 ns to 10 ms, pulse amplitude is ±10 V with pulse top and baseline at any level from + to −10 V, and transition times are variable from 5 ns to 10 μs. All parameters are accurate to better than 5% of set value. Datapulse Div., Systron-Donner Corp.

CIRCLE 150 ON INQUIRY CARD



See at Booths 2B11-21



See at Booth 2F06

POWER SUPPLIES

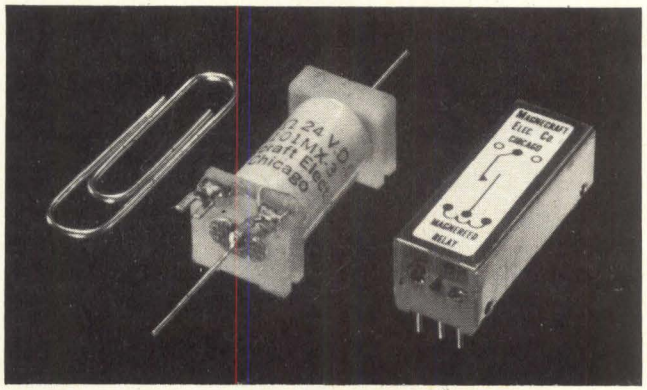
The "L" series, available in five case sizes, provides high efficiency, high current outputs with full overvoltage and overcurrent protection, of particular value to the IC and logic markets. Units are interchangeable with the earlier series line. Typical of the rating is a 5.0-5.5 V unit rated at 75 A, packaged in a rack panel configuration of 3½" in height. Standard voltages available in the five case sizes also include 12.5- and 15.5-V nominal output units. Dynage, Inc.

CIRCLE 151 ON INQUIRY CARD

IC COMPATIBLE REED RELAYS

Packaged in either printer circuit mounting or low-cost in-line axial leads, these low profile, printed circuit, highly reliable reel relays, designed for 5 V logic systems, have a typical coil wattage of 40 mW at 4 dc. Contact combinations available from stock are SPST-NO and SPDT. The SPST-NO class "101" has a contact rating of 10 VA at 0.5 A max. or 100 Vdc max. resistive load; the SPDT class "104" has a contact rating of 3 VA at 0.25 A max. or 28 Vdc max. resistive load. Typical life for these relays at full rated load is 5 million operations. Longer life is probable at reduced loads. Also available are relays designed to operate directly from 2.4 V integrated circuit systems. Magnecraft Electric Co.

CIRCLE 152 ON INQUIRY CARD



See at Booth 3E11

The Greatest Shows On Earth

Introducing Delta Data Systems' TeleTerm. The only video terminal that can display over 100 lines of data on the screen.

TeleTerm is a totally new concept in remote computing. Its storage and display capability of over 100 lines of data puts it a giant step ahead of all other video terminals. No video display on the market can show as much data. Because no video display has the up and down *paging* feature, exclusive with TeleTerm.

And 80 characters per line on 27 lines. Formatting that allows fixed and variable data fields. A blink feature that flashes data on the screen twice per second. Data transmission speeds to 9600 baud asynchronous, 4 million bits per second synchronous. A memory capacity of 2500 characters. Plus a separate numeric pad on the keyboard.

And all that capability is yours in three TeleTerm models. All are desk top units with keyboard, display, and control electronics in one package. And they're designed for applications like time-sharing, reservation systems, communications and information systems, inventory control, process control. Each TeleTerm model has its own special capability and an unbeatable price, like

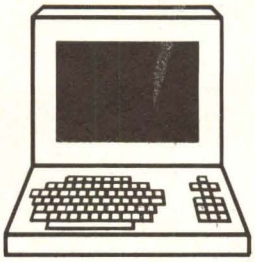
TeleTerm 1. $90 a month. Our Teletype Replacer. That rings a bell when the 64th character on a line is entered. TeleTerm's low price and high speed for receiving and displaying information puts it generations ahead of teletype.

TeleTerm 2. $100 a month. Our Block Mode Transfer Display. Has an editing feature that inserts and deletes lines and characters. Conversation mode. An adjustable margin with bell and 5 tab positions. And transmission can take place on a message or page basis.

TeleTerm 3. $120 a month. Our IBM 2265 Replacer. The feature presentation that brings the curtain down on the IBM 2265. Besides having all the characteristics of TeleTerm 2, TeleTerm 3 is completely IBM 2265 compatible.

And all video terminal options include built-in acoustic couplers or modem, external printer or cassette tape recorder.

TeleTerm 1, 2, or 3. Anyway you look at them, they're the greatest shows on earth.



Delta Data Systems Corp.,
Woodhaven Industrial Park,
Cornwells Heights, Pa. 19020
(215) 639-9400

Delta Data Systems

CIRCLE 45 ON INQUIRY CARD

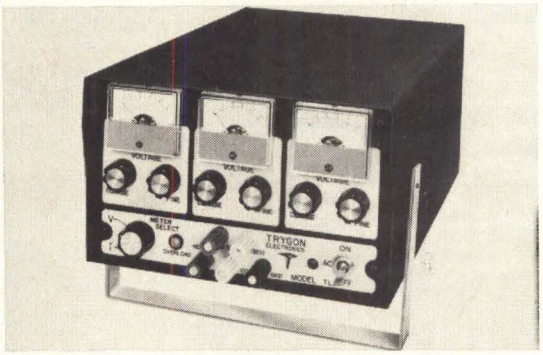
IEEE PRODUCTS

POWER SUPPLIES

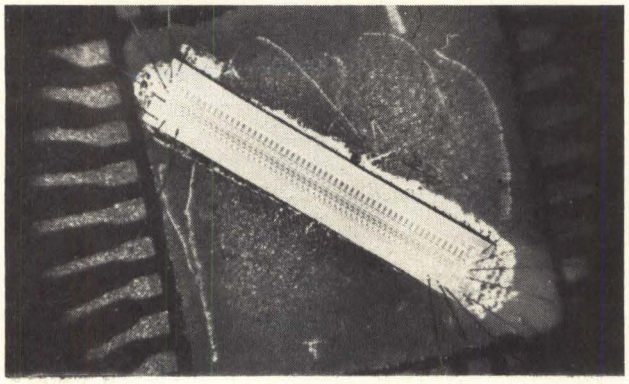
A triple output bench type laboratory power supply, the model TL8-3, features three independent outputs: positive 0 to 8 Vdc at 3 A, positive 0 to 32 Vdc at 1 A, and negative 0 to 32 Vdc at 1 A. Other features include automatic current limiting, 0.01% regulation, and 0.05% stability. Each output has a separate dual scale ammeter/voltmeter and is independently adjustable from the front panel. The model M7C5-130 0V is a 0 to 130 A, precision regulated power supply in a 7-inch panel height. This unit is of all silicon design and is fully programmable externally. It provides provisions for both constant voltage/constant operation and master-slave programming.

Also on display will be a series of power modules providing three dc outputs and a modular series of power supplies designed specifically for systems and OEM applications. Trygon Electronics, Inc.

CIRCLE 153 ON INQUIRY CARD



See at Booths 2B47-49



See at Booth 3B30

DIODE ARRAY

A self-scanned linear array of photo sensors which gives a directly usable analog sequential signal as an output, the IPL20 array consists of 50 planar diodes each with an amplifier and gate element integrated onto a single chip of silicon with a 51-bit shift register. The array is totally mounted within a ½" diameter 40-lead flat pack. The shift register is driven by a two phase and data clock system and an output video signal is obtained whose amplitude is proportional to the scanning rate and light intensity at any point in the array.

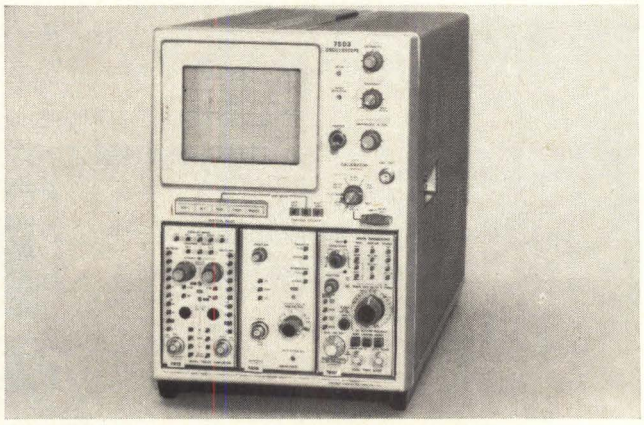
Also featured is the IPL 13 light to frequency converter, a light sensitive integrated circuit in a TO-18 can which will give electronic pulses with repetition rate proportional to light intensity. Teknis, Ltd.

CIRCLE 154 ON INQUIRY CARD

OSCILLOSCOPES

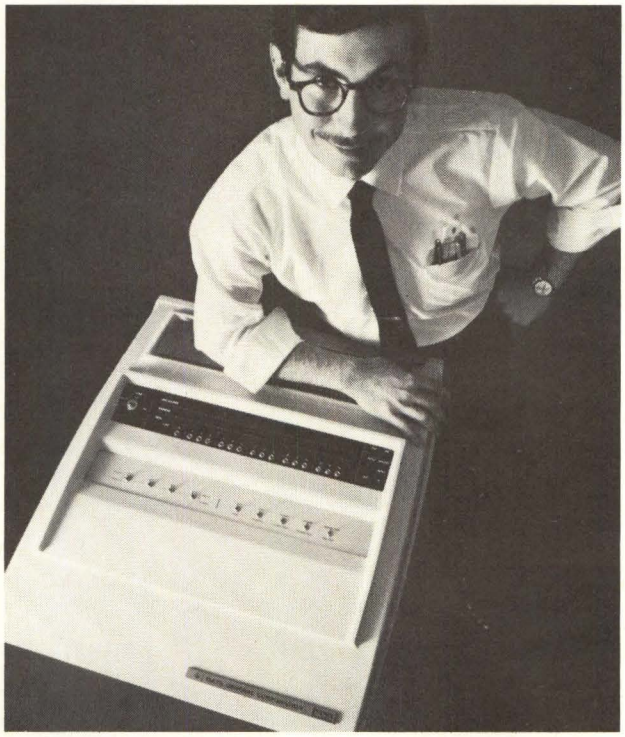
The 7503 is a 90-MHz, three plug-in oscilloscope with a "dual-trace" vertical amplifier in the main-frame provided by vertical mode switching which enables the user to simultaneously measure waveforms with widely different characteristics by electronically switching between two vertical plug-ins. The vertical mode chopped and alternate operation, and the modular approach to plug-in selection, provides for a better match between instrument and application. This flexibility allows an unusual range and combination of multi-trace, differential, high-gain, current, and sampling input configurations. The 7000 Series is a full measurement system presently consisting of 3 mainframes and 14 plug-in units, including 6 amplifiers, 5 time-base units, 2 sampling units, and a dual delay line plug-in unit. Three trace-recording cameras, six voltage and current probes, and a Scope-mobile are all compatible accessories. Tektronix, Inc.

CIRCLE 155 ON INQUIRY CARD



See at Booths 2G25-32

IT USED TO TAKE GUTS TO BUY A NOVA.



Sorry, pal.

But if you're the kind of guy who delights in sticking his neck out, Nova is no longer for you.

Used to be.

But that was nearly 400 deliveries ago.

Now, the only kicks you'll get from a Nova will come from the performance, cost, and loads of peripherals and software we offer.

For instance, you can buy a Nova in its basic 4K configuration with 16-bit word length, multi-accumulator design, data channel, and Teletype interface for $7950. Or you can get it with a lot less for a lot less.

Or you can buy a Nova-based system.

Which includes such good things as read-only memory, compatible mag tape units, a variety of discs, A/D, D/A, and communications equipment.

Finally, there's our software.

And the only thing we have to say about that is what our customers say: specifically, it includes all the right things and it's working in hundreds of applications.

Still looking for more?

Supernova.

Everything Nova is and then some.

Including an add time of 300 nanoseconds from read-only memory, 800 nanoseconds from core, making it the fastest mini computer in the world.

What's more, Supernova is still brand new.

Which (we can assume) means it still takes a certain amount of guts to buy.

Here's your chance, pal.

Data General Corporation, Southboro, Mass. 01772 (617) 485-9100

DATA GENERAL

Makers of Nova and Supernova mini computers.

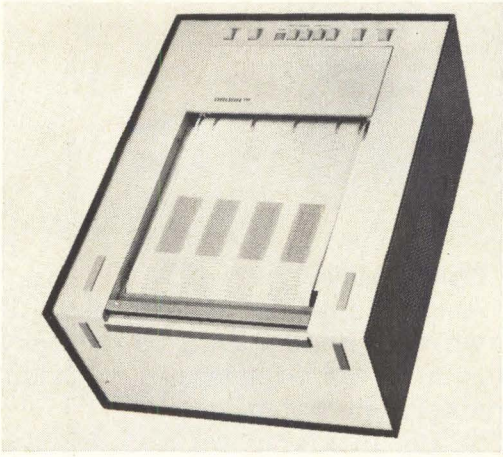
IEEE PRODUCTS

HIGH PRESSURE BLOWER

This advanced centrifugal blower, designed for packaging within the confines of equipment having a vertical profile of no more than 1¾", provides up to 25 cfm free delivery forced air cooling. It may also be used for spot cooling against hot components at 1700 fpm. Encapsulated stator construction integrates the electrical portion of the shaded pole motor into the blower housing to provide a monolithic structure totally impervious to dust or moisture. Designed with a minimum depth of only 1 9/16", the blower can be mounted from the back, the inlet, or the discharge. Other options include an inlet ring, duct clamp, outlet guard, and plug and cord assembly. Acoustically, the unit operates at a speech interference level of 44 dB. Rotron, Inc.

CIRCLE 156 ON INQUIRY CARD

See at Booths 3F11-15



See at Booths 2E25-35

MULTI-CHANNEL RECORDERS

The model 440 has four, 40-mm channels, two event markers, and eight pushbutton-controlled chart speeds. It can be used with equal reliability in laboratory, factory, and field conditions, and is compatible with all model 4200 and 4300 series signal conditioners. The unit has a pressurized ink system that utilizes disposable plastic ink cartridges, and a pen position servo system that assures 99½% accuracy. Trace is rectilinear on a channel span of 50 divisions across 40 mm. Frequency response at 50 divisions is flat within ±2% of full scale from dc to 40 Hz. The model 480, an 8-channel recorder with performance characteristics similar to the 4-channel unit, has 12 chart speeds and can be either rack mounted or portable. Brush Instruments Division, Gould, Inc.

CIRCLE 157 ON INQUIRY CARD

TEN BINARY BIT D/A CONVERTER

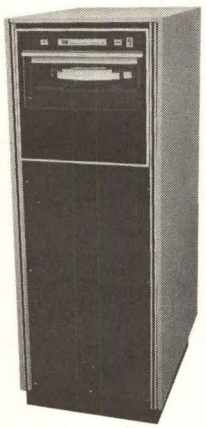
DAC-I series, completely self contained plug-in mini-modular units measure only 2 x 2 x 0.4" and are available with resolutions up to 12 binary bits or 3 digit BCD. They have an output current settling time of 40 ns to within 0.05% of full scale. Interfacing logic, electronic switches, precision ladder network, and a temperature compensated voltage reference source with reference amplifier are incorporated. Digital inputs are compatible with DTL or TTL logic. Full scale output current can be either bipolar (2.5 mA) or unipolar (5 mA). An output voltage is available by simply adding an external resistor from the output summing junction to ground.

An ultraminiature dual dc power supply (28 V @ 100 mA and 14 V @ 140 mA) for powering MOS/LSI integrated circuits will also be featured. Completely self contained, including input isolation transformer, the model BPM 14/28 measures only 2 x 2 x 0.4" (1.6 cubic inches). Datel Systems Corp.

CIRCLE 158 ON INQUIRY CARD

See at Booth 3B29

Now, a Disk Memory Drive, less than $3,000.*



A good Disk Memory Drive doesn't have to be expensive.

We're producing and delivering single-disk, removable-media, disk drives to major computer manufacturers at prices that are an industry breakthrough.

These disk drives, which utilize the IBM 2315 disk cartridge or equivalent, are built to meet the needs of the mini-, small-, and medium-size computer manufacturer. Conservative design and rigorous testing ensure ultra-reliable and consistent performance.

So if you spend more than $3,000 for a single-disk memory drive, you'll spend too much... a Disk Memory Drive doesn't have to be expensive to be good.

For further information and complete specifications, contact Jim Flynn at Computer Memory Devices, Inc., 5170 West Bethany Home Road, Glendale, Arizona 85301. Phone (602) 939-9444.

*In OEM quantities.

Computer Memory Devices, Inc.

5170 West Bethany Home Road, Glendale, Arizona 85301

CIRCLE 47 ON INQUIRY CARD

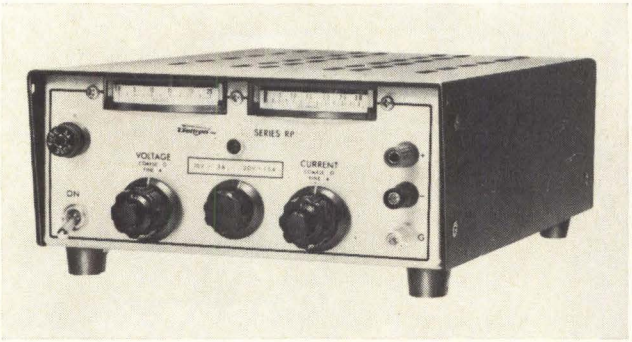
IEEE PRODUCTS

INSTRUMENT/SYSTEMS COMPATIBILITY

Solid-state interconnectable instruments constitute a flexible line of programmable instrumentation which is adaptable to either low-cost systems configurations or use as discrete units. All products are designed for full compatibility with each other to assure the user the greatest flexibility and widest applicability without the need for additional costly interface engineering for specific applications. Instruments include 150 MHz, half-rack, digital frequency counter which covers the range from 5 Hz to 150 MHz, has 100-mV sensitivity, and includes 9-digit readout; a sine wave oscillator providing sine, square, or positive pulsed outputs from 10 Hz to 1.2 MHz with continuous coverage of 5 pushbutton-selected ranges; a 20-MHz counter featuring solid-state driver circuits, counting to 20 MHz; a frequency synthesizer with discrete outputs from dc to 3 MHz, stabilized through a multi-speed phase-locked loop; and a programmable double pulse generator with plug-in for 1-ns rise and fall time pulses to 70 MHz. Monsanto Electronic Instruments.

CIRCLE 159 ON INQUIRY CARD

See at Booths 2F45-50



See at Booth 2J39

LABORATORY POWER SUPPLIES

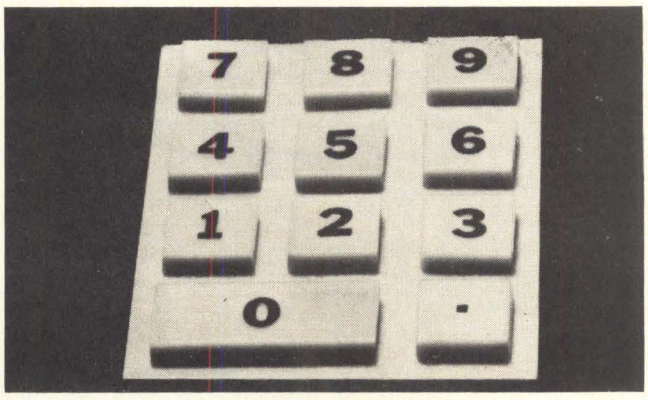
These RP and SP laboratory power supplies have an exclusive integrated circuit regulation system and feature new standards of regulation, stability, and freedom from transient thermal conditions. On the SP series where larger power is controlled, a high performance, non-dissipative pre-regulator is used. Greater than usual number of protective and guard circuits are used to provide long trouble free service. Ten turn current and voltage controls as well as crowbars and rack adapters are available. Deltron, Inc.

CIRCLE 160 ON INQUIRY CARD

ULTRATHIN KEYBOARD SWITCHES

Conventional mechanical parts have been eliminated in these very thin switches which require absolutely no space behind the panel and a total projection of ¼" or less above the panel, including buttons. The heart of the FLEX-KEY system is a series of printed circuit modules placed in a keyboard arrangement. The button keys are molded as an integral part of this keyboard and are placed on top of an anti-static conductive elastomeric element. Slight depression of the operator's finger actuates the printed circuit switching elements on the base board. A thin aperture film placed between the elastomeric element and the PC prevents short circuits, but allows conductivity with the circuit board. Physically, there are no parts to wear out. Thus, its operational life is inherently increased to 50 million operations and more. Alco Electronic Products, Inc.

CIRCLE 161 ON INQUIRY CARD



See at Booth 4G23

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Sylvania diode arrays come in units from 2 to 16 diodes connected either common cathode or common anode.

Because all of the diodes in the array are made at the same time under the same conditions, you get closely matched characteristics over a wide temperature range.

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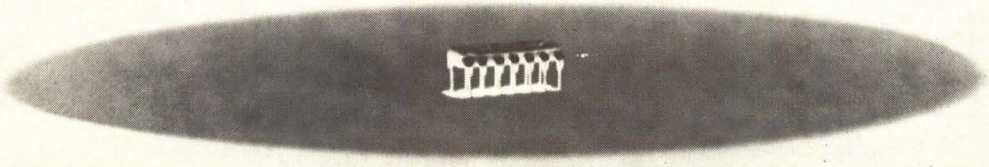


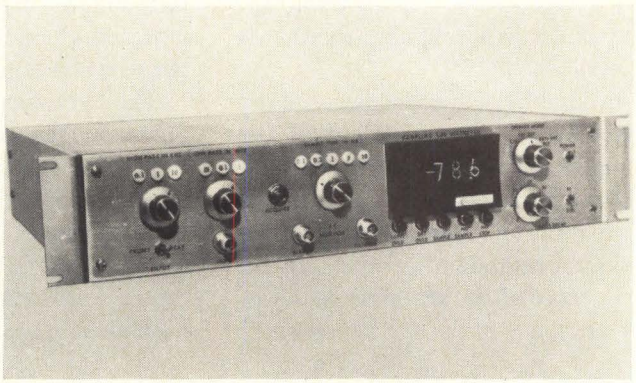
IEEE PRODUCTS

SAMPLING LOG VOLTMETER

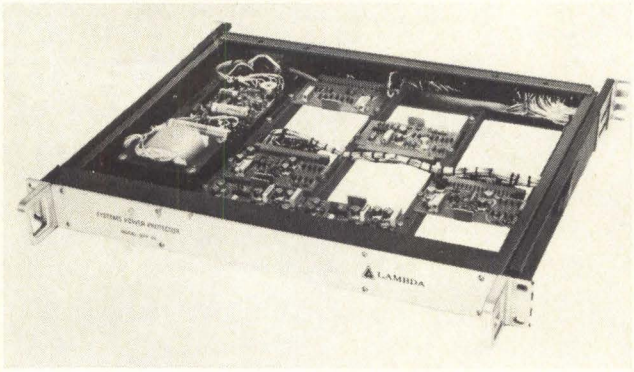
Direct digital readout of single or multiple bursts of ac signals is featured in the model 220 sampling logarithmic voltmeter. The unit has a frequency of 100 Hz to 1 MHz. Sample and hold outputs are DVM, dc (linear and logarithmic), and BCD. The unit is programmable for single or repetitive measurements up to 1000 samples per second with output independent of Direct digital readout of single or multiple bursts of ac signals sampling time or duty cycle.

Also displayed is a line of computing modules which includes a dc log amplifier; four phase generators; four precision phase to dc converters, and two phase sensitive detectors. All of these new products feature solid-state integrated circuits and sizes compatible to PC board mounting. Dranetz Engineering Laboratories, Inc.

CIRCLE 162 ON INQUIRY CARD



See at Booths 2C18-20



See at Booths 2E04-08

SYSTEMS POWER PROTECTOR

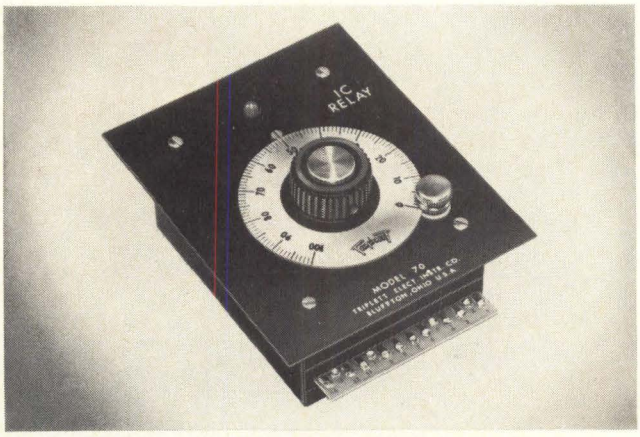
Designed for use where absolute protection of associated equipment is essential, typical applications include check-out test instrumentation, computer memory systems, and peripheral equipment. The unit provides complete fault protection to a power supply system. It will control up to eight power supplies independent of polarity; monitor overvoltage, undervoltage, and ac input line voltage simultaneously; and protect against ac input line voltage faults, overvoltage, and undervoltage. Available mounting styles are: a 1¾ x 19 x 14″ standard full rack (SPP-90 Series) or as a 3⅛ x 3 13/16 x 13¼″ sub-rack (SPP-80 Series) self-contained system component that can be mounted in a standard rack adapter. Lambda Electronics Corp.

CIRCLE 163 ON INQUIRY CARD

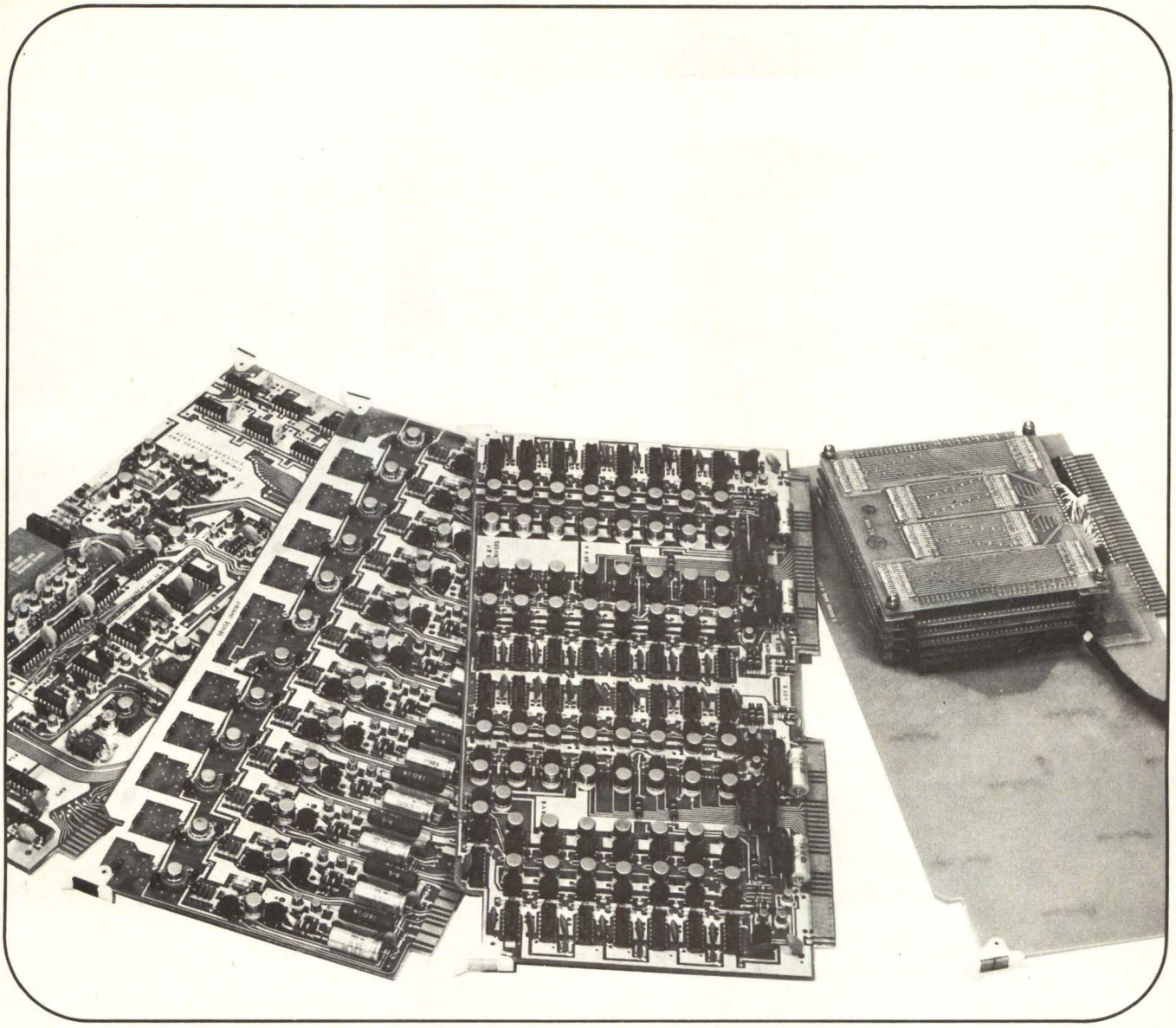
INTEGRATED CIRCUIT RELAY CONTROLLER

A small, 3.391 x 4.319 x 2″ unit that can be used as an ON-OFF controller with a 50-ms response, and which performs the same function as a meter relay, the model 70 IC relay controller, is an all solid-state device. It can be used with or without a panel meter. When a meter is used, it performs a monitoring function only and does not affect the operation of the relay. The relay may be used in industrial manufacturing applications where processes with variables of current or voltage have to be measured or controlled. The controller accepts either current or voltage input control signals within the range of the precalibrated limits of the IC relay. Power supply voltages are: +12 Vdc ± 1% at 0-125 dc mA; −12 Vdc ± 1% at 0-50 dc mA; 5 Vac ± 10% at 50 mA. The unit fits into a panel opening of 3.437 × 4.406″. Triplett Corp.

CIRCLE 164 ON INQUIRY CARD



See at Booths 2D40-42



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CIRCLE 49 ON INQUIRY CARD

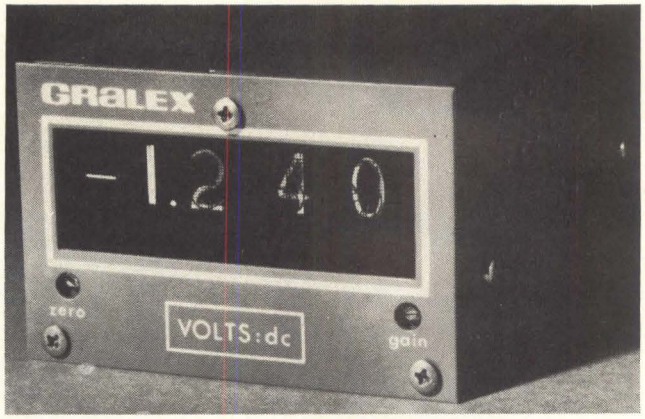
IEEE PRODUCTS

DIGITAL PANEL METER

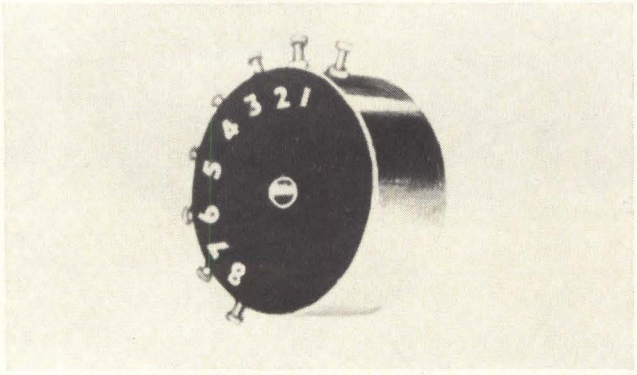
The series DM-30 digital panel meters feature a 3-digit display, using Nixie-type readouts, together with over-range and negative polarity symbols. The meters require only suitable transducers to provide direct readings. Response characteristics are compatible with standard types of transducers used for these measurements. The position of the display's decimal point is selectable, by simple rear connector wiring, to suit the measurement application. With internal triggering, measurements are at the rate of 3 per second, and can be at any slower rate with external triggering.

Also on display is a remotely programmable delay unit for high frequency, pulse, and digital applications featuring selectable delays up to 63 ns, better than 1% accuracy, and bandpass above 1 GHz. The unit, designated model 1204, has been designed to meet many automatic test requirements for inserting a precise time delay in a signal path in 1-ns steps. Gralex Industries, Inc.

CIRCLE 165 ON INQUIRY CARD



See at Booths 3K20-21



See at Booth 3E18

DC/DC CONVERTER TRANSFORMERS

The 20-KHz switching frequency of these compact dc to dc converter transformers results in a considerably smaller transformer for a given rating. Reduced transformer size, coupled with smaller filter element requirements, permits a significant reduction in the total package size of the power supply. Transformer size is 1¼" D x ¾" H. Units are epoxy molded; weight is approximately 1 ounce. Designed for 13.8 or 28 Vdc input, the units provide ±15 or 30 V output at 1 A and are power rated at 30 VA. They are also suitable for center tapped full wave applications. Microtran Co., Inc.

CIRCLE 166 ON INQUIRY CARD

PRINTERS AND LISTERS

Both serial and parallel entry model digital printers, listers, accumulators, calculators, and time-data printers are available with standard or customized features. The serial entry units come in four basic models: a lister; an accumulator which will add, subtract, total, or subtotal; a unit which will also multiply; and a full four function calculator. Serial entry models come in capacities up to 14 columns. Combinations of alpha and numeric printout are available. Parallel entry units are available in lister models with print speeds up to 2½ lps and accumulator models with print speeds up to 2 lps. The digit entry and print command may be simultaneous on parallel entry models. Victor Comptometer Corp.

See at Booth 2A16

CIRCLE 167 ON INQUIRY CARD

INDUSTRIAL DESIGN AND CONTROL

The EAI 380 analog/hybrid 10-V computing system features the capability of expanding from 10 to 50 amplifiers. Parallel logic may be added, as well as a data interface to a digital computer. The industrial control system is a completely integrated, solid state control computer, built to operate reliably in the industrial environment, with capability for expansion to meet the needs of the user. Also on display will be a 430 Data-plotter. Electronic Associates, Inc.

See at Booths 2C06-09

CIRCLE 168 ON INQUIRY CARD

The Tektronix T4002
graphic computer terminal

Displays high-resolution graphics and alphanumerics
Brings computer access to your desk
Retains the display without high-cost refreshing
Features a Line-Buffer Edit Area on the CRT

When you face the difficult, time-consuming task of analyzing reams of alphanumeric computer print outs, think of *graphics.* Graphics is a format which lends itself to quick, easy, more accurate and complete analysis of data. Don't hamper your decision-making process with reams of alphanumeric print outs when the same data is retrievable faster and easier in clear, concise *graphics.*

The T4002 brings the benefits of local or remote computers to you on an individual basis, in the office, laboratory, production area, or wherever GRAPHIC and alphanumeric computer support serves you best!

The display device of the T4002 is the Direct-View Bistable Storage CRT designed, developed, and manufactured by Tektronix. A few of the more important features of this unique storage CRT are zero flicker, zero drift, and a density of 39 lines of 85 characters each. But most significantly, it retains displays without costly refreshing.

The T4002 saves Central Processing Unit time through operator use of the Line-Buffer Edit Area, where you edit, compose, erase, retype, verify, or delete. Compose a line of data in the Line-Buffer Area; then transmit it at your maximum baud rate, rather than at the slow manual keyboard rate.

Alphanumeric outputs are displayed at an average rate of 2000 characters per second. Graphic outputs are by any of three programmable modes: Point plot, incremental plot and linear interpolate. The linear interpolate mode draws absolutely addressed vectors in 10 ms or less.

Tektronix has 57 domestic offices located in major cities throughout the United States and 48 foreign offices. For a demonstration or additional information, contact your local office directly. Or call (301) 825-9000 Baltimore; (617) 894-4550 Boston; (415) 326-8500 Palo Alto; or write Tektronix, Inc., P. O. Box 500, Beaverton, Oregon 97005.

T4002 Graphic Computer Terminal $8,800
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CIRCLE 50 ON INQUIRY CARD

APPLICATION NOTE

D/A Conversion for Fast, Inexpensive Display

Carl M. Kramer

Hybrid Systems Corporation
Burlington, Massachusetts

A series of D/A converters particularly suited for CRT display systems can be readily used to generate characters, straight lines, and other displayed symbols.

In order to achieve the required high speed with minimal expense, the optimum D/A converters are those with current rather than voltage outputs. Simple resistor networks can convert these currents into voltage sufficient for CRT sensitivity, without the need for amplifiers.

In practice each axis of a CRT is controlled by two D/A converters whose outputs are summed together as shown in Fig. 1. One of the converters is of the type where a ramp may be externally applied to its reference; the other has a fixed built-in reference. The two output currents are then summed together through a resistor and the resultant voltage is applied to the deflection input of the CRT. The fixed-reference D/A converter locates the initial position of the CRT beam while the variable reference unit generates a line segment from the initial position.

By using these D/A converter pairs as inputs to both the X- and Y-deflection coils, a series of straight line segments can be generated anywhere on the CRT. Under computer control any shape may be drawn on the display in this way. Since complex shapes require many straight line segments, very fast D/A converters are required. Hence, the advantage of

TABLE 1

	Economy Fast Model	Extra Fast Models	
		Internal Reference	External Reference
No. of Bits (Resolution)	10(0.1%)	10(0.1%)	10(0.1%)
Logic Code	Binary	Binary	Binary
Full Scale Output	+15 mA	+10 mA	+10 mA
Linearity	½ LSB	½ LSB	½ LSB
Output Impedance	1 MΩ	1 MΩ	1 MΩ
Settling Time to 0.05%	750 ns	200 ns	200 ns
Reference Range	+10 V/+15 V	Built In	0 to +10 V
Accuracy vs Temp (PPM/°C)	50	25	25
Power Supply Rejection	N/A	0.005 %/%	N/A
Power Supply	+10 V/+15 V @ 25 mA	±15 V @ 25 mA	±15 V @ 30 mA
Operating Temp	−25 to +70°C	−25 to +70°C	−25 to +70°C

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provides the data acquisition/reduction community with the following advanced features . . .

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- Front panel programmable or computer interfaced for automatic operation.
- Excellent adjacent channel rejection characteristics . . . greater than 40dB at three deviations from center frequency for all constant bandwidth channels.
- Only FM demodulator capable of reducing a data channel where the wow and flutter components exceed the actual data bandwidth.
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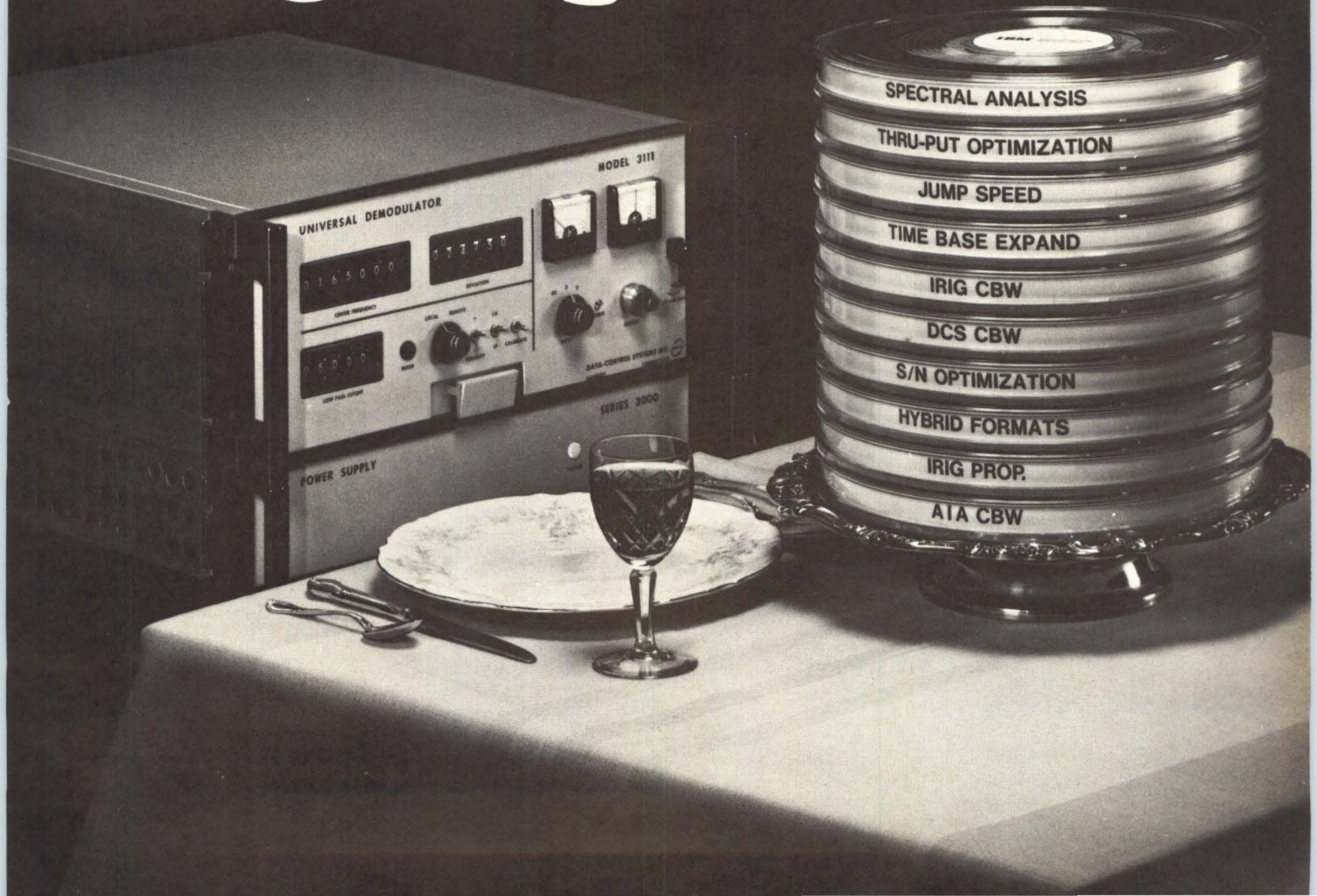
DCS

DATA·CONTROL SYSTEMS, INC.

CIRCLE 51 ON INQUIRY CARD

Feed it just about anything



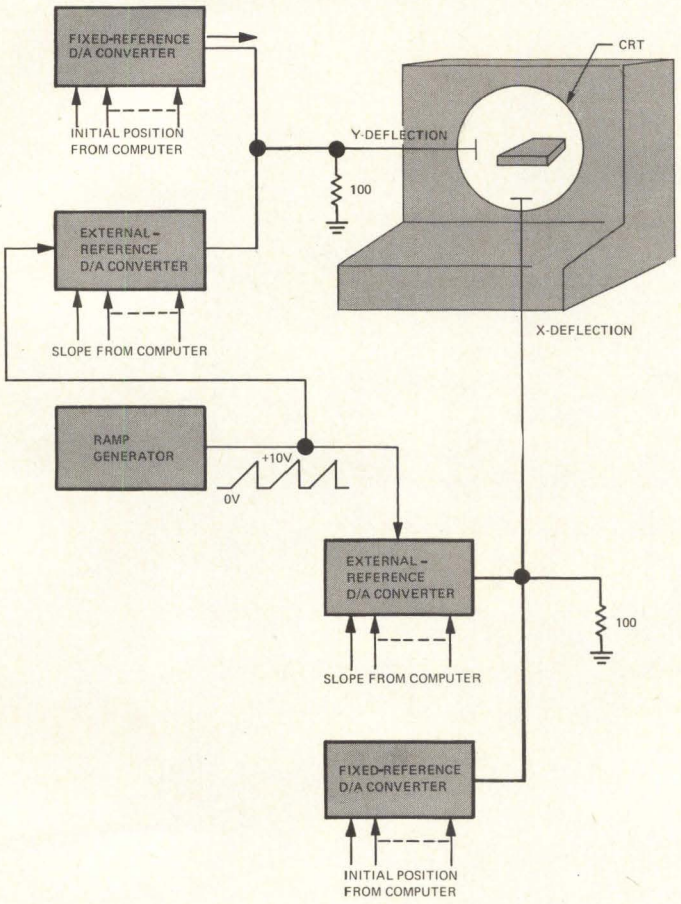


Fig. 1 Typical circuit with CRT display controlled by two sets of D/A converters

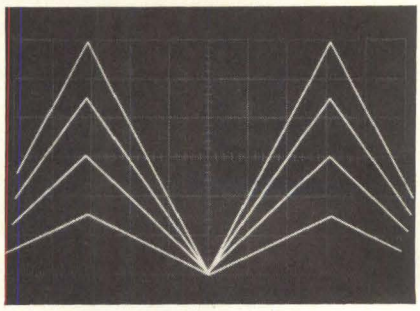


Fig. 2 Converter outputs

current output D/A converters. Specifications are summarized for different types of current output D/A converters in Table 1. All units listed are appropriate to this application.

Figure 2 illustrates the CRT display for a typical, simple application. For this figure a repetitive triangular wave was applied to the reference of a D/A converter. Four successive digital codes were applied to the converter and the output superimposed in the photo. If this output had been added to that of a standard D/A converter, the triangular wave could have been placed anywhere on the scope.

BIPOLAR OUTPUTS

To take advantage of the current output these units operate more conveniently with a modified ones or twos complement code. The modification is such that the sign bit is reversed (complement) from the true sign bit. What this means is that from the storage register which feeds the D/A converter, the "0" line instead of the "1" line should be used as input to the sign bit. These codes are illustrated in Table 2.

NOTES ON USES

In the following illustrated procedures for converting the output current to voltage note that all of the units can operate over a range of +2 to −10 V without the use of ampifiers. In Figures 3 and 4 resistor values are given for full scale current of 10 mA. Units are true current sources having a minimum output impedance of 1 MΩ; con-

TABLE 2

Code	Bipolar Voltage Out 2's Complement*	1's Complement*	Unipolar Binary
11...111	+1.022	+1.023	+1.023 V
11...110	+1.020	+1.021	+1.022
.			
.			
.			
10...000	+0.000	+0.001	+0.512
01...111	−0.002	−0.001	+0.511
.			
.			
.			
00...001	−1.022	−1.021	0.001
00...000	−1.024	−1.023	0.000

*Modified (Offset Binary)

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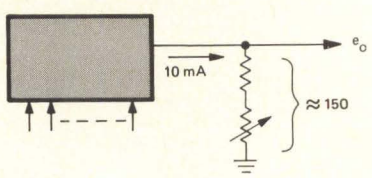

Fig. 3 Current to voltage conversion, 0 to +1.5-V output range

sequently loading effects are negligible. Selecting potentiometers to give a ±10% variation will more than compensate for any variations in the nominal full scale output current.

In the example of Fig. 3 the digit code is set to all ones and the potentiometer is adjusted for +1.5 V (+2 V max.).

In Fig. 4, for offset binary code, the digital code is set to 10000...0 and R_1 is adjusted to 0 V out. The digital code is set to all zeroes and R_2 is adjusted for −1.024 V out. These steps are repeated once or twice for adjustment. Then with the digital code reset to 10000...0, R_1 is adjusted for a +½ LSB (±1.0 mV).

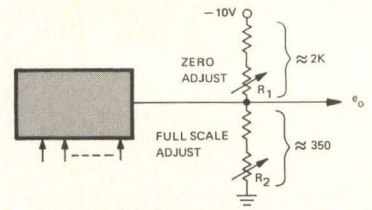

Fig. 4 Current to voltage conversion, bipolar ±1.0-V output range

For a twos complement code the digital code is first set to 1000 . . . 0 and R_1 adjusted for 0 V out. Then the digital code is reset to all zeroes and R_2 adjusted for −1.024 V out. These steps are repeated once or twice for final adjustment.

Note that with codes generated in this manner the sign bit is reversed from its true sense. The sign bit complement is used as an input to the D/A converter.

For additional information, circle 198 on inquiry card.

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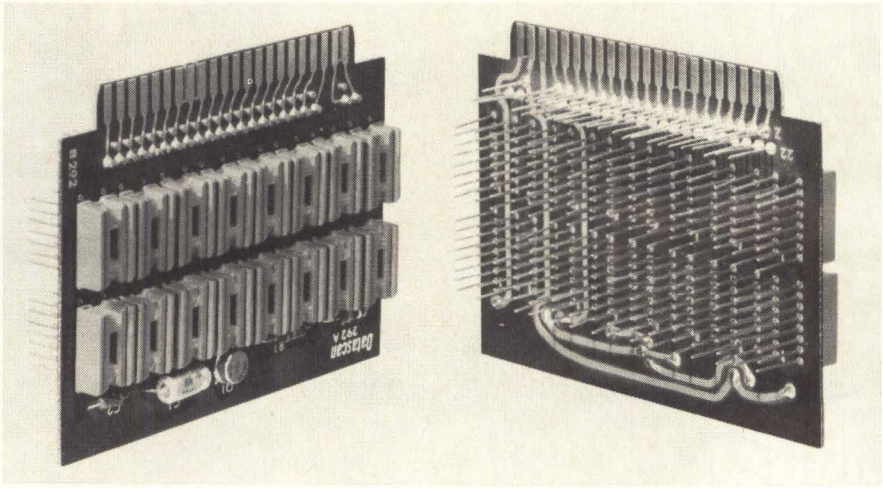
CIRCLE 54 ON INQUIRY CARD

CD PRODUCT FEATURE

Logic Card System Concept Permits User to Prepare Own Logic

DATASCAN, INC.

Clifton, N.J.



See at Booth 2E51

A systems engineer can select the complex function cards that he requires and then do the simple logic himself—without the many hours of physical design and drafting time required by standard logic-card or back-plane approaches —by using the WRAP-X™ logic-card system concept introduced by Datascan, Inc.

The PC board module contains 16 wire-wrap sockets for 14-pin ICs and/or 16-pin MSI chips. This card is mechanically compatible with over 100 DTL, HTL, and TTL standard off-the-shelf function logic cards such as decimal converters, comparators, and shift registers. The user can readily prepare his own logic once he has determined his particular requirements or, if he prefers, can supply a block diagram or schematic to the manufacturer and the system will be completely wire-wrapped for him, using computer-aided design and automatic wire-wrapping techniques.

BENEFITS

The back-plane approach requires very complex wire-wrap interconnections to replace the function cards. Therefore, an extensive run list and many hours of engineering design time are necessary, whereas in the wire-wrap system most of the interconnect is plated. Also, in the back-plane discrete components and semiconductors must be housed on plug-in platforms, each

(Continued on pg. 116)

Problem:

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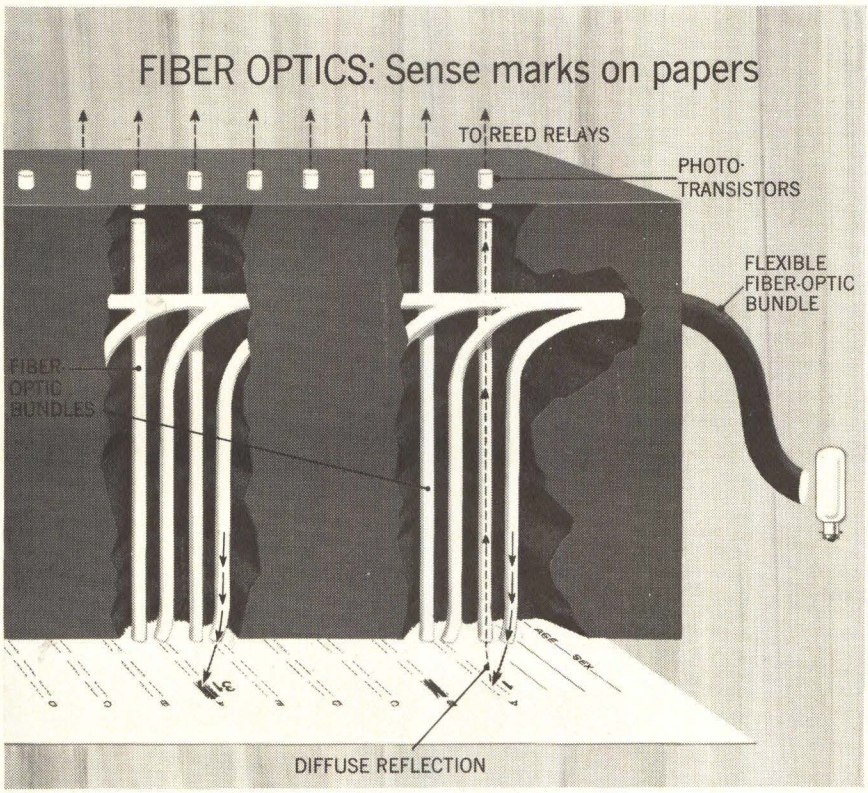

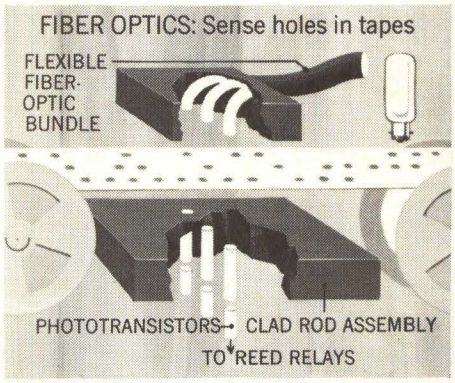

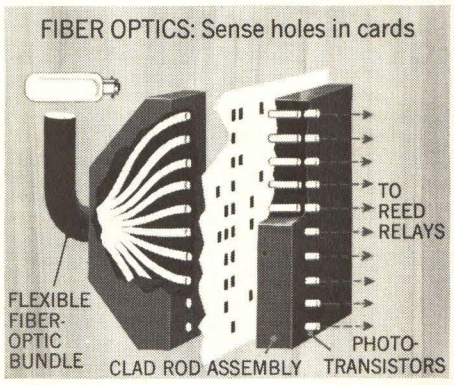

Electro-optical systems incorporating fiber optics are operating at up to four times the speed of electro-mechanical systems. When a combination of fiber optics, phototransistors, and reed relays is used, reading of basic data is not controlled by mechanical limitations. The use of fiber optics allows wide design freedom to increase system operating speed.

In addition, electro-optical devices provide inherently quieter operation. And the need for continual replacement of expensive electromechanical components is eliminated. The use of fiber-optic devices isolates heat and eliminates friction, the major causes of wear and failure. In most applications, both initial cost and use cost can be reduced by design simplicity.

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CIRCLE 55 ON INQUIRY CARD

of which requires a physical design before the run list can be generated. This also necessitates many hours of design and drafting time over and above the wire-wrap and standard card approach where function cards have already been designed and laid out.

Another benefit is that both the wire-wrap and standard card approach include Dynamic Decoupling™ circuits which greatly reduce a system's susceptibility to noise on the power lines (noise is usually a significant contributor to system failures). This circuit provides the power supply isolation necessary for reliable system operation. A compound power supply furnishes a high current regulated 7.0 Vdc (17.0) for collector drive and low current very well regulated, clean 5.6 Vdc (15.6) for base drive of the Dynamic Decoupling emitter follower. The emitter follower (with base input filtering) decouples it from the high current 7.0 V (17.0) power feed and provides a clean high side power bus on each logic module. Competitive cards and back-plane systems which have capacitive decoupling do not have isolation between power buses and logic circuitry. This is particularly critical for high-frequency noise spikes since they will be reflected to the power bus and can convey false information to other system logic, resulting in false counts. The large-scale back-plane approach does not and cannot include this benefit.

In addition, wiring for the large back-plane unit is much more extensive than the wire-wrap system because all of the plated interconnect on the function cards must be hard wired. There is, then, a far greater chance of noise problems because summing junctions and other low level signal points must be run over some distance, and may be mixed with digital wiring. Wire-wrap also provides the benefits of all plug-in boards including ease of troubleshooting, isolation of system parts, and better maintainability.

Competing with the large scale back-plane approach, the concept has the significant and important economic advantage in small systems and prototype quantities of large systems because complex function cards cannot be economically duplicated with the back-plane approach.

PRICE DATA

The following price comparisons show the differences between the standard logic-card approach, the back-plane approach, and the new wire-wrap approach (with IC sockets). Wire-wrap proves to be $179 (35%) less than standard logic cards and $242 (42%) less than the back-plane approach.

Standard Logic Cards*

2-268 A/D converter control boards
3-230 decade counters
1-293 3-decade BCD comparator
1-202 3-input NAND gate
1-275 2-input AND gate
Connector (wire-wrap type)

Total $515

Back-Plane Approach

2-268 parts
1-MC836P
3-MC1806P
1-MC861P
6-SN7490N
Back-plane (79 sockets)
Platforms
Analog component design, layout, and wiring**

Total $578

WRAP-X Board and IC Sockets*

6-SN7490N
1-MC836P
3-MC1806P
1-MC861P
2-268 A/D converter control boards
Connector (wire-wrap type)

Total $336

*Has dynamic decoupling

**Extra engineering plus time to design platforms and to specify and wire interconnect which is plated on the 268 boards

For additional information circle 199 on inquiry card.

Our 5000 and 7500 permeability Ceramag® ferrite materials can pack a terrific amount of inductance into a small size.

And the higher the perm, the fewer turns required. Results. Lower distributed capacity. Material savings. Improved performance.

Ceramag® offers the designer a true 5000 permeability. New, Ceramag® 24K is also a true 7500 permeability. Both materials hold their permeability over a wide range of sizes.

Ceramag® 24H and 24K are production materials, ready for immediate use in your design. Stock available in some sizes.

Precisely engineered, Stackpole ferrite materials are produced by exact processing, density checks, rigid kiln controls and accurate sintering. You get more out of Stackpole Ceramag® materials simply because we put more into them.

Study the characteristics of 24H and 24K, then consider how you might use these ferrites.

	$\frac{L}{N^2}$ (nh) TOROID SIZE: 0.230" O.D. 0.120" I.D. 0.060" L.	MAXIMUM PERMEABILITY	SATURATION FLUX DENSITY @ 1.5 OERSTED	RESIDUAL MAGNETISM	COERCIVE FORCE	CURIE POINT	TEMPERATURE COEFFICIENT OF μ_0	
							−25° to 25° C.	25° C. to 75° C.
CERAMAG® 24K	1485	9700	4100	700	0.05	175	+1.000	−0.450
CERAMAG® 24H	990	6900	3800	850	0.1	175	+0.700	−0.450
2500 PERM REFERENCE	495							

Disaccommodation factor for both materials is 1.4×10^{-6}, typical.

For more information, samples and applications, contact:

Stackpole Carbon Company, Electronic Components Division, St. Marys, Pa. 15857. Ph: 814-834-1521. TWX: 510-693-4511.

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Producing high quality Ceramag® ferrite components for the home entertainment, industrial electronics and computer industries for over twenty-two years.

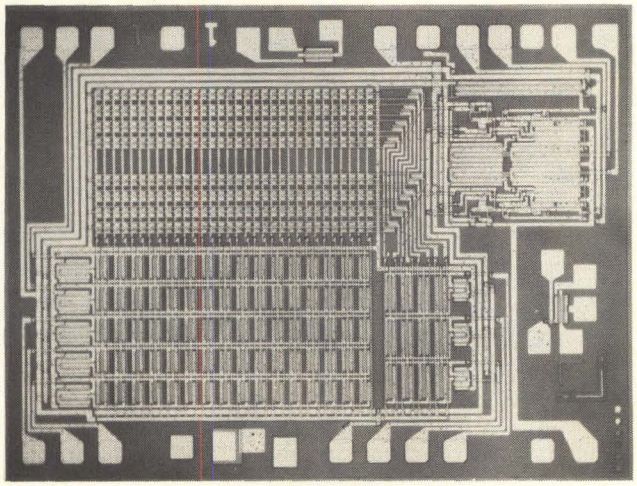
CIRCLE 57 ON INQUIRY CARD

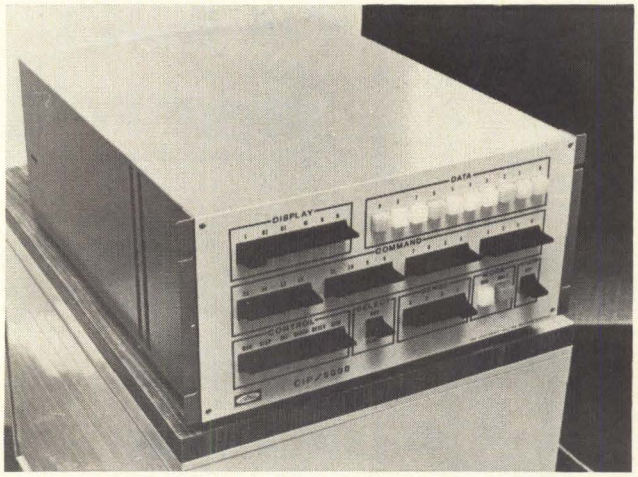
NEW PRODUCTS

HIGH SPEED N-CHANNEL READ-ONLY MEMORY

The ICM6008 512-bit read-only memory is arranged in a 256-word by 2-bit format. Arrays can be tied in parallel, making the memory expandable, both in the number of words (in multiples of 256) and in the number of bits per word (in multiples of 2). Operation above 3.0 MHz, over the full industrial temperature range, is attained with only a slight increase in power over conventional low-speed P-Channel MOS, due to the higher transconductance (lower R_{ON}) of the channel IGFET resulting from the increased carrier mobility of N-type material. The unit interfaces directly with bipolar logic, has chip select (Read Enable), "Wire Or" capability, and can be connected to permit use in a simplified one clock system. In addition, special high voltage clock drivers are not required, as with standard P-Channel MOS devices. Input and output stages of the register are protected by true zener diodes, eliminating the possibility of gate rupture due to static charges. To assure long term reliability, silicon nitride passivation techniques have been used in the construction of the gate dielectric. Intersil, Inc.

CIRCLE 200 ON INQUIRY CARD





MICROPROGRAMMABLE MINICOMPUTERS

A dedicated model, the CIP/2000, is a microprogrammable unit with read-only memory designed for all types of dedicated applications and with adaptability for unique and changing systems requirements. Standard features include 15 general purpose, 8-bit file registers; 7 dedicated working registers; microprogram control; 16 powerful micro-instructions (including logical, arithmetic, control, and literal data); 220-ns micro-instruction execution time; and read-only memory space up to 1024 instructions. The user can define his own instructions, input-output, and interrupt capabilities to suit particular needs. In the CIP/2100 general-purpose model, the microprogram (firmware) converts the basic system into a software programmable unit. Programs are stored in the core memory and instructions are interpreted by microprogram subroutines in the read-only memory. Standard features include 6 operational registers; extensive powerful instruction set, including 89 instructions; 8 operand addressing modems; multi-precision 1-, 2-, 3- or 4-byte load, store, and arithmetic operations; concurrent input-output; and built-in bootstrap loader. Cincinnati Milling Machine Co.

CIRCLE 201 ON INQUIRY CARD

Logical Logic Engineers Build With Monitor's Monilogic IC Logic Cards

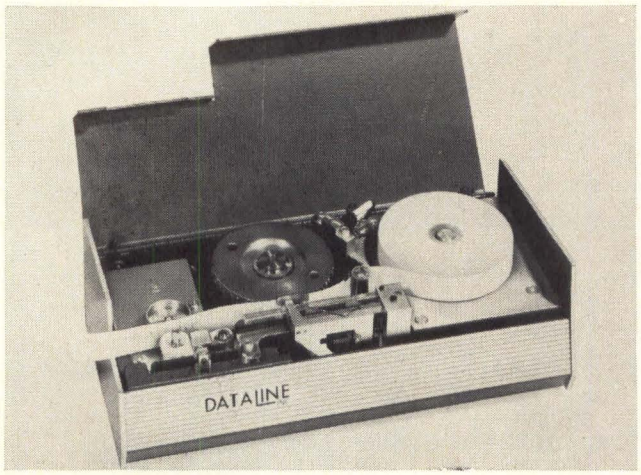
You may select from over 300 different digital and analog IC circuit cards to build your system. The MONILOGIC line consists of A/D's, D/A's, code converters, amplifiers, counters, oscillators, gates, inverters, expanders, delays, matrix gates, numerous interfaces, registers, flip-flops and reference voltages. Also, there are card file drawers and chassis, power suppliers and associated hardware. Request details.

FORT WASHINGTON, PENNA. 19034 • PHONE (215)-646-8100 • TWX 510-661-1520

MONITOR SYSTEMS
an AYDIN company

CIRCLE 58 ON INQUIRY CARD

NEW PRODUCTS



DESK-TOP STRIP PRINTER

The model 3064-C desk-top strip printer, less than 8 inches long and weighing just 4 pounds, is an economical digital impact printer that gives hard-copy readout right on top of a desk at a speed of 30 characters per second, asynchronously. Sound of operation has been attenuated to a very low level, making the unit practicable for use in offices or public places. Easy readout is provided by the large-size characters—nearly one-eighth inch high, nine to the inch in a font of 64 characters —ASCII full alphameric plus symbols subset. Logic levels are completely compatible with integrated circuit logic elements commonly found in data communication systems and devices. Interfaced with a remote computer, this unit can be used for inventory reports, to print out stock quotations, to list sales, for price changes, and many other applications. Besides receiving information without query, it can also be interfaced with most data systems to record replies. Applications include using the strip printer rather than a costlier or unnecessary multiple-column printer, and uses where hard copy for permanency is needed rather than just a voice response or visual display. Dataline, Inc.

CIRCLE 202 ON INQUIRY CARD

INFRARED DATA TRANSCEIVER

A full-duplex point-to-point communications system linking high-speed data terminals with a central computer facility, the model 1805 Optran™ infrared data transceiver system operates over the 1200 to 250,000 serial bits per second range. The system is specifically designed for applications where remote computer terminal or facsimile equipment would otherwise require costly or impossible cable installations. It can be used in any installation where the two optical units are in line-of-sight contact and free from accidental obstruction. A typical system consists of two terminal end equipments, each comprised of an optical unit and an interface unit. The optical unit features a telescopic sight for facilitating alignment with the opposite terminal end optical unit. The interface unit may be located up to 250 feet from the optical unit and is typically installed near the terminal or computer. A standard or high-speed current interface is provided for connection to the data terminal equipment. Operating range is one mile in clear weather and 500 to 3,000 feet for all weather usage, depending upon local climatic conditions. Standard operating mode is full duplex but half duplex and unidirectional modes are optional. Computer Transmission Corp.

CIRCLE 203 ON INQUIRY CARD

The Established Standard of Excellence In Digital Cassette Recording

(For Less Than $300)*

Two and a half years ago, International Computer Products, Inc., began development of Philips-type magnetic tape cassette recording devices for digital applications. Tests quickly demonstrated that audio tape drives were not built for the rigorous, precise demands of digital recording. So ICP engineers designed a drive system specifically for digital use—the DigiDeck. It demands evaluation by any manufacturer contemplating a digital cassette recorder in his system. Here's why:

- Read/write speed is 500 characters a second.
- Servo-controlled spindle speed eliminates the need for capstan or pinchroller and results in less wear on the cassette and recording head. Since the tape touches only the head, greater tape life and reliability is assured.
- Motor speed control electronics is adjustable to fit most applications.
- Read/write electronics and EOT/BOT sensing are included.
- All these features are standard in this compact (5 in. h. x 4 in. w. x 7 in. d.) package that weighs about two pounds.
- The unique design simplicity of the DigiDeck assures greater reliability.
- Delivery is 30 days after receipt of order.

The DigiDeck is a subsystem of these other ICP products:

DigiCorder: I/O cassette recorder with self-contained electronics, logic and power supply.

KeyCette: Key-to-tape system for direct incremental recording on cassettes.

Write or telephone for the ICP catalog. See for yourself the industry standard set by ICP digital cassette products.

*In OEM quantities.

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INTERNATIONAL COMPUTER PRODUCTS, INC.

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Phone: (714) 926-3020

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Dallas, Texas 75234
Phone: (214) 239-5381

34 West Putnam
Greenwich, Conn. 06830
Phone: (203) 661-3239

100 Main Street
Reading, Mass. 01867
Phone: (617) 944-7177

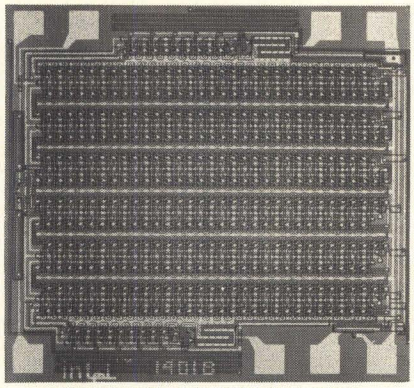
Box 1269
Upper Marlboro, Maryland 20870
Phone: (301) 736-3435

CIRCLE 59 ON INQUIRY CARD

NEW PRODUCTS

LSI SHIFT REGISTERS

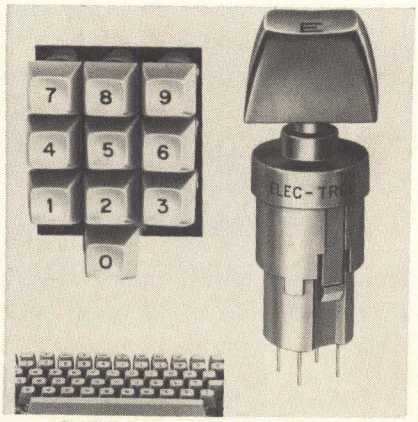
These dual 100-bit shift registers have a clock input capacitance of 35 pF, and use only 15 mA of power supply current at 10 volts. All units are guaranteed to operate at clock rates of up to 2 MHz. They may be interfaced directly with standard DTL and TTL logic. Two models are specified to operate from −55C to +125°C: one with an open drain output (model 1-406) and one with a 20-kΩ output pull-up resistor (model 1-407). Two similar models operate from −25 to +70°C: open drain (model 1-506) and 20 kΩ (model 1-507). Intel Corp.



CIRCLE 204 ON INQUIRY CARD

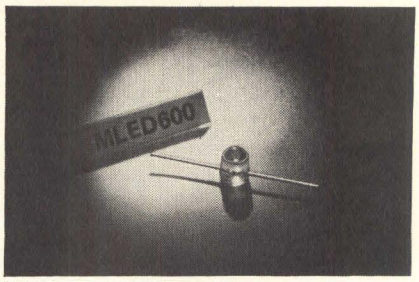
DATAKEYS/KEYBOARDS

Snap-Lock datakeys, available as individual components, have a snap-lock feature which inserts into a rigid metal panel requiring no mounting hardware. Up to three internal diodes are available within the datakey for steering, encoding, and MOS logic address. Legend buttons of various sizes, shapes and colors with standard or special markings are available. Keyboards have a rigid metal mounting plate for the datakeys which protects the printed circuit board from operating stresses. Compatible with DTL, T^2L, or MOS logic, optional features of keyboard include ASCII, EBCDIC, BAUDOT and other codes; multiple shift; strobe delay; roll-over blanking; odd or even parity; positive or negative logic; error signal; repeat function; output latching. Elec-Trol, Inc.



CIRCLE 205 ON INQUIRY CARD

LIGHT-EMITTING DIODE



Emitting in the visible red waveband with typical peak emission at 660 nm, the type MLED600 gallium arsenide-phosphide photodioxide exhibits a minimum brightness of 50 ft-L at 10 mA and typical brightnesses as high as 700 ft-L at drive currents above 40 mA. Other major electrical specifications are a low-nanosecond response time, a low typical forward voltage of 1.5 V at 20 mA, and a typical spectral line width of 20 nm. Maximum safe power dissipation is 100 mW at 25°C. The low forward voltage makes light-emitting diodes (LED) compatible with IC logic systems. Motorola Semiconductor Products, Inc.

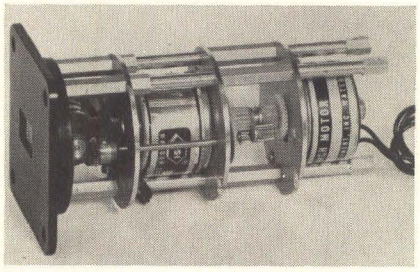
CIRCLE 206 ON INQUIRY CARD

DISC SYSTEMS

The FASTRACK™ 8100 disc systems are fast access head-per-track disc systems designed specifically for high performance real-time random access applications. Features include a 3-MHz bit serial data rate, 16.7-ms average initial access time, and random access to the next sector on any track in less than 15 μs. Sector counters, manual write protection, and multi-controller access are included. Standard capacities are 24, 48, 72 and 96 M bits within one 19″ rack mounted unit. In addition, a 6-MHz, 2-bit parallel version is now offered. Computer Peripherals Corp.

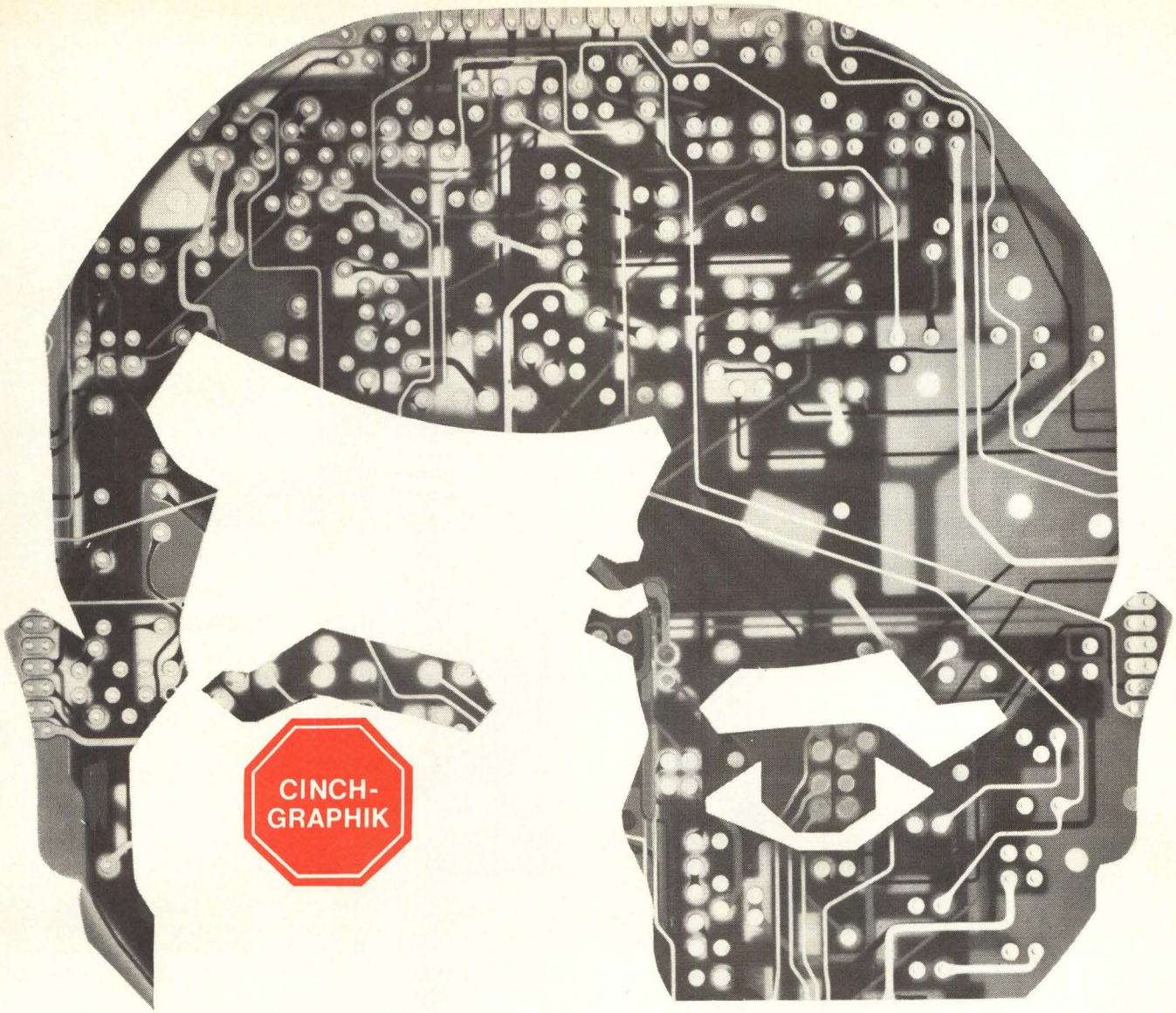
CIRCLE 207 ON INQUIRY CARD

ADD-SUBTRACT PULSE COUNTER



A simple application of two new stepper motors results in an add-subtract pulse counter that will accept plus and minus pulse counts simultaneously without ambiguity. This algebraic function is provided by a pair of 2-wire stepper motors coupled to the counter through a mechanical differential. One motor handles the "add" pulses, while the other receives the "subtract" signals. Pulse rates of as high as 60 pps may be achieved with pulse durations of 0.015 s, at a power consumption of 2 W max. per motor. Haydon Switch and Instrument, Inc.

CIRCLE 208 ON INQUIRY CARD



your multilayer man for volume production

Twenty million boards a year make Cinch-Graphik the world's largest independent producer of printed circuits. The industry's most advanced equipment, including an exclusive, 6-ton, 28 foot multilayer camera is housed in a 125,000 square foot plant that has capacity for additional volume production.

For information on how Cinch-Graphik can produce precision boards in volume, for you, contact your Cinch—Sales District Office or Cinch-Graphik, 200 South Turnbull Canyon Road, City of Industry, California 91744, Telephone, (213) 333-1201.

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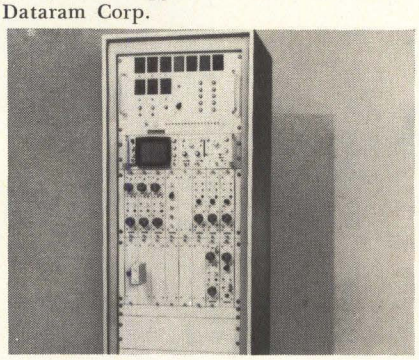
CIRCLE 61 ON INQUIRY CARD

NEW PRODUCTS

MEMORY-CORE TESTER

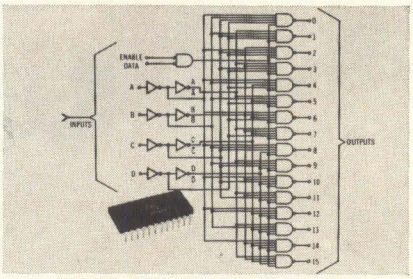
The model 201 provides both comparison and absolute-value testing. Comparison testing uses a transformer to show any differences between a standard core and a test core. Absolute-value testing measures the sense output at predetermined time and voltage. A core under test is accepted or rejected according to those values. Both testing methods can be used on every core. The unit tests up to 25 cores per second and is capable of handling current and anticipated demands of technological advances. The handler stops when two consecutive cores are missed or when 16 cores are rejected consecutively. Missing two cores in a row could indicate malfunction in the handler; rejecting 16 without interruption could suggest a bad lot of cores. Dataram Corp.



CIRCLE 209 ON INQUIRY CARD

LINE DECODER/DEMULTIPLEXER

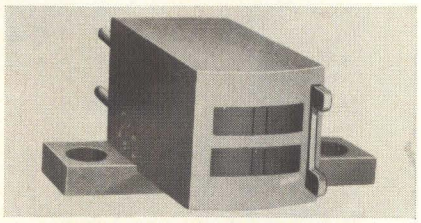
A transistor-transistor logic (TTL) 4-line to 16-line decoder/demultiplexer integrated circuit has four binary coded inputs which are coded internally to address one of the 16 output gates. Applications for the SN54154/SN74154 include demultiplexing serial data to parallel; decoding BCD and binary codes and sequentially distributing serial word data. In addition, the circuit can serve as a clock-time or minterm generator, and it is cascadable to n-bits (even for decoding) on n-words. The demultiplexers are fully compatible for use with other TTL or DTL circuits. Input clamping diodes are provided to minimize transmission line effects and thereby simplify system design. Typical propagation delay time for data is 20 ns. Typical power dissipation is 170 mW. Texas Instruments, Inc.



CIRCLE 210 ON INQUIRY CARD

CASSETTE ERASE HEAD

An erase head Model W2ER, for cassette tape players offers ferrite cores for excellent erase efficiency and low power requirement. It has an inductance of 20 mh at 1 kHz and a dc resistance of 12 Ω. Operating erase current is 17.0 mA at approximately 13 V (for 56 dB erasure of saturated tape.) The head is compatible with all standard cassette track configurations and is used in such mini-digital applications as desk-top calculators and data processing peripherals. Nortronics Company, Inc.



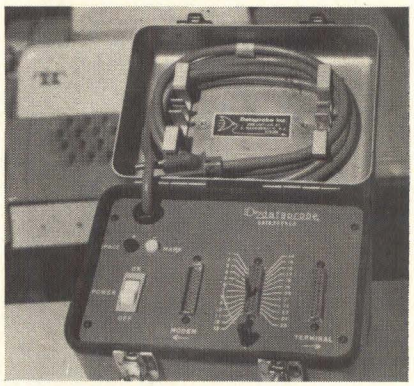
CIRCLE 211 ON INQUIRY CARD

ROCKER SWITCH

A series of miniature rocker switches, each containing a neon indicator light, are available with amber, red, or clear lenses. The indicator panel is illuminated when the switch is turned on. Standard models have white bezels and black rockers. Electrical ratings are 12 A, 125 Vac; 6 A, 250 Vac; and ½ hp, 125-250 Vac. Required panel opening is 1.400 x 1.105" with a panel thickness of 0.040 to 0.100". SPST models are available from stock with ¼" male spade terminals. SPDT models with a wide variety of color combinations are available on special order. McGill Manufacturing Co.

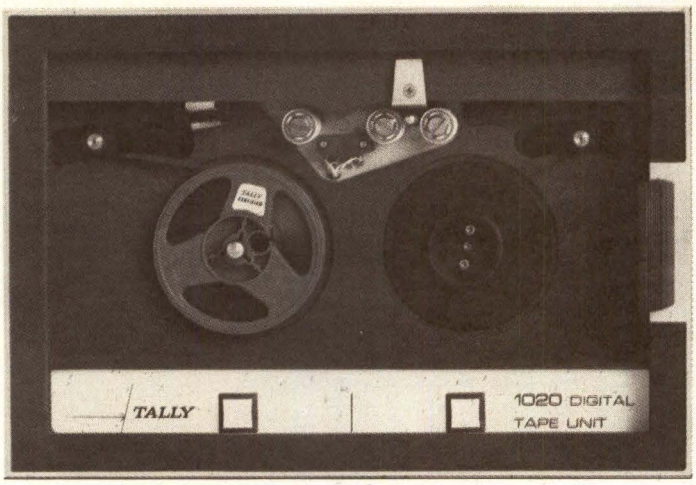
CIRCLE 212 ON INQUIRY CARD

DATA TERMINAL TEST SET



The Dataseeker series of portable test and trouble shooting instruments isolate interface problems between telephone modems and data terminals and facilitate installation, field service, and test of data terminal systems. The model EIA100 allows electrical access to each of the 25 wires in a standard EIA interface cable. On-line tests using the self-contained mark, space, and data indicators, speeds fault isolation. Other models contain built-in control voltages and data simulation. Dataprobe, Inc.

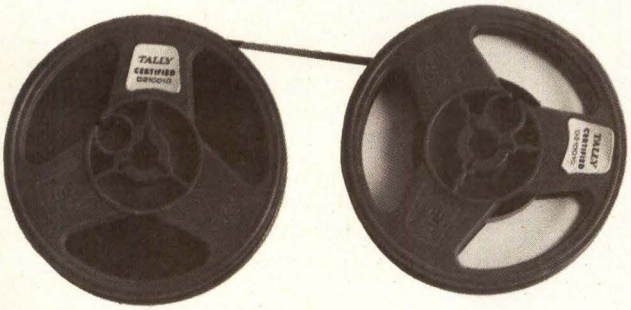
CIRCLE 213 ON INQUIRY CARD



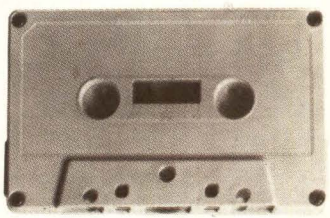
The low cost Tally 1020 incremental ¼-inch mag tape unit transfers data incrementally at 120 characters per second and continuously at 1600 characters per second. Unique among all incremental units, it can backspace and rewrite a single character or block of characters anywhere in the tape (try that on your cassette). Other features include new DTL logic, error checking, simplified construction and maintenance, 280,000 or 560,000 character storage on a 3-inch reel, and low tape wear because of single capstan drive.

Tally's answer to the reel question.

It's funny how those of us in the peripheral equipment business get carried away by new devices from time to time. A few years back, a lot of us thought punched cards would be displaced by paper tape. Then magnetic tape equipment came along and you know what the doomsayers said. Fact: More cards and paper tape are in use today than ever before, even as mag tape use increases. As a matter of fact, Tally thought so much of magnetic tape we developed a line of mag tape equipment to complement our broad paper tape line.



☐ Now, we come to the latest controversy in data handling, reel-to-reel versus cassette. Tally's prediction: both will share a part in an ever growing market. Parenthetically, our view is illustrated by the home entertainment field. Although cassettes are in the limelight, for full fidelity recording and reproduction, nothing beats reel-to-reel handling of music tapes. ☐ When we add up the key factors, we find both cassettes and reel-to-reel offer distinct advantages in a data handling environment. ☐ Reel recording offers greater storage capacity, faster continuous transfer rates to and from the CPU, and faster asynchronous transfer rates to and from the communications lines. Reel recording offers high speed incremental recording and a history of proven reliability. The cassette offers easy loading and ease of handling, and it doesn't require a precision drive. Cassettes require less physical room and are more manageable in a less than ideal environment. ☐ So our advice to you when you design a working storage device into your data system is to choose the method best suited to solve your application problem. ☐ For information on the Tally 1020, as well as other Tally products, please write us for our interface specifications at Tally Corporation, 8301 South 180th Street, Kent, Washington 98031. Phone (206) 251-5500.



TALLY®

CIRCLE 63 ON INQUIRY CARD

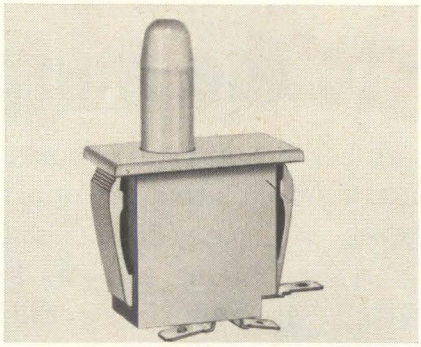
NEW PRODUCTS

MOS CLOCK DRIVER

The MS302 and MS302M film hybrid microcircuits provide two-phase clock inputs to metal oxide semiconductor (MOS) circuits. The industrial version is rated for operation over the 0 to +70°C temperature range. The military version performs over the military temperature range of −55 to +125°C. Both modules are contained in a standard TO-8 package. The units function as interface circuits between TTL and MOS and may be operated in conjunction with TTL integrated circuits to provide fixed width, two-phase clock pulses for MOS registers. Each is a dual microcircuit, consisting of two identical but independent drivers. Sylvania Electric Products, Inc.

CIRCLE 214 ON INQUIRY CARD

PUSHBUTTON SWITCH



Momentary action switch E69-00A is specifically engineered for use as a door interlock and office machine "start" switch. It is housed in a long-life white molded nylon case, featuring a "snap-in" design for easy panel mounting and features coil spring snap-action mechanism and rock-wipe contact action. The switch is available in spdt or spst, either normally open or normally closed. Maximum operating force is 15 oz. A free sample is available upon request. Cherry Electrical Products Corp.

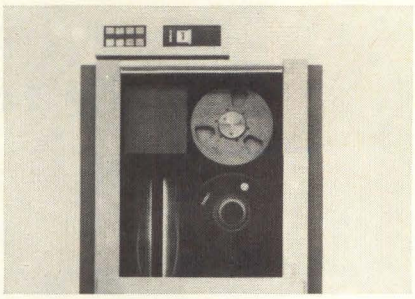
CIRCLE 215 ON INQUIRY CARD

MAGNETIC TAPE RECORDER

Model 1610 is an incremental recorder with 10½", 2400-foot reels. Complete ease of interface is accomplished with DTL compatible inputs. Standard recording speed is 0-500 steps/second with 0-750 and 0-1500 characters/second available as standard options. Tape format can be either 7- or 9-track IBM compatible with gapping, parity, and check character generation automatically inserted on tape upon command from the interface. In addition to Write Only, the recorder is available in Continuous Read/Incremental Write and Incremental Read/Incremental Write versions. Kennedy Co.

CIRCLE 216 ON INQUIRY CARD

MAGNETIC TAPE SUBSYSTEM



The MTS110 subsystem, designed for use with the GE-115 computer system, is primarily for initial entry into magnetic tape processing. This sybsystem uses a single channel controller and as many as four tape handlers. Reliability and minimum tape wear are provided by use of a single capstan drive in the handlers. The subsystem has a 7-track recording density of 200 or 556 characters per inch. Maximum transfer rate is 10.4 kHz and reading/writing tape speed is 18.75 ips, with an extremely high rewind speed of 300 ips. The subsystem is compatible with the IBM 729, IBM 7330, and GE-400 tape handlers. General Electric Co.

CIRCLE 217 ON INQUIRY CARD

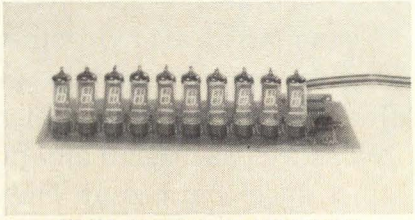
ASYNCHRONOUS COUPLER

The model 101 features all integrated circuits, active filtering, all circuitry encompassed in resilient rubber cups, a carrier detect circuit, which eliminates teletype chatter prior to "hook-up" and prevents early transmission from the remote computer. Full or half duplex operation is selectable. The coupler replaces the access plate on the model 33 and is a complete single unit which can be installed without need for special tools or skills. Source Data.

CIRCLE 218 ON INQUIRY CARD

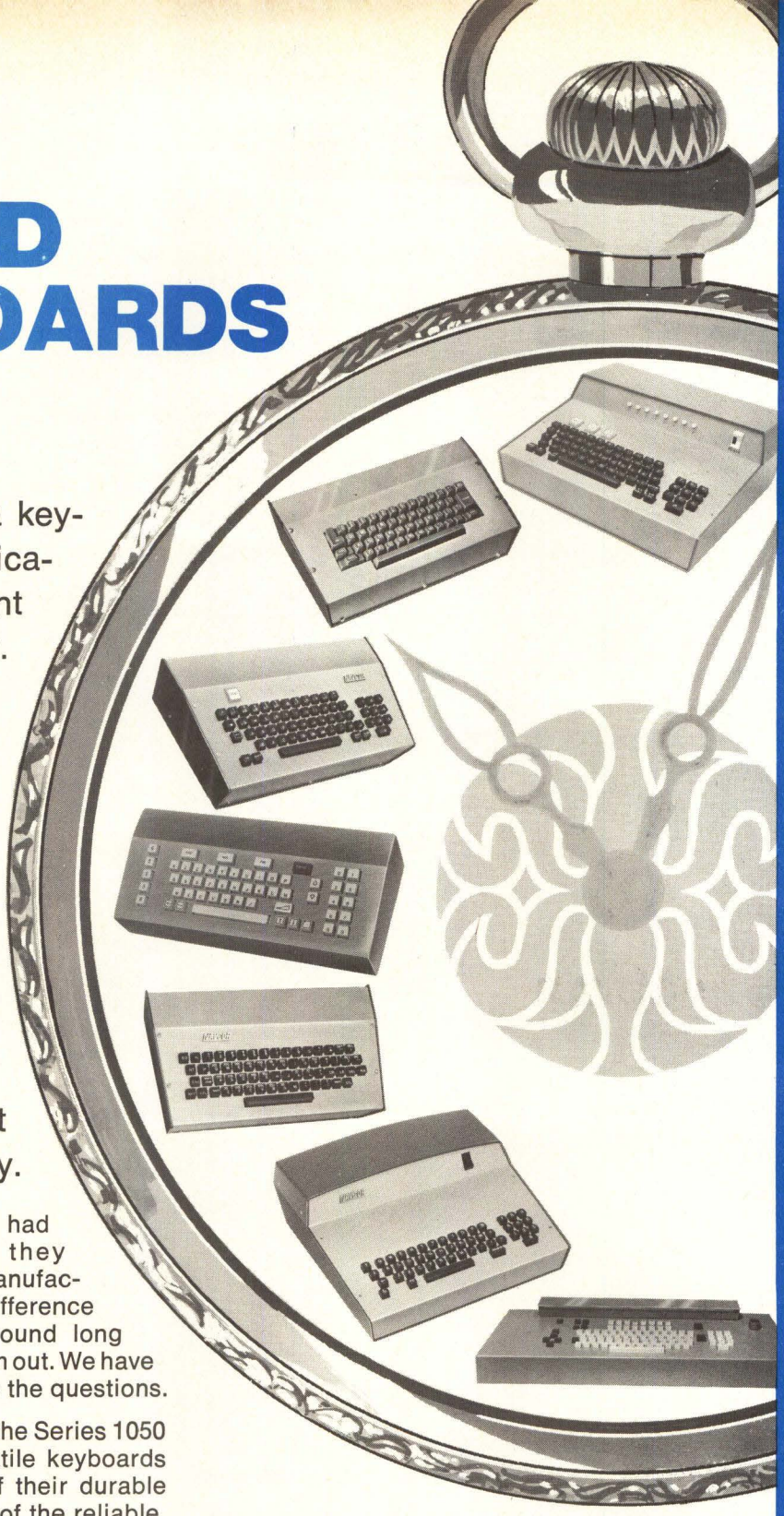
NUMERICAL DISPLAY

The ND-10 is a 10-character numerical display which features time multiplexing and low voltage single-plane readout tubes. This low power consuming display produces bright green characters which are visible over a wide viewing angle from several feet away in a high ambient light environment. Data input is in BCD (8-4-2-1) format where it is converted to a seven segment code. Multiplexing or character activation is performed by providing a logical 0 (zero volts) to the active character display tubes "blanking" control. UNIS Corp., Communications Div.



CIRCLE 219 ON INQUIRY CARD

TIME TESTED KEYBOARDS



When you choose a keyboard for your application, you don't want an unproven gadget. You need a reliable product, backed by years of dependable service ...you need the NAVCOR Series 1050, the one with

OVER 5 YEARS OF EXPERIENCE IN FIELD OPERATION!

But, being first is not the whole 1050 story.

During those years, we've had problems to solve and they weren't unique. Other manufacturers have them too. The difference is — they haven't been around long enough to have worked them out. We have the answers. They just have the questions.

We've worked hard making the Series 1050 the most rugged and versatile keyboards in the industry. The root of their durable flexibility is our unique use of the reliable, magnetic reed switch. No one knows this keyswitch like NAVCOR . . . we invented it.

Each keyswitch is designed to function independent of the others. Variations or expansion of their arrangement can be tailored to any application and keep first unit design costs to a minimum.

With a patented electronic interlock to prevent double-strike, the Series 1050 can be supplied with direct switch closure, coded outputs or a variety of buffered output configurations. Other options include backlighting, lighted keytops, two key rollover and delayed strobes.

It's a lot, but we've been learning for 5 years . . . so, if you're satisfied only with the best, try NAVCOR. You'll be pleasantly surprised at how good the Series 1050 is.

For more information on the Series 1050 or any other NAVCOR product, call: 215-666-6531, or write: Marketing Manager, KDI NAVCOR, INC., Valley Forge Industrial Park, Norristown, Pennsylvania 19401.

KDI NAVCOR INC.

CIRCLE 65 ON INQUIRY CARD

NEW PRODUCTS

DIGITAL TAPE UNIT

The model 1500 tape unit writes IBM computer-compatible tape on reel sizes of up to 10½" (2400 ft.). Interface specifications are similar to the model 1300 now in use for data processing. The unit is available in incremental, continuous, or combined incremental/continuous versions. Overall dimensions are 19" wide, 24½" high, and 16" deep. Weight is 50 pounds. Digi-Data Corp.

CIRCLE 220 ON INQUIRY CARD

D/A CONVERTER

The low cost model 320 contains a complete set of switches and a resistance ladder. Full scale output is 15 mA which may be converted to a voltage by means of a resistor to ground. The unit may be powered by any voltage from +10 V to +15 V, has an operating temperature range of −25 to +70°C, and has a drift with temperature of 50 PPM/°C. It has extremely fast settling—750 ns for 10 bits and 200 ns for 8 bits—making it extremely suitable for use in graphic display systems. The unit is completely encapsulated, and extremely thin. Its dimensions are 1.75 x 2.5 x 0.385". It weighs under 3 oz. Hybrid Systems Corp.

CIRCLE 221 ON INQUIRY CARD

PC CONNECTORS/ASSEMBLIES

Back-plane printed circuit connectors adapted to automatic wire wrapping are applicable for computers, business machines, and other devices that use many printed circuit boards. Panels for the assemblies are manufactured to customer specification with the connector tails oriented for automatic wire wrapping. Either complete assemblies or separate connectors are available. The connectors, available in six sizes, accept 1/16" printed circuit boards with 0.100" contact-to-contact centers (0.200" row-on-row) and have a preloaded bifurcated contact with 0.025" square wire-wrap tail. ITT Cannon Electric.

CIRCLE 222 ON INQUIRY CARD

HYBRID VOLTAGE REGULATOR

The model VR401 features a load regulation of 0.5% at ±15 V $0<I_o<100$ mA with output voltage temperature stability is 0.01%/°C. Line regulation at ±15 V is 5 mV out/1.0 V in. Packaged in a dual in-line assembly (0.75 x 0.50 x 0.170") the quantum regulators will accept an input of ±18 V rectified. Standby current drain is held to 3 mA max. and output noise voltage ($0 \leq I_o \leq 10$ kHz) is 60 μV rms. Ripple rejection is down 60 dB min. Output impedance is 0.100 Ω, max. Quantum regulators may be modified to deliver output rating from ±4 to ±35 Vdc. A transformer and rectifier assembly is also available as a separate module. Quantum Devices Corp.

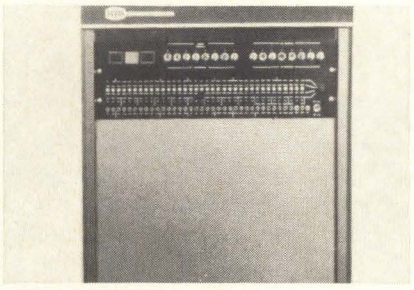
CIRCLE 223 ON INQUIRY CARD

ELECTROMAGNETIC TRANSDUCER

The Mag-Shaper Series 70 magnetic pickup contains a built-in solid-state pulse shaping network which delivers an output in the form of a ready-to-use voltage pulse of fixed width. The pickup is of 3.2" overall length and is designed for a wide variety of speed sensing applications without direct mechanical contact. Movement of a ferromagnetic material such as a gear tooth, pump vane or turbine blade past the electromagnetic monopole pickup creates a change in flux resulting in a voltage pulse. This pulse is fed to an exclusive pulse shaping network where it is amplified and converted to a standardized pulse output of fixed width. The input signal may be either rotary or linear motion; the output is a pulse of known width at a magnitude of approximately 2 V less than B+ and is capable of driving a 100-mA load such as a relay, meter, or counter. Standard models include units rated for pulse frequencies of from 1,000 to 10,000 pps, and pulse widths of from 50 to 500 μs. Tempo Instrument, Inc.

CIRCLE 224 ON INQUIRY CARD

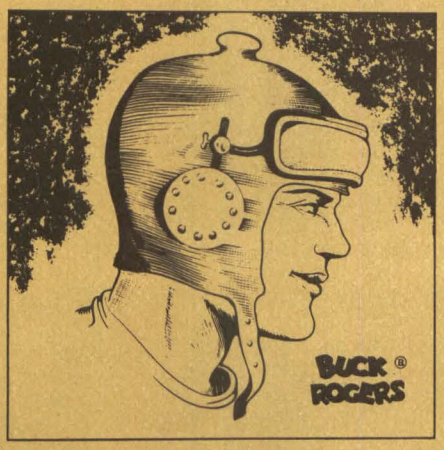
DISC DRIVE CONTROLLER



The DC-16 interfaces with all available mini-computers and from one to eight IBM 2311 or 2312 type disc drives. The controller avoids the former requirement for the processor to drive the disc and, in addition, simplifies programming, increases subsystem efficiency, and takes over several software functions. The system requires only seven commands for easy programming and has 10 records containing 2,560 bytes per track. KDI Interactive Data Systems, Inc.

CIRCLE 225 ON INQUIRY CARD

Brand-Rex reaches into the 25th Century for its new spokesman



Willimantic, Conn. Planet Earth — The Brand-Rex Division of American Enka Corp., a leading manufacturer of wire, cable and insulating materials, announced today at a special conference that it has appointed the world-renowned science fiction hero, Buck Rogers, as its new spokesman. "Buck Rogers was selected for the post because of his reputation as a man who is way ahead of his time," said Mr. John P. O'Connor, Director of Sales and Marketing, at Brand-Rex.

"Buck Rogers stands for the promise of the future, just as the Brand-Rex wire and cable you install for trouble-free operation today promises greater growth potential for tomorrow. Like Buck Rogers, Brand-Rex is way ahead," he continued.

To illustrate this, Mr. O'Connor cited recent Brand-Rex advances in several fields. For the telephone industry, Brand-Rex is intimately involved in new types of wire and cable to meet the growing needs of "total communications," such as, data transmission and telemetry, CATV and microwave systems. For the computer industry, in which the company is the leading wire and cable supplier, Brand-Rex continues to develop thousands of new designs each year for new generations of computers and peripheral equipment. For industrial plants and utilities, the company is advancing the state of the art in control cables, particularly those sophisticated electronic types demanded by accelerating computerization and automation.

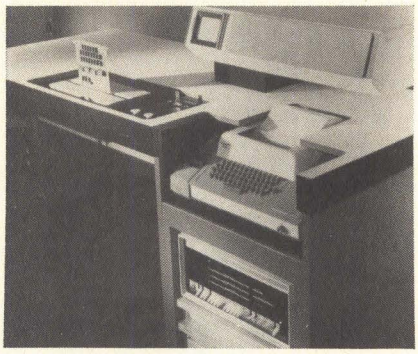
Mr. Harry Wasiele, Jr., Brand-Rex General Manager, stated that he was extremely optimistic about Buck's alliance with the company.

"I feel the Adventures of Buck Rogers will be an excellent way to illustrate the many Brand-Rex advances in wire and cable for communications and electronics," he said.

"It should be an exciting and informative series."

NEW PRODUCTS

LOGIC-CIRCUIT ANALYZER



A computer-controlled functional and diagnostic test system capable of performing up to 4,000 tests per second on printed circuit boards, rapidly tests and diagnoses complex logic circuits. The flexibility of the analyzer, built around a DEC PDP-8/L computer, eliminates the need for costly special tooling, test fixtures, and documentation. For each circuit to be tested, only a simpler adaptor and test program are required. Up to 4,000 functional or diagnostic tests per second can be performed on logic complexes with as many as 240 pins. Anything from a 14-pin IC to a 240-pin large-scale IC or a circuit board with up to 96 inputs and 144 outputs can be tested. Options include 32K words of additional memory and programmable logic levels which permit the testing of many logic families. General Radio Co.

CIRCLE 226 ON INQUIRY CARD

LOGIC TEST PROBE

Logic Pen™ features 5-ns pulse detection and 50-MHz response. The unit is designed for check-out and fault isolation of digital logic circuits, both discrete component and IC types. When the probe is applied to a test point, four miniature lamps indicate "1" and "0" logic levels, and "Q" and "$\overline{Q}$" change of state. The device features fail-safe overload protection to ±400 Vac or dc. Standard Models operate from a power supply of +5.0 Vdc, although supplies ranging from −3.0 to +7.5 Vdc in .7-V increments may be specified. Advanced Digital Research Corp.

CIRCLE 227 ON INQUIRY CARD

DATA DISPLAY UNIT

This compact data display unit is designed specifically for use with the GE Mark Century 120 (model 2) numerical positioning control. The illuminated readout displays X- and Y-axis coordinate information to six digits, plus sign and decimal point, for each axis. A 4-digit, resettable end of block counter is optionally available. Circuitry is monolithic integrated and all-silicon solid-state and readout of signals decoded from 8-4-2-1 BCD input code are provided by neon tubes. Excellon Industries.

CIRCLE 228 ON INQUIRY CARD

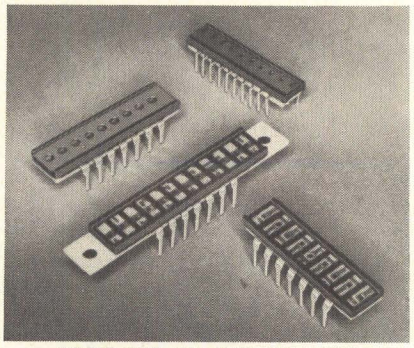
ENGRAVED KEY TOPS

Precision molded key tops with 47 standard engraved and filled inscriptions are a standard light gray in color and come in two sizes. The standard single key is 0.715″ square; the oversize key is 1.218 x 0.715″. Both key tops have the same base-to-top dimension which is 0.531″ and are finger contoured on top. In addition, a standard space bar is available which is 0.715 x 5.00″ and has the same base-to-top dimension as the key tops. The engravings are filled with either white or black special pigmented filler. Mechanical Enterprises, Inc.

CIRCLE 229 ON INQUIRY CARD

PHOTOTRANSISTOR ARRAYS

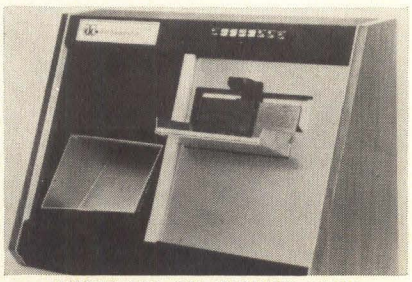
A line of standard photo arrays for optical character recognition applications are available with from 5 to 12 phototransistor sensors and a variety of on-center distances. All phototransistor chips are available with standard positioning tolerances of up to ±0.001″. Designed for the fiber-optic technique of character recognition, these photo arrays can be mounted directly to a fiber-optic head or a printed circuit board. They can also be plugged into standard sockets or attached by the two mounting holes. HEI, Inc.



CIRCLE 230 ON INQUIRY CARD

REMOTE CARD READERS

A remote card reader with speed-compatible CRT terminals, the Card-liner 30 accepts Hollerith coded cards and outputs ASCII code at 300 baud. It can be operated with CRT and GE Terminet 300 terminals or used independently. The family consisting of the models Card-liners 10, 15, and 30 features simplified mechanical handling of the cards with only two moving parts: picker knife and rotary feeder. All models are desk top mounted and are packaged in contemporary office styling. Data Computing, Inc.



CIRCLE 231 ON INQUIRY CARD

This tape cartridge is computer compatible.

It comes with our own vacuum tape drive. All for under $3000.

Our V-SERIES transport is the simple solution to problems of pampering magnetic tape. The plastic cartridge shown above houses standard 8½" reels and tape. The reel is put into the cartridge, the cartridge is put into the tape drive, the tape is threaded and advanced to the load point automatically. The system eliminates contact between the non-technical operator and tape. It also protects the tape in a non-computer environment.

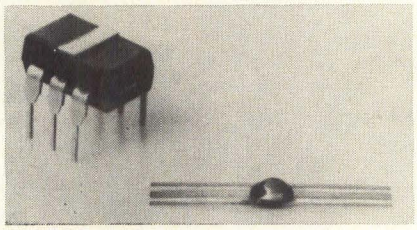
The V-SERIES is unique in other important respects. Operated entirely by vacuum, it has only one mechanical moving part. Our "subtraction modularity" principle gives you a choice of packs to fit your specifications and price—from a rack-mounted deck to the complete unit. $1700 to $3000 in quantities of one.

Write to us.

DIGITAL INFORMATION DEVICES, INC.
210 Welsh Pool Road, Lionville, Pa. 19353 215-647-3700

NEW PRODUCTS

MAG SENSITIVE TRANSISTOR



The Magnistor™ is a magnetically sensitive transistor with two collectors and one emitter. When the device is connected to biasing circuitry similar to that used for differential amplifiers, a differential signal from the two collectors proportional to the magnetic field intensity is available. With an output sensitivity of 0.5 mV/gauss, the Magnistor can be used to interpret information stored magnetically with greater resolution than previously possible. The unit is available in a package configuration which will allow detection of a magnetized region 30 x 50 mils in size. Hudson Corp.

CIRCLE 232 ON INQUIRY CARD

DATA SET

An acoustically-coupled data set, model C, operates in either the originate or answer mode, thus permitting terminal-to-terminal conversations. This unit operates in either full or half duplex mode and is equipped with carrier detect circuitry, in addition to having the answer/originate capability. Data rate is greater than 300 baud, compatible with all Selectric and Teletype printers. The portable unit is housed in a solid walnut case. Livermore Data Systems, Inc.

CIRCLE 233 ON INQUIRY CARD

HAND-HELD LOGIC PROBE

The model 1280C Digi-Probe is a small, hand-held instrument designed for testing DTL, TTL, and RTL type logic circuits. By touching the probe tip to the circuit under test, the engineer or technician can immediately determine high or low logic levels, presence of pulse train, open circuit or improper logic level, presence of a single pulse as fast as 25 ns, and relative duty cycle, a valuable feature for detecting faulty circuits. Readout is displayed by two indicator lamps (HI and LO) to reduce ambiguity in determining logic states. Logic levels include 0 to 1 V LO, 1 to 2.5 V NO INDICATION, and 2.5 to 15 V HI. The unit will detect a square wave greater than 10 MHz and 25-ns positive and negative going pulses. Pulse Monitors, Inc.

CIRCLE 234 ON INQUIRY CARD

Model 58364
Shown
actual size.

No other magnetic pickup can match the performance of Electro's new *DI-MAG**

The digital pulse output of the new Di-Mag* pickup is a dramatic breakthrough development in non-contact sensing. Another example of ELECTRO leadership in metal detection that started more than 25 years ago.

PROVIDES DIGITAL PULSE OUTPUT:
CONSTANT AMPLITUDE PULSES
FROM BUILT-IN CIRCUITRY

ELIMINATES INTERFACE CIRCUITRY:
SIGNAL IS ALREADY PROCESSED
FOR DIRECT USE IN DIGITAL
COMPUTATION EQUIPMENT

CHOOSE FROM 3 MODELS:
FOR OUTPUT VOLTAGES OF
+5, +12 OR –12 VOLTS NOMINAL

LOWER SENSING SPEEDS:
FULL OUTPUT AT 15″ PER SEC.

GREATER SENSING DISTANCES:
FROM 0.010″ TO 0.100″

LESS SUSCEPTIBLE TO NOISE:
COMPLETELY SHIELDED CIRCUITRY

COMPACT:
SMALL SIZE FOR DENSE PACKAGING

WRITE FOR BULLETIN DM-769

ELECTRO

ELECTRO PRODUCTS LABORATORIES, INC.
6125 West Howard St., Chicago, Ill. 60648 • 312/647-8744

*Patent Pending

CIRCLE 72 ON INQUIRY CARD

NEW PRODUCTS

MODULAR MEMORY CARDS

Two ultra high-speed, fully functional, read-write memory printed circuit cards, AMS 0238 and AMS 0239, feature 15-ns access and 10-ns cycle times. One card is organized for 32 words x 8 bits and the other for 32 words x 9 bits. Inputs are fully buffered and outputs permit wired-OR operation to facilitate word expansion. Features include TTL and ECL compatible—15-ns access time; NDRO; buffered inputs—50 μA loading typically; two card select inputs to simplify memory expansion; write strobe. Advanced Memory Systems.

CIRCLE 235 ON INQUIRY CARD

MAG TAPE SYSTEM

A cartridge-loaded magnetic tape system, the 1024 CartriFile is used with minicomputers, data terminals, test equipment, and process control systems. It incorporates a tape transport, read and write electronics, power supply, and tape controller in a single rack-mountable cabinet. Interfaces to more than 24 minicomputers are available. The system can read and write data on the same 2-tape cartridge used in the model 4096. Data written by the 1024 may be read on the 4096 and vice versa. Tri-Data Corp.

CIRCLE 236 ON INQUIRY CARD

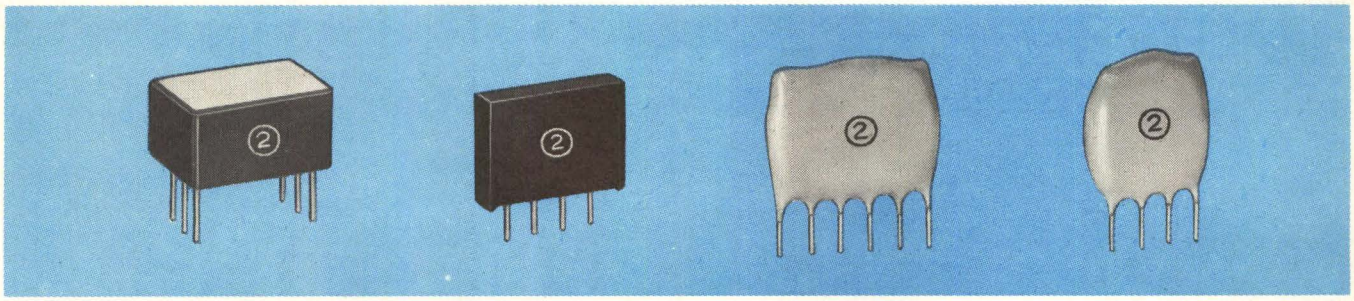
MULTIPLEXER

The model MUX-810, for use in high-speed digitizing of analog inputs, permits eight analog signals to be connected to a single output at a rate of 6.6 million connections per second. The connections can be made sequentially, with any number of channels in the sequence; or on a random access basis. A front panel push-button and digital readout tube can also be used for stepping the connections one channel at a time. The equivalent "ON" resistance of the unit is 0.2 Ω, permitting use for switching 100-Ω lines. It is completely equipped with internal power supplies and operates over a frequency range of 47 through 420 Hz. Computer Labs.

CIRCLE 237 ON INQUIRY CARD

Now from Sprague Electric!

Your *custom* pulse transformer is a *standard* DST* transformer



Some of the case styles in which Sprague DST Pulse Transformers are available. Note the in-line leads.

You can select the transformer design you need from the new Sprague DST Family, a fully-characterized series of Designer Specified Transformers which Sprague Electric has pioneered. It's easy. Start with the two basic parameters dictated by your circuit requirements: primary (magnetizing) inductance and volt-second capacity.

New Sprague engineering data gives basic information from which all nominal sine wave parameters are derived. This data allows you to specify the one transformer from thousands of possibilities which will optimize performance in your application.

Design Style A minimizes magnetizing inductance change as a function of temperature. Typically it's $< \pm 10\%$ change from 0 to 60C; $< \pm 30\%$ from -55 to $+85$ C.

Design Style B and C give you broad bandpass characteristics, and still keep magnetizing inductance change $< \pm 15\%$ from 0 to 60 C.

Design Style D is *fast*. Associated leakage inductance and coupling capacitance are kept at a minimum. This style is just what you need for interstage and coupling devices in computer drive circuits.

The Sprague DST Series packs a lot of transformer into minimum volume packages — epoxy dipped for minimum cost, or pre-molded. The 100 mil in-line lead spacing is compatible with integrated circuit mounting dimensions on printed wiring boards.

To solve your pulse transformer design, start now. Write for Engineering Bulletin 40,350 to the Technical Literature Service, Sprague Electric Company, 555 Marshall St., North Adams, Massachusetts 01247.

*Trademark

SPRAGUE COMPONENTS

PULSE TRANSFORMERS	INTEGRATED CIRCUITS	CERAMIC-BASE PRINTED NETWORKS
THIN-FILM MICROCIRCUITS	INTERFERENCE FILTERS	PACKAGED COMPONENT ASSEMBLIES
TRANSISTORS	PULSE-FORMING NETWORKS	BOBBIN and TAPE WOUND MAGNETIC CORES
CAPACITORS	TOROIDAL INDUCTORS	SILICON RECTIFIER GATE CONTROLS
RESISTORS	ELECTRIC WAVE FILTERS	FUNCTIONAL DIGITAL CIRCUITS

4SSC-7137R1

SPRAGUE®
THE MARK OF RELIABILITY

CIRCLE 31 ON INQUIRY CARD

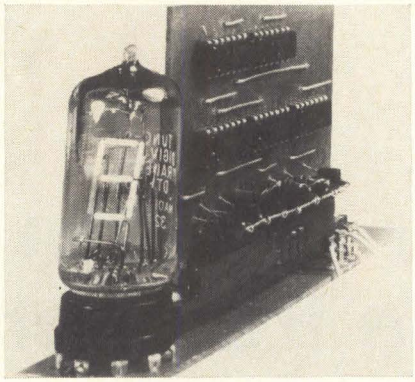
NEW PRODUCTS

COUNTER/DISPLAYS

AN500 series counter/displays are compact, self-contained units which provide two, three, four, or five full decades of decimal display or counting functions. A polarity symbol and/or overrange "one" may also be provided as options. All models are available with optional buffers storage registers and/or decade counters, and the outputs of both are simultaneously available at the rear connector. All I/O signals are DTL/T²L compatible, and the use of high-speed logic permits counting rates of up to 10 MHz. Signal inputs present only one DTL load, and all outputs are capable of driving nine DTL loads. Analogic Corp.

CIRCLE 238 ON INQUIRY CARD

DIGITAL COUNTER

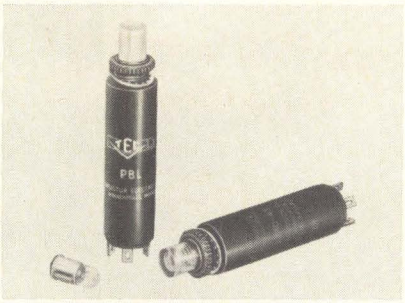


This subassembly for incorporation into any digital system can be used in systems counting items on a conveyor belt; closures of a switch or relay; radio frequencies; and other counting applications. Precise interval measurements are also possible. The readout tube displays the accumulated count as a green, high visibility numeral that can be read at angles up to 150 deg. Multiple units can be mounted in combination and wired on cascade to allow counts as high as desired. The unit is available in one-piece or as a plug-in card for a 15-pin card socket. Modulo 6 is available at no extra cost. Varitron Corp.

CIRCLE 239 ON INQUIRY CARD

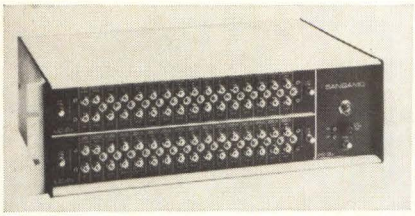
SWITCH/INDICATORS

High-current switch/indicators that mount in $\frac{5}{8}$" holes with centers as close as $\frac{19}{32}$" for a 5 A model and $\frac{23}{32}$" for a 15 A model are rated @115 Vac, 60 Hz or 28 Vdc. Switch circuitry is spdt. Both momentary and alternate snap action switches are available. For alternate action, the switch mechanism is a bi-stable design which maintains either open or closed contact positions until the switch is actuated again. The PBS Series model is available for those applications requiring only a switch. The PBL Series model combines switch and indicator in one device to conserve panel space. Lenses are flat top design and can be hot stamped with one letter, numeral, or symbol up to $\frac{3}{16}$" high or three characters up to $\frac{3}{32}$" high. TEC, Inc.



CIRCLE 240 ON INQUIRY CARD

EQUALIZER



A line conditioner, the LC-2 equalizes voice-grade communication circuits for high-speed data transmission. The unit features amplitude compensation at ±3.5 dB at 13 points across the pass band in addition to proven band-edge compensation. Also provided are 13 delay compensation networks across the pass band. The equalizer was specifically designed to facilitate equalizing a line to the stringent requirements of C3, C4, and S3 specifications with a minimum of equipment. Time required for the complete equalization task is minimized by a special circuit which permits amplitude adjustments independent of previously set time delay compensation. Sangamo Electric Co.

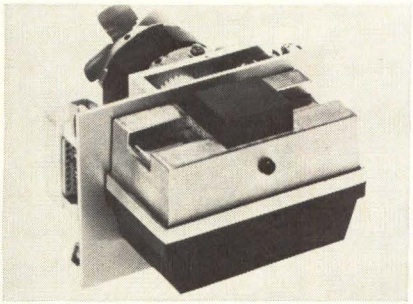
CIRCLE 241 ON INQUIRY CARD

EPOXY SCR

A family of six low-cost lead-mount silicon controlled rectifiers 2N5787 through 2N5792 with forward and reverse voltage ratings from 30 to 400 V, offered in an epoxy TO-106 package, conform to the electrical specifications of the registered TO-92 series, 2N5060 through 2N5063. Operation of the devices is guaranteed at junction temperatures of −65 to +125°C. These SCRs feature a high gate sensitivity (10 μA typically) and a low on-state voltage drop (1.0 typically at 200 mA). All have maximum current ratings of 500 mA rms. Fairchild Semiconductor.

CIRCLE 242 ON INQUIRY CARD

PERFORATED TAPE READERS

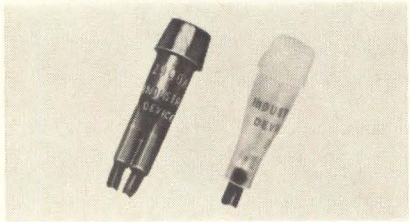


Known as the model R-50, a unidirectional perforated tape reader capable of asynchronous operating speeds of up to 50 characters per second features a "top load" read head design that allows convenient fast "straight line" tape loading. Positive hole/no-hole starwheel sensing from the bottom of the tape assures accurate reading. The unit reads 5-, 6-, 7- or 8-level tapes in standard $11/16$", $7/8$" or 1" widths without modification. Any tape material can be read without regard to color, thickness or opacity. Tally Corp.

CIRCLE 243 ON INQUIRY CARD

NEW PRODUCTS

INDICATOR LIGHTS



One-piece, lens/body GLO-DOT Series 6- and 12-V indicator lights are available in five lens colors: red, white, green, blue, and yellow. The economical lights have built-in incandescent lamps and 4½" long 24 AWG insulated leads, pre-stripped one-half inch for rapid connection. Lights are designed for easy mounting in 5/16" diameter holes, with push-on mounting nuts supplied. Industrial Devices, Inc.

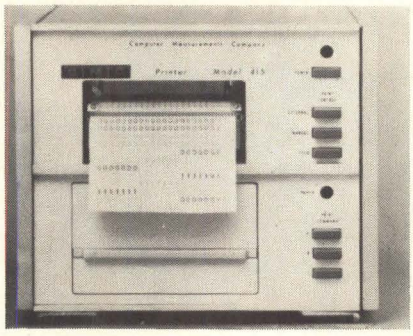
CIRCLE 244 ON INQUIRY CARD

MEMORY CORES

Coincident current memory cores for use in high-speed, temperature-sensitive application feature high drive and fast switching. The type 14-100, an 18-mil wide-temperature range, fast switching, high drive core is ideally suited for use in 1 to 2 μs range coincident current memories which operate over the temperature range of −55 to +100°C. Other available cores are: 18-mil, type 18-100; 20-mil, type 28-100; and two types of 30-mil, types 38-100 and 38-101. The cores provide optimum performance over the temperature range of −25 to +75°C. Electronic Memories.

CIRCLE 245 ON INQUIRY CARD

DATA LOGGING PRINTER

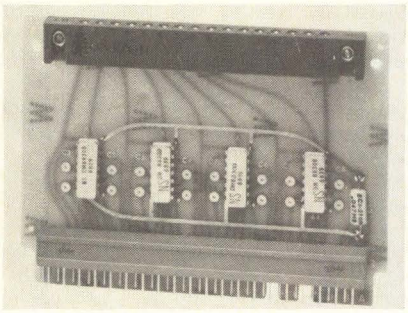


The model 415 printer has a mechanical printing mechanism that operates for more than 5 million cycles without adjustment, is replaceable in the field, and provides the legibility of an electric typewriter. From 7 to 21 columns of line capacity are offered, and red/black printing with color selection by numerical field is provided. Floating decimal point and automatic zero suppression are standard features. It prints at a speed of 3 lines per second. Computer Measurements Division, Newell Industries.

CIRCLE 246 ON INQUIRY CARD

LINE DRIVERS AND RECEIVERS

The L031 consists of eight integrated circuit differential line receivers. Each receiver can accommodate up to 15 V of common mode voltage and has DTL/TTL compatible outupts. The L032 consists of eight differential line drivers. Each differential output is balanced and is designed to drive twisted pair transmission lines with characteristic impedances of 50 to 500 Ω. Both cards operate from a single 5-V power supply and are packaged on a standard card, 4.65 x 3.3". Test points are provided at the output of each driver and receiver to facilitate debugging and system checkout. Monitor Systems.



CIRCLE 247 ON INQUIRY CARD

DC SERVO MOTOR

Designed to directly drive computer tape cassettes for digital data entry without requiring any intervening mechanical gearing this servomotor exhibits typical torquer associated characteristics of low ripple torque to keep tape drive uniform and speed control accurate to within ±3%, a high starting torque and a low starting voltage. It will drive cassette tape at speeds of 2 to 20 ips (selected by choice of oscillator frequency) with start times of 3 to 8 ms, and provides a reversible high-speed rewind capability. Rewind or fast forward operation of a 300-foot cassette tape is less than 90 s. Clifton Div. of Litton Industries.

CIRCLE 248 ON INQUIRY CARD

ACOUSTIC COUPLERS

The 240 series of acoustic couplers and modems compatible with the 103A Dataphone features a flexible rubber cup design which provides both a positive mechanical connection and an acoustic shield. Generation of erroneous characters are prevented by a switch which shorts out the microphone until the handset is firmly seated. FM techniques such as limiters, LC filters, and discriminators assure high immunity to both line and room noise and sidetone effects. The receiver provides a minimum out-of-band attenuation of −37 dB. Anderson Jacobson, Inc.

CIRCLE 249 ON INQUIRY CARD

X-Y COORDINATE DIGITIZER

Programming directly from basic artwork or graphics to prepare a paper tape, eliminating the need for dimensioning, is one of the uses of this graphic digitizer. In addition it may be used for numeric display of linear measurements and for hard copy record of coordinate measurements. The display control unit features in-line Nixie numeric readouts and choice of bidirectional encoder or +2 V to +10 V sine or square waves in quadrature input signals. The incremental encoder is non-contacting photoelectric with amplifier and has available resolution of up to 1000 or 4000 counts per revolution. IKL, Inc.

CIRCLE 250 ON INQUIRY CARD

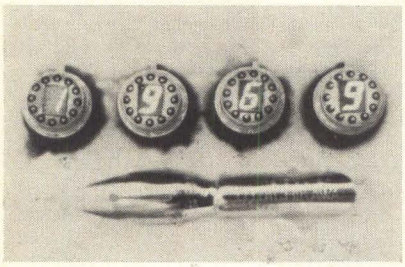
MEMORY MODULES

CM 2400 series Ultramem modules are 4096-bit hybrid LSI memory subsystems consisting of up to 16 each MOS storage chips and up to 6 each bipolar chips for driving, sensing, and output. Chips are interconnected on an alumina substrate with a hermetically-sealed cap for ultimate reliability and protection. Available units are 4096 W x 1 bit, 2048 W x 1 or 2 bit, and 1024 W x 1, 2, or 4 bit. These modules are designed for buffers, scratchpads, and main-frame memories where speed, size, power dissipation, and overall system cost are important. Input and output signals are TTL. Computer Microtechnology, Inc.

CIRCLE 251 ON INQUIRY CARD

NEW PRODUCTS

INTEGRATED PHOTODIODES

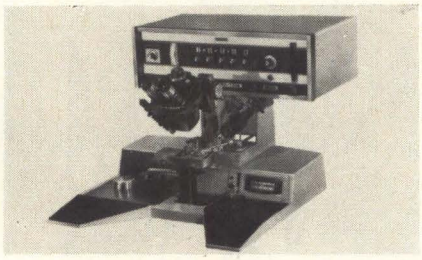


An 8-segment display about the size of a thumbtack which produces figures from 0 to 9 and a stop sign in bright red, and a 16-segment diode which produces the complete alphabet, are designed to replace currently available photodiodes as well as incandescent lamps and discharge tubes for use in electronic readout devices. They provide bright readouts, fast response to switching, very low power consumption, and long life. The monolithic integrated structures, containing large crystals of arsenic phosphate gallium, replace the conventional hybrid structure and obtain a number of display units from a single, large crystal sheet. Hitachi, Ltd.

CIRCLE 252 ON INQUIRY CARD

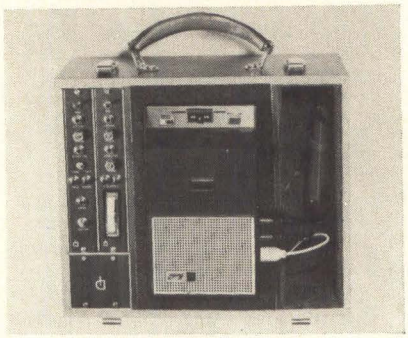
THERMAL IC RESISTOR-ADJUSTOR

Instead of abrasive or laser methods, the Model 1100 IC resistor adjustor uses a short-interval low-voltage electrical current to change resistance value thermally. Its rate of operating speed is equivalent to abrasive systems but it offers accuracy to 0.01%. The range of resistor adjustment is in excess of 25% with most film depositions. Rather than removing resistive material, this process raises the temperature of the resistor briefly, causing an oxide to form. The oxide increases the resistance value and also serves as a protective coating. Resistors adujsted using this method are very stable. An unusual application of value in the laboratory is TCR matching to produce paired resistors that are matched both for resistance and temperature coefficient. Operation is automatic once the initial setup has been made. Data Systems Corp.



CIRCLE 253 ON INQUIRY CARD

CASSETTE RECORDER

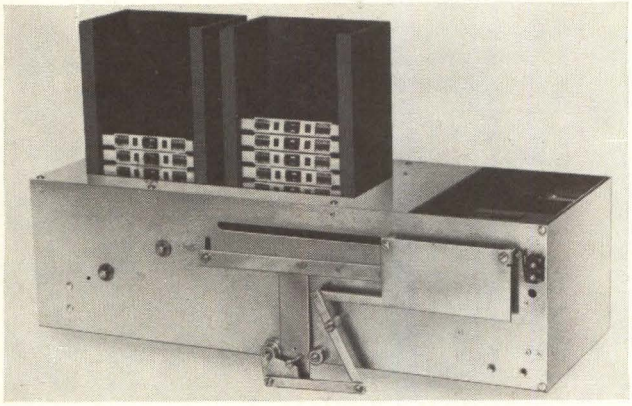


A single channel, dc to 1000 Hz instrumentation recorder which utilizes convenient cassette tapes, is designed for portability and maximum utility. The 11-pound battery powered instrument contains FM record/reproduce electronics and has pushbutton calibration. It has provisions for visual, audible, or external monitoring of record/reproduce mode data signals, and the operator may insert voice comments as desired. Input to the recorder for full-scale output may vary from ±0.1 to ±1.0 V. Output current is adjustable for up to ± 10 mA into a 400-Ω load. Electronic speed regulation of the capstan drive motor maintains constant tape speed and permits peak-to-peak signal-to-noise ratios of better than 34 dB. Dallas Instruments.

CIRCLE 254 ON INQUIRY CARD

CASSETTE CHANGER

This automatic tape cassette changer, for use within the disciplines of an EDP environment, accommodates all EIA Type CP-2 tape cassettes. Data is read serially at speeds from 1⅞ ips to 20 ips in both read and write modes. Operation is controlled manually or by external commands. Manual controls include rewind, load, on-line, fast forward and reject. The input hopper holds up to 10 cassettes. After each cassette is read it is automatically moved to the output stacker. The next cassette is then fed into read/write position. Start/stop times are such that a single record at a time may be read. Start time is 10 ms and stop time is 15 ms. Cassette change cycle time is 10 s., and fast forward or rewind time for a full 300 ft. cassette is 60 s. The basic tape drive utilizes a single capstan and pinch roller. Data Instruments Co.



CIRCLE 255 ON INQUIRY CARD

LOW POWER PLATED WIRE MEMORY

SMP 1212 series low power plated wire memories are available in capacities of up to 4,096 words of 12 bits each. Designed for operation in nondestructive readout mode, the memories are suitable for all aerospace and central storage applications where loss of all or any portion of the stored data cannot be tolerated. Operation is at 400 ns for read cycle time and 550 ns for write cycle time. At a 100-kHz word rate, write power consumption is 800 mW in the write mode and 450 mW in the read mode. Volume is 110 cubic inches, and the entire unit weighs less than 4.5 lbs. Space and Tactical Systems Corp.

CIRCLE 256 ON INQUIRY CARD

ACOUSTIC COUPLER

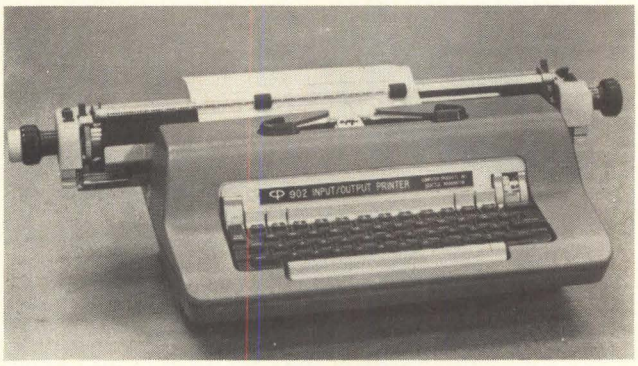
A 300-baud acoustic coupler that transmits digital data reliably over noisy, weak lines compensates within the coupler for line problems. The second harmonic distortion problem is eliminated by the third harmonic which virtually cancels the interfacing second harmonic, regardless of the characteristics of the microphone. With "remote echo" option, the coupler will echo the received data back to the computer for verification. This operates under direct computer control. If there is an error, the computer can, for example, repeat print the entire line containing the error. A second option allows parallel data interfacing between the coupler and the user's equipment as an alternative to the standard TTY and EIA serial data interfaces. Applied Digital Data Systems, Inc.

CIRCLE 257 ON INQUIRY CARD

NEW PRODUCTS

INPUT/OUTPUT PRINTER

The CP902 input/output printer is an office typewriter harnessed electrically so that it may be operated automatically by electrical impulses from outside equipment. The unit will generate alternate or simultaneous electrical output to operate other equipment. Operating features and specifications include typing speed of 16.7 characters per second (200 wpm), one character mechanical buffer, optimum driving pulse of 15 ms duration, feedback switches for all characters and functions, character array of 90 characters, and key error protection. Computer Products, Inc.



CIRCLE 258 ON INQUIRY CARD

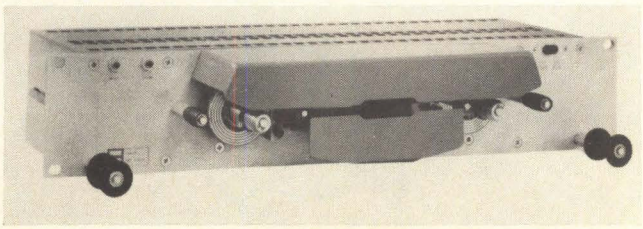
PC BOARD CONNECTORS

A series of printed circuit board connectors offering 312 different configurations from available tooling is used in military and commercial electronics, communications, industrial controls, and computer peripheral equipment. Choice is offered of either a gold plated bellows or a gold dot contact with either 0.100″ or 0.125″ contact centers. The connectors meet military shock and vibration specifications as well as number of card insertions and withdrawals. The positioning of the tip of each contact tail is held to within a diameter of 0.020″ of its locus or true position. The entire line is designed to accommodate automatic wire-wrapping machines. The bellows contact has a bifurcated or dual mating surface which offers two points of contact per circuit path, even on irregular printed circuit card surfaces. Contacts are plated with 30 millionths of an inch of gold over nickel. Sylvania Electric Products, Inc.

CIRCLE 259 ON INQUIRY CARD

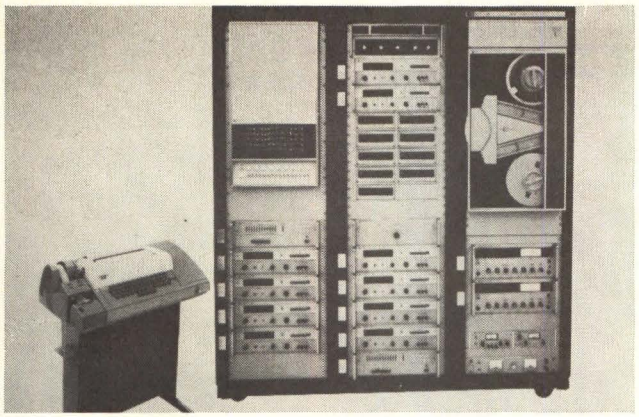
PUNCHED TAPE READERS

Increased capability of the 5000 series of punched tape readers and handlers is provided by offering any desired combination of input and output characteristics. Voltages may be specified between 3 and 15 V, either positive or negative, with the option of going to ground on either the "hole" or "no-hole" condition. Start time is 5 ms and the readers stop "on character" under all operating conditions to 625 characters per second. Tape handling capabilities range from loop to 1,200 ft. This series of readers incorporates a lamp regulator circuit which automatically compensates for tape opacity, tape alignment, and lamp interchangeability. The elimintion of adjustments results in an estimated MTBF of 12,000 hours. Chalco Engineering Corp.



CIRCLE 260 ON INQUIRY CARD

DATA RECORDING SYSTEM



The model 7401B system measures and records up to 10 channels of analog data with greater accuracy and speed as well as improved resolution and a formatted magnetic tape for off-line analysis. Composed primarily of standard instruments and the 2116B computer, which acts as system controller, the system scans up to 10 channels of analog data and up to 18 on/off events at a 10-times-per-second rate. After measuring and digitizing the analog data and converting to engineering units, the system records all of the data on magnetic tape along with timing and identification information, and displays the data on its front-panel digital readouts. Hewlett-Packard Co.

CIRCLE 261 ON INQUIRY CARD

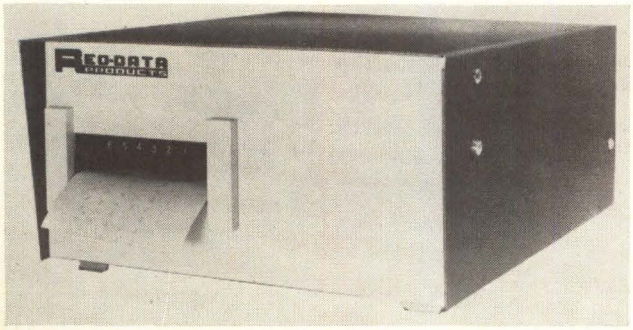
DIGITAL COMMAND SYSTEM

The model DM-3 digital command system directs machinery, valves, and processes from a remote location. At the command station, instructions are inserted via punched card or tape. Each command position is immediately displayed upon an illuminated digital readout at both the command station and the control station. At the control station, the digital error signal between command position and actual position drives the prime mover in the proper direction. Connection between stations may be hard-wired or via voice-grade telephone lines. One command station, by the multiplexing technique, may serve several control stations. Accuracy and resolution are 1 part in 10,000. Theta Instrument Corp.

CIRCLE 262 ON INQUIRY CARD

DIGITAL DATA PRINTERS

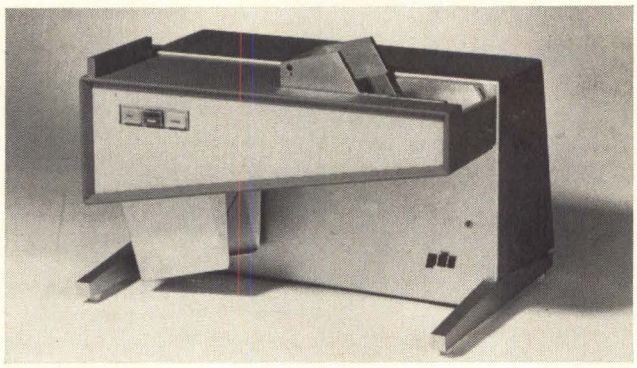
Models REO-20 and REO-21 are low-cost printers designed to interface with low-cost DVMs. There are two basic configurations—a desk top version with 1 to 12 column capacity and a panel mount version with 1 to 8 column capacity. Print rate is 5 lines per second under worst case conditions. Data entry is parallel, BCD or 10-line decimal or 12-line wire data inputs. The printers have positive or negative true logic to interface with integrated circuit output levels. Standard features include visual readout, input memory, inhibit signal, print complete, print inhibit and multiple copies. Options available are paper out indicator, floating decimal point, custom control switches, special print characters, sequential counters, and special input codes. Reo-Data Products.



CIRCLE 263 ON INQUIRY CARD

NEW PRODUCTS

CARD READERS



Series 300 table model and rack-mounted card readers can operate at a rate of 300 cards per minute with either a general-purpose computer or remote terminal. Standard features of this series include card feed stop, motor shut down in case of a card jam, and an attention light that tells the operator when the output hopper is full, the input hopper is empty, or if there is a no-pick condition—the card not being transferred to the read station. Only three illuminated controls are required: power on-off, card feed start with operator attention light, and card feed halt. Optional features include a read station light/dark check for each card feed, line drivers for signal transmission of over 30 feet and provision for 50-Hz operation. Peripheral Dynamics, Inc.

CIRCLE 264 ON INQUIRY CARD

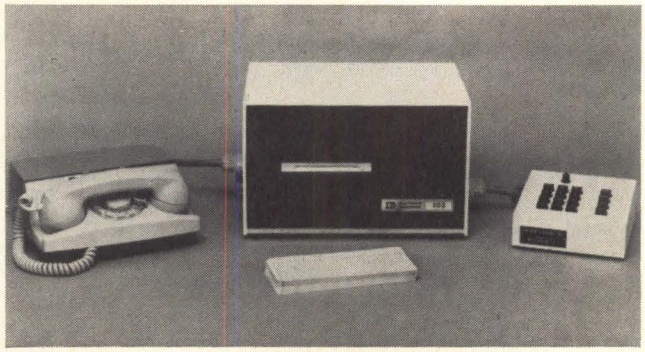
HYBRID MICROCIRCUIT

A power hybrid microcircuit capable of handling a 500-W power output, the DPS-1000 is a dual power Darlington switch mounted in a TO-3 package. Each switch is capable of delivering output currents of 5 A average, 10 A peak, from power supplies up to 50 V. Features include complete isolation between the two Darlingtons, minimum current gain of 1000 and reverse transient suppression. Characteristics at 5 A include 150-ns total rise time; 1.5-μs storage time, and saturation at less than 2.0 V. The units can be driven from logic over a −15 to +65°C temperature range. Applications include hammer drivers, relay drivers, ferrite drivers, and series regulators. TRW Semiconductors Div.

CIRCLE 265 ON INQUIRY CARD

DATA TRANSMISSION CARD READER

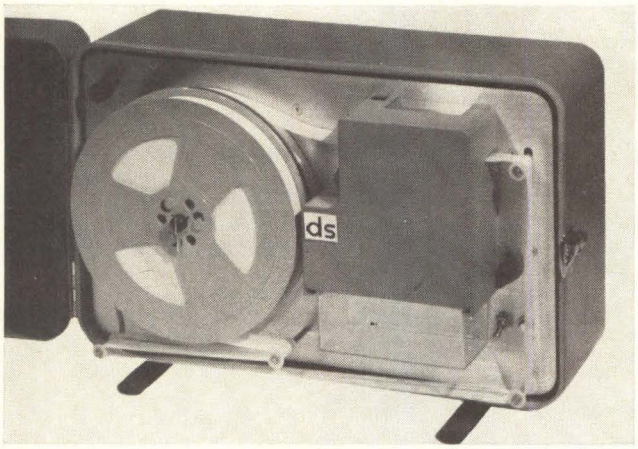
The model 102 card-to-card data transmission card reader interfaces with the Bell System 401-E series dataphone. Features include the ability to read all 80 columns of a standard tab card alphanumerically; a select switch for 36 or 22 columns; im mediate variable input; throughput design permitting quicker card handling; and fiber-optic photo electric card reading for more accurate data transmission. The unit measures 8″ high, 12″ wide and 7″ deep. Electrical requirement is 110 Vac with reading speed of 10 columns per second. Datron Systems, Inc.



CIRCLE 266 ON INQUIRY CARD

TAPE PERFORATOR

Model SP-100, a self-contained, 10-character-per-second, 8-level tape perforator does not require power in the standby mode and is completely enclosed in a shock-mounted, sound-insulated, deep-drawn aluminum cabinet which has a hinged front cover for rapid accessibility to tape and controls. This type of design minimizes radiated noise and at the same time protects the tape and mechanism. Thus, the unit has applications in both office and industrial environments. The perforator features provision for supply and take-up of 1,000 feet of tape, torn tape alarm, tape out alarm, feedout switch, on/off switch, and tape release lever. Data Specialties, Inc.



CIRCLE 267 ON INQUIRY CARD

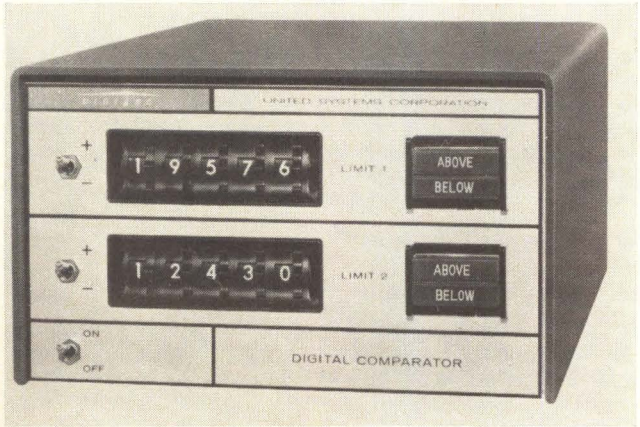
TIME DIVISION MULTIPLEXERS

Two multiplexers provide an economical means to transmit multiple independent low-speed data streams over a single voice-grade telephone circuit. The TTC-2000 concentrator is intended primarily for point-to-point communication links. The TTC-3000 is designed for multipoint networks and will permit full contention for all channels from all remote stations. Both units will transmit up to 38 full duplex channels of data over a single 3-kHz Type 3002 voice-grade circuit. The channels may be 110, 135, 150, or 300 bps. Tel-Tech Corp.

CIRCLE 268 ON INQUIRY CARD

DUAL DIGITAL COMPARATOR

Model 681, a solid-state dual comparator, simultaneously compares the two decimal numbers set on the front panel thumbwell switches to the algebraic magnitude of the 1-2-4-8 BCD input. This input is presented at the rear input connector from a Digitec series 250 voltmeter or other suitable logic source. The status of the BCD input, compared to each setpoint, is indicated by both front panel indication and relay contact outputs. These outputs may be connected in various configurations to obtain "alarm" and/or "control signal" outputs for conditions such as "above limits" or "below limits." United Systems Corp.



CIRCLE 269 ON INQUIRY CARD

LITERATURE

Design and Manufacturing

Booklet describes computer systems group's capabilities for blending hardware and software design with manufacturing. Ex-Cell-O Corp.
CIRCLE 300 ON INQUIRY CARD

Connector Products

Miniature catalog/folder consists of 23 individual 4 x 7½" data sheets describing several categories of connector products, with general information and specifications. Anderson Power Products, Inc.
CIRCLE 301 ON INQUIRY CARD

Send/Receive Teletypewriter

Data sheet describes lightweight, self-contained, portable electronic send/receive console teletypewriter providing complete hard-copy terminal capability. DataTerm, Inc.
CIRCLE 302 ON INQUIRY CARD

Cable and Tubing

Concise catalog lists line of wire and cable, tubing and sleeving, and microwave dielectric products. Brand-Rex Division of American Enka Corp.
CIRCLE 303 ON INQUIRY CARD

Mini-Computer Peripheral System

Two brochures as well as specification sheets describe a peripheral system for expanding information storage and retrieval capabilities of mini-computer. Sykes Datatronics, Inc.
CIRCLE 304 ON INQUIRY CARD

Keyboard Switches

Product sheet describes solid-state momentary or alternate action keyboard switches available in individual modules complete with snap-in mounting hardware. Micro Switch Division of Honeywell, Inc.
CIRCLE 305 ON INQUIRY CARD

Personnel Services

Types of services, classification of personnel, and manner of operation for design, installation, and programming of information systems for computer users are described. Data Management Services, Inc.
CIRCLE 306 ON INQUIRY CARD

Binary-Decimal Converters

Data sheet provides description, applications data, and specifications for series of binary-to-decimal converters. Digital Systems Division of Microwave/Systems.
CIRCLE 307 ON INQUIRY CARD

Resistor Networks

Application engineering bulletin describes 2- and 4-element resistor networks to extend the performance of amplifiers, voltage dividers, and R-2R ladder networks. Vishay Intertechnology, Inc.
CIRCLE 308 ON INQUIRY CARD

Pulse Generator Applications

Latest in applications magazine series features pulse generators for frequency-domain testing and computer control of a frequency synthesizer. Monsanto Electronic Instruments.
CIRCLE 309 ON INQUIRY CARD

Transient Suppressor Diodes

Data sheet introduces series of 1500-peak watt voltage transient suppressor diodes in 30.5- to 175-volt range. KSC Semiconductor Corp.
CIRCLE 310 ON INQUIRY CARD

DC Power Supplies

Catalog/handbook contains description and specifications on ultraminiature dc power supplies for CCSL, DTL, ECL, HNIL, HTL, RTL, and TTL digital integrated circuits. Datel Corp.
CIRCLE 311 ON INQUIRY CARD

DART

Brochure describes design analysis and review techniques (DART) developed to optimize effectiveness of engineering talent while conserving time and expense between product inception and production. Data Technology Corp.
CIRCLE 312 ON INQUIRY CARD

Diagnostic Computer

Advanced technique for functional testing of logic devices from simplest integrated circuit to complex logic cards and complete logic systems is described in brochure form. Digital/General Corp.
CIRCLE 313 ON INQUIRY CARD

Random Access Memory System

Data sheet describes low-cost, high performance random access disc memory system consisting of up to 9 disc drives and a controller. Potter Instrument Co.
CIRCLE 314 ON INQUIRY CARD

Coding Keyboard

Brochure describes features of coding keyboard with readily interchangeable modules containing mercury movement switching and encoding diodes. Mechanical Enterprises, Inc.
CIRCLE 315 ON INQUIRY CARD

Data Set

Brochure describes modem for use with computers or other high-speed terminals in a point-to-point private line network. Data rates selectable from 4800 to 9600 bps. Rixon Electronics.
CIRCLE 316 ON INQUIRY CARD

Cabling

Booklet illustrates company capabilities for manufacturing multiconductor and coaxial cables as well as terminations, molding, and harnesses. Microdot, Inc.
CIRCLE 317 ON INQUIRY CARD

FETs and ICs

Short form catalog contains data on junction, MOS, and special field-effect transistors and digital, linear, and special analog switching integrated circuits. Siliconix, Inc.
CIRCLE 318 ON INQUIRY CARD

IC Core Memories

Compact, modular design core memory systems featuring integrated circuitry and high-density packaging are described. Brochure also includes timing charts for functional operation capabilities. Ampex Corp.
CIRCLE 319 ON INQUIRY CARD

Code Converter

Data sheet provides basic information on unit or converting 10-digit BCD output into hard copy teletypewriter printout and computer compatible punched paper tape. Nationwide Electronic Systems, Inc.
CIRCLE 320 ON INQUIRY CARD

Oscillographic Recorders

Brochure describes characteristics of analog, direct-writing oscillographic recorders and points to consider when choosing one for a particular system. Beckman Instruments, Inc.

CIRCLE 321 ON INQUIRY CARD

Pilot Lights

One-piece, lens/body indicator light as well as other pilot lights and accessories are briefly described in catalog data sheet. Industrial Devices, Inc.

CIRCLE 322 ON INQUIRY CARD

Terminal Bus Bars

A technique for rapid, simple interconnection of common terminals on a pin/bus bar is demonstrated in this brochure which also contains a 3-inch sample. Lear Siegler, Inc.

CIRCLE 323 ON INQUIRY CARD

High-Speed Printers

Brochure outlines high-speed ink jet printer for uses other than as simple communications printer. Unit prints data as fast as transmitted over telephone lines and also functions as remote printer. A. B. Dick Co.

CIRCLE 324 ON INQUIRY CARD

Component Data

Short form catalog describes solid-state sources, IC hybrids, transistors, chips, optical devices, and arrays. Microwave and Electronics Division of Fairchild.

CIRCLE 325 ON INQUIRY CARD

Digital Printers

Brochure features numeric and alphanumeric printers for either 10 or 20 lines per second. Units may be obtained in either table or rack mounting configurations. Datadyne Corp.

CIRCLE 326 ON INQUIRY CARD

Mil-Spec Connectors

Illustrated manual describes 12 types of connectors which meet military systems design requirements. Full specifications as well as cross reference data are included. Elco Corp.

CIRCLE 327 ON INQUIRY CARD

Systems Capabilities

Booklet illustrates typical installations of producing packaged solid-state digital readouts and controllers, packaged drives, and engineered systems. Emerson Electric Co.

CIRCLE 328 ON INQUIRY CARD

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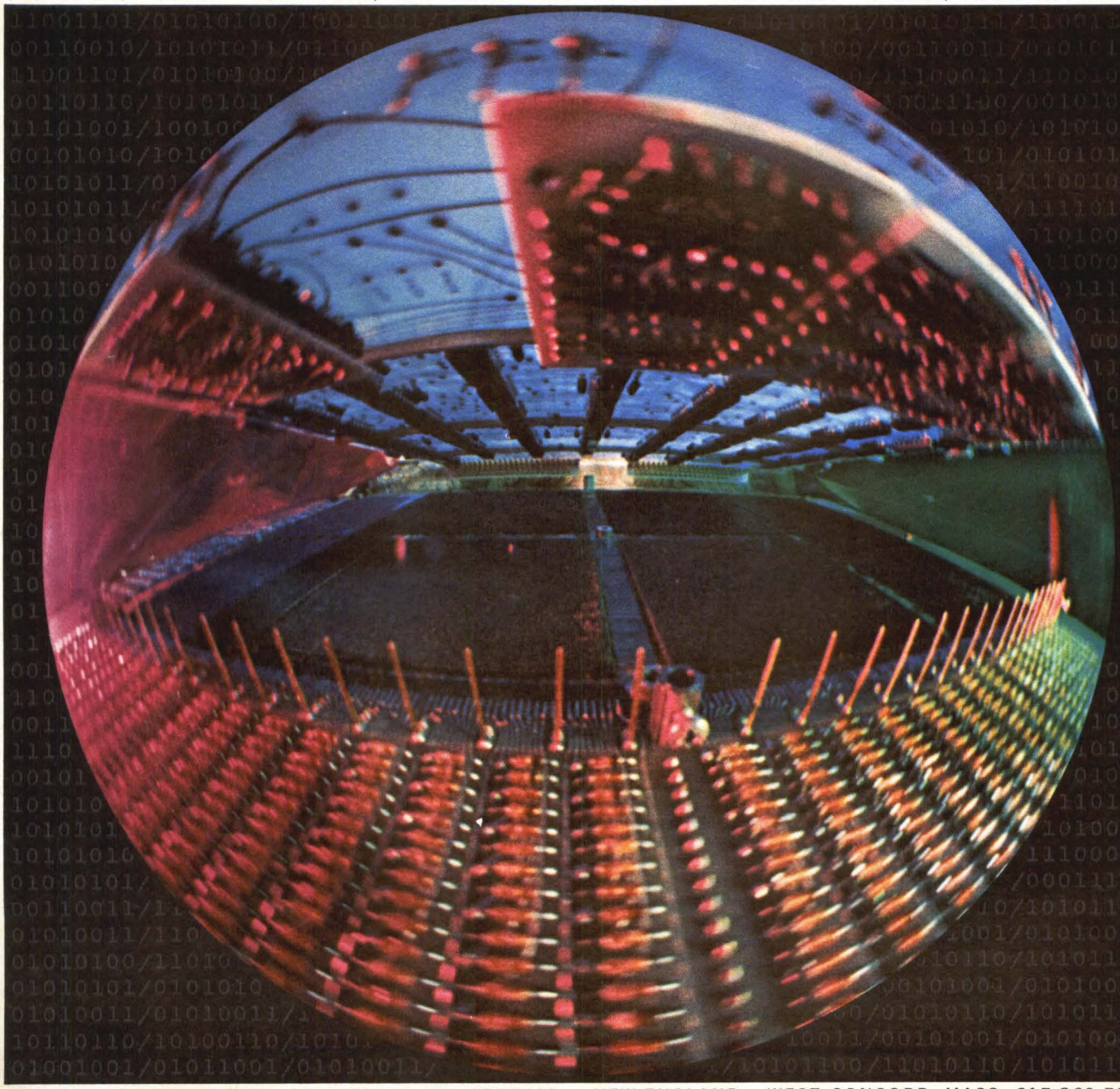

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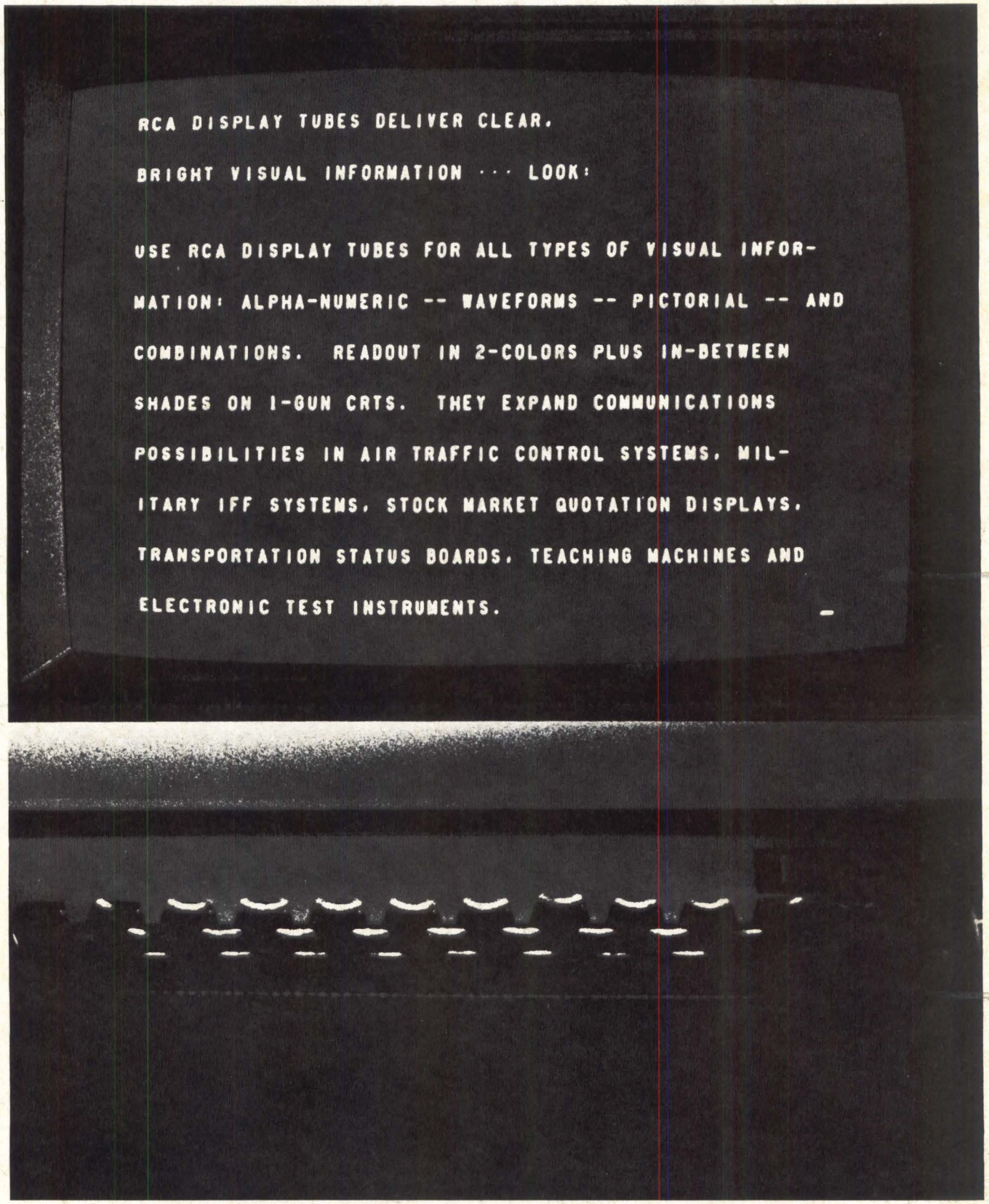

Ask your local RCA Representative or RCA Industrial Tube Distributor for more information on these tubes which add new dimension to computer readout. For technical data, write: RCA Electronic Components, Commercial Engineering, Section ZB-3/ZC-3, Harrison, N.J. 07029. In Europe, contact: RCA International Marketing S.A. 2-4 rue du Lièvre, 1227 Geneva, Switzerland.

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