

# MICROCOMPUTER DIGEST

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NEW RATES EFFECTIVE MARCH 1, 1975  
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 BILL ME  BILL MY COMPANY

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February, 1975

## MOSTEK 5065'S BY THE 1000'S

The Mostek 5065 microprocessor, designed specifically for a realtime, interrupt response environment, such as telecommunications, is currently being shipped in "thousands per month" quantities according to Ken Davis, spokesman for the Carrollton, TX based microprocessor manufacturer. Quantity shipments actually began back in February of 1974.

Briefly, the 5065 is a single chip, 40-pin, 8-bit parallel PMOS microprocessor, equipped with 51 instructions. Execution time ranges from 3 to 16 us. Several unique architectural features have been incorporated into the 5065 design. Foremost is the triple level architecture, so called because the processor chip triplicates the program counter, accumulator and the carry/link bit. This permits program level switching to occur immediately without the usual machine status saving overhead. Another design feature of the 5065 is its multiple indirect addressing capability.

(cont'd on page 2)

## INSIDE THIS ISSUE

LAS VEGAS--CA firm displays new microcomputer video response controller. Story on page 5.

FAIRCHILD--First large production CCD memory announced. Story on page 8.

FEBRUARY LITERATURE REVIEW--Microprocessor Field Survey and Data Book is this month's MD Review. Story on page 14.

COURSES--Upcoming microcomputer courses and seminars for February thru April on page 16.

FINANCIAL--'74 earnings are in for microcomputer manufacturers. See page 18.

## FIRST $\mu$ C FLOPPY DISC SYSTEM

National Semiconductor has just announced a floppy disc operating system for its IMP-16 Microprocessor Development Systems.

The new Disc Operating System (DOS) offers unprecedented convenience and speed of operation to the microprocessor system engineer by completely eliminating paper tape, cards, and other source media. Source programs are written and edited at the system keyboard, then stored directly on floppy disc, using the source editor. The source program may then be assembled instantly with National's macro-assembler, under operating system control, with a single command.

(cont'd on page 3)

## COMPLETE $\mu$ C KIT UNDER \$500

A full microcomputer development system is being offered for the first time in kit form for less than \$400. MITS, Inc.'s ALTAIR 8800 microcomputer kit includes an Intel 8080 microprocessor, 256 x 8 RAM, assorted IC, front panel, 4 PC boards, and enclosure.

(cont'd on page 3)

## THE INTELLEC 8 DEVELOPMENT SYSTEM

(SECOND IN A SERIES)

Intel manufactures two development systems to support their 4-bit and 8-bit microprocessors, Intellec 4/40 and Intellec 8/80. This issue will discuss the 8/80 system. The Intellec 8/80 system evolved from the SIM 8 development system introduced by Intel in 1971 (SIM 8's are now out of production).

The Intellec 8/80 has all necessary hardware and software to support a complete system development. It was designed to simplify the development of microcomputer systems using Intel's 8-bit chips. (cont'd on page 3)



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MOSTEK 5065's By THE 1000's

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The basic instruction format supports several addressing modes, including direct (to page 0), page relative and indirect addressing. Furthermore, the left-most bit of an indirect address is used to indicate further indirect references, such that a chain of indirect addresses can be implemented. This feature has the effect of limiting the memory addressing range of the 5065 to 32K bytes.

Other features include a 256 byte RAM stack (page 1) which permits 128 levels of subroutine nesting, DMA capability via a WAIT signal input, and on-chip decoding of control signals to facilitate I/O interfacing. Supply voltages are +5, -5 and -12 V.

Supporting development tools include a cross assembler, installable on a 16-bit mini-computer (available for \$100) and an evaluation board (2Q75) complete with clock, 512 ROM, 1K RAM bytes, UART for TTY and a very usable systems development aid called PAR (Program Aid Routine). PAR provides a console debugging facility through the TTY, complete with loader, single step, display, alter, breakpoint, etc., features of a debugger program. Mostek supplies their customers with complete documentation for a build-it-yourself hardware development system.

The 5065 is immediately available in production quantities. CPU chip prices are \$58 in quantities of 100 to 499 pieces. The evaluation board will be priced in the \$800 range. ROMs and RAMs are also available from Mostek as well as a realtime clock chip (MK5009). A PIA (Peripheral Interface Adaptor) will be introduced in the third quarter of 1975.

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Ed's Note: Six month subscriptions are now beginning to expire. Please make sure you have renewed yours.

We are most interested in your views and opinions. Address all comments to the Reader's Forum Department.



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## FIRST $\mu$ C FLOPPY DISC SYSTEM

(from page 1)

The assembled program may be stored on disc in binary form, then loaded into the processor through the DOS Linking Loader, along with other object modules and the DEBUG program. Software debug may then be carried out quickly and easily. All this without ever touching paper tape, or loading source programs more than once.

From the programmer's standpoint, DOS means he can write and debug programs much faster than ever before, and without the confusion of handling paper tapes. He is freed from burdensome computer operator chores, and his time becomes much more productive.

National's new DOS will run on any IMP-16P or 16L development system with 8K or more words of memory. The Shugart dual-drive floppy disc system provides the user with over 5M-bits of storage for his system software and application programs.

Although DOS requires only a floppy disc and a TTY for operation, it will support a host of peripheral devices including a high-speed paper tape reader, card reader, CRT terminal and line printer.

DOS may be ordered now for delivery in April. The package price of \$5500 includes a dual-drive floppy disc, interface, cable, DOS software and documentation.

## COMPLETE $\mu$ C KIT UNDER \$500

(from page 1)

The front panel display board has 36 LED lamps, associated drivers, interfacing circuitry for the control panel to microprocessor, and programming switches. The front panel display board slides into the enclosure's front. Both the address line inputs A0-A16 and data lines D0-D7 have LED indicators. The address line inputs can be programmed through a row of 16 switches.

Another PC-board houses the Intel 8080, two-phase clock, buffers and status registers.

The memory board houses the 256 x 8 RAM (expandable to 1000 words), input/output data-gating, address-decoding, memory-wait and memory protect circuits. A 100-line bus

interconnects the memory board to the micro-processor card.

The printed-circuit boards and supplies are mounted on an 18" x 17" x 7" metal cabinet with room to spare such that 17 additional boards can be inserted for added capabilities.

The kit is now available from MITS, Inc. for \$395 unassembled and \$498 assembled (after March 1, prices will increase to \$495 and \$750). The company is also in the process of designing several peripheral units to complement the microcomputer.

## THE INTELLEC 8 DEVELOPMENT SYSTEM

(from page 1)

The Intellec 8/8 uses the 8008-1 as its CPU while the Intellec 8/80 uses the 8080 as its CPU. The basic Intellec system has its own power supply, cabinet, display and control panel, 8K bytes of RAM, 4K PROM module with sockets, an I/O module which will handle 32 input lines and 32 output lines as well as provisions to add a UART (Universal Asynchronous Receiver Transmitter) for serial communication interfaces, and a PROM programmer module. The Bare Bones 8 Intellec is the basic unit but without power supply, display and control panel or cabinet. Both versions have the capability to expand memory to 16K for the 8/8 and 64K for the 8/80. The standard software includes a resident System Monitor, Text Editor and Assembler.

The CPU module contains the 8008-1, crystal controlled clock as well as necessary memory interfacing and I/O control logic. The memory interface contains a latched 14-bit address bus, an 8-bit input bus and an 8-bit output bus. I/O control also utilizes these lines. The module is also able to process interrupts. It contains an interrupt request line and an 8-bit interrupt port. An external device may request service by placing an appropriate instruction code on the interrupt port's lines and activating the request line.

The RAM memory module provides the user with 4K bytes of random-access memory per module. Up to 4 modules can be used in a system. The PROM memory module provides up to 4K bytes of non-volatile read-only memory. Sixteen sockets are provided on the module  
(cont'd next page)



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which accepts 1702A PROMs. Up to four modules can be used. The system can accommodate four RAM and four PROM modules simultaneously but only four of the modules, in any combination, are enabled at a given time. Enabling is provided on the PROM module on a socket-by-socket basis, thus allowing any PROM (socket) to be enabled and override RAM at those memory locations. The result is any mixture of RAM or PROM (within 16K bytes) in groups of 256 bytes each. The lower 16 bytes of memory must always be RAM memory if the System Monitor program is to be utilized.

The I/O module provides the user with an input/output facility containing four individually addressable input ports (32 lines), two of which provide built-in Teletype interfacing and control, and four individually addressable output ports (32 lines). The Intellec is designed to handle two I/O modules per system. Cabling and connectors are provided allowing easy access to the I/O lines from the rear of the chassis. An additional output module allows output expansion with eight-individually addressable output ports (64 lines). All output lines are individually latched and change only under program control.

The PROM Programmer module is an option to the Intellec 8 system. It contains all necessary timing and logic to program Intel 1602A and 1702A Programmable Read Only Memories when used in conjunction with the System Monitor. A PROM Power Switch is provided on the control panel enabling AC power to be applied to this card which is used to generate the 48 volts required during the PROM programming cycle.

The Console Control module along with the front panel provides the user with program monitoring and debugging capability. Features include memory read and write capability, interrupt control, address halt, CPU status, limited register display, and program single-step capability.

The Intellec 8/80 system contains the same basic operations as above except with new CPU (with 8080), console controller, and I/O modules. All memory cards can be used with the 8/8 or 8/80 system.

The Intellec System Software is provided in two forms. The System Monitor is provided on PROM and the Text Editor and Assembler on paper tape.

The System Monitor is contained in four (eight for 8/80) 1702A PROMs and is assigned to the upper 1K (2K) words of memory, leaving lower memory for program and data storage. This executive software allows the operator to load and punch BNPF or hexadecimal format tapes, display and alter memory, load constants to memory, move blocks of RAM memory, program PROMs from RAM, load RAM from PROMs, and execute user programs.

The 8/80, in addition, allows the operator to set program breakpoints, display CPU registers, and restart program execution from the last breakpoint.

The Text Editor allows the operator to edit his source code, making corrections and additions. He may append code, delete code, locate strings, insert strings, substitute strings and output edited code via paper tape. The text editor runs on a minimum Intellec 8 system with Teletype I/O. (Requires a minimum of 8K x 8 of RAM.)

The Symbolic Assembler is a multiple pass type. During Pass 1 the assembler reads the source code from the paper tape and generates a symbol table for later use. During Pass 2 the assembler generates the assembly listing. Also at this time, any detectable errors such as undefined jumps or missing symbols are indicated by a diagnostic printout on the teletype. Pass 3 may now be run. It generates object code and punches it on paper tape. (Requires a minimum of 8K x 8 of RAM.)

The Text Editor or Assembler must first be loaded in RAM prior to execution using the System Monitor. Loading of these programs by a 10 cps terminal takes 20-40 minutes, thus it is recommended that a user purchase (at the minimum) a high speed paper tape reader reducing the loading time to under 10 minutes. Further software development support is available as cross products on several national time-sharing systems. This includes an extensive assembler, instruction simulator and PL/M compiler. These programs are written in Fortran and will not run on the Intellec 8 systems.

Intel provides complete documentation with each Intellec 8 including operators manual, hardware and software reference manuals.

Prices start at \$3540 for the 8/8 and \$3840 for the 8/80. They include software and documentation. Delivery is 30 days ARO.



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**TECHNOLOGY:****FRENCH FIRM UNVEILS I<sup>2</sup>L P-8**

RTC-La Radiotechnique Compelec has completed development of an I<sup>2</sup>L 8-bit parallel microprocessor for Electronique Marcel Dassault (EMD). The 40-pin chip, called P-8 because it processes 8-bit words in parallel, is a custom chip which meets military specifications and will be used in the next generation of EMD microcomputers.

The device consists of three major blocks, a logic block, an arithmetic block, and a forward-carry block. The blocks are interconnected to input and output registers through a pair of multiplexers and an 8-bit, 8-channel shift register. Logic operations take a maximum of 900 ns and arithmetic operations require a maximum of 1.2  $\mu$ s.

**ROCKWELL LOWERS  $\mu$ C PRICES**

Rockwell is evidently going to compete with Intel for low volume market of both 4-bit and 8-bit microcomputers. The firm has written off a major portion of their development cost by selling the chips to high volume users. They are now reducing low volume prices for the PPS-8 8-bit microprocessor.

Prices between the two companies are almost identical at the 10K level, however at the 100-up level, Rockwell is higher. Company sources say this is a hindrance but one has to remember that their PPS-4 is about twice as fast as Intel's at the instruction level.

The PPS-8 has an instruction cycle time of 4  $\mu$ s and a 12  $\mu$ s per digit decimal addition time. Features include a fast direct-memory access at 4  $\mu$ s per byte, a 26-line parallel bus structure, and three-level priority interrupts.

Rockwell is planning to introduce a new kind of PROM which can be altered one byte at a time. The RAM/PROM device would be especially suited for minimal systems and would be organized as 256 x 4. Later this year, they will announce a PROM directly competitive with Intel's ultra-violet-erased PROMs.

Under development is a floppy-disc inter-

face chip to handle both IBM and non-IBM formats. Rockwell is also engaged in the design of a CRT interface set. Neither have been scheduled for announcement.

**MICROCOMPUTER-BASED PRODUCTS:****IN-HOUSE  $\mu$ C SOFTWARE SUPPORT**

C. A. Pullen and Associates, a microprocessor consulting firm, has linked National Semiconductor's IMP-16 and IMP-4 microcomputers to a core memory for in-house hardware and software development.

The requirement arose as a result of frequent power-downs for inserting and removing interface cards which necessitated reloading programs each time from paper tape. To eliminate the time-consuming chore of reloading large programs, a Fabritek core memory was installed because of its non-volatility.

Because the architecture of the National Semiconductor microprocessors makes it very easy to interface with any type of memory device, the adapter logic was relatively simple.

The core is not cost-effective for end product use; however, the firm has more than recovered the investment in time saved and convenience in the process of developing several large programs.

**LAS VEGAS SHOW DEBUTS VRC-100**

Videonics, Inc. and Microcomputer Associates Inc. have announced their plans to manufacture and market the VRC-100 VIDEO RESPONSE CONTROLLER. The VRC-100 is a microcomputer controlled device that allows a videocassette player to become a teaching and testing instrument.

The VRC-100 applies the basic teaching and testing philosophies of audio response systems to a video response system. This is unique since the precise control and positioning of helical video tape players is extremely difficult. Microcomputer Associates, responsible for design and manufacturing of the VRC-100, incorporated the latest microprocessor techniques and components to solve these complex control functions.

The VRC-100 was unveiled in Las Vegas at the National Audio Visual Show on January 9.



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## POINT PLOTTER MODULE ANNOUNCED

A new point plotter to allow microprocessors to readout digital information onto CRT displays and analog recorders has been announced by Data Translation Inc. The DT212 point plotter is the first standardized, modular function product for generating images on CRT screens.

According to Aaron Fishman, the company's vice president of engineering, "The dual DAC-point plotter allows microprocessors and minis the capability of displaying graphic and alphanumeric data onto CRTs and plotters using an XY matrix. The system designer now has one module that gives him all the controls, timing functions, X and Y axis D/A converters to fill the gap between the computer and the CRT display. The problems of screen ambiguity, uniform position information, and intensity timing and control are solved."

System features include complete 12-bit D/A converters for both the X and Y axis, linearity of  $\pm 1/2$  LSB for each axis, Z axis control and set-up delay, and mode control for selecting any of 4 modes of operation depending upon whether a refresh or storage CRT is used. Most popular CRTs will interface with the DT212.

The DT212 is part of Data Translations growing DATA series. Prices begin at \$245 for 100 quantity with two week delivery.

## PROCESSING COST HALVED

A French company is using a microcomputer in their data processor in the hopes of halving the cost of their European Economic Community CAMAC (a computer aided measurement and control system).

The JCAM-10 is built around the Intel 8080, and has 7K bytes of memory but can be interfaced to an add-on memory capable of 49,152 bytes of memory.

The JCAM-10 can process data from 24 modules loaded into two standard CAMAC racks. Maximum system configurations can include up to seven racks.

Although just out of the prototype stage, the French company, Commissariat a l'Energie Atomique (CEA), has estimated the production

model will cost around \$6500. This compares favorably with minicomputer prices of \$13,000 or with the latest French microcomputer, the Micral S, at \$8350.

The French company is just beginning a development program for the CAMAC software. Sources indicate it will be another year before the module reaches the stage where users can plug a programmed unit into their system with no software problems.

Several U.S. companies, e.g., Aluminum Co. of America, Westinghouse, and General Motors, are presently evaluating the CAMAC system.

## 8008--HEART OF NEW MI<sup>2</sup> PROCESSOR

A new microcomputer has been announced by MI<sup>2</sup> Data Systems. The machine, called Design 349, is aimed for the communications processor and low-end minicomputer markets.

At the heart of the system is an Intel 8008 microprocessor. Other features include a 2K PROM, 2K RAM, one terminal interface and one modem connection. Options include polling features, printers, floppy discs, synchronous transmission, parallel I/O connections and other peripherals.

The system has 48 basic instructions and 250 executable instructions. Average execution time is 40 us.

Single unit prices begin at \$2395 and drop to \$1916 for 25-up quantities.

## SURVEILLANCE SYSTEM HARNESSES $\mu$ C

Fairchild Space and Defense System has chosen the Intel MCS-4 4-bit microcomputer to be the heart of a new surveillance receiver. The receiver can be interfaced to a minicomputer and CRT display for automated frequency management.

The microcomputer-driven system performs the proper decimal manipulations required for setting the divide-by-n counters in the receiver's frequency synthesizers.

The microcomputer also decodes upper and lower frequency limits and frequency scan rates.

Analog signal strengths are displayed on the front panel and the microcomputer controls all transaction, meter monitoring and keyboard debouncing.

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Applications of the system are in ECM, EMI testing and direction finding. Range of the receiver is 10 kHz to 1 GHz with a maximum of 10 dB noise.

## TEXT EDITOR WITH FLOPPY DISCS

Two microcomputer based-dispersed data processing terminal systems have been announced by Microtech Data Systems Inc.

Both systems, Model 8/640 and Model 8/640 II feature "Microtext", a total software package, CRT monitor, typewriter keyboard with 10 key numeric pad, twin digital cassettes, microprocessor, 8K to 16K bytes of ROM, PROM or RAM memory. The model 8/640 II has additional memory capability to 65K bytes, floppy discs, fixed head discs, character and line printers, 3M cartridge and 7/9 track magnetic tape units.

Prices begin at \$3590 for the 8/640 and \$4270 for the 8/640 II. Delivery is 90 days ARO.

## CUSTOM FAST FOURIER TRANSFORM

Applied Systems Corp. has announced a fast fourier transform microprocessor for custom applications. Their ASC/8 FFT microcomputer is designed for spectrum analysis or signal processing and is able to calculate the spectrum squared of 128 or more spectral lines in realtime, while simultaneously processing other signals.

Features include realtime frequency distributions, power spectrums, harmonic analysis, or one-third octave filtering. Several options available are input signal conditioning, multiple sampling rates, dynamic signal scaling, data transformation, and output classification functions.

By tailoring the instruction set to each user, variations in data reduction techniques, computation algorithms, operator display information, printed report formats, or process control outputs can be matched for more specific applications.

Also designed into the system are provisions for signal digitizing at rates to 50,000 points/s, input frequency ranges to over 3 kHz, quantization precision from 8 to 16-bits, memory modules from 4K to 16K words, peri-

pheral device interfaces, and data communication adapters.

The company says an optional CRT unit is also available to allow digital display of spectrum calculations. A printer can be easily connected for alphanumeric printout.

## µC MEMORY SYSTEM FOR MINIS

A microcomputer-controlled cartridge memory system, the Intelifile BG 7000, is designed to provide data storage for minicomputers, data terminals, data acquisitions systems, or NC tool stations.

The system, manufactured by J. Bobst & Fils' Graphic Division in Switzerland, uses the Intel 8008 microcomputer to execute and control macro commands received from host equipment. The system performs all control functions without host intervention. A 5-channel DMA (built to a 1K or 2K RAM is initialized by the microcomputer for asynchronous data transfer to and from the host equipment and the memory cartridge in write and read-after-write modes.

## 8-BIT MICROCOMPUTER

Digital Products Corp. is marketing their 8-bit microcomputer complete with a 256 x 8 PROM, 1K RAM, and special logic for DMA channel logic operation. The DMA provides automatic addressing, permitting data input and output at rates up to 800 kHz under direct control of the CPU. The system memory can be expanded up to 16K bytes. I/O is TTL compatible

The microcomputer operates at +5 and -9 V supplies.

## µC CONTROLS ARCADE-BOWLING GAME

Bally Manufacturing is marketing their new microcomputer-based amusement game, the Bally Alley arcade-bowling game. Controlling all of the game's functions is an Intel MCS-4, a 4-bit microcomputer.

It took the company a year to develop the game; 500 units have since been produced.

A panel displaying the ball and pin operation hangs on the wall while players, via a remote control box, operate the game. All

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official bowling scoring and rules are stored in memory.

Among many benefits, the company cited savings in materials, labor and servicing to be the prime reason they have inaugurated electronics into their system.

## ACTION UPGRADES PROCESSOR WITH $\mu$ C

The Telecontroller, a programmable minicomputer-based communications processor has recently been upgraded with a microcomputer.

The processor, built by Action Communication Systems, uses the microcomputer to allow higher throughput, increased port capabilities and use of additional high capacity disc controllers. The microprocessor addition allows the system to be used in high speed, high volume data communications networks that employ a number of terminal types and communication techniques.

The communication processor is a programmable unit that controls data transmission rates, circuit characteristics, line conventions and terminals.

## RUGGED MICRO

Applied Systems Corp. has introduced a new ruggedized microcomputer that has at its heart the Intel 8080 microprocessor. The system was designed to withstand extreme temperature, vibration, shock, EMI/RFI, and humidity. The unit is housed in a standard ATR enclosure with provision for optional I/O modules.

## MEMORIES AND PERIPHERALS:

### FIRST PRODUCTION CCD MEMORY INTRODUCED

Fairchild Camera and Instrument Corp. has announced that the first charge-coupled device (CCD) memory has just been put into large scale production.

The device, the CCD 450, is a 1024 x 9-bit serial storage element for memory applications in terminal buffers, video display refresh, microprocessor-control data stores, smart terminals, and electronic switching in data communication networks.

"The Fairchild CCD 450 proves that CCD memory is here on a production basis," said

Dr. Thomas A. Longo, vice president and group general manager of Fairchild's Integrated Circuit Group.

"This device utilizes a high-performance blend of Fairchild's proven NMOS and CCD technology and is as easy to use as any MOS memory. It will perform a range of medium-speed memory jobs better, cheaper, and more reliably than other solutions," Dr. Longo added.

The new memory uses technology developed by Fairchild in full-scale production of CCD imaging devices during the past two years. Fairchild introduced the first commercial CCD device, a 500-element linear image sensor, early in 1973. Since then the company has introduced and put into production a 100 x 100 element area image sensor and a 256-element linear image sensor. Fairchild also manufactures a miniature television camera based on the 10,000 element sensor.

The CCD 450 memory utilizes Fairchild's isoplanar, buried-channel, ion-implanted barrier structure in the storage registers, combined with N-channel silicon-gate MOS structures for on-chip timing, charge detection and level conversion circuitry. The nine bidirectional data lines are TTL compatible and have tri-state output buffers for wired-OR application.

The device is organized as 1024 x 9 (9216 bits). It contains nine 1024-bit low-power CCD registers which are shifted in parallel to provide storage and retrieval of 9-bit words in a byte-serial mode. Each register is accessed by its own bidirectional data line, and all nine registers are serviced by common two-phase data transfer clocks and read and write control functions. The device operates in four modes: read, write, read/modify/write, and recirculate.

Power dissipation in the read and write modes is 250 mW maximum, and only 30 mW in standby recirculate mode. Average random byte access time is 200 us. The device uses simple two-phase clocking, and is packaged in a standard 18-pin ceramic DIP. Data rate is 50 kHz to 3MHz.

According to Fairchild, the CCD 450 will offer users lower cost per bit for small memory, reduced system size, low power requirements, reduced heat dissipation and simple

(cont'd next page)



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BOB FULLER, 114 Glenmont Dr., Rochester, N.Y. 14617, Eastern  
Correspondent; RAY HOLT, Applications Technical Advisor;  
MANNY LEMAS, Applications Technical Advisor.

application in comparison to other memory solutions. It is the first of a family of high density CCD memory devices to be announced by Fairchild this year.

Evaluation quantities of the CCD 450 are available on four-week delivery and production quantities will be available by the fourth quarter of 1975. Sample pricing is \$90 each in quantities of 1-10. Production quantity pricing for volume orders will be less than .1-cent per bit by year end, according to Dr. Longo.

## New \$21 4K RAM

Intel Corp. has introduced a new high-speed 4096-bit dynamic RAM, the 2107B. The new design features the smallest chip size of any 4K RAM now available, according to Intel sources.

The 2107B has a worst-case access time of 200 ns and a guaranteed minimum cycle time of 400 ns over the operating temperature range of 0° to 70°C. A lower cost version, the 2107B-4, has a worst-case access time of 250 ns and minimum cycle time of 450 ns. Both types are available from stock from Intel distributors.

The 2107B chip is 55% smaller than previous RAMs with single-transistor cells. Mike Markkula, components marketing manager, commented that the 2107B chip is almost as small as some of Intel's 1K N-channel RAMs now selling in the \$4 range in high volume. Yet the chip is fabricated with Intel's standard process at standard production tolerances.

Unlike earlier RAMs with single-transistor cells, the device operates at standard MOS supply voltages of -5, +5 and +12 V. The new design avoids the charge-sensing and substrate voltage problems of competitive designs. Also, system non-volatility can be achieved with a small backup battery.

The 2107B retains the industry standard 22-pin configuration of the 2107A. It is a single-clock, fully decoded RAM with a TTL-compatible, tri-state output and TTL level inputs.

These characteristics reduce system overhead costs to about 0.05 cents per bit, compared with 0.15 cents per bit for 1K dynamic RAMs. Prices begin at \$21.10 in 100-up quantities.

## NEW 12-BIT A/D CONVERTER

The advent of microprocessor chips has rapidly accelerated the need for miniature high speed A/D converters for use in data acquisition systems.

New system design concepts are placing the microprocessor chip and the associated data acquisition system close to the equipment, system, or process being monitored and controlled.

In cases such as oil well logging or control of fluid, measurement and flow, analog readings on temperature, pressure, velocity, gravity, and density must be monitored and these data inputs must be processed by the minicomputer. Rather than transmitting all data to the central processing computer, it is now possible with microprocessor chips to do the necessary computation and integration at the monitored site, control the function, and report back to the computer.

In many applications, the effective location of the microprocessor at the measurement site also places constraints on the Data Acquisition System which incorporates the A/D converter.

These considerations generally require that the (1) A/D be small in size to enhance the advantage of miniaturization attained with the microprocessor; (2) A/D be low in power to save on power supply requirements and keep heat low; (3) unit be adjustment-free, not only to reduce initial calibration cost, but also to provide for free operation in the field; and (4) unit be capable of operating at high speed over broad temperature ranges.

Micro Networks Corp. has announced a new 12-bit A/D series, the MN 5210 family, in DIP packages to meet the high speed requirements and operation over a range of 0° to 70°C.

The total conversion time of this unit offers to the industry, for the first time, a high speed converter in a DIP package competitive in speed with the large A/D modules. These DIP units have a maximum conversion time of 13 us which allows for full accuracy with a 1 MHz clock. The MN5210 has a conversion time of 1 us per bit. (cont'd next page)



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The MN5210 12-bit A/D converter requires standard supply voltages of +15, -15 and +5 V. Power dissipation is typically 700 mW, about one-half to one-fourth the power of modular A/D's.

Micro Networks' A/D converter is able to meet additional stringent requirements of adjustment-free operation with its "active trimming" of the resistor ladder with the semiconductor switch. By compensating for the exact resistance in the switch, the A/D can be virtually error free. This is done at the Micro Networks plant by trimming the thin film precision resistor networks of the A/D for both zero and offset. Thus the user need not resort to the use of "pots" to "tweak" the converter. In addition, temperature tracking of thin film resistors to better than 1 ppm/°C guarantees long term stability and continuous adjustment-free operation.

The extreme stability of the resistor network makes it possible to guarantee the MN 5210 to be  $\pm$  one-half LSB linear over the full operating range of 0° to 70°C. For full MIL range of -55° to +125°C, the "H" versions guarantee this same  $\pm$  one-half LSB linearity.

All units in the series provide both serial and parallel outputs. The converters are available in three input ranges: 0 to -10 V,  $\pm$  5 V, and  $\pm$  10 V. For each of the ranges, the user has the option of specifying a model complete with an internal reference or with an external reference when a tighter absolute accuracy is desired.

Price of the commercial version is \$275 each in quantities of 1 to 24. Price of the MIL range "H" version is \$425. Delivery is from stock to four weeks ARO.

## PHOTOPEN FOR $\mu$ C TERMINAL

An all solid-state Photopen Device, the 9081, which features a 200 ns response time, a high degree of noise immunity and the capability of operating with either stroke-written or high resolution TV displays, both alphanumeric and graphic, is now available from Sanders Associates, Inc.

The Photopen can be used as an option for the Sanders Series 8171 and 8172 terminals. Each terminal consists of a 12K microcomputer, two CRT displays with keyboards, and emulation

software. The terminal is designed to meet a number of on-line alphanumeric applications.

The 9081 is completely self-contained, has a pressure activated tip switch and requires only +5 V. It is designed for applications such as a menu selection, tracking cursors, construction of graphic displays and facilitating addition, deletion and editing of displays.

The unit is designed to detect low light levels from CRT phosphors, with no false triggering from high ambient light levels or EMI sources. Two outputs are provided: pulse and switch. The pulse signal is generated when the unit detects the CRT beam while the switch signal is generated by lightly depressing the pen tip against the CRT display surface.

The Photopen is unit priced at \$1200; however quantity discounts are available.

## NATIONAL SHIPS MOSRAM 410

National Semiconductor's Memory Systems group has begun volume production shipments of its MOSRAM 410 memory system.

The MOSRAM 410, which features National's MM2102 1K static memory chip, has been designed to offer the user maximum flexibility. Access/cycle times of 550 ns, 700 ns, and 1050 ns are available, and capacities may vary from 1K x 8 to 32K x 10 with no external support circuitry required.

The memory requires only +5 V and has tri-state outputs for bus-oriented systems. A single 4K x 8, 1050 ns memory sells for \$444 and is available off-the-shelf.

## NEW 1024-BIT CMOS RAM

A new 1024-bit static CMOS RAM, the IM6508, is now available from Intersil, Inc. in both military and commercial versions. The device has a 250 ns access time over the full range with a +5 V supply, decreasing to less than 100 ns at 10 V. Total power requirements are 5 mW in standby and 10 mW at 1MHz.

The IM6508 is a synchronous RAM with TTL compatible inputs and outputs. The military device is packaged in a 16-pin DIP or flat-pack, and the commercial version is available  
(cont'd next page)



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in 16- and 18-pin packages. The 18-pin device, IM6518, contains three chip enable inputs, two of which control write enable and output buffer circuitry, and one that controls the address registers.

The IM6508 is the second CMOS RAM produced by Intersil and is part of a family of associated systems-oriented CMOS devices for the data processing industry, including RAMs, ROMs, microprocessors and input/output devices.

The new memory is presently available from Intersil. Prices in 100+ quantities begin at \$70 for the military and \$28 for the commercial model.

## NEW $\mu$ C PERIPHERAL LINE

Fairchild Camera and Instrument Corp. will introduce a new family of high-speed LSI bipolar logic elements centered around high performance Schottky processor and peripheral logic devices. Three of the devices are now available, and the other eight will become available during the first half of 1975.

The new family, called Macrologic, is designated by 9400 series part numbers, and are essentially subsystems in integrated circuit form. These devices can solve many application requirements and are expandable with virtually no external components.

"The Macrologic family is aimed at solving system requirements of computer and peripheral equipment manufacturers," said Dr. Thomas A. Longo, vice president and group general manager of Fairchild's Integrated Circuits group.

"Where speeds permit, new systems can be built around MOS/LSI microcomputers, such as Fairchild and other manufacturers will be producing," Dr. Longo said.

"Macrologic, however, offers solutions for systems that need higher operating speeds and longer word lengths. Macrologic elements can be used with any bit length, instruction set or organization, without performance penalties, loss of flexibility or the need for custom development."

The Macrologic elements use advanced Schottky TTL technology for high operating speed, performance and economy. Typical complexity is from 150 to 250 gates per device, and the circuits are packaged in standard 14, 16, 18 and 24-pin packages. Gate delays are

typically 3.5 ns per gate on the chip, and 5 ns per output buffer. The speed/power product is 6 picojoules per gate and 10 picojoules per output buffer. The process also allows high density, typically 50 gates per square millimeter.

Complementing the Macrologic family is a new line of compatible RAM and PROM memories using Fairchild's Isoplanar technology. The PROMs incorporate a new combination of Isoplanar and Schottky processing that provides higher speed, improved delay-power and lower production costs. The initial family consists of 12 logic and memory devices:

- o 9401 Cyclic Redundancy (CRC) Generator/Checker
- o 9403 Serial/Parallel FIFO
- o 9404 Data Path Switch (DPS)
- o 9405 Arithmetic Logic Register (ALRS)
- o 9406 6 x 4 Push Down/Pop Up Stack or LIFO
- o 9407 Data Access Register
- o 9410 16 x 4 Clocked RAM
- o 93L422 256 x 4 RAM
- o 93425A 1024 x 1 RAM
- o 93446 512 x 4 PROM
- o 93448 512 x 8 PROM
- o 93454/93464 1024 x 8 ROM

## NATIONAL ADDS 4K RAM TO LINE

National Semiconductor has enlarged its memory products line with the addition of the MM4030, a 22-pin 4096-bit RAM.

The 4K RAM is an N-channel, silicon gate device with on-chip registers for addresses and chip select. It features an access time of 200 ns and a cycle time of 400 ns. All inputs are TTL compatible, except chip enable, as are the tri-state outputs, which may be OR'ed with other 4K RAMs.

The MM4030 is the second 4K RAM from National. The company had recently announced its Tri-Share MM5270, an 18-pin N-channel RAM. The MM5270 offers 4K RAM users the opportunity to nearly double the usual PC card memory density possible with 22-pin RAMs.

Production quantity deliveries of the MM4030 will start in mid-1975.



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## SIGNETICS TO SHIP SAMPLE 4K RAM

Signetics Corp. has announced it will begin sampling its 4096-bit RAM this month. The 22-pin device has a speed of 300 ns and operates at 5 V. The device is compatible with both TI's and Intel's devices.

The company says they should be in full production by June.

## PEOPLE, LITERATURE AND EVENTS:

### SIEMEN'S BID FOR EUROPEAN MARKET

A major wafer fabrication facility for MOS integrated circuits has been opened in Munich, Germany by the West German firm, Siemens.

The plant will manufacture production quantities of ROM, RAM, PROM and an unannounced microprocessor kit. Production will originally be with standard metal-gate P-channel devices, with ion implantation being used when necessary for low threshold circuits. A P-channel silicon-gate technology will be used for some memory devices. N-channel silicon-gate technology will soon be used.

Included in the RAMs to be manufactured is a 4096-bit RAM, both dynamic and static.

Siemens is planning, at a future date, to manufacture devices using charged-coupled devices technology (CCD) and MNOS non-volatile memories.

### NCR'S SECOND MICROELECTRONICS PLANT

NCR has revealed plans to establish a microelectronics production facility in Colorado Springs, CO.

The 15,000 square-foot plant will manufacture various types of microelectronic circuits used in NCR computers and other electronic business machines produced by the company.

Production will begin in a newly leased facility by the fourth quarter of 1975, with 35 employees. It is anticipated that employment will increase to over 100 the following year.

The Colorado Springs plant will complement a similar facility established by NCR three years ago at Miamisburg, OH.

## CUSICK NAMED WD'S NEW VP

A. B. Phillips, president and chairman of Western Digital Corp. has announced the appointment of Paul M. Cusick as vice-president of finance and treasurer for the MOS/LSI integrated circuits manufacturer. Cusick replaces Lawrence J. Alves, who recently resigned to accept a position with another firm.

Reporting to Cusick will be the Corporate Accounting, Purchasing and Budget Control departments.

## ROCKWELL TO PUSH STANDARD PRODUCTS

Rockwell International's new marketing vice-president at the Microelectronic Device division, Daniel P. Del Frate, is realigning the company's marketing effort. The company will be moving from custom to standard MOS and he is preparing the division for the move.

In contrast to economic indications of a flat or negative year, Del Frate expects LSI to increase 10 to 12 per cent. Microprocessors, he feels, will increase anywhere from 50 to 60 per cent.

To aid small users, he plans to increase the company's internal applications effort threefold and to add a number of manufacturer's rep organizations and distributors by year end. A second-source 4096-bit RAM and a 1103A memory device will be the division's first standard product entries.

## EDN $\mu$ P DESIGN SERIES

EDN magazine is currently offering reprints of their 1974 "EDN Microprocessor Design Series". The series includes 14 EDN articles in full color, a condensed recap of EDN's comprehensive "Microprocessor Market Study" and a complete "Microprocessor Directory." The directory is a complete listing of all microprocessors currently available. Price for the entire 112 page package is \$6.95. Payment must accompany each order and no CODs will be accepted.



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## MICROCOMPUTER STRUCTURES

Microcomputer Associates Inc. has available a new 50 page report titled "Microcomputer Structures". Contents include microprocessor introduction, microprocessor chip technology including semiconductor processes and chip logic organization, and an excellent summary and block diagram of over 20 current microprocessors.

This paper is a reprint of slides from a one day tutorial on microcomputer structures presented by Manny R. Lemas and Ray M. Holt at the 2nd Annual Symposium on Computer Architecture. A unique collection of information covering microprocessor organization and architecture. The price is \$25 (1), \$20 (2-10), and \$15 (10 or more).

## EUROPEAN MICRO ORGANIZATION

Euromicro, the European Association for Microprocessing, publishes quarterly, for members, a newsletter covering activities of interest in the field of microprogramming and microprocessing. Two issues thus far have covered subjects such as Microcomputer Systems: A Survey; Microprogramming and Microcontrol: A Hardware Definition; and Microprogramming and Microprocessing in Europe: A Status Report.

Membership is open to all persons and institutions active in the microprocessing field. Annual membership is \$7. Subscription and newsletter manuscripts can be sent to Prof. Rodney Zaks, Chairman, Universite de Technologie de Compiègne, BP233, 60206 Compiègne, France or Prof. M. Sami, Editor, Politcnico Instituto di Elettronica, Piazza Leonardo Da Vinci, 32-30 133 Milano, Italy.

## THE ICS $\mu$ C EDUCATIONAL CONGRESS

Integrated Computer Systems, Inc., a firm active in giving microcomputer courses in North America, Europe and the Middle East, has recently announced three International Educational Congresses on Microprocessors/Microcomputers and Minicomputers. The congresses will be held in Paris on April 1-8 at the Tour Olivier de Serres; in Washington D.C. on May 5-10 at the Sheraton Inn; and

in Brussels on July 2-7 at the Brussels-Sheraton.

Dr. Collins, president of ICS, explained that the "Educational Congress" consists of a combination of four educational/informational components: 1) A week-long series of intensive short courses on microcomputer and minicomputer hardware, software and systems level concepts, 2) "An Invitational Microcomputer Applications Symposium", 3) "A Microcomputer/Minicomputer Manufacturers' Seminar" and 4) an educational hardware demonstration of many major microcomputer and minicomputer systems.

According to Dr. Collins, the key component of the congress is the series of intensive short courses, each taught by professional lecturers who have practical hands on experience in their subject. The lectures are designed to form a coherent curriculum and are backed up by a comprehensive set of notes and documentation.

The courses offered include:

- o "A Manager-Level Overview of Microprocessors and Microcomputers" 1 day \$185
- o "Microprocessors/Microcomputers" 2 days \$305
- o "Software Development for Microcomputers" 2 days \$305
- o "Advanced Microcomputer Applications" 2 days \$325
- o "Minicomputer System Development" 2 days \$305
- o "Minicomputer Real Time Software and Advanced Applications" 2 days \$325

"The Invitational Microcomputer Applications Symposium" (1 day, \$60 to course attendees) consists of papers presented by expert users from academic or engineering environments.

"The Microcomputer Manufacturer's Seminar" (1 day, \$60 to course attendees) will consist of brief technical descriptions by representatives of major vendors of microcomputers. Speakers from Intel, Motorola, National, Rockwell and others will describe technical aspects of their products, current applications and future trends. A similar seminar will be held on minicomputers.

"The Microcomputer/Minicomputer Hardware Educational Demonstrations" will provide attendees the opportunity to view working hardware from major microcomputer vendors. (no cost)



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## RECENT LITERATURE

Microprocessor Field Survey and Data Book  
AH Systems, Inc.

The AH Systems, Inc. Microprocessor Field Survey and Data Book is a compact reference volume that provides microprocessor theory, configurations, costs, advantages and disadvantages to the circuit designer, and includes comparisons aimed to answer the question "Which microprocessor is the most cost effective for my specific application?" This report is intended to provide business and industry with the most current, comprehensive and reliable information on the following subjects:

Microprocessors	Semiconductor Memories
Microcomputers	Programming Aids
LSI Technology	Software Support
LSI Computer Systems	Interface Chips

This data allows more objective comparisons of various microprocessors, their characteristics and costs. New revisions are issued quarterly in January, April, July and October of each year. The updating service provides details on the current state-of-the-art and significant new developments in the field of microprocessors, systems and LSI Technology.

AH Systems' Microprocessor Field Survey contains four sections.

- o EXECUTIVE SUMMARY--Condensed data in brief presentation form, directly oriented to the business manager, program manager, design engineer, chief engineer, software specialists and others interested in a brief overview of the microprocessor field with a comparative analysis of each device.
- o INTRODUCTION--General description of the survey, the basic parameters of microprocessors and baseline system data.
- o MICROPROCESSOR SURVEY--The survey contains comparisons of the currently available and/or announced microprocessors as a function of key parameters. Over 20 microprocessors are discussed. Areas covered include:

Selection Parameters	Hardware Support
Technologies	Software Support
Benchmark Programs	Second Sourcing
Instruction Sets	

- o SUMMARY DATA--Current information on each microprocessor is presented in summary form. The following information is provided for each processor.

General--Word length, technology, cycle time, cycle time/shortest instruction, power, and configuration.

Instruction Set--Number of instructions, number of bytes/instruction, microprogrammable, addressing modes, decimal arithmetic capability, push down stack description, and interrupt capability.

Overhead Circuitry--Requirements, T<sup>2</sup>L compatibility, manufacturer supplied chips, and start-up conditions.

Memory--Memory addressing capability and DMA capability.

Support Items--Hardware and software.

Availability--Samples and Production

General Comments

Marketing Approach

Recent Announcements

Major Advertised Customers

Second Sources Status

Military Specification Conformance--Specifications and reliability data.

Literature Available from Manufacturer

Support Material Included

In addition, detailed information is provided when available for:

- o System Architecture
- o Actual Instruction Sets
- o Support Items
- o Benchmark Program Listing

An outstanding feature of the AH Systems report is the set of benchmarks which have been programmed for ten of the microprocessors. A complete set of benchmark results are presented in both tabular and graphic form.

The price of the AH Systems report is \$495 and includes the quarterly updates. In addition to the report, AH Systems provides consulting services including systems and software development, training courses and seminars, market research and analysis, and other related services.

# # # #

Next month Microcomputer Digest will feature the book, "Microcomputer Design", by Martin Research Ltd.



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"When Your System's Data Rates Differ, It's Time For A Microprocessor"

J. S. Byrd, DuPont

EDN November 20, 1974

The author has summed DuPont's realtime TDS-DAS system developed for the U.S. Atomic Energy Commission. The microcomputer (Control Logic's L-Series using Intel's 8008) is used to handle and control asynchronous data transmission from a Telemetered Data System (TDS) to a Data Acquisition System (DAS). An in-depth description of the application is given along with several tips for developing a microcomputer-based product.

"EDN's First Annual Microprocessor Directory, 1974"

Robert H. Cushman, Special Features Editor

EDN November 20, 1974

Fifteen microprocessors are summarized on small file cards to allow easy comparison of both microcomputer hardware and software features. Price and availability are also indicated. Each system's architecture is pictured using the topology EDN has been using throughout the year. The index card also includes information on system bussing, hardware and software support available from the manufacturer, purchasing information, and a breakdown of the instruction set into four basic categories. These include data manipulation, data movement, program manipulation and program status manipulation instructions.

"Newest uP's Split Into Two Divergent Paths"

Robert H. Cushman, Special Features Editor

EDN December 20, 1974

A brief discussion of six machines, National's PACE, General Instrument's CP-1600, Western Digital's MPS-1600, Fairchild's F-8, Mostek's 5065, and Rockwell's PPS-8. The article mainly compares their computer architecture and classification. A major portion of space is given to National's PACE microcomputer as it is the latest entry and the first CPU to feature a 16-bit wide ALU in a single chip.

"Counter Keeps Track of Microprocessor Interrupts"

Douglas M. Risch, Woodard Governor Co.

Electronics December 26, 1974

Not all microcomputers are endowed with interrupt-enable and interrupt disable instructions to permit nested interrupts. Hence, Mr. Risch suggests how to design a counter to monitor and keep track of the number of times a microcomputer executes these instructions.

"Single-Chip Microprocessor Employs Minicomputer Word Length"

George F. Reyling, Jr., National Semiconductor Electronics December 26, 1974

The article is an in-depth discussion of PACE, National's most recent microcomputer entry.

PACE (Processing And Control Element) was designed by National to overcome an 8-bit microcomputer's cumbersome method of handling 16-bit instructions. The single chip PACE not only handles 16-bit instruction and address processing, but also provides the user with the option of either 8- or 16-bit data processing.

Two applications, a card-reader controller and an electronic cash register, are discussed to illustrate the PACE microcomputer's capabilities.

An excellent article and highly recommended for readers desiring additional material after reading Microcomputer Digest's January story on PACE.

"Printer Control: A Minor Task For A Fast Microprocessor"

Al Moore, Mark Eidson, Motorola Semiconductor Electronic Design 25 December 6, 1974

Since printer control is such a minor task for a high-performance microcomputer such as the Motorola M6800, Mr. Moore and Mr. Eidson illustrate how to use the MPU to control seven to ten additional peripherals while still performing the executive function. The article is a carefully detailed description of an application involving a Seiko AN-101F printer and Motorola's microprocessor chip and PIA (Peripheral Interface Adapter). The key to designing with the MPU is to fully describe the functions to be controlled by the MPU and decide on an optional tradeoff between external circuitry and MPU use. The article not only presents an excellent application but also provides a very worthwhile working description of the MPU and PIA.



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**EDUCATION:**

MICROCOMPUTER COURSES, SEMINARS, CONFERENCES.  
Date, title, cost, location, sponsoring organization (addresses on page 17).

February

- 3- 5 Microprocessors and Systems Applications \$350 Saddlebrook, NJ Automata Information Services
- 3- 5 Intel MCS80 Workshop \$350 Boston, MA and San Jose, CA Intel Corp.
- 4- 6 Microprocessor Design Course \$250 Palo Alto, CA Pro-Log Corp.
- 4- 7 Minicomputers/Microcomputers \$425 Dallas, TX Integrated Computer Systems, Inc.
- 5- 7 Microprocessors/Microcomputers \$410 Barcelona, Spain Integrated Computer Systems, Inc.
- 5- 7 Microcomputers/Microprocessors in Instrumentation Systems Louisiana State University
- 10-11 How to Write Software \$275 New York, NY and San Francisco, CA Microcomputer Technique, Inc.
- 10-12 1976 Computer Science Conference Anaheim, CA ACM
- 10-12 Intel PL/M Workshop \$395 Boston, MA and San Jose, CA Intel Corp.
- 11 Microcomputer Programming Laboratory (6 week course) \$350 University of Santa Clara
- 11-13 Microprocessors/Microcomputers \$410 London, England Integrated Computer Systems, Inc.
- 11-13 Nepcon '75 West and International Microelectronics Exhibition Anaheim, CA Contact: Industrial Scientific Conference Management, Inc.
- 12-14 How to Select a Microprocessor \$395 New York, NY and San Francisco, CA Microcomputer Technique, Inc.

- 12-14 International Solid-State Circuits Conference Philadelphia, PA SSC Council
- 12-14 Microprocessors and Systems Applications \$350 Philadelphia, PA Automata Information Services
- 12-14 Microprocessor Product Survey \$395 San Francisco, CA and New York, NY Microcomputer Technique, Inc.
- 17-19 Intel MCS40 Workshop \$350 Boston, MA and San Jose, CA Intel Corp.
- 17-19 Microprocessors/Microcomputers \$410 Atlanta, GA Integrated Computer Systems, Inc.
- 18-20 Computer Science Conference 1975 Washington, DC ACM
- 18-21 Minicomputers/Microcomputers \$425 Vienna, Austria Integrated Computer Systems, Inc.
- 19-21 Microprocessor Design Course \$250 Chicago, IL Pro-Log Corp.
- 24-26 How to Design Microprocessor Systems \$425 New York, NY and San Francisco, CA Microcomputer Technique, Inc.
- 24-27 Minicomputers and Microprocessors \$395 Zurich, Switzerland Technology Service Corp.
- 25-27 COMPCON SPRING San Francisco, CA Contact: Compata, Inc., L. D. Amdahl
- 25-27 Microprocessors/Microcomputers \$410 Washington, DC Integrated Computer Systems, Inc.
- 27-28 How to Program Microprocessors \$275 New York, NY and San Francisco, CA Microcomputer Technique, Inc.

March

- 3- 5 Intel MCS80 Workshop \$350 Boston, MA and San Jose, CA Intel Corp.
- 4- 6 Microprocessors/Microcomputers \$410 Boston, MA Integrated Computer Systems, Inc.
- 10-11 How to Write Software \$275 Boston, MA and Chicago, IL Microcomputer Technique, Inc.



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International Symposia Washington, DC
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**FINANCIAL:**

**EARNINGS**

<u>Fairchild</u>	<u>1974</u>	<u>1973</u>	<u>%</u>
Dec. 29			
Share Earnings	\$ .79	\$ 2.17	-63.6
Earnings	4,129K	12,142K	-65.9
Sales	81,127K	104,817K	-22.5
Year			
Share Earnings	\$ 5.00	\$ 7.51	-33.4
Earnings	27,032K	41,159K	-34.2
Sales	395,552K	361,568K	+9.2

<u>Intel</u>	<u>1974</u>	<u>1973</u>	<u>%</u>
Dec. 31			
Share Earnings	\$ .44	\$ .61	-27.9
Earnings	2,997K	4,049K	-26.0
Sales	31,284K	24,130K	+29.6
Year			
Share Earnings	\$ 2.96	\$ 1.41	+110.0
Earnings	19,776K	9,214K	+114.6
Sales	134,456K	66,170K	+103.1

<u>Nat'l Semiconductor</u>	<u>1974</u>	<u>1973</u>	<u>%</u>
Dec. 15			
Share Earnings	\$ .27	\$ .32	+18.5
Earnings	3,335K	3,827K	+14.8
Sales	48,283K	55,061K	+14.0
6 months			
Share Earnings	\$ .60	\$ .77	+28.3
Earnings	7,313K	9,353K	+27.9
Sales	100,337K	130,181K	+29.5

<u>RCA</u>	<u>1974</u>	<u>1973</u>	<u>%</u>
Dec. 31			
Share Earnings	\$ .21	\$ .70	-70.0
Earnings	16,600K	53,400K	-68.8
Sales	1,219M	1,184M	+2.9
Year			
Share Earnings	\$ 1.45	\$ 2.39	-39.3
Earnings	113,300K	183,700K	-38.3
Sales	4,627M	4,281M	+8.1

<u>Rockwell Int'l</u>	<u>1974</u>	<u>1973</u>	<u>%</u>
Dec. 31			
Share Earnings	\$ .64	\$ .96	-33.3
Earnings	22,238K	28,889K	-23.0
Sales	1,189M	908M	+31.0

<u>Signetics</u>	<u>1974</u>	<u>1973</u>	<u>%</u>
Dec 29			
Share Earnings	\$ .91	\$ .00	N/R
Earnings	4,604K	-5,585K	-221.3
Sales	29,930K	19,631K	-34.4
Year			
Share Earnings	\$ 2.28	\$ .00	N/R
Earnings	10,123K	-3,876K	-138.2
Sales	98,274K	120,836K	+22.8



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According to Dennis Daniels, Zentec marketing vice-president, "The agreement with Bartlett Associates culminates three months of discussions with several East Coast representative firms." Daniels added, "We are both pleased and excited to have a firm of Bartlett's reputation representing our company. They were our first choice right from the beginning." Daniels noted that Zentec is building a direct sales force in the West, but will continue to utilize representatives in the East during the foreseeable future.

Zentec is an OEM supplier of CRT intelligent programmable terminals utilizing microcomputer technology.

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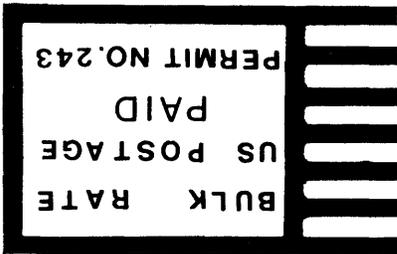
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