

MICROCOMPUTER DIGEST

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FAIRCHILD INTRODUCES 2-CHIP F8 μ C

Fairchild Camera & Instrument Corp. has introduced a versatile, two chip set, 8-bit, N-channel Isoplanar microcomputer system, the F8, which is aimed at applications encompassing over 80% of the available microprocessor market. Four additional circuits will become available for use with the CPU chip and the Program Storage Unit (PSU) chip by mid-1975. (cont'd on page 3)

GI & HONEYWELL ANNOUNCE JOINT VENTURE

Honeywell's Process Control Division and General Instrument Corp. have jointly developed a high performance single chip, 16-bit microprocessor with DMA capability for high speed data transfers. The disclosure was made in a paper delivered before the IEEE COMPCON meeting in San Francisco and at joint press conferences in New York and San Francisco. (cont'd on page 4)

INSIDE THIS ISSUE

A NATIONWIDE TELEVISED microcomputer course is scheduled for the second week of this month by Texas Instruments. Story on page 6.

PRELIMINARY AGREEMENT has been reached between Corning Glass and U.S. Philips Trust for the largest U.S. Semiconductor Manufacturer takeover. Story on page 13.

SEMICONDUCTOR MEMORIES to hit \$1.75 billion by 1978 according to a recent semiconductor technology report. Story on page 17.

COURSES--Upcoming microcomputer courses and seminars for April thru July on page 15.

MIS is featured in this month's MD development series. Story on page 8.

INDUSTRY'S MOST UNKEPT 8080 SECRETS

Although Intel reports they are not actively seeking second-sourcing for their 8080 microprocessor, Texas Instruments and Advanced Micro Devices are gaining wide publicity on the subject.

According to two recent Electronic News articles, TI will be second-sourcing the device shortly. (cont'd on page 4)

DATA COMMUNICATION MICROPROCESSOR

A dedicated single chip, 8-bit, N-channel silicon gate MOS microprocessor has been announced by National Semiconductor. The CMP-8 microprocessor is specifically tailored for the communications data-handling market. It has been designed to handle both 8- and 16-bit words. Features include an 8-bit ALU, accumulators, index registers, interrupt register, program counter and a stack pointer. Control is provided by Programmable Logic Arrays. More information available soon.

MICROCOMPUTER SOFTWARE SUPPORT

One of the most perplexing, expensive and misunderstood problems has been the extensive role software plays in developing microcomputer products. Two major news announcements have paved the way for next generation higher-level programming for microcomputers.

Unfortunately most microcomputers have not had the software available to use higher-level languages. Intel's PL/M has been the sole leader, thus far, in a higher-level language. That is, until National Semiconductor's (NSC) recent offering of a resident PL/M+ microprocessor compiler for their 16-bit development systems. (cont'd on page 5)



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EDITORIAL:

WE'RE EXPANDING OUR SERVICES

This month highlights several new and exciting services which we believe will give the Digest that added plus flavor. First, every subscriber has received MICROCOMPUTER DIGEST's First Reference Index containing Microprocessor Bibliography, Microprocessor Company Index, Microcomputer Company Index, and Microcomputer Service Company Index.

Second, a new Employment Opportunity section will list as many positions open and wanted as space permits (FREE).

And thirdly (ALSO FREE), an opportunity for users and manufacturers to list uP/uC products and services offered or wanted. To participate in any of these departments, please contact the editorial office.

If you are unemployed, we may be able to help. Send us a few copies of your resume and we'll make them available to companies that are looking for people.

We welcome your suggestions and criticisms concerning these new services. And don't forget! June is the month for our first Semi-Annual Microprocessor Index. If you liked our Reference Index, you'll love the Microprocessor Index.


Editor



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FAIRCHILD INTRODUCES 2-CHIP F8 μ C

(from page 1)

Evaluation quantities of the F8 CPU (3850) and PSU (3851) are available now on four-week delivery from Fairchild distributors or directly from the factory. Pricing is \$130 each in quantities of one to nine. Production quantities will be available in the third quarter of 1975, according to Dr. Thomas A. Longo, vice-president and general manager of Fairchild's Integrated Circuits Group.

Potential systems use of the F8 spans simple equipment such as appliance controls, all the way up to very sophisticated point-of-sale systems, according to Dr. Longo. Other applications include interactive intelligent terminals, floppy disc controller, electronic games and vending machines, and a variety of automotive systems.

The basic two chip F8 system consists of the 3850 CPU and the 3851 PSU, containing 1024 x 8 bits of storage plus I/O capability, interrupt, timer and clock generator. The CPU chip communicates with other F8 circuits by means of an 8-bit bidirectional data bus, and has five control lines to set the state of other chips.

The chips are each provided with two 8-bit bidirectional I/O ports, resulting in a total of 32 available I/O bits. This allows the two chips to directly accommodate virtually all common I/O devices such as keyboards, printers, readers, displays, modems and magnetic devices.

Contained in the CPU circuit are an arithmetic logic unit, an accumulator, a 512-bit scratch-pad memory, a W (status) register, two 8-bit bidirectional I/O ports, clock circuits to control all chips in the system, an interrupt control circuit, and a power-on detect circuit that disables the interrupt system and assures that processing starts from a unique address when power is first applied.

The PSU chip serves principally for storage of programmed instructions and non-volatile data constants used during program execution. It can directly interface with the CPU without the use of buffer circuits. The PSU also contains a program counter, stack

register, data counter, local interrupt control and a timer.

The program counter contains the address of the next instruction byte to be fetched from memory and is automatically incremented after each fetch cycle. The stack register receives the contents of the program counter and aids in developing a multilevel program function. The 16-bit data counter, used to reference memory addresses, can address up to 65K memory.

More complex systems using expanded memory can be implemented using the memory interface circuit and the DMA chip.

The four new circuits being added to the basic CPU and PSU F8 system include a Memory Interface (MI), Direct Memory Access (DMA), Communications Interface (USART), and a 256 x 4 N-channel static RAM.

The MI chip allows standard memory elements such as the 2102 or the 256 x 4 RAM, the 3538, or 4K RAM to be incorporated into the F8 system. The DMA chip is designed to provide a high-speed data path between the F8 memory and a high-speed peripheral memory, the FIFO memory or another F8 set.

Medium complexity systems can be designed by adding additional PSU chips. Each PSU adds not only 8K bits of storage, but also an additional interrupt level, another system timer and two more 8-bit I/O ports.

A system consisting of one CPU and two PSU chips would provide two timers, two interrupts, an inboard clock, inboard power-on, and 48 bidirectional I/O bits. Such a system could be used for traffic light control, for example, providing monitoring of traffic in four directions from in-road vehicle detectors for both through traffic and left and right turn lanes, as well as providing an interrupt capability for pedestrian control buttons on each corner of an intersection.

The USART is a peripheral device programmed by the CPU to operate using a serial data transmission technique currently in use. It will have a speed of 4 megabits per second for synchronous operation and 250K bits per second for asynchronous operation.

Systems simulation boards, debug packages and the F8M simulator will be available shortly. The F8M is priced at \$850 and can be used with a teletype.



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GI & HONEYWELL ANNOUNCE JOINT VENTURE

(from page 1)

Neither Honeywell or GI spokesmen would define the end product application of the chip. Sources inside and outside Honeywell hint that it may be used for an oil refinery process control system or a freeway traffic control system for some California cities. Spokesmen would only say that the microprocessor is under test in a pilot application and is scheduled for market introduction later this year.

Designated the CP 1600, the architecture for the microprocessor was developed and benchmarked by Honeywell. The detailed circuit design and manufacturing implementation is being performed by GI.

The CP 1600 is fabricated with the N-channel ion-implant Giant II process. The processor architecture utilizes eight 16-bit general purpose registers. All registers are program-accessible and can be used as accumulators or address registers. The internal micro-control maintains one register as the program counter and another as the memory stack pointer providing last-in-first-out storage in main memory. The general registers and the high speed pipelined ALU and its status register form the data processing logic for CP 1600.

The CP 1600 easily integrates into a versatile high throughput microcomputer system. The 16-bit word enables fast and efficient processing of numeric- or byte-oriented data. The 16-bit address permits accessing 65,536 words in any combination of program memory, data memory or peripheral devices. This single address space concept permits the full instruction power to operate on memory and peripheral devices.

The instruction set consists of 87 commands. Jeff Stein, manager of microprocessor development at GI, says that programming is "very comfortably" done at the assembly level. Honeywell does have the software; however, should GI offer the microprocessor as a standard product, they will support it completely with software.

Other characteristics of the 1600 include: 16-bit, two's complement, fixed point binary

arithmetic, full 16-bit address and data exchange with external devices, eight 16-bit general purpose registers, capability for DMA channels for high speed data transfers, 16 external sense lines for simple digital state testing, two interrupt request lines with priority resolution capability and self-identifying vectors, and simple bus structure.

Stein would not comment on when or if the 1600 would become a GI standard product. He said that negotiations were presently underway. Although he would not disclose the new product in which the CP 1600 would be used, he did say there would be several new products introduced in the next year or two.

It was learned that other Honeywell divisions are expecting to use the microprocessor. In New York, Frank G. Hickey, president and chief executive of GI, disclosed that the micro will be used in GI's POS and paramutuel wagering systems.

Although spokesmen would not say how many chips had been shipped, they did confirm that the microprocessor is being shipped and used in pilot applications.

Price of the CP 1600 will be less than \$100 in 500-piece quantities and around \$150 in single units.

The CP 1600 is the first microprocessor of a series of new devices being planned by the microprocessor system group at GI.

INDUSTRY'S MOST UNKEPT 8080 SECRETS

(from page 1)

The article reports that William Davidow, Intel's manager of microcomputer systems, said, "TI has told (Intel) customers that it will second source the 8080. Basically its something they're (TI) doing unilaterally. It's everyone's impression here that they are going to do it."

However, TI spokesmen in Dallas could not confirm or deny the reports. But sources close to TI have told MICROCOMPUTER DIGEST that May 1 is the tentative announcement date.

With TI's announcement pending, and MII's withdrawal from the semiconductor industry, odds are that AMD will be the first second-source for the Intel 8080 microprocessor. An official announcement from AMD is expected



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sometime this month.

AMD's AM 8080 is nearly finished and close to shipping. Samples should be ready either in June or July with production quantities by the third quarter.

The device incorporates N-channel, recessed field-oxide silicon-gate technology and will be offered with a host of bipolar and MOS peripheral chips. The device will be supported by existing 8080 software.

MICROCOMPUTER SOFTWARE SUPPORT

(from page 1)

Also, National CSS (NCSS) announced their engagement in a massive software effort to provide a PL/M translator for many popular, available microprocessors.

NCS's PL/M+ is a compatible extension of the PL/M language developed by Intel which can run on National's IMP-16P, -16L, and PACE development systems.

Previously microprocessor compilers have been available only on large-scale computers, mostly through timesharing facilities. This was because the microprocessors were not powerful enough to support a resident compiler. NSC's 16-bit microcomputers do have enough power when equipped with 8K of memory and a TTY. However, the compiler will support a full range of standard peripherals including a paper tape reader, card reader, line printer, and CRT terminal. It is also available as a module in NSC's Disc Operating System (DOS).

John Arnold, NCSS's marketing manager, says that they are currently working on an extensive PL/M language that will offer users a wider capability on their large computers. The language will first be available in three months for 8080 users. According to Arnold, NCSS will offer within six months, a series of microprocessor translators that will compile code for many of the popular microcomputers. One translator will be required for each microprocessor type.

Within a year, NCSS will also be introducing a FORTRAN language for microcomputers. With additional translators, FORTRAN will also produce machine code for other microcomputers. A direction that many programmers had previously considered unlikely.

Other software support from NCSS includes cross assemblers and simulators for the Intel 8008, 8080, 4004 and 4040, the Fairchild F-8, and the National IMP-16. Support for Motorola's 6800 and Signetic's 2650 will be on line by the end of april. Negotiations are currently underway with Rockwell for PPS-4 and -8 support.

Software support from United Computer Systems includes a cross assembler, assembler and simulator for the Intel 4004 and 4040; cross assembler, converter, two-pass PL/M compiler and simulator for the Intel 8008; assembler, two-pass PL/M compiler and simulator for the Intel 8080; assembler, simulator and build-virtual-machine program for Motorola's M6800; and on line in 4-6 weeks, a cross assembler and simulator for the Intel 3000 bipolar microprocessor. Ed Drummond, San Francisco district marketing manager for UCS, said negotiations are currently underway for F8 support.

Drummond added that UCS will supply system analysts support from all nationwide offices. Support will include aiding customers in nearly any manner to develop software for their product. Classes can be arranged on a one-to-one basis.

Although UCS is not rewriting microcomputer software, Drummond did say that UCS is studying the use of PROSE for their simulation programs. PROSE is based on Digital Calculus and UCS will be offering a brochure explaining the entire usage of PROSE.

Ben Russel from Tymshare, Inc. reports that their firm offers complete software support for the National, Intel and Rockwell microcomputers. PL/M is available for all 8-bit Intel microcomputers and negotiations are underway to supply PL/M for Intel's 3000 bipolar microprocessor.

Russel says Tymshare offers world-wide services with all microcomputer software.

Tymshare is not currently generating their own compilers, but through agreements, are providing all available software from microprocessor manufacturers.

General Electric Information & Timesharing's marketing manager, Rick McBurney, says GE is supporting all of National's, Rockwell's, Motorola's and Intel's (except 3000) microprocessor software. Negotiations are underway for several other new micros.



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TECHNOLOGY:**Two Hour TV Morning Course**

Tune in your television the mornings of April 15-18 for two hours of microprocessor technical lectures presented by the Texas Instruments Learning Center. You'll see four half-hour sessions--one each morning, Tuesday through Friday--on system architecture, chip fabrication technologies, potential applications and a special session on microprocessors in communications systems. Check the broadcast schedule below for your metropolitan area.

A microprocessor handbook is also available from TI and includes background information on ALUs, controllers, memories, and timing. Special sections cover system architecture and practical applications. A microprocessor selection guide, comparison chart, supplier listing and a comprehensive bibliography are included. The book is available and sells for \$24.95 and can be used to support the home-TV presentation.

CITY	CHANNEL	TIME
Boston	7	6:20 AM
Chicago	9	6:00 AM
Cleveland	8	6:00 AM
Dallas	5	6:00 AM
Dayton	7	6:00 AM
Denver	4	6:30 AM
Detroit	2	6:00 AM
Houston	11	6:30 AM
Los Angeles	11	6:30 AM
Miami	4	6:00 AM
Minneapolis	11	6:30 AM
New York City	5	6:30 AM
Orlando	6	6:00 AM
Philadelphia	To be announced*	
Phoenix	5	6:00 AM
Rochester	10	6:00 AM
San Diego	6	6:30 AM
San Jose	11	6:00 AM
Seattle	11	6:30 AM
Washington, D.C.	5	6:30 AM

8080 LIKELY LSI-12 CANDIDATE

General Automation is expected to hand Intel the contract for supplying 8080 microprocessors for its LSI-12 microcomputer. The Intel chip will replace the SOS chip that Rockwell could not produce economically in volume. Synertek is reportedly the top contender for the LSI-16 microcomputer chip. Partially owned by GA, Synertek will develop a two chip microprocessor along the same lines as the SOS chip, but using N-channel MOS silicon gate technology instead.

HITACHI & TOSHIBA ANNOUNCE NEW CHIPS

Two Japanese semiconductor firms have announced new microprocessors. Hitachi Ltd. is introducing a two chip, 8-bit, P-channel MOS microprocessor that is dedicated to the calculator market. The chip consists of an ALU chip and a control chip that contains a microprogram of 128 words by 30-bits plus registers. Total memory capacity is 65K and cycle time is 2.3 us.

The Toshiba microprocessor is a single-chip version of the TLCS-12 which goes on the market this month. Program timing was cut by almost a third, and divide and store instructions were added.

TDY 52 ABORTED

Teledyne Systems has aborted its TDY 52 microcomputer project. The decision has ended Teledyne's nine month venture into the commercial microcomputer market. However, the company will continue to participate in Mil Spec 5400 Class 2 military business.

M6800 ENTERS TRW MARKET

Motorola has emerged as the winner to supply microprocessor chips for all future TRW Data Systems Terminals. The five-year contract will launch the M6800 into TRW's POS and financial terminals. Also under consideration was Intel's 8080 micro. TRW is reportedly leaning toward AMI for second-sourcing.



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Dr. A. J. Nichols, standard products manager at AMI, says they have been shipping sample quantities of their 6800 microprocessor for a few months now. Production quantities should begin soon.

MICROCOMPUTER-BASED PRODUCTS:

REMOTE DATA COMMUNICATION SYSTEMS

Tycom's new Buffer Communications System Model 4210 consists of an Intel 8008 microprocessor, IBM Selectric typewriter, a 4K character buffer expandable to 16K characters and a 1200-baud automatic answer modem.

In operation, data, messages, or information can be typed on standard forms, using the Selectric typewriter. The microprocessor controls and performs all editing, correcting, and searching for specific characters in the text in order to change or update the information. Once the data is verified, it is entered into the protected area of the buffer for automatic unattended transmission to a central site at 1200 baud. At the same time, messages can be received and stored in another protected area of the buffer.

The Model 4210 is priced at \$6,500 plus discounts, depending on quantities. Delivery is four weeks ARO.

SINGLE-BOARD μ C SYSTEM

A new single-board general purpose microcomputer system has been introduced by Mycro-Tek, Inc. The board features a wire-wrap section to allow custom tailoring for a wide range of microcomputer applications. The MT 8080 PB is built around an Intel 8080 CPU and includes clock generator, power inverter, bus interface, timing, logic and provisions for 1K x 8 PROM memory.

An on-card power inverter allows the system to be operated from a 5V source. A companion board containing up to 32K x 8 RAM is also available. Two memory boards can be used for 64K of RAM.

Mycro-Tek also offers an optional control panel that uses hexadecimal keypad and displays with separate CPU indicators to allow users to do useful programming and software debugging at minimum cost.

MICROCOMPUTER VACUUM COATER

To increase the quality and success of a vacuum coating run, Varian Vacuum Division has designed their new Model 3135 vacuum coater around the Intel 8008 microcomputer according to Rich Scholl, product design engineer. The microcomputer automatically puts the machine through its entire operating sequence, thus improving process control and repeatability. The Model 3135 eliminates such variables as operator skill and response time which affect the success of a coating run.

Prices range from \$55,000 to \$65,000 depending upon configuration, and delivery is typically three months.

NORLAND ENTERS INSTRUMENTS MARKET

Norland Instruments has entered the general instruments market with a digital oscilloscope controlled by an Intel 8080 microprocessor. Model NI 2001 uses plug-in data acquisition units and provides CRT display of signals.

The microprocessor was used because it not only added flexibility but also cut cost and met interfacing and programming requirements. The microprocessor allows the oscilloscope to be modified, expanded or updated to meet future application needs.

Production units will be ready in June and pricing is expected to be between \$13,000 and \$15,000.

I/O CONTROLLERS DESIGNED WITH 3 μ Cs

Systems Engineering Labs has incorporated microcomputers into the microprogrammed mini-computers to simplify I/O control interfacing. The system, dubbed SEL 32, is a 32-bit mini which features two floating-point processors, mass-storage, shared memory, micro-programmed firmware, and single bus structure with throughput rates up to 26.6 Mbyte/sec. Prices range from \$18,000 up depending upon complexity. SEL has told MICROCOMPUTER DIGEST that they have designed their I/O controllers around the Signetics, Intersil and TI microprocessors.



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TOSHIBA EYEING U.S. AUTO MARKET

Ford Motor Co. is currently developing an onboard computer system which uses a custom-designed 12-bit microprocessor to control ignition timing and exhaust gas recirculation flow rate regulation. Tohsiba is believed to be one of several suppliers which are providing the custom designed chips. But neither Ford nor Toshiba is talking. Ford is expected to choose a supplier from among the ones they are now working with. Ford's future plan consists of a list of 16 motor vehicle control applications that the microprocessor is expected to eventually accomplish.

MIS ANNOUNCES μ C DEVELOPMENT SYSTEM

(FOURTH IN A SERIES)

A high performance microcomputer-based program development system, the MPD-1000, is currently being produced by Millennium Information Systems, Inc. The system is designed to answer all the needs of the system programmer for efficient development of application programs for microcomputer-based systems employing the 8008 or 8080 microprocessor. Its capabilities for program development are similar to that of a disc-based minicomputer system.

System configuration includes the Intellec 8 (Mod 8 or Mod 80) microcomputer, a dual drive floppy disc subsystem, a high speed printer (optional) and an ASR-33 Teletype. It features a floppy disc operating system called MDOS.

The Millennium Disc Operating System (MDOS) is a comprehensive floppy disc operating system that offers users a very flexible file management capability which enables an Intellec 8 to be used for applications as well as program development. The text Editor and Macro Assembler incorporated into the MDOS are the latest versions of the standard Intel-supported programs. The capabilities of the Editor and Assembler are enhanced by MDOS through the logical I/O feature of the Intellec 8 Monitor.

MDOS allows named disc files of varying lengths to be created and deleted quickly and easily. Any logical input or output device can be assigned to any named disc file on any

one of up to eight floppy disc drives. Named files can be copied, merged, concatenated, and otherwise manipulated as the user desires. Upon command, the directory of a discette on any floppy disc drive can be listed on the console output device.

The Text Editor can be loaded into the Intellec 8 from a floppy disc in less than 2 sec. The Macro Assembler can be loaded into an Intellec 8 in less than 4 sec. The user can assemble source statements from a named disc file or from any other input device attached to the Intellec 8 and direct the punch output device attached to the Intellec 8. All of the desired passes of the Macro Assembler are performed automatically.

The MPD-1000 employs a comprehensive repertoire of hardware error checks to insure error-free data. These include CRC generation and checking; illegal command checking; automatic error recovery in the event of a read ID failure; and automatic seek verify to insure the desired track was reached.

The system includes a program which converts MCS-8 hardware assembler source program paper tapes into the format required for the Intel Macro Assembler. This capability allows MCS-8 owners to convert over to the Intellec 8 based MPD-1000 program development system quickly and easily.

Millennium plans to develop additional software for the MPD-1000 as an on-going effort to enhance the system and increase its capability. Development of an easy to use high level language tailored to the needs of logic designers is currently being evaluated.

To interface the MPD-8 Floppy disc subsystem with the Intellec 8, the user can simply (1) add a PROM module to the standard Intellec 8 PROM board, and (2) plug a ribbon cable from the floppy system to the I/O board that comes with the Intellec. No additional I/O boards are needed, no device codes are taken away, and no power is drawn from the Intellec 8 power supply. The 12K of RAM memory in the Intellec gives a powerful disc operating system which allows cost-effective program development.

Prices are FOB and begin at \$4,250. Interested persons should contact Millennium for a more specific price per configuration.



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NEW μ C TERMINAL SERIES DISPLAYED

A new data communications terminal which has an 8008 microprocessor beating at its heart has been announced by Trendata. The microprocessor controls all machine functions of the Model 4000 terminal.

Frank Cameron, product line manager, says the 4000 is the first of a new series of microcomputer-based terminals to be announced by Trendata.

Cameron said that a cassette tape will be offered with the 4000 terminal later this month. It will feature automatic search capabilities and be able to address up to 4800 positions. Transmission can be at either 10, 15, 30 or 1200 baud. Full editing functions for word, line, or characters can be controlled from either the terminal or a host processor.

The 4000 terminal sells for \$5800 or leases for \$180/month and includes all maintenance. The cassette tape leases for \$85/month including maintenance or sells for \$2495. Cameron said that Trendata will service customers through their own direct maintenance group located throughout the U.S.

VENDING MACHINE DEMOS μ C POWER

A demonstration microcomputer-aided vending machine has been built by James Barnes, section manager and systems development engineer at Motorola Semiconductor Products, to demonstrate the versatility available to electromechanical devices by microprocessors.

The vending machine's microcomputer system consists of the M6800 microprocessor, four M6820 peripheral interface adapters, an M6810 RAM with 128 8-bit bytes of storage, and approximately 600 8-bit bytes of ROM.

The machine can sell 16 different items in 999 possible prices from free to \$9.99. The vending machine can keep track of all money exchanges and indicate to the buyer if enough money has been inserted. It can also dispense change or monitor which items cannot dispense change due to the combination of change left in the machine. The microcomputer can be tied to a host computer by a telephone hookup to determine when service or

merchandise is needed. An added advantage to monitoring all transactions is to discourage pilferage by employees.

Barnes is also thinking of a cooking range vending machine using a microcomputer that would read binary coded cooking instruction on the side of a can, open the can, and cook the contents accordingly.

Whatever else can they do for a tubesteak?

MICROWAVE OVEN JOINS BANDWAGON

A microwave oven that uses a microcomputer to control the timing and control functions has been introduced by Amana.

Users may program the range for a regular cooking cycle, a slow cook cycle, defrost cycle or an automatic progression of several of the cooking cycles. The MOS microprocessor is manufactured by Essex International.

A price has not been established for the Amana Touchmatic Radarange Model RR-6, but it is expected to retail for less than \$600.

TYCOM'S SMART TERMINAL

A two-page technical bulletin on the new Tycom Model ASR 37 intellignet terminal which can be used with almost any IBM Selectric I or II typewriters is available from Tycom Systems Corp.

The tech sheet contains a general description of the ASR 27 as well as information on applications, technical specifications and operating characteristics.

The new microcomputer-based terminal operates in ASCII and serves such office requirements as source data capture, interactive time sharing, batch transfer, and off-line preparation of formatted documents, letters, and other materials. The unit uses its internal memory and magnetic tape cassette to allow for batch transfer at 30 char/sec while printing on- or off-line at up to 15 char/sec. It is switchable for 10, 15 or 30 char/sec transmission in a teletypewriter-compatible mode.

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Ed's Note: Don't miss a single exciting issue of MICROCOMPUTER DIGEST. Check to make sure you have renewed your subscription.



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NO MORE COFFEE BREAKS

Marconi Research Laboratories in England is experimenting with a microcomputer that tracks vehicles automatically by radio. Doppler sensors mounted on the side of a vehicle would send signals to the microcomputer whenever a turn was made and an odometer-type sensor would measure distance. The microcomputer would then compare the data with a map stored in memory. Results would be outputted at a remote or central station.

DEC'S NEW STARTER KIT

Digital Equipment Corp. has announced new spring prices for their Microprocessor Series (MPS) Starter Set. The \$995 price includes an 8-bit microcomputer, demonstration programs, a 1K RAM which is upward expandable to PROM memory and more RAM, and a Monitor/Control Panel. Without the Monitor/Control Panel, the starter set sells for \$695 each for two or more sets. Individual list prices had been \$1709.

KIT AVAILABLE FOR 8008 PRODUCTS

Promeco Inc. is providing a complete prototyping kit for hardware and software development for any dedicated 8008 microprocessor-based system. Model 8P consists of a PROM programmer, CPU card, 8K byte RAM card, 8K byte ROM card, buffer card, teletypewriter interface card, input port card (3 ports) and output port card (3 ports). The kit can be expanded to include 8 input ports, 24 output ports, and 16K bytes of RAM or ROM memory. The basic kit sells for \$1800; the expanded kit is priced at \$2200.

M6800 HARDWARE & SOFTWARE SUPPORT

A new series of microcomputer development modules based on Motorola's 6800 Series Microprocessor chip set will soon be available from Wintek.

Functional modules include CPU, RAM, ROM, programmable parallel I/O, programmable serial I/O and telephone modem modules. By using a common tri-state bus structure, these

modules can be combined to suit the needs of the individual customer, thus giving a maximum of flexibility with a minimum of development time.

The CPU and RAM cards will be available May 30; other cards are under development and will be available in late summer. Prices will also be announced later.

Support software for the M6800 consists of a cross assembler and a simulator written in standard FORTRAN IV. Modular programming techniques have been employed and any code which is necessarily machine specific is isolated in separate functions or subroutines.

The cross-assembler is a full two-pass assembler, with EQU TITLE, and LIST pseudops, in addition to the more basic pseudops. Operands may be non-parenthetical expressions using plus, minus, multiply, and divide operations. Output from the assembler can be fed to the simulator, read by a 6800 system, or used to program a RAM or PROM. A second version of the cross assembler that includes macro conditional assembly and relocatable code is under development.

The simulator has a debugging facility that includes partial memory dumps, register dumps, and break points. It can easily be adapted to an interactive system. The assembler will optionally dump the symbol table to provide the simulator with a de-assembling capability using the original labels and variable names.

These programs are available on cards, magnetic tape or paper tape. A complete manual is enclosed, and additional copies can be ordered at nominal cost.

The cross-assembler and simulator are available at \$600 each or \$1000 for both.

SAFEGWAY TO USE 2ND DATACHECKER

A second Datachecker POS terminal is being developed for Safeway Stores by National Semiconductor. The microcomputer-based product is in addition to the order mentioned last month in the MICROCOMPUTER DIGEST. The POS system under development does not include a scanner or other peripheral equipment.

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M6800 USED IN WATCH TESTER

In an effort to speed up production, decrease testing costs and time for CMOS watch circuits, ALMA Corp., a division of Develco, has introduced an M6800 microcomputer controlled test system.

The Model 720 tests for continuity, output breakdown voltages, input leakage, static and dynamic supply current, oscillator gain, functional checks, output-drive parametric evaluations, and time intervals.

Via programmable interface adapters and data-bus architecture, the Motorola microcomputer generates test programs and program sequences, and controls the connector pin electronics. The system can be equipped to test from 4 to 8 digits along with other watch features such as chronometers.

Maximum system configuration includes a console-mounted electronics section, CRT display with keyboard and printer, a control module, a high speed 16-track, 128K byte floppy disc memory and the microcomputer with 8,192-bits of RAM.

The tester is available and interested individuals should contact ALMA for pricing.

MEMORIES AND PERIPHERALS:

MICRO DISC FILE SYSTEM OFFERED

BRD, Inc. is providing mass data storage for the Olivetti P600 series LSI microcomputer with their D-473 system. Tom Hallate, president of BRD, said that various versions of the disc can be used with the various available microprocessors on the market that are TTY compatible. In fact, he said the disc system can be used directly on the microprocessor's TTY ports to handle input/output data.

The microcomputer disc file system includes data storage capacity of 217K alphanumeric characters in 1K sectors on a removable diskette; 217 characters storage at each address; fully buffered independent I/O memories; 1 sec and greater max read/write times; data I/O via IPS0 at P600 clock rates; operation with only four program instructions; and modular system construction. Special features of the D-473 include vari-

able select code addresses, automatic motor idle during non-use times and release for manual return of control.

DANYL DEVELOPS IMP-16 AIDS

Danyl Corp. has announced the development of several new accessory items for the National IMP-16C microprocessor.

Among them is a 4K x 18 RAM/2K x 16 PROM memory module on a single, 144-pin PC board. It is compatible with the IMP-16C CPU and National's prototyping hardware. The module is unit priced at \$1,325 and is available within 30 days.

Also available is a Peripheral Interface Module which permits connection of a 300 cps paper tape reader, a PROM burner and a unique, calculator style, hexadecimal Debugging Control Panel.

The Peripheral Interface Module is priced, in units of 1-10, at \$510; the paper tape reader at \$1,380; and the Debugging Control Panel at \$785. Each device is supplied with IMP-16C compatible firmware in PROM and is available within 45 days.

The firm also offers PROM burning and custom hardware, firmware or software services for the IMP-16 series and other microprocessor systems.

INTEL SOFTWARE SUPPORT ANNOUNCED

Microtec is currently offering several software packages to support the Intel 4-bit and 8-bit, and the Motorola 6800 microprocessors. These assembler and simulator programs are written in ANSI standard FORTRAN IV, and may be adapted for use on timesharing systems that offer FORTRAN IV compilation.

Microtec says that the cost of the software is easily recovered in a few months since the programs currently available on timesharing networks are only available at premium prices.

Microtec will modify purchased programs for nominal fees, if desired; however, the company will not maintain user-modified programs.

A test program and its output listing
(cont'd next page)



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accompanies each program delivered. These programs allow quick customer verification of assembler and simulator operations.

The assemblers all require an 80-column card image source program as input. They develop a 132 character per line output listing as well as an 80-column card image, object file as output. The output file is compatible with Intel's hexadecimal format and can be punched on paper tape and read into the Intellec for simulation.

The instruction mnemonics are identical to those established by Intel in their literature. However, the 8008 assembler can be made available with instruction mnemonics equivalent to the corresponding 8080 mnemonics.

The simulator can simulate the ROM/RAM environment, input/output operations, and also includes the more conventional breakpoints, patching facility, register presetting, etc. A spokesman for the company says that other software as well as hardware products are now under development. Microtec intends to provide support to users of all popular microprocessors.

AMD To SECOND SOURCE 93415

Advanced Micro Devices is expected to announce their pin-for-pin compatible version of Fairchild's 93415 1K RAM sometime this month. The device will be Fairchild's first second source for their line of isoplanar bipolar memories. AMD is planning on expanding their line with random logic arrays and PROMs. Speed is expected to be around 30 ns.

NEW FIELD PROGRAMMABLE PROM

A 4096-bit field programmable PROM has been developed by National Semiconductor for use in computer peripheral equipment, in the design of data terminals, in communications systems, and with microcomputers.

The MM5204 PROM is a 24-lead, static, non-volatile memory organized into 512 x 8 configuration. It is manufactured using a P-channel silicon-gate process that employs floating-gate avalanche MOS technology, which permits the PROM to be erasable as well as compatible with bipolar logic devices. Ac-

ording to Moore, the process is the same one that National uses to produce its MM5203, a 2096-bit erasable PROM. The device features tri-state outputs, chip-select input, 750 ns access time; 5V and -12V supplies are required.

The MM5204 PROMs are shipped from the factory with a logical 0 in each cell. With the application of a 50V pulse to each cell selected by the user, the 0 is replaced by a logical 1 in the form of a stored charge. The complete programming procedure takes approximately 30 sec. An ultraviolet light exposed on the chip erases all cells by returning them to a logical 0.

Applications include code conversion, character generation, synthesis of random logic, generation of alterable look-up tables, formation of microprograms, and in electronic keyboards.

The price per unit is \$50 when ordered in 100 lots. Delivery is four weeks ARO.

NATIONAL OFFERS BLUE/GREEN SUPPORT

Complete sets of support and interface circuits have been developed by National Semiconductor to make the IMP series microcomputers easier to use, according to Bill Slaymaker, product manager.

"Any microprocessor needs two kinds of external circuitry, one that helps the device to operate, and another that lets the processor communicate with the outside world," said Slaymaker.

The Blue chips support the CPU, and the green chips are the peripheral interface devices. Together they permit the user to build simpler, more reliable, efficient, and economical bus-organized microcomputer systems. One 4" x 5" PC card can contain a complete processing system.

In supporting the CPU, one of the blue chips generates clock pulses (IMP-00A/542), and one handles interrupts, flags, and jump conditions (IMP-00A/544). Another buffers the outputs of the CPU for high-level TTL drive capability; these devices include 8- and 16-bit transceivers (IMP-00A/541 and IMP-00A/551).

Green chips are used on the system I/O bus to provide I/O storage, simplified im-



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plementation of the I/O timing controls and peripheral interfaces. The chips are the 8-bit (IMP-00A/543) and 16-bit (IMP-00A/553) bidirectional interface latches. Another green chip provides unidirectional I/O or latched address for peripheral or memory addressing; the IMP-00A/548 performs these functions for the 8-bit systems, and the IMP-00A/558 for 16-bit systems.

These blue and green chips have a similar set available for use with the PACE microprocessor. In the IMP series, two P-channel MOS circuits of LSI form bit-slice systems ranging from simple 4-bit processors for control functions to a powerful 32-bit system which handles complex calculations. The two LSI chips are a register and arithmetic logic unit, and a control and read-only-memory.

QUADRUPLE TRANSCEIVER

A quadruple transceiver, Model DS8642, with high-current driving capability is now available from National Semiconductor for use in bus-organized data transmission systems, according to Stephen Fields, product marketing manager.

The transceiver is intended for systems that terminate with a 50-ohm impedance. Applications include uses in large and small computer systems, with microprocessors and in smart terminals. It is also useful in data-acquisition systems built around a group of instruments that feed either a programmable calculator or a microcomputer.

Features include four bus receivers and four bus drivers controlled by a common strobe, 100 mA drive current, and open collector outputs which can be wired-OR with as many as 19 other drivers and 20 bus receivers.

The DS8642 is immediately available from stock and sells for \$2.65 for 100 lots in an epoxy DIP package.

512 x 1 CMOS RAM IN PRODUCTION

American Microsystems, Inc. is now shipping sample quantities of their 512 x 1 CMOS RAM. The SS2222 has an access time of 200 ns typically and 350 ns maximum. Power is 4 nW/bit. To be announced later this year are 1024 x 1 and 256 x 4 CMOS RAMs.

Intel and Intersil have already announced similar products, and National Semiconductor will be introducing their 74C920, a 256 x 4 CMOS RAM, shortly.

CURTIS UNVEILS PROM PROGRAMMER

A new PROM programmer, the PR-2300S has been announced by Curtis Electro Devices, Inc. The unit will program Signetics 82S23 and 82S123 Schottky PROMs from a pin-compatible ROM, ROM simulator or computer. Average PROMs can be programmed in only 1 sec and a "verify only" function will allow the operator to sort unknown devices. The PR-2300S is intended for use as a high speed PROM duplicator.

PEOPLE, LITERATURE AND EVENTS:

HANNUM WINS 'BIT BUCKET' CONTEST

John R. Hannum of RCA in Camden, NJ won National Semiconductor's "Name the Group" contest. The contest was conducted to select a name for National's microprocessor user's group. Mr. Hannum submitted the name "COMPUTE" (meaning Club of Microprocessor Programmers, Users, and Technical Experts) for the group and also suggested the Bit-Bucket as a name for the group's monthly newsletter.

Hannum won a NOVUS 4510 Mathematician scientific calculator for submitting the winning names.

Anyone interested in microprocessors may join COMPUTE. Annual memberships are \$15.

U.S. PHILIPS TO TAKEOVER SIGNETICS

A preliminary agreement with Signetics Corp. and U.S. Philips Trust has been termed as the industry's largest takeover of a semiconductor manufacturer. The Dutch based company will absorb all of Corning Glass Works 70% interest in Signetics and will pay \$8 per share for all of the 5,748,000 Signetics common shares outstanding. The takeover is subject to approval of Signetics stockholders and a definitive contract.

When asked if Philip's takeover would affect Signetic's microprocessor effort, George
(cont'd next page)



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Rigg, product manager of MOS microprocessors, says it was too soon to say. However, according to him, everyone is pleased with the acquisition and believes that Signetics will have more funds to aggressively participate in the microprocessor/microcomputer market.

NEW INTERNATIONAL SALES NETWORK

Pro-Log Corp. has just announced setting up an international sales network by naming four new firms in Europe, Canada and Japan. They are Technitron Inc. for England and France; Electronic Service for Germany, C. Iton & Co. for Japan and Data Graphics in Canada.

Other appointments are expected for Scandinavia, Spain and Australia.

INVITATIONAL WORKSHOP

The Western Area Committee of the IEEE Computer Society is sponsoring a two-day workshop on the advanced architecture and applications of LSI microprocessors to be held on April 30, May 1 and 2 at the Asilomar facilities near Pacific Grove, CA. Cost to IEEE members is \$70 (\$85 for non-members) including room and board.

The objective of the workshop is to bring LSI microprocessor users and manufacturers together in an open discussion environment to understand microprocessor characteristics and applications. Contact Don Senzig, Hewlett-Packard, Palo Alto, CA.

RECENT LITERATURE

"The Classroom Microcomputers"

Dean Brown, RRC International and Phyllis M. Cole, SRI

Computer Decisions February 1975

The area of Computer-Aided-Instruction (CAI) is virtually an untapped market for microcomputers. The authors present several possible areas where microcomputers can be most actively and economically used. They challenge instructors to use their imaginations in incorporating CAI into the classroom.

A simple but comprehensive guideline is presented for teachers to follow in selecting the right microcomputer-based CAI.

"Microprocessor System Design"

J. David Callan and Robert Baskin, iCom Corp.
Digital Design February 1975

This article is a good presentation of the considerations pertinent to the selection of a microcomputer. It is a good non-technical discussion of what a microcomputer is, where and when it can best be used, speed requirements, and how to go about incorporating them into a particular application. Anyone considering a microcomputer-based product for the first time will find this 15-minute article well worth the time.

"Single Chip Microprocessors Move Into The 16-Bit Arena"

Robert H. Cushman, Special Features Editor
EDN February 20, 1975

Almost on the very heels of Honeywell and Giant Instrument's joint announcement of the CP 1600 16-bit microprocessor, EDN has presented a complete description of the system in their traditional manner. The article is a thorough examination of the chip's internal working in a system composed of microprocessor, I/O interface, memory, decoders and buffers.

The article does point out one important fact. In very large volume it may be possible to arrange customized microprogramming with General Instruments. But readers should note that the CP 1600 is not commercially available. Negotiations are underway, and it may just be a matter of time.

The article is an excellent analysis of the new directions third generation microprocessor architectures are taking.

"Developing Software For Microcomputer Applications"

John L. Pokoski, Univ. of NH and Oliver Holt, Raytheon Co.

Computer Design March 1975

The article relates an alternate approach to microcomputer software generation by combining a DEC PDP-8/L minicomputer and an Intel MCS-8 microcomputer. The basic principles can be applied to any mini/micro configuration. The system was designed to eliminate the problems resulting from developing software in the microcomputer system itself or by simulation on large computers or time-share networks.



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EDUCATION:

MICROCOMPUTER COURSES, SEMINARS, CONFERENCES. Date, title, cost, location, sponsoring organization (addresses on page 16).

April

- 1- 3 Microprocessor Design Course \$250
Denver, CO Pro-Log Corp.
- 1- 8 ICS International Microcomputer Educational Congress \$185-\$325 Paris, France Integrated Computer Systems
- 7- 8 How to Write Software \$275 Philadelphia, PA Microcomputer Technique, Inc.
- 7- 9 MCS-80 Microcomputer Workshop \$350 Santa Clara, CA and Boston, MA Intel Corp.
- 7- 9 Micro, Mini & Midicomputer Systems Structure, Implementation and Application Chicago, IL AIEE
- 8-10 Microprocessor Design Course \$250 Palo Alto, CA Pro-Log Corp.
- 9-11 How to Select a Microprocessor \$395 Philadelphia, PA Microcomputer Technique, Inc.
- 10-11 MCS-80 Microcomputer Workshop \$350 Santa Clara, CA and Boston, MA Intel Corp.
- 13-16 Microcomputers I: Basic Concepts and Applications \$395 St. Charles, IL National Engineering Consortium, Inc.
- 14-15 How to Write Software \$275 Toronto, Ont. Microcomputer Technique, Inc.
- 14-16 How to Design Microprocessor Systems \$425 Philadelphia, PA Microcomputer Technique, Inc.
- 14-16 PL/M Microcomputer Workshop \$350 Santa Clara, CA and Boston, MA Intel Corp.
- 15-18 Designing with Microprocessors--A Two Hour Home TV Special Texas Instruments Check Page 6 for Air Times
- 16-18 How to Select a Microprocessor \$395 Toronto, Ont. Microcomputer Technique Inc.

- 16-18 Microcomputers II: Architecture, Software and Systems \$395 St. Charles, IL National Engineering Consortium, Inc.
- 16-18 Microprocessor Design Course \$250 Chicago, IL Pro-Log Corp.
- 17-18 How to Program Microprocessors \$275 Philadelphia, PA Microcomputer Technique, Inc.
- 21-23 How to Design Microprocessor Systems \$425 Toronto, Ont. Microcomputer Technique, Inc.
- 21-23 MCS-40 Microcomputer Workshop \$350 Santa Clara, CA and Boston, MA Intel Corp.
- 21-23 Micro, Mini & Midicomputer Systems Structure, Implementation and Applications Chicago, IL AIEE Seminars
- 21-23 Microprocessor Design Course \$250 Syracuse, NY Pro-Log Corp.
- 21-25 Mikrodator 75 Stockholm, Sweden Integrated Computer Systems, Inc.
- 24-25 How to Program Microprocessors \$275 Toronto, Ont. Microcomputer Technique, Inc.
- 24-26 MCS-40 Microcomputer Workshop \$350 Santa Clara, CA and Boston, MA Intel Corp.
- 30- 2 Workshop on the Advanced Architecture and Application of Microcomputers Pacific Grove, CA Contact: D. Senzig, Hewlett-Packard Labs

May

- 5- 9 Microprocessors--Hardware, Software, Applications \$395-\$445 Phoenix, AZ Opto-Logic Corp.
- 5-10 ICS International Microcomputer Educational Congress \$185-\$325 Washington D.C. Integrated Computer Systems
- 6- 8 Microprocessors and Systems Applications \$395 San Francisco, CA Automata-Benwill Courses
- 6- 8 Microprocessor Design Course \$250 Los Angeles, CA Pro-Log Corp.



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May

- 10 Annual Multi-Logic Engineering Symposium San Francisco, CA IEEE Contact: T. McGill, Stanford Research Institute
- 12-14 MCS-80 Microcomputer Workshop \$350 Santa Clara, CA and Boston, MA Intel Corp.
- 13-15 Microprocessors and Systems Applications \$395 Los Angeles, CA Automata-Benwill Courses
- 14-16 Microprocessor Design Course \$250 Washington, D.C. Pro-Log Corp.
- 15-17 PL/M Microcomputer Workshop \$350 Santa Clara, CA and Boston, MA Intel Corp.
- 19-21 MCS-40 Microcomputer Workshop \$350 Santa Clara, CA and Boston, MA Intel Corp.
- 19-21 Microprocessor Design Course \$250 Lexington, MA Pro-Log Corp.
- 19-22 1975 National Computer Conference Anaheim, CA AFIPS
- 20-22 Microprocessors and Systems Applications \$395 Boston, MA Automata-Benwill Courses
- 20-22 SEMICON/West 75 \$3 San Mateo, CA Golden Gate Enterprises
- 27-29 Microprocessors and Systems Applications \$395 New York, NY Automata-Benwill Courses

June

- 2- 7 ICS International Microcomputer Educational Congress \$185-\$325 Brussels, Belgium Integrated Computer Systems
- 3- 5 Microprocessors and Systems Applications \$395 Houston, TX Automata-Benwill Courses
- 3- 5 Microprocessor Design Course \$250 Palo Alto, CA Pro-Log Corp.
- 3- 6 1975 International Symposium on Military and Industrial Microprocessor Systems San Diego, CA AH Systems Inc.

- 4- 6 Conference on New Components and Subsystems for Digital Design \$295 Los Angeles, CA Technology Service Corp.
- 8-13 Microprocessors & Minicomputers; Interfacing & Applications Blacksburg, VA American Chemical Society
- 9-11 MCS-80 Microcomputer Workshop \$350 Santa Clara, CA and Boston, MA Intel Corp.
- 10-12 Automotive Electronics Conference and Exposition Anaheim, CA Automotive Electronics
- 10-12 Microprocessors and Systems Applications \$395 Chicago, IL Automata-Benwill Courses
- 12-14 PL/M Microcomputer Workshop \$350 Santa Clara, CA and Boston, MA Intel Corp.
- 16-18 MCS-40 Microcomputer Workshop \$350 Santa Clara, CA and Boston, MA Intel Corp.
- 16-20 Microprocessors--Hardware, Software, Applications \$395-\$445 Marina Del Ray, CA Opto-Logic Corp.
- 17-19 Microprocessors and Systems Applications \$395 Washington, D.C. Automata-Benwill Courses
- 17-19 NEPCON '75 New York, NY ISCM

July

- 14-18 Microprocessors--Hardware, Software, Applications \$395-\$445 Palo Alto, CA Opto-Logic Corp.
- 14-18 Mini and Micro Computers: Their Applications and Use \$425 University of California at Berkeley
- 28- 1 Mini and Microcomputers: Their Structures, Characteristics and Applications \$300 Ann Arbor, MI University of Michigan

SPONSORING ORGANIZATIONS AND CONTACTS

AFIPS, 210 Summit Ave., Montvale, NJ 07645
(201) 391-9810



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AH Systems, Inc., Dr. G. A. Nelson, Program Director, 9710 Cozycroft Ave., Chatsworth, CA 91311 (213) 998-0223

AIEE Seminars, Dept. K, P. O. Box 25116, Los Angeles, CA 90025 (213) 826-7572

American Chemical Society, Education Division, 1155 16th St. N.W., Washington, D.C. 20036 (202) 872-4508

Automata-Benwill Courses, 167 Corry Rd., Brookline, MA 02146 (617) 232-5470

Automotive Electronics Conference and Exposition, 5544 E. LaPalma Ave., Anaheim, CA 92807 (714) 528-2400

Golden Gate Enterprises, 1333 Lawrence Expy., Suite 213, Santa Clara, CA 95051 (408) 241-7400

Hewlett-Packard Labs, D. Senzig, 1501 Page Mill Rd. Palo Alto, CA 94304 (415) 493-1501

Integrated Computer Systems, Inc., 4445 Overland Ave., Culver City, CA 90230 (213) 559-9265

Intel Corp., Microcomputer Systems Training Program, 3065 Bowers Ave., Santa Clara, CA 95051 (408) 246-7501

ISCM, 222 W. Adam St., Chicago, IL 60606 (312) 293-4866

Microcomputer Associates Inc., 10440 N. Tantau Ave., Cupertino, CA 95014 (408) 247-8940

Microcomputer Technique, Inc., 11227 Handlebar Rd., Reston, VA 22091 (803) 620-9676

National Engineering Consortium, Inc., Oakbrook Executive Plaza #1, 1301 W. 22 St., Oak Brook, IL 60521 (312) 325-5700

Opto-Logic Corp., 3450 E. Spring St., Long Beach, CA 90806 (213) 595-1631

Pro-Log Corp., 852 Airport Rd., Monterey, CA 93940 (408) 372-4593

Stanford Research Institute, T. McGill, 333 Ravenswood Ave., Menlo Park, CA 94025 (415) 326-6200 #2664

Technology Service Corp., 2881 Wilshire Blvd., Santa Monica, CA 90403 (213) 829-7411

Texas Instruments, 13500 N. Central Expy., Dallas, TX 75222 (214) 238-4076

The Society for Information Display International Symposia, 664 Sepulveda Blvd., Los Angeles, CA 90049

University of California at Berkeley, Continuing Education in Engineering, UC Extension, 2223 Fulton St., Berkeley, CA 94720 (415) 642-4151

University of Michigan, Eric M. Aupperle, Continuing Engineering Education, 300 Chrysler Center--North Campus, Ann Arbor, MI 48105

FINANCIAL:**KOKUSAI TO MARKET ZENTEC 9002**

Zentec Corp. has announced the signing of a multi-million dollar, 5-year pact with Kokusai Electric Co. of Tokyo, Japan. Terms of the agreement call for Zentec to ship hundreds of its microcomputer-based 9002 User Programmable Video Display Terminals to Kokusai.

Under terms of the agreement, Kokusai will act as Zentec's exclusive distributor in the Far East. Kokusai may also elect to manufacture the 9002 under royalty arrangements made with Zentec.

\$1.75 BILLION MEMORY MARKET BY 1978

A study on semiconductor technological trends by H. C. Wainwright & Co., a New York investment firm, indicates that the semiconductor memory market will reach 435 billion bits worth \$1.75 billion by 1978.

The report indicated that four classes of memories will be responsible for the growth: MOS, bipolar, CCD and SOS. Currently MOS dominates the field in number of bits sold while bipolar accounts for the highest percentage in dollars.

Per bit cost is expected to drop between 0.1 and 0.2 cents per bit by mid 1975. This rise in semiconductor memory bits and dollars will be at the expense of magnetic memory, mainly core. According to the report, core memory has reached its price floor.



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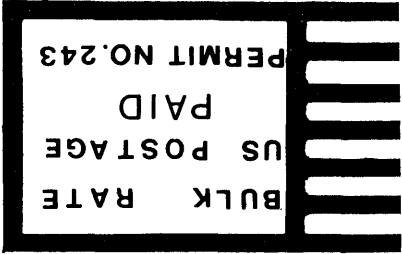
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