

# MICROCOMPUTER DIGEST

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Printed in U.S.A.

Volume 2, Number 2

August, 1975

## 3RD GENERATION MICROPROCESSOR

A third generation family of 8-bit microprocessors faster than the 6800 or the 8080, but compatible with the 6800, has been announced by MOS Technology. According to Chuck Peddle, marketing director for microcomputers, MOS Technology designed the entire family to be sensibly priced while giving the user a high performance microprocessor system.

The family's first entries are the MCS6501 and the MCS6502. (cont'd on page 2)

## \$15 SINGLE CHIP, 8-BIT $\mu$ P

A new single-chip, P-channel MOS microprocessor called SCAMP, priced around \$15, is about to be unveiled by National Semiconductor Corp. The 8-bit, single-chip microprocessor will be aimed at the random-logic replacement market for applications where speed is not a prime factor.

Minimum system configuration will consist of three chips, the CPU, a 16K ROM and a 1K RAM. (cont'd on page 3)

## INSIDE THIS ISSUE

SCIENTIFIC MICRO SYSTEMS "unbundles" their MicroController. Story on page 6.

NATIONAL SEMICONDUCTOR's microprocessor enters the drinking world. Story on page 7.

MICROKIT announces a universal microcomputer development system. Story on page 8.

HAMILTON/AVNET to open 16 new microcomputer centers. Story on page 11.

COURSES--Upcoming microcomputer courses for September, October and November on page 15.

ARTHUR D. LITTLE study predicts 16-17% annual growth in computer terminals. Story on page 18.

## 100 NS BIPOLAR MICROPROCESSOR

A 4-bit monolithic, bipolar microprocessor that can be cascaded to any bit width has been introduced by Advanced Micro Devices. The Am2901, designed for use as CPU segments of slower computers, is available from stock for \$30 in 100 quantities.

The 40-pin Am2901 is the first of a family of low-power Schottky circuits planned by AMD for computation, control, communication or storage in microprogrammed computers. The family offers designers the architectural and functional flexibility of medium scale integrated circuits with the performance and cost advantages of large scale devices.

(cont'd on page 3)

## BRITISH FIRM STEPS UP $\mu$ C EFFORTS

Plessey Microsystem, an autonomous division of Plessey Co., Ltd., has been formed to intensify the company's impact in the microcomputer market. The company has its own 16-bit microprocessor and plans to fabricate additional microcomputer systems in either standard form or custom designed units.

The group's first microprocessor, Miproc, was recently introduced at the Paris Airshow and features 16-bit capability with an instruction execution time of 350 ns.

(cont'd on page 4)

## MOSTEK INTRODUCES GEMS-8

Mostek's new General Evaluation Microprocessor System (GEMS-8) is now available to assist users in learning and designing microcomputer-based products.

Mostek's GEMS-8 can perform in a variety of applications including test instrumentation, data terminals, POS Terminals, communications, office and business machines, industrial control, education, (cont'd on page 4)



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**TABLE OF CONTENTS:**

<u>SPECIAL FEATURES</u>	<u>Page</u>
3rd Generation Microprocessor .....	1
\$15 Single Chip, 8-Bit uP .....	1
100 ns Bipolar Microprocessor .....	1
British Firm Steps Up uC Efforts .....	1
Mostek Introduces GEMS-8 .....	1
Microcomputer Development System .....	4
<u>TECHNOLOGY</u>	
SMS Unbundles MicroController .....	6
2-Chip Version Of PPS-4 Due .....	6
8-Bit uP Withstands Auto Environment ..	6
AMI S6800 Starter Kit .....	7
Fairchild Obtains Restraining Order ...	7
<u>MICROCOMPUTER-BASED PRODUCTS</u>	
uP Enters The Drinking World .....	7
8- & 16-Bit uC Development System .....	8
uC Educational System .....	8
uC Teaching Instrument .....	9
uC Signal Generator .....	9
PPS-4 Development System .....	9
uC Capacitance Bridge .....	9
Process Control Microcomputer .....	10
MicroPac 80/A .....	10
2nd Generation Microcomputer .....	10
<u>MEMORIES AND PERIPHERALS</u>	
Stand Alone Printer .....	11
Intellec Printer & Controller .....	11
IMP Data Acquisition System .....	11
Intellec Analog Peripherals .....	11
<u>PEOPLE, LITERATURE AND EVENTS</u>	
Rockwell Reorganization .....	12
Hamilton Opens 16 uC Centers .....	12
Siemens Computest Products Move .....	12
Lincoln Semiconductor Opens .....	12
People On The Move .....	12
Swiss Hands-On uC Course .....	13
Game Programs Wanted .....	13
PL/M Programming Course .....	13
8080 vs 6800 .....	13
Micro-Scope Bulletin .....	14
Course Materials Available .....	14
Microprocessor Studies .....	14
Recent Literature .....	14
<u>EDUCATION</u>	
Microcomputer Courses, Seminars And	
Conferences For Sept. thru Nov. ....	15
<u>FINANCIAL</u>	
Earnings .....	17
Computer Terminal Impact Study .....	18
<u>COMPANY ADDRESSES FOR THIS ISSUE</u>	18
<u>MICROCOMPUTER STUDIES AVAILABLE</u>	19

**SPECIAL FEATURES:****3RD GENERATION MICROPROCESSOR**

(from page 1)

Both are N-channel, silicon-gate, depletion load, 5V devices compatible with the Motorola and AMI 6800. They will be offered for delivery in September at single unit prices of \$20 with production orders priced substantially less.

Future software compatible versions of various pin configurations will range from very low cost devices to very high performance 16-bit competitive products.

The MCS6501 microprocessor uses an external two phase clock, is a plug-in replacement for the 6800 and can address up to 65K memory. The MCS6502 has an on-chip clock, external single phase input, RC time base input, and a crystal time base input. Both microprocessors are available in 40-pin packages and are currently being sampled by selected accounts. A cross assembler and emulator is also available on national timeshare services.

MOS Technology says they will demonstrate their microprocessors and software, and display their full line of documentation at the McArthur suite in the St. Francis Hotel during WESCON. Both devices and the software will be available for purchase and delivery at that time.

Other members of the 650X family will include combinations of RAM, ROM and I/O as well as versions of current peripheral devices, and a full range of memory products.

The microprocessors will be second sourced by Synertek. The companies have entered a verbal agreement in which MOS Technology will provide Synertek with masks for all 650X microprocessors and Synertek will provide MOS Technology with masks for their 2101, 2102, 2111 and 2112 RAMs. Synertek expects to have samples of the microprocessors in September.

Although the architecture of the MCS650X family is based around the PDP 11, several architectural innovations have made this microprocessor the first of a third generation. These include significantly expanded addressing capability, including two real index registers (not available on any other micro), two powerful forms of indirect addressing, an 8080-type Ready, fast decimal arithmetic (in-



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cluding subtract), and pipelining for higher thrupt. According to AH Systems' benchmark tests at 1MHz, the 6501 outperforms all competitive 8-bit machines.

Hardware features of the 6500 microprocessor family include an accumulator, two output buffers, data buffer, a high and a low program counter, two real index registers, stack pointer, instruction register, condition code register, ALU, and all instruction decode and control circuitry. The 6501 adder can perform both binary and decimal arithmetic operations.

There are 55 commands in the 6501 instruction set and eleven addressing modes: accumulator, immediate, absolute, zero page, indexed zero page, indexed absolute, implied, indexed indirect, indirect indexed, absolute indirect and relative.

As an added enhancement, MOS Technology has configured their 40-pin peripheral interface device (6530) with a mask programmable 1024 x 8 ROM, a 64 x 8 RAM, two 8-bit bidirectional peripheral data busses and an interval timer. The 6530 is designed to operate individually with the 6501 microprocessor or in groupings of up to seven 6530s without the use of extraneous interface circuits.

The peripheral interface section is programmed by the MPU during system initialization and each peripheral data line can be programmed to act as an input or an output. An interval timer on the device allows the system user to program time intervals from as small as one clock time period to as great as 256 x 1024 clock periods.

The 6530 will be priced at \$30 in 100 lots plus a small mask charge. Sample units will be available in September.

## \$15 SINGLE CHIP, 8-BIT $\mu$ P

(from page 1)

The chip's architecture consists of four 16-bit address registers, one accumulator, an extension register, and 8-bit data and I/O busses. The chip has an internal clock that requires only an external capacitor or crystal.

SCAMP's basic cycle time will be 2 us, and its instruction set will consist of one- and two-byte instructions and an interrupt structure. Up to 65K of memory can be addressed

by the microprocessor.

National Semiconductor will manufacture two versions of the microprocessor to allow system operation with either CMOS or tri-state interfacing.

## 100 NS BIPOLAR MICROPROCESSOR

(from page 1)

The circuits are ideally suited for emulation of existing microprocessors so that software programs will not have to be changed.

The chip's architecture consists of a 16 x 4, two-port RAM; a high-speed, 4-bit, 8-function ALU; 4-bit data and I/O busses; status flags for carry-out, sign-bit, overflow and zero detect; 4-bit Q register for scratch pad or accumulator extension; plus all associated shifting, decoding and multiplexing circuitry. The microprocessor can be cascaded with full look-ahead or with ripple carry, and has tri-state outputs.

The ALU itself is capable of performing three binary arithmetic and five logic functions. These include AND, OR Exclusive OR, Exclusive NOR, ADD, SUB, MASK and ZERO.

Sven Simonsen, technical director, said that the 2901's 100 ns instruction cycle and microprogrammability offers users an excellent opportunity to upgrade existing microcomputer-based products for higher speeds. This option is available without requiring existing software to be rewritten. Simonsen explained that while the Am2901 was currently being offered without a standard instruction set, one would soon be available.

The microprocessor's instruction word consists of a 9-bit field which is organized into three groups of three bits each. The word selects the ALU source operands, the ALU function and the ALU destination register.

The Am2901 is being offered with a family of 21 support chips. Currently available from stock are the Am2901 microprocessor, the Am2902 look-ahead carry generator, the Am2918 4-bit shift register with standard and tri-state outputs, the Am2950 256-bit open collector RAM, and the Am2951 256-bit tri-state RAM.

Simonsen also said that the Am2909 microprogram sequencer is scheduled to be announced next and that the rest of the family would be ready within the next three to six months.



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## BRITISH FIRM STEPS UP $\mu$ C EFFORTS

(from page 1)

The new company is headed by William A. T. White, general manager; Dr. C. H. Paterson, engineering manager; and D. W. Tarrant, sales and marketing manager.

The companies future products will include commercially available microprocessors as well as in-house designs. A company spokesman said that the firm will market both standard OEM and end-user products and will also undertake the design and manufacturing of special customer-specified products.

Plessey Microsystems has also announced a joint microprocessor research agreement with the Norwegian Ministry of Defense and Aksjeselkapet Mikro-Electronik, a Norwegian electronics firm. Under the contract, Plessey will develop a more powerful version of Miproc for military applications. Plessey has been working with the Norwegian firm in manufacturing a hybrid version of Miproc. Miproc is also being used in Norway for missile, airborne, naval and ground-based equipment.

It has also been learned that Plessey has entered an informal technical cooperation agreement with National Semiconductor. The contract terms call for the Microsystem division to fully provide technical systems and software support to current and potential customers of National's entire family of microcomputers. National, in turn, will supply Plessey Microsystems with all of its product technology, hardware and literature. Many industry sources see this as a possible stepping stone for the British company to second source National's microcomputers.

## MOSTEK INTRODUCES GEMS-8

(from page 1)

medical, electronic games, traffic light controllers, ~~or as a home computer.~~ The complete microcomputer is priced at \$995.

The GEMS-8 system consists of a processor board designed around Mostek's MK5065 8-bit microprocessor; a PAR (Programmer Aid Routine) ROM, to aid in program development; and a 12K x 8 memory board with direct interfacing to the processor board.

The software support includes a resident assembler which can generate object tapes

from source tapes, an ASCII dump to dump memory in ASCII format and a test editor that lets users generate and modify the source text prior to assembly. Documentation for a GEMS-8 is provided through a complete system manual with detailed descriptions of GEMS-8 hardware, programs and applications.

With this package, the user simply adds a teletype interface, cabinet and power supplies and he has an economical, 8-bit microcomputer with 12K x 8 memory, capable of solving mini-computer-type applications. Additional memory boards can be added to the GEMS-8 system.

The processor board has a universal I/O port, standard power supply requirements of +5V,  $\pm$ 12V, and a TTL-compatible variable baud rate. There are 51 basic instructions with a typical execution time of 7  $\mu$ s.

The PAR ROM contains the MK 5065 standard loader compatible with other MK 5065 software. It allows the initialization of internal MK 5065 registers, stack pointer, execution of the standard loader, writing and dumping of memory data, execution of user programs, and breakpoint operation.

The memory board operates on the same power supplies and features totally transparent automatic refresh and separate address, data input, and data output busses. Both data input and data output can be wire OR'd.

Priced separately, the processor board with PAR ROM is \$595, the memory board is \$597, software is \$100, and documentation is \$25.

## MICROCOMPUTER DEVELOPMENT SYSTEMS

(SIXTH IN A SERIES)

The MPS Development System manufactured by Digital Equipment Corp. can best be typified by its Starter Set Series. Two Starter Sets, #1 and #2, are built around a 24-slot pre-wired backplane and a basic set of microcomputer modules, i.e., CPU module, 1K RAM memory module, data input module, data output module, peripheral device selector module, and a logic inverter module.

The complete assembly also includes a standard 19" mounting panel so the Starter Sets may be mounted on a bench, table top or standard 19" rack. The basic premise behind the Starter Sets is to teach the beginner how to use microcomputer hardware and software.



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After he becomes familiar with these fundamental aspects, he is ready to use a complete developmental system which is a logical upwards progression from the Starter Sets.

Each Starter Set includes the CPU (Intel 8080) with TTY interface, 1K x 8 RAM, Device Selector Module, Signal Inverter Module, Parallel Input Interface Module, Parallel Output Interface Module, Power Connector Module, Prewired System Unit Mounting Panel and 19" Rack Mounting Frame. The #1 Set includes a PROM Module with MDP Routine and an External Event Detection Module, whereas the #2 Set contains a Monitor/Control Panel with cable.

Both sets are essentially stripped down, basic assemblies, and do not include cabinets or power supplies. A compatible cabinet is, however, available as an option.

The KC341-B Monitor/Control Panel (MCP) serves as an operator's panel for Starter Set #2. In addition to the conventional panel controls and indicators, the MCP is equipped with controls and visual displays for examining and changing the content of manually accessed read/write memory locations and for performing single-step instruction execution. These functions are supported by a resident memory consisting of a 256 x 8-bit PROM and a 32 x 8-bit RAM completely contained on the MCP. The PROM contains the Microprocessor Program Loader (MPL). The RAM and the PROM are directly addressable as system memory, and the RAM can be used as a scratch pad by user-diagnostics and by operating programs.

The MCP interfaces with the M7341 CPU module through a dedicated cable of up to four feet. Although normally configured for table mounting, the MCP can be panel-mounted in a standard EIA rack panel fitted with a suitable bezel.

Programming for Starter Set #2 is the least sophisticated and is done manually via the KC341-B Monitor/Control Panel switches, using the basic Intel 8008 instruction set. Programming for Starter Set #1 achieves the next level of sophistication in that a full keyboard terminal (usually a teletype) is used for program entry. Programs may be written symbolically but must be translated to machine language octal code through the Programmer's Reference Card, and then typed in via the terminal keyboard.

The M7345 PROM module control program can read and punch paper tape; access specified memory locations for modification and allow the previous, current and next locations to be accessed and displayed; print the contents of program addresses, status flip-flops, and index registers on the Teletype; allow a program segment to run under MDP control for test purposes; specify a breakpoint location for program execution and load specified locations in memory with a constant value.

The MPS software tools package consists of several programming aids to assist the user in developing application programs.

The Microprocessor Language Assembler (MLA) is a three-pass symbolic assembler that operates on a PDP-8 to produce either a listing or a binary punched paper tape of an MPS object program from punched paper tape source code. This program has been designed to conform generally to the operational characteristics of other PDP-8 assemblers. Assembled code is generated in punched paper tape form or as a printed listing at the option of the user. Diagnostic messages are also printed out to designate syntax errors and to indicate warnings or actions taken by the assembler.

The Microprocessor Language Editor (MLE) is an on-line symbolic editor that operates on the PDP-8 to create and modify MPS source program punched paper tapes. This editor implements both program entry and on-line program editing. Source text can be entered from a keyboard or from a punched paper tape reader. After editing, the user may produce a source paper tape ready for input to MLA and/or a source text listing. Listings and tapes of source text can be made in whole or in part as required by the user.

The Microprocessor Host Loader (MHL) is a PDP-8 utility program used to read binary-coded data from paper tape and to store it in memory, and used primarily to load binary object programs.

The Microprocessor Read-Only Memory Programmer (MRP) operates on an MR873 PROM writer in conjunction with a PDP-8/E, /F, or /M to set data and instruction bits into ultraviolet light erasable PROM circuits using the object tapes produced by MLA.

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The Microprocessor Debugging Program (MDP) operates on the processor module in conjunction with the Monitor/Control Panel (MCP) from either PROM or RAM memory. The MDP, under control of the MCP, allows the user to read and punch paper tapes; access specified memory for display or modification; dump memory, status flip-flops, and index registers on the Teletype printer; and execute a program segment under MDP control with break-point control.

The Microprocessor Program Loader (MPL) is MPS' binary paper tape loader that operates on the processor module and resides in the Monitor/Control Panel PROM memory. This program provides for the loading of a binary punched tape from an external paper tape reader through the universal asynchronous receiver/transmitter integral to the PM. Operation of MPL is performed from the MCP control panel.

A new set of software tools which will utilize less than 8K x 8 of Development System memory for program assembling and editing will be available soon. Thus, a Starter Set, with the addition of extra Read-Write Memory, can be used for program assembling and editing.

Progression to a full Development System or an actual on-line MPS microcomputer system can be easily achieved using the same pre-wired backplane which will allow adding up to 7K x 8 of memory (RAM, PROM, or a RAM/PROM mixture) plus space, if required, for user-developed interface or control circuitry.

Documentation of the MPS Starter Sets includes User's Handbook, module data sheets, logic schematics, application notes, and Programmer's Reference Card.

Starter Sets #1 and #2 are offered at \$995 per set. Prices of more complete development systems, including software and documentation, begin at approximately \$1700. Delivery is 30 days ARO. Requests for pricing on specific configurations and applications should be directed to Michael S. Gutman, Manager of Component Computers, Marlborough, MA.

# # # #

Back issues, References Indexes and the Annual Index are available at a minimum charge. Send for a price list.

## TECHNOLOGY:

### SMS UNBUNDLES MICROCONTROLLER

Scientific Micro Systems has announced the "unbundling" of their SMS MicroController. The SMS-300 CPU and its support components will now be available for individual component purchases.

SMS is also offering a starter kit for \$495 that includes the SMS300 Interpreter, four SMS-360 IV Bytes (8-bit bidirectional I/O registers), six SMS-82S115 PROMs, and data sheet reference manual.

James Geers, vice president of marketing, told MICROCOMPUTER DIGEST, that SMS has unbundled their MicroController boards as an added service to customers wishing to buy only individual components. Geers indicated that the board assembly would still be the most cost-effective method of utilizing the MicroController, but that SMS was out to provide each customer with what they desired for their particular application.

Geers also added that SMS was currently engaged in second-sourcing talks with several manufacturers. He declined to identify the companies or indicate how far the talks have progressed, but he did emphasize that SMS fully intends to have a second source for their MicroController by year end.

### 2 CHIP VERSION OF PPS-4 DUE

Rockwell sources have confirmed that the company has upgraded their PPS-4 microprocessor with a new two chip version. Designated PPS-4/2, the new microcomputer will consist of a CPU/clock chip and one chip housing a 2K ROM and a 128-byte RAM.

Samples of the chips are being delivered now with volume production expected sometime in the fourth quarter. Prices were not available at press time.

### 8-BIT $\mu$ P WITHSTANDS AUTO ENVIRONMENT

Essex International has joined the custom microcomputer market by developing an 8-bit PMOS microprocessor designed specifically to withstand the harsh environment of automobiles. Often quoted as the worst possible environment for microprocessors and other solid-state devices, the automotive environment consists of several G's of stress and



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vibration, large current and voltage surges, extreme engine heat as well as seasonal weather changes.

The company is currently looking for one or more of the auto manufacturers to define memory and system requirements for their microprocessor.

## AMI 6800 STARTER KIT

As a special get-acquainted offer, Weatherford, an electronic parts distributor, has reduced their prices on AMI's S6800 microprocessor. The price reduction is only in the 100 unit price category, however, anyone can purchase up to 25 parts from the S6800 family and receive the low 100 unit price. In addition, Weatherford will throw in free, two 256 x 4 PROMs programmed to the customer's specification.

Prices on the S6800 microprocessor have been reduced from \$215 to \$75; from \$14.20 to \$9.60 for the S6810 128 x 8 static read/write memory and from \$16.25 to \$12.00 for the S6810-1 128 x 8 memory. Prices for the following have not been reduced: S6820—\$15.30; S6830 ROM—\$20.50; and the S6850 ACIA—\$15.30.

The introductory offer will be in effect until August 29.

## FAIRCHILD OBTAINS RESTRAINING ORDER

Fairchild Camera & Instrument Corp. obtained a temporary restraining order on June 26, 1975, preventing National Semiconductor Corp. from obtaining or attempting to obtain Fairchild's proprietary Isoplanar technology from Martin Alter, a former Fairchild employee now employed by National.

Judge William Ingram of the California Superior Court, Santa Clara County, entered the temporary order. National and Alter appeared in court on July 29, 1975, to show why the order should not be continued.

The restraining order was issued in an action brought by Fairchild alleging that National intends to appropriate the Isoplanar technology by attempting to induce Fairchild employees familiar with the technology into employment with National.

The complaint also asks the court to enjoin National from "obtaining, utilizing or attempting to obtain or utilize Fairchild's Isoplanar technology."

## MICROCOMPUTER-BASED PRODUCTS:

### µP ENTERS THE DRINKING WORLD

Electro Units Corp. has added a new dimension in bartending—microcomputers. Generally referred to as the Inventory Control System (ICS), the system dispenses the appropriate amount of liquor for each standard mixed drink, accomodates appropriate amounts of each liquor used in a customer's special recipe and calculates and displays the proper charge for the drinks. The system also provides instant management information—total bottles in stock, ounces remaining in each bottle, total dollar value of the inventory, and individual and total bar reports on volume and pour-costs in six categories: shift, day, week, month, quarter and year.

The heart of the system is the 16-bit PACE microcomputer manufactured by National Semiconductor Corp. The microcomputer controls which brand name liquors are to be used, sequencing of pours, inventory, pricing and all accounting information.

A 48-button, touch-control panel allows the bartender to select any of 30 brand-name liquors and 14 mixed, increase or decrease the standard amount of liquor dispensed, store customer drink orders, clear errors, and recall the memory.

Each brand-name liquor bottle is mounted on its own special pump reservoir and the microcomputer keeps track of how many bottles have been put on the reservoir for any given period, as well as recording how much liquor has been dispensed from each reservoir during any given period. From this data, the remaining volume of liquor is calculated by the microcomputer along with the cost of each pour.

In large systems of up to 256 pour stations, PACE is used in two applications. The first is at each pour station to control drink dispensing and acquire inventory and accounting data, the second is the central processor itself. Here, PACE formats the data, performs all calculations and displays requested data on either a TTY or a CRT display.

The central processor also has an internal master clock, which not only records time and

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data, but will automatically reprogram the microcomputer at each pour station to change prices and pour quantities for special periods such as "happy hour" and "showtime".

The central microcomputer provides a printed report on the pour-cost/revenue percentage, liquor inventory, total revenue and usage for the entire establishment for any given pour station (bar) or for any specific bartender over a selected period of time.

Russell Stebbins, research and development engineer, said they had first used an Intel microcomputer in the system but switched after examining PACE's 16-bit capacity and vectored interrupt capabilities.

Stebbins expects the company to reach production quantities within three months.

According to Lester Kirk, president, ICS could significantly increase a bar's profit from 12-20% in operations which have a monthly gross volume of \$20,000 or more.

Kirk said the approximate cost of the ICS which includes two pour stations, reservoirs, computer and terminal is \$25,000. He estimates that additional pour stations will cost about \$10,000 each.

## 8- & 16-BIT $\mu$ C DEVELOPMENT SYSTEM

Microkit Inc. has begun production of their newly developed Microkit 8/16 microcomputer development system. The system is a complete stand-alone system for writing, debugging and executing programs on the Intel 8080 microprocessor but not limited to it.

Bruce Gladstone, vice-president of Microkit, told MICROCOMPUTER DIGEST that the 8/16 has a universal bus that will allow other types of 8- and 16-bit microprocessors to be used in the system.

Gladstone said that the company is now developing another 8-bit microprocessor card for the system and would shortly begin development on a third 8-bit microprocessor. Both cards are expected to be ready within 8-12 weeks.

The first systems that use an 8080 have been delivered to an unidentified peripherals manufacturer and a large systems development house. These systems are being used in the development of test equipment and special communications systems.

The standard microcomputer system comes

with an alphanumeric CRT display, an ASCII keyboard and two cassette tape units. Software for the Microkit 8/16 includes a monitor, editor and assembler designed to take full advantage of the CRT and tape I/O.

Other features include 8K RAM, memory write protect where each 1K page of memory can be write-protected under software control, a crystal controlled real-time clock with 32 us resolution, interrupt driven I/O, memory expansion to 56K bytes, interprocessor I/O port for development and production testing of microprocessor systems, and a bootstrap loader in PROM.

According to Bruce Gladstone, the company can provide a complete computer system with keyboard, CRT, two cassettes and line printer for \$5500 in single unit quantities. He further said that when the other microprocessor modules are complete, one could change his entire system over with full software for less than \$2000. Delivery is 15 days ARO for the basic system.

## $\mu$ C EDUCATIONAL SYSTEM

A new microcomputer educational unit built around the Intel 8080 has been introduced by E&L Instruments. The system is provided with CPU and interface control, 3K read/write memory, 1K PROM or ROM, front panel, and the manufacturer's interface board. The front panel has complete control over the system, including the software.

The student can easily study microcomputer operations without being required to interface a teletypewriter, printer or terminal into the system. However, a special series of Kluge cards are available for special in-house designs.

A software-teletype debug package is available in PROM and allows the student to examine locations, change data, set breakpoints and begin the program.

The debug package can also be used with a parallel ASCII keyboard and a small electrostatic printer. Optional interface modules include universal asynchronous communications interface, parallel bugboard input, printer output, priority interrupt with real time clock, dual D/A converters, A/D converters with 8 channels of mux, 4K read/write memory, 2K PROM and cassette I/O.



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## μC TEACHING INSTRUMENT

Dedicated Computer Systems, Ltd. is offering a low cost microcomputer system for use in schools, colleges and universities. The system was designed for the purpose of teaching the fundamentals of computer operation, interfacing of I/O devices, writing of software and firmware, etc.

The input device is a small keyboard while the output is a CRT monitor. Examples of other uses are in the programming of a square root function or in the implementation of a small control system.

## μC SIGNAL GENERATOR

The John Fluke Mfg. Co. has announced the first marriage of a general purpose signal generator with a small but powerful microcomputer.

Designated Model 6010A Synthesized Signal Generator, the instrument features a keyboard control that allows free-form entry of frequency in Hz, kHz, or MHz. Programmed frequencies are read on a bright 7-digit LED display. The real secret of the 6010A however, is its internal microcomputer, the Intel 4040, which provides the instrument with a high degree of automation.

A key feature of the 6010A is that the entire output of the instrument is programmable. Up to 10 preset frequencies, modulation and attenuator settings can be stored and recalled using the keyboard. With the microprocessor, the instrument is able to provide the user with automatic range selection.

Whenever an entry is made, the unit automatically justifies the number on the bright LED readout to give the greatest possible resolution. The instrument covers the frequency range from 10 Hz to 11 MHz.

The signal generator provides added protection to each device under test by always starting out with the maximum range of attenuation, 60 dB. Other values of attenuation are 20 and 40 dB.

Since 7-digit frequency ranges can be recalled by just pressing a button, repetitive measurements can be made without tedium, and with less chance for error.

The 6010A can fit directly into any auto-testing system and will handshake directly

with any ASCII (IEC) system, since the microcomputer handles all interfacing. Any additional costs for more sophisticated ASCII interfacing are thereby minimal.

The instrument is available from John Fluke for \$2495.

## PPS-4 DEVELOPMENT SYSTEM

Applied Computing Technology Inc. has announced their new UMPS-4 Universal Microprocessor System that provides prototyping and/or limited production of Rockwell's PPS-4 microcomputer-based products.

The basic UMPS-4 system includes the card cage, Universal CPU board and Universal PROM board. The CPU module contains the crystal controlled clock circuitry, microprocessor, 256 words of scratch pad memory, 32 inputs, and 28 outputs. The PROM board interfaces with the CPU bus and provides for up to 4K x 8 of program storage. The chassis comes with the address and data bus connected to the CPU and PROM board plus an additional card. Additional modules can be added to expand RAM, program storage and I/O. Specialized I/O cards, such as the keyboard display chip, printer controller, and address data bus extender, are also available.

Price of the basic system is \$695 and delivery is 30 days ARO.

## μC CAPACITANCE BRIDGE

The Boonton Model 76A capacitance bridge combines established precision bridge techniques with an automatic balancing system and internal computing facilities, all under microcomputer control. The bridge performs fully automatic, triggered or free running, 1 MHz parallel capacitance and conductance measurements with test levels from 5 to 200 mV rms. Individual selection of capacitance and loss range, or autoranging, may be made by a series of push button controls. The bridge will also compute and display on demand the equivalent series capacitance, series resistance, dissipation (tan), and Q of the test.

In addition, any capacitance measurement can be displayed as a deviation in capacitance or a percentage deviation versus a previously entered and stored value.

(cont'd next page)



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The push button controls have a secondary function when the "entry" mode is selected. In this mode, the microcomputer programs numbers into storage as a reference capacitance value for deviation measurements or entered to set a DC bias voltage on the optional internal supply.

Other functions available in the entry mode are "corrected zero", where the zero offsets of every combination of C & G ranges are measured by the bridge, remembered and subtracted from all subsequent readings; and "remote test point", where a stored program is used to calculate and correct for each measurement made through the 30" test cables.

The Model 76A is priced at \$5475 and delivery is approximately 20 weeks.

## PROCESS CONTROL MICROCOMPUTER

Comstar Microcomputers/EPD of the Warner & Swasey Co. has announced the addition of the new System 4B microcomputer CPU module.

The System 4B is functionally and electrically compatible with the recently announced Comstar System 4A. Both systems are built around the Intel 4040 microprocessor; however, the new System 4B operates at a typical cycle time of 7.0 us.

Like its predecessor, the 4B CPU is offered with an interrupt control module which provides 12 channels of priority interrupt, switch selectable real-time interrupt, power fail detect, auto restart and watch-dog timer. It is also offered with a portable front panel analyzer which provides on-line control and program diagnostic capability.

The system's CPU is available as a wide-ambient-temperature range module, with an operating temperature range of -40 to +80°C.

Designed for industrial microcomputer control applications, the System 4B interconnects via a data/control bus to RAM and PROM modules as well as the complete Comstar 4 family of peripherals and interface modules.

The Comstar 4B is priced at \$260 in OEM quantities. A system including a central processor, 1K x 8 PROM, 1K RAM, a portable front panel analyzer, and a 32 channel digital I/O module is priced at \$1,085 in OEM quantities. Delivery is 90 days ARO.

## MICROPAC 80/A

Process Computer Systems, Inc. has introduced a new microcomputer development system called MicroPac 80/A.

Designed to simplify operator use, the 80/A features a basic operating system (BOS 80/A) that resides in 2K bytes of PROM. The BOS 80/A contains built-in power fail restart linkages and other software including a stand-alone macro assembler.

Each system includes 8K of RAM and 2K of PROM; however, up to 64K bytes of RAM, PROM or any combination of both are available.

The standard 80/A also includes a terminal interface and a control panel with start, stop, load, register, alter, display and 16 data switches. The unit is available with a low-cost PROM programming system which is also compatible with the PCS MicroPac 80 development system.

Delivery is within 30 days ARO and price depends upon configuration.

## 2ND GENERATION MICROCOMPUTER

Martin Research Inc. has introduced their Mike 203A microcomputer system that uses the Intel 8008 microprocessor. The system consists of four circuit boards, the 2-1 CPU, 2-20 Console and 2-3 PROM/RAM, PC boards, and the 2-15 breadboard.

The CPU board contains the 8008 microprocessor, crystal-controlled oscillator, and all timing circuits. The Console board has large, 0.3" seven-segment display digits and a 20-key calculator-type keyboard for programming and system debugging. The PROM/RAM board is expandable up to 1K of RAM and 2K of PROM. The PROM can be programmed with the console board and a monitor program is available for the Mike systems.

The 2-15 module is a standard size Mike board, half of which is configured for standard 14- and 16-pin DIPS while the other half has universal spacing for any size sockets. A connector is used to interface the 2-15 to the system bus.

Software support includes the Mike 2 Monitor for reading and writing instructions into memory using the M2-20 Console board.

Price for the full Mike 203 system is \$269.95 in kit form and \$319.95 fully assembled.



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**MEMORIES AND PERIPHERALS:****STAND-ALONE PRINTER**

A new stand-alone printer which can be used with microcomputers for output, data logging and communication applications has been introduced by Victor Comptometer Corp.

The Model 5010 printer uses a seven-wire printing head to make a 5 x 7 matrix character, printing in two colors on standard adding machine paper. Printing speeds reach 110 cps in 34-character lines, or 90 to 240 lines per minute. Options include serial interfaces ranging from 100 to 9600 baud in either TTY current loop or RS232C configurations.

Other applications include receive-only terminals and diagnostic printout for circuit testers.

In single unit quantity the 5010 printer sells for \$1,195 with parallel ASCII interface.

**INTELLEC PRINTER & CONTROLLER**

IMS Associates, Inc. has introduced a Diablo/Hytype printer and controller for the Intellec 8/Mod 80 at a price of \$2,695 in unit quantities.

The price includes controller, Diablo/Hytype printer, power supply, case and cable assembly.

Called the IMSAI-30, the product supports and includes all standard Diablo/Hytype options. Delivery is off-the-shelf.

**IMP DATA ACQUISITION SYSTEM**

A low cost data acquisition system, specifically designed for users of the National Semiconductor IMP microcomputer series, has been announced by Data Translation Inc. The new data acquisition system, the DT1721, is offered on a standard 8-1/2" x 11" IMP board and includes up to 64 channels of analog multiplexing, sample and hold, and 12-bit A/D converter. A full 16-channel system sells for \$725 in single unit quantities.

The DT1721 allows full bus structure digitizing of analog signals to the IMP-8 and IMP-16 microcomputers. A tri-state data format, available in either two 8-bit bytes or a single 16-bit byte, connects to the IMP bus for direct processing of analog signals.

The DT1721 also offers full 12-bit resolution and a throughput rate of 25 KHz. The system is powered directly from the computer's +5V supply by a Data Translation DC-DC converter that provides highly regulated, noise-free  $\pm 15V$  for the analog circuitry.

A special feature of the DT1721 is its capability to process 4 to 20 mA current signals that are often used in process control applications as well as the standard analog voltage signals more commonly used in medical and laboratory computer systems.

The maximum system configuration using 64 channels, the DT1721-64S, is available at \$1325. All versions of the DT1721 are available from stock to two weeks.

**INTELLEC ANALOG PERIPHERALS**

Burr-Brown is introducing a set of analog peripherals that are electrically and mechanically compatible with the Intellec 8 microcomputer system.

Three PC boards are included in the set; namely, the MP8104, a four channel analog output system; the MP8208, a complete eight channel data acquisition system; and the MP8216, a 16 channel data acquisition system.

All boards contain the necessary circuitry to interface directly to the Intellec 8 bus. They also include a +5V to +15V DC/DC converter so that the boards can operate solely on the microcomputer's 5V supply.

The analog systems are treated as memory locations by the Intellec to simplify the programming required to acquire and distribute signals. They can be plugged directly into any memory or I/O slot of the Intellec. The address block occupied by each peripheral is strap selectable so that it can be placed anywhere in memory.

The MP8104 analog output system includes four 12-bit DA converters to provide the four individually controlled analog outputs. The input buffer registers and other registers are used to allow simultaneous transfer of all 12 data bits to the DAC input buffer resulting in minimal output transients. A number of output voltage ranges ( $\pm 10V$ , 0-10V,  $\pm 5V$  and  $\pm 2.5V$ ) are strap selectable on the MP8104 board.

The MP8208 and MP8216 systems contain in-

(cont'd next page)



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put analog multiplexers, an instrumentation amplifier, sample/hold amplifier, 12-bit A/D converter, interface, control and timing logic and a DC/DC converter.

The cost of the MP8104, including all necessary cables and connectors, is \$695 in single unit quantities. The MP8208 and MP8216, with all necessary cables and connectors, are priced at \$795 in single unit quantities.

## PEOPLE, LITERATURE AND EVENTS:

### ROCKWELL REORGANIZATION

Rockwell International Corp. has reorganized the company's microelectronics activities to strengthen its calculator business and to accelerate its growth in semiconductors.

As a result of the reorganization, Robert Anderson, Rockwell's president and chief executive officer, announced that the company's microprocessor activities will now be under the direction of Donn L. Williams, president of Rockwell's Electronics Operations, headquartered in Anaheim, CA.

Anderson said that Rockwell "has a major market share in several segments of the semiconductor industry and is directing additional efforts on further penetrating computer memories, automotive systems and other growth markets."

### HAMILTON OPENS 16 $\mu$ C CENTERS

Sixteen new microcomputer centers are being opened across the United States and Canada by Hamilton/Avnet, electronic distributors.

Each center will be equipped initially with the Intel MDS microcomputer system, including all peripherals. The MDS System is used to develop 8080 and 3000 microcomputer hardware and software products. John Cole, manager of technical programs, said the centers would be equipped with additional development systems at a later date; however, initially, all centers would be equipped with just the Intel MDS Systems.

Cole said the centers are being opened to demonstrate to customers how microcomputers operate, basic microcomputer functions, and the various options available with each system. He added that each center will give the free demonstration on a customer-request basis.

The six centers currently open are in Los Angeles CA, Chicago IL, Boston MA, Westbury Long Island NY, Dallas TX, and Toronto Canada.

On August 18, centers will open in Baltimore MD, Cedar Grove NJ, Houston TX, Mt. Laurel NJ, Cleveland OH, and Mt. View CA. Four additional microcomputer centers located in San Diego CA, Denver CO, Hollywood FL and Dayton OH will open on September 15.

### SIEMENS' COMPUTEST PRODUCTS MOVE

Siemens Corp. has announced that their Computest Products Department has moved to the larger Siemens facility in Burlingame CA. Sales and service that relate to Computest's full line of test products will be handled at this office. The new address is 860 Hinckley Rd, Burlingame CA 94010 (415) 697-6851.

### LINCOLN SEMICONDUCTOR OPENS

A new custom circuit design and consulting house has been formed to aid in the production of microcomputer-based products. The new firm, Lincoln Semiconductor, will concentrate its activities in designing custom LSI I/O and support circuits to replace the numerous TTL and MSI chips used in microcomputers and other logic systems.

Larry Lincoln, president, said the firm was presently involved in redesigning the I/O circuitry of two microcomputer systems. He said that in large production products, it becomes cost-effective and necessary to design a custom LSI chip to replace the microcomputer's "overhead" circuitry.

Lincoln has had considerable circuit design and consulting experience while at Quantum Sciences, American Microsystems, Electronic Arrays and Interconsal Associates.

The new firm will be located in Sunnyvale, CA.

### PEOPLE ON THE MOVE

Motorola Semiconductor Products, Inc. has announced the appointments of CHARLES E. THOMPSON and COLIN CROOK to the positions of director of marketing and assistant director of marketing.

GENE CAVANAL has switched employment to Fairchild from Transistron but no one will reveal his new assignment. At Transistron, he worked on a 7-chip bipolar microprocessor.



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ED LAWSON has joined Signetics as the new marketing manager for bipolar RAMs. Lawson had previously been at Texas Instruments.

JAMES H. SMITH has been appointed central regional sales manager for the Microelectronic Device Division of Rockwell International. Other appointments included VERNON E. HILLS, former manager of RCA's microprocessor application group, as manager-Eastern Microprocessor Applications Center. Also, CHARLES A. FRENCH has been appointed as controller of the Microelectronic Device Division.

WILLIAM J. MAZZIER has been appointed as national manager of sales at Omron Corp. Other appointments include STANLEY W. GRABOWSKI as regional manager, sales; DONALD NELSON as eastern regional manager; and DOUGLAS E. CULTICE as manager, marketing services.

The Board of Directors of Western Digital Corp. has announced that it has accepted the resignation of A. B. PHILLIPS as chairman and president. Phillips will continue as a director and an employee of the company.

STUART HARRIS has been named manager for Advanced Micro Devices' bipolar memory product line. He replaces JOHN SPRINGER who has been promoted to a new post as marketing manager for the bipolar memories and the 2901 microprocessor.

CHARLES S. ADAMOVIC and DONALD F. BERGIN have been respectively appointed general manager of subsystem assembly and marketing manager at Interlek, Inc.

## SWISS HANDS-ON $\mu$ C COURSE

A new intensive hands-on microcomputer course was announced by the Mini and Microcomputer Laboratory of the Swiss Federal Institute of Technology. The course presupposes some basic knowledge of digital systems and minicomputers. Its objective is to demonstrate, in detail, how to define, build, program and debug microcomputer systems. Two PDP 11s, three NOVA 1200s, three Motorola 6800s and four Intel 8080s will be available for student exercises.

The first class will be given in Lausanne, Switzerland on Sept. 22. Tuition is \$320 and includes all class notes.

# # # #

## GAME PROGRAMS WANTED

The People's Computer Co. Dragon is seeking information on computer games written in assembly language for the Intel 8008, 8080, Motorola 6800, or for other microprocessors. To submit a game, send an annotated listing of the program and available information to Bob Albrecht.

People's Computer Co. is a non-profit group that provides educational and entertainment programs to the interested public.

## PL/M PROGRAMMING COURSE

Microcomputer Programming in PL/M is a new course being offered by Stanford University to give engineers, technical managers, scientists and electronic designers experience in writing PL/M, the only high level language for microcomputers.

The class is organized into three lectures, assigned lab times and a dial-up timesharing system where most of the work required can be done outside of formal hours, either at home, off work hours or on weekends. The material is arranged so that a minimum amount of time is spent in commuting. The student will be given sample programs to duplicate and then several problems designed to familiarize the attendee with the timeshare system and microcomputer prototyping system in a real work-type situation.

The first lecture will be held Sept. 3 at the University at 7 PM. Tuition is \$400, including all notes and computer time. For more information call (415) 497-1563.

## 8080 vs 6800

Integrated Computer Systems is now offering two new courses designed for specific applications in the microprocessor field.

"8080 vs 6800" is a one-day, no-holds-barred, side-by-side comparison of the relative merits of each microprocessor. The course provides direct comparison and contrasts of performance, interfacing, program development support and systems costs. The course will be presented just prior to WESCON, and throughout the U.S. and Europe this fall.

"Military Microprocessor Systems" is a one to three day course that addresses the entire spectrum of military applications.



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## MICRO-SCOPE BULLETIN

Micro-Scope Bulletin is a new informal publication similar to a user's group bulletin that is prepared by the Mini and Microcomputer Laboratory of the Swiss Federal Institute of Technology. The bulletin will be used to exchange information and ideas between microcomputer users.

The publication is divided into three sections: didactic and introductory papers on processors and peripherals; application notes and listing of programs; and users' ideas, suggestions, questions, offers, etc.

The first complimentary issue will be mailed to individuals requesting a copy at the end of September. The regular subscription rate is \$45 per year.

## COURSE MATERIALS AVAILABLE

Integrated Computer Systems is now offering materials from six of their microcomputer courses. Each has over 1100 pages containing detailed copies of lecture notes, a bound volume of technical articles on microcomputer topics and a comprehensive volume of manufacturers' literature on microprocessor product descriptions and data sheets. Quarterly updates to these materials will also be available on a yearly subscription. Prices are available from Integrated Computer Systems.

## MICROPROCESSOR STUDIES

Technology Service Corp. has prepared a new timely report entitled "New Components and Subsystems for Digital Design". The report covers the latest innovations in microprocessors, microcomputers, logic arrays, LSI computing elements, custom LSI and memory devices as presented by leading engineers in each area.

The report is priced at \$75 and additional copies are available for \$50 each. (Ed Note: MICROCOMPUTER DIGEST will review this book in an upcoming issue.)

## RECENT LITERATURE

"Making The Most Of Your Micro"  
Vinay Khanna and Thomas Daly, Motorola  
Digital Design July 1975

The authors have presented techniques for testing the degree of utilization of proposed

microcomputer systems. This may result in the elimination of extra hardware or may uncover marginal software timing problems. A floppy disc and cassette interface with the M6800 is used as an example. Basic mathematics is presented for calculating I/O, word processing rates and processing efficiency.

Two models are presented, the prioritized and flip-flop. The former handles I/O to service requests on a priority basis while the latter alternates requests. Such analysis on the microcomputer system can eliminate problems or make one aware of excess processing time before a system is delivered.

This article is recommended for those involved in I/O interfacing, microcomputer system analysis, or system reliability.

"Beware Of The Errors That Can Creep Into uP Benchmark Programs"

Robert H. Cushman

EDN June 20, 1975

This article is the third in a series evaluating microprocessor benchmark results. Seven machines are examined.

Cushman makes several good points. For instance, the test program should be optimally written for the machine being evaluated. Also, the timing results must be "normalized" to account for different word sizes.

While interpreting benchmark results, he mentions architectural features which are not highlighted by the benchmark program (typical subtask, in this case, a block data move). Thus, he edges up to and then backs away from consideration of the basic validity of benchmark programs at the machine or assembly language level. In reality, the kinds of subtasks required in a program are partly determined by implementation techniques which are largely determined by the machine's architecture (this is not true for higher level languages). What matters is the appropriateness of the machine to the problem at hand. Thus the only valid benchmark is the actual problem to be solved.

"Floating-Point Computation"

Pat H. Sterbenz, IBM Systems Research Inst.

This book is an exhaustive but readable summary of floating point principles and is intended for the user of a compiler-level language who desires high quality results.



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**EDUCATION:**

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

September

- 1 PROM Programming--A Systems Approach  
Free San Jose CA Data I/O Corp.
- 3,10, Microcomputer Programming in PL/M  
17 \$400 Palo Alto CA IMSSS
- 8 8080 vs 6800 \$120 Washington DC  
Integrated Computer Systems Inc.
- 8- 9 MCS-8080 Microcomputer Workshop \$350  
Santa Clara CA and Boston MA Intel
- 8-12 MicroPac 80 Workshop \$400 Flint MI  
PCS Inc.
- 9 8080 vs 6800 \$120 Boston MA Inte-  
grated Computer Systems Inc.
- 9-11 COMPCON Fall Washington DC Contact:  
M. Smith T J Watson Research Center
- 9-11 M6800 Microprocessor Course \$430  
Wichita KS Motorola Inc.
- 10-12 How To Design With Microprocessors  
\$395 Boston MA Microcomputer Tech-  
nique Inc.
- 11 8080 vs 6800 \$120 Montreal, Ont.  
Integrated Computer Systems Inc.
- 11-13 PL/M Microcomputer Workshop \$350  
Santa Clara CA and Boston MA Intel
- 12 How To Profit From Microprocessors  
\$35 Palo Alto CA Pro-Log Corp.
- 12-16 Engineering In The Ocean Environment  
International Conference Washington  
DC IEEE
- 14-19 Microprocessors and Minicomputers--  
Interfacing and Applications \$325-  
\$360 Blacksburg VA American Chemical  
Society
- 15 8080 vs 6800 \$120 Chicago IL Inte-  
grated Computer Systems Inc.
- 15-17 MCS4/4040 Microcomputer Workshop \$350  
Santa Clara CA and Boston MA Intel

- 16 8080 vs 6800 \$120 Denver CO Inte-  
grated Computer Systems Inc.
  - 16-18 M6800 Microprocessor Course \$430  
Dayton OH Motorola Inc.
  - 16-19 Western Electronic Show & Convention  
San Francisco CA WESCON
  - 17-19 How To Design With Microprocessors  
\$395 Dallas TX Microcomputer Tech-  
nique Inc.
  - 18 8080 vs 6800 \$120 San Francisco CA  
Integrated Computer Systems Inc.
  - 21-24 Western Electronic Show & Convention  
Los Angeles CA WESCON
  - 22-26 How To Define, Build, Program and De-  
bug A Microprocessor System \$320  
Lausanne, Switzerland Swiss Federal  
Institute of Technology
  - 22-26 Next Generation of ICs Los Angeles CA  
EE Times
  - 23 Introduction To Microprocessors/Micro-  
computers With Applications 3 Month  
Course \$80 Sunnyvale CA University  
of California at Berkeley
  - 23-25 Hands-On Microprocessor Design Course  
\$300 Anaheim CA Pro-Log Corp.
  - 24-26 How To Design With Microprocessors  
\$395 Northern New Jersey Microcom-  
puter Technique Inc.
  - 25 Introduction To Microprocessors/Micro-  
computers With Applications 3 Month  
Course \$80 Berkeley CA University  
of California at Berkeley
  - 26 Military Microprocessor Systems \$135  
San Diego CA Integrated Computer Sys-  
tems Inc.
  - 30-31 Microprocessors/Microcomputers £150  
London, England Integrated Computer  
Systems Inc.
  - 30- 2 Hands-On Microprocessor Design Course  
\$300 Northern New Jersey Pro-Log
- October
- 1 PROM Programming--A Systems Approach  
Free San Jose CA Data I/O Corp.



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October

- 1- 3 How To Design With Microprocessors  
\$395 Irvine CA Microcomputer Tech-  
nique Inc.
- 2- 3 Microcomputer Software & Application  
Techniques £150 London, England  
Integrated Computer Systems Inc.
- 5- 8 Electronic & Aerospace Systems Con-  
vention Washington DC EASCON
- 6 8080 vs 6800 \$120 Washington DC  
Integrated Computer Systems Inc.
- 6- 9 Digital Integrated Circuits: Technol-  
ogy, Device Structures and Applica-  
tions \$275-\$295 Waterloo, Ont.  
University of Waterloo
- 6-10 MicroPac 80 Workshop \$400 Flint MI  
PCS Inc.
- 7- 9 Hands-On Microprocessor Design Course  
\$300 Palo Alto CA Pro-Log Corp.
- 8-10 How To Design With Microprocessors  
\$395 Washington DC Microcomputer  
Technique Inc.
- 8-10 Military Microprocessor Systems \$425  
Washington DC Integrated Computer  
Systems Inc.
- 14-15 Microprocessors/Microcomputers \$425  
Copenhagen, Denmark Integrated Com-  
puter Systems Inc.
- 14-16 Hands-On Microprocessor Design Course  
\$300 Dallas TX Pro-Log Corp.
- 15-17 How To Design With Microprocessors  
\$395 Chicago IL Microcomputer Tech-  
nique Inc.
- 16-17 Microcomputer Software & Application  
Techniques \$425 Copenhagen, Denmark  
Integrated Computer Systems Inc.
- 21-22 Microprocessors/Microcomputers  
1400SKR Oslo, Norway Integrated  
Computer Systems Inc.
- 21-23 Hands-On Microprocessor Design Course  
\$300 Chicago IL Pro-Log Corp.
- 23-24 Microcomputer Software & Application  
Techniques 1400SKR Oslo, Norway  
Integrated Computer Systems Inc.

- 27 8080 vs 6800 500SKR Stockholm,  
Sweden Integrated Computer Systems
- 28-30 Hands-On Microprocessor Design Course  
\$300 Washington DC Pro-Log Corp.
- 29 Microprocessors/Microcomputers 500dm  
Munich, Germany Integrated Computer  
Systems Inc.
- 30 Software Development 500dm Munich,  
Germany Integrated Computer Systems
- 31 Microcomputer Application Techniques  
500dm Munich, Germany Integrated  
Computer Systems Inc.

November

- 3 PROM Programming--A Systems Approach  
Free San Jose CA Data I/O Corp.
- 3- 7 MicroPac 80 Workshop \$400 Flint MI  
PCS Inc.
- 5- 7 How To Design With Microprocessors  
\$395 Cleveland OH Microcomputer  
Technique Inc.
- 11 8080 vs 6800 \$120 Dallas TX Inte-  
grated Computer Systems Inc.
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FINANCIAL:

EARNINGS

<u>Adv. Micro Devices</u>	<u>1975</u>	<u>1974</u>	<u>%</u>
June 29			
Share Earnings	\$ .06	----	----
Earnings	160K	-1,371K	+111.7
Sales	7,039K	7,392K	-4.8

<u>Amer. Microsystems</u>	<u>1975</u>	<u>1974</u>	<u>%</u>
July 28			
Share Earnings	\$ .10	\$ .55	-81.8
Earnings	223K	1,230K	-81.9
Sales	16,157K	20,174K	-19.9
6 Months			
Share Earnings	\$ .19	\$ 1.25	-84.8
Earnings	415K	2,787K	-85.1
Sales	31,359K	39,274K	-20.2

<u>Fairchild</u>	<u>1975</u>	<u>1974</u>	<u>%</u>
June 29			
Share Earnings	\$ .61	\$ 1.46	-58.2
Earnings	3,287K	7,673K	-57.2
Sales	68,964K	105,811K	-34.8
6 Months			
Share Earnings	\$ 1.23	\$ 3.43	-64.1
Earnings	5,542K	18,085K	-63.8
Sales	138,721K	206,628K	-32.9

<u>Intel</u>	<u>1975</u>	<u>1974</u>	<u>%</u>
June 30			
Share Earnings	\$ .52	\$ .100	-48.0
Earnings	3,613K	6,701K	-46.1
Sales	31,501K	36,223K	-13.0
6 Months			
Share Earnings	\$ 1.06	\$ 1.99	-46.7
Earnings	7,305K	13,304K	-45.1
Sales	61,866K	68,709K	-10.0

<u>Intersil</u>	<u>1975</u>	<u>1974</u>	<u>%</u>
June 28			
Share Earnings	\$ .07	\$ .21	-66.7
Earnings	202K	558K	-63.8
Sales	6,958K	8,327K	-16.4
6 Months			
Share Earnings	\$ .08	\$ .39	-79.5
Earnings	226K	1,047K	-78.4
Sales	12,721K	15,443K	-17.6



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<u>Mostek</u>	<u>1975</u>	<u>1974</u>	<u>%</u>
June 27			
Share Earnings	----	\$.27	----
Earnings	-981K	1,117K	-187.8
Sales	9,036K	14,216K	-36.3
6 Months			
Share Earnings	----	\$.83	----
Earnings	-640K	3,332K	-119.2
Sales	23,999K	28,319K	-15.1

<u>Motorola</u>	<u>1975</u>	<u>1974</u>	<u>%</u>
June 30			
Share Earnings	\$.40	\$.90	-55.6
Earnings	11,730K	25,282K	-52.9
Sales	344,844K	364,615K	-5.3
6 Months			
Share Earnings	\$.69	\$1.51	-54.3
Earnings	19,360K	42,476K	-53.2
Sales	648,725K	693,381K	-6.3

<u>Nat'l Semiconductor</u>	<u>1975</u>	<u>1974</u>	<u>%</u>
May 31			
Share Earnings	\$.33	\$.41	-19.5
Earnings	4,295K	5,165K	-16.8
Sales	57,160K	60,379K	-5.3
Year			
Share Earnings	\$1.34	\$1.33	+1.8
Earnings	16,748K	16,372K	+2.3
Sales	235,457K	213,398K	+10.3

<u>RCA</u>	<u>1975</u>	<u>1974</u>	<u>%</u>
June 30			
Share Earnings	\$.34	\$.45	-24.4
Earnings	36,800K	35,200K	-23.9
Sales	1,155M	1,146M	+0.8
6 Months			
Share Earnings	\$.55	\$.85	-35.3
Earnings	43,800K	66,400K	-34.1
Sales	2,245M	2,227M	+0.8

<u>Rockwell Int'l</u>	<u>1975</u>	<u>1974</u>	<u>%</u>
June 30			
Share Earnings	\$.73	\$1.00	-27.0
Earnings	27,436K	37,346K	-26.5
Sales	1,221M	1,224M	-0.3
9 Months			
Share Earnings	\$1.89	\$2.85	-33.7
Earnings	70,700K	100,780K	-29.8
Sales	3,648M	3,116M	+17.0

<u>Texas Instruments</u>	<u>1975</u>	<u>1974</u>	<u>%</u>
June 30			
Share Earnings	\$.49	\$1.10	-55.5
Earnings	11,295K	25,229K	-55.2
Sales	330,961K	403,386K	-18.0
6 Months			
Share Earnings	\$1.10	\$2.19	-49.8
Earnings	25,287K	49,983K	-49.4
Sales	663,718K	778,865K	-14.8

## COMPUTER TERMINAL IMPACT STUDY

Domestic shipments of computer terminals will more than double by 1980, and an annual growth rate of 16 to 17% for the next five years is forecast for the industry in a new impact study by Arthur D. Little, Inc. Shipments of computer terminals will total nearly \$3 billion by 1980, up from \$1.3 billion in 1975. By 1981, three million terminals will be in place—three times as many as today. They will account for 25% of the total computer value as opposed to 10% in 1974.

The ADL survey which covered a cross section of manufacturers by type and size—principally mainframe, communications and independent—and a sampling of users, reveals that growth will not be uniform for the two basic classes of computer terminals. Shipments of general purpose terminals, keyboard/printer and visual display, will double in the next five years. Those of special purpose terminals, banking teller and POS, for example, will triple, moving them from 14 to 30% of units in place.

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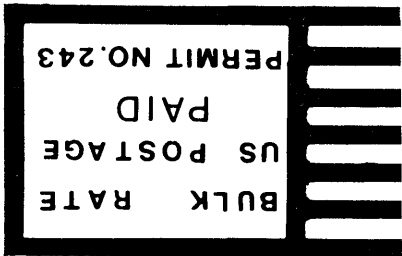
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