

MICROCOMPUTER DIGEST

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MOTOROLA TO INTRODUCE 4-BIT ECL μ C

Motorola Semiconductor is now working on a new ECL/LSI microcomputer chip set that will be aimed at both the microcomputer and main-frame computer market.

Irwin Carroll, spokesman for Motorola's Technical Communications Group, said the five chip system has a "target introduction date set for the first quarter, 1976." The MC-10800 is a 4-bit slice microprocessor that will be expandable up to 64-bits or more.

(cont'd on page 2)

TI CONFIRMS 8080 SECOND SOURCE PLANS

Texas Instruments has confirmed that they will indeed second-source Intel's 8080 microprocessor. Parts will be available at TI's distributors later this month in 50-piece quantities and volume production of the microprocessor is scheduled for the third quarter. The announcement was made by Ed Huber, TI's MOS marketing manager based in Houston.

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INSIDE THIS ISSUE

ELECTRONIC WARFARE--First of a three part series discussing μ P in EW. See page 4.

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1976 MICROCOMPUTER MARKET predicted to reach \$120 million. Story on page 17.

MICROCOMPUTER STUDIES AVAILABLE on page 19.

MOSTEK & FAIRCHILD ENTER F8 PACT

Fairchild's Integrated Circuits Group and Mostek Corp. have jointly announced that Mostek will second source Fairchild's F8 microprocessor set. Mostek will supply the complete five-circuit F8 family, including the CPU, ROM, dynamic and static memory interface and DMA circuits. In addition, Mostek will second source the 3538, a 256 x 4 RAM suitable for use with the F8. (cont'd on page 3)

NSC ENTERS LOW-COST μ P ARENA

National Semiconductor Corp. has entered the market for low-cost microprocessors with a 4-bit machine that it calls "FIPS" for Four-Bit Integrated Processor System, according to Hash Patel, product marketing manager.

The FIPS machine, designed as a pin-for-pin replacement for the vintage MCS-4 microprocessor system produced by Intel, features a central processing unit (CPU) that sells for less than \$10. Power dissipation is typically 20% lower than that of the MCS-4.

(cont'd on page 3)

INTELLEC MDS INTRODUCED AT NCC

(FIFTH IN A SERIES)

Intel Corp. took the wraps off their first in-circuit microcomputer development system, the Intellec MDS, at the NCC Conference.

The system's multiprocessor configuration allows the implementation of designs based on the Intel 8080 or Series 3000 microcomputers. An internal 8080 microprocessor controls and supervises all system resources, while a second processor, an In-Circuit Emulator called ICE, is plugged directly into the user's system for further hardware and software checkout.

ICE-80 for 8080 based systems and ICE-30 for the Series 3000 bipolar microcomputer set are used to control, interrogate, revise and

(cont'd on page 3)



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SPECIAL FEATURES:

MOTOROLA TO INTRODUCE 4-BIT SLICE uC

(from page 1)

The five chips will consist of an MC-10800 4-bit slice microprocessor, MC-10801 Control Register chip, MC-10802 Timing Function chip, MC-10803 Slice/Memory Interface device, and the MC-10804 Slice Look Ahead device.

Carroll said a new feature of the system, parity check, had been added because of the many requests by customers for such capability in a microcomputer. He estimates the ECL system's typical execution speed for one microinstruction cycle to be around 75 ns. The instruction set will consist of 70 commands and the microprocessor will be user microprogrammable to allow the customers to configure the system around their current software packages.

Carroll said that pricing had not yet been established.

TI CONFIRMS 8080 SECOND SOURCE PLANS

(from page 1)

According to Huber, the TMS 8080 design is complete and characterization tests have been underway for some time. The TMS 8080 is reportedly the first in a new line of microprocessor products. Besides the 8080, TI is producing a 4-bit P-channel microprocessor, the TMS 1000, and is said to be sampling the SBP0400 CPU. The TMS 1000 will be used in dedicated control applications.

Spokesman for Motorola Semiconductor felt that TI's announcement would impact the microprocessor market in the 8080's favor but noted that Motorola would soon respond with a "couple of things" of equal impact. Industry sources have speculated that an American and/or a European firm may soon announce a decision to second source Motorola's 6800.

Advanced Micro Devices reports that they are still planning to have their 8080 mil-spec microprocessor available within a month.



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MOSTEK & FAIRCHILD ENTER F8 PACT

(from page 1)

The alternate source agreement includes exchange of masks, manufacturing and applications software and applications hardware. In addition, both firms will cooperate in expanding current F8 hardware, software and support programs, as well as in developing new F8 components.

Dr. Thomas A. Longo, Fairchild's vice-president and general manager, said, "Mostek's N-channel Isoplanar processing is completely compatible with ours, and the tooling is interchangeable. Specifications for the F8 parts will be identical whether supplied by Fairchild or by Mostek."

The F8 (see MICROCOMPUTER DIGEST, April, 1975) is aimed primarily at the controller market, however, L. J. Sevin, Mostek's president, said a major reason for Mostek's decision to second source the F8 rather than other designs is the F8's ability to cover a broad range of applications.

Mostek expects to have samples of the F8 circuits available for marketing late this summer.

NSC ENTERS LOW-COST μ P ARENA

(from page 1)

The FIPS microprocessor is a general-purpose chip set intended for use in process control, numerical control, measuring instruments, traffic signal systems, and intelligent terminals.

Patel said that National sees the microprocessor market branching in two main directions. One is to high speed, high powered, minicomputer oriented systems and the other to small, low cost, dedicated control processors.

According to Patel, the FIPS microprocessor is extremely cost-effective in control applications because it easily interfaces with keyboards, switches, displays, and other peripheral devices.

The FIPS chip set consists of a 4-bit CPU (INS4004), a 256 x 8 mask-programmed ROM combined with a 4-bit I/O port (INS4001), a 320-bit RAM with a 4-bit output port (INS4002), and a 10-bit serial-in parallel-out shift

register (INS4003).

An 8-bit address latch memory interface (INS4008), and 8-bit instruction and I/O transfer device (INS4009), are included in the chip set. Together they permit the use of standard MML702AQ 256 x 8 bit erasable PROMs.

The INS4004 CPU contains all of the control logic needed to request, decode, and execute the program instructions stored in the program memory. The chip also consists of a 4-bit arithmetic logic unit, 16 4-bit index registers, a 12-bit program counter with a three-level stack, and miscellaneous control logic. Communication with the other chips in the system is accomplished over a time-multiplexed 4-bit data bus.

The INS4001 ROMs, which store the μ C's instructions, are arranged in banks of sixteen. Switching between banks is done under control of the program, with the CPU selectively enabling the appropriate bank of ROMs to fetch an instruction.

All the chips are available now in production quantities and prices in lots of 100 are as follows:

INS4001	256 x 8 ROM & 4-bit I/O port	..\$9.95
INS4002	32-bit RAM & 4-bit I/O port	... 9.95
INS4003	1-bit serial shift register	... 3.95
INS4004	4-bit CPU 9.95
INS4008	8-bit address latch interface	. 7.50
INS4009	8-bit instruction & I/O transfer port 7.50

INTELLEC MDS INTRODUCED AT NCC

(from page 1)

completely debug a user's system in its own environment.

The MDS is a modular system whereby users can update their system with peripherals and options as needed. These include the Intellec MDS, ICE, a complete Diskette Operating System, a universal PROM programmer, a system console, a line printer and appropriate memory and I/O options.

The basic system includes an 8080 microprocessor, 16K RAM, 2K ROM, 256-bytes of PROM, and hardware interfaces for a teletypewriter, CRT, line printer, high-speed paper tape punch, and Universal PROM programmer. MDS features include a 2 us instruction cycle,

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unlimited subroutine nesting, a 78 command instruction set, an 8-level nested priority interrupt structure, and full DMA capability.

Memory can be expanded to 64K bytes by adding 16K RAM or 5K PROM modules. Customized I/O requirements are satisfied by adding general-purpose I/O modules containing four 8-bit input ports, four 8-bit output ports and eight system interrupt lines.

DMA modules allow maximum efficiency of data transfers between the MDS memory and selected I/O devices. A universal bus and independent bus clock support multi-processor configurations that are not limited to any one Intel microcomputer family.

According to Intel, the single feature providing the greatest ease and versatility in developing products, and the heart of the multi-processor system configuration is the In-Circuit Emulator (ICE).

As soon as the user has determined the microprocessor and bus structure, the ICE can be plugged into the user's system in lieu of the microprocessor. ICE controls and interrogates the system in real-time operation, reducing the total debug time considerably.

ICE provides hardware breakpoints to suspend program execution for examination and modification of memory and internal registers. A single-step capability enables information to be stored or displayed at intermediate states within an instruction cycle. The program flow can be dynamically traced while operating in real-time, displaying previously executed instructions with corresponding data and address bus contents, as well as the system status. The user's system can be operating with its I/O under ICE control, stopping at designated points for examination.

Prices start at \$3995 with \$1000 allowed for trade-in on your Intellec 8/Mod 80.

µP IN ELECTRONIC WARFARE SYSTEMS

(FIRST IN A THREE-PART SERIES)

By H. Dean McKay, President, A H Systems

This series will examine the potentially rich application area of using microprocessors in electronic warfare (EW) systems. The purpose of EW processor systems will be analyzed along with many of the problems encountered in implementing such systems. Finally, the design of several EW systems utilizing microprocessors will be described.

Electronic warfare is one of the fastest growing segments of the military electronics industry today. Its growth arises from the increased threat, demand and the deployment of more sophisticated communications, weapons and countermeasure systems. There is a basic requirement to increase the level of intelligence of the individual components of the EW system, i.e., receiver, signal processor, signal recognizer, jammer, antenna array, etc. All of these systems demand highly efficient telecommunications between remote locations and a central processor. Transferring information by a telecommunications system between a remote location and a central processor does not consist of merely plugging in the remote unit to a computer output port.

There are more demanding essential requirements that are particularly difficult, such as high speed signal processing requirements, that can't be handled over conventional data links. This is where the microprocessor will make significant improvements in current and future EW systems.

Probably the most important of all reasons for utilizing micros in EW systems is increased operational capability. Electronic warfare hardware is in a dynamic environment, that is, the threat is continually changing. It is desirable to have EW systems that both meet today's threat and are capable of being upgraded for future threat requirements. The microprocessor is ideally suited to provide this capability.

The microprocessor can be used as a basic subsystem controller with stored programs for current assessed threats. As a future threat is identified the particular system capability can be increased by changing only the system or subsystem software rather than redesigning the hardware system. This allows an extremely flexible operational system. It is simply a matter of re-programming PROMs and a receiver can be changed from a monitoring receiver to a search and acquisition receiver, or a communications jammer could be changed to a radar jammer.

This flexibility is probably most important in electronic warfare because quick reaction is a basic axiom of the EW user. In addition to increased capability and flexibility, the classical factors of size, weight



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and power are important. The fact that microprocessors are LSI devices make them ideal for small size, light weight, low power systems, particularly utilizing the new technologies of CMOS/SOS and I²L. Both of these technologies have the speed requirements while being several orders of magnitude lower in power than current TTL

Another reason for using microprocessors in EW systems is that they are a good match to RF subsystems. One must often wait for the receiver IF to settle or the jammer synthesizer to slow to a new frequency. These waiting times normally bog down large processors and are difficult to handle in hard-wired systems. However, the micro with cycle times in the 200 ns to 1 us range are ideally suited for controlling RF elements. The cost of the microprocessor is low, making it viable as an element for control of almost every major subsystem in EW systems.

(Next month Mr. McKay will discuss typical applications for microprocessors in EW systems.)

FIRST WEST COAST NCC NETS 30,000

Challenges In The New Era was the major theme of the Conference Program for the 1975 National Computer Conference & Exposition held from May 19-22 at the Anaheim Convention Center. The conference's 89 technical programs analyzed issues facing the computer industry and data processing users in science and technology, methods and applications, and interaction with society. The microprocessor sessions were organized by Ted Laliotis of Fairchild System Technology.

Virtually every segment of data processing technology and related services was represented by the 274 organizations that occupied 795 booths.

On the floor, a large variety of microcomputer-based products were displayed including Intel's new Intellec MDS, the new microcomputer development system for their Series 3000 bipolar microprocessor and DCC's 16-bit minicomputer implemented with the 3000 bipolar chip set (see MDS article, this issue, page 1).

National Semiconductor demonstrated their line of microprocessors, memories and had a hands-on demonstration model of the PACE

microcomputer system.

Danyl Corp. displayed their accessory items for the National IMP-16C microprocessors which included a 4K x 18 RAM/2K x 16 PROM module.

Applied Data Communications exhibited their Series 70 Microcomputer System which uses an 8080 microprocessor. Included in the basic unit is an operator terminal controller, 4K RAM, 1K PROM, autostart bootstrap, and a floppy disc controller.

The Spintronic data communications terminal from Intertec Data Systems featured an 8-bit microprocessor, Diablo HyType character printer, IBM Selectric keyboard, and 4 to 6K memory.

Pro-Log demonstrated their new 8811 CPU card containing the 8080 microprocessor and associated circuitry. Also on display were the PLS-441 and PLS-442 4040 microprocessor cards.

The MPA-1 Logic Analyzer, a diagnostic tool for hardware and software operations of microprocessors was featured by Motorola Inc. along with the entire M6800 microcomputer family.

Intel Corp. showed their user-programmable intelligent terminal system, OP-1. The terminal features three microprocessors (CPU, display and I/O). The system can operate in a stand-alone or online environment.

A high-speed dot matrix microprocessor-controlled printer was shown by Applied Computing Technology. Standard features include 132 columns, multiple copies, horizontal tab, vertical formatting and forward-reverse line feed.

Conrac Corp. displayed their first CRT computer terminal in a new series of compatible units. The terminal is based on a microprocessor concept that allows most of the terminal's characteristics to be reprogrammed through PROM changes. The 480/25 is fully TTY compatible, and has full edit capability with optional keyboard configuration.

Microprocessor family boards holding 4K RAMs, 40-pin microprocessor, and 28 pin I/O chips were exhibited by the Electronic Engineering Company of California.

The Hydra Corp. demonstrated their medium speed matrix printer whose printing mechanism and data format are controlled by a built-in

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microprocessor. Model-B prints bidirectionally at 80 cps to provide 85 lpm throughput.

Mits, Inc. demonstrated their Altair 8800 microcomputer kit and had their Mits-Mobile van on display. The van is fully equipped with the entire Altair product line.

The MSC8080 microcomputer system, a single board assembly, was displayed by Monolithic Systems Corp. The board is designed to mate the Intel 8080 microprocessor to the Monostore family of semiconductor memory systems.

Sord Computer Systems, Inc. demonstrated their SMP80, an 8080-based microcomputer that is a complete software development system. Software support includes assembler (cross and resident), editor, debugger, IOX, FDOS, Multi-Task Monitor, and various kinds of diagnostics. Sord says they can provide a custom designed microcomputer, including system software, using any kind of microprocessor chip.

The 3800 Flexible Floppy Disc Subsystem that can be interfaced to minicomputers and microcomputers was shown by Shugart Associates. Features include double density capability, single PCB controller, IBM 3740 compatibility option, and simplified control interfacing.

TECHNOLOGY

µC'S ARE INSTRUCTION SENSITIVE

Microprocessors are definitely instruction sensitive according to Dr. William C. W. Mow, president of Macrodata, an LSI test system manufacturer. In an interview with Electronic Engineering Times (EET), Dr. Mow explained, "Through the use of a technique called diagnostic emulation, which tests the CPU with its operating instructions, we can show conclusively that microprocessors are instruction sensitive."

According to Macrodata's test results, the sensitivity occurs during the jump, interrupt and scratchpad memory instructions. Simple instructions do not seem to be affected at all. Dr. Mow said that the sensitivity is comparable to the pattern sensitivity found in MOS memories.

The cause of the problems is believed to lie in the fabrication process of microprocessor wafers. Investigations by Macrodata

point to the charge storage effects associated with all MOS/LSI devices, especially in memories.

Dr. Mow feels that if manufacturers were to perform exhaustive instruction sensitivity tests on microprocessors their cost would be prohibitive. He therefore suggests that users "set up microprocessor tests using instruction sequences in an environment similar to the one anticipated. By introducing sufficient guard bands for supply voltages and varying timing signals and dc parameters to the limits expected in the actual system, the limits of reliable performance can then be determined."

GEC AND INTEL IN CLOSE RELATIONSHIP

GEC Semiconductor in Wembley, England, has signed a distribution agreement with Intel covering all Intel microprocessor products.

At the same time GEC has introduced three devices for use with Intel's 8080 microprocessor. They include an asynchronous bi-directional I/O buffer and two versions of a chip that give the 8080 a direct multiply capability. It was also learned that an incremental divider for the 8080 is under development.

The signing of this agreement between GEC and Intel has given rise to speculation that GEC may soon be manufacturing the 8080 in England. Two recent developments give further credence to such speculation. First, new test equipment had been installed at the Wembley plant that gives the firm the capability of testing the 8080 in both wafer and packaged form. Second, Intel would probably not be able to effectively enter the coveted UK defense and telecommunications market without a European manufacturing base.

MICROCOMPUTER-BASED PRODUCTS

CHRYSLER ORDERS 5000 M6800s

Motorola Semiconductor reports that they have received their second M6800 microprocessor order from Chrysler's Huntsville division. The microprocessors are slated for use in Electronic Spark Advance (ESA) diagnostic equipment. Of the 5,000 chips in the order, 2,000 are expected to be incorporated into



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test equipment for Chrysler dealers by year end.

According to a spokesman from the auto firm, Chrysler chose the microprocessor over hardwired logic as it would easily enable the company to update the test equipment for newer engines.

Sensing the spark advance is accomplished using a flip-flop that is set by a slot in the rotating engine damper and reset by the primary of the ignition coil. The number of sets and resets are then stored in two different microprocessor registers to determine the set/reset timing ratio. This information allows the M6800 to calculate the time differential within a fraction of one degree between spark and engine rotation.

PACE DEVELOPMENT SYSTEMS & IMP KITS

National Semiconductor has begun deliveries of their PACE Development System, a hardware prototyping system designed to aid in the development of interfaces and software for the PACE microprocessor.

Fashioned after the IMP-16P model, the PACE system includes power supply, memory, interface provisions, sockets for PROMs and other elements for writing and debugging programs.

Each unit is priced at \$3850 and National says deliveries are now running about four weeks, however, the firm is expected to have the systems available from stock within a month.

In another move, National has reviewed its packaging policy for its IMP microprocessors, giving distributors the green light to offer the MPU and interface circuits as a kit. The move affects the IMP-4, -8 and -16 microprocessors.

The following sets are now available from distributors with the first price indicating quantities of 1-24 and the second 25 and up.

- *IMP-4: MPU, RALU, CROM and FILU set
\$105, \$83
- *IMP-8: MPU, 2-RALUs, CROM and FILU set
\$203, \$162
- *IMP-16: MPU, 4-RALUs, CROM
\$330, \$198

Hamilton/Avnet, the Wyle Group, Hall-Mark, Kierulff, Harvey, and Semiconductor Concepts are among distributors now offering the kits.

DISTRIBUTED DATA PROCESSING SYSTEM

A new distributed data processing system, the DXS Data Exchange System, featuring a microcomputer-controlled video terminal has been announced by the Digital Systems Division of Texas Instruments Inc.

The DXS is an expandable and flexible transaction processing system for distributed data base networks, and uses TI Model 960B minicomputers for transaction processing and disc file management, terminal communications, and optional host interface. An important feature of the system is the new Model 914A video terminal which enables stand-alone transaction processing or communication to 360/370 host systems. The 914A terminal provides 3270 emulation, as well as programmability for intelligent data entry, inquiry and programmed keyboard functions with its built-in microprocessor.

The terminal incorporates a microprocessor with 8K bytes of memory for intelligent data entry and inquiry response to DXS or host 360/370 data files with full 3270/2260 emulation. The 1920-character screen provides programmable field formats, protected and non-protected fields, and a complete range of field editing functions to minimize data entry errors and reduce the data to be transmitted. An optional parallel printer interface enables direct connection to 80 or 132-column printers.

The 914A terminal is priced at \$3200 in single unit quantity and quantity discounts are available.

THREE μ P BOARDS INTRODUCED

Pro-Log Corp. has announced three new microcomputer boards for use in dedicated control and data processing applications.

Model PLS-441 includes the Intel 4040 4-bit microprocessor, crystal clock, external and power on reset interrupt, 256-word instruction PROM expandable to 1024 words, and an 80 character data RAM with capacity to 320 characters. I/O lines for the 441 include 16 TTL inputs, 16 TTL outputs, and four MOS output lines.

The Model PLS-442 is identical to the 441
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except that the instruction PROM is expandable to 1536 words and the board has 32 field selectable TTL I/O lines with expandability to 128 lines.

The 8811 CPU board incorporates the Intel 8080 microprocessor and is fully compatible with the ROM, RAM, and I/O cards used with the 8111 (8008) CPU card. The basic clock time for the 8811 is 1.6 us, but the clock can easily be changed on the CPU card to .8 us.

Prices are \$345 for the PLS-441, \$445 for the PLS-442, and \$490 for the 8811.

INTELLIGENT FLOPPY DISC SYSTEM

Applied Data Communications has introduced their Series 62 Intelligent Floppy Disc System for use in intelligent and remote batch communications systems. The 8080 microcomputer-based system is programmable and provides terminal storage and peripheral control functions.

The system features from one to eight IBM compatible floppy disc drives, 4K RAM, 1K PROM with 256-word boot, and ASCII controller (TTY current-loop selectable).

The basic system is housed in a tabletop enclosure with one or two floppy disc drives, power supplies, disc format electronics board and microcomputer board. Up to 4K PROM and up to 16K RAM are included on the microcomputer board along with the asynchronous controller and the floppy disc DMA controller. Another board houses the disc format electronics to provide IBM 3740 disc compatibility, and an optional memory board allows expansion up to 64K of combined RAM and ROM.

A control panel and keyboard allows the system to be used for dedicated functions such as offline print/plot, data entry, data communications and buffering, test and control, and word processing. The Series 62 can support more sophisticated applications by using more complex consoles.

Available software includes driver handlers, utility programs, diagnostics, editor, assembler, boot loader and monitor. Programs can be assembled onto disc and manipulated by file name using an optional disc operating system.

#

MICROCOMPUTER TEACHING KIT

E & L Instruments has announced their latest Intel 8080-based microcomputer for teaching software and hardware design. The system features a CPU interface, a memory card expandable to 3K RAM and 1K ROM/PROM, a front panel, and an interface board capable of handling 12 IC's.

Program access is through the front panel, but since there is no PROM memory in the front-panel control loop, diagnostic software routines for debugging have to be accessed through a teletype or similar I/O.

The system's 72-pin bus structure is configured so that no special bus expanders, converters or interfaces are necessary.

Software support includes a teletype debug package (in PROM) for changing data, examining a location, setting a break point, and beginning a program. Commonly used subroutines such as teletype, I/O, punch I/O, BCD binary conversion and time delay loops have also been preprogrammed in PROM.

BOURNS TO USE μ C IN TERMINAL

Bourns Inc. is heavily investigating the use of microprocessors in their planned line of custom intelligent data entry terminals. Sources within the company say one such system using a 16-bit microprocessor could be ready by the end of 1975. However, they declined to further identify the system.

DATA COMMUNICATIONS CONTROLLER

Pulsecom's Micromite-400 is a modular data communications control unit which includes a system control module containing a microprocessor, the Intel 8008, to execute a series of data communications and/or terminal procedures which are stored in various memory devices. The module also includes memory devices which may be used as temporary data or message storage for processing or buffering purposes.

Line and terminal interfaces are accomplished by adding line and/or terminal interface modules as needed. Both EIA and TTY interfaces are available. The resulting system can be used to control the flow of data



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communication between lines and/or terminals. For instance, the M-400 could conceivably allow data communication between two or more lines of different speeds or protocols, a line and a terminal as a selector, or between terminals of different types.

8080 SLATED FOR PROCESS CONTROL

The Intel 8080 microcomputer has been designated the candidate for use in Bell & Howell's new PDQ 200 digital control system for process control applications.

The microcomputer will process analog and binary input signals back to the output bus for control of the process. The PDQ 200 will perform the mathematical computations and process control equations found in large computers and is also compatible with several other computers, printers, external storage and input devices.

A two-mode PDQ 200 featuring eight analog inputs, four analog outputs, eight contact closure inputs, four contact closure outputs and control panel is priced at less than \$12,000. Delivery is 30 days after receipt of order.

MEMORIES AND PERIPHERALS:

SAGA OF THE 4K RAM

Back in 1972, Intel introduced the first 4096-bit RAM, a 22-pin version. But things didn't settle for long. Texas Instruments quickly followed with their 22-pin device, but with a new pin-configuration. Intel must have liked TI's layout, for they quickly adopted the pin-out in a new version.

The industry was just relaxing when Motorola and American Microsystems decided to announce their jointly produced 22-pin RAM. Of course, it had a new pin configuration. And to make matters a little more confusing, Mostek chose to unveil their small 16-pin 4K RAM. The device was somewhat limited in speed and needed to be multiplexed, but no one seemed to mind. Peripheral and computer mainframe manufacturers quickly endorsed the RAM, and Fairchild, Motorola, AMI and Intel soon announced interchangeable 16-pin versions.

Believing that the pin battle was over,

industry was in for another surprise when TI announced a third package size, an 18-pin 4K RAM that needed no multiplexing. Well, before you could shout 'gotcha', National Semiconductor displayed their 18-pin beauty and, of course, it had another pin-out configuration.

So instead of an industry standard, there are now five different 4K RAMs with three different package pin counts and five different pin configurations.

Last, but not least, Intersil and Signetics say they are going to build 18-pin 4K RAMs. And now, the \$64K question.....?

LOGIC ANALYZER AND CLOCKS FOR μ P

Motorola has announced a completely new microprocessor diagnostic tool to analyze both hardware and software operations.

The MPA-1 logic analyzer will display 32 consecutive addresses and associated data. The display can be set to start or end with the trigger address, which can also be delayed. The trigger can be set on any location within 65K addresses.

The analyzer's CRT unit displays 32 words of 24 bits each in hexadecimal characters on a nine-inch screen. The characters are arranged in groups of four and two, representing a 16-bit address and eight data bits.

Motorola has not yet announced prices or delivery times.

Motorola also introduced two new clock circuits for use with microprocessors. The model K117A is designed to drive the Intel 8080 and the MC 6970A is designed for Motorola's M6800 microprocessor.

Each module contains the crystal, oscillator circuit, NMOS and TTL drivers, waveshaping and interface circuitry. The clocks provide non-overlapping, two phase waveforms for the respective microprocessors.

The price for each clock circuit is \$68.13 and delivery is from stock to 4 weeks.

4K AND 8K PROM SLATED FOR μ C MARKET

Intel is now offering their first 8K and a new 4K erasable PROM. The new 24-pin memory devices were designed with a faster access time to match the speed of the latest microcomputers. (cont'd next page)



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The C2708 8192-bit PROM is organized in a 1024 x 8 format, while the C2704 4096-bit memory is configured as a 512 x 8 device. Worst case access times of 500 ns are guaranteed over the 0° to 70°C temperature range.

All devices are available from stock at Intel distributors. Prices vary according to access time requirements, but the 8K C2708 price ranges from \$53.05 to \$65.50 each in 100 to 999 lots. Free programming is normally available from distributors for prototype quantities, but Intel reports they will provide a programmer for orders of 10,000 or more units.

MICROCOMPUTER UART UNVEILED

Guili Microprocessing Inc. has announced their new Model 412, CMOS universal asynchronous receiver and transmitter. The unit performs serial to parallel conversions to interface microprocessors with conventional modems for communications.

The UART board has pin selectable baud rates from 75 to 9600 baud. CMOS inputs and tri-state TTL outputs reduce power consumption significantly. The board's versatility and flexibility is enhanced by the unit's EIA and teletype compatible outputs, half or full duplex operation, and the three serial interfaces.

NATIONAL BIDS FOR NUMBER 1 SPOT

As part of National Semiconductor's bid for the number one spot in the microcomputer marketplace, several new developments have taken place in recent weeks.

First, a compiler for the IMP-16 microprocessor is under development with availability planned for next month. The resident compiler uses a new language developed by National, SM/PL (pronounced 'simple'). The language will be modified for the 16-bit PACE chip at a later date. Phil Roybal, product marketing manager, microprocessors, considers SM/PL a very powerful answer to Intel's PL/M high level language for microcomputers.

A second new product is a floating-point math library that offers both single and double precision arithmetic for number crunching applications.

A new instruction set, POWR I/O, has been

developed for the IMP-16 that allows the microprocessor to perform block transfers in and out, memory-search for a character, and data stack, store or reclaim with a single instruction.

It was also learned that National has reached a royalty-to-National agreement with GE Timesharing for a MACRO Expander package for IMP-16 microprocessors. This will allow IMP-16 users to begin software development of their products while awaiting deliveries of the microprocessor chips.

National also has a new conversational assembler that is effectively a text editor and relocating assembler in one package. With the assembler, users will be able to create source code, store it in memory, edit, assemble and re-edit without using paper tape.

In the low end microprocessor area, National recently announced a 4-bit chip set, compatible with the Intel MCS-4 family (see story, this issue, page 1).

NEW MACRO ASSEMBLER FOR 8008/8080

Zeno Systems Inc. has introduced a combined macro cross-assembler for use on the Intel 8008 and 8080 microprocessors. The assembler is written in the Macro-10 assembler language for the PDP-10 computer. ZSI says they will have an IBM 360/370 assembly version ready soon.

The ZSI cross-assembler is available in either a batch version or as a conversational program for a time-sharing system.

The package is functionally equivalent to the software provided by Intel, however, extra features have been added. These include octal, decimal and hexadecimal listing of the assembler, numbering of every statement on the listing, refined user interface, and error messages that reference exact statement numbers.

ZSI has priced the package at \$3750 under a one-time licensing agreement or be utilized on a pay-as-you-go basis on a time-sharing network.

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ROCKWELL & SYNERTEK REACH AGREEMENT

In January of this year, Rockwell International Corp. signaled its entry into the standard memory marketplace by announcing the appointment of Adrian C. Bos, a 20-year veteran of the computer industry, as director of Memory Products Marketing for its Microelectronic Device Division. Simultaneously, the company offered as its initial product, a low-priced 1103A metal gate P-channel 1K RAM with a 205 ns access time.

Rockwell has disclosed further details of its standard memory marketing plans. Under a licensing agreement with Synertek, Rockwell will produce and market worldwide, Synertek's 1103A-1 and -X silicon gate, P-channel 1K RAMs. At the same time, Rockwell announced that it had developed its own silicon gate, N-channel, 16-pin 4K RAM (P/N 1604-1) and that a 16-pin, 16K RAM is planned for introduction in 1976.

The Synertek circuits complete Rockwell's family of 1103A devices. The 1103A has a maximum access time of 145 ns, while the 1103A-X is specified at 110 ns. In 100 to 999 quantities, prices are \$9.70 and \$11, respectively. Evaluation parts of the new devices will be available in June and should be in full production by late summer.

The 4K RAM, P/N 1604-1, is pin compatible with Mostek's, Motorola's and Intel's 4K RAM. Evaluation parts are scheduled for August and production quantities by late 1975.

Maximum access time for the 1604-1 is specified at 200 ns, and variations of the product will be available on the basis of speed and voltage characteristics. For 100 to 999 quantities, the 1604-1 device is priced at \$37.70.

WASHINGTON μ C DEVELOPMENT CENTER

Almac/Stroum Electronics, a Division of Laser Link Corp., has just announced the opening of its new Microcomputer Development Center. This facility will assist designers in developing the hardware and software for their microprocessor derived products, without incurring the capital cost of a prototyping system.

Presently, the center contains the Intel

Intellec 8/Mod 80 and the National IMP 16P/308 prototyping systems. Each prototype system has its associated high-speed paper tape reader and teletypewriter. The inclusion of additional peripherals is planned for the future.

Almac/Stroum also provides PROM programming using Data I/O PROM programmers. The development center is open daily and a variety of utility packages are available.

PROCESS CONTROL COMPILER

Warner & Swassey is now offering a compiler for their "Process Control Language". The language was developed for use with their Comstar-4 process control system which uses the Intel 4004 microcomputer.

The language is a translation for ladder diagrams and Boolean equations familiar to process control engineers. Using the English language commands, the engineer can express on/off control functions in ladder-diagram terms and easily express most other control modes.

The compiler converts the English language commands into source code and provides for machine language editing of the program.

MEMORY AND LSI CHIP TEST SYSTEM

Micro Control Co. has developed a new memory and LSI test system, M-10A, for testing memory, microprocessors, LSI chips, memory boards and memory systems in production or engineering environments.

The M-10A features crystal-controlled digital timing with 1 ns resolution in the range from 0 to 65 μ s. Up to nine clock phases and separate read/write timing are available. Operating at 10 MHz, the tester's internal 8-bit microprocessor provides complete automatic test operation.

The front panel controls include keyboard display and digital voltmeter. An optional keyboard display or teleprinter operation includes Schmo plots; and test programs are stored on tape cartridges.

Test jigs are available for memory chips, microprocessor chips and other LSI chips. The entire test system is available in either a benchtop or a floor model.



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NEW BACK-UP MEMORY ASSURES DATA

Cambridge Memories' new MicroSTOR memories provide microprocessor and computer users with non-volatile, 100 us storage on 4K or 8K cards in either 8- or 12-bit word sizes.

MicroSTOR is a TTL compatible read/write system having its own storage, drivers, I/O registers and timing. It stores 4096 or 8192 words with 8, 9, 10, 11, or 12-bits per word. The storage is contained on four 2K x 12 pluggable planes.

The memory system's main function is to restore a computer's program in the event of a power failure or other such outages. When a computer system using the MicroSTORE has a program loaded into main memory, MicroSTOR automatically duplicates the data. Thus, if data is lost or altered in main memory from a power failure, MicroSTOR reloads the main computer's memory.

Back-up applications for the MicroSTOR range from processing and point-of-sale terminals, numerical control systems and data-logging devices, to eliminating the need for batteries, ROMs, or auxiliary storage such as floppy discs and cassettes.

MicroSTOR can also operate as a main memory if high-speed random-access searches are not required. Worst-case read/write time is 400 ms.

Pricing begins at \$395 for the 8K x 12 system and delivery is 30 days ARO.

FIRST OF NEW FPLA GENERATION

Intersil has announced availability in production quantities of the IM5200, the first of a new generation of TTL programmable logic arrays (PLA) that can be electrically programmed in the field.

The IM5200 has 14 inputs and eight open-collector outputs. It has a total of 48 product terms and provides a complexity of more than 480 four-input logic gates. Packaged in a 24-pin ceramic dip and pin-compatible with the 7576 mask-programmable logic array, the device uses a single 5 V supply with typical propagation delays of 65 ns.

Functionally, the IM5200 is equivalent to a collection of AND gates whose outputs can be selectively ORed. Since some functions

may be more easily represented in their inverted form, the output level is also programmable to either a high or low active level. IM5200 programming is accomplished by Intersil's patented avalanche-induced-migration process, in which switching transistors in the logic connection structure are electrically converted to diodes.

Pricing begins at \$37.50 in single unit quantity, plus a minimal programming charge.

PEOPLE, LITERATURE AND EVENTS:

CALIF. CONSULTANT TRADE ASSOCIATION

A new consultant trade association, PATCA, has been formed in the San Francisco Bay Area to promote consultant expertise for companies needing their services. Independent consultants (programmers, engineers, etc.) are invited to join the 80 member organization.

Dennis Paull, president of the trade association said PATCA will maintain a full time consultant referral service in which companies can call the association, state their need, and be referred to a member consultant qualified in that particular area.

Annual membership is \$20 per person and microcomputer consultants are welcome. Further information can be obtained by contacting PATCA.

PEOPLE ON THE MOVE

JERRY CROSBY has rejoined the Systems Technology Division of Fairchild Camera & Instrument Corp. as product marketing manager of small systems (Qualifier 901, etc.).

RICHARD J. EAGAN has resigned his post as senior vice-president of Cambridge Memories, Inc. to join Intel as assistant general manager of the Memory Systems division.

JIM GIBBONS, former Motorola M6800 product planner, has joined Ryan-McFarland as product manager for microcomputers.

DON A. MITCHELL has been named president of the Microelectronics Group of Rockwell International Corp.

WILLIAM E. WAGNER is now in charge of all Rockwell International's microprocessor and memory circuits as the new director of worldwide sales at the Microelectronic Device division.



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WILLIAM ROBERTS, senior vice-president of research and development for Western Digital Corp., has resigned. He is succeeded by LUKE DRU, director of engineering.

MITS-MOBILE TOURS WEST COAST

Mits, Inc. has announced that they are touring the countryside exhibiting their Altair 8800 microcomputer in the Mits-Mobile van. The camper van is completely equipped with an Altair BASIC language system. Included is an Altair computer, Comter terminal, ASR-33 teletypewriter, Altair Line Printer, Altair Floppy Disc and BASIC language.

Individuals are invited to attend the free evening seminars. The seminars include demonstrations and exhibits and emphasize basic computer concepts, BASIC language programming, and technical aspects of the Altair 8800. There are question and answer sessions and time given to hands-on experience. A special Altair discount will be offered to attendees. Contact Mits for seminar schedules in your area.

WESCON 80 PER CENT SOLD

William C. Weber, recently named general manager of WESCON, said that 384 of the 480 exhibit units were assigned this week to 233 electronic firms. This is about 80% of the available display space.

The show will run four days in the Brooks Hall exposition arena in San Francisco, CA from Sept. 16-19, 1975. Professional program sessions will be presented concurrently in the adjoining Civic Auditorium.

This will be the 24th annual WESCON in California. WESCON is a non-profit activity, sponsored by the Los Angeles Council and San Francisco Bay Area Council of IEEE and the Northern and Southern California Chapters of the Electronic Representatives Association.

SIX VOLUME μ C COURSE AVAILABLE

Iasis Inc. has announced a unique concept in microcomputer education in the form of programmed self-teaching texts. The firm has completed work on an exhaustive six volume course that contains more than 700 pages

of detailed, illustrated microcomputer information, including several programming and design aids and more than 1,700 self-tests.

The six volumes are Binary Arithmetic; Microcomputer Architecture; The 4-Bit Microcomputer; The 8-Bit Microcomputer; Assemblers and Prototyping Systems; and 8-Bit Assemblers and Compilers.

The entire set of texts is priced at \$124.50 but orders submitted before June 30, 1975 receive the special discounted price of \$99.50. BankAmericard or Master Charge can be used.

(Editor's Note: MICROCOMPUTER DIGEST will review the Iasis text set and feature the results in our Book Review section when completed.)

RECENT LITERATURE

"Exposing The Black Art Of Microprocessor Benchmarking"

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

EDN presents an excellent discussion of benchmark testing for evaluating microcomputer performance. Robert Cushman dissects five benchmarks developed by AH Systems, Inc. for his analysis. He examines the strengths and weaknesses of each test to provide readers with insights for developing their own benchmark programs. The article concludes that there can be no industry standard benchmark programs. Each user needs to compare microprocessors using his own custom set of benchmarks directed specifically to his own application.

"Motor Control By PPL Can Be Achieved With A Microprocessor"

Howard A. Raphael, Intel Corp.
Electronic Design April 26, 1975

A good discussion of motor controlling where software is used to replace the phase detector and the CPU clock provides the accurate timing. An example is discussed where the 4040 is used in a closed-loop system driving a small motor with an optical tachometer as the feedback. Error correction is also briefly discussed.

(cont'd next page)

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"Speed Microcomputer Multiplication"
Herman Schmid, General Electric Co.
Electronic Design 9 April 26, 1975

In real-time applications, microcomputers may take too long to perform simple arithmetic multiplication. Hence the author suggests using either external circuitry to complement the CPU or separate, peripheral multipliers to overcome the speed limitations. The complementary circuit approach requires that the microprocessor be microprogrammable and have an externally accessible control bus. The required circuitry will, of course, be different for each micro. In his paper, Schmid details his design experience using National Semiconductor's IMP-16C microprocessor.

"Benefits Of Localized Control With uC"
Arthur D. Harmala, PCS
Computer Design May 1975

The cost and installation advantage of localized control using microcomputers is the main subject of this article. By example, the author shows how a process control system requiring 1100 and 3300 monitoring points can save 60.2% and 76.2%, respectively. This savings is primarily the result of fewer terminals, fewer cables and faster installation times. Several other examples are presented illustrating localized microcomputer control. A must article for those involved with digital control and automation systems.

"Explore Microcomputer I/O Capabilities"
Andre G. Vacroux, Bell Labs
Electronic Design May 20, 1975

This article reviews elementary concepts of I/O device servicing by a central processor and provides examples of microprocessors which lend themselves to different I/O handling techniques.

The article surveys the capabilities and constraints implied by I/O bus structures, the availability of interrupt lines, and device addressing capabilities. The latter is shown to be constrained by the I/O instruction format.

The article highlights the need for system analysis, in terms of acceptable response time, data transfer rate, device priorities, and non-I/O processor tasks, as part of microprocessor selection for a particular application.

"Microprocessor Field Survey and Data Book"
A H Systems Staff

The first quarter's update of the A H System's Microprocessor Field Survey and Data Book includes data sheets on 23 different products from 21 manufacturers. The data sheet format itself has been redesigned and significantly expanded. The architecture section of the data sheet now provides a reasonably complete picture of a processor's organization and capabilities. Of the nine newly reviewed microprocessors, four are 16-bit devices, three are 8-bit and two are 4-bit machines.

"Markets For Computer Memories"
Reference Report #292
Frost & Sullivan

The market for memory systems will climb from \$415 million in 1974 to \$525 million in 1975 and to \$1 billion by 1983. Add-on memories for mainframe computers will account for most of the growth, but the core and semiconductor memory component markets will soar from \$478 million in 1974 to \$851 million by 1978 and to \$1.2 billion by 1983.

From virtually no sales base at all three years ago, microcomputer revenues will tally \$500 million by 1978 and \$1 billion by 1982. The study also notes that the memories for this market will greatly exceed the value of the microcomputers themselves.

"Microprocessor Benchmarks: How Well Does The uP Move Data?"
Robert Cushman, Special Features Editor
EDN May 20, 1975

This is EDN's second benchmark article and explores the uP's ability to move blocks of data. Robert Cushman explains A H System's test in a step-by-step analysis comparing both the Signetics 2650 and Motorola M6800 performances. The program basically initializes then executes a loop to move data through the CPU to a new memory location.

The 2650 used the fewest instructions, four, as its all-in-one instructions automatically performed all loop housekeeping.

The M6800 was tested twice, first to move data within a 256-byte page and then to move data from one page to another using the stack pointer. The M6800 performed both tests faster than the 2650 (21 us and 19 us, respectively) but used more instructions.



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EDUCATION:

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

July

- 1 PROM Programming--A Systems Approach
Free San Jose, CA Data I/O Corp.
- 1- 3 F8 Microcomputer Course \$125 Dayton,
OH Fairchild Semiconductor
- 1- 3 M6800 Microprocessor Course \$430
Detroit, MI Motorola, Inc.
- 1- 4 ICS International Microcomputer Educa-
tional Congress \$175-\$425 Munich,
Germany Integrated Computer Systems
- 7-10 ICS International Microcomputer Educa-
tional Congress \$175-\$425 San Diego,
CA Integrated Computer Systems
- 7-11 Microcomputer Series Training Course
\$375 Maynard, MA Digital Equipment
Corp.
- 8-10 M6800 Microprocessor Course \$430
North New Jersey Area Motorola, Inc.
- 9 How To Profit From Microprocessors
\$35 Palo Alto, CA Pro-Log Corp.
- 14-16 MCS-8080 Microcomputer Workshop \$350
Santa Clara, CA and Boston, MA Intel
- 14-17 Advanced Programming \$395 Miami, FL
National Semiconductor
- 14-17 Microprocessor Fundamentals \$395
Dallas, TX National Semiconductor
- 14-18 Microprocessor Approach To System De-
sign \$375 Los Angeles, CA Univer-
sity of California at Los Angeles
- 14-18 Microprocessors--Hardware, Software,
Applications \$395-\$445 Palo Alto,
CA Opto-Logic Corp.
- 14-18 Mini and Micro Computers: Their Appli-
cations and Use \$425 University of
California at Berkeley
- 15-17 M6800 Microprocessor Course \$375
Phoenix, AZ Motorola, Inc.

- 15-18 ICS International Microcomputer Educa-
tional Congress \$175-\$425 Boston,
MA Integrated Computer Systems
- 17-19 PL/M Microcomputer Workshop \$350
Santa Clara, CA and Boston, MA Intel
- 21-23 MCS4/4040 Microcomputer Workshop \$350
Santa Clara, CA and Boston, MA Intel
- 21-24 IMP-16 PACE Applications \$395 Dal-
las, TX National Semiconductor
- 21-24 Microprogramming \$395 Miami, FL
National Semiconductor
- 22-24 M6800 Microprocessor Course \$430
Charlottesville, VA Motorola, Inc.
- 22-25 ICS International Microcomputer Educa-
tional Congress \$175-\$425 Dallas,
TX Integrated Computer Systems
- 28-31 Advanced Programming \$395 Dallas,
TX National Semiconductor
- 28-31 Microprocessor Fundamentals \$395
Santa Clara, CA National Semiconduc-
tor
- 28- 1 Microcomputer Systems Design I: Hard-
ware, Software & Applications \$360
Los Angeles, CA University of South-
ern California
- 28- 1 Mini and Microcomputers: Their Struc-
tures, Characteristics and Applica-
tions \$300 Ann Arbor, MI Univer-
sity of Michigan
- 29-31 F8 Microcomputer Course \$125 Dallas,
TX Fairchild Semiconductor
- 29-31 Microcomputer Design Course \$300
Palo Alto, CA Pro-Log Corp.
- 29-31 M6800 Microprocessor Course \$430
Los Angeles, CA Motorola, Inc.

August

- 1 PROM Programming--A Systems Approach
Free San Jose, CA Data I/O Corp.
- 4- 7 IMP-16 PACE Applications \$395 Santa
Clara, CA National Semiconductor
- 4- 8 Advanced Computer Memory Technology
\$345 Los Angeles, CA University of
Southern California



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August

- 4- 8 Computer Architecture and Organization \$345 Los Angeles, CA University of Southern California
- 4- 8 Microcomputer Systems Design II: Applications, Programming & Implementation--Through Actual Experience \$375 Los Angeles, CA University of Southern California
- 5- 7 M6800 Microprocessor Course \$430 Rochester, NY Motorola, Inc.
- 5- 8 ICS International Microcomputer Educational Congress \$175-\$425 Philadelphia, PA Integrated Computer Systems
- 11-13 MCS-8080 Microcomputer Workshop \$350 Santa Clara, CA and Boston, MA Intel
- 11-13 Microprogramming: Concepts, Trends and Applications \$320 Washington, D.C. George Washington University
- 11-14 Advanced Programming \$395 Santa Clara, CA National Semiconductor
- 11-14 Microprocessor Fundamentals \$395 Santa Clara, CA National Semiconductor
- 11-15 Applications of Microprocessors and Digital Techniques to the Design of Control and Information Processing Systems \$345 Los Angeles, CA University of Southern California
- 11-15 Microprocessors--Hardware, Software, Applications \$445 Newport Beach, CA Opto-Logic Corp.
- 12-14 M6800 Microprocessor Course \$430 Tulsa, OK Motorola, Inc.
- 14-16 PL/M Microcomputer Workshop \$350 Santa Clara, CA and Boston, MA Intel
- 18-20 MCS4/4040 Microcomputer Workshop \$350 Santa Clara, CA and Boston, MA Intel
- 18-21 IMP-16 PACE Applications \$395 Miami, FL National Semiconductor
- 18-22 Microcomputer Series Training Course \$375 Maynard, MA Digital Equipment Corp.
- 19-21 M6800 Microprocessor Course \$430 Washington/Baltimore Area Motorola

- 25-28 Advanced Programming \$395 Miami, FL National Semiconductor
- 26-28 M6800 Microprocessor Course \$375 Phoenix, AZ Motorola, Inc.
- 26-28 2nd USA-Japan Computer Conference Tokyo, Japan AFIPS

September

- 8- 9 MCS-8080 Microcomputer Workshop \$350 Santa Clara, CA and Boston, MA Intel
- 9-11 M6800 Microprocessor Course \$430 Wichita, KS Motorola, 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.
- 15-17 MCS4/4040 Microcomputer Workshop \$350 Santa Clara, CA and Boston, MA Intel
- 16-18 M6800 Microprocessor Course \$430 Dayton, OH Motorola, Inc.
- 23-26 ICS International Microcomputer Educational Congress \$175-\$425 Paris, France Integrated Computer Systems

SPONSORING ORGANIZATIONS AND CONTACTS

- AFIPS, 210 Summit Ave., Montvale, NJ 07645 (201) 391-9810
- Data I/O Corp., 1376 N. 4th St., San Jose, CA 95112 (408) 287-8755
- Digital Equipment Corp., Educational Services Group, Maynard, MA 01754 (617) 897-5111
- Fairchild Semiconductor, Microcomputer Training Labs, 770 Welch Rd., Suite 154, Palo Alto, CA 94304 (415) 327-2110
- George Washington University, Continuing Engineering Education, Washington, D.C. 20052 (202) 676-6106
- 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
- Microcomputer Associates Inc., 10440 N. Tantau Ave., Cupertino, CA 95014 (408) 247-8940



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Motorola M6800 Course, Ron Bishop, BB102,
P. O. Box 2953, Phoenix, AZ 85062 (602)
962-2345

National Semiconductor Corp., 2900 Semicon-
ductor Dr., Santa Clara, CA 95051 (408)
732-5000

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

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

University of California at Los Angeles Ex-
tension, 10995 Le Conte Ave., Los Angeles,
CA 90024 (213) 825-3344

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

University of Southern California, Continu-
ing Engineering Education, Powell Hall 212,
University Park, Los Angeles, CA 90007
(213) 746-6708

FINANCIAL:

EARNINGS

<u>Fairchild</u>	<u>1975</u>	<u>1974</u>	<u>%</u>
Mar. 30			
Share Earnings	\$.62	\$1.97	-68.5
Earnings	3,255K	10,412K	-68.7
Sales	71,728K	108,695K	-34
<u>Western Digital</u>	<u>1975</u>	<u>1974</u>	<u>%</u>
Mar. 31			
Share Earnings	\$.00	\$.17	---
Earnings	-752K	230K	-426.8
Sales	2,844K	2,923K	-2.7
9 Months			
Share Earnings	\$.00	\$.85	---
Earnings	-1,458K	1,147K	-122.7
Sales	8,399K	8,216K	+2.2

1976 μ C MARKET TO REACH \$120 MILLION

In an exclusive interview with the English electronic newspaper, Electronics Weekly, Harvey Cragon, Texas Instrument's microprocessor strategy manager, pegged the 1976 microcomputer and memory market to hit \$120 million. Cragon said that TI defines microprocessors as one of the top three significant areas for multi-million dollar development. The major area for this expansion would come in the consumer market, especially in home appliances and automobiles. Cragon also believes the European interest in microcomputers is just as intense as the U.S.

SHUGART & NATIONAL IN DISC DEAL

National Semiconductor has signed an agreement with Shugart Associates for \$2 million of floppy discs. The discs will be used in National's new line of IMP-16 microprocessor Disc Operation Systems (MDOS--see MICROCOMPUTER DIGEST, Feb. 1975).

Shugart will begin deliveries immediately on the dual-drive disc systems that have a capacity in excess of 5 mega-bits of storage for system software and application programs.

CA SLASH MEMORY & μ P PRICES

With the recent incorporation of 1K, 4K and 8K MOS RAM memories, Computer Automation has announced reduced prices of 20-35% for their Naked Milli and LSI microcomputers.

The Naked Milli with 1K x 16 RAM is now selling for \$489, a 4K system is priced at \$616 and an 8K configuration for \$941. 4K and 8K versions of the LSI-11 microcomputers have been reduced to \$1,679 and \$2,036, respectively.

All prices are based on OEM quantities of 100. Computer Automation said the reductions were not across-the-board reductions on all their products, but only reflected lower RAM costs from suppliers and the switch from core to semiconductor memories in the LSI-11 microcomputer.

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COMPANY ADDRESSES FOR THIS ISSUE:

A H Systems, Inc., 9710 Cozycroft Ave., Chatsworth, CA 91311 (213) 998-0223

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American Microsystems Inc., 3800 Homestead Rd., Santa Clara, CA 95051 (408) 246-0330

Applied Computing Technology, 17815 Sky Park Circle, Irvine, CA 92664 (714) 549-3123

Applied Data Communications, 1509 E. McFadden Ave., Santa Ana, CA 92705 (714) 547-6954

Bell & Howell, 360 Sierra Madre Villa, Pasadena, CA 91109 (213) 796-9381

Bourns, Inc., 1200 Columbia Ave., Riverside, CA 92500 (714) 684-1700

Cambridge Memories, 285 Newton Ville Ave., Newtonville, MA 02160 (617) 271-6503

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Mits, Inc., 6328 Linn N.E., Albuquerque, NM 87108 (505) 265-7553

Monolithic Systems Corp., 14 Inverness Dr. E., Englewood, CO 80110 (303) 761-2275

Mostek Corp., 1215 W. Crosby Rd., Carrollton, TX 75006 (214) 242-0444

Motorola Semiconductor, P. O. Box 2953, Phoenix, AZ 85062 (602) 244-4826

National Semiconductor Corp., 2900 Semiconductor Dr., Santa Clara, CA 95051 (408) 732-5000

PATCA, 2680 Bayshore Frontage Rd., Suite 411, Mountain View, CA 94043 (415) 961-1155

PCS, G-4025 S. Center Rd., Flint, MI 48507 (313) 744-0225

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

Pulsecom, Division of Harvey Hubbell, Inc., 5714 Columbia Pike, Falls Church, VA 22041 (703) 820-0652

RCA Solid State Division, Box 3200, Route 2, Somerville, NJ 08876 (201) 722-3200

Rockwell International, 3370 Miraloma Ave., Anaheim, CA 92803 (213) 647-5000

Shugart Associates, 1030F E. Dwain Ave., Sunnyvale, CA 94086 (408) 738-2524

Signetics Corp., 811 East Arques Ave., Sunnyvale, CA 94086 (408) 739-7700

Synertek, 3050 Coronado Dr., Santa Clara, CA 95051 (408) 241-4300



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Texas Instruments, P. O. Box 5012, Dallas,
TX 75222 (214) 238-2011

Warner & Swasey Co., Comstar Division, 30300
Solon Industrial Pkwy., Solon, OH 44139
(216) 368-6200

Zeno Systems, Inc., Santa Monica, CA 90400

MICROCOMPUTER STUDIES AVAILABLE:

EDN Microprocessor Design Series \$6.95
Microprocessor Reprints, EDN Magazine, 221
Columbus Ave., Boston, MA 02116

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Microcomputer Digest \$28

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(214) 238-2011

Minicomputer & Microcomputer \$595
Industrial Market for Microcomputers \$445
Lucy Hendry, Frost & Sullivan, Inc., 106 Ful-
ton St., New York, NY 10038 (212) 223-1080

Programmed Learning Course on Microcomputers
\$99.50 Six volume set, Iasis Inc., 770
Welch Rd., Suite 154, Palo Alto, CA 94304
Bob Warr (408) 329-0110

EMPLOYMENT OPPORTUNITIES:

MOTOROLA SEMICONDUCTOR is looking for two individuals to fabricate new product definitions for new microprocessor families and application support for M6800. Should have hardware and software capability with marketing charisma and be willing to relocate to Austin, TX. Send resumes to Van Lewing, Motorola, P. O. Box 2953, Phoenix, AZ 85062

MICROCOMPUTER PRODUCTS/SERVICES:

STANDARD SET OF MICROCOMPUTER BUILDING BLOCKS consisting of CPU (8080 uP), RAM, EROM, I/O, Parallel I/O and Analog Input. Logical Services, Inc., 1901 Old Middlefield Way, Suite 17, Mountain View, CA 94043 (415) 965-8365

TYMSHARING SERVICES for Intel and Motorola uP. \$5 per hour for connect time; no royalties or CPU charges. 10¢ per sector/mo. storage chg. Guili Microprocessing Inc., Box 24186, San Jose, CA 95154 (408) 292-8058

MICROCOMPUTER DEVELOPMENT CENTER, Intellec 8/80, TTY, technical support. Sorrento Valley Group, 11339-K Sorrento Valley Rd., San Diego, CA 92121 (714) 452-0101

MICROCOMPUTER-BASED custom product development, hardware, software, production, publications available. Send for free price list. Microcomputer Associates Inc., 10440 N. Tantau Ave., Cupertino, CA 95014 (408) 247-8940

EUROMICRO--The European Association for Microprocessing, quarterly newsletter covering activities of interest in microprocessing. Annual membership \$7. Rodney Zaks, Chairman, Universite de Technologie Compiegne, BP233, 60206 Compiegne, France.

DOS DEVELOPMENT SYSTEM, Intellec 8/80, floppy disc, hardware error checks, interface kit, 12K RAM required, \$4250. Millennium Information Systems, 420 Mathew St., Santa Clara, CA 95050 (408) 243-6652

MICRO SYSTEMS SOFTWARE, 355 W. Olive #216, Sunnyvale, CA 94086 (408) 735-1650. George Fraine, Richard Ware. uP system support programs (assemblers, simulators, etc.). Engineering applications programming for uC.

RIGHTS AVAILABLE to general purpose system for debugging microprocessor-based hardware. Also product development service. Arthur D. Little, Inc., Acorn Park, Cambridge, MA 02140 (617) 864-5770 (X2361)

MICROCOMPUTER SOFTWARE, specializing in resident assemblers, high-level languages and applications for small uC systems. Sam Holland, 1114 Abby Wood Ct., Los Gatos, CA 95030 (408) 378-3460



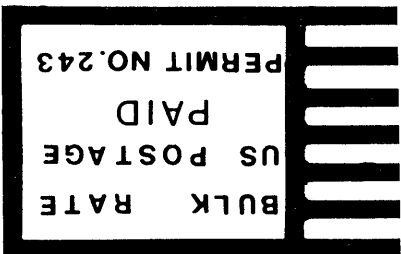
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Time Critical

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