MICROCOMPUTER DIGEST

MMI 300 Now Available

Monolithic Memories Inc. has incorporated their 4-bit expandable bipolar microcontroller, the 6701, into a general purpose microcomputer system. The system has a 16-bit word length and 16 accumulators and is supplied with interrupt, DMA and power restart logic. The MMI 300 is microprogrammed and operates at 300 ns per instruction cycle.

The microprogrammed instruction set emulates the minicomputers manufactured by Data General Corp. A facility for user expansion of the instruction set is provided which permits the use of PROMs for storing the microprogrammed instruction decoding logic. The MMI 300 can operate in direct, indexed, base page, and relative addressing modes, and can directly address up to 37K words of memory.

The system, available from MMI, is designed for applications in both military and industrail environments.

Inside This Issue

EM&M To Produce 16-Bit µC

Electronic Memories & Magnetics will be introducing a static 16-bit, NMOS microprocessor sometime in the third quarter this year. The processor is intended for the OEM market and is based on a mask from General Instrument and on software originally developed for Honeywell.

EM&M's first microprocessor entry is a result of an NMOS cross-licinsing agreement between EM&M and GI. General Instrument is also expected to announce that their CP 1600 will soon be available to the general public.

$300 Microcomputer Kit

Motorola is now offering a microcomputer design kit containing the M6800.microcomputer devices for $300 in quantities of one to four. Designated the MEK6800K1 Design Package, the kit consists of one MC6800 microprocessor, two MCM6810L1 1K RAMs, an MCM6830L7 8K ROM, two MC68201 peripheral interface adapters and one MC6850 asynchronous communications interface adapter.

The package also includes applications and programming manuals, module, support software and linear interface descriptions, a pocket programming card and additional reference literature.

Rockwell's New Exclusive Auto µC

In a move to spur the automotive engineer to consider the use of microprocessors in automobiles, Rockwell International is introducing a new two-chip microprocessor system designed for that application.

The two chips include a P-channel MOS 8-bit microprocessor (called a Programmable Automotive Controller--PAC) and a control ROM, both

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ROCKWELL'S NEW EXCLUSIVE AUTO μC

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operating at 9 volts. The first chip also contains data RAM, specialized I/O, an oscillator, the arithmetic and logical processor, an interface RAM, working registers, accumulator, and program counter and an analog-to-digital converter. The second chip is a 1024 x 10-bit control ROM. The A/D converter will digitize signals to PAC's 8-bit accuracy in about 10 ms and is unaffected by normal power supply variations.

Harold Howansky, manager of Rockewell's automotive product marketing, told MICROCOMPUTER DIGEST that the microprocessor can be used to control fuel injection, metering, spark timing, diagnostics, transmission control and cruise setting.

Rockwell supplies the automotive engineer with a keyboard-emulator-control module that allows him to develop software. The module also has a four-digit display for reading operating parameters of the engine and PROM addresses.

With the emulator, an automotive engineer can develop software that will direct the microprocessor in dedicated applications. An entire project can be completed in about 24 weeks.

According to Howansky, an automotive engineer can compile and emulate a program in six to eight weeks and modify and test it in two weeks. "We can build field test prototypes in two weeks and have them debugged and operational within twelve weeks. Field testing of 500 to 1000 parts can be completed in four to six additional weeks."

Howansky said all automobile manufacturers have working models of the system now, and

one major auto maker is expected to announce an application soon.

"What makes the microprocessor so unique," says Howansky, "is that it can be used with today's sensors." The chip's 70 command instruction set includes data curve look-up instructions for solving non-linear control functions by interpolation. The I/O sections handle discrete signals, variable frequencies and digital pulses. Seven separate analog input channels accept voltage signals from 1.8 to 5.7 volts.

The microprocessor is slow, but it can easily handle the engine speed. PAC can perform each new calculation in 10 to 12 ms and asynchronous control signals are available at 3.6 us intervals.

COMPCON SPRING NETS OVER 600 ATTENDEES

Over 600 attendees convened at the Jack Tar Hotel in San Francisco for the tenth annual COMPCON Spring 75. Microcomputers dominated the scene as more than twenty speakers presented papers in six different sessions on the subject. Three forum type sessions were also held to answer user's questions.

Lowell D. Amdahl, general chairman of the tenth IEEE Computer Society International Conference and president of Compata, Inc., said he was quite pleased with the turnout. He felt this conference had more than provided industry with timely and useful computer information.

A one day tutorial, "Microcomputer Hardware" preceeded the conference. The tutorial was organized by Ted Laliotis of the program committee and was presented by Dave Hodges and Dennis Allison.

In Session 4, W. D. Drumheller and L. S. Schmitz of Westinghouse Security Systems, Inc. and Westinghouse R&D, respectively, presented the paper "Security Communications Custom Microprocessor System." They discussed Westinghouse's microprocessor communications control device that functions as a part of a residential emergency system to control the flow of information over switched telephone networks. The programming language, microprocessor architecture and system operation were discussed in detail.

Howard A. Raphael of Intel Corp. discussed

the ecomonies, design and capabilities afforded by using the Intel MCS-40 in a Distributed Intelligence Microcomputer System (DIMS).

Allen Baum and Don Senzig of Hewlett-Packard Laboratories described four modules and an interconnection protocol used to form a multiple-bus, multiple-processor microcomputing system.

Copies of the tutorial and the papers presented at COMPCON Spring 75 can be obtained by writing to IEEE Computer Society, 5855 Naples Plaza, Suite 301, 1261 Lincoln Ave., Long Beach, CA 90803

H/A OFFERING BASIC MOTOROLA KIT

John Cole of Hamilton/Avnet·in Culver City, CA reports that Hamilton is now offering an illustrative 500 page book of the most famous paintings of Leonardo Da Vinci with each basic Motorola MPU Design Kit order.

Each kit includes an MC6800 microprocessor, two PIA's, two 128 x 8 RAMs, an ACIA chip and one modem chip. Kit price is $300.

Cole also noted that Hamilton/Avnet will begin setting up their nationwide network of microcomputer centers this month. The centers will be designed to demonstrate microcomputer system capabilities for both hardware and software for the various manufacturer types. The centers will not be used as education sites for enrolled students, but as demonstration centers to familiarize and show customers how the various microcomputer systems operate.

TECHNOLOGY:

COMSTAR DEVELOPS INHOUSE µC CHIPS

A new series of 8-bit bipolar microcomputers were introduced at the Cleveland Electronics Conference by the Comstar Microcomputers Group of the Warner & Swasey Company. The new 8-bit bipolar microcomputer series, known as the Comstar System 8 (CS-8) Series is based on the proprietary bipolar design, incorporating LSI components into microprogrammed control logic driven by a single phase clock.

Warner & Swasey designed their own chip sets since they felt that the currently avail-

able selection of microprocessors were not fast enough to provide the capabilities their market demanded. The series includes four 8-bit central processor modules—the M-8A, M-8B, M-8C and M-8D. The first three, differing in their microprogrammed instruction sets, are single-card modules with a 250 ns microcycle time and are priced under $300 in OEM quantities.

The M-8A and M-8B feature a 106 instruction set, including multiply and divide. The M-8C is microprogrammed to be software compatible with the Intel 8080. The M-8D is a three-card module which operates at a 125 ns microcycle time and features a 110 instruction set including multiply, divide, overflow and floating point arithmetics.

All four central processor modules include a full logical instruction set and powerful bit manipulation instructions. A seven level priority interrupt multiprocessing system allows high speed interrupt processing without the time customarily used for saving registers and storing status.

Each interrupt level incorporates three 16-bit index registers and eight 8-bit general registers. Additional features include a common bus organization which allows asynchronous interface to various speed memories including a multiport memory which can interface with up to eight processor modules.

The CS-8 is designed for industrial control applications and uses the same types of control modules and peripherals offered with the company's Comstar 4 microcomputers. Additional peripheral equipment includes displays, card and paper tape equipment, CRT's, magnetic tape and magnetic disc. A new 64K x 8 charge-coupled storage device is also available with the system.

A configuration including a 250 ns microcycle central processor module which is software compatible with the Intel 8080, 1K x 8 RAM, 2K x 8 PROM and a 32 channel input/output module, is priced at $835 in OEM quantities. Delivery is 90 days ARO.

TOKO ENTERS U.S. MARKET

Toko Inc. has reportedly shipped six new microcomputers to an American firm for evaluation. Sources would not identify the American company, but did say that the microcomputer, Model Tokom 80, is an 8-bit microprocessor with plated-wire memory modules.

The Japanese firm now markets their 1K and 4K semiconductor memories in the U.S.

MICROCOMPUTER-BASED PRODUCTS:

RUGGEDIZED 8080 MICROPROCESSOR

Applied Systems Corp. has announced their new ASC Ruggedized 8080 MicroProcessor System, now being offered for custom implementation in real-time computing applications. Designed for severe environments, the system is designed around the Intel 8080 microcomputer and configured for on-line computer control functions that are expandable to communications or data acquisition operations as an integral system.

Incorporating field re-programmable PROM and compatible RAM, the ASC system was constructed for extended reliability in severe environments. The MicroProcessor System has been ruggedized to withstand vibration, shock, EMI/RFI, humidity and temperature extremes beyond the capabilities of commercial computers. The Rugged 8080 is packaged in a standard ATR enclosure of 7-5/8" x 10-1/8" x 16" dimensions or an optional one-half ATR unit only 5" wide.

A complete configuration would include the system CPU, peripheral I/O adapters, control panel, AC or DC power supplies, and up to 16K words of RAM and PROM memory. Standard I/O modules permit installation of A/D and D/A converters, multiplexers, digital expanders, serial data communications and modem interfaces within the system enclosure. The I/O modules can include A/D converters with up to 14-bits precision, analog multiplexers for up to 256 inputs, digital expanders for up to 2048 lines, and asynchronous or synchronous serial data adapters offering up to 240K baud communications rates.

The system is supported by an available program library, and provides complete compatibility with Intel's 8080 processor components and system software for prototype development.

Complete technical support is offered for the ASC Rugged 8080 MicroProcessor including

application engineering, system documentation, customer education and maintenance services with special development and prototype capabilities available for custom production requirements.

4-Bit Industrial Control Microcomputer

The Comstar Microcomputers Group of the Warner & Swasey Company has unveiled a new 4-bit industrial microcomputer system, the Comstar System 4A, built around the Intel 4040 microprocessor chip.

The Comstar 4A is functionally and electrically compatible with the company's Comstar System 4, of which 1,000 units have already been installed. The 4A features 60 instructions, automatic interrupt processing, single-step operation, crystal controlled clock and subroutine nesting to seven levels.

The system is offered with a new interrupt control module which provides eight channels of photo isolated interrupts and four channels of TTL priority interrupts, a switch selectable real time interrupt, power fail detect, auto restart and watchdog timer. The System 4A also features a new portable front panel analyzer which provides on-line control and program diagnostic capability.

Like its predecessor, the Comstar System 4, the 4A is designed for industrial microcomputer control applications. Thus it interconnects via a data/control bus to RAM and PROM modules and Comstar System 4 interface modules and peripherals, which include: digital I/O modules; power switching I/O modules; analog inputs and outputs; communications interface modules; special interface modules with timers and counters; displays, card and paper tape equipment, CRT's, magnetic disc.

The Comstar 4A Central Processor Module is priced at $260 in OEM quantities. A system including a central processor, 1K x 8 PROM, 1.28K RAM and a 32 channel digital I/O module is priced at $790 in OEM quantities. Delivery is 90 days ARO.

µC Joins Fight Against Air Pollution

Electrolabs, Inc., has announced development of a microcomputer system for control-

ling air pollution equipment in coal-burning power generating plants. Developed under contract from Industrial Clear Air (ICA) Inc., the Electrolabs innovation provides a timed-sequence control of 180 dampers plus several fans and heaters, all of which are housed in a four-story building called a "baghouse."

The baghouse, which derives its name from the fabric filter bags used, resembles a giant vacuum cleaner. Under microcomputer control, the baghouse treats noxious coal fumes at 450°F by systematically passing the fumes and vaporized sulphur through a series of filtering stages. The microcomputer control of dampers, fans and heaters is said to result in 99.9% efficient filtration.

The microcomputer system is designed to operate around the clock in a severe electrical environment. More than 60 inputs and some 200 outputs, all optically coupled, are fed into and out of the microcomputer via advanced multiplexing techniques. Some of the outputs are used to provide recording and display of all critical functions. The system, which uses the Pro-Log PLS-402 microcomputer and 6K bits of PROM, is destined to be used by a major power authority in the mid-west to generate power by burning expensive low-grade fuel, and without polluting the air.

8080 Digital Oscilloscope

Norland Instruments has introduced a new digital oscilloscope that utilizes an Intel 8080 8-bit microprocessor.

Dr. Fred Rose, president of Norland Instruments, in describing the instrument, said, "The NI 2001 provides 90% of the instrumentation needs required in many laboratories. It is the first instrument to fully utilize the microprocessor's capabilities for programming and control." The oscilloscope allows users to perform complex data manipulations quickly and accurately without interfacing to a minicomputer or programmable calculator.

The NI 2001 requires no computer instructions or programming experience. Pre-programmed "fixed function" buttons on the keyboard perform exact calculations of rise

times, integrals, differentials, peak areas, RMS values, peak-to-peak measurements, n-point averaging, frequency and square root.

Plug-in data acquisition units are equipped with controls similar to those of a standard oscilloscope and provide a CRT display of signals and alphanumerics and high speed real-time data storage. It has an interactive keyboard for calculating, converting units and programming for automatic processing of repetitive signal data. Options are available to permit output of an analog signal (through a D/A converter) or any of several digital control pulses.

The NI 2001 provides a 4K x 12-bit data memory, 900 ns RAM and a program memory of 200 keystrokes. It provides for two plug-ins for up to four channels of data with 8-, 10- or 12-bit resolution at a sample rate up to 1 MHz. Either signal acquisition plug-ins or calculating plug-ins can be used. The CPU incorporates an Intel 8080 microprocessor and up to 16K bytes of ROM and 2K bytes of RAM. The range of sample intervals is 1 us to 1000 seconds, internal; 1.2 us to infinity, external. The unit utilizes two cursors which can be moved either manually or under program control. Horizontal and vertical expansion, in powers of 2 up to 2^7 is available on one cursor.

Production units will be available for delivery approximately May 31, pricing starts at $8500.

MICROCOMPUTER BUILDING BLOCKS

A standard set of six microcomputer building blocks on compatible printed circuit cards is now available from Logical Services Inc. These modules together with their standard software drivers are available individually or assembled together as a microcomputer.

The 9300 CPU module features an 8080 microprocessor expanded to 85 instructions, 2 MHz crystal clock; three-state TTL drivers and receivers; seven breakpoint signals; NO OP insertion permitting 400 KHz pseudo DMA, selective skips, etc.; LED indicators for WAIT, HALT, and INTE, and a master reset switch.

Featuring up to 4096 bytes of RAM per module, the 9310 RAM module is available in 1024

byte increments. The 9320 EROM module has a total of 4096 bytes available in 1702A type erasable ROMs in 256 byte increments.

The 9330 serial I/O Module includes a standard 20 mA TTY current loop interface with UART; ASCII format or programmable bit/character, stop bits, parity; selectable data rates at 110, 300, 600, 1200, 2400, 4800 and 9600 baud. Other features include real time clock timebase generator, priority interrupt with programmable RESTART, programmable INTR masks for buffer empty, buffer full, and real time clock.

The 9340 Parallel I/O module consists of four 8-bit I/O ports in any I/O combination; four automatic handshake lines; priority interrupt with programmable RESTART; program maskable interrupt; and TTL interface levels.

The 9350 Analog Input Module features 16 analog inputs, 8-bit A/D converter, random or sequential addressing with manual override, and up to 100 KHz per channel sample rate.

In addition to these modules, Logical offers general purpose modules, power supplies, back planes, PROM programmers, system hardware and others. A standard software library is maintained that includes drivers for I/O modules, a system monitor, a standard subroutine library, and diagnostics for each module. Logical's microcomputer laboratory has access to worldwide timesharing services offering assembler, editor and simulator programs for popular microcomputer systems.

DATA LOGGER SCANS UP TO 1000 PTS/SEC

Doric Scientific Corp.'s new data logger, the Digitrend 220, uses an Intel 8008 microprocessor and will scan 20 to 1000 point/sec.

Standard range/functions offered are: four ranges of linear dc voltages with resolution to 1 uV and automatic ranging, with thermocouple compensation and two ranges of current transmitter inputs to handle process signals of 4-20 mA and 10-50 mA. Options include random access ports with parallel BCD output, nine interface cards, 7- or 9-track incremental magnetic tape recorders, TTYs and modems.

Prices begin at $4000 and delivery is within 60 days.

PORTABLE µP CHIP TESTER

A portable analyzer for testing 8008 microprocessor chips is now available from Pro-Log Corp. The M-821 unit can be used with any system which incorporates the Intel 8008 microprocessor.

An 18-pin DIP connector that clips onto the 8008 chip ties the M-821 into any 8008 system. The tester displays cycle data, chip status and time-status data. System tests can be performed in static, single-step mode or dynamic run mode. The step mode allows the program to be stepped through each memory cycle while the run mode captures and displays data without interfering with the program.

The M-821 operates on standard 115 V ac current and automatically references the most positive supply of the 8008. Price is $550 with immediate delivery.

µC MONITOR/EMULATOR TERMINAL

A programmable data monitor/emulator terminal, the CMT-101, uses a microprocessor with programmed control to provide the necessary functions to find errors in telecommunications protocol, format, system programming and response times.

When used as a data link monitor, the system, built by Digitech Data Industries, Inc., provides a real-time video display of all control and text characters appearing on the data channel. When used as a CPU emulator, the terminal transmits all control and text character sequences in the proper protocol to test terminals. The CMT-101 can be used alternately to emulate a terminal to exercise the CPU, front-end processor and system software.

MICROCOMPUTER-BASED FORMATTER

Hewlett-Packard has introduced Model 7905A, a new moving-head cartridge disc drive that is rack-mountable and is only 10-1/2" high including power supply. Its associates microcomputer-based formatter, HP Model 13037, offers a simplified interface to the CPU of any processor and includes error correction, multi-access from as many as eight CPU's and automatic macro I/O operations for reducing overhead in the central processor.

The 7905A Disc Drive and the 13037 Controller are being offered together as an OEM product, called DISCU/15. The U.S. price in OEM quantities is less than $8400. First deliveries are expected later this month and the new subsystems will be incorporated by mid-1975 into HP computer systems of both the 21MX and 3000 series.

REI TO LEASE SANDER'S LINE

The Products Division of Sanders Associates, Inc. has announced a new lease and lease/purchase program for its complete line of digital data sets, including Sanders' 8171 and two microcomputer terminal systems.

Rental Electronics, Inc. will handle the leasing of the complete line of Sanders all-digital modems for both private and leased line as well as switched voice networks. Standard leases for the modems are for 12, 24 and 36 month periods with a lease/purchase program.

MEMORIES AND PERIPHERALS:

TESTER DEBUGS µC WITHIN SYSTEMS

Arthur D. Little has developed a proprietary system for testing and debugging prototype products containing microprocessors. The system can be easily adapted for most microprocessor chips, and includes several unusual features.

The system, designated MDS (Microprocessor-based product Development System), can perform real time tracing of the prototype under test. Each bus operation of the prototype is stored in high-speed RAM for later retrieval by an internal processor. This feature allows uninterrupted real time operation of the prototype while providing information to the operator on as many as 256 prototype microprocessor bus operations.

Once the desired prototype operations are recorded, the MDS automatically prints or displays data on a CRT. Thus it is possible to review the actual operation of a program, after the fact, even if it were executed only once. In addition to the trace capability,

the MDS can control the operation of a proto-type via instructions such as freeze, step, write prototype RAM, read prototype RAM and execute. All interaction between the opera-tor and the MDS is via a teletypewriter or CRT terminal. A small customized interface board is used to adapt the MDS to the proto-type under test. Little hardware or software is required inside the prototype to accommo-date the MDS interconnection.

The MDS differs from the hardware develop-ment aids available from the microprocessor manufacturers in several ways. The principal difference is that it is used to monitor and analyze bus activity of the prototype hard-ware operation whereas conventional develop-ment systems monitor its instruction execu-tion. This system was developed by ADL for use in product development programs for clients and will be offered as a product in the future.

.5¢/Bit Isoplanar PROM

Fairchild's Integrated Circuits Group has announced a new bipolar PROM with a projected price of less than a half-cent per bit in volume quantities.

The new 2048-bit TTL PROM incorporates two technological firsts, according to Wil-liam D. Baker, general manager of the com-pany's Bipolar Memory Division. It is the first device to utilize both Isoplanar pro-cessing and Schottky technology on the same chip, as well as to combine these structures with fuse-link technology. Typical read cy-cle for the devices is 30 ns.

The PROM can be used as a direct plug-in replacement for standard 1024-bit PROMs by changing one pin from chip select to address.

Fairchild is now delivering production quantities of the 2048-bit PROM from factory stock. Price in 100-999 quantities for the commercial range device is $20.48 and is $51.50 for the full military range device.

GMI Offers μC Timeshare System

A new timesharing service specifically oriented for microcomputer users is being offered by Giuli Microprocessing Inc. Robert M. Giuli, president, told MICROCOMPUTER DI-GEST that the inhouse timeshare service

supports cross assemblers for the Intel 4004, 4040, 8008 and 8080 microcomputers as well as the recently delivered Motorola 6800.

The firm developed the system in an effort to avoid expensive monthly timeshare bill-ings. The system, based on a BTI-3000, sup-ports a library of scientific programs writ-ten in BASIC. Users may also write programs written in EXTENDED BASIC for general use. Cost of the service is only $5 per hour of connect time with no royalty or CPU charges. The storage charge is 10 cents per sector per month. Competitive timesharing services may run as high as $35/hour. Giuli said the low cost was possible because of extremely low overhead.

MicroDos Aimed At Development Market

Jacquard Systems has introduced a new disc-based microcomputer software development system. Called MicroDos, the system will aid users in software development for National, Intel and several other microcomputers. The system can also be used for general applica-tions when not in use for software development.

Programs are written in BASIC and system configurations include an integrated video display, typewriter keyboard, two flexible discs, a line printer, 32K bytes of core mem-ory, assembler, source file editor, program loader, file manager, microprocessor utility programs, and microprocessor simulator. The entire system leases for $500 per month.

Free Library Access For Contributors

A free 12-month membership to its micro-computer user library is now being offered by Intel Corp. to anyone who contributes a qualified program. Regular subscriptions are $100. Presently included in the library are over 55 programs, subroutines and macros for the 4004, 4040, 8008 and 8080 Intel mi-crocomputers.

Intel will also be awarding a Microma digital watch each week thru July 1 to the submitter of the best program to the library. Submitted programs will be made available to all members of the library. Interested per-sons should contact Jean M. McKenzie at (408) 246-7501.

National Announces New Memory System

Two dynamic RAM systems have been announced by National Semiconductor Corp. David Martin, general manager of National's Memory Systems Group, said the MOSRAM II is intended for the mainframe memory storage market for small- to medium-scale computers. Features include tri-state outputs, low power requirements (less than 3W), optional byte control and optional common data bus.

The other system, the MOSRAM 104, directly replaces the Dataram Model DR 104 magnetic-core memory system and has a storage capacity of 16,384 words of 8-bits each.

The system is partitionable to 8,192 words for use in equipment designed for 8K x 8 core memories. The entire system draws less than 6W.

Prices begin at a little more than 0.33 cents per bit. OEM discounts are available. Small quantities are available from stock and large production orders can be filled in less than 30 days.

DL-8A Cross Assembler Available

Data Numerics has developed a cross-assembler runnable on a PDP-8 for its 8080-based DL-8A microcomputer. The PDP-8 computer converts the programs into machine code. Prior to running a cross-assembly, the PDP-8 Edit program can be used for linking the assembly language programs. This is to allow system programs to be written and debugged before they are designed into a specific application.

The cost of the cross-assembler is $250 and delivery time is within 4 days depending upon requirements.

Maintenance Console For Mighty Micro

Control Logic has introduced a new diagnostic tool for their Mighty Micro series of Intel processor-based microcomputers. The Stand-Alone Programmer Maintenance Console displays and provides for instruction simulation of the contents of its memory locations.

The unit can monitor outputs and simulate inputs for up to 16 I/O paths. Data words, CPU status and flags, and addresses can be displayed; controls are available for reset, run, halt, instruction step, and interrupt enable/disable. Hardware breakpoints may be triggered either upon initial calls to a selected address or after an instruction at that address has been executed some number of times (up to 255).

The console can provide data for the input ports via console switches that will be read into the microprocessor when the selected ports are addressed. To provide test and maintenance operations, an optional Maintenance Memory Module provides extra sockets for inserting up to four diagnostic and/or device simulation PROMs.

Floppy Disc Controller

Applied Data Communications has introduced a new floppy disc controller to interface the Intellec 8/80 microcomputer to a series 61 IBM compatible floppy disc system.

Configured as a single card to fit into a slot in the Intellec, the controller is connected to the rack-mounted floppy disc via flat cables. The disc system contains format electronics, fan, power supply and one or two drives (expandable to eight). An optional ROM to bootload the system from the floppy disc fits into a socket in the microcomputer and permits memory reload from the disc by entering one address into the microcomputer control panel switches. DOS-80 permits programs or files to be loaded or saved by file name as well as performing program assemblies on the disc.

Hi-Speed µC Paper Tape Reader

A high-speed paper tape reader for the Intellec 8/Mod 8 and 8/Mod 80 microcomputer development systems is available from the Intel Corp. The imm 8-90 transfers data 20 times faster than a standard TTY, tape reader. For example, an 8K byte program can be loaded into an Intellec memory in 1.5 minutes.

The imm 8-90 reader is completely software and hardware compatible with all Intellec 8 systems. The Intellec 8 resident monitor software includes a general-purpose tape reader driver that enables all system software to use the imm 8-90. The driver can be called by user-written application programs.

Also, the monitor provides dynamic I/O reconfiguration whenever peripherals are reassigned. All interface cables and documentation are included in the $975 price. Delivery is normally two weeks.

PEOPLE, LITERATURE AND EVENTS:

CALIFORNIA MICROCOMPUTER HOUSE FORMED

Floyd L. Nordin has announced the formation of his new company, Nordin Enterprises, Inc. which will offer microprocessor hardware/software consulting services along with prototyping services.

Nordin has spent the last three and a half years in direct microprocessor design and seminar teaching. This has capped a 13 year career in computer-related system design. Most recently, he was a senior consultant with Compata, Inc.

NEW ENGLISH 6800 SERVICE FIRM FORMED

A new English microprocessor consultant firm has opened its doors. The firm, Pelco Ltd., will provide educational courses for the Motorola MC6800 microprocessor and aid users in selecting the right microprocessor for a particular application. They will also offer debugging and system proving facilities.

The founder of the firm, Gordon Dale-Smith, was formerly manager of Motorola's Defense and Communications Division at Wembley. The new company will receive full technical backing from Motorola but there have been no financial arrangements. The new firm is based in Hove, near Brighton.

INTEL DOUBLES EUROPEAN STAFF

To provide adequate hardware and software support for their full line of microcomputers, Intel plans to nearly double its applications staff in Europe. The expansion program will provide at least one application engineer for each country in which Intel operates. According to Electronics Weekly, recruiting plans include the appointment of an applications manager in the UK and a further applications engineer both of whom will be based at Intel UK's Oxford office.

The increased support force will have local applications-evaluation facilities plus access to Intel's recently established and extensively equipped applications center in Parid, and will report to European applications manager, Guy de Bryne.

Commenting on the plans to EW, Intel's European director of marketing, Tom Lawrence, said, "We intend to make it as easy as possible for customers' engineers to become conversant with software techniques, particularly the use of high-level languages such as PL/M."

The program was decided upon due to the large number of customers responding to Intel's latest microcomputer market entries: the 4040, 8080 and 3000 bipolar microprocessors.

PEOPLE ON THE MOVE

JACK CARSTEN has left his post as MOS division manager at Texas Instruments to become Intel's new marketing vice president.

RALPH KAPLAN has been promoted to manager of Bipolar Memory Marketing for Signetics Corp.

GEORGE M. SENKO has been appointed to the position of director at AH Systems. The position includes responsibility for all AHS' programs and contracts throughout California.

PHILIP R. THOMAS has been appointed vice president of RCA's U.S. Solid State Division and HARRY WEISBER the new Solid State Division vice president for Europe.

DICK RIBAS has been promoted to manager, product sales for the Systems Technology Division of Fairchild Camera & Instrument Corp.

PAUL H. McNAMARA is Sanders Associates new national sales manager with responsibilities for all of Sanders' Data Systems sales operations in the U.S.

HASMUKH PATEL has joined National Semiconductor Corp. as product line marketing manager in the Microprocessor Group, reporting to Phil Roybal.

DON LARSON has resigned as general manager of WESCON after 19 years. He will be establishing a new firm which will specialize in trade show management and promotion, and in electronics marketing.

DR. RUSSELL J. ABBOTT has been named editor of AH System's Microprocessor Field Survey and Data Book.

RECENT LITERATURE

"Join Micros Into Intelligent Networks"
Howard A. Raphael, Intel Corp.
Electronic Design 5 March 1, 1975

An excellent discussion on the fundamentals of Distributed Intelligence Microprocessor Systems (DIMS). Topics include: how DIMS systems are configured; functions performed; comparisons to multiprocessing systems; detailed descriptions of two DIMS systems implemented with Intel's 4040 microcomputer; and shared memory configurations. Well written in tutorial form.

"Microprocessor Instruction Sets: The Vocabulary Of Programming"
Robert H. Cushman, Special Features Editor
EDN March 20, 1975

Bob Cushman has written an easy to understand, basic introduction to the concepts of programming microcomputers. The tutorial article is intentionally elementary, but manages, nonetheless, to take the reader from primitives to an understanding of a servo-controller example. Anyone interested in microprocessors will find this article extremely informative, especially hardware designers that are just coming face-to-face with their first microconster.

"Four-Chip Microprocessor Family Reduces System Parts Counts"
David Chung, Fairchild Semiconductor Corp.
Electronics March 6, 1975

A comprehensive description of Fairchild's F8 microprocessor and supporting chip family. The author functionally describes each chip and then outlines sample applications which include a traffic light controller and a credit verification terminal. Multiprocessing systems are also discussed.

"Programmable Logic Arrays: A Dormant Giant Awakening"
Staff
EDN March 5, 1975

Standard PLA's have been around for years, but very few people have fully explored their power and potential uses. To help evaluate the potential of the PLA in comparison to the ROM, EDM brought together leaders in the memory and computer field: Dale A. Mrazek, Man-

ager of Digital Systems Application for National Semiconductor Corp.; Dr. James Luisi, SOS Product Development at Rockwell International; Ken Gorman, Manager of Processor Development for Computer Automation; Joseph McDowell, Systems and Applications Manager at Monolithic Memories Inc.; and Glenn Oliver, Vice President of Engineering at Scientific Micro Systems. These knowledgeable gentlemen aided by another expert, Mr. Robert Lowry of Technology Marketing Inc., discuss the pros and cons of PLA's versus ROMs and microprocessors. Very interesting reading.

"Only Small Clever Programs Need Apply"
Douglas A. Cassell, Control Logic Inc.
Digital Design March 1975

A refreshing article that describes the microcomputer technology, capabilities and practical uses. The reader is first familiarized with the elements of microcomputer structures and design and then given a potpourri of applications illustrating potential useage. The author summarizes his views with "The most that we can say about microcomputers is that they are revolutionary. The least we can say is that they will have a significant impact on our lives, both as consumers and as designers. But the microcomputer is by no means a complete answer-- the devices and people that surround it represent the tougher problems."

"Guidelines For Point Plotting On CRT's With Mini And Microcomputers"
Aaron Fishman, Data Translation, Inc.
EDN March 5, 1975

This article concerns itself with design considerations for driving analog CRT's and methods for achieving optimum thruput and aesthetically pleasing pictures. The article covers the three basic types of CRT display (television raster, XY refresh and XY storage) currently used with mini and microcomputers. Each display type is explored in some detail while pointing out strengths and weaknesses.

"Test Schemes For Microprocessor Chips"
Albert C. L. Chiang, Macrodata Corp.
Computer Design April 1975

This article is a discussion of the four

general testing techniques of microprocessors which prevail today: computer simulation, signature testing, pattern recognition and pattern generation. The pros and cons of each test are discussed with particular attention given to pattern recognition and pattern generation techniques, since it is believed that the latter will be adopted by most end-users and vendors because of its low cost, if the burden of user microprogramming can be substantially relieved. The article will be of interest to those engaged in microprocessor manufacturing.

LSI Technology Market Report

AH Systems has just completed a new market analysis report on the "Markets For LSI Technology in Command, Control and Communications (C^3) Systems," using their data base on LSI technologies, microprocessors, memories and military systems. The report includes a summation of hundreds of interviews with key government and semiconductor research specialists, as well as an in-depth analysis of current technological advances in Integrated Injection Logic, Charged Coupled Devices and Silicon-On-Sapphire. The report is presently available for $345.

µC To Grow By 150 Fold This Decade

Some 150,000 minicomputers and 100,000 microcomputers were installed toward the end of 1974, and they will soar to 2 million minicomputer and 15 million microcomputer installations over the next decade, according to Frost & Sullivan, Inc., a market research firm.

According to the study, entitled "Markets for Minicomputers and Microcomputers", "the market is so large as to appear unbelievable." Moreover, "the technology eventually will have a similar impact on our lives as the electric motor has had."

Growth is virtually assured since prices are destined to decrease to as little as $2000 for a complete computer system by 1984. The market for mini/micro peripherals will parallel this growth, increasing from $525 million in 1974 to $690 million this year to $2.8 billion by 1984, a cumulative market of $115 billion over the next decade.

Already some 100 manufacturers produce miniperipherals, the report notes, but the microperipheral market is just getting underway. The very first company in the field for example, recently introduced a microcomputer-based tape reader, and plans to produce a full line of microperipherals.

Three major application areas, business data processing, industrial automation and data communications, constitute 70% to 80% of the mini/microcomputer market and this concentration is expected to remain a characteristic of the market into the 1980's. The process industries for example, will turn extensively to microcomputers for assembly line control, materials handling and machine tool control.

"Microprocessors used on automobiles and trucks to warn drivers of malfunctions are destined to become a reality in the late 1970's or early 80's," according to the report. The current delay is due to the relatively high cost of the sensors in a microprocessor system.

In accounting computers, Frost & Sullivan "anticipates a revolution" as the microcomputer and minicomputer re-enter this market. The study foresees microcomputer systems priced under $7000, displacing both traditional accounting machines and service bureaus, especially for payroll and accounts receivable. "Prices of microcomputer-based accounting systems will drop to $5000 for a complete turnkey system by 1980."

The report predicts "a blending of minicomputers and microcomputers into a virtually indistinguishable product line, with price becoming the main distinction. For now, microcomputers tend to differ from minicomputers by having smaller word size (from 4 to 16 bits, with 8 bits on average), slower memory cycle time (1/5 as fast), more limited instruction sets, about 30% less cost, about 70% less power consumption, and customized controls for specific applications.

The report forecasts a 50-50 division of the market between mini and microcomputer systems, and muses that "no one should expect a dull ten years." A big decision for manufacturers, for example, will be whether to enter the original equipment or end-user markets or both. Thus, a primary purpose of the study has been to assist manufacturers in making the decision.

EDUCATION:

MICROCOMPUTER COURSES, SEMINARS, CONFERENCES. Date, title, cost, location, sponsoring organization (addresses on page 15).

May

1　　PROM Programming--A Systems Approach Free　San Jose, CA　Data I/O Corp.

5- 8　IMP-16 PACE Applications　$395　Santa Clara, CA　National Semiconductor

5- 8　Microprocessor Fundamentals　$395 Miami, FL　National Semiconductor

5- 9　Microcomputer & Minicomputers　$395 Indianapolis, IN　Wintek, Inc.

5- 9　Microprocessors--Hardware, Software, Applications　$395-$445　Phoenix, AZ Opto-Logic Corp.

5-10　ICS International Microcomputer Educational Congress　$185-$325　Washington D.C.　Integrated Computer Systems

6- 8　Microprocessors and Systems Applications　$395　San Francisco, CA　Automata-Benwill Courses

6- 8　Microprocessor Design Course　$250 Los Angeles, CA　Pro-Log Corp.

10　　Annual Multi-Logic Engineering Symposium　San Francisco, CA　IEEE　Contact:　T. McGill, Stanford Research Institute

12-14　MCS-80 Microcomputer Workshop　$350 Santa Clara, CA and Boston, MA　Intel Corp.

12-15　Advanced Programming　$395　Santa Clara, CA　National Semiconductor

12-15　IMP-16 PACE Applications　$395　Miami, FL　National Semiconductor

13-15　Microprocessors and Systems Applications　$395　Los Angeles, CA　Automata-Benwill Courses

14-16　Microprocessor Design Course　$250 Washington, D.C.　Pro-Log Corp.

15-17　PL/M Microcomputer Workshop　$350 Santa Clara, CA and Boston, MA　Intel Corp.

19-21　MCS-40 Microcomputer Workshop　$350 Santa Clara, CA and Boston, MA　Intel Corp.

19-21　Microprocessor Design Course　$250 Lexington, MA　Pro-Log Corp.

19-22　Advanced Programming　$395　Miami, FL National Semiconductor

19-22　1975 National Computer Conference Anaheim, CA　AFIPS

20-22　Microprocessors and Systems Applications　$395　Boston, MA　Automata-Benwill Courses

20-22　SEMICON/West 75　$3　San Mateo, CA Golden Gate Enterprises

21-23　Microcomputers:　Fundamentals/Applications　Florence, Italy　Polytechnic of Central London

27-29　Microprocessors and Systems Applications　$395　New York, NY　Automata-Benwill Courses

June

2　　PROM Programming--A Systems Approach Free　San Jose, CA　Data I/O Corp.

2- 5　IMP-16 PACE Applications　$395　Dallas, TX　National Semiconductor

2- 6　ICS International Microcomputer Educational Congress　$185-$325　Brussels, Belgium　Integrated Computer Systems

3- 5　Microprocessors and Systems Applications　$395　Houston, TX　Automata-Benwill Courses

3- 5　Microprocessor Design Course　$250 Palo Alto, CA　Pro-Log Corp.

3- 6　1975 International Symposium on Military and Industrial Microprocessor Systems　San Diego, CA　AH Systems

4- 6　Conference on New Components and Subsystems for Digital Design　$295　Los Angeles, CA　Technology Service Corp.

8-13　Microprocessors & Minicomputers; Interfacing & Applications　Blacksburg, VA　American Chemical Society

9-11　MCS-80 Microcomputer Workshop　$350 Santa Clara, CA and Boston, MA　Intel

June

9-12   Advanced Programming $395 Dallas, TX National Semiconductor

9-12   Microprocessor Fundamentals $395 Santa Clara, CA National Semiconductor

10-12 Automotive Electronics Conference and Exposition Anaheim, CA Automotive Electronics

10-12 Microprocessors and Systems Applications $395 Chicago, IL Automata-Benwill Courses

10-13 ICS International Microcomputer Educational Congress $185-$325 Toronto, Ont. Integrated Computer Systems

12-14 PL/M Microcomputer Workshop $350 Santa Clara, CA and Boston, MA Intel Corp.

16-18 MCS-40 Microcomputer Workshop $350 Santa Clara, CA and Boston, MA Intel Corp.

16-19 IMP-16 PACE Applications $395 Santa Clara, CA National Semiconductor

16-20 Microprocessors--Hardware, Software, Applications $395-$445 Marina Del Ray, CA Opto-Logic Corp.

17-19 Microprocessors and Systems Applications $395 Washington, D.C. Automata-Benwill Courses

17-19 NEPCON '75 New York, NY ISCM

17-20 ICS International Microcomputer Educational Congress $185-$325 San Diego, CA Integrated Computer Systems

23-26 Advanced Programming $395 Santa Clara, CA National Semiconductor

23-26 IMP-16 PACE Applications $395 Miami, FL National Semiconductor

24-27 ICS International Microcomputer Educational Congress $185-$325 London, England Integrated Computer Systems

July

1   PROM Programming--A Systems Approach Free San Jose, CA Data I/O Corp.

1- 4   ICS International Microcomputer Educational Congress $185-$325 Munich, Germany Integrated Computer Systems

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14-17 Microprocessor Fundamentals $395 Dallas, TX National Semiconductor

14-18 Microprocessors--Hardware, Software, Applications $395-$445 Palo Alto, CA Opto-Logic Corp.

14-18 Mini and Micro Computers: Their Applications and Use $425 University of California at Berkeley

15-18 ICS International Microcomputer Educational Congress $185-$325 Boston, MA Integrated Computer Systems

21-24 IMP-16 PACE Applications $395 Dallas, TX National Semiconductor

21-24 Microprogramming $395 Miami, FL National Semiconductor

22-25 ICS International Microcomputer Educational Congress $185-$325 Dallas, TX Integrated Computer Systems

28-31 Advanced Programming $395 Dallas, TX National Semiconductor

28-31 Microprocessor Fundamentals $395 Santa Clara, CA National Semiconductor

28- 1 Microcomputer Systems Design I: Hardware, Software & Applications $360 Los Angeles, CA University of Southern California

28- 1 Mini and Microcomputers: Their Structures, Characteristics and Applications $300 Ann Arbor, MI University of Michigan

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

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

11-13   Microprogramming: Concepts, Trends and Applications $320 Washington, D.C. George Washington University

11-14   Advanced Programming $395 Santa Clara, CA National Semiconductor

11-15   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.

18-21   IMP-16 PACE Applications $395 Miami, FL National Semiconductor

25-28   Advanced Programming $395 Miami, FL National Semiconductor

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

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

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FINANCIAL:

EARNINGS

Adv. Memory Systems	1975	1974	%
Mar. 28			
Share Earnings	$.18	$.11	+63.6
Earnings	439K	213K	+106.1
Sales	7,681K	9,075K	-15.4
6 Months			
Share Earnings	$.30	$.13	+130.8
Earnings	745K	245K	+204.3
Sales	15,184K	16,451K	-7.7

Adv. Micro Devices	1975	1974	%
Year			
Share Earnings	$.00	$.98	----
Earnings	-2,472K	2,429K	-201.8
Sales	25,815K	26,429K	-2.3

Amer. Microsystems	1975	1974	%
Mar. 29			
Share Earnings	$.09	$.70	-87.1
Earnings	192K	1,557K	-91.6
Sales	15,202K	19,100K	-20.4

Gen. Instruments	1975	1974	%
Year			
Share Earnings	$1.46	$1.78	-18.0
Earnings	11,776K	13,956	-15.5
Sales	419,664K	425,698	-1.4

Intersil Inc.	1975	1974	%
Mar. 29			
Share Earnings	$.01	$.18	-94.4
Earnings	23K	489K	-95.3
Sales	5,763K	7.116K	-19.0

Mostek Corp.	1975	1974	%
Mar. 28			
Share Earnings	$.08	$.56	-85.7
Earnings	342K	2,215K	-85.5
Sales	14,963K	14,104K	+6.0

Motorola Inc.	1975	1974	%
Mar. 31			
Share Earnings	$.27	$.61	-55.7
Earnings	7,630K	17,194K	-55.6
Sales	303,881K	328,766K	-7.5

Nat'l Semiconductor	1975	1974	%
Mar. 9			
Share Earnings	$.24	$.31	-22.6
Earnings	3,120K	3,894K	-19.9
Sales	48,549K	52,698K	-7.9
9 Months			
Share Earnings	$1.00	$.92	+8.7
Earnings	12,453K	11,207K	+11.1
Sales	179.089K	153,109K	+17.0

Raytheon Co.	1975	1974	%
Mar. 31			
Share Earnings	$1.06	$.82	+29.3
Earnings	15,901K	12,263K	+29.7
Sales	529,949K	429,088K	+23.5

Rockwell Int'l	1975	1974	%
Mar. 31	$.56	$1.00	-44.0
Share Earnings	$.56	$1.00	-44.0
Earnings	21,026K	34,545K	-39.1
Sales	1,238,044K	983,568K	+25.9
6 Months			
Share Earnings	$1.16	$1.84	-40.0
Earnings	43,264K	63,434K	-31.8
Sales	2,427,470K	1891,603K	+28.3

Signetics Corp.	1975	1974	%
Mar. 23			
Share Earnings	----	$.58	----
Earnings	-3,385K	2,801K	-220.9
Sales	18,286K	31,454K	-41.9

Texas Instruments	1975	1974	%
Mar. 31			
Share Earnings	$.61	$1.09	-44.0
Earnings	13,992K	24,754K	-43.5
Sales	332,757K	375,479K	-11.9

COMPUTER INDUSTRY HITS $10B PACE

The computer industry may not be recession proof, but business should continue briskly for all of 1975, with suppliers feeling minimum recession impact. This analysis, which was disclosed by International Data Corp. in briefings for financial and industry executives, is explored in the March 26 issue of EDP Industry Reports.

According to the report, the briskness will be marked by user spending in excess of

$23 billion this year for computing hardware, peripherals, services and personnel. Surveys by IDC pegged 1975 user spending at 14% higher than last year. $55 billion worth of U.S. made computers will be at work worldwide by the end of 1975, $30 billion in the U.S. a-lone.

Rapid growth by the industry as a whole should continue into the foreseeable future, said IDC, at rates over or near 10% a year. Users, IDC says, consider their EDP equipment a bargain despite recent price hikes. Companies are holding their total data processing spending in line by keeping the lid on employment and doing more smart shopping with third party lessors, independent peripheral equipment manufacturers and suppliers of services.

Copies of the March 26 issue of EDP Industry Report are available for $10 a copy or special bulk rates from IDC.

French Firm To Market Micro-One

Microdata Corp. will begin marketing its high-speed microprogrammed microcomputer, the Micro-One, in France through the the Instrument division of Intertechnique. The exclusive marketing agreement follows previous pacts involving Microdata minicomputers. Intertechnique is one of France's largest minicomputer manufacturers.

Zentec & CMC Sign 5 Year Pact

Zentec Corp. and CMC Ltd. have announced a five year multi-million dollar agreement. Under terms of the contract, CMC Ltd., a United Kingdom company, will act as exclusive distributor for Zentec's line of microcomputer-based programmable terminals for distributed processing.

In addition to representing Zentec in the United Kingdom, Middle East and Scandinavia, CMC Ltd. will employ Zentec's terminals in their own data entry equipment. CMC has been independent of its former parent company, Computer Machinery Corp. of Los Angeles for over 18 months.

CompuSystems Given U.S. Territory

Micro Computer Machines Inc., of Ontario, Canada has named CompuSystems, Inc. as their exclusive U.S. distributor for their entire microcomputer and programmable calculator line. CompuSystems will also be responsible for supplying support to distributors of MCM products in Europe and Asia. CompuSystems has specialized in the marketing of stand-alone microcomputers, systems, peripherals and application packages.

Qualterm Wins $250K Contract

American National Computing Corp. has awarded Qualterm Inc. a $250,000 contract for 50 units of their X100 microcomputer controlled teleprocessing terminal (MICROCOMPUTER DIGEST, Nov. 1974, pg 8). The terminals are said to be used in American National's timesharing network.

WDC Signs $6.3 Million Loan

Western Digital Corp. announced that on April 11, 1975 the company had completed negotiations and entered into a revised $6.3 million loan agreement with United California Bank. According to A. B. Phillips, president and chairman of the board, WD had already borrowed $3.7 million from UCB and the new credit agreement provides for additional borrowings up to $2.6 million assuming all conditions are met. The maturity date for all of the loan notes is July 1, 1976

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Microcomputer Design, Systems and Hardware for the 8008, 8080 $100 Martin Research Ltd., 1825 S. Halsted St., Chicago, IL 60608 (312) 829-6932

Microcomputer Digest $28

Microcomputer Structures $25 100 pages Microcomputer Associates Inc., 10440 N. Tantau Ave., Cupertino, CA 95014 (408) 247-8940

Microprocessor Field Survey & Data Book $495
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Module and the 9356 Analog Input Module. Log-
ical Services, Inc., 1901 Old Middlefield
Way, Suite 17, Mt. View, CA 94043   (415)
965-8365

TYMSHARING SERVICES for Intel and Motorola
microprocessors. $5 per hour for connect
time; no royalties; no CPU charges. 10¢ per
sector per month storage charge. Guili Mi-
croprocessing Inc., Box 24186, San Jose, CA
95154   (408) 292-8058

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EUROMICRO--The European Association for Mi-
croprocessing, 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 Infor-
mation Systems, 420 Mathew St., Santa Clara,
CA 95050   (408) 243-6652

ALTAIR 8080 KIT, a kit including 8080 CPU,
256 bytes/RAM, front panel, pc boards, en-
closure, peripherals available, manual.
$495 kit, $750 assembled. MITS Inc., P. O.
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M6800 DEVELOPMENT MODULES, CPU, ROM, RAM,
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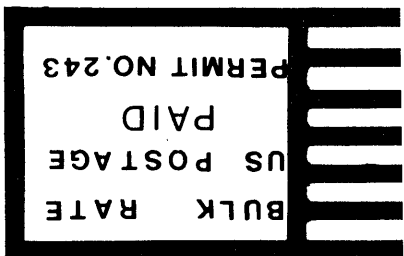Sunnyvale, CA 94088   (408) 259-8372

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