MICROCOMPUTER DIGEST

Volume 2, Number 3 September, 1975

16-Bit Panafacom Microprocessor

The latest entrant in the microprocessor arena, Panafacom Ltd. of Tokyo Japan, has unveiled a 16-bit microprocessor chip set fully supported by a series of microcomputer cards and a resident hardware development system.

The PFL-16A is a three chip LSI microcomputer designed to offer users functions matching those of a minicomputer in the form of a system component. (cont'd on page 2)

8080 In Circuit Emulator

Ramtek Corp. has announced an In Circuit Emulator for the 8080 microprocessor. The MM 80 (nicknamed the ICEBOX) directly replaces the 8080 microprocessor in the user's system and allows the designer to examine, alter and control the 8080 system. ICEBOX is a real 8080 to the user's system and requires no special design considerations.

The MM 80 was designed to provide the in circuit emulation ability in a basic system. (cont'd on page 3)

Inside This Issue

The JOLT From MAI

Microcomputer Associates Inc. has announced the world's lowest cost microcomputer system yet available. The system is offered in kit form as well as assembled. The heart of the JOLT system is MOS Technology's 6502 8-bit microprocessor.

The outstanding feature of the system is a ROM mask programmed DEbug-MONitor (DEMON) which provides instant software to the user after completion of the kit.

DEMON includes a unique feature found in no other microcomputer system, that is, a self-adapting interface to any terminal speed from 10 to 30 cps. A TTY 20 mA current loop as well as an EIA interface is standard with the kit.

Other DEMON features include display-alter CPU registers, display-alter memory, read/write hex formatted data, read/write BNPF formatted data, unlimited breakpoint capability, high-speed 8-bit parallel input option and user callable DEMON I/O subroutines. (cont'd on page 2)

Low Cost µP Enters Market

National Semiconductor has formally announced their SCAMP microprocessor, a single-chip 8-bit p-channel MOS device priced around $15.

SCAMP (acronym for Simple to use Cost effective Application MicroProcessing) can be used alone or in a multiprocessor configuration. National will be backing the microprocessor with a wide array of software and software tooling support. (MD, August 1975)

With only two chips, the microprocessor and any standard memory, a user can address up to 4K bytes of memory to implement the control (cont'd on page 4)

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SPECIAL FEATURES:

THE JOLT FROM MAI

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The basic CPU card contains the 6502 CPU, 512 bytes of user RAM, 64 bytes of interrupt vector RAM, and 16 fully programmable I/O lines. Power on reset and auto bootstrap to the monitor are included.

The 6502 has a built-in clock generator, thus eliminating the need for an external clock generator. Two external interrupts are provided to the CPU, one maskable under software control and the other non-maskable. Appropriate signals are brought out to a connector to allow the user to add single step and address halt features.

Other available cards include 4K RAM, I/O (32 lines), power supply, universal breadboard card and an accessory kit. Single quantity kit prices are: CPU—$249; 4K RAM—$265; I/O—$96; Power Supply—$145; Universal Card—$25; and Accessory Kit—$40. Prices include the DEMON and all documentation. Deliveries are 10 days ARO.

16-BIT PANAFACOM MICROPROCESSOR

(from page 1)

The PFL-16A microprocessor is manufactured using N-channel LOCOS silicon gate E/D MOS technology. The three chip set consists of a 16-bit parallel microprocessor and two I/O control chips (a subchannel adapter and a direct memory access channel controller). The microprocessor features an extremely

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efficient architecture, flexible system construction, easy-to-use I/O interface and high throughput. Each chip is housed in a 40-pin package and is completely TTL compatible.

The microprocessor architecture consists of seven 16-bit registers; an instruction counter, instruction register, stack pointer, two accumulators and two index registers. Typical instruction execution time is 3 us with the microprocessor operating on a two-phase 2MHz 12V clock. Other features include three level multiple interrupts, DMA capability, automatic restart, a 33 command instruction set and six addressing modes. The addressing modes include direct, PC relative, indirect,. PC relative indirect, index modification, and indirect index modification. Three supplies are required: +12V, +5V and -3V.

Software development support is available on the Panafacom U Series industrial computers and the MACC-7/L minicomputer, or is resident with the PFL-16A development system. Moreover, various program modules residing in the target system are offered.

Four groups of software aids have been developed to operate on the above systems. These categories include the self-standing system, UMOS/D support system, UMOS/C support system and the MACC support system.

The self-standing system contains program modules used in debugging the hardware and software of the target system by using the PFL-16A hardware support system. This also includes software modules which can be incorporated into the object program.

UMOS/D is an operating system for a relatively larger configuration of Panafacom U Series industrial computers containing an auxiliary memory unit (magnetic disc or magnetic drum). Object programs are efficiently developed by using this support system under the control of UMOS/D.

The UMOS/C system is a programming system which uses Panafacom U Series to perform object program development using a comparatively small scale system not having an auxiliary memory unit.

The MACC programmable support system utilizes the MACC-7/L minicomputer to generate object code.

The self-standing system software aids consist of an initial program loader, micro monitor, I/O control subroutines, arithmetic subroutines, linkage loader, debugging utility and ROM support utility.

The support systems software aids consist of a cross assembler, linkage loader, simulator, source program editor, RB program utility, EB program utility and a debugger.

The PFL-16A microcomputer development system consists of a front panel, power supplies, and ten standard cards for a versatile system.

The CPU card houses the microprocessor, clock generator circuit, bus driver/receiver, and controls the sequencing of program instructions.

The CPU Option card provides the microcomputer with DMA channel connection, memory parity check, power fail interrupt, interval timer, etc.

Three types of memory cards are offered: core memory card, IC RAM card and IC PROM card. All three memories can be freely combined.

Other cards include the console panel and control panel card, Basic I/O control card, communications line control card, PROM writer card, channel connection card, DMA channel card, and the subchannel card.

The microprocessor and microcomputer will be displayed at WESCON in booth number 1631.

8080 In Circuit Emulator

(from page 1)

The unit is lightweight (16 lbs) and portable for easy use at the bench or in the field. The base unit can be expanded with a variety of hardware and software options to provide a full scale floppy disc based system when a major software effort is required.

Hardware designers can start using the MM 80 when their breadboard has working clocks. The MM 80 will read and write memory or perform input and output without the need for a program executing in the user's memory or even without the user's memory working. The MM 80 can be used to repeatedly generate memory and I/O reference signals so that breadboard systems can be debugged. The ICEBOX's

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front panel provides scope probe points for user M_1, sync, ϕ_1 and ϕ_2 signals and for a specific address reference. RAM diagnostic programs and ROM checksum computation are also provided.

The front panel displays the complete user processor status so that problems can be rapidly detected. The displays include interrupts pending, interrupts enabled, ready/wait, reset, hold/hold acknowledge and halt plus M_1, sync, ϕ_1 and ϕ_2.

Software designers have available with the ICEBOX all the features of a software simulation but none of the limitations of fake I/O. The programmer can load his program into the user's system RAM or program a PROM. The MM 80 monitor will trace, step or breakpoint even when the user's program is completely in ROM. The programmer can select any or all of the registers to be displayed during the tracing. The programmer can also snapshot (trace on specific locations) to give a concise picture of program execution. The MM 80 allows interrupts to be executed in the simulation mode as well as in the real time mode.

Real time debug is greatly aided by the use of the real time address comparator and the real time instruction trace. The MM 80 maintains the addresses of the last 255 instructions executed so the programmer can now really find out "how did I get here?"

The MM 80 console is an ASCII terminal such as a teletype or CRT running at any standard rate from 10 cps to 1200 cps. The data rate is switch selectable and interface is either RS232 or 20 mA current loop. The ICEBOX has an additional RS232 interface for connection to remote computers allowing the console to be used as the terminal on a time-sharing network.

The base unit provides the in circuit emulation ability and sells for $3,950. The MM 80 option list includes 2708 PROM programmers, memory expansion modules and special software packages. The MM 80 also offers a ROM resident one pass assembler for quick and easy assembly on the basic unit.

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Low Cost µP Enters Market

(from page 1)
logic for electronic games, small intersection traffic signals, simple industrial systems, appliances, vending machines, simple terminals—anything that previously made use of sheet-metal logic.

Jumping to a four-chip system, the microprocessor, a bidirectional transceiver, an address latch and a buffer element, the SCAMP user can address 65K bytes of standard memory to implement complex control functions as in credit card verification, business and accounting machines, text-editing typewriters, intelligent stand-alone terminals, complex instrument/measurement systems and so on.

The chip's architecture consists of an 8-bit ALU that can perform binary ADD, AND, OR, EXCLUSIVE OR, and two-digit BCD ADD. Other features include an 8-bit accumulator with an 8-bit extension register for separate serial I/O operations; four 16-bit address pointer registers usable as stack pointers to external memory for unlimited subroutine nesting; an 8-bit status/flag register whose contents are treatable as data or storable in memory; a 16-bit address output register; an 8-bit data I/O register, 8-bit instruction register; and associated circuitry for I/O control, instruction decoding and clock timing.

The microprocessor's instruction set consists of 46 instructions grouped into five classifications: memory reference, transfer, memory increment/decrement, immediate and delay.

SCAMP is intended for low cost applications and operates from a single 10-14V power supply, has I/O control compatibility with standard logic, features a simple, efficient addressing scheme and includes on-chip generation of timing and all strobes.

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ELECTRONIC WARFARE

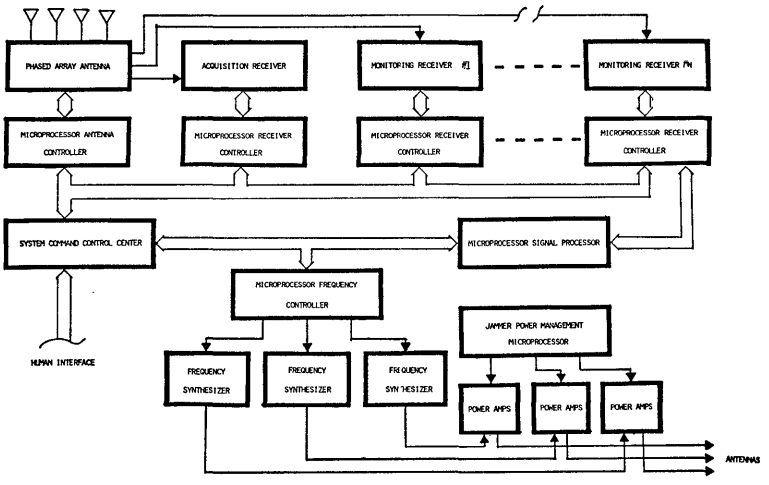
(THIRD IN A THREE-PART SERIES)

By H. Dean McKay, President, AH Systems

The architectural structure of microcomputer-based electronic warfare systems consists of several intelligent subsystems under the control of a central processor. Each EW subsystem, such as the receiver antenna or the jammer, is modular and utilizes its own LSI microcomputer controller. These controllers typically have 8- or 16-bit word lengths, a 200 ns to 1 us cycle time, memory address capability of up to 64K words, and good I/O capability.

A typical example of a multiprocessor EW system consists of microcomputers being utilized as antenna controllers, receiver controllers, signal processors, power management processors, frequency control processors and as an overall system command controller. A common control bus is utilized to interface all the subsystems. Each subsystem uses machine language for its applications program, while a higher level PL/1-type language is used for EW systems applications.

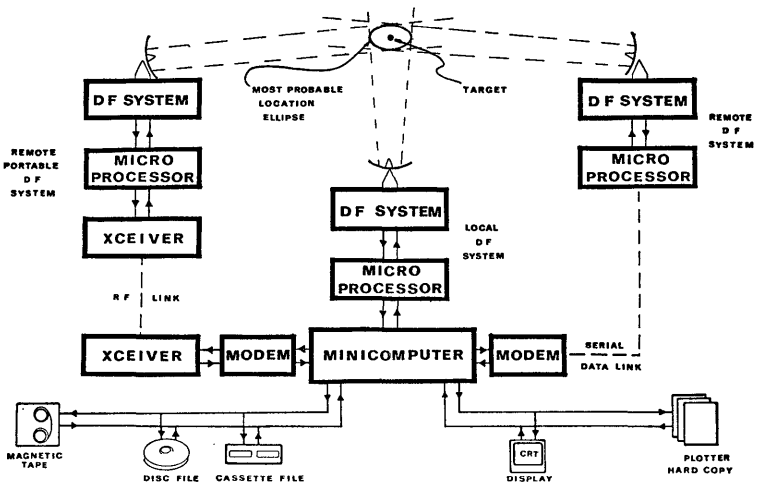
FIGURE 1



TYPICAL EXAMPLE OF MULTIPROCESSOR EW SYSTEM

The operator communicates with the system by English commands which allow him to configure specific operational scenarios without deep technical knowledge of the system's operation. The system allows the operator to request the system to search a particular frequency band, acquire a signal, dedicate a monitoring receiver to that signal, and upon recognition of a particular pulse pattern, jam it. While this is normally a major programming task in conventional minicomputers, the system shown in Figure 1 performs the task easily, while the overall system is busy performing other functions.

FIGURE 2



DIRECTION FINDING SYSTEM USING MICROPROCESSOR CONTROLLERS

Another example is that of a direction finding (DF) system using microcomputer controllers. In the system, three DF systems are interfaced with a microcomputer controller. An overall minicomputer is utilized as a message switch and a most-probable-location analyzer. The DF systems could be located remotely either over an RF data link or a serial telecommunications line.

Once acquisition is determined by one of the sites, the minicomputer commands the other two DF sites to execute a direction find in a gross location at a known frequency. When all three sites have acquired and determined the most probable angle of arrival, the data is fed back to the minicomputer and the most probable locational eclipse is calculated. Such a system utilizes standard off-the-shelf minicomputer and microcomputer hardware and peripherals and allows the implementation of a very cost-effective and highly capable direction finding system without major cost penalties.

In conclusion, microcomputers offer six basic advantages in EW systems: (1) flexibility to configure systems; (2) speed in acquisition, signal processing and signal control;

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(3) standard hardware; (4) expandability; (5) local processing and control; and (6) simple implementation of complicated functions.

Most disadvantages with EW microcomputer systems can be traced to the learning curve of designers in utilizing the new devices. However, once system designers become accustomed to using these devices as an integral part of EW systems, microcomputers will be commonplace in almost every system. Microcomputers provide program managers with the most sophisticated hardware system possible in a relatively short design cycle. Microcomputers also provide the military with unheard of flexibility to quickly and easily reconfigure a system to meet the increasing and ever-changing threats of our world today.

(Ed. Note: This article concludes MICROCOMPUTER DIGEST's series on the microcomputer's role in electronic warfare. If you've enjoyed this series, let us know.)

Micros Micros—WESCON Theme

WESCON 1975, the 24th annual Western Electronic Show and Convention, will be presented September 16-19, 1975 in Brooks Hall and Civic Auditorium in San Francisco, CA. The theme of both the product exposition and professional program is "Electronics in the Next Thousand Days."

The exhibits will be open each day, Tuesday through Friday, at 9:30 a.m. The show will close at 5 p.m. on Tuesday and Thursday; at 9 p.m. on Wednesday; and at 4 p.m. on Friday.

Thirty-two half-day technical sessions will be held in the Civic Auditorium, one level above Brooks Hall. The sessions are scheduled for 10 a.m. and 1:30 p.m. daily except, no afternoon sessions will be held on Friday.

Overall, WESCON attendance by members of the electronics industry is expected to top 25,000. Attendance for 1974 was 28,212 and 27,436 for 1973.

The WESCON Professional Schedule for microprocessors is as follows:

Sept. 16 a.m.	Microcomputers—How To Get Started. Rm 105
Sept. 16 p.m.	Microprocessor/Microcomputer Hardware & Software Support Systems Rm 105
Sept. 17 a.m.	Microprocessor Applications Rm 105
Sept. 17 p.m.	Microcomputer Design Aids Rm 105
Sept. 18 a.m.	High-Speed Printers for Minis and Micros Rm 104
Sept. 18 p.m.	Microprocessors in Medical Instrumentation Rm 105

Microcomputer Education

By Darrell Crow

In the past few months I have been exposed to several types of microcomputer education. Briefly, they consisted of a five day lab and lecture course, an intensive four day lecture course, a college course, and a self-learning home study manual. In the next four months I will relate these experiences and what can be expected from each program.

National Semiocnductor has established three microprocessor training centers throughout the U.S. They conduct courses consisting of five days of lecture with hands-on experience.

In the Fundamentals course, each student receives all documentation for the IMP-16 and PACE microprocessors. These texts were used in conjunction with class notes and exercises that teach the student how to use the manufacturer's literature. Although National microcomputers and documentation were used, the instructors first discussed a hypothetical microprocessor and then applied the concepts to the IMP-16 and PACE systems. I was extremely impressed by the instructors not pushing National's line or elaborating on any deficiencies of other microprocessors.

This course is strictly basic, and National is, thus far, the only semiconductor firm offering such a course. It is designed for those who have had little or no computer experience. Course content includes Boolean algebra, logic, number systems, conputer and programming fundamentals, software aids, debuggers, editors, loaders, development systems and chip architecture.

Since the key to understanding microprocessors lies in the software, a considerable

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TECHNOLOGY:

GI IM1600 Now Available

General Instrument Corp.'s Microelectronics Division will be offering its Series 1600 Microcomputer System to the general public for the first time at WESCON. The system, based on the GI IM1600 16-bit microprocessor, is built using the company's N-channel Ion-Implant Giant II process. (MD, April 1975)

Supporting the microprocessor concept is a series of high-speed N-channel MOS-LSI logic devices that include upward compatible processors and standard ROM and RAM memory circuits.

The Series 1600 incorporates a powerful intelligent I/O interface concept with its complement of Programmable Interface Controllers (PIC). Most of the popular industry peripherals can be interfaced to the 1600 Series.

Compatible assembler/simulator software is available for popular minicomputer systems and large time sharing systems. Comprehensive subroutine libraries, diagnostics, utility programs and an easy-to use On-Line Debug Program (ODP) for direct program checkout of the 1600 system are available.

A unique feature of the Series 1600 software is the Language Generation Program (LGP) which enables a high level language to be developed to match each application.

Prices and delivery dates for the Series 1600 will be posted at WESCON.

Rockwell Announces 2-Chip µP

A new two-chip microprocessor system, the PPS-4/2, has been introduced by Rockwell International Corp. The high-speed PPS-4/2 consists of one chip with clock, CPU and 12 I/O lines and a second chip with 2K x 8 ROM, 128 x 4 RAM and 16 bidirectional I/O lines.

The PPS-4/2 is instruction and bus compatible with the Rockwell PPS-4 microprocessor so that all 17 input/output, memory and peripheral controller chips now provided can be used with the 4/2.

The PPS-4/2 is $80 each for quantities up to 99 two-chip sets and $56 for quantities of 100 to 999. Masking charges for quantities under 1000 is $1250; for quantities of 1000 and over, masking charges are included.

Engineering samples of the PPS-4/2 will be available this month with evaluation boards ready for sale in October and full production quantities by January 1976.

NEC To "Truly" Second Source 8080

Determined to capture a major portion of the uC market, NEC Microcomputers Inc. is introducing a second microprocessor and increasing their network of U.S. manufacturing reps by 10.

The second microprocessor, slated for sale in October, is a pin-compatible device with Intel's 8080A 8-bit microprocessor.

The uCOM-8, currently offered by NEC, is an independent designed software compatible version of Intel's 8080 CPU. The new microprocessor will be a true second source device.

Intel's Higher-Speed 8080 µP

A higher-speed series of the popular 8080 microprocessor is now being offered by Intel. The 8080A-1 and 8080A-2 feature an instruction cycle time of 1.3 and 1.5 us, respectively.

The 8-bit microprocessors are available from distributors off-the-shelf in lots of 1 to 99. Large volume deliveries are scheduled for the fourth quarter of 1975.

Intel distributors are also offering the 8080A in a 13-chip microcomputer kit for $250. The kit includes the 8080 microprocessor, two 256 x 4 RAMs (8111); two bus drivers (8216); a 1K x 8 erasable ROM (8708); a decoder (8205); priority interrupt control unit (8214); an 8080 clock generator (8224); 8080 system controller (8229); 8-bit I/O port (8219); programmable USART (8251); programmable peripheral interface (8255); and an 8080 systems user's manual.

Intersil Drops µP Prices

Effective immediately, Intersil, Inc. is reducing the price on their recently announced IM6100 microprocessor. Formerly

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priced at $395, the industrial grade (-40° to +85° C) IM6100 is now priced at $150 in 1-24 quantities.

In addition, the cost of their 1024 x 1 CMOS RAM, the IM6508, is reduced from $28 to $17.90 in 100-999 quantities. This RAM is designed to interface directly with the IM6100 for use in CMOS microprocessor systems.

Ronald P. Hammer, manager of CMOS product marketing, attributed the price reduction to significant customer acceptance and the fact that process yield improvements have greatly exceeded earlier Intersil projections.

MICROCOMPUTER-BASED PRODUCTS:

4-Bit Educational Microcomputer

Dedicated Computer Systems has announced a new 4-bit microcomputer designed for educational use in teaching the fundamentals of computer design and to enable students to develop their own computer system at a reasonable cost.

The system, DCS4-1K uses the Intel 4040 microprocessor. The minimum configuration has 256 x 4 bits of PROM which can be expanded up to 1024 x 4. It also has 20 x 4 RAM (expandable up to 80 x 4) and a slow shift register memory (1024 x 8) for CRT refresh which can be used as read/write memory by the microprocessor. The input is a small keyboard which outputs a video waveform for use on a standard 32 x 32 TV monitor.

Also provided is an IC socket for an external PROM unit, with suitable power supplies to enable data to be written on it. Examples of the system's use would be the programming of a square root function, or the implementation of a small control system, where the student would write his PROM to achieve a particular system.

Tentative price for the DCS4-1K system is $595 with deliveries 90 days ARO.

Dedicated Computer Systems is a new Canadian firm that offers consulting services in minicomputers and microcomputers; they also develop standard microcomputer products such as the DCS-1K.

Future products will include an 8-bit microcomputer configured for use with a terminal to give it specialized characteristics for both the scientific and business environment. Another system will be a high-speed arithmetic processor for use as a subsidiary unit in a minicomputer environment to allow high-speed calculation of specific tasks such as vector manipulation, spectrum analysis and formatting of data.

Cramer To Offer µC Kits

A new microcomputer kit available initially in three models, has been intorudced by Cramer Electronics Inc. Each of the kits are priced at $495.

Developed under a special contractual agreement with Microcomputer Technique, Inc. the specially designed kits come equipped with either an Intel 8080, a Motorola 6800 or a Texas Instruments TMS 8080 as the CPU, which will be followed in mid-October with the inclusion of the AMD 9080, Mostek F8 and the RCA COSMAC. Early in the first quarter of '76 Cramer will introduce bipolar Cramerkits using the Intel 3001, AMD 2901, TI SBP 0400 and the Motorola 10800.

Each Cramerkit contains all the active and passive components (except board and power supply) necessary to build a functional microcomputer. In addition to all parts, literature, schematic diagram and programs recorded on a cassette tape. The complete components and documentation package enables a designer to design and fabricate a custom microcomputer to suit his specific needs.

µC Spectrum Analyzer

Operational ease has been greatly increased in Tektronic's new 7L5 spectrum analyzer. The analyzer's intelligence (Intel 8080 microprocessor) is used to decode control settings and process frequency as well as reference level information for CRT readout of display parameters. Sweep time and resolution are automatically optimized for each span position.

The microcomputer allows pre-setting of the analyzer's power-up conditions. When power is turned on, the 7L5 automatically sets the reference level to +17 dBm and sets the frequency to zero. Thus, users are pro-

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vided with input attenuation to protect against high input levels and a marker to verify correct operation.

Other 7L5 features include buffer control and a plug-in front-end module. Input buffer control trades input attenuation for IF gain, thereby maintaining a constant reference level while greatly increasing front-end immunity to intermodulation. The first plug-in front-end modules are the 50-ohm L1 and the 75-ohm L2. Other units are planned for 600 ohms and 1 megohm. This unique modular concept permits the user to adapt to new measurement requirements. Each front-end module will provide displays calibrated appropriately for the impedance in use.

Approximate cost of the spectrum analyzer with plug-ins and mainframe is around $6,500.

Upgradable POS System

National Semiconductor Corp. has introduced a new microcomputer controlled cash register for supermarkets which will retail in quantity for $2500. It has all the features of a stand-alone electronic cash register, but can be upgraded to an in-store computerized checkout system.

The Datachecker has an internal IMP-16 microcomputer that handles over 140 coded items and has a non-tamperable, non-resettable group total. In addition, it offers food stamp eligibility and accounting by department, two clerk totals (clerk accountability), quantity extension (multiplication), split pricing, checks tendered, tax eligibility and accounting by department, and ability to run automatic coin dispensers. The T-2500 interfaces with an electric produce scale which is accurately calculated to one-hundredth of a pound and displayed on the register. The price is computed, displayed and printed on the customer receipt tape along with the actual weight and the price per pound.

Microcomputer Serial Printer

A new low cost, 120 cps dot matrix serial printer that features a microprocessor and digital control printer/head advancement is available from Tally Corp.

Designated the Series 1000, the new 132 column, multicopy desk unit is designed for use with microcomputers, minicomputers, mini-based business systems, data entry systems, intelligent terminals and remote batch terminals. First in a line of serial printers is the 120 cps Model 1120 which features a new needle printing technique, the microprocessor, cartridge ribbon, and tractor engagement above and below the print line.

The Model 1120 prints an original plus four carbon copies and handles form widths from 4 to 15 inches. Specifications include six lines per inch line spacing, ten characters per inch character spacing, a 64 character USASCII character set and a 9 x 7 half-space matrix character.

The printer offers a wide selection of interface controllers for data communications applications, for direct plug compatibility with popular minicomputers and for emulation of other printers.

Unit prices for the printer start at $2,575. Substantial OEM discounts are available. Evaluation units will be available during the third quarter of 1975, with production deliveries beginning in the fourth quarter.

New Version Of Model 340 Terminal

Sycor, Inc. has introduced a new version of its Model 340 intelligent terminal, with an ECMA/ANSI-compatible cassette recorder, designed primarily to interface with small business computers.

The Model 340-E is functionally the same as the Model 340 terminal, incorporating a microprocessor, CRT and typewriter-like keyboard. Options include a flexible disc recorder, four speeds of printers, three magnetic tape drives, card readers and both asynchronous (110-1200 bps) and binary synchronous (1200-4800 bps) communications.

The terminal features a read-after-write head, 2K 80-character data capacity and may write on both sides of the tape cassette.

The Model 340-E is priced at $216 per month on a one-year lease and $184 per month on a two-year lease. The purchase price is $7800. Deliveries are expected in the fourth quarter of 1975.

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Intelligent Floppy Disc

IMS Associates, Inc. has introduced the first Intelligent Disc, the IMSAI 108, which incorporates five interacting Intel 8080 microcomputers in a distributed network. The disc system is intended to remove the load of data-base access functions from the user's CPU.

The 108 system is currently available in 54 megabyte (single spindle) or 108 megabyte (dual spindle) configurations. It can be connected to multiple CPUs and/or terminals with RS232C communications interfaces, I/O bus parallel interfaces or by direct memory access.

The controller's 450 ns cache memory is expandable from 16K to 128K bytes. The disc uses standard IBM type discs, has a transfer rate of 806 kilobytes per second, and a maximum track-to-track access time of 6 ms.

The data-base management system, which resides in the 108 controller, enables the user's CPUs and intelligent terminals to deal with symbolically named files, records and fields. Despite the protocol imposed by most information storage and retrieval applications, only host commands and specified data fields will pass between the host CPU and the IMSAI controller. All indexing, searching and deblocking operations are performed by the controller and an RS232C interface can be used to connect any CPU or intelligent terminal to the IMSAI 108.

The IMSAI 108 is priced at $29,500 in the single spindle configuration. Deliveries are 90 days ARO; OEM quantities will be considered.

Pro-Log Supporting M6800 & F8

Pro-Log has announced they are now fully supporting the M6800 and will support the F8 microprocessor by December.

The basic 6800 CPU card (8611) provides full buffering for the address, data and control busses, clocks and power-on, and external reset. The 6800 microcomputer card is essentially pin-compatible with Pro-Log's 8008 and 8080 CPU cards. All CPU cards operate with Pro-Log's line of RAM, ROM, I/O and interface cards.

In addition to offering the CPU cards separately, Pro-Log is also offering the 6800 card in a 3- and 5-card system. A minimum system consisting of a 6800 CPU card, ROM/RAM and 8113 I/O card sells for $650.

The M823 System Analyzer for the 6800 features clip-on testers for program debugging and system analysis. The tester is a self-contained, fully buffered unit and does not interfere with system operations. The M823 is priced at $750.

µC-Controlled Wiring Analyzer

Algorithm Technology, Inc. manufacturers of high-speed bare circuit board testers, announces the introduction of a new high-speed microcomputer controlled wiring analyzer for back plane panels, card racks, cables and harnesses, and other wired assemblies, expandable in 64 node increments.

The test system is fast and can completely test a circuit board and provide GO/NO GO indications of good or bad assemblies in less than one second for a 50,000 point back panel or other wired unit. Programming takes approximately ten seconds for a 50,000 point assembly when using a known good unit and entering a developed program number into thumbwheel switches. The system can be programmed from an optional cassette or from other external sources. GO/NO GO programming can be done using the program number only. A listing of errors is available at the rate of one to forty errors per second depending on the optional printer selected. A known good unit or the cassette input is required.

A 1024 node system is priced at $13,120 and does not include the printer or cassettes. Delivery is 90 to 120 days.

Correction

An error was made on Microkit Inc.'s telephone number in the August issue. The correct number is (213) 828-1722. Microkit manufactures a universal microcomputer development system for 8- and 16-bit microprocessors.

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 M.R. Lemas, President. Published monthly. Subscription $28.00 per year, overseas $40.00 per year. DARRELL D. CROW, Editor; LILLIAN LAU, Associate Editor; PATRICIA L. DREISBACH, Circulation Editor; RAY HOLT, Applications Technical Advisor; MANNY LEMAS, Applications Technical Advisor.

MEMORIES/PERIPHERALS:

FPLA Programmer Now Available

Data I/O's newest product is the Model X Field Programmable Logic Array Programmer. Scheduled for introduction in the third quarter of 1975, the Model X will be capable of programming all Field Programmable Logic Arrays (FPLA) as they are developed. Data I/O has been working closely with several semiconductor manufacturers to insure compatibility with their FPLAs.

Features of the Model X Programmer include processor control, CRT display and ease of operator programming. The programmer will perform not only an array verification of the part after programming, but also a logical verification of the part to insure that it is programmed properly. Inputs can be accepted from a previously programmed FPLA, a keyboard entry, paper tape, and mark sense card readers.

The price of the Model X programmer is presently set at $8,000. Data I/O also manufacturers PROM programmers to fit all levels of programming from the basic engineering level up to and including full production. Their entire family can be seen at WESCON.

Flexible Disc System For MicroPac

iCOM, Inc. is now in production on a flexible disc system for the PCS MicroPac 80A. The iCOM FD360 plugs directly into a standard PCS PM-5001 I/O assembly. The system includes all required interconnecting ribbon cables.

In addition to being hardware compatible with the MicroPac 80A, the FD360 is fully supported by a complete FDOS (Floppy Disc Operating System), contained on a compact diskette for improved program development. FDOS contains such single command operations as disc-to-disc program editing and assembling; disc-to-memory program loading; named files; disc-to-paper tape; paper tape-to-disc and disc-to-disc file transferring.

FD360 prices start at $2400 for a single disc drive system including all software and interfacing to the PCS MicroPac 80A. Delivery is 3 to 4 weeks ARO.

6800 Relocatable Macroassembler

American Microsystems, Inc. has announced a new relocatable macroassembler for their S6800 microprocessor. The program features a linkage loader allowing locations for symbols to be assigned after the program has been fully debugged. This allows the user the flexibility to assemble only sections of his programs at a time instead of the entire program.

Final documentation for the program is currently being prepared, however, the software is up, running and available on National CSS timeshare services. The program, written in FORTRAN, can also be purchased for $1200.

The assembler version was written in 360 assembly language for low-cost and high-speed assembly processing.

Low Cost CMOS Static RAM

Intel Corp. has introduced the P5101-8 1K (256 x 4) silicon-gate CMOS RAM priced at $10.20 in 100 to 999 quantities.

The P5101 features a maximum standby current of 50 nA per bit and a worst-case access time of 850 ns. The RAM is completely static and chip enable clocking is not required during address transitions. It can be placed into the low power standby mode by applying a logic low level to the second chip enable input. Also, it operates on a single +5V power supply. The 22-pin provides four data inputs, four tri-state data outputs with an output disable control, two chip-enable inputs, read/write control and address inputs. The output configuration allows the P5101 to operate on either separate memory system I/O busses or on a common I/O bus without bidirectional bus logic.

Fairchild Shipping 4K RAMs

Fairchild's Integrated Circuits Group has announced it is shipping production quantities of a 4096-bit N-channel dynamic RAM memory circuit having an access time of 250 ns.

The memory, designated as the 4096, utilizes single transistor memory cell and sili-

(cont'd next page)

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con nitride capacitor technology. Two versions are available: 40963 (250 ns time) and 40964 (300 ns time). Both parts are packaged in a 16-pin ceramic DIP and are fully TTL compatible. Power dissipation is specified at 250 mW; typical active access power is 120 mW.

A unique method of address multiplexing and latching allows the use of the 16-pin standard package rather than the alternate 22-pin design available from other suppliers. This results in an 80% increase in packaging density on memory boards.

The 40963 and 40964 are available from stock and pricing for 100 to 999 quantities is $23 and $17.50 respectively.

µC Tape Storage System

Qantex has introduced the Model 2200 Tape Storage System which is compatible with the Intel 8080 microcomputer.

The ANSI-compatible system utilizes the 3M data cartridge as well as the Qantex 600 tape drive which has a read/write speed of 30 ips, rewind speed of 90 ips and packing density of 1600 bpi phase encoded.

The 2200 is available with either one or two cartridge tape drives with storage capability of up to 5.76 million bytes for a dual drive system. The drives are available with 1- 2- or 4-track read-after-write heads. Each track is either computer or manually selectable.

The built-in ANSI-compatible tape formatter features 90 ips search, command chaining to emulate a disc where no computer interrupt is requested until the proper tape mark is found, hardware CRCC and data phase encoding.

Prices start at $2,175 without computer interface and $2,750 with interface. Delivery is 30 days ARO.

New 1K Schottky RAM

Intersil has introduced two new Schottky TTL 1024 x 1 bit RAMs, the IM55S08 and IM55S18. The IM55S08 provides an open-collector output and the IM55S18 has a tri-state output.

The IM55S08 is equivalent to the N82S08; both RAMs are replacements for the (non-Schottky) 93415.

Typical access time is 45 ns, input current is 250 uA maximum for both. Maximum read and write cycle times are 70 ns for the commercial devices and 75 ns for the military parts. Both are compatible with other DTL and TTL logic circuits and contain on-chip address decoding and chip select capability to facilitate incorporation into larger memory arrays.

Both devices are available in CERDIP packages in commercial and military temperature ranges. Prices in 100 to 999 quantities are $22 for the commercial version and $61.60 for the military.

Microprocessor Test System

A computer-controlled test system for microprocessors and other complex digital logic circuits on PC boards has been announced by Instrumentation Engineering Inc.

The Model 103 incorporates a two-family Digital Word Generator/Receiver (DWG/R) which enables the user to test as many as four different levels of logic simultaneously.

The DWG/R contains bidirectional pins so that it can test bidirectional busses on microprocessor PC cards in real time, as well as test associated RAMs, ROMs, shift registers, and the CPU. It can also be programmed for static and functional testing at rates up to 20 MHz. As with other stimulus and measurement devices used with the Model 103, the DWG/R does not require special adapter boards or patch panels for interfacing with the circuit board under test. Regardless of which pins are designated as inputs or outputs on the unit-under-test, all variations can be handled through program control.

An interactive software package completely supports program preparation and data handling.

Rapid fault isolation for component or production process failure is accomplished by a computer-directed, multipoint, buffered IC probe.

Timer, Counter & Generator

Intersil is introducing a new family of monolithic programmable counter-timers, the 8240, 8250 and 8260, which can generate ac-

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curate, externally settable time delays from microseconds to five days. The circuits will also count external pulses, and can be used as frequency generators, putting out 99 or 256 selectable frequencies.

Each device in the family consists of an accurate low-drift oscillator, a counter section of master-slave flip flops and appropriate logic and control circuitry. The counter's output taps are open-collector transistors and additional logic circuitry will allow timing to be programmed by a microcomputer.

All timers are available in 16-pin plastic DIP packages, and operate from 0° to +70°C. Prices in 100 to 999 quantities for the 8260 are $3.50, for the 8250—$4.00 and for the 8240—$3.25.

PEOPLE, LITERATURE AND EVENTS:

SRI To Study Industrial μC

Stanford Research Institute's Artificial Intelligence Center has received a two-year grant of $500,000 from the National Science Foundation for continuation of research in computerized automation.

The research, headed by staff scientist Charles A. Rosen, has as its ultimate objective, computer-controlled inspection, material handling and assembly line systems for industry. Under the project, researchers have assembled a laboratory test-bed for studying the practical problems of applying programmable automation to industry.

Rosen told MICROCOMPUTER DIGEST that the test-bed will, for the time being, consist of a distributed network using DEC's LSI-11 microcomputer to reduce the central processor's (PDP 11/40) workload. Rosen said that SRI selected the system since it requires less software and could easily perform all distributed intelligence computation.

Wyle Gains Intel μC Franchise

Intel Corp. has announced the appointment of the Wyle Distribution Group as an additional franchised distributor of microcomputer and memory components in five locations: Liberty Electronics, El Segundo CA; Elmar Electronics, Mountain View CA; Liberty, San Diego CA; Elmar, Denver CO; and Liberty, Phoenix AZ.

The Wyle Distribution Group has added Intel's full line of development systems and Data I/O's PROM programmer at their microcomputer centers in El Segundo and Mountain View, CA.

Computer Printer Analysis

A comprehensive, 1000 page analysis and evaluation of computer printers was put on the market in July by S. P. Davis and Co.

The report is designed both as a buyer's guide and an analysis of the printer field. It identifies 96 OEM manufacturers of printers, characteristics of 298 systems, and also compares characteristics as they pertain to applications, according to Tom Tracy, vice president of S. P. Davis.

"The report," explained Tracy, "was prepared for a client with a specific product planning requirement. From that base it was expanded into a complete tutorial and analysis of the total printer market. In its expanded form it will be sold at $495 per copy."

The report evaluates all types of impact and non-impact printers by type, printing technique, process and operation format. Features compared include multiple copies, speed, paper feed, inking systems, buffers, interfaces, price, reliability, field service costs, supply expenses, human factors engineering and environmental conditions.

European μC Study Available

Microcomputer usage in Europe, at a $10 million level in 1974, will explode 60-fold to become a $600 million market by 1984, according to a new study by Frost & Sullivan. Cumulative shipments over the decade will tally $2.5 billion. Of that total, microprocessor components will account for $1 billion; memories for $850 million with ROM memories at 29%, RAM memories at 71%; I/O interfaces for $550 million; and other ancillary circuits for $75 million.

The two-volume, 622-page study broke the accumulative ten year total into the follow-

(cont'd next page)

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ing markets: industrial control—$720 million; lab equipment—$183 million; data collection entry and communications—nearly $1 billion; and transportation, building, environmental control and word processing—$350 million.

The microcomputer market is currently dominated by the U.S., but the first European and Japanese units are now becoming available.

People On The Move

JAMES D. BOWEN and GEORGE D. WELLS have been elected vice-presidents of Fairchild Camera and Instrument Corp.

DAVID A. ARMSTRONG and TED L. NICHOLS have joined General Automation as manager of microcomputer marketing and manager of peripheral product marketing, respectively.

Mits Inc. has opened two new regional sales offices to service the Western and Southeastern regions of the U.S. BILL GRAY is the newly-appointed regional manager on the West Coast and ED CURRIE will head the Southeastern office.

ROBERT B. PALMER will head Mostek's newly-formed Computer Products Group as vice-president. He had previously been vice-president of engineering.

FRED W. HORNE, microprocessor and memory systems specialist for National Semiconductor in the southcentral area states has been promoted to sales manager, reporting to KEITH KOLERUS, area manager.

JOHN SCHULER has joined Pro-Log Corp. as southern regional sales manager.

As a result of Rockwell's reorganization, CHARLES V. KOVAC will run the Microelectronic Device division as vice-president and general manager.

ROBERT ANGUS and R. JOSEPH KRAUS have been named as area sales managers for Zentec's line of microcomputer-based intelligent programmable terminals.

Recent Literature

"Microprocessors"
Edited by Laurence Altman
Electronics Book Series 1975

In the absence of text books describing the use of the newest microprocessors, the editors of Electronics magazine have attempted to fill the gap by reprinting, in one volume, over 40 of their most recent uC articles. The book is broken down into four general categories: device technology, microprocessor design, applications, and a special news roundup.

Most of the articles in the book have previously been reviewed by MICROCOMPUTER DIGEST, however, reading the book was enjoyable, educational and provided an excellent journey back through time to when the first microcomputer was introduced.

Ten separate microprocessors are described, tracing uC history from the 4-bit machine to the monolithic 16-bit chip. Full length features depict how to work with micros, possible special techniques and many applications. For $8.95 the book is an absolute must.

"Microcomputers: Fundamentals and Applications"
Edited by G. Cain
Miniconsult Ltd. 1975

The material for this book was assembled from the lecture notes presented at a special course given in London in late 1974 and published in 1975.

Basic definitions and general characteristics of uP are followed by an extensive uP survey providing valuable insight and commentary on the present state of commercial uP production. Hardware and software aspects are highlighted and general observations on overall system design, implementation and self-testing considerations are then followed by several application examples where uCs have been employed to advantage. Finally, useful background information on design fundamentals of logic circuitry in included.

"How to Pick a Microprocessor, or a Mini or Anything in Between"
David N. Kaye, Sr. Western Editor
Electronic Design 16 August 2, 1975

This article is a light discussion on uC selection criteria with quotes from 30 top industry sources to focus on the most critical variables. No clear-cut formulae for choosing micros is presented, however, designers are given direction for that time when they will be ordered to incorporate a uC into the company's next mousetrap.

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EDUCATION:

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

September

29- 1 International Electrical, Electronics Conference and Exposition $40-$50 Toronto Ont. IEEE

30- 2 Hands-On Microprocessor Design Course $300 Northern New Jersey Pro-Log

30- 2 M6800 Microprocessor Course $430 Lincoln NE Motorola M6800 Course

October

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

1- 2 M6800 Support Hardware Phoenix AZ Motorola M6800 Course

1- 3 How To Design With Microprocessors $395 Irvine CA Microcomputer Technique Inc.

2- 3 Software Development & Applications Techniques for Microcomputers £150 London England Integrated Computer Systems

5- 8 Electronic & Aerospace Systems Convention Washington DC EASCON

6 6800 vs. 8080—A Side by Side Comparison $135 Washington DC Integrated Computer Systems

6- 9 Advanced Programming $395 Miami FL National Semiconductor Corp.

6- 9 Digital Integrated Circuits: Technology, Device Structures and Applications $275-$295 Waterloo Ont. University of Waterloo

6- 9 Microprocessor Fundamentals $395 Santa Clara CA National Semiconductor Corp.

6-10 MicroPac 80 Workshop $400 Flint MI PCS Inc.

7- 8 Microprocessors and Microcomputers—A Comprehensive Technical Introduction and Survey 1400Skr Oslo Norway Integrated Computer Systems

7- 9 Hands-On Microprocessor Design Course $300 Palo Alto CA Pro-Log Corp.

8-10 How To Design With Microprocessors $395 Washington DC Microcomputer Technique Inc.

8-10 Military Microprocessor Systems $395 Washington DC Integrated Computer Systems

9-10 Software Development and Applications Techniques for Microcomputers 1400Skr Oslo Norway Integrated Computer Systems

13-16 IMP-16 PACE Applications $395 Santa Clara CA National Semiconductor

14-15 Microprocessors and Microcomputers—A Comprehensive Technical Introduction and Survey 1400 Skr Copenhagen Denmark Integrated Computer Systems

14-16 Hands-On Microprocessor Design Course $300 Dallas TX Pro-Log Corp.

14-16 M6800 Microprocessor Course $430 Toronto Ont. Motorola M6800 Course

15-17 How To Design With Microprocessors $395 Chicago IL Microcomputer Technique Inc.

16-17 Software Development and Applications Techniques for Microcomputers 1400Skr Copenhagen Denmark Integrated Computer Systems

20-21 Microprocessors and Microcomputers—A Comprehensive Technical Introduction and Survey 1400Skr Helsinki Finland Integrated Computer Systems

20-22 Computers and the Quality of Life $45-$70 Minneapolis MN ACM '75

20-22 M6800 Microprocessor Course $430 Denver CO Motorola M6800 Course

20-23 Advanced Programming $395 Santa Clara CA National Semiconductor

20-23 Microprocessor Fundamentals $395 Dallas TX National Semiconductor

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21-23 Hands-On Microprocessor Design Course $300 Chicago IL Pro-Log Corp.

21-23 M6800 Microprocessor Course $430 Phoenix AZ Motorola M6800 Course

22-23 Software Development and Applications Techniques for Microcomputers 1400Skr Helsinki Finland Integrated Computer Systems

23-24 M6800 Support Software Denver CO Motorola M6800 Course

27-30 IMP-16 PACE Applications $395 Dallas TX National Semiconductor

27-30 Microprogramming $395 Santa Clara CA National Semiconductor

28-30 Hands-On Microprocessor Design Course $300 Washington DC Pro-Log Corp.

28-30 M6800 Microprocessor Course $430 Lexington MA Motorola M6800 Course

29 A Manager-Level Overview of Microprocessors, Microcomputers and Minicomputers 500 DM Munich Germany Integrated Computer Systems

30 Microprocessors and Microcomputers, Condensed Version 500 DM Munich Germany Integrated Computer Systems

31 Software Development and Applications Techniques for Microcomputers 500 DM Munich Germany Integrated Computer Systems

November

2- 7 Microcomputers—Principles and Applications $595 Oak Brook IL National Engineering Consortium Inc.

3 PROM Programming—A Systems Approach Free San Jose CA Data I/O Corp.

3- 5 SEMICON/Europa Zurich Switzerland Golden Gate Enterprises Inc.

3- 6 Microprocessor Fundamentals $395 Miami FL National Semiconductor

3- 7 Advanced Programming $395 Dallas TX National Semiconductor

3- 7 MicroPac 80 Workshop $400 Flint MI PCS Inc.

5- 7 How To Design With Microprocessors $395 Cleveland OH Microcomputer Technique

10-13 IMP-16 PACE Applications $395 Miami FL National Semiconductor

10-13 Microprocessor Fundamentals $395 Santa Clara CA National Semicondcutor

11 6800 vs 8080—A Side by Side Comparison $135 Dallas TX Integrated Computer Systems

12-14 How To Design With Microprocessors $395 Palo Alto CA Microcomputer Technique Inc.

12-14 Military Microprocessor Systems $395 Dallas TX Integrated Computer Systems

17-20 Advanced Programming $395 Miami FL National Semiconductor

17-20 IMP-16 PACE Applications $395 Santa Clara CA National Semiconductor

18 6800 vs 8080—A Side by Side Comparison $135 Boston MA Integrated Computer Systems

18-20 Microcomputer Application Workshop San Diego CA Naval Electronics Lab

19-21 How To Design With Microprocessors $395 Long Island NY Microcomputer Technique Inc.

19-21 Military Microprocessor Systems $395 Boston MA Integrated Computer Systems

24 6800 vs 8080—A Side by Side Comparison $135 Ottowa Ont. Integrated Computer Systems

25-27 Military Microprocessor Systems $395 Boston MA Integrated Computer Systems

December

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

1- 4 Advanced Programming $395 Santa Clara CA National Semiconductor

1- 4 IMP-16 PACE Applications $395 Dallas TX National Semiconductor

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1- 4 Microprocessor Fundamentals $395 Miami FL National Semiconductor

3- 5 How To Design With Microprocessors $395 Philadelphia PA Microcomputer Technique

8-11 Advanced Programming $395 Dallas TX National Semiconductor

8-11 IMP-16 PACE Applications $395 Miami FL National Semiconductor

8-11 Microprocessor Fundamentals $395 Santa Clara CA National Semiconductor

8-12 MicroPac 80 Workshop $400 Flint MI PCS Inc.

10-12 How To Design With Microprocessors $395 Denver CO Microcomputer Technique

14-19 Microprocessors & Minicomputers—Interfacing and Applications $325-$360 Blacksburg VA American Chemical Society

15-18 Advanced Programming $395 Miami FL National Semiconductor

15-18 IMP-16 PACE Applications $395 Santa Clara CA National Semiconductor

SPONSORING ORGANIZATIONS AND CONTACTS

ACM '75, 45 S 7th St, Minneapolis MN 55402

American Chemical Society, Educational Activities Division, 1155 16th St NW, Washington DC 20036 (202) 872-4508

Data I/O Corp., 990 E Arques, Ste 106, Sunnyvale CA 94086 (408) 732-8246

EASCON, 1629 K St NW, Ste 700, Washington DC 20006

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

IEEE, 7061 Yonge St, Willowdale Ont. (416) 881-1930

Integrated Computer Systems Inc, 4445 Overland Ave, Culver City CA 90230 (213) 559-9265 European Office: 33 Rue de Congress, 1000 Brussels, Belgium 218-5005x358

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

Microcomputer Technique Inc, 11227 Handlebar Rd, Reston VA 22091 (703) 620-9676

Motorola M6800 Course, Ron Bishop BB102, PO Box 2953, Phoenix AZ 95062 (602) 962-2345

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

National Semiconductor Corp, Microprocessor Training Center, 2900 Semiconductor Dr, Santa Clara CA 95051 (408) 732-5000x7183

Naval Electronics Lab, W J Dyka, Code 4050, San Diego CA 92152 (714) 255-6454

PCS Inc, 5467 Hill 23 Dr, Flint MI 48507 (313) 767-8920

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

University of Waterloo, I R Grant, Electrical Engineering, Waterloo Ont N2L 3G1

FINANCIAL:

DIGITAL CONTROLS IN PROCESS INDUSTRY

The process industries' expenditures on digital controls will increase from $245 million in 1973 to $404 million by 1977 and to $845 million by 1983, according to a new study by market research specialists, Frost & Sullivan, Inc.

The microprocessor itself will realize an increase in the digital control marketplace from less that 1% of total expenditures in 1973 to 31% of the total by 1983 at $260 million. It is a harbinger of lower prices and greatly expanded applications.

Use of direct digital controls will expand and the process industries will increase their expenditures by 245% over the next 10 years. The rubber and plastics industry will show the greatest overall growth at 290%; the chemical industry will be next at 280%. Export sales will grow by some 255% on average, and to regions other than the industrialized countries, they will grow by 500% over the decade.

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Programmable logic controllers will have a relatively modest, but steadily growing market. The report also stated that microcomputer-based controllers using distributed-control networks, promise substantial savings in installation costs of control systems. One major oil company is claiming a 30% reduction in initial cost over that of an analog counterpart.

Further information on the 183-page study (Reference Report #344) can be obtained by contacting Frost and Sullivan.

MICROCOMPUTER SPOTLIGHT:

EUROPEAN MICROPROCESSOR ACTIVITIES

Microcomputer Spotlight is a new department highlighting, each month, one aspect of the industry. This month, a series of articles survey the European microprocessor activity country by country. The articles have been extracted and reprinted with permission from Euromicro. Euromicro is a quarterly European newsletter devoted to serving the microprogramming and microprocessor segments in Europe.

ITALY

By MARIAGIOVANNA SAMI

SGS-Ates has recently announced that it is participating with AEG-Telefunken and General Instruments Microelectronics in the implementation of MOS-LSI microprocessors to be assembled by Olympia, the German business machine manufacturer.

Until now, studies in the universities have been limited mostly to surveys of the existing microprocessors or to their didactical potential. Application work has been done by students at the graduate level (for instance, at the Polytechnic Schools of Turin and Milan). At the University of Bologna, interest centers on the use of microprocessors in systems such as the "mininet" sponsored by the Polytechnic of Central London. More precise research is presently in the course of definition.

Several Italian industries, operating in various fields, are concerned with the possible applications of microprocessors. Here some indicative instances are recalled. Olivetti inserts microprocessors in its new series of intelligent terminals and business machines. FIAT is investigating the use of microprocessors for control systems involving the motor's carburation and the vehicle's motion. It is also looking to employ microprocessors at data acquisition points on its assembly lines.

Particular interest is shown by the telecommunication industries. While SIT-Siemens considers the use of microprocessors for samll electronic telephone switching centers, Telettra is concerned with their application to the control of highly reliable telecommunication systems. In this last context, the existing microprocessors are not considered satisfying, particularly from the point of view of reliability, and "ad hoc" systems (with diagnostic programs stored in PROMs) are proposed. This same approach—of defining the specifications of microprocessors for well-defined applications—is taken by some engineering firms (as Techint) working in the field of industrial control. Here, microprocessors are used as non-standard man-machine interfaces and factory terminals; attempt is made to distribute the control over the whole controlled system rather than concentrating it in the central computer. A very particular dedicated system using an array of microprocessors is the one developed by Elettronica San Giorgio for high-speed mail address recognition.

GERMANY

By LUTZ RICHTER

There is a diversity of activities within the field of microprocessing in Germany. Although most of the reported work herein seems to be done at the universities, there is at least a comparable effort being spent at the industrial level.

University of Bochum:

Three different activities are grouped around microprocessors, their software and their applications. Microprocessors are being used to realize data traffic controllers by means of centralized multiplexed I/O control systems. Suitable microprocessors and control programs are expected.

Within the field of real-time applications

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and process control, some investigations are being conducted to develop dedicated systems with a single custom microprocessor and the necessary programs to serve a specific application.

As most of today's available microprocessors lack complete software support, there is a considerable demand for such program support tools. Several software modules for the Intel 8080 have been developed and current research is concerned with the implementation of compilers for problem oriented languages for microcomputers.

Technical University of Munchen:

There is a widespread area of different activities at this university. It ranges from the usage of Intel 8008 microcomputers for controlling display units via applications within the field of artificial intelligence and process control up to hierarchically ordered multiprocessor systems. Most of these reports are concerned with investigations that have already been completed.

Microcomputers are also constructed in a modular fashion using Intel 8008, 8080 and 3000 chips. One such application has been concerned with the development of suitable interfaces for microprocessors and storage units via bus structures.

Another ongoing research is related to associative control memories. Continuing investigations are looking at the increase of parallelism of address and data between a fast cache and a pipeline organization. Special effort will also be spent on considering program branches as bypass action.

Nuclear Research At Karlsruhe:

The department of data processing service and instrumentation at this Nuclear Research Center uses Intel 8008 microcomputers to implement automatic chemical analysis procedures for the regeneration of nuclear fuel material. Multi level priority controlled interrupt structures are implemented to support these applications.

University of Karlshruhe:

A computer organization design using a microprocessor with associative control store is being developed. Special features include hardware-implemented primitives for scheduling algorithm implementations. The processor has been simulated and its efficiency in scheduling applications is at least one order of magnitude better than that of software-implemented conventional schedulers.

The Intellec-8 will be used as a tool for designing reliable multi-microprocessor systems where microprocessors will mutually check each other.

Although the foregoing description gives a rather small selection of microprocessor activities in Germany, it should show the wide spectrum of current research interests.

BELGIUM

By ANDRE A. S. DANTHINE
INSTITUT D'INFORMATIQUE-NAMUR

Microprocessor Design

The most important project is EPRON (Experimental PROcessor Namur). This processor is designed to support effective interaction bewteen software and firmware. Its hardware mechanism allows FETCH/GENERATOR mini-instructions features. In this way, a macro-assembler supported by firmware substitutes micro-procedures call to code expansion in software. EPRON is not yet a "silicon" microprocessor. It is beyond a "paper" processor and has recently completed simulation.

KATHOLIEKE UNIVERSITEIT LEUVEN
CIRCUITS AND SYSTEMS DIVISION

Microprocessor Utilization

In 1973, an Intel MCS-4 microprocessor was used for a Direct Digital Control unit of a heat exchanger pilot plant.

In 1974, an EKG-preprocessor for high-care patients was developed based on an Intel MCS-8 microcomputer. The microcomputer analyzes the EKG waveform and detects the P-wave, the heart rate, trends of this rate, fibrillation, and transitions of pre-set limits. Eight systems were installed by the end of 1974 in the St. Raphael Hospital at Leuven.

Microprocessor Design

A project is now under study for realization of a send-receive preprocessor for coding and decoding transmitted data. The preprocessor will be coupled to normal digital computers and will have to transmit blocks of words at DMA speeds. The main problem is related to the speed of the preprocessor

(cont'd next page)

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which will be studied in cooperation with the laboratory for solid state electronics and the laboratory of hybrid circuits of the University.

RIJKSUNIVERSITEIR-GENT

ELECTRONICS AND ELECTRIC MEASUREMENTS LAB

Microprocessor Utilization

An Intel MCS-8 microcomputer has been used as the controller of a serial ASCII-oriented instrumentation bus system.

A project is soon to be started to develop an MCS-8 controlled text editing system with a magnetic tape cassette recorder and an electric typewriter.

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Microprocessor Utilization

For the development of an optical data entry system, a microcomputer is under consideration for the pattern recognition aspect.

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LABORATOIRE D'AUTOMATIQUE

Microprocessor Utilization

The application of microcomputers is in the field of automatic control systems with special emphasis placed on Digital Differential Analyser.

SPAIN

By DR. J. PERACAULA

The activity in the microcomputer field began two years ago and has since grown quite rapidly. An estimated 15 to 20 universities and private and public companies are now engaged in microcomputer technology with a larger number of other companies planning to enter the field.

At this point it has been impossible to assemble a complete list of centers involved. Thus the following should be taken as indicative of the type of work being done in Spain.

UNIVERSITIES AND RESEARCH CENTERS

At the University of Santander, Department of Electronics, work is being done using Intel's MCS-4. The Automatic Control Laboratory at the Technical High School of Engineering of Sevilla and the Department of Electronics of the University at Sevilla also report developments using the same microcomputer.

In Madrid, at the Instituto de Automatica, industrial work is being done on Direct Digital Control using Intel's 8080 and 8008. Development is also underway at different technical high schools of engineering at the Politechnica University. At the Junta de Energia, nuclear work is being done using a National IMP-16.

In Barcelona, work was pioneered in 1973 with a SIM-8 at the Automatic Control Laboratory of Industrial Engineering High School at the Politechnical University. At the Electronics Laboratory of this center, emulators of 8080 and 4004 have been developed on a NOVA 1220, and a Power Integrator module using a 4004 is underway.

Work on microcomputers is also currently in progress at the High School of Telecommunications Logic Laboratory at the same university. A joint research effort involving the Electronic and Logic Laboratories deal with efficient algorithms for Boolean function implementation using microprocessors.

PRIVATE INDUSTRIAL CENTERS

Two years ago, EYSSA, a traffic control and automation company, used an Intel 8008 microcomputer in a data acquisition project. Since then, several companies have started using microcomputers, among which we have knowledge of the following: ENHER (electrical utility), MOBBA (industrial scales), TEAM (process-control-automation), ITT Research Laboratory (communications), IKASLAN (engineering for telecontrol), TELESCI NCRO (computer manufacturer), and DISTESA (teaching equipment manufacturer).

Finally, we would like to mention that this report was not intended to be a complete summary on the state-of-the-art of microcomputer developments in Spain due mainly to the lack of exhaustive information concerning microcomputer activities there.

SWEDEN

By H. LAWSON, JR.

At the Royal Institute of Technology in Stockholm (S-100 44 Stockholm 70, Sweden) the following two projects concerning microcomputers are in progress.

An Intel 8008 microcomputer has been installed in a Tektronix 4010 display. The microcomputer controls communications and

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graphics with a DEC PDP-10 remote computer.

The second project concerns program systems for developing software utilizing the Intel microcomputers. Assemblers and simulators, running on PDP-11, have been developed for the 4004 (assembler only), 8008 and the 8080. Reports on the project are:

- o TR 72: Program development on a PDP-11 system for the Intel 8008 and 4004 microcomputers.
- o TR 83: SIM08 and SIM08 User's Guide. Two interactive microcomputers on a PDP-11 simulating Intel's 8008 and 8080.

The reports can be obtained from Staffan Westbeck, Department of Telecommunication.

THE NETHERLANDS

By J. WILMINK

The Technological University of Eindhoven has researched several microprocessor applications. All the software and hardware products mentioned here have been developed around the Intel 8008 microprocessor and are currently available.

Software support consists of a cross assembler on the IBM 360 and a simulator written in PL-1. For the 8008, a complete set of double precision floating point routines have been written. There is also a software library with many application programs, such as for traffic control.

The 8008 hardware has been designed in a modular system using Eurocards (100 x 160 mm). Adaptation of an 8080 or another microprocessor to the system is relatively simple.

A universal traffic controller and a 128 channel I/O multiplexer has also been built by the university.

The Technological University of Delft is also using microcomputers, the first system being a desk calculator based on Intel's 8008. Other applications use Intel's SIM-8 cards. For example, a braille editor was designed to translate data in ASCII code to braille code. The system provides for many options to correct the code in final braille text.

Additional applications include a telex terminal to send measured data automatically to a host computer, a display unit (Mini Bee) coupling to a CDC-STAR computer and an off-line text editor. Also under development is a modular system using the 8080. The system contains CPU cards, PROM and RAM memory cards, and I/O cards. The cards are Eurocards with a 72 pin connector.

The Technological University de Twente is devoted more to microprocessors and microprogrammed designed from an architectural point of view than to microprocessor applications. Much attention has been given to structured design. The description and simulation techniques use APL as a design language.

A description of Intel's 8080 in APL, which is under simulation in an interactive way, is nearly completed. A simple text editing system around the 8080 is also in development.

Among the other universities, the work done at the medical faculty of the Erasmus University of Rotterdam includes implementation of SIM-8 microcomputer boards in a specimen distribution system, a system to handle data from analyzing devices, automatic sorting of specimen, and automatic labelling.

The Dutch PIT is paying particular attention to microprocessors in their research and development lab at Leidschendam. A terminal system has been built around the Intellec-8 system and an interface card to the PDP 8-E memory has been developed.

Within Philips, the Industrial Data Processing System Department of PIT Eindhoven has delivered a microcomputer control system, built arount the 8008. It has a modular combination of RAMs, ROMs, and PROMs and contains cards for a CPU, a variety of memories, input, interrupt option, display and an IEC bus card.

Software support includes utility programs cross assemblers for Philips computers, test programs, standard arithmetic routines, and interrupt handlers. An update of the system using the 8080 is in preparation.

The company is also considering the use of Intel's 8008 or 8080 microcomputers for in-house telephone installation. Attention is also being paid to the application of specialized microprocessors in line controllers for communication purposes.

(cont'd next page)

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Philips Computer Industrie in Apeldoorn is using Intel's 4004 and 8008 in their synchronous data communication products.

In process control, Hoogovens is using Intel 8008s in simple applications for measurement devices. The idea here is to use microcomputers if the problem is too simple for a PDP 8 computer, but too complex to use hardwired logic. Normally the microcomputer operates on one fixed program and is built into the measurement device.

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

MICROCOMPUTER EDUCATION

(from page 6)
amount of time is spent in describing instruction sets, programming techniques and software aids. As each instruction is described, the student is shown how the microprocessor's program counter, registers, accumulators, ALU and status flags are affected. Students are given several simple programming exercises to write, execute and debug in the lab. National's lab is fully equipped with IMP-16 development systems, floppy disc, TTY and software. One lab station is provided for every two students.

On the last day, the course dealt primarily with microcomputer applications, selection criteria, design techniques, floating point routines, higher level languages and PROM programming. This course should be followed by National's application course, or equivalent.

To make the most of your microprocessor course, I suggest the following. Leave your job and office behind until the course is over and concentrate solely on the course. Once you've begun to get a handle on things, arrange an hour of 'solo' time on the development system. When first writing your sample programs, keep them small to insure sufficient time to step through and learn the entire process of flowcharting, coding, assembling, editing, program executing and debugging. Once you know the process, you can easily expand to lengthier programs. Above all—keep you micro-monster smiling.

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