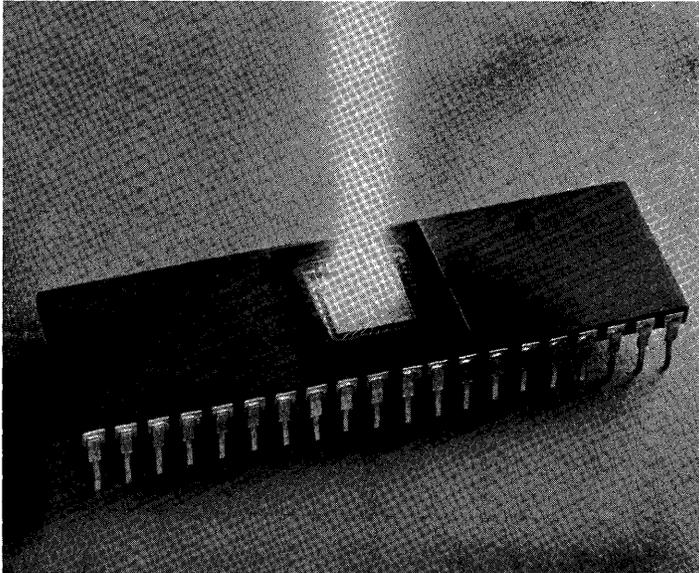


MICROCOMPUTER DIGEST

Volume 3, Number 7

January/February, 1977

SINGLE CHIP MICROCOMPUTER



The 8048 single-chip microcomputer has been introduced by Intel Corp.'s Microcomputer Systems Division. The new microcomputer is one of three single-chip systems comprising the MCS-48 Microcomputer Systems family, with a series of MCS-48 peripherals and a line of programming and product development tools. Intel plans to supply samples early 1977 and to begin production deliveries in the spring.

The Intel 8048 and the 8748, a programmable version of the new microcomputer, are the first general-purpose digital processing and control systems to be integrated into a single chip of semiconductor material. An alternate design, the Intel 8035 microcomputer, provides addition system expansion options.

The 8048/8748 microcomputers can operate as self contained systems with the addition of a few simple parts such as the clock

(Cont'd on page 2)

MOS SC/MP NOW OFFERED

Samples are now available of a new N-channel MOS version of the "SC/MP" 8-bit single-chip microprocessor that is twice as fast and uses only one-fourth as much power as the P-channel version.

Power consumption of SC/MP-11 is less than 200 mW, and only a single +5 V supply is required. (Cont'd on page 9)

GI & ITT SIGN 6100 PACT

General Instrument and ITT have signed a licence agreement for ITT to second source GI's 16-bit microprocessor, the CP6100. GI will provide ITT with masks, hardware, and software knowledge. There will be no payment of money or transfer of technology from ITT to GI. However, a provision for future exchange of technical improvements developed by either company relating to the 1600 and relevant software was spelled out.

ITT will produce the CPU at its Intermetall operation in Freiburg, Germany.

PROCESS CONTROL INDUSTRY REPORT

The process control industry is eager to tap new, sophisticated types of analytical instruments--Fourier Transform Infrared, Mass Spectrometry, Microwave Rotation 1 Spectrometry, and Raman Spectrophometry--for on-line control applications, but their high cost has deterred widespread use. Now microcomputers promise to remedy that. "The instrument-control and data-handling capability that microcomputers can impart will render such instrument applications very cost effective," says a new study by Frost & Sullivan.

(Cont'd on page 2)



2589 SCOTT BLVD., SANTA CLARA, CA 95050 • (408) 247-8940

Copyright© 1977 by Microcomputer Associates, Inc., All Rights Reserved. M.R. Lemas, President. Published monthly. Subscription \$28.00 per year, overseas \$46.00 per year. DARRELL D. CROW, Editor; LILLIAN LAU, Associate Editor; LINDA KOCHANOWSKI, Circulation Editor; RAY HOLT, Applications Technical Advisor; MANNY LEMAS, Applications Technical Advisor.

SPECIAL FEATURES

SINGLE CHIP MICROCOMPUTER

crystal, timing resistors and capacitors, and cable drivers.

The chip, itself, contains all functions required for digital processing and control, and all generally required I/O logic interfaces, latches and buffers. Basic subsystems on the chip are:

- o 8-bit central processor with an internally expandable register stack array, 96 instructions and 2.5 us instruction cycle.
- o Basic peripherals and utilities, including a programmable interval time/event counter, two built-in priority interrupt vectors, system clock generator and a full set of timing and control utilities. 1K program storage in ROM and EPROM and a 64-byte static RAM for read/write data storage, registers and stack
- o 32-line I/O subsystem with three lines for interrupts, jump tests and extra clock rate, and five system bus controls.

The processor can service inputs and outputs on the same ports, set and reset bits, and perform logical processing operations on data right as the I/O ports.

The instruction set is designed to simplify applications programming, enhance throughput and increase the effective capacity of the resident program memory. It includes numerous branch instructions to make logic functions easy to implement. Most instructions are single-byte.

The central processor can operate as a byte processor (8-bit parallel binary processor), 4-bit binary or BCD arithmetic processor. The number of registers and stack levels can be modified by the programmer to suit the application.

The 8035 microcomputer adds program memory size options to the basic system. Although it does not contain a program memory, it can address and execute identical programs and is plug-compatible with the 8048/8748.

The three microcomputers have the same addressing structure, which allows either internal or peripheral memory to be addressed without changing program addresses. This feature also facilitates product testing. The 8048/8748 microcomputers can be programmed for the applications and the same program memory space can be used to access a peripheral containing special test programs.

The register array and the hardware stack, which is used for program nesting, is integrated with data memory to provide more flexibility in processing capability.

(Cont'd on page 9)

EDITORIAL

1977 — NEW ADVANCES

This year promises to be MICROCOMPUTER DIGEST's best ever. Starting with the March issue we'll be changing our name to MICROCOMPUTER DIGEST AND INDUSTRY REPORT. It debuts a new monthly feature, "Industry Report." This column will critically analyze every segment of the industry beginning with "Current Status and Future Trends" next month.

We're also moving our publication date to the first. A number of our readers have indicated a preference for this date. The January/February combination issue is our first step. March will follow in approximately 10 days with the April issue delivered on your doorstep on Old Fools Day.

This year we've had to follow the other magazines and up our prices to keep pace with rising production, paper and labor costs. Foreign subscribers will note we are asking for payment with orders and renewals to further cut accounting costs. Advertising rates are also rising a bit in May making today the opportune time to advertise on an annual basis at the old rates.

In July we unveil our heart's pride and joy, the all new MICROCOMPUTER DIGEST AND INDUSTRY REPORT ANNUAL REFERENCE INDEX. We're in the midst of collecting data for this magnificent volume, so have your company send a complete package of all microcomputers, peripherals, memories, and support products as well as a complete list of distributors, reps, and stores that are handling your products. Deadline for information packets is May 31, 1977.

Have a pleasant and prosperous 1977.



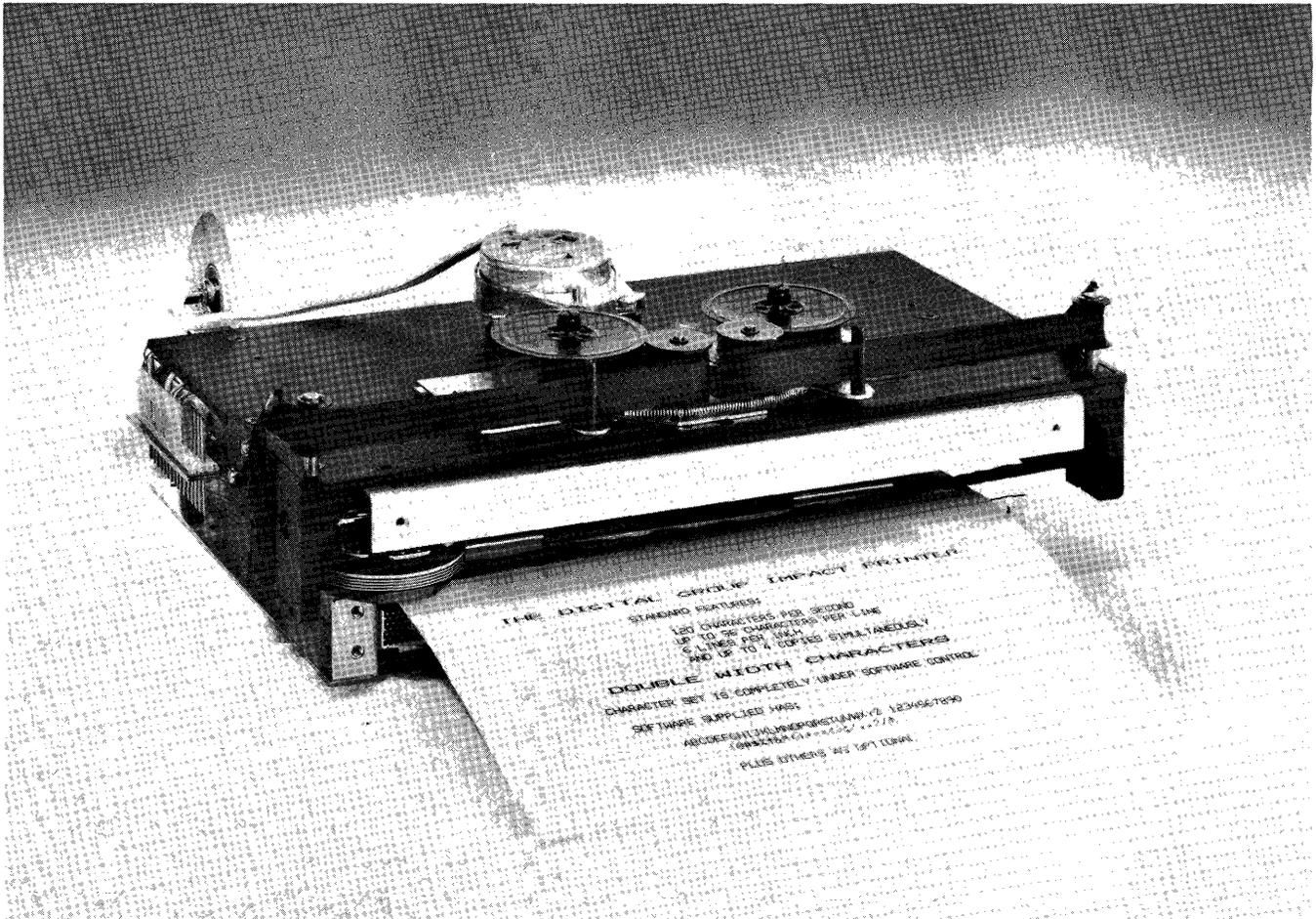
Darrell D. Crow, Editor

PROCESS CONTROL INDUSTRY REPORT

(from page 1)

Such potential power, inherent in micro computers, accounts for some glowing projections in the F&S study. Shipments of industrial microcomputer equipment at \$45 million in 1975 will soar to \$1.2 billion by 1985, for example, the study says. Here's another big, broad application area: Industry is turning to multiplexed, wire digital communications to reduce inplant wiring costs, and microcomputers can be "an effective vehicle" to do

(Cont'd on page 4)



Print Your Heart Out.

With help from the Digital Group, naturally.

Now, that small computer system you own or have been considering for personal or business use suddenly becomes a lot more usable—with the addition of a full-size *impact* printer from the Digital Group. A printer designed for small computers that need big output (like yours).

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Just look at these specifications:

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this job, the 241-page study says. "In petroleum refining, for example, digital data communications can reduce the total installed cost of a control system by as much as 30 percent."

Shipments of MPU's to industry alone at \$22 million in 1975 will soar to \$405 million by 1985, the study projects. Memory sales at \$18 million in 1975 will climb to \$570 million by 1985. Meanwhile, interface and I/O components whole sales tallied a mere \$5 million last year and will reach \$200 million.

The fastest growing market within the I/O category, in turn, are data conversions devices-- analog/digital converters, data transmission devices, clock circuits, interrupt circuits, I/O buffers, and so on. Their share of the total I/O market at between 20% to 25% in 1975 will increase to as much as 50% by 1985. "In this sector, non microprocessor manufacturers stand a good chance to achieve a major share of the market," the study points out. Analog Devices and Teledyne Semiconductor, for example, have their own component manufacturing facilities, and as a result they could achieve substantial penetration.

The study also revealed:

- o Bit-slice microprocessors will become a major growth area as its share of the CPU market, virtually nil currently, rises to 5% in 1977 and 20% in 1985. "As the superior processing capability of bipolar bit slice unit becomes appreciated by industrial designers, who do not now understand the technology, its usage will grow at a rate faster than that of MPU shipments overall," the study says.

- o The 8-bit microprocessor, which accounted for 60% of all shipments by unit volume in 1975 will decline to a 35% market share by 1985. The 16-bit units on the other hand, which has a 10% market share currently, will snare a 45% market some 10 years out. Indeed, shipments of 16-bit units at \$2 million in 1975 are projected to soar to \$183 million in 1985.

- o The outlook for the 4-bit microprocessor is entirely different. Shipments at \$5 1/2 million in 1975 will inch up to \$7 million by 1977, and then decline to a negligible amount by the end of the decade. Current sales for the 12-bit devices is less than \$1 million and accounts for no more than 3% of the total market. And though this figure will increase to 5% over the near term, the device, "will begin to fade from the scene starting about 1978."

Among end users, the chemical industry will comprise the largest single industrial market for microcomputers by 1985. Here, they

will be used as components in distributed control networks, data transmission networks, and dedicated controllers, in addition to their use in measuring instruments.

Microcomputer-based instruments will also be widespread in the petroleum industry to account for a \$110 million annual market by 1985. Another big growth area is food and beverage industry whose trend to synthetic foods is creating a need for more exciting measurement and control techniques. Other big end user categories include iron and steel, aluminum, extractive metals, pulp and paper, rubber and plastic, waste and water treatment, and virtually every other process industry.

Discrete parts manufacturers, who currently comprise the industrial microcomputer's largest end user market, will continue to adopt the technology. Programmable logic controllers are increasingly acquiring greater arithmetic capability, digital throughput, and signal-processing for example, and such a trend clearly points to an increased reliance on microcomputers in the design of such equipment, the study says. Digital Equipment for example, has essentially stopped development work on its series 14 programmable logic controllers and, instead, is pressing forward on an LSI-11 based product line.

Microcomputer use does face some hurdles in industry, the study notes. Lack of product standardization is one, for example. "This is a principal concern among prospective users," the study finds. Report #431 106 Fulton St., New York, NY 10038 (212) 233-1080.

SINGLE CHIP F8 OFFERING

Mostek Corp., has unveiled a new single-chip microcomputer that offers complete F-8 software and hardware compatibility, 2K x 8 of mask PROM and a single +5 volt power requirement. The N/MOS device, MK 3870, is fully compatible with the existing F-8 multi-chip family and can execute the entire F-8 instruction set.

System implemented with the 3870 but eventually requiring more memory or I/O can simply upgrade to the expandable MK 3850 without major redesign or software development. Feature include 2K bytes of mask PROM, 64 bytes of scratchpad RAM and a module 'N' binary timer and multiple clock modes. The 3870 is supported with a complete line of developmental tools--the Software Development Board, the Application Interface Module and the Emulator--70 for field prototyping.

The 3870 will be available in the first

quarter of 1977 with prices under \$10 for 100 units. 1215 W. Crosby Rd., Carrollton, TX 75006 (214) 242-0444.

8X300 EVALUATION KIT

An evaluation kit that allows design engineers to evaluate the Signetics 8X300 bipolar microprocessor for planned applications is now available from Signetics.

The single-board evaluation kit includes bipolar microprocessor, 4-I/O ports, 256 bytes of RAM. PROMs in the kit are preprogrammed with I/O control logic, RAM control and RAM diagnostic programs.

The microprocessor kit 8X300 KT100SK, is unit priced at \$299. 811 East Arques Ave., Sunnyvale, CA 94086; (404) 739-7700.

LOW-COST DEVELOPMENT SYSTEM

Hardware and software designs that involve the "SC/MP" 8-bit microprocessor can easily be developed and quickly tested with a new Low-Cost Development System (LCDS) now available from National Semiconductor.

According to Hashmukh Patel, marketing manager for the SC/MP microprocessor family, the Low-Cost Development System is a simple controller configured with a SC/MP CPU card plugged into one of four sockets in a card bus on a 10 x 12" motherboard. Along with the CPU card, the motherboard also contains a 16-key, dual function hexadecimal keyboard, four keys that control function, three control switches and 6 digit hexadecimal LED display.

With the basic LCDS configuration alone, control logic scratchpad memory and ROM-based firmware on the motherboard allow the user to alter the SC/MP registers and memory locaters, run SC/MP programs in continous or single instruction mode, and even operate with an optional TTY using SC/MP DEBUG.

The LCDS features easy interfacing and expansion: four pre-wired 72-pin edge connector sockets provide a plug-in interface for SC/MP family cards, and also allow interconnection of additional SC/MP applications hardware.

The built-in control and monitor functions in the interface logic of the LCDS permit transfer of control between resident firmware and application programs generated by the user. The firmware subroutines allow entry of software debug commands via the control and display panel or an optional teletype.

A 2k x 8 read/write memory card and a 4k x 8 ROM/PROM cards, are also available.

Pricing of single units of the LCDS is

\$499.00, with the 2k x 8 RAM card priced at \$160.00 each. 2900 Semiconductor Drive, Santa Clara, CA 95051 (408) 737-5173.

8085 MICROCOMPUTER SYSTEM

Intel expects to begin shipping the 8085 Microcomputer System to equipment manufacturers in sample quantities during 1Q77.

The new system is an extension of the 8080 microcomputer system and runs 8080 programs without modification and is entirely bus-compatible with 8080 components.

Each 8085 component is said to replace a group of three to five 8080 components, buffers are required only in the largest systems, timing margins are relaxed and pinouts are organized for X-Y layout of PC board wiring.

The new system includes the MCS-85 Microcomputer System components family, compatible MCS-80 devices, and a line of support products. The support products are low-cost updates of those used to develop 8080 system software and hardware design.

Minimum system configuration would consist of the 8085, 8155, 2K RAM, I/O Timer, and 8355 16K ROM & I/O or 8755 16K erasable ROM & I/O .

These three devices provide CPU, 256 bytes of RAM 2K program storage, 38 programmable parallel I/O lines, serial I/O ports, system clock, system controller, multi-level vectored interrupt control and programmable interval timer and event counter.

Typical instruction cycle time is 1.3 us. System performance overlaps that of TTL logic systems, allowing it to be used in high-performance applications ranging from controllers to 8-bit minicomputers. 3065 Bowers Ave., Santa Clara, CA 95051: (408) 246-7501.

TECHNOLOGY

MICROCONTROLLER OFFERED

WD/40, a single chip microcontroller for dedicated computing and control applications, is a new standalone 40-pin device requiring few or no support circuits. It contains its own register file, mask programmable control ROM, output PLA, internal oscillator, and power reset circuitry. The Western Digital chip requires only a single power supply and is directly TTL compatible. An editor, assembler, and simulator are also available.

Another chip comes in a 64-pin package with internal control ROM inputs and outputs available on the outside for direct connec-

tion to PROMs. A development board containing the 64-pin chip and PROMs is also available.

WD/40 has two programmable interrupts and one wait input. Scanned output and 16 static outputs can drive an 8-digit numeric display.

Its instruction set is applications rather than computer oriented; instruction format is register-to-register. Multiple-digit arithmetic operations such as adds and subtracts are programmed at the instruction level. A program ROM of 4K bits and one level of subroutine are provided. Internal register file storage (exclusive of output registers) is 128 bits. 3128 Red Hill Ave. P.O.Box 2180, Newport Beach, CA 92663.

MMI RELEASES MFGR. RIGHTS

Randal Data Systems reports it has acquired manufacturing rights to the 605-A microprocessor formerly built by Monolithic Memories Inc., and used in Randal's Link 100 and 200 computer systems. Randal also acquired manufacturing rights to Monolithic Memories' boards which use Intel and NEC 4K RAMs.

TRANSITRON MICRO RESURRECTED

Parts Purchasing of Fort Lee, NJ has revealed they are in the process of purchasing Transitron's 16-bit bipolar microcomputer for under \$3 million. The micro, scrapped last summer, will be manufactured in the U.S. with overseas assembly.

Parts Purchasing bought the entire Transitron Microcomputer division and is now receiving estimates from several semiconductor firms for manufacturing costs. The micro is expected to be marketed in 1978.

8080 INTERFACE/SUPPORT CIRCUITS

An expanded line of interface and support circuits for the 8080A microprocessor family plus two new additional versions of the 8080A CPU are now available from National Semiconductor Corp.

National's pin-for-pin and function-for-function replacement for the 8080A device, available since June, is being joined by the INS8080A-1 and INS8080-2. The 8080A-1 features a 1.3 us cycle and the -2 has a 1.5 us cycle.

The interface devices being introduced include an 8-bit I/O port (DP8212), a clock generator and driver (DP8224) and a single-chip system controller and bus driver (DP2228, DP-

8238), all built using schottky bipolar technology. Two other interface circuits, a microprocessors interface latch element (MILE) manufactured by silicon-gate CMOS process (DP8301) and an 8-bit bi-directional bus transceiver fabricated by low-power schottky process (DP8304) should be available by March 1st. 2900 Semiconductor Dr., Santa Clara, CA 95051 (408) 737-5000.

TWO-CHIP 6800

Although Farichild will be producing a second source version of the 6800 microprocessor, Motorola has opted not to supply the two-chip F-8 chip. Instead, the firm will concentrate on a two-chip version of its own 6800 aimed at the same low-end market as the F-8. Introduction of the MC6801 is scheduled for 2Q77.

Motorola, however, has not ruled out the possibility of producing the new single chip F-8. The firm is reportedly feeling the market pulse.

SATELLITE MICROPROCESSOR

A microprocessor to be used in communication satellites from 1980 on is now in the chip fabrication stage at Hawker Siddeley Dynamics facilities in Stevenage, England. The NMOS microprocessor incorporates two unique features: direct, high-level language programming that provides a one-to-one compilation into assembly language instructions, and sophisticated self-repair redundant facilities. Flight trials are scheduled for 1978.

AMI TO BUILD AMD'S 4K RAM

Advanced Micro Devices has licensed American Microsystems, Inc. to build its proprietary 4096-bit MOS static memory family. For an undisclosed sum, AMD will provide detailed technical assistance for the design of the AM9130/9140 and related low-power versions. AMD will also provide updated information as device improvements are made.

These TTL compatible circuits require only +5 V and are organized 1K x 4 and 4K x 1. The standard device offers speeds to 200 ns with maximum power dissipation of 550 mW, while the low-power version offers maximum power dissipation of 350 mW with speeds to 250 ns.

MICROCOMPUTER SOFTWARE

SOFTWARE DEVELOPMENT SYSTEM

A software system to generate micro-instructions for use with the AM2900--AMDASM--system has been developed by Advanced Micro Devices.

Documentation now available explains how to interact with AMDASM to microprogram all control signals and memory to reduce prototype and developing time for 2900 systems.

This microprogram assembler provides software assistance and documentation for writing and modifying microprograms and generating tapes for PROM programmers. AMDASM includes a framework for a common language, automatic accounting information and billing control. Budget limits, character rate option and batch rates make AMDASM cost competitive with in-house versions.

AMDASM is on the time-sharing service of Computer Science Corp. It is accessible from a standard time sharing terminal from most major cities. (408) 732-2400

6502 PROGRAM EXCHANGE CENTER

In the market for 6502 programs? One western company has recently opened the 6502 Program Exchange Center. For 50¢ you can obtain a complete listing of available software. 2920 Moana, Reno, NV 89509

RELOCATABLE TRACING SIMULATOR

Peters Associates is marketing their latest software entrant, TRACE-80, a relocatable tracing simulator for 8080-based systems with 4K memory.

Major features of the interactive debugging aid include selection of registers for printing, display on writing to user requested areas of memory, and the capability of running the user program at full speed until a breakpoint returns control to TRACE-80. In an alternate mode, TRACE printing is suppressed while a circular queue stores machine status for the last 100 instructions or branch commands. A breakpoint causes display of this list. TRACE-80 also warns of probable errors in the user program, such as store instructions to a non-data area, execution of undefined commands, and failure to return properly from a subroutine.

TRACE-80 includes a relocating loader, relocatable object tape, test cases and full documentation for a one time license fee of \$500. P.O. Box 61622, Sunnyvale, CA 94088 (408) 245-1519.

NEW ASSEMBLER-EDITOR VERSION

IMS Assoc. is introducing a new version of its assembler-editor package for 8080 micros. The \$40 price includes paper tape source listing and user manual.

The package can now handle multiple device driver routines which are generated by the system itself. Also, the assembler's symbol table space has been enlarged to 8K. The debugger can handle multiple breakpoints, number conversions, and has tracing capability. 1922 Republic Ave., San Leandro, CA 94577 (415) 483-2093

MICROC SYMBOLIC LANGUAGE

SLAM, (Symbolic Language Adapted for Microcomputers), a compact, powerful operating system designed to operate on Intel's Intellect 8/MOD 80 and MDS microcomputer systems, has been introduced by PennMicro.

SLAM incorporates a text editor and a high level language interpreter in a package occupying less than 3200 bytes of memory, according to the company.

With SLAM, a user can create a program using the text editor, then run it immediately using only the microcomputer and a TTY. SLAM uses a high-level language similar to BASIC and 16-bit signed decimal numbers. It features powerful I/O and bit masking operations, has a variety of conditional and sub-routine commands, and is totally symbolic in nature--the user need not assign registers or memory addresses. An optional feature permits program development while the microcomputer is operating other real-time systems.

SLAM is loaded and entered using the Intel system monitor. It is supplied on paper tape, ready to load without modification. A complete instruction manual is supplied. SLAM is available directly from PennMicro for \$99; delivery is stock to two weeks.

FANTOM II — MONITOR/DEBUGGER

Wintek is offering the FANTOM-11, a 1K monitor/debug program for the Wince 6800 microcomputer. It allows single step execution of user programs, insertion and deletion of breakpoints, and setup of interrupt vectors. FANTOM II also enables the user to load memory, print and punch memory, display registers, go to user's programs, and reset. 902 N. 9th St., Lafayette, IN 47904 (317) 742-6802.

BASIC ETC.

Ease of program development and straightforward program execution are goals of BASIC ETC, an interpreter for 8080-based microcomputer small business applications and game programming.

The program uses the lower 8K or memory plus at least 1K of RAM for scratchpad. Features include full string capability, n-dimensional arrays, variable precision arithmetic, and DMA and I/O addressing. There are 27 error codes, 31 commands and statements, eight standard functions and user defined functions. Priced at \$125, media is either paper or audio cassette tape. 6345 Central Expressway, Richardson, TX 75080.

RESIDENT 8080 FORTRAN COMPILER

A resident FORTRAN compiler, said to run on any 8080 system with a minimum of 16K bytes, is available now from Unified Technologies, Inc. The program produces a formatted output, handles one to 31 character symbolic names, and will perform single or double byte integer arithmetic. An optional floating point package is available.

Priced at \$750, the compiler is available on an IBM-type diskette, paper tape, or PROM. Islington, Ontario.

DOS AND BASIC SYSTEM OFFERED

A disc operating system and a compiled BASIC language system for the 8080 micro are being offered by Intelligent Computer Systems. Included in the software are debug capability, an assembler, text editor, BASIC compiler and a BASIC interpreter.

Software features include sequential and random-access file manipulation, print editing, assembly-routine linking, sub-routine linking and program chaining through console control. Also included are binary and logic operations, 7-digit variables, 255 character string variables and two-dimensional arrays. 777 Middlefield Rd., Suite 40, Mountain View, CA 94043 (415) 961-8941

NATIONAL CSS EXPANDS LIBRARY

A substantial increase in its microcomputer software library, currently consisting of 25 microcomputers from 15 manufacturers, has been announced by National CSS, Inc. Added products includes AMD 9080A, SMS MCCAP, NSC SC/MP, and Zilog Z-80. Products from AMI, Electronic Arrays, Fairchild, Intel, MOS Technology, Raytheon, RCA, Rockwell Int., Signet-

ics, Texas Instruments, and Intermetrics are also available on the network, which is claimed to have the largest library available on an inter-active, time-sharing basis. 542 Westport Ave., Norwalk, CT 06851

TWO PASS MACRO ASSEMBLER

A two-pass macro assembler, a linking loader and a text editor designed for use on 8080-based microcomputer development systems, is being offered by muPro, Inc.

The assembler and linking loader, are available in cross or resident versions, with the resident version requiring 8K bytes of memory and 2K bytes for the loader. The text editor requires 4K bytes of resident memory.

Both resident programs can be purchased together for \$1,250. The assembler is said to provide a cross-referenced symbol table and enable high-level syntax to be used for structures such as loops and conditional branching.

Resident assembler and loaders are priced at \$975 each while the cross version is \$1250. The text editor is \$350, media is either paper tape or diskette copy. Sunnyvale, CA.

FORT 80

A FORTRAN compiler, FORT 80, compiles a subset of ANSI FORTRAN IV, which produces 8080 machine-language object code. It requires 16K-bytes of memory: 12K for the compiler and the remainder for work space.

The object code produced by FORT/80 can be linked to additional machine language subroutines to make a complete program. Symbolic names containing 1 to 31 characters may be used. However, only single and double-byte integer arithmetic is permitted.

A library of useful subroutines and functions comes with the compiler, including absolute values, random 8-bit number, and the square root of positive and SQRT integers. Available on either a floppy disc or on paper tape, the price is \$750. 4800 Dundas St. W., Suite 209, Islington, Ont. M9A 1B1 (416) 236-1159.

UTI PACKAGE

The UTI package offered by Pragmatic Systems, is written in 8080 assembly and contains commonly used code conversions, I/O routines for numbers and character strings, and I/O drivers for commonly used peripherals. A source listing of the program with user documentation is \$3.35. Mountain View, CA

MICROCOMPUTERS

MOS SC/MP NOW OFFERED

(from page 1)

The new version takes 1 us to complete a microcycle, and typical instruction execution time is 5 us. The SC/MP II is fully compatible with its predecessor in terms of pin-configuration, object code, and software, and with slight modifications to the crystal frequencies, it will be compatible with all SC/MP support equipment.

Sample quantities are immediately available at \$17.76 in single units. 2900 Semiconductor Dr., Santa Clara, CA 95051 (408) 737-5173.

460Z CPU EXPANDER

The Ohio Scientific Instruments' 460Z CPU expander is a totally new computer building block with phenomenal performance and flexibility. The 460Z's main purpose is to allow a user to run 8080, Z-80, and 6100 software on OSI's 400 system without modifying the software.

The 460Z contains a Z-80 and Intersil's 6100 microprocessor, four PIAs for control, and several multiplexers and demultiplexers.

The OSI 460Z, like most other 400 series boards, is only \$29 bare with manual. A special \$99 introductory package includes 460Z Bare Board with manual, IM6100 and a Z-80. 11679 Hayden St., Hiram, OH 44234.

SINGLE CHIP MICROCOMPUTER

The processor can use the programmable timer to monitor and control I/O servicing delay, instead of software timing loops. In addition, the timer's 8-bit counter can be used to count external operations, generate operating rates and perform other functions under program control. Also, clock rates at different frequencies are available for equipment control.

Two maskable, vectored priority interrupts are built in. One can be used with the timer/counter or for external inputs and the other is dedicated to external inputs. Each vector jumps the program to a specific memory address.

Other functions include the system clock generator, reset control, single-step control, and in the 8048, low-power standby. All three microcomputers operate on a single +5V supply. In addition, the 8748 has a 25 V input used only during EPROM programming.

There are 32 I/O lines on each microcomputer.

Standard static RAMs, ROMs, or EPROMs interface with the bus through an 8212 I/O Port. One 8212 can act as an address latch/buffer for a large array of standard memory parts. It is

a Schottky TTL component of the MCS-80 family.

Intel said pricing would be posted once devices were available off the shelf. 3065 Bowers Ave., Santa Clara, CA 95091 (408) 246-7501.

8080 USERS

Make software debugging almost fun with . . .

TRACE-80

A flexible resident tracing monitor for any 8080-based system with 4K memory.

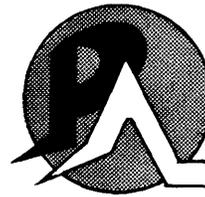
Featuring:

Printing of register contents after each instruction or branch,

Multiple breakpoints, allowing the user program to run at full speed and to return to TRACE-80,

Display on memory write mode

*Another human engineered debugging aid . . .
from the people who care about
your mental health . . .*



PETERS ASSOCIATES
P.O. BOX 61622
SUNNYVALE, CA 94088
(408) 245-1519

RUGGED MICROCOMPUTER SYSTEM

Omnibyte Corp., is offering a microcomputer system housed in a rugged 16-slot card cage interconnected by a printed circuit. A bus-oriented backplane requires no custom wiring. Fourteen of its 16-slots will accept any combination of RAM, ROM, or I/O cards. The remaining two slots contain the CPU card and a multifunction controller card. Oakbrook, IL

Z-80 MICROCOMPUTER CARD

A new generation CPU board has been integrated into the Digital Group's microcomputer system.

Features of the Z-80 system includes 80 new instructions over the 8080 set, 696 operation codes, extensive 16-bit arithmetic, three interrupt modes, built-in automatic dynamic memory refresh and eleven addressing modes.

The Z-80 CPU is completely inter-changeable with Digital Group's (Cont'd next page.)

8080A, 6800, and 6500 CPUs. A complete system is priced as low as \$475. P.O. Box 6528, Denver, CO 80206 (303) 861-1686.

COMPUTER POWER & LIGHT

Computer Power & Light is selling its new COMPAL-80 microcomputer system for homes and small businesses at \$1863. The fully assembled, guaranteed system includes an 8080A-based CPU; two serial I/O ports (one configured for audio tape cassette, the other as TTY or RS-232), 12K of RAM, 16 x 64 characters and graphics, 9" high resolution monitor; ASCII keyboard, enclosures; and extended BASIC residing in 10K, including formatted PRINT, double precision, all transcendental functions and user defined functions.

COMPAL-80 is easily expanded into a small business system with additional memory (up to 32K) dual floppy disc drive in IBM compatible format; a choice of hard copy devices including matrix and daisy wheel printer; disc BASIC with multiple file handling and management features; and various application programs written in BASIC. The typical business system with printer sells for under \$9000.

ASTRAL DESIGN INCLUDES CABINET

M&R Enterprises' 2000 microcomputer kit is specifically designed for ease of assembly and minimum debugging time. The basic Astral computer includes the cabinet, motherboard, card, rack, power supply module and boards for the front panel, 6800 processor and 8K RAM. The only wiring consists of bringing line voltage into the machine to the power supply and then distributing power supply voltages to the motherboard. Sunnyvale, CA.

EDUCATIONAL/FIELD MICROCOMPUTER

Digital Electronic Corp. is now marketing their DE68 Microcomputer designed for use in the laboratory, classroom and field. Using the 6800 chip, the DE68 has a mnemonic translator that automatically converts characters from the self contained alphanumeric keyboard into machine language. Total PROM storage is 5.5K.

An optional DE/100+ Teaching Module is available. It has LED displays, hex keyboard and a random number that simulates a data source for real-time acquisition programming. The teaching module plugs into the DE68 via a flat cable and contains 12 ICs, including a PIA.

Price of the DE68 is \$3000 without the DE-

681 printer, and \$3500 with it. The teaching module will sell for \$100. Oakland, CA 94601 (415) 532-2920.

FULLY ASSEMBLED APPLE COMPUTER

The Apple-1 microcomputer comes fully assembled, tested and burned-in. The system's basic price is \$666 and includes 6502 micro, regulated power supply, 4K-bytes of RAM, the video interface and ROM monitor. 4K of memory and cassette-tape are available for an additional \$195.

The microcomputer's video interface connects directly to either a monitor or a TV set via an rf modulator. The interface displays 24 lines of 40 characters and features automatic scrolling.

The Apple-1 uses 16-pin, 4-K dynamic memory chips. But when the 16 K RAMs become available, some minor modifications to the Apple-1 board will make it possible to replace the 4-K chips with the larger memories for a total on-board capacity of 32-k bytes. 770 Welch Rd., Palo Alto, CA 94304 (415) 326-4248.

JUPITER IIC HOUSES 6800

The Jupiter 11C microcomputer hardware consists of an MC6800-based CPU, 8k of RAM, and 3k of ROM with a video-terminal interface, keyboard and a dual audio-cassette interface. Software includes a monitor/debugger package with interrupt handling and I/O monitor call instructions. A programmable macro-editor, expanded assembler and proposed ANSI-standard BASIC is included.

The Jupiter is available in kit for \$2200 and \$3200 assembled. Both offerings include 2 cassette units and a 12-in. B&W TV. Wave Mate, 1015 W. 190th St., Gardena, CA 90248. (213) 329-8941.

AMI'S 6800 SUPPORT KITS

American Microsystems, Inc., is offering three S6800 microprocessor and support parts in kit form. They include the EVK 99, priced at \$133, the EVK 100 at \$295 and the EVK 200, \$495. A fully-assembled and tested version, the EVK 300, is offered for \$765.

The EVK 99 consists of a TW board with two edge connectors and nine 6800 family parts, including a 6800 to address up to 65K of memory, four 128 x 8 RAMs, and one PIA. The EVK 100 includes the same plus terminal communi-

cations capability.

The EVK 200 comes with all the above features, including the I/O interfaces, memory, a single EPROM device, on-board EPROM programmer and a crystal clock.

The fully-assembled version of the kits, the EVK 300, includes a tiny BASIC tape which can be programmed into the four EPROM chips.

Z-1 DEVELOPMENT SYSTEM

The Z-1 development system from peripheral maker Cromemco is based on the Zilog Z-80/4 chip. Besides the chip, the \$2495 system has 8K RAM, 8K PROM, PROM programmers, RS 232 interface and a 28 amp power supply. Mountain View, CA.

PRO-LOG ANNOUNCES 9002 CARD

Pro-Log Corp., has added the PLS-891 to their line of microcomputer design cards. Based on the EA9002, the card contains 64 bytes of scratchpad RAM, 2K of PROM and 2K of ROM and several I/O ports which consists three-latched 8-bit output ports and two 8-bit input ports. Output drive is 10TTL loads and input loading is one TTL load.

The microcomputer has an instruction execution time of 3.2 us for one-byte and 6.4 us for two-byte instructions. The clock is on-board the card. Power requirements are 5V at 1.8A, and 10V at 0.5A. 2411A Garden Road, Monterey, CA 93940, (408) 372-4593.

8080 EXPANDABLE CARD RACKS

Two expandable 8080A microcomputer card rack systems pre-wired for 10 cards with connectors for 16 cards are being offered by Pro-Log.

The four-card CRS-81 system, using 1702 PROMs includes an 8080A, 1K RAM, sockets for 2K ROM, four 8-bit input ports and four 8-bit output ports. Price is \$730 in single quantities.

The second system CRS-82, using 2708 PROMs, also uses the 8080A, and has characteristics similar to the CRS-81 system. Differences include 4096 words of ROM available, a 0.488us state-time crystal clock and a \$670 price.

QUAY USING Z-80 IN LATEST KIT

The Quay 80 AL microcomputer kit incorporates the Zilog Z-80 microprocessor and runs at 2.5 MHz.

It requires a power supply and terminal device for independent operation, or one can plug its 100-pin edge connector into an Altair

or Imsai bus.

The kit also incorporates a ROM-based monitor that allows memory alter, dump or load, programming UV-EPROMs.

A serial I/O port permits use of RS 232C or 20 mA terminals at rates ranging to 2400 baud. A parallel input port services an 8-bit ASCII keyboard and supports a memory-type TV monitor interface. The price is \$450 in kit, \$600 assembled. P.O. Box 386, Freehold, NJ 07728 (201) 681-8700.

DIGITAL CASSETTE RECORDER

A microcomputer-controlled digital cassette recorder, the dcr/10 comes complete with proper interface cable. The micro edits data to produce consistent blocked records for computer analysis. Firmware control allows units to accommodate serial or 8-bit parallel data at any baud rate, as well as any code conversion required. William Palmer Industries, 1627 Pontius Ave., Los Angeles, CA 90025.

DEVELOPMENT/PRODUCTION CARD

An 8080/9080 microcomputer board that serves both development and production application is now being offered by Quarndon Electronics. The QMS 80-1180 offers 2K bytes of RAM, full memory address decoding, built-in single-step circuitry, RS232 and 20mA serial interface and 1.5K bytes of PROM containing a monitor program.

The QBUG monitor, expandable to include a full mnemonic direct assembler, operates in octal or hexadecimal and communicates with either a serial or parallel terminal. It allows alteration of memory locations or blocks. Four breakpoints may be set to display all the register contents when a given address is encountered, and blocks of memory contents can be moved to a new locations. Slack Lane, Derby, England 32651.

ZILOG OFFERING FULL Z-80 CARD LINE

A new, compact microcomputer board set has been introduced by Zilog. The board consists of microcomputer board, MCB, and a disc controller board with RAM memory, MDC, and a 16K RAM card, RBM.

The MCB uses the Z80 as its heart and contains 4K bytes of RAM with sockets available for up to 4K bytes of ROM, PROM or EPROM. The board contains one serial channel for use by CRT and two channels of parallel I/O. Other features include:

- o Programmable full duplex serial I/O port with RS-232,

- o Universal parallel I/O programmable to define any direction and data-transfer characteristics for two 8-bit ports,
- o Four programmable counter-time circuits and driver/termination devices.

The disc controller board (MDC) allows the user to store and retrieve data from up to four floppy discs. This board also contains 12k RAM, 16-bit CRC generation and checking, Z80-PIO used for disc status reading and control under CPU software control, data separator and data encoder that can be used for single density drives, parallel/serial converter and wait control logic to allow the Z80-CPU to transfer data to or from the disc under software control, and parallel I/O port.

As part of these two boards, the Zilog Disc Operating System, ZDOS, is provided.

Third part of the new board series is the Memory Board (RBM) that allows the user to expand the series to 65K bytes in 16K increments. This board uses low power, high speed RAMs.

Each board in the series needs only +5volts to operate, and each can be operated as an independent modular unit. The boards have a standard 122 pin connector with 100 mil. spacing. Board size is 7.7 x 7.5" and fits in 0.5" spacings.

As an option, Zilog offers the board set in a complete system including card cage, systems chassis, power supply, two floppy discs and a front panel. 10460 Bubb Rd., Cupertino, CA 95014 (408) 446-4666.

LOW-COST I/O MODULES

PCS has introduced a new line of low-cost, off-the-shelf I.O modules for the company's 180 microcomputer.

A new AC/DC module, the PCS 1804, accepts up to eight AC inputs, eight digital inputs eight AC outputs and eight digital outputs.

The module optically isolates all signals to minimize feedback, crosstalk, ground loops, and noise generation.

A new multifunction module, the PCS 1820, accepts up to 32 digital inputs and 32 digital outputs under the control of a PCS 1806 or 1810 microcomputer. The 1820 also accepts up to eight priority interrupt inputs and has three software programmable 16-bit counters.

A new TTL module, the PCS 1823, accepts up to 64 TTL digital inputs and 64 TTL digital outputs under the control of a PCS 1806 or 1810 microcomputer.

The company also announced an integrated, low-cost power A/D module, the PCS 1850. Because this 16-channel module makes extensive use of CMOS circuitry, it consumes only 1 1/2

watts of power, or one third that required by standard TTL models. Optional expansion modules expand the 1850's input channels to 32, 48, or 64 channels.

The PCS 1804 is priced at \$360, the 1820 at \$400, the 1823 at \$295, and the 16-channel 1850 at \$700. Quantity discounts available and shipments 1Q77. 5467 Hill 23 Drive, Flint, MI 48507, (313) 767-8920.

COMMUNICATIONS MICROCOMPUTER

A new, self-contained communications-oriented microcomputer for facilitating the firmware implementation of custom communication controllers has been announced by Micom Systems Inc.

The 40 Series Communications Processor is designed to perform such functions as data concentration, channel contention, message routing, polling control, speed and code conversion, protocol conversion, and voice response. The basic system is self-contained on a single card Central Control Module, including a LED display and a 10-position function switch for diagnostic test or system monitoring.

Normally supplied in turnkey communications controller systems complete with firmware, the 40 series is also available to OEM's with a complete Program Development System to facilitate firmware development. Prices start at \$1800. with delivery 45 days ARO. 9551 Irondale Ave., Chatsworth, CA 91311. TWX 910/494-4910.

EXPANDED — 68

Electronic Product Associates, Inc., has announced a complete, microcomputer system for \$1186.00 called the Expanded-68, the computer is based on the Motorola/AMI/Hitachi 6800 microprocessor chip set.

Designed for system prototype development use, the Expanded-68 comes complete with 8K of memory, power supply, 16 digit keyboard, TCC3 adapter, hexadecimal LED display, expansion cabinet, 36 pin edge connector, and Mik-bug. Also available for direct interfacing are: dual floppy disc drive, IMP-1 printer, 132 column printer, TV interface, and a full ASCII keyboard. 1157 Vega St., San Diego, CA 92110. (714) 276-8911.

MOLDING CENTRAL SYSTEM

A molding central system first introduced by the Instruments Division of Barber-Colman Co. features microcomputer control. MACO 11 controls all molding machine parameters and alarm set points.

MICROCOMPUTER BASED PRODUCTS

PICK & PACK MACHINE

A computer-based pick and pack machine which loads four standard die trays is being offered by Mechanization Associates. A micro-computer is used to calculate the last filled die position in each tray, and then calculate the movement required to move from the present position to the next empty pocket in the tray selected.

BUFFERED TAPE CASSETTE TERMINAL

MFE has designed a u8080-controlled buffered tape cassette terminal built around the MFE 2508B cassette drive. The Model 5000 performs edit, search, and communications functions.

Operating at speeds up to 120 cps, the \$1995 drive stores 175,000 bytes of formatted data. It employs read/alter/write and CRC for error detection. It also includes routines for error correction. Salem, NH 03079

μC CUTS ENERGY COSTS

Lund Inc., is using PCS' Micropac 180 microcomputer control system to cut energy costs 17% in six of its Minneapolis supermarkets.

The 180 controls the operations and maintains the performance efficiency of refrigerators, freezers, the central heaters, unit heaters, water heaters, air conditioners, ventilator fans and curtain doors which control the passage of air of varying temperature into and out of the 36,000 sq. ft. buildings.

DTC ADDS TWO MICROCOMPUTERS

Micro File MK II and MK IV microcomputer systems from Data Terminals and Communications come with two and four floppy disc drives—each with over 300,000 bytes of storage.

Of the two serial I/O ports provided, one handles a data terminal and the other a data communications line, each at independent speed speeds and ranging from 110 to 9600 baud. An included operating system provides file management and utility routines for data transmission and reception.

MK II with two floppy disc drives cost \$4,295, and with the MI IV with four floppy disc—\$6,750. 1190 Dell Ave., Campbell CA 95008.

CPU USES DEC'S LSI-11 MICRO

General Robotics Corp. has introduced the GRCl1/03, a CPU based on DEC's LSI-11 micro. The \$4,995 unit, housed in a five and one-quarter inch chassis, is said to be suitable for rack-mounting or tabletop operation. The standard GRCl1/03 includes an extended instruction set, floating point arithmetic, 20K RAM, extended memory addressing to 512K words and serial I/O module with switch-selectable data rates.

WORD PROCESSOR

NBI of Boulder, CO has introduced a \$9,990 Intel 8080 based word processor. The unit has super and subscripts repagination, document assembly capability and standard editing functions. The unit includes a Dysan diskette drive and Qume daisy wheel printer.

SYSTEM LINKS 8080 TO HOST CPU

Beckman Instruments, Inc.'s new microcomputer-based computer interface system contains an Intel 8080 microprocessor that links the process controller to a host data processing system. The system connects the analog functions of the control loop with a central computer via a five-wire, bi-directional data highway.

TYCHOM'S WORD PROCESSOR

A \$7,000 microcomputer-controlled word processor has been released by Tychom Systems. Editerm includes an 8080, 4K RAM, tape cassette, baseplate and interfacing for an IBM Selectric. Options include floppy disc, Diablo Hytype Printer, and an IBM-compatible magnetic card reader/writer. Fairchild, NJ.

MICRO-CONTROLLED WEAPONS

When the F-18 aircraft strike fighter makes her maiden voyage in mid-1978, an Intel 8080 will be in the pilot seat of a microcomputer-controlled weapons firing system. The 8080 was chosen because it has double-precision accuracy and can be programmed to operate like a 16-bit machine. The micro will allow the Navy to change the F-18 weapons complement mostly through software changes.

PROCESS CONTROLLER

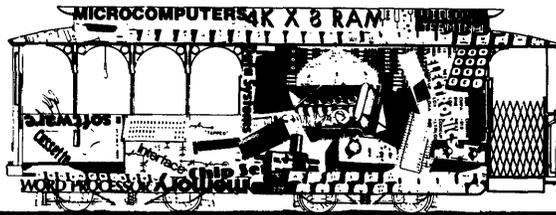
The microcomputer-based Model 117815 Process controller from Orbitran Co. provides logic storage and control for a variety of in-

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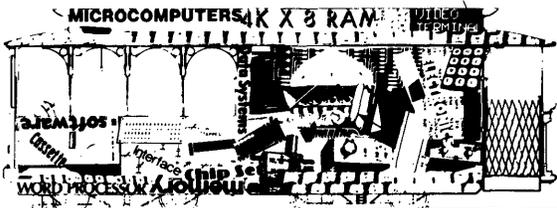
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TRAFFIC CONTROL SIGNALS

New York state's Department of Transportation is installing over one hundred 6800 microcomputer-based traffic control signal systems. The system receives data from up to 44 sensors on vehicle presence and speed, pedestrian presence and others, giving green light priority to the direction of the heaviest traffic.

INTERACTIVE TERMINALS

Log Abax has introduced a new interactive terminal that contains a microprocessor. The 8008 lets the terminal communicate in ASCII, BCD, and Telex codes at speeds from 75 to 4800 baud, either synchronously or asynchronously. Operation in full-duplex, half-duplex and echoplex modes is possible.

SLASH 6 COMPUTER

Harris Corp.'s SLASH 6 computer is designed around a high-performance, 8-bit bipolar microprocessor. Its I/O structure permits the sharing of peripherals in multiple CPU configurations. The memory is expandable in 48K byte increments to 768K bytes maximum. SLASH 6 with 48K bytes of memory is priced \$14,500.

MICROS MANNING WEATHER POST

8080 microcomputers will be working alongside Air Force observers later this year to demonstrate automated techniques for airfield operation weather support. The Modular Automated Weather System Monitor (MAWS), is expected to handle most of the observing and short range forecasting chores of a base weather station. Weather data will be processed faster, in greater detail, and for a lower cost than is presently being done.

MICRO AIMS ARMY'S LATEST TANK

The Army's new XM1 battle tank, now in the development stage at Chrysler Corp., includes a digital ballistic computer with a microcomputer designed to determine proper aiming off-

sets for the weapon system in horizontal and vertical planes.

COMMUNICATIONS MICRO

International Computer Products, Inc.'s TD-1 Termidisk communications-oriented microcomputer is equipped with one to four standard IBM compatible diskettes. The \$2,450 unit is designed for data collection, time-sharing and business communications. Interfacing is via 20 mA current loop or RS232. 2925 Merrell Road, Dallas, TX 75229.

AUTOMATIC CONTROLLER

Available with either CRT or LED displays, a new \$2600 automatic controller that uses a microprocessor for positioning up to four axes for a combination of linear or circular motion is being offered by Anorad Corp.

The system features a 12 V CMOS bus interconnecting the microprocessor to all input and output devices. All logic controls are CMOS.

SMART VOLTMETER

John Fluke Mfg. Co.'s Model 8500A 5½ digit voltmeter is using an 8080 microcomputer to achieve efficiency and versatility. The microprocessor allows communications with the instrument from either a front panel or a remote keyboard terminal.

DECWRITER GAINS INTELLIGENCE

Providing intelligence, system programmability, and buffer memory for DECwriter LA36 or LA180 terminals, a new Communications Controller from Applied Systems Corp., controls data networks at rates up to 9600 baud using asynchronous/synchronous modems or computer interface adapters.

An 8080 microprocessor provides communications protocol control, code conversion/editing, local data processing, or custom programming functions for one or more terminals. Included are network communications line adapters plus optional peripheral interface for CRTs, flexible discs, or tape cassettes. 26401 Harpet Ave., St. Clair Shores, MI 48081.

AIRBORNE ALTITUDE SYSTEM

Osborne-Hoffman, Inc. has selected RCA's 1802D CMOS microprocessor for use in an airborne altitude system. Information is displayed in both digital and analog form. The digital shows altitude or depth within 1%.

BEI USING MICRO

Consisting of both motor/encodes and controller, a microcomputer-based BEI Electronics MPS 10 system provides many pre-programmed nonlinear position output functions upon external digital command. With 42 arc-min resolution and 1 rms accuracy this system offers almost 512 output instructions. 1101 McAlmont St., Little Rock, AR 72203 (501) 372-7351.

ENVIRONMENTAL SYSTEM

Beukers Laboratories has incorporated five 6800 microcomputers into their WL-3DS Environmental System. The micros perform preprocessing on atmosphere profile measurements supplied by free falling sensors. Data is then logged on tape and sent to a Nova microcomputer for processing.

DATA COLLECTION TERMINAL

Coastal Data Services' microcomputer-based data collection terminal, the Smart Clock, interfaces with virtually any type of processor. The terminal, which can operate in either a real-time/on-line or stand-alone mode, reads up to 16 digits of Hollerith code from plastic ID badges and IBM cards, and will also accept numeric information via 10 pushbuttons.

HIS COMPUTERS USING 2900'S

Honeywell Information Systems model 6/43 small computers, recently introduced, are designed using Advanced Micro Devices' 2900 bit-slice microprocessors. The HIS computers, which have a floating point processor option, use 17 of the AMD 2901s on a single board. Four additional 40-pin microprocessors are used for matrix shifters to assist the floating point processor. They are also included on the floating point processor board. These four CPUs are manufactured by Honeywell.

The micros are mounted on a 16 x 16" multi-layer etched board, which also contains the Honeywell-made MPUs, PROM firmware, megabus interface circuitry, various support logic and a logic voltage regulator.

PIN-BALL ANYONE?

A microcomputer-controlled pin-ball machine by Mirco Games is said to have a number of substantial advantages over its electromechanical relay-operated counterparts. Called the "Spir-it of '76", the pinball machine uses a 6800

microprocessor, PIA, and 8K of memory.

Three diagnostic routines stored in the program not only minimize the machine's downtime, but also checks every working component in the machine on a routine basis.

One diagnostic routine checks out all the bulbs for burned-out lamps, while another routine determines if trouble is present in any one of the switches. Another diagnostic briefly turns on all the solenoids in sequence to make sure they are all working. It also checks the LED digits by cycling the scoring digits from 0-9 and back to zero.

OIL FLOW MEASUREMENT SYSTEM

Because of the soaring cost of petroleum products, major oil and chemical companies are now demanding more accurate measurement of their products at every point between the well head and the end consumer. A microcomputer-based flow measurement system, developed by UGC Industries, Inc. of Shreveport, LA, is now providing petroleum processors with an economical, highly accurate means for measuring their spectrum of products in widespread locations.

Based around the Process Computer Systems' 1806 microcomputer, the "Microflo" measurement system can calculate the flow of liquids, gases, or steam in volume, mass, standard 60°F barrels, or other units of measure.

INTERFACE UNIT

Emerson Electric Company, Industrial Controls Division has introduced a new 8080-based RS 232 interface that will be offered as an option with the company's 2000 Series Tape Pac recorder systems. Price is \$1000.

8080-BASED TERMINALS/CONTROLLER

To aid OEMs in capitalizing on the explosive growth of data collection needs, a new line of compact 8080-based terminals and controllers, System Control Units (SCUs) have been introduced by Epic Data Corp.

Three SCUs are available. Model 1647-1 electro-optically reads up to 12 columns on 3½ inch wide punched badges with 80-column ANSI format. Time of day can be shown in hours and minutes on the numeric display.

The Model 1647-2 also has the ability to accept data from both punched badges and 80-column ANSI cards. The Model 1647-3 further offers 40 user-defined keys and up to 10 LEDs for prompting. Prices range from \$995 to \$1615. Bellevue, WA (206) 332-8724.

MICROCOMPUTER SUPPORT

TIME DIVISION MULTIPLEXER

A microcomputer-based time-division multiplexer from Computer Transmission Corp. (TRAN) accommodates up to 16 asynchronous or synchronous digital data channels or any mixture of both. The \$10,000 M1318 Multitran multiplexer can be used in point-to-point multiplexing between terminal clusters and central computers and is fully compatible with the company's M3200 Network Switching and Management System.

ELECTRONIC SCALE

StreeterAmet's microcomputer-based Quantumatic 4500 electronic weighing indicator handles most operations involved in static weighing and simple batching. Large LED display over-capacity, motion, minus weights, and zero zone. The instrument can measure in either pounds or kilograms.

Three models accommodate tare weight, identification, preset weight control, time and date and related information.

PROGRAMMABLE INSTRUMENT

E-H Laboratories has developed automatic integrated, modular measurement system, the 8200. It is compact and microcomputer controlled.

The 8200's 6800 allows the execution of complex test sequences and can provide for the analysis of test results. It runs the programs generated by the operator and entered through a keyboard or an IEEE-488 interface into a programmable memory. The system is expandable.

Depending on which instruments are included, the model 8200 is priced between \$35,000 and \$40,000.

INTELLIGENT TERMINAL

Using two 8080s, the React intelligent terminal system can either communicate with a host computer or operate offline in a free-standing mode. Users can program in Intel's PL/M high level language and can access from 250K to 1M bytes of floppy storage and 16K to 32K bytes of RAM.

Also part of the system are up to three CRTs and a serial impact printer. Teletype 33/35 protocol is standard, but the system can also operate under binary synchronous and IBM's SDLC. Raleigh, NC.

LOGIC-WAVEFORM ANALYZER

Designed for hardware and software debugging of microcomputer system, the model DM 230 logic-waveform analyzer has a built-in memory with a capacity of 128 32-bit words.

The start or stop address is set on a 4-digit hexadecimal thumbwheel switch, and digital data is displayed on a six-digit hexadecimal readout. For a real-time look at analog waveforms, including timing relationships and noise spikes, the instrument allows a standard single-channel oscilloscope to be used as a 32-channel measuring tool.

Access to the microprocessor under test is by means of a clip-on probe. A probe buffer is positioned close to the probe to minimize loading of the MUT. Different microprocessors require separate buffers.

The price of the DM is \$2,900 which includes one buffer; additional buffers are \$750. Delivery time is 60 days. 169 Ridgedale Ave., Morristown, NJ 07960 (201) 267-4990 (353)

PICODAC 80 TRAINING COMPUTER

Designed as a training computer to teach microcomputer principles and programming, Picodac 80 allows analysis and display of the CPU with registers, flags, program counter and stack pointer, and permits visualization of elements such as memory, inputs, and outputs. This enables debugging of various structure, addressing modes and interrupts.

Introduced by Laboratoires d'Electronique et d'Automatique du Nord, the microcomputer contains an 8080 microprocessor with clock, bus amplifier, RAM, and PROM, which are all pluggable boards. The console, providing LED binary displays and switches, is controlled by the program constituted in the memory board. 236, rue Sadi Carnot, 59320 Haubourdin, France.

GENERAL PURPOSE INTERFACE

The UPC 6001 offered by SMC Microsystems Corp., is a general purpose interface circuit designed to act as a subcontroller between 8080 peripherals such as cassette recorders, floppy discs, punched-card readers, and etc. It can also provide full control for direct memory access (DMA) operation.

The MOS device contains control and status registers that are programmed to handle single character, block (multicharacter), or multi-block transfers on DMA or interrupt basis. 35 Marcus Blvd., Hauppauge, NY 11787 (516) 273-3100.

TESTING FACILITY OPENED

Microtest of Sunnyvale, CA has just opened a new facility dedicated to testing all industry standard microprocessors. The company also claims it can run the complex test patterns for most types of RAMs and ROMs, including 4K and 16K dynamic RAMs. (408) 739-8001.

PDP-11 μ C DEVELOPMENT KIT

A new kit, MAX11, contains a cross assembler simulator, and PROM programmer, and converts a DEC PDP-11 into a microcomputer development system. Written in macro assembly language, the cross assembler features user defined macro library, local symbols, symbolic cross reference, assembly list control, full nested macros, and conditional assembly. It executes under DOS at the rate of, and uses the same kind of format as Macro II. It is able to examine and modify location and register, search ROM, modify object file output on the system, and change radix of typeout.

The \$3550 kit is presently available for Intel 4040, 8080 and Motorola 6800. 6 Preston Ct., Bedford, MA 01730. Aivex Inc. (617) 275-2333.

MANUAL EPROM PROGRAMMER

The 1702A Manual EPROM Programmer features hex keypad, two digit hex address and two digit hex data display. Controls include load, clear, go, step, key/copy, data in/data out, and counter up/down.

The profile card includes high voltage pulse regulator, timing, 8-bit address and 8-bit data drivers/receivers. Programming is in 20 minutes--copying in 5 minutes. Requires +5, -9 and +80 volts. Assembled version is \$299.95 and kit is \$189.95. 1244 Lambert Circle, Garden Grove, CA 92641 (714) 539-0735.

THREE PROGRAMMERS MARKETED

Three different types of PROM programmers are offered by CCIP. The PRO-2000 VLC is used for programming only 1702A PROMs. Information is inputted via switches and is displayed on LEDs,

The other two programmers are microcomputer controlled and accept the PROM types 1702A, 2704, and 2708. A hexadecimal keyboard provides input data to the PRO-2001, and data is presented in hexadecimal format, on a LED display. Optionally, a TTY or paper-tape reader can be connected.

The PRO-2002 unit must be connected to a TTY. The PROMs are programmed through the keyboard as well as through the paper-tape reader. Prices of the three programmers range from \$423 to \$2116. 7104 Obersulum-Willsback Schillerstrasse 2, West Germany (07134) 3014.

EUROPEAN μ C PROTOTYPE BOARDS

Vero Electronics is offering a series of microcomputer prototype boards that comply with European DIN standards. All boards are pre-assembled with wire-wrap DIPS, testpoints, and component mounting pins. A CPU board is priced at \$60.11, Memory \$56.60, interface \$60.75. 171 Bridge Rd., Hauppauge, NY 11787 (516) 234-0400.

PROGRAMMER BOARD

A PROM/RAM/PROM Programmer Board for the Altair 8800, IMSAI 8080 and other S100 bus microcomputers is now available from Xybek. This 2K memory board contains 256 bytes of RAM and space for 1792 bytes of 1702A PROMs.

One of the 1702A sockets doubles as a 1702A programmer. The PRAMMER is not an I/O device, but occupies any 2K slice of system memory.

The kit is complete with its own 80V power supply and features on-board timing independent of the CPU clocks. It contains its own microprogram for read and write control. Introductory price is \$189 with the extension kit at \$15. Box 1631, Cupertino, CA 95014.

SOFTWARE MAINTENANCE PROGRAM

A spokesman for a local electronics firm this week announced a digital computer program that through fresh application of an old technique--virtually eliminates lost time due to malfunction of computer components. Called OREMA (oh-Ray-ma, from the Latin oremus, meaning "let us pray"), the program offers prayers at selected time intervals for the continued integrity of memory units, tape transports and other elements subject to depravity.

Basically liturgical in structure, Orema uses standard petitions and intercessions stored on magnetic file tapes in Latin, Hebrew, and FORTRAN. It holds regular Maintenance Services thrice daily on an automatic cycle, and operator intervention is required only for mounting file-tapes and making responses, such as "And with they spirit", on the TTY.

Prayers in Hebrew and FORTRAN are offered directly to the Central Processing Unit, but Latin prayers may go to the peripheral equip-

ment for transfer to the Central Processor by internal subroutines.

Although manufacturer-supplied prayer reels cover all machine troubles known today, the program will add punched card prayers to any file-tape as needed after the final existing Amen block. Classified prayer reels are available for government installations.

In trials on selected machines, OREMA reduced by 98.2% the average down time due to component failure. The manufacturer's spokesman emphasized, however, that OREMA presently defends only against malfunctions of hardware. Requested errors and other human blunders will continue unchecked until completion of a later version, to be called SIN OREMA.

16-BIT FLOATING POINT UNIT

A 16-bit floating point unit for minis, micros, Model DD154 provides automatic left-right justify and operates in controlled-shift modes. In automatic-up justify mode, the Interface Engineering Inc. unit accepts 16-bit data and 4-bit exponent and shifts the message up until the most significant 1 appears in the MSB position on the output lines. It also counts the number of shifts and outputs a corrected 4-bit exponent. The automatic-down justify mode reverses this process by shifting the data right until the exponent becomes zero. In the controlled-shift mode, the unit shifts data up to 15 places up or down, using 4-bit shift command lines to define the number of shifts.

Internally clocked and capable of shifting 16 lines in less than 5 us, the device requires one program instruction and provides TTL compatible I/O logic levels. The DD154 is packaged in a fully encapsulated plug-in module. 386 Lindelof Ave., Stoughton, MA 02072 (617) 344-7383.

PROGRAMMER/DUPLICATOR

Pro-Log's combination programmer and duplicator for PROMs, the series 92, consists of a master control unit and a plug-in PROM personality module. The M920 master control unit sells for \$995 with personality modules ranging in price from \$350 to \$550.

When the unit is connected to a TTY or similar terminal the 92 can be commanded to program, list, duplicate, and verify PROMs. The unit is packaged in an attache case and weighs less than 15 lbs with the personality module. Options include an RS 232 interface. 2411 Garden Rd., Monterey, CA 93940.

INTELLIGENT BREADBOARD

IMS Associates has introduced an intelligent breadboard for the development of discrete logic, I/O interfacing, memory systems and microcomputer circuits. Supplied as a complete integrated package, the console connects directly with the IMSAI-8080 computer, allowing circuits to be implemented in hardware and transferred to software in a step-by-step manner. Hardware/software trade-offs can be easily studied and circuit designs tested extensively since the computer and breadboard communicate via the computer's programmable parallel I/O Board.

Features of the \$435 kit include easy access to signals for probing, connection of multiple computers and breadboards, use of LEDs as latched and unlatched level indicators, and capacitors into solderless terminal strips. 14860 Wicks Blvd., San Leandro, CA 94577.

SMARTER FLOPPIES

The addition of an Intel 8080 microcomputer to the Three Phoenix Co.'s FD-33 floppy disc tester allows for new tests such as amplitude, resolution determination, dropout, extra pulse, and modulation.

The microcomputer also allows users to select exactly what tests they wish to have performed, or to develop their own custom tests. In the future, the manufacturer plans to offer requesting users custom software packages. -0632 N. 21st Ave., Phoenix, AZ 85029 (602) 944-2222.

SUPPORT PRODUCTS

Shepardson Microsystems has announced the first in a line of products being developed to aid users of microcomputers in their system development. The first product, Model 2708 PROM programmer, is an intelligent programmer that will program all major manufacturer's 2704 and 2708 PROMs. Model 2708, listed at \$850, provides RS 232 and 20 mA current loop interfacing and an internal microprocessor.

Full editing capability is provided for users to move, alter, and store data. A paper tape reader can be used to input the desired data, and a paper tape can be generated to store the PROM data for later user or modification. The paper tape may be in BNPF, BHLF, binary or ACSII hexadecimal format.

The programmer will also automatically adapt to any terminal baud rate up to 6000 baud. The user can modify both the pulse width and the

plant production operations. The unit provides 24 output control lines which may be expanded to 120 separately controllable lines. Software programming can be provided by the company. Lakeside, CA.

MEMORIES AND PERIPHERALS

DESKTOP DISPLAY TERMINAL

The VT71/t desktop display terminal for the printing and publishing industry is designed around DEC's LSI-11 microcomputer. The terminal permits internal storage and editing of up to 40,000 characters of copy. Custom editing features can be added to the system.

PROGRAMMABLE DATALOGGER

The 90MC is a microcomputer-based field programmable datalogger and monitor. Consolidated Control's unit features include acquisition rates up to 100 points per sec; capacity to 1,000 points with four multiplexing assemblers; programmable alarms; and battery protected programming. Bethel, CT.

μC-BASED SWITCHBOARD

Datapoint Corp. is introducing a microcomputer-based switchboard designed to cut large corporation telephone bills by 30 to 50%. Info switch first checks the priority rating of a caller's identity number and tries to select the least expensive route using WATS, FX, tie lines, or other voice communications facilities. If all circuits are busy, and the priority number warrants it, the call is put through via Dial Direct.

The switching equipment consists of a microprocessor with a 300 ns cycle, a 16K ROM program, a 4K RAM temporary storage and a reed-relay switch matrix.

MODULAR μC SYSTEM

Artronix, Inc. has announced a multiprocessor modular microcomputer system designed for medium and small sized businesses. A two-CPU 96K-byte system with 160M bytes of mass storage, line printer, and 16 terminals is priced at \$100,000.

WIRE BONDER

Hughes Aircraft's Industrial Products division has introduced a wire bonding system that is controlled by a microcomputer. HMC-1460 is equipped with a memory capable of storing 200 wires, expandable to 1,000 wires. Basic system price is \$19,750.

MATRIX TELEPRINTER

A microcomputer controlled 180cps matrix teleprinter has been introduced by MI². Dubbed the Design 2400 KSR/T, the unit is priced at \$4,440, and includes an RS232 interface and keyboard, and is controlled by an Intel 8008.

PROGRAMMABLE POS TERMINAL

NCR has introduced a microcomputer controlled, programmable POS that, it says, will replace its NCR 280 retail terminal.

The NCR 2151 terminal uses an Intel 8080 MPU, has 32K bytes of RAM expandable to 64K, an 8-position LED display and 30 programmable LED descriptors.

The terminals are programmed to user specifications, and employ distributed processing techniques that share functions between the terminal, in-store concentrator, small computer and host mainframe.

The basic terminal with 32K of RAM is available at a price of \$4,145. Dayton, OH.

μC IN MILITARY PROGRAMS

United Technologies Corp.'s Norden division is developing a microcomputer based upon AMD's Mil Spec AM2901 4-bit bipolar slices. Configured in a 16-bit system, the microcomputer will be used in two military programs. One as a digital moving target indicator and automatic target detector system designed to be integrated with an existing U.S. Navy shipboard surveillance radar. The second is an update of Norden's F-111D display equipment.

μC DIGITAL CASSETTE RECORDER

DCR110, a microcomputer-based digital cassette recorder, logs data from any user-specified instrument in formats readable by TI's Silent 733ASR, Wang's 2200 series and DEC's Decassette. The \$1885 DCR/10 is standard with custom cabling for interfacing to the data sampling instrument. William Palmer Industries, 1627 Pontius Ave., Los Angeles 90025

REDUCES PROGRAMMING COSTS

The Model 5600 MicroDATA TRAK reduces programming costs and increases flexibility for industrial process programmers by providing one or two analog set point programs for process manipulation vs time, plus seven programmable on/off event functions. Programs are generated by best-fit straightline segments of

number of loops in programming a PROM, when used in conjunction with a terminal. 20823 Stevens Creek Blvd. Bldg. C4-H, Cupertino, CA 95014 (408) 257-9900.

MICROCOMPUTER ANALYZER

Biomation's Model 168-D microcomputer analyzer records a history of up to 256 memory accesses and displays the information on a 9" CRT in hex notation using memory maps or as a function of time. It comes with a personality module for either 8080A or 6800 microprocessors. Maximum record rate is 10MHz. Price is \$5,650 with cabling. 10411 Bubb Rd., Cupertino, CA 95014.

GAI VIRTUAL CONSOLE

General Automation, Inc. has available a new virtual console for its GA-16/220 and GA-16/330 microcomputers.

Four functions comprise the virtual console; an extended programmer's console capability via local/remote/CRT/TTY, a serial I/O port, an autoloader capability and a set of lights and controls on the edge of the CPU boards.

Heart of the console is GA's BASIC Utility Software PROM package. This provides console control and displays functions as well as a complete set of user debugging facilities. For example, a programmer can display and change any register, display and change any memory location, display a block of data from memory, load and dump binary tapes, store pattern in memory, single step, set multiple traps and "Go".

Access to the virtual console is through RS 232 and current loop serial I/O port servicing CRT, TTY or modem. 1055 S. East St., Anaheim, CA 92805 (714) 778-4800.

PORTABLE CRT LOADER/MONITOR

The portable Model 395 Microcomputer-based CRT loader/monitor offers contact/relay symbology, keyboard loading, and real-time on-line monitoring. Each contact in the control circuit is displayed on the CRT as entered from the keyboard, providing immediate verification of the program and permitting editing and correction. Any two complete control circuits, each containing up to seven series elements and four parallel paths, can be displayed simultaneously in the run/monitor mode.

The entire memory program can be stored on magnetic tape cassettes or punched paper tape for use in verification, dumping and reload-

ing, or programming other controllers. When interfaced to a teleprinter, the unit will provide hardcopy printout of the program in ladder diagram format, with cross-reference listing. 425 W. Philadelphia St., York, PA 17405.

SELECTRIC-LIKE μ C TERMINAL

Multiterm Corp's latest data terminal, Model T-3000, features an internal 8080 microcomputer for system control and flexibility. The \$2,875 unit prints error codes for noise pulses, failures in the communications link or operator-keyed entry errors.

Styled after the IBM Selectric typewriter, the terminal uses a Diablo printer mechanism. Interfacing is RS232 in ASCII code. 2612 Artesia Blvd., Redondo Beach, CA 90278.

44-COLUMN DOT MATRIX PRINTER

IMS Associates' new 44-column dot matrix printer designed for use with the IMSAI-8080 computer as well as other computers, offers hardcopy output at \$399 in kit, and \$549 assembled. Features include standard 64 character ASCII subset, double-sized characters are software selectable, and automatic line wrap-around output lines. The printer offers multiple copy printing using carbon or NCR paper, and can interface to a parallel output port with handshaking. 1922 Republic Ave., San Leandro, CA 94577 (415) 483-2093.

8080 ANALOG INTERFACE CARDS

The four Sine-Trac 800 analog interface cards mate into Intel's MDS 80 microcomputer rack and operate under the control of its CPU. Each of these cards can be accessed by the 8080 in either the program control, programmed interrupt or DMA mode.

The a/d board, at \$845 for singles, accepts 32 single-ended or 16 differential analog inputs up to 10V, either unipolar or bipolar. It converts each of these to 12-bit outputs in binary, offset-binary or two's complement coding.

The \$295 a/d X board, expands the input analog interface in increments of 32 single-ended channels per board up to a maximum of 256.

The \$695 d/a board, outputs eight analog channels from the digital input of the microcomputer's data bus. The \$595 X d/a board, expands the analog-output capacity up to 256 channels in 8-channel steps.

Each card uses 5 V at 2 Amps. Datelek Systems GMBH, Becker-Gundahlstrasse 1, 8 Munich 71, West Germany, (089) 78 4045.

Turn us on.

And the Digital Group will get you going.

One of the first things you'll discover when you get started with microprocessors is that there's a lot more involved than the hardware. That's why you should consider a system's software, too.

With a Digital group system, you can get going fast...and you don't have to be a programming genius to make your computer do something for you. Turn us on, and your system really does what you want it to do—easily and quickly. Because the Digital Group firmly believes that a computer without usable software is useless.

Every system the Digital Group delivers has several operating programs included with it. As soon as you turn it on it's doing something! In addition, we make available an ever-growing number of software packages for Digital Group systems at all levels of support. (They're listed below.)

But first, how do you get started?

With Tiny Basic Extended.

For only \$5, you get the "beginning" and for an additional \$5 you can get a cassette full of game programs that work with it. Both are on audio cassette that your Digital Group system can understand. You can list the programs on the TV screen of your Digital Group system and see exactly how they work step by step.

Now the real fun begins.

Change the program. See what happens. Make it work better. Try other variations. The best way to learn how to program your computer is by studying an easy-to-understand operating program and changing it to see what happens. Bit by bit, understanding will come. (And it's nice to know that in the meantime, your system can be working while you're learning.)

When you're ready for more, so are we.

Here are a few programs we have for you:

TINY BASIC EXTENDED \$5.00

TINY BASIC GAMES:

Volume 1—Chomp, Checkers, Tic-tac-toe, Digiguess and Brainteaser \$5.00

Volume 2—Artillery, Dr. Therapy, Reverse, Biorythm and Golf \$5.00

Volume 3—Taxman, Snark, Trap, Number, Square-Root and Clock \$5.00

Volume 4—Hamurabi, Stars, 23-Matches, 20-Questions, Blackjack, Factor and Batum .. \$5.00

Volume 5—Bomber, Lunar Lander, Spacebattle, Matador and Dice \$5.00

Volume 6—Chief, Mr. Quizzer, Addition, Subtraction and Multiplication \$5.00

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Z-80 Educator \$10.00

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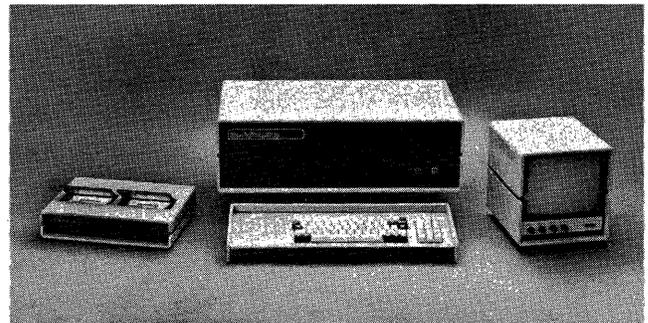
Z-80 Dis-Assembler \$10.00

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(303) 777-7133

OK, Get me going. I want all the details.

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Address _____

City/State/Zip _____

MICROCOMPUTER POWER SUPPLIES

Deltron Inc. has introduced a series of four output microcomputer power supplies designed for micro systems. Priced from \$99 to \$141 each, the units feature barrier block output terminals and infinite resolution adjustments, and are capable of 115/220 VAC operation. The four terminals provide various combinations of +5 V, +12 V, +15 V, 9 V, and a variable output of 5 V to 24 V. North Wales, PA.

IBM ADDS 5100 SUPPORTS

IBM's General Systems division has introduced a matrix printer and a plotting software package for its 5100 portable computer.

The IBM 5103 Model 2, is priced at \$4,175 and has 132 print positions and speeds up to 120 cps. The new software, Print Plot/Problem Solver Library, is available on magnetic tape cartridge for a one time charge of \$500. The software enables the 5100 to use either the 5103 Model 1 or Model 2 as a plotting output device, or as a printer.

DISKETTE DRIVE CONTROLLER

PerSci, Inc. has designed their Model 1070 diskette drive controller with an 8080 microcomputer with internal disc operating software for all file management functions. The controller is said to be able to communicate by file name and assume all housekeeping functions usually performed by a computer.

The unit is designed for and can interface to most major microcomputers. A complete sub-system would include the 1070, interface, cabling, and from one to four Model 70 drives or one to two Model 270 dual drives. Total data capacity in a four diskette system exceeds one million kilobyte. Marina del Rey, CA 90291, (213) 821-5545.

SELF-CONTAINED PROGRAMMER KIT

Engineering Resources' 9700 kit is designed to build a completely self-contained programmer for 2708 and 2704 PROMs. Housed with integral power supplies, the unit features internal timing circuitry to handle PROM timing requirements, allowing asynchronous operation and easy interfacing with virtually any microcomputer system, and requiring only simple programs for its control. Kit includes all hardware and design documentation. 1903 Alameda Padre Serra, Santa Barbara, CA 91303.

DRIVE DESIGNED FOR MICROS

Memodyne Corp.'s new cassette drive was designed for microcomputer applications and comes in a portable case with front panel controls, I/O connectors and internal supply. The recorder writes 7-bit ASCII or 8-bit parallel data using a standard Philips cassette. Price is \$775 in quantity. Newton Upper Falls MA.

SBC 80/10 FLOATING POINT UNIT

A new floating point unit from Cybernetics Micro Systems will interface to an Intel MDS 800 or SBC 80/10 based system. Features include binary-to-floating point decimal conversion; all trig. functions; logs and powers; co-ordinate transformation; mean and standard deviation and more. Supply requirements are +12, +5 and -10V. 2460 Embarcadero Way, Palo Alto, CA 94303 (415) 321-0410.

ANALOG SUPPLY

Compatible with any 8-bit microprocessor, the Optical Electronics' 7462 DAC operates on a single 5 V supply and provides 0- to 3 V analog output. The 8-bit device features standard binary digital coding and 00000000 digital input code for 0 analog output. P.O. Box 11140, Tucson, AZ 85734 (602) 624-1283.

PI/MP TRANSDUCERS

The Astrosystems Inc.'s new PI/MP family of transducers supply position data in real time to microcomputers. Single-turn resolutions are available to 12-bits and 3 decades BCD. Multiturn units provide resolutions to 17 bits and 5 decades BCD. Zero set and pre-set is available.

Each unit requires a maximum of 8 wires to interface to a microcomputer. Prices start at \$550. 6 Nevada Dr., Lake Success, NY 11040 (516) 328-1600.

MODEL 380 TROUBLESHOOTER

The Model 380 Troubleshooter can serve as a standard 10, 15 or 30 cps portable terminal, yet has an operator switchable character set that allows printing of nonprint characters such as device control codes, tabs, etc. The terminal operates on full upper/lower case ASCII. Other codes are available.

The unit's built-in acoustic coupler features AT&T's 103 and RS 232 compatibility. E. 66 Midland Ave., Paramus NJ 07652

CASSETTE TAPE TRANSPORT

For use in microcomputer systems, the Model CS400 TTL-compatible cassette tape transport requires a 14-30 V power supply. The transport manipulates serial data at 8kpbs and records 800 bpi at 10 ips. With its dual channels, CS-400 lets you write one track, switch channels, change direction and continue writing on the other track without rewinding. The system utilizes Manchester phase encoding and provides ANSI-compatible data.

It is priced at \$350 each in 1000 lots.
11950 Twelfth Ave. South, Burnsville, MN
55337 (612) 890-5135.

MICRO FLOPPY DISKETTE DRIVE

Wango has introduced their Micro Floppy diskette drive with a track-to-track access time of 30 ms, a random average seek time of 370 ms, and a large-quantity price of \$300.

The unit has a basic capacity of 109.4K bytes on 35 tracks. However, a variety of capacity-increasing features, adding tracks, double density recording, using both sides of the disc, and various combinations of these techniques can increase the capacity to 498.8K bytes. 5404 Jandy Pl., Los Angeles, CA 90066 (213) 390-8081.

MOTOROLA INCREASING LINE

Motorola has revealed it is increasing its Micro Module line with eight new offerings as well as a printer and software. Software additions will include an 8K BASIC interpreter and DOS. The printer will be manufactured by Okidata. Motorola did not detail the functions of the eight new boards.

CASSETTE INTERFACE CARD

The RO-CHE Systems' controller controls up to four cassettes and interfaces to a Tarbell or MITS cassette board. The status bits generated by the interface boards are software controlled to select which recorder to use, and function desired. LEDs on the face of the controller indicate which deck has been selected and when that deck is writing. The operator can program to position the tape, put it in read mode, or provide for error recovery. Price of the four-part controller is \$125. Van Nuys, CA.

OPEN-LOOP MOTOR CONTROLLER

Advanced Control System Corp.'s Model MCU-652 is an open-loop stepping motor controller made to interface with an 8- or 16-bit micro.

Single-step, index and slew functions with override stop control are provided. Rates are up to 10,000 steps/s, in increments of 1 step/s. The controller includes three command inputs—start forward, start reverse and stop. The \$800 unit is available with either automatic or manual operating mode. Wakefield, MA.

PROGRAMMABLE VOICE READOUT

A solid state programmable voice readout system for users with small quantity requirements and changing vocabularies is being marketed by Master Specialties Co. The system uses PROMs for each new word, and Model 1650 permits vocabulary expansion from one to 112 words in standard half ATR rack, by adding plug-in circuit boards.

Words may be announced by providing a 4-bit word and 3-bit board address, and enable signal. A male voice is used to achieve high fidelity with natural human sound. 1640 Monrovia, Costa Mesa, CA 92627.

MICROFLOPPY

A floppy disc system with operating software and interface electronics to provide complete plug compatibility with popular microcomputers, has been announced by iCOM, a division of Pertec Computer Corp.

Called the Microfloppy, the system is priced at just \$1,095. Model FD 2411 includes the flexible disc drive, power supply, cabinet, controller/interface card, power cord, fuse and all cables. The unit, incorporating an iCOM's FDOS-M software on diskette, is fully factory assembled and tested, and is ready to plug in. Additionally, as a limited time offer, an 8K BASIC software package is included at no additional charge.

The iCOM FD2411 is 100% compatible with any microcomputer using the popular Altair bus format. The controller/interface card, contains all of the electronics necessary to interface the floppy disc to the microcomputer. The card incorporates an LSI controller chip that offers automatic track seek with verification, single or multiple record read/write with automatic sector search, auto CRC, address mark detection, entire track read and entire track write for diskette initialization. 6741 Variel Ave., Canoga Park, CA 91301 (213) 348-1391.

PEOPLE, LITERATURE AND EVENTS

μP MARKETING GROUP FORMED

A new MOS microprocessor marketing organization to focus on specific industries and applications, in addition to products, has been announced by Norm Rothstein, MOS microprocessor marketing manager at Signetics.

The new organization creates five management functions, four of which have been filled. PAUL D. HANSEN is product merchandising manager, GARY D. MILLER is product sales manager, MICHAEL M. ZYLA is product planning manager, and THOMAS MARSHALL is business manager. The post field support manager for the division has not yet been filled, but will be soon, according to Rothstein.

SOFTWARE SUBSIDIARY FORMED

MITTS INC. has formed a new subsidiary company designed to provide Altair microcomputer users with application software. Announcing the formation of the Altair Software Distribution Company, MITTS' President, Ed Roberts, said, "The ASDC will provide a mechanism to make certain that Altair computer users have application software that meets their needs and will be fully supported for years to come."

The Altair Software Distribution Company will acquire software from persons around the country. The software will then be carefully evaluated, thoroughly checked for errors, documented and distributed through all Altair Computer Centers. The ASDC will contract for application software on either a direct purchase arrangement or on a continuing royalty basis. 2450 Alamo S.E., Albuquerque, NM 87106.

PERSONAL COMPUTING SHOW

Personal Computing Magazine has announced that Los Angeles, Philadelphia and Boston will be the sites of the first regional Personal Computing Shows. The shows will feature exhibits of new microcomputers for home, schools and small businesses.

Tom Munnecke, president of Metasystems in Riverside CA, will conduct three seminars designed to show the average person how to program a personal computer. Patricia Wood, a member of the Southern California Computer Society will conduct a seminary on how to build a computer from a kit. For the more advanced computerist, Dr. Adam Osborne, author of the best seller, "Introduction to Microcomputers" and Dr. Rodney Zaks, author of more than thirty books and publications in the computer field, will teach six intensive courses

on microprocessors. A number of other special seminars and programs are being planned. Dates and sites of these three shows are: Los Angeles--March 19, International Hyatt House; Philadelphia--April 30, Marriott at City Line; Boston--June 18, Hynes Auditorium. Tickets are \$10. 401 Louisiana S.E. Albuquerque, NM 87108 (505) 266-1173.

FAIRCHILD/DATA WORKS ACQUISITION

The acquisition of Data Works Instrumentation in Chatsworth, CA has been announced by James D. Bowen, vice president and general manager of the Instrumentation Systems Group of Fairchild Camera and Instrument Corp.

Data Works Instrumentation manufacturers microcomputer-based data acquisition and analysis instruments used primarily in solar, environmental and process industries. The instruments are fully programmable and perform calculations on acquired data. Details of the acquisition were not released.

TRACE SEMINARS

Peters Associates is holding a series of seminars on their line of resident tracing programs for 8080, Z-80 and MC6800 microcomputer systems. For further information and reservations for the free seminars contact P.O. Box 61622, Sunnyvale, CA 94088 (408) 245-1519.

PEOPLE ON THE MOVE

Elmar Electronics in Mountain View, CA has increased their Microcomputer Technical Staff to four with DUNCAN PETERSON, a former consultant and staff member of the University of California, Berkley.

JOHN TOROK has joined Intersil, Inc., as product marketing engineer in the firm's Low Power Product Marketing group, a new post created as part of the group's recent expansion.

INTERFACE AGE, formerly SCCS INTERFACE is now an independent publication covering the home computer market. SCCS, however, is continuing to publish their magazine, INTERFACE, as the official magazine of the computer society. Other recent hobby magazine startups include PERSONAL COMPUTING by Benwill Publishing and KILOBAUD by Green Publishing.

EDWIN J. TURNEY, former vice president of marketing at Electronic Arrays, Inc. and a co-founder of Advance Micro Devices, Inc. has been named to the newly-created position of vice president of marketing and sales for Semiconductor Products at Intersil, Inc.

Publishers of 73 Magazine have bound their most popular articles and editorials on hobby computing into a new book, HOBBY COMPUTERS ARE HERE. \$4.95, 73 Magazine, Peterborough, NH 03458

DR. JOSEPH P. HAWRANEK has been named manager of market support for National Semiconductor's Systems division.

Pro-Log Corp. has named YREL as their sales rep for France.

SHIGEHICO MURASE has joined National Semiconductor Corp. of Japan as manager of Distributor Sales.

As part of an expansion of Signetic's MOS Microprocessor Marketing Group, THOMAS MARSHALL has joined the firm as MOS Microprocessor business manager.

Synertek has named GERALD DEMSKY to a new position as microprocessor marketing manager.

H.R. ANDERSON is the new manager of Microprocessor Product Planning for Rockwell's Microelectronic Device division. He was formerly with NCR.

RCA's SOLID STATE division reports it is now in production of several 1802 support chips at its new West Palm Beach, FL facilities.

PERTEC TO BUY MIT'S

Pertec Computer Corp. has reported that it has signed a letter of intent to purchase MITs, Inc., manufacturers of the Altair microcomputer. Although details were not released, the purchase is said to be for \$5 million worth of Pertec stock. A definitive acquisition agreement is expected to be completed sometime in February, 1977.

4K RAM BULLETIN

Texas Instruments has published a 12-page Application Summary Bulletin entitled "Introduction to Refreshing TI 4K Dynamic RAMs."

Bulletin MOSA3 introduces refresh principles and their implementation. It also compares static and dynamic RAMs in terms of speed, power consumption, refresh requirements, relative costs, and power supply requirements. Various kinds of simple refresh circuitry are outlined and block diagrammed, including transparent, cycle steal and burst methods. Inquiry Answering Service, P.O. Box 5012, M/S 308, Dallas TX 75222.

THREE VOLUME BASIC LIBRARY

A three volume collection of programs written in BASIC is now being offered by Scientific Research Instruments.

All programs in BASIC SOFTWARE LIBRARY are reported to have been thoroughly listed and executed on several computer systems, including microcomputers. Each program is prefaced with text describing the program, listing potential users/applications, giving instructions for running the program, states amount of memory needed to store and executes each program, and noting statements which may need to be changed for certain implementation of BASIC.

Volume I, BUSINESS & RECREATIONAL PROGRAMS is \$24.95; Volume II, MATH, ENGINEERING STATISTICS & PLOTTING PROGRAMS is also \$24.95; Volume III, BILLING, A/R, INVENTORY, PAYROLL, ETC. is tagged at \$39.95. Combination price of Volume I & II is \$39.95 and \$69.95 for all three texts. P.O. Box 2096 Ashland, VA 23005.

MICRO-PRODUCT MARKET REPORT

The new micro-products market is growing in every direction and Datapro's latest report on microcomputers covers 125 models--nearly four times as many as their report a year ago.

Selection and utilization of microcomputers is discussed for large, specialized systems, or smaller stand-alone application systems. This 32-page report offers comparison charts and guidelines to aid in selecting microcomputers as well. Details on packaging, hardware characteristics, performance, software, applications and pricing from 65 vendors is said to be included. \$12, 1805 Underwood Blvd., Delran NJ 08075.

TECHNITROL 8080 MANUAL

Written for non-computer oriented professional, the 170-page examination of the Intel 8080 is said to cover flowcharting and programming techniques with typical problems. \$13.95 Technitrol, Inc., 1952 E. Allegheny Ave., Philadelphia, PA 19134.

NSC DROPS PACE PRICE

National Semiconductor Corp. has reduced the price of its 16-bit single-chip PACE microprocessor, ISP-16A/520D, from \$40 to \$20 in 100 lots. In quantities of 1000 to \$15, and in 5000 quantities to \$13.

6100 PRICE CUT BY 65%

Intersil, Inc. has reduced prices on all grades of its IM6100 microprocessor up to 65%. The IM6100 CCPL, a 3.3 MHz circuit in a

plastic package has been reduced from \$25.20 to \$15 in 100 lots. The IM6100 IPL, a 4.0MHz device in plastic, was cut from \$46.80 to \$16.50 in 100 lots; and the IM6100 AIPL, an 8.0 MHz chip was reduced from \$67 to \$23.60 in the same quantities.

Military temperature range versions of the 4.0 MHz and 8.0 MHz devices were cut from \$100 to \$52.80, and \$143 to \$76.25, respectively. 10900 North Tantau Ave., Cupertino CA 95014 (408) 996-5261.

F8 VIDEO GAME PRICES HIKED

Fairchild Camera & Instrument reports it has raised the price of its F8-based video game from \$150 to \$170. The price change is said to be a result of design modifications needed to meet Federal Communications Commission standards. The Fairchild game, Model FVE 100, has two resident games, dual hand controls, color and sound.

ZILOG BIDDING ON 8080 MARKET

Zilog has reduced the price of its Z-80 microprocessor by 51%, from \$25.50 in 100 lots. The firm also reduced its large volume negotiated price on the device to under \$10 from a previous volume price in the \$20 range.

The move is said to be prompted by the announcement of Intel's new 8085 family as well as Zilog's desire to compete with 8080A family suppliers at the low-priced end of the general purpose microprocessor market.

HARRIS FOLLOWS INTERSIL CUTS

Harris Semiconductor division reports it is cutting prices on its 6100 microprocessor in response to a similar move by Intersil. Harris spokesman did not release specific prices, but said the prices would be competitive.

10% MARKET INCREASE SEEN

The U.S. Commerce Department's 1977 Industrial Outlook released last month forecasts a 10% increase in this year's total U.S. electronics market to \$58.39 billion. The largest market segment area is in the computer equipment--up 14% to \$12 billion and IC's up 15% to \$2.61 billion.

SEMI SALES REACH \$303 MILLION

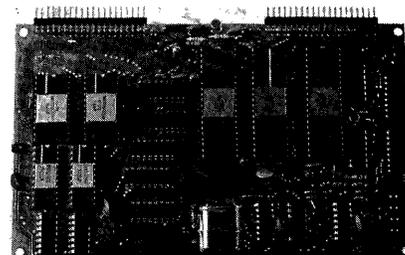
U.S. Semiconductor manufacturers reported total worldwide sales of \$303 million during the month of October.

October sales were divided \$184 million for

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integrated circuits and \$119 million for discretely. This brought the year-to-date cumulative shipment total to \$2.8 billion.

These figures were revealed in the monthly Semiconductor Marketing Statistical report published by WEMA, trade association for the electronics industries. Data supplied by 49-U.S.-based semiconductor manufacturers, and includes estimates of sales and bookings for the few non participating companies.

Orders booked during October totalled \$306 million, divided \$180 million for integrated circuits and \$126 million for discretely. The strong October sales resulted largely from increased shipments in U.S. and Western Europe Markets, while other international markets remained relatively flat.

HOBBY MARKET 250% GROWTH

The hobby computer market will increase by 250% this year, from just under 7,500 units last year to more than 18,600 units by January 1977, according to a market study by Venture Development. The study identified more than 100 computer clubs, nearly a dozen

(Cont'd on page 29)

EDUCATION

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

January

- 10-13 Microprocessors Fundamentals NSC
\$395 Coral Gables, FL. (305) 661-7971
- 11-12 Microprocessor in Mfgr. and Control
\$395 Cincinnati, OH Int. Comp. Sys.
- 11-14 F8 Microprocessor \$300 San Jose, CA
Fairchild Micro Systems
- 13-14 Microcomputer Software/Systems \$395
Cincinnati, OH Int. Comp. Systems
- 14-18 Microprocessors and Microcomputers:
Theory and Applications \$425
George Washington University, WA D.C.
- 17-20 Microprocessors Fundamentals NSC
\$395 Santa Clara, CA (408) 247-7924
- 17-21 SC/AMP Application NSC \$395
Coral Gables, FL (305) 661-7971
- 18 LSI-11 Technical Seminar Free
Palo Alto, CA DEC
- 18-19 Microprocessors in Mfgr. and Control
\$395 Toronto, Canada, Int. Comp. Sys.
- 18-20 Microprocessors \$365 Hampton, VA
George Washington University
- 20-21 Microcomputer Software/System \$395
Toronto, Canada Int. Comp. Systems
- 21-27 SC/AMP Application NSC \$395
Santa Clara, CA (408) 247-7924
- 24-26 Integrated Circuits and Applications
\$360 Washington D.C. George Washington
University
- 24-27 PACE Application NSC \$395
Coral Gables, FL (305) 661-7971
- 25-27 Microprocessor Short Course with take
home Computer Wintek Corp., 902 N.9th
St., Lafayette, IN 47904 317 742-6802
- 27 RCA Cosmac Free Elmar Electronics
2288 Charleston Rd., Mt. Vw. CA (415)
961-3611
- 25-28 F8 Microprocessor \$400 Miami, Florida
Fairchild Micro Systems
- 30- 3 Advanced Programming NSC \$395
Coral Gables, FL (305) 661-7971

February

- 1- 3 Microprocessor Short Course with take
home computer Petersburg Beach, Fl
Wintek Corp., 902 N.9th St., Lafayette
IN 47904 (317) 742-6802 \$495
- 2 Intel 8748 Free Elmar Electronics 6777
W.50th St., Commerce City, CO 303 287-
9611
- 3 Intel 8748 Free \$495 415 961-3611
Elmar Electronics 2288 Charleston Rd.,
Mt. Vw. CA

- 8 - 9 Microprocessors in Mfgr. and Control
\$395 Newark, NJ Int. Comp. Systems
- 8 -11 F8 Microprocessor \$300 San Jose, CA
Fairchild Micro Systems
- 9 -11 Microprocessor Short Course with take
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902 N.9th St., Lafayette, IN 47904
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Newark, NJ Int. Comp. Sys.
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- 14-17 SC/AMP Application NSC \$395
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- 21-24 PACE Application NSC \$395
Coral Gables, FL (305) 661-7971
- 21-24 Microprocessor Fundamentals NSC
\$395 Santa Clara, CA (408) 247-7924
- 22-25 F8 Microprocessor \$300 San Jose, CA
Fairchild Micro Systems
- 23 NSC PACE Free Elmar Electronics 6777
W.50th St., Commerce City, CO 303 287-
9611
- 24 NSC PACE Free Elmar Electronics 6777
W.50th St., Commerce City, CO 303 287-
9611
- 24-25 Microprocessors and Design Automation
San Francisco, CA TC on Design Auto-
mation of the Computer Society
- 28- 3 Advanced Programming NSC \$395
Coral Gables, FL 305 661-7971
- 28- 3 COMPCON Spring '77 San Francisco, CA
COMPCON
- 28- 3 PACE Application NSC \$395
Santa Clara, CA 408 247-7924

March

- 1 - 3 Microprocessor Short Course with take
home computer WA D.C. Wintek Corp.,
902 N.9th St., Lafayette, IN 47904
- 2 Motorola 2900 Free Elmar Electronics
6777 W. 50th St., Commerce City, CO
(303) 287-9611
- 3 Motorola 2900 Free Elmar Electronics
288 Charleston Rd., Mt. Vw. CA (415)
961-3611
- 7- 10 Microprocessor Fundamentals NSC \$395
Coral Gables, FL 305 661-7971
- 8- 10 Microprocessor Short Course with take
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902 N.9th St., Lafayette, IN 37904
- 8- 11 F8 Microprocessor \$400 Los Angeles
Fairchild Micro Systems
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Coral Gables, FL 305 661-7971
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902 N.9th St., Lafayette, IN 47904
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\$395 Santa Clara, CA 408 247-7924
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Coral Gables, FL 305 661-7971
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home computer Huntsville, AL Wintek
Corp., 902 N.9th St., Lafayette, IN
- 22-25 F8 Microprocessor \$300 San Jose, CA
Fairchild Micro Systems
- 23-25 Fourth Annual Computer Architecture
Symposium College Park, MD Dr. B. Wald
- 28-31 Advanced Programming NSC \$395
Coral Gables, FL 305 661-7971
- 28-31 SC/AMP Application NSC \$395
Santa Clara, CA 408 247-7924
- 30-31 Intel Memory Sys. Design Seminar \$15
Elmar Electronics 6777 W.50th St.,
Commerce City, CO 303 287-9611

April

- 2- 5 SC/AMP Application NSC \$395
Santa Clara, CA 408 247-7924
- 6- 7 Intel Memory Sys. Design Seminar \$15
2288 Charleston Rd., Mt. Vw. CA (415)
961-3611
- 6- 8 Microcomputer '77 Oklahoma City, OK
Dr. S.C. Lee, University of Oklahoma
- 13 Motorola 10800 Free Elmar Electronics
6777 W.50th St., Commerce City, CO
303 287-9611
- 18-21 Microprocessor Fundamentals NSC
\$395 Coral Gables, FL 305 661-7971
- 18-21 Microprocessor Fundamentals NSC
\$395 Santa Clara, CA 408 247-7924
- 19-22 F8 Microprocessor \$300 San Jose, CA
Fairchild Micro Systems
- 25-28 Advanced Programming NSC \$395
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- 25-28 PACE Application NSC \$395
Santa Clara, CA 408 247-7924

May

- 3- 6 F8 Microprocessor Houston \$400
Fairchild Micro Systems
- 9- 11 EUROCON '77 Venice, Italy Eurocon
- 16-19 PACE Application NSC \$395
Coral Gables, FL 305 661-7971
- 17-20 F8 Microprocessor \$300 San Jose, CA
Fairchild Micro Systems
- 23-26 Advanced Programming NSC \$395
Coral Gables, FL 305 661-7971
- 24-26 International Minicomputer, Microcom-
puters and Microprocessors '77 Geneva
Switzerland Industrial and Scientific
Conference Management

June

- 7 - 8 Digital Electronics for Automation
Workshop VA Polytechnic Institute and
State University Blacksburg, VA 24061
(703) 951-6328
- 7 -10 F8 Microprocessor \$300 San Jose, CA
Fairchild Micro Systems
- 9 -10 Microcomputer Interfacing Workshop
VA Polytechnic Institute and University
Blacksburg, VA 24061 (703) 951-6328

Sponsoring Organizations and Contacts:

- COMPCON Spring '77 P.O. Box 639 Silver Spring,
Maryland 20801
- DEC, 2565 Walsh Ave., Santa Clara, CA 95050
(408) 984-0200
- Eurocon '77 AEI, Viale Monza 259, 20126 Milan
Italy
- Fairchild Micro Systems 1725 Technology Drive
San Jose, CA 95110 (408) 998-0123
- Industrial and Scientific Conference Manage-
ment, 222 W. Adams St., Chicago, IL 60606
(312) 263-4866
- George Washington University, Continuing Eng-
ineering Education Program, Washington D.C.
(202) 676-6106
- Integrated Computer Systems, Inc., 445 Over-
land Ave., Culver City, CA 90230 (213) 559-
9265
- Dr. S.C. Lee, School of Electrical Engineering
University of Oklahoma Norman, OK 73019
- National Semiconductor Corp., 2900 Semiconduc-
tor Dr., Santa Clara, CA 95051 (408) 732-5000
- Pro-Log Corp., 2411 Garden Rd., Monterey, CA
93940 (408) 372-4593
- TC on Design Automation of the Computer
Society, Dr. W.M. vanCleeput, Stanford Univ.
Digital Systems Labs., Stanford, CA 94305
- DR. B. Wald, Communications Science, Naval
Research Lab., 4555 Overlook Ave., Washington
D.C. 20390

HOBBY MARKET 250% GROWTH

computer hobbyist publications, and more than
50 retail stores that presently serve some
20,000 hobbyists.

"As the market matures," the report notes,
"it will become increasingly important to
differentiate between these many groups. The
same products can appeal to several interests,
but its form and marketing approach must be
tailored to each segment. Manufacturers
who fail to appreciate this may find that
what is an excellent product to one group is
a 'rip off' to another group." Wellsley
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