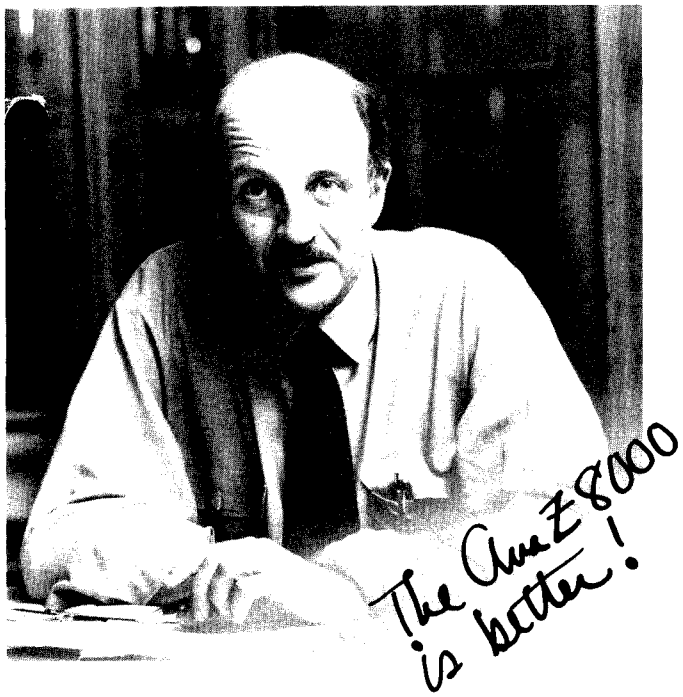
Advanced Micro Devices

The AmZ8000 Family



A PROCESSOR FAMILY FOR YOU

The AmZ8000 Family is a group of semiconductor components, boards, systems and software products that brings the benefits of modern 16-bit architecture and big computer features to the microcomputer user. The product family is built around a series of MOS/LSI components jointly designed, developed and manufactured by Advanced Micro Devices and Zilog.

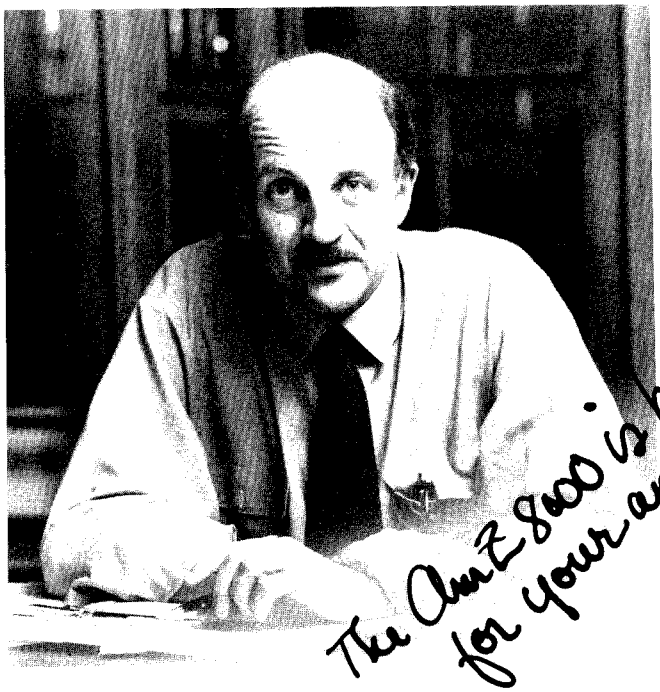
The AmZ8000 Family resolves the many limitations now apparent in the simpler microprocessor families preceding it. It is much better suited to running large programs written in high-level languages than are the older, control-oriented 8-bit machines. At the same time, the AmZ8000 Family incorporates features like rapid context switching, vectored interrupts and bit-manipulation instructions so important in real-time controllers. In these applications, too, the AmZ8000 Family offers major improvements over older architectures—improvements in throughput, code density and response time.

In addition to two CPU devices, the product family includes a number of specialized peripheral processors for functions such as DMA, memory management, disk and CRT controllers and I/O ports. (These products are described in the following pages). Most of the Am8080A and Am8085A microprocessor peripherals can also be used easily, though the new devices provide substantially more sophisticated features with simpler interfacing. A comprehensive collection of bipolar buffers, latches, transceivers and memory interface parts makes the AmZ8000 Family a complete set of components for microcomputers of the '80s.

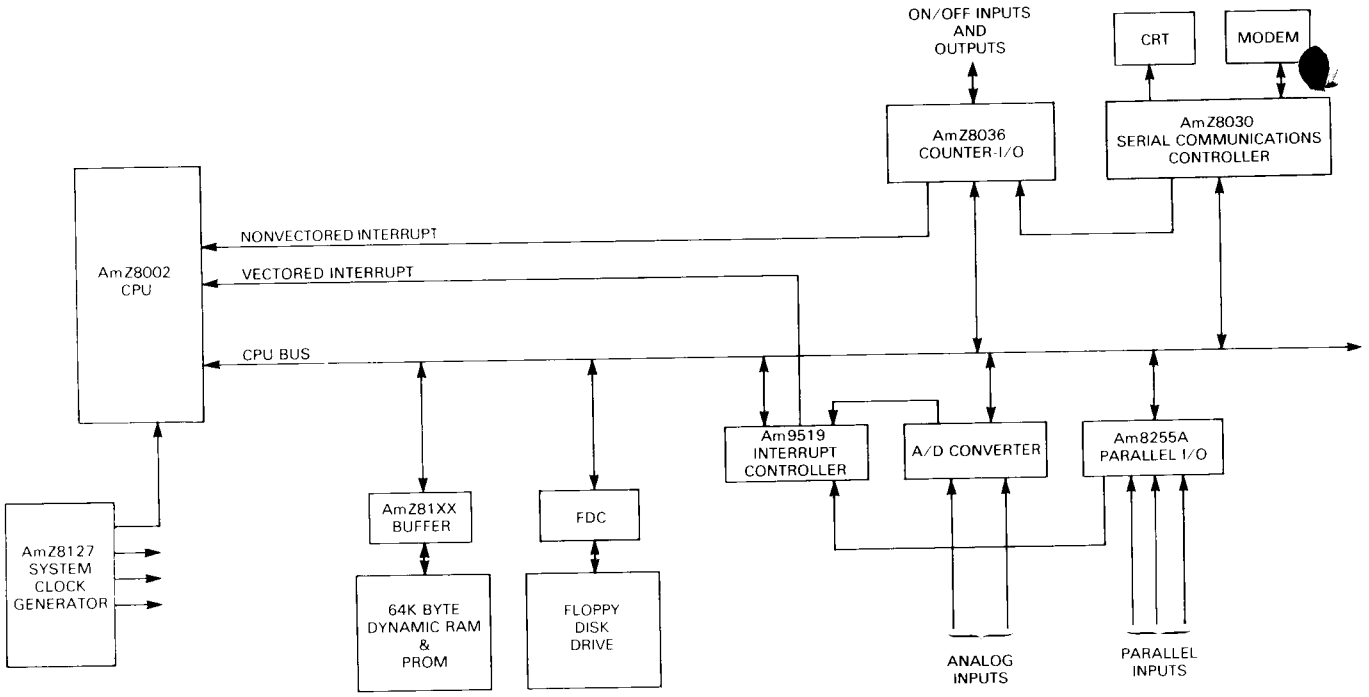
Beyond components, AMD offers the AmZ8000 user a wealth of tools, briefly described in this brochure. They include:

- ☐ Evaluation board—a complete AmZ8000 CPU with memory, monitor, assembler and I/O on one board.
- ☐ Complete development system, with double-density floppy disks, cartridge disk, and real-time in-circuit emulation.
- ☐ Powerful macroassembler and linker.
- ☐ Translator to convert Am8080A, Am8085A, and Z80A source code to AmZ8000 source code.
- ☐ PASCAL direct compiler and a C compiler for real-time programs and operating systems.
- ☐ Variety of cross-software products for software development on larger machines.
- ☐ Series of short seminars offered in the field and full courses with labs offered at the School of Advanced Engineering in our customer education center.

The AmZ8000 Family is the best choice for today's new designs. It combines modern architectural features, intelligent peripheral processors and a growing array of systems and software support tools that enable you to build a better system than ever before: fewer parts, higher throughput, shorter design time and quicker software development. The AmZ8000 is better.



TWO CPU'S FOR TWO KINDS OF SYSTEMS



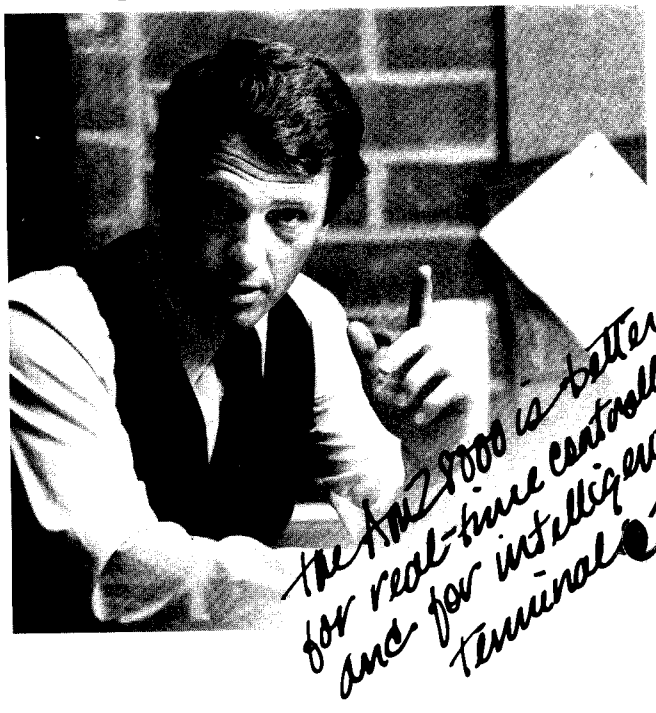
POWER FOR REAL-TIME CONTROL

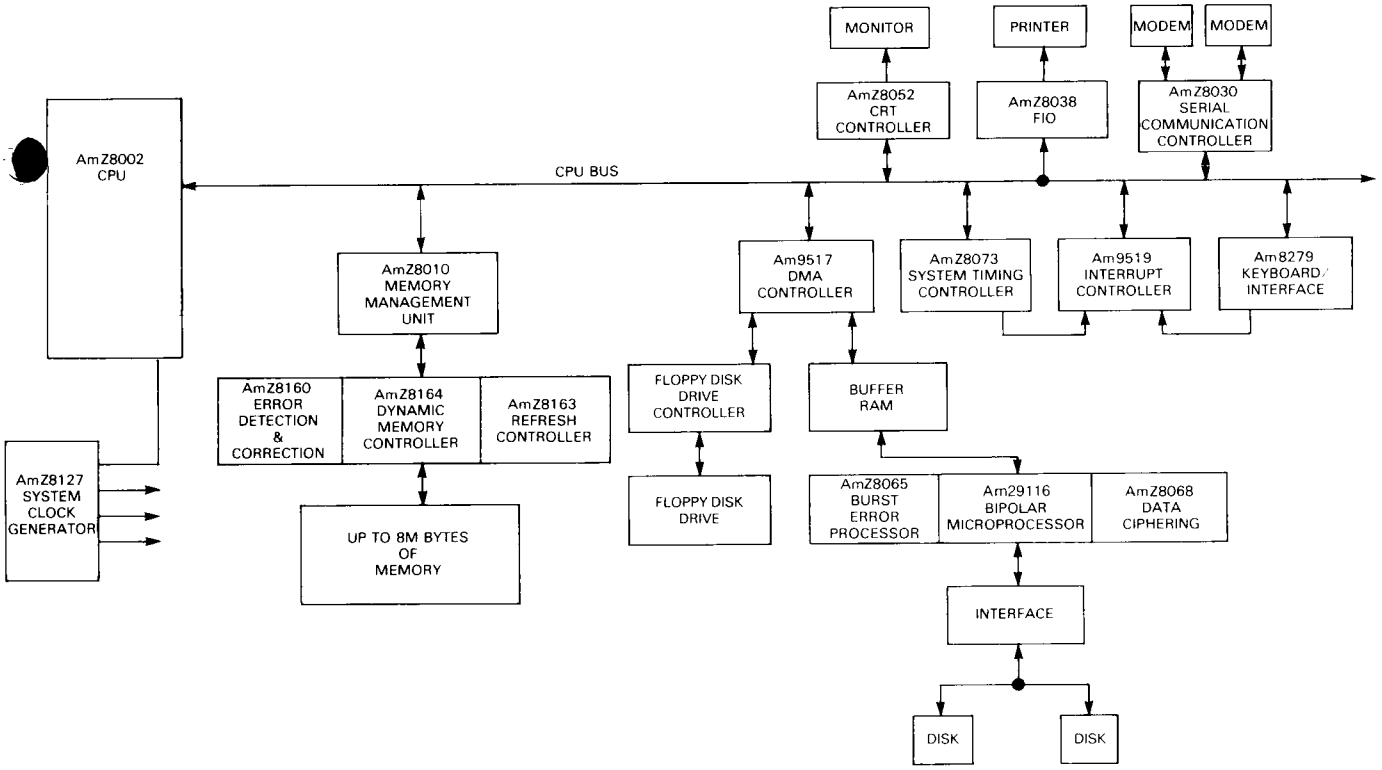
The real-time control system shown demonstrates the use of the AmZ8002 CPU in such equipment as instruments and computer peripherals. It includes a variety of support circuits that might be used in a real-time controller.

In such a system, the AmZ8002 CPU offers many advantages over other processors. The CPU itself executes the rich AmZ8000 instruction set and is packaged in a standard 40-pin DIP. The part can directly address up to 64K bytes of memory and can be interfaced to a variety of LSI peripheral circuits with a minimum of extra gates and buffers, resulting in a very powerful system occupying a small space. Throughput is high because addresses occupy only one 16-bit word and because of the well-designed interrupt scheme.

An AmZ8127 System Clock Generator produces the special CPU clock as well as all clocks for peripheral components. Data and programs are stored in up to 64K bytes of dynamic memory that is interfaced to the system bus through a collection of bipolar memory interface circuits. The CPU itself provides refresh control for the RAMs. A floppy disk drive connects to the system through an appropriate controller. AmZ8002 block I/O instructions efficiently move data between the disk and memory without the need for separate DMA hardware.

Up to eight interrupt levels can be handled by the Am9519 Interrupt Controller. This circuit interfaces easily to the CPU bus and provides quick, vectored interrupt service for each I/O device it handles. Two circuits shown operating under Am9519 control are an Am8255A parallel I/O port and an analog-to-digital conversion system. The other I/O devices shown are daisy-chained into the nonvectored interrupt input. These include the dual-port AmZ8030 Serial Communication Controller and the AmZ8036 CIO, which provides a group of programmable timer/counters as well as bit-oriented parallel I/O lines.





SOPHISTICATION FOR INFORMATION PROCESSING

The information processing system shown above illustrates the extraordinary power achieved by a small computer using the AmZ8001 segmented CPU, along with the AmZ8010 Memory Management Unit and other AmZ8000 LSI peripheral processors. It is typical of a word processor or data base management system.

The AmZ8001 provides a segment number and an offset value for every memory reference—a total of 23 bits to address up to 8M bytes of memory directly. The memory management scheme allows code and data to exist in blocks (segments) of up to 64K bytes, each of which can be dynamically relocated in memory by the operating system. Each block, for example, might represent a user or an independent task.

Memory management provides sophisticated protection features such as read-only, system-only and execute-only for each segment. Several different users or tasks can use the same copy of a data base or program (such as a compiler).

Further memory control comes from the AmZ8160 series of memory interface products. These include Error Detection and Correction (AmZ8160), Refresh and EDC Controller (AmZ8163, Dynamic Memory Controller (AmZ8164) and Data and Address Buffers (AmZ8161/2/5/6). The Am9517 provides four DMA channels into the memory; one is used for a hard disk controller and one is used for a floppy disk controller. The hard disk controller is shown with an Am29116 Bipolar Microprocessor, coupled with the AmZ8065 Burst Error Processor for error detection and correction of the serial bit stream and the AmZ8068 Data Ciphering Processor for data encryption.

The AmZ8030 Serial Communications Controller provides full-duplex channels for two modems, while the AmZ8073 System Timing Controller provides multiple programmable counters as well as a time-of-day clock. The printer is driven from an AmZ8038 FIFO I/O port, which can accumulate one line of data at a time.

An AmZ8052 CRT Controller drives the CRT. It serves as a DMA channel between the CRT and main memory and provides for split screen, subscripts and superscripts, and linked-list addressing for efficient editing.

This system is designed to work with a sophisticated operating system for optimizing the allocation of resources. It sets up buffer areas for the CRT controller and the DMA channels, assigns memory segments to tasks as needed and manages interrupts and I/O channels. Applications software written in a structured language like PASCAL and compiled into relocatable linked segments takes full advantage of hardware capabilities.

THE AmZ8000 COMPONENT FAMILY

MOS/LSI CIRCUITS

AmZ8001 CPU

Segmented CPU (48 pins). Executes the full AmZ8000 instruction set while directly addressing 8M bytes of memory. Address references consist of a 7-bit segment and a 16-bit offset within the segment. Designed to be used with the AmZ8010 Memory Management Unit, which provides segment relocation and sophisticated memory protection.

Available now.

AmZ8002 CPU

Nonsegmented CPU (40 pins). Provides the same instructions as the AmZ8001, but addresses only 64K bytes directly. All address references are single 16-bit words, providing for compact code in systems not needing very large memories.

Available now.

AmZ8010 MMU

Memory Management Unit. Interfaces between the segmented CPU and physical memory. This circuit translates segment numbers and offsets from the CPU into physical memory addresses through a programmable table. It also provides facilities for preventing unauthorized access to a segment. *Available 4Q 1980.*

AmZ8016 DTC

Direct Memory Access Transfer Controller. An intelligent I/O processor capable of handling two independent I/O channels on a DMA basis. It can transfer bytes, words or strings to and from memory or peripherals at speeds up to 2M bytes/sec. DMA operations can be chained automatically and character searches can be conducted without CPU intervention. *Available mid-1981.*

AmZ8030 SCC

Serial Communications Controller. A two-channel serial I/O port that can handle a variety of synchronous and asynchronous formats, including SDLC, HDLC and Bisync. The device includes CRC-16 and CCITT block frame checking and separate modem controls for two full-duplex channels.

Available early 1981.

AmZ8036 CIO

Counter/Timer Parallel I/O Port. Includes four general purpose, double-buffered, 8-bit I/O ports, as well as three independent 16-bit counters. Each bit of the parallel ports can be separately programmed for input or output. *Available 4Q 1980.*

AmZ8038 FIO

FIFO Input/Output Interface. A general purpose 8-bit I/O port that includes a 128-word FIFO in the data path. Devices can be cascaded to form wider words or a deeper stack. *Available 1Q 1981.*

AmZ8052 CRT

CRT Controller. A raster-scan CRT controller with a host of features for sophisticated display systems. This device includes control for horizontal and vertical split screens, superscripts and subscripts, simple line drawing capability and linked-list processing. *Available late 1981.*

AmZ8065 BEP

Burst Error Processor. Implements 56-, 48-, 35-, and 32-bit Fire codes for error detection in serial data streams. It detects burst errors and permits corrections of errors up to 12 bits in length.

Available now.

AmZ8068 DCP

Data Ciphering Processor. Implements the National Bureau of Standards encryption algorithm. It interfaces directly to the AmZ8000 CPU bus and handles data rates up to 1M byte/sec.

Available 3Q 1980.

AmZ8073 STC

System Timing Controller. Includes five independent 16-bit counters that can be programmed to count up or down in binary or BCD from a number of different clock sources. The device provides for frequency synthesis, digital one-shots, time-of-day, coincidence alarms and much more.

Available now.

SYSTEM CLOCK GENERATOR

AmZ8127 SCG

System Clock Generator. Generates clock signals for the AmZ8000 CPU and peripherals. There is also a 16MHz buffered TTL output for dynamic memory timing. Reset, wait, halt, single-step and time-out controls are provided. *Available now.*

MEMORY INTERFACE DEVICES

AmZ8160 EDC

Error Detection and Correction Circuit. Provides polynomial error detection and correction on parallel 16-bit words with six extra bits. It detects all double errors and corrects all single errors in less than 100nsec. *Available 3Q 1980.*

AmZ8161/2

Quad data buffers in a "T" configuration for interface between the data bus and the memory. They provide a connection to the EDC circuit for data correction on the fly. *Available now.*

AmZ8163 REC

Refresh and EDC Controller. Complete control interface between AmZ8000 CPU and dynamic RAMs. It includes RAS/CAS sequencer, memory request/refresh arbitration, refresh interval timer and control signals for EDC chip. *Available 4Q 1980.*

AmZ8164 DMC

Dynamic Memory Controller. Provides address latches, refresh address counter and RAS decode for dynamic RAMs. *Available now.*

AmZ8165/6

High-drive quad buffers with matched impedance in HIGH and LOW states, to drive high-capacitance loads with controlled rise and fall times. *Available now.*

BUFFERS AND INTERFACE CIRCUITS

AmZ8140/44

Octal three-state buffers. Inverting and noninverting versions. *Available now.*

AmZ8103/4, AmZ8107/8

Octal bus transceivers. Similar to 8304. Noninverting and inverting versions. *Available now.*

AmZ8120

Octal edge-triggered register with a reset, clock enable and three-state outputs. *Available now.*

AmZ8133/8173

Octal latch with three-state outputs. Both inverting and noninverting versions. *Available now.*

AmZ8121

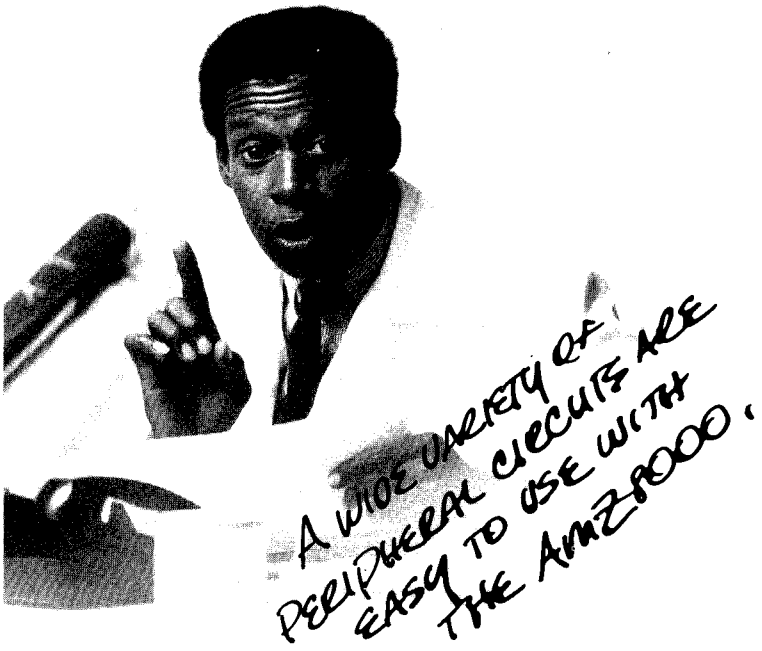
Equality Comparator. Signals equality between two 8-bit words. It is used for address comparison. *Available now.*

AmZ8136

Eight-bit decoder with control storage. On-chip register stores inputs to decoder so encoded chip-select field can be strobed in. *Available now.*

AmZ8148

Address Decoder with Acknowledge. A one-of-eight decoder with multiple enable inputs and an acknowledge output. *Available now.*



EASY HARDWARE AND SOFTWARE DEVELOPMENT

AN INEXPENSIVE, VERSATILE DEVELOPMENT SYSTEM

The AmSYS™ 8/8 Development System supports the AmZ8000, Z80A, Am9080A/8080A and Am8085A microprocessors. AmSYS8/8 is especially designed to support the AmZ8000 CPU in both hardware and software development.

A basic system furnishes 64K bytes of main memory, two floppy disk drives, serial and parallel I/O ports, disk operating system, an extensive software development package, and a MultiMaster system bus as standard features. The system's modular construction is easy to expand with memory, I/O peripheral controller, and mass storage options.

The Am96/4016 Evaluation Board provides a low-cost means of executing AmZ8000 code in a controlled hardware environment with limited debugging capability. A real-time emulator for either the AmZ8001 or AmZ8002 may be added to extend the capabilities of the development system. The emulator runs at a full 4MHz with no wait states and has its own memory.

AmSYS8/8 FEATURES

- ☐ 64K bytes RAM
- ☐ Dual floppy disk drives (single or double density)
- ☐ MultiMaster bus
- ☐ Peripherals, including CRT, printer, and cartridge disk
- ☐ Real-time emulator for the AmZ8000
- ☐ 8K byte high-speed static RAM
- ☐ Up to 256K bytes dynamic RAM
- ☐ 48-bit trace, expandable to 96 bits
- ☐ Symbolic referencing
- ☐ AMDOS®8 operating system compatible with CP/M*
- ☐ Macroassemblers for the AmZ8000, Am9080A/8080A, Am8085A, and Z80A CPUs
- ☐ Translator from Am8080A, Am8085A, or Z80A to AmZ8000
- ☐ PASCAL compilers for AmZ8000 and Am8080A
- ☐ C compilers for the AmZ8000 and Am8080A
- ☐ Download software to the Am96/4016 Evaluation Board

*Trademark of Digital Research Corp.

Amz8000 hardware is easy to design & debug.

AmZ8000 SOFTWARE

PASCAL

PASCAL is a high-level language recently developed for users seeking new features to solve today's problems. PASCAL incorporates such modern language concepts as variable data types: character, integer, real, records, sets, scalars and others that are appropriate to the solution of complex problems. The block-structured nature of the language permits the user to create software in a structured environment, resulting in lower development costs, more concise documentation and lower maintenance costs.

PASCAL is a direct compiler, compatible with Jensen and Wirth PASCAL. Output of the PASCAL compiler can be linked with MACRO8000 assembler output. Programs can be executed from RAM-based or ROM-based target systems.

C

The C language was designed for two primary applications: implementing systems software such as language compilers and editors, and writing real-time applications programs and operating systems. It offers many of the benefits of high-level languages, such as producing very compact programs, while preserving the detailed control over the CPU available with assembly language.

C language compilers for both the Am8080A and the AmZ8000 are available on AmSYS8/8. The AmZ8000 C compiler is also available to run on the PDP-11.

MACRO8000

The MACRO8000 assembler offers the development system user a dynamic way to develop AmZ8000 code for any application. A typical MACRO8000 program is a combination of AmZ8000 assembly instructions and higher-level constructs. MACRO8000 provides great flexibility in structuring the program and in fine-tuning to produce the most efficient AmZ8000 code for the application.

MACRO8000 produces a user-selectable output file of either absolute or relocatable AmZ8000 code for either the nonsegmented AmZ8002 or segmented AmZ8001 processor.

LINK8000 is a separate AmSYS8/8 module for linking relocatable modules of any size. It can bring in library routines to satisfy external references. It also controls the mapping of modules into the object file, as well as the mapping of user segments within modules. Furthermore, LINK8000 can handle relative address references across segments. The linker produces an object file that can be run on either the nonsegmented AmZ8002 or the segmented AmZ8001.

TRANZ

The translator utility TRANZ is a programming tool designed to aid in translating standard Am9080A/8080A, Am8085A and Z80A source codes to the AmZ8000 instruction set and format. It executes in an AmSYS8/8 environment in 64K bytes of memory, translating source statements into functionally identical AmZ8000 statements. Registers specified in source code operands are automatically mapped to the functionally equivalent AmZ8000 registers.

The output of TRANZ is compatible with MACRO8000, the AmZ8000 assembler, and can be used as the source code input to that utility.

AmZ8000 BOARD-LEVEL PRODUCTS

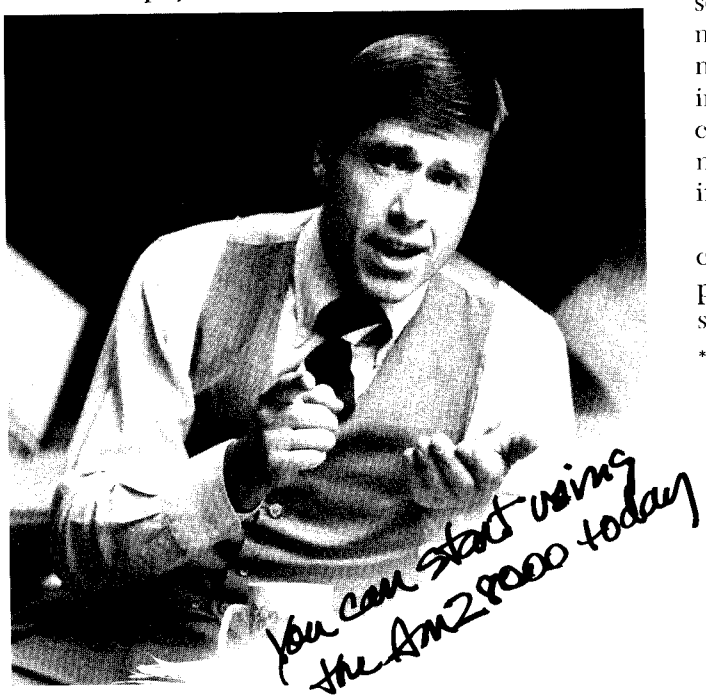
A LOW-COST WAY TO GET STARTED

You can start using the AmZ8000 immediately by buying the Am96/4016 Evaluation Board. Fully assembled and tested, this single-board computer designed around the AmZ8000 CPU has I/O channels, RAM and a PROM-based monitor all together on a SBC-80 size board. Simply connect it to a power supply and a terminal or the optional keyboard/display board and it's up and running, ready for you to start programming and executing code.

The Am96/4016 enables you to write software routines in assembly language with the optional PROM-based assembler and use them to benchmark the AmZ8000 CPU. You can connect other devices to the CPU to verify interface designs. You can expand the memory to 64K bytes for exercising the full AmZ8002 addressing capability. And you can start today, because the Am96/4016 is available and inexpensive.

Some additional features of the fully assembled and tested Am96/4016 are the following:

- ☐ 4MHz operation
- ☐ 8K bytes (4K words) of RAM and sockets for 12K bytes of PROM
- ☐ PROM-based monitor with debugging capability
- ☐ Optional PROM-based line-by-line assembler
- ☐ Two serial ports with programmable baud rates
- ☐ Three byte-wide parallel ports
- ☐ Three interval timers
- ☐ Direct interface to a CRT terminal or the optional keyboard/display
- ☐ SBC-80 physical size



Besides serving as an AmZ8000 evaluation module, the Am96/4016 Evaluation Board is also designed to be an important module of the AmSYS8/8 system. When connected to the CPU board in the development system, the evaluation board serves as a 4MHz execution vehicle for programs generated within AmSYS8/8.

A POWERFUL MULTIBUS-COMPATIBLE OEM COMPUTER

The Am96/4116 MonoBoard Computer is a complete single-board computer with exceptional CPU power provided by a 16-bit AmZ8002 microprocessor operating at 4MHz. It is fully compatible with the Multibus* bus standard and SBC-80 card format for ease and versatility of system integration. MultiMaster bus control and arbitration logic enhance its computing capability and associated system performance.

Both random access memory and sockets for PROM/ROM memory are provided. Further capability is added by on-board LSI peripheral circuits that furnish I/O, timing/counting, and interrupt control.

On-board memory consists of 32K bytes of dual-ported high-speed RAM along with dual sockets for up to 8K bytes of PROM/ROM. Two types of I/O capability are included: two serial I/O ports implemented as RS232 interfaces and 24 lines of software-configurable parallel I/O. A multiple mode interrupt structure including a programmable interrupt controller supports three types of interrupt signals. To provide for many types of counting, timing and resynchronizing requirements, a programmable system timing controller is incorporated.

Other Multibus-compatible board products can be used with the Am96/4116 MonoBoard Computer to configure powerful and versatile computer systems for a wide variety of applications.

* Multibus is a trademark of Intel Corporation.

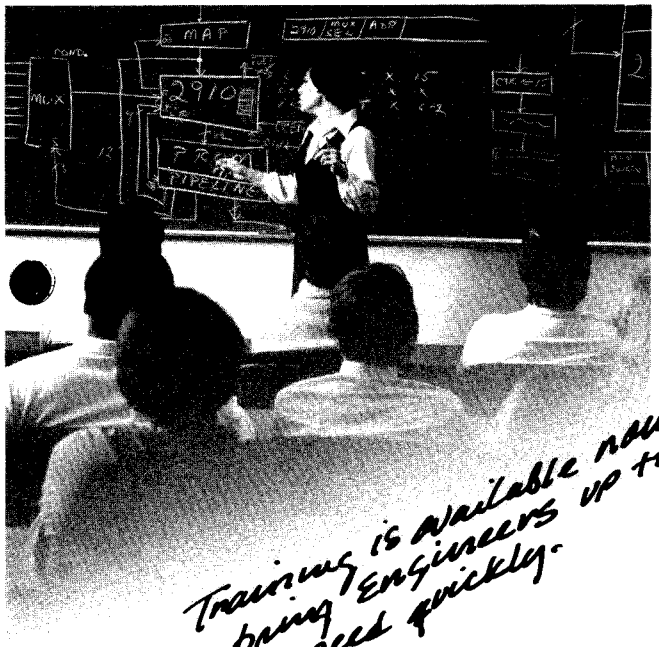
LEARN ALL ABOUT THE AmZ8000 FAMILY

FREE SEMINARS

AMD offers a series of free seminars to bring you the latest information on the AmZ8000 Family. You can learn what this family offers you in one of our half-day presentations held at a location convenient to you. Attend only those sessions of special interest to you, or attend them all to get the full story. Complete schedule information is available from your local AMD sales office.

GRADUATE-LEVEL COURSES

The School of Advanced Engineering, at Advanced Micro Devices' customer education center, offers detailed courses to bring you up to speed quickly on design, development and programming of AmZ8000-based systems.



Training is available now to bring Engineers up to speed quickly.

Introduction to the AmZ8000 Family

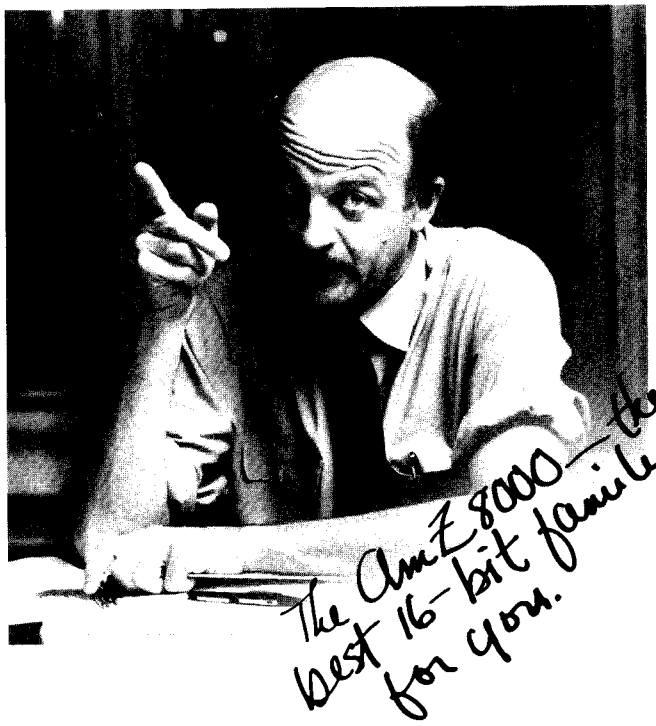
A five-day lecture/lab seminar introduces the AmZ8000 Family to managers, engineers and programmers. Emphases are on the architecture and the instruction set of the two CPUs, the segmented AmZ8001 and the nonsegmented AmZ8002, and the AmZ8010 Memory Management Unit. Topics include timing and interfacing with existing MOS peripherals, as well as an overview of the entire AmZ8000 Family. Labs use the AmZ8002 with a line-by-line assembler and the evaluation board.

Assembly Language Programming for the AmZ8000

This seminar/workshop introduces the AmSYS8/8 Development System using assembly-level programming as the instructional vehicle. The student is paced through system utilities and the AmZ8000 assembler (MACRO8000), and linker. Students create code using AmSYS8/8, link code segments, including library code routines, and download to the Am96/4016 Evaluation Board via the HOST monitor routine for execution.

HOW TO FIND OUT MORE ABOUT THE AmZ8000 FAMILY

Call your local AMD sales office or authorized distributor at the number listed below to get more detailed descriptions or complete technical information on any of the products described in this brochure. A field applications engineer is available in most areas to answer technical questions as well. When you've heard the whole story, you'll agree. The AmZ8000 is better.



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