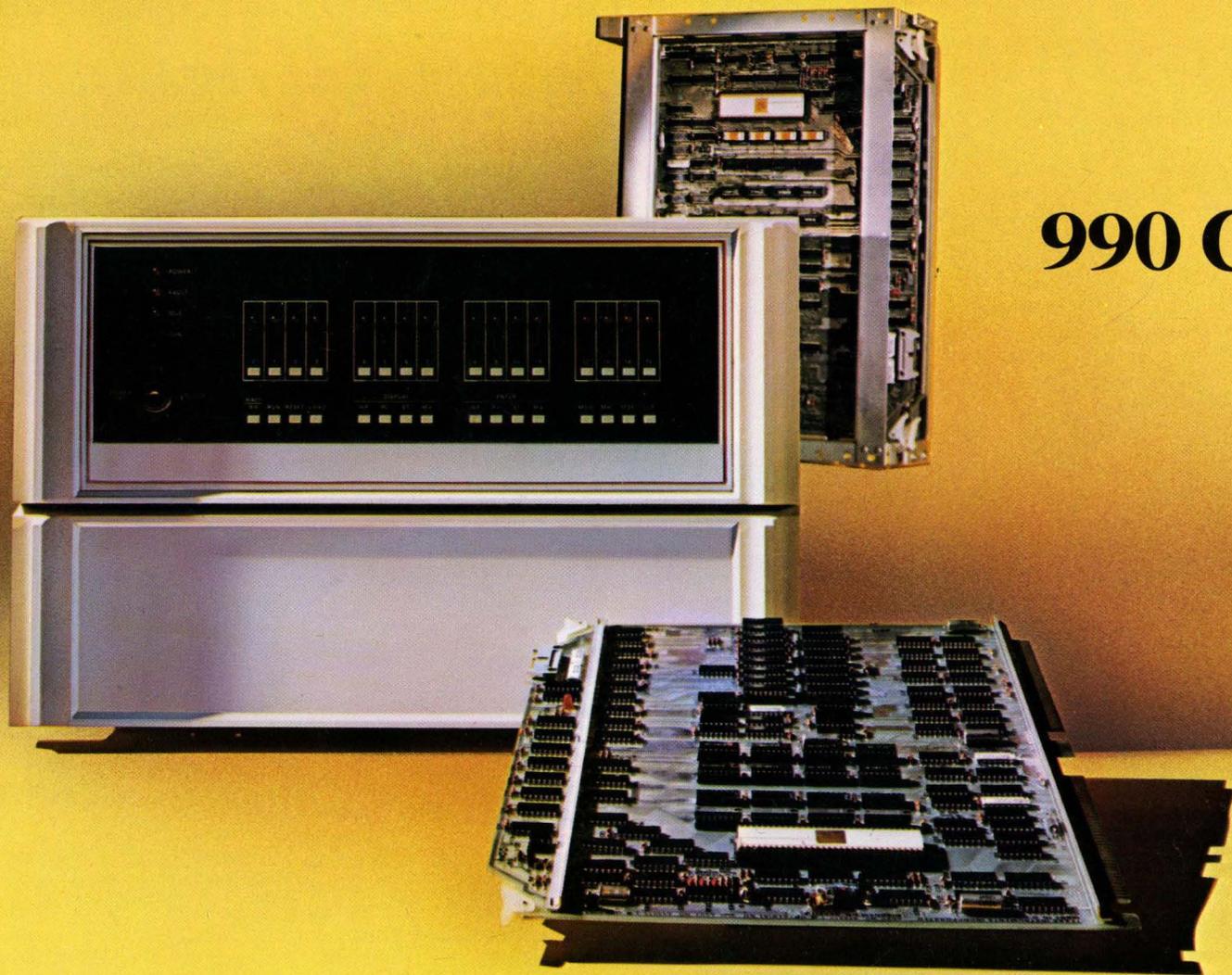
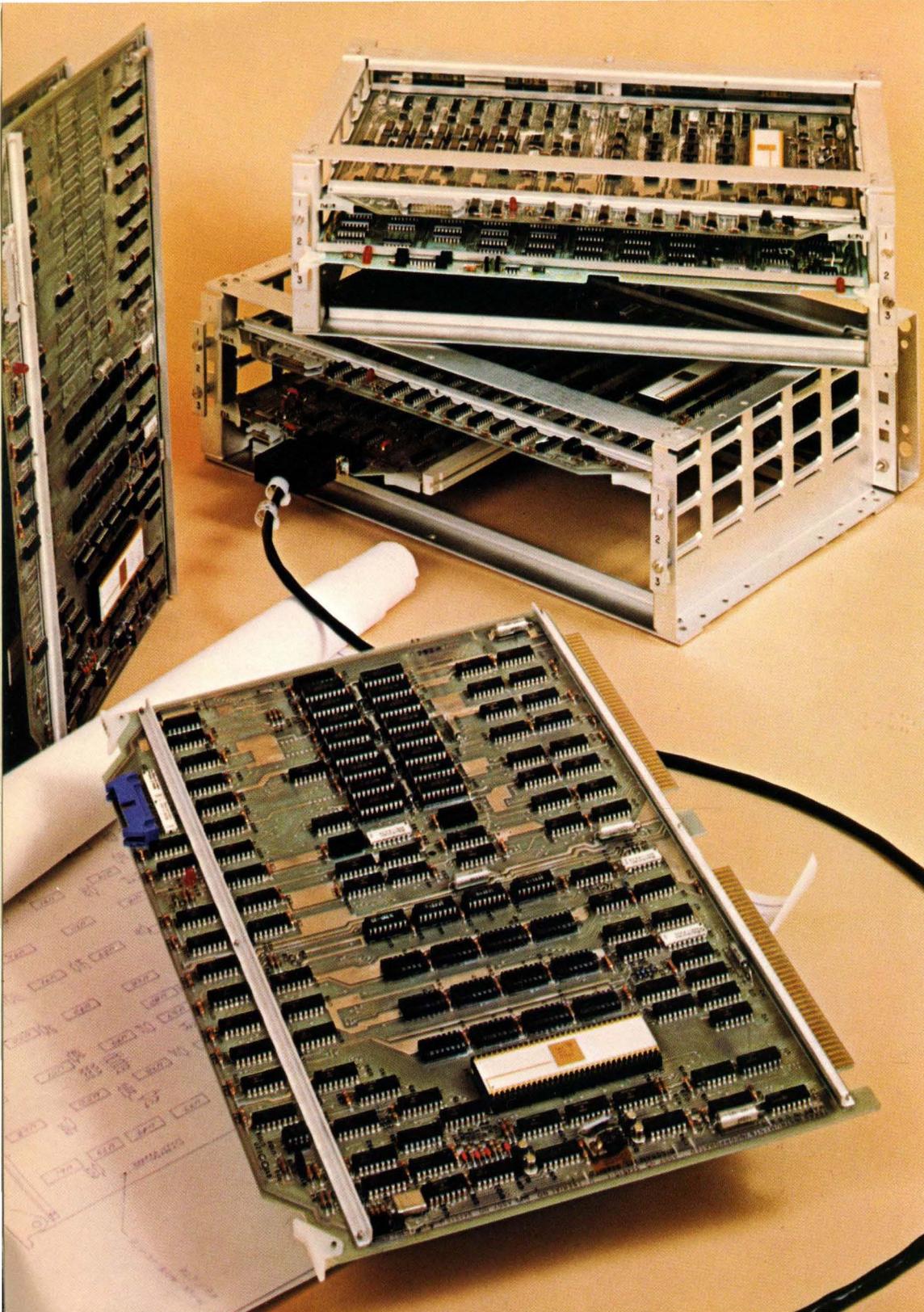




# 990 COMPUTER FAMILY



# TEXAS INSTRUMENTS.

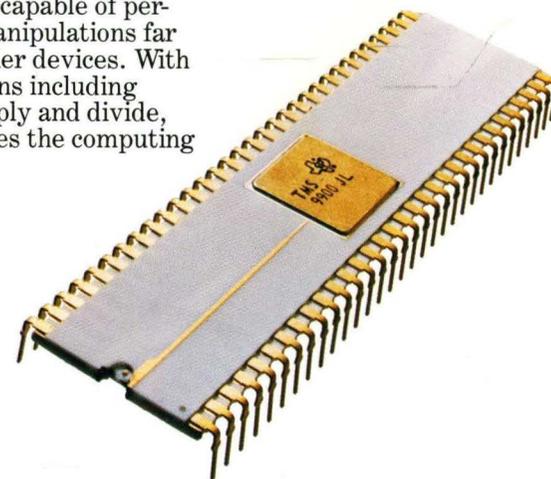


## The TMS 9900 microprocessor.

Powerful enough to be the central processing unit of a full minicomputer, the 9900 is the ideal microprocessor for countless OEM applications.

The 9900 is a one-chip NMOS microprocessor capable of performing data manipulations far surpassing earlier devices. With its 69 instructions including hardware multiply and divide, the 9900 provides the computing

logic of a 16-bit TTL computer. The 9900 and system components provide total system design capability including directly accessible memory, interrupt and I/O devices.



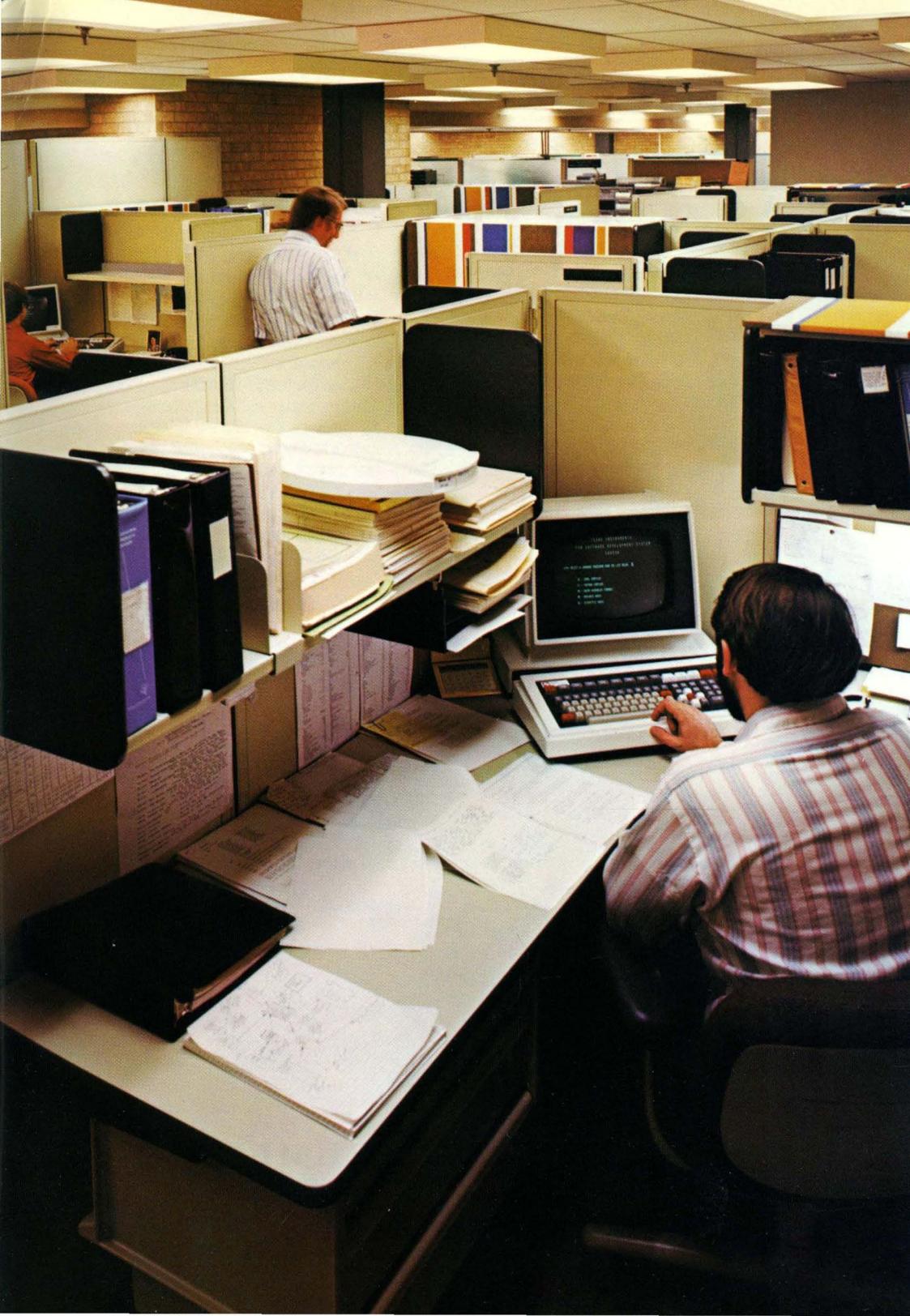
## The model 990/4 microcomputer. A low-cost package with surprising versatility and power.

A complete microcomputer on a single printed circuit board, the powerful 990/4 offers all the benefits of flexible memory configurations and CPU options.

Built around the TMS 9900 microprocessor, the 990/4 is suitable for standalone intelligent terminal control, dedicated machine monitoring, central peripheral device interface control and as a CPU for OEM customers. The card contains up to 4096 words of dynamic RAM memory, up to 1024 words of

RAM and/or PROM, plus real-time clock input, an eight-level hardware interrupt structure, front panel interface, and optional ROM utilities.

The basic 3-slot chassis provides connectors and mounting space for three full cards, and can be configured with the 990/4, additional memory, and Communication Register Unit (CRU) Modules. An easy method of connection is provided for an external power source. The 990/4 is also available in a 6-slot or 13-slot chassis with power supply and a choice of programmer or operator front panel.



## Complete software packages and development aids.

The 990 Computer Family offers a wide range of software packages and tools to minimize your program development efforts. In addition to both memory-resident and disc-resident operating systems, a comprehensive selection of higher level languages and program development aids are available.

Both the TX990 Memory Resident Executive System and the DX10 Disc Executive System are multi-tasking, real-time systems. Both systems give you a flexible framework for implementation of application software. The TX990 system is suitable for low-cost computer controller applications using a minimum of peripheral devices. The DX10 system provides support and flexibility for larger 990/10 systems requiring high mass storage and rapid access to program and data files.

High level languages including FORTRAN IV, COBOL, Multiuser BASIC and 990 family assembly language are offered to

satisfy a wide variety of programming environments. The easily understood 990 assembly language optimizes memory usage for smaller systems. Higher level languages satisfy the requirements of larger system users for mathematical, scientific or business applications.

An extensive set of utility programs, including a linkage editor, assembler, linking loader, debug monitor and trace debug, aid the user in developing application software. The Prototyping System Software Package eases the generation and verification of software and firmware modules for the 990/4, and for any customer-designed dedicated controllers using the 9900 microprocessor.

A cross support system, consisting of a cross assembler and simulator, is available on several worldwide timesharing services. It allows the user to assemble programs for any member of the 990 family and to simulate the TMS 9900 instruction set for debugging programs.



## A wide range of peripherals for versatile system configurations.

The 990 Computer Family is supported by a variety of standard peripherals, plus general purpose interface boards for custom equipment. Interactive data terminals include the Model 913 Video Display Terminal, the Silent 700® twin cassette Model 733 ASR Terminal, and the Silent 700 Model 743 KSR Data Terminal. For mass storage, both floppy discs for low-cost data storage and retrieval, and moving head discs for high-speed,

large-volume storage of up to 90 million 16-bit words are offered. The Model 979A Magnetic Tape Unit is available with 800 and 1600-bpi options. Medium and low-speed devices for input/output batch processing operations include the Model 306 Line Printer, the Model 588 Line Printer, and the Model 804 Card Reader. In addition to this broad range of peripherals, TI offers communication modules to support synchronous or asynchronous data transmission.

## Our technology helps us build them better, back them better.

Recognizing that equipment availability is the important factor in any computer installation, TI has designed the 990 family members for rapid field service. Simplified troubleshooting procedures and built-in diagnostic firmware enable the Customer Engineer to minimize your equipment downtime.

TI's concern with providing superior products and service does not stop with the design and sale of the system. High-quality customer service, complete documentation, total customer

support and training, and comprehensive maintenance combine to insure optimum system performance and customer satisfaction.

In addition to training and applications assistance programs, TI backs its nationwide service network with TI-CARE †, an automated remote diagnostic, service dispatching, and real-time field service management information system. It's especially designed for customers who operate large, widespread installations of TI computer equipment or systems to assure the same exacting attention after the sale as was given during manufacture.



## The 990/10 Minicomputer. Power you need at a price you can afford.

The 990/10 is the most powerful member of the 990 computer family. A TTL implementation of the 990 architecture, the 990/10 is a sensible, low-cost mini that can host clustered terminal networks, or meet the needs of a variety of industries. Whatever your application, the 990/10 gives you the speed and high performance you need.

A unique feature of the 990/10 which helps it to achieve higher performance levels is TILINE\*, an asynchronous, high-speed, 16-bit, parallel I/O data bus.

TILINE links the CPU, memory and peripheral devices. Because the bus is asynchronous, it can support both high- and low-speed devices, taking advantage of design simplicity for data transfer between peripherals, CPU and memory.

For larger memory requirements, the 990/10 supports memory expansion up to one million words with memory protection provided by an optional mapping feature. And an optional error correcting memory module gives you high reliability with large memory systems.

The 990/10 chassis and power supply options are the same as those for the 990/4.



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## Specifications.

### TMS 9900 Microprocessor

Architecture: 64-pin DIP (separate address and data bus)

Word Size: 16 bits

Memory Size: 32K 16-bit words

Instruction Set: 69 versatile

instructions including hardware multiply and divide; 5 addressing modes

System clock: 3 MHz frequency

Interrupt: 16-level hardware interrupt structure

I/O channels: DMA and CRU (up to 4096 input and 4096 output lines, instruction driven)

### 990 / 4 Microcomputer

CPU: TMS 9900

Memory: Expandable to 32K 16-bit words (PROM, EPROM, ROM, RAM)

Memory Protection: Optional program-controlled memory write protect

Interrupts: 8 level priority hardware interrupt structure (power fail/auto-restart highest level)

Clock: Line frequency real-time clock input

I/O interfaces: DMA bus for high-speed devices; CRU for low-speed devices

### 990 / 10 Minicomputer

CPU: TMS 9900 architecture implemented with TTL

Memory: 1024K 16-bit words max. 24K words max. on one board

Memory Protection: Optional memory mapping with privileged instructions; optional error correcting memory

I/O interface: TILINE asynchronous bus supports high-speed devices, memory, and multiprocessor configurations (utilizes 1024 words of memory)

Extended instructions: XOP (Extended Operations Feature) 16 hardware instructions

Interrupts: 16 level hardware priority interrupts including power fail/auto restart, memory data error, mapping error, 120-Hz clock, illegal operating code, privileged instruction violation, TILINE time out

### General

Chassis: 3-slot OEM, 6-slot, 13-slot

Programmer Panel: Keylock On/Off switch; 16 status and memory data LED's, fault indication LED, run LED, idle LED

Operator Panel: Keylock power On/Off, load switch, power on LED, Fault indication LED

Operating Temperature

Range: 0°C to 50°C

Humidity: 0 to 95%, noncondensing

Architectural features: Rapid context switching, workspace concept, memory-to-memory architecture, Communications Register Unit (CRU) addresses I/O in bits, bytes and words

### Software

Operating Systems: Disc-based DX10, Memory Resident TX990

Programming Languages: FORTRAN IV, Multiuser BASIC, COBOL, Assembly Language

### Software Packages

Prototyping System: Debug Monitor, One-pass Assembler, Text Editor, Front panel and bootstrap firmware

990/733 ASR System: Debug Monitor, One-pass Assembler, Linking Loader, Source Editor, Instruction Level Trace Package (TRACE)

990/Disc System: DX10, Automatic System Generation, Macro Assembler, Source Editor, Link Editor, Debug Package, Librarian, Card Reader Loader

## 990 Computer Family standard features.

All members of the 990 family are designed for maximum processing power. Standard features include line frequency real-time clock input, vectored hardware interrupt structure, Communications Register Unit (CRU) I/O interface, memory I/O bus, hardware context switching, hardware multiply and divide, bit, byte, word addressing, and a powerful instruction set with extended operation feature (XOP).

### Bit / Byte / Word Versatility

Programming versatility and software efficiency are increased by 990 addressing flexibility. Bit, byte and word addressing of memory and I/O interfaces is especially advantageous to users with distributed data bases, data communication networks and manufacturing environments.

### CRU Versatility

The architectural simplicity of the CRU means minimal I/O interfacing costs for the user. Bit, byte and word addressing offers an effective tool to aid the engineer and programmer in interfacing the CRU with peripherals.

### Rapid Context Switching

Rapid context switching is a program control transfer feature enabling 990 computers to oper-

ate with extraordinary efficiency in a multi-task environment. It is made possible by programmable 16-word workspaces located in memory.

### Extended Operation (XOP) Instruction

Standard 990 hardware includes 16 XOP instruction traps. These traps extend the 990 instruction repertoire when applications dictate by permitting hardware modules to perform the complex arithmetic and logical operations normally executed by software.

### Options to increase your performance

For applications requiring even more processing power and versatility, TI offers a full array of options. CPU options include a programmer front panel, memory parity, power fail/auto restart, battery pack and standby power, ROM loaders, RAM, PROM, and EPROM expansion, write protect and mapping with privileged instructions. RAM modules may have an optional parity or error correcting feature.

For more information, call the TI sales office nearest you. Or, write Texas Instruments Incorporated, P. O. Box 1444, M/S 784, Houston, Texas 77001. Or, call Computer, Systems Marketing at (512) 258-5121.



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