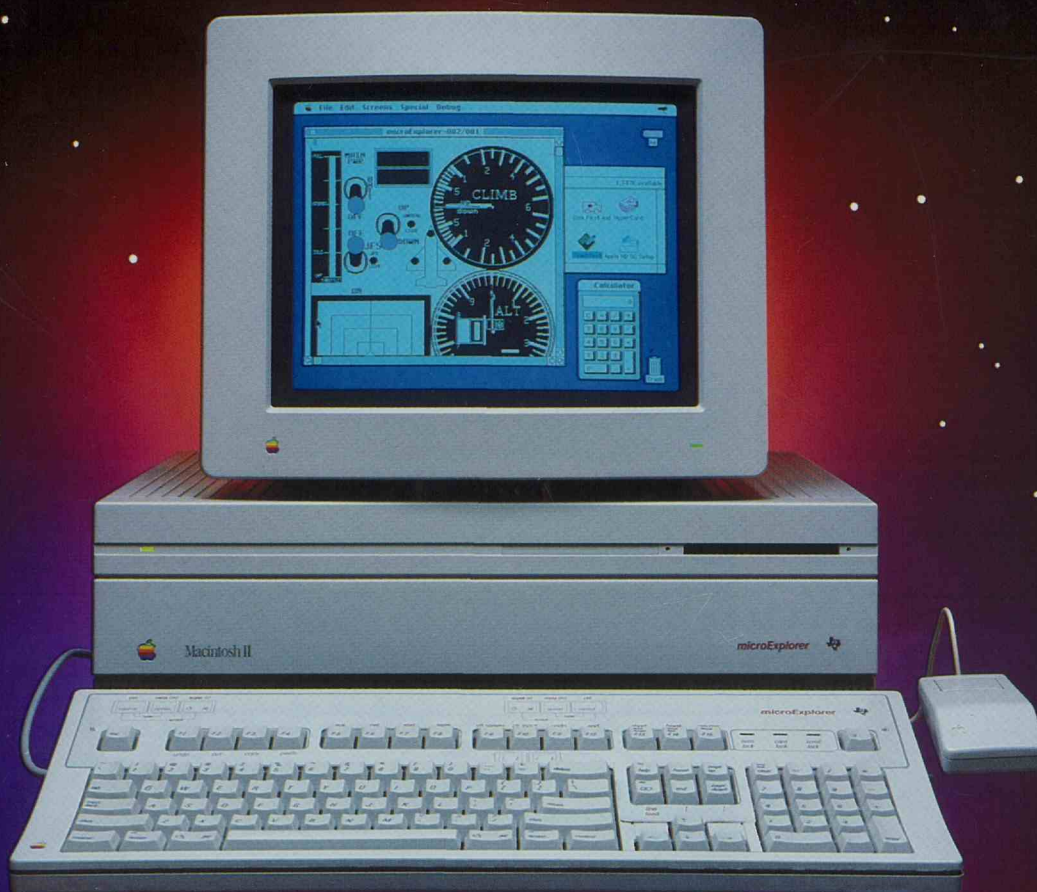# TEXAS INSTRUMENTS
MICROEXPLORER™
COMPUTER SYSTEM

Combining the power of Explorer™ and Macintosh® II.

The Explorer computer family: powerful solutions for complex problems.

Solutions to complex problems that have resisted traditional computerization require a combination of new architectures, powerful software environments, and performance beyond the capabilities of traditional computers.

Symbolic processing, a computing technology that uses symbols to represent real-world objects and properties associated with them, provides the means to solve many of these problems. This approach requires powerful computers designed for efficient execution of symbolic processing software.

The Explorer family of high-performance symbolic processing computers was developed to meet this need by Texas Instruments, a pioneer in the development and implementation of artificial intelligence (AI) technology. The Explorer combines the Lisp symbolic processing language, an integrated software environment, and optimized hardware support to provide the most powerful, reliable, and cost-effective symbolic processing systems available.

Practical applications of artificial intelligence.

An increasing number of companies are already beginning to achieve substantial returns from applications using AI technology. Expert systems have become an important aid in dynamic scheduling, equipment diagnostics, monitoring and control, configuration, and design. Rapid software prototyping is increasingly being used for large, complex software systems. For a growing list of customers around the world, the Explorer is the key to helping them solve difficult problems in numerous applications.

Technology leadership.

Texas Instruments is a world leader in the field of artificial intelligence. A research program that began in 1978 has grown into a company-wide strategy for developing and applying AI technology.

TI brings its semiconductor expertise to AI through MegaChip™ Technologies, a set of process, design automation, and manufacturing technologies used to create a new generation of semiconductor products and services. The superior performance of the Explorer Lisp microprocessor is a result of this program.

TI offers the broadest range of AI products and services in the industry, including the Explorer computer family, the Personal Consultant™ Series of expert system development tools, Knowledge Engineering Services, AI education, and product support services.

TI is also a world leader in the practical application of AI in its own operations. This internal experience puts TI in a unique position to help customers solve their business problems.

New delivery alternatives.

TI has long recognized the need for a range of delivery options to meet differing customer and application requirements.

Some symbolic processing applications require the power of an Explorer II, TI's highest performance symbolic processing system, either as a workstation or as a server in a networked environment. Smaller applications can often be effectively deployed on PCs or technical workstations. But as a growing number of significant applications are being developed, a new kind of delivery system is needed—one that has the full power of an Explorer and the applications base of a leading conventional system.

The microExplorer is ideal for delivery of complex expert system applications, such as diagnostics and dynamic scheduling.

microExplorer: ideal for delivery of symbolic processing applications.
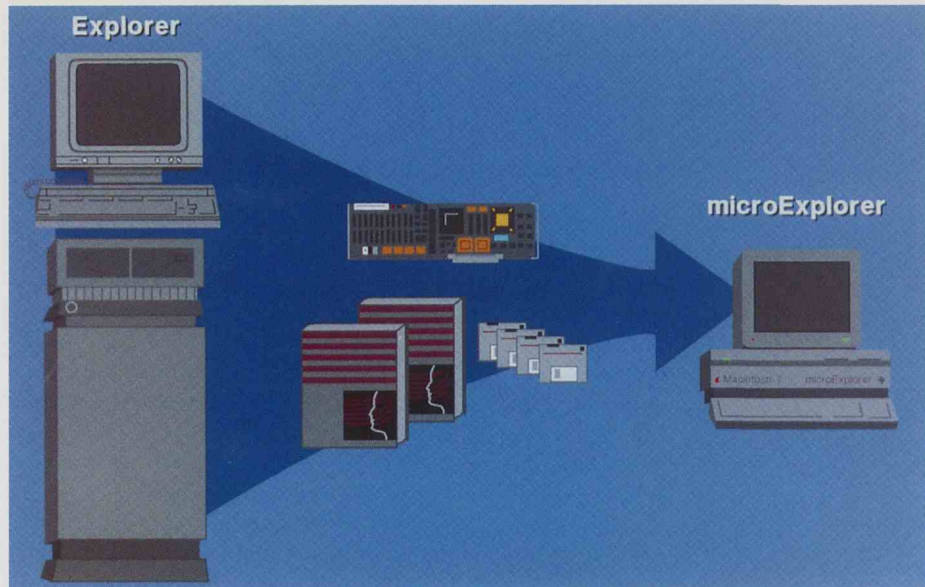
The microExplorer combines TI's powerful Explorer software environment and Lisp chip with the widely acclaimed Apple Macintosh II computer.

The microExplorer system combines the best of two computing worlds:

- **TI Explorer.** The Explorer family features a powerful software environment and optimized hardware support for productive development and efficient execution of symbolic processing applications.
- **Apple® Macintosh® II.** The Macintosh II extends the Macintosh family with a new open architecture. Based on the same industry standard TI NuBus™ used in Explorer systems, the Macintosh II has the power to run not only the most advanced productivity applications, but also new applications such as desktop engineering.

The innovative microExplorer system makes the widespread deployment of expert systems and other symbolic processing applications possible, and enables the development of a new generation of intelligent integrated applications.

Applications delivery.

The microExplorer is designed to meet the needs of developers and users who want to bring the power of symbolic processing to bear on solving complex problems such as dynamic scheduling and computer-aided engineering.

Multipurpose system. The user can run both symbolic applications and conventional applications on a single system without having to compromise in either area.

Integrated symbolic/conventional applications. In cases where users desire to augment or add intelligence to conventional applications, the microExplorer provides a unique platform for integrated applications. Such an approach would use the resources of both operating environments concurrently. For example, the Macintosh II gathers data and does numeric calculations, while the microExplorer processor adds expert system capabilities.

Extensive networking. The microExplorer takes advantage of the many networking and communication products available for the Macintosh II. This makes it easy for the microExplorer to fit in with modern corporate computer networks.

Family compatibility. The microExplorer is based on the same Explorer software environment and Lisp chip as the Explorer II. Applications developed on other Explorer family members can be easily installed on the microExplorer.

Low cost. State-of-the-art VLSI and computer technology make the power of the microExplorer available for a surprisingly low cost. And its unsurpassed price-performance ratio makes many new AI applications economically practical.

Two computers in one.

The concept behind the microExplorer is simple. Start with the superior Explorer software environment. Using TI's unique Lisp chip and application specific VLSI components, build a processor board that has the power needed to run the environment efficiently, yet is small enough to fit in a desktop computer. Then select an exceptional host system—the Macintosh II—and develop special software interface facilities to smoothly couple the two environments.

The result is the microExplorer—the first system to combine the extraordinary capabilities of the TI Explorer and the Apple Macintosh II in one powerful desktop package.

Two powerful software environments for high productivity.
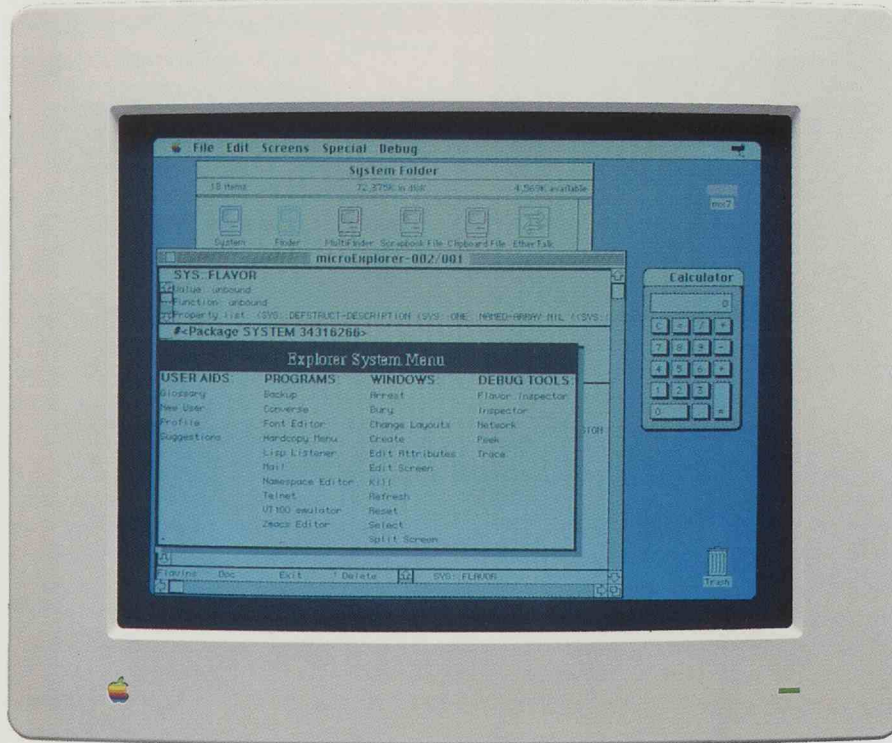
Symbolic and conventional applications operate concurrently on the microExplorer, and can be integrated to solve different aspects of a complex problem.

Macintosh II software.

Thousands of software packages are available for the Macintosh II, ranging from computer-aided design to professional productivity applications. The point-and-click simplicity of its graphic interface sets a standard for ease of learning and ease of use. And a host of available communications packages provide connectivity to other computers from mainframes to PCs.

Combining two environments.

The Explorer environment is smoothly coupled to the Macintosh II operating environment. Starting an Explorer application on the microExplorer is the same as starting any Macintosh II application because the Explorer system interfaces to the user via the Macintosh II window system. Similarly, Explorer software uses the Macintosh II file system, so there are no separate disk storage problems.

For integrated applications that make use of both operating environments, a Remote Procedure Call capability is provided. This allows applications to run concurrently on both processors, and exchange information as needed.

Explorer software environment.

All members of the Explorer computer family feature an extraordinarily powerful and productive software environment, and the microExplorer is no exception. Explorer software provides the tools that developers need to solve complex problems, and the supporting environment needed to run these applications effectively. Key features include:
- Fully integrated environment
- Common Lisp with Zetalisp extensions
- Flavors object-oriented programming system
- Comprehensive set of prototyping and development tools
- Thousands of application building blocks

Development and delivery.

The microExplorer comes with a runtime version of the Explorer software environment. Development tools are omitted in order to decrease the size of the software. This permits applications developed on larger Explorer systems to be delivered on lower-cost systems with smaller memory and disk configurations, and with the capability of running conventional application software. Because the underlying software and hardware architectures are the same, there are no porting difficulties as are often encountered when developing on one system and delivering on another. This makes the microExplorer ideal for applications delivery.

But the microExplorer is not limited to delivery only. Optional development software packages are available that provide full Explorer software development capabilities.

Multiple processor hardware for high performance.

Concurrent processing.

Like the Explorer family, the Macintosh II uses TI's NuBus, an advanced, processor-independent bus architecture that is designed to support multiple processors. This design makes it possible to incorporate the micro-Explorer processor and Macintosh II processor in a single system. Operating concurrently, the two processors provide the user with unprecedented power in a desktop system.

Architecture optimized for symbolic processing.

One reason that symbolic processing is effective in solving difficult problems is that it automates many lower-level details, freeing the developer to focus on the conceptual level of the problem. Two examples of this are dynamic data type processing and dynamic memory management.
- Dynamic memory management automatically allocates and reclaims memory.
- Dynamic data type processing frees the developer from explicitly having to declare data types in advance. This gives applications more flexibility to deal with complex and changing situations.

To implement these functions Lisp systems use tags, specially designated bits associated with each data word. The Explorer system architecture provides hardware support to process tags in parallel with instruction execution. This eliminates the costly overhead of performing these functions with software, as required by other systems. And TI's unique Temporal Garbage Collection capability reclaims memory incrementally during program execution in a way that is virtually invisible to the user.

State-of-the-art VLSI processor.

At the heart of the microExplorer processor is TI's Explorer Lisp chip, the world's first 32-bit microprocessor designed for symbolic processing applications. It is one of the most complex integrated circuits ever produced, with more than a half-million transistors on a one-centimeter square chip of silicon. The Lisp chip's high speed and on-chip support for tag processing and other symbolic processing functions enable the development of both higher-performance systems and smaller systems than previously possible.

The microExplorer processor has its own on-board memory of four megabytes, expandable to twelve megabytes. By using one-megabit memory chips, TI's application-specific integrated circuits (ASICs), and the unique TI Lisp chip, the microExplorer packs the power of an Explorer on a single board that occupies just one expansion slot in the Macintosh II system unit.

Macintosh II.

The Macintosh II computer is an ideal host system for the microExplorer. Its crisp high-resolution graphics provide an advanced user interface. Its powerful 32-bit processor handles computationally intensive applications effectively. And its expandability— memory to eight megabytes and beyond, mass storage to several hundred megabytes, and six internal NuBus expansion slots—provides an easy growth path.
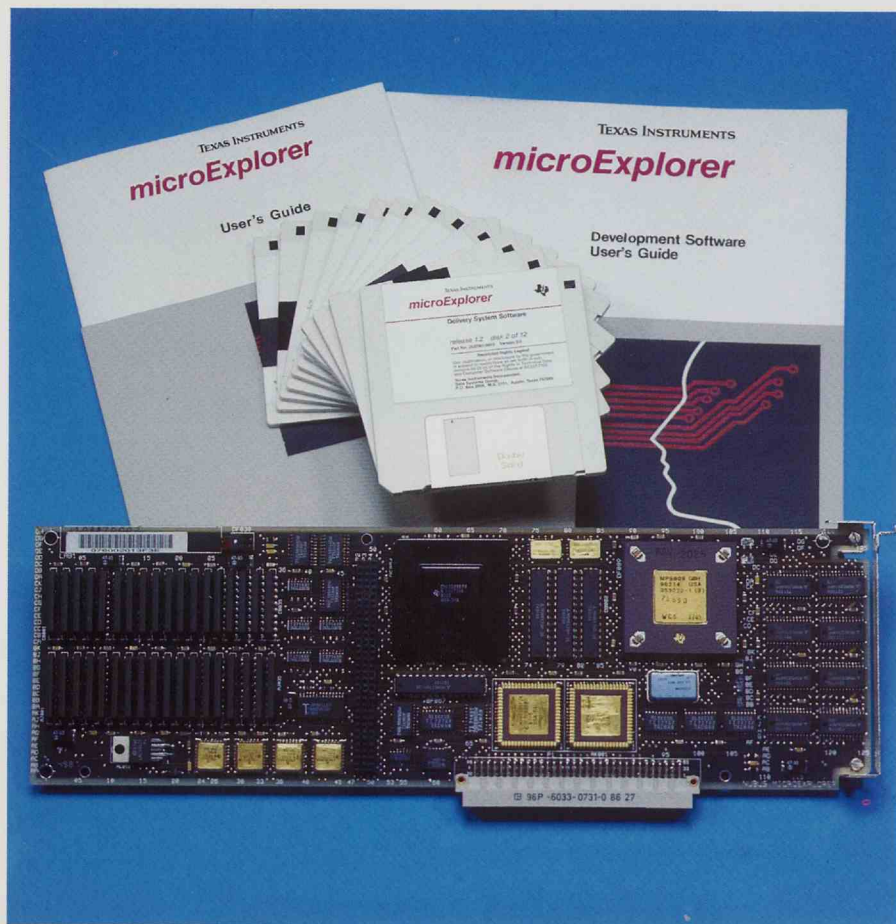
The microExplorer uses the world's first AI microprocessor to run the powerful Explorer symbolic processing environment.

Helping customers put AI to work.

Knowledge Engineering Services.

TI can help your organization get started in expert systems development through its Knowledge Engineering Services.

TI's experienced knowledge engineers are available to work with customers in all phases of development—application and tool selection, feasibility demonstration and prototyping, and full custom projects including knowledge acquisition, system development, deployment, integration, and maintenance.

Education and support.

The Texas Instruments Education and Development Center has developed a broad curriculum of courses designed specifically for the people who will use Explorer family computers. Featuring live instruction by highly-qualified TI personnel, the courses are available at a Texas Instruments facility or at the customer's site. More than 2,500 people have already received Explorer training through the Education and Development Center.

TI is also making information on AI available to a wide audience through its Artificial Intelligence Satellite Symposium series. More than 150,000 people have attended these symposia.

In addition to knowledge engineering, formal education, and apprenticeship programs, TI's ongoing customer support includes such services as a technical customer support line and field analyst support.

Field service.

Explorer family computer systems have been designed for highly reliable operation. They have also been designed for easy maintenance, including powerful built-in diagnostic tests and easily accessible components.

TI's worldwide base of customer service representatives is ready to provide installation, contract maintenance, and on-call service, allowing customers to choose the service program that best meets their needs. TI offers several standard maintenance contracts or will tailor a contract to fit specific customer needs. TI's comprehensive service programs are consistently rated excellent in user surveys.

Quality: we've built our reputation on it.

At Texas Instruments, quality is part of our culture. Whether it is our systems, software, or services, our goal is to be the industry leader in quality and customer satisfaction.
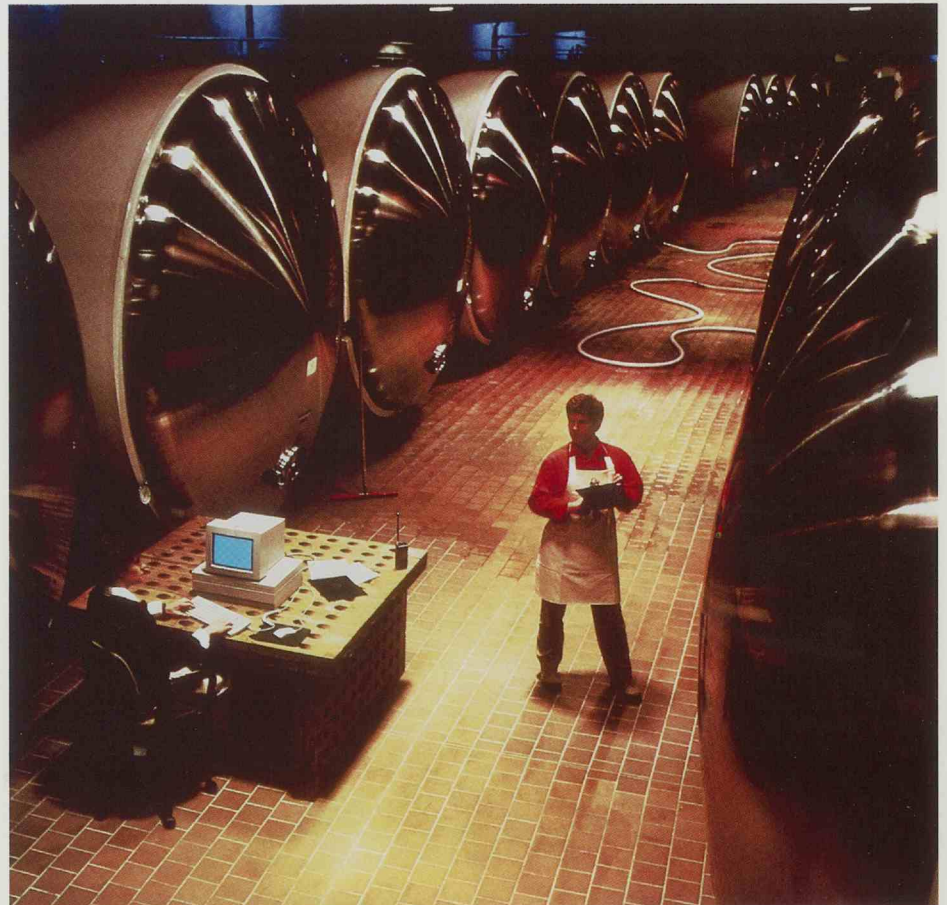
TI provides the industry's broadest range of AI products and services to help our customers put AI to work.

microExplorer system specifications.

Hardware specifications.

microExplorer processor and memory
- 32-bit VLSI Explorer Lisp microprocessor
- 4MB on-board memory
- Optional 4MB or 8MB memory expansion board
- 32K word x 63 bit writable control store
- Seven application-specific VLSI chips for bus control, NuBus data path, DRAM data path

Macintosh II processor and memory
- 32-bit 68020 microprocessor, 15.7 MHz
- 68881 floating point accelerator
- 2MB RAM, expandable to 8MB on-board
- 256K System ROM

Mass storage
- Internal hard disk
  - 40MB or 80MB formatted capacity
  - SCSI interface
  - 30ms average seek time
  - 937 kilobyte/second transfer rate
- External hard disk
  - 80MB formatted capacity
  - Up to six per system
- Internal diskette
  - 800KB formatted capacity
- External ¼ inch cartridge tape
  - 40MB capacity

Displays
- 12 inch monochrome display
  - 640 x 480 pixel resolution
  - Displays 16 gray levels (256 with optional video expansion kit)
- 13 inch color display
  - 640 x 480 pixel resolution
  - Displays 16 colors from palette of 16 million (256 with optional video expansion kit)
- 21 inch monochrome display
  - 1152 x 870 pixel resolution

Keyboard and mouse
- 105 key Apple Extended Keyboard with Explorer overlays
- One-button mouse with three-button emulation

Networking
- AppleTalk® Personal Network Interface
- Optional EtherTalk™ Interface Card

Software specifications.

System software
- Common Lisp
- Flavors object-oriented system
- Interpreter
- Temporal Garbage Collection
- Adaptive Dynamic Training
- Remote Procedure Call/External Data Representation
- microExplorer to Macintosh II interface routines

Development system software
- Common Lisp compiler
- Zmacs editor
- Debugger
- Inspector
- Peek utility
- Trace utility
- Window system
- Constraint frame editor
- Zetalisp extensions
- Visidoc
- System compaction tool

Development system software source
- Lisp source of microExplorer system software and program development tools
- Visidoc text base and indexes

Other options
- TI Prolog
- TCP/IP
- Network File System (NFS™)

Macintosh II software
- System tools
- HyperCard™
- Training disks

For more information.

For more information on the Texas
Instruments microExplorer computer
system or other Explorer family
members, please contact your local TI
account representative, or call
1-800-527-3500, or write:

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