



**Artificial Intelligence:  
A New Productivity Tool**

Building on the 4404 AI System, Tek now broadens its AI family to include the 4405 with increased processing power and the 4406 with its high speed 16 MHz Motorola 68020 32-bit microprocessor and 68881 co-processor. The Tek AI family offers a powerful range of capabilities for application developers, researchers, software engineers, and computer scientists at prices well below the industry norm.

The 4400's advanced languages make it an excellent exploratory programming and software prototyping tool.

All of the major AI languages in use today are represented on the 4400 including Tek Common LISP, Smalltalk-80, MProlog and Franz LISP. This offers AI researchers and developers a clear choice of programming environments—all accessible from a single desktop device, all fully compatible with the entire 4400 Series Artificial Intelligence Systems.

A quick review of the specifications (see box) clearly shows the performance of the new 4406 and 4405 is comparable to systems that cost significantly more. AIM expects these new AI systems, based on optimized architecture and powerful, low-cost, general-purpose components, to capture a major portion of emerging AI market because of their outstanding price/performance.

**4400 SERIES SELECTION GUIDE**

	<b>4404</b>	<b>4405</b>	<b>4406</b>
<b>Architecture</b>	68010 @ 10 MHz Floating point accelerator	68020 @ 16 MHz 68881 Floating point co-processor	68020 @ 16 MHz 68881 Floating point co-processor
<b>Display</b>			
Size	13 inch monochrome	13 inch monochrome	19 inch monochrome
Viewable Points	640 x 480	640 x 480	1280 x 1024
Addressable Points	1024 x 1024	1024 x 1024	1024 x 1024
Input Devices	Joydisk, mouse	Joydisk, mouse	Joydisk, mouse
<b>Software</b>			
Operating System	UNIX-like OS with 8 MB Virtual memory address space	UNIX-like OS with 32 MB Virtual memory address space	UNIX-like OS with 32 MB Virtual memory address space
Languages			
Standard	Smalltalk-80 Tek Common LISP Franz LISP MProlog	Smalltalk-80 Tek Common LISP Franz LISP MProlog	Smalltalk-80 Tek Common LISP Franz LISP MProlog
Optional			
<b>Memory</b>			
Standard	1 MB dynamic RAM	1 MB dynamic RAM	2 MB dynamic RAM
Optional	Additional 3 MB	Additional 4 MB	Additional 4 MB
<b>Communications</b>			
Standard	RS-232C Centronics parallel SCSI	RS-232C Centronics parallel SCSI	RS-232C Centronics parallel SCSI
Optional	ANSI X3.64 emulation IEEE Ethernet	ANSI X3.64 emulation IEEE Ethernet	ANSI X3.64 emulation IEEE Ethernet
<b>Mass Storage</b>			
Standard	45 MB hard disk 5 1/4 inch, 320 KB flexible (1)	45 MB hard disk 5 1/4 inch, 320 KB flexible (1)	90 MB hard disk 5 1/4 inch, 320 KB flexible (1)
Optional	90 MB hard disk & streaming tape drive	90 MB hard disk & streaming tape drive	90 MB hard disk & streaming tape drive
<b>Prices Begin At</b>	\$11,950	\$14,950	\$23,950



## Artificial Intelligence Systems

Smalltalk-80 Programming Environment

32-Bit CPU

Floating Point Co-Processor

Large Dynamic RAM

Multi-Tasking, Hierarchical File System

C Compiler with Std. I/O Library

Several Programming Language Options

Large Hard Disk, Floppy

High Resolution Display

Virtual Memory Operating System

Three-Button Mouse

Low Profile Detached Keyboard; 14-Key Numeric Keypad; Four Special, Eight Dedicated Programmable Function Keys; N Key Roll-over and Joydisk

Programmable Sound Generator

Crystal-Controlled Clock/Calendar with Battery Backup

ROM/EPROM Expansion Sockets

### 4404 AI System

The Tektronix 4404 Artificial Intelligence System provides a powerful, highly interactive environment for AI research and development. A low-cost desktop system, the 4404 sets a new price/performance standard for AI applications such as expert systems, natural languages, vision systems, theorem proving, intelligent robotics and automatic programming.

The 4404 comes standard with a high-speed, proprietary implementation of Smalltalk-80, an extensible, object-oriented language which supports rapid prototyping and exploratory programming. Smalltalk-80, in conjunction with the 4404 display capabilities, offers the most sophisticated user interface available for AI program development.

A bit-mapped graphics display with mouse input is closely coupled to the processor for a state-of-the-art user-interface. The 13-inch monochrome display has a 640 x 480 pixel resolution and operates at 60 Hz, noninterlaced. It functions as a window into a 1024 x 1024 bit-map memory with smooth panning whenever the cursor reaches a physical display edge. The bit-mapped display facilitates advanced concepts such as overlapping windows, "pop-up" menus and pointing with the mouse. Graphics performance makes screen animation possible. The full keyboard provides programmable function keys and a joydisk.

### NEW 4405 AI System

The Tektronix 4405 Artificial Intelligence System joins the Tek 4404 and 4406 to offer a complete family of AI application development tools and delivery systems. The Tek 4405 offers a complete, state-of-the-art, personal AI development system that rivals units costing much more.

Delivering significantly more processing power than the 4404, the 4405 is ideally suited for larger AI efforts. It provides all the software and hardware capabilities needed for developing major artificial intelligence programs.

As with the 4404, the Smalltalk-80 programming environment is included standard with the 4405. This exploratory programming tool offers a highly integrated, object-oriented user interface and is ideal for quick prototyping of complex images. It includes text and graphics editors, incremental compiler, debugging tools and multiple-window management capabilities.

### NEW 4406 AI System

The Tektronix 4406 Artificial Intelligence System is the highest performance member in the compatible 4400 Series AI Systems. The 4406 has the power and memory to handle even the most complex AI programs with speed and efficiency. The system includes a 32 Mbyte virtual memory address space, a full 2 Mbytes of dynamic RAM (expandable to 6 Mbytes) and a 90 Mbyte hard disk. The optional 4944 Mass Storage Unit further enhances 4406 performance by providing incremental 90 Mbyte hard disk backup.

The 4406 inherits the innovative design and advanced manufacturing techniques pioneered by the 4404. Employing VLSI architecture and 32-bit data paths, the 4406 is nearly twice as powerful as the 4404. It is equally appropriate for AI research, application development, or as a cost effective delivery system.

### AI Programming Environments

The 4406 supports all of the popular AI programming languages in use today. Smalltalk-80, Tek Common LISP, MProlog, and Franz LISP all run on the 4406. Programs developed on the Tektronix 4404 and 4405 are upwardly compatible with the 4406.

**CHARACTERISTICS**

**DISPLAY**

**Size** — 330 mm (13 in); [482.6 mm (19 in) 4406 only].

**Viewing Area** — 241 mm x 178 mm (9.5 in x 7 in); [356 mm x 267 mm (14.0 in x 10.5 in) 4406 only].

**MEMORY**

**CPU** — Motorola 68020 (68010, 4404 only).

**Floating Point Co-Processor** — Motorola 68881 (National 32081 Semiconductor on 4404).

**Dynamic RAM** — 1 Mbyte (2 Mbyte, 4406 only).

**Terminal Emulation** — ANSI X3.64; 80 characters x 32 lines.

**BIT-MAP RESOLUTION**

**Viewable Points** — 640 x 480 (1280 x 1024, 4406 only).

**Addressable Points** — 1024 x 1024 (1280 x 1024, 4406 only).

**Max Baud Rate** — 9600 baud.

**Flexible Disk Capacity** — 320 kB.

**Hard Disk Capacity** —

4404: 45.0 MB.

4405: 45.0 MB.

4406: 90.0 MB.

**Communications Interfaces** — SCSI, RS-232C, Hard Copy.

**AC POWER**

**Line Voltage Ranges** — 87 V ac to 128 V ac, 174 V ac to 250 V ac.

**Line Frequency** — 48 Hz to 66 Hz.

**Operating Power** — < 200 W

**PHYSICAL CHARACTERISTICS  
4400 CPU MODULES**

Dimensions	4404, 4405		4406		Mass Storage (All)	
	mm	in	mm	in	mm	in
Width	419	16.5	553.7	21.8	368.3	14.50
Height	353	13.9	429.3	16.9	127.6	5.03
Depth	495	19.5	566.4	22.3	433.1	17.05
Weight Net	kg	lb	kg	lb	kg	lb
	20.0	44.0	31.8	70.0	6.35	14.0

**ORDERING INFORMATION**

- 4404** Artificial Intelligence System **\$11,950**
- 4405** Artificial Intelligence System **\$14,950**
- 4406** Artificial Intelligence System **\$23,950**

**HARDWARE OPTIONS**

- Option 01** — 1 MB additional memory (4404 only). **+\$1,750**
- Option 02** — 2 MB additional memory (4405, 4406 only). **+\$3,500**
- Option 03** — 3 MB additional memory (4404 only). **+\$5,250**
- Option 04** — 4 MB additional memory (4405, 4406 only). **+\$7,000**
- Option 10** — Ethernet Interface. **+\$2,000**
- Option 21** — 90 MB Hard Disk **+\$2,500**

**INTERNATIONAL POWER PLUG OPTIONS**

- Option A1** — Universal Euro 220 V/16 A, 50 Hz.
- Option A2** — UK 240 V/13 A, 50 Hz.
- Option A3** — Australian 240 V/10 A, 50 Hz.
- Option A4** — North American 240 V/15 A, 60 Hz.
- Option A5** — Switzerland 230 V/6 A, 50 Hz.

**SOFTWARE OPTIONS**

- 4400P30** — Franz LISP Programming Language **\$3,000**
- Option 04** — (4404 only). **NC**
- Option 05** — (4405 only). **NC**
- Option 06** — (4406 only). **NC**

- 4400P31** — MProlog Programming Language **\$4,000**
- Option 04** — (4404 only). **NC**
- Option 05** — (4405 only). **NC**
- Option 06** — (4406 only). **NC**
- 4400P32** — EMACS Editor **\$500**
- Option 04** — (4404 only). **NC**
- Option 05** — (4405 only). **NC**
- Option 06** — (4406 only). **NC**
- 4400P33** — Tek Common LISP Programming Language **\$6,000**
- Option 04** — (4404 only). **NC**
- Option 05** — (4405 only). **NC**
- Option 06** — (4406 only). **NC**

**Smalltalk-80**

**Extensible, Object-Oriented Programming**

**Bit-Mapped Graphics User Interface**

**Designed for Exploratory Programming**

Smalltalk combines an object-oriented programming language with the most advanced user-interface available. Pioneered at Xerox PARC, Smalltalk permits exploratory programming through rapid prototyping and experimentation. Smalltalk provides an interactive approach to solving complex problems.

**High Performance Implementation**

Tektronix' method of implementing Smalltalk-80 combined with the powerful hardware architecture of the 440 Series, provides graphic response fast enough to support screen animation under direct control of Smalltalk.

Smalltalk satisfies the needs of programmers in the AI field. It is ideal for Artificial Intelligence research and development. Smalltalk can be extended by defining new instances of an object class (each with its own internal state) or by defining an entirely new object class with a distinct set of rules and default behavior. The class structure of Smalltalk provides both multiple inheritance and hierarchical inheritance mechanisms. Over 200 predefined classes support the data and control abstractions most commonly used in AI applications development.

**Original Windowing System**

Bit-mapped graphics and window management were originally developed for Smalltalk. The Smalltalk "Model-View-Controller" window-based manager supports the creation of new window-based applications. Multiple processes are supported with a virtually unlimited number of overlapping windows.

Smalltalk supports primitive graphic functions such as scaling, translation, rotation, logical combination of pixels and text attribute modification through its integral "BitBlit" operator.

Virtually any activity—text editing, file manipulation, compilation, execution, debugging—can be performed at any time, re-

gardless of the current state. The user simply "opens" another window and proceeds with the new operation. Smalltalk allows immediate access to any of its subsystems, whether user-defined or predefined, for inspection or modification.

**MPROLOG®**

**Configured for 4400 Series AI Systems**

**Interactive Development Support**

**Modular Development Capability**

MProlog, as implemented on the 4400 Series, is a unique language that allows programmers to solve problems by specifying what answers are needed rather than describing a detailed solution procedure. MProlog is non-procedural, based entirely on logical relationships or rules, among an assortment of facts.

MProlog operates on the principle of "controlled deduction." The programmer creates a network of facts and rules that describe the known relationships between the elements of a problem. Once the logical network is defined, MProlog makes logical inferences from the relationships when queried by the programmer. These characteristics make MProlog ideal for many AI applications including expert systems, natural language processing, data base query languages and automatic programming systems.

**Performance for Complex Problems**

MProlog makes complex problems easier to solve and reduces program development time. The inherent efficiency of MProlog is enhanced by the power of the 4400 Series hardware. The MProlog system is an ideal vehicle for both software development and end-user AI applications. PROLOG is one of the acknowledged languages in artificial intelligence technology. Now, Tektronix adds the programmer productivity and application development tools needed to move AI into the marketplace.

**ORDERING INFORMATION**

**4400P31** MPROLOG Programming Language **\$4,000**

**OPTIONS**

- Option 04** — 4404 Version. **NC**
- Option 05** — 4405 Version. **NC**
- Option 06** — 4406 Version. **NC**

## TEK® Common LISP

A Full Common LISP Implementation

Optimized for 4400 Systems

Rapid Prototyping of AI Concepts

Run-Time Compiler for Optimized Machine Code

Tek Common LISP has been specifically optimized and enhanced for performance on the Tektronix 4400 Series. It provides AI researchers and software developers with a personal LISP programming environment previously available only on dedicated LISP machines.

Common LISP was conceived by a large committee of academicians and AI researchers as a language that would incorporate the very best features of other LISP dialects. Tek Common LISP is a full implementation of this language (as specified in "Common LISP, The Language" by Guy Steele). It offers a much richer set of data types and more complex program structures than other LISP dialects currently in use.

### A New Standard

Common LISP is considered by many artificial intelligence experts to be a new industry standard for AI programming environments. This consensus is reflected in the general parameters established for the language:

**COMMONALITY:** Common LISP focuses the features of several different implementations of LISP into a common dialect.

**PORTABILITY:** Applications written in Common LISP are easily ported to any Common LISP implementation.

**EXPRESSIVENESS:** Common LISP is a very rich language that employs the most valuable constructs from other LISP dialects.

**EFFICIENCY:** Common LISP has features designed to facilitate the production of fast, high-quality compiled code.

**COMPATIBILITY:** Since Common LISP is derived from a number of popular dialects, code from other LISP dialects should readily map into Common LISP.

### Additional Tek Common LISP Features Include:

A powerful optimizing compiler with built-in debugging features; lexically scoped interpreter and compiler; full featured package system for symbol name differentiation; rich collection of numerical primitives and built-in functions; built-in garbage collector and dynamic storage management; complete implementation of arrays, vectors and strings;

flexible interactive user interface; flexible debugging aids; powerful facilities for structures and macros; lexical closures; user-extensible data type facility; and built-in user-extensible data type facility; and built-in user-extensible parser and hash-table facility.

The rich set of primitives available in Common LISP makes the language an appropriate candidate for expert systems, natural language interfaces, and all types of symbolic programming. Tek Common LISP goes beyond the specifications of the language to provide on-line documentation; a user-definable error handler; powerful and robust foreign function interfaces to C and FORTRAN programs and a built-in Flavors system for object-oriented programming.

### ORDERING INFORMATION

**4400P33** Tek Common LISP Programming Language **\$6,000**

#### OPTIONS

<b>Option 04</b> — (4404 only)	<b>NC</b>
<b>Option 05</b> — (4405 only)	<b>NC</b>
<b>Option 06</b> — (4406 only)	<b>NC</b>

### Customer Software Services

Tek Common LISP includes a one-year software update service which can be renewed annually.

## FRANZ LISP

Configured for 4400 AI Systems

Full-Featured Development Language

Optimizing Compiler Generates 4400 Series Machine Code

A commercial derivative of the MacLISP language from MIT, FRANZ LISP is the long-time favorite for AI programming because of its uniqueness as a high-level machine language for symbolic processing. Many natural languages and expert systems have been built using the recursive programming facilities of LISP. Traditionally, LISP has resided only on expensive mainframe computers. Now, Franz LISP is available on the 4400 Series Artificial Intelligence Systems.

### A Powerful AI Programming Environment

4400 Series LISP is a programming environment that includes many tools to enhance research and development. Besides the popular language primitives, functions and data types, LISP contains a powerful macro facility, and allows programs written in other languages to be called. The system supports separately compiled functions, UNIX-like file accessing, and I/O redirection.

Franz LISP supports a wide variety of data types, arithmetic and mapping functions.

The language provides dynamic storage allocation and garbage collection. It provides operators for creation, accessing, and manipulation of data types, data type determination, and structure comparison. Users may create their own data types out of vectors and specify how standard system functions, like **print**, should handle them.

Franz LISP provides simple arithmetic functions, arithmetic predicates, trigonometric functions, "bignum" functions and a host of conversion and special purpose arithmetic functions. It includes a set of operators to allow dynamic error indication and recovery, with nonstandard control flows, through the powerful **catch**, **throw** and **errset** functions.

Franz LISP in the 4404 environment provides many functions for communicating with I/O devices, including I/O redirection to and from files. It supports UNIX-like disk file operations such as direct file access with the **fseek** function, allowing reading or writing at random locations within a file.

Many system functions allow interaction with internal components of LISP and the operating system. These include new process generation from within a program with the process and signal functions.

### ORDERING INFORMATION

**4400P30** FRANZ LISP Programming Language **\$3,000**

#### OPTIONS

<b>Option 02</b> — 5 1/4 Floppy Media	<b>NC</b>
<b>Option 04</b> — (4404 only).	<b>NC</b>
<b>Option 05</b> — (4405 only).	<b>NC</b>
<b>Option 06</b> — (4406 only).	<b>NC</b>

