Artificial Intelligence Systems

Smalltalk-80 Programming Environment

32-Bit CPU

Floating Point Co-Processor

Large Dynamic RAM

Multitasking, Hierarchical File System

C Compiler With Standard 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; 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.

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.

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 Mb virtual memory address space, a full 2 Mb of dynamic RAM (expandable to 6 Mb) and a 90 Mb hard disk. The optional 4944 Mass Storage Unit further enhances 4406 performance by providing incremental 90 Mb hard disk back-up. 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 the popular AI programming languages in use today. Smalltalk-80, Tek Common LISP, Prolog, and Franz LISP all run on the 4406. Programs developed on the Tektronix 4404 and 4405 are upwardly compatible with the 4406.

CHARACTERISTICS

Size — 4404/4405:330 mm (13 in). 4406: 482.6 mm (19 in).

Viewing Area — 4404/4405: 241 mm x 178 mm (9.5 in x 7 in). 4406: 356 mm x 267 mm (14.0 in x 10.5 in).

CPU — 4405/4406: Motorola 68020. 4404: 68010.

Floating Point Co-Processor — 4405/4406: Motorola 68881. 4404: National Semiconductor 32081.

Dynamic RAM — 4404/4405: 1 Mb. 4406: 2 Mb.

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

Viewable Points — 4404/4405: 640 x 480. 4406: 1376 x 1024.

Addressable Points — 4404: 1024 x 1024. 4405/4406: 1376 x 1024.

Max Baud Rate — 9600 baud.

Flexible Disk Capacity — 320 Kb.

Hard Disk Capacity — 4404/4405: 45.0 Mb. 4406: 90.0 Mb.

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

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
Weights ≈	kg	lb	kg	lb	kg	lb
Net	20.0	44.0	31.8	70.0	6.35	14.0

Ordering Information—see next page.

ORDERING INFORMATION

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

HARDWARE OPTIONS

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

INTERNATIONAL POWER PLUG OPTIONS

Option A1 — Universal Euro 220 V, 50 Hz.
Option A2 — UK 240 V, 50 Hz.
Option A3 — Australian 240 V, 50 Hz.
Option A4 — North American 240 V, 60 Hz.
Option A5 — Switzerland 220 V, 50 Hz.

Smalltalk-80

Extensible, Object-Oriented Programming

Bit-Mapped Graphics User Interface

Designed for Exploratory Programming

Smalltalk-80 combines an object-oriented programming language with the most advanced user-interface available. Pioneered at Xerox PARC, Smalltalk-80 permits exploratory programming through rapid prototyping and experimentation. Smalltalk-80 provides an interactive approach to solving complex problems.

High Performance Implementation

Tektronix' implementation of Smalltalk-80, combined with the powerful hardware architecture of the 4400 Series, provides graphic response fast enough to support screen animation under direct control of Smalltalk-80.

Smalltalk-80 satisfies the needs of programmers in the AI field and is ideal for AI research and development. Smalltalk-80 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-80 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-80. The Smalltalk-80 *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-80 supports primitive graphic functions such as scaling, translation, rotation, logical combination of pixels and text attribute modification through its integral "BitBlt" operator.

Virtually any activity—text editing, file manipulation, compilation, execution, debugging—can be performed at any time, regardless of the current state. The user simply "opens" another window and proceeds with the new operation. Smalltalk-80 allows immediate access to any of its subsystems, whether user-defined or predefined, for inspection or modification.

PROLOG

Configured for 4400 Series AI Systems

Interactive Development Support

Modular Development Capability

PROLOG, 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. PROLOG is non-procedural, based entirely on logical relationships or rules, among an assortment of facts.

PROLOG 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, PROLOG makes logical inferences from the relationships when queried by the programmer. These characteristics make PROLOG ideal for many AI applications including expert systems, natural language processing, data base query languages and automatic programming systems.

Performance for Complex Problems

PROLOG makes complex problems easier to solve and reduces program development time. The inherent efficiency of PROLOG is enhanced by the power of the 4400 Series hardware. The PROLOG 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—See Next Page.

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 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

Additional 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; 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—See Next Page.
TEK Common LISP is a registered trademark of Tektronix, Inc.

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.

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 4400 Series 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

4400P31 PROLOG Programming Language	$3,000
4400P33 Tek Common LISP Programming Language	$3,500
4400P30 Franz LISP Programming Language	$3,000

OPTIONS

Option 02 — (Franz LISP) 5¼ Floppy Media.	NC
Option 04 — 4404	NC
Option 05 — 4405	NC
Option 06 — 4406	NC

NEW 4400 UNIX EMACS Editor

An extensible display editor used for typing and modifying documents, programs, or other kinds of text, the EMACS uses a display to interact with the user, keeping an accurate representation of what is happening in the text visible on the screen. EMACS interacts with the user through several windows and a line at the bottom of the terminal screen for messages and questions from EMACS.

Extensibility

This is the feature that distinguishes EMACS from most other editors, allowing the user to tailor EMACS to individual requirements and design.

Interactive Help Menus

The detailed menus ensure smooth operation and understanding of EMACS help areas, commands, and key functions.

Buffers and Windows

The EMACS user views the buffer—the section of text being edited—through a window. A buffer may be viewed in several windows, so the user can work on or examine several different areas of a file at the same time. Similarly, two different buffers can be viewed in two different windows simultaneously.

Other EMACS features include definable macros to identify and facilitate working with blocks of program or text, an interpreter for a language similar to LISP, debugging tools, program structure commands, and the ability to handle multiple interactive subprocesses.

ORDERING INFORMATION

4400P32 UNIX EMACS Editor	$500

OPTIONS

Option 01 — 4404	NC
Option 02 — 4405	NC
Option 03 — 4406	NC

NEW 4944 Mass Storage Unit

Compatible With Tek 4400 Artificial Intelligence Systems, 4132 and 6130 Intelligent Graphics Workstations, and 4120 Color Graphics Workstation

Removable 45 or 60 Mb Streamer Tape

Standard SCSI Interface

45 or 90 Mb Disk Drives

To satisfy a variety of customer requirements, this mass storage unit offers a flexible combination of streamer tape, hard disk, and floppy disk drives.

Options

- Two 45 Mb and 90 Mb capacity high performance, Winchester disk drives, with seek time of less than 30 µsec and track to track access time of less than 6 µsec.
- Dual 5.25 inch double density, single- or double-sided, flexible disks, with average access time of 93 ms and formatted capacity of 327 Kb.
- 4944 streamer tape drive operating at 90 inches per second and transferring data at a maximum rate of 86.7 Kb per second, making it ideal for quick back-up and restoring information stored on hard disks.

4944 options have been tailored for use with a variety of Tektronix host computers and terminals: 4400 Series Artificial Intelligence Systems, 4132/6130 Intelligent Graphics Workstation, and 4120 Color Graphics Workstations.

ORDERING INFORMATION

4944 Mass Storage Unit	$1,000

Includes: Power cord (161-0066-00); two meter SCSI cable (012-1117-00); instruction manual (070-5978-00); SCSI terminator (011-0090-00); DC300XL tape cartridge (119-0680-00).

OPTIONS (4400 Series)

Option 01 — 60 Mb streamer tape.	+$2,500
Option 02 — 90 Mb disk.	+$5,500
Option 03 — 60 Mb streamer tape/90 Mb disk.	+$8,000

OPTIONS (4132/6130 Series)

Option 11 — 60 Mb streamer tape.	+$2,500
Option 12 — 90 Mb disk.	+$5,500
Option 14 — 60 Mb streamer tape/45 Mb disk.	+$6,000
Option 15 — 60 Mb streamer tape/90 Mb disk.	+$8,000

OPTIONS (4120 Series)

Option 21 — 45 Mb disk.	+$3,200
Option 22 — 45 Mb disk/dual floppies.	+$4,500

FIELD INSTALLED KITS

4944F01 — 60 Mb streamer tape.	$2,750
4944F02 — 90 Mb fixed hard disk.	$5,750

INTERNATIONAL POWER PLUG OPTIONS

Option A1 — Universal Euro 220 V, 50 Hz.
Option A2 — UK 240 V, 50 Hz.
Option A3 — Australian 240 V, 50 Hz.
Option A4 — North American 240 V, 60 Hz.
Option A5 — Switzerland 220 V, 50 Hz.

**WARRANTY-PLUS SERVICE PLANS
SEE PAGE 496**

Contact your local Sales Engineer for prices.
S0 — On-Site Product Installation and Set-Up.
S1 — 1 Year On-Site Service.
S2 — 2 Years On-Site Service.
S3 — 3 Years On-Site Service.
S9 — Software Subscription Agreement.

OPTIONAL ACCESSORIES

SCSI Cables —

(25 inch) 4944 to 4944 or 4926 or 61TC01. Order 012-1178-00	$150
(2 m) 4944 to 4400 or 4120. Order 012-1117-02	$250
(2 m) 4944 to 4132/6130. Order 012-1146-00	$140
SCSI Interface — For 4132/6130. Order 61KP04	$800
DC600A Tape Cartridge — Order 119-1463-00	$47

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