2200 VP

PRODUCT
DATA SHEET

SYSTEM OVERVIEW

The Wang 2200VP Central Processing Unit is a versatile, high-performance processor which offers computerlike speed and processing power at a fraction of the cost of a large mainframe computer. Programmable in the popular high-level BASIC language, and available with an extensive array of peripherals, the 2200VP is designed to meet the computing needs of the technical, commercial, or educational user.

The 2200VP CPU offers a unique combination of speed, ease of programming, flexibility, and expandability. Its execution speeds are extremely fast, providing an overall throughput capability which enables the 2200VP to be considered for a variety of data processing and heavy number-crunching jobs which previously required much larger systems. Complementing the 2200VP's exceptional performance is its powerful version of the BASIC language, called "BASIC-2." The system's interactive programming and debugging capabilities can substantially reduce learning and program development time. The 2200VP can be configured with a wide range of peripherals, which, in conjunction with the powerful BASIC-2 language, provide the programmer with a system versatile enough to solve any processing problem. The basic CPU is equipped with 16K of user memory, expandable up to a maximum of 64K. Such expandability coupled with Wang's expansive selection of peripherals, ensures the user that his system will continue to grow with him for many years.

The basic CPU contains 16K (16,384) bytes of user memory and nine I/O slots (controller boards for peripheral devices are plugged into the I/O slots). Each CPU also is equipped with more than 48K of control memory. The operating system and BASIC-2 interpreter are loaded into control memory from a system disk or diskette at the start of the working day, an arrangement which leaves the user memory (minus about 3K used for "housekeeping" purposes by the system) available exclusively for the user's programs

- Efficient Program Storage
- Expandable to 64K of User Memory
- Programmable Interrupt Feature
- Supports all Wang Peripherals
- Wang-Enhanced BASIC-2 Language

WANG

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and data. Because the operating system is totally resident in control memory, it does not permanently tie up one of the disk drives; once the operating system has been loaded, the system disk can be removed, and the drive is available for the user's application disks. (The system software is shipped on a single diskette; although the user can copy some or all system programs to a hard disk, every system requires at least one diskette drive for initial system loading.) The 2200VP employs a unique and efficient "atomization" technique for program storage, as a result of which programs occupy less user memory in a 2200VP than they would require in systems that store all program text character by character. Such storage efficiency, combined with the use of separate control memory for system software, extends the capacity of the available user memory to store large and complex programs.

The System 2200 is designed to be an interactive, CRT-oriented system which can be programmed and controlled directly from the system keyboard. This approach makes the system easier to learn and use than batch-oriented systems, and saves both programming and operating time. Wang offers a variety of different CRTs, keyboards, and CRT/keyboard console units for use with 2200 systems. Although the user is free to configure nearly any CRT with the 2200VP CPU, a 24 x 80 CRT with an audio signal is recommended, because the 2200VP utilizes the audio signal to indicate a variety of non-fatal error conditions.

PERFORMANCE

Speed is a major feature of the 2200VP. State-of-the-art hardware components and a custom-designed microprocessor have been combined to provide a memory cycle time of 600 nanoseconds. This speed is used to full advantage by an extremely efficient operating system, with the result that actual instruction execution times truly reflect the speed of the processor. Some representative timings for floating-point mathematical operations with full 13-digit precision are given below. (Because all floating-point mathematical operations are performed in BCD arithmetic, the time and inaccuracies which result from converting to and from binary are eliminated.)

OPERATION	TIME (Milliseconds)
X + Y	.13
X – Y	.13
X * Y	.41
X / Y	.92

OPERATION	TIME (Milliseconds)
10 ↑ Y	3.7
X ↑ Y	6.8
LOG	3.5
LGT	2.8
EXP	3.5
SQR	1.7
SIN	5.4
COS	5.7
TAN	9.0
ARCSIN	13.6
ARCCOS	13.7
ARCTAN	10.8
RND	.56
INT	.11
FIX	.11
MOD	1.1
ROUND	.25

VARIABLES

The 2200VP supports two types of variables, numeric variables and alphanumeric string variables. In each case, scalar variables as well as one-dimensional and two-dimensional arrays are allowed. The maximum number of elements in a one-dimensional array is 65,536 and two-dimensional arrays may have a maximum size of 255 x 255. Each alphanumeric array element or alpha scalar variable can be dimensioned from 1 to 124 bytes in length. Alphanumeric arrays can be used in data manipulation statements as scalar variables (element boundaries are ignored), thus providing a convenient technique for manipulating extremely long character strings.

THE BASIC-2 LANGUAGE

Wang has implemented a greatly enriched version of the popular BASIC language, called BASIC-2, on the 2200VP. BASIC-2 is an English-like high-level programming language which is designed for interactive programming, and which can be easily learned by beginning programmers. A variety of Wang extensions and enhancements have been added to BASIC-2 to make the tasks of writing, documenting, and debugging programs easier and less time consuming, and to provide more powerful and flexible language capabilities for a wide range of applications.

The BASIC-2 instruction set is both comprehensive and extremely powerful. The versatile math package includes a multitude of system-defined math and trig functions; results are generally accurate to 13 digits,

and may be either rounded or truncated (truncation is useful for certain iterative mathematical techniques). 2200VP math package execution speeds are among the fastest in its product class. Alphanumeric data can be compared, analyzed, and modified with a truly impressive array of data manipulation instructions. These instructions permit the programmer to manipulate characters at the bit and byte levels, and to perform various Boolean and binary arithmetic operations. A group of system commands provide the operator with complete control over system operations from the keyboard, and also serve as powerful debugging tools. The set of general-purpose BASIC-2 statements includes statements which facilitate common programming tasks such as formatting printed output, decision-making and branching, looping, passing data to subroutines, controlling the format of the CRT display, overlaying program modules, and accepting and processing operator-entered data. In addition to the general-purpose statements, several groups of special-purpose statements are provided, including statements designed to perform such specialized operations as code conversion, sorting, matrix arithmetic, and customized I/O control.

NUMERIC INSTRUCTIONS

BASIC-2 offers a standard set of arithmetic operators and a multitude of system-defined numeric functions. Most numeric operations are carried to 13 digits of accuracy; the user may specify whether results are to be rounded or truncated at 13 digits. The range of legal values is shown below:

$$-10^{100} < \text{value} <= -10^{-99}, 0, 10^{-99} <= \text{value} < 10^{+100}$$

Trigonometric calculations may be performed in radians, degrees, or grads.

2200 VP FEATURES

Immediate Mode Operations

- Unnumbered statement lines can be entered and executed in Immediate Mode to perform quick calculations. Multi-statement lines are legal in Immediate Mode, in effect making the 2200VP an extremely powerful one-line calculator.

- Because Immediate Mode lines can, in many cases, be entered and executed without altering the contents of memory, they provide the programmer with a useful debugging tool for examining programs and data.

Efficient/Reliable Memory Use

- Most BASIC-2 words are automatically converted by the system into one-byte "text atoms" when stored, thereby conserving memory.

- Multi-statement program lines are legal; they conserve memory and speed up program execution, and provide a means of logically grouping related statements for purposes of documentation.

- The BASIC-2 interpreter and the operating system reside in a special control memory separate from user memory. Thus user memory — except for about 3K reserved for "housekeeping" functions — is available to the user for program and data storage. Two special instructions, END and SPACE, provide the programmer with an accurate account of how much free space is available in user memory at any time.

- Full memory parity is provided throughout both program and user memory to protect against system failure or data loss.

Special Function Keys

- Sixteen keyboard Special Function Keys can be used, in conjunction with SHIFT, to access up to 32 user-defined subroutines from the keyboard. Special Function Keys also can be used to define text strings for single-key entry, and to initiate program execution at a particular point.

- Special Function Keys also can be used to pass multiple arguments from the keyboard to a subroutine in memory.

Error Diagnostics, Editing, Debugging, and Error Control

- A complete set of system diagnostics automatically verifies user and control memory, and CPU operation, whenever the system is Master Initialized. In this way, the operator is notified of any problem before he begins daily operation.

- Additional system diagnostics automatically identify errors at each stage of program entry and execution. Errors normally are signalled with an error code identifying the error, and an arrow pointing to its approximate position in the program line.

- Normal system response to many types of errors can be suppressed, and the errors handled under program control, with three special error control instructions.

The SELECT ERROR statement suppressed system response to specified computational errors, and permits program execution to continue (using a default value) following an error without a diagnostic message. The ERR function returns the code of the most recent error, for examination and response under program control. The ERROR statement intercepts errors in a BASIC statement, and automatically executes a user-supplied error control routine when an error is detected.

- Extensive debugging facilities are provided both in Immediate mode and under program control. In particular, the LIST statement provides, in its various forms, complete program, variable, and subroutine cross-reference listings. HALT/STEP enables the programmer to step through the execution of a program one statement at a time, while TRACE enables the programmer to trace through program execution, observing variable assignments and program transfers as they occur.

- Program lines are easily inserted in and deleted from a program in memory. The RENUMBER command renumbers an entire program , or portion of a program, with a specified line-number increment between successive lines.

- The powerful Edit mode enables the programmer to edit program lines, Immediate Mode lines, and input data values both during and after entry. Program lines can be recalled from memory and edited at any time.

Programmable Interrupt Feature

- A program-controlled interrupt capability enables an external device to interrupt execution of a BASIC program following any statement, and branch to a special routine; following interrupt processing, normal program execution automatically resumes at the interruption point.

- Interrupts can be defined for up to eight different devices within a single program. Interrupt priority also is defined in the program. This feature greatly enhances the system's ability for real-time instrument monitoring and control, and permits more efficient handling of I/O processing in many types of applications.

- All interrupts can be temporarily inhibited at any time, and individual interrupts can be selectively enables or disabled.

- All current interrupt information can be obtained by executing a single LIST I command.

I/O Device Selection

- The SELECT statement can be used in Immediate mode or under program control to select one or more devices for particular I/O operations.

- Device selections are maintained independently for several different classes of input and output operations, enabling a program to control a variety of different I/O devices.

- The ON/SELECT instruction is a computed or conditional SELECT statement in which the particular set of devices selected for I/O operations is determined by the value of a specified expression.

DISK CONTROL INSTRUCTIONS

The 2200VP is designed to be a disk-based system, and it provides a sophisticated disk control capability. Two separate types of disk I/O instructions are available: Automatic File Cataloging instructions, and Absolute Sector Addressing instructions. Automatic File Cataloging instructions permit the programmer to establish a catalog on the disk which will contain both program and data files. Instructions are provided to save and load program files by name, and to open and access data files by name. (The system itself automatically keeps track of where each file is stored on disk.) A maximum of 16 data files can be open simultaneously for multiple-file processing operations. Additional features of Automatic File Cataloging mode include the capability to move an entire catalog, or only selected files, from one disk to another; to save programs on disk in a protected format; and to automatically load and run multiple program modules in sequence.

Absolute Sector Addressing statements permit the programmer to directly access specified sectors on the disk, and to read or write information in a user-specified format.

Available Peripherals

The following standard peripherals are available for the 2200VP.
Model 2207A RS-232-C I/O Interface Controller
Model 2209 800 BPI Nine-Track Tape Drive (NRZI)
Model 2209A 1600 BPI Nine-Track Tape Drive (PE)
Model 2210 Disk Workstation
Model 2221W Matrix Line Printer (132 Col./200 cps)

Model 2231W-1 Matrix Line Printer (112 Col./120 cps)
Model 2231W-2 Matrix Line Printer (132 Col./120 cps)
Model 2231W-3 Graphic CRT Accessory Printer (132 Col./120 cps)
Model 2231W-6 High-Density Matrix Line Printer (132 Col./70 cps)
Model 2226B Interactive Terminal
Model 2227B Buffered Asynchronous Telecommunications Controller
Model 2228B Bisynchronous Communications Controller
Model 2230MXA-1 Disk Multiplexer Master Controller
Model 2230 MXB-1 Disk Multiplexer Slave Controller
Model 2232B Digital Flatbed Plotter
Model 2236DE Interactive Terminal
Model 2236MXD Interactive Terminal Multiplexer
Model 2244B Mark Sense/Punch Card Reader
Model 2260B 2.5, 5, 10 and 20-Megabyte Fixed/Removable Disk Drive
Model 2260BC 2.5, 5, 10 and 20-Megabyte Fixed/Removable Disk Drive
Model 2260C 2.5, 5, 10 and 20-Megabyte Fixed/Removable Disk Drive
Model 2261W Matrix Line Printer (220 LPM)
Model 2263-1 Chain Line Printer (400 LPM)
Model 2263-2 Chain Line Printer (600 LPM)
Model 2263-3 Chain Line Printer (430 LPM)
Model 2270 Diskette Drive
Model 2270A IBM 3740 Compatible Diskette Drive
Model 2272-2 Triple Pen Drum Plotter
Model 2273-1 Band Printer (250 LPM)
Model 2273-2 Band Printer (600 LPM)
Model 2280 26.8, 53.6 and 80.5-Megabyte Fixed/Removable Disk Drive
Model 2281W Daisy Printer Plotter
Model 2282 Graphic CRT

2200VP CPU SPECIFICATIONS

Dynamic Range

$-10^{100} < n < = -10^{-99}, 0, 10^{-99} < = n < 10^{+100}$

Accuracy

13 digits (typical)

Maximum Data Rate

100,000 bytes/sec

Memory Size

16K bytes (standard). Expandable to a maximum of 64K bytes in 16K increments.

Power Requirements

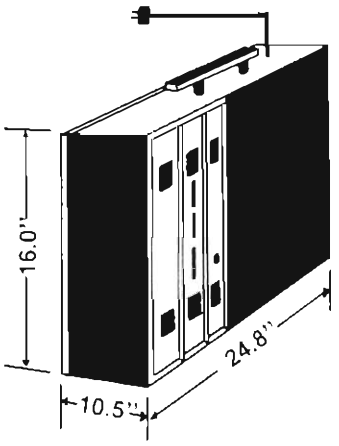
Voltage	115 VAC ± 10%, 60 Hz ± 1 cps
	230 VAC ± 10%, 50 Hz ± 1 cps
Power	230 Watts
Fuses	3ASB @ 115V
	1.5ASB @ 230V

Operating Environment

50° F to 90° F (10° C to 32° C)
20% to 80% relative humidity, non-condensing (maximum range)
35% to 65% relative humidity (recommended range)

CPU Dimensions

Height	16.0 in. (40.6 cm)
Width	24.8 in. (63.0 cm)
Depth	10.5 in. (26.7 cm)



Shipping Weight

47 lb (21 kg)

ORDERING SPECIFICATIONS

A keyboard-programmable, high-performance Central Processing Unit with a BASIC-2 interpretive compiler, operating system, and extensive system diagnostics. The standard CPU must be provided with 16K bytes of user memory (the operating system and BASIC-2 interpreter must reside in a separate control memory), and must be expandable in 16K increments to 64K. The memory cycle time must be 600 nanoseconds nominal. Full memory parity must be provided throughout both user and control memory. An enriched version of the high-level BASIC language must be provided which supports extensive built-in editing and debugging features; a programmable error control capability; programmable interrupt; extensive alphanumeric/binary data manipulation capability; and built-in internal data conversion, sort, math matrix, and general I/O features. The system must support all Wang peripherals with the exceptions of tape cassette, manual-feed mark sense card reader, and teletype, and must provide a complete set of I/O instructions to control standard peripherals, including both automatic cataloging and indirect addressing instructions for disk I/O operations. The math package must include a complete set of system-defined mathematical and trigonometric functions, and must provide 13-digit accuracy for most operations. A round/truncate option, and the option to perform trig functions in radians, degrees, or grads, also must be offered.

Standard Warranty Applies

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