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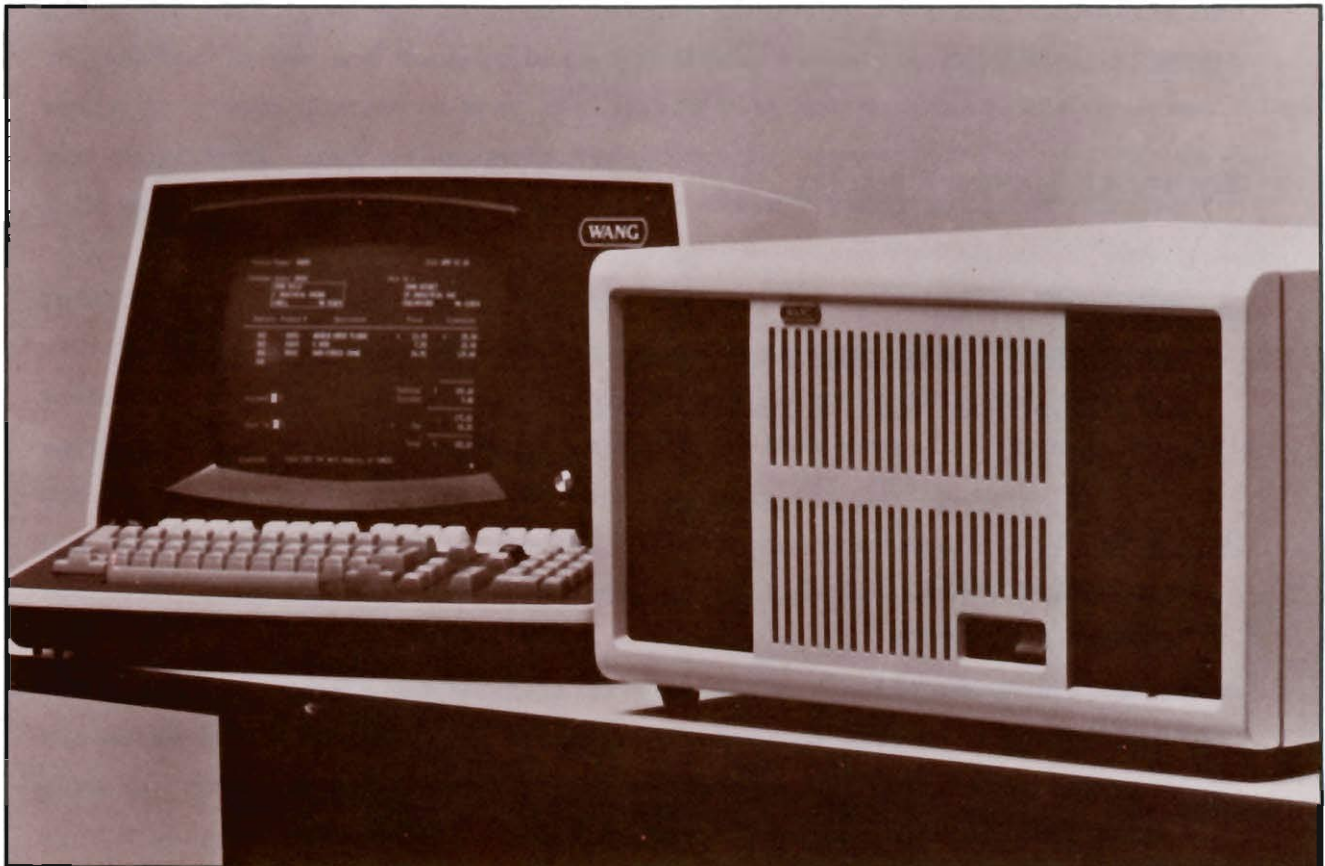
# BENCHMARK REPORT



Association of  
Computer Users

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*In This Issue:*

## The WANG 2200SVP

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WANG 2200SVP: BENCHMARK REPORT

TABLE OF CONTENTS

	<u>Page</u>
<u>Preface</u> . . . . .	3
<u>Executive Summary</u> . . . . .	4
<u>Summary of Benchmark Results</u> . . . . .	5
<u>Benchmarks:</u>	
The Process: Wang 2200SVP . . . . .	6
Overview of Programs and Results . . . . .	7
<u>Detail Pages</u>	
Pricing Components . . . . .	13
Hardware Components . . . . .	14
Software Components . . . . .	17
Support Services . . . . .	20
<u>Summary of User Comments</u> . . . . .	21
<u>Conclusions</u> . . . . .	23

## PREFACE

This report on the Wang 2200SVP is the fifth in our continuation of Series 1 and 2. Included in this series are systems designed primarily for single users and costing less than \$25,000. The 2200SVP reviewed here is another example of an apparent trend on the part of many large computer manufacturers towards offering single-user, non-expandable systems at the low end of their product line. Often, these systems are "turnkey," or the manufacturer supplies some standard application packages.

As always, the advantages and disadvantages of such a system will be determined by the user's (often unique) applications. On the one hand, these systems offer the high level capabilities and user-friendly features originally designed for larger and more expensive systems. However, frustration may later build as a user discovers that the system will not grow with his business. On the other hand, they may require more computer "expertise" to operate, or provide added versatility that might be more than a small business can use.

Indeed, because of all the potential "pitfalls" in purchasing a computer system, it is to everyone's benefit to learn as much about computers as possible, even in light of the trend towards user-oriented and turnkey systems. From our user surveys, we've found that overall, the most satisfied end-users are those who are most knowledgeable about computers. They know the limitations of a small computer system and consequently have the most realistic expectations of what a computer will do for their business.

Our benchmark reports continue to be a valuable resource for sifting through the often subtle differences among small computer systems. These reports provide the comparative results of running five benchmark programs on each of the systems under study, programs which represent capabilities needed by users in an operating environment. Additional information is given on the alternative configuration which can be assembled, internal and external storage and memory capabilities, languages available, the operating system, availability of application packages, and general comments on ease of use. Finally, a survey of users is conducted, and their comments on ease of use, relationships with hardware and software suppliers, problems encountered, etc., are included in each report.

## EXECUTIVE SUMMARY

The Wang 2200SVP is the single-user version of Wang's 2200 series of computers. The system as configured for our tests consisted of the Wang CPU, 32 kilobytes of central memory, a one megabyte floppy disk, a two megabyte hard disk, a Wang 2236DE terminal, a 2231W-1 matrix printer, and Wang's BASIC-2. The cost of this configuration is \$14,600.

- The 2200SVP has features for both the novice user and the experienced programmer alike. The clear and concise documentation, an interactive language, and the absence of a job control language make it an easy system to learn. For the more experienced, Wang's BASIC-2 language offers features and enhancements that help to ease the application programming task.
- There is a large array of software available for the 2200 series machines from third-party software houses and Wang itself. Wang maintains an extensive network of "Wang-approved" vendors (software firms, approved by Wang, who sell packages for Wang hardware), offering numerous business and engineering packages for a variety of businesses and industries.
- The 2200SVP's timings on the benchmark runs place it among the fastest systems we've tested. As with other Wang systems, the SVP's "number-crunching" abilities are outstanding. It also performed very well in the I/O tests, though business application programmers may find the SVP's file handling procedures awkward at best.
- The SVP, at this point in time, fills out the low end of Wang's 2200 series offerings. Designed as a single-user system only, it cannot be expanded to a multi-user configuration. In addition, maximum storage capacity is about 5 megabytes (a 4 megabyte hard disk and a single floppy). This limited hardware expandability can be a restriction for the buyer who wants the computer system to grow as fast as the business. However, software compatibility throughout the 2200 line ensures an easy transition into the larger 2200 series models. For about \$1,000 more, one can buy the 2200VP system which can be upgraded to a multi-user system. This would be a much more cost effective approach for anyone considering expansion.
- The users we contacted in our survey were very pleased with their SVP. They said it was fast, reliable, and they liked BASIC-2 and their software purchases. The major drawback was a noisy and slow printer.

As the third Wang machine tested in ACU's BENCHMARK REPORTS, we certainly felt comfortable with the 2200SVP. With the well-designed 2236DE terminal and BASIC-2 in operation, it is hard to tell the SVP from any of the other 2200 series systems offered by Wang. Though its limited expandability may be a drawback for some users, the latest 2200 product appears to be another capable Wang system.

# BENCHMARK REPORT

SYSTEM: WANG 2200SVP

PRICE AS TESTED: \$14,600

## SPEED TESTS

Benchmark Number	CPU INTENSIVE	TOTAL TIME	
		Min.	Sec.
A-1	N = 500 .....		2.7
A-2	N = 1000 .....		5.2
A-3	N = 2000 .....		10.2
A-4	N = 3000 .....		15.2
A-5	N = 500 .....		2.4
A-6	N = 1000 .....		4.5
A-7	N = 2000 .....		8.8
A-8	N = 3000 .....		13.0
<b>I/O INTENSIVE</b>			
B-1	N = 500 .....		7.6
B-2	N = 1000 .....		10.6
B-3	N = 2000 .....		16.9
B-4	N = 3000 .....		23.0

## "REAL LIFE" PROBLEMS

Benchmark Number		TOTAL TIME	
		Min.	Sec.
C-1	SCIENTIFIC/ENGINEERING .....	2	13.3
C-1A			48.4
C-2	NEW PRODUCT PLANNING .....		5.2
C-2A		1	10.7
C-3	ACCOUNTS RECEIVABLE .....	2	23.0
C-3A		4	20.6

## EASE OF USE TEST

E-1	NUMBER OF KEYSTROKES REQUIRED .....	162
E-2	SUBJECTIVE JUDGMENT .....	Very Easy

Note: For the hard disk times, see pages 9, 11 and 12.

## THE BENCHMARK PROCESS

All benchmarks were run in Wang's BASIC-2 language on a 2200SVP with 32 kilobytes of main memory, a one megabyte floppy disk drive, a two megabyte hard disk, a Wang CRT and keyboard, and a model 2231W matrix printer. Wang shipped these components to our office in Boulder, Colorado, where the unit arrived and was operational immediately. ))

From a programmer's point of view, the 2200SVP (like other Wang 2200 series machines) is a BASIC machine. That is, there is no distinction made between the programming environment and the operating system. There is no special job control language (JCL) which must be learned to communicate with the operating system. The programmer/user is always in the BASIC language subsystem and the operating system is transparent to the user.

Once the system is up and running, the user is free to write a program, execute a program, use utilities, or edit corrections, all without changing "modes" (e.g., from program development to operating system, and back ...). All commands on the SVP are either BASIC-2 functions, BASIC-2 system commands (LIST, RENUMBER, SAVE), or RUN commands to execute user-written (or Wang-written) programs or utilities. ))

Wang's BASIC-2 is a highly enhanced version of BASIC. A very powerful language, it provides the programmer with a variety of features including:

- Logical operations and data manipulation at the bit and byte level.
- 13-digit accuracy from a full array of mathematics and trigonometric functions.
- Groups of special purpose statements to perform operations such as code conversion, sorting, and matrix arithmetic.

Though we've enjoyed our experiences with BASIC-2, it does have some procedures which we feel require too much effort on the part of the programmer. In the area of file handling and data management, the user discovers that each write to a disk file, no matter how much information is to be written, will take up a whole sector (see the note to the I/O-Intensive timings). Therefore, in order to make the most efficient use of the disk, the user must plan out blocking and deblocking routines for every file created. On the other hand, )

the user who is interested in having the ultimate in efficient I/O has available BASIC statements which allow disk storage to be addressed at the sector level.

Another aspect we've found inconvenient is saving a program on disk. If the programmer later calls up the program, modifies it, and wishes to "resave" the program over the original, it must first be SCRATCHed from the disk before it can be SAVED again. Also, if the modified program is larger than the original, it must be SAVED under a new name (unless the user originally allocated extra space for the program to "grow"). As one gets used to this awkward procedure, the user will create with each program file a function that is invoked by a single function key and will perform the necessary steps to resave the program. Similar problems occur with saving and resaving data files.

To run the benchmark timings, the programs were entered, debugged, and then loaded into memory. The execute key and stopwatch were pressed simultaneously and when results appeared on the screen, the stopwatch was stopped. To change I/O devices, a SELECT statement is used.

#### OVERVIEW OF PROGRAMS

The benchmark program set consisted of:

##### Speed Tests

- A CPU-Intensive job of varying parameters
- An I/O-Intensive job of varying parameters

##### "Real Life" Problems

- A scientific/engineering job
- A new product planning problem
- An accounts receivable generation, update and report

##### Ease of Use Test

- A script-based editing test

#### SPEED TESTS: CPU-Intensive and I/O-Intensive Jobs

Both the CPU-Intensive and the I/O-Intensive benchmarks were designed to test

the speed of specific computing tasks that used repeated, short, individual operations.

CPU-INTENSIVE JOB

This short program executes a variety of calculations including addition, multiplication, division, square root and exponentiation. The program runs through an iterative process N times, with "N" values of 500, 1000, 2000 and 3000.

A - 1	Results:	N = 500	2.7 seconds
A - 2		N = 1000	5.2 seconds
A - 3		N = 2000	10.2 seconds
A - 4		N = 3000	15.2 seconds

Variation:      CPU-Intensive Alternate Runs (A5-A8)

This program performs the same number of calculations as the standard CPU-Intensive run but without exponentiation and square root.

A - 5	Results:	N = 500	2.4 seconds
A - 6		N = 1000	4.5 seconds
A - 7		N = 2000	8.8 seconds
A - 8		N = 3000	13.0 seconds

I/O-INTENSIVE JOB

This run stores numbers from 1 to N on floppy disk and then hard disk and retrieves the first 50 of them in a factorial fashion (for example, a total of 1276 reads following 3000 writes). Several combinations were run with "N" values of 500, 1000, 2000 and 3000.



B - 1	Results:	N = 500	7.6 seconds
B - 2		N = 1000	10.6 seconds
B - 3		N = 2000	16.9 seconds
B - 4		N = 3000	23.0 seconds

Comment: In Wang's version of BASIC, output to the disk is always in blocks of 256 bytes, regardless of the number of bytes contained in the data list of the output statement, so the I/O program would have used 3000 sectors of disk space. Wang personnel rewrote this job using program data blocks of 28 numbers. Thus, the job actually performed only 108 write accesses and 74 read accesses to the disk. Results of this program are not directly comparable with other I/O times reported in this series. (See Series 2 report on the Wang 2200VP.) For the hard disk, these times were 5.4, 6.8, 9.6, and 12.4 seconds, respectively.

"REAL LIFE" PROBLEMS: Scientific/Engineering, New Product Planning, Accounts Receivable Generation

The next three benchmarks were designed to test the running time of actual programs that the user might want the computer to perform.

SCIENTIFIC/ENGINEERING

This program solves a system of linear equations, using the Gauss-Jordan method of elimination. The program sets up the following system of "N" equations with "N" unknowns:

$$\begin{array}{r}
 0.1x_1 + 0.1x_2 + 0.1x_3 + \dots + 0.1x_N = 0.2 \\
 0.1x_1 + 0.3x_2 + 0.3x_3 + \dots + 0.3x_N = 0.4 \\
 0.1x_1 + 0.3x_2 + 0.5x_3 + \dots + 0.5x_N = 0.6 \\
 \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \\
 \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \\
 \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \\
 0.1x_1 + 0.3x_2 + 0.5x_3 + \dots + 9.9x_N = 10.0
 \end{array}$$

To show that the run has been executed successfully, the values of  $x_1$ ,  $x_2$ , and  $x_N$  are printed at the end of the execution.

C - 1

Results:

2 minutes 13.3 seconds

Variation:      C-1 Alternate Run (C-1A)

This program performs the C-1 run with a smaller number of equations and unknowns (35 equations/unknowns as compared to 50 in the larger run).

C - 1A

Results:

48.4 seconds

NEW PRODUCT PLANNING PROBLEM

This program models the relationship between product production costs and profitability over the range of the next four years. A baseline run is established and several parameters are varied in a "what if" mode on subsequent runs. Program output is printed in a standard report format of report line items across column years. The model's display line items are:

- |                 |                    |
|-----------------|--------------------|
| - Units Sold    | - Distribution     |
| - Selling Price | - Gross Profits    |
| - Revenue       | - Fixed Costs      |
| - Raw Material  | - Net Before Taxes |
| - Direct Labor  | - Taxes Payable    |
| - Packaging     | - Net Income       |

C - 2

Results:

5.2 seconds

Variation:      C-2 Using Printer (C-2A)

This run reports the timing for the New Product Problem when results are routed to the printer for hard copy output.

C - 2A

Results:

1 minute 10.7 seconds

ACCOUNTS RECEIVABLE GENERATION

In this job, an accounts receivable file of 50 records is created. Each record has 10 fields: customer number, salesman number, year-to-date sales, prior month sales (five fields), payments and credit limit. The file is updated randomly 10 times by customer number for sales amounts and payments. A report is displayed with billing detail, including company, salesman, year-to-date sales, credit limit, amount outstanding and sales by month.

C - 3

Results: 2 minutes 23.0 seconds
---------------------------------

*Note: For the hard disk, this time was 29.1 seconds.*

Variation:      C-3 Using Printer (C-3A)

This run reports the timing for the accounts receivable problem when results are routed to the printer for hard copy output.

C - 3A

Results: 4 minutes 20.6 seconds
---------------------------------

*Note: For the hard disk, this time was 2 minutes, 27.3 seconds.*

EASE OF USE TEST

The Ease of Use Test is a script-based benchmark specifically designed to compare all editors with respect to ease of use. This comparison is accomplished by starting with a nine-line file, changing it to an interim form (in effect, editing in all the errors) and then changing the file back to its initial form. These changes test the editing capabilities when making the errors as well as when correcting them.

The editing tasks are:

- Line deletion
- Line insertion
- Line appendage
- Change/Addition/Deletion of unique words in a line/string
- Change/Addition/Deletion of non-unique words in a line/string
- Change/Addition/Deletion of unique characters (including spaces embedded in and not embedded in words) in a line/string
- Change/Addition/Deletion of non-unique characters (including spaces) in a line/string

E - 1

Results: Approximately 162 keystrokes were required to edit the nine-line test file.

*Comment: We found Wang's line-editor very easy to use, and a total of 162 keystrokes for the Editor test shows that it is also very efficient.*

WANG 2200SVP: PRICING COMPONENTS

COSTS

Wang 2200SVP (as tested) ..... \$14,600

2200SVP includes:

- . Unit with processor, memory and storage
- . 1 megabyte double-sided, double-density drive
- . 2 megabyte hard disk
- . 32K bytes memory
- . 120 characters-per-second matrix printer
- . BASIC-2 language

Components

- Processor, 32K bytes memory, 1 megabyte floppy disk, and  
2 megabyte hard disk 9,000
- 2236DE terminal 2,700
- 2231W-1 120 cps printer 2,900
- BASIC-2 (included in the price)

OUR OBSERVATIONS

In addition to a straight purchase of the SVP, Wang offers lease or rent with option to buy arrangements. These are attractive options for anyone who is unsure of his company's long-range growth. There is an International Society of Wang Users which offers its members a "comprehensive" software library and user publications.

USER COMMENTS

- . *Overall the SVP is very good. We're happy with it. It's doing everything we want it to and we are looking forward to doing more with it.*
- . *Speed is very good, much faster than I anticipated. The only faster system we've encountered is an IBM Series 1. At this point our evaluation couldn't be higher.*

CENTRAL UNIT.... Single Unit, 12" by 21.5" x 26.0", which includes the processor and disk drives.

CPU Memory: The standard is 32K bytes and is expandable to a maximum of 64K bytes. Since the operating system and BASIC-2 interpreter reside in a separate control memory, the user has about 29K bytes for his programs, after subtracting 3K for system "housekeeping."

Keyboard/Screen: The user interacts with the SVP through a Model 2236DE terminal. The keyboard supports upper- and lower-case characters and has user-programmable function keys. The CRT is a 12-inch, 24 x 80 screen, and supports an alternate set of graphics characters, special symbols, underlining, box drawing, blinking, etc. There is brightness and contrast control and the cursor may be manipulated via program control.

### OUR OBSERVATIONS

Memory capacity of 32K bytes was quite sufficient for our benchmark programs. The ability to pass parameters between programs with the COM (common) statement and Wang's use of compression techniques makes actual memory size less restrictive.

The Model 2236DE terminal also supports an alternate character set which can be used for character and box graphics. This, along with cursor control from a program, make the system ideal for business graphics. Also, important information on a screen can easily be highlighted with boxes, blinking, or reverse video.

### USER COMMENTS

- . *Best feature is that it's a desk-top unit and doesn't take up a lot of room. Worst is that it's heavy. We can't move it around as much as we wanted to. We're happy with it.*
- . *Speed is fine. Hardware is really good. We're happy with the system.*
- . *Keyboard and screen are fantastic--very easy to read and I like the touch of the keyboard.*

STORAGE

Storage on the SVP can be configured in a variety of ways by mixing floppy disk drives with a Winchester-type 2 or 4 megabyte hard disk (both manufactured by Control Data Corporation).

- . One 1-MB double-sided, double-density floppy disk drive 991,744 bytes
- . Two 1-MB double-sided, double-density floppy disk drives 1,983,488 bytes
- . One 1-MB floppy disk drive and one 2-MB hard disk 3,072,512 bytes
- . One 1-MB floppy disk drive and one 4-MB hard disk 5,169,644 bytes

The diskettes are also compatible with IBM 3741 format.

OUR OBSERVATIONS

At first glance, a 2 or 4 megabyte fixed disk hardly seems worth the extra expense. But looking more closely, and comparing this option to other low-end systems which often do not have any hard disk capability whatsoever, we think that a two megabyte hard disk is a definite plus.

In a maximum configuration a user has a storage capacity of over five million characters, and an increase in access time. A dramatic example of the difference in speed is the Accounts Receivable program run on the SVP, where the floppy disk time was 2 minutes and 23 seconds, and the hard disk time was 29.1 seconds.

USER COMMENTS

- . *Storage capacity is very good--we allowed for growth for two or three years.*
- . *We're going to need a 4MB hard disk.*

OTHER DEVICES

Printers: 2231W-1 and 2231W-2 Line Printers

- 120 characters-per-second
- impact dot matrix
- vertical format tape reader
- full alphanumeric, 96-character ASCII set
- Hex code designations
- 16-character zones

Communications:

- Model Option 27B: asynchronous, half/full duplex, and 300 to 9600 bps.
- Model Option 28B and Option 28C: asynchronous or synchronous, from 300 to 4800 bps.

OUR OBSERVATIONS

The Version 1 printer has a maximum line length and buffer size of 112 characters while Version 2 line length and buffer size is 132 characters. Under program control a user can sound an audible alarm, clear the buffer, set vertical tabs and cause line and form feeds. Other features include the capability to enlarge character size for highlighted output and a continuous variable form width adjustment capability.

A user engages the printer by a SELECT statement either from within the program or in immediate mode, so it is easy to redirect output between the screen and printer.

With the communications hardware and appropriate software, it is possible to connect "foreign" devices to the 2200, or link it into a network of computers.

USER COMMENTS

- . *What we like least about the SVP is the noisy printer.*
- . *The paper on the printer creeps out of alignment. Also, the printer is noisy--we're going to have to start scheduling printing at night.*



OPERATING SYSTEM, LANGUAGES, UTILITIES

Operating System:	System 2200SVP
Languages:	BASIC-2
Access Methods:	Sequential, Absolute Sector Addressing
Utilities:	The SVP has capabilities to move files, format disks, format vertical control, backup disks, recover from backup and move files. Some utilities are accessible through a menu.

OUR OBSERVATIONS

The 2200SVP operating system is transparent to the user since system control is handled through the interactive BASIC-2 language. However, there are some system commands such as CLEAR, HALT, SAVE, RUN and so on.

Some of Wang's enhanced BASIC-2 features are IF . . . THEN, MAT operations, image and print using. Extensive error trapping, math matrix functions, data conversion techniques, and multiple statements on a line also distinguish BASIC-2. Debugging is relatively easy in Wang's interactive environment, and features a trace mode, single stepping, and cross-reference listings of variables.

The SVP file handling capabilities are surprisingly cumbersome. A user cannot simply save a modified program of the same name, he must first scratch the old program then save the new version. Any data files associated with the previous version must also be scratched, and each write will take up a whole sector. Wang has implemented some of its own nomenclature such as DATALOAD and DATASAVE for read and write, respectively. The SVP can support up to 16 open files at a time.

USER COMMENTS

- . *Editing capabilities are real good. BASIC-2: I did not know how to program six weeks ago and now I'm writing programs. It's easy and workable.*
- . *BASIC-2 is very nice--so far it has saved us a lot of time.*

WANG SUPPLIED PACKAGES

Wang currently offers three packages for the SVP.

- GBS (General Business Systems), which includes general ledger, accounts payable/receivable, and payroll;
- 2200 Word Processor; and
- IDEAS (Inquiry Data Entry Access System), a report writing and applications development tool.

OUR OBSERVATIONS

Most of the software will come from vendors who develop application programs and distribute turnkey systems which include the Wang hardware and their own programs or Wang packages. They maintain close contact with the dealer network, so they can generally refer a user to an OEM having a package fitting user requirements.

We are seeing more and more computer manufacturers providing their own application development package. IDEAS is Wang's offering in this category and should be a great help to anyone doing in-house application development. It is a very high level language which facilitates defining files, screen and printed report formats, etc. Thus, the user can produce data entry and reporting applications without having to rely on a programmer.

Wang also produces some communications packages for use in networks and for interfacing non-standard equipment.

USER COMMENTS

- . *General Business System programs are great. Word processor is fine.*

EDITOR

Operations in the edit mode are cursor and line-oriented. The cursor is a highlighted, one-character wide underline. To enter edit mode the user simply presses the EDIT key and an asterisk prompt appears on the screen. Typing in a line number, then pressing the EDIT and RECALL keys puts the specified line in the work buffer, ready to be edited. Pressing EDIT, RETURN or LINE ERASE returns the user to text-entry mode. RECALL can be used in immediate mode, that is, for statements without line numbers, but can retrieve only the last line the user keyed in.

The cursor can be moved horizontally one or five spaces (tab) to the right or left as well as jump to the beginning or end of a line. If a statement is continued to the next line the cursor can be moved up or down between the lines. The line can be expanded or reduced with the insert or delete keys. An erase function removes everything to the right of the cursor to the end of the line.

OUR OBSERVATIONS

Wang offers very nice editing capabilities; however, the only drawback, though other systems have the same limitation, is that the editor is line-oriented rather than screen-oriented.

USER COMMENTS

- . *Editing capabilities are the best I've seen. BASIC-2 does everything we need it to.*

DOCUMENTATION

We found Wang's documentation to be quite useful. The manuals are well written and give many examples. The introductory manual gives an overview of the SVP and general operating procedures, while other manuals cover programming in BASIC and disk operations.

MAINTENANCE

After the 90-day standard warranty, Wang offers a Priority Maintenance Contract which costs between \$68 and \$137 per month, depending on the hardware configuration. Service is provided through Wang's network of customer service representatives. It is often recommended that users take advantage of maintenance contracts when they are offered.

TRAINING

Training for software use and hardware operation is left to the vendor to provide except when the SVP is purchased directly from Wang. In this case, Wang will provide basic hardware operating instructions.

USER COMMENTS

- . Documentation is reasonably good.
- . Documentation is very good. Training was superb.
- . So far the documentation is excellent. Training was very minimal. They gave me the manuals and said "there you are."

## SUMMARY OF USER COMMENTS

We called eleven users of the Wang 2200SVP using names supplied by Wang Laboratories. The SVP was being used for market research, real estate appraisal analyses, engineering applications, job costing, mailing lists, word processing, and standard accounting procedures. These firms had owned their SVP's from six weeks to ten months; one to six people used them an average of four hours a day, five days a week. Most of the firms had purchased some third-party programs, while only one user had Wang packages (General Business Systems and 2200 Word Processor). He thought they were "great," and said that they were "self-explanatory." Nearly half of the users were doing some in-house programming.

Users had looked at many other computers before buying the SVP. Their reasons for choosing it were local service, ease of programming, speed, third-party software, expandability, and its power for the price. In contrast to one user who thought there was a supply of third-party application software for the SVP, another said that what he disliked most about Wang was that there was not an abundance of user-software available.

Most of the users had 32K central memory, dual floppy disk drives, either 2 megabytes hard disk or no hard disk at all, and two users who had 4 megabytes hard disk. Nine users had the 2231W matrix printer, and three had daisy wheel printers. Wang's hardware was proving to be dependable and service was rated "fine" to "excellent." The few complaints there were about hardware centered around the printer. Some users said it was too noisy or too slow, and one user said they were going to start scheduling printing at night. The daisy wheel printer wasn't sturdy enough for one company--they were "overtaxing" it and planned on getting a matrix printer as soon as they could. I/O for the users through Wang's keyboard and screen caused no problems. Users said the keyboard was easy to work with, they liked its touch, and said the screen was easy to read. One user noted that they were better than what Wang put out five years ago.

The data storage capacity of the system just about fit everyone's needs. We bought the right machine for what we want." Only two users were expecting to upgrade to 4 megabyte hard disks or a larger system entirely. One user said

that he had bought the SVP because he was told by a salesman that it could be expanded to a multi-user system. Unhappily, he found out that this was not the case and had needed a 2200LVP instead. His opinion of the SVP was that it's a good system for someone with a technical application and who has "absolutely no need to expand."

Central memory, 32K in most configurations, was also ample and users were able to work within its size. A user who was sure he would need a larger system later on did have problems running some complex matrix programs. The users also found the SVP's speed more than acceptable. They reported that it was "very quick," and "really fast." Another comment was, "Speed is very good, much faster than we anticipated." Only one user said it was "slow compared to a regular computer."

Wang's BASIC-2 language was another well liked feature of the SVP. Probably its strongest commendation came from the user who said, "I did not know how to program six weeks ago and now I'm writing programs." Other comments were that it was easy to work with, saved time, and allowed them to make modifications to their programs. According to one user though, one of its severest limitations was that it allows only two-character variable names. Wang's editor capabilities received equally high praise from those who were programming.

One of the most important supports for a user is system documentation. These users found Wang's manuals to be "good" and "above average." Some people though, couldn't understand them, and said that if they were better they could "learn to make program modifications themselves." Users were generally pleased with the training they had received, some did not need to be trained, and one user was very displeased with the "sketchy" instruction he had been given. These users were fortunate too because they did not encounter difficulties with their third-party programmers, dealers, or service personnel.

Just about every aspect of the 2200SVP was fulfilling this groups' expectations. Its good points outweighed its drawbacks, which were different for each user, and everyone, except the user who bought the SVP instead of an LVP, was satisfied with the system. Their exuberance shows in the following comments. "I think it's a fantastic machine." "At this point our evaluation couldn't be higher."

## CONCLUSIONS

The Wang 2200SVP is a new addition at the bottom end of Wang's 2200 series of systems. It features a very capable processor, a single floppy disk, a two megabyte hard disk, the excellent model 2236DE terminal/keyboard, and the 2231W matrix printer.

Since this is essentially the same 2200 processor we've tested twice before, the timings were nearly the same. It is a fast system on compute-bound problems, and reasonably fast for I/O-intensive problems (direct comparison with other computer systems is not possible because of a special modification made to the Wang version of the I/O-intensive program).

As we have found previously, Wang users are highly satisfied with their system. Programmers like the BASIC, and end-users like the application software they have purchased. Documentation is well done, and most had good relations with their third-party systems houses.

The extended BASIC has some very nice features, including matrix operations, some structured programming statements, and debugging aids. Programmers are often amazed at their increased productivity on the Wang. When the 2200 is "booted up" it is automatically in BASIC. Utilities are just BASIC programs which can be modified to fit a user's particular needs. The system is easy to use--the programmer simply has to know BASIC--and is not encumbered with knowing the idiosyncracies of an operating system.

The CRT/keyboard features cursor control, reverse and blinking video, an alternate graphics character set for business graphics, line drawing, and function keys. BASIC is designed to take advantage of these features and it is easy to produce business graphs, form fill-out applications, etc.

As a single user system, the 2200SVP has some outstanding features. Its only limitation is the inability to upgrade hardware, or expand to a multi-user system. For about \$1000 more, one can buy the 2200VP with greater expansion capabilities, an alternative we would recommend to the growing firm.

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**ASSOCIATION OF  
COMPUTER USERS**

P.O. Box 9003  
Boulder, Colorado 80301  
Tel. (303) 443-3600

**BUSINESS RESEARCH  
DIVISION**

University of Colorado  
Boulder, Colorado 80309  
Tel. (303) 492-8227