The Wang Computer System/30 (WCS/30) is a powerful, low cost, fixed/removable hard surface disk based system offering the first time user or the branch office operation the capabilities of large scale computers. The three logical storage units provide an easy to use foundation for data processing needs.

The WCS/30 features a 16K Central Processing Unit including a “hardwired” Extended BASIC language interpreter, an operator console comprised of a 1,024 character Cathode Ray Tube (CRT) Display and operator keyboard, a diskette drive for off line program and data storage and a 5-megabyte disk for mass storage, and a 132-column line printer — all in three coordinated pieces of office furniture. Through additional options, e.g., a 10-megabyte disk, higher speed matrix printers, telecommunications capability, Work Stations available now, and planned for the future, the WCS/30 maintains a flexibility for the user, preventing the rapid obsolescence plaguing many other computer systems.

PROCESSOR

The nucleus of the WCS/30 is a Central Processing Unit containing 16K bytes of Random Access Memory (RAM) expandable in 8K modules to a maximum of 32K bytes. A powerful 42.5K BASIC Interpreter is resident in a separate Read Only Memory area of the CPU. By “hardwiring” the interpreter, the time and necessity of ‘paging’ the system in and out of user memory is eliminated with only 700 bytes of the user area allocated for system tables. In this way, WCS/30 compares favorably to a large computer with a much greater memory.

OPERATOR CONSOLE

The WCS/30 Console is situated on a desk unit which also houses the CPU and memory. The compact and attractive operator’s console centralizes Wang’s unique 1,024 character display, a diskette drive and a functional user’s keyboard. The keyboard includes a standard alphanumeric typewriter key configuration which includes our unique “Single Key BASIC Verb” feature, a numeric 10-key pad with arithmetic operations, a set of special function keys capable of turn key operations and Wang’s indispensable line EDIT feature.

STORAGE

With the WCS/30 System is a 262 kilobyte diskette unit and a 5 megabyte fixed/removable hard surface disk providing high-speed, direct access external storage. A 10-megabyte fixed/removable hard-surface disk is available for larger storage requirements. The use of removable disks permits off line program and data storage capacity, limited only by the number of disks one has on hand. The inclusion of a diskette drive allows a media interchange mechanism between systems and data entry devices.

PHYSICAL CHARACTERISTICS

The WCS/30 disk comprises three separate disk platters — a Fixed Disk Platter, a Removable Disk Platter, and a Diskette Platter. The Removable Disk Platter can be replaced by the user. Each disk platter is divided into a series of concentric circular tracks, and each track is segmented into twenty-four 256-byte sectors (16 sectors for diskette). Information is transferred to and from the disk in blocks of 256 bytes, with each block occupying a sector. Records of more than 256 bytes are automatically allocated additional sectors as needed. The sectors on each disk platter are sequentially numbered and randomly accessible.

STORAGE CAPACITY

The total on-line capacity of the WCS/30 disk unit is 5,275,648 bytes — 2,506,752 reside on the Fixed Disk Platter; 2,506,752 bytes on the Removable Disk Platter, and 262,144 on the Diskette Platter.

It is difficult to translate the available storage in bytes into the precise amount of alphanumeric or numeric information which can be stored on the disk, since this figure is determined by several factors, including the type of information and the method of storage. In general, each full precision number (13 digits) requires nine bytes of storage on disk, and each literal string requires one byte for each character plus one additional byte (e.g., a literal string containing 16 characters requires 17 (16 + 1) bytes of disk storage). Thus, the WCS/30 fixed removable disk can store about 557,000 full-precision numbers or 295,000 16-character literal strings. However, the amount of storage required by individual numbers can be reduced from nine bytes to as few as two bytes per number with the PACK statement if a full 13 digits of precision are not required.
Speed

Information is transferred to and from the disk at high speed. The total time required to read or write an item of data on disk can be broken down into two components — the track access time and the disk latency time.

Track Access Time — is the time required to position the read/write head to a specified track on the disk platter. The “average access time” is the time required for the read/write head to move from track #0 to the middle track on a disk platter. For the WCS/30 fixed removable disk, the average access time is 41 ms (about .04 second) and for the diskette unit, 401 ms. If information is written or read sequentially on a platter, access time is minimized.

Disk Latency Time — is the time required for the desired sector on a track to rotate to the read/write head. The “average latency time” is the time required for a sector which is one-half track (12 sectors) away from the read/write head to rotate to the read/write head. Since the fixed or removable platter makes one complete revolution in 40 ms, the average latency time is one-half this time, or 20 ms (0.02 second), and for the diskette unit, 80 ms. The staggered arrangement of sequential sectors on a track (which is transparent to the user software) makes it possible to read or write multi-sector records with significant savings in total latency time.

File Maintenance

Files can be maintained on disk in one (or both) of two modes: Automatic File Cataloging mode and Absolute Sector Addressing mode. The BASIC commands and statements in both modes are built into the Wang Computer System/30.

Automatic File Cataloging — includes 17 BASIC statements and commands which constitute an internal data management system. Catalog mode permits the user to save and load programs or data by name, without concern for where or how the files are actually stored on disk or the actual sector address of the data. (This information is recorded in a special “catalog index” which is automatically maintained by the system itself.)

Absolute Sector Addressing — includes eight BASIC statements which permit the programmer to address specific sectors on disk, thus enabling him to design his own data management system. Two Absolute Sector mode statements are provided which make possible the saving and loading of unformatted data, enabling the programmer to include his own control information in individual records.

Reliability

Although the Disk Unit is an extremely reliable device, both cyclic redundancy (CRC) and logical redundancy (LRC) checksum tests are made automatically on all data read from the disk. If a CRC error is detected in a sector, the sector is automatically reread four times before an error is signalled. An additional read-after-write verification test can be optionally specified by the programmer simply by including a single parameter in the appropriate BASIC statement or command.

The main disk unit sits under a table, thus affording additional desk space for the operator.

PRINTER

The Line Printer provides complete, high-speed alphanumeric printing capability to the Wang Computer System/30. The printer prints characters composed of a 9 by 9 dot matrix at a rate of approximately 200 characters per second, with limits between 65 and 300 lines per minute, depending upon line length (i.e., 65 lpm for a 132-character line and approximately 300 lpm for a 10-character line). Maximum line length is 132 characters. The WCS/30 printer is capable of printing out a fully-formatted alphabetic and numeric character set under program control. The printer has a 96 character set including uppercase and lowercase letters. The standard character set prints a scientific zero that is a slashed zero. An option is available to provide a nonslashed zero.

Since the WCS/30 printer uses a matrix impact printing technique, as many as four carbon copies can be generated simultaneously with the original. Proper registration of printed material on all copies is guaranteed by a pin-feed platen, the width of which is continuously adjustable from 4 to 14.5 inches.
(10.16 to 36.83 cm). Paper is automatically advanced from one line to the next, controlled by a punched paper tape loop.

In addition to producing program output, the WCS/30 printer also can be instructed to LIST program (the text lines to be listed are specifiable) and serve as Console Output (in which case every keystroke from the keyboard, whether under program control or in Immediate Mode, is printed out just as it would appear on the CRT).

WCS/30 OPTIONS

Available as System/30 options are higher speed matrix printers, a higher volume 10 megabyte Fixed/Removable disk drive and a work station. And, your WCS/30 doesn’t stop here . . .

SOFTWARE

Software currently available in the 2200 Series products are also compatible with WCS/30, thereby making available a vast library of programs that have been developed over the years.

AVAILABLE 2200 PERIPHERALS

Model 2201 Output Writer
Model 2202 Plotting Output Writer
Model 2203 Punched Tape Reader
Model 2207A I/O Interface Controller (RS-232-C)
Model 2209 ½-inch, 9-track Tape
Model 2212 Analog Flatbed Plotter (10” x 15”)
Model 2217 Single Tape Cassette Drive
Model 2218 Dual Tape Cassette Drive
Model 2227 Asynchronous Telecommunications Controller
Model 2228 Communications Controller
Model 2231 Line Printer (80 Column)
Model 2232A Digital Flatbed Plotter
Model 2234A Hopper-Feed Punched Card Reader
Model 2244A Hopper-Feed Mark Sense Punched Card Reader
Model 2250 I/O Interface Controller (8-bit Parallel)
Model 2252A Input Interface Controller (BCD-1 to 10-Digit-Parallel, scannable)
Model 2261 High Speed Line Printer
Model 2262 Digitizer
Model 2270-1, 2, 3, Diskette Drive
Model 2292 Auxiliary Display

WCS/30 INSTRUCTION SET

General Basic Statements

| ADD | HEXPRINT | READ |
| AND | % (Image) | REM |
| BIN | INIT | RESTORE |
| BOOL | INPUT | RETURN |
| COM | KEYIN | RETURN CLEAR |
| COM CLEAR | LET | ROTATE |
| CONVERT | NEXT | SELECT |
| DATA | ON GOTO/ | STOP |
| DEFFN | GOSUB | TRACE |
| DEFFN’ | ON ERROR | UNPACK |
| DIM | OR | X OR |
| END | PACK | IF-THEN |
| FOR | PLOT | IF END THEN |
| GOSUB | POS | |
| GOSUB’ | PRINT | |
| GOTO | PRINT USING | |

Basic Commands

| CLEAR | HALT/STEP | RENUMBER |
| CONTINUE | LIST | RUN |
| | | RESET |

Disk Statements

Automatic File Cataloging Mode Statements

| DATALOAD DC | LOAD DC |
| DATALOAD DC OPEN | MOVE |
| DATASAVE DC | MOVE END |
| DATASAVE DC CLOSE | SAVE DC |
| DATASAVE DC OPEN | SCRATCH |
| DBACKSPACE | SCRATCH DISK |
| DSKIP | VERIFY |
| LIST DC | |

Absolute Sector Addressing Mode Statements

| LIMITS | LOAD DA |
| SAVE DA | |
| COPY | DATALOAD BA |
| DATASAVE BA | |
| DATASAVE DA | DATALOAD DA |
WCS/30 INSTRUCTION SET (Cont.)

The Character EDIT Instruction Set provides
greater editing flexibility for the WCS/30 in all mem-
ory sizes. Individual alphanumeric characters in a line
of program text resident in memory, or in data values
of program text currently being entered from a key-
board, can be altered, inserted, or deleted, without
retyping the entire line.

The SORT Instruction Set includes six matrix
statements for flexible and rapid searching, moving
and sorting data on the WCS/30. These statements are
particularly effective in speeding up sorting operations,
performing multi-file merges, and executing multi-pass
searches over large bodies of data. The six state-
ments are:

MAT CONVERT MAT MOVE
MAT COPY MAT SEARCH
MAT MERGE MAT SORT

Matrix Instruction Set is available on the WCS/30
which provides fourteen built-in matrix operations.

OPERATION
MAT addition
MAT CON
MAT equality
MAT IDN
MAT INPUT
MAT INV,d
MAT multiplication
MAT PRINT
MAT READ
MAT REDIM
MAT scalar multiplication
MAT subtraction
MAT TRN
MAT ZER

The General I/O Instruction Set for the WCS/30
adds five BASIC language statements to the system.

$IF ON A statement designed to test the Ready/
Busy signal of an I/O device (or test
the Empty/Full signal of the input
buffer on a device controller board)
and initiate execution of a conditional
branch to a specified line number.

$TRAN A statement designed to facilitate high-
speed character code translations.

$PACK $UNPACK Statements designed to facilitate data
packing and unpacking by fields or
delimiters, between a specified alpha-
numeric array buffer and specified
variables in an argument list.

MATHEMATICAL FUNCTIONS

Mathematical functions are calculated to 13 sig-
nificant digits.

LOG — Natural Logarithm
ABS — ABSOLUTE VALUE
SQR — SQUARE ROOT
RND — RANDOM NUMBER
INT — INTEGER PART
SGN — assigns 1 if positive, 0 if zero, or −1 if negative.
#PI π = (3.14159265359)
EXP — e^x
*SIN — SINE
*COS — COSINE
*TAN — TANGENT
*ARCSIN — ARCSINE
*ARCCOS — ARCCOSINE
*ARCTAN — ARCTANGENT
(*trig arguments: degrees, radians, or gradians)

Arithmetic Operators:

↑ exponentiation        + addition
* multiplication        − subtraction
/ division               = equal

Relational Symbols:

< less than
<= less than or equal to
> greater than
>= greater than or equal to
<> not equal
String Functions:
STR  VAL
LEN  NUM
HEX

User Defined Special Function Keys
All 32 Special Function Key operations can be
defined by the user and instantly redefined to meet
changing requirements. The keys can be used to
write, store and then access, with a single keystroke,
commonly used character strings for text entry, or
the keys can provide program entry points directly
from the keyboard.

WCS/30 Keyboard Operations
Most BASIC words are entered with a single stroke
and require only one byte of memory. The keyboard
has two modes of operation: Keyword/A and A/a. The
Keyword/A mode provides most BASIC words and
uppercase alpha characters. A/a mode functions as a
standard typewriter providing upper and lowercase
alpha characters.

Character EDIT Mode
The Character EDIT Mode is designed to facilitate
editing of lines of program text recalled from memory
or data being input and displayed on the CRT: (Multispace left), (Space left), (Space right), (Multispace
right), INSERT, DELETE, ERASE, and RECALL.
The EDIT Key is used to enter EDIT mode. The
RECALL key is used to recall a program line pre-
viously entered into memory. The Multispace (left
and right) keys are provided to move the cursor five
spaces to the left or right. Two Space keys are pro-
vided to move the cursor a single space to the left
or right. The INSERT key is used to expand a line to
allow for additional text or data. When the DELETE
key is depressed, the character at the current cursor
position is deleted. A program or data line can be
erased from the current cursor position to the end of
the line by touching the ERASE key.

SPECIFICATIONS
WCS/30 Central Processing Unit
Average Execution Time (Milliseconds)
Add/Subtract 0.8

Multiply 3.8
Divide 7.4
Square Root 46.4
e^x 25.3
Log e x 23.2
x^y 45.2
Integer Value 0.24
Absolute Value 0.25
Sign 0.25
SINE 38.3
COS 38.9
TAN 78.5
ARCTAN 72.5
Read/Write Cycle 1.6 μ sec

Average execution times are determined using random
number arguments with 13 digits of precision. Speeds
are faster in calculations with arguments of less
precision.

Memory Size: 16K, 24K ,32K
Subroutine Stacking – 50
WCS/30 Fixed/Removable Disk
Storage Capacity
Platters 2
Sectors per Platter 9,792
Total Sectors 19,584
Bytes per Platter 2,506,752
Total Bytes 5,013,504

Performance
Rotation Speed 1,500 RPM

Access Time (Position Head to Track)
Minimum (one track) 9 ms
Average (across one-half available
tracks) 41 ms
Maximum (across all available
tracks) 82 ms

Latency Time (Platter Rotation to Sector on Track)
Average (one sector read/write one-half
revolution) 20 ms

MOVE/COPY Time (Entire Disk Platter)
Approx 4.9 min
Raw Transfer Rate
195,000 bytes/sec
Matrix Printer with stand

A 1,024 Character, 12-inch Display

Sixteen Special Function Keys

A Standard Typewriter-Like Alphanumeric Keyboard

CPU conveniently contained in the table housing

A 250-kilobyte Flexible Disk with two additional drives for expanded storage capacity
Ten-key Pad with arithmetic operators

A 5-megabyte Fixed/Removable Hard Surface Disk
SPECIFICATIONS (Cont.)

WCS/30 Diskette
Storage Capacity
Platters ........................................ 1
Sectors per Platter/total Sectors ............... 1,024
Bytes Per Platter/total bytes .................. 262,144

Performance
Rotation Speed .................................. 375 RPM

Access Time (Position Head to track)
Minimum (one track) ............................ 15 ms
Average (across one-half available tracks) .... 401 ms
Maximum (across all available tracks) .......... 803 ms

Recovery Time (Platter Rotation to Sector on Track)
Average (one sector read/write one-half revolution) .... 80 ms
Additional sectors in same revolution .......... 40 ms

Read/Write Time
One 256 byte sector (including CPU, Controller overhead) .................. 21.8 ms

MOVE/COPY Time (Entire Disk Platter) Approx 2 min
Raw Transfer Rate 31,000 bytes/sec

Size of WCS/30 Console & CPU & Storage
Height ........................................... 40 in. (101.6 cm)
Depth ............................................ 30 in. (76.2 cm)
Width ............................................ 72 in. (182.84 cm)

Weight
385 lb (174.6 kg) (approx)

Cable
8 ft (2.4m) to power source

Power Requirements
115 or 230 VAC ± 10%
50 or 60 Hz ± 1 Hz

Wattage
900 W

Operating Environment
50°F to 90°F (10°C to 32°C)
20% to 80% Relative Humidity

Recommended Relative Humidity
35% to 65%

ORDERING SPECIFICATIONS

A Keyboard Programmable Central Processing Unit (CPU) with hardwired BASIC language. The CPU must have at least 16,384 bytes of memory, expandable in 8,192 byte increments to 32,768 bytes and be able to drive a 132-column High-Speed Printer. An EDIT feature must be hardwired into the CPU. The CPU must be capable of supporting any or all of a number of peripheral devices: Cathode Ray Tube display (16 lines by 64 characters per line); a Selectric Output Typewriter; an Input Keyboard of typewriter characters and single keystroke BASIC language verbs; an 80 or 132 column Line Printer; 2207A I/O Interface-Controller; Models 2234A and 2244A Card Readers; Model 2227 Telecommunications Controller; Model 2228 Communications Controller; Model 2250 I/O and Model 2252A Input Interface Controllers; the Model 2262 Digitizer; and 2209 9-track tape.

A triple removable diskette drive capable of storing programs and data for the Wang Computer System/30. The disks must provide a storage capacity of 5,275,648 bytes. Disk platters must be easily inserted and removed from the unit; individual platters must be formatted automatically by the unit. The System must provide the capability to read and write multi-sector records of any length, and to use entire arrays as arguments. The system also must provide a hard-wired internal data management system, as well as a number of BASIC statements and commands which permit the programmer to design his own disk management system. Finally, the system must provide a rapid platter-to-platter backup capability for at least two of the three disk drives in the disk unit. All of these features, as well as all interface and control electronics, must be included in the price quoted for the disk drive; none should be considered optional extras. A single WCS/30 must be capable of supporting a minimum of four disk drives.

Standard Warranty Applies.

Maintenance Contract Available.
Sales and Service Offices

Alabama
Birmingham
Mobile

Alaska
Anchorage

Arizona
Phoenix

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Foster City
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San Diego
San Francisco
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Stamford
Wethersfield

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Via Haverford, Penna.

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Jacksonville
Miami
Orlando
Tampa

Georgia
Atlanta

Hawaii
Honolulu

Idaho
Via Seattle, Washington

Illinois
Chicago
Des Plaines
Moline
Morton

Indiana
Highland
Indianapolis
Mishawaka

Iowa
Via Moline, Illinois

Kansas
Overland Park
Wichita

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Louisville

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Baton Rouge
Metairie

Maine
Via Waltham, Mass.

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Baltimore
Gaithersburg
Kensington
Rockville

Massachusetts
Boston
Littleton
Tewksbury
Waltham
Worcester

Michigan
Grand Rapids
Okemos
Southfield

Minnesota
Minneapolis

Missouri
St. Louis

Montana
Via Seattle, Washington

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Omaha

Nevada
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Manchester

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Charlotte
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Oklahoma City
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Oregon
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