

# WCS/40 Technical Information

# Wang Computer Systems



# WCS/40

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The Wang Computer System/40 (WCS/40) is a powerful, multi-user, fixed/removable large disk-based system which offers the customer with concurrent multiple job and multiple site requirements the capabilities of larger computers at a modest small business computer system cost. The WCS/40 can initially provide a versatile multiprogramming capability in an easy-to-use system that not only meets today's data processing needs, but also can easily be expanded to meet tomorrow's growth.

The WCS/40 standard configuration features a large, partitionable 32K high performance Central Processing Unit with a loadable, microcoded, multi-user Operating System and BASIC-2 interpretive language. The operating system resides in a unique second System Memory of over 48K. Also included in the system are three Interactive Terminal/Operator Consoles comprised of 1920 character Cathode Ray Tube (CRT) Displays and operator keyboards, a diskette drive for off-line program and data storage, a 10 million byte fixed/removable disk system for random, mass storage, and a 240 line per minute full width, dual pitch impact printer — all in five coordinated pieces of office furniture. Through additional options, e.g., higher speed 400/600 LPM Line Printers, up to eight interactive terminals, expansion of main memory to 64K, extended disk storage, data communications, and unique Wang multiprocessing disk work stations, the WCS/40 maintains a flexibility for the user, preventing the rapid obsolescence plaguing many lesser small business computer systems.

## PROCESSOR

The new multi-user Central Processing Unit constitutes the heart of the WCS/40 configuration. The WCS/40 CPU provides a functional partitioned multi-user capability, with each partition supporting a separate console/terminal. The system utilizes Wang's new Interactive Terminals through a Terminal Multiplex Controller that supports up to eight users simultaneously. (Note: The standard WCS/40 configuration employs the four-port controller, but the eight-port controller may be used instead.)

The CPU utilizes fixed partitions, the number and size of which are specified at system load time. The language supported is BASIC-2, which is essentially compatible with Wang's 2200 VP BASIC, and upward compatible with Wang standard BASIC. Most current Wang disks, printers and communication controllers are supported by the WCS/40 CPU in addition to the

Interactive Terminals, which are the only CRT consoles supported by the system.

Because of the large standard memory of the WCS/40, and because of the low overhead required by the multi-user, multiprogramming operating system, several users can be provided with what looks like their own processor. For instance, on the standard WCS/40 configuration with 32K main memory and three interactive terminals, each user can operate in an 8K partition, or two users could be running minimal 4K partitions for such tasks as data entry or inquiry/response, while the third could be running a large 16K partition for more demanding program tasks.

## INTERACTIVE TERMINALS/OPERATOR CONSOLES

The main source of system output to the operator is the 24 line, 80 character per line CRT display which enables full-screen operator prompting and validation of keyed characters. The screen measures 12 inches (30.4 cm) diagonally and displays 1920 character positions. The display and keyboard support both upper and lowercase alphabetic characters. The keyboard consists of four zones: (1) a typewriter-like keyboard, (2) program control function keys, (3) a numeric keypad, and (4) a row of special function keys. Associated keyboard electronics and display logic are, of course, contained within the Interactive Terminal housing.

When running application programs, all terminals function identically as interactive data entry terminals. For operations which involve direct communication with the system, however, one of the terminals has a special status. This terminal functions as the operator's console for operations such as initializing the system, loading programs, and receiving system-generated error messages.

A programmable audio alarm is provided to signal the operator when special conditions occur. Brightness and contrast controls provide a sharp, clear image on the screen. Display speed is 9600 bps, which allows the entire screen to be filled almost instantaneously. Optionally, one of Wang's broad range of character and line printers may be attached to the Model 2236 Interactive Terminal, providing a hardcopy output of all or selected transactions. Each terminal is equipped with a buffer in the Multiplex Controller, allowing CRT operations and printing to proceed concurrently.

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## TERMINAL MULTIPLEX CONTROLLER

Consisting of a microprocessor, communication electronics, and separate input and output buffers for each terminal, the Multiplex Controller is available in two versions. The first supports up to four Interactive Terminals and is standard on the WCS/40, using one I/O slot. The second supports up to eight Interactive Terminals, and may be optionally employed on a WCS/40, occupying two I/O slots. Because all multiplexer electronics are contained on the controller boards, neither a separate chassis nor a power supply is required.

The microprocessor coordinates data transfer between the CPU, the Multiplex Controller I/O buffers, and each terminal; therefore, it performs overlapped processing duties by leaving the CPU free to perform each user's programming in the assigned CPU partition, while it handles full-duplex asynchronous communication with all Interactive Terminals. Each terminal's 256-byte input buffer accepts keyed input, while its output buffer concurrently displays characters on the respective terminal's CRT screen.

Line handling between the WCS/40 CPU and each Interactive Terminal is asynchronous full-duplex at up to 9600 baud. Each Interactive Terminal can be situated in a 1000 foot direct local, extended local through "short haul" modems, or remote environment through compatible modems. In all cases, the four or eight plugs at the Multiplex Controller and the plug at the Interactive Terminal are 25-pin, RS-232-C compatible.

## STORAGE

The WCS/40 System is equipped with a 262 kilobyte diskette unit and a fixed/removable hard disk with 10 megabytes — providing high-speed, direct access external storage. 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. Optionally, an additional 10 megabytes of fixed/removable hard disk storage may be added, along with two additional diskette drives. One or more of the diskette drives may be added with IBM 3740 compatibility.

## PRINTER

The WCS/40 Line Printer is a 240 lines per minute matrix impact printer. It prints either a 136-character

line (10-pitch format) or 160-character line (nominal 12-pitch format) utilizing four print heads which operate in unison, printing in both forward and reverse directions. The four print heads enable the Line Printer to maintain a printing rate of 240 lines per minute independent of line size and pitch format. Its unique printing scheme, selectable line length, line density (6 or 8 lines per inch) and additional standard features combine to provide high quality printed output to the WCS/40.

The Line Printer uses a high density dot matrix (11 x 9 for 10 pitch and 9 x 9 for 12 pitch) to print a full ASCII set of 96 characters containing both upper and lowercase letters, numbers and symbols. Standard features of the printer include a CLEAR switch, alarm lamp and tone, manual line feed, adjustable print head carriage for multiple forms, vertical format control with punched tape loop, paper feed control with pin-feed units, bottom-loading paper feed with concealed tray, full-line buffer, and a SELECT/deselect switch to enable the printer to receive data from the WCS/40 or to halt printing temporarily without causing loss of data.

## WCS/40 OPTIONS

### WORK STATION

The Work Station brings independent remote processing power to your Wang system, along with full access to your disk data base. It is a powerful, compact and complete computer designed to complement a WCS/40 system.

Up to three Work Stations can be multiplexed to any WCS/40 equipped with a Model 2230 MXA disk multiplexer. Work Stations can concurrently carry out different processing tasks while sharing a common disk data base. Simplicity of operation, modularity of design, a powerful BASIC language set, and true multiprocessing power highlight the Work Station.

### SOFTWARE

The Multiplex Controller, and thus the interactive terminals, are programmable through supplied Terminal Access Method (TAM) utility software. TAM subroutines are easily incorporated into user-written BASIC Language programs, and simplify programming a multi-terminal configuration because of their modular functions. Terminal polling using TAM, which is usually done on an equal priority

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basis, does allow timing priorities among the terminals. TAM also provides display control functions and returns keyed messages of up to 80 characters to the user's program.

Software currently available in the 2200 Series products are also compatible with WCS/40, thereby making available a vast library of programs that have been developed over the years.

## AVAILABLE 2200 PERIPHERALS

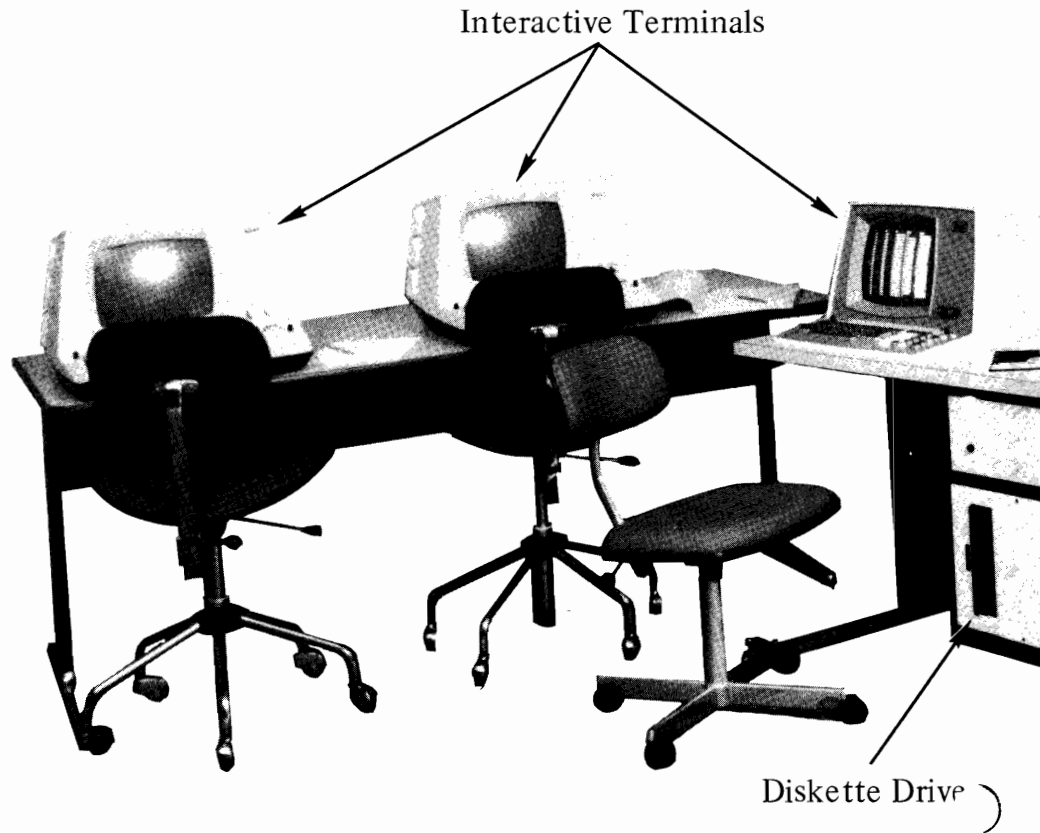
- Model 2221W Line Printer (132 Columns)
- Model 2227B Buffered Asynchronous Communications Controller
- Model 2228B Bisynchronous/Asynchronous Communications Controller
- Model 2230MXA Four-Port Disk Multiplexer
- Model 2230MXC-2 Eight-Port Controllers
- Model 2231W-1 Line Printer (112 Column)
- Model 2236MXC Eight-Port Multiplex Controller
- Model 2236 Terminal/Consoles
- Model 2260-2 Twenty Megabyte Disk
- Model 2261W High Speed Line Printer
- Model 2263-1 400 LPM Printer
- Model 2263-2 600 LPM Printer
- Model 2270-1, -2, -3, Diskette Drive

## WCS/40 INSTRUCTION SET

COM	IF...THEN	PRINT AT
COM CLEAR	Image (%)	PRINT HEXOF
DATA	INPUT	PRINT TAB
DEFFN	KEYIN	PRINTUSING
DEFFN'	LET (Assignment)	PRINTUSING TO
DIM	LINPUT	READ
END	MAT COPY	REM
FN	MAT MOVE	RESTORE
FOR...TO	MAT SEARCH	RETURN
GOSUB	ON/GOSUB	RETURN CLEAR
GOSUB'	ON/GOTO	STOP
GOTO	PRINT	

## Basic Commands

CLEAR	HALT/STEP	RENUMBER
CONTINUE	LIST	RUN
		RESET



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## 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	COPY	DATASAVE DA
LOAD DA	DATALOAD BA	DATALOAD DA
SAVE DA	DATASAVE BA	

## Character EDIT Instruction Set

The Character EDIT Instruction Set provides greater editing flexibility for the WCS/40 in all memory 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 keyboard, can be altered, inserted, or deleted, without retyping the entire line.

## Sort Instruction Set

The SORT Instruction Set includes three matrix statements for flexible and rapid searching, moving and sorting data on the WCS/40. 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 three statements are:

MAT MERGE      MAT MOVE      MAT SORT

## Matrix Instruction Set

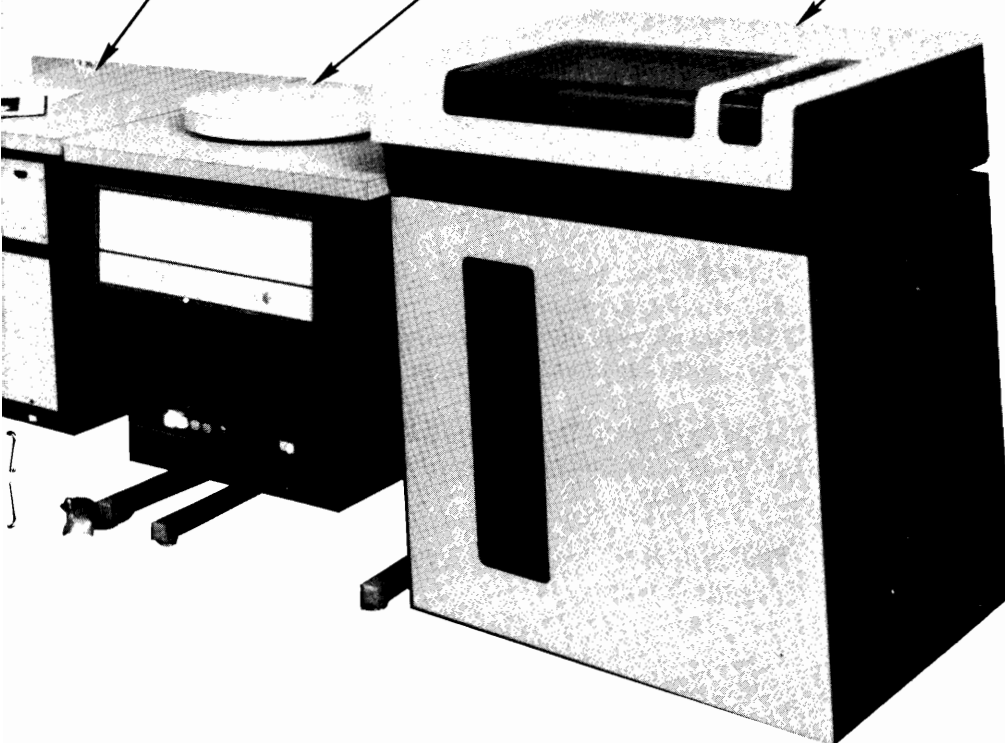
A complete Math Matrix Instruction Set is available on the WCS/40 and provides fourteen built-in matrix operations.

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

CPU conveniently  
contained in the  
table housing

Ten-megabyte  
Fixed/Removable  
Disk Drive

240 LPM  
Matrix Line  
Printer



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## General I/O Instruction Set

The General I/O Instruction Set for the WCS/40 adds five BASIC language statements to the system.

Statement	Description
\$GIO	A generalized I/O statement designed to perform data input, data output, and I/O control operations with a programmable signal sequence.
\$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.
\$STRAN	A statement designed to facilitate high-speed character code translations.
\$SPACK \$UNPACK	Statements designed to facilitate data packing and unpacking by fields or delimiters, between a specified alphanumeric array buffer and specified variables in an argument list.

## String Functions:

STR VAL	HEX
LEN NUM	VER

## 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/40 Keyboard Operations

The keyboard has two modes of operation: A/A and A/a. The A/A mode forces all alphabetic characters to uppercase — a useful feature when entering program text and in many data entry operations. 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), BEGIN, END, ↑ (UP), ↓ (DOWN), INSERT, DELETE, ERASE, and RECALL.

The EDIT Key is used to enter EDIT mode. The RECALL key is used to recall a program line previously 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 provided to move the cursor a single space to the left or right. BEGIN repositions the cursor to the start of the current line, END moves it to the end of the current line. Up and down arrows move the cursor up or down one line on the CRT. The INSERT key is used to expand a line to allow for character insertion. The DELETE key causes the character at the current cursor position to be 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/40 Central Processing Unit

Memory size: 32K, 48K, 64K

### WCS/40 Fixed/Removable Disk Storage Capacity

Sectors per Platter	19,584
Total Sectors	39,168
Bytes per Platter	5,013,504
Total Bytes	10,027,008

### Performance

Rotation Speed . . . . . 2,400 RPM

### Access Time (Position Head to Track)

Minimum (one track)	4.5 ms
Average (across one-half available tracks)	40 ms
Maximum (across all available tracks)	80 ms

### Latency Time (Platter Rotation to Sector on Track)

Average (one sector read/write one-half revolution)	12.5 ms
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### MOVE/COPY Time (Entire Disk Platter)

Approx 10 min

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## SPECIFICATIONS (Cont.)

### WCS/40 Diskette Storage Capacity

Platters . . . . .	1
Sectors per Platter/total Sectors . . . . .	1,024
Bytes per Platter/total bytes . . . . .	262,144

### Performance

Rotation Speed . . . . .	375 RPM
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### 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

### Latency 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
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### MOVE/COPY Time (Entire Disk Platter)

Approx 2 min

### Size of WCS/40 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  $\pm$  10%  
50 or 60 Hz  $\pm$  1 Hz

### Wattage

900W

### Operating Environment

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

### Recommended Relative Humidity

35% to 65%

### WCS/40 Interactive Terminal/Console

#### Size

Height . . . . .	13½ in. (34.3 cm)
Depth . . . . .	20½ in. (52 cm)
Width . . . . .	19¾ in. (50.2 cm)

### Weight

51 lb (23.1 kg)

### CRT

Display Size . . . . .	12 in. diagonal (30.4 cm)
Capacity . . . . .	24 lines, 80 characters/line
Character Size	
Height . . . . .	0.16 in. (0.4064 cm)
Width . . . . .	0.09 in. (0.2286 cm)

### Power Requirements

115 or 230 VAC  $\pm$  10%  
50 or 60 Hz  $\pm$  ½ Hz  
255 Watts

### Fuses

2.5A @ 115V/60 Hz  
1.2A @ 230V/50 Hz

### Operating Environment

50°F to 90°F (10°C to 32°C)  
20% to 80% relative humidity, allowable  
35% to 65% relative humidity, recommended

### Cable

One 8 ft (2.4m) cord to power source.  
One length of 25 ft (7.6m) direct connection cable is provided with each 2236; extension cables in increments for distances up to 1,000 ft (304.8m) are available optionally. Connection from modems to Wang equipment is optionally available also in lengths of 12 ft (3.7m), 25 ft (7.6m), and 50 ft (15.2m). Connectors and cable are 25-pin RS-232-C compatible.

### WCS/40 Printer

#### Printer Size:

Height . . . . .	36 in. (91 cm)
Depth . . . . .	26 in. (66 cm)
Width . . . . .	27 in. (68.6 cm)
Weight . . . . .	210 lb (94.5 kg)
Speed . . . . .	240 lines/min independent of line length

### Character Configuration

11 x 9 and 9 x 9 dot matrix (dots not in adjacent columns of same row)  
10 char/in. (4 char/cm) or 11.76 char/in. (4.6 char/cm), selectable  
6 lines/in. (2.4 lines/cm) or 8 lines/in. (3.1 lines/cm), selectable



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## SPECIFICATIONS (Cont.)

### Character Set

Full ASCII, 96 characters, both upper and lowercase

### Line Width

136 characters, maximum with 10 pitch  
(68 characters, expanded)  
160 characters, maximum with 12 pitch  
(80 characters, expanded)

### Ribbon

Nylon, double spool, reversible  
1½ in. (3.8 cm) wide  
64 yd (58.5m) long

### Switches/lamps

ON/OFF, SELECT, PITCH, LINE/IN., LINE FEED, TOP OF FORM, CLEAR, FORMS OVERRIDE, paper out alarm and lamp, power on lamp, select lamp, and alarm tone.

### Control Codes

Audio Alarm HEX (07), Line Feed HEX (0A), Vertical Tab HEX (0B), Form Feed HEX (0C), Expanded Print HEX (0E), and Delete (to clear buffer of partial line) HEX (7F).

### Vertical Format Control

3-channel, std – 1 in. (2.54 cm) tape. Vertical Tab, Top of Form, Page Reject.

### Paper Size

Maximum width . . . . . 14.9 in. (37.8 cm)  
Minimum width . . . . . 5.0 in. (12.7 cm)  
Paper width settings adjustable  
maximum form length. . . . . 11 in. (27.9 cm)  
(Up to four copies plus original can be printed.)

### Cable

6 ft (1.8m) to power source  
12 ft (3.7m) to controller

*Standard Warranty Applies.*

*Maintenance Contract Available.*

## ORDERING SPECIFICATIONS

A multi-user, partitionable, multi-programming Central Processing Unit (CPU) with reloadable microcoded Operating System, and interpretive BASIC language with over 48K RAM Reserves System Storage. The CPU must have at least 32K bytes of additional user RAM memory, expandable in 16K byte increments to 64K bytes and be able to drive a 136-column High-Speed Printer. A powerful EDIT feature must be available as part of the operating system. The CPU must be capable of supporting any or all of a number of Wang Disks and Printers, as well as the Model 2228B Telecommunications Controller.

A single removable diskette drive and a ten megabyte fixed/removable disk drive capable of storing programs and data for the Wang WCS/40. The disk must provide a storage capacity of 10,289,152 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 an internal disk file 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 the disk units. Three interactive terminals must also be provided with the system, each consisting of a 1920 character CRT (80 x 24) and typewriter keyboard.

A bidirectional printing, 4-head line printer providing complete alphanumeric printing capability. It must print a full-line of up to 160 characters using a dot matrix printing technique with either a 11 x 9 or 9 x 9 dot matrix. It must print a full ASCII character set with both upper and lowercase letters in either 10 pitch (136 column) or 12 pitch (160 column) format, and react to ASCII control codes. All printable characters must be fully programmable and the printer must have a full-line buffer. It must have expanded print capability, a selectable 6 lines/in. or 8 lines/in. format and print 240 lines per minute (independent of line length).



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*Wang Laboratories reserves the right to change specifications without prior notice.*

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