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DATA SHEET

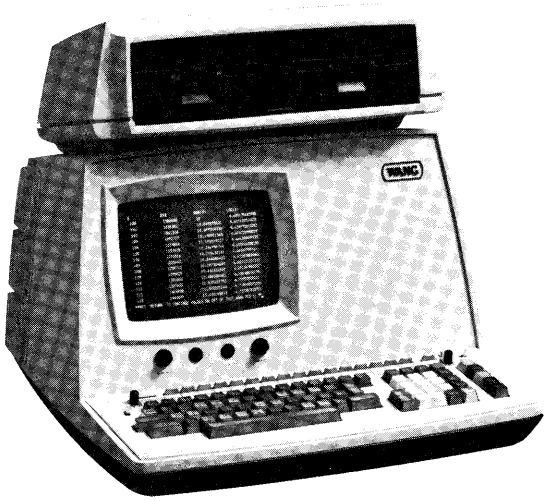
Wang's PCS-II is a compact, quick-access, low-cost, minidiskette-based desktop computer powerful enough to meet the specialized needs of engineers, laboratory technicians, and scientists — yet flexible enough to meet the data processing needs of students, accountants, business people, and administrators. With the PCS-II, both first-time or experienced computer programmers have standalone computing capability located where data generation takes place. Data entry, retrieval, editing, and processing tasks can be performed by the PCS-II. Furthermore, available software supports a variety of scientific, technical, and business applications.

Residing within the PCS-II is a central processor with a standard 8K-byte random access memory (RAM), expandable to 16K, 24K or 32K bytes. Only 700 bytes of RAM are utilized for "housekeeping" purposes, leaving all remaining RAM accessible to the user. A 42.5K-byte BASIC language interpreter, "hardwired" in read only memory (ROM), translates and executes Wang's BASIC language instruction set. With the many interactive programming and debugging capabilities provided by Wang BASIC, learning time as well as program development time are minimized.

In addition to its powerful central processor, the PCS-II combines the following features in the self-contained unit:

- a typewriter keyboard, with numeric pad and special function keys for simplified data entry and program control;
- a 9-inch cathode ray tube (CRT) with a 1024-character display capacity (standard) or 1924-character capacity (optional);
- a minidiskette drive for high speed, random access data storage operations;
- a printer/plotter connector for plug-in installation of one of Wang's optional hardcopy output devices; and
- an optional microprocessor-based communications controller or an instrumentation interface controller.

A wide range of data transmission and reception capabilities can be added to the standalone computer capabilities of the PCS-II by including an optional communications controller in the system. With either one of Wang's microprocessor-based communications controllers, separate tasks related to data transmission/reception can be performed concurrently by the central processor and the communications controller. With the Option 62 asynchronous controller, a PCS-II can be programmed (or software available) to emulate a Teletype® terminal or an IBM 2741 Selectric® Typewriter Terminal. Alternatively, the Option 62B synchronous/asynchronous communications controller, together with a Wang-supplied turnkey software package, supports batch data transmission to or from a host system via IBM's 2780, 3780, or 3741 Binary Synchronous Communications protocol.



PCS-II

The information which follows gives a detailed description of the standard PCS-II. Separate data sheets describe the Option 62 and 62B communications controllers. Other data sheets describe the printers and a drum plotter which are available for selection of one optional hardcopy output device best suited to particular applications.

PCS-II INSTRUCTION SET

The BASIC Instruction Set

The PCS-II is programmable in Wang's BASIC language. Generally speaking, BASIC is a popular, high-level, English-like language utilized by a number of companies in the computer industry today; however, few companies, if any, offer a version of the language as comprehensive as the BASIC instruction set developed by Wang Laboratories for its successful System 2200 and related product lines.

The BASIC instruction set falls into categories representing functionally and historically related statements. Included within the general-purpose category are 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. Other categories include special-purpose statements which perform operations such as code conversion, sorting, matrix arithmetic, and customized I/O control. Brief descriptions follow for several categories of the Wang BASIC instruction set.

General-purpose Statements

The general purpose category includes some statements commonly found in less comprehensive BASIC language versions, and other statements which qualify Extended BASIC as a powerful and versatile high-level programming language. For example, the PRINTUSING and % (Image) statements facilitate concise formatting of printed reports containing both text and numeric data fields with or without automatically inserted commas, decimal points and leading dollar signs ($) in numeric fields. The PRINTUSING, PRINT, HEXPRINT, and PLOT statements can be used to control output to the CRT or a hardcopy output device.

The COM and COM CLEAR statements reduce memory usage when common data must be passed between overlayed program modules. The GOSUB' statement passes multiple arguments to a subroutine. The FOR and NEXT statements define loops which can be nested, if desired. Simple program branching can be implemented with GOTO statements, while conditional branching can be achieved with IF, ON, and ON ERROR statements. These and other general-purpose statements are included in the following list:

COM	HEXPRINT	PRINT
COM CLEAR	IF END THEN	PRINTUSING
DATA	IF THEN	READ
DEFFN	(%) Image	REM
DEFFN'	INPUT	RESTORE
DIM	KEYIN	RETURN
END	LET	RETURN CLEAR
FOR	NEXT	SELECT
GOSUB	ON	STOP
GOSUB'	ON ERROR	TRACE
GO TO	PLOT	

Matrix Statements

The so-called Matrix Statements represent a category containing fourteen statements designed primarily for mathematically-oriented operations on entire arrays. In addition to input and output operations, the statements perform calculations and manipulations according to the rules of linear algebra; redimensioning of arrays is automatic for arithmetic operations and optional for other operations. The names of the statments are as follows:

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

Sort Statements

The so-called Sort Statements represent a category containing six matrix statements designed to facilitate text editing operations as well as high-speed data sorting, searching, merging, moving, and copying. Names of the statements are as follows:

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

General I/O Statements

The five statements in the so-called General I/O Instruction Set represent a category of historically related operations identified by names beginning with a dollar sign ($) character as follows:

$GIO	$PACK
$IF ON	$UNPACK
$TRAN	

One statement, $GIO, uses a machine-language technique to custom-tailor I/O operating sequences which are executable within the framework of Wang's Extended BASIC language. The $GIO statement provides flexibility which far exceeds the capabilities of any other I/O statement in the Extended BASIC instruction set. The $IF ON statement performs a conditional branch to a specified program line after testing the device-ready or data-ready condition of a specified I/O device. The $TRAN, $PACK, and $UNPACK statements perform data conversion operations often required before or after I/O operations associated with data communications or specially-interfaced equipment.

Numeric Instructions

Extended BASIC provides a standard set of arithmetic operations including + (addition), − (subtraction), * (multiplication) / (division), and ↑ (exponentiation). The set of relation symbols include < (less than), < = (less than or equal to), = (equal to), > (greater than), > = (greater than or equal to), and < > (not equal to).

System-defined trigonometric and algebraic functions for a specified expression include SIN, COS, TAN, ARCSIN, ARCCOS, ARCTAN, absolute value (ABS), natural logarithm (LOG), exponentiation (EXP), square root (SQR), random value (RND), sign (SGN), and integer value (INT). The value of π is obtained by using the function #PI.

Most numeric operations are executed with 13-digit precision. The range of legal values for data entry or storage is as follows:

$-10^{100} < \text{value} <= -10^{-99} <= \text{value} < 10^{100}$.

Arguments for trigonometric functions can be specified in degrees, radians, or grads, as preferred.

System-defined Functions

System-defined functions include LEN, which determines the number of characters (excluding trailing blanks) currently stored in a specified alpha variable; NUM, which determines the number of legal numeric characters currently stored in a specified alpha variable; POS, which scans a specified alpha variable to determine the first byte-position in the current value where a particular relationship (e.g.,) is satisfied with respect to a specified character; HEX, which permits any 8-bit codes (whether represented by keyboard characters or not) to be introduced in a program in hexadecimal notation; STR, which specifies a substring of an alpha variable; TAB, which specifies the column position to which the CRT cursor (or the print head of an output device) is to be moved; VAL, which converts the binary equivalent of an ASCII character to a decimal-system integer; BIN, which converts the integer value of a specified expression (if non-negative and 256) to an equivalent binary code and stores the corresponding ASCII hexadecimal character in the specified alpha variable.

System Commands

System commands provide the operator with a means of directly controlling system operations from the keyboard. Some commands provide convenient and powerful debugging features, such as the ability to interactively modify, trace, renumber, list, and step through programs. Names of commands are as follows:

CLEAR	HALT/STEP	RENUMBER	RUN
CONTINUE	LIST	RESET	LOAD

PCS-II FEATURES

Immediate Mode

- Unnumbered single or multistatement lines, up to 192 keystrokes long, can be entered and executed immediately to perform quick calculations.
- Since unnumbered lines can be entered and executed, in many cases without altering programs or data currently stored in memory, selective program dumps can be obtained as a debugging tool.

Program Mode

- Numbered statements, entered in any order, are stored in memory for later execution.
- Most BASIC words are automatically converted into one-byte "text atoms" when stored, thereby conserving memory ordinarily required by systems which store all program text character-by-character.
- Multistatement program lines are legal; they conserve memory and reduce program execution time.

Special Function Keys

- Sixteen Special Function Keys, in conjunction with the SHIFT key, can be used to access up to 32 user-defined subroutines, text strings, and program entry points.
- Via the Special Function Keys, the keyboard can be customized for special applications, thereby increasing operator efficiency.

Edit Mode

- The EDIT key automatically activates edit mode operations on the eight rightmost Special Function Keys, without affecting any user-defined functions on those keys. A line currently being entered can be changed quickly, or the RECALL key can be used to recall a specified line from memory for quick and discrete editing.
- To indicate where a change is to occur, the four cursor-positioning edit operation keys can be used individually or successively to move the cursor one space to the left, one space to the right, five spaces to the left, or five spaces to the right, as needed.
- Once the cursor is properly positioned, the INSERT key can be used to expand the line prior to insertion of additional characters; the DELETE key can be used to delete the character at the current cursor position, or the ERASE key can be used to erase the remainder of the line beginning with the current cursor position.
- After changes are complete, the RETURN key deactivates the edit mode, and the edited line is automatically stored.

Error Diagnostics and Debugging

- Coded error messages automatically identify errors at each stage of program entry and execution. Normally, an arrow points to the approximate position where an error occurs in the program line.
- The HALT/STEP key enables the programmer to step through the execution of a program one statement at a time.
- The TRACE statement enables the programmer to trace through program execution, observing variable assignments and program transfers as they occur.
- The ON ERROR GOTO statement can be used to implement error recognition and/or recovery procedures under program control.
- Program lines are easily inserted and deleted, as needed; furthermore, the RENUMBER command can be used to renumber an entire program, or a portion of a program, with a specified line-number increment between successive lines.

The Minidiskette Unit

- The PCS-II has a single minidiskette drive (standard) or dual minidiskette drive (optional) to provide high speed, direct access, online storage. Offline storage is limited only by the number of available minidiskette platters.
- The platters are approximately 5¼ inches (13.4 cm) in diameter; only one surface is used to record data. The recording surface is divided into 35 concentric tracks, and each track is divided into 10 sectors. The 350 sectors are numbered from 0 to 349. Each sector can store 256 bytes of information. The standard 89,600 bytes of online information can be increased to 179,200 bytes with the dual drive option.
- The total time required to read or write an item of data on a minidiskette consists of two components — the track access time and the disk latency time. The track access time is the time required to

position the read/write head to a specific track on a platter. The disk latency time is the time required for the desired sector to rotate to the read/write head. The staggered (interlaced) arrangement of sequential sectors on a track is transparent to user software and produces a significant savings in total latency time during multi-sector read/write operations. Average times are included in the specifications.

- Files can be maintained on minidiskettes in one (or both) of two modes: Automatic File Cataloging Mode and Absolute Addressing Mode. Automatic File Cataloging includes several BASIC statements and commands which constitute an internal data management system. Catalog mode permits the user to save and load programs or data files 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 a number of BASIC statements which permit the programmer to address specific sectors on disk, and a customized file access method, if desired. Two Absolute Sector mode statements make possible the saving and loading of unformatted data with programmer-specified control information in individual records, where needed.
- Although the minidiskette drive is an extremely reliable device, both cyclic redundancy checks (CRC) and longitudinal redundancy checks (LRC) are made automatically on all data read from a minidiskette. If an LRC error is detected, the system signals an error at once; if a CRC error is detected, a sector is automatically reread four times before an error is signaled. An additional read-after-write verification test can be specified optionally by a programmer via a parameter in the appropriate BASIC statement used to control a minidiskette operation.

The CRT

- The CRT screen brightness and contrast can be adjusted manually via controls on the front of the PCS-II.
- Up to 16 lines with a maximum of 64 characters per line (standard), or 24 lines with a maximum of 80 characters per line (optionally), can be displayed at one time. Once the screen is full, the lines of information scroll; upward when each new line appears at the bottom, the top line disappears.
- The cursor (the sybol indicating where the next character will appear on the screen) can be operated under program control using the eight available cursor-positioning codes; thus, specially formatted displays can be created to increase operator efficiency for particular applications.
- The interactive BASIC language utilizes the CRT for automatic displays of information designed to assist programmers during text entry and debugging operations, and operators during program execution.

The Keyboard

- The dual-mode keyboard can be converted from a standard typewriter keyboard to a BASIC language keyboard by moving the toggle switch in the upper left corner from the standard A/a position to the Keyword/A position. In the A/a position, shifted (SHIFT key depressed) alpha keys produce uppercase letters while unshifted keys produce lowercase letters. In the Keyword/A position, shifted alpha keys produce BASIC words, as labelled, while unshifted keys produce uppercase letters, thereby reducing the number of keystrokes necessary to enter program text. The BASIC words are arranged in logical groups, e.g., FOR, STEP, and NEXT (used to control loops) occupy adjacent keys.
- The keyboard is divided into zones. The largest zone contains the double-duty standard/BASIC keys, plus some operational keys such as TRACE, LIST, LINE ERASE, and RETURN(EXEC). Next in size is the numeric pad which contains the digits (0, 1, ..., 9), the arithmetic operators (+, −, *, /,), the mathematical functions (e.g., SIN, LOG, SQR), and the PRINT key used for immediate mode calculator-type output or as a text entry word. Other keyboard zones contain program control keys (e.g., HALT/STEP, CONTINUE), special function keys for user-defined functions, edit mode keys, the system RESET key, and the PCS-II On/Off toggle switch.
- An optional keyboard clicker provides audio feedback when a key is touched with sufficient pressure to ensure entry of the corresponding character, BASIC word, or command. An experienced typist need not "bottom out" a key to ensure entry, thereby increasing input speed; also, the click lessens the need to verify entry by checking the CRT.

Audio Alarm

- An optional programmable audio alarm is activated via the ASCII Bell code, hexadecimal 07.
- Operator monitoring of the system is minimized when application programs utilize the audio alarm to signal special events, such as the need for input or the completion of a task.

Add-On Equipment

- Either one of the following communications controllers:
- Option 62 Buffered Asynchronous Controller.
- Option 62B Synchronous/Asynchronous Controller provides an interface between the central processor and the RS-232-C connector on the back cover. When a user-supplied modem is plugged into the connector and a data communications program is being executed by the PCS-II, specific tasks are separately and concurrently performed by the controller and the central processor.
- Memory may be expanded from the standard 8,192 (8K) bytes to 32,768 (32K) bytes in 8K-byte increments.
- Additional Minidiskette Drive may be added.

- Any one of the following Wang hardcopy output devices may be plugged into the printer/plotter connector on the back cover:
- The 2221W Line Printer — a 200 characters per second, up to 132 characters per line, 9 x 9 dot matrix impact printer with a full ASCII 95-character set in normal and expanded (double-width) print.
- The 2231W-1 Matrix Character Printer — a 120 characters per second, 112 characters per line, 10-pitch, 7 x 9 dot matrix printer with a 96-charactger ASCII character set.
- The 2231W-2 Matarix Character Printer — a 120 characters per second, 132 characters per line, 12-pitch, 7 x 9 dot matrix printer with a 96-character ASCII character set.
- The 2231W-3 Matrix Character Printer — a 120 characters per second, 132 characters per line, 12-pitch, 7 x 8 dot matrix printer with a 112-character ASCII character set. When used in conjunction with the Model 2282 Graphic CRT, the 2231W-3 provides an accurate hardcopy representation of the graphic information on the CRT.
- The 2231W-6 Matrix Character Printer — a 70 characters per second, 132 characters per line, 12-pitch, 20 x 12 dot matrix printer with a 96-character ASCII character set.
- The 2251 Line Printer — Up to 90 lines per minute and 40 characters per line, 7 x 8 dot matrix impact printer with an extended ASCII 111-character set in normal print on 3¾-inch wide continuous roll paper.
- The 2261W Line Printer — 132 column, 240 lines per minute, bidirectional printer.
- The 2263-1 or 2263-2 Printer — 132 column, 400-600 lines per minute printer.
- The Model 2281P Plotting Daisy Output Writer — a daisy character wheel printer which functions as both a digital plotter and an output writer. It bidirectionally prints an 86-character ASCII character set at a rate of 30 characters per second.
- The 2282 Graphic CRT — 12-inch diagonal measure with dot matrix 800(X) by 512(Y) for dynamic plotting capability. When used with the 2231W-3, a hardcopy of the CRT field is possible.
- The 2272-2 Digital Drum Plotter — a point-by-point or continuous line plotter with fully automatic lettering capability using an ASCII 64-character set in 15 selectable sizes. The 2272-2 three-pen-holder model supports programmably selectable three-color plotting.
- Model 2273-1, 2273-2 Band Printers — provide 250 or 600 lines per minute, 132 characters per line, and operator changeable bands.
- The Model IP41L Image Printer — a non-impact image page printer which provides the user with three fonts and portrait (vertical) and landscape (horizontal) printing capabilities in 10-, 12-, and 15-pitch. The printer prints up to 18 pages per minute.

Software

Wang Laboratories, Inc., maintains and continually expands its comprehensive software library. Information regarding available software is provided upon request.

SPECIFICATIONS

Unit Size
Height ..... 12½ in. (34.3 cm)
Depth ..... 20½ in. (52 cm)
Width ..... 19¾ in. (50.2 cm)

Weight
57 lb (25.8 kg)

Display Size
9 in. diagonal (22.9 cm)

Display Capacity
16 lines, 64 char/line

Character Size
Height ..... 0.125 in. (.32 cm)
Width ..... 0.125 in. (.32 cm)

Minidiskette Drive
Tracks 35
Sectors/Track 10
Total Sectors 350
Bytes/Sector 256
Total Bytes 89,600
Average Access Time ..... 533 ms
Average Latency Time ..... 100 rpm
Speed ..... 300 rpm
Transfer Rate ..... 125 kilobits/sec (15,625 bytes/sec)

Minidiskette
5¼ in. (13.3 cm) diameter with write protect notch

Power Requirements
115 or 230 VAC ± 10%
50 or 60 Hz ± ½ Hz

Wattage
260W

Fuses
3 amp 115V/60 Hz
1.5 amp 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

Memory
8K, 16K, 24K, or 32K

ORDERING SPECIFICATIONS

In one self-contained unit, the PCS-II must include the following components: (1) a dual-mode, zone-arranged, standard/BASIC keyboard providing special function keys to access user-defined functions and system-defined edit mode operations, standard typewriter keys with alternative single-keystroke BASIC words and commands, numeric keys, keys with arithmetic operations and system-defined mathematical functions, mode and off/on switches and a reset key, (2) a 9-inch diagonal CRT supporting displays with 16 lines and 64 characters per line, or 24 lines and 80 characters per line, (3) a minidiskette for high speed, random access data storage operation, (4) a central processor with Wang's interactive BASIC language interpreter in read-only-memory, and at leastl 8,192 bytes of random-access-memory, expandable in 8,192-byte modules to 32,768 bytes, (5) a printer/plotter connector with plug-in compatibility for one of the optional Wang hardcopy output devices, and (6) provision for internal installation of an optional microprocessor-based communications controller or instrument interface controller.

Standard Warranty Applies

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

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