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Options 21, 22, 23 and 24 provide four expansion levels for Wang's standard System 2200S BASIC language instruction set. See Table 1.

Table 1. System 2200S BASIC Language Options

Option	Statements	Relation to Other Options
21	14 Matrix Statements	Lowest level of expansion beyond the standard System 2200S instruction set.
22	14 Matrix Statements 18 Advanced Programming Statements	Second level of expansion -- equivalent to Option 21 plus the Adv. Programming Statements.
23	14 Matrix Statements 18 Advanced Programming Statements 5 General I/O Statements	Third level of expansion -- equivalent to Option 22 plus the General I/O Statements.
24	14 Matrix Statements 18 Advanced Programming Statements 5 General I/O Statements 3 Program Control Statements 6 Sort Statements 23 Disk Statements	Fourth level of expansion -- equivalent to Option 23 plus the Program Control Statements, the Sort Statements, the Disk Statements, and a Performance Package which provides improved program loading speeds.

In the information which follows, each set of statements in Table 1 is described briefly and a list of the particular statements included in each set is given.

MATRIX STATEMENTS

A set of fourteen matrix instructions designed to reduce execution time and use less memory than would be required using the standard System 2200S statements to program 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

The instructions perform matrix input/output and arithmetic operations including addition, subtraction, multiplication, inversion and transposition. Redimensioning of arrays is automatic for arithmetic matrix operations and optional for other matrix operations.

ADVANCED PROGRAMMING STATEMENTS

A set of eleven bit/byte manipulation statements and functions which greatly enhances the System 2200S language capability to operate on alphanumeric and binary data, and a set of seven I/O statements needed to support such peripherals as the Model 2203 Punched Tape Reader, the Models 2234A and 2244A Card Readers, the Model 2207A Teletype Controller, the Model 2262 Digitizer, and the Models 2202, 2212, and 2232A plotters. Also reading and writing of blocked records on tape cassettes are supported.

Bit/Byte Manipulation Statements and Functions

ADD	XOR	INIT	ROTATE
AND	BIN	PACK	UNPACK
OR	BOOL	POS	

I/O Statements

DATALOAD BT	LOAD
DATASAVE BT	SAVE
DATALOAD	PLOT
DATASAVE	

The BOOL instruction is capable of performing any one of 16 different logical (Boolean) operations on two specified arguments. The BIN statement converts the decimal system value of an expression into a binary value and stores the result in a specified alphanumeric variable; the operation is the inverse of the VAL statement in the standard instruction set. The INIT statement sets every byte in one or more specified arguments equal to a specified value; the statement is useful for initializing operations. The POS function provides the capability to scan an alphanumeric variable and find the first position in its value where a particular relationship is satisfied (e.g., <, >, =) with respect to a specified character. The ROTATE statement rotates the bits within each byte of a specified alphanumeric variable a specified number of positions from low-to-high order.

The statements LOAD, SAVE, DATALOAD and DATASAVE in the standard System 2200S support cassette operations only. The seven I/O statements included in the Advanced Programming Statements extend the peripheral support capability of the system to include the devices previously mentioned.

GENERAL I/O STATEMENTS

The five statements included in this instruction set are identified by the following names:

$GIO	$TRAN	$UNPACK
$IF ON	$PACK	

In particular, the $GIO statement is unlike any other BASIC language I/O statement since a technique similar to machine language programming is used to custom-tailor I/O operations in a "general input/output" format which is executable within the framework of the high-level BASIC language. The $GIO statement is required when a Model 2209 Nine Track Tape Drive, a Model 2227B Buffered Asynchronous Communications Controller, or a Model 2228 Communications Controller is used with the System 2200S. Furthermore, the statement can be used to support the operation of non-Wang devices and instruments interfaced to a System 2200S via the Model 2207A, 2227, 2250, and 2252A interface controllers. The $IF ON statement is designed to test the device-ready condition of a specified output device or test the data-ready condition of a specified input device and initiate a branch to a specified line number if a ready condition is sensed. The $TRAN statement provides a high-speed character conversion capability implemented by a table look-up or character replacement procedure. The $PACK and $UNPACK statements are designed to facilitate data packing and unpacking (by fields, delimiters, or Wang's standard record format) between a specified alphanumeric array buffer and specified numeric and/or alphanumeric arguments in an argument list.

PROGRAM CONTROL STATEMENTS

The three statements in this set are COM CLEAR, DEFFN' HEX, and ON ERROR. The COM CLEAR statement can be used to redefine as non-common some or all previously defined common variables or vice versa; the statement is useful for optimization of available memory when overlaying (chaining) programs. With a DEFFN' HEX statement, a HEX function can be used to specify codes for characters not appearing on the keyboard and to associate such characters with a special function key; when the corresponding key is depressed, the characters are entered automatically as program text. The ON ERROR statement provides an error recovery procedure during execution of a BASIC language program; the normal error display is bypassed and execution branches to a specified line number after error code and statement number information is stored in the specified variables.

SORT STATEMENTS

A set of statements which provides byte moving and searching capabilities, extends data byte manipulation and statistical processing capabilities of the System 2200S and, also, provides the capability to execute disk-based sorting operations approximately two to five times faster than using standard 2200S operations. The statements are:

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

DISK STATEMENTS

With the twenty-three statements in this set, the System 2200S can control any of the devices in Wang's complete line of disk drives including the Model 2230-1, 2230-2, 2230-3, and 2260 Fixed/Removable Disk Drives, the Model 2270-1 Single Removable Diskette Drive, the Model 2270-2 Dual Removable Diskette Drive, and the Model 2270-3 Triple Removable Diskette Drive. The disk statements fall into two categories as follows:

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

DATALOAD BA	LOAD DA
DATASAVE BA	SAVE DA
DATALOAD DA	LIMITS
DATASAVE DA	COPY

ORDERING SPECIFICATIONS – OPTION 21

A set of fourteen hardwired BASIC language instructions compatible with Wang's System 2200S Central Processing Unit. The instruction set must perform matrix input/output and arithmetic operations including addition, subtraction, multiplication, inversion and transposition. Array default dimensions must be 10 x 10 bytes with a 16-byte default alphanumeric element size. Redimensioning of arrays must be automatic for arithmetic operations.

ORDERING SPECIFICATIONS – OPTION 22

A set of thirty-two hardwired BASIC language instructions compatible with Wang's System 2200S Central Processing Unit. The instruction set must include 14 matrix input/output and arithmetic operations with array default dimensions 10 x 10 bytes with a 16-byte default alphanumeric element size and automatic redimensioning capability for arithmetic operations. Additionally, there must be 11 bit/byte manipulation operations including a generalized logical (Boolean) instruction capable of performing any one of 16 operations including AND, OR, XOR, EQUIVALENCE, etc. Seven I/O operations must provide support for such peripherals as the Model 2234A and 2244A Card Readers, the Model 2262 Digitizer, the Model 2203 Punched Tape Reader, and Wang's complete line of plotters.

ORDERING SPECIFICATIONS – OPTION 23

A set of thirty-seven hardwired BASIC language instructions compatible with Wang's System 2200S Central Processing Unit. The instruction set must include 14 matrix input/output and arithmetic operations, 11 bit/byte manipulation operations, 7 I/O operations, and 5 additional operations including a generalized input/output instruction capable of performing data input/output/control functions with a programmable signal sequence defined by a technique similar to machine language programming.

ORDERING SPECIFICATIONS – OPTION 24

A set of sixty-nine hardwired BASIC language instructions compatible with Wang's System 2200S Central Processing Unit. The instruction set must include 23 operations providing the capability to maintain files in one (or both) of two modes – Automatic File Cataloging Mode and Absolute Sector Addressing Mode – on Wang's complete line of disk peripherals. Also the set must include 14 matrix input/output and arithmetic operations plus 6 additional matrix operations to perform such functions as convert, copy, merge, move, search, and sort. The set must include 11 bit/byte manipulation operations, 7 I/O operations, and 8 additional operations including a generalized input/output instruction capable of performing data input/output/control functions with a programmable signal sequence defined by a technique similar to machine language programming.

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