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DATA SHEET

Option 5, the SORT ROM, is a Read-Only Memory that includes six matrix statements for flexible and rapid searching, moving and processing data on the System 2200 B or C. 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 statements are:

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

The operation of the six matrix statements is as follows:

STATEMENT	OPERATION
MAT CONVERT	Converts the values in the input numeric array to sort format and stores them in the output alpha array, either in successive elements or in specified fields within each element. Data in sort format have been pre-processed to optimize sort operations.
MAT COPY	Transfers data from the input alpha array byte-by-byte to the output array. The arrays are treated as a contiguous group of bytes without regard to array element boundaries. It can be used to construct new arrays from old, combine or divide elements, move data within arrays and, (using the minus (-) parameters) reverse data within arrays. A portion of an array to be transferred or filled can be specified by using the $<e_1, e_2>$.

OP-5 SORT ROM

STATEMENT	OPERATION
MAT MERGE	Performs a segment of the merge operation typically used in sorts. Each row of the input array A^1 represents a group of sorted records which are to be merged. With each execution of the MAT MERGE statement, part or all of them are merged by storing their subscripts in the output subscript locator array L^2, in order of ascending records. The MAT MERGE statement terminates when either a row of the input array (merge buffer) is depleted or the output subscript locator array is full. At this point, the row can be replenished with new data or the records presently merged can be moved (by a MAT MOVE command) and processed; another merge segment can then be executed. The W^1 argument is a one-dimensional array which contains information to indicate the starting and/or current record to be processed in each row (merge buffer), how a MAT MERGE statement was terminated, and which merge rows are depleted or are to be subsequently ignored. This information is supplied by both the user program and the ROM.
MAT MOVE	Takes all or part of the data from an input alpha array (A^1) and places it in the elements of another array starting with a specified element of an output array (A_0^O). The data are moved in a specified order according to the subscripts given in the locator or subscript array. The scalar (s) can be used to specify the maximum number of elements to be moved and returns the number of elements which are moved. Field expressions (f_1, f_2) can be used to define what part of the input array elements are moved.
MAT SEARCH	Scans the input array for substrings of characters that satisfy the relation defined (<, >, <=,>=, < >, or =) and stores the location of each such substring in the output locator array. The locations are stored in the order in which they are found. The scanned array is treated as a contiguous group of bytes (array element boundaries are ignored) comparing v bytes at a time. The comparison is made on the array at intervals defined by the STEP e_3 value. The number of characters compared is determined by the comparison value, ignoring trailing spaces. A portion of the input array can be searched by using the $<e_1, e_2>$ expressions.
MAT SORT	Takes the elements of the input array and creates an output locator array of subscripts arranged according to the ascending order of the elements from the input array. The input array for MAT SORT cannot exceed 4095 elements. Once the locator array has been created with MAT SORT, MAT MOVE can be used to create a new array in ascending order. The work array and the locator array must have at least as many elements as the input array and have elements of length 2.

FEATURES AND BENEFITS

FEATURES	BENEFITS
1. Subscript *locate mode* arrays are automatically created by MAT MERGE, MAT SEARCH and MAT SORT.	1. Data arrays can stand without alteration while subscript arrays provide pointer information for sort and scan operations. Known as *locate mode,* this is a means to access data by pointing to its location (in this case, its location in an array) instead of moving it.
2. Array element boundaries are ignored in MAT SEARCH and MAT COPY operations.	2. Text editing applications can be efficiently and readily programmed.

FEATURES AND BENEFITS (Continued)

FEATURES	BENEFITS
3. Option hardware provides straightforward MAT statements which do the work of many times the number of standard System 2200 A/B/C BASIC statements.	3. Programs for sorting, merging, scanning and text editing applications can be written which operate substantially faster than equivalent BASIC programs. Sorting can be 5 to 50 times faster for a memory sort and 2 to 5 times faster for a disk sort than equivalent BASIC programs without Option 5.
4. Arrays can be rearranged as needed with the MAT MOVE statement.	4. Defining a subscript array is all that is needed for reordering an entire alphanumeric array. Thus, the input array needs to be scanned once; not many times as would be the case when sorting with the usual techniques.
5. The Sort ROM statements have modular structure.	5. The sort statements typically found in the high level languages of expensive large-scale computers can sort only on a disk. In the System 2200 Sort ROM, sort operations are modularized or broken down into components. A statement is thus provided for each component. This offers much greater flexibility than other machines have, to customize and optimize many sorting operations with various storage media and for general use in applications where byte manipulations are needed.

SYNTAX SPECIFICATIONS

The syntax of the Sort ROM statements is as follows; items in brackets [] are optional, those in braces { } are alternatives (one must be used).

MAT CONVERT N^I TO A^O [(f_1, f_2)]

MAT COPY [-] A^I [(e_1, e_2)] TO [-] A^O [(e_1, e_2)]

MAT MERGE A^I TO W^1, W^2, L^2

MAT MOVE A^I[(f_1, f_2)], L_0^2 [,s] TO A_0^O

or

MAT MOVE N^I, L_0^2 [,s] TO N_0^O

MAT SEARCH A^I[(e_1, e_2)], { < <= >= > = <> } v TO L^2 [STEP e_3]

MAT SORT A^I TO W^2, L^2

Subscripts on array names refer to a single element in that array; superscripts (I, O, 1, 2) refer to input (I), output (O) and the length of each element in an array (1 or 2).

A^I is an input alphanumeric array

A^O is an output alphanumeric array

N^I is an input numeric array

N^O is an output numeric array

L^2 is the locator or subscript array; its elements must be of length 2.

(f_1, f_2) are field expressions (location of starting character of an array element, number of characters to be used in each array element).

e_1, e_2, e_3 are numeric expressions

e_1 must be $0 < e_1 \leq$ bytes in A^I

(e_1 represents the starting byte in an array without regard to array element boundaries.)

e_2 must be $o < e_2 \leqslant$ bytes in $[(A^I - e_1) + 1]$

(e_2 represents the total number of bytes to be used in an entire array.)

e_3 must be $0 < e_3 < 256$

(e_3 represents the number of bytes to be incremented after each operation.)

W^1, W^2 are work arrays which do not need to be directly accessed by the programmer; they must have elements of lengths 1 and 2, respectively.

v is an alpha variable

s is a scalar numeric variable

The optimum input array contains a number of elements slightly above a power of 2.

DATA SHEET

SPECIFICATIONS

Approximate Timings for Internal Operations:	MAT SORT (100 elements) 0.66 sec MAT MERGE (5 x 100 elements) 4.6 sec
SORT ROM VERBS:	MAT CONVERT, MAT COPY, MAT MERGE, MAT MOVE, MAT SEARCH, MAT SORT
Maximum Array Size:	for MAT SORT: 4095 elements.

Equipment Configuration: System 2200B or C required; Option 1, the (scientific) MAT ROM cannot be installed in a system simultaneously with Option 5.

ORDERING SPECIFICATIONS:

The Option 5 SORT ROM must be a Read-Only Memory fully compatible with the Wang System 2200B or C. It must perform the following matrix operations on command from MAT statements: CONVERT, COPY, MERGE, MOVE, SEARCH, SORT. Work arrays used by SORT ROM statements must be accessible by the System 2200 HEXPRINT statement.

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