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COMPUTER SYSTEMS
MASS STORAGE
SORT/MSOS
REFERENCE MANUAL

CONTROL DATA
CORPORATION

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The Mass Storage Sort/MSOS program is included on the library of the Mass Storage Operating System (MSOS) and operates under MSOS on the CONTROL DATA® 3100, 3200, 3300, and 3500 Computer Systems.

The user calls Mass Storage Sort (MSS) into core by the MSOS control card, MSSORT.

1.1 INPUT

The input to an MSS program consists of:

- MSS control cards which describe input and output files and specify collating sequences and orders (ascending or descending) and other information. MSS control cards are placed on the standard input unit.
- Input files (consisting of logical records at least 17 characters long) to be sorted or merged. MSS reads input files and writes output files as directed by MSS control cards. The input files may be on magnetic tape or mass storage. Tape input files must be sequential; in sequential files, records appear on the file in the order in which they are to be read. Mass storage input files may be sequential (unblocked) or linked blocks.

1.2 OPERATIONS

MSS is modularized to permit the following operations:

- Sort; rearranging logical records of one input file into an order described by the user
- Merge-only; combining 2-15 presorted input files into one output file
- Sort and merge; sorting one input file and merging the output with 1-14 presorted files

1.2.1

SORT KEYS

MSS uses sort keys in processing requests for sort-and-merge operations. A sort key is a field which has the same position, relative to record origin, in every record in a file. The contents of the sort key fields of a record determine the position of the record in the output file; the rest of the record is irrelevant. For example, in alphabetizing a file in which the logical records contain names and salaries, only the field which contains the name is a sort key. The user identifies the bounds of sort key fields through MSS control cards; each sort key field has an associated collating sequence and order (ascending or descending).

Each file may have a hierarchy of up to 12 sort keys. The sort keys of a file need not have the same type of collating sequence or order. For example, a file which contains names and salaries may be sorted in descending order according to salary, and the names associated with a given salary may be sorted in ascending alphabetical order. Of the two sort keys, salary field and name field, the salary sort key is major to the name sort key.

When presorted files are to be merged, they must be sorted in the same way; that is, they must have identical hierarchies of sort keys.

1.2.2

TAG RECORDS

The user may request tag record sorting for mass storage input files. Tag record sorting speeds operation and allows several types of output files. When tag record sorting is requested, MSS uses the sort keys to construct a tag record for each logical record in the file. The tag record consists of the address of the first character of the record (block number in file followed by character position in block) followed by the data in the sort key fields for that record.

1.3

OUTPUT FILES

Output files may be on magnetic tape or mass storage. The user may select one of the following types of output files:

- Full record output file; contains the full logical records of the input file arranged in the order specified by the user. A full record output file is required if the output file is on tape, if merge-only or sort-and-merge operations are requested, or if full record sorting is requested. When the user requests tag record sorting for mass storage input files, he may request a full record output file.
- Tag record output file; contains tag records arranged in the order specified by the user. A tag record output file is legal only on mass storage and only when tag record sorting is specified.

- Chained record output file; MSS writes address pointers in the records of the input file to reflect the order produced by the MSS run. A chained record output file must be on mass storage. This type of output file is possible when the first two words of each record of the input file provide space for MSS to write the chain links.

1.4 PROGRAM EXITS

Program exits to modification routines allow deletion, insertion, summarization, record size or content changes, nonstandard label checking and modification, generation of operator messages, and job termination. These previously assembled routines, written by the user, are in relocatable binary on the standard input unit or some other specified unit; they are indicated by control cards.

1.5 RESTART DUMP

MSS provides a restart dump feature which is useful in processing large input files. MSS sorts all files in one pass through the tournament technique; this produces a number of sorted strings of records. These strings are merged in successive passes in the intermediate merge phase of the program. Before each intermediate merge pass and before the final merge, MSS, if requested by the user through a parameter in an MSS control card, writes the results of the last pass on a restart dump file and rewinds the file. If, in the next pass, hardware errors are encountered or the operator terminates the job, the user may request a restart. MSS continues processing, using the contents of the restart dump file as input. This feature eliminates the need for repeating successfully completed passes of the program because of errors encountered in a succeeding pass.

1.6 FILE CONTROL

Tape files (input and output only) may be unlabeled or may have standard or nonstandard header and trailer labels. Mass storage files must be labeled according to MSOS mass storage labeling conventions (appendix C).

The following summarizes user responsibility for file availability:

- Input files (tape or mass storage); must be equipped or opened by the user. The logical records of the input file may be fixed or variable length, blocked or unblocked.
- Two intermediate merge files (always mass storage). The user may allocate and open these files; if he does not, MSS allocates and opens them on MSOS system scratch.

- Restart dump file; if the user requests restart dump, MSS allocates and opens the restart dump file on MSOS system scratch.
- Output file (tape or mass storage); must be equipped or allocated and opened by the user.

1.7 HARDWARE REQUIREMENTS

MSS requires the minimum MSOS configuration. The total mass storage required by the intermediate merge files is approximately twice the size of the input file. When the intermediate merge files are allocated by the user, additional mass storage devices may be required.

Mass Storage Sort/MSOS is a multiphase program composed of:

- Sort monitor
- Edit
- Internal sort
- Intermediate merge
- Final merge

2.1 MONITOR

The sort monitor supervises the phases of the program. It is the communication link between MSS and MSOS. The sort monitor is responsible for program loading and interphase control during the MSS run.

2.2 EDIT

The edit phase reads MSS control cards from the standard input unit, examines the parameters, and determines what portions of the MSS program are required. MSS also checks for parameter validity and prints messages on the standard output unit when it encounters errors or inconsistencies. During the edit phase, MSS logs minor errors on the console typewriter also, giving the operator the option to continue or terminate the program.

2.3 INTERNAL SORT

During the internal sort phase, MSS rearranges the input records (for a tag sort, the extracted sort key records) into sequenced strings and writes the strings onto one of the intermediate merge disk files. These strings vary in length and number.

MSS uses the replacement selection (tournament) technique in sorting. Records or their sort keys are moved into a record storage area from the input buffer. From this time until a record is moved to the output buffer, only a pointer containing the record location is actually moved. In the record storage area, the record sort keys are compared in pairs. The lower ordered record (when descending order is used, the record with a higher value is lower ordered) is the winner of the comparison. The winner of each pair is

compared with the winner of the adjoining pair. MSS continues comparison until it determines the lowest ordered record in the record storage area. This record is moved to the output buffer. A new record from the input buffer replaces the moved record.

If a new record is equal to or higher ordered than the record last moved to the output buffer, the new record is entered in the tournament to determine the next winning record. A new record which is lower ordered than the last record moved to the output buffer automatically becomes a loser and is flagged as being in the next sequence. The current sequence is complete when all the records in the record storage area are lower ordered than the last winning record. When the sequence (string) is complete, its final records are written, and a new sequence is begun.

When MSS reaches the end of the sort input data, it substitutes dummy records for each winning record to fill the record storage area. When the internal sort is completed, control returns to the sort monitor.

During the internal sort phase, before actually moving a new record to the record storage area, MSS takes user exit 1 (section 5.1.1) to allow the user to modify, delete, or insert a record from another file.

2.4 INTERMEDIATE MERGE

During the intermediate merge phase, MSS combines the sequenced strings into successively longer sequenced strings until the number of strings remaining plus the number of presorted merge files is less than or equal to the merge order computed during the edit phase.

Merging is accomplished by a minor modification of the replacement selection technique used by the internal sort. A balanced merge is used; in each merge pass, the strings on one intermediate merge file are merged into longer strings on the other intermediate merge file. Maximum speed is achieved if the two merge files are on different disk packs.

At the beginning of each intermediate merge pass, MSS prints the following message on CTO:

```
I MSSORT 119 MERGE PASS n
      n   Number of merge pass
```

2.5

FINAL MERGE

The final merge phase includes one of several operations possible. For a full record sort, MSS combines the remaining strings from the intermediate merge phase and the presorted merge files into a single sorted string on the output file.

For a tag sort, MSS combines the remaining intermediate strings into a single sorted string. As it forms this string, MSS writes it on the output file if tag record output is specified. If full record or chained record output is specified, MSS uses the tag record to retrieve the data record to which it refers. It then writes this data record either on the output file or, in the case of a chained record, back in its original location on the input file with a new chain address.

For a merge-only operation, MSS combines the presorted merge files into a single sorted output file.

At the beginning of the final merge, MSS prints the following message on CTO:

```
I MSSORT 120 FINAL MERGE
```

2.6

RESTART

The user controls restart dumps through the first primary control card. If the user selects the restart dump option, MSS writes a restart dump at the end of the internal sort phase and after each intermediate merge. After writing the dump, MSS repositions the file to its origin. Thus, only one core dump appears on the restart file at any time. The size of the restart file is determined by the amount of core required by MSS.

2.6.1

OPERATOR ACTION

If a parity or length error occurs on a read during a merge pass and if operator action is specified on the first primary control card, MSS writes on CTO:

```
I MSSORT 110 UNIT xx { READ PARITY  
                      { BUFFER LENGTH }
```

```
A MSSORT 208 ALL KEYS OFF TO REREAD,  
JK6 ON TO RESTART, JK2  
ON TO TERM
```

The operator responds by pressing SELECT JUMP 2 to terminate the run, by pressing SELECT JUMP 6 to restart, or by setting both SELECT JUMP switches (2 and 6) to off for a reread of the record. He then presses MANUAL INTERRUPT, types a slash (/), and presses MANUAL INTERRUPT. MSS resumes processing or terminates according to the option selected.

If the restart option is not chosen at this time, the operator may respond to an accumulation of parity or buffer length errors by pressing SELECT JUMP 5. When SELECT JUMP 5 is set, MSS types the following message on CTO before writing a new restart dump:

A MSSORT 214 TO RESTART SET JK6

To select the restart, the operator sets SELECT JUMP 6. To direct MSS to write the new restart dump and continue processing, the operator sets SELECT JUMP 6 to off. In either case, he then presses MANUAL INTERRUPT, types a slash (/), and presses MANUAL INTERRUPT. MSS then restarts or continues normal processing according to the option selected.

2.6.2

PROGRAMMER ACTION

If an MSS run terminates before completion of the internal sort phase (MERGE PASS 1 or FINAL MERGE PASS has not appeared on CTO), it is necessary to rerun the job from the beginning.

If, after the internal sort phase is complete, the program terminates abnormally either through system or operator action, the program may be restarted from the point at which the last restart dump was taken.

To restart, the user removes any control cards which allocate files, sets SELECT JUMP 6, and resubmits the job as if starting from the beginning.

3.1

PHYSICAL RECORD

Mass storage physical records are addressable units (tracks or sectors). A physical record on magnetic tape is the information contained between two interrecord gaps.

3.2

DATA FILES

Input and output files are composed of fixed or variable length logical records written in binary or BCD mode. Logical records may be blocked or unblocked.

3.2.1

LOGICAL RECORD

A logical record is a group of related facts or fields of information. The user may define logical records as fixed or variable length. All logical records to be processed by MSS must be at least 17 characters long. Fixed length records in a file all contain the same number of characters. MSS merges presorted files composed of fixed length records with presorted files composed of variable length records if the variable length records contain a character count field as the first word of the record. MSS adds a one-word character count to the beginning of each fixed length record to perform the merge.

In variable length records, the number of characters in a logical record is indicated by one of the following:

Character count

A one- to four-character field within each logical record contains the number of characters, including itself, in the record. It must occupy the same relative position in each logical record of a file and may be in binary or BCD mode.

Record mark

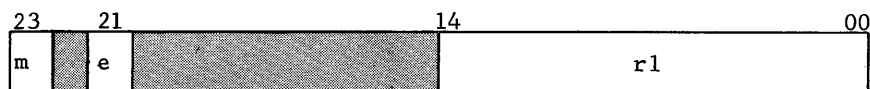
A special mark (72_g) terminates each logical record. When MSS reads this type of record, it adds a one-word character count field as the first word of the record. MSS uses this field (in binary) for internal processing (sort and/or merge). The user may retain this field on the output file by specifying the following on the output file control card (section 4.2.2):

Added length (four characters)	columns 5-8
Change in type of control	column 14
Number of characters in count field (4 if binary, D if BCD)	column 15
Position of count field (0001)	columns 16-19

When the user specifies other than a character count record for the output file, MSS eliminates this field.

Universal

Each logical record has a one-word header.



- m Mode:
 - 1 Binary
 - 0 BCD
- e 1 End-of-file record
 - 0 Data record
- r1 Character length of record, excluding the four characters of the record header

Interrecord gap

Unblocked logical records on a magnetic tape file may be terminated by an interrecord gap. No character count field is necessary for input files. MSS adds a character count field for internal processing as described in record mark type records.

MSS adds the character count fields, when necessary, before taking user exits (chapter 5).

3.2.2 RECORD BLOCK

Record blocks are groups of two or more logical records.

Mass Storage

The user specifies record block size when describing a mass storage file for allocation. The block size is fixed length for a given file and may be no more than 4095 characters long. Setting the block length to a multiple of the physical record size results in optimum use of mass storage.

The first word of each record block on mass storage must contain, in binary, the number of the next logically sequential block in the file. The second word must contain, in binary, the number of characters containing data in the block.

Records may be sequential or chained. In sequential files, records are arranged to be read in succession from record 1, block 1; record 2, block 1; . . . ; record 1, block 2; . . . ; record x, block n. In chained files, each record has a field containing the address (block number followed by the character position in the block) of the next record in sequence. This address must be the first field in the record. The first record in the file must be a dummy containing only the address of the actual first record. The address field in the last record must be all 7's.

Magnetic Tape

Record blocks on magnetic tape may be variable length in multiples of four characters. They must be sequential but do not require the two-word block number and character length described for mass storage. Each record block constitutes a physical record.

3.3 LABELS

Mass storage file labels must conform to the format specified in appendix C. Magnetic tape files may contain standard or nonstandard labels or may be unlabeled.

3.3.1 STANDARD HEADER AND TRAILER LABELS

MSS checks standard header and trailer labels on input files according to information specified on the input file control cards. In addition, the program compares trailer labels with the actual number of physical records read.

For output files, MSS writes standard header and trailer labels according to information specified on the output file control card.

3.3.2 NONSTANDARD HEADER AND TRAILER LABELS

Nonstandard labels occupy one physical record; the user may check nonstandard labels at program exits 1 and 2.

For output files, MSS writes nonstandard header labels according to information specified in the label control card. The user may construct nonstandard trailer labels at program exit 3.

3.4 MERGING PRESORTED FILES

Presorted files may be merged with the sort output during the final merge phase or as a separate job.

Presorted files need not be in the same mode or tape density. The sort keys, however, must be the same mode and size and in the same relative location in the records of each file.

MSS merges files with different logical record types without user modification if:

1. The output file records are character count variable with the character count field as the first word of each logical record, and
2. Any input files with character count variable records have the character count as the first word of each logical record.

If, when merging files with different types or lengths of records, the user requires output file records of a type other than character count variable, he must modify the input records at program exit 1 or 2 to fit the description of the output file.

3.5 INTERMEDIATE MERGE FILES

When sort operations are to be performed, MSS requires two intermediate merge files, each about the length of the input file to be sorted. These files are always on mass storage. The user may allocate and open the intermediate merge files. The greatest speed in operation is achieved when the user allocates each merge file on a different on-line device. In this case, simultaneous read/write is possible and sort time is reduced considerably. If the user does not allocate and open the intermediate merge files, MSS does so. In this case, however, it is generally not possible to assign each file to a different disk pack.

When tape sort input is specified, it is also desirable for the user to allocate and open the intermediate merge files. This allows more efficient use of the disk since MSS cannot determine the length of a tape file and thus cannot accurately allocate mass storage. When MSS allocates the intermediate merge files, MSS releases them prior to the normal termination of its operation.

Sort operations to be run under MSOS require MSOS control cards and MSS control cards.

4.1 MSOS CONTROL CARDS

MSS operates as a batch program under MSOS. The MSOS control statements usually associated with an MSS job are:

SEQUENCE	
JOB	
EQUIP	
RAT	} MSIO-related control statements
FET	
ALLOCATE	
OPEN	
CLOSE	
EXPAND	
RELEASE	
MODIFY	
MSSORT	
EOF	

These statements are described below with specific reference to MSS. More general descriptions of these statements appear in the MSOS Reference Manual.

4.1.1 SEQUENCE

The SEQUENCE card must be the first card of the input deck, unless the MSS job appears in the job stack immediately following a priority job.

SEQUENCE, j

j 1-3 digits; must be present

4.1.2 JOB

The JOB card must immediately follow the SEQUENCE card, or, if there is no SEQUENCE card (when a batch job immediately follows a priority job), JOB must be the first card of the input deck. JOB signals the beginning of a batch job to MSOS.

$\overbrace{7}^{\text{JOB}}$ JOB, c, i, t, NP, ND

- c Account number; 0-8 characters
- i Programmer identification; any number of characters, provided that all parameters appear on a single card
- t Estimated running time in minutes; 1-999
- NP Specifies no system unit protection; when omitted, system unit protection is in effect
- ND Specifies no dump; when omitted, a recovery dump is taken on abnormal termination

4.1.3 EQUIP

All tapes used in the MSS run must be equipped as logical units, through EQUIP statements, before MSS is loaded. All EQUIP statements must appear after the JOB statement and before the MSSORT statement. EQUIP parameters are specified in three forms; any or all forms may appear in a single EQUIP statement.

$\overbrace{7}^{\text{EQUIP}}$ EQUIP, $u_1=MT, u_2=MT, u_3=MT, \dots, u_n=MT$

u_i Logical unit number

MSOS assigns an available magnetic tape to u_i and logs the assignment on the CTO.

$\overbrace{7}^{\text{EQUIP}}$ EQUIP, $u_1=MTCxEyUzz_1, \dots, u_n=MTCxEyUzz_n$

u_i Logical unit number

x Channel number

y Equipment number

zz Unit number

MSOS assigns to u_i the specific tape described by the hardware code CxEyUzz_i.

7 EQUIP, u₁=u₂, ..., u_m=u_n

The logical unit on the left of = is assigned to the same physical unit as the logical unit on the right. The unit on the right of = must have been previously assigned. If the logical unit on the left has been previously assigned, the physical unit is released and the new assignment is made.

4.1.4 EOF

An end-of-file card is the last card of the MSS input deck.

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88

4.1.5 MSIO CONTROL CARDS

The programmer must allocate and open any mass storage input and output files before MSS is loaded. The user may allocate and open the intermediate merge files (section 3.5).

The sequence of control statements for opening mass storage files is:

RAT	Optional
FET	Required
ALLOCATE	Must be present if the file has not been previously allocated; must be omitted if the file has been previously allocated
OPEN	Required

To close a mass storage file, the following statement is required:

CLOSE

MSS automatically closes and releases the restart dump file and the intermediate merge files. The user may close the input and output file at the end of the MSS run. If he does not, MSOS closes them before beginning the next job.

A file must be closed before a user can release it, expand it, or modify its label. The following sequences are required for release, expansion, and modification, respectively:

FET	FET	FET
RELEASE	EXPAND	MODIFY
		FET (optional)

These MSIO control statements are described below. If an optional parameter is omitted, its trailing comma must appear unless no other parameters follow.

RAT The RAT statement enters mass storage devices in the MSOS resident allocation table. ALLOCATE statements cause MSOS to allocate files on the device or devices named in the last preceding RAT statement.

$$\left\{ \text{RAT, dt}_1/\text{dn}_1, \dots, \text{dt}_n/\text{dn}_n \right.$$

dt device type; 852, 853, 854, 813, 814, or 863

dn device number; any positive integer less than 262144_{10}

When the RAT statement names more than one device, MSOS attempts to allocate the file on a device which can contain the file without segmentation. When this is not possible, MSOS segments the file across devices named in the RAT statement, selecting devices so as to create the smallest possible number of segments in the file.

At SEQUENCE time, MSOS clears the resident allocation table. In order to clear the table during a job, the user inserts a RAT statement with a blank parameter field. For example, the following sequence of statements opens files on separate devices:

```

7SEQUENCE
9
7JOB
9
7RAT, dt1/dn1
9
7FET
9
7ALLOCATE
9
7OPEN
9
7RAT
9
7RAT, dt2/dn2
9
7FET
9
7ALLOCATE
9
7OPEN
9

```

The first file is allocated on dt₁/dn₁; the second file is allocated on dt₂/dn₂.

FET FET parameters are used by MSOS to construct a file label for an unallocated file. For an existing file, the FET statement is used to identify the file referenced by a following OPEN, EXPAND, RELEASE, or MODIFY statement.

```

7FET, owner, name, blksize, edition, accsec, modsec
9

```

- owner 1-8 character identification
- name 1-30 character file name
- blksize Number of characters in each data block; for MSS file, may not exceed 4095
- edition Two decimal digits specifying edition number; set to zero if omitted
- accsec 1-4 character access security code; optional
- modsec 1-4 character modification security code; optional

Imbedded blanks are not permitted in the parameters.

ALLOCATE

$\overbrace{9}^7$ ALLOCATE, n, exp, mode, NOSEG, dt

- n Number of mass storage tracks to allocate for the file;
 $1 < n \leq 262143_{10}$ for 852, 853, 854, and 863 devices;
 $1 \leq n \leq 8192$ for 813 and 814 devices
- exp 6-digit decimal integer of the form yymmdd (yy=year,
 mm=month, dd=day) specifying expiration date; if omitted
 the current date is used
- mode S indicates sector mode; any other symbol indicates track
 mode
- NOSEG Specifies contiguous allocation; any other value indicates that
 the file may be segmented
- dt Type of device on which to allocate the file; 852, 853, 854,
 813, 814, or 863

OPEN

$\overbrace{9}^7$ OPEN, fo, use

- fo Unique file ordinal, 1-59, supplied by the user, referenced in
 MSS control cards
- use I indicates read only file; any other symbol indicates read/
 write file

An open file is ready for MSS processing.

CLOSE MSOS processes a CLOSE statement by updating the label of the specified file and releasing associated mass storage tables. The CLOSE statement follows the last card on INP associated with MSS processing (ENDMSS or MSS loader control card).

$\overbrace{9}^7$ CLOSE, fo

- fo File ordinal assigned when the file was opened

RELEASE

RELEASE, n

n	decimal integer	Number of tracks of file to release
	ALL	Release entire mass storage file
	UNUSED	Release all tracks of the file beyond highest written block number

EXPAND With the EXPAND statement, the user can reserve additional space for an existing file.

EXPAND, n, NOSEG

n	Number of additional tracks to allocate for the existing file
NOSEG	Specifies contiguous expansion; any other term indicates that the expansion may be segmented

MODIFY

MODIFY, prot, exp, newfet

prot	Changes file protection indicator in file label
	I Read only indicator
	O Read/write indicator. No other value will change an existing read only indicator.
exp	Changes expiration date of file label; 6-digit decimal integer in the form yymmdd (yy=year, mm=month, dd=day). If omitted or zero, the expiration date in the label is not changed.
newfet	Hollerith character $\neq 0$ Insert the contents of the immediately following FET statement into the file label
	= 0 No FET for label modification follows.

4.1.6
MSSORT

The MSSORT card is an MSOS library name card which directs MSOS to load and give control to the MSS monitor.



4.2
MSS
CONTROL CARDS

MSS control cards provide parameters relevant to the requested sort and/or merge operations.

- Primary Control Cards
- File Control Cards
- Nonstandard Output Label Control Cards
- Collating Sequences Control Card
- Modification Control Cards
- ENDMSS
- MSS Loader Control Cards

4.2.1
PRIMARY

The primary control cards contain fundamental information concerning the sort keys and other options available to the user.

These options include:

- Type of run (sort, merge, sort and merge)
- Type of sort (record, tag)
- Type of output (full record, tag record, chained record)

Primary Control Card 1

This control card is required for all MSS runs.

<u>Card Columns</u>	<u>Contents</u>
1,2	01
3	Type of run; options 2 and 3 are legal only for the record sort or tag sort with full record output options. 1 Sort only 2 Merge only 3 Sort and merge
4	Type of sort; tag is legal only when the input file is on mass storage. 0 Record 1 Tag
5	Parity error option 1 Accept record, print on standard output unit 2 Reject record, print on standard output unit 3 Accept record, do not print 4 Reject record, do not print 5 Stop run; operator may terminate job (set SELECT JUMP 2), restart at beginning of current merge pass if column 7 of primary control card 1 = 0 (set SELECT JUMP 6), or cause reread of record (set all keys to off, press MANUAL INTERRUPT, type a slash (/), press MANUAL INTERRUPT).
6	Buffer length read error 1 Accept record, print on standard output unit 2 Reject record, print on standard output unit 3 Accept record, do not print 4 Reject record, do not print 5 Stop run; operator may terminate job (set SELECT JUMP 2), restart at beginning of current merge pass if column 7 of primary control card 1 = 0 (set SELECT JUMP 6), or cause reread of record (set all keys to off, press MANUAL INTERRUPT, type a slash (/), press MANUAL INTERRUPT).
7	Restart option. When option 1 is chosen, there is no restarting capability. 0 Write restart dump. 1 Do not write restart dump.

<u>Card Columns</u>	<u>Contents</u>
8	Output format (applies to tag sorting only) 0 Full record file 1 Tag record 2 Chained record blank Option not applicable
9	Output tape rewind option R Rewind only U Rewind and unload N No rewind blank Option not applicable
10	Blank
11	End-of-input option (tape input only) 0 Operator control (SELECT JUMP 1 off to signal end of input; SELECT JUMP 1 on to read input from next reel) 1 Reel count control; MSS requests a new input reel until it has read the number of reels specified in the file control card, columns 27, 28. 2 Standard trailer label; MSS requests new input tape when trailer label is EOT; a trailer label of EOF indicates end of input. blank Option not applicable
12-22	Blank

Columns 23-32 describe the major sort key. The order of dominance of sort keys is from left to right; any sort key is major to the following key and minor to a preceding key.

23	Type of collating sequence 1 Standard BCD or user's BCD if collating sequence control card is present 2 3300 internal BCD (blank has lowest value; other characters sort as in type 3) 3 Logical magnitude binary Example: Sort key of two 6-bit bytes, ascending sequence. The lowest number is 0000 ₈ and the largest number is 7777 ₈ . 4 Sign magnitude binary (negative numbers are lower than positive) 5 Numeric BCD. Sign is carried in upper 2 bits of least significant character in the field. Bit configuration 10nnnn is negative; any other configuration is positive. Negative numbers are lower than positive.
----	--

<u>Card Columns</u>	<u>Contents</u>
24	Order of sequence 1 Ascending 2 Descending
25-28	Character length of sort key
29-32	Location of first sort key character relative to first character (0001 = first character) of a logical record; for universal records, the first character of the record header is the first character of the record.

The remaining columns describe additional sort keys as required. All keys have the same construction as the major sort key.

33-42	Second sort key
43-52	Third sort key
53-62	Fourth sort key
63-72	Fifth sort key

Primary Control Card 2

If more than five sort keys are required, this card must be used to describe sort keys 6 through 12. They are constructed the same as the major sort keys.

<u>Card Columns</u>	<u>Contents</u>
1, 2	02
3-12	Sixth sort key
13-22	Seventh sort key
⋮	⋮
63-72	Twelfth sort key

4.2.2 FILE

A file control card describes the file characteristics. One file card is required for each sort and presorted merge input file, the output file, and each of the two intermediate merge files if they are allocated and opened by the user.

<u>Card Columns</u>	<u>Contents</u>
1	1
2	A-Z; file identification character to identify merge input files at program exit 2
3,4	Types of files DS Mass storage sort input DM Mass storage merge input TS Tape sort input TM Tape merge input DO Mass storage output TO Tape output IT Intermediate merge
5-8	Maximum logical record length in characters nnnn. For variable length records, length includes the record character count or record mark (for universal records, length includes the four characters of the record header). For tag and chained records, length includes record address.
9-12	For blocked records, mass storage data block size, or maximum physical record length for tape files, in the form nnnn with leading zeros. For unblocked records, columns 9-11 are blank and column 12 contains U.
13	Record type F Fixed record size V Variable record size
14	Type of variable length record control 0 Record character count 1 Record mark 2 Interrecord gap (tape files only) 3 Universal
15	Size of record character count in 6-bit bytes, 1 to 4 1 to 4 Binary mode A to D (A=1, . . . , D=4) BCD mode
16-19	Location of the first character of the variable record character count field. The location is specified relative to the first character of the record (0001 = first character position of a logical record).

For mass storage files, columns 20-70 have the following meanings:

<u>Card Columns</u>	<u>Contents</u>
20,21	File ordinal (fo) designated by OPEN control card

Columns 22-69 are always required for the intermediate merge files, and are required for the output file when it may be necessary for MSS to expand the output file size. Columns 22-69 are not used for input files.

22-29	Owner (if less than 8 characters, trailing blanks should be used; imbedded blanks are illegal)
30-59	File name (trailing blanks, no imbedded blanks)
60-61	Edition number
62-65	Access security
66-69	Modification security
70	Disk mode (applicable to 852 devices only)
	S Sector
	T Track

For a tape file, columns 20-70 have the following meanings:

20	Blank
21	Tape recording mode
	B Binary
	C BCD
22	Tape density
	H 800 bpi
	M 556 bpi
	L 200 bpi
23,24	Logical unit number of this file
25,26	Alternate logical unit number for this file, used for mounting additional reel when input or output requires more than one. MSS will alternate between the alternate and standard units.
27,28	Number of input reels; optional for sort or presorted merge input tapes (see column 11, primary control card 1)

<u>Card Columns</u>	<u>Contents</u>
29	Label type S Standard N Nonstandard without trailer label T Nonstandard with trailer label X None C Copy input header label onto output tape (legal only for tape output file when sort input file is on tape)
30-58	Standard label description used only when an S is in column 29 30,31 Logical unit number 32-45 File name (14 alphanumeric characters) 46,47 Reel number (2 numeric BCD characters) 48-53 Date written (6 numeric BCD characters, mmddy) 54-55 Edition number (2 numeric BCD characters) 56-58 Retention cycle (3 numeric BCD characters)
59-70	Blank

4.2.3 NONSTANDARD OUTPUT LABEL

These control cards describe a nonstandard label for the output file. They are used only when option T or N is specified in column 29 of the tape output file control card. Maximum size of nonstandard label is 120 characters.

First Label Card

<u>Card Columns</u>	<u>Contents</u>
1,2	30
3,4	Number of characters on card (01-60) used as the first part of label
5-10	Blank
11-70	Contents of label (must start in column 11)

Second Label Card

<u>Card Columns</u>	<u>Contents</u>
1,2	31
3,4	Number of characters on card (01-60) following those in card 30
5-10	Blank
11-70	Contents of label (must start in column 11)

Example:

<u>1</u>	<u>11</u>
3040	CONTROL DATA CORP. PAYROLL PERIOD ENDING
3113	JUNE 15, 1967

4.2.4 COLLATING SEQUENCE

The user may specify an arbitrary collating sequence with this optional control card. The user's collating sequence replaces the standard BCD collating sequence described in appendix B and is used for comparison if type collating sequence 1 is specified in any sort key of primary control cards 1 and 2.

<u>Card Columns</u>	<u>Contents</u>
1,2	00
3	Type of Hollerith conversion E External format I Internal format

Each character is converted from Hollerith to internal BCD. If external format is specified and the fifth bit is 1, the character is reconverted by complementing the sixth bit before inserting the character into the sequence table.

Example:

A, internal format, = 21

If external format is specified, A is reconverted to 61 before being inserted into the collating sequence.

<u>Card Columns</u>	<u>Contents</u>
4-67	64 characters, representing the collating sequence, with the lowest order character in column 4 and each succeeding character major to the preceding character
68	Column 68=S when a short list of characters is to be sorted. The edit program scans the characters in the control card from columns 4 to 67. The end of the list is signaled when a blank is encountered the second time. All characters not accounted for in the control card are sorted as highest if they are encountered during the sort.

Example:

1 2 3 4	68
0 0 1 1 2 3 4 5 6 7	S

**4.2.5
MODIFICATION**

This control card indicates to the MSS program that a user modification routine is to be executed. MSS requires one control card for each routine.

<u>Card Columns</u>	<u>Contents</u>
1,2	60
3	Program exit number (1-3)
4-11	Name of modification routine (1-8 Hollerith characters)
12-16	Decimal number of locations required by user modification routine
17-18	Logical unit number (or file ordinal) containing this user modification routine. If no logical unit number is present, the modification program will be loaded from the standard input unit. The user modification routine may not be loaded from the MSOS library unit.

**4.2.6
ENDMSS**

This must be the last MSS control card. It indicates that all of the control cards have been read and sorting may begin.

```

┌───────────────────────────────────────────────────────────────────────────────────┐
│ 9ENDMSS                                                                 │
└───────────────────────────────────────────────────────────────────────────────────┘

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4.2.7

MSS LOADER CONTROL CARDS

MSS loader control cards, recognized by MSOS, indicate to the loader that user modification routines have been completely loaded. (User routines for program exits 2 and 3 are loaded as one routine.) The format of the MSS loader control cards is:

<u>Card Columns</u>	<u>Contents</u>
1	Punches in rows 12, 11, 0, 1, 2, 3, 7, and 9 (binary card with word count = 77)

The number and position of the MSS loader control cards depends on the number and placement of the user modification routines, as follows:

<u>Placement of Routines for Program Exits</u>	<u>Number of MSS Loader Control Cards</u>	<u>Position of Loader Control Cards</u>
Routine for exit 1 on standard input	1	Follows modification routine deck
Routine for exit 1 on logical unit u	1	Follows ENDMSS control card. An end-of-file mark must appear at the end of the modification routine on logical unit u.
Routines for exits 1, 2, and 3 on standard input	2	One loader control card follows the routine deck for exit 1; one loader control card follows the routine deck for exit 3.
Routines for exits 1, 2, and 3 on logical unit u	2	Two loader control cards follow the ENDMSS control card.

4.3

SAMPLE PROGRAMS

Sort and Merge Run with User Allocated Intermediate Merge Files

In the following sort and merge job, the user allocates and opens the two intermediate merge files, MERGEONE and MERGETWO. The MSS program sorts the mass storage file DUNCAN by the standard BCD collating sequence in ascending order. The result is merged with the mass storage file SCHEER and written on the output file MUSTE. MSS writes a restart dump during the intermediate merge passes and, if a parity or buffer length error is encountered, MSS writes on the CTO:

I MSSORT 110 UNIT xx { READ PARITY }
 { BUFFER LENGTH }

A MSSORT 208 ALL KEYS OFF TO REREAD,
 JK6 ON TO RESTART, JK2 ON
 TO TERM

This gives the operator the option to reread the record, terminate the job, or restart. At the end of the MSS run, the user closes all user-opened files and releases the intermediate merge file.

7
9 SEQUENCE, 024

7
9 JOB, 470, LEVY, 10

7
9 RAT, 852/30

7
9 FET, LEVY, MERGEONE, 0080

7
9 ALLOCATE, 6, , S, , 852

7
9 OPEN, 01, O

7
9 RAT

7
9 RAT, 852/31

7
9 FET, LEVY, MERGETWO, 0080

7
9 ALLOCATE, 6, , S, , 852

7
9 OPEN, 02, O

7
9 FET, LEVY, DUNCAN, 0080

7
9 OPEN, 03, I

7
9 FET, LEVY, SCHEER, 0080

7
9 OPEN, 04, I

7
9 FET, LEVY, MUSTE, 0080

7
9 ALLOCATE, 12, , S, , 852

7
9 OPEN, 05, O

7
9 MSSORT

01315500^^^^^^^^^^^^^^^^1100800001
1AIT0080 ^^^ UF ^^^^^ 01LEVY ^^^^ MERGEONE (22 blanks) 00 ^^^^^^^ S
1BIT0080 ^^^ UF ^^^^^ 02LEVY ^^^^ MERGETWO (22 blanks)00 ^^^^^^^ S
1CDS0080 ^^^ UF ^^^^^ 03LEVY ^^^^ DUNCAN (24 blanks) 00 ^^^^^^^ S
1DDM0080 ^^^ UF ^^^^^ 04LEVY ^^^^ SCHEER (24 blanks)00 ^^^^^^^ S
1EDO0080 ^^^ UF ^^^^^ 05LEVY ^^^^ MUSTE (25 blanks)00 ^^^^^^^ S
9ENDMSS

7
9 CLOSE, 01

7
9 CLOSE, 02

7
9 CLOSE, 03

7
9 CLOSE, 04

7
9 CLOSE, 05

7
9 FET, LEVY, MERGEONE, 0080

7
9 RELEASE, ALL

7
9 FET, LEVY, MERGETWO, 0080

7
9 RELEASE, ALL

77
88

Sort Only Run; Mass Storage Input File, Tape Output File; User Modification
Routine for Exit 1 on Standard Input

7
9 SEQUENCE, 126

7
9 JOB, 470, FE, 10

7
9 EQUIP, 01=MTC0E3U06

7
9 FET, DALE, SELBY, 400, 01, LI, PO

7
9 OPEN, 02, I

7
9 MSSORT

Primary Control Card 1
File Control Card (for input)
File Control Card (for output)
Nonstandard Output Label Control Card 1
Nonstandard Output Label Control Card 2
Modification Control Card (Exit 1)
9ENDMSS
User Modification Routine for Exit 1
77
88

5.1
PROGRAM EXITS

MSS provides three program exits to user-written modification routines. The modification routines must have been assembled previously into relocatable binary form and must consist of one subprogram with no external linkage except to the SORT entry point and to system entry points. These routines may verify or modify labels, change the contents or size of logical records, insert or delete logical records, summarize logical records, or generate operator messages. Input/output operations requested by the user must be handled by MSOS. The program exits occur as follows:

- Exit 1 The logical record or the label has been read and is ready to be passed to the internal sort phase.
- Exit 2 The logical record or the label of a presorted merge input file has been read and is ready to be merged.
- Exit 3 The logical record or the label is ready to be moved to the final output buffer.

The user must supply one modification control card (section 4.2.5) for each program exit required. When a request occurs, the edit phase tabulates the information to ensure loading during the correct phase.

Contents of register file locations 50g-60g must be saved and restored by the user if they are used during execution of a modification routine.

Each modification routine must be written as a single, closed subroutine with an eight-word transfer vector. The first word of the transfer vector is the entry point in the transfer card (there may be only one named transfer point in each routine).

(entry 1)	name	UJP	**
		UJP	address of user logical record checking routine
(entry 2)	+2	UJP	**
		UJP	address of user header label routine
(entry 3)	+4	UJP	**
		UJP	address of user trailer label routine
(entry 4)	+6	UJP	**
		UJP	address of user routine for end of input
	name	entry point name of the modification routine for a specific exit	

When control transfers to the user, an RTJ from MSS places the normal return address in the specified entry (name, name+2, name+4, name+6) to the modification routine.

MSS enters the modification routine for each of the four options that is applicable for a given exit. The normal return is to the address of the UJP at the respective entry point. This address is incremented by one or two in order to select alternate returns.

MSS accepts logical records in the format described in the output control card. For example, if the output file records are variable length and the input fixed, a character count or record mark must be added to the input record by the user at a program exit when the record is read. MSS does not verify the logical record size and format upon return from any user program exit. It is, therefore, the user's responsibility to ensure that inserted or modified records conform.

5.1.1 EXIT 1

MSS takes this exit after reading each logical input record into the input buffer but before entering it into the sort routine, after reading each tape header or trailer label, and again at the end of input.

Entry 1 Logical Record

Logical records may be accepted (unmodified or modified) by a normal return, inserted by adding one to the normal return address, or deleted by adding two to the normal return address. When the routine is entered, the A register contains the character address of the record just read and the Q register contains the length of the record.

If a record is to be accepted, modified (except for a length increase), or deleted, the A and Q register should have the same contents at exit as when the routine was entered. When a record is to be lengthened, the user must assemble it in a work area and must modify the A and Q registers to reflect the new record address and length.

Similarly, an inserted record must be read into a user area and the A and Q registers modified to reflect its address and length.

MSS enters an inserted record into the sort routine and then returns to the user exit with the A and Q registers set to the address and length of the record just read from the input file. The same record is referenced each time this exit is taken until it is either accepted or deleted.

Entry 2 Header Label (Tape)

A standard or nonstandard header label may be accepted by a normal return, rechecked by adding one to the normal return address, or rejected by adding two to the normal return address. If the recheck option is taken, the operator is instructed to mount a new tape. The reject option terminates the job.

Entry 3 Trailer Label (Tape)

A standard or nonstandard trailer label may be accepted by a normal return or rejected (terminating the job) by adding one to the normal return address.

Entry 4 End of Input

The end-of-input exit occurs at the completion of reading all sort input and before completion of the internal sort. Sorting continues when the normal return is taken. Logical records may be inserted by adding one to the normal return address, or the job may be terminated by adding two to the normal return address. Logical records are inserted in the same way as in entry 1. MSS takes this exit after each record insertion until a continue or termination return is executed.

5.1.2 EXIT 2

MSS takes this exit after reading each logical record from a presorted merge input file (for either a sort/merge or merge only run), but before entering the record into the merge routine. MSS also takes this exit after reading each tape header or trailer label and at the end of input for each file.

Entry 1 Logical Record

Logical records may be accepted (unmodified or modified) by a normal return, inserted by adding one to the normal return address, or deleted by adding two to the normal return address. When the routine is entered, bits 23-18 of the A register contain the file identification character from column 2 of the file control card, bits 16-00 of A contain the character address of the record just read, and the Q register contains the length of the record.

Records may be accepted, modified, inserted, or deleted as in entry 1, exit 1. If the user elects to assemble logical records within his modification routine, he must provide a separate work area for each merge input file. MSS saves the address returned in the A register and does not move the record until it has been merged and transferred to the output buffer. This transfer takes place after the modification routine for exit 3, if any, has been executed.

Entry 2 Header Label (Tape)

The description of entry 2, exit 1 applies to this entry also.

Entry 3 Trailer Label (Tape)

The description of entry 3, exit 1 applies to this entry.

Entry 4 End of Input

The end-of-input exit occurs at the completion of all merge input data from each merge input file. Merging may be continued by a normal return, or the job may be terminated by adding two to the normal return address. The user may insert logical records by adding one to the normal return address and following the procedure described for entry 1, exit 1. This exit is taken after each record insertion until a continue or termination return is executed.

5.1.3 EXIT 3

MSS takes this exit after merging each record but before moving the record to the final output area. The user has the option of accepting control before each logical record is written, at the end of the job and, for a tape output file, before each header or trailer label, end of reel, or end-of-file is written.

Entry 1 Logical Records

Logical records may be accepted (modified or unmodified) by a normal return, inserted by adding one to the normal return address, or deleted by adding two to the normal return address.

Record modifications at this exit are limited; neither the sort key nor the record length may be changed.

When MSS takes this exit, bits 16-00 of the A register contain the character address of the current record and bits 16-00 of the Q register contain the character address of the immediately preceding record. Index register 3 contains zero when the sort keys of these two records are equal. This provides a way for the user to obtain a summary of sorted output (for example, by number of occurrences of records with identical sort keys) by summarizing into the previous record and deleting the current record for equal keys.

For all normal returns, the character address of the current record must be in the A register and the character address of the previous record in the Q register.

A logical record, which must agree with the description in the output file card, may be inserted by placing its character address in A, the number of characters in index register 1, and the character address of the previous record in the Q register before taking the insert return. These records must not cause a sequence error in the final output. MSS accepts the inserted record for transfer to the final output area and then returns to this exit with the A and Q registers set to the same addresses of current and previous records as before the insert return was taken. MSS refers to these two records each time this exit is taken until the current record is either accepted or deleted.

Entry 2 Header Label (Tape)

At this entry the user may change or replace a standard or nonstandard header label after it has been generated but before it is written. The first word address (fwa) of the label appears in the A register and the label character length in the Q register. Upon normal return, MSS writes the label whose fwa and length are in the A and Q registers. The user may terminate the job by adding one or two to the normal return address.

Entry 3 Trailer Label

Upon entry to the user modification routine, the A register is positive for the end of an intermediate output reel or negative for the final output reel. The user may change the contents of the trailer label before taking either return. If the normal return is elected, MSS requests a new output reel when required and continues the sort or merge to completion. A sort or merge may be terminated at the end of any final output reel by adding one to the normal return address. The word address of the trailer label must be in the A register and the character length in the Q register before either return is taken.

Entry 4 End of Job

The job is complete. When the user returns from this exit, MSS returns control to MSOS.

5.2 SUMMARY OF EXITS

The following tables summarize the structure and use of MSS program exits.

EXITS 1 AND 2

To User At	Return	Description	Contents When Control Returns to Sort†	
			A Register	Q Register
Entry (logical record)	Normal	Accept logical record	Character address of logical record††	Character count (binary)
	p+1	Insert record	Character address of insert record	Character count (binary)
	p+2	Delete logical record		
Entry+2	Normal	Accept header label	Word address of header label	Character count (binary)
	p+1	Retry with new tape		
	p+2	Reject label and terminate job		
Entry+4	Normal	Accept trailer label	Word address of trailer label	Character count (binary)
	p+1	Reject label and terminate job		
Entry+6	Normal	Continue sort		
	p+1	Insert record	Character address of input record	Character count (binary)
	p+2	Terminate job		

†When the user receives control, the information in the A and Q registers is the same as indicated for all normal returns.

††When the user receives control at entry from exit 2, bits 23-18 of the A register contain the file identification character.

EXIT 3

To User At	Return	Description	Contents When Control Returns to Sort †		Index Register 1
			A Register	Q Register	
Entry (logical records)	Normal	Accept logical record	Character address of current record	Character address of previous record	Number of characters in current logical record
	p+1	Insert logical record	Character address of insert record	Character address of previous record	Number of characters in logical record to be inserted
	p+2	Delete logical record			
Entry+2 (header label)	Normal	Accept header label	Word address of header label	Character count (binary)	
	p+1	Terminate job			
	p+2	Terminate job			
Entry+4 (trailer label with end of reel or output flag)	Normal	Accept trailer label	Word address of trailer label Bit 23=0 End of reel Bit 23=1 End of final output reel	Character count (binary)	
	p+1	Terminate output	Word address of trailer label	Character count (binary)	
Entry+6 (end of job)	Normal	Return control to MSOS			

† When the user receives control, the information in the A and Q registers is the same as indicated for all normal returns.

APPENDIX SECTION

This appendix lists MSS messages appearing on CTO followed by messages appearing on OUT.

OPERATOR RESPONSE PROCEDURE

Many MSS messages present options to the operator. The options which the operator may select are described in the ACTION paragraphs following the message description. Unless otherwise stated in the description, the operator, after performing any of the actions described in the ACTION paragraphs, always returns control to MSS through the following manual interrupt procedures:

1. Press MANUAL INTERRUPT.
2. Type a slash (/).
3. Press MANUAL INTERRUPT.

MESSAGES ON CTO

MSS messages on CTO have the following format:

prefix	MSSORT	error code	description
prefix	A		Action message; operator action is required.
	D		Destructive message; a serious or fatal error condition has been encountered (operator action may be required).
	I		Informative; MSS has initiated or completed some action or has encountered an error condition (operator action may be required).
error code			Three decimal digits associated with the error description
description			Description of type of error or condition encountered or of operator action required

The MSS messages on CTO are listed below in alphanumeric order:

A MSSORT 200 STACKER FULL

The card reader stacker is full.

ACTION: Clear the card reader.

A MSSORT 201 ABOVE ERRORS MAY BE IGNORED TO PROCEED SET JK3 ON

Only minor errors (listed above this message on CTO and OUT) were detected during the edit phase.

ACTION: To continue the job, press SELECT JUMP 3.

A MSSORT 202 JK2 OFF TO REREAD - ON TO TERM

The operator option for read parity or buffer length error was chosen and there is no restart capability.

ACTION: To terminate the job, set SELECT JUMP 2. To reread the record, return to MSS through the manual interrupt procedures with SELECT JUMP 2 off.

A MSSORT 203 UNIT uu EOT. JK1 ON FOR EOT, OFF FOR EOF.

MSS detected an end-of-file mark on a sort input file and the user has requested operator control for the end-of-input option.

ACTION: If there is another reel of input for a multireel file, set SELECT JUMP 1. MSS prints a message to mount the next reel.

If there is not another input reel, return to MSS through the manual interrupt procedures with SELECT JUMP 1 off.

A MSSORT 204 UNIT uu. MOUNT NEXT INPUT REEL

The operator signaled the existence of another reel of input, or MSS read an EOT trailer label on a sort or merge input and the end-of-input option is standard trailer label control.

ACTION: Mount next reel.

A MSSORT 205 JK1 ON TO ACCEPT, OFF TO TERMINATE

MSS detected an error in a trailer label.

ACTION: To accept the label as read and continue the job, set SELECT JUMP 1.

To terminate the job, return to MSS through the manual interrupt procedures with SELECT JUMP 1 off.

A MSSORT 206 JK1 ON TO ACCEPT

JK1 OFF AND —
JK2 ON TO RETRY
JK2 OFF TO TERM

MSS encountered a header label error.

ACTION: To accept the label as read and continue the job, set SELECT JUMP 1.

To reread the label, set SELECT JUMP 1 off and SELECT JUMP 2 on.

To terminate the job, return to MSS through the manual interrupt procedures with both SELECT JUMP 1 and SELECT JUMP 2 off.

NOTE: For messages requiring operator response, see the operator response procedure on page A-1.

A MSSORT 207 RECORD COUNTS DO NOT AGREE, SET JK3 ON TO CONTINUE, OFF TO DELETE JOB

MSS encountered a discrepancy between the record count at the end of one pass and the record count at the end of a preceding pass.

ACTION: To accept the discrepancy, set SELECT JUMP 3.

To terminate the job, return to MSS through the manual interrupt procedures with SELECT JUMP 3 off.

A MSSORT 208 ALL KEYS OFF TO REREAD, JK6 ON TO RESTART, JK2 ON TO TERM

The user-selected operator control for parity or buffer length error.

ACTION: Set SELECT JUMP 6 on to restart; set SELECT JUMP 2 on to terminate the job; set both jump keys to off to reread the record.

A MSSORT 209 UNIT uu. FILE y. EOT. JK1 ON FOR EOT OFF FOR EOF

MSS detected an end-of-file mark on a merge input file, and the user specified operator control for the end-of-input option.

ACTION: To signal the existence of another reel of input, set SELECT JUMP 1.

If there is not another input reel, return to MSS through the manual interrupt procedures with SELECT JUMP 1 off.

A MSSORT 210 UNIT uu. MOUNT O/P TAPE

MSS has begun the final merge pass and is ready to write on the final output tape.

ACTION: Mount tape on requested unit.

A MSSORT 211 INTERPHASE RECORD COUNTS DO NOT AGREE. SET JK3 ON TO CONTINUE OFF TO DELETE THE JOB

The record count at the end of the merge does not agree with the combined records counts of the sort phase.

ACTION: To accept the discrepancy and continue the job, set SELECT JUMP 3. To terminate the job, return to MSS through the manual interrupt procedures with SELECT JUMP 3 off.

A MSSORT 212 NON-RETRIEVABLE REC, MI/MI TRIES AGAIN

MSS encountered an error in attempting to read a record from an input file for full record output from tag sort.

ACTION: To reread the record, return to MSS through the manual interrupt procedures.

To terminate the job, use the MSOS batch termination procedure: press MANUAL INTERRUPT; type TERM,F; press MANUAL INTERRUPT. Do not follow this message with the normal manual interrupt procedures for returning to MSS.

NOTE: For messages requiring operator response, see the operator response procedure on page A-1.

A MSSORT 213 MSS RESTART ENTERED — CLEAR JK6

MSS is ready to restart.

ACTION: Set SELECT JUMP 6 off.

A MSSORT 214 TO RESTART SET JK6

This message appears before MSS writes a new restart dump when SELECT JUMP 5 is set.

ACTION: To prevent a new restart dump and restart the program with the contents of the last dump, set SELECT JUMP 6.

To continue processing, set SELECT JUMP 6 to off and return to MSS through manual interrupt procedures. MSS writes a new restart dump and resumes normal processing.

A MSSORT 215 CANNOT RESTART - MI/MI TO CONTINUE

MSS attempted to restart, but the restart dump file contains errors.

ACTION: To continue the program without restarting, return to MSS through normal manual interrupt procedures.

To terminate the job, use the MSOS batch termination procedures: press MANUAL INTERRUPT; type TERM, F; press MANUAL INTERRUPT. Do not follow this message with the manual interrupt procedures for returning to MSS.

A MSSORT 216 ENTER DEVICE TYPE OF INTERMEDIATE MERGE FILES, MI/DT, MI

1311=40, 852=41, 853=50, 854=51, 813=60, 863=70

MSS is beginning a restart and needs to know the device type of user-allocated intermediate merge files.

ACTION: Press MANUAL INTERRUPT, type a slash (/), type appropriate code for device type, press MANUAL INTERRUPT. Do not follow this message with manual interrupt procedures for returning to MSS.

A MSSORT 217 UNIT uu NOT READY

Unit uu is not ready.

ACTION: Ready unit.

D MSSORT 001 LOADER ERROR

The MSS sort monitor encountered an error in loading subprograms or modification routines. The job is terminated.

D MSSORT 002 JOB DELETED

When major errors occur or the operator accepts an option to terminate the job, this message appears following the edit phase diagnostics.

NOTE: For messages requiring operator response, see the operator response procedure on page A-1.

D MSSORT 003 FO fo INSUFFICIENT MERGE AREA AVAILABLE

MSS is unable to expand the intermediate merge files to meet the requirements of the job. fo is the ordinal of the first intermediate merge file which MSS unsuccessfully attempts to expand. The job terminates.

D MSSORT 004 LOCATE ERROR

MSS encountered an error in attempting to locate for a mass storage read or write request. The error may be due to incorrect information in a user file control card. The job terminates.

D MSSORT 005 OUT OF SEQUENCE

Input records are not in sequence according to the sort keys specified. The job terminates.

D MSSORT 006 UNENDING MERGE

During each merge pass, MSS determines if the number of sequences is less than the number for the preceding merge pass. If it is not, an unending merge condition has been encountered and the job terminates.

D MSSORT 007 END OF INT MERGE DISK FILE, SYSTEM ERROR

A status check on write operation indicates end-of-tape; since the intermediate merge file is a disk file, this condition should not occur. The job terminates.

D MSSORT 008 CANNOT RESTART — INSUFFICIENT FOS

MSS cannot open the restart file because no file ordinals are available to assign to it. The job terminates.

D MSSORT 009 IRRECOVERABLE WRITE ERROR

MSS attempted an MSIO WRITE function but cannot complete it because:

1. The request is to write on a read-only file.
2. The request specifies an illegal file ordinal.
3. An irrecoverable I/O error occurred.

The job terminates.

I MSSORT 100 RCC PARAMS IGNORED IF UNBLOCKED, RCD MARK CONTROL OR UNIVERSAL

The user specified record character count field parameters in a file control card and also specified that the file contains unblocked, record mark or universal records. MSS ignores the character count information.

I MSSORT 101 INSUFFICIENT INTERNAL MERGE FILES SPECIFIED

The user allocated only one intermediate merge file. MSS allocates the additional intermediate merge file and continues processing.

I MSSORT 102 SEQ TABLE — xx CHARS

The user included a collating sequence control card which contains less than 64 characters and does not contain an S in column 68. xx is the number of character in the user's collating sequence.

I MSSORT 103 SI CD ILLEGAL

The user specified a merge-only run but included a sort input file control card. The card is ignored and the job continues.

I MSSORT 104 NS OP LABEL CD IGNORED

The output file control card label option specifies S, X, or C; a nonstandard output label control card is ignored.

I MSSORT 109 MI CDS ILLEGAL

The user specified a sort-only run but included merge input file control cards. The cards are ignored and the job continues.

I MSSORT 110 UNIT xx { READ PARITY
BUFFER LENGTH }

MSS encountered a parity error in five attempts to read a record or encountered a buffer length error. According to the options selected in the primary control card, MSS accepts or rejects the record or writes an additional message on the CTO specifying operator options.

I MSSORT 111 nnnn IN

MSS read nnnn records in the current pass.

I MSSORT 112 nnnn ADDED

A modification routine added nnnn records.

I MSSORT 114 nnnn OUT

MSS wrote nnnn records. This message appears after the internal sort phase and after the final merge phase; this message also appears after any intermediate merge pass when the number of records written differs from the number of records read.

I MSSORT 115 nnnn SEQ

MSS generated nnnn sequences (strings) during the internal sort phase.

I MSSORT 116 nnnn DUMPED

MSS wrote nnnn records on the restart dump file.

I MSSORT 117 UNIT uu. FINAL OUTPUT REEL xx.

The final output reel xx on unit is complete.

I MSSORT 118 xx INTERMEDIATE MERGE PASSES

xx intermediate merge passes are required for this sort run.

I MSSORT 119 MERGE PASS n

MSS has completed merge pass n.

I MSSORT 120 FINAL MERGE

MSS has begun the final merge pass.

I MSSORT 121 FO fo IS MERGE INPUT

MSS identifies each merge input file with this message.

I MSSORT 122 $\left\{ \begin{array}{l} \text{RECORD} \\ \text{BLOCK} \end{array} \right\}$ CNT EXCEEDS MAX

The block or record count exceeds the maximum specified. MSS writes the record or the block on OUT and continues processing.

I MSSORT 123 RCD EXTENDS PAST END OF BLOCK

The record size exceeds the maximum specified. MSS writes the record on OUT and continues processing.

I MSSORT 124 NO RESTART DUMP

MSS detected a parity error when writing the restart dump. The program continues, but there is no restarting capability until the next restart dump is written successfully.

I MSSORT 125 CANT ALLOCATE, OPEN — NO RESTART DUMP

MSS is unable to allocate or to open a restart file; therefore, no restart dumps will be taken and there is no restarting capability.

I MSSORT 127 UNIT uu LABEL ERROR

LABEL READ

(label read)

LABEL EXPECTED

(label expected)

MSS found a discrepancy in comparing the standard header or trailer label read with the label expected. The error occurred on unit uu.

I MSSORT 128 UNIT uu WRITE PARITY

MSS made five unsuccessful attempts to write a record on unit uu.

MESSAGES ON OUT

MSS messages on OUT are listed below in alphabetical order.

ABOVE ERRORS MAY BE IGNORED TO PROCEED SET JK3 ON

Only minor errors (used above this message on OUT and CTO) were detected during the edit phase.

ACTION: To continue the job, press SELECT JUMP 3.

mnnn ADDED

A modification routine added mnnn records.

ASSUMED ENDMSS CARD

MSS encountered a type 9 card which was not ENDMSS. The card encountered is listed on OUT, and MSS assumes an ENDMSS card.

BLOCK CNT EXCEEDS MAX

The block count exceeds the maximum specified. MSS writes the block on OUT and continues processing.

CANNOT RESTART — INSUFFICIENT FOS

MSS cannot open the restart file because no file ordinals are available to assign to it. The job terminates.

CANNOT RESTART — MI/MI TO CONTINUE

MSS attempted to restart, but the restart dump file contains errors.

ACTION: To continue the program without restarting, return to MSS through normal manual interrupt procedures.

To terminate the job, use the MSOS batch termination procedures: press MANUAL INTERRUPT; type TERM, F; press MANUAL INTERRUPT. Do not follow this message with the manual interrupt procedures for returning to MSS.

CANT ALLOCATE, OPEN — NO RESTART DUMP

MSS is unable to allocate or to open a restart file; therefore, no restart dumps will be taken and there is no restarting capability.

COPY OPTION INV

The output file control card specifies the copy option, but the input file control card (or the first merge file control card for a merge-only run) specifies no label. The erroneous control card appears on OUT and the job terminates.

NOTE: For messages requiring operator response, see the operator response procedure on page A-1.

nnnn DUMPED

MSS wrote nnnn records on the restart dump file.

DUP CD TYPE

Certain control cards, such as the primary control card, may appear only once in the input deck. When MSS encounters duplicates of these cards, the first card read is accepted and the duplicates are ignored.

DUP FILE ID

Merge input file control cards contain duplicate identifiers in column 2. This is a minor error and MSS writes another message, giving the operator the option to continue or terminate the job.

END OF INT MERGE DISK FILE, SYSTEM ERROR

A status check on write operation indicates end-of-tape; since the intermediate merge file is a disk file, this condition should not occur. The job terminates.

ENTER DEVICE TYPE OF INTERMEDIATE MERGE FILES, MI/DT, MI

1131=40, 852=41, 853=50, 854=51, 813=60, 863=70

MSS is beginning a restart and needs to know the device type of user-allocated intermediate merge files.

ACTION: Press MANUAL INTERRUPT, type a slash (/), type in appropriate code for device type, press MANUAL INTERRUPT. Do not follow this message with manual interrupt procedures for returning to MSS.

EOF ERR

MSS encountered an end-of-file out of sequence on the standard input unit. The job terminates.

FILE PARAM MISSING OR INVALID parameter

A parameter in a file control card is missing or invalid. The parameters appearing in the message are:

ALT LOGICAL UNIT	Alternate logical unit
FILE IDENT CHARACTER	File identification character
LABEL DATE	Standard label date
LABEL LOGICAL UNIT	Standard label logical unit
LABEL TYPE	

NOTE: For messages requiring operator response, see the operator response procedure on page A-1.

LOGICAL UNIT	Logical unit number of this file
MAX LOGICAL RCD LEN	Maximum logical record length
MAX PHYSICAL RCD LEN	Mass storage data block size, or maximum physical record length for tape files
NUM INPUT REELS	Number of input reels
RECORD MARK CONTROL	
RECORD TYPE	
REEL SEQUENCE NUMBER	
FILE ORDINAL	
UNIVERSAL-OPFILE	Universal record specified for output file; input records are not universal
RETENTION COUNT	Standard label retention code
SORT IP LOGICAL UNIT/ FILE ORDINAL	File ordinal or logical unit number for sort input file
TAPE DENSITY	
TAPE MODE	
VAR REC CHARA CNT MODE	Variable record character count mode
VAR REC CHARA CNT POS	Location of first character of variable record character count field
VAR RCD CHARA CNT SIZ	Variable record character count size

The erroneous control card is printed on OUT following this message. The job terminates.

FINAL MERGE

MSS has begun the final merge pass.

FO fo INSUFFICIENT MERGE AREA AVAILABLE

MSS is unable to expand the intermediate merge files to meet the requirements of the job. fo is the ordinal of the first intermediate merge file which MSS unsuccessfully attempts to expand. The job terminates.

FO fo IS MERGE INPUT

MSS identifies each merge input file with this message.

nnnnIN

MSS read nnnn records in the current pass.

INSUFFICIENT INTERNAL MERGE FILES SPECIFIED

The user allocated and opened only one intermediate merge file. MSS opens the additional file and the job continues.

INSUFFICIENT MERGE AREA AVAILABLE

MSS cannot allocate the intermediate merge files. The job terminates.

xx INTERMEDIATE MERGE PASSES

xx intermediate merge passes are required for this sort run.

INTERPHASE RECORD COUNTS DO NOT AGREE. SET JK3 ON TO CONTINUE OFF TO DELETE THE JOB

The record count at the end of the merge does not agree with the combined record counts of the sort phase.

ACTION: To accept the discrepancy and continue the job, set SELECT JUMP 3. To terminate the job, return to MSS through the manual interrupt procedures with SELECT JUMP 3 off.

INV CARD ID

The control card identification in columns 1 and 2 is invalid. The erroneous card is listed on OUT and the job terminates.

IRRECOVERABLE WRITE ERROR

MSS attempted an MSIO WRITE function but cannot complete it because:

1. The request is to write on a read-only file.
2. The request specifies an illegal file ordinal.
3. An irrecoverable I/O error occurred.

The job terminates.

JK1 ON TO ACCEPT

JK1 OFF AND —

JK2 ON TO RETRY

JK2 OFF TO TERM

MSS encountered a header label error.

ACTION: To accept the label as read and continue the job, set SELECT JUMP 1. To reread the label, set SELECT JUMP 1 off and SELECT JUMP 2 on. To terminate the job, return to MSS through the manual interrupt procedures with SELECT JUMP 1 and SELECT JUMP 2 off.

NOTE: For messages requiring operator response, see the operator response procedure on page A-1.

JK1 ON TO ACCEPT, OFF TO TERMINATE

MSS detected an error in a trailer label.

ACTION: To accept the label as read and continue the job, set SELECT JUMP 1.

To terminate the job, return to MSS through the manual interrupt procedures with SELECT JUMP 1 off.

JK2 OFF TO REREAD — ON TO TERM

The operator option for read parity or buffer length error was chosen and there is no restart capability.

ACTION: To terminate the job, set SELECT JUMP 2. To reread the record, return to MSS through the manual interrupt procedures with SELECT JUMP 2 off.

JOB DELETED

When major errors occur or the operator accepts an option to terminate the job, this message appears following the edit phase diagnostics.

LABEL CHR CT ERR

The character count on the nonstandard output label control card is non-numeric. The erroneous control card is listed on OUT and the job terminates.

LOADER ERROR

The MSS sort monitor has encountered an error in loading subprograms or modification routines. The job terminates.

LOCATE ERROR

MSS encountered an error in attempting to locate for a mass storage read or write request. The error may be due to incorrect information in a user file control card. The job terminates.

NO NS OP LABEL CD

The file control card specified nonstandard labeling but there is no nonstandard label control card. The job terminates.

NO OP CD

The output file control card is missing. The job terminates.

NO RESTART DUMP

MSS detected a parity error when writing the restart dump. The program continues but there is no restarting capability until the next restart dump is written successfully.

NOTE: For messages requiring operator response, see the operator response procedure on page A-1.

NO SI CD

The primary control card specifies a sort-only or sort-and-merge run, but there is no sort input file control card. The job terminates.

NO SRT KEYS

Columns 23-32 of the primary control card are blank. The erroneous card is printed on OUT and the job terminates.

MSS RESTART ENTERED — CLEAR JK6

This message indicates that MSS is ready to restart.

ACTION: Set SELECT JUMP 6 off.

NEED EXIT 1

Input and output records are not the same type and the user modification routine required at exit 1 in this situation is missing. The job terminates.

NEED EXIT 2

Merge input files contain records not of the same length and type as those of the output file. User modification routine for exit 2, required in this situation, is missing. The job terminates.

NEED EXIT 3 FOR NS TLR LABEL

The user specified label option T on the output file control card, and user modification routine for exit 3, required in this situation, is missing. The job terminates.

NO ENDMSS CARD

MSS encountered a 7,9 card before encountering an ENDMSS card. The job terminates.

NO MERGE IP CDS

The primary control card specifies a merge-only or sort-and-merge run, but there are no merge input file control cards. The job terminates.

LOG REC LEN NOT A FACTOR OF PHYS REC LEN ON

The user specified fixed length records but the specified physical record length is not an even multiple of the fixed length record size. The erroneous control card appears on OUT and the job terminates.

LOGICAL RECORD LENGTH TOO SMALL ON

A file control card specifies a maximum record length of less than 17 characters. The erroneous control card appears on OUT and the job terminates.

NOTE: For messages requiring operator response, see the operator response procedure on page A-1.

MEMORY TOO SMALL

The requirements of the type of run specified exceed available memory. (The sizes of modification routines, input and output buffers, merge input buffers, and the merge order are considered in calculating memory requirements for an MSS run.) The job terminates.

MI CDS ILLEGAL

The user specified a sort-only run but included merge input file control cards. The cards are ignored and MSS writes a message at the end of the edit phase giving the operator the option to continue or terminate the job.

MOD UNIT CANNOT = SRT IP UNIT

The unit specified for loading a modification routine is also specified as a sort input unit. The job terminates.

MOD UNITS 2, 3, MUST BE =

The user has not specified the same logical unit for loading of modification routines 2 and 3. The job terminates.

MOUNT NEXT INPUT REEL

The operator signaled the existence of another reel of input or MSS read an EOT trailer label on a sort or merge input and the end-of-input option selected is standard trailer label control.

ACTION: Mount next reel.

NON-RETRIEVABLE REC, MI/MI TRIES AGAIN

MSS encountered an error in attempting to read a record from an input file for full record output from tag sort.

ACTION: To reread the record, return to MSS through the manual interrupt procedures.

To terminate the job, use the MSOS batch termination procedure: press MANUAL INTERRUPT; type TERM, F; press MANUAL INTERRUPT. Do not follow this message with the normal manual interrupt procedures for returning to MSS.

NS OP LABEL CD IGNORED

The output file control card label option specifies S, X, or C; a nonstandard output label control card is ignored.

OP RCC MISSING

The user specified variable length record output files with no record character count and the input file records are not under interrecord gap or record mark control. The job terminates.

NOTE: For messages requiring operator response, see the operator response procedure on page A-1.

nnnn OUT

MSS wrote nnnn records. This message appears after the internal sort phase and after the final merge phase; this message also appears after any intermediate merge pass when the number of records written differs from the number of records read.

OUT OF SEQUENCE

Input records are not in sequence according to the sort keys specified. The job terminates.

PARAM MISSING OR INV parameter

A parameter is missing or invalid in a control card other than a file control card. The parameters listed in the message are:

SORT METHOD

END OF INPUT OPTION

FINAL OP REWIND-OPT

Final output rewind option

RD BUF LEN ERROR OPT

Buffer length read error option

RD PARITY ERR OPTION

Parity error option

O/P CONFIGURATION

Output configuration: tag sort output is not full record, tag record, or chained record

RESTART OPTION

USERS SEQ E-I CODE

Type of Hollerith conversion in collating sequence card

MODIFICATION x UNIT

x denotes modification routine 1, 2, or 3. This message appears if the specified unit for loading of the modification routine is unassigned, non-numeric, or invalid; or if the modification unit is the same as the input unit or alternate input unit.

The erroneous control card is listed on OUT and the job terminates.

RCC PARAMS IGNORED IF UNBLOCKED, RCD MARK CONTROL OR UNIVERSAL

The user specified record character count field parameters in a file control card, and also specified that the file contains unblocked, record mark or universal records. MSS ignores the character count information.

RCD EXTENDS PAST END OF BLOCK

The record size exceeds the maximum specified. MSS writes the record on OUT and continues processing.

NOTE: For messages requiring operator response, see the operator response procedure on page A-1.

RD ERR, BYPASS

MSS encountered a read error on the standard input unit. Processing continues through the edit phase and the job then terminates.

REC EXCEEDS MAX ON $\left\{ \begin{array}{l} \text{SORT IP} \\ \text{MERGE x} \end{array} \right\}$ FILE

A physical record on the specified file (sort input or merge file x) is larger than the maximum allowed. The relevant file control card appears on OUT and the job terminates.

RECORD COUNTS DO NOT AGREE, SET JK3 ON TO CONTINUE, OFF TO DELETE JOB

MSS encountered a discrepancy between the record count at the end of one pass and the record count at the end of a preceding pass.

ACTION: To accept the discrepancy, set SELECT JUMP 3.

To terminate the job, return to MSS through the manual interrupt procedures with SELECT JUMP 3 off.

RECORD CNT EXCEEDS MAX

The record count exceeds the maximum specified. MSS writes the record on OUT and continues processing.

nnnn SEQ

MSS generated nnnn sequences (strings) during the internal sort phase.

SEQ TABLE xx CHARS

The user included a collating sequence control card which contains less than 64 characters and does not contain an S in column 68.

SEQ TABLE DUP CHAR, x

MSS encountered nonblank duplicate character x in the user's optional collating sequence control card. The erroneous card is printed on OUT and the job terminates.

SI CD ILLEGAL

The user specified a merge-only run but included a sort input file control card. The card is ignored and the job continues.

SORT KEY xx INV

Sort key xx (01-12) is invalid: the sequence type, order, key size, or location is non-numeric; the sequence type is not 1, 2, 3, or 4; or the sequence order is not 1 or 2. The erroneous control card appears on OUT and the job terminates.

NOTE: For messages requiring operator response, see the operator response procedure on page A-1.

SRT KEY xx TOO LONG

Sort key xx (01-12) extends beyond the maximum record length. The erroneous control card appears on OUT and the job terminates.

STACKER FULL

The card reader stacker is full.

ACTION: Clear the card reader.

SURPLUS MERGE FILE

The user specified more than 14 merge files for a sort-and-merge file or more than 15 merge files for a merge-only run. MSS ignores the surplus merge files and continues processing.

TO RESTART SET JK 6

This message appears before MSS writes a new restart dump when SELECT JUMP 5 is set.

ACTION: To prevent a new restart dump and restart the program with the contents of the last dump, set SELECT JUMP 6.

To continue processing, set SELECT JUMP 6 to off and return to MSS through manual interrupt procedures. MSS writes a new restart dump and resumes normal processing.

UNENDING MERGE

During each merge pass, MSS determines if the number of sequences is less than the number for the preceding merge pass. If it is not, an unending merge condition has been encountered and the job terminates.

UNIT xx BUFFER LENGTH

MSS encountered a buffer length error. According to the option selected in the primary control card, MSS accepts or rejects the record or writes an additional message on the CTO specifying operator options.

UNIT uu EOT. JK1 ON FOR EOT, OFF FOR EOF.

MSS detected an end-of-file mark on a sort input file and the user requested operator control for the end-of-input option.

ACTION: If there is another reel of input for a multireel file, set SELECT JUMP 1. MSS prints a message to mount the next reel.

If there is not another input reel, return to MSS through the manual interrupt procedures with SELECT JUMP 1 off.

NOTE: For messages requiring operator response, see the operator response procedure on page A-1.

UNIT uu. FILE y. EOT. JK1 ON FOR EOT OFF FOR EOF

MSS detected an end-of-file mark on a merge input file, and the user specified operator control for the end-of-input option.

ACTION: To signal the existence of another reel of input, set SELECT JUMP 1.

If there is not another input reel, return to MSS through the manual interrupt procedures with SELECT JUMP 1 off.

UNIT uu. FINAL OUTPUT REEL xx

The final output reel xx on unit uu is complete.

UNIT uu FOR SORT INP (UNIT xx FOR ALT INP)

This message instructs the operator to mount unit uu as the sort input unit and unit xx as the alternate input unit if an alternate unit is specified.

ACTION: Mount the requested unit or units.

UNIT uu LABEL ERROR

LABEL READ

(label read)

LABEL EXPECTED

(label expected)

MSS found a discrepancy in comparing the standard header or trailer label read with the label expected. The error occurred on unit uu.

UNIT uu. MOUNT INPUT REEL nn

MSS detected an end-of-file while reading a sort or merge input file. The primary control card specifies reel count control and MSS requests reel nn.

ACTION: Mount the next input reel on unit uu.

UNIT uu. MOUNT O/P TAPE

MSS has begun the final merge pass and is ready to write on the final output tape.

ACTION: Mount tape on requested unit.

UNIT uu NOT READY

Unit uu is not ready.

ACTION: Ready unit.

NOTE: For messages requiring operator response, see the operator response procedure on page A-1.

UNIT uu. MOUNT MERGE INPUT A

MSS is ready to start the final merge pass and requests the operator to mount merge input files.

ACTION: Mount merge file tape on unit uu.

UNIT xx READ PARITY

MSS encountered a parity error in five attempts to read a record. According to the option selected in the primary control card, MSS accepts or rejects the record or writes an additional message on the CTO specifying operator options.

UNIT uu WRITE PARITY

MSS made five unsuccessful attempts to write a record on unit uu.

VAR RCC EXCEEDS REC LEN ON

The variable record character count field extends beyond the maximum record length. The erroneous file control card is printed on OUT and the job terminates.

1ST NS OP LABEL CD MISSING

MSS encountered nonstandard label control card 2 before encountering nonstandard label control card 1. The erroneous control card appears on OUT and the job terminates.

NOTE: For messages requiring operator response, see the operator response procedure on page A-1.

STANDARD BCD COLLATING SEQUENCE

B

Printer Character	BCD Tape Code	3000 Internal BCD Code	Card Punches	Seq. No. ††	Printer Character	BCD Tape Code	3000 Internal BCD Code	Card Punches	Seq. No. ††
BLANK	20	60	BLANK	00	G	67	27	12,7	40
:	†00	†12	8,2	01	H	70	30	12,8	41
≡	15	15	8,5	02	I	71	31	12,9	42
%	16	16	8,6	03	∨	52	52	11,0	43
[	17	17	8,7	04	J	41	41	11,1	44
→	35	75	0,8,5	05	K	42	42	11,2	45
≡	36	76	0,8,6	06	L	43	43	11,3	46
^	37	77	0,8,7	07	M	44	44	11,4	47
↑	55	55	11,8,5	10	N	45	45	11,5	50
↓	56	56	11,8,6	11	O	46	46	11,6	51
>	57	57	11,8,7	12	P	47	47	11,7	52
≡	75	35	12,8,5	13	Q	50	50	11,8	53
]	76	36	12,8,6	14	R	51	51	11,9	54
.	73	33	12,8,3	15	]	32	72	0,8,2	55
)	74	34	12,8,4	16	S	22	62	0,2	56
;	77	37	12,8,7	17	T	23	63	0,3	57
+	60	20	12	20	U	24	64	0,4	60
\$	53	53	11,8,3	21	V	25	65	0,5	61
*	54	54	11,8,4	22	W	26	66	0,6	62
-	40	40	11	23	X	27	67	0,7	63
/	21	61	0,1	24	Y	30	70	0,8	64
,	33	73	0,8,3	25	Z	31	71	0,9	65
(	34	74	0,8,4	26	0	12	00	0	66
=	13	13	8,3	27	1	01	01	1	67
≠	14	14	8,4	30	2	02	02	2	70
<	72	32	12,0	31	3	03	03	3	71
A	61	21	12,1	32	4	04	04	4	72
B	62	22	12,2	33	5	05	05	5	73
C	63	23	12,3	34	6	06	06	6	74
D	64	24	12,4	35	7	07	07	7	75
E	65	25	12,5	36	8	10	10	8	76
F	66	26	12,6	37	9	11	11	9	77

†00 is an illegal character when written in even parity. If a 12 is generated in core and written in even parity, it will appear on tape as a 12; and when it is read in even parity, it will be converted to 00 internally.

†† Seq. No. 00 is lowest order (minor)
Seq. No. 77 is highest order (major)

STANDARD LABELS

C

MASS STORAGE FILE LABEL

1	OWNER			
2				
3				
	FILE NAME			
10				EDITION
11	ACCESS SECURITY			
12	MODIFICATION SECURITY			
13	*			
14	*	BLOCK SIZE		
15	BLOCK COUNT			
16	USAGE COUNT			
17	CREATION DATE			
18	EXPIRATION DATE			
19	LAST ACCESS DATE			
20	DT	SC	P	*
21	DTM	*	*	*
22	*	*	*	*
23	FILE SIZE			
24	NEXT AVAILABLE			
25	SAK			
26	RM	RF	BF	LRS
27	MAX			TIS
28	✓	KFS	KEY Location	
29	✓	IDL	STATUS	ID Location
30				
	*			
49				
50	CHECKSUM			
51		DEVICE NUMBER		
52	LOW SEGMENT LIMIT			
53	SEGMENT LENGTH			

These three words are repeated for each segment of the file.

* Denotes reserved

FILE LABEL FIELDS

Field Name	Size	Description
File identifier	40 characters	Uniquely identifies a file in label directory; standard identifier consists of: Owner identification - 8 characters File name - 30 characters Edition number - 2 characters May be divided in other ways if an installation chooses to do so
Access security	4 characters	Supplied when file is allocated and must be supplied for each succeeding OPEN request
Modification security	4 characters	Supplied when file is allocated and must be supplied for each RELEASE, EXPAND, and MODIFY request
Block size	3 characters	Contains, as a binary integer, number of 6-bit characters in each record block ($0 < \text{block size} < 131072$)
Block count	4 characters	Contains, as a binary integer, highest block number that has been written; if file is processed sequentially, this is number of blocks written into file ($0 \leq \text{block count} < 2^{23}$)
Usage count	4 characters	Binary count of number of times file has been opened
Creation date	4 characters	Date, yymmdd, stored as binary integer, supplied by I/O system when file was allocated
Expiration date	4 characters	Date, yymmdd, stored as binary integer, supplied by user when file was allocated; determines when a file may be deleted
Last access date	4 characters	Date, yymmdd, stored as binary integer, supplied by I/O system each time file is opened or changed
DT (device type)	1 character	Indicates type of mass storage device on which file is located DT = 40_8 (1311 disk pack) = 41_8 (852 disk pack) = 50_8 (853 disk pack) = 51_8 (854 disk pack) = 60_8 (813, 814 disk file) = 70_8 (863 drum)

Field Name	Size	Description
SC (segment count)	1 character	Contains, as binary integer, number of segments in file (0 < segment count < 64)
P (protection)	1 character	Contains protection flags for use by I/O system; values currently defined are: 0 - file may be read or written 1 - file may not be written
DTM (device type modifier)	1 character	Provides further device information; for 1311 and 852 disk packs, values are: xxxxx0 - track mode xxxxx1 - sector mode For 853, 854, 813, 814, and 863, value is: xxxxx1 - sector mode
File size	4 characters	Contains, as binary integer, number of allocatable units (tracks) assigned to file (0 < file size < 2 ²³)
Next available SAK	8 characters	Block and record positions where next record can be written within file
RM (record mark)	1 character	Record mark character which terminates each record when record format is record mark variability
RF (record format)	3 bits	Denotes type of records within file: 00 - fixed length records 01 - key field contains total number of characters 02 - key field contains number of occurrences of fixed length trailer item 03 - universal format 04 - record mark specified by RM terminates each record
BF (block format)	1 bit	1 - One logical record per block 0 - Logical records are blocked and each block contains a two-word header which specifies next block number (NBN) and position of first available character within block (POFAC)
LRS (logical record size)	2 characters	Logical record size, in characters, of fixed length record; size of fixed portion of variable records which have trailer items; zero if records vary by key field or record mark

Field Name	Size	Description
MAX (maximum logical record size)	2 characters	Maximum size in characters of variable portion of logical records; for variable records with trailers, size of trailer item times maximum number of occurrences; for all others, maximum size of a record within file
TIS (trailer item size)	2 characters	Trailer item size in characters if RF = 02, otherwise zero
KFM (key field mode)	1 bit	Mode of key field address: 0 - key field is within each record 1 - key field is outside record (does not appear in file)
KFS (key field size)	5 bits	Number of characters in key field
Key location	17 bits	Character position of key field relative to beginning of record if key field is within record
IDM (ID mode)	1 bit	Specifies type of record identification associated with every record in file: 0 = alphanumeric 1 = numeric
IDL (ID length)	5 bits	Specifies length in characters of record identification field of every record in file
Status	1 character	Reflects current status of file as defined by each operating system or library program
ID location	2 characters	Starting character position of identification field in each record of file
Checksum	4 characters	24-bit binary checksum of entire label; checked by I/O system to detect accidental modification of label
Device number	3 characters	Number of device on which this file segment is stored; checked against device label to ensure that proper packs are mounted
Low segment limit	4 characters	Binary hardware address at which this file segment begins
Segment length	4 characters	Number of allocatable units (tracks) in this segment
* (Reserved)	93 characters	Reserved for future use by I/O system

MAGNETIC TAPE GENERAL HEADER LABELS

All header label records are 80 characters (480 bits) long and are unblocked. They are recorded in even parity at the same density as the remainder of the data file. Header records are separated from succeeding data records by an interrecord gap. Header label record fields are defined below; they are positioned as shown within the physical record. Values that may be used within these fields are also specified.

Field Name	Starting Character Position	Length in Characters	Defined Values (BCD Only)	Function
Density	1	1	2, 5, 8	Specifies density of recording file
Header label identifier	2	2	()	Identifies record as header label record
Logical unit number	4	2	As applicable	Specifies logical unit to which file is assigned
Retention code	6	3	000-999	Specifies, in days, retention period of file
File name	9	14	Any combination of legal BCD characters	Identifies file
Reel number	23	2	01-99	Identifies sequence of reels for multireel files
Date written	25	6	Any legal numeric date, expressed as mmddy	Identifies date written; used with retention period to determine release date of file
Edition number	31	2	00-99 or blank	Identifies single file set
User-supplied information	33	48	Any combination of legal BCD characters	User's comments

GLOSSARY

ASCENDING SORT	A sort in which, in the final sequence, records whose keys are lower ordered according to the collating sequence precede records whose sort keys are higher ordered
BATCH JOB	One of a sequence of jobs stacked on the standard input unit to be processed in sequence. MSOS processes batch jobs in a multiprogrammed manner with the priority program.
COLLATING SEQUENCE	The sorting sequence; a definition of the relationship between the elements of a character set
CTO	Comments to operator; the console typewriter, when used by MSS or MSOS to transmit messages to the operator
DESCENDING SORT	A sort in which, in the final sequence, records whose sort keys are higher ordered according to the collating sequence precede records whose sort keys are lower ordered
FINAL MERGE	A merge pass which results in a single sequence of sorted records
FULL RECORD SORT	A sorting technique in which the entire record is transferred in all phases of sorting and merging operations
INTERMEDIATE MERGE	A merge pass which does not reduce the sequences to a single sorted string
MERGE	A pass which combines multiple strings of records (all strings sorted according to the same hierarchy of sort keys) into a smaller number of such strings
MERGE ORDER	The largest number of sequences which may be the input to a merge pass. The merge order depends on the block size of the files which are to be merged.
OUT	The standard output unit

PRIORITY PROGRAM	A program which gains and relinquishes control through interrupts and may share the processor with one of a sequence of batch jobs
RESTART	The return in a program to a point preceding certain known errors, in order to resume processing from that point
SORT KEY	Also sequence key or sequencing key; a field in a record used as a basis for determining the position of that record in the output file
STRING	A group of sequenced records on mass storage
TAG SORT	A sorting technique in which only the sort key and record address (tag record) are transferred after the initial read
TOURNAMENT SELECTION	A sorting technique in which the results of comparison of groups of records are stored for later use. A selected record is placed in the output buffer and a new record replaces the selected record.

CONTROL DATA

CORPORATION

COMMENT AND EVALUATION SHEET
3100/3200/3300/3500 Mass Storage SORT/MSOS

Reference Manual

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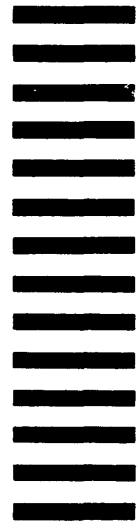
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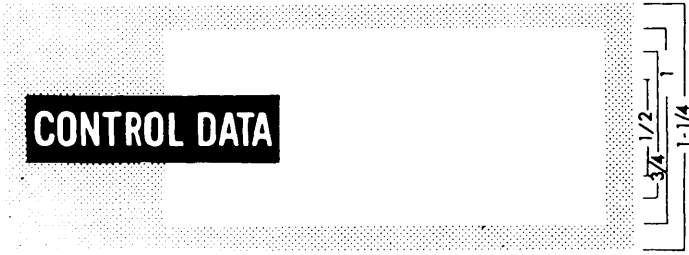
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