



## **1401 Data Analysis and Reduction System**

**(1401-CA-04X), Version 2**

### **Programmer's and Operator's Manual**

The IBM 1401 Data Analysis and Reduction System is a powerful series of programs to generate tabular and statistical reports from existing card or magnetic tape files. Three types of programs, modified by control cards to suit individual requirements, operate under the control of a monitor program.

The data preparation programs accept punched cards or magnetic tape in a variety of formats, and add, delete, and/or change the format and content of each record or user-selected records from the data file. Records may be selectively extracted for information retrieval purposes.

The report programs produce, as specified in control cards, matrix-type, frequency tabulation, listed, punched and statistical reports. The matrix reports, consisting of horizontal columns and vertical rows, present crossfooted distributions expressed in percentages, counts, or summaries as required. The frequency tabulation report contains the frequency of occurrence of the values in a specified field of every data record. The quantitative statistical report contains parameters such as the mean, variance, and standard deviation, along with a matrix-type presentation of frequency, count, and percentage for each defined group.

The utility programs provide the ability to list records, control program operating sequence, prepare and modify the system tape, and perform various other functions to facilitate using the system.

The programs can be used in almost any industry to provide a concise analysis of subjects such as inventory activity, traffic characteristics, sales analysis, communications systems, engineering studies, medical reports, payroll analysis, and personnel studies.

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## INTRODUCTION

The IBM 1401 Data Analysis and Reduction System is a powerful series of programs to generate tabular and statistical reports from existing card or magnetic tape files. Three types of programs, modified by control cards to suit individual requirements, operate under the control of a monitor program.

1. The data preparation programs accept punched cards or magnetic tape in a variety of formats, and add, delete, and/or change the format and content of each record or user-selected records from the data file. Records may be selectively extracted for information retrieval purposes.
2. The report programs produce, as specified in control cards, matrix-type, frequency tabulation, listed, punched, and statistical reports. The matrix reports, consisting of horizontal columns and vertical rows, present crossfooted distributions expressed in percentages, counts, or summaries as required. The frequency tabulation report contains the frequency of occurrence of the values in a specified field of every data record. The quantitative statistical report contains parameters such as the mean, variance, and standard deviation, along with a matrix-type presentation of frequency, count, and percentage for each defined group.
3. The utility programs provide the ability to list records, control program operating sequence, prepare and modify the system tape, and perform various other functions to facilitate using the system.

These programs can be used in almost any industry to provide a concise analysis of subjects such as:

- Inventory activity
- Traffic characteristics
- Sales analysis
- Communications systems
- Engineering studies
- Medical reports
- Payroll analysis
- Personnel studies

The system, with its ability to accept records from cards or magnetic tape in a variety of formats, can provide management with new insight into complex activities without extensive programming and data reduction effort.

## PROGRAM CLASSIFICATIONS

The programs in the system may be divided into six general groups:

1. Input Programs
2. Data Manipulation Programs
3. Data Extract Program
4. Report Programs
5. System Programs
6. System Generation and Modification Programs

A brief description of the functions of each of these programs follows:

### Input Programs

Data Input Control - accepts fixed- or variable-length, fixed-format card or tape records and converts them to a format suitable for the data preparation or report programs. Input fields are defined by their position in the record. Subsequent references to fields are by field number, from 01 to 25. Serial numbers may be assigned to each record if desired.

Variable Input Control - accepts variable-length, variable-format tape or card records and converts them to a format suitable for the data preparation or report programs. Input fields are defined by field divider codes, consisting of length, occurrence, and character representations.

### Data Manipulation Programs

Field Edit - provides right or left adjusting of fields in formatted tape to prepare for sorting or report producing.

Field Redefinition - combines, separates, adds, or deletes fields in formatted tape records.

### Data Extract Program

Extract - selects records and creates a new file based on relational conditions, testing all records or only those records occurring at user-specified intervals. This program is a valuable aid in statistical sampling and information retrieval.

### Report Programs

Matrix Report - produces reports expressing counts, percentages, or summation of values.

Data Record List - prints a formatted listing of input records by fields. Fields may have decimal or comma punctuation, sign control, and suppression of nonsignificant zeros. Up to ten fields with a maximum of 18 positions each may be specified for tabulation. Records may also be punched and listed.



Data Record Tabulate - produces a report on the frequency of occurrence of the values in a specified field of every data record. Each value that occurs within the field is listed, along with the frequency of occurrence, that is, the number of times the same value appears in successive records.

Quantitative Statistical Parameters Report - computes and prints a comprehensive tabular report of statistical parameters such as mean, variance, and standard deviation.

### System Programs

Monitor - controls system programs.

I/O Program - consists of common input/output routines for all system programs using magnetic tape.

Blank Identification - provides for immediate reuse of any operational program, or produces a formatted print of the system program tape, or prints the program identification table from the system via the monitor.

### System Generation and Modification Programs

Tape Load - prepares a program system tape from cards.

General Utility - provides a storage printout with optional printouts of the input, output, and system tapes.

Modify System - duplicates and/or modifies the system tape by adding, deleting, or replacing system programs.

## SYSTEM DESCRIPTION

### Input

Input data may consist of:

1. Cards — with one or more cards used to create one record.
2. Blocked or unblocked fixed-length tape records. The maximum single record size is 999 characters; maximum block size is 1500 characters.
3. Unblocked variable-length tape records. The maximum usable portion is the first 999 characters. These records may not contain record marks, tapemarks, or groupmarks as data characters.
4. Variable-length records with variable-length fields, such as messages, reports, or data, to be converted from punched paper tape to cards or magnetic tape, and subsequently reformatted to fixed-length, fixed-field records for processing.

Figure 1 illustrates how the various types of input are accepted by the system.

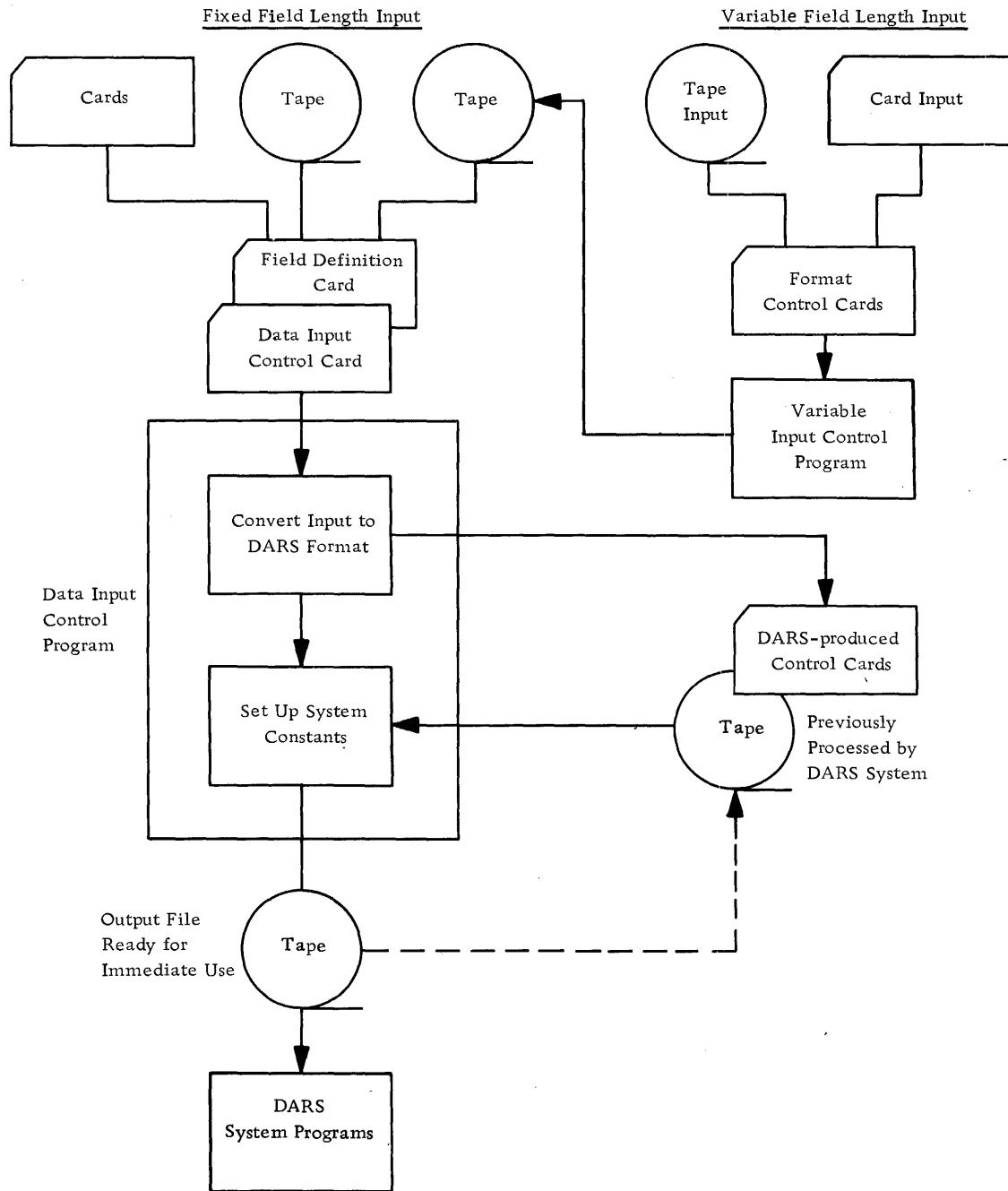


Figure 1. Input flow in the system

## Processing

A monitor controls the system, permitting the running of operational programs with minimum operator intervention. The same input data may be used to produce a variety of reports. The output of one program can be used as the input to another, to provide a multilevel analysis. Original input data may be saved on request.

Operator intervention is minimized by internally scheduling the output tape unit of the current program to become the input tape unit for the next program. Programs may be run in any logical order by arranging the control cards accordingly.

Control cards are checked for format and reasonableness. The detection of an error that may cause a program malfunction or loss of data will set a system error switch on. Subsequent control cards in the card reader are checked, and error messages printed, but the programs are not executed. This feature prevents dependent programs from attempting to process improper data.

## Output

Reports are produced on the 1403 Printer; punched cards are produced on the 1402 Card Read Punch.

## Program Modifications

User-written modifications (additions, deletions, or changes) may be made to the system as required. A system program is included to facilitate locating errors in new additions to the operational program file.

The system can duplicate itself on a second reel of magnetic tape.

## Tape Labels

A control card indicates the presence or absence of an 80-character header label on a single reel of input, or on the first reel of a multireel file. All subsequent reels in a multireel file must contain header labels.

## OPERATING PROGRAMS

The operating programs are stored on magnetic tape and loaded as required by a system monitor program. Control cards are analyzed by the system monitor, which selects and loads the appropriate program. At the end of the program run, control is returned to the system monitor.

Operating programs on the system tape are written in load mode, one program or program segment per block. Programs requiring more than 4000 storage positions are written as two or more blocks.

## STORAGE ASSIGNMENTS

For this system, 1401 core storage is logically divided into three areas:

- Area 1. Positions 001 - 599. The monitor occupies positions 340 to 599. Positions 001 through 332 are reserved for the card reader, punch, printer, and index registers.
- Area 2. Positions 600 - 4599. This area is reserved for the current operational program. Only one program from the system tape may occupy this area at any one time.
- Area 3. Positions 4600 - 7999. This area is reserved for system constants, tables, a 1500-position common tape input/output area, the common tape input/output routine, an 80-character header and trailer label area, and the calling sequence for the general utility program.

## CONTROL CARDS

The data input control card defines the input card or magnetic tape file. The field definition control card defines the fields within the input file. Fields not used need not be defined.

Operational control cards describe the operations to be performed on the defined input file and the defined fields within each record.

Information from the data input control cards is placed in tables in storage at the beginning of each run. When the monitor reads in the operational control cards, the appropriate programs are loaded and executed. Upon completion of an operational program, control is returned to the monitor, which reads in the next control card and loads in the appropriate operational program.

## GENERAL DESCRIPTION OF ERROR HANDLING

Normally, several of the programs in the system are linked -- used one after the other. When a control card error is detected affecting one of the programs, a diagnostic message is printed. Since the linked programs usually require the output of the preceding program as input, a control card error in one program prevents the execution of that program and any following linked programs. To assist the user, the detection of a control card error terminates the run after checking all control cards including those for the following programs. In this way the system provides either the execution of all linked programs or, if errors are detected, an audit of all control cards entered into the system.

## SYSTEM CONFIGURATION REQUIREMENTS

The Data Analysis and Reduction System operates on the IBM 1401 Data Processing System with the following minimum configuration:

1401 Processing Unit, 8K

Three 729 or 7330 Magnetic Tape Units (four required if Error File option is used with the Variable Input Control Program)

1402 Card Read Punch

1403 Printer, Model 2

Advanced Programming Feature

High-Low-Equal Compare Feature

Multiply-Divide Feature

Sense Switches (required for Variable Input Control Program)

## CHAPTER 1: INPUT PROGRAMS

### DATA INPUT CONTROL PROGRAM

The program creates a formatted data tape from the user-furnished input data file and sets up common systems constants and tables.

Input data may be on cards, blocked or unblocked fixed-length records on magnetic tape, or unblocked variable-length records with fixed-length fields on tape.

Maximum record length is 999 characters. Maximum blocking factor is 99. Maximum block length is 1500 characters.

Single-reel tape input may contain a header label, with or without a following tapemark. Multireel or multfile multireel input must have header labels on all but the first reel, where the header label is optional.

Two or more separate files with the same format may be combined as described under "Operating Procedures", using sense switch B.

Field selection is provided. The number of card or tape records to be combined into one output record may be specified. The user indicates the fields to be used in the output record and their arrangement.

In order to facilitate sorting on the IBM 7080 or IBM 7090, data records may be padded to a multiple of five or six character positions.

The program accepts input from a previous system run without modifying the data records. The data input control card must precede any run of one or more system programs to set up the common system constants and tables describing the file and records.

With card or tape input, the user may have a serial number automatically inserted in every output data record. The field number, starting serial number, and increment per record must be provided in the control card.

Two additional options are available when using card input:

1. When more than one input card is used to create a single output record, a user-specified control field may be checked on each card within each card group. If an unequal condition is found within the card group used to construct an output record, the first card of the group is dropped from the file and listed on the printer. The next card is read in and the check repeated.
2. The contents of a single user-specified column of every input card record within a group may be checked to ensure that it is equal to or greater than that of the preceding card within the same group. An out-of-sequence condition causes the low card to be dropped from the file and listed on the printer. The next card is read in and the check repeated.

## Output Data Tape Format

Data tapes produced by the data input control program have a system header label record, 80 positions in length, not followed by a tapemark. Individual or blocked records follow the header label record. The trailer label, 80 positions in length, is preceded by and followed by a tapemark. Maximum block size is 1500 characters. Each output record has a record mark as the last character.

The header label is automatically generated by the program from information contained in the control cards. With normal DARS processing the user need not concern himself with the format of the header and trailer labels. It is offered here as additional informational material. The header label format is:

<u>Position</u>	<u>Content</u>
1-4	1 HDR
5-12	Blank
13	Number of padding characters per record including record mark. The minimum entry is 1, the maximum 6.
14-15	Number of fields per record
16-17	Blocking factor (number of records per block)
18-20	Record length, including padding and record mark
21-22	Length of first field in record
23-24	Length of second field in record
25-70	Lengths of successive fields in record, from third to twenty-fifth field. Two positions per field, as in columns 21-22, and 23-24.
71-80	Not used

The trailer label format used is as follows:

<u>Position</u>	<u>Content</u>
1-4	1 EOR if end of reel 1 EOF if end of file
5	Blank
6-80	Not used

The maximum file specifications are as follows:

Block length:	1500 positions
Field length:	99 positions
Record length:	999 positions
Blocking factor:	99 records per block

### Control Card Formats

#### Data Input Control Card

This card defines the input file, and permits optional serial numbering of records, sequence checking, and output blocking.

<u>Column</u>	<u>Contents</u>
1	* (control card identification)
2	Input format indicator:  1 - Input file in acceptable format because it was produced by a previous run of this program.  Blank - Input is not in DARS format, not processed by the system before this time, or requires adjustments in record formats.
3	Type of input — use when column 2 is blank:  Blank - card input  1 - unblocked tape records  2 - blocked tape records
4-6	Length of input record in characters. Maximum record length is 999 (see note).
7-8	Number of input records per block. Maximum blocking factor is 99 (see note).
9-10	Number of input records, as defined by field definition control cards, that constitute one output record. Maximum of 99. If the value is greater than 1, it must be evenly divisible into the value in columns 7 and 8 of this control card (see note).
11	Input header indicator for tape files:  Blank - no header label record  1 - contains header label record



<u>Column</u>	<u>Contents</u>
12-14	Length of output record in characters. The number of characters to be extracted from the input record or records to constitute one output record, plus the number of characters for serialization if the option is used. Maximum of 999 (see note).
15-19	Definition of control field in cards when using multiple card input for each output record (see note): <ul style="list-style-type: none"> <li>Blank - no check made by system</li> <li>Columns 15-16 — length of identification field (see note)</li> <li>Columns 17-19 — low-order (rightmost) card column of identification field (see note)</li> </ul> <p>If these control card columns (15-19) are punched, the defined field is compared to the same field in each card of the group of cards used to constitute a single output record. The field must be equal within the group.</p>
20-22	Sequence check position of input record (see note). This single card column or tape record character position is used to sequence check input records within a group of card or tape records used to constitute a single output record. An equal or ascending sequence is acceptable within each group. If columns 20-22 of this control card are blank, no check is made.
23	Generate serialization number: <ul style="list-style-type: none"> <li>1 - insert a serial number in each output record</li> <li>Blank - no serialization desired</li> </ul>
24-25	Output field number to contain serial number. Field numbers are assigned on the field definition card(s) (see note).
26-34	Starting serial number to be placed in the first output record
35-37	Increment of serial number from record to record
80	Record padding indicator. To facilitate sorting, each record may be padded with 9s so that the number of characters per record is a multiple of 5 or 6. <ul style="list-style-type: none"> <li>5 - Pad records to a multiple of 5 for sorting or processing on the IBM 7080</li> <li>6 - Pad records to a multiple of 6 for sorting or processing on the IBM 7090</li> </ul> <p>Any value other than 5 or 6 indicates no record padding.</p>

Note: These fields must contain only the numerical characters from 0-9 with leading zeros.

## First Field Definition Card

Up to 25 fields can be defined by using the first and second field definition cards. Only the first card is required when twelve or fewer fields are defined. The output fields are located as defined.

<u>Column</u>	<u>Contents</u>
1	A (control card identification)
2	1 (indicates first field definition control card)
3-4	Number of fields to be defined (see note). Maximum of 25 fields.
5-10	First output field, to consist of input field as follows: 5-7 - Input high-order character position in record 8-10 - Input low-order character position in record
11-16	Second output field, to consist of input field as follows: 11-13 - Input high-order character position in record 14-16 - Input low-order character position in record  Third through twelfth output fields follow the same format as the first and second fields (see note):
17-22	Field 03
23-28	Field 04
29-34	Field 05
35-40	Field 06
41-46	Field 07
47-52	Field 08
53-58	Field 09
59-64	Field 10
65-70	Field 11
71-76	Field 12
77-79	Unused
80	Total number of field definition cards (1 or 2) used

Note: These fields must contain only the numerical characters from 0 — 9 with leading zeros.

## Second Field Definition Card

This card is a continuation of the first field definition card and is used only if more than twelve fields are defined.

<u>Column</u>	<u>Contents</u>
1	A (control card identification)
2	2 (indicates second field definition card)
3-8	Thirteenth output field, to consist of input field located as follows: 3-5 - Input high-order character position in record 6-8 - Input low-order character position in record
9-14	Fourteenth through twenty-fifth fields defined as in control card columns 3-8 (see note)
15-20	Field 15
21-26	Field 16
27-32	Field 17
33-38	Field 18
39-44	Field 19
45-50	Field 20
51-56	Field 21
57-62	Field 22
63-68	Field 23
69-74	Field 24
75-80	Field 25

Note: These fields must contain only the numerical characters from 0-9 with leading zeros. Unused fields are left blank.

## Control Card Use

These card(s) are read in the sequence presented, with the data input control card followed by the first (and second) field definition card(s).

When the input is a card file, the data cards must follow the data input and field definition control cards. A blank card with a lozenge (◻) in column 80 follows the last data card.

A set of these control card(s), defining the output file, are punched by the DARS system at this time for use in subsequent runs if the input to this program is a card file or a tape not in the required system format.

Linked program runs, where system programs are executed immediately after the data input control program, do not require the DARS-punched control cards. The necessary control information is retained in storage for use by the subsequent linked programs in the run.

#### Blank Field Generation

Blanks may be inserted in the output data records by the user. These blanks may be used to expand a data record, or to enable data fields to be formatted for listing purposes. To insert blanks, the user must define the length of the output record larger than the length of the input record specified on the data input control card. The specified length of the output record should therefore reflect the required number of blanks to be inserted. For example, to insert a field of ten blanks between the first and second of three prescribed fields, and a field of ten blanks between the second and third of these fields, the length of the output record is increased by twenty characters. The enlarged record is padded with twenty blanks in the low-order position by DARS. The field definition control cards must reflect these two additional fields between the designated fields. To avoid inadvertent insertion of the record mark or groupmark, which may be part of the input data record, the low-order position of the input data record should not in this case be defined as part of the output record.

The data input control program will manipulate the fields and insert the blank fields in the proper positions.

#### Example of Field Definition Card Use

Assuming an input card file, select certain fields in a specified sequence to form an output data tape record. The source card columns, the output tape format, and the field numbers are shown in Figure 2. The record padding shown was specified in column 80 of the associated data input control card. Note that in the example the contents of columns 25-30 are included in both fields 2 and 3 of the output.

#### Messages

All messages are followed by a computer halt, except as noted.

#### CONTROL CD SEQ ERR

This is an error in the card numbering of the field definition control card(s) in column 2 and/or column 80 (card \*1 only). The card in error is listed on the same line as this message.

#### DATA RCD EXCEED MAX

The input data record exceeds the maximum size permitted.

<u>Input Card Columns</u>	<u>Output Record Field Number</u>	<u>First Field Definition Control Card</u>	
		<u>In Card Column</u>	<u>Contains</u>
		1-4	A105
1-10	1	5-10	<u>001010</u>
25-30	2	11-16	<u>025030</u>
15-30	3	17-22	<u>015030</u>
75-80	4	23-28	<u>075080</u>
50-62	5	29-34	<u>050062</u>
		80	1

<u>Output Record Format on Data Tape</u>						
<u>Data Source</u>	<u>From cc 1-10</u>	<u>From cc 25-30</u>	<u>From cc 15-30</u>	<u>From cc 75-80</u>	<u>From cc 50-62</u>	9 9 9 †
<u>Output Tape Record Positions</u>	1-10	11-16	17-32	33-38	39-51	52 53 54 55
<u>Field Numbers</u>	1	2	3	4	5	Record padding and record mark

Figure 2. Data input and output example, data input control program

FIELD DEF CONTROL CARD MISSING

A field definition control card has not been recognized by the program.

FIELD DEF CONTROL CARD 1 ERROR CLMS 3-4

Columns 3-4 of the field definition control card contain a number not within the limits of 01-25, inclusive.

INPUT CONTROL CARD ERROR IN COLUMN 7-8 or 9-10

Columns 7-8 or 9-10 indicate a blocking system that the program is not able to handle.

INPUT RCD OUT OF SEQUENCE REC BYPASSED

When checking the sequence, a data record was found to be out of sequence. The card is listed on the printer and bypassed, and the run continues. The processor is not halted.

OUTPUT RCD EXCEEDS MAX

The output record size exceeds 1500 character positions.

\*RCDS NOT PADDED

The padding indicator, card column 80 of the data input control card, is not 5 or 6. No padding will be added to records. Processing continues.

In addition to the above, messages are printed indicating the start and end of each program. The field definition table with title and headings, giving the format of the output tape record, is also printed (see Figure 3).

	LOW-ORDER	HIGH-ORDER	FIELD LENGTH
FIELD NUMBER 01	001	010	010
FIELD NUMBER 02	011	016	005
FIELD NUMBER 03	017	032	016
FIELD NUMBER 04	033	038	006
FIELD NUMBER 05	039	051	013
INPUT CONTROL COMPLETED			

Figure 3. Example of field definition table

## VARIABLE INPUT CONTROL PROGRAM

### Purpose

This program provides a method for converting machine-readable information in an irregular format to fixed-length records suitable for further analysis by the system. Although particularly suited to analyzing communications traffic such as data or administrative messages, the program can be used for a wide variety of applications with similar characteristics. The resultant output consists of fixed-length records in a format specified on control cards.

### Input Specifications

Data records may be up to 999 characters in length on magnetic tape or punched cards. Card records must have a groupmark following the last character, or the 999th character. Tape records must be unblocked. Groupmarks within a card or tape record will terminate the record.

Multireel magnetic tape files must have a header record on each reel, except the first reel where it is optional. Single reel files may or may not have a header record.

Information on punched paper tape can be converted to punched cards by using the IBM 46 Tape to Card Punch or 47 Tape to Card Printing Punch. Information on punched paper tape can be converted to magnetic tape by using the IBM 7765 Paper Tape to Magnetic Tape Converter.

With the IBM 46 or 47, the control panel should be used to:

1. Either bypass line control characters or, if they are to be used as field separators, convert them to any desired character.
2. Convert a unique character, or combinations of characters found at the end of each input record to a groupmark to indicate the end of the record. The "Figures H" character at the end of telegraph-type messages is an example.
3. When the groupmark character is punched, the card should be skipped out so that each new record starts in the first column of a card.

With the IBM 7765, the end-of-record indication should initiate a write operation so that an interrecord gap exists between each input record. Otherwise the instructions for the IBM 46 apply.

A record mark in a data card input file will cause error conditions. A simple editing program can be written to read the data cards and eliminate or change those containing record marks.

The groupmark at the end of any data record (magnetic tape records included) must be defined as the divider (last character) of the last input field in the record. Control code A can be used for this purpose.

## Output Format

The output file consists of fixed-length blocked or unblocked records. A field three characters in length may optionally contain a count of the number of characters in the entire input record, including the groupmark.

## Output Specifications

Program output consists of a file containing reformatted copies of input records that met the specifications, and an optional output file containing copies of input records that did not meet the specifications. The optional file can be printed, reviewed, and reentered into the system with a new format control card.

Acceptable output records, written on tape unit 3, may be blocked at the user's option. Each block may contain up to 1500 characters, including the record mark following each record. The last block will be padded with 9s as required.

The optional error tape on tape unit 5 will contain unblocked records in the original input format. Card records exceeding 999 characters plus a groupmark are considered as error records. The optional tape will contain the first 920 characters and the last card containing the groupmark. Tape records exceeding 999 characters are not considered as errors but are truncated to the maximum acceptable length of 999 characters.

## Messages

Informational status and error conditions are indicated in code on the printer. The printing of unacceptable data records and the associated code message is optional. The normal full printout of error records can be limited to the first hundred characters by turning sense switch E on. Sense switch D stops all error records from printing.

## Control Cards

### First Format Control Card

<u>Column</u>	<u>Contents</u>
1	Y (control card identification)
2	Blank indicates one control card, any other punch indicates two cards
3	1 - Card input 2 - Tape input
4	Blank - unblocked tape record output. Other than blank - tape output to be blocked within 1500-position limitation. Blocking factor maximized.



<u>Column</u>	<u>Contents</u>
5	<p>Last card code for card input:</p> <p>Blank - sense switch A used.</p> <p>Other than blank - a card with LAST CARD punched in columns 1-9 will be used to terminate the input.</p> <p>If neither is present subsequent cards will be treated as a continuation of the data.</p>
6-7	Number of data input fields
8-9	Number of data output fields
10-11	<p>Input record or message length option:</p> <p>00 - Exclude input record character count from the output record</p> <p>Other than 00 - The number of the output field to contain the character count of the input record</p>
12	<p>Error tape option. If a copy of all input records that do not meet the specifications is desired, punch any digit in this column. Blank indicates that the error tape will not be produced.</p>
13	<p>Input file header label record on single-reel file or first reel of a multireel file:</p> <p>Blank - no header record</p> <p>Not blank - header record present</p>
14	<p>Record padding indicator. If each output record, whether the file is blocked or unblocked, is to be a multiple of a certain number (including record mark), the appropriate number (2-9) is entered.</p> <p>Blank - no record padding</p> <p>2-9 - record padding multiple</p> <p>0 - pad to multiple of 10</p>
15-80	The remainder of the format card is used for field dividers, the codes enabling the program to manipulate the data fields

#### Second Format Control Card

This card is prepared in the same manner as columns 15-80 of the first format card.

## Preparing Control Cards

Fields dividers are discussed in detail in subsequent sections.

A record mark must follow each field divider statement. Two record marks indicate the end of the last control card containing field dividers.

## Use of Field Dividers

The program logic consists of a left-to-right scan of the input file records, searching for characteristics that would identify the end of a field, either by the known characteristics of the beginning of the following field, or by character used to actually separate fields.

The test characteristics used are:

- One or more known characters appearing an exact number of times in succession, such as FFF, or BARBARBAR.
- One or more known characters appearing at least a minimum number of times in sequence.
- Certain characters appearing, with one of them repeated a specific number of times, or at least a minimum number of times, such as the letter A in BAAR, BAAAAAR, or BAR.
- A field defined by the change from alphabetic to numeric characters indicating the beginning of the next field, thereby serving to identify the preceding field.
- Combinations of these tests as alternate means of identification.

In order to use these means of identification, the input records must have some degree of consistency, in that each field within a record must occur in the same order as fields in all other records, although the field lengths may be irregular, and fields may be missing or replaced by other fields in some records.

A typical input file arrangement from a punched paper tape telegraph system may appear as:

<u>Fields in Maximum Format</u>	<u>First Record</u>	<u>Second Record</u>	<u>Third Record</u>
A	Field A	Field A	Field A
B	B	B	
C	C		C
K or D	K		D
E	E	E	E
F, or S, or T	F	S	T
G or R	G	G	R
H	H		H
Total fields	<u>8</u>	<u>5</u>	<u>7</u>

As noted in the maximum format column, up to three alternative fields may be present. By reviewing the characteristics of each field in a record, and the characteristics of the following field, the appropriate field divider criteria can be applied.

Field Divider Specifications

The field dividers used on the format control cards follow the general format:

CONTENTS	Field Divider Characters	N	Code	Output Field Sequence	Maximum Field Size	‡
NUMBER OF POSITIONS	5	1	1	2	3	1

Field Divider Characters (1-5 positions, variable length)

As many as five characters may be used to indicate the end of a field. These characters are not necessarily part of a field, but may serve only to divide fields.

N Field, Code Field (1 position each)

These fields contain codes indicating the conditions that the field divider characters must meet to be acceptable. This is a mandatory entry.

Output Field Sequence (2 positions)

This entry indicates the position of the field in the output record. An entry of 00 indicates that the described field is not desired as output. Entries of 01 through a maximum of 20 determines the sequence of the field in the output record. This is a mandatory entry.

Maximum Field Size (3 positions)

This entry defines the maximum possible size of the field in characters. Larger fields are considered unacceptable. This mandatory entry determines the size of the fixed-length output field. Data in the field will be right-justified with blank fill.

The three positions provide for a maximum field size of 999 characters; however, other programs in the system are limited to accepting 99-character maximum field lengths. The sequence should be considered in determining output field size.

Field Divider Codes

The purpose of these codes is to permit the program to select input information based on the user's specifications.

Code

Criteria

nA

Specific characters appear an exact (n) number of times. For example, as shown below, the characters EVEDC appear once, indicating the end of a field of up to 16 characters to be placed in the fourth field of the input record. The field dividers would appear as:

EVEDC 1 A 04 016‡

where: EVEDC are the specific characters and 1 is the number of times they appear. A is the code for this criterion, 04 is the output record field to receive the data, and 016 is the maximum field size, followed by the required record mark (‡). If the identifying characters were DC, the field divider would be DC1A04016‡.

nB

Specific characters appear n or more times in succession. For example, the characters WDV appear 3 or more times in succession. The field dividers would appear as:

WDV 3B 04016‡

where: WDV are the characters  
3 is the minimum number of appearances  
B is the code for this criterion  
04016‡ is the output field sequence, size, and end-of-divider record mark.

To be acceptable, the record would have to appear as:

XXXWDVWDVWDVXX

n1-5

Specific characters must be present, one of which is repeated consecutively exactly n times. The code number, from 1 to 5, indicates which of the five characters is repeated, while the n indicates exactly how many times. For example, 815402304016‡ would indicate that the characters 81540 must be present in sequence with the third character (5) repeated exactly twice. An acceptable sequence would be 815540, while 81540 or 8155540 would not be acceptable. Another example, where b indicates a blank, is GGbbb9304016 indicating that the third character, a blank, is to be repeated exactly nine times, preceded and followed by the letters GG. Alternately, b2104016‡; indicates two blanks.

<u>Code</u>	<u>Criteria</u>
n6-0	<p>This code is similar to the preceding n1-5 code, except that the code structure uses the digits 6 through 0 to represent the first through the fifth field divider characters, and the appearance criteria is "n or more" instead of exactly n. ABCDE22‡... , for example, indicates that the sequence to be found must include the second character two or more times, as in ABBBCDE or ABBBBBCDE.</p>
C	<p>The field is defined as ending at the point where an alphabetic character is followed by a numeric character (0 through 9). Note that the alphabetic character is at the end of the defined field and the numeric character is at the beginning of the next field. The entire field divider consists of the code, output field, and maximum field size, such as CO4016‡.</p>
D	<p>Similar to C above, except that a numeric character is followed by an alphabetic character.</p>
E	<p>The field is exactly n characters in length, equal to the specified maximum field size in the field divider. For example EO506‡ indicates a six-character field destined for the fifth output field, specified as six characters in length.</p>
nF	<p>The specified amount of numeric characters, from 1 to 9, serves to define the end of this field, since they are the first characters in the next sequential field. For example, 4F03009‡ indicates that when four numeric characters are located, the end of this field immediately precedes the first of the four characters. This field is moved to the third output field, defined as nine positions in length.</p> <p>For example, in the record:</p> <p>CHICAGObbb<u>5338</u>35972</p> <p>The end of the first field is the last of the three blank (b) positions following the word CHICAGO. The four underlined digits signal the start of the next field.</p>
nG	<p>This code is the same as code F, except that a specific number of alphabetic characters serve to indicate the beginning of the next successive field, thereby locating the end of this field.</p>

<u>Code</u>	<u>Criteria</u>
nZ	<p>This code provides alternative field separator identification. Up to three of any of the other codes may be used to satisfy the conditions. The n code must be either 2 or 3, the number of tests to be made. Following the code Z are the output field sequence number and maximum output field size, followed by a record mark, such as 3Z08015‡. This example indicates three options for the eighth output field, which is 15 positions in length. Immediately following are any of the format codes with the last two fields (output field sequence number, and maximum field size) omitted. Assuming the use of the A, C, and F codes, the normal individual formats would be:</p>

	<u>Field Divider Characters</u>	<u>N</u>	<u>Code</u>	<u>Output Field Sequence</u>	<u>Maximum Field Size</u>	<u>Criteria</u>
ALICE1A08015‡	ALICE	1	A	08	015	ALICE appears only once
C08015‡			C	08	015	Alphabetic to numeric data
3F08015‡		3	F	08	015	Exactly three numerics

Using the nZ format for testing alternatives requires only the first seven positions or less of the alternatives, since the last two factors have already been stated. For example:

<u>Basic statement</u>	<u>Alternatives</u>
3 Z0801 5‡	ALICE1A‡C‡3F‡

The number of alternatives given must agree with the digit preceding the Z code in the basic statement. A record mark follows the basic statement and each alternative.

Figure 4 contains a field divider summary chart for reference.

<u>General Format</u>	<u>Field Divider Characters</u>	<u>N</u>	<u>Code</u>	<u>Output Field Sequence</u>	<u>Maximum Field Size</u>
Maximum number of positions	5	1	1	2	3
Format by code	1 to 5 chars.	X	A	XX	XXX
	1 to 5 chars.	X	B	XX	XXX
	1 to 5 chars.	X	1-5	XX	XXX
	1 to 5 chars.	X	6-0	XX	XXX
	not used		C	XX	XXX
	not used		D	XX	XXX
	not used		E	XX	XXX
	not used		F	XX	XXX
	not used		G	XX	XXX
SPECIAL		X	Z	XX	XXX

Each field divider must be followed by a record mark.

Figure 4. Field divider format summary chart

## Example

### Sample Input

The following two data cards were converted from punched paper tape used in a communications message switching system:

1. ABCbCORPORATIONbbbXYZbTIREbCORPORATION050164  
ORDERb1bGROSSb750-14bSUPERbDELUXEb051564YYYYMARY#
2. ABCbCORPORATIONbbbSMITHbPENCILbCOMPANY050164  
ORDERb10bGROSSbNO.2b51564XXXXXXJANET#

### Message Input Format

<u>Input Field</u>	<u>Contents of First Sample Record</u>
1 - Sender	ABC CORPORATION
2 - Receiver	XYZ TIRE CORPORATION
3 - Date	050164
4 - Message	ORDER 1 GROSS 750-14 SUPER DELUXE 051564
5 - Operator	MARY

### Message Output Format

<u>Output fields</u>	<u>Source</u>
1 - Input record length	This three-position field is optional, and includes the record mark, all characters, any blanks, and the groupmark in the entire input message. Any output field can be designated as the input record length field.
2 - Sender field	This field is from the <u>first</u> input field. This fixed-length field will be 25 positions in length, right-justified, with blank fill.
3 - Receiver field	This is from the <u>second</u> input field. The output is to be 30 positions in length, right-justified, with blank fill.
4 - Operator field	This field identifies the operator who sent the message. It is from the <u>fifth</u> input field and is ten positions in length.



Output fieldsSource

5 - Date field

This is from the third input field and is six positions in length.

## Control Card and Commentary for Example

<u>Column</u>	<u>Control</u>	<u>Comments</u>
1	Y	Identifies control card
2	Blank	A second format card is not needed
3	1	Indicates card input
4	Blank	Single record input
5	X	Any nonblank entry, indicating sense switch A is to be used for the last card check
6-7	05	Indicates five input fields
8-9	05	Indicates five output fields, including the input record length field
10-11	01	Indicates that optional character count of input message length is desired, and that the count is to be in the first output field
12	X	Indicates that an error tape is to be written containing those messages that could not be formatted according to the specifications given
13	Blank	Indicates no header label record. This applies only to tape files, and a card file is to be processed.
14	6	Output records to be padded with 9s so as to be a multiple of 6
15-23	b3B02025‡	This is the field identifying the sender of the message. End-of-field identified by three or more blanks (b3B). This is to be the second output field, 25 positions long (02025). A record mark follows each field divider definition.

<u>Column</u>	<u>Control</u>	<u>Comments</u>
24-31	6F03030‡	This is the receiver field, ending with the occurrence of six or more numeric characters belonging to the following field (6F). This is the third output field, 30 positions long (03030).
32-38	E05006‡	This identifies the date field, exactly six positions long, equal to the length of the output field, and assigned to the fifth output field.
39-54	2Z00500‡ X3B‡Y3B‡	This is the input field containing the actual message. The basic Z statement indicates two alternatives (2Z), no output field specified (none desired), and an input length of up to 500 characters. The first alternative (X3B) indicates that the character X must appear three or more times. The other alternative (Y3B) is the same, except that the recurring character is Y.
55-62	‡1A 04010‡	This field is the operator identification field, identified as ending with a group-mark appearing once ( 1A). It is to be the fourth output field, ten positions long (04010).
63	‡	Field divider statements are terminated by a record mark. The end of the format card is signaled by two successive record marks.

### Sample Output Records

The following two output records were produced from the input based on the specifications provided in the control card:

- 093bbbbbbbbbbABCbCORPORATIONbbbbbbbbbbXYZbTIREbCORPORATION  
 bbbbbMARY050164999‡
- 080bbbbbbbbbbABCbCORPORATIONbbbbbbbbbbSMITHbPENCILbCOMPANY  
 bbbbbJANET050164999‡

Note that each record was padded with 9s so as to be a multiple of six. The field lengths in the output file are:

Input record length	3
Sender	25
Receiver	30
Operator	10
Date	6
	<hr/>
Total	74
Padding	3
Groupmark	1
	<hr/>
Record Length	78

### Messages

#### Phase 1 Messages with Program Halt

- F2 Number of input data fields defined not equal to count in columns 6-7
- F3 Insufficient Z alternatives available
- F4 An output field sequence number is not numeric
- F5 Second format card indicated but not present
- F6 An output field sequence number is greater than the entry in columns 8-9
- F7 Too many output fields specified in columns 8-9. Cannot exceed number of input fields (6-7) plus one for message length field (10-11).
- F8 Columns 6-7 not numeric, or contain 00
- F9 Column 3, input type, not 1 or 2
- F10 Incorrect field divider code. Incorrect code printed next to message.
- F11 Output field definition missing. Sequence incomplete.
- F12 Columns 8-9 not numeric, or contain 00
- F13 Column 14 not numeric, or blank

- F14        Number of alternatives for Z code other than 2 or 3
- F15        A field size maximum is alphabetic, 00, or blank
- F16        An n character is alphabetic or 0
- F17        Blocked output requested, but calculated blocking factor not between 02 and 99, inclusive. Record size is less than 16 or more than 750 characters.
- F18        Output record size greater than 999. The sum of all output field sizes must be less than 1000.

#### Phase 2 Messages

The following messages printed during phase 2 of the program do not cause a programmed halt (except F1). The associated error record may be printed in full or in part, or printing may be suppressed, according to the setting of sense switches D and E.

- F1        Groupmark not used to identify last field. Format control card error. Tape unit 1 rewound and machine halted at position 3008. Correct control cards and restart job.
- R1        Input card record exceeds 1000 characters
- R2        Last card processed, last data record incomplete
- R3        Groupmark found before format card specification tests were fully applied
- R4        A requested field was not found although the specified divider was recognized

## CHAPTER 2: DATA MANIPULATION PROGRAMS

### FIELD EDIT PROGRAM

This program will left- or right-justify the fields of a data tape produced by the input control program. Up to ten data fields may be defined for an alphabetic sort (left-justified), and up to fifteen fields for a numeric sort (right-justified).

The control card does not include the file specifications since these are already available in storage from the input control program.

#### Field Adjustment

Fields are adjusted by repositioning them so that the left or rightmost character is other than a BCD blank character. Normally, left adjustment is used to align alphabetic fields for sorting, while right adjustment is used to align numeric fields for logical and arithmetic operations. The first part of the control card specifies fields to be left-adjusted, while the second part controls right adjusting. In the following examples, a lowercase b indicates a blank:

#### Left Adjustment

Alphabetic comparison or sorting require fields to be left-adjusted, with blank fill. For example:

<u>Before</u>	<u>After</u>
bbbABC	ABCbbb
bbRSbT	RSbTbb

#### Right Adjustment

Arithmetic and logical operations require right-adjusted fields, with either blanks or zeros for fill. For example:

<u>Before</u>	<u>After</u>	
b21886bbb	bbbb21886	(Blank fill)
b21886bbb	000b21886	(Zero fill)

To completely zero-fill the high-order positions, the field should be specified for both left and right adjustment on the same control card, as in:

b21886bbb	(original field)
21886bbb	(left adjust)
000021886	(right adjust)

## Control Card Format

<u>Column</u>	<u>Contents</u>
1	E (control card identification)
2-3	Number of fields to be left-adjusted. If none, enter 00. Maximum is ten (see note).
4-5	Field number of first data field to be left-adjusted as defined to the data input control program run that generated the input file must be blank if columns 2-3 contain 00. The entry 00 is invalid (see note).
6-7	Field numbers of the second through tenth input data fields to be left-adjusted (card columns 6-7 to 22-23). Use two columns per field. Columns should not be skipped. Unused columns are left blank. At least two blank columns must follow the last specified field number (see note).
8-9	
10-11	
12-13	
14-15	
16-17	
18-19	
20-21	
22-23	
24-25	Blank
26-29	Unused
30	Insert character. Must always be a zero or blank. This character will be used to fill the high-order position of fields when right adjusting a data field.
31-32	Number of fields to be right-adjusted. Maximum of fifteen fields. Enter 00 if none (see note).
33-34	Field number of first data field to be right-adjusted. Must be blank if 31-32 contains 00.

35-36	Second through fifteenth fields to be right-adjusted. Follow specifications outlined for columns 4-23 (see note).
37-38	
39-40	
41-42	
43-44	
45-46	
47-48	
49-50	
51-52	
53-54	
55-56	
57-58	
59-60	
61-62	
63-64	Blank
65-79	Unused
80	Input file disposition. Any value indicates input is to be saved. Blank indicates that input file is not to be saved.

Note: These fields must contain only the numerical characters from 0-9 with leading zeros. Field range is from 01 through 25.

Messages

CONTROL CARD ERROR LIST, CARD COLS 2-23

This is the heading for error messages pertaining to columns 2-23, and will always be printed.

ERROR LIST, CC 30-62

This is the heading for error messages pertaining to columns 30-62, and will always be printed.

\*\*\*\*MAX. VALID FIELD NO. IS XX\*\*\*\*

XX is the number of data fields per tape record as specified in the control card for the data input control program. It is always printed.

TOO MANY FIELDS TO BE ADJUSTED, MAX. L-10, R-15

Card columns 4-25 and/or 33-64 have been used, thus requesting more than ten and/or fifteen data fields to be left/right-adjusted, respectively. This error message may appear under one or both of the above headings.

INVALID FIELD NO. IN CC#OXX/OYY

One (or both) of the character(s) at card columns XX and/or YY (YY=XX+1) is an alphabetic or special character, 00, or a number greater than the number of data fields as specified in the system data input control program (which number was printed out as stated above). This is an error condition.

FIELD COUNT NOT EQ. TO NO. OF FIELDS TO BE ADJ.

The left and/or right field count(s), card columns 2-3 and 31-32, is not equal to the number of left/right card fields used which precede the required two blank card columns. This is an error condition.

CHARACTER IN CC 30 NOT ZERO OR BLANK

The insert character used when right adjusting a data field can only be either a zero or a blank. This is true even when there are no fields to be right-adjusted.

SAVE TAPE UNIT X READY NEW TAPE SAME UNIT — PRESS START

This message is printed as a result of card column 80 of the control card not being blank. It is not an error message.

NONE

This message, appearing below the two error list headings, indicates no control card errors, and the program will begin to adjust the specified data fields if the system error switch is not on.

\*\*\*\*PREV. SYSTEMS ERROR - CONTROL RETURNED TO MONITOR\*\*\*\*

After printing the NONE message the system error switch is tested. If the switch is off, it adjusts the specified data fields; if the switch is on, the above message is printed and the control is returned to the system monitor. This indicates that one of the previously run programs had detected a control card error and set the switch on.



### CONTROL CARD INDICATES NO ADJ. REQD.

The left and right field counts, card columns 2-3 and 31-32, are both 00, columns 4-5 and 33-34 are blank, and column 30 is blank or contains a zero. This condition is not considered a control card error, though no data field adjustment is performed. Control is turned over to the system monitor.

### Considerations

The start and end of program messages are printed on the IBM 1403 Printer. A CONTROL CARD message with a printout of the control card content is always printed by the program.

Card errors are noted, the program sets the system error switch on, completes checking the entire control card, printing any other error messages, and then transfers control to the system monitor. The program will not perform any data field adjustments.

Before execution of the program, either the monitor or the previously executed system program will read the field edit control card. The program, upon being read into storage, will begin to scan the control card for validity errors. An error message is printed for each error and a program error switch set. At the completion of the control card scan, the program error switch and the systems error switch are tested (see "System Rules for Operational Programs" for a description of the system error switch. The program switch indicates whether or not the control cards were acceptable to the program). If either is on, control is given to the monitor. If both are off, a check is made to ensure that the left and right field counts (card columns 2-3 and 31-32), are not both 00. If both are zero, control is given to the monitor; otherwise, the program continues.

### SYMBOL SUBSTITUTION PROGRAM

This program provides a means of inserting specific values in user-designated data fields within a file of records produced by the data input control program.

Control cards used to locate records in the file contain two values, each up to 34 characters long. One is the current value used to locate designated records. The other value is used to replace the current value, or be inserted in another field of the records containing the current value.

The options provided are:

#### A. Insert a value in every record.

This may be used, for example, to insert a date or project number, or other constant value in each record when the file is to be merged with other files, but individual records must retain their source identity.

B. Insert or substitute a value in selected records.

The finder value in the control card is used to select specific records. The new or replacement value is either substituted for the current value or inserted in another field in the record.

C. Selectively replace values in a file containing several ascending sequences or strings of records. A new sequence is identified by a record with a value lower than that of the preceding record.

Three suboptions are available for this type of file:

C1. Substitute the new value from the control card whenever a record in the input file contains the current value specified in the control card. The new value from a single control card may be entered in many successive records, as long as the control card current field equals the tape record current value. When a new sequence in the input is detected, or the current value in a file record is higher than the current value in the control card, a new control card is read in.

C2. This option is similar to C1, except that the substitution is made only in the first matching record found by the program. A new control card is then read in.

This option provides the facility for modifying individual records in a file if the file sequence is known.

C3. This option is similar to C2, except that no substitution is made, and the first matching record is copied onto the output file. The next data record and control card are then read in.

By using two control cards, this option can be used to skip the first matching record and:

- a. Option C2 used to insert a value in the second record, or
- b. Option C1 used to insert a value in all matching records except the first.

### Control Card Formats

Two types of control cards are used. The C-type control card is used if a single constant is to be entered in every record. If used, it is the first card to be read in. For substituting a new value, as many F-type control cards are used as necessary, but only one C-type card in any given run. Both C- and F-type cards may be used in the same run.

### Symbol Definition Control Card C

<u>Column</u>	<u>Contents</u>
1	C (program identification)
2	C (control card identification)
3-4	Not used
5-6	Number of field in which the new value is to be inserted. This must be a number with any necessary leading zeros.
7-9	Not used
10	Input tape file disposition. Any character other than a blank indicates that the input tape is to be saved.
11-46	Unused
47-80	The constant value to be inserted. Value to be punched right-adjusted. Length should not exceed the data field in which the constant is to be inserted. Use leading (high-order) blanks or zeros as required to fill the receiving field.

### Symbol Definition Control Card F

<u>Column</u>	<u>Contents</u>
1	C (program identification code)
2	F (control card identification)
3-4	The number of the input record field that contains the current (old) value to be tested. This number must be the same on all CF control cards in any one run (see note).
5-6	The number of the input record field in which the new value is to be inserted. This number must be the same on all CF control cards in any one run (see note).
7-8	Sequence number. All CF control cards in a given run are assigned an arbitrary sequence number from 01-99 by the user. These columns are left blank to indicate the same sequence as the preceding control card. The first card of a new sequence must not be left blank (see note).

- 9                   Option control. Only the following values are valid:
- Blank - substitution of new value is to be made in all data records containing the old value.
- 0 - do not change matching record. Copy it on output file, read next control card and next data record.
- 1 - substitute new value in the first matching record, then read in next control card and data record.
- 10                  Input file disposition:
- Blank - do not save input tape.
- Any other value - save input tape. If a CC card is not used, this must be on first CF card to save the input.
- 11                  No match error indicator:
- Blank - If a control card does not match a tape record, it is not to be treated as an error condition
- Any other value - an unmatched control card is to be treated as an error condition
- 12-45              Old value to be located within the data file records. This value is also used for matching control cards and tape records. The value is punched right-aligned, and may consist of any BCD characters. The length of the value and the use of leading zeros or blanks must be consistent with the old value field in the tape record. The old value field number is in columns 3 and 4 of this control card.
- 46                  Unused
- 47-80              New value to be substituted or inserted in the output record field indicated in columns 5 and 6 of this control card. The value is punched right-aligned, and may consist of any BCD characters. The value should use high-order zeros or blanks so as to equal the length of the output field. This field should be left blank if card column 9 contains a zero (0).

Note: These fields must contain only the numerical characters from 0-9 with leading zeros. Unused fields are left blank.

### Sequence Control

This program alters tape records only to the extent of inserting a new value in a specified field, or substituting the new value for the old or previous value.

The tape records are considered to be in ascending sequence according to the value in the old value field (columns 3-4). A sequence break in the data file is signaled by an old value lower than the old value in the previous record. This initiates a new sequence in the file. When a control card indicates a continuation of a sequence (columns 7-8), and the tape file has a sequence break, a tape sequence error is assumed unless the "no match" error indicator (column 11) is blank.

### Messages

The following messages pertain to error conditions. Errors detected that would cause erroneous results are signaled by setting an error switch. Control card analysis continues, but program execution is suppressed. Setting the error switch establishes a "Don't Do" condition. This is preceded by:

- Rewinding and unloading tape units 3 and 4
- Printing a message indicating which tape unit contains the input file to be saved
- Setting the system error switch
- Printing a message indicating the transfer of the Don't Do routine to check the remaining control cards. After the control cards have been checked, control is returned to the monitor instead of executing the program.

### ERROR, CARD COLUMN 1, INVALID FIRST CARD

Character is not a C. Card is listed. TRANSFER TO MONITOR message is printed (but not if error message is produced by Don't Do routine), and control is returned to the monitor program.

### ERROR, CARD COLUMN 2, INVALID FIRST CARD

Character in column 2 is not a C or F. Transfer to Don't Do routine.

### ERROR, CARD COLUMN 2

Character is not a C or F. Card is listed. Transfer to Don't Do routine.

### ERROR, CARD COLUMN 9

Character is not a blank, 0, or 1. Card is listed. Transfer to Don't Do routine.

ERROR, INVALID FIELD NUMBER, CARD COLS. 3-6

Refer to explanation of these columns in control card format. Card is listed. Transfer to Don't Do routine.

ERROR, INVALID FIELD NUMBER CARD COLS. 7-8

Field is not all blank or numeric. Card is listed. Transfer to Don't Do routine.

EOF, NO MATCH FOR CARD

End-of-tape file has been reached with a CF control card still remaining in the card reader to be processed. Card is listed. This is repeated for each card if more than one card remains to be processed. If the no match error indicator (card column 11) field on the card is blank, the condition is not an error and the program continues normally. If the field is not blank, the condition is an error and the program is transferred to the Don't Do routine. This message is produced by the EOF routine.

NO MATCH, OLD VALUE NOT FOUND

Column 11 of the control card indicates if this is an error condition. No match of control card with data record on tape was found. Card is listed. If not an error condition (card column 11 is blank), the program continues normally. If an error condition (card column 11 is not blank), program is transferred to the Don't Do routine. This message is produced by the Don't Do routine.

SEQUENCE ERROR

The old value (card columns 12-45) of the control card being checked is lower than that of the previous card. The cards are not in the proper sequence to match the file. Card is listed. This message is produced by the Don't Do routine.

SEQUENCE ERROR, CARD COLUMN 7-8

The sequence number (card columns 7-8) of the current control card is of lower sequence value than the previous card. Card is listed. Control is transferred to the Don't Do routine.

SEQUENCE ERROR TAPE VALUE IS Y-Y. PREVIOUS TAPE VALUE WAS X-X.

The old value of the tape record being processed (Y-Y) is of lower sequence value than the previous record (X-X). Refer to sequence control section for an explanation of this type of error. Transferred to Don't Do routine.

SEQUENCE ERROR CARD VALUE IS Y-Y. PREVIOUS CARD VALUE WAS X-X.

The old value (card columns 12-45, which replaces Y-Y) of the current control card is of lower sequence value than that (which replaces X-X) of the previous card. Transferred to Don't Do routine. This message is not produced by the Don't Do routine.

## SAVE TAPE UNIT X MOUNT NEW TAPE INSTEAD PRESS START TO CONTINUE

This message is produced only by the End-of-File (EOF) routine as a consequence of card column 10 not being blank in the control cards of the run. X is replaced by the tape unit number on which the input data file is mounted. The unit is rewound and unloaded and the computer halts. When the new tape for the next program is mounted, press start to continue.

### Other Messages

In addition to the above messages, start and (if run is completed, producing a closed output tape file) end-of-job messages are printed, along with program identification, as well as TRANSFERRED TO MONITOR, and TRANSFERRED TO DON'T DO ROUTINE messages.

### FIELD REDEFINITION PROGRAM

This program provides the ability to change the format of data records and ready the system for immediate processing of the new records. The following options are available:

- Combine two or more fields into a single field
- Separate a field into two or more fields
- Add or delete fields
- Specify a new blocking factor
- Pad records with 9s to a multiple of 5 or 6 to facilitate sorting on the IBM 7080 or 7090

The program produces the new data tape, modifies the system constants and tables, and punches control cards for the data input control program. These cards are used if the redefined tape is to be used as input at another time. A report is printed specifying:

- Output blocking factor
- Number of fields per record
- Number of padding characters per record
- Record size
- A definition of each field, including the high- and low-order positions as well as the length

## Redefining Fields

The three digits used to define the high- and low-order positions of each field must be greater than 000, and equal to or less than the size of the input record.

Fields are deleted by not specifying them on the control cards.

Fields must be defined in consecutive columns of the control cards without blanks between any six-column group. The defined field positions will reflect the new output data record. Leave the unused fields blank. The first blank column between 7 and 78 in the first card, and 3-80 in the second card signals the program that the last entry was the last field defined.

The number of fields defined must equal the number of fields per record (columns 5-6, first control card).

If fields are to be combined, enter the resultant number of fields in 5-6. For example, if seven fields are defined, and three are combined into one field, the field count should be 5.

Any number of fields up to 25 may be combined. A plus sign must be punched over the units position of the low-order address of fields to be combined with the next defined field.

A plus sign in the last column of the last field defined is an error, since the defined field cannot be combined with any following field.

No field in the new record may exceed 99 characters in length, no record may exceed 999 characters in length, and no block may exceed 1500 characters in length.

## Control Card Formats

Up to twelve fields can be redefined using one control card. A second card is required for up to 25 fields.

New fields are defined by field number and contents, with the contents expressed as the high- and low-order positions of the desired data within the old record.

### First Field Redefinition Control Card

<u>Column</u>	<u>Contents</u>
1	R (control card identification)
2	Number of field redefinition control cards. Enter either 1 or 2.
3-4	Blocking factor for new records. Blank if blocking factor is to remain the same; otherwise, enter a two-digit number.



5-6		Number of fields to be defined for the new record, up to a maximum of 25. Must be a two-digit number from 01-25. Leave blank if not changing the record, but only reblocking.
7-12	Field 01	Definition of first field of a new record. Six columns are used to define a field. The first three, such as columns 7-9, contain the high-order character position of the field in the old record. The second three, such as 10-12, contain the low-order character position of the field in the old record. Leading zeros must be punched.
13-18	Field 02	
19-24	Field 03	
25-30	Field 04	
31-36	Field 05	To combine different sections of the record into a single field, define both sections of the old record in 12 successive columns, and put a plus sign (12 punch) over the units position of the low-order character position in the first of the two defined fields. These field definitions consist of six numeric entries with leading zeros, except for the described field combination option.
37-42	Field 06	
43-48	Field 07	
49-54	Field 08	
55-60	Field 09	
61-66	Field 10	
67-72	Field 11	
73-78	Field 12	
79		Record padding indicator:  Blank - no padding  5 - pad records to a multiple of 5  6 - pad records to a multiple of 6  Any other value is an error
80		Any value punched in this column indicates that the input tape file is to be saved

Second Field Definition Control Card

<u>Column</u>	<u>Contents</u>
1	R (control card identification)
2	2 (number of control cards)

<u>Column</u>	<u>Contents</u>
3-8	Field 13
9-14	Field 14
15-20	Field 15
21-26	Field 16
27-32	Field 17
33-38	Field 18
39-44	Field 19
45-50	Field 20
51-56	Field 21
57-62	Field 22
63-68	Field 23
69-74	Field 24
75-80	Field 25

Columns 3-80 are used to define the thirteenth to the twenty-fifth fields, as required. Leading zeros must be punched.

#### Redefined Data Record

The input data records for the field redefinition program are fixed-length tape records, blocked or unblocked. The output tape consists of the new redefined data records formatted as defined in the field redefinition control card(s). The new record will consist of:

1. All the fields defined in the control card(s)
2. A record mark as the last character of the record
3. Enough padding characters (nines) to make the number of characters in the record (record mark included) a multiple of 5 or 6, if specified in the control card

#### Messages

The entire control card is checked for validity before any file processing takes place. The detection of errors causes a transfer to the monitor program. The input tape is rewound if the file had been opened.

ERROR FOUND - DON'T DO SWITCH SET

This message follows the printout of any of the error messages. The processor is then placed in a locked halt. Correct error condition and restart program.

CHAR LOCATION EXCEEDS RECORD SIZE, CARD X COL Y

X is 1 or 2; Y is the last (sixth) column of the field definition field. The low-order number is not less than the size of the input record.

COL 2 INVALID IN CARD 1

COLS 3-4 INVALID IN CARD 1

COLS 5-6 INVALID IN CARD 1

COL 79 IN CARD 1 INVALID

ERR ON INPT TAPE -- NO TM AFTER 9S RCD

In the system, the last block of blocked tape records is padded with a nines record when necessary. This message is printed if a nines record appears, but is not in the last block of the input. The program, after printing this message, assumes that this was the last block, executes the end-of-file routine, and then returns control to the monitor program without setting the system error switch.

FIELD EXCEEDS 99 CHAR.

One of the fields to be defined in the control card(s) for the new records would exceed 99 characters in length. This error is detected when processing the input tape.

ILLEGAL BLANKS BEFORE CHAR IN CARD X COL Y

X is 1 or 2; Y is the last (sixth) column on the field definition field. The message appears when what was presumed to be the last field definition is not the last one. The first column of the field is blank, but the last (sixth) column is not blank.

INVALID CHAR IN CARD X COL Y

X is 1 or 2; Y is any column in a field definition field.

NO 2 IN CARD 2 COL 2

NO R IN CARD 1 COL 1

NO R IN CARD 2 COL 1

NO. OF FIELDS WRONG IN COLS 5-6 CARD 1

NONEXISTENT FIELD IN CARD X COL Y

X is 1 or 2; Y is the last (sixth) column of the field definition field. The error is that the three-digit high-order number is greater than the low-order number.

ONLY 1 CARD WITH 2 IN C/C2

No second card.

OUTPUT BLOCKS EXCEED 1500 CHAR

Processing of the input tape record brought out this error, which was not apparent from the control card(s).

PLUS NUMERIC ON LAST FIELD IN CARD X COL Y

X is 1 or 2; Y is the last (sixth) column of the field definition field.

RECORD EXCEEDS 999 CHAR.

This error, not apparent from the control card(s), has been brought out by the processing of the input tape record.

SAVE REEL ON TP UN X, MOUNT NEW REEL - PRESS START

X is the tape unit on which the input data file is mounted. This is an instruction to the operator and is printed when the user requests the program to save the input reel by punching a character in column 80 of card 1. The tape is rewound and unloaded and the computer halted to allow the operator to intervene.

STOP - DON'T DO ON

No error has been found in the control card(s) but the system error switch is on, having been set by a previous program. No further processing is performed. Control is returned to the monitor program.

ZERO CHAR LOCATION IN CARD X COL Y

X is 1 or 2; Y is the last (sixth) column of the field definition field. The message appears when either or both the high-order number or the low-order of the field is 000.

Program Operation

The program computes the length of each field and the length of the record, including padding characters and record mark. A check is made to see that the field, record, and block sizes do not exceed the maximum allowed. Constants, such as the record size, are updated in storage to reflect the new format.

A data input control card and one or two field definition control cards are punched, for use with the data input control program. Only card columns 1-8 in the data input card are punched. The cards are stacked in pocket 4.

After the last new record has been written on tape, certain housekeeping functions, such as setting field defining wordmarks in the input area, are performed. The new records can at this point be used as input for any program in the system. Control is then returned to the monitor program.

## DATA EXTRACT PROGRAM

### Function

This program permits the user to extract a defined subset of records from the data input file.

A sample of the input file may also be selected with this program for statistical analysis. For example, every Nth record can be examined to determine if it belongs to the defined subset. The factor N may range from 01 to 99.

The output is determined by statements punched in a maximum of two control cards. Selection of a record for the subset is dependent on one or more conditions specified in the logical statement.

Six compare functions with logical AND/OR functions are available to establish selection criteria. For example:

1. (Field A = Constant X) or (Field B = Constant Y) or (Field B = Constant Z)
  2. (A = X or B < Y) and (C > Z)
  3. (A > X) or (B < Y and C ≠ Z)
  4. (A > B)
- } where, A, B, C = fields  
X, Y, Z = constants

In example 1, the record will be selected if the conditions relating to either A or B are true. In example 2, the record will be selected only if field C is greater than constant Z, and either field A is equal to X or field B is less than Y. In example 3, the record will be selected if field A is greater than X, or if both the conditions relating to fields B and C are satisfied. In example 4, the content of field A is compared to the content of field B in the same record.

In addition to the logical statement being contained on no more than two control cards, the total sum of the lengths of all data fields specified in the statement cannot exceed 300 characters.

### Control Card Format

The logical statement, which defines the subset, consists of a set of one or more relational conditions joined by a logical operator with each relational condition containing

field number (may be omitted after the first time if repeated in use), a compare function, and a constant value called an argument. A description of the compare functions and the logical operations is given after the format of the control card which follows.

#### Extract Control Card 1

<u>Column</u>	<u>Contents</u>
1	X (control card identification)
2	1 (card number)
3-4	Record interval selector. It denotes the Nth record to be tested; that is, the interval to be used in the selection of records. Must always be blank or numerical in value, with leading zeros. If it is all blank or zero, the program will interpret it as 01 and test every record.
5-6	Starting record designator. It designates the first record to be tested. Must always be blank or numerical in value with leading zeros. If it is all blank or zero, the program will interpret it as 01 and start with the first record.
7	Save input tape indicator:  Blank - do not save input tape  If other than blank, the input tape will be saved
8-80	Logical statement of relational conditions defining the subset of records for the output tape

Columns 8-9: Field number of first field to be compared in the first relational conditions. Must not be greater than the number of fields in the input record. Must be a numeric entry with leading zeros.

Columns 10-11: Compare function of the first relational condition. Must be one of the six compare functions.

Columns 12-XX: The argument (constant) of the first relational condition. XX depends on the length of the constant specified here, which must be from 1 to a maximum of 99 characters, including the leading zeros that may be inserted by the program, and may not contain a / \* , = or □, since these will be interpreted as logical operators or the end-of-statement symbol. If the argument contains one or more blanks, or alphabetic or allowable special characters, it must be exactly the same length as the field compared, and leading or trailing blanks or zeros must be punched into this field of the control card. If the argument is entirely numerical, it may be shorter in length than the field compared and leading zeros need not be punched in this card as they will be inserted by

the program. A one-character argument of a single zero is not considered a leading or trailing zero. Column XX + 1 must contain a logical operator if another relational condition is to follow, or an end-of-statement ( □ ) symbol if the last relational condition of the logical condition of the logical statement has been given.

The equal sign serves a special function. When the argument or constant field contains a value preceded by "=", the value is taken as a two-digit field number (01 to 25) which contains the constant. That is, each data record may carry its own unique constant.

#### Extract Control Card 2

This card is used only if needed to complete the logical statement. It must contain X2 in columns 1 and 2. The rest of the card will be a continuation of card 1 and must end with an end-of-statement ( □ ) symbol immediately following the last argument.

#### Compare Functions

The six compare functions with their card code symbols are:

- EQ - equal to
- NE - not equal to
- LT - less than
- GT - greater than
- LE - less than or equal to
- GE - greater than or equal to

The logical operators with their card code symbols are:

- / minor OR
- \* minor AND
- ,/ major OR
- ,\* major AND

Note that the major and minor operators differ only by the addition of a comma. Their usage is illustrated in the four examples given in "Function" above. A comma takes the place of a right parenthesis with the exception of the last relational condition of the logical statement when a □ is used. No symbol is used for a left parenthesis. The presence of a left parenthesis is assumed immediately to the right of a major logical operator. Using the four previous examples, the logical operators and compare functions would be punched in the control card without spaces as follows:

1. AEQ X, /AEQY, /BEQZ □
2. AEQX/BLTY, \*CGTZ □
3. AGTX, /BGTY \* CNEZ □
4. AGT = B □ (A is greater than the value contained in field B)

The program does not make a redundancy or logical sense check of the logical statement.

### Messages

The control cards are validity checked for format, but not for redundancy or logical sense, before any movement of tape or transfer to the monitor. All errors result in the setting of the system error switch and a transfer to the monitor. The messages printed by the program follow. If a card column number greater than 80 is printed, it indicates a column on the second control card; subtract 78 to get the column number of the second card.

### XXX CARD OUT OF ORDER

The only acceptable extract control card sequences are (1) a single card with X1 in columns 1-2, or (2) a single card with X1 in columns 1-2, followed by a second card with X2 in columns 1-2. Any other sequence or occurrence is an error condition. The message indicates whether the first or second control card caused the error message to be printed.

### CARD CHK. RESTARTS IN CARD COL. XXX

This appears after an error message has been printed. The program looks for the next comma on the control card and resumes checking in that column, column XXX.

### COLUMNS XX TO YY WRONG - ALPHA

Columns 3-4 and 5-6 must be numerical or blank.

### CARD IMAGE AREA OVERFLOW

The control card(s) contain too many fields. Their representation overflows the 300 positions of storage allocated.

### X CHAR CAN'T FOLLOW COMMA - COL YYY

A comma must be directly followed by / or \*. Any other character, which replaces X, is an error. YYY is the column where X is located.

### X CHAR CAN'T FOLLOW COMP F - COL YYY

X designates a logical operator or end-of-statement character in card column YYY. The compare function must be directly followed by an argument which cannot contain any of



these special symbols (see "Control Card Format" in this section). Note, therefore, that to compare a single zero or a single blank, the card argument field must contain the zero or blank.

COMP FUNCT ERR IN COLS XXX TO YYY

The compare function punched into the control card columns designated must use the card code symbols of one of the six legitimate compare functions (for the symbols, see "Control Card Format" in this section).

FLD NO ERR IN COLS, XXX TO YYY

Invalid field number in the control card columns designated (see explanation of asterisk in "Control Card Format" in this section).

LGTH FROM TABLE GR THN 99 IN FLD IN CARD COL XXX

XXX is the first column of the field number punched on the control card. The length of this field has been found to be greater than 99 characters.

NO □ ON EITHER CARD

The required end-of-statement symbol (lozenge, 12-4-8 punch) is not on the control card(s).

NUM CNT COL XXX GR THN CALC LNGTH

XXX specifies the last column of the argument. The argument is longer than the length of the data field.

TOT LNGTH ALL COMBND FLDS GR 300

The calculated sum of the length of all fields plus field identification exceed 300 positions and would therefore overflow the data list area. The length of each data field indicated in the control card is added to the total accumulated length each time an argument appears, even though the field number is not repeated.

VARIABLE ALPHA FLD START IN COL XXX IS YYY CHAR LONG.

DATA FIELD IS ZZZ CHAR LONG

The argument, starting in the specified column of the control card, is non-numeric and is not the same length as the data field. The message indicates the actual length in place of YYY and ZZZ. When alpha data is used, it is necessary to insert enough leading or trailing blanks on the control card in the same positions as such blanks occur in the data, to make both fields of equal length.

### CONTROL CARD ERRORS

This message is printed from the left-hand edge of the paper at the end of phase 1 of the program, to indicate that one or more errors have been found on the control card. The program will not execute phase 2 but will transfer control back to the monitor program.

### NO CONTROL CARD ERRORS

This message is printed at the end of phase 1 of the program to indicate that the control card(s) are correct, and that the program is ready to continue with phase 2.

### PROG TAPE RD ERR, PRESS START TO TRY AGAIN

The program completed phase 1 and, finding no control card errors, has attempted to read in phase 2 from the system program tape. Upon detecting one read error the program halts. The operator may cause another read attempt by pressing the start key.

### START PHASE 2

Phase 2 has been successfully read into storage.

### 9S RCD FOUND

A record consisting entirely of nines and ending with a record mark was found and bypassed. This message is printed only once per data block processed.

### SAVE TAPE UNIT X, MOUNT NEW TAPE SAME UNIT

X is the unit number of the input file drive. Unit X is unloaded and the processor is halted. After mounting a new reel, press the start key.

### Program Operation

The program is a two-phase operation. Phase 1 is read in to check the validity of the control card fields and set up in storage the various criteria governing the selection of individual data records for the new data tape. If there are one or more errors in the control card(s), the system error switch is set on and control is returned to the monitor, therefore, phase 2 of the program will not be executed. Phase 2 also will not be executed if the system error switch is on from a previous program. If there are no control card errors and the system error switch is not on, phase 2 of the program is read from the program tape and the processing of the old data tape is performed. During phase 2, blocked data records are examined by the program according to the criteria set up in phase 1. Records that meet the desired requirements are selected and the entire record placed in an output area, using the same blocking factor as the data record input tape. As the testing of a set of blocked records is completed, a new block of records is read into storage. In turn, as blocks of selected records are created they are written on the output tape -- the new data tape. This process is repeated until all the specified records are examined.

## CHAPTER 3: REPORT PROGRAMS

### MATRIX REPORT PROGRAM

#### Function

This program produces a summary report in a matrix format. It provides a distribution by class based on two fields in each record of a sorted file. Figure 5 shows the general format of the report.

FIELD B  
SORT  
SEQUENCE

FIELD A  
DISTRIBUTION

	Group 1	Group 2	Group 3	Group 4	Group N	Over	Total
Class A	3		1			2	6
Class B		1	7	2			10
Class C	1	1	1				3
Class N	2				1	1	4
Over	5	4		3		3	15
Total	11	6	9	5	1	6	38

Figure 5. General format of matrix report

Each line in the report is developed individually. In Figure 5, for example, a total of ten records were found in class B. Of these, one was in group 2, seven were in group 3, and two were in group 4.

In order to produce the report, the vertical (class) and horizontal (group) limitations must be defined. The single control card required by the program includes:

- Vertical starting value
- Vertical limiting value
- Vertical increment
- Horizontal starting value
- Horizontal increment

This provides a high degree of selectivity, and many levels of summarization from a single file.

Figure 6 illustrates four input records and three types of reports that can be produced with this program. The four records represent sales records on the input file that have been sorted on field 5, the city code. Each record on the file represents one sale.

The first report form shown (type 1) is a count report, containing record counts for each class (city code group) and group (dollar class) within class. The second report (type 2) is the count report converted to percentages, based on the total number of records. The third report (type 3) is a summation report, where two fields in each record (month and city) are used to locate the cell in the matrix to contain the sum of a third field (amount of sale).

The input file must be sorted in ascending sequence on the vertical field. Each line on the report is printed based on a minor control field change. Major and intermediate control fields may be specified on the vertical axis and used to produce a series of reports from a single file in a single run. If major and intermediate fields are not specified, a single report will be produced.

If a single report is produced, all records in the input file will be included in the overall total on the report. If several reports are produced because intermediate and major control fields were specified, the sum of the totals on the reports produced will reflect all of the records in the input file.

The count report in Figure 6 shows the output resulting from the four records shown. In the example, the intermediate and major control fields were not specified, and the report was defined on the control card as follows:

Vertical starting value - This could have been any number between zero and 139. However, when the starting value is known, it should be stated to reduce the valid number of output lines in the report. The value specified is an upper limit range for the vertical control output line. All records equal to or lower than this value are included on the first line of the report.

Vertical limiting value - Any value in the file higher than this value is entered in the "over" line at the bottom of the report. Given a vertical limiting value of 159, any city code exceeding 159 would appear in the "over" line.

Vertical increment - This is the basic vertical control specifying the ranges of values to be included on each line. The detection of a value exceeding the range causes a minor break and the printing of the accumulated line data. In Figure 6, the vertical increment was specified as 10. As shown in parentheses, the first line contains values from 000 to 139, and the second line values from 140 to 149. Only the upper limits are printed on the vertical lines of the actual report.

INPUT RECORDS

	Field Numbers						N
	1	2	3	4	5	6	
	Month	Year	Amount of Sale	State	City	Salesman	Other Data
Record 1	02	64	0018600	31	132		
Record 2	02	64	0504000	31	132		
Record 3	04	64	0001935	31	149		
Record 4	05	64	0028500	31	158		

TYPE 1 - COUNT REPORT

City Codes		Dollar Class						Total
		(0-100)	(101-200)	(201-300)	(301-400)	(401-500)	(501 and up)	
		100	200	300	400	500	Over	
(000-139)	139		1				1	2
(140-149)	149	1						1
(150-159)	159			1				1
(160-up)	Over							
Total		1	1	1			1	4

(Number of sales within each city group by dollar amount groups.)

TYPE 2 - PERCENTAGE REPORT

City Code		Dollar Amount						Total
		100	200	300	400	500	Over	
139			25.00				25.00	50.00
149		25.00						25.00
159				25.00				25.00
Over								
Total		25.00	25.00	25.00			25.00	100.00

(Sales within each city group by dollar amount groups expressed as a percentage of total numbers of sales.)

TYPE 3 - SUMMATION REPORT

City Code		Month					Total
		01	02	03	04	05	
139			522600				522600
149					1935		1935
159						28500	28500
Over							
Total			522600		1935	28500	553035

(Total dollar amount of sales within each city group by month.)

Figure 6. Input records and matrix reports

Horizontal starting value - This is similar to the vertical starting value. However, the data need not be sorted for horizontal values as these values are automatically calculated and placed in the correct cells. In Figure 6, the horizontal value was specified as 100. As a result, all values equal to or less than 100 in the horizontal control field will be included in the first column. The upper limits for each column are shown on the report's title page.

Horizontal increment - This is similar to the vertical increment. However, it need not be in sort sequence; it establishes upper limits for each column. The increment shown is 100, grouping sales from 0-100 dollars, 101-200 dollars, and so forth. No upper limit can be specified, since a limited number of columns can be accommodated on the printer. Note that all records on the input file exceeding the last column are reflected in the "over" column.

The percentage report (type 2) shown in Figure 6 uses the same report defining controls. Record counts, however, are expressed as percentages of the overall total.

The summation report shown in Figure 6 can be produced with the same input file. The vertical control field remains field 5, since this is the sequence control field. The horizontal control field is changed to field 1, the month of the sale. A third field, field 3, has been specified as the summation field. A horizontal increment of one has been specified.

In developing the lines of the report, the city code (field 5) determines the line, the month of the sale (field 1) determines the horizontal group within the line. The third field, the amount of the sale (field 3) is added into the appropriate cell.

Matrix Report Title Page. A title page always precedes each report. As illustrated in Figure 7, up to five lines of titles and headings may be printed. This provides a convenient control sheet for each report, reflecting the information in the matrix control card as well as identifying the report.

Count Report - Type 1. The number of columns is fixed at twelve, not including the "over" and total columns. When less than twelve fields are specified, unused columns are left blank on the report. Since the first column necessarily includes all data with a value from zero up to the specified horizontal starting value, as many as eleven groups may be isolated by equal increments on each line.

Each entry or total may not exceed eight digits (99,999,999 or 999,999.99).

Up to 999 lines may be printed in each report. The input file must be sorted on the vertical field. Both the vertical and horizontal fields must contain unsigned numeric values not more than thirteen digits in length. The symbol substitution program can be used to modify alphabetic and signed fields to the required unsigned numeric fields for processing.

The count report is illustrated in Figure 8.

(1ST LINE - THE OPTIONAL TITLE LINE)

FIELD NAME FIELD NUMBER	MAJOR 01	INTERMEDIATE 02	VERTICAL 03	HORIZONTAL 04	SUMMATION
----------------------------	-------------	--------------------	----------------	------------------	-----------

(THE OPTIONAL HEADING LINES)

00001 - MAJOR FIELD  
00001 - INTERMEDIATE FIELD

HORIZONTAL FIELD UPPER LIMITS

X01	500
X02	1000
X03	1500
X04	2000
X05	2500
X06	3000
X07	3500
X08	4000
X09	4500
X10	5000
X11	5500
X12	6000

**NOTE:** THIS IS AN EXAMPLE OF THE TITLE PAGE LISTED PRIOR TO THE EXECUTION OF THE MATRIX REPORT PROGRAM. THE VALUES APPEARING ON THIS PAGE REFLECT THE MATRIX REPORT CONTROL CARD FIELDS USED IN GENERATING THE OUTPUT REPORTS. THE HORIZONTAL FIELD UPPER LIMIT VALUES ARE REFERENCED BY X01, X02, X03...ETC.

Figure 7. Title page -- matrix report program

COUNT REPORT

UPPER LIMIT	X01	X02	X03	X04	X05	X06	X07	X08	X09	X10	X11	X12	OVER	TOTAL
1948			10	10	10	5	5							40
1949			10	10	10	10	10							50
1950			10	10	15	10	5							50
1951			10	15	15	10	10							60
1952				15	15	10	10							50
1953				10	15	10	5							40
1954				15	20	10	5							50
1955				20	10	15	10	5						60
1956				15	15	10	5	5						50
1957				15	20	15	5	5						60
1958				15	20	15	15	5						70
1959				10	20	15	10	5	5	5				70
1960			5	15	20	20	15	10	10	5				100
1961			5	10	25	20	15	10	5	5	5			100
1962				20	30	20	20	10	10	5	5			120
OVER				5	10	5		5	5					30
TOTAL			50	210	270	200	145	60	35	20	10			1000

Figure 8. Count report — matrix report program



Percentage Report - Type 2. The percentage report specifications are the same as those for the count report. Percentages are based on the overall total in the lower right-hand corner of the report, and are expressed to two decimal places (100.00).

The percentage report is shown in Figure 9.

Summation Report. This report has the same basic specifications as the count report with a few exceptions. The number of columns is not fixed at twelve, but can range from four to eighteen, depending on the length of the summation field. A table of the number and size of columns for the summation report is included in Figure 11 along with the formula used by the program.

The values in the summation field in the input record may be signed or unsigned, and not more than thirteen digits in length. Negative sums are printed on the report with a B-bit over the units position so that 1234-, for example, appears as 123M.

Figure 10 illustrates the summation report.

Processing. The report-producing program operates in four phases, reflecting the user's option to produce a count report, a percentage report, both of these, or only a summation report.

Phase 1 sets up the titles, headings, and field numbers in a reserved area of storage along with the print routine for the title pages. This information is contained in the control cards. Phase 1 reads in and passes control to phase 2.

Phase 2 checks the matrix report control card. Appropriate error messages are printed as required. The entire card is checked regardless of the number of errors found. If no errors are found and the system error switch was not set on previously, phase 2 reads in and passes control to phase 3. A control card error turns on the system error switch, which causes control to be passed to the monitor instead of calling in phase 3.

Phase 3 consists of two sections. One contains routines common to all three reports, such as sequence checking and input/output programming. The other section contains the routines for the count and percentage reports. Phase 3 prints the title page except for the horizontal limits, then tests to see if the summation report has been requested. If so, phase 4 is read in, overlaying the section of phase 3 used for the count and percentage reports. The summation report is then processed. If the summation report is not requested, all processing is done in phase 3. At the end of file indication, control is returned to the monitor program.

Print lines are developed one at a time. A minor change in the vertical field causes the current line to be printed, and the succeeding line started. A major or intermediate change results in the completion of the matrix report, and the start of the next report.

If a percentage report is called for, with or without a count report, each line is retained on a scratch tape. When the report is completed, this tape is rewound and used to calculate and print the percentage report. This procedure is followed for each pair of count and percentage reports.

PERCENTAGE REPORT

UPPER LIMIT	X01	X02	X03	X04	X05	X06	X07	X08	X09	X10	X11	X12	OVER	TOTAL
1948	.00	.00	1.00	1.00	1.00	.50	.50	.00	.00	.00	.00	.00	.00	4.00
1949	.00	.00	1.00	1.00	1.00	1.00	1.00	.00	.00	.00	.00	.00	.00	5.00
1950	.00	.00	1.00	1.00	1.50	1.00	.50	.00	.00	.00	.00	.00	.00	5.00
1951	.00	.00	1.00	1.50	1.50	1.00	1.00	.00	.00	.00	.00	.00	.00	6.00
1952	.00	.00	.00	1.50	1.50	1.00	1.00	.00	.00	.00	.00	.00	.00	5.00
1953	.00	.00	.00	1.00	1.50	1.00	.50	.00	.00	.00	.00	.00	.00	4.00
1954	.00	.00	.00	1.50	2.00	1.00	.50	.00	.00	.00	.00	.00	.00	5.00
1955	.00	.00	.00	2.00	1.00	1.50	1.00	.50	.00	.00	.00	.00	.00	6.00
1956	.00	.00	.00	1.50	1.50	1.00	.50	.50	.00	.00	.00	.00	.00	5.00
1957	.00	.00	.00	1.50	2.00	1.50	.50	.50	.00	.00	.00	.00	.00	6.00
1958	.00	.00	.00	1.50	2.00	1.50	1.50	.50	.00	.00	.00	.00	.00	7.00
1959	.00	.00	.00	1.00	2.00	1.50	1.00	.50	.50	.50	.00	.00	.00	7.00
1960	.00	.00	.50	1.50	2.00	2.00	1.50	1.00	1.00	.50	.00	.00	.00	10.00
1961	.00	.00	.50	1.00	2.50	2.00	1.50	1.00	.50	.50	.50	.00	.00	10.00
1962	.00	.00	.00	2.00	3.00	2.00	2.00	1.00	1.00	.50	.50	.00	.00	12.00
OVER	.00	.00	.00	.50	1.00	.50	.00	.50	.50	.00	.00	.00	.00	3.00
TOTAL	.00	.00	5.00	21.00	27.00	20.00	14.50	6.00	3.50	2.00	1.00	.00	.00	100.00

Figure 9. Percentage report — matrix report program

UPPER LIMIT	X01	X02	X03	X04	X05	X06	X07	X08	X09	X10	X11	OVER	TOTAL
1948			15000	20000	25000	15000	17500						92500
1949			15000	20000	25000	30000	35000						125000
1950			15000	20000	37500	30000	17500						120000
1951			15000	30000	37500	30000	35000						147500
1952				30000	37500	30000	35000						132500
1953				20000	37500	30000	17500						105000
1954				30000	50000	30000	17500						127500
1955				40000	25000	45000	35000	20000					165000
1956				30000	37500	30000	17500	20000					135000
1957				30000	50000	45000	17500	20000					162500
1958				30000	50000	45000	53500	20000					197500
1959				20000	50000	45000	35000	20000	22500	25000			217500
1960			7500	30000	50000	60000	52500	40000	45000	25000			310000
1961			7500	20000	62500	60000	52500	40000	22500	25000	27500		317500
1962				40000	75000	60000	70000	40000	45000	25000	27500		382500
OVER				10000	25000	15000		20000	22500				92500
TOTAL			75000	420000	675000	600000	507500	240000	157500	100000	55000		2830000

Figure 10. Summation report -- matrix report program

When the length of summation field is	The number of columns in summation report (excluding OVER and TOTAL) is	The number of print positions in each column of the report is
1	17 - 18	6
2	14 - 15	7
3	12 - 13	8
4	10 - 11	9
5	9 - 10	10
6	8 - 9	11
7	7 - 8	12
8	6 - 7	13
9	6	14
10	5 - 6	15
11	5	16
12	4 - 5	17
13	4	18

Note: The exact number of columns also depends on the size of the vertical field. The program computes the number of columns by means of the following formula:

$$\text{Number of Columns} = \frac{\text{Field C} + \text{Field B} - 119 - 2(\text{Summation Field Length}) - (\text{Vertical Field Length})}{5 + (\text{Field C Length})}$$

A minimum value of 5 is taken for field B if it is less than 5 in length.

Figure 11. Table of number and size of columns for summation report

## Using the Matrix Report Program

This program must be preceded by the data input control program. It produces a formatted data tape acceptable to the matrix report program. If the input file is in the proper format, the data input control program sets up the necessary system constants and tables without modifying the data records.

A maximum of eleven control cards can be used by this program, ten of which are optional heading and title control cards containing an M punch in column 1.

If a single report is required, major and intermediate fields should not be specified. If the intermediate field is omitted, reports will be produced on changes in the major field.

### Title Page Format

Figure 7 illustrates the title page, and Figure 12 shows the format. The optional lines, 1, 7, 8, 10, and 11, may all be used, or only those desired. The program treats the optional lines as three groups, with line 1 considered as one group, lines 7 and 8 as a second group, and lines 10 and 11 as a third group. If all cards of a group are omitted, the next group that contains one or more cards is moved up to take its place. Note that two cards are required to print each line if more than 66 print positions are required.

The matrix control card must be immediately followed by the title and header control cards in the sequence shown in Figure 12.

### Control Card Formats

#### Title Control Card Preparation (Optional)

<u>Column</u>	<u>Contents</u>
1	M (program identification, matrix program)
2-3	Blank
4	T (identifies card as title control card)
5	Card number: 1 for print positions 1-66 2 for print positions 67-132
6-71	Actual title section to appear on title page in print positions specified in column 5. Space and punctuate as desired.
72-80	Blank

<u>Line</u>	Print positions 1 - 66	Print positions 67 - 132	<u>Source of Data</u>	<u>Optional</u>		
1	<table border="1"> <tr> <td>T1</td> <td>T2</td> </tr> </table>		T1	T2	Title Control Cards	YES
T1	T2					
2	(blank)		Program			
3	(blank)		Program			
4	FIELD NAME	MAJOR INTERMEDIATE	Program			
5	FIELD NUMBER	01 02	Matrix Report Control Card	NO		
6	(blank)					
7	<table border="1"> <tr> <td>F1</td> <td>F2</td> </tr> </table>		F1	F2	Heading Control Cards	YES
F1	F2					
8	<table border="1"> <tr> <td>F3</td> <td>F4</td> </tr> </table>		F3	F4	Heading Control Cards	YES
F3	F4					
9	(blank)					
10	<table border="1"> <tr> <td>F5</td> <td>F6</td> </tr> </table>		F5	F6	Heading Control Cards	YES
F5	F6					
11	<table border="1"> <tr> <td>F7</td> <td>F8</td> </tr> </table>		F7	F8	Heading Control Cards	YES
F7	F8					
12	0000 - Major Field		Matrix Control Card	NO		
13	0000 - Intermediate Field		Matrix Control Card	NO		
14	Horizontal Field Upper Limits		Program			
Balance	Calculated Upper Limits		Matrix Control Card	NO		

Figure 12. Title and header format - matrix report

### Heading Control Cards (Optional)

<u>Column</u>	<u>Contents</u>
1	M (program identification, matrix program)
2-3	Blank
4	F (heading control card identification)
5	Card number. Cards are identified as F1 through F8 in columns 4 and 5 according to desired line and print positions as shown in Figure 12.
6-71	Actual heading as desired for print positions 1-66 or 67-132. Space and punctuate as desired.
72-80	Blank

### Matrix Report Control Card

Numbers in all nonblank fields must contain leading zeros. Alphabetic and special characters cannot be used. Field numbers must correspond to fields defined on field definition control cards used in the data input control program that prepared the input file.

<u>Column</u>	<u>Contents</u>
1	M (program identification)
2-3	Blank
4	Report indicator. Must be 0, 1, 2, or 3.  0 - Count Report 1 - Percentage Report 2 - Count and Percentage Reports 3 - Summation Report
5-6**	Major field number. This field must contain a two-digit number or blanks (optional).
7-8**	Intermediate field number. This field must contain a two-digit number or blanks (optional).

<u>Column</u>	<u>Contents</u>
9-10**	Vertical field number. Must be a two-digit number (required).
11-23*	Vertical axis starting value. Must be numeric, not exceed 13 digits, and equal in length to the vertical field.
24-33*	Vertical axis increment. Must be greater than zero. Length must be less than or equal to vertical field length.
34-36*	Vertical axis limiting value. This must be equal to or greater than the starting value (columns 11-23). The difference between the vertical axis starting value and the vertical axis limiting value must be less than 1001.
47-48**	Horizontal field number. Must be a two-digit number.
49-61*	Horizontal axis starting value.
62-71*	Horizontal axis increment. This field may be zero.
72-73**	Summation field number. Must be blank or contain a two-digit number. Must not be blank if column 4 contains number 3.
74-80	Not used.

Note: Card columns marked with a single asterisk must contain the digits from 0-9 only, with leading zeros. Card columns marked with a double asterisk (\*\*) have the same limitation, and in addition must contain a value greater than 00, and less than or equal to the total number of fields defined for the input record in the data input control program.

#### Messages

The program operates in four phases. Most of the printed messages listed below are generated in phase 2, which checks columns 4-73 of the matrix report control card.

#### CODE IN CC 4 INVALID

Column 4 of the matrix report control card contains an invalid character.



#### COLUMN XX NON-NUMERIC

XX specifies a column from 04 to 73 of the matrix report control card that contains an invalid character.

#### COLUMNS XX - YY INVALID

XX-YY specifies a field of the matrix report control card, such as 47-48. There is an error in one of the field numbers. Consult the control card format section.

#### DATA SEQUENCE ERROR

Phase 3 or 4 of the program, in the process of producing the matrix reports, has discovered a sequence error in either the major, intermediate, or minor fields. The system error switch is turned on and control is returned to the monitor program without completing the matrix reports.

#### END HDR SETUP. MATRIX PRGRM BEING READ IN

Phase 1 of the header setup operation has been completed. The phase 2 instructions are being read in from the program tape.

#### END OF MATRIX REPORT

This is an end-of-job message printed at the conclusion of phase 3 or 4 to indicate the completion of the printing of the matrix reports. Control is returned to the monitor program.

#### ILLEGAL BLANKS IN CC XX-YY

XX-YY specifies a field of the matrix report control card, such as 11-23. The error is in one of the five constant fields of the control card and indicates that the numeric constant is not right-adjusted or that there are blanks within the number.

#### MORE THAN 1000 LINES REQUIRED

The vertical axis starting value, increment, and limiting value in control card columns 11-46 indicate that more than 1000 lines are required for the matrix report. The difference between the starting and limiting values divided by the increment must be less than 1001.

#### NO T/M

The last record of the input tape must be a record filled with nines and followed by a tapemark to indicate an end-of-file situation. Phase 3 or 4 of the program has located a nines record but it is not followed by a tapemark. This is a system tape error and causes the system error switch to be turned on and an immediate branch to the monitor program leaving the last matrix report incomplete.

#### START MATRIX HEADER SETUP

This is a start-of-job message printed by phase 1 of the program.

#### START OF MATRIX REPORT

This message, for information only, is printed by phase 2 of the program at the start of its matrix report control card check operation.

#### STOP DONT DO SWITCH ON

Phase two of the program has found no error in the matrix report control card, but in a test of the system error switch, before proceeding to phase 3 or 4 to produce the matrix report, the program found the switch on, indicating a previous system error condition. Control is returned immediately to the monitor program.

#### STOP ERROR IN REPORT DEFINITION CARD

Phase 2 of the program completes its check of the matrix report control card, which is the report definition card, regardless of whether or not an error is found. When the check is completed, this message is printed if an error has been found. The system error switch is set on and control is returned immediately to the monitor program. No matrix report is produced.

#### TAPE READ ERROR, START TO TRY AGAIN

A read error has occurred in reading in the instructions of phases 2, 3, or 4 from the program tape. Pressing start will begin another read attempt.

#### TITLE OR HEADING CTL CARD ERROR IN CC 4-5, CARD IGNORED

Phase 1 of the program sets up the title and heading lines of title pages that accompany the matrix reports from the title and heading control cards. The correct card identification, either T1, T2, or F1 to F8, in columns 4-5 of the card has not been found. The program continues its operation, ignoring this error card. If duplicate title or heading control cards are used (same identification in columns 4-5), only the last correct card of each type is used.

#### VERT INCR ZERO

Columns 24-33 of the matrix report control card contain a zero value. See explanation in the control card formats section.

#### WRONG LENGTH FIELD IN CC XX-YY

XX-YY specifies a field in the matrix report control card, such as 11-23. The error is in one of the five constant fields of the control card. Consult the explanation of the indicated field in the control card format section.

## QUANTITATIVE STATISTICAL PARAMETERS REPORT PROGRAM

### Function

This program produces a report in a tabular format containing various statistical values. The report may be used for direct problem analysis or as source information to be used as input to the IBM General Purpose Systems Simulator (7090-CS-05X or 7090-CS-13X).

The statistical parameters are computed on a single user-defined data field (the minor field). One to four control fields may be specified. When the content of any control field changes, a new report is produced. Input data must be sorted on the minor field. Other control fields do not have to be sequenced.

The content of the minor field (X) must be an unsigned or positive numerical value not more than 13 digits in length. The user specifies from 1 to 999 continuous ranges or intervals (N) in which to observe X.

Figure 13 is an example of this report. Note that the "field values" line of the report displays the values of the four control fields, beginning with the third intermediate and ending with the major field.

The user may select either the full quantitative report or a simplified report. The simplified report contains only those parameters indicated with an asterisk in the following section describing the parameters.

With either report, the user has the option to obtain totals on one or two specified data fields. The total fields, called secondary sum totals 1 and 2, can accommodate 15 digits.

The program allows the optional use of a title line and a header line, as indicated in Figure 13.

### Description of Statistical Parameters

Total Count*	Number of observations in the report. It is the sum of the numbers in the observed frequency column.
Number of Intervals*	The number of intervals in which the minor field (X) may be observed.
Sum of Values*	The sum of the values contained in the minor field (X) of the observed data records.
Mean Value	The sum of values divided by the total count.
Variance	The sum of the squares of the minor field values observed, minus the quotient of the sum of values squared divided by the total count, and this difference divided by a number one less than the total count.

Standard Deviation	The square root of the variance.
Mean Interval Frequency	The total count divided by the number of intervals.
Observed Frequency*	The number of observed items whose minor field value is less than or equal to the corresponding upper limit, but greater than the preceding limit. Values that exceed the last limit are counted in an "over row", which is suppressed when not needed.
Cumulative Count*	The total number of values tabulated in the observed frequency column that were less than or equal to the corresponding upper limit.
Total Percent*	The observed frequency divided by the total count. This represents the percentage of values that fall within the interval or range of values.
Cumulative Percent*	The cumulative count divided by the total count. This represents the total percentage of values that were less than or equal to the corresponding upper limit.
Remainder Percent*	100% minus the cumulative percent, representing the total percentage of values that were greater than the corresponding upper limit.
Multiple of Mean	The corresponding upper limit divided by the mean value. This statistical parameter is sometimes useful in studying exponential-type distributions.
Deviations From Mean	The corresponding upper limit minus the mean value, and this difference divided by the standard deviation.
Multiple Mean Frequency	The observed frequency divided by the mean interval frequency.
Secondary Sum No. 1*	The sum of the values in the first secondary sum field of the observed items tabulated in the corresponding upper limit.
Secondary Sum No. 2*	The sum of the values in the second sum field of the observed items tabulated in the corresponding upper limit.

SORTING HIERARCHY MAJOR (TITLE LINE) INTER 1 INTER 2 INTER 3 MINOR PAGE 000001  
 FIELD NUMBER 02 INTER 1 04 INTER 2 03 INTER 3 05 MINOR 01  
 FIELD IDENTIFICATION (HEADER LINE)  
 FIELD VALUES 0000100000100000100001

	TOTAL COUNT	NO. OF INTV	SUM OF VALUES	MEAN VALUE	VARIANCE	STANDARD DEVIATION	MEAN INTERVAL FREQUENCY			
	2	20	15	7.500	12.500	3.535	.100			
UPPER LIMIT	OBSERVED FRE- QUENCY	CUMUL COUNT	TOTAL PER- CENT	CUMUL PER- CENT	RMDR PER- CENT	MULT OF MEAN	DEVTNS FROM MEAN	MULT MN FRE- QUENCY	SECONDARY SUM NUMBER 1	SECONDARY SUM NUMBER 2
00005	1	1	50.00	50.00	50.00	.666	.707	10.000	0000000001	0000000001
00010	1	2	50.00	100.00	.00	1.333	.707	10.000	0000000001	0000000001
00015		2	.00	100.00	.00	2.000	2.121	.000	0000000000	0000000000
00020		2	.00	100.00	.00	2.666	3.536	.000	0000000000	0000000000
00025		2	.00	100.00	.00	3.333	4.950	.000	0000000000	0000000000
00030		2	.00	100.00	.00	4.000	6.364	.000	0000000000	0000000000
00035		2	.00	100.00	.00	4.666	7.779	.000	0000000000	0000000000
00040		2	.00	100.00	.00	5.333	9.193	.000	0000000000	0000000000
00045		2	.00	100.00	.00	6.000	10.608	.000	0000000000	0000000000
00050		2	.00	100.00	.00	6.666	12.022	.000	0000000000	0000000000
00055		2	.00	100.00	.00	7.333	13.437	.000	0000000000	0000000000
00060		2	.00	100.00	.00	8.000	14.851	.000	0000000000	0000000000
00065		2	.00	100.00	.00	8.666	16.265	.000	0000000000	0000000000
00070		2	.00	100.00	.00	9.333	17.680	.000	0000000000	0000000000
00075		2	.00	100.00	.00	10.000	19.094	.000	0000000000	0000000000
00080		2	.00	100.00	.00	10.666	20.509	.000	0000000000	0000000000
00085		2	.00	100.00	.00	11.333	21.923	.000	0000000000	0000000000
00090		2	.00	100.00	.00	12.000	23.338	.000	0000000000	0000000000
00095		2	.00	100.00	.00	12.666	24.752	.000	0000000000	0000000000
00100		2	.00	100.00	.00	13.333	26.166	.000	0000000000	0000000000

MIN OBS VALUE 00005 MAX OBS VALUE 00010 SECONDARY SUM TOTALS 000000000002 00000000002

NOTE: THE LENGTH OF THE FIELDS AND TOTALS FOR SECONDARY SUMS 1 AND 2 ARE ACTUALLY 5 POSITIONS LARGER IN LENGTH THAN INDICATED ABOVE.

Figure 13. Sample of quantitative report -- quantitative statistical parameters report program

Minimum Observed* Value	Self-explanatory
Maximum Observed* Value	Self-explanatory
Secondary Sum Totals	Self-explanatory

Control Card Formats

A maximum of five control cards may be used for this job run. They are the required report control card and four optional control cards for one title and one header line.

Statistical Parameters Report Control Card (Required)

<u>Column</u>	<u>Contents</u>
1	Q (program identification)
2-3	Must be blank
4	Blank for full report, 1 for simplified report
5-6*	Major field number, or blank
7-8*	First intermediate field number, or blank
9-10*	Second intermediate field number, or blank
11-12*	Third intermediate field number, or blank
13-14*	Minor field number, cannot be blank
15-16*	First secondary sum field number, or blank
17-18*	Second secondary sum field number, or blank
19-20	Not used
21-33*	Interval limiting value (the final upper limit value). Must be a multiple of the interval increment and greater than or equal to the starting value, with the difference of the two divided by the interval increment less than 1000.

34-46**	Interval increment, must be greater than zero
47-59**	Interval starting value (the initial upper limit value)
60-80	Not used

\*These fields must contain a two-digit number greater than 00 and less than or equal to the total number of fields per input data record as defined to the system. Data field values may not exceed 13 digits.

\*\*Indicates that the values must be the same length as the minor field value, zero-filled if necessary. The values must be positive numerical constants, unsigned or signed over the units position. They must be punched right-aligned.

#### Title Control Cards (Optional)

<u>Column</u>	<u>Contents</u>
1	Q (program identification)
2-3	Must be blank
4	T (control card identification)
5	1 for first 60 print positions 2 for second 60 print positions (last 12 positions used for page number)
6-65	Characters (including blanks) of the title line of the report
66-80	Not used

Note: Two title cards are allowed (optional).

#### Heading Control Cards (Optional)

<u>Column</u>	<u>Contents</u>
1	Q (program identification)
2-3	Must be blank
4	F (control card identification)

5	1 for print positions 25 to 74
	2 for print positions 75 to 124
6-55	Characters (including blanks) of the field identification print line
56-80	Not used

Note: Two heading control cards are allowed (optional).

### Program Operation

The first phase of this three-phase program reads and checks the control cards, and sets up the control information for the subsequent phases. The second phase overlays the first, reads the data tape, and writes summary information on an intermediate tape. Phase 3 overlays phase 2, and uses the data tape and intermediate tape to print the report. The report is printed one line at a time until a control field break is encountered, requiring a new report to be produced.

Errors in control cards or data files cause the system error switch to be set on, unless otherwise specified in the error message description, and an immediate transfer of control to the monitor program.

### Messages

#### ALPHA DATA IN MINOR FIELD

Alphabetic characters are located in other than the units position of the minor field of an input data record.

#### CONTROL FIELDS NOT EQUAL PHASE 2

A change has occurred in a control field of the input records, but the control field on the summary or intermediate tape record does not equal that of the detail input record. This message is printed if the record sequence checking indicates that records have been dropped.

#### DATA AND LIMIT ZONES DIFFER

The zone or sign in the interval starting value, increment, and limiting value fields of the control card differ from the zone in the minor field of the first data record (see note\*\* in Control Card Formats in this section). The zone in the data record replaces those in the interval fields.

#### END OF FILE INTER TAPE BEFORE DETAIL

A control is missing at the end of the intermediate or summary tape. This tape error condition may have been caused by a program error or by record skipping on a tape read.



FIELD LENGTH GREATER THAN 13 DIG CC XXX-YYY

XXX-YYY specifies the minor or secondary sum fields of the control card, 013-014, for example. A control card error. Exit to monitor.

FIRST INPUT RCD INPUT END OF REEL

The first data record is a tapemark in phase 2 of the program, or in phase 3 if this precedes this message.

HEADING CARD ERROR CC OOX

X is 4 or 5. The title or heading card has an incorrect identification or number. The program ignores this card, and continues its operation without setting the system error switch on.

INVALID CHAR IN CC 004

The character in the control card is not 1 or blank. The program treats it as blank, and continues its operation, setting the system error switch on.

INVALID CHAR IN CC XXX-YYY

XXX-YYY specifies any one of the control fields, the minor field, or the secondary sum fields; for example, 005-006 (see note\* in Control Card Formats in this section). It may specify 001-003 if the column does not contain Qbb (b=blank). A control card error.

INVALID CONTROL FIELD SIZE

The total size of the control fields as specified in the control card (major and all intermediate fields) exceeds 52 positions, or four fields with a maximum of 13 positions each.

INVALID FIELD SIZE IN CC XX-YY

XX-YY specifies either the interval starting value, the increment, or the limiting value field; for example, 21-33 (see note\*\* in Control Card Formats in this section). A control card error.

INVALID ZONE CC 59

The interval starting value is not positive or unsigned. A control card error. Exit to monitor.

INVALID ZONES OVER MINOR FIELD ON DARS DATA TAPE

The units position is neither unsigned nor positive in sign. A data input tape error.

#### LIMIT ZONES ON CARD DIFFER

The zone or sign in the interval starting value, increment, and limiting value fields is not the same. A control card error. Exit to monitor.

#### MINOR FIELD CHANGING SIGNS ON DATA TAPE

An unacceptable data tape.

#### MINOR FIELDS ARE OUT OF SEQUENCE

A break in sequence has occurred in the minor field of the data records. A data input tape error.

#### NO EOF AFTER NINES RCD FOUND

The next tape record following a nines record (used to fill a partial data block) should be a tapemark. A data input tape error.

#### NO. OF LINES GREATER THAN 999

The number of ranges of the minor field values specified in the interval fields of the control card exceeds the maximum of 999 allowed.

#### PROG TAPE READ ERR

A tape read error has occurred in reading the next program phase from the system tape. Pressing start will cause another read attempt.

#### START QUANT/QUAL DISTRIBUTION REPORT

The start-of-job message that is always printed by phase 1 of the program.

#### DATA RECORD LIST PROGRAM

This program provides the ability to produce a formatted listing of data records with several options:

- Records may be listed as they appear on the input file
- A fixed number of records may be listed from the file
- Selected fields from each record may be edited, listed, and tabulated
- Up to ten fields may be tabulated

- Selected fields from each record may be punched or punched and listed
- Field and page headings of up to five lines are optional
- Block padding records (all nines) are bypassed and not printed

These functions are requested by control cards as described in the following sections:

- Record List
- List X Program
- Edit and List
- Tabulate
- Punch and List
- Use of Control Cards for Titles and Headings

#### Record List

The fields of the data records are positioned across the page, separated by one blank between fields, in the order in which they appear in the input record. If more than 132 positions are required, the record is divided and continued on the next line. A blank line appears between records, and two blank lines between blocks. A record count total is provided. File specifications are provided by the tables in storage set up by the input control program.

The optional title and header cards may be used with this program.

#### Record List Control Card

<u>Column</u>	<u>Contents</u>
1	L (program identification)
2-80	Not used, leave blank

#### List X Program

The user may specify a fixed number of data records to be listed on the printer. The records are listed, the input tape rewound, and control returned to the monitor. The format is similar to the data record list output.

The optional title and header cards may be used with this program.

### List X Control Card

<u>Column</u>	<u>Contents</u>
1	L (control card identification)
2-4	Number of records to be listed, up to 999. When blank, the system will print 40 records.
5	2
6-80	Not used, leave blank

### Edit and List

Every field in every record is printed, with a blank position between fields. Fields may be edited. If editing is specified, leading zeros are suppressed, and negative numbers indicated by a minus sign to the right of the units position of the field. A comma or decimal point can be inserted at any point in the field to the left of the units position. Tabulations can be specified for up to ten fields, using up to 18 positions for accumulating each total. The tabulated fields are listed at the end of the list program on a separate sheet of paper.

Title and header cards may be used with the edit and list function. Edited fields are not divided or split between two printed lines if more than one line is required to print the record.

Starting with columns 6-8 of the control card, three columns are used to indicate how each field is to be processed. Columns 6-8 indicate the first field, columns 9-11 indicate the second field, and so forth for the maximum of 25 fields. The appropriate three columns should be left blank if the field is not to be edited. This permits the inclusion of alphanumeric information in the output report.

### Edit and List Control Card

<u>Column</u>	<u>Contents</u>
1	L (control card identification)
2-4	Must be blank
5	1 (function)
6-8	First input field processing Column 6 - A 1 indicates that this field is to be edited, or both edited and tabulated. Columns 6-8 should be blank if this field does not require editing or tabulating.

Column

Contents

Column 7 - This entry is for the punctuation placement. Specify the number of digits to be printed to the right of the punctuation. Do not exceed field size. A no-zone punch with a numeric punch in this column indicates that a decimal point is to be inserted. A 12-zone punch indicates a comma is to be inserted. A blank or zero in column 7 indicates that no punctuation is desired.

Column 8 - A 12-zone punch indicates that this is one of a maximum of ten fields to be tabulated during the edit and list run.

<u>Columns</u>	<u>Field number</u>	<u>Columns</u>	<u>Field number</u>
9-11	2	45-47	14
12-14	3	48-50	15
15-17	4	51-53	16
18-20	5	54-56	17
21-23	6	57-59	18
24-26	7	60-62	19
27-29	8	63-65	20
30-32	9	66-68	21
33-35	10	69-71	22
36-38	11	72-74	23
39-41	12	75-77	24
42-44	13	78-80	25

Fields 2-25 are processed as described for field 1 in control card columns 6-8. If a field is not to be edited or tabulated, leave the appropriate 3 columns blank. Fields may be tabulated without editing. Tabulated totals carry the same punctuation as specified for the fields being tabulated.

## Tabulate

Up to ten fields may be tabulated without listing the data file. Tabulations are maintained in ten accumulators of 20 positions each. Two positions are for the field number designation and 18 positions for the total. The possibility of overflowing the 18-position accumulator should be considered when selecting fields for tabulation. Whenever tabulated fields are specified, a control card analysis routine notifies the user of possible overflow conditions prior to program execution. The user is apprised of possible overflow whenever the size of the field exceeds 15 positions in length. High-volume files may affect overflowing on fields of smaller size.

Punctuation may be specified as part of the printed tabulated totals.

### Tabulate Control Card

<u>Column</u>	<u>Contents</u>
1	L (control card identification)
2	T
3-4	Blank
5	1 (function)
6-8	<p>First input field processing. Three columns are used to define the processing for each input field up to a maximum of 25. The appropriate three columns are to be blank if the field is not to be tabulated. The first input field processing is described in columns 6-8, the second input field in columns 9-11, and so forth.</p> <p>Column 6 - A 1 indicates that this field is to be tabulated</p> <p>Column 7 - A zero or blank indicates suppress zeros and carry the sign.</p> <p>Numerals 1 through 9 indicate the number of digits to be printed to the right of the punctuation. Do not exceed field size.</p> <p>No zone punch in this column indicates that decimal point punctuation is to be used. A 12-zone punch indicates a comma.</p> <p>Column 8 - A 12-zone punch indicates that this is one of a maximum of ten fields to be tabulated.</p>

Column

Contents

9-80

Use the coding indicated for columns 6-8, with three columns for each field. Fields not to be tabulated are to have the appropriate three columns blank.

Punch and List

The entire input file, or selected fields within each record can be punched or punched and listed. Up to three duplicate output decks can be specified. The low-order positions of the output punched card fields are specified in the control card.

As the record is punched, an optional image of each card can be printed. Title and header cards cannot be used with this program.

Multicard output (more than one card punched per input record) requires designating one of the input fields as a control field. This control field must be specified as part of the first card to be punched to avoid an error condition. The control field is automatically punched in the same column of all following cards in the group. Each card within a multicard group is sequentially numbered by the user from 0-9, for a maximum of ten cards per record group. This value is punched in column 1 of each output card of a multicard group. It is not punched with single card output.

Input record fields punched must be sequentially related to the output cards. Field 1, for example, cannot be assigned (unless it is the control field) to output card 5 since assignments to cards 0-4 have not been made. The control card is scanned serially from field 1 to field 25; therefore, the card serial number (0-9) within each multicard group must be equal or higher for each successive field, from left to right in the control card.

Fields in each output card may be punched in any sequence within each card, with the limitation that all fields (other than the control field) in any output card of a group must be assigned field numbers higher than any fields in the preceding card. For example, given input record fields:

1 2 3 4 5 6 7 8 9

The user may specify several output cards from the record. If three cards are desired they could contain, in part:

321            546            879

With the control field specified as field 3:

321            3546            3879

With the control field specified as field 2:

321            5246            8279

A record mark may be placed in the last card of a multicard output group in a column specified by the user. The record mark will be punched in column 80 of the last card if no specific column is entered in card columns 3-4 of the control card.

Up to ten fields may be specified for tabulation. Three duplicate output decks may be produced. Single deck output cards are in the normal punch stacker, while the second and third decks are selected into stackers 4 and 8 respectively.

Each field, up to a maximum of 25 fields, is assigned three columns on the control card, with columns 6-8 used for field 1, columns 9-11 for field 2, and columns 78-80 for field 25. If a field is not to be punched in the output card, the assigned three columns are left blank.

The high-order column of the three columns for any specified punch field determines the output card number. A 12-zone punch in the same column indicates that the field is to be the control field for multicard output, punched into each output card. Only one control field may be specified. A zero indicates single card output. A control field is not required and therefore never specified with single card output.

The second and third columns indicate the low-order (rightmost) card column for the output field in the punched card. The third column may also contain a 12-zone punch, indicating that this is one of a maximum of ten fields to be tabulated during the run. For example:

010 - Indicates single card output, with this field punched with the low-order position of the field in column 10.

&10118132 - Indicates that the contents of field 01 is punched into the first card of a two-card group. The 12-zone punch indicates the control field. Field 2 is punched into the second card, with the units position in column 18. Field 1 is punched with its low-order position in column 10. Field 3 is also punched into the second card, with the units position in column 32. The serial numbers 0 and 1 are punched in column 1 of the first and second cards respectively.

#### Punch and List Control Card

This control card must be immediately followed by a blank card.

<u>Column</u>	<u>Contents</u>
1	L (control card identification)
2	Number of duplicate output decks to be punched  Enter either 1, 2, or 3. Punch a 12-zone in this column if a record mark is to be punched in the last output card of a multicard group from a single input record.



3-4	Placement of record mark in the last card of multiscard output from a single record. Enter the card column in which the record mark is to be punched. If left blank, the record mark is punched in column 80 of the last card of the group.
5	8 - indicates punch and list 9 - indicates punch only
6-8	First field of output  Column 6 - Card serial number for multiscard output, from each input record. The range is from 0 to 9. Punch a zero for single card output.  A 12-zone punch in column 6 indicates that this three-position definition also specifies the control field for multiscard output. Only one control field is permitted per record.  Columns 7-8 - Low-order card column in the output card record. Characters in the field are moved from right to left to the punch area. Entry must range from 01-80.  A 12-zone punch in column 7 indicates that this defined output field will be one of up to ten fields tabulated during the run.
9-11	Second field of output
12-14	Third field of output
15-80	Fields 4 through 25 of the output card or cards per record. All fields follow the format shown for columns 6-8.

Note: Title and header cards cannot be used with the punch or punch and list programs.

#### Use of Control Cards for Titles and Headings

When all the control cards are used they are assigned the specific areas of the printed page as shown in Figure 14. The title and heading control cards are divided into three groups: the title control cards T1 and T2 are in group 1, heading control cards F1 to F4 are in group 2, and heading control cards F5 to F8 are in group 3. The blank lines following each group, two for group 1, and one each for groups 2 and 3, are considered

a part of the group. All title and heading control cards are optional in use. When used, they are grouped to handle heading format variations. If all cards of a group are omitted, the next group that contains one or more cards is moved up to take its place, and in turn, the next used group moves up to take the vacated place. In Figure 14, if title control cards are not used, group 2 is moved up to occupy lines 1-3 even though only one card of group 2 is used. The missing cards of a used group are considered blank and, therefore, their corresponding print positions on the printed page will be blank. For example, if only one of the two title control cards is present, the other half of the title line will be blank. The 66 characters in card columns 6-71 of card T1 are printed in print positions 1-66, and those of card T2 in positions 67-132.

For the heading control cards, the odd-numbered ones always occupy the left side of the printed page, and the even ones are on the right side. If no title and heading control cards are used, the program output will not contain page headings. When heading control cards are used, the page headings appear at the top of every printed page. A variety of heading formats can be obtained based on the selection of control cards and the arrangement of heading characters in the cards.

A possible use of all the control cards, as shown in Figure 14, may be to use cards F1 to F4 for a two-line subtitle and cards F5 to F8 as headings for the data record fields; or to use cards F1 to F4 as a two-line heading and cards F5 to F8 as a two-line subheading for unit designators, such as the amount of dollars, number of hours, or volume per hour.

		Print Position	
1		66	67
132			
1st line of page	T1		T2
Line 2		Blank Line	
3		Blank Line	
4	F1		F2
5	F3		F4
6		Blank Line	
7	F5		F6
8	F7		F8
9		Blank Line	
10		First line of data record output	

Figure 14. Structure of page headings of data record list program using all control cards

## Title Control Card

<u>Column</u>	<u>Contents</u>
1	Program identification. Must always be L. (L specifies title card for use with data record list program)
2-3	Not used. Blanks are recommended.
4	Control card identification. Must always be T.
5	Card number. 1 for print positions 1-66, 2 for print positions 67-132.
6-71	Characters of the title line, including blanks.
72-80	Not used. Blanks are recommended.

## Heading Control Card

1	Program identification. Must always be L. (L specifies header card for use with data record list program)
2-3	Blank
4	Control card identification. Must always be F.
5	Card number. Must be 1 to 8 inclusive (see the description of the use of control cards for an explanation of their numbering).
6-71	Characters of the heading line, including blanks.
72-80	Blank

## Messages

Control card errors do not necessarily stop the operation of the program. A missing L in card column 1 signifies the end of the data record list control cards and phase 2, as explained in a printed message. If duplicates of any of the title or heading control cards are present, and the characters in card columns 4-5 are equal, the last one is considered correct.

### CTL CARD PRESENT

This message is printed to the left of a printed image of the control card at the beginning of a program run. Directly beneath the control card, a field number guide is printed so that the user can review the processing instructions for each input field. The three

positions in the control card for each input field are identified by F01F02F03... and so forth, up to field 25 (F25). These field numbers are based on the information supplied by the field definition card.

The columns in the control card are identified on the line following the field numbers as follows:

```
F01F02F03.....
.08.11.14.....
```

The low-order column of the three columns used to specify processing is column 8 for the first field (6-8), column 11 for the second field (9-11), and so on. This facilitates reviewing and checking control cards.

The succeeding printed lines provide a reference table containing the field number, field size, and processing instructions. These instructions are the codes from the three-position control card field established for each input record. For example, the preceding control card image and field identification:

```
12 12 1C
F01F02F03.....
.08.11.14.....
```

results in a table that appears as:

FLD NO.	FLD SIZE	FLD FUNCT.	
01	5	12	(two positions follow the decimal point)
02	8	12	(two positions follow the decimal point)
03	4	1C	(three positions follow the comma)

CNTRL CARDS HAVE BEEN READ, DON'T DO SWITCH WAS ON, END RCD LIST WITHOUT PROCESSING

The system error switch had been set by a previous program. Control is returned to the monitor without continuing with phase 2 of the program, which prints the tape records.

END HDR SETUP. RCD LIST PRGRM BEING READ IN

Phase 1 has been completed and phase 2 instructions are being read in from the program tape. This message is always printed.

RCD MARK NOT AT INDICATED LOCATION IN 1ST BLK, END RCD LIST PROGRAM

Phase 2 of the program was in operation in checking the first data record block before printing it, when a system tape or constant error was discovered, such as input tape improperly prepared or read, or record size constant was incorrect. The system error switch is set on and the program returns to the monitor program without printing any of the data records.

RPT DEF IS ONLY CTL CARD PRESENT

No title and heading control cards have been found; only the program control card is present. The program continues on to start phase 2. No page headings will be printed.

START HDR SETUP. RCD LIST

This message is always printed to indicate the start of phase 1 of the program.

START RCD LIST PROGRAM

This message is always printed to indicate the start of phase 2 of the program.

TAPE READ, ERR, PRESS START TO TRY AGAIN

A read error has been detected in reading in phase 2 from the system program tape. The tape is backspaced and the program halts with I-register at 130. Pressing start will cause another read attempt.

TITLE OR HEADING CTL CARD ERROR IN C/C 4-5, CARD IGNORED

T1, T2, or F1 to F8 are not present in card columns 4-5. The program continues its operation ignoring this error card.

DATA RECORD COUNT XXXXX, END RCD LIST

This end-of-program message appears at the end of phase 2 after the last data record has been printed. The total data record count is printed. Control is returned to the monitor program. Padding records, identified by 9s in the low-order 13 positions are neither printed nor added to the total data record count.

FALSE ZONE BITS. XXX FIELD NUMBER YY

This message indicates that zone punches were detected in the high-order position of a three-column control card field where zones are not permitted. XXX represents an image of the three positions defining the processing of an input field. YY indicates the actual field number. Program execution is suppressed.

XX FIELD TABULATIONS REQUESTED

NO FIELD TABULATIONS REQUESTED

These are informational messages printed during control card analysis. XX indicates the number of fields to be tabulated.

EXCEED LIMIT OF 10 TAB FLDS, SYSTEM WILL TAB FIRST 10 SPEC. FLDS.

When more than the limit of ten fields are specified for tabulation, this message is printed and only the first ten fields are tabulated.

SPECIFIED EDIT FLDS EXCEED FLD DEF CD

This message indicates that the number of fields to be edited exceeds the number of fields described in the field definition card. Program execution is suppressed.

NUMBER OF RECDS FOR LIST IS SPECIFIED

NUMBER OF RCDS FOR LIST NOT SPECIFIED. SYS WILL PRT 40 RECORDS

The above informational messages indicate how the user specified the number of records to be printed on the control card for the list X program.

X PUNCHED OUTPUT DECKS

This message indicates the number of output decks requested. X is replaced by either 1, 2, or 3.

RECORD MARK IN CC XX OF LAST PUNCH CARD

This message indicates the user-specified location of the optional record mark in the last card of a multicard punched output. If a record mark is requested, but no card column is specified, it will be punched in column 80 of the last card of the group.

RCD MK POS XX CC 3-4, SYSTEM PLACES RCD MK CC 80 OF LAST PUNCH CARD

This message is printed whenever the record mark location specified by the user exceeds card column 80. XX is the location specified by the user.

CTL FLDS NOT PERMITTED

This message indicates that a control field has been specified when the output is to be a single card for each input record. Program operation is suppressed.

MULTI-CTL FLDS NOT PERMITTED

This message indicates that more than one control field has been specified when the output is to be more than one card per input record. Program operation is suppressed. When several contiguous fields are to be used as a control field, they should be defined as a single field in the control card.

LOW CARD SEQUENCE NUMBER

This message indicates that the serial number (0-9) in a multicard group punched from a single input record is lower than the preceding serial number. Program execution is suppressed. Multicard groups are related by a common control field, and sequenced by the 0-9 serial number.

## Program Operation

The program is composed of two phases. Phase 1 operates to process the control cards and set up the page heading image in a storage area (title and header cards not used with punch programs). When phase 1 is completed, the instructions for phase 2 are read in overlaying phase 1. If the system error switch is on, control is returned to the monitor program. If it is off, phase 2 operates to print or punch out the data records on the IBM 1403 Printer or 1402 Card Read Punch. Unless a system tape or constant error is discovered (see "Messages"), printing continues until the last record is printed. Control is then returned to the monitor program at the end of the job. No output data tape is produced.

When the editing and listing option is used, an advisory message is printed indicating whether the printed output will require one or more lines for each record. The program makes this determination by counting the size of the input data record, allowing a space between fields, a position for requested decimal points or commas, a position for field signs, and a position for the record mark. This information can be used to lay out the title and header cards for the report.

The reference table printed after the control card indicates fields to be tabulated as well as fields that may have an overflow. For example:

FLD NO.	FLD SIZE	FLD FUNCT.	
01	2	11+	
TAB FIELD, 01			
02	7	11	
03	18	1E+	POSSIBLE OVERFLOW ON THIS FIELD
TAB FIELD, 03			
04	7	11	

When punched cards are requested as output, the control card image and field identifications are printed as previously described. The reference chart printed appears in the format:

FLD NO.	FLD SIZE	CD NO.	CD-LO ORDER	PUNCH CARD DATA FLDS.
01	2	0	03	
02	7	0	10	CTL FLD
03	2	0	21	
04	9	0	41	
02	7	1	10	CTL FLD
05	10	1	31	
06	10	1	41	
07	10	1	51	
02	7	2	10	CTL FLD
08	6	2	57	
09	1	2	58	
10	3	2	61	

NO FIELD TABULATIONS REQUESTED.

RECORD MARK IN CC 79, OF LAST PUNCH CD.

03 PUNCHED CARDS PER RCD.

In the above example, multicard output of three cards per input record was requested. The control field relating these cards is in the same position in each card (7 positions, low-order in column 10). Up to ten cards may be punched from a single record, numbered from 0-9 in column 1 of each card. A control field must be specified. If not, the message NO CTL FLD is printed, and program execution is suppressed.

In setting up information in the punch output area of storage (101-180), characters are moved in from right to left, with a word mark to the right of the low-order position of each field. This stacking approach makes it possible to move input fields to smaller punch area fields, truncating records or reducing the size of the output record while protecting fields previously moved into the punch area.

Since the punch area is cleared after each card is punched, fields can be arranged within the output cards so that they are suitable for use as detail or activity cards. This enables the user to create time cards, disbursement cards, and other useful documents from a master file.

#### DATA RECORD TABULATE PROGRAM

##### Function

This program provides a frequency count of the values in a single user-specified field. The maximum field size that may be specified is twenty characters. The field may contain any combination of special, alphabetic, and numeric BCD characters. The printed report may have up to seven lines of headings at the user's option. Each value that occurs within the field is listed, along with the frequency of occurrence, that is, the number of times the same value appears in successive records. Included in the report are the number of sequences that occur within the field, the number of records examined, and the number of lines printed exclusive of the headings. An asterisk is printed to the right of the frequency value each time a sequence ends.

The program may be used in conjunction with the symbol substitution program. It will establish the values of the field that the symbol substitution program will replace. This program will, therefore, at the user's option, punch control cards for the use of the symbol substitution program. These cards will contain the value V1, and the field number F1, as described in the symbol substitution program description, and the sequence number in which the value V1 appears. The program and card code CF is punched, while the other fields, such as the read selector and no match error indicator, are left blank. Only one card is punched for each frequency; that is, the same value appearing in four successive records will be represented by only one card.

Figure 15 is an example of an input file and the resultant report format.



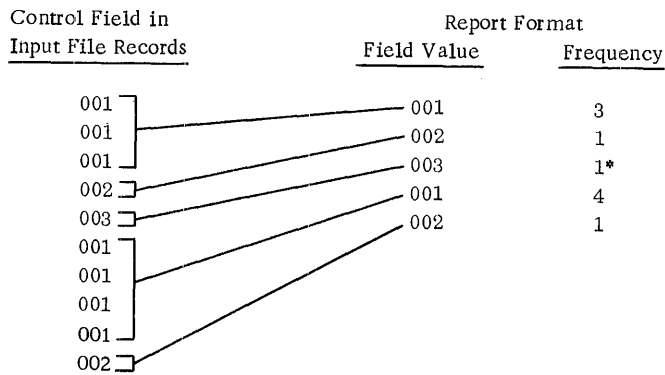


Figure 15. Example of data record tabulate program processing

### Control Card Format

As in the data record list program, there is a maximum of eleven control cards. The formats of the title and heading control cards are the same, except for card column 1, which always contains T. The format of the program control card, the record tabulate control card, follows:

#### Record Tabulate Control Card

<u>Column</u>	<u>Contents</u>
1	T (control card identification)
2	Not used
3	Symbol substitution control card punch option: Blank - do not punch control cards (F cards) for symbol substitution program  1 - punch control cards  Any other value is an error and a blank is assumed
4-5	Control field number - must be a numeric value with leading zeros and not greater than the number of data fields as defined to the system
6-80	Not used

## Use of the Control Cards

The record tabulate control card must be present in order to call in the data record tabulate program, and must precede any title or heading control cards. For a description of the use of the title and heading control cards, see "Data Record List Program".

### Messages, Phase 1

Title and heading control cards are checked in this phase of the program; the record tabulate control card is saved and checked in phase 2. Only card columns 1 and 4-5 are examined in this phase, and errors do not stop the operation of the program. If duplicate title and heading control cards are present the last one is considered correct.

#### CNTL CARDS INDICATE NO TITLES, HEADINGS

No title and heading control cards have been found; only the program control card is present. No page headings will be printed. The program proceeds to read in phase 2.

#### START HDR SETUP, RCD TAB

This message is always printed to indicate the start of phase 1 of the program.

#### END HDR SETUP. RCD TAB PRGRM BEING READ IN

Phase 1 of the program is completed and phase 2 is being read in from the program tape. This message is always printed.

#### INCORRECT DATA IN C/C 4-5 OF CONTROL CARD

Correct title or heading card identification (either T1, T2, or F1 to F8) is not present in the control card. The program continues, ignoring this error card.

#### TAPE READ, ERR, PRESS START TO TRY AGAIN

A read error has occurred in reading phase 2 from the program tape. Pressing start will cause another read attempt.

### Messages, Phase 2

No report will be printed if an error is found in card columns 4-5 or the record tabulate control card.

#### ALPHA DATA IN FIELD

A nonnumeric character has been found in the designated field of the first input data record. This information is printed once below the column headings before the report commences to list the field values and their frequencies. It is not an error condition; processing of the report continues.

### CC 3 INVALID

The punch option field, card column 3, of the program control card does not contain a 1 or blank. Card columns 1-40 of the control card are also printed to the right of the message, on the same line. This error does not prevent the program from continuing to process the report. A "no punch" option is assumed.

### CC 4-5 INVALID

The control field number of the program control card contains either a blank, a value less than 01, a value greater than the number of fields in the data records as recorded in the system field definition table, or any nonnumeric characters. Card columns 1-40 of the control card are printed to the right of this message, on the same line. The program proceeds to check column 3 and returns to the monitor program after printing PROCEEDING TO NEXT PROGRAM message.

### DATA RECORD TABULATING

This message is always printed to indicate the start of phase 2 of the program.

### ERR ON INPUT TAPE, SHOULD BE T/M AFTER 9S RCD

The last record of the input tape, a record filled with nines, is not followed by a tape-mark to indicate an end-of-file condition. This causes the system error switch to be turned on and an immediate branch to the monitor program.

### FIELD SIZE GREATER THAN 20 CHARS

The length of the field designated in card columns 4-5 has been found to be greater than 20 characters. The program proceeds to print PROCEEDING TO NEXT PROGRAM message and returns control to the monitor program.

### PROCEEDING TO NEXT PROGRAM, INVALID CONTROL CARD

This message is printed after an error has been discovered pertaining to the control field number, card columns 4-5, of the record tabulate control card. Card columns 1-40 of the control card are printed on the next line after this message. Control is returned to the monitor, no report is printed. The system error switch is not set on.

### Considerations

The program is divided into two phases. Phase 1 is similar to phase 1 of the data record list program and operates in the same way to process the title and heading control cards. The first card read in, the record tabulate control card, is saved in storage starting at 3501 and followed by storage for the page heading image. When phase 1 has completed its operation by means of instructions set up in the punch area, phase 2 is read in from the program tape overlaying phase 1. Phase 2 checks the validity of the information in card columns 3-5 of the record tabulate control card. If the control card is invalid or the system error switch is on, control is returned to the monitor; otherwise, phase 2 continues to print each line of the report. The report is completed unless a system tape error is discovered and the system error switch turned on. In either event, control is returned to the monitor. No output data tape is produced.

## CHAPTER 4: SYSTEM PROGRAMS

### MONITOR

Every operational program has, as its first character, a unique identification character. The monitor selects the proper operational program from the system tape using the character in card column 1 of the user-furnished control card as its search argument. The operational program is read into area 2, and execution is commenced by the monitor executing a branch to storage position 601. If a tapemark is sensed before a match is found, an error message is printed and the system stops. The monitor contains its own I/O routine.

The purpose of the monitor is to provide program-controlled transition from one program to another in the DARS system with a minimum of operator intervention. The monitor reads control cards and causes the appropriate program to be loaded and executed. At any program termination, control is returned to the monitor.

#### Control Messages

##### FIRST CARD DOES NOT HAVE \* IN COLUMN ONE, HIT START TO READ ANOTHER CARD AND TRY AGAIN

The first card must contain either an asterisk in column 1, or SYS in columns 2-4.

##### NOT ON TAPE PROG X

No match was found on the system tape for the ID character in column 1 (X) of the current control card. The processor is halted. Depressing start will cause the next control card to be read in.

##### PROG TAPE IN ERROR SKIPPED PROG X

Ten successive tape errors occurred while searching the system program tape for program X. The processor is halted. Depressing start will cause the next control card to be read in. To retry ten more times, alter the I-address to the location indicated in the program halt list.

##### EOJ

Card read hopper empty.

### INPUT/OUTPUT PROGRAM

A common input/output program is used by all operational programs to perform tape reading, writing, and checking — including header and trailer label processing. In a multiphased program, however, each phase reads the next phase into storage without using this program.

Ten attempts are made to overcome a tape read error before halting. Pressing start causes ten additional read attempts. With sense switch C on, the record is bypassed and processing continues.

Processing is halted after 50 unsuccessful write attempts (ten write instructions followed by a skip and blank operation, repeated five times). The run must be restarted, using the output of the last successful run before the error occurred.

#### Control Messages

##### FIRST INPUT RCD IN ERROR SKIPPED

A standard 80-character header record has not been found on the data tape. The processor does not halt; the nonstandard header is skipped and a header error switch set. A DARS label is written on the output tape file.

##### FIRST RECORD NOT HEADER SKIPPED

No header format is found. The header error switch is set on, and a DARS label written on the output tape file. The first record is bypassed.

##### 10 READ ERRORS, SWC TO SKIP ON TP X

Depressing a start key with sense switch C off will cause ten additional reads. With switch C on, the error record will be skipped, and the next record read. Turn switch C off after the record has been bypassed.

##### 50 WRITE ERRORS, 4 ERASES, BAD UNIT/REEL START JOB AGAIN TAPE X

The processor halts. To restart the job, refer to the section in the operating instructions on error procedures. (50 more write attempts may be achieved by following the indicated procedure in the program halt list.)

##### INPUT END OF REEL, CHANGE TAPE

A 1EOR trailer label has been found; the tape is rewound and unloaded. Press start to continue after mounting next tape.

##### INPUT END OF REEL, SWB ON IF MORE REELS

The input tape is rewound and unloaded, and the trailer label ignored. This option is given during the data input control program, in order to permit the loading of more than one file.

Switch B must be on if there are more reels to the job; it is set off if it is the last input reel. Press start after mounting the next tape.

INPUT END OF REEL, NO TRAILER, SWB ON IF MORE REELS

The record following the EOF tapemark is not a valid trailer label. The tape is rewound and unloaded. Press start to continue after mounting the next tape, if required. Sense switch B must be set on if there are more reels to the job.

NO OUTPUT

The current operational program has branched to the close (write trailer) routine without having written any data on the output tape during the run. The system error switch is set on, and control is transferred to the system monitor.

OUTPUT END OF REEL, CHANGE TAPE

Multireel output. Depress start key after mounting new output tape.

LOAD FIRST OUTPUT

The output of the run was multireel. The first reel of the output must now be loaded on the same tape unit used to generate the last output reel.

The following block count messages are printed whenever an end of file condition is sensed on an input or output tape (WR means write, RD means read, and X is replaced by the tape unit number).

-----BLKS SKIPPED ON READ-----BLKS READ

-----BLKS WR X

-----BLKS RD X

Printed with these messages is the message PROG X. The identification code of the current operational program replaces X.

BLANK IDENTIFICATION PROGRAM

This program performs four functions, only one of which may be performed whenever the program is called in by its control card. The four options are as follows:

1. This option, identified by an entire blank control card, permits the user to sequentially reuse any of the operational programs. A blank column 1 of the card causes the monitor to call in the blank identification program from the program tape while the rest of the blanks provide for immediate return of control to the monitor to enable the operational program to be brought in again for immediate reuse. It enables the user to easily reinitialize the switches, counters, and index registers in a program for another run.
2. This option, identified by an alphabetic character A-D in card column 5, is to read the system modify program, a utility program, into core storage area 3 (see "Storage Assignments") in order to modify the system program tape. The alphabetic

characters A-D are coded for the features add, delete, change, or duplicate, respectively. Control is released to the program described in "Utility Programs". The contents of area 3 are destroyed by the exercise of this option.

3. This option, identified by a P in card column 5, prints out the entire system program tape. This function is performed by reading the general utility program from the program tape into core memory, starting at location 6400, and then turning over control to that program to dump and print out the program tape.
4. This option, identified by a T in card column 5, prints out the program identification table that is located at the end of the system program tape. Instructions needed to perform this function are a part of this program.

The last three options are referred to as system options and require the code SYS to be inserted in columns 2-4 of the input control card.

The program uses its own tape I/O routine.

#### Control Card Format

The following is the only control card required for each run of this program (the program options are described above):

<u>Column</u>	<u>Contents</u>
1	Program identification - must always be blank
2-4	General system options code: Blank - the nonsystem option, option 1. User desires to reuse an operational program. SYS - the system options 2, 3, or 4. The user indicates which option in column 5. Any other value is invalid
5	The specific system option codes: A-D - option 2: add, delete, change, or duplicate feature respectively P - option 3 T - option 4 Any other value is invalid
6-80	Not used - must be blank if columns 2-4 are blank or if column 5 contains A, B, C, or D. Columns 71-75 must be blank if column 5 contains A, B, C, or D. This is required by the system modify program.



## Messages

### BLANK CONTROL CARD SKIPPED

Program identified the input control card as an entire blank card. Control is returned to the monitor program.

### COLUMN 5 OF SYS CARD IN ERROR

Invalid character or blank in card column 5 of the input control card (see "Control Card Format" for a description of valid characters). This error message is followed by a printout of the card image and a return of control to the monitor program.

### PROG TAPE READ ERROR 10 TIMES, START TO TRY 10 MORE

The program, using its own tape I/O routine, encountered a tape read error in reading the system program tape. This message is printed after ten unsuccessful attempts to read the tape. Pressing start will enable ten more attempts to be made.

### START BLANK IDENT PROGRAM

This message is always printed to signal the start of this program. An end-of-program message is not printed.

### TABLE OF PROGRAMS ON SYSTEM TAPE

This message or heading is printed before the program identification table on the system program tape is printed out.

### THIS CARD IS NOT A SYS CARD

Columns 2-4 of the input control card are not blank and do not contain SYS. This error message is followed by a printout of the card image and a return of control to the monitor program.

## UTILITY PROGRAMS

### General Utility

This program produces a formatted storage printout from location 0001 up to location 6399 and, depending on the sense switch settings, offers the options of a formatted printout of the input and output data tapes and the system program tape. The user may exercise the options by setting on, in advance, the assigned sense switches as follows:

Sense Switch B    Printout of first 99 records or up to the second tapemark encountered (whichever comes first) of the last data tape processed by the system, that is, the tape reel on either tape drive 3 or 4 as designated in the system constant in storage location 4602.

Sense Switch C The same as above for the other data tape, that is, the tape reel on either tape drive 3 or 4, whichever is not designated above.

Sense Switch D Printout of the entire system program tape on tape drive 1.

An input control card is not used. This program may be called into core storage, starting at location 6400, from the system program tape by means of a calling sequence routine in core storage beginning at location 7946. In initializing the system, this routine was set up in core storage area 3 by the monitor program. The calling sequence may be entered manually from the operator's console by altering the I-address to 7946, or by a program branching to location 7946. The utility program is also called in by an option in the blank identification program.

All tapes are rewound before this program begins its operation.

A groupmark with a wordmark is placed by the DARS system in core storage location 4600 to prevent the read program tape operation from destroying the contents of storage from location 4600 on up.

#### Messages

##### END OF SYS DEBUG

This is the end of program run message.

##### LAST TAPE NO. X

X is 3 or 4. A message to indicate the content of the system constant in location 4602, which is the number of the last tape processed by the system.

##### LAST TAPE NO. IN ERROR

The content of the system constant in location 4602 is not 3 or 4. The program adjusts this error condition by inserting a 3 in location 4602 and continues on with this assumption (see the description of sense switches B and C above). If sense switch C alone is set, tape number 3 in this case will be printed out.

##### PROG TAPE ERR

This message is printed by the calling sequence routine when it encounters a tape read error in reading in this program from the system program tape. Pressing start will inaugurate another read attempt.

##### 10 READ ERRS

The program, in printing out one of the data tapes according to the setting of the sense switches, encountered a tape read error. The message is printed after ten unsuccessful attempts to read the tape. Pressing start will cause ten more attempts to be made.

## OPERATING PROCEDURES

### Production Run (see Figure 16)

- Mount the system tape on unit 1.
- Ready the printer and card read punch.
- Set sense switch A on.
- Place the control card deck (and data cards if card input) in the card read hopper.

For card input:

- Ready scratch tapes on units 3 and 4.

For tape input:

- Mount input data tape on unit 3, ready a scratch tape on unit 4.
- Depress the check reset, start reset, and tape load keys.
- Depress start key.
- Further operating instructions as required, will be produced on the 1403 Printer.

### System Tape Modify Run

Procedure identical to "Production Run" above with the following exception:

- Ready unit 2 for new system tape, units 3 and 4 need not be readied.

### System Tape Creation

Procedure identical to "Production Run" above with the following exception:

- Ready unit 1 with the tape which will become the system tape.

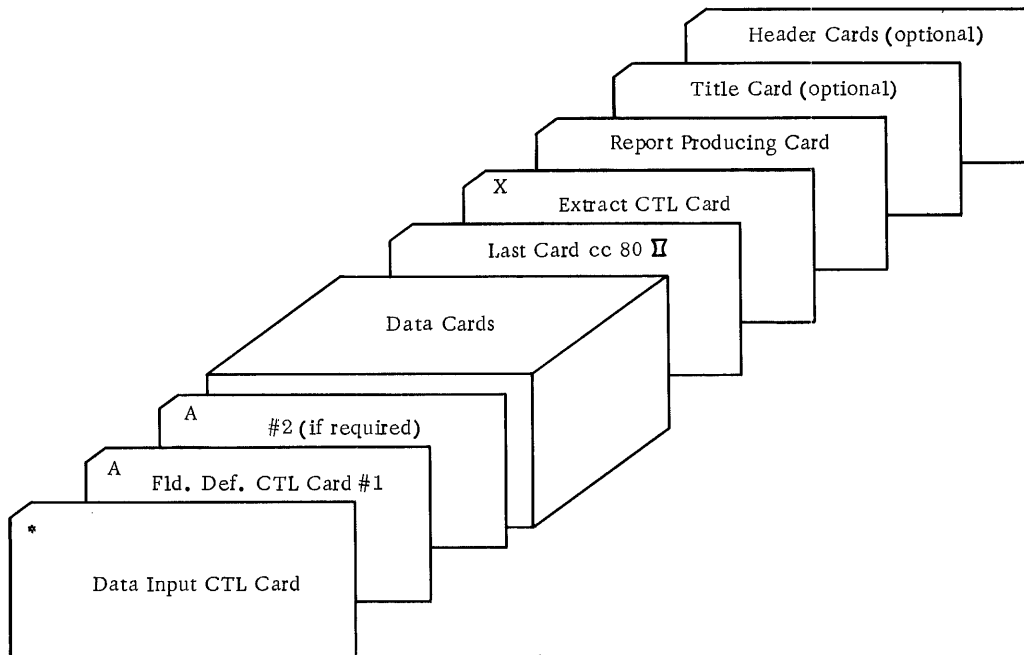
Note: The 1403 carriage control tape must be punched in channels 1 and 12 for start and end of page, respectively.

## SENSE SWITCH UTILIZATION

### Production Run Switch

Sense  
Switch

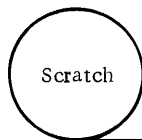
- A - always on for last card
- B - on to indicate additional input reels; off, end of input (use required if trailer labels are not standard, or if tape errors occur when reading trailer)



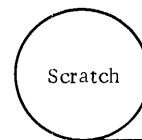
An example of a typical DARS run (card deck setup)  
Place cards in card reader



Tape Unit 1



Tape Unit 3



Tape Unit 4

Ready tape drives and assign as above

#### Production Run

1. Ready the printer and card read punch.
2. Set sense switch A on.
3. Place the control card deck (and data cards as shown above) in the card read hopper.
4. Depress the check reset, start reset, and tape load keys.
5. Depress any start key.
6. Follow operating instructions on the 1403 Printer.

Figure 16. Operating procedures - example run

C - on to skip tape record after ten successive read errors; off to try reading ten more times

D-F - unused

### System Tape Creation and Modification Switch

#### Sense Switch

A - always on for last card

B-G - unused

### SYSTEM OPERATION NOTES

The system alternately uses (flip-flop) tape units 3 and 4 for input and output tapes, and for immediate (scratch) tapes when necessary. Messages indicating the number of tape records read/written and the unit number are printed out when the end of an input or output reel is sensed, along with instructions for changing tapes when required.

Almost all tape handling functions are performed by the system I/O program. The exceptions are as follows:

1. Each phase of a multiphase program reads into storage the next program phase. If a read error is detected, an error message is printed and the program halts. The operator may request read attempts by depressing the start key.
2. If the monitor detects a tape error, when reading from the system tape, it will attempt to reread the program nine times. If the error persists, an error message is printed and the processor halted. The operator may cause the next scheduled program to be read into storage by depressing the start key. To cause ten additional read attempts, the I-address must be manually altered to the location indicated in "Program Halts".

### Tape Handling

#### Single Reel Input and Output

No operator intervention is required except when tape read or write errors occur. Tapes 3 and 4 are flip-flopped as input and output tapes for each program. The user can flag certain programs to save the input data tape at the end of its particular run. The input tape will then be unloaded and a message printed to save the tape on unit X.

#### Multireel Input and/or Output

Each reel is rewound and unloaded when either an end-of-file or end-of-reel marker is sensed. A message describing the operator action to be taken is printed and the processor is halted.

Generally, all input reels in a multireel file are mounted on the same tape drive in the proper sequence. Output reels should be marked to indicate their generation sequence. At the end of a program run, the output tape drive is changed to the input tape drive by the DARS system. This feature is a convenience for immediately processing single-reel output. With multireel output, the tape drive used to produce the final output reel is used to read the first input reel for further processing. Location 4602 contains the current input tape unit address, which may be displayed for reference.

#### RESTART

In order to effect a restart (that is, starting a production run after having stopped in the middle of a previous run), the following procedures should be followed:

1. Determine on which drive the input data is located. This may be accomplished via the 1403 error message. However, some report programs create intermediate scratch tapes; thus a read error message may refer to the scratch tape and not the input data tape. A more general procedure is to display the content of core storage position 4602. The displayed value is the drive number of the current program's input data tape.
2. Determine which program was operational when the system was stopped. This may be done by inspection of the printer output.
3. Prepare the control card deck for input as described, using the control cards punched by the redefinition or data input control program, depending upon which was run last. Discarding the control cards for those successfully completed programs, place only those remaining cards behind the data input control beginning with the incompletd program. Proceed as described for an operational run with tape input.

#### PROGRAM HALTS

<u>Address</u>	<u>Program</u>		<u>Cause and action</u>
0130	Record List	L	Tape error reading program tape. Depress start to try again.
0130	Record Tabulate	T	Tape error reading program tape. Depress start to try again.
0130	Matrix	M	Tape error reading program tape. Depress start to try again.
0142	Monitor	-	First card not * or SYS card. Depress start to read next card.
0156	Monitor	-	Tape error reading in I/O program. Depress start to try again.
0199	Extract	X	Tape error reading program tape. Depress start to try again.

0540	Monitor	-	Tape error in searching program tape. Hit start to read next control card; or alter I-address to 0419 to try ten more times.
0549	Monitor	-	Operational program not found on program tape. Hit start to read next control card.
0572	Monitor	-	End of job.
0868	Redefinition	R	System error switch on. Remove job.
1077	Blank ID	-	Program tape read error 10 times. Depress start to try again.
1209	Tape Load	-	End of job. System tape on unit 1.
1319	Extract	X	Save input tape. Mount new tape on same drive; depress start.
1541	Input Control	*	Input control card error. Remove job.
1553	Tape Load	-	Tape write error unit 1; depress start to try again.
1554	Tape Load	-	Tape write error on program tape. Depress start to try again.
1580	Field Edit	E	Save input tape. Mount new tape on same drive; depress start.
1594	Tape Load	-	Tape write error on program tape. Depress start to try again.
1600	Tape Load	-	Tape write error. Depress start to try again.
1604	Tape Load	-	Tape write error. Depress start to try again.
1619	Tape Load	-	Output end of reel. Short tape. Ready new tape on unit 1; restart job.
1645	Tape Load	-	Tape read error. Depress start to try again.
1670	Tape Load	-	Output end of reel; restart job.
1847	Input Control	*	Input control card error. Remove job.
2231	Symbol Substitution	C	Save input tape, ready new tape same unit; depress start to continue.

2351	Variable Input Control	1	Program terminated. User must correct format cards and restart.
3008	Variable Input Control	2	Groupmark must be used to identify end of last field. Correct data control cards and restart job.
3814	Redefinition	R	Save input tape. Mount new tape on same drive; depress start.
4289	Quantitative Stat. Para.	Q	Tape error reading program tape. Depress start to try again.
5386	System Modify	-	End of job; new system tape on unit 2. See printer instructions to start new run.
5423	System Modify	-	Tape errors reading system tape bootstrap. Depress start to try again.
5558	System Modify	-	Temporary halt. Dial unit 2 to 1, ready new unit 1, depress start.
5628	System Modify	-	Output end of reel; short program tape. Restart job.
5690	System Modify	-	Tape error reading program tape. Depress start to try again.
5807	System Modify	-	Tape write errors on unit 2; change tape/unit; reload all cards; depress start.
6189	Tape Load	-	Tape write error on program tape. Depress start to try again.
6229	Tape Load	-	Tape read error on program tape. Depress start to try again.
6254	Tape Load	-	Output end of reel; short tape; restart job.
6698	General Utility	-	End of job. Depress start to start new job.
7031	I/O	-	Tape error in reading data tape. Hit start to try ten more times; or set sense switch C on to skip error record.
7227	I/O	-	Input end of file, multireel input. Mount next reel on the same unit and depress start.



- |      |     |   |  |
|------|-----|---|--|
| 7424 | I/O | - | Tape write errors on data tape. 50 more write attempts can be made by altering content of location 6690 to 0, and the I-address to 6832. |
| 7248 | I/O | - | Input end of file, if more input, mount on same unit, set sense switch B on, and depress start.  |
| 7485 | I/O | - | Output end of reel. Ready new output tape; depress start.  |
| 7741 | I/O | - | Multireel output end of file. Mount first output reel as first input reel on same unit, and depress start.                               |
| 7946 | I/O | - | Tape error on reading in general utility. Depress start to try again.  |

## CHAPTER 5: SYSTEM GENERATION AND MODIFICATION PROGRAMS

### TAPE LOAD PROGRAM

This three-phase program creates the system tape from 1401 Autocoder condensed card input.

Phase 1 writes a clear storage routine as the first tape block, followed by a block for the system monitor and another block for the system input/output program.

Phase 2 writes the operational system programs on tape, validates the program identification character, and checks that all operational programs fit in the storage area between 600 and 4599. A tapemark follows the last program.

Phase 3 writes the utility programs and system program identification table on tape. The table reflects the sequence in which the system programs are written on the tape. A tapemark follows the identification table.

#### System Tape Creation

The DARS system tape can be created as outlined in instructions 1 and 2 below. However, under normal circumstances the distributed DARS tape can be used to punch a prearranged system deck. The punched deck, in loadable form, can then be used to create the DARS system tape.

The tape load program may be used to create a system tape (refer to the program description for the meaning of the 1403 messages).

1. Separate the tape load program into its three phases using the load card sequence number in card columns 72-75. These are:

<u>Phase</u>	<u>Sequence Number</u>
1	1-37
2	38-92
3	93-135

2. Arrange the program decks as illustrated in Figure 17 and described below:
  - a. The monitor and I/O programs (in that order) must be placed directly behind phase 1.
  - b. Phase 2 directly follows the I/O program; all operational programs follow phase 2.
  - c. The last operational program must be followed by a card with AAAAA punched in columns 1 through 5, the remainder of the card being blank.

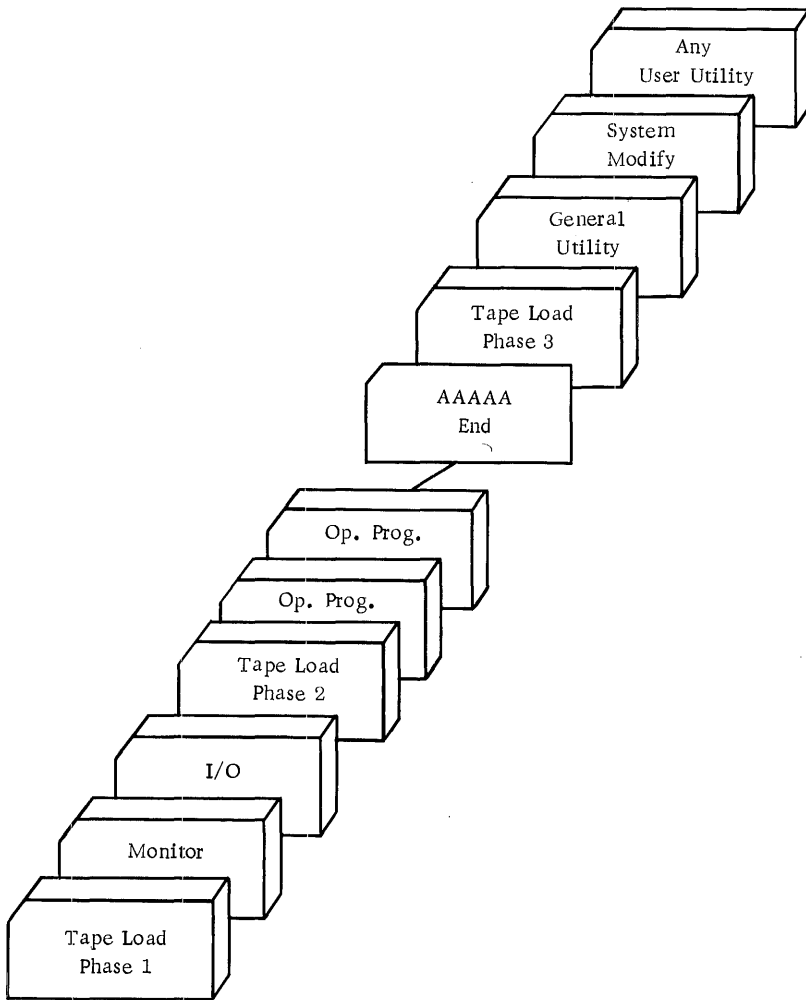


Figure 17. Program arrangement for system tape creation

- d. Phase 3 follows the AAAAA card.
- e. The general utility and system modify program (in that order) follow phase 3.
- f. Any user-furnished utility program may follow the system modify program.

Note: All programs placed on the system tape (that is, system, operational, or utility not including the three phases of the tape load program) must contain an end card (a card with a / in column 40) as its last card. Each phase of a multiphase program is treated as a separate program by the load program. Therefore, multiphase programs, if assembled by the execute statements, must be modified. The cards generated by the execute statements must be removed and end cards substituted. All multiphase programs must be placed on the system tape in the proper sequence, commencing with phase 1. The phase may be determined by inspection of the program identification in card columns 76-80. For example, the matrix report program contains 4 phases, which are identified by DARM1, DARM2, DARM3, DARM4, respectively.

- 3. In order to properly create a system tape, the following modifications must be made to the:
  - a. Matrix report program — Insert a card containing a slash (/) in card column 40 between cards 81-82, 160-161, and 229-230.
  - b. Quantitative statistical parameter report program — Insert a card containing a slash (/) in card column 40 between cards 131-132 and between 159-160.

#### Control Messages

##### ER MONITOR

One of the cards of the monitor program has a loading address that is over 599. The error card will be listed on the same line as the message.

##### ER UPPER C

One of the object program cards of the I/O program has a loading address below 4600. The error card will be listed on the same line as the message.

##### ER PROGRAM

One of the cards, during phases 2 and 3, has an incorrect loading address — for phase 2, not between 600 and 4599; for phase 3, not between 4600 and 7997. The error card is listed on the same line as the message.

##### DUP ID, X, PROG DROPPED

A previous program on the system tape has an identical program identification character (X). The present program was not added to the new system tape.

## END OF PASS TWO

The programs in phase 2 have all been written on tape.

## END OF JOB, SYSTEM TAPE ON UNIT #1

The system programs and the identification table have all been written on tape unit 1. Tape 1 is rewound and unloaded.

## PROG DROPPED, BEGINS AT XXXX

A program written during phase 2 does not begin at location 600. XXXX is the starting address. The program will not be written on tape.

## PROG. DROPPED, ENDS AT XXXX

A program in phase 3 does not end at or below 7997. XXXX is the ending address. The program will not be written on tape.

## SYSTEM MODIFY PROGRAM

### Function

The user is enabled by this program to obtain a duplicate system tape, and to tailor the system tape to his specific needs by addition, deletion, or replacement of operating programs. System and utility programs cannot be modified via this program. However, the user may modify them by using the tape load program to create a new system tape.

The program operates through the blank identification program, which calls this program into core storage from the program tape (see option 2 in "Blank Identification Program").

The program is able to perform the four functions add, delete, change, and duplicate in one run in whatever combination desired by the user. The only requirement is that for the delete and change functions the processing must proceed in the same sequential order that the operational programs appear on the system tape. The SYS control cards, with the program decks that may follow each one, must be arranged in corresponding order.

To accomplish the add function, the card deck(s) of the program(s) to be added to the system tape must follow directly behind a control card with SYSA in columns 2-5. Note that more than one program may be added with the one control card. The program is added following the last operational program on the system tape.

The following verification checking operations of the tape load program are performed:

1. The storage positions of the program are not lower than position 600
2. The program identification character is unique (except that it is permissible to have the same one as the preceding program)

3. The program does not contain a groupmark with wordmark (if one is encountered, the wordmark is cleared in order not to interfere with writing the program on the system tape)

A program with more than one phase could be only partially loaded on the system tape if an end card for any of the program phases is missing from the program card deck.

The delete function operates to remove an operational program from the system tape. The program to be removed is specified by the user in the SYS control card. More than one program may be deleted by using additional control cards. A phase of a program may not be deleted; the entire program with all its phases is deleted by the delete function. A valid control card must follow a delete card. If one is not found, the card image is printed with an error message and the search is continued for passing on to the next operation.

The change function is in effect a combination delete and add operation. The program to be added is loaded into the place vacated by the deleted program. The add function operations described are performed except that, in case of a missing end card for a part of the program to be loaded, the entire program is not added. The delete operation for this function is the same as the delete function above.

The duplication of the system tape function was incorporated into the system to provide the following features:

1. Read and write tape with wordmarks
2. Handle records up to 4000 characters in length
3. Produce a multiframe reel, that is, more than one tapemark is recorded on the reel

Regardless of the function(s) performed, the new system tape is always found on tape drive 2 at the completion of the program run.

#### Control Card Formats

The blank identification program is used to call in this program. The control card must have the information punched as described below. For the add and change functions, the card deck of the program to be added must follow the SYS control card.

#### SYS Control Card

<u>Column</u>	<u>Contents</u>
1	Program identification — must always be blank
2-4	System code — must always be SYS

<u>Column</u>	<u>Contents</u>
5	Function Code: A - add function B - delete function C - change function D - duplicate function Any other value is invalid
6	Not used
7	Remove program indicator — must be the program identification code character of the program to be removed from the system tape if column 5 contains a B or C; otherwise, not used
8-39	Not used
40	Program control field — must not contain an L in order to enable the program to distinguish the control card from a card in the program deck
41-70	Not used
71-75	Program control field — must always be blank to enable the program to distinguish this control card from a card in the program deck
76-80	Not used

**SYS End Control Card**

<u>Column</u>	<u>Contents</u>
1-5	Card identification — must always be AAAAA
6-70	Not used
71-75	Program control field — must always be blank
76-80	Not used

The above card is required only if the user wishes to enter a production run immediately following an add, change, or delete operation. It is used as a separator between the cards of this program run and the control cards for the production run.

Messages

50 ERRS, TU2, REPLACE, RELOAD ALL CARDS, PRESS START

The program has encountered 50 tape write errors (ten writes, five skips). Tape drive 2 has been unloaded and number 1 rewound. Follow the instructions of the message for restart.

DIAL UNIT 2 TO 1, READY NEW UNIT 2, PRESS START

This system modify program has not completed all the operations requested. The new system tape on drive 2 has been rewound, while the old one on drive 1 has been rewound and unloaded. To complete the run, drive 2 should be dialed to 1, a new drive 2 made ready, and the start button pressed. The following situations may cause this message to be printed:

1. A request for a duplicate tape (the modified one) is made after the system tape has been modified
2. A change or a delete operation is requested after an add operation has been performed
3. A change or a delete operation is requested immediately following an unsuccessful effort to locate a particular program on a change or delete request

DUP ID, X, PROG DROPPED

X is the program identification character of the program not added because its identification character is not unique.

ER GMWM XXX

XXX is the storage location that contains a groupmark with wordmark. The wordmark was cleared to enable the program to be added to the system tape. The content of columns 72-80 of the end card of the program is printed alongside this message.

ERR, NO SYS.A, B, C, D

The SYS control card is invalid, or absent following a delete operation. The card image is printed alongside this message. The program continues its search for the next valid control card. Until it finds one, any program cards encountered will produce appropriate error messages and the program will not appear on the new system tape.

ER PROGRAM

A storage position of the program is not located between 600 and 4600. The error card is deleted from the program and the card image is printed alongside this message. This error condition alone will not prevent the program from being loaded onto the system tape.

ID TABLE FULL, PROG-X-ACCEPTED

X is the program identification character. The program is written on the new system tape. Because the identification table on the system tape is full at its maximum capacity of 132 positions, the program identification character of the loaded program is not added to the table, nor is it checked for uniqueness.



## NEW DATA SYS TAPE ON UNIT 2

Self-explanatory.

## NEW IDENTIFICATION TABLE

This message followed by a one-line printout of the identification table located at the end of the new system tape is always printed when a new system tape is created.

## NO END CARD PROG-X-

X is the program identification character. A SYS control card has been encountered before finding an end card when reading in a program card deck. The program is not written on the new system tape.

## OLD IDENTIFICATION TABLE

This message preceded by START SYS RUN and followed by a one-line printout of the identification table located on the old system tape always appears at the start of a run of this program.

## PROG DROPPED, BEGINS AT XXX

XXX is the storage location below 600 used by the program that was dropped. The content of columns 72-80 of the end card of the program is printed alongside this message.

## PROG NOT FOUND

This message with the SYS control card printed alongside appears when the program to be removed from the system tape (on a delete or change operation) has not been located on the tape. This can happen if the request is out of sequence, that is, the SYS control card is read in the card input after the program has been passed on the system tape.

## PROG TAPE READ ERROR

A read error has occurred in reading in the system tape bootstrap from tape drive 1. Press start to try once more.

## TAPE 2 SHORT, REPLACE, RELOAD ALL CARDS, PRESS START

An end-of-reel marker has been detected on tape 2. The tape has been unloaded and number 1 rewound. Follow the instructions of the message for restart.

## 10 RD ERRORS UNIT 1, PRESS START

The program has attempted ten times to read the system tape. Press start to try ten more times.

### TO ENTER RUN DIAL UNIT 2 TO 1, PRESS START

This system modify program has completed its run and the new system tape is rewound on tape drive 2. Tape drive 1 has been rewound and unloaded. To start a production run, the required control cards should be placed in the read hopper, tape drives 3 and 4 made ready, tape drive 2 dialed to 1, and the start button pressed.

### TO ENTER RUN, PRESS START

This system modify program has completed a request to duplicate the system tape. The duplicate tape on drive 2 has been rewound and unloaded. The original system tape on drive 1 has been rewound. To start a production run, the required control cards should be placed in the read hopper, tape drives 3 and 4 made ready, and the start button pressed.

### END SYS RUN

Appears at the end of the system run.

### SYSTEM RULES FOR OPERATIONAL PROGRAMS

Any number of user-furnished operational programs may be added to the system. There are, however, certain rules the user must follow in order to have the program work in conjunction with the other operational programs. These are enumerated below:

1. Every program (or every phase of a multiphased program) must have a unique single identification character at location 600. This may be any valid BCD character except a groupmark, record mark or tapemark.
2. The first instruction of every program must be at location 601.
3. Programs (and associated constants) must be contained between storage positions 600-4599. Programs larger than 4K positions must be segmented into logical phases each 4K positions or less. These phases must be placed consecutively on the system program tape, and each phase must read the next phase into storage from the program tape. Neither the I/O program nor the monitor performs this function.
4. Storage positions 340-599, and 4600-7999 are reserved for the monitor, system constants, and I/O program.
5. Programs may not contain a constant of a groupmark with wordmark. If detected, the wordmark will be removed before the program is written on tape. A system constant of a groupmark with wordmark is provided at location 4600.
6. At the start of each operational program, that program's first control card is located in the card read area. The program must set any wordmarks it requires (except in location 001) in the card read area, as the area is cleared by the system at the end of the previous program.

7. Wordmarks are set by the system in positions 087, 092, and 097, the first high-order index register positions. Locations 087 through 339 may contain information from preceding programs. Each program must clear the area itself, when required.
8. If a program, when reading control cards (if there is more than the initial card), detects a card for another program, that card should be left undisturbed in the card read area. The monitor will take the appropriate action. Whether the program reads cards or not, the identification character in location 001 in the card read area must not be destroyed or changed. If it is, it will cause the monitor to erroneously search the program tape for a new program.
9. Any program that changes the format of the data tape must change those affected system constants (described below).
10. When reading a prepared data tape, the program must first cause the header to be read as described below. Similarly, when writing a data tape, the header label must be written first.
11. Location of system components:
  - a. Loc. 340. Entrance point to the monitor. At the normal end of job, or when an error as described under "c" below is detected, control is returned to the monitor by branching to location 340.
  - b. Loc. 4600. Groupmark with wordmark. No program in the system may contain, as a constant or otherwise, a groupmark character with a wordmark on the program tape. Once processing begins, the constant at 4600 may be moved into the program area.
  - c. Loc. 4601. System error switch. A one-position DCW. The switch is on when it contains a 1; off when 0 (zero). If the switch is on, each program should perform its control card check but do no processing. If at any time a program detects an error in its control card or in the data it is processing, that will either cause program malfunction or destroy the data file, the switch should be set on. The programmer must use his own discretion as to what condition should cause the switch to be set.
  - d. Loc. 4602. Input tape number. A one-position DCW that contains the number of the drive reading the current input file. At the end of an operational program that modifies the input file and creates a new output file, the content of this location is changed by the system to reflect the logical drive number of the output tape (which will become the next operational program's input tape). Normally, system data tapes are alternated between drives 3 and 4.
  - e. Loc. 4603-4604. Blocking factor. A two-position DCW that contains the number of data records per block on the data tape.
  - f. Loc. 4605-4606. Number of fields. A two-position DCW that indicates the number of fields per record as defined by the user to the system. The maximum permissible is 25.

- g. Loc. 4607-4609. Input record size. A three-position DCW that contains the size of an input record including any padding characters and the record mark placed at the end of every data record.
- h. Loc. 4610-6109. Tape I/O. A 1500-position area that may be used by any program for tape reading and/or writing. The area contains wordmarks under the high-order position of each defined data field for as many records as indicated by the blocking factor. A groupmark with a wordmark is located to the right of that position defining the end of a block.
- i. Loc. 6111-6191. Header and trailer area. An 81-position area used by the I/O program to read and write header and trailer labels. A groupmark-wordmark is in the 81st position.
- j. Loc. 6192-6194. Zeros. A three-position DCW of all zeros.
- k. Loc. 6195-6344. Field definition table. A 150-position table made up of 50 three-position DCW's. Each successive set of 2 DCW's defines the high- and low-order addresses of each user-defined file in the data records. That is, the first three positions define the high-order address of field 1, the next three refer to the low-order address of field 1.
- l. Loc. 6552-6556. Write tape counter. A five-position DCW used as a counter to record the number of times the write tape routine has been entered. The content of the counter is printed (and then initialized to zero) when an end-of-reel marker is sensed or when the user branches to the write trailer routine.
- m. Loc. 6570-6574. Read tape counter. A five-position DCW used to record the number of times the read tape routine has been entered. The content of the counter is printed (and then initialized to zero) immediately before the I/O routine branches to the user's end-of-file routine and when an input end-of-file is sensed.
- n. Loc. 6692. Header error switch. If the header label is read in error, or has an incorrect format, a wordmark is set. Any program modifying the header should clear the location of a wordmark.
- o. Loc. 6719. A one-position wordmark switch. When set on (WM = on), the I/O program returns to the user's end-of-file routine and does not print the read tape counter. This is to permit a program to finish printing a report (for example, total lines) without the read tape counter messages being included in the report. This switch should be set on at the start of the program if it is desired to use the feature.
- p. Loc. 6720. Entrance to tape read or write routine of the I/O program.
- q. Loc. 6732. Entrance point to the read header routine of the I/O program.
- r. Loc. 6752. Entrance point to the write header routine of the I/O program.

- s. Loc. 6744. Entrance point to the write trailer routine of the I/O program. The calling sequence to enter the I/O tape header and trailer routines consists of a branch (conditional or unconditional) instruction to the proper address, followed by a four-character NOP instruction with an A operand, which is the label of the tape instruction to be executed. After performing the required action, the I/O program will cause a branch to the next sequential instruction following the NOP.
- t. Loc. 6765-6767. Address of user's end-of-file routine. A three-position field where the user places the address of his end-of-file routine. Upon detecting an input EOF condition, the I/O program unloads or rewinds the input tape as required, then branches to this user location. The user may do any EOF processing (for example, print and end-of-job message) and then cause a trailer to be written (by branching to location 6744).
- u. Loc. 6768. Entrance point to the I/O routine that prints the read tape counter. Used in conjunction with the switch at location 6719 described in 'o' above. When the user has caused the suppression of the read tape counter and has completed the end-of-file routine, the program must then turn the switch off (clear word-mark at 6719) and branch to 6768. However, before branching to 6768, the user must change the address of the EOF routine as stored in location 6765-6767. This could be changed to location 6744 (the write trailer routine), to 340 (the monitor), or to any other location.

A simple example is given below to illustrate the use of some of the system constants:

Example

A CONTROL CARD CONTAINS A TWO-DIGIT FIELD NUMBER IN COLUMNS 2-3. THE PROGRAM MUST MODIFY THE CONTENT OF THE FIELD AND CREATE A NEW DATA TAPE.

*			
LABEL	OP	OPERAND	
*			
CONSTANTS			
*			
MONTR	EQU	340	ENTRANCE POINT TO MONITOR
ERRSW	EQU	4601	SYSTEM ERROR SWITCH-ON IS 1
TAPENO	EQU	4602	CURRENT FILE DRIVE NUMBER
NOFLDS	EQU	4606	NUMBER OF FIELDS PER RECORD
OUTPUT	EQU	4610	
INPUT	EQU	4610	
TABLE	EQU	6195	HI ORDER ADDR OF DEFINITION TAB.
EOF	EQU	6767	
READ	RT	4, INPUT	READ COMMD FOR I/O ROUTINE
WRITE	WT	3, INPUT	WRITE COMMD FOR I/O ROUTINE
OPENW	EQU		ENTRANCE TO WRITE HEADER
OPENR	EQU		ENTRANCE TO READ HEADER
*			

```

        ORG      600                START AT 600
        DCW      @X@                PROGRAM IDENT. CHARACTER
START
        ANY HOUSEKEEPING
*
* CHECK CONTENT OF COLS 2-3 TO VALIDATE FIELD NUMBER.
* IT MUST BE NUMERIC, AND NOT GREATER THAN THE MAX INDICATED
* TO THE SYSTEM.
*
        C        003, @01@
        BH       ERROR                IF 01 IS HIGH - ERROR
        C        003, NO FLDS COMPARE NO. TO MAXIMUM VALUE
        BL       ERROR                IF MAX LESS THAN NO. - ERROR
        C        003, @Z@            TEST LO ORDER DIGIT
        BL       VALID                MUST BE GREATER THAN Z
ERROR
* ROUTINE TO PRINT ERROR MESSAGE
        MCW      @1@, ERRSW SET SYSTEM ERROR SWITCH ON
        B        MONITOR RETURN CONTROL TO MONITOR
* VALID FIELD NUMBER - CHECK IF PREVIOUS SYSTEM ERROR
VALID   BCE     MONITR, ERRSW, 1     RET. TO MONITOR IF ERRSW ON
        MCW      &EOJ, EOF           GIVE I/O ROUTINE END OF JOB ADDR
*
* SET UP TAPE COMMANDS FOR I/O ROUTINE AND CHANGE SYSTEM CONSTANT
*
        MCW      TAPENO, READ&3      SET UP TO READ FROM LAST OUTPUT
        BCE     OPEN, READ &3, 4     IF READ NOT 4 SET WRITE
        MCW      @4@, WRITE&3        COMMAND TO 4
OPEN    B        OPENR                READ HEADER FROM DATA TAPE
        NOP     READ                  LOC OF READ COMMAND FOR I/O
        B        OPENW               WRITE HEADER ON NEW DATA TAPE
        NOP     WRITE                LOC OF WRITE COMMAND FOR I/O
*
* DETERMINE POSITION OF FIELD FROM FIELD DEFINITION TABLE
        MCW      003, PRODC-2        FIELD NO. TO PRODUCT AREA
        M        @6@, PRODC#5        MULT BY SIX
        MN       PRODC, 089          MOVE RESULT TO XREG 1 WITHOUT
        MCW      TABLE-1&X1, SAVE#6 MOVE HI AND LO ADDRESSES FROM
        LCA      TABLE-1&X1, SAVE#6 TABLE TO SAVE LOC.
*
        B        TAPE                READ DATA RECORD
        NOP     READ
* ANY PROCESSING TO BE DONE BY PROGRAM
        B        TAPE                WRITE DATA RECORD
        NOP     WRITE
* I/O ROUTINE WILL BRANCH TO EOJ WHEN END OF FILE DETECTED
EOJ
* PRINT END OF JOB MESSAGE AND ANY OTHER NEC. PROCESSING
        MCW      WRITE&3, TAPENO     ADJ TAPENO WITH WRITE
        B        CLOSE               WRITE OUTPUT TRAILER
        NOP     WRITE

```

## APPENDIX: WORKSHEET FORMATS

The worksheets in this section are provided as a convenient aid to quick and accurate control card preparation. They are available only as an appendix to this manual, but may be reproduced locally.

### Worksheet for

Data Input Control

Field Definition

Variable Input Control

Field Edit

Symbol Substitution

Field Redefinition

Data Extract

Matrix Report

Quantitative Statistical Parameters (including title and heading cards)

Data Record List

Data Record Tabulate

Title and Heading Control Cards

# DATA INPUT CONTROL CARD

Program		System		Sheet	of
Programmer		Date			
Input file ID numbers				Page	

1	*	
2		Input format indicator. b = not prior processed by system. 1 = tape input in proper format by prior pass.
3		Type of input format.** b = card input, 1 = unblocked tape, 2 = blocked tape.
4		Length of input record (including record mark [ † ] if tape record).
7		Number of input records in an input block.
9		Number of input records as defined by field definition card.
11		*Input header indicator. b = no header, 1 = header.
12		Length of output record (excluding DAR †).
15		Control field definition of multiple record card input. b = no check made 15-16 I, D, field length 17-19 Low-order character position.
20		Sequence check position of input record. b = no check.
23		Generate serialization indicator. b = no serialization, 1 = serialize output.
24		Output field number to contain serial number as defined by field definition card.
26		Serial number in first output record. 34
35		Increment of serial number.
80		Padding indicator. b = no pad, add †, 5 = pad 5, 6 = pad 6.

\* DARS-prepared tape includes a header label.

\*\* When card input is specified a lozenge (12-4-8 punch in card column 80) card trails the last data card to signal the last data input card.



### FIELD DEFINITION CONTROL CARD #1 AND #2

Program		System		Sheet	of
Programmer		Date			
Input file ID numbers				Page	

1 A Card # 1

2 1

3  Number of fields to be defined (maximum 25).

5 

--	--	--	--

OUTPUT\*  
Fields 1, 2

17 

HI	LO		
----	----	--	--

 16  
Fields 3, 4

29 

--	--	--	--

 28  
Fields 5, 6

41 

--	--	--	--

 40  
Fields 7, 8

53 

--	--	--	--

 52  
Fields 9, 10

65 

--	--	--	--

 64  
Fields 11, 12

80  79  
Number of field definition cards.

1 A 2 Card # 2 (Required only when more than 12 fields defined.)

3 

--	--	--	--

OUTPUT\*  
Fields 13, 14

15 

--	--	--	--

 14  
Fields 15, 16

27 

--	--	--	--

 26  
Fields 17, 18

39 

--	--	--	--

 38  
Fields 19, 20

51 

--	--	--	--

 50  
Fields 21, 22

63 

--	--	--	--

 62  
Fields 23, 24, 25

80

\* Plug in the high- and low-order positions of input data record(s).

# VARIABLE INPUT CONTROL CARD

Program		System		Sheet	of
Programmer		Date			
Input file ID numbers				Page	

1	<input checked="" type="checkbox"/>	Card # 1	
2	<input type="checkbox"/>	Number of format cards (1 or 2).	
3	<input type="checkbox"/>	Input type. 1 = card, 2 = tape.	
4	<input type="checkbox"/>	Output type. b = unblocked, and punch = blocked.	
5	<input type="checkbox"/>	Last card code. b = use sense switch A, any punch = last card.	
6	<input type="checkbox"/>	Number of input data fields.	
8	<input type="checkbox"/>	Number of output data fields (including length of message field).	
10	<input type="checkbox"/>	Length of message field number (00 if not desired).	
12	<input type="checkbox"/>	Error tape #5 option. b = no error tape, any punch = error tape.	
13	<input type="checkbox"/>	Input header. b = no header, any punch = header.	
14	<input type="checkbox"/>	Padding indicator (2-9 or 0). b = no pad, 0 = pad 10.	
Variable Format Statement *			
15			47
48			80
Card # 2 (same as 15-80 of card # 1)			
1			33
34			66
67			80

- \* Field divider code description.
- A Characters appear exactly N times.
- B Characters appear N or more times.
- 1-5 Characters appear exactly N times. Digit tells which character.
- 6-0 Characters appear N or more times. Digit tells which character.  
6 = 1st      7 = 2nd . . . 0 = 5th
- C Field is ended by change from alpha to numeric.
- D Field is ended by change from numeric to alpha.
- E Field is exactly N characters long.
- F N consecutive numeric characters follow the end of the field.
- G N consecutive alpha characters follow the end of the field.
- Z Special code (see instructions).

**FIELD EDIT**

Program	System	Sheet	of
Programmer	Date		
			Page

1 E

\*2-3  Number of fields to be left adjusted.  
Maximum is 10. If none, must contain 00.

\*4-5  Field number of first data field. Must be blank if columns 2-3 contain 00.

\*6-21            Field number of second to tenth data field.

21

30  Insert character. Must be either zero or blank.  
This character will be used to pad (fill) the high-order positions when right-adjusting a data field.

\*31-32  Number of fields to be right-adjusted.  
Maximum is 15. If none, must contain 00.

\*33-34  Field number of first data field. Must be blank if columns 31-32 contain 00.

\*35-48         Field number. Second to eighth data field.

\*49-62         Field number. Ninth to fifteenth data field.

80  Save input tape  
Blank - do not save input tape  
Any value indicates save the tape

\* Indicates that these fields must not omit leading zeros, nor contain alphabetic or special characters.

Note: Card columns 4-23 and 33-62 are to be skipped only as required, the remainder being left blank. Card field numbers must be entered without skipping field boxes. Data field numbers used must be no greater than specified to the system data input control program, nor may they contain 00.

# SYMBOL SUBSTITUTION

Program	System	Sheet	of
Programmer	Date		
		Page	

## Symbol Definition Control Card C

1   C C

5  New value field number. Must not be greater than the number of data fields per tape record. Use leading zeros.

10  Save input tape. b = do not save input tape. 1 = save input tape.

47  Constant value to be inserted. Field length should not exceed the length of the data field in the tape record. Right-justified.

63

64  80

## Symbol Definition Control Card F

1   C F   Substitution field numbers. Include leading zeros.

OLD NEW

7  Sequence number (maximum 99). It may be left blank, to indicate continuation of the same file sequence as the preceding card. Use leading zeros.

9  b = substitution of new values is to be made in all data records containing the old value. 0 = skip. Do not substitute the new value; copy matching record, read next card and next data record. 1 = substitution of the new value is to be made in only one data record, the one that the program has matched with the control card, then the next control card and data record are read in.

10  Save input tape. b = do not save input tape. 1 = save input tape.

11  No match indicator. b = no card/tape match does not indicate an error condition. 1 = no card/tape match indicates an error condition.

12  \*\* Old value. Right-justified.

28

29  45

47  \*\* New value. Right-justified.

63

64  80 Leave blank if card column 9 is 0.

\*\* The field length should not exceed the input tape record length and be consistent with it.

**FIELD REDEFINITION CONTROL CARD #1 AND #2**

Program	System	Sheet	of
Programmer	Date		
		Page	

1	R	Card # 1	
3		*Blocking factor for new records.	
5		*Number of fields to be defined for the new record (maximum 25).	
<b>Definition of fields in the new output record (enter character positions of old data input record fields).</b>			
7			OUTPUT FIELDS 1 to 4
31			5 to 8
55			9 to 12
79		Padding indicator. b = no padding, 5 = pad records in multiples of 5, 6 = pad records in multiples of 6.	
80		Save input tape. b = do not save input tape. 1 = save input tape.	

1	R	Card # 2 (Required when more than 12 fields are to be defined.)	
3		13th Field	
9			OUTPUT FIELDS 14 to 17
33			18 to 21
57			22 to 25

\* Heading zeros required or may be left blank if blocking factor is the same for the old and new records.

\*\* Plug in the high- and low-order positions of the old input record; a + sign in the units position of the low-order field definition indicates combine with next defined area as one field.

DATA EXTRACT CONTROL CARDS #1 AND #2

Program	System	Sheet	of
Programmer	Date		
		Page	

1 

X	1
---	---

 Card # 1

3 

--	--

 Record interval selector (Nth record to be tested). b = every record.

5 

--	--

 Starting record designator (first record to be tested). b = first record.

7 

--	--

 Save input tape indicator. b = do not save input tape. 1 = save.\*

8 

															**
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	----

31

32 

															55
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	----

55

56 

															80
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	----

80

1 

X	2
---	---

 Card # 2 (as required)

3 

															26
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	----

26

27 

															50
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	----

50

51 

															74
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	----

74

75 

															80
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	----

80

\*7 Output not tapemarked and rewound until input replaced with scratch tape.

\*\*8-9 Field number of first field to be compared in the first relational condition.

10-11 Compare function of the first relational condition. Must be one of six compare functions as follows:

Relational Operators	{	EQ-equal to	NE-not equal to
		GT-greater than	LT-less than
		GE-greater than or equal to	LE-less than or equal to

Logical	{	/ minor OR	* minor AND
		,/ major OR	,* major AND

12-XX The argument of the first relational condition. XX depends on the length of the constant specified here, from 1 to 99 characters, terminated by a lozenge (12-4-8 punch).

# indicates constant in record.

# MATRIX REPORT CONTROL CARD

Program	System	Sheet	of
Programmer	Date		
		Page	

1	<input type="text" value="M"/>		
4	<input type="text"/>	Type of report. Selection indicator.	
5	<input type="text"/>	FIELD NUMBER Major *	
7	<input type="text"/>	Intermediate *	
9	<input type="text"/>	Vertical **	
11	<input type="text"/>		Vertical axis starting value. Exactly equal in length to vertical field.
23	<input type="text"/>		← 23
24	<input type="text"/>		Vertical axis increment. Length must be equal to or less than vertical field.
33	<input type="text"/>		← 33
34	<input type="text"/>		Vertical axis limiting value. Same requirements as card columns 11-23. Cannot be less than vertical axis starting value.
46	<input type="text"/>		← 46
47	<input type="text"/>	Horizontal field number. Must be specified. **	
49	<input type="text"/>		Horizontal axis starting value. Exactly equal in length to horizontal field.
61	<input type="text"/>		← 61
62	<input type="text"/>		Horizontal axis increment. Length must be equal to or less than horizontal field. It may be zero.
71	<input type="text"/>		← 71
72	<input type="text"/>	Summation field number. Must be either blank or contain a two-digit number. It must not be blank if a 3 is designated in card column 4.	

- Report Type
- 0 = Count
  - 1 = Percentage
  - 2 = Count and Percentage
  - 3 = Summation
  - Any other value is an error

\* Blanks or contain a two-digit number.  
 \*\* No blanks are allowed. Must be a two-digit number.  
 ← Right justified.

Remarks:

---



---



---



---



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# QUANTITATIVE STATISTICAL PARAMETERS REPORT

Program	System	Sheet of
Programmer	Date	
		Page

**Statistical Parameters Report Control Card**

1 

Q	b	b	
---	---	---	--

 c/c 4. Type of report. b = full. 1 = simplified.

5 

Major	1st.	2nd.	3rd	(Int.)
-------	------	------	-----	--------

 \* Major and intermediate fields.

13 

Minor	1st.	2nd.	(Sec.)
-------	------	------	--------

 \* Minor and secondary sum fields.

21 

* *										
-----	--	--	--	--	--	--	--	--	--	--

 \* Interval limiting value (final upper limit value).\*\*\*

34 

--	--	--	--	--	--	--	--	--	--	--

 \* Interval increment. Greater than zero.\*\*\*

47 

--	--	--	--	--	--	--	--	--	--	--

 \* Interval starting value (initial upper limit value).\*\*\*

**Title Control Card (maximum allowed 2)**

1 

Q	b	b	T	
---	---	---	---	--

 c/c 5. 1 = first 60 print positions.  
2 = second 60 print positions. (Following 12 positions used for page numbering by the program.)

6 

--	--	--	--	--	--	--	--	--	--

 Title

26 

--	--	--	--	--	--	--	--	--	--

 25

46 

--	--	--	--	--	--	--	--	--	--

 45

65 

--	--	--	--	--	--	--	--	--	--

 65

**Heading Control Card (maximum allowed 2)**

1 

Q	b	b	F	
---	---	---	---	--

 c/c 5. 1 = print positions 25 to 74.  
2 = print positions 75 to 124.

6 

--	--	--	--	--	--	--	--	--	--

 Header

31 

--	--	--	--	--	--	--	--	--	--

 30

55 

--	--	--	--	--	--	--	--	--	--

 55

- \* Do not omit any leading zeros, no alphabetic or special characters.
- \*\* No blanks are allowed in card columns 13 and 14.
- \*\*\* Indicates that the value must be the same length as the minor field value, zero filled if necessary. The value must be positive and numeric, with the plus sign, if any, over the units position. Fields to be punched right-aligned.
- Note: Interval value field sizes must be exactly equal to data fields.



# DATA RECORD LIST, EDIT, LIST X, TABULATE, AND PUNCH CONTROL CARDS

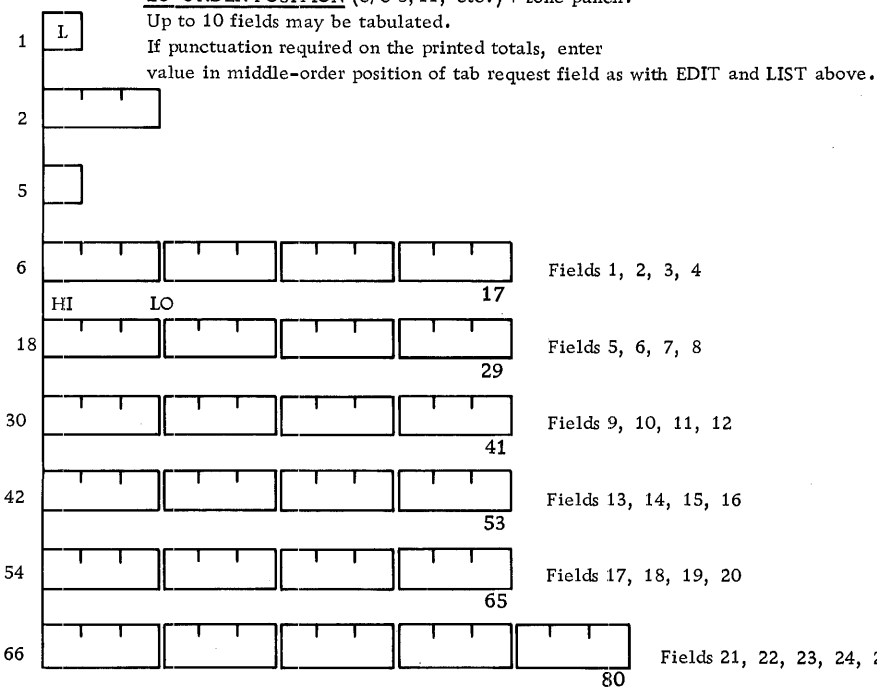
Program	System	Sheet	of
Programmer	Date		
Input file ID numbers			Page

**EDIT AND LIST** c/c 5, "1"

Field Number, HI-ORDER POSITION (c/c 6, 9, etc.) Edit this field, "1"  
MID-ORDER POSITION (c/c 7, 10, etc.) Number of places from low-order position to place decimal/comma. Equal to or less than field size, 1 to 9. Leave blank if punctuation not desired.  
 + zone, comma punctuation.  
 No zone, decimal punctuation.  
LO-ORDER POSITION (c/c 8, 11, etc.) + zone, for tabulation.

**TABULATE ONLY** c/c 2, "T"; c/c 5, "1"

Field Number, HI-ORDER POSITION (c/c 6, 9, etc.) "1"  
LO-ORDER POSITION (c/c 8, 11, etc.) + zone punch.



**PUNCH REQUEST** c/c 2, Number of punched decks "2 or 3", or blank for 1.

+ zone, record mark placement.  
 c/c 3-4, Card column of last card per record to place † or leave blank for column 80.  
 c/c 5, 9 (punch only) - 8 (punch and list).

Field Number, HI-ORDER POSITION (c/c 6, 9, etc.) Serial number of output card in which this field is punched.

Single card output, 0 (zero). Multicard output, 0-9 in sequence.  
 + zone, Control field for multicard output, one per record.  
LO-ORDER POSITIONS (c/c 7-8, 10-11, etc.) Card column in which low-order position of output field is moved from right to left, 01-80.  
LO-ORDER POSITION (c/c 8, 11, etc.) + zone, tabulate this field.  
 No title or header cards permitted.

DATA RECORD TABULATE AND TITLE AND HEADING CONTROL CARDS

Program	System	Sheet	of
Programmer	Date		
		Page	

Data Record Tabulate Control Card

1  T

3  1 = punched card output (frequency count) for use with the symbol substitution program  
blank = no punched card output

4  Control Field Number.

Title Control Card

1  \*\* M, L, or T

4  T \* Two cards allowed, 1 and 2. One full print line.

6  29

30  53

54  71

Heading Control Card

1  \*\* M, L, or T

4  F \* Eight cards allowed, 1 to 8. Four full print lines.

6  29

30  53

54  71

- \* 1 in card column 5 designates print positions 1-66
- 2 in card column 5 designates print positions 67-132
- \*\* Matrix report title and heading control cards require M in card column 1 of Title and Heading Control Cards; Data Record List, L; Record Tabulate, T.



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