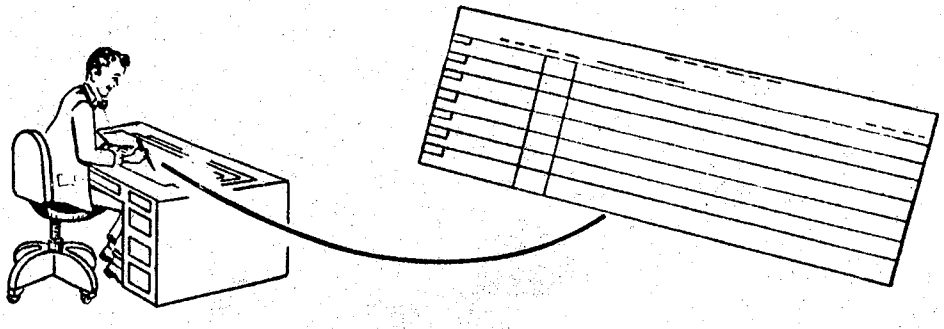
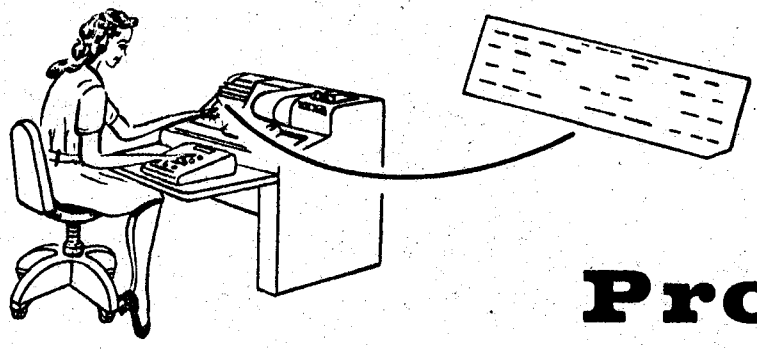
File Copy — Return To Foremans Office

1.181
LP-1576-1

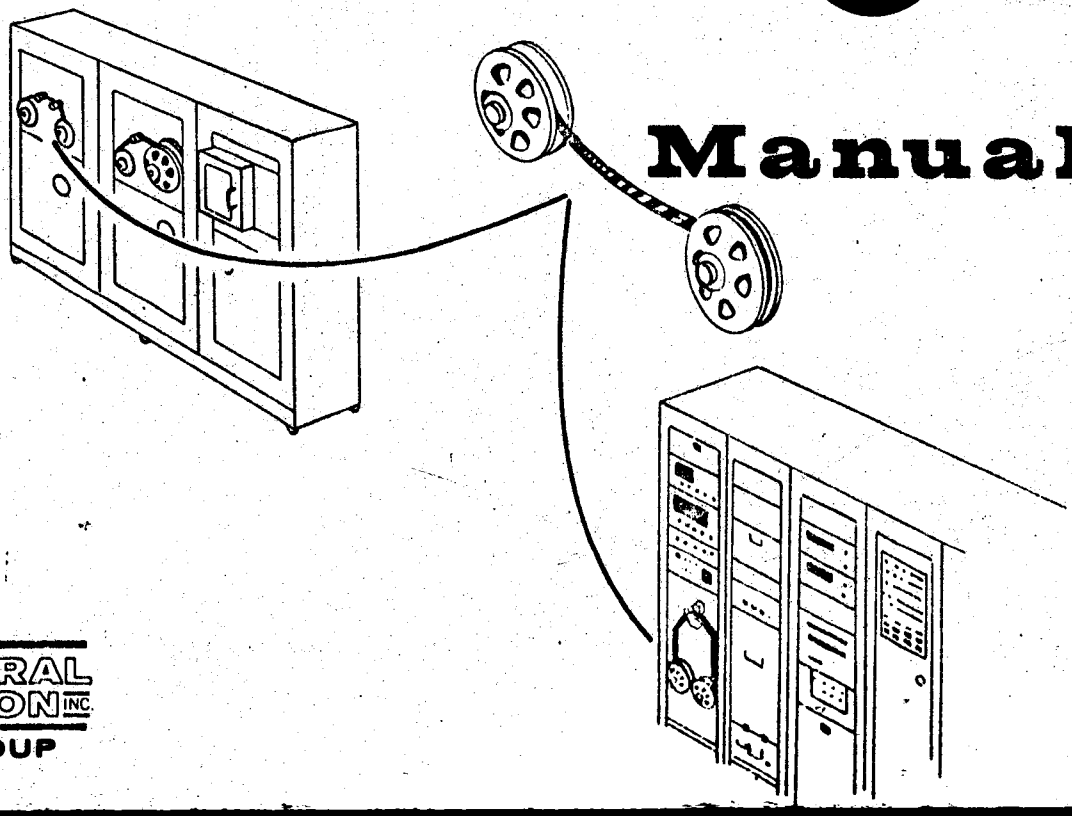


Program



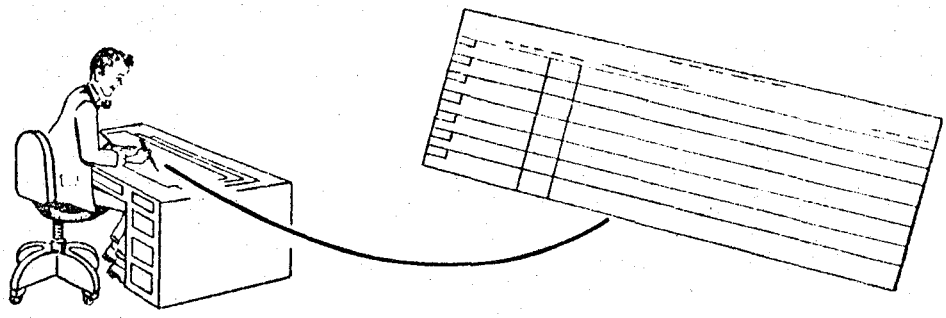
Processing

Manual

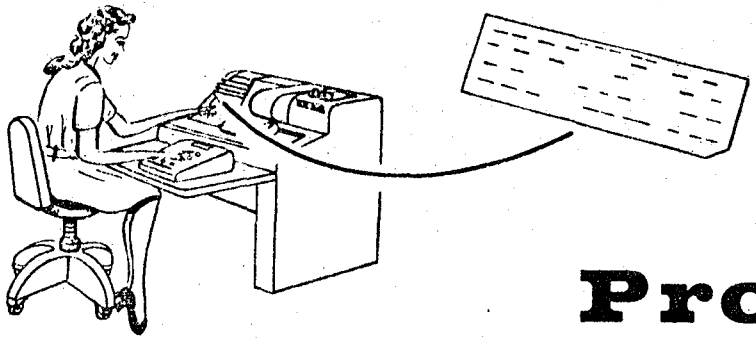


GENERAL PRECISION INC.
LINK GROUP

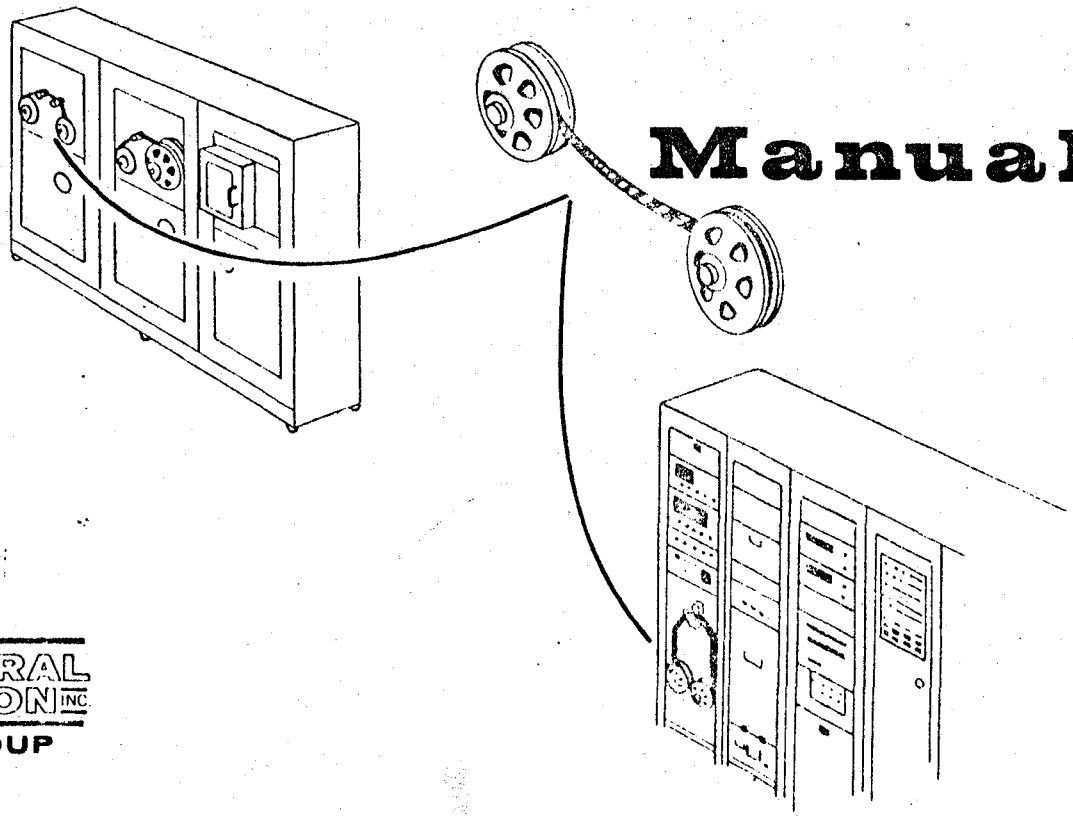
1,181
LP-1576-1



Program



Processing



Manual

GENERAL PRECISION INC
LINK GROUP

Program Processing Manual

Prepared by
Technical Publications Department,
Link Group – Systems Division,
Binghamton, N.Y.

LP-1576-1

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List of Illustrations

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Introduction

The purpose of this manual is to describe the program processing procedures used in conjunction with the Mark I and Mark II digital computers. Section I contains descriptions of program procedures, while Section II contains a description of the program data package supplied with each digital computer.

Section One
Program Procedures

1-1. GENERAL.

1-2. Three types of programs are used to program the Mark I and Mark II digital computers: the general purpose (GP) program, the linear function interpolator (LFI) program, and the data preselect (DP) program. The data preselect program is divided into two separate programs: the initial conditions program, which is used for spacecraft simulation, and the radio aids program, which is used for aircraft simulation.

1-3. GENERAL PURPOSE PROGRAM.

1-4. The GP program is composed of solutions to differential, algebraic, and Boolean equations descriptive of airframe motion, systems operation, initial conditions, and radio aids. Once the programmer has determined the program necessary to solve a particular problem, the solution is given an equation number and documented via a program data sheet. The program data sheet is then used as an input source document for punching GP program cards. The program cards are allocated to bands by quadrants, and placed in a card reader of a Tape Preparation Unit (TPU), which produces a punched paper tape. Finally, the tape is used to load the program on the desired drum band of the computer. The order of procedures required to process data representing the general purpose program is shown in figure 1-1.

1-5. GENERAL PURPOSE PROGRAM SHEET AND CODING AND CONSTANT SHEET.

1-6. The Program Sheet and the Coding and Constant Sheet are used to document the general purpose program. The programmer, after acquiring data for a specific aircraft or aerospace craft, forms equations for simulator purposes. When the programmer determines the equations, programs are formulated and placed on Program Sheets or Coding and Constant Sheets. The Program Sheet (figure 1-2) is used for eight instructions per card, while the Coding and Constants Sheet (figure 1-3) is used for a single instruction per card. The Coding and Constant Sheet is primarily used for diagnostic checks, using the remarks section as an aid in troubleshooting. The Program Sheet and the Coding and Constant Sheet are the input sources for punching the eight instruction cards and the single instruction cards, respectively.

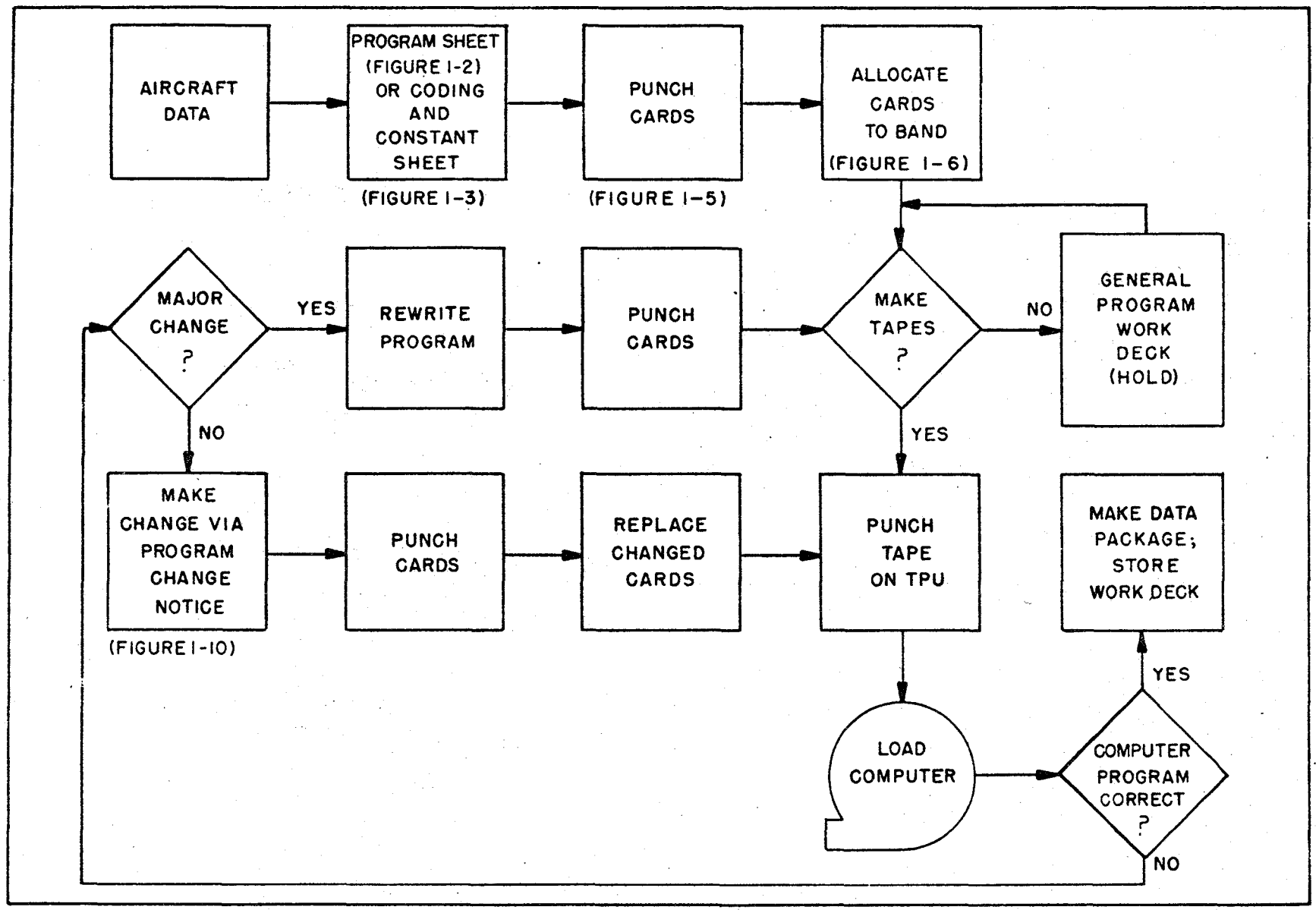


Figure 1-1. General Purpose Program Block Diagram

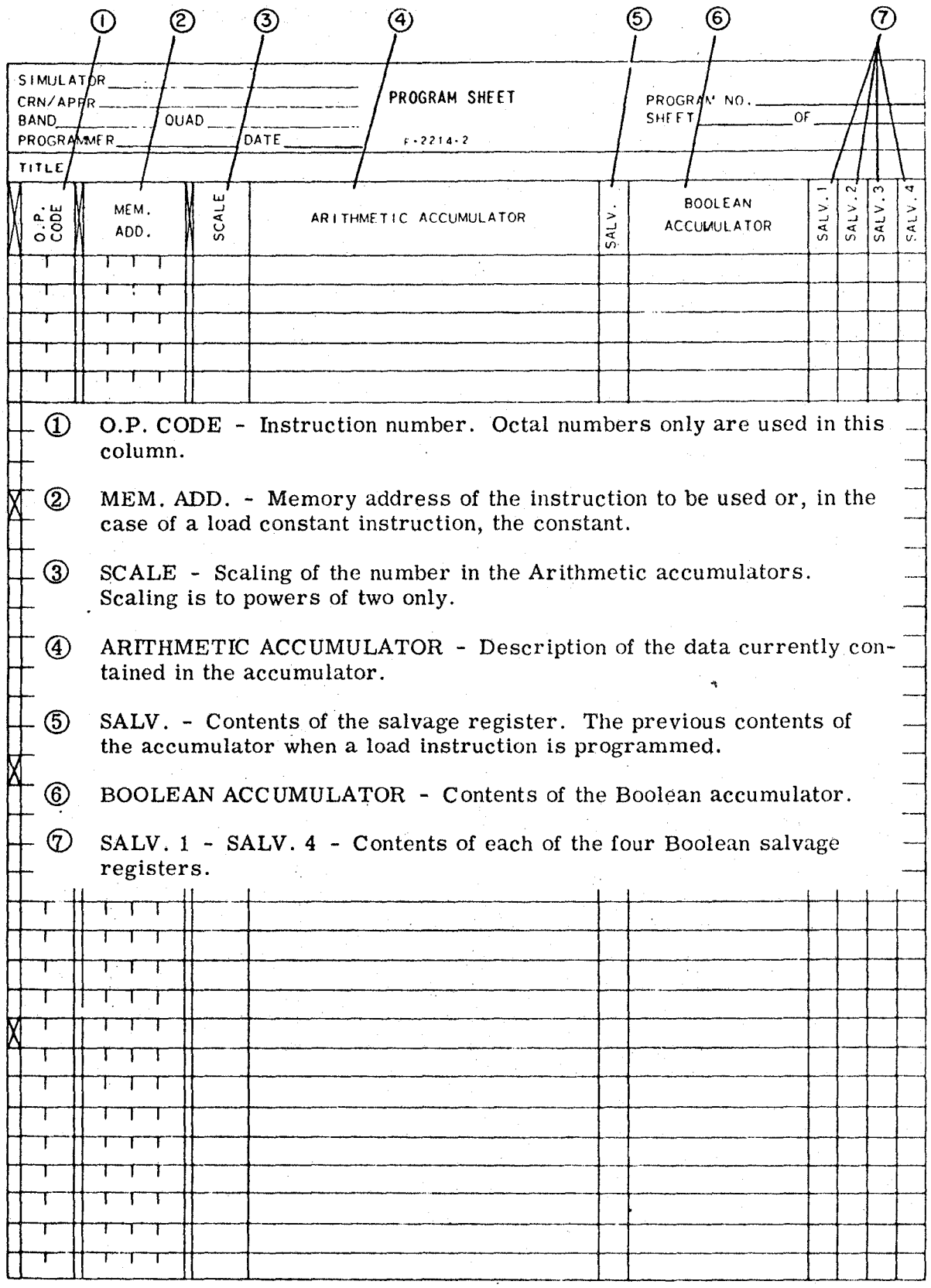


Figure 1-2. Program Sheet

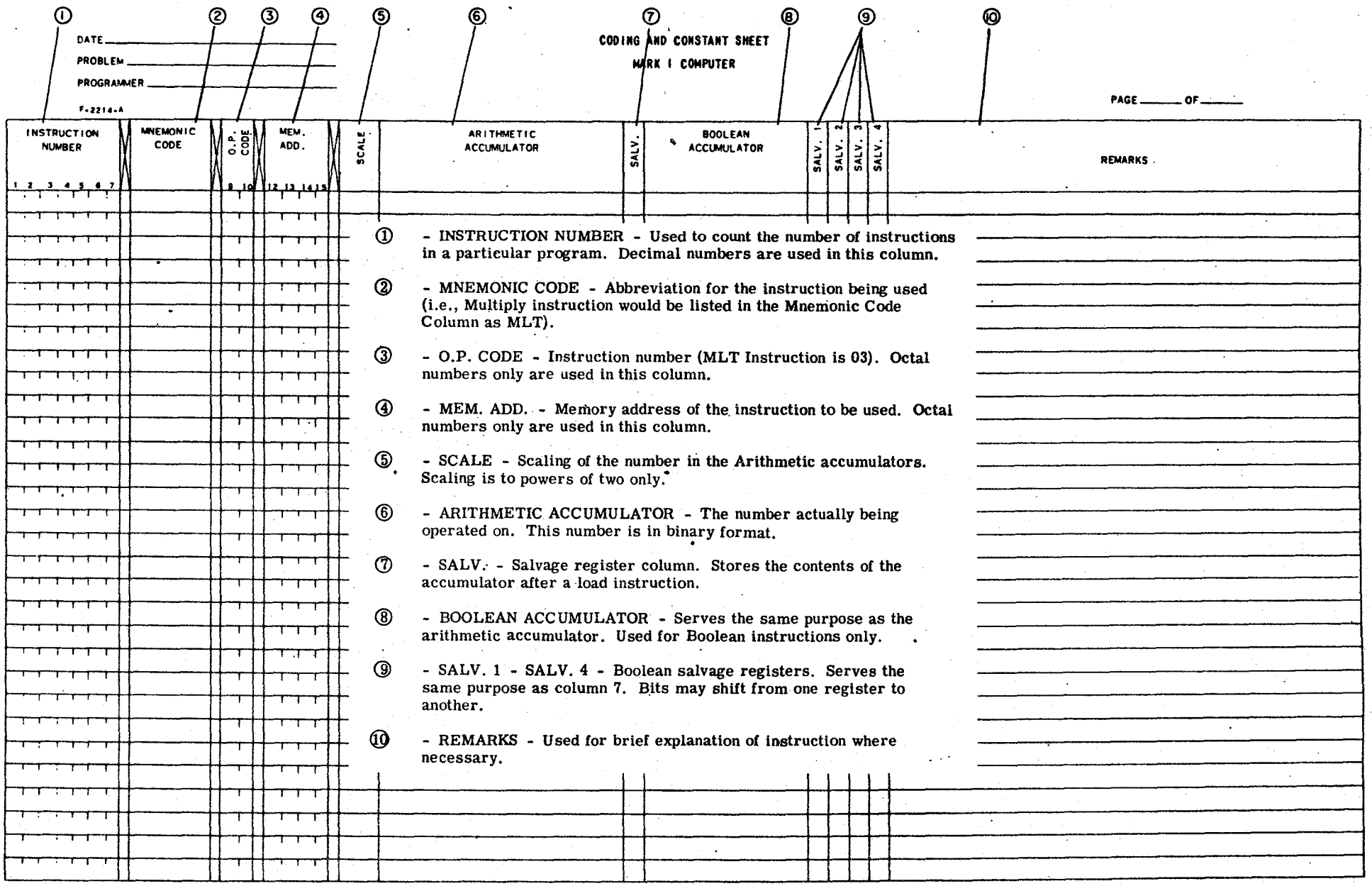


Figure 1-3 Coding and Constants Sheet

1-7. GENERAL PURPOSE PROGRAM CARD.

1-8. The IBM type 5081 punched paper cards contain the permanent program data. The standard Hollerith card coding is used. (See figure 1-4.) There are several card formats used for the general purpose program. The following is a list containing brief description of each card:

a. Single Operation Card. The information punched on this card is taken from the Coding and Constant Sheet. The single operation card (figure 1-5) contains: (1) equation number, (2) instruction number, (3) operation code and memory address, and (4) remarks.

b. Eight Operation (8-OP) Card. This card is punched using the Program Sheet as the source of information. The eight-operations card (figure 1-5) contains: (1) operation code and memory address (eight places) and (2) sort number. (This type of card is no longer used on the new simulators.)

c. Eight Operations Plus Equation Number Card. The data required to punch this card is taken from the Program Sheet. The eight operations plus equation number card (figure 1-5) contains: (1) operation code and memory address (eight places), (2) equation number, and (3) sort number.

d. Program Title Card. The information required to punch this card is taken from the program sheet. (See figure 1-6.) The header card (figure 1-5) contains: (1) equation number, (2) band and quadrant number, (3) number of operations, (4) customer, (5) title of equation, (6) programmer's name, and (7) the date that the program was written.

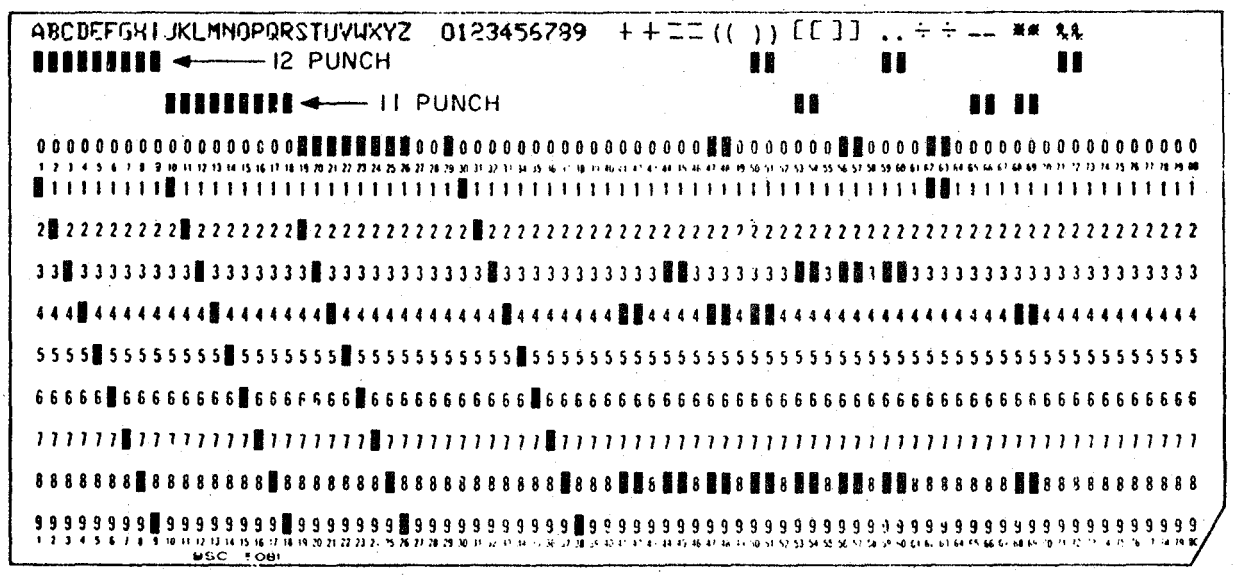
e. Quadrant Header Card. The information required to punch this card is obtained from the drum allocation list. The quadrant header card (figure 1-5) contains: (1) band type, (2) band number, (3) quadrant number, (4) band address, and (5) quadrant's first address.

Note

The quadrant header card is not punched until the equations are allocated on the Drum Allocation Sheet by the programmer. The program title card is updated after the bands on the drum have been assigned.

1-9. The GP program cards are punched and filed numerically in a work deck according to equation numbers. The cards will remain in numerical order by equation numbers until the equations are allocated to bands and quadrants (each band having four quadrants).

1-10. The equations are allocated to bands by a programmer on a Drum Allocation Sheet (figure 1-6). The Drum Allocation Sheet provides the initial information to arrange programs in drum order and to update the program title cards. When the equations have been allocated to bands, the 8-OP cards are arranged in band and quadrant order in the work deck. The overall arrangement of the work deck is by band type, i.e., fast, medium, and slow. Each quadrant card group is followed by a card containing a block end code (figure 1-7). The cards are held in the work deck until a tape is requested to be punched. A Tape To Be Run Sheet (figure 1-8) is used for requesting tapes to be punched and maintaining a change record.



CHARACTERS	PUNCHED ROW	CHARACTERS	PUNCHED ROW
A	12-1	T	0-3
B	12-2	U	0-4
C	12-3	V	0-5
D	12-4	W	0-6
E	12-5	X	0-7
F	12-6	Y	0-8
G	12-7	Z	0-9
H	12-8	0 thru 9	0 thru 9
I	12-9	Plus Sign	4-8
J	11-1	Equal Sign	3-8
K	11-2	Left Parenthesis	0-4-8
L	11-3	Right Parenthesis	12-4-8
M	11-4	Left Bracket	11-3-8
N	11-5	Right Bracket	0-3-8
O	11-6	Decimal Point	12-3-8
P	11-7	Division Sign	0-1
Q	11-8	Minus Sign	11
R	11-9	Asterisk	11-4-8
S	0-2	Ampersand or Plus Sign	12

Figure 1-4. Hollerith Card Table

IBM 1401, 1410, 1440, AND 1460 DATA PROCESSING SYSTEMS

STORAGE LAYOUT

APPLICATION GENERAL PURPOSE PROGRAM DATE

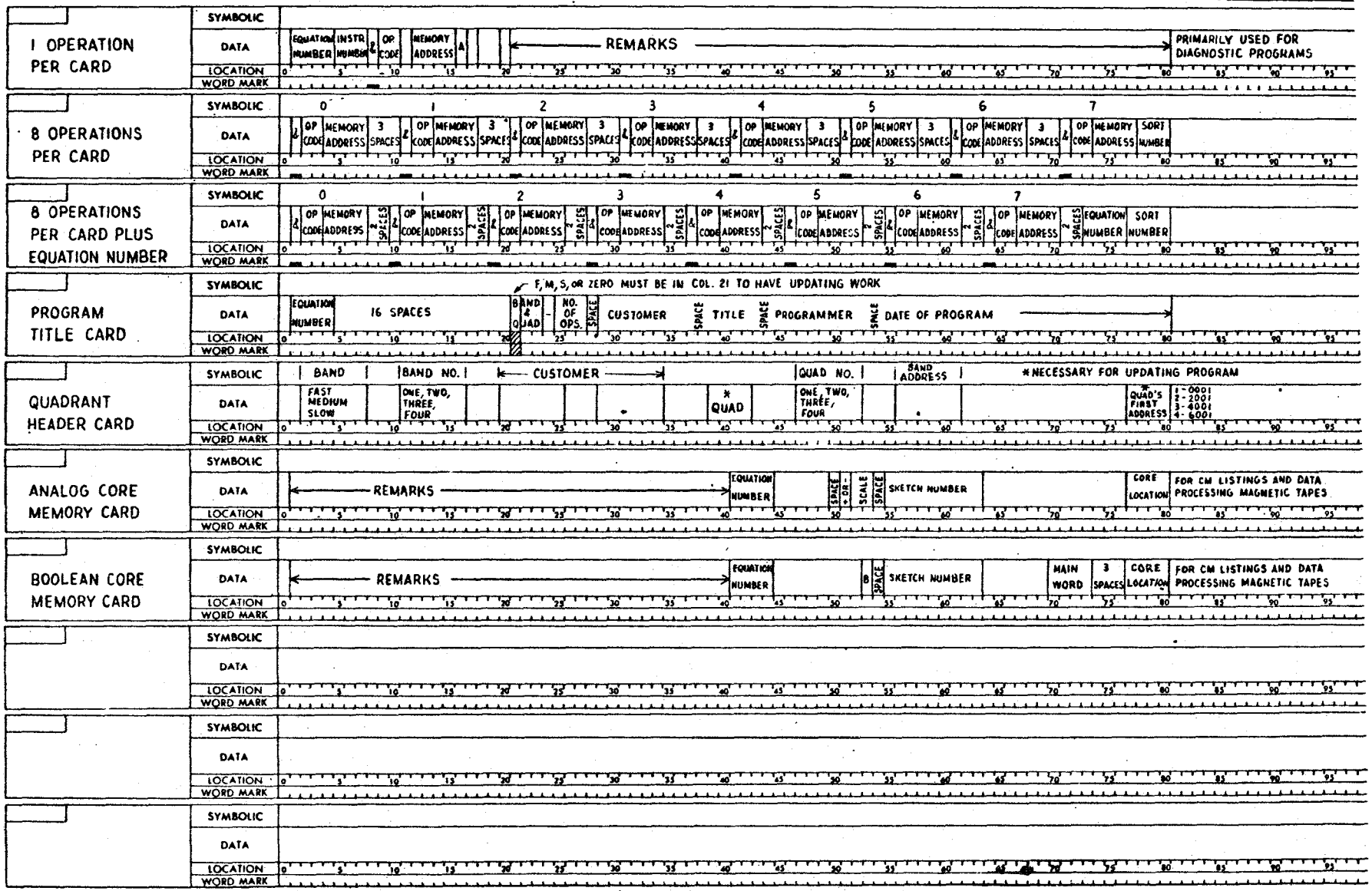


Figure 1-5. General Purpose Program Card Format

F-2244

EQUATION NUMBER	NO. OF STEPS	SUB-TOTAL	DRUM LOCATION OF FIRST STEP	ENGR.	

DRUM ALLOCATION

CUSTOMER/SIMULATOR　　　　BAND ____________ QUADRANT ____________

Figure 1-6. Drum Allocation Sheet

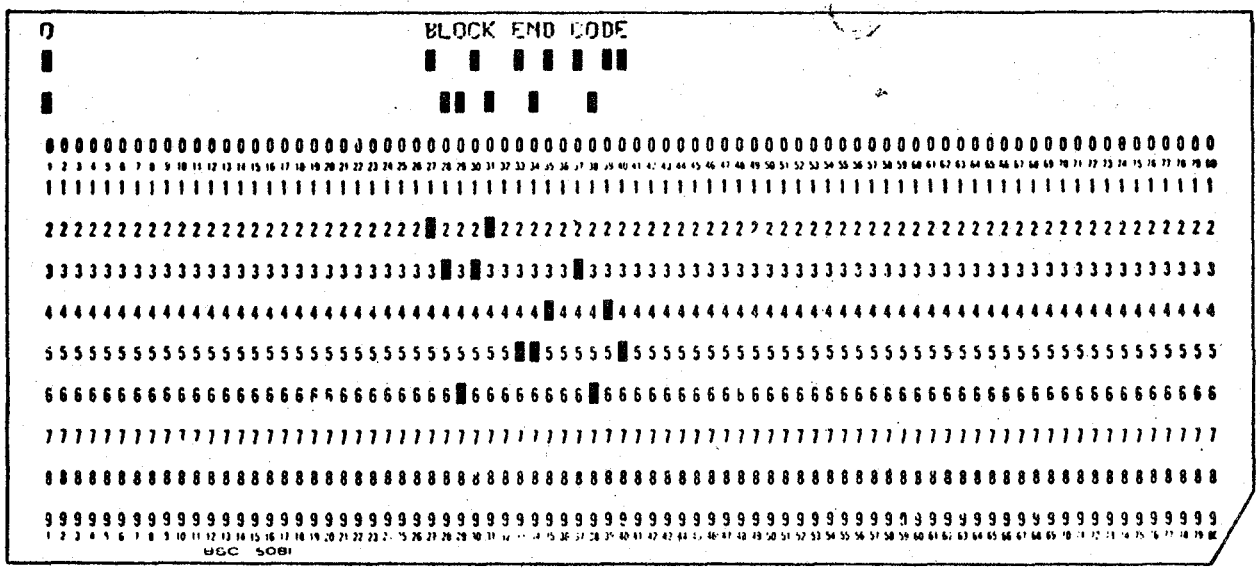


Figure 1-7. Block End Code Card

1-11. GENERAL PURPOSE PROGRAM TAPES.

1-12. The paper tapes are punched by the TPU from programmed cards that are fed into the TPU card reader. Each general purpose program computer word occupies two lines of punched tape; each line containing eight binary digits. A punched hole in the tape indicates a number, and a blank, a zero. The tape format for the general purpose program computer word is illustrated in figure 1-9, where "C" is the OP code and "A" is the address.

1-13. For ease in drum-loading and implementing tape changes, each tape reel contains information for only one band (four quadrants). A full block (quadrant) contains 1024 instructions (1023 and a block end code or a reel end code). Two block end code cards are placed at the end of a full block to stop the TPU so that each quadrant number can be manually marked on the tape. When a quadrant contains less than the 1024 instructions, (short block) only one block end code card is needed to stop the tape in the TPU. Quadrants are normally short blocked so that programs can be changed without having to move entire programs from one quadrant to another. A reel end code is punched at the end of each tape. The reel end code is used during a drum loading operation, and ends the transfer of data from the computer tape reader to the computer. When all the data to be stored on a particular drum-band quadrant is loaded into the computer (it is stored in core-memory), the data is then transferred to the selected drum-band quadrant. After completion of the drum loading, the data in core-memory is checked against the data on the applicable drum band quadrant. This allows the information on the drum to be checked after each quadrant is loaded.

1-14. The programmer's name, the date the tape was punched, the operator who punched the tape, the time the tape was punched, the simulator designation, and the band and quadrant number are written at the beginning of each tape reel. After the tape for the first quadrant is punched, the number of the next quadrant is manually written on the tape. This procedure is also used on the second, third, and fourth quadrants.

TAPES TO BE RUN							
BAND	QUAD	TNR	REQUESTED BY	TIME & DATE	REQUIRED BY	TAPE PREP BY	REMARKS

Figure 1-8. Tape to be Run Sheet

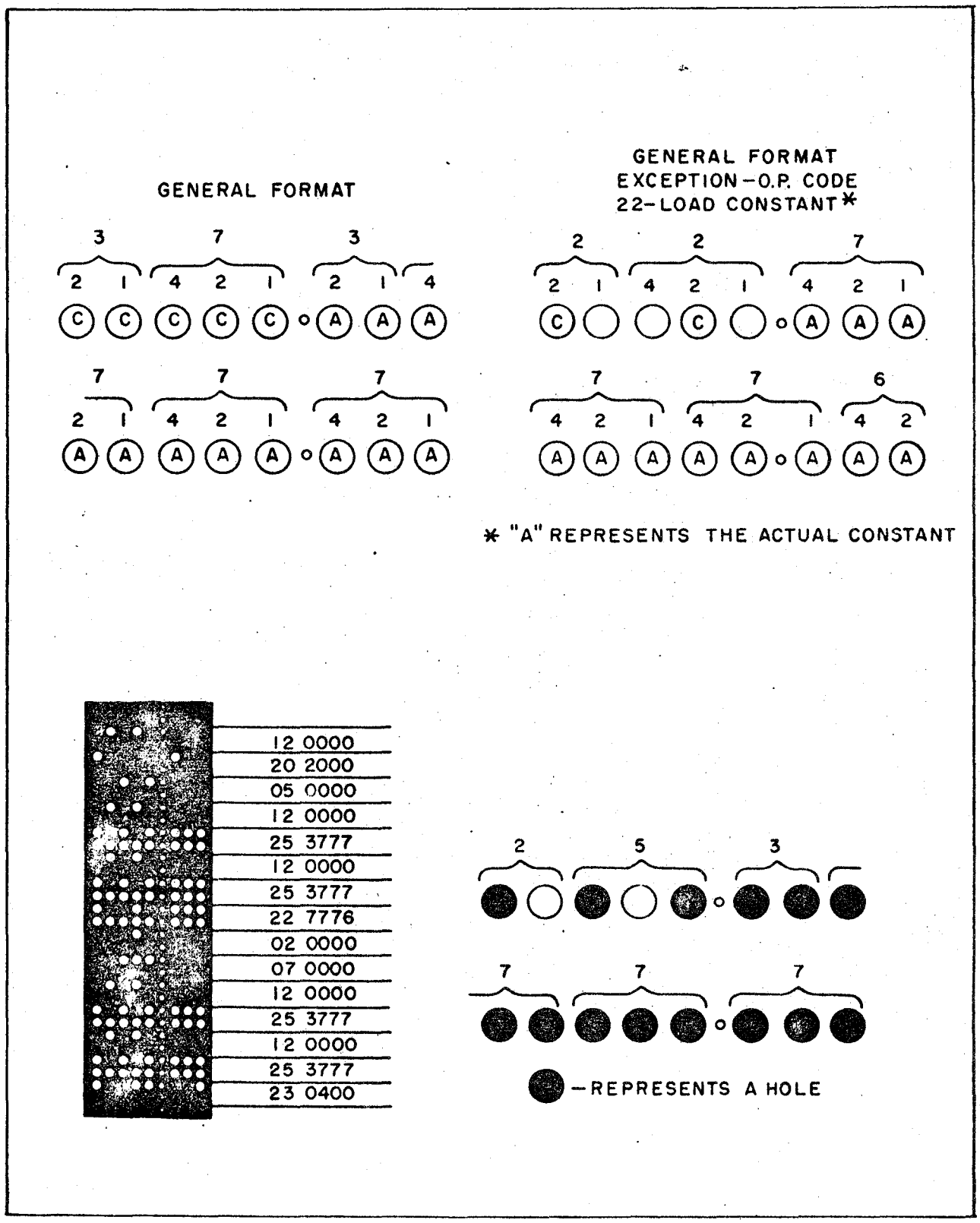


Figure 1-9. General Purpose Tape Format

1-15. GENERAL PURPOSE PROGRAM CHANGE NOTICE.

1-16. A major Change in a program may require that the program be rewritten, while a minor change is recorded on a Program Change Notice (figure 1-10). For minor changes, new cards are punched from the information recorded on the change notice; then, the old cards are replaced in the work deck by the changed cards. A new tape will be punched from the revised work deck. After the tape is punched, the quadrant that was changed is annotated by underlining the previously written quadrant number. Quadrants that are not changed are loaded in the computer in the check mode to provide a running check of the TPU and the drum loader. Each time a tape is loaded on the drum, a Drum Status Sheet (figure 1-11) is also updated.

1-17. A sample general purpose program is shown as follows: Figure 1-12 illustrates the Program Sheet; figure 1-13 illustrates the punched program cards; figure 1-14 illustrates the punched tape; figure 1-15 illustrates the Program Change Notice; and figure 1-16 illustrates the changed program cards.

1-18. CORE LOCATIONS SHEET.

1-19. The Core Locations Sheet (figure 1-17) is filled out the time the general program is written, and the core location assignments are made. All mathematical quantities needed in the simulator program (with the exception of constants which may be stored on the drum) are stored in core memory. The mathematical quantities are assigned specific core addresses on the Core Locations Sheet. After core addresses have been assigned (analog and Boolean addresses), analog and Boolean cards are punched from the data on these sheets. These cards are punched using the format in figure 1-5. A magnetic tape is prepared from the cards and used in making a detailed program listing, which will be explained in the Data Processing Section II.

1-20. LINEAR FUNCTION INTERPOLATOR (LFI) PROGRAM.

1-21. Characteristics of flight equations are placed on Linear Function Interpolator Data Input Sheets that are used to document the LFI Program. Then, cards are punched using a decimal card format that must be converted to an octal card format prior to the generation of a paper tape. Conversion from a decimal-to-octal format is accomplished through the use of an IBM 1401 computer, containing a special decimal-to-octal conversion program. The resultant cards are used to produce the punched paper-tape, which is then loaded onto the selected interpolator drum band. A block diagram of the LFI program procedures is shown in figure 1-18.

1-22. LINEAR FUNCTION INTERPOLATOR DATA INPUT SHEET.

1-23. The Linear Function Interpolator Data Input Sheet (figure 1-19) contains the data needed to punch LFI input cards. This sheet is divided into two sections. The first section contains information concerning the number of variables, whether or not the variables are indexed, scaling of the variables, etc. The second section contains the values of the breakpoints, as taken from the LFI curves.

SIMULATOR_____ PROGRAM_____

CRN/APPR_____ **PROGRAM CHANGE NOTICE** SHEET_____ OF_____

LINK DIVISION, GENERAL PRECISION, INC.

BAND_____ QUAD_____ DATE REQUIRED TAPE ☐ CARDS ☐

PROGRAMMER_____ DATE_____ LISTINGS 1._____

CHANGE BY_____ DATE_____ F-2347 2._____

DESCRIPTION OF CHANGE

REASON FOR CHANGE | REFERENCE

TITLE

CARD ①	STEP ②	OP CODE ③	ADDRESS ④	REMARKS ⑤

① CARD - The number of the card that changed (sort number).

② STEP - The number of the step on the card that is to be changed (counted octally 0-7).

③ OP CODE - The operation code of the step that changed.

④ ADDRESS - The address of the step that changed.

⑤ REMARKS - The description of change that is made.

Figure 1-10. Program Change Notice

DRUM STATUS

F	000									
	001									
	002									
	003									
M1	010									
	011									
	012									
	013									
M2	020									
	021									
	022									
	023									
M3	030									
	031									
	032									
	033									
S1	040									
	041									
	042									
	043									
S2	050									
	051									
	052									
	053									
S3	060									
	061									
	062									
	063									
S4	070									
	071									
	072									
	073									

Figure I-11. Drum Status Sheet

SIMULATOR 707 XXX
CRN/APPR
BAND M2 QUAD 2
PROGRAMMER I. SNODGRASS DATE 2

PROGRAM SHEET

F-2214-2

PROGRAM NO. 8050
SHEET 1 OF 1

TITLE COSINE LATITUDE

	O.P. CODE	MEM. ADD.	SCALE	ARITHMETIC ACCUMULATOR	SALV.	BOOLEAN ACCUMULATOR	SALV.1	SALV.2	SALV.3	SALV.4
	12	0000								
	20	2000	2°	SIN L						
	05	0000								
	12	0000								
	25	3777								
	12	0000								
	25	3777		SIN^2L						
	22	7776	2°	ONE						
0000	X									
	02	0000		$1-SIN^2L$						
	07	0000								
	12	0000								
	25	3777								
	12	0000								
	25	3777		$\sqrt{1-SIN^2L}$						
	23	0400	2°	COS L						
0001	X									
	X									

Figure 1-12. GP Program Example — Program Sheet

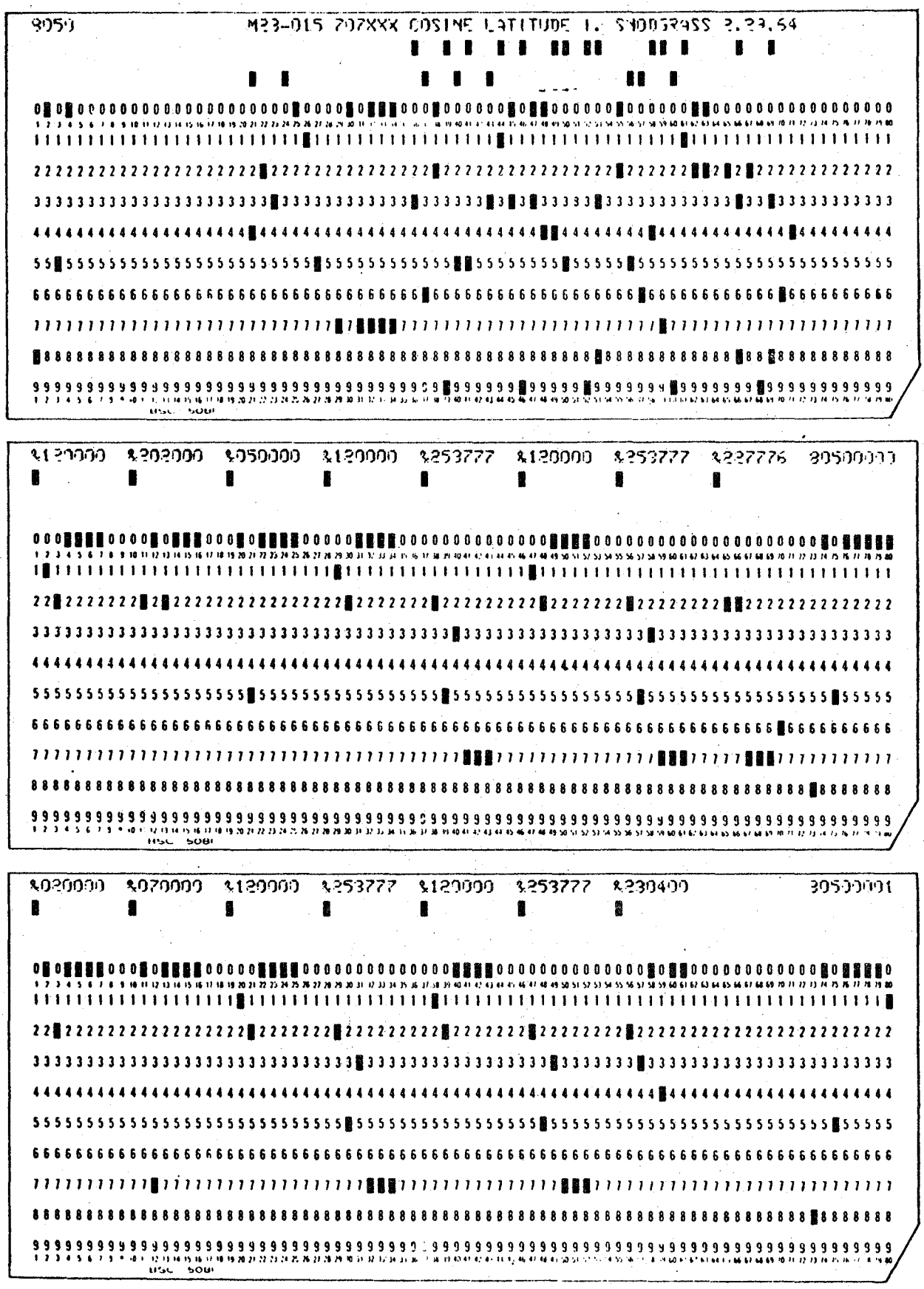


Figure 1-13. GP Program Example — Program Cards

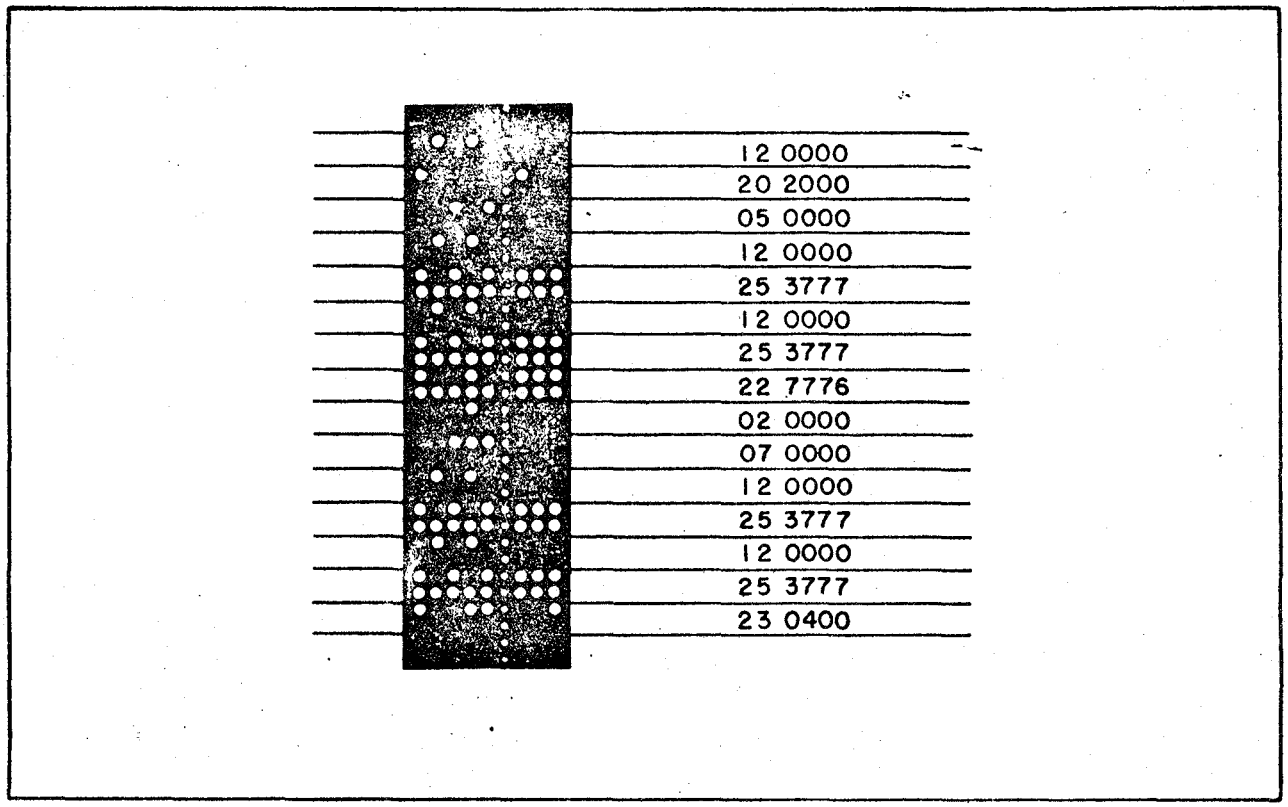


Figure 1-14. GP Program Example — Program Tape

SIMULATOR 707 XXX

PROGRAM CHANGE NOTICE

LINK DIVISION, GENERAL PRECISION, INC.

PROGRAM 8050

CRN/APPR ———

SHEET 1 OF 1

BAND M2 QUAD 2

DATE REQUIRED TAPE ☐ CARDS ☑

PROGRAMMER SNODGRASS DATE 4-1-64

LISTINGS 1. ———

CHANGE BY J. WEBBLY DATE 4-1-64

F-2347

2. ———

DESCRIPTION OF CHANGE

CHANGED ADDRESS

REASON FOR CHANGE SIN²L USED IN OTHER CALC. — WRONG ADDRESS

REFERENCE

TITLE COSINE LATITUDE

CARD	STEP	OP CODE	ADDRESS	REMARKS
0000	6	25	3777	REF
0000	6A	23	2002	ADDED STEP
0000	7	22	3776	REF
0001	6	23	0404	was 23 0400

Figure 1-15. GP Program Example — Program Change Notice

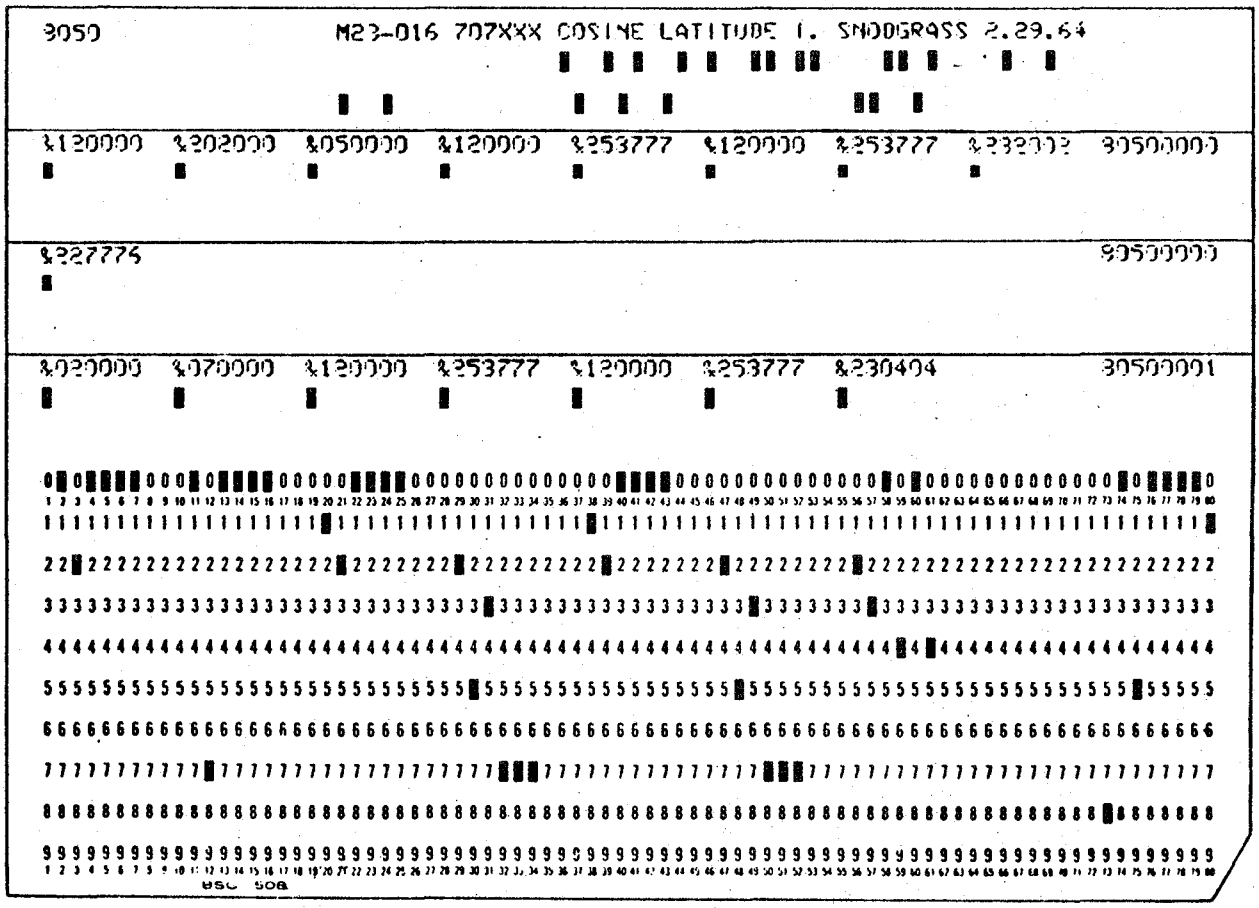


Figure 1-16. GP Program Example — Revised Cards

CORE LOCATIONS

DEFINITION	SYMBOL	SCALE	SKETCH	CORE ADDRESS

F.2249 A

ANALOG
- INPUT
- OUTPUT
- STORAGE WITH INTERPOLATOR ACCESS
- PURE WORKING STORAGE

BOOLEAN
- INPUT INTERROGATE LINE _____
- OUTPUT
- WORKING STORAGE

CUSTOMER _____

SIMULATOR _____

ENGINEER _____

Figure 1-17. Core Locations Sheet

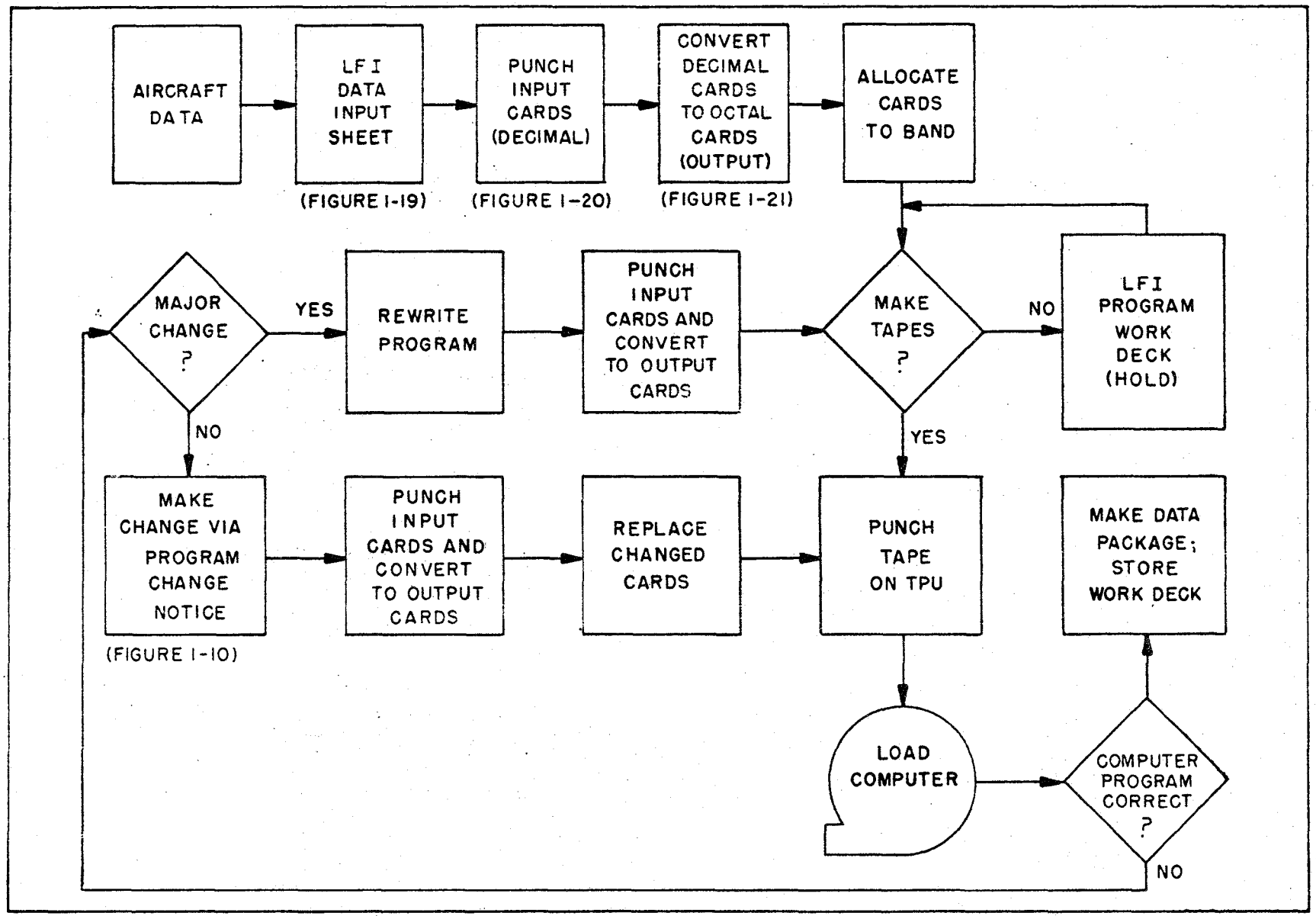


Figure I-18. LFI Program Block Diagram

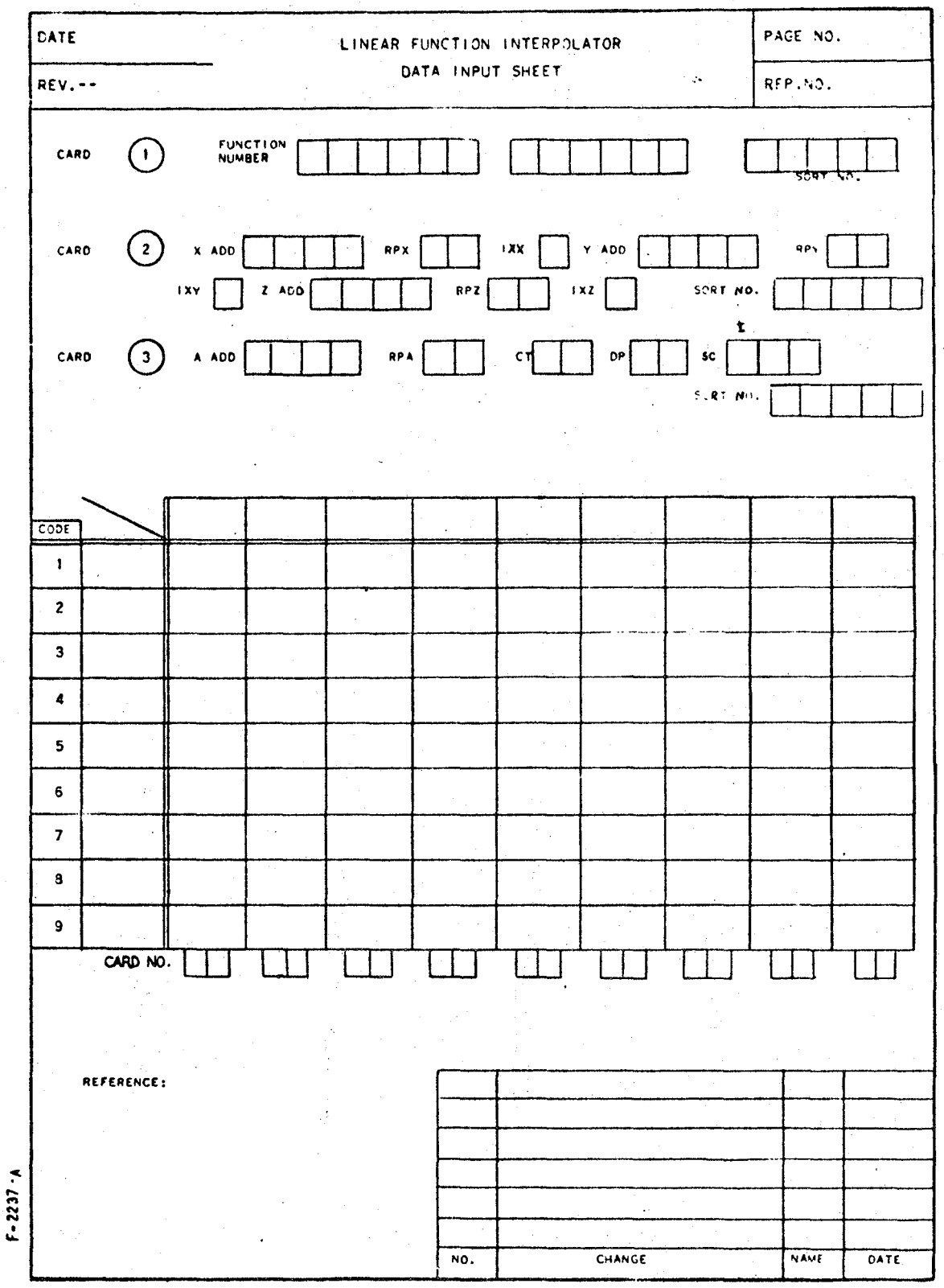


Figure 1-19. Linear Function Interpolator Data Input Sheet

1-24. LFI PROGRAM CARDS.

1-25. The LFI input cards are punched in a decimal format and filed numerically in an input deck according to an alphanumeric sort number. The first three cards are punched using the data in the first section (top-half) of the LFI Data Input Sheet, while the remaining cards are punched using data in the second section (lower-half) of the LFI Data Input Sheet. The required number of input cards is dependent on the number of unknown variables (see Appendix A). A description of each item placed on the LFI input cards is presented as follows:

a. Card 1 (Figure 1-20.)

1. Function Numbers - The function number space has twelve blocks assigned. The first three blocks will be used to show the numerical function number. The second three blocks are used for the first variable input number, the third set of three blocks for the second variable input number, and the last three blocks for the third variable input number. Function numbers are assigned by the project aerodynamicist. These numbers are written decimally on the input sheet.

2. Sort Number - This number is a convenient combination of alphabetics and numerics which describes the order of this card. Two alphabetics and three numerics will be used. (This is only used with punched cards and card reader.)

b. Card 2 (Figure 1-20.)

1. X Address - (X ADD) - The address will contain the core address (in octal) of the independent variable X. If the term is to be indexed (the same set of curves and with different inputs), the X ADD will be the core address (in octal) of the first item to be indexed and must have a zero or a four as the last numeric in the octal number. The next three serial octal core locations must be the remaining indexed inputs.

2. Repeat X (RPX) - The number of times the X address will appear in the output data. If the X address is to appear five times, this will be written on the sheet as 05. At the present, five will always be used.

3. Index X (IXX) - If X is to be indexed, X will appear. If X is not to be indexed, the space will be left blank.

4. Y Address (Y ADD) - Similar to X address except this is for the second variable in a two or three variable function. For a single variable this will be left blank.

5. Repeat Y (RPY) - The number of times the Y address is to appear in the output data. Five is the only number used at this time, and it would appear on the input sheet as 05. These blocks are only used for a function of two or three variables.

6. Index Y (IXY) - If Y is to be indexed, Y will appear. This will be filled out only if this is a function of two or three variables.

7. Z Address (Z ADD) - Similar to X ADD except for the third variable of a three variable function. For single or double variable functions this will be left blank.

8. Repeat Z (RPZ) - The number of times the Z address is to appear in the output data. Five is the only number used at this time and would appear on the input sheet as 05. This will be filled out only for a three variable function.

IBM 1401, 1410, 1440, AND 1460 DATA PROCESSING SYSTEMS

STORAGE LAYOUT

APPLICATION LFI PROGRAM (INPUT CARD FORMAT) DATE

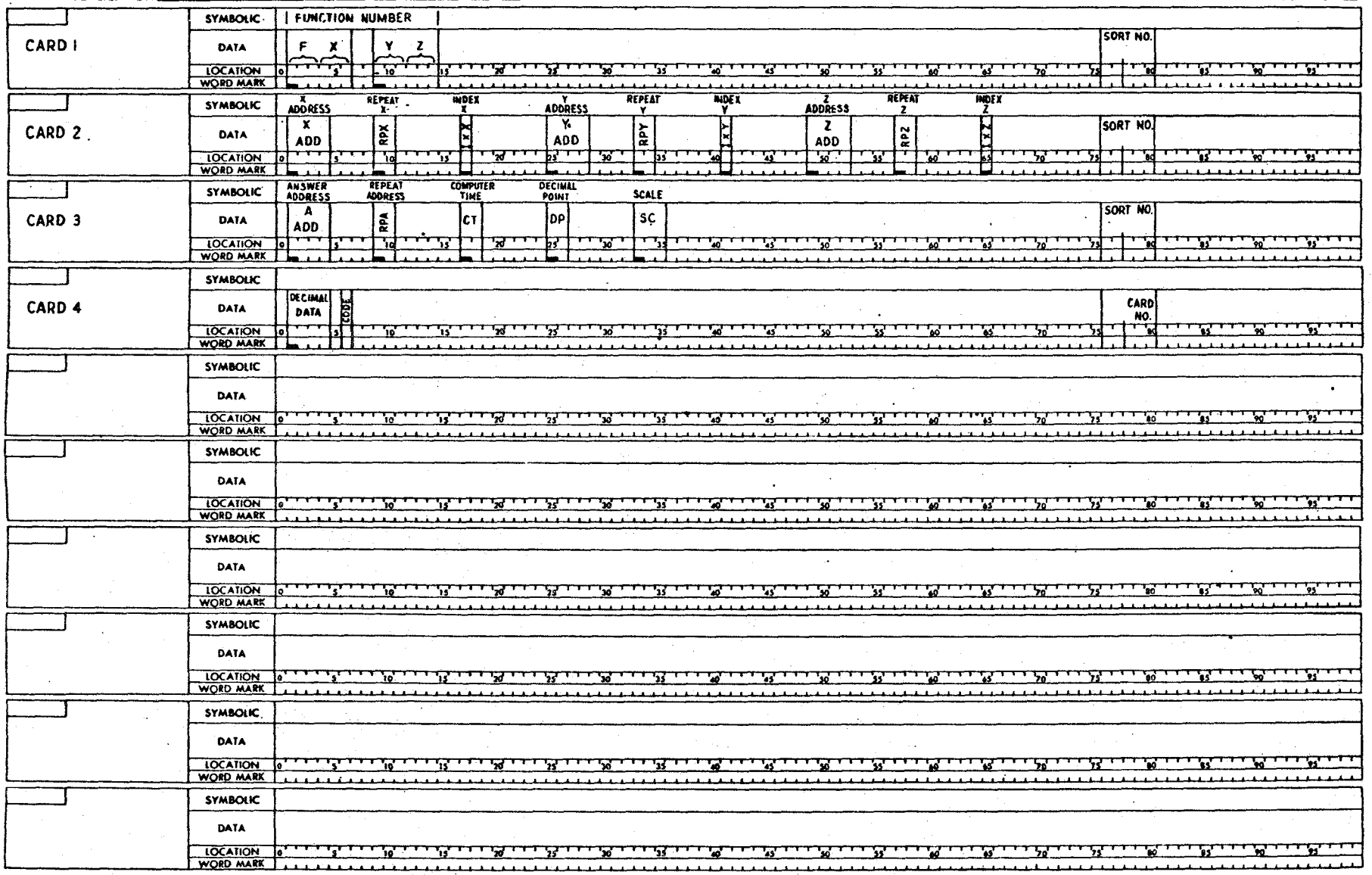


Figure I-20. LFI Program Input Card Format

9. Index Z (IXZ) - If Z is to be indexed, Z will appear to be filled out only for a function of three variables.

10. Sort Number - Number used to signify the order of this card in the input data.

c. Card 3 (Figure 1-20.)

1. Answer Address (A ADD) - The answer address will contain the core address (in octal) where the answer (dependent variable) will be located. For functions which are being indexed, the answer address will be that of the first answer and the core location in octal must have a zero or a four in its last numeric. The next three core locations will be the indexed answers.

2. Repeat answer (RPA) - The number of times the answer is to appear in the output data. Five is the value of the number to be used and will appear on the input sheet as 05.

3. Computer time (CT) - The number of words consisting of all zeros that is to appear in the output data. 02, 04, or 06 will be used for a function of one, two, or three variables, respectively.

4. Decimal Point (DP) - The number of places the decimal point in the input data is to be shifted. The decimal point in the input data is always at the extreme left. 50 written in these blocks implies no shift, 51 implies a decimal point shift to the right of one place, 52 means a shift to the right of two places, 49 means a shift to the left of one place, 48 shift left two places, etc.

5. Scale (SC) - The proper power of two. -05 implies that the adjusted decimal number is to be divided by 32, +07 means the adjusted decimal number is to be divided by 0.0078125. As an example, if the largest decimal number for this function is 15.87, the scale factor is -04; or if the largest decimal number was 0.007753, the scale factor would be +07.

6. Sort Number - Signifies the order of this card in the resultant card deck.

d. Cards 4 Through N (Figure 1-20.)

1. The lower half of the input sheet contains 81 blocks for the independent variables. Each data block should contain 4 digits. Since a single variable of a curve has nine data words (f0, f1/8, f1/4, f3/8....f1.0), a single page may contain all the data words for a two variable function (2 curves 9 x 9 = 81). A three variable function would have 729 data words (9 x 9 x 9) and require nine input sheets to show the whole program. Each punched card contains one breakpoint.

1-26. The LFI input cards are then processed by the IBM 1401 computer, which converts the cards from the decimal card format to an octal card format. The input (decimal) cards are scrapped after the output (octal) cards are checked and filed, according to the alphanumeric sort number, in a work deck. A description of each item placed on the LFI output cards is presented as follows:

a. Format A (Figure 1-21.)

1. Control Word - The number of variables of a function One variable (0100), two variables (0200), or three variables (0300) is punched in the card. An eleven punch in column two of the card, in addition to the regular data, signifies a flag bit.

2. Sort Number - This number is a convenient combination of alphabetics and numerics which describes the order of this card. Two alphabetics and three numerics are used.

Note

Refer to Appendix A for a chart concerning the number of cards, the number of steps and the number of flags for the selected number of variables.

b. Format B (Figure 1-21.)

1. X Address - Consists of five identical words. It is the core memory location of the independent variable X. In column two there is an 11 punch in addition to the data (flag bit).

2. Sort Number - Refer to format A.

c. Format C (Figure 1-21.)

1. Same as card 2, except card 3 contains the independent variable Y

d. Format D (Figure 1-21.)

1. Same as card 2, except card 4 contains the independent variable Z.

e. Format E (Figure 1-21.)

1. Data - The stored data words that describe the function at the various fixed breakpoints. In column two of the first data card only, there is an 11 punch in addition to the regular data.

2. Sort Number - Refer to format A.

Note

There maybe more than one card used depending upon the number of independent variables. One variable requires a minimum of one data card, two variables have a maximum of nine cards, and three variables have a maximum of 81 cards. This note is applicable to formats E, F, and G.

f. Format F (Figure 1-21.)

1. Computer Time - The time allowed the computer to finish the interpolation. 02, 04, or 06 will be used for a function of one, two, or three variables respectively. In column two there is an 11 punch in addition to the data. Example: 04 (2 variables) +0000+0000+0000+0000

2. Sort Number - Refer to format A.

STORAGE LAYOUT

APPLICATION LFI PROGRAM (OUTPUT CARD FORMAT) DATE

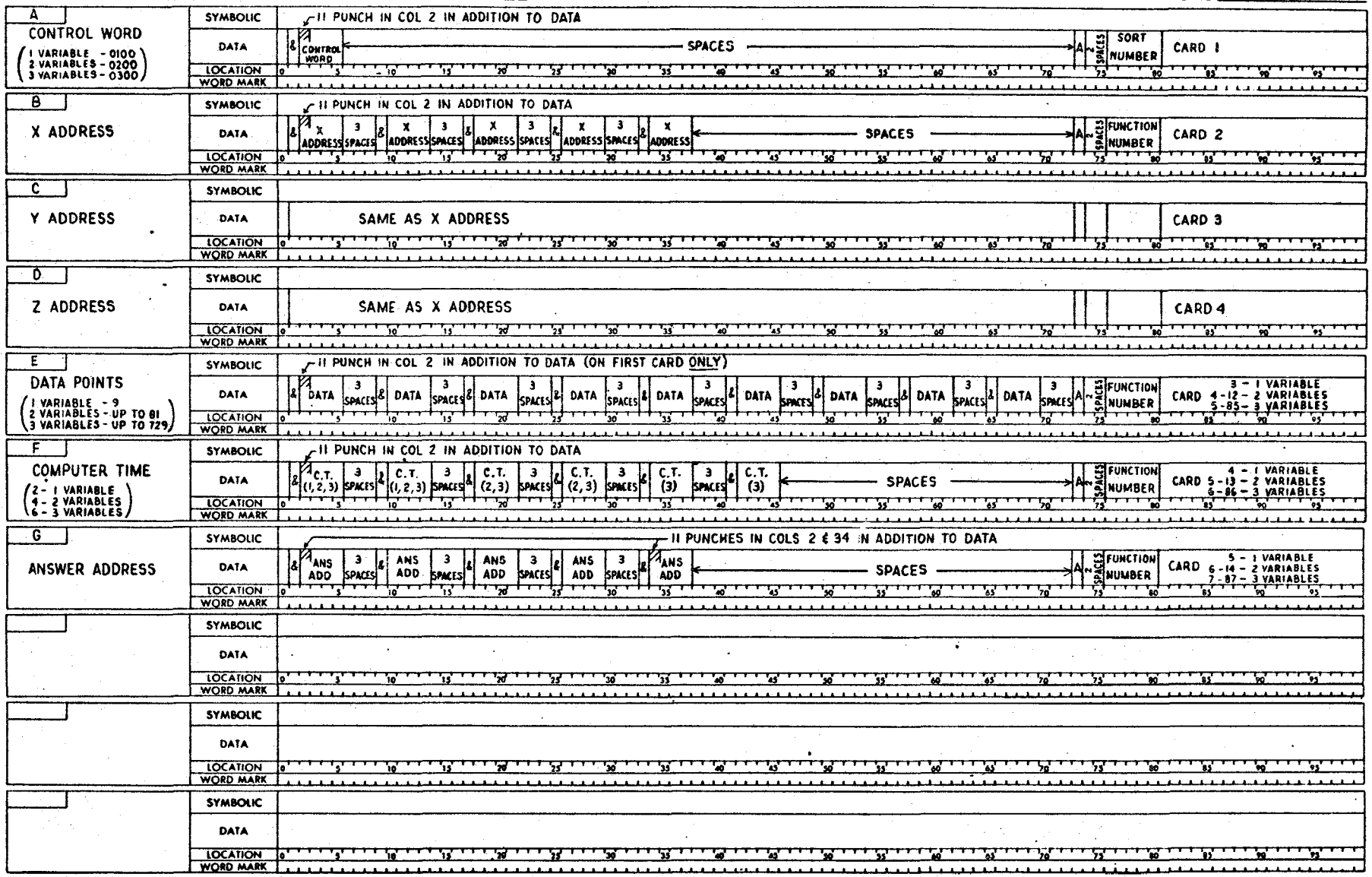


Figure 1-21. LFI Program Output Card Format

g. Format G (Figure 1-21.)

1. Answer Address - Contains the core memory address when the result of the interpolation f(X, Y, and Z) is to be stored. The address is repeated five times, with the first and fifth address containing a flag bit in columns 2 and 34.

2. Sort Number - Refer to format A.

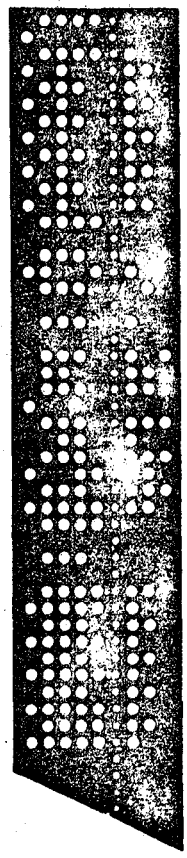
1-27. The octal output cards are usually placed in band and quadrant order, according to the alphanumeric sort numbers. (There are four LFI bands, each band containing four quadrants.) After the cards are arranged in the output work deck, a tape can be punched by the TPU. When an LFI tape is requested to be run, it is recorded on a Tape To Be Run Sheet (figure 1-8).

1-28. LFI PROGRAM TAPE.

1-29. The LFI tape punching operation is similar to that of the general purpose program tape (refer to paragraph 1-11). Each two lines of punched paper tape (each line containing eight binary bits) represents one LFI computer-word. The LFI program tape is divided into several zones (figure 1-22). Six dummy codes are punched at the beginning of the LFI tape reel. The least number of zones allowed is six for a single variable function, seven for a two variable function, and eight for three variables. These zones are described in the following paragraphs.

1-30. Zone 1 - Control Word - One word, the first bit of which is always 1 (flag bit) and the second bit always zero. The tape format for a control word is shown in figure 1-23.

1-31. D represents the dummy code which is always 0111 and is located at the beginning of every interpolator word. F is the flag bit, which is always 1 in the control word, 0 is bits not recognized and X is valid bits. The binary/octal format of the control word is shown in figure 1-24, where octal word A is the flag bit, octal digit C is not used, and octal digits B and D are coded words. Octal digit B tells whether the function is of one, two or three variables, D tells which of the variables are indexed.



CONTROL WORD – ZONE 1

X ADDRESS

ZONE 2

DATA WORDS

ZONE 5

COMPUTER TIME – ZONE 6

ANSWER ADDRESS

ZONE 7

ANSWER ADDRESS – ZONE 0

Figure 1-22. LFI Program Tape Zones

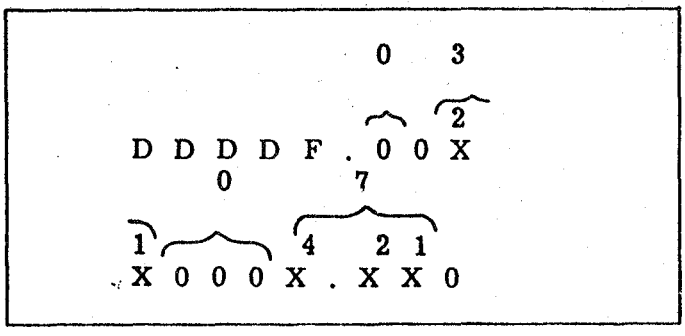


Figure 1- 23. Control Word Tape Format

A	B	C	D
F0	0XX	000	XXX

Figure 1-24. Control Word Binary/Octal Format

1-32. Octal digit B is coded as shown in table 1-1.

Table 1-1. Control Word, Octal Digit B Code

Number of Variables	Binary Equivalent
1	001
2	010
3	011

1-33. Octal digit D is coded as shown in table 1-2.

Table 1-2. Control Word, Octal Digit D Code

Indexed Variables	Binary Equivalent
None	000
X	001
Y	010
X, Y	011
Z	100
X, Z	101
Y, Z	110
X, Y, Z	111

1-34. Zone 2 - Consists of five identical words. It is the core memory location of the independent variable X. The first word in zone 2 always has a flag bit and all five words have the dummy code. The tape format and the binary equivalent of an address instruction is shown in figure 1-25.

1-35. Zone 3 - Identical to zone 2 except that it contains the address of the independent variable Y.

1-36. Zone 4 - Identical to zone 2 or zone 3 except that it contains the address of the independent variable Z.

1-37. Zone 5 - The data field consisting of the sequentially stored data words, which describe the function at fixed breakpoints. The first word in this zone always contains a flag bit, and all words have a dummy code. The tape format and the binary equivalent for a data word is shown in figure 1-26.

1-38. Zone 6 - Blank words that are used to allow the computer time to finish the interpolation. The first word in the zone always contains a flag bit (F) and all words contain a dummy code (D). Tape format for a computer blank word is illustrated in figure 1-27.

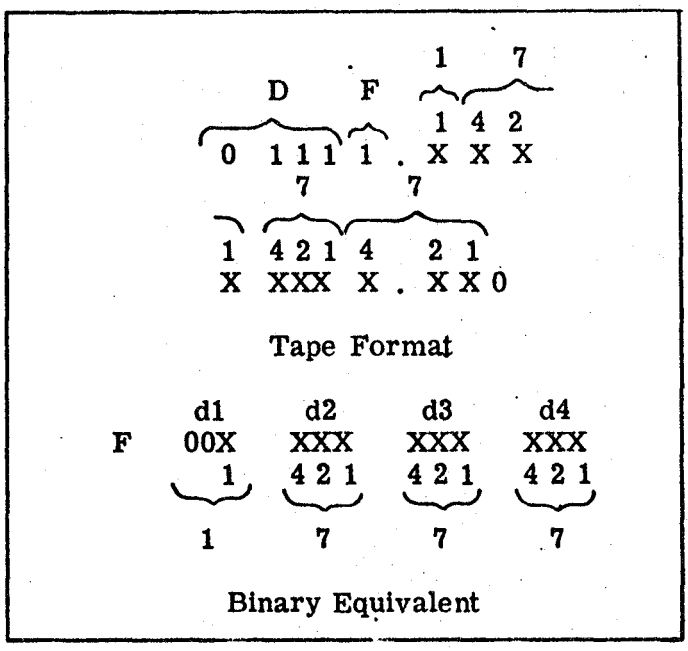


Figure 1-25. Address Instruction Word

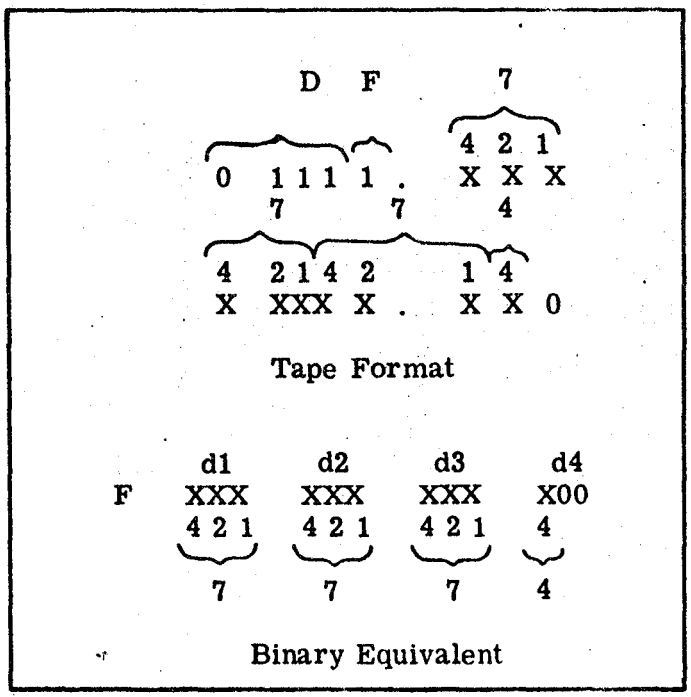


Figure 1-26. Data Word

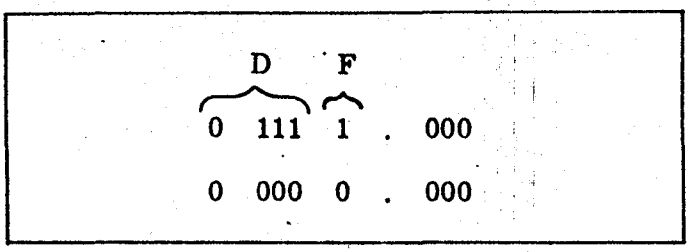


Figure 1-27. Computer Time Word, Tape Format

1-39. Zone 7 - Contains the core memory address where the result of the interpolation f(X, Y, Z) is to be stored. The address is repeated four times. The first word always contains a flag bit and all four words have a dummy code. The tape format and binary equivalent of the answer address is illustrated in figure 1-25.

1-40. Zone 0 - The fifth time the answer address is repeated, it is a single word always containing a flag bit and dummy code. Zone 0 is used to reset the counter that tells the computer that the interpolator program has been completed.

1-41. After the LFI program tape is punched, it is ready to be placed on the computer tape reader. The beginning of the LFI tape is annotated in the same manner as the general purpose tape (paragraph 1-14). The same procedure used in loading and checking the general purpose bands is also used for loading and checking the LFI bands.

1-42. A sample interpolator program involving a one variable function is illustrated in figures 1-28 through 1-31. Figure 1-28 illustrates the data contained on the LFI Data Input Sheet; figure 1-29 illustrates the decimal cards; figure 1-30 illustrates the octal cards; and figure 1-31 illustrates the program punched on the paper tape.

1-43. LFI PROGRAM CHANGE.

1-44. Change procedures in the LFI program are identical to those used for the general purpose program; refer to paragraph 1-16.

1-45. DATA PRESELECT PROGRAM.

1-46. The data preselect program can be either the initial conditions type or the radio aids type. The initial conditions program is used for spacecraft simulation, while the radio aids program is used for aircraft simulation.

1-47. INITIAL CONDITIONS PROGRAM.

1-48. Information pertaining to the initial conditions program is placed on an Initial Conditions Data Sheet, punched on paper cards, transferred to a paper tape, and loaded onto the data preselect band of the computer drum. A block diagram of the initial conditions program is shown in figure 1-32.

1-49. Initial Conditions Data Sheet.

1-50. The data preselect cards for the initial conditions program are punched from the Initial Conditions Data Sheet. The data sheet is divided into eight sections. Refer to figure 1-33 for a description of the eight sections on the Initial Conditions Data Sheet.

DATE 6-26-63 | LINEAR FUNCTION INTERPOLATOR DATA INPUT SHEET | PAGE NO. 1

REV.-- | REP.NO.

CARD (1) FUNCTION NUMBER 0 0 9 0 0 2 — 1st VARIABLE (X) | 2nd VARIABLE (Y) | 3rd VARIABLE (Z) — A A 0 0 1 SORT NO

CARD (2) X ADD 1 1 2 3 RPX 0 5 IXX | Y ADD | RPY | IXY | Z ADD | RPZ | IXZ | SORT NO. A A 0 0 2

CARD (3) A ADD 1 5 7 6 RPA 0 5 CT 0 2 DP 5 1 SC (t) - 0 3 SORT NO. A A 0 0 3

CODE	X	* POINTS ON CURVE			SCALED NO.2^3				TAPE DATA		
					DECIMAL		DECIMAL				
1	0	0000			0000		.0000		0000		
2	1.0	0800			0.800		.1000		0630		
3	2.0	2000			2.000		.2500		2000		
4	3.0	4000			4.000		.5000		4000		
5	4.0	5400			5.400		.6750		5314		
6	5.0	6500			6.500		.8125		6400		
7	6.0	7200			7.200		.9000		7150		
8	7.0	7600			7.600		.9500		7464		
9	8.0	7999			7.999		.9999		7774		

CARD NO. 0 4

* REFER TO APPENDIX PAGE A-20 FOR A ILLUSTRATION OF THE LFI CURVE.

REFERENCE:

NO.	CHANGE	NAME	DATE

F-2237-6

Figure 1-28. LFI Program Example — LFI Data Input Sheet

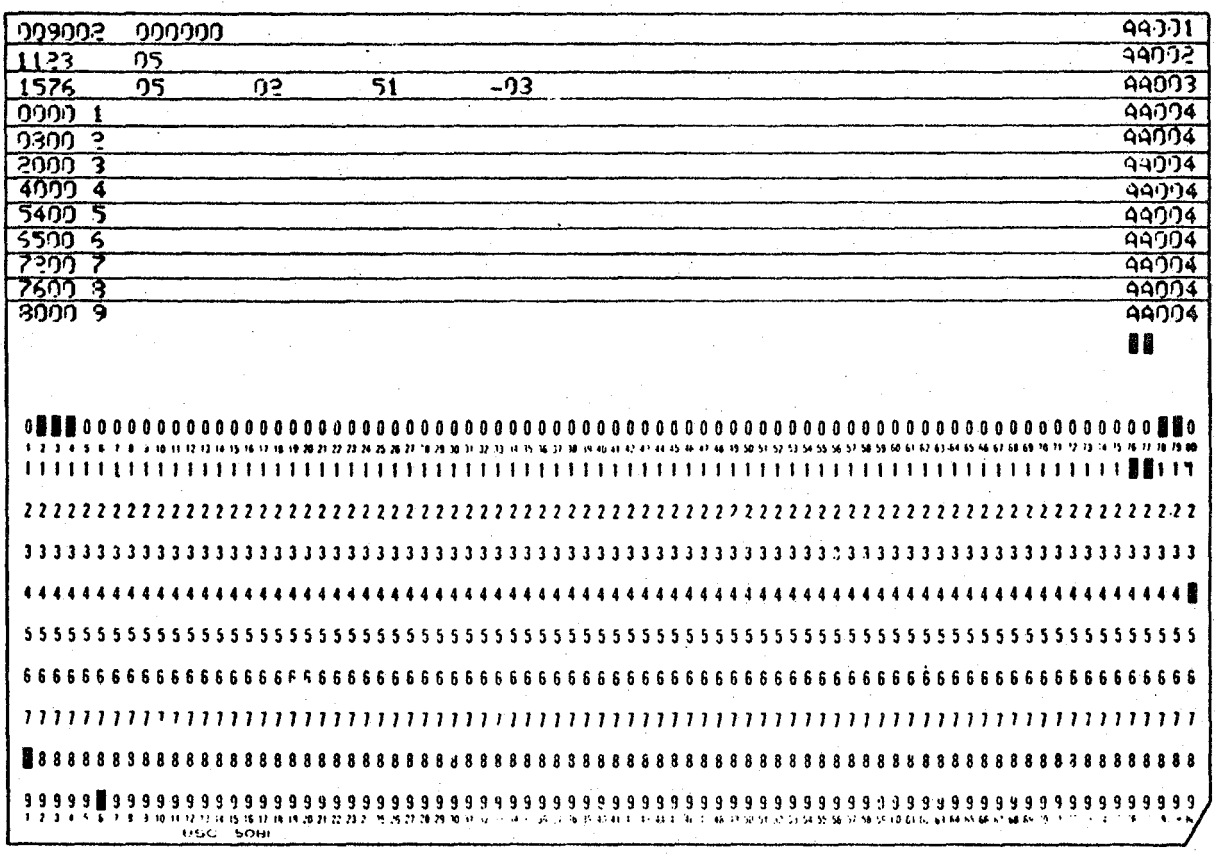


Figure 1-29. LFI Program Example — Decimal Input Cards

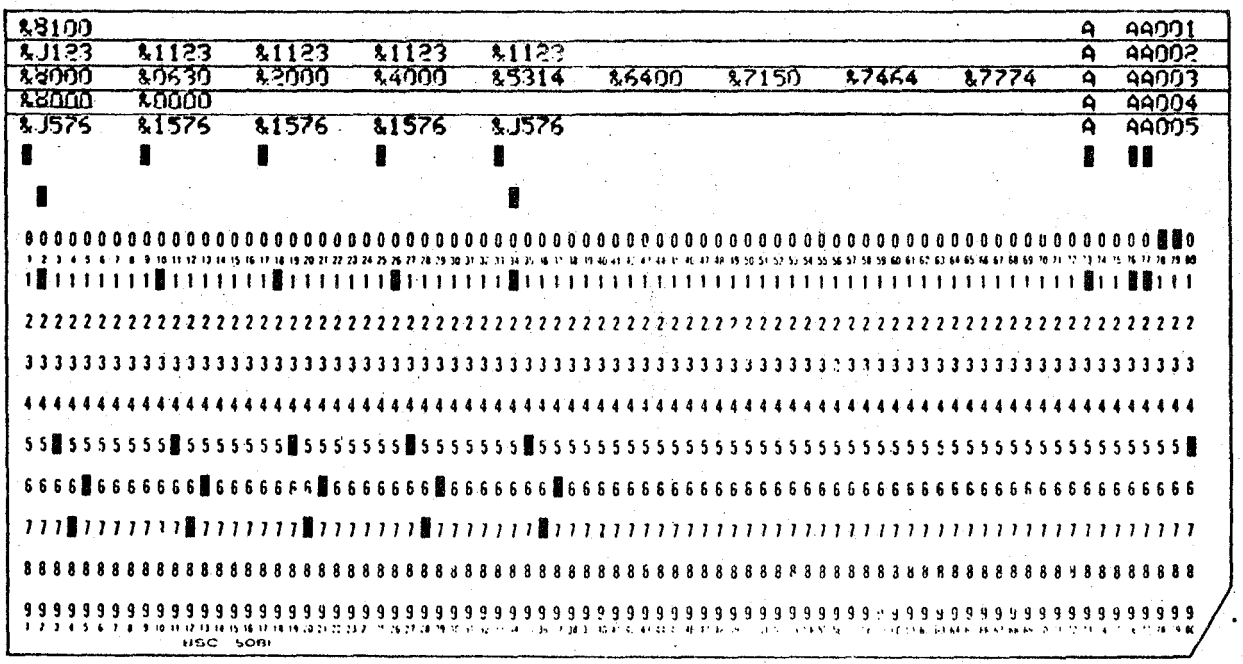
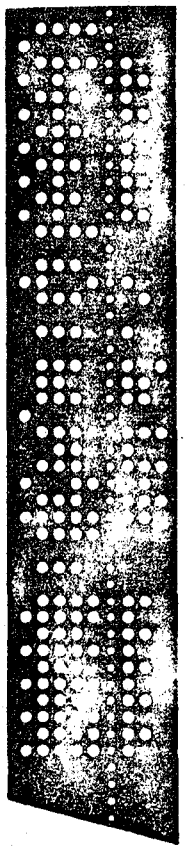


Figure 1-30. LFI Program Example—Octal Output Cards



		* CARD SORT NUMBER
CONTROL WORD – ZONE 1 – 0100		AA001
X ADDRESS – 1123 (5 TIMES) ZONE 2		AA002
DATA WORDS ZONE 5	← f(0) = .0000 ← f(1.8) = .0630 ← f(1.4) = .2000 ← f(3.8) = .4000 ← f(1.2) = .5314 ← f(5.8) = .6400 ← f(3.4) = .7150 ← f(7.8) = .7164 ← f(1.0) = .7774	AA003
COMPUTER TIME – ZONE 6 – 0000 0000		AA004
ANSWER ADDRESS – 1576 (4 TIMES) ZONE 7		AA005
ANSWER ADDRESS – ZONE 0 – 1576		

* REFER TO FIGURE 1–30

Figure 1–31. LFI Program Example — Punched Paper Tape

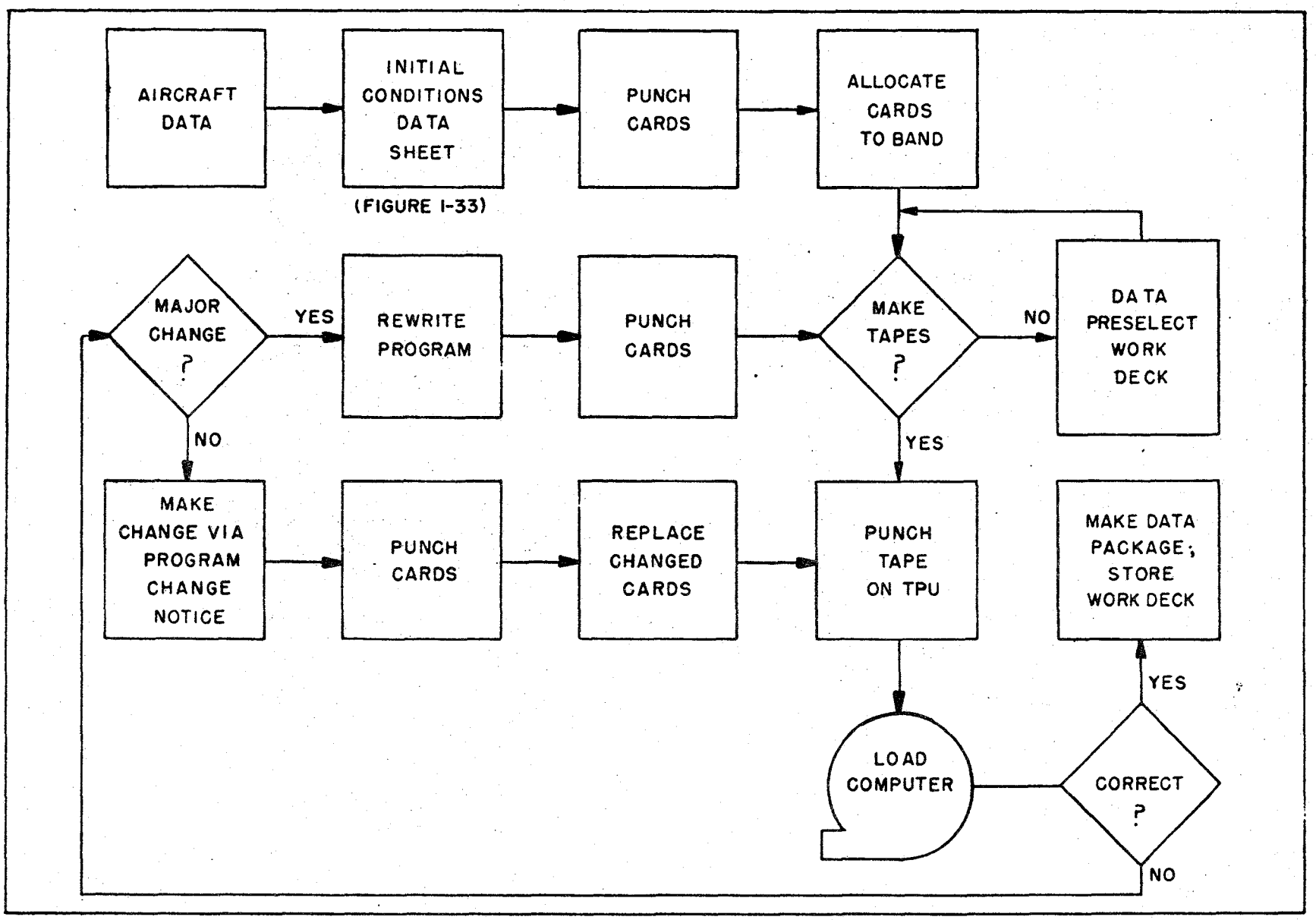


Figure I-32. DP Program (Initial Conditions) Block Diagram

SIMULATOR _____ (57 — 63)
CRN/APPR _____
PROGRAMMER _____ DATE _____
CHANGE BY _____ DATE _____

INITIAL CONDITIONS DATA SHEET

F-2462-2

SHEET _____ OF _____
DATA REQUIRED:
TAPE ☐ CARDS ☐
LISTING _____

DESCRIPTION OF CHANGE

①	②		③	④	⑤	⑥	⑦
REASON FOR CHANGE			REFERENCE				
&	1ST OCTAL WORD	2ND OCTAL WORD	LABEL	DECIMAL MAGNITUDE	DRUM ADDRESS	GRP NO.	C.M. ADDRESS
1	2 — 5	7 — 10	15 — 35	41 — 55	66 — 69	74 — 75	77 — 80

① & - This symbol is filled in when the data is to be entered on the data preselector drum-band. When recognized by the TPU (a 12 punch in card), this code "arms" the TPU for punching data in the paper tape. If the data is a comment this column is left blank.

② OCTAL WORDS 1 and 2 - The octal value of the data to be stored on the drum is written in these two columns. Because of differences in the TPU format and the word length of the data preselector drum-band, the following format is used in writing the two octal words:

OCTAL WORD 1				OCTAL WORD 2			
d_1	d_2	d_3	d_4	d_5	d_6	d_7	d_8
0XX	XXX	0XX	XXX	XXX	XXX	0XX	0XX

Where: d is the octal digit, X is a valid binary bit, and 0 is not recognized: Bit 2 of d_1 = the sign Bit; therefore, if Bit 2 = 1 the sign is negative.

③ LABEL - This column contains a description of the data. A maximum of 21 characters, including spaces. Words must be separated by a space.

④ DECIMAL MAGNITUDE - This column contains the sign and magnitude (decimal) of the data to be stored.

⑤ DRUM ADDRESS - The data preselector drum-band address where the data is to be stored.

⑥ GRP NO. - The initial conditions group number for this data word; 00 through 37, octal.

⑦ C.M. ADDRESS - The core-memory address (octal) where this data word will be stored when the initial conditions group to which it belongs is selected.

Figure 1-33. Initial Conditions Data Sheet

1-51. Initial Conditions Card.

1-52. The initial conditions cards are punched from the Initial Conditions Data Sheet. The cards are punched by an IBM 026 Printing Card Punch. The format for punching the cards is shown in figure 1-34. After the cards are punched, they are arranged in a work deck according to the group number and the core memory address.

1-53. Initial Conditions Tape.

1-54. The initial conditions tape is punched from the initial condition cards. The first two octal words on the cards are the only words punched on the tape. The ampersand sign in column 1 on the card arms the TPU for punching the two octal words.

1-55. An example showing the steps involved in converting a decimal quantity to its octal equivalent and the processing required to obtain the desired TPU tape format are shown in figure 1-35.

1-56. The initial conditions tape is used to load the program on the data preselect band. Part of an actual initial conditions tape is illustrated in figure 1-36.

1-57. Initial Conditions Program Change.

1-58. The change procedures are identical to those used in the general purpose program. Refer to paragraph 1-16 for an explanation of the change procedures.

1-59. RADIO AIDS PROGRAM.

1-60. Radio aids program data is placed on Radio Facility Data Sheets, punched on cards in decimal, converted to octal, transferred to a paper tape by the TPU, and loaded onto the data preselector band of the computer drum. A block diagram of the procedures required to process the radio aids data is shown in figure 1-37.

1-61. Radio Facility Data Sheet.

1-62. The Radio Facility Data Sheet contains the information necessary to punch the three input cards. The sheet is divided into three card-sections for convenience in punching the three input cards. A standard procedure is required to fill out the data sheet for each type radio facility. The procedure for completing the Radio Facility Data Sheet (figure 1-38) is as follows:

a. Card #1

1. TYPE-Six characters - fill in starting at extreme left. Any unused spaces will appear on the right. The type of facility used at the station. This will be filled in for all types of radio aids stations.

Example: ILS would appear as ILS

IBM 1401, 1410, 1440, AND 1460 DATA PROCESSING SYSTEMS

STORAGE LAYOUT

APPLICATION DATA PRESELECT PROGRAM

DATE

Card	Data fields (in location order, positions 0–99)
INPUT CARD 1 (RADIO AIDS)	TYPE; CALL LETTERS; LATITUDE; LONGITUDE; ELEV.; POWER; FREQ.; RL-RTG COS. MAG.; (ILS) (VOR); COSINE LAT.; SORT NUMBER
INPUT CARD 2 (RADIO AIDS)	SINE AXIS; COSINE AXIS; DIA 1; DIA 2; DIA 3; DIA 4; GPA; MAG. VAR.; SINE MAG. VAR.; SORT NUMBER
INPUT CARD 3 (RADIO AIDS)	SIMULATOR NUMBER; BASE ADDR. AND J. NO.; SORT NUMBER
OUTPUT CARD (RADIO AIDS)	TYPE; CALL LETTERS; CARD NO.; ADDRESS; SIMULATOR; &; OCTAL DATA; BLANK; OCTAL DATA; BINARY BITS
INITIAL CONDITIONS CARD	&; FIRST OCTAL WORD; SECOND OCTAL WORD; LABEL; DECIMAL MAGNITUDE; SIMULATOR; DRUM ADDRESS; GROUP NO.; CORE MEMORY ADDRESS

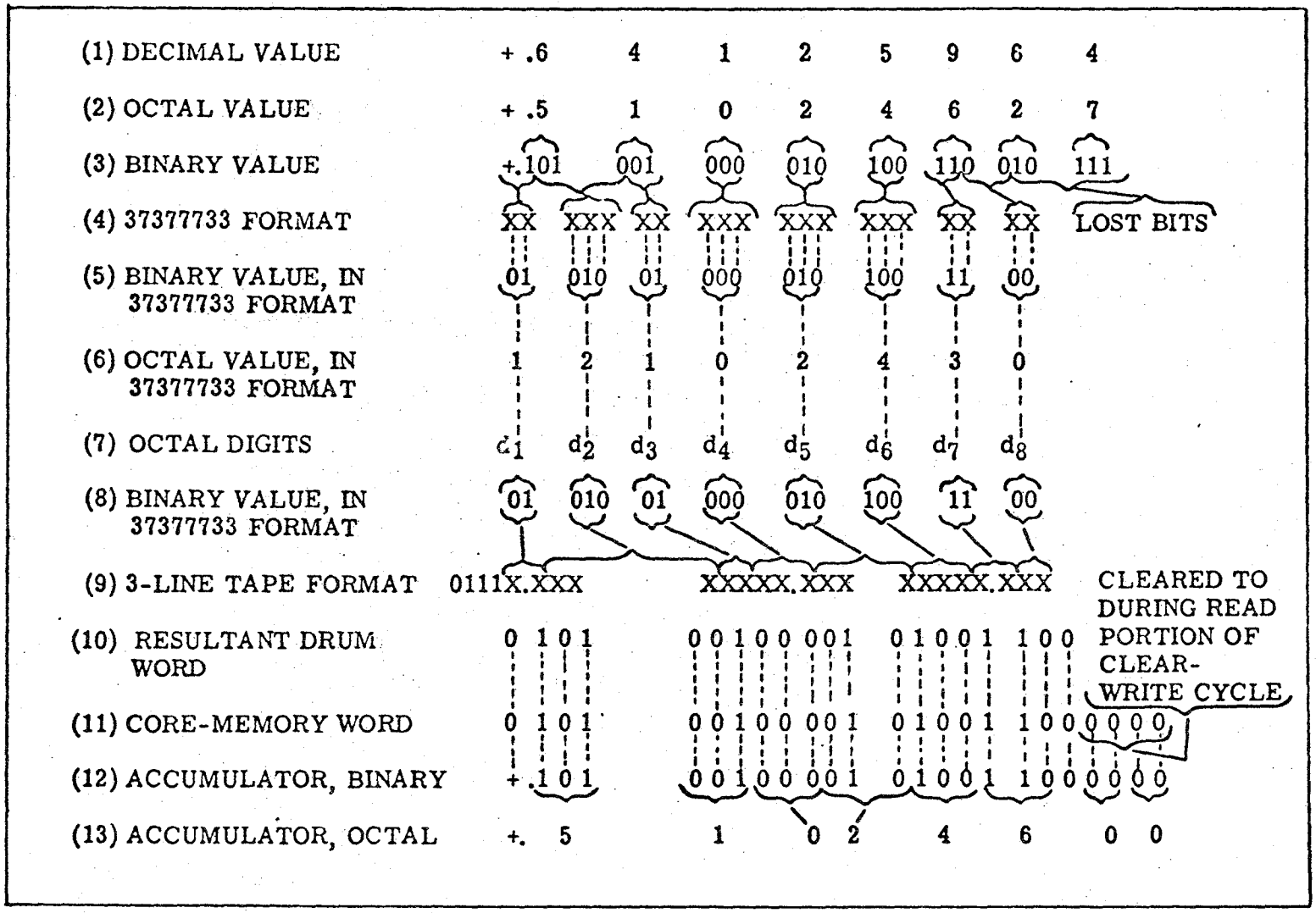


Figure 1-35. Initial Conditions Conversion Example

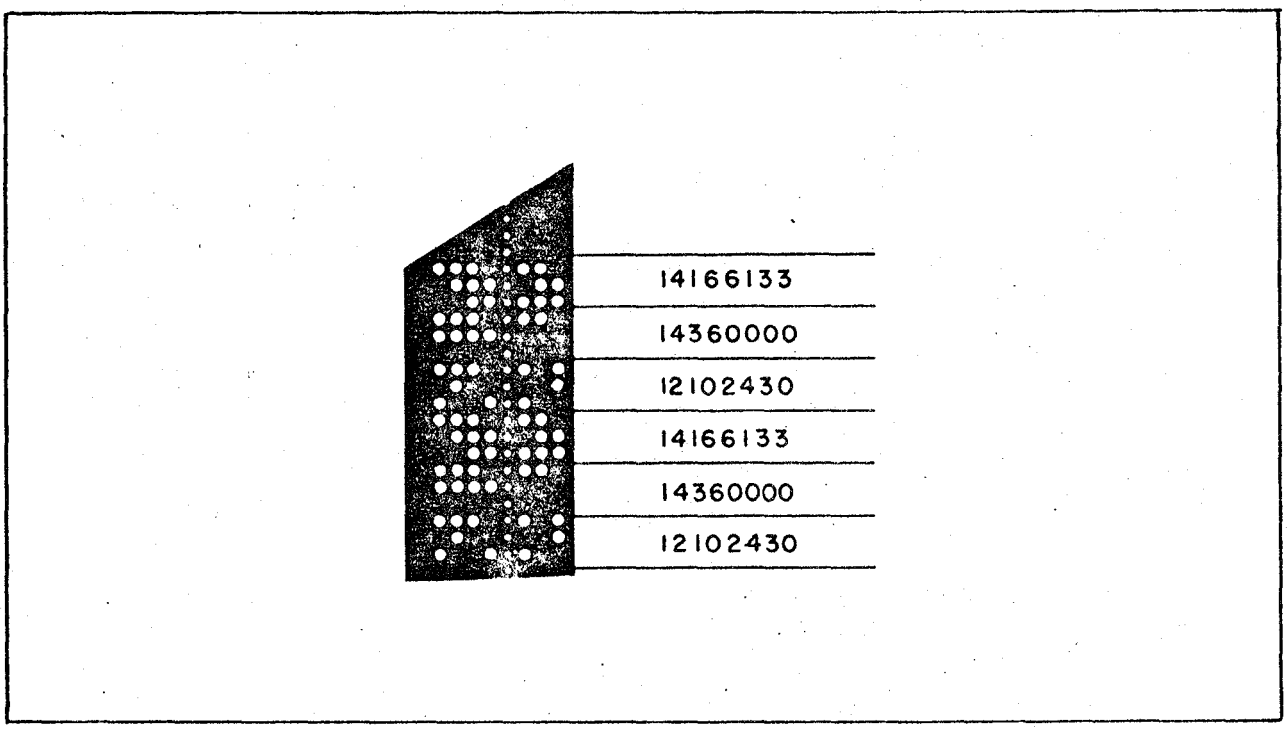


Figure 1-36. Initial Conditions Punched Paper Tape

2. CALL LETTERS - Seven characters - fill in starting at extreme left. Any unused spaces will appear on the right. The identifying call letters of the station. This will be filled in for all type radio aids. Two or three alphabetics will usually be written, but for FM, BONE, Z, and LFM, numerics will be written. A 3 will represent a dash and a 1 will represent a dot.

Example: a. ACY would appear as A C Y
b. ._._ would appear as 13 13

3. LATITUDE (Point of Touchdown) - Seven digits - one digit for sign, two digits for degrees, and four digits for fractional parts of a degree. This will be filled in for ILS radio aids stations.

Example: N4.2256 degrees would appear as +04 2256

4. LONGITUDE (Point of Touchdown) - Eight digits - one digit for sign, three digits for degrees, and four digits for fractional parts of a degree. This will be filled in for all types of radio aids stations.

Example: E74.8279 degrees would appear as +074 8279

5. ELEVATION (Feet) - Five digits - this will be filled in for all types of radio aids stations.

Example: 518 feet would appear as 00518.

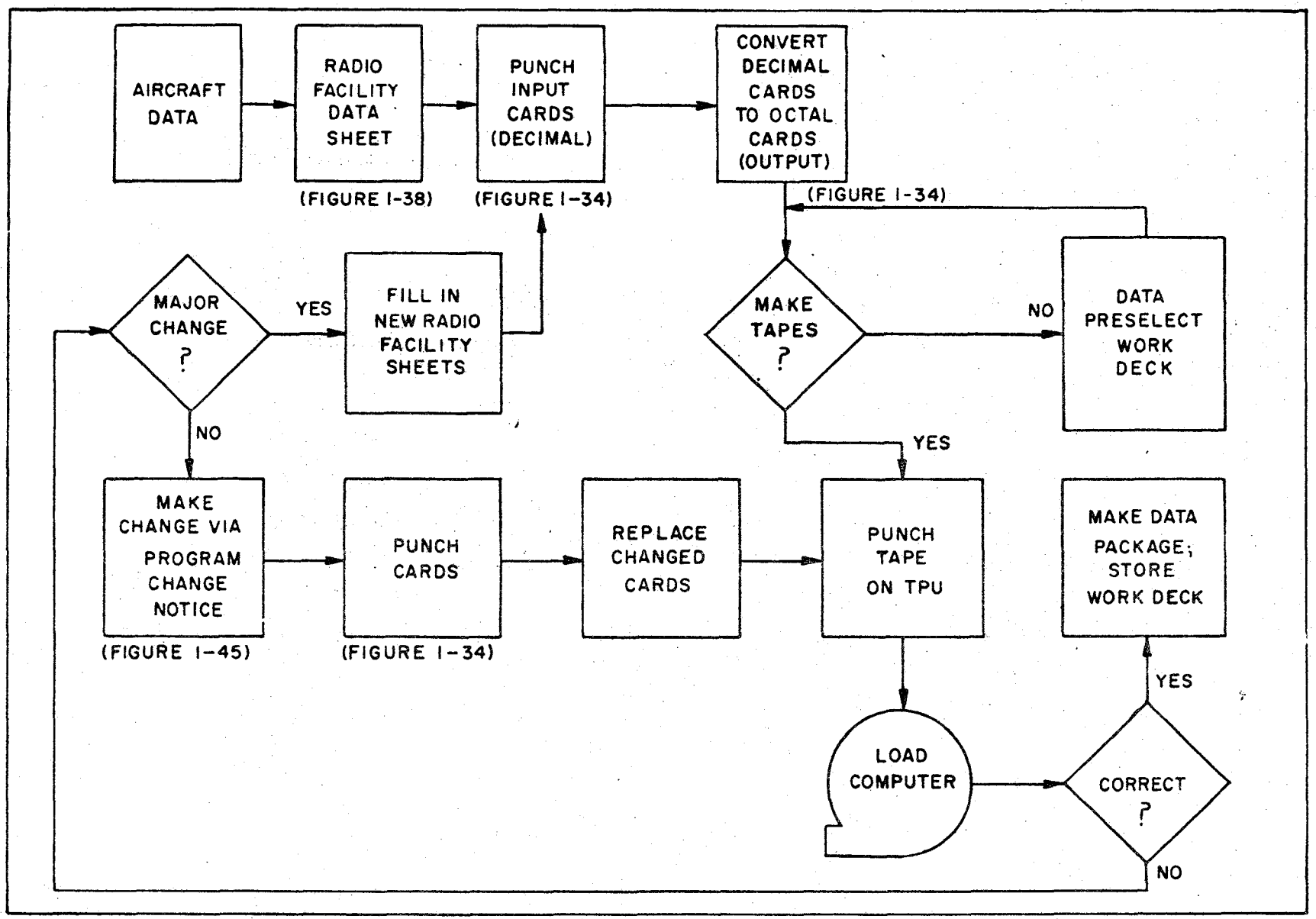


Figure 1-37. DP Program (Radio Aids) Block Diagram

-2256-B

RADIO FACILITY DATA

ID ____ — ____ — ____
TYPE STATE ID

TYPE	CARD NO. 1
ALL	TYPE (1 2 3 4 5 6)
ALL	CALL LETTERS (9 10 11 12 13 14 15)
ALL	LATITUDE (±16 17 18 19 20 21 22) ° ' "
ALL	LONGITUDE (±24 25 26 27 28 29 30 31) ° ' "
ALL	ELEVATION (33 34 35 36 37) FEET
ILS VHF LF LFRR	POWER (41 42 43 44)
ALL	FREQUENCY (49 50 51 52)
VHF LFRR	COSINE MAG. VAR. (57 58 59 60)
ILS	TO. TO LOC. (57 58 59 60 61)
ALL	COSINE LATITUDE (65 66 67 68)
ALL	SORT A (73 74 75 76 77 78 79 80) 1

TYPE	CARD NO. 2
MARKERS	MINOR AXIS ANGLE °
	SINE AXIS (±1 2 3 4 5)
	COSINE AXIS (9 + 10 11 12 13)
VHF	MAG. VAR. + °E − °W
	SINE MAG. VAR. (65 66 67 68 69)
ILS (OM) (MM) (LOM) (LMM)	RNWY BRG (MAG) °
	MAG. VAR. + °E − °W
	RNWY BR. (TRUE)
	SINE BRG (±1 2 3 4 5)
	COSINE BRG (±9 10 11 12 13)
	G/S ° ' (49 50 51) °
LFRR	MAG. VAR. + °E − °W
	SINE AXIS (±1 2 3 4 5)
	COSINE AXIS (±9 10 11 12 13)
	LEGL NO. / MAG. BRG. / TRUE BRG. (17 18 19 20) 1 ____ ____ (25 26 27 28) 2 ____ ____ (33 34 35 36) 3 ____ ____ (41 42 43 44) 4 ____ ____
	SINE MAG. VAR. (±65 66 67 68 69)
ALL	MISC. (57 58 59 60 61 62)
	SORT NO. (73 74 75 76 77 78 79 80) 2

CARD NO. 3

ALL TYPES

SIMULATOR NO. (1 2 3 4 5 6 7)

BASE ADDRESS (9 10 11 12 13 14)

SORT NO. (73 74 75 76 77 78 79 80) 3

REV.	DATE AND NAME
0	
1	
2	
3	
4	

Figure 1-38. Radio Facility Data Sheet

6. POWER - Four digits. 512/2048 would appear as 0512. 2048's considered max power equivalent to 480 NM range. Thus 512 = 120 NM or 1/4 MAX RGE. This is filled in for type codes 5, 6, and 7. (See figure 1-39.)

7. FREQUENCY - (MC or KC) - Four digits filled in for all types of radio aids stations.

(a) 400 KC would appear as 0400 for type codes 6 and 7, but for type codes 4 and 5 the decimal point will be after the third significant digit. 117.5 would appear as 1175.

(b) A special code will be used for type codes 1, 2, and 3.

8. COSINE MAG. VAR. (Cosine magnetic variation) - Four decimal digits. Filled in for type codes 5 and 7.

9. TD. TO LOC. (runway length minus distance from threshold to touchdown plus 1000 feet). Five digits - this represents the distance between TD and localizer in feet. Filled in for type code 4 only.

Example: 9971 would appear as 09971

10. COSINE LATITUDE - Four digits with decimal point at extreme left. Cosine of the latitude in the input data. Filled in for all type codes.

11. SORT NUMBER - Any convenient combination of alphabetics or numerics that describes the order of this card (where used). This number does not enter in the computation. Filled in for all type codes.

Example: 6 NY BGM 1. In this example 6 represents the type facility, NY the state, BGM the call letters, and 1 the card number.

b. Card #2

1. MARKERS

(a) SINE AXIS - Sign and four decimal digits. Axis of facility is measured positive clockwise from north (negative measured counterclockwise from north). If the angle is between 0 and $+90^{o}$, sign of the sine is positive. If the angle is between 0 and -90^{o}, the sign of the sine is negative. Decimal point of the sine is always assumed to be at the extreme left. Filled in for type codes 1, 2 and 3.

Example: +.0156 would appear on the form as +0156

(b) COSINE AXIS - Sign and four decimal digits. Axis is measured positive clockwise from north. Sign of the cosine is always positive. The decimal point of the cosine is always assumed at the extreme left. Filled in for type codes 1, 2 and 3.

Example: +.0156 would appear as +0156

2. VHF

(a) MAG. VAR. (Magnetic Variation) - Write in directly.

(b) SINE MAG. VAR. - Five digits, one digit for sign, four digits for the decimal value of the sine of the magnetic variation. An east magnetic variation would have a plus sign, and a west magnetic variation would have a minus sign. (+ for East, - for West)

3. ILS (Cross out facilities not associated with the ILS installation.)

(a) RNWY BRG (MAG) - Magnetic runway bearing in degrees with 360^{o} magnetic north. Write in directly.

(b) MAG VAR - Magnetic variation. Write in directly.

(c) RNWY BRG (TRUE) - True runway bearing. Write in directly. (TRUE = MAG + M.V.)

(d) SINE BRG - Sine of the true runway bearing. One digit for the sign of the sine and four digits for the numerical value of the sine.

(e) COSINE BRG - Same as (d) except cosine.

(f) G/S - Glide Slope Angle (degrees) - Three digits. The decimal point is assumed to be after the first digit. 4.11 degrees would appear on the input sheet as 411. Filled in for type code 4. Maximum angle 4.99 degrees, minimum 2.00 degrees.

4. LFRR

(a) MAG. VAR. - Magnetic variation - same as previously explained.

(b) SINE AXIS - Five bits, one bit for sign and four bits for magnitude.

(c) COSINE AXIS - Five bits, one bit for sine and four bits for magnitude.

(d) LEG NO. - MAG. BRG and DIA

(1) LEG NO. - The four A-N course legs. The leg numbers are counted clockwise starting in the northerly quadrant.

(2) MAG. BRG - Magnetic Bearing, write in directly.

(3) DIA - Diameter of the circular radiation patterns. Consists of four decimal digits with the decimal point at the extreme left.

5. ALL

(a) MISC - Miscellaneous - Six bits to be used whenever necessary (i.e., simulating certain foreign facilities). If none used, leave blank.

(b) SORT NO. - Same as Card #1.

c. Card #3

1. SIMULATOR NO. - A convenient seven character array that describes the simulator being worked on.

2. BASE ADDRESS, J NUMBER - Base address will be a four digit number and J will be a two digit number. The base address is the octal drum address of the start of the preselect data for this facility, and the J number is an octal number ranging from 00 to 37. Filled in for all type codes.

Example: base address of 540 and a J number of 7 will appear on the sheet as 0540 07

3. SORT NO. - Same as Card #1.

1-63. Radio Aids Program Cards.

1-64. The Radio Aids Input Cards are punched using the Radio Facility Data Sheet as an input source. There are three cards of input data that are punched using a decimal format (figure 1-34). Each card will contain a maximum of nine data words and a seven digit sort number; each data word can contain as many as eight characters. The input cards are punched with the same data (in the same order) that is contained in the three card sections of the Radio Facility Data Sheet.

1-65. The input cards, punched directly from the Radio Facility Data Sheet, will be placed into a IBM 1460 and converted into octal output cards (figure 1-34). The number of octal output cards will depend upon the radio aids "type" code (figure 1-39). The following paragraph contains a description of the data contained in the octal output cards. Material is arranged by radio aid type code.

Type Code 1

MM - Middle marker of ILS (instrument landing system)

Type Code 2

OM - Outer marker of ILS

Type Code 3

FM - VHF (very high frequency) fan marker
LFM - Low power VHF fan marker
BONE - VHF location marker
Z - VHF location marker

Type Code 4

ILS - Instrument landing system
ILSDME - ILS distance measuring equipment

Figure 1-39. Radio Aids Tape Codes (Sheet 1 of 2)

Type Code 5

LVR - Low power VOR (VHF omni directional range)
MVR - Medium power VOR
HVR - High power VOR
LVRDME - Low power VOR distance measuring equipment
MVRDME - Medium power VOR distance measuring equipment
HVRDME - High power VOR distance measuring equipment
LVRLTC - Low power VOR with lower power TACAN
LVRMTC - Low power VOR with medium power TACAN
LVRHTC - Low power VOR with high power TACAN
MVRLTC - Medium power VOR with low power TACAN
MVRMTC - Medium power VOR with medium power TACAN
MVRHTC - Medium power VOR with high power TACAN
HVRLTC - High power VOR with low power TACAN
HVRMTC - High power VOR with medium power TACAN
HVRHTC - High power VOR with high power TACAN
LTC - Low power TACAN
MTC - Medium power TACAN
HTC - High power TACAN
UHF DF - Ultra high frequency direction finder

Type Code 6

H - No directional radio beacon (homing) 50 to 2000 watts
HH - No directional radio beacon (homing) over 2000 watts
MH - No directional radio beacon (homing) less than 50 watts
BC - Broadcast band
LMM - Compass locator station when installed at middle marker site
LOM - Compass locator station when installed at outer marker site

Type Code 7

MA - Range (adcock, vertical radiators), power less than 50 watts
MAZ - VHF range (adcock, vertical radiators), power less than 50 watts
ML - Range (loop radiators), power less than 50 watts
MLZ - VHF range (loop radiators), power less than 50 watts
MRA - Range (adcock, vertical radiators), power 50 to 150 watts
MRAZ - VHF range (adcock, vertical radiators), power 50 to 150 watts
MRL - Range (loop radiators), power 50 to 150 watts
MRLZ - VHF range (loop radiators), power 50 to 150 watts
RA - Range (adcock, vertical radiators), power 150 watts or greater
RAZ - VHF range (adcock, vertical radiators), power 150 watts or greater
RL - Range (loop radiators), power 150 watts or greater
RLZ - VHF range (loop radiators), power 150 watts or greater

Figure 1-39. Radio Aids Tape Codes (Sheet 2 of 2)

1-66. Processing Type Code 1 and 2 Inputs (1 = MM, Z = OM). Each output card for the radio aids program will contain a maximum of seven character-words. Each output card, in addition to the last two octal words, will contain the following information.

a. Call letter - maximum seven alphabetics or numerics.

b. Type - maximum six alphabetics.

c. Card number - two numerics.

d. Octal address - four numerics.

e. Simulator - maximum seven alphabetics or numerics.

1-67. Preselect Data. The preselect data will appear on the first four output cards. One word is punched on each card; therefore, Card 1 = Word 1, etc. At least one space will separate the first two octal words. Call letters, type, and simulator number will not vary from output card to output card for each station; however, the card number and octal address will change.

1-68. Card 1. Items a, b, c, d, and e of paragraph 1-66 will be punched on this card. The first two octal words of the preselect data for outer marker or inner marker inputs will consist of an ampersand sign (&) followed by six 0's, a space, and then six more 0's. The remaining two words will be all zeros. The card number will be 1, and the address will equal the base address of the input data.

Note

Refer to Appendix A for a chart concerning the data on each card for the various radio aids type codes.

1-69. Card 2. The second card will consist of the same data as the first card, except the address will be incremented by one (octal), and the card number will be 2. The two octal words will be 000077 330000 and 200077 330000 or 000037 330000, depending upon the values in the frequency input field. (See table 1-3).

1-70. Card 3. The third card will be similar to card 2 except the address will be incremented by one (octal), and the card number will be 3. The two octal data words will consist of latitude lower and latitude upper.

Table 1-3. Input Card Frequency Versus Octal Output

Input Card Frequency	Octal Output
0700	000077 330000
2700	200077 330000
0300	000037 330000

1-71. There are two methods of forming the data word for cards 3, 4, 5, and 6. The system used on the 727 simulators is called the "Continental U.S. Version". The new system to be used on the C-135 and the following simulators will be the "World-Wide Version". The two versions are both explained below.

Continental U.S.

a. The latitude lower and upper for card 3 will be formed respectively by subtracting the size of the lower latitude from the latitude and by adding the size of the upper latitude to the latitude. The size of the upper and lower latitude and longitude and frequency are shown in table 1-4.

World-Wide

a. The latitude lower and upper for card 3 will be formed respectively by algebraic subtraction of the size of the lower latitude from the latitude plus 90^{o} and by algebraic addition of the size of the upper latitude of the latitude plus 90^{o}. The size to upper and lower latitude, longitude, and frequency are shown in table 1-4.

Table 1-4. Latitude, Longitude, and Frequency Field

Type	Lat (Deg)	Long (Deg)	Freq (KC)
IFRR	±4.1667	±4.1667	06
OM, MM	±.1000	±.1000 Con. U.S. Version	
	±.3000	±.3000 World-Wide Version	
Z, LFM	±.1000	±.1000 Con. U.S. Version	
	±.3000	±.3000 World-Wide Version	
Bone, FM	±.6667	±.6667	
ILS, ILSDME	±1.0	±1.0	
HVR, MVR, HVRTAC, MVRTAC, TACAN	±4.1667	±4.1667	
UHFDF	±1.0	±1.0	
LVR	±1.0	±1.0	06
LOM, LMM	±1.0	±1.0	06
RBN, BC	±4.1667	±4.1667	

Continental U.S.

b. The two octal words will be formed in the following manner. The lower latitude will be divided by 256 to produce a 7-digit decimal number from 0000 to .9999999. This number will be multiplied successively by 2 to produce a 12-bit binary number. The first two bits will be ignored and bits 3 through 12 will make up the first 10 significant bits of the resultant 20-bit number. After division by 256, the upper latitude will form the 10 least significant bits. The resultant 20-bit binary word will be converted to two octal words by the following rules:

World-Wide

b. The two octal will be formed in the following manner. The lower latitude will be divided by 256 to produce a 7-digit decimal number from 0000 to .9999999. This number will be multiplied successively by 2 to produce a 10-bit binary number. This binary number will make up the first 10 significant bits of the resultant 20-bit number. After division by 256, the upper latitude will form the 10 least significant bits. The resultant 20-bit binary word will be converted to two octal words by the following rules:

1. 1st character	- beginning of word definer	
2. 1st two significant bits	- will form octal digit 0 to 3	
3. next three bits	- will form octal digit 0 to 7	
4. next two bits	- will form octal digit 0 to 3	OCTAL WORD 1
5. next three bits	- will form octal digit 0 to 7	
6. next three bits	- will form octal digit 0 to 7	
7. next three bits	- will form octal digit 0 to 7	
8. next 2 bits	- will form octal digit 0 to 3	OCTAL WORD 2
9. last 2 bits	- will form octal digit 0 to 3	

Note

Four zeros will make up the last four digits of the second octal word. This is the case for the second octal word of all data.

1-72. Card 4.

Continental U.S.

a. The same process that was used on card 3 can be used to form card 4 except that, instead of subtracting and adding the sizes of the upper and lower longitude, the sizes will be divided by cosine latitude before they are subtracted or added to longitude. The lower and upper longitude will be formed into a 20-bit number and converted to octal in exactly the same manner as card 3. The base address will be incremented by 1 and the card number will be 4.

World-Wide

a. A similar process to the one used on card 3 can be used to form card 4, except that instead of subtracting and adding the sizes of the upper and lower longitude, the sizes will be divided by cosine latitude before they are subtracted or added to longitude plus 180^{o}. The lower longitude will be divided by 512 to produce a 7-digit decimal number from 0.0000 to .9999999. This number will be converted to binary and combined with the upper

Continental U.S.	World-Wide
	longitude to form a 20-bit binary word. The resultant 20-bit word will form two octal words in the same manner as card 3. The base address will be incremented by 1 and the card number will be 4.

1-73. Data Words. There are four data words for the outer or middle markers.

a. Data Word A - latitude - 19 bits, with a leading sign bit (0 = plus, 1 = minus)

b. Data Word B - longitude - 19 bits, with a leading sign bit (0 = plus, 1 = minus)

c. Data Word C - sine (10 bits) cosine (10 bits)

d. Data Word D - ten loading zeros and elevation (10 bits)

1-74. Each word will be defined by two octal words, as was the preselect data. The call letters, type, card number, base address and simulator will also be punched on the card. (Refer to paragraph 1-66, items a, b, c, d, and e.)

1-75. Card 5. The call letters, type and simulator will appear the same as in Card 1, 2, 3, and 4. The number 200 will be added octally to the base address - 3j and multiplied octally to form the octal address for this card, and the card number will be 5. The two octal words representing latitude will be formed in the following manner:

Continental U.S.	World-Wide
a. The latitude, which was stored when the input data was read in, will be divided by 256 and converted to a 21-bit pure binary by successive multiplications by 2. The first two most significant bits will be ignored, the most significant binary bit will be made a zero, and the 20 resultant bits will be converted to octal in the same manner as card 3. (This will form data word A.)	a. The latitude which was stored when the input data was read in will be divided by 256 and converted to a 19-bit pure binary number by successive multiplication by 2. A 20-bit binary word will be formed; the most significant binary bit is the sign of latitude (0 = plus, 1 = minus), and the remaining 19 bits are the magnitude bits derived above. These 20 resultant bits will be converted to octal in the same manner as card 3. (This will form data word A.)

1-76. Card 6. Card 6 will be the same as card 5, except that the longitude will be converted to two octal words, after division by 256. The card number will be 6, and the octal address will be formed by octally adding 40 to the octal address of card 5. Card 6 will form data word B.

Continental U.S.	World-Wide
a. Instead of the most significant bit being a zero, it will be made a one.	a. The most significant bit will be the sign of longitude.

1-77. Card 7. The card number is 7, and the address is octal 40 plus the octal address of card 6. The sine and cosine of the axis which is contained on the input cards will be converted to binary and then to octal. The sign of the sine will form the most significant bit (minus will be 1, plus will be zero). The remaining 9 bits of the sine will be formed by multiplying by 2, nine times. The cosine will be treated in the same manner to form the 10 least significant bits of the 20-bit word. The 20 bits will then be converted to two octal words and eventually punched out. Card 7 will form data word C.

1-78. Card 8. The card number is 8 and the octal address will be octal 40 plus the octal address of card 7. The 20-bit elevation word will be formed by 6 miscellaneous bits and 4 zeros, dividing the elevation +1000 by 16,384, and multiplying by two 10 times to produce the remaining ten bits. The 20-bit word will then be converted to two octal words. Card 8 will form data word D.

1-79. This completes the description of processing of outer and middle marker inputs. Some of the programming involved in this program will be duplicated with other type radio aids. The upper and lower latitude and longitude for preselect and the formation of latitude and longitude sine, cosine and elevation for other type radio aids will be exactly the same as, or very similar to, those methods used in outer marker or middle marker processing.

1-80. Processing Type Code 3 Inputs (Fan/Z Marker). If the type listed on input card 1 is FM, Z, BONE or LFM, this program will be used to process them. The input data for this program will be the same as that used for OM and MM (type code 1 and 2 inputs), although, as is the case with OM and MM, this program will not utilize all the input words.

1-81. Preselect Data. Formation of the preselect data will be exactly the same as the technique used for OM and MM.

1-82. Data Words. Data words A, B, C and D will be formed in the same manner as radio aid type codes 1 and 2, with the following exception: In the case of data word D, instead of the first 10 bits of the twenty bit word, containing 6 miscellaneous bits and 4 zeros, the first four bits will be formed according to table 1-5.

Table 1-5. First Four Bits of Data Word D

Type	Binary Bits
LFM	1000
BONE	0100
FM	0010
Z	0001

1-83. The remaining six bits of the most significant 10 bits of data word D will be placed with zeros. The least significant 10-bits will contain elevation, and will be formed in exactly the same manner as the 10 bits representing elevation for the outer and middle markers.

1-84. Call Letter Generation. In addition to the preselect data and the data words, this program must generate call letters. There are four 20-bit words of call letters, although only the first 16 most significant bits will be used in each word, and the remaining 4 bits will be miscellaneous bits and/or zeros; when processing ILS or ILSDME, these fields may contain other data.

1-85. In the case of the Z marker, the program will merely insert 16 1's in each word. In this case, the first octal word for cards 9, 10, 11 and 12 will be 373777.

1-86. Card 9. This card will contain the 4 most significant miscellaneous bits. They will form binary bits 17, 18, 19, and 20. These are converted to be the first two octal bits of card 9's second octal word. The remaining four octal bits will be zeros.

1-87. Card 10. This card will contain the 2 least significant miscellaneous bits. They will form binary bits 17 and 18. These are converted to the first octal bits of card 10's second octal word. The remaining five octal bits are zeros.

1-88. Card 11 and 12. These cards will have the second octal word equal to 000000. In the case of the other types of fan markers, the call letter words must be generated from the numeric information contained in the input data word representing the call letters. A 3 will produce three 1's followed by a zero. A 1 will produce one 1 followed by a 0. The program will continue to follow this process and count up the number of bits it has formed. The counting and bit formation will commence at the most significant numeric digit of the word. A 1 will be subtracted from the count after the last numeric is processed.

1-89. When all the bits are formed, the computer will divide the count into 64, and determine the quotient and the remainder.

a. If the quotient is less than or equal to the remainder, the remainder will be divided by the quotient. The integer obtained will be the number of zeros placed between the call letters and after the last call letter. The call letters will be placed in the 64 bits depending upon the number of times specified by the quotient.

b. If the quotient is greater than the remainder, the quotient will be reduced by one, and the count will be added to the remainder.

c. If the reduced quotient multiplied by five is less than or equal to the accumulated remainder, the remainder will be divided by the quotient. The integral result will be the number of zeros inserted between the call letters of the 16-bit words. Any uneven number of zeros left over will appear at the end of the last call letter.

d. If the quotient multiplied by five is greater than the remainder, repeat steps b and c.

1-90. These 64 bits will form 16 bits of 4 binary words. The 4 least significant bits (bits 17, 18, 19, and 20) of the 1st word will be the 4 most significant miscellaneous bits. The 17th and 18th bit of the record word will be the 2 least significant miscellaneous bits. All remaining bits needed to form four 20-bit words will be zeros. The four 20-bit words will be punched out on 4 cards. There will be two cards of output data.

1-91. Call letters, type and simulator will not change on each output card, but card number and octal address will change (table 1-6).

Table 1-6. Data Preselector Word Storage Locations

Word	Card Number	Octal Address*
1 (Preselector Word 1)	1	Base Address +4J
2 (Preselector Word 2)	2	Base Address +4J+1
3 (Preselector Word 3)	3	Base Address +4J+2
4 (Preselector Word 4)	4	Base Address +4J+3
5 (Data Word A)	5	Base Address +J
6 (Data Word B)	6	Base Address +J+40
7 (Data Word C)	7	Base Address +J+100
8 (Data Word D)	8	Base Address +J+140
9 (First Call Letter Group)	9	Base Address +J+200
10 (Second Call Letter Group)	10	Base Address +J+240
11 (Third Call Letter Group)	11	Base Address +J+300
12 (Fourth Call Letter Group)	12	Base Address +J+340
13 (Data Word E)	13	Base Address +J+400
14 (Data Word F)	14	Base Address +J+440
15 (Data Word G)	15	Base Address +J+500
16 (Data Word H)	16	Base Address +J+540

*All arithmetic performed under this heading is octal.

1-92. Processing Type Code 4 Inputs (ILS).

1-93. Preselect Data. The preselect data will consist of two octal words consisting of zeros on the first output card. The second output card will consist of frequency in the first 10 bits. The first 9 will be as shown in table 1-7. These same 9 bits will be the 11 through 19 bits inclusive of the frequency word. Bits 10 and 20 are illustrated in table 1-8. Cards 3 and 4 will consist of latitude and longitude lower and upper.

Table 1-7. Type Code 4 Frequency Bits 1 thru 9

Frequency	Bits 1 thru 5	Frequency	Bits 6 thru 9
108	10100	.0	1000
109	10101	.1	0100
110	11010	.2	1010
111	11011	.3	0101
112	11100	.4	0010
113	11101	.5	1001
114	01110	.6	1100
115	01111	.7	0110
116	00110	.8	0011
117	00111	.9	0001
133	10111		
134	01010		
135	01011		

Table 1-8. Type Code 4 Frequency Bits 10 and 20

Type	Bit 10	Bit 20
ILS	0	0
ILS DME	0	1

1-94. Data Words. Cards 5 and 6 will consist of latitude and longitude (20 bits each), formed in the same manner as previously described.

1-95. Card 7. This card will consist of true runway bearing sin and cos: one bit for sign, and nine bits for the magnitude of both sine and cosine, for a total of 20 bits. A zero in the sign position denotes positive sign and a 1 denotes negative sign.

1-96. Card 8. This card will consist of 1 and zero in the two most significant bits for ILS and two 1's for ILS DME. The next six significant bits will be the miscellaneous bits from the input data. The 12 least significant bits (for a total of 20 bits) will be elevation. The elevation +1000 in the input data will be divided by 13,384 and converted to 12 binary bits.

1-97. Call Letters. Cards 9, 10, 11 and 12 will consist of the call letters. The call letters will be formed from the alphabetic call letters in the input data and not repeated, as in the case with markers. The call letter bits will be formed starting with the first word and any unused bits will be "padded" with zeros. Spaces between letters will be represented by three zeros as shown in table 1-9. There will be a maximum of three call letters in the input data.

1-98. The four least significant bits of cards 9, 10, 11 and 12 consist of the binary representation of glide path angle and runway length minus distance from threshold to touchdown. Two will be subtracted from the glide path angle in the input data and the result will be divided by three and converted to binary. The four most significant bits of glide path angle will be placed in the four least significant bits (17, 18, 19 and 20) of card 9. The four least significant bits of glide path angle will be placed in the four least significant bits of card 10.

1-99. The eight binary bits of runway length minus threshold to touchdown +1000 feet after division by 16,384 will be placed in the four least significant bits of the data word on cards 11 and 12. The four most significant bits will be described by the second octal word of card 11 and the four least significant bits will be described by the second octal word of card 12.

1-100. Processing Type Code 5 Inputs (UHF/VHF).

1-101. Preselect Data. The first preselect word will contain 20 bits of zeros. The second preselect word is frequency, which is formed in the manner previously described, except that the 10th and 20th bits are as shown in table 1-10.

Table 1-9. Call Letter Generation

Call Letter	Binary Equivalent	Number of Bits
A	10111000	8
B	111010101000	12
C	11101011101000	14
D	1110101000	10
E	1000	4
F	101011101000	12
G	111011101000	12
H	1010101000	10
I	101000	6
J	1011101110111000	16
K	111010111000	12
L	101110101000	12
M	1110111000	10
N	11101000	8
O	11101110111000	14
P	10111011101000	14
Q	1110111010111000	16
R	1011101000	10
S	10101000	8
T	111000	6
U	1010111000	10
V	101010111000	12
W	101110111000	12
X	11101010111000	14
Y	1110101110111000	16
Z	11101110101000	14

Table 1-10. Type Code 5 Frequency Bits 10 and 20

Type Facility	Tenth Bit	Twentieth Bit
-VR	0	0
-VR - TC	0	1
-VRDME	0	1
-TC	1	1

1-102. The third and fourth preselect words will be two 20-bit words consisting of latitude and longitude lower and upper respectively.

1-103. Data Words.

a. Data Word A - Card 5 - latitude (20 bits)

b. Data Word B - Card 6 - longitude (20 bits)

c. Data Word C - Card 7 - Sine and cosine of magnetic variation. One sign bit (either 1 or 0) and nine magnitude bits each.

d. Data Word D - Card 8 - Type and elevation. The type is formed according to table 1-11.

Table 1-11. Data Word D Type Code 5

Type	ILS	DME	VOR	UHF-DF	TAC BRG
LVR	0	0	01	0	0 0
MVR	0	0	10	0	0 0
HVR	0	0	11	0	0 0
LVR DME	0	1	01	0	0 0
MVR DME	0	1	10	0	0 0
HVR DME	0	1	11	0	0 0
LVR LTC	0	1	01	0	0 1
LVR MTC	0	1	01	0	1 0
LVR HTC	0	1	01	0	1 1
MVR LTC	0	1	10	0	0 1
MVR MTC	0	1	10	0	1 0
MVR HTC	0	1	10	0	1 1
HVR LTC	0	1	11	0	0 1
HVR MTC	0	1	11	0	1 0
HVR HTC	0	1	11	0	1 1
LTC	0	1	00	0	0 1
MTC	0	1	00	0	1 0
HTC	0	1	00	0	1 1
UHF-DF	0	0	00	1	0 0

1-104. Processing Type Code 6 Inputs (LF).

1-105. Preselect Data. The preselect data will consist of two octal words consisting of zeros on the first output card. The second card will consist of the lower frequency in the first ten most significant bits and upper frequency in the ten least significant bits. Frequency will be formed by subtracting the size (table 1-4) to lower frequency from the frequency in the input data, and adding the size to upper frequency to the frequency in the input data. The two formed numbers will be divided by 2048 and converted to ten binary bits. Cards 3 and 4 latitude and longitude will be formed as previously described.

1-106. Data Words. Cards 5 and 6 will be 20 bit latitude and longitude respectively. Card 7 will be the frequency-converted to binary after division by 2048. The 13 most significant bits will contain frequency (with a leading bit of zero), and the seven least significant bits will be padded with zeros. Card 8 will contain a leading bit of zero. The next nine significant bits will contain power (divided by 2048) and converted to nine binary bits. The last 10 bits (Card 8) will contain elevation +1000, formed as previously described.

1-107. Call Letters. The alphabetic call letters contained in the input data will be used to generate the 64 bits of call letters. The call letters will be generated according to table 1-9. Call letters will be generated as many times as possible for one-letter calls, twice for two-letter calls, with at least five zeros spacing between each word, and after the last call letter. Where three call letters are used, generate the call only once.

1-108. The process to be used is explained in paragraphs 1-88 to 1-90. The four least significant bits in each of the third and fourth call letter words will be padded with zeros. The first and second call letter words will have the miscellaneous bits.

1-109. Processing Type Code 7 Inputs (LFRR).

1-110. Preselect Data. The preselect data words are formed in exactly the same manner as used in Type Code 6 (LF).

1-111. Data Words.

a. Data Word A - Card 5 - 20 bit latitude

b. Data Word B - Card 6 - 20 bit longitude

c. Data Word C - Card 7 - The most significant 13 bits (with a leading bit of zero) contain the frequency. The seven least significant bits are "padded" with zeros.

d. Data Word D - Card 8 - Most significant bit = 1; next nine bits = power divided by 2048; ten least significant bits = elevation +1000 divided by 16,384.

1-112. Call Letters. Same as Type Code 4 process, paragraph 1-97, except the first 16 bits of the first call letter word will be zero. Remainder of bits will contain the call letters formulated once, with zero "padding" for the remaining bits.

1-113. Data Words E, F, G, and H. These data words are used only in the simulation of LFRR facilities. The storage locations of these words can be found by utilizing table 1-6.

1-114. Data Word E punched on card 13 will consist of the diameters of the first two circles (LEG No. 1 and 2), in the input data (ten bits each). Data word F punched on card 14 consists of the diameters of the last two circles (LEG NO. 3 and 4), in the input data (ten bits each).

1-115. Data words G and H, cards 15 and 16, will consist respectively of the sine and cosine of the axis, and the sine and cosine of the magnetic variation. The sine will be made up of one bit for sign and nine bits for magnitude. The cosine will always be positive and consist of a zero and nine magnitude bits. These conditions hold true for both axis and magnetic variation.

1-116. The octal output cards (processed by the IBM 1401) are filed numerically according to the sort number in an output work deck. (The sort number appears in the center of the output card.) After the output cards are arranged, a tape can be requested on a Tape To Be Run Sheet (figure 1-8).

1-117. Radio Aids Program Tape.

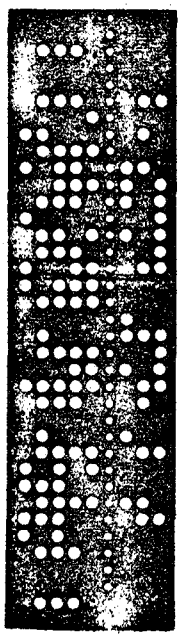
1-118. The data on the radio aids tape is punched from the 20 binary bits, representing an octal word, at the end of each output card. The first binary bit on the output card is preceded by a "12 punch", which arms the TPU and punches the data into the tape. Refer to figure 1-40 for the radio aids tape format.

1-119. The descriptive information concerning the radio aids tape is placed at the beginning of the tape. The descriptive information is similar to the information contained in paragraph 1-14. The one tape reel generated in the radio aids program contains four quadrants. The radio aids tape reel is placed on the computer tape reader, transferring the data to the data preselector drum band.

1-120. A sample data preselector problem involving a radio aids facility will be shown as follows: figure 1-41 illustrates the Radio Facility Data Sheet; figure 1-42 illustrates the decimal card format; figure 1-43 illustrates the octal card format; and figure 1-44 illustrates the punched paper tape.

1-121. Data Preselect Change Notice.

1-122. The Data Preselect Change Notice (figure 1-45) is the basic document for recording a minor data preselector change. If major changes occur, new Radio Facility Data Sheets are filled out. The Data Preselect Change Notice gives a detailed description of the change and the location of the change on the cards. Each time a program change is loaded onto the drum, a Drum Status Sheet (figure 1-11) is updated.



WORD 1 – ZERO
WORD 2 – FREQUENCY
WORD 3 – LATITUDE (U AND L)
WORD 4 – LONGITUDE (U AND L)

PRESELECT WORDS

A – LATITUDE
B – LONGITUDE
C – SIN AND COSINE (MAG. VAR.)
D – TYPE AND ELEV.
CALL LETTERS – 1
CALL LETTERS – 2
CALL LETTERS – 3
CALL LETTERS – 4

DATA WORDS

TAPE FORMAT

D = DUMMY CODE
R = RADIO AIDS DATA
20 BIT WORD LENGTH
MAX OCTAL NO. = 37 377733

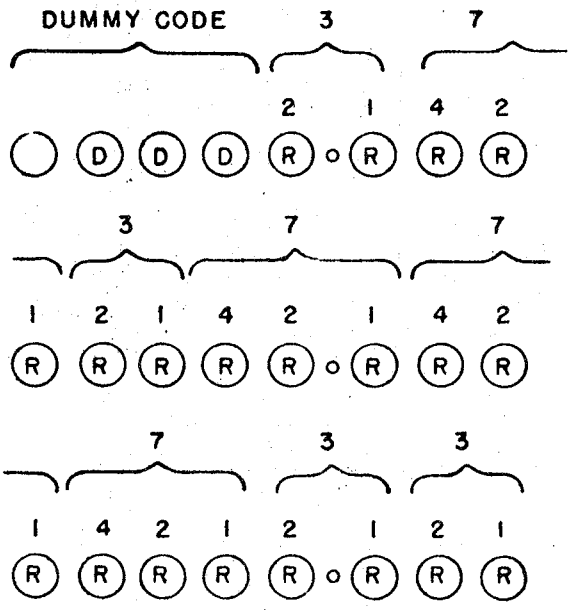


Figure 1-40. Radio Aids Tape Format

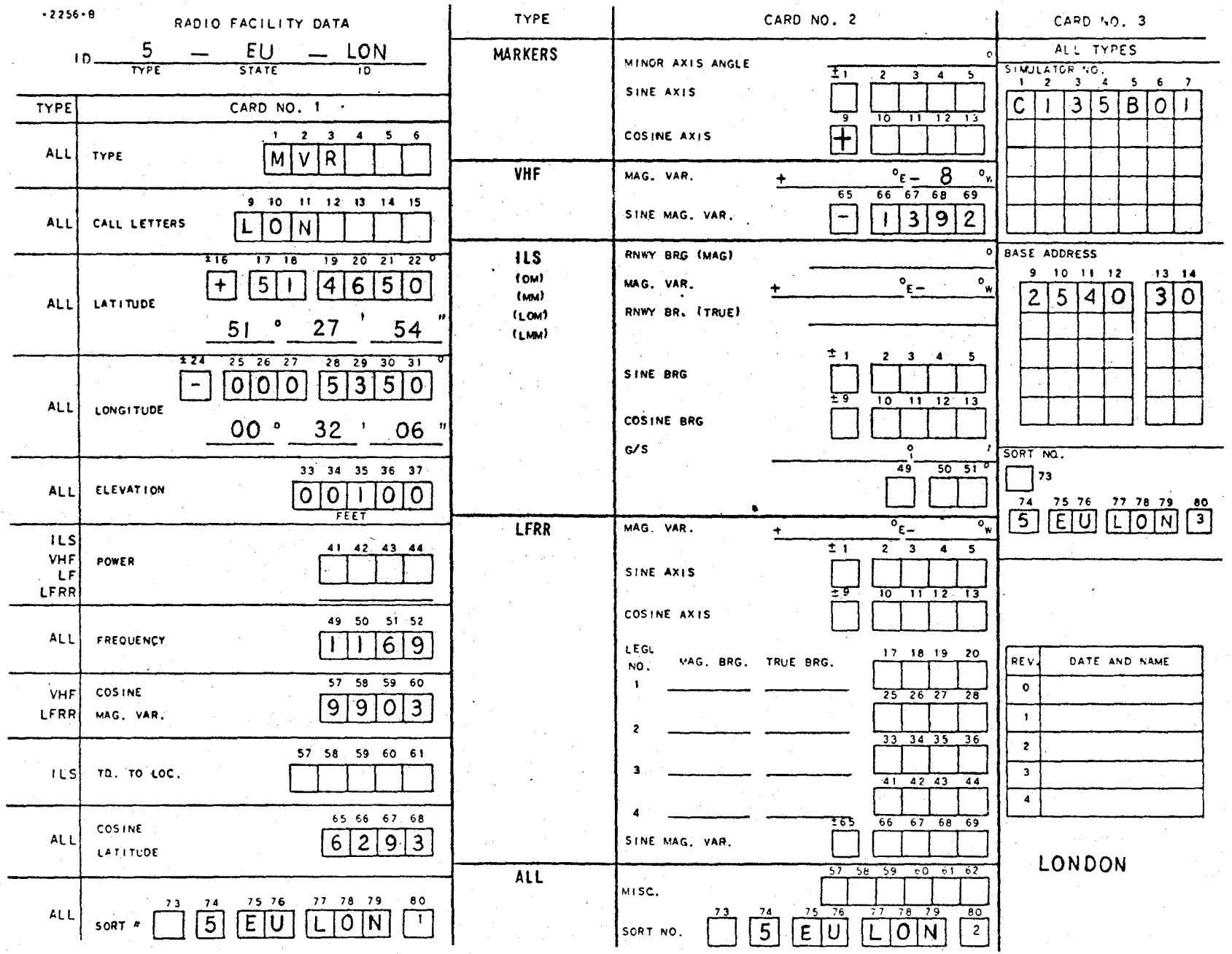


Figure 1-41. DP Program Example — Radio Facility Data Sheet

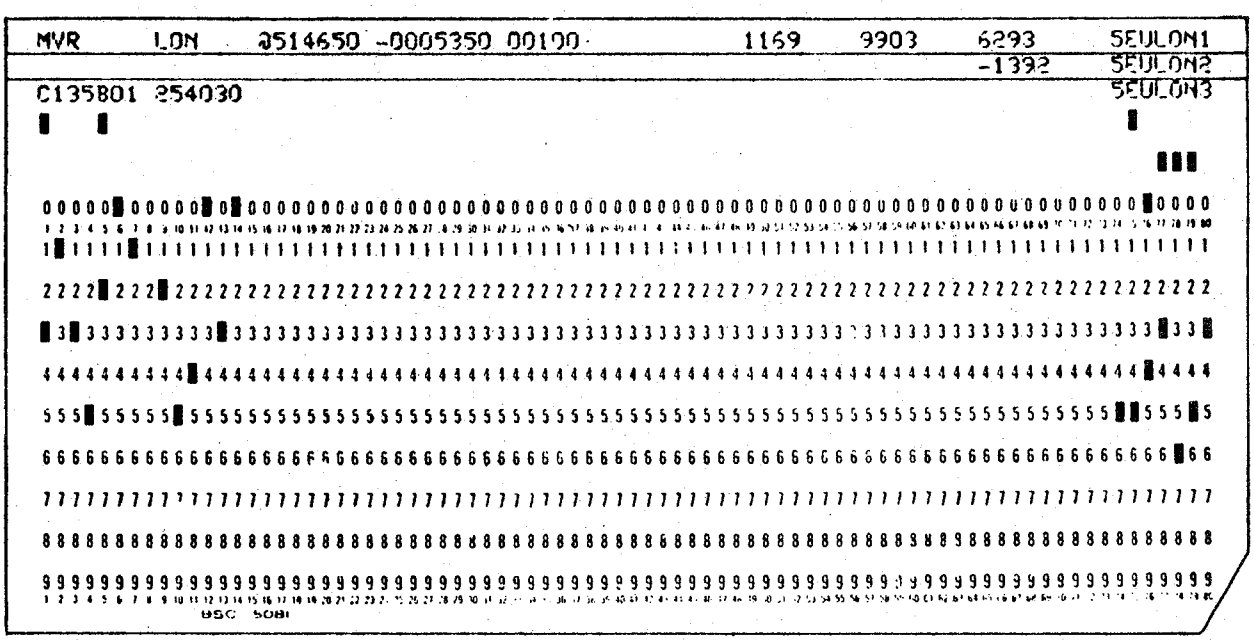


Figure 1-42. DP Program Example — Decimal Input Cards

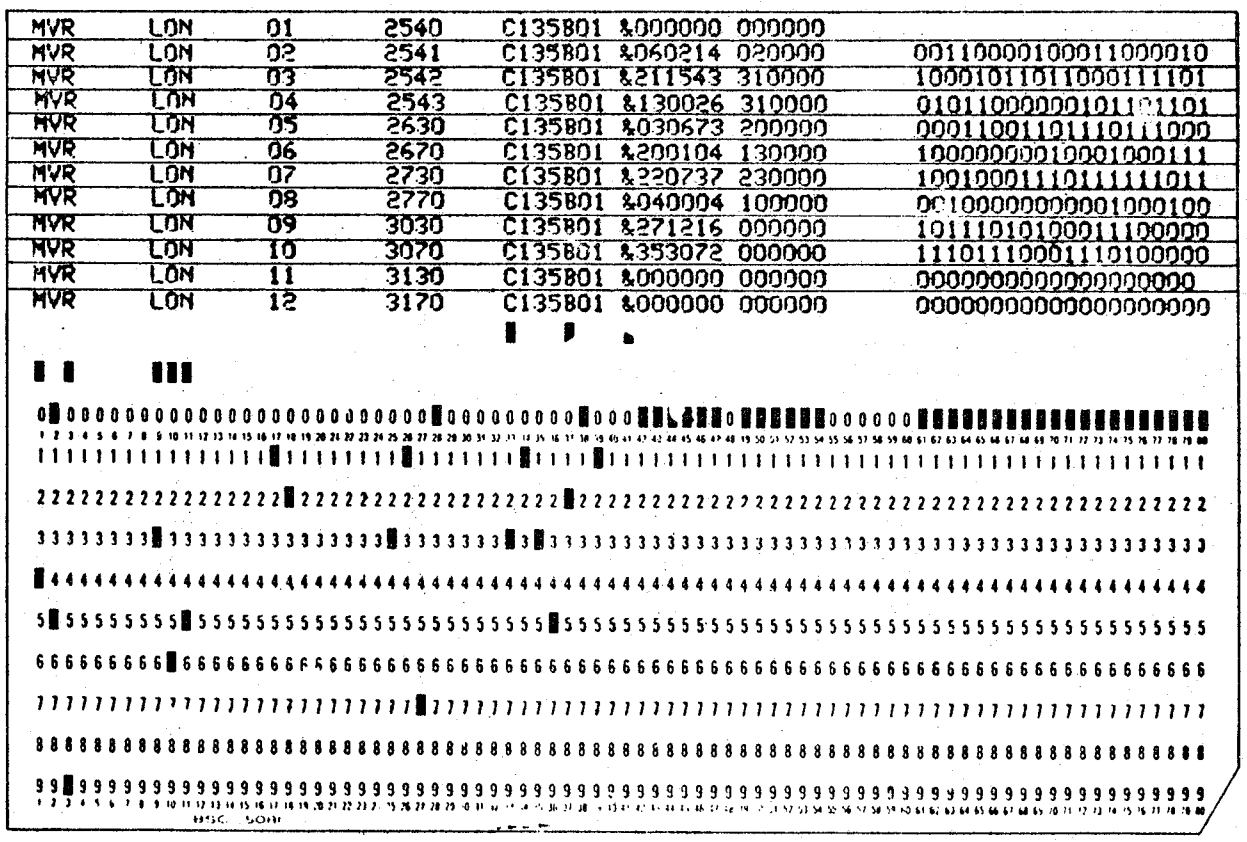


Figure 1-43. DP Program Example — Octal Output Cards

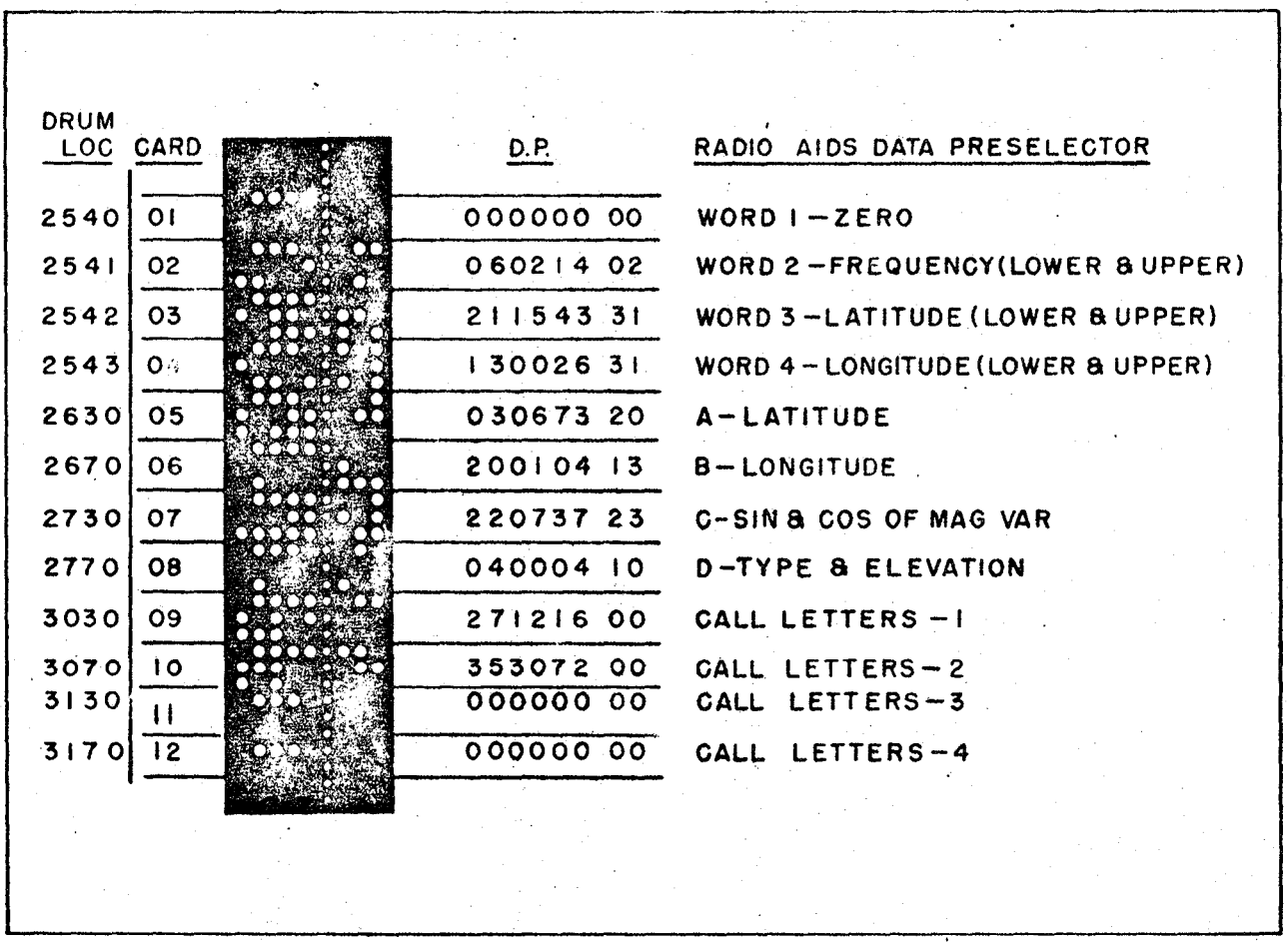


Figure 1-44. DP Program Example — Punched Paper Tape

SIMULATOR ____________ & ____ (33 — 40, 41)

CRN/APPR ____________

PROGRAMMER ____________ DATE ________

CHANGE BY ____________ DATE ________

DATA PRESELECT CHANGE NOTICE

LINK DIVISION
GENERAL PRECISION, INC

F-2346

SHEET ______ OF ______

DATA REQUIRED:

TAPE ☐ CARDS ☐

LISTING ____________

DESCRIPTION OF CHANGE

REASON FOR CHANGE

REFERENCE

TYPE	CALL	CARD NO.	DRUM ADDRESS	1ST OCTAL WORD	2ND OCTAL WD	BINARY WORD	
0 — 8	9 — 16	17 — 18	25 — 28	42 — 47	49 — 54	61 — 70	71 — 80

Figure I-45. Data Preselect Change Notice

Section Two
Data Package

2-1. GENERAL.

2-2. This section contains a description of the software data package supplied with the simulators, incorporating the Mark I or the Mark II digital computer. The data package supplied with the simulator contains program cards, program tapes, and program listings. These items are necessary to maintain a flight simulation program.

2-3. PROGRAM CARDS.

2-4. General purpose eight operations cards, linear function interpolator cards, data preselect cards, analog core memory cards, and Boolean core memory cards are supplied in the data package. The general purpose eight operations cards, the analog core memory cards, and the Boolean core memory cards are punched octally by the IBM 026 Printing Card Punch. However, the data preselect cards and the LFI cards are punched decimally by the IBM 026 Printing Card Punch and converted to octal by the IBM 1401 Computer. When extra copies of cards are required, they are duplicated by the IBM 519 Card Reproducer.

2-5. PROGRAM TAPES.

2-6. The program tapes are punched from cards placed in a TPU. The general purpose tape is punched from the eight operations cards, the LFI tape is punched from the LFI output cards, and the data preselect tape is punched from the data preselect output cards supplied in the data package. Extra tapes are punched either from punched cards or duplicated from the punched tapes by the TPU.

2-7. PROGRAM LISTINGS.

2-8. Program listings are made from punched cards that are processed by the IBM 1401 Computer and printed up by the IBM 1402 High Speed Printer. There are several types of listings that will be discussed as follows:

a. Numerical List of Equations. This listing contains all the programs listed numerical order. This listing is produced from the program title cards. Included in the listing is the following information: (1) the drum band type (fast, medium, or slow) where the equation is located; (2) the equation name; (3) the initials of the originating programmer (on an equation-by-equation basis); and (4) the date of origin of each segment of the program (on an equation-by-equation basis). Figure 2-1 illustrates the format used for this listing.

b. Drum Order Loading of Equations. This listing provides the programmer with the order in which the various program segments are placed on the drum. Because these segments are the solutions to the various flight equations, they are referred to by their associated equation number and name. This list is made up from the general program title cards in drum band order. Included in the listing is the following information: (1) the drum band and quadrant where the solution to the associated equation is located; (2) the name and number of the equation; (3) the originating programmer's initials; and

(4) the date the particular program segment was written. Figure 2-2 illustrates the format used for this listing.

c. General Program Bands (8-OP) Listing. This listing contains the instructions for the general program bands. The list is derived from punched cards which contain eight instructions per card. Included in the listing is the following information: (1) card number; (2) operation code and specified address; (3) the equation name and number; and (4) the band type (fast, medium, or slow) where the instructions are located. Figure 2-3 illustrates the format used for this listing.

d. Core-Memory Locations, Analog. This listing provides the programmer with a numerical list of core-memory locations (non-Boolean) and a short description of the data stored therein. This list is made directly from the analog core memory cards. Figure 2-4 illustrates the format used for this listing.

e. Core-Memory Locations, Boolean. This listing provides the programmer with the pseudo coded address of the one-bit Boolean words contained in core-memory. Included in the listing is a brief description of the data contained in each Boolean-core location. This list is made directly from the Boolean core memory cards. Figure 2-5 illustrates the format used for this listing.

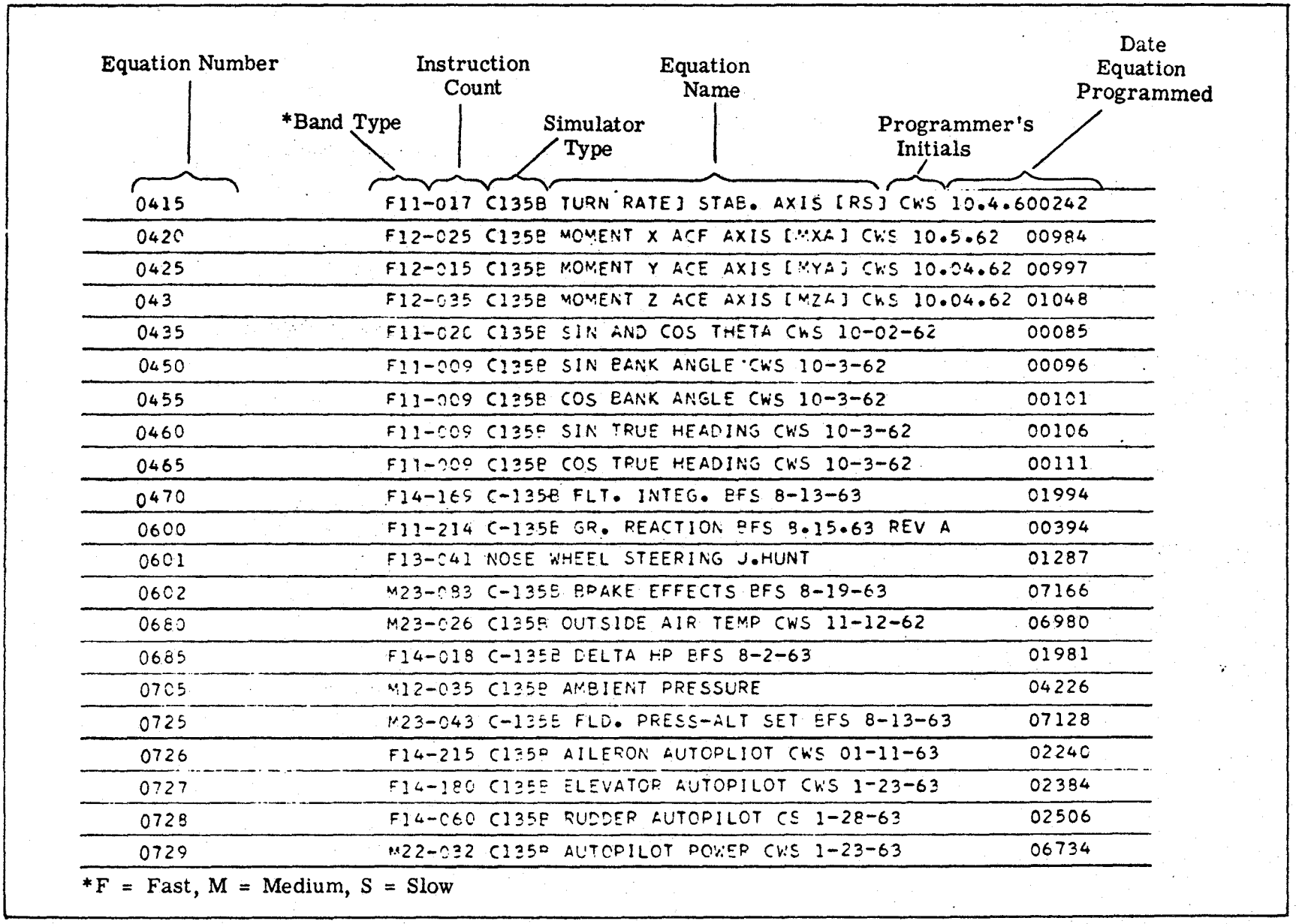
f. Linear Function Interpolator Program Listing. This listing contains the data for linear interpolation of the various function curves used in the simulation program. This listing is obtained from the LFI output card deck. Included in this listing are the addresses of the variables and the octal values for each breakpoint. Figure 2-6 illustrates the format used for this listing.

g. Data Preselector Program (Initial Conditions) Listing. This listing contains a printout of initial conditions data from the initial condition cards. Included is the following information: (1) first octal word, (2) second octal word, (3) description, (4) Simulator Type, (5) drum address, (6) group number, and (7) core memory address. Figure 2-7 illustrates the format used for this listing.

h. Data Preselector Program (Radio Aids) Listing. This listing contains a printout of the radio aids data from the data preselect output cards. Included is the following information: (1) station type; (2) station call letters; (3) drum band address; and (4) all variables. Figure 2-8 illustrates the format used for this listing.

i. General Program Bands Listing (Absolute). This listing is produced by the IBM 1401 Computer, with the aid of analog and Boolean core memory magnetic tapes. It contains the instructions used in the solution of the various flight equations. When the OP-Code addresses a core address, the core address description is printed out in the data description. This listing differs from the 8-OP listing in that the actual band address is included. Figure 2-9 illustrates the format used for this listing.

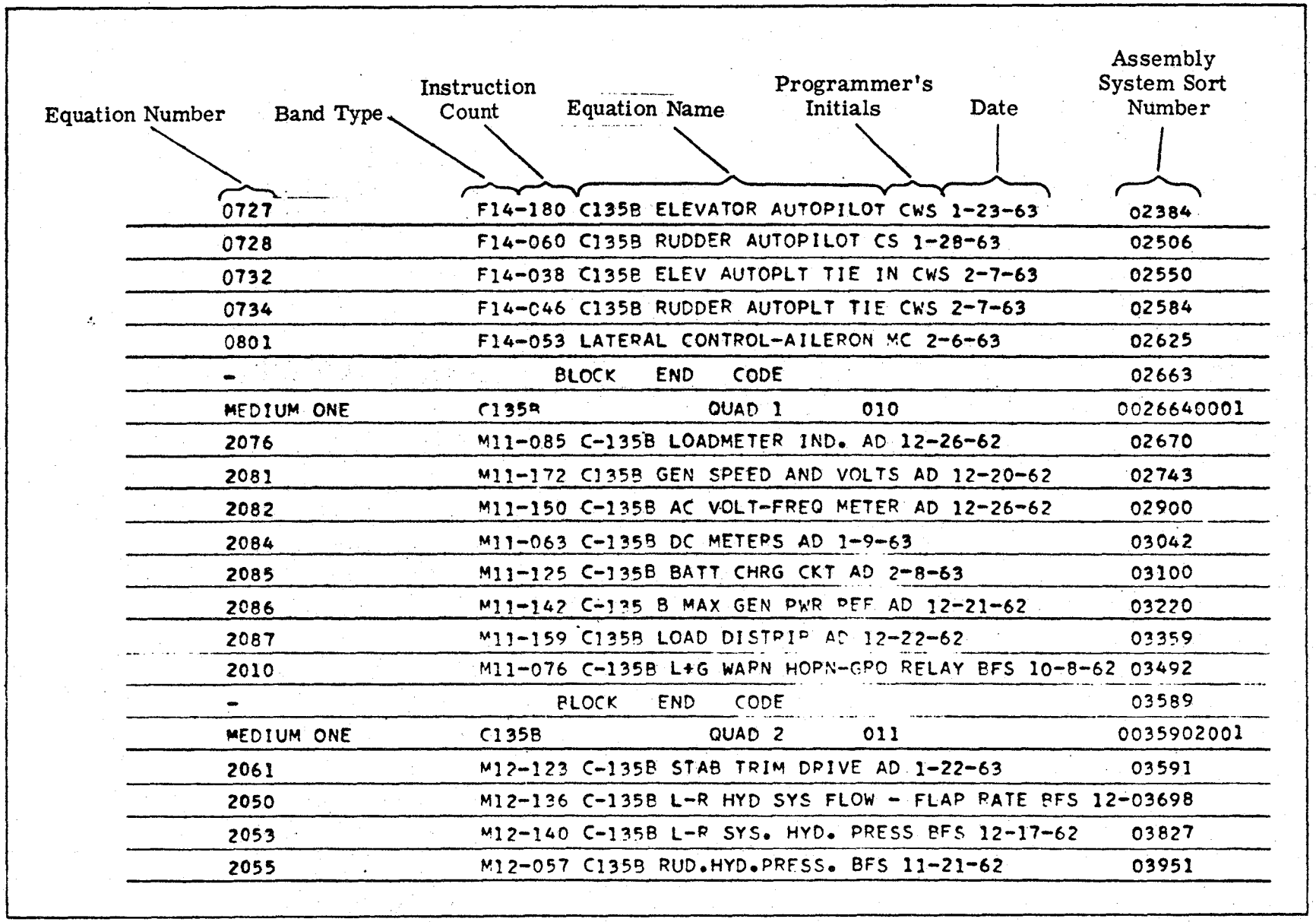
j. Listing of Core-Memory Loads and Stores (Read/Write Table). This listing provides the programmer with the equation number and band address of all instructions which are used to insert or extract core-memory data. Figure 2-10 illustrates the format used for this listing.



0415	F11-017 C135B TURN RATE] STAB. AXIS [RS] CWS 10.4.60	0242
0420	F12-025 C135B MOMENT X ACF AXIS [MXA] CWS 10.5.62	00984
0425	F12-015 C135B MOMENT Y ACE AXIS [MYA] CWS 10.04.62	00997
043	F12-035 C135B MOMENT Z ACE AXIS [MZA] CWS 10.04.62	01048
0435	F11-020 C135B SIN AND COS THETA CWS 10-02-62	00085
0450	F11-009 C135B SIN BANK ANGLE CWS 10-3-62	00096
0455	F11-009 C135B COS BANK ANGLE CWS 10-3-62	00101
0460	F11-009 C135B SIN TRUE HEADING CWS 10-3-62	00106
0465	F11-009 C135B COS TRUE HEADING CWS 10-3-62	00111
0470	F14-169 C-135B FLT. INTEG. BFS 8-13-63	01994
0600	F11-214 C-135B GR. REACTION BFS 8.15.63 REV A	00394
0601	F13-041 NOSE WHEEL STEERING J.HUNT	01287
0602	M23-083 C-135B BRAKE EFFECTS BFS 8-19-63	07166
0680	M23-026 C135B OUTSIDE AIR TEMP CWS 11-12-62	06980
0685	F14-018 C-135B DELTA HP BFS 8-2-63	01981
0705	M12-035 C135B AMBIENT PRESSURE	04226
0725	M23-043 C-135B FLD. PRESS-ALT SET BFS 8-13-63	07128
0726	F14-215 C135B AILERON AUTOPLIOT CWS 01-11-63	02240
0727	F14-180 C135B ELEVATOR AUTOPILOT CWS 1-23-63	02384
0728	F14-060 C135B RUDDER AUTOPILOT CS 1-28-63	02506
0729	M22-032 C135B AUTOPILOT POWER CWS 1-23-63	06734

*F = Fast, M = Medium, S = Slow

Figure 2–1. Format for Numerical List of Equations



	0727		F14-180 C135B ELEVATOR AUTOPILOT CWS 1-23-63			02384
	0728		F14-060 C135B RUDDER AUTOPILOT CS 1-28-63			02506
	0732		F14-038 C135B ELEV AUTOPLT TIE IN CWS 2-7-63			02550
	0734		F14-046 C135B RUDDER AUTOPLT TIE CWS 2-7-63			02584
	0801		F14-053 LATERAL CONTROL-AILERON MC 2-6-63			02625
	-		BLOCK END CODE			02663
	MEDIUM ONE		C135B QUAD 1 010			0026640001
	2076		M11-085 C-135B LOADMETER IND. AD 12-26-62			02670
	2081		M11-172 C135B GEN SPEED AND VOLTS AD 12-20-62			02743
	2082		M11-150 C-135B AC VOLT-FREQ METER AD 12-26-62			02900
	2084		M11-063 C-135B DC METERS AD 1-9-63			03042
	2085		M11-125 C-135B BATT CHRG CKT AD 2-8-63			03100
	2086		M11-142 C-135 B MAX GEN PWR REF AD 12-21-62			03220
	2087		M11-159 C135B LOAD DISTRIB AD 12-22-62			03359
	2010		M11-076 C-135B L+G WARN HOPN-GPO RELAY BFS 10-8-62			03492
	-		BLOCK END CODE			03589
	MEDIUM ONE		C135B QUAD 2 011			0035902001
	2061		M12-123 C-135B STAB TRIM DRIVE AD 1-22-63			03591
	2050		M12-136 C-135B L-R HYD SYS FLOW - FLAP RATE BFS 12-			03698
	2053		M12-140 C-135B L-R SYS. HYD. PRESS BFS 12-17-62			03827
	2055		M12-057 C135B RUD.HYD.PRESS. BFS 11-21-62			03951

Figure 2-2. Format for Drum Order Loading of Equations

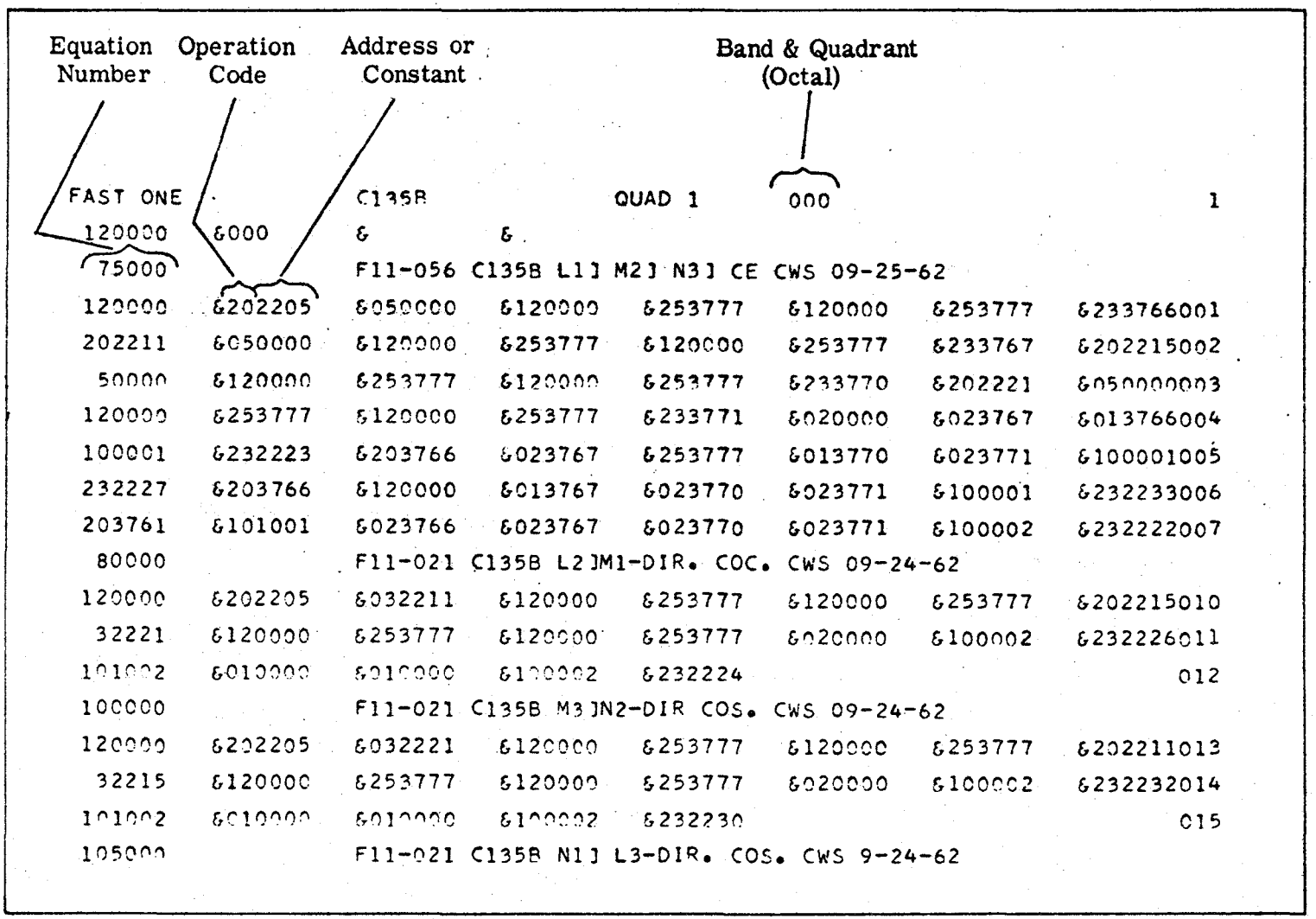


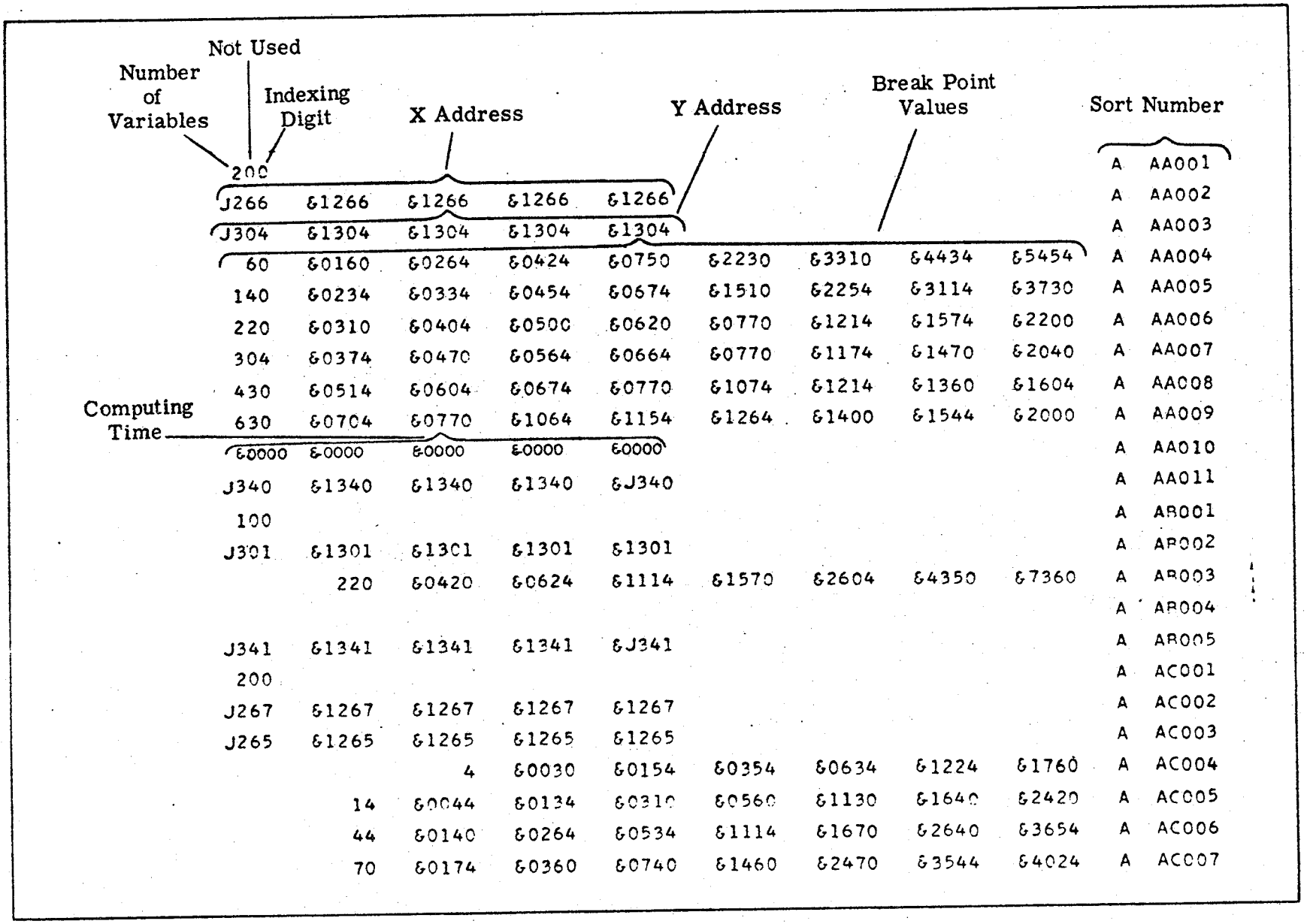
Figure 2–3. Format for General Program Bands 8-OP Listing

Data Description	Originating Programmer's Sketch Number	Core Memory Address (Octal)
STABILIZER TRIM CONTROL WHEEL	462134 SH2	0254
START LEVER NO 1	462134 SH3	0255
START LEVER NO 2	462134 SH3	0256
START LEVER NO 3	462134 SH3	0257
START LEVER NO 4	462134 SH3	0260
X %VISUAL□	RA039	0261
Y %VISUAL□	RA039	0262
ZA-ZF %VISUAL□	RA039	0263
ADF LOOP - 1 ERROR	RA030	0264
ADF LOOP - 2 ERROR	RA031	0265
PILOT LEFT BRAKE PEDAL	464091 SH2	0266
PILOT RIGHT BRAKE PEDAL	464091 SH2	0267
CO PILOT LEFT BRAKE PEDAL	464091 SH2	0270
CO PILOT RIGHT BRAKE PEDAL	464091 SH2	0271
PARAMETER SET	473563 SH3	0272

Figure 2-4. Format for Core-Memory Locations, Analog

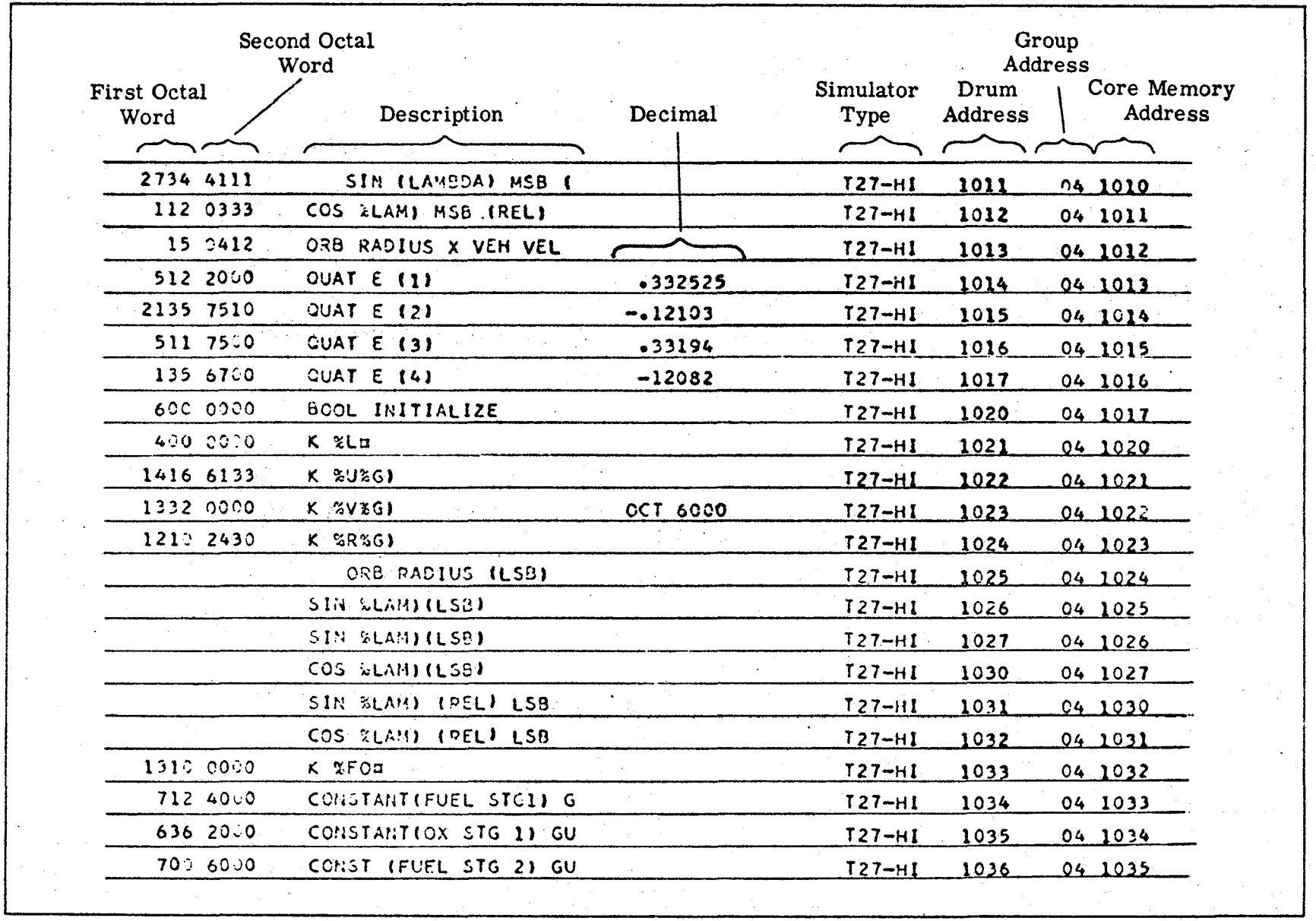
Data Description	Originating Programmer's Sketch Number	Boolean Core-Memory Address (Octal)
START IGNITION FAIL - ENG 1 C135B	B463031SH2	0020
START IGNITION FAIL - ENG 2	B463031SH2	0021
START IGNITION FAIL - ENG 3	B463031SH2	0022
START IGNITION FAIL - ENG 4	B463031SH2	0023
HOT START - ENG 1	B463031SH2	0024
HOT START - ENG 2	B463031SH2	0025
HOT START - ENG 3	B463031SH2	0026
HOT START - ENG 4	B463031SH2	0027
HUNG START - ENG 1	B463031SH2	0030
HUNG START - ENG 2	B463031SH2	0031
HUNG START - ENG 3	B463031SH2	0032
HUNG START - ENG 4	B463031SH2	0033
SURGE BLEED PORT STUCK - ENG 1	B463031SH2	0034
SURGE BLEED PORT STUCK - ENG 2	B463031SH2	0035
SURGE BLEED PORT STUCK - ENG 3	B463031SH2	0036
SURGE BLEED PORT STUCK - ENG 4	B463031SH2	0037
FLAMEOUT - ENG 1	B463031SH3	0040
FLAMEOUT - ENG 2	B463031SH3	0041
FLAMEOUT - ENG 3	B463031SH3	0042

Figure 2-5. Format for Core-Memory Locations, Boolean



200									A AA001
J266	&1266	&1266	&1266	&1266					A AA002
J304	&1304	&1304	&1304	&1304					A AA003
60	&0160	&0264	&0424	&0750	&2230	&3310	&4434	&5454	A AA004
140	&0234	&0334	&0454	&0674	&1510	&2254	&3114	&3730	A AA005
220	&0310	&0404	&0500	&0620	&0770	&1214	&1574	&2200	A AA006
304	&0374	&0470	&0564	&0664	&0770	&1174	&1470	&2040	A AA007
430	&0514	&0604	&0674	&0770	&1074	&1214	&1360	&1604	A AA008
630	&0704	&0770	&1064	&1154	&1264	&1400	&1544	&2000	A AA009
&0000	&0000	&0000	&0000	&0000					A AA010
J340	&1340	&1340	&1340	&J340					A AA011
100									A AB001
J301	&1301	&1301	&1301	&1301					A AB002
	220	&0420	&0624	&1114	&1570	&2604	&4350	&7360	A AB003
									A AB004
J341	&1341	&1341	&1341	&J341					A AB005
200									A AC001
J267	&1267	&1267	&1267	&1267					A AC002
J265	&1265	&1265	&1265	&1265					A AC003
		4	&0030	&0154	&0354	&0634	&1224	&1760	A AC004
	14	&0044	&0134	&0310	&0560	&1130	&1640	&2420	A AC005
	44	&0140	&0264	&0534	&1114	&1670	&2640	&3654	A AC006
	70	&0174	&0360	&0740	&1460	&2470	&3544	&4024	A AC007

Figure 2-6. Format for Linear Function Interpolator Listing



First Octal Word	Second Octal Word	Description	Decimal	Simulator Type	Group Address: Drum Address	Group Address: Core Memory Address
2734	4111	SIN (LAMBDA) MSB (		T27-HI	1011	04 1010
112	0333	COS %LAM) MSB .(REL)		T27-HI	1012	04 1011
15	0412	ORB RADIUS X VEH VEL		T27-HI	1013	04 1012
512	2000	QUAT E (1)	.332525	T27-HI	1014	04 1013
2135	7510	QUAT E (2)	-.12103	T27-HI	1015	04 1014
511	7500	QUAT E (3)	.33194	T27-HI	1016	04 1015
135	6700	QUAT E (4)	-12082	T27-HI	1017	04 1016
600	0000	BOOL INITIALIZE		T27-HI	1020	04 1017
400	0000	K %L¤		T27-HI	1021	04 1020
1416	6133	K %U%G)		T27-HI	1022	04 1021
1332	0000	K %V%G)	OCT 6000	T27-HI	1023	04 1022
1210	2430	K %R%G)		T27-HI	1024	04 1023
		ORB RADIUS (LSB)		T27-HI	1025	04 1024
		SIN %LAM)(LSB)		T27-HI	1026	04 1025
		SIN %LAM)(LSB)		T27-HI	1027	04 1026
		COS %LAM)(LSB)		T27-HI	1030	04 1027
		SIN %LAM) (REL) LSB		T27-HI	1031	04 1030
		COS %LAM) (REL) LSB		T27-HI	1032	04 1031
1310	0000	K %FO¤		T27-HI	1033	04 1032
712	4000	CONSTANT(FUEL STG1) G		T27-HI	1034	04 1033
636	2000	CONSTANT(OX STG 1) GU		T27-HI	1035	04 1034
700	6000	CONST (FUEL STG 2) GU		T27-HI	1036	04 1035

Figure 2-7. Format for Data Preselector (Initial Conditions) Listing

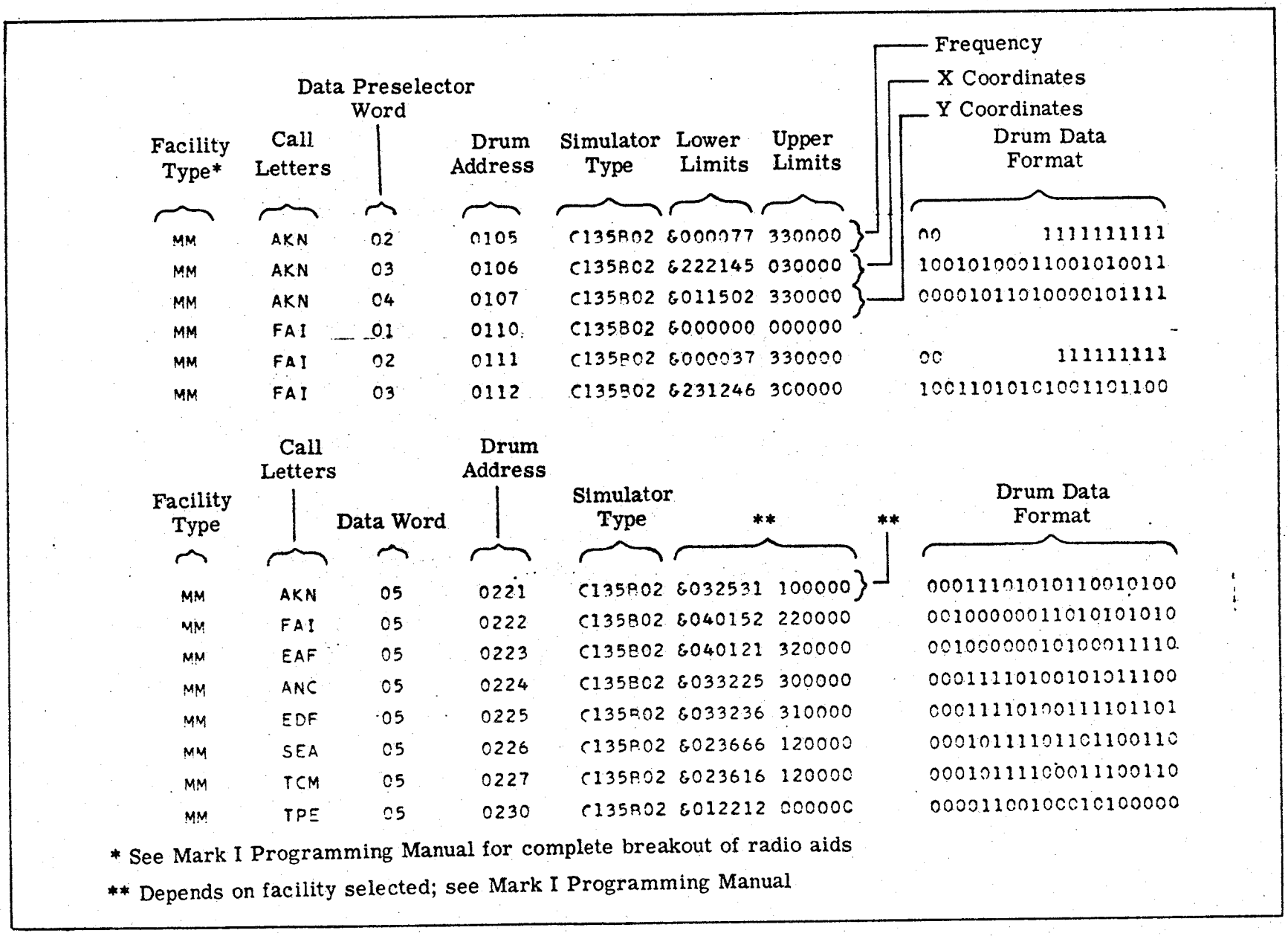


Figure 2-8. Format for Data Preselector (Radio Aids) Listing

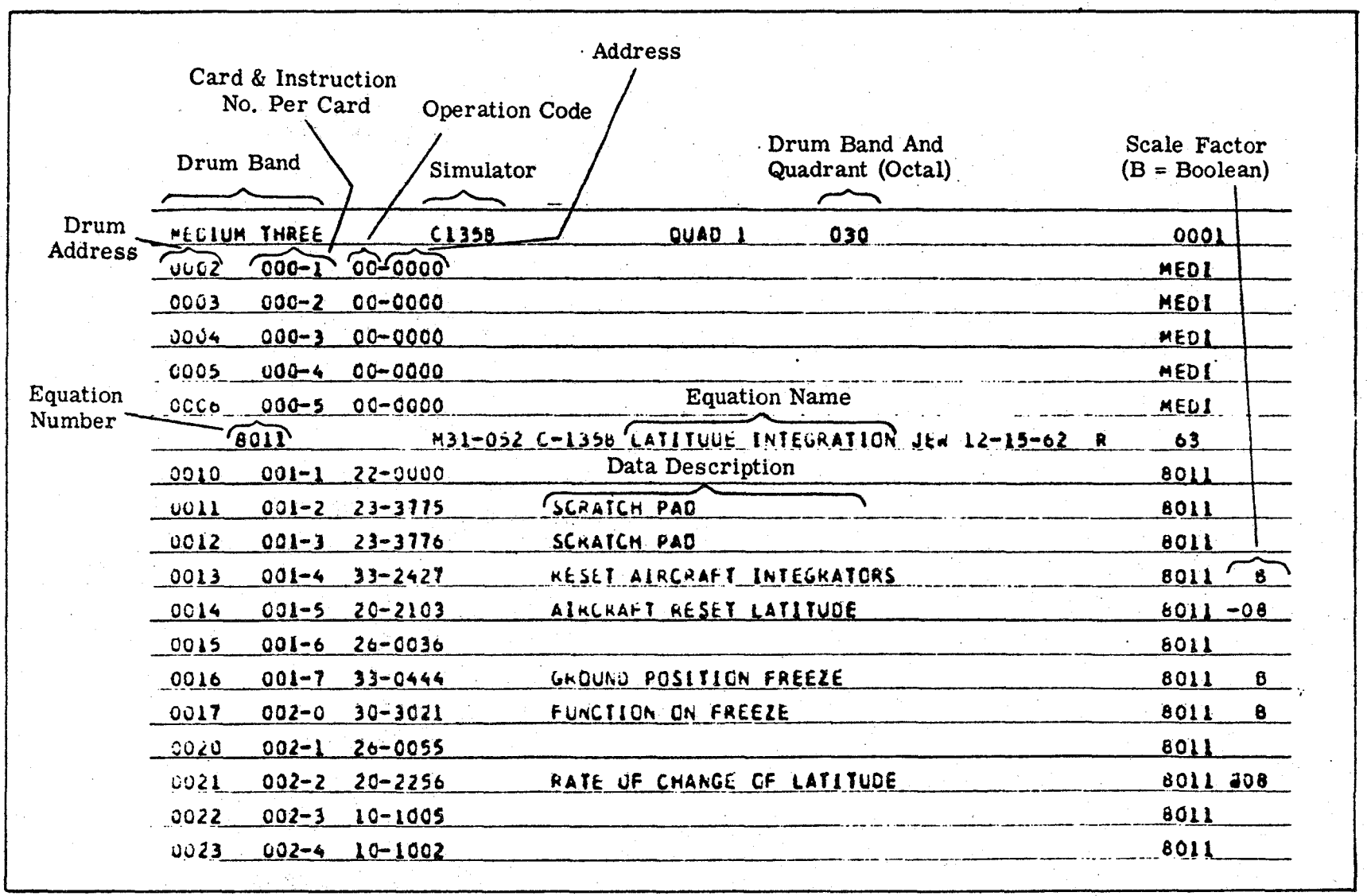


Figure 2-9. Format for General Program Bands Listing (Absolute)

Drum Address	Card No. And No. of Instruction (1-8) on Cards	Operation Code And Address	Data Description	Equation Number	Scale Factor (B = Boolean)
2601	226-1	34-3307	TCN-1 RANGE FREEZE	8078	B
0057	C06-0	20-3310	GEN 2 VOLTS %COMP¤	2076	-08
0305	031-1	23-3310	GEN 2 VOLTS %COMP¤	2081	-08
3132	261-5	30-3310	TCN-2 RANGE FREEZE	8079	B
4134	163-6	33-3310	TCN-2 RANGE FREEZE	8090	B
2776	246-1	34-3310	TCN-2 RANGE FREEZE	8079	B
0113	011-4	20-3311	GEN 3 VOLTS %COMP¤	2076	-08
0376	040-2	23-3311	GEN 3 VOLTS %COMP¤	2081	-08
2614	227-4	31-3311	TCN-1 RCVR FIL WARN	8078	B
2612	266-0	33-3311	TCN-1 RCVR FIL WARN	8101	B
2575	225-5	34-3311	TCN-1 RCVR FIL WARN	8078	B
2400	245-4	01-3312	GEN 1 OVERLOAD CLOCK	2093	
242	250-1	02-3312	GEN 1 OVERLOAD CLOCK	2093	
2403	245-7	23-3312	GEN 1 OVERLOAD CLOCK	2093	
3011	247-4	31-3312	TCN-2 RCVR FIL WARN	8079	B
2757	303-0	33-3312	TCN-2 RCVR FIL WARN	8102	B
2772	245-5	34-3312	TCN-2 RCVR FIL WARN	8079	B
2410	246-4	01-3313	GEN 2 OVERLOAD CLOCK	2093	
2431	250-5	02-3313	GEN 2 OVERLOAD CLOCK	2093	
2413	246-7	23-3313	GEN 2 OVERLOAD CLOCK	2093	

Figure 2-10. Format for Loads and Stores Listing

Appendix A

PROGRAM PROCESSING FORMS.

Form Number	Title
GENERAL PURPOSE PROGRAM	
F-2214-A	Coding and Constant Sheet "B" Size
F-2214-2	Program Sheet "A" Size
F-2347	Program Change Notice
F-2243	Master Equation List
F-2244	Drum Allocation
F-2249A	Core Memory Locations
LINEAR FUNCTION INTERPOLATOR PROGRAM	
F-2237-B	Linear Function Interpolator Data Input Sheet
DATA PRESELECT PROGRAM	
F-2256-A	Radio Facility Data
F-2346	Data Preselect Change Notice
F-2462-2	Initial Conditions Data Sheet

GENERAL PROGRAM NUMBERING SYSTEMS

EAL-727 UAL-727 TWA-727

EQUATION NUMBERS	SIMULATOR SECTION EQUATIONS
0000 - 0999	Flight
1000 - 1999	Not Used
2000 - 2999	Flight Accessories
3000 - 3999	Not Used
4000 - 4999	Engines
5000 - 5250	Air Conditioning and Pressurization
5251 - 5500	Electrical
5501 - 5750	Hydraulics
6000 - 6999	Engine Accessories
7000 - 7999	Not Used
8000 - 8999	Navigation Communications
9000 - 9499	Not Used
9500 - 9999	Miscellaneous

EQUATION NUMBERS	SIMULATOR SECTION EQUATIONS
C-135B	
0000 - 0999	Flight
1000 - 1999	Not Used
2000 - 2999	Flight Accessories
3000 - 3999	Not Used
4000 - 4999	Engines
5000 - 5999	Not Used
6000 - 6999	Not Used
7000 - 7999	Not Used
8000 - 8999	Navigation Communications
9000 - 9999	Miscellaneous
Dora	
0000 - 0999	Flight
1000 - 1999	Not Used
2000 - 2999	Flight Accessories
3000 - 3999	Not Used
4000 - 4999	Engines
5000 - 5199	Weapons
5200 - 5299	Air Conditioning and Pressurization
5300 - 5499	Electrical
5500 - 5599	Fuel
5600 - 5750	Hydraulic
6000 - 6999	Engine Accessories
7000 - 7999	Not Used
8000 - 8999	Navigation Communications
9000 - 9499	Not Used
9500 - 9999	Miscellaneous
Gemini	
0000 - 0999	Motion
1000 - 1999	ACME and Change in Velocity
2000 - 2999	Weight and Balance
3000 - 3999	Propulsion
4000 - 4999	Not Used
5000 - 5999	Launch System Integration
6000 - 6999	Not Used
7000 - 7999	Not Used
8000 - 8999	Sensors - Platform, Horizon, Rate of Gyros, and Radar
9000 - 9499	Instructor Clocks and Drift Generator Nos. 1 thru 13
9500 - 9999	Miscellaneous

EQUATION NUMBERS	SIMULATOR SECTION EQUATION
C-141A	
0000 - 0999	Flight
1000 - 1999	Not Used
2000 - 2999	Flight Accessories
3000 - 3999	Not Used
4000 - 4999	Engines
5000 - 5999	Accessories
6000 - 6999	Not Used
7000 - 7999	Not Used
8000 - 8999	Navigation Communications
9000 - 9999	Miscellaneous
QEA - 707	
0000 - 1999	Flight
2000 - 3999	Flight Accessories
4000 - 4999	Engines
5000 - 5199	Electrical Accessories
5200 - 5399	Fuel Accessories
5400 - 5599	Hydraulics Accessories
5600 - 5799	Not Used
5800 - 5999	Miscellaneous Accessories
6000 - 6999	Not Used
7000 - 7999	Not Used
8000 - 8999	Navigation Communications
9000 - 9999	Miscellaneous
T-27	
0000 - 0999	Motion
1000 - 1999	Deorbit
2000 - 2999	Weight and Balance
3000 - 3999	Propulsion
4000 - 4999	Not Used
5000 - 5999	Launch Guidance and Rendezvous
6000 - 6999	LFI Program
7000 - 7999	Not Used
8000 - 8999	Sensor, Platform, Radar and Visual
9000 - 9499	Target
9500 - 9999	Miscellaneous

LFI CARD PROGRAM

CARD NO.	SINGLE VARIABLE		FLAGS	
1	1	Control Word (100)	"11" Punch in Col 2	
2	5	X Addresses	"11" Punch in Col 2	
3	9	Data Points	"11" Punch in Col 2	- Curve of 9 Points
4	2	Computer Time	"11" Punch in Col 2	
5	5	Ans. Addresses	"11" Punch in Col 2 and 34	
	22	Steps	6 Flags Total	

CARD NO.	2 VARIABLE		FLAGS	
1	1	Control Word (200)	"11" Punch in Col 2	
2	5	X Addresses	"11" Punch in Col 2	
3	5	Y Addresses	"11" Punch in Col 2	- Page of 9 Curves
4-12	81	Data Points (Maximum)	"11" Punch in Col 2	
13	4	Computer Time	"11" Punch in Col 2	
14	5	Ans. Addresses	"11" Punch in Col 2 and 34	
	101	Steps (Maximum)	7 Flags Total	

CARD NO.	3 VARIABLE		FLAGS	
1	1	Control Word (300)	"11" Punch in Col 2	
2	5	X Addresses	"11" Punch in Col 2	
3	5	Y Addresses	"11" Punch in Col 2	- Book of 9 Pages of Curves
4	5	Z Addresses	"11" Punch in Col 2	
5-85	729	Data Points (Maximum)	"11" Punch in Col 2	
86	6	Computer Time	"11" Punch in Col 2	
87	5	Ans. Addresses	"11" Punch in Col 2 and 34	
	756	Steps (Maximum)	8 Flags Total	

RADIO PRESELECTOR TYPE CODE WORDS

Type Code 1 or 2 MM or OM

Card 1 - Word 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Card 2 - Word 2 * 0 0 0 0 0 0 0 0 0 * 1 1 1 1 1 1 1 1 1 1
Card 3 - Word 3 Latitude lower (10) Latitude upper (10)
Card 4 - Word 4 Longitude lower (10) Longitude upper (10)
Card 5 - Word 5 Sign (1) Latitude (19)
Card 6 - Word 6 Sign (1) Longitude (19)
Card 7 - Word 7 sine of axis (10) cosine of axis (10)
Card 8 - Word 8 MISC (6) 0 0 0 0 elevation +1000 (10)

Type Code 3 FM, Z, BONE, LFM

Card 1 - Word 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Card 2 - Word 2 * 0 0 0 0 0 0 0 0 0 * 1 1 1 1 1 1 1 1 1 1
Card 3 - Word 3 Latitude lower (10) Latitude upper (10)
Card 4 - Word 4 Longitude lower (10) Longitude upper (10)
Card 5 - Word 5 Sign (1) Latitude (19)
Card 6 - Word 6 Sign (1) Longitude (19)
Card 7 - Word 7 sine of axis (10) cosine of axis (10)
Card 8 - Word 8 type (4) 0 0 0 0 0 0 elevation +1000 (10)
Card 9 - Word 9 call letters (16) MISC (4) (16 one's for Z)
Card 10 - Word 10 call letters (16) MISC (2) 00 (16 one's for Z)
Card 11 - Word 11 call letters (16) 0 0 0 0 (16 one's for Z)
Card 12 - Word 12 call letters (16) 0 0 0 0 (16 one's for Z)

Type Code 4 ILS, ILSDME

Card 1 - Word 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Card 2 - Word 2 frequency (10) frequency (10)
Card 3 - Word 3 Latitude lower (10) Latitude upper (10)
Card 4 - Word 4 Longitude lower (10) Longitude upper (10)
Card 5 - Word 5 Sign (1) Latitude (19)
Card 6 - Word 6 Sign (1) Longitude (19)
Card 7 - Word 7 Sine of axis (10) cosine of axis (10)
Card 8 - Word 8 1 DME MISC (6) Elevation +1000 (12) (10 for ILS, 11 for ILSDME)
Card 9 - Word 9 Call letter (16) g.p.a. (4) (MSB)
Card 10 - Word 10 Call letters (16) g.p.a. (4) (LSB)
Card 11 - Word 11 Call letters (16) R_L - R_{tg} (4) (MSB)
Card 12 - Word 12 Call letters (16) R_L - R_{tg} (4) (LSB)

Type Code 6 RBN, LOM, LMM, BC

Card 1 - Word 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Card 2 - Word 2 frequency lower (10) frequency upper (10)
Card 3 - Word 3 Latitude lower (10) Latitude upper (10)
Card 4 - Word 4 Longitude lower (10) Longitude upper (10)
Card 5 - Word 5 Sign (1) Latitude 19
Card 6 - Word 6 Sign (1) Longitude 19
Card 7 - Word 7 0 frequency 12 0 0 0 0 0 0 0
Card 8 - Word 8 0 power (9) elevation +1000 (10)
Card 9 - Word 9 Call letters (16) MISC (4)
Card 10 - Word 10 Call letters (16) MISC (2) 0 0
Card 11 - Word 11 Call letters (16) 0 0 0 0
Card 12 - Word 12 Call letters (16) 0 0 0 0

Type Code 7 LFRR

Card 1 - Word 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Card 2 - Word 2 frequency lower (10) frequency upper (10)
Card 3 - Word 3 Latitude lower (10) Latitude upper (10)
Card 4 - Word 4 Longitude lower (10) Longitude upper (10)
Card 5 - Word 5 Sign (1) Latitude (19)
Card 6 - Word 6 Sign (1) Longitude (19)
Card 7 - Word 7 0 frequency (12) 0 0 0 0 0 0 0
Card 8 - Word 8 1 power 9 elevation +1000 (10)
Card 9 - Word 9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Card 10 - Word 10 Call letters (16) MISC (4)
Card 11 - Word 11 Call letters (16) MISC (2) 0 0
Card 12 - Word 12 Call letters (16) 0 0 0 0
Card 13 - Word 13 diameter circle 1 (10) diameter circle 2 (10)
Card 14 - Word 14 diameter circle 3 (10) diameter circle 4 (10)
Card 15 - Word 15 sine axis (10) cosine axis (10)
Card 16 - Word 16 Sine mag. var. (10) 0 cosine mag. var. (9)

Type Code 5 VOR, TACAN, UHF/DF

Card 1 - Word 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Card 2 - Word 2 frequency (10) frequency (10)
Card 3 - Word 3 Latitude lower (10) Latitude upper (10)
Card 4 - Word 4 Longitude lower (10) Longitude upper (10)
Card 5 - Word 5 Sign (1) Latitude (19)
Card 6 - Word 6 Sign (1) Longitude (19)
Card 7 - Word 7 sine mag. var. (1) 0 cosine mag. var. (9)
Card 8 - Word 8 0 type (6) 0 0 0 elevation +1000 (10)
Card 9 - Word 9 Call letters (16) MISC (4)
Card 10 - Word 10 Call letters (16) MISC (2) 0 0
Card 11 - Word 11 Call letters (16) 0 0 0 0
Card 12 - Word 12 Call letters (16) 0 0 0 0

* Octal Input	Binary Output
1. 03 (0 to 1/2)	00000000001111111111
2. 27 (1/2 to full)	10000000001111111111
3. 07 (0 to full)	00000000001111111111

EAL 727, UAL 727, TWA 727, C-135B, and DORA CORE MEMORY CHART

MAIN CORE

OCTAL WORD ADDRESS	FUNCTION
0000	NOT USED
0001 – 0100	DIGITAL SWITCH INPUTS (1,024 BOOLEAN WORDS)
0101 – 0137	BOOLEAN WORKING MEMORY (496 BOOLEAN WORDS)
0140 – 0177	DIGITAL SWITCH OUTPUTS (512 BOOLEAN WORDS)
0200	A/D INPUTS – 100 WORDS
0375	EXPANDABLE BY 28 WORDS
	0376 & 0377 FOR WORKING MEMORY
0400	D/A OUTPUTS – 128 WORDS
0677	EXPANDABLE BY 64 WORDS
0700 – 0777	WORKING MEMORY – 64 WORDS
1000 – 1117	RADIO AIDS – 80 WORDS
1120 – 1777	WORKING MEMORY – 432 WORDS
2000 – 3777	WORKING MEMORY & CONSTANTS – 1024 WORDS

INTERPOLATOR ACCESS AVAILABLE

DATA LOST DURING DRUM LOADING

DATA HELD DURING DRUM LOADING

DETAIL OF BOOLEAN CORE

OCTAL WORD ADDRESS		FUNCTION
MAIN CORE	BOOLEAN CORE	
0000	0-0017	NOT USED
0001 – 0100	0020 – 2017	BOOLEAN INPUTS 64 WORDS X 16 BITS PER WORD = 1024 INPUTS
0101 – 0137	2020 – 2777	BOOLEAN WORKING STORAGE 31 X 16 = 496 WORKING STORAGE LOC.
0140 – 0177	3000 – 3777	BOOLEAN OUTPUTS 32 X 16 = 512 OUTPUTS

NOTES:
1. OCTAL WORDS 3766-3777 ARE RESERVED FOR THE ARITHMETIC SCRATCH PAD.
2. BOOLEAN WORDS 2766-2777 ARE RESERVED FOR THE BOOLEAN SCRATCH PAD.

GEMINI CORE MEMORY CHART

MAIN CORE

OCTAL WORD ADDRESS	FUNCTION
0000	NOT USED
0001 – 0100	DIGITAL SWITCH INPUTS (1,024 BOOLEAN WORDS)
0101 – 0120	DIGITAL SWITCH OUTPUTS (256 BOOLEAN WORDS)
0121 – 0177	BOOLEAN WORKING MEMORY (752 BOOLEAN WORDS)
0200 – 0377	A/D INPUTS – 100 WORDS EXPANDABLE BY 28 WORDS
0400 – 0677	D/A OUTPUTS – 192 WORDS
0700 – 0777	WORKING MEMORY – 64 WORDS
1000 – 1175	INITIAL CONDITIONS – 126 WORDS
1176 – 1777	WORKING MEMORY – 386 WORDS
2000 – 3777	WORKING MEMORY CONSTANTS – 1024 WORDS

BOOLEAN CORE

INTERPOLATOR ACCESS AVAILABLE

DETAIL OF BOOLEAN CORE

OCTAL WORD ADDRESS		FUNCTION
MAIN CORE	BOOLEAN CORE	
0000	0-0017	NOT USED
0001 – 0100	0020 – 2017	BOOLEAN INPUTS 64 WORDS X 16 BITS PER WORD = 1024 INPUTS
0101 – 0120	2020 – 2417	BOOLEAN OUTPUTS 16X16=256 WORKING STORAGE LOC.
0121 – 0177	2420 – 3777	BOOLEAN WORKING STORAGE 47X16=752 OUTPUTS

NOTES:
1. OCTAL WORDS 3766-3777 ARE RESERVED FOR THE ARITHMETIC SCRATCH PAD.
2. BOOLEAN WORDS 2766-2777 ARE RESERVED FOR THE BOOLEAN SCRATCH PAD.

C-141A CORE MEMORY CHART

MAIN CORE

OCTAL WORD ADDRESS	FUNCTION
0000	NOT USED
0001 – 0140	DIGITAL SWITCH INPUTS (1,536 BOOLEAN WORDS)
0141 – 0177	BOOLEAN WORKING MEMORY (496 BOOLEAN WORDS)
0200 – 0377	A/D INPUTS – 100 WORDS EXPANDABLE BY 28 WORDS
0400 – 0707	D/A OUTPUTS – 200 WORDS
0710 – 0777	WORKING MEMORY – 56 WORDS
1000 – 1117	RADIO AIDS – 80 WORDS
1120 – 1777	WORKING MEMORY – 432 WORDS
2000 – 2037	32 MAIN WORDS DIGITAL SWITCH OUTPUTS (512 BOOLEAN WORDS)
2040 – 3777	WORKING MEMORY AND CONSTANTS – 1024 WORDS

INTERPOLATOR ACCESS AVAILABLE

DATA LOST DURING DRUM LOADING

DATA HELD DURING DRUM LOADING

DETAIL OF BOOLEAN CORE

OCTAL WORD ADDRESS		FUNCTION
MAIN CORE	BOOLEAN CORE	
0000	0-0017	NOT USED
0001 – 0140	0020 – 3017	BOOLEAN INPUTS 96 WORDS X 16 BITS PER WORD = 1536 INPUTS
0141 – 0177	3020 – 3777	BOOLEAN WORKING STORAGE 31 X 16 = 496 WORKING STORAGE LOC.

NOTES:
1. BOOLEAN CORE BIT DISTRIBUTION: C.M. BIT 2^0 = BOOLEAN 0037; C.M. BIT 2^1 = BOOLEAN 0036; ETC.
2. DSO CORES ARE ADDRESSABLE ONLY AS FOLLOWS:
   35 1---EQUALS BOOLEAN LOAD OF DSO.
   35 0---EQUALS BOOLEAN STORE OF DSO.

QEA 707 CORE MEMORY CHART

MAIN CORE

OCTAL WORD ADDRESS	FUNCTION
0000	NOT USED
0001 – 0100	DIGITAL SWITCH INPUTS (1024 BOOLEAN WORDS)
0101 – 0137	BOOLEAN WORKING MEMORY (496 BOOLEAN WORDS)
0140 – 0177	DIGITAL SWITCH OUTPUTS (512 BOOLEAN WORDS)
0200 – 0377	A/D INPUTS – 100 WORDS EXPANDABLE BY 28 WORDS
0400 – 0707	D/A OUTPUTS – 200 WORDS
0710 – 0777	
1000 – 1127	RADIO AIDS – 88 WORDS
1130 – 1177	414 WORDS WORKING MEMORY
2000 – 3777	1024 WORDS WORKING MEMORY

INTERPOLATOR ACCESS AVAILABLE

DETAIL OF BOOLEAN CORE

OCTAL WORD ADDRESS		FUNCTION
MAIN CORE	BOOLEAN CORE	
0000	0 – 0017	NOT USED
0001 – 0100	0020 – 2017	BOOLEAN INPUTS 64 WORDS X 16 BITS PER WORD = 1024 INPUTS
0101 – 0137	2020 – 2777	BOOLEAN WORKING STORAGE 31 X 16 = 496 WORKING STORAGE LOC.
0140 – 0177	3000 – 3777	BOOLEAN OUTPUTS 32 X 16 = 512 OUTPUTS

NOTES:

1. OCTAL WORDS 3766–3777 ARE RESERVED FOR THE ARITHMETIC SCRATCH PAD.
2. BOOLEAN WORDS 2766–2777 ARE RESERVED FOR THE BOOLEAN SCRATCH PAD.
3. BOOLEAN CORE, BIT DISTRIBUTION: (MAIN CORE ADDRESS = 0001) CM BIT 2^0 = BOOLEAN 0037; CM BIT 2^1 = BOOLEAN 0036; CM BIT 2^2 = BOOLEAN 0035; ETC.

T-27 CORE MEMORY CHART

MAIN CORE

OCTAL WORD ADDRESS	FUNCTION
0000	NOT USED
0001 – 0100	DIGITAL SWITCH INPUTS (1,024 BOOLEAN WORDS)
0101 – 0137	BOOLEAN WORKING MEMORY (496 BOOLEAN WORDS)
0140 – 0177	DIGITAL SWITCH OUTPUTS (512 BOOLEAN WORDS)
0200	A/D INPUTS – 100 WORDS
0375	EXPANDABLE BY 28 WORDS
	0376 & 0377 FOR WORKING
0400	D/A OUTPUTS – 192 WORDS
0777	EXPANDABLE BY 64 WORDS
1000 – 1117	INITIAL CONDITIONS – 128 WORDS
1120 – 1777	WORKING MEMORY – 384 WORDS
2000 – 3777	WORKING MEMORY & CONSTANTS – 1024 WORDS

INTERPOLATOR ACCESS AVAILABLE

DETAIL OF BOOLEAN CORE

OCTAL WORD ADDRESS		FUNCTION
MAIN CORE	BOOLEAN CORE	
0000	0-0017	NOT USED
0001 – 0100	0020 – 2017	BOOLEAN INPUTS 64 WORDS X 16 BITS PER WORD = 1024 INPUTS
0101 – 0137	2020 – 2777	BOOLEAN WORKING STORAGE 31X16 = 496 WORKING STORAGE LOC.
0140 – 0177	3000 – 3777	BOOLEAN OUTPUTS 32 X 16 = 512 OUTPUTS

NOTES:
1. OCTAL WORDS 3766-3777 ARE RESERVED FOR THE ARITHMETIC SCRATCH PAD.
2. BOOLEAN WORDS 2766-2777 ARE RESERVED FOR THE BOOLEAN SCRATCH PAD.
3. BOOLEAN CORE, BIT DISTRIBUTION: (MAIN CORE ADDRESS = 0001) C.M. BIT 2^0 = BOOLEAN 0037; C. M. BIT 2^1 = BOOLEAN 0036; C.M. BIT 2^3 = BOOLEAN 0035; ETC.

COMPUTER MNEMONIC AND NUMERIC CODES

MARK I			MARK II	
Operation	Mnemonic Code	Numeric Code	Mnemonic Code	Operation
Add	ADD	01	ADD	Add
Subtract	SUB	02	SUB	Subtract
Multiply	MLT	03	MLT	Multiply
Negative Multiply	NMT	04	DPA	Double-Precision Add
Square	SQ	05	SQ	Square
Divide	DIV	06	DIV	Divide
Square Root	SRS	07	SRS	Square Root
Step				Step
Scale	SCL	10	SCL	Scale
Shift	SFT	11	SFT	Shift
No-Operation	NPA	12	NPA	No-Operation
Invert Sign	INS	13	INS	Invert Sign
Absolute Value	ABS	14	ABS	Absolute Value
Zero Slice	ZSL	15	ZSL	Zero Slice
Flag Negative	FLN	16	FLN	Flag Negative
		16	FLO	Flag Zero
		17	MSK	Mask Accumulator
Load Accumulator	LD	20	LD	Load Accumulator
Index Load Accumulator	ILD	21	ILD	Index Load Accumulator
Load Constant	LDK	22	LDK	Load Constant
Store Accumulator	ST	23	ST	Store Accumulator
Index Store Accumulator	IST	24	IST	Index Store Accumulator
No-Operation	NPB	25	NPB	No-Operation
Conditional Skip	SKP	26	SKP	Conditional Skip
Conditional Stop	STP	27	STP	Conditional Stop
Boolean Sum	OR	30	OR	Boolean Sum
Boolean Product	AND	31	AND	Boolean Product
Invert Boolean Accumulator	BIN	32	BIN	Invert Boolean Accumulator
Load Boolean Accumulator	BLD	33	BLD	Load Boolean Accumulator
Store Boolean Accumulator	BST	34	BST	Store Boolean Accumulator
		35	MQS	Store MQ Register
		36	OFD	Overflow Disregard
Tape Stop Code	TRS	37	TRS	Tape Stop Code

OCTAL-DECIMAL INTEGER CONVERSION TABLES

0000 to 0777 (Octal)	0000 to 0511 (Decimal)

Octal	Decimal
10000 -	4096
20000 -	8192
30000 -	12288
40000 -	16384
50000 -	20480
60000 -	24576
70000 -	28672

	0	1	2	3	4	5	6	7
0000	0000	0001	0002	0003	0004	0005	0006	0007
0010	0008	0009	0010	0011	0012	0013	0014	0015
0020	0016	0017	0018	0019	0020	0021	0022	0023
0030	0024	0025	0026	0027	0028	0029	0030	0031
0040	0032	0033	0034	0035	0036	0037	0038	0039
0050	0040	0041	0042	0043	0044	0045	0046	0047
0060	0048	0049	0050	0051	0052	0053	0054	0055
0070	0056	0057	0058	0059	0060	0061	0062	0063
0100	0064	0065	0066	0067	0068	0069	0070	0071
0110	0072	0073	0074	0075	0076	0077	0078	0079
0120	0080	0081	0082	0083	0084	0085	0086	0087
0130	0088	0089	0090	0091	0092	0093	0094	0095
0140	0096	0097	0098	0099	0100	0101	0102	0103
0150	0104	0105	0106	0107	0108	0109	0110	0111
0160	0112	0113	0114	0115	0116	0117	0118	0119
0170	0120	0121	0122	0123	0124	0125	0126	0127
0200	0128	0129	0130	0131	0132	0133	0134	0135
0210	0136	0137	0138	0139	0140	0141	0142	0143
0220	0144	0145	0146	0147	0148	0149	0150	0151
0230	0152	0153	0154	0155	0156	0157	0158	0159
0240	0160	0161	0162	0163	0164	0165	0166	0167
0250	0168	0169	0170	0171	0172	0173	0174	0175
0260	0176	0177	0178	0179	0180	0181	0182	0183
0270	0184	0185	0186	0187	0188	0189	0190	0191
0300	0192	0193	0194	0195	0196	0197	0198	0199
0310	0200	0201	0202	0203	0204	0205	0206	0207
0320	0208	0209	0210	0211	0212	0213	0214	0215
0330	0216	0217	0218	0219	0220	0221	0222	0223
0340	0224	0225	0226	0227	0228	0229	0230	0231
0350	0232	0233	0234	0235	0236	0237	0238	0239
0360	0240	0241	0242	0243	0244	0245	0246	0247
0370	0248	0249	0250	0251	0252	0253	0254	0255

	0	1	2	3	4	5	6	7
0400	0256	0257	0258	0259	0260	0261	0262	0263
0410	0264	0265	0266	0267	0268	0269	0270	0271
0420	0272	0273	0274	0275	0276	0277	0278	0279
0430	0280	0281	0282	0283	0284	0285	0286	0287
0440	0288	0289	0290	0291	0292	0293	0294	0295
0450	0296	0297	0298	0299	0300	0301	0302	0303
0460	0304	0305	0306	0307	0308	0309	0310	0311
0470	0312	0313	0314	0315	0316	0317	0318	0319
0500	0320	0321	0322	0323	0324	0325	0326	0327
0510	0328	0329	0330	0331	0332	0333	0334	0335
0520	0336	0337	0338	0339	0340	0341	0342	0343
0530	0344	0345	0346	0347	0348	0349	0350	0351
0540	0352	0353	0354	0355	0356	0357	0358	0359
0550	0360	0361	0362	0363	0364	0365	0366	0367
0560	0368	0369	0370	0371	0372	0373	0374	0375
0570	0376	0377	0378	0379	0380	0381	0382	0383
0600	0384	0385	0386	0387	0388	0389	0390	0391
0610	0392	0393	0394	0395	0396	0397	0398	0399
0620	0400	0401	0402	0403	0404	0405	0406	0407
0630	0408	0409	0410	0411	0412	0413	0414	0415
0640	0416	0417	0418	0419	0420	0421	0422	0423
0650	0424	0425	0426	0427	0428	0429	0430	0431
0660	0432	0433	0434	0435	0436	0437	0438	0439
0670	0440	0441	0442	0443	0444	0445	0446	0447
0700	0448	0449	0450	0451	0452	0453	0454	0455
0710	0456	0457	0458	0459	0460	0461	0462	0463
0720	0464	0465	0466	0467	0468	0469	0470	0471
0730	0472	0473	0474	0475	0476	0477	0478	0479
0740	0480	0481	0482	0483	0484	0485	0486	0487
0750	0488	0489	0490	0491	0492	0493	0494	0495
0760	0496	0497	0498	0499	0500	0501	0502	0503
0770	0504	0505	0506	0507	0508	0509	0510	0511

1000 to 1777 (Octal)	0512 to 1023 (Decimal)

	0	1	2	3	4	5	6	7
1000	0512	0513	0514	0515	0516	0517	0518	0519
1010	0520	0521	0522	0523	0524	0525	0526	0527
1020	0528	0529	0530	0531	0532	0533	0534	0535
1030	0536	0537	0538	0539	0540	0541	0542	0543
1040	0544	0545	0546	0547	0548	0549	0550	0551
1050	0552	0553	0554	0555	0556	0557	0558	0559
1060	0560	0561	0562	0563	0564	0565	0566	0567
1070	0568	0569	0570	0571	0572	0573	0574	0575
1100	0576	0577	0578	0579	0580	0581	0582	0583
1110	0584	0585	0586	0587	0588	0589	0590	0591
1120	0592	0593	0594	0595	0596	0597	0598	0599
1130	0600	0601	0602	0603	0604	0605	0606	0607
1140	0608	0609	0610	0611	0612	0613	0614	0615
1150	0616	0617	0618	0619	0620	0621	0622	0623
1160	0624	0625	0626	0627	0628	0629	0630	0631
1170	0632	0633	0634	0635	0636	0637	0638	0639
1200	0640	0641	0642	0643	0644	0645	0646	0647
1210	0648	0649	0650	0651	0652	0653	0654	0655
1220	0656	0657	0658	0659	0660	0661	0662	0663
1230	0664	0665	0666	0667	0668	0669	0670	0671
1240	0672	0673	0674	0675	0676	0677	0678	0679
1250	0680	0681	0682	0683	0684	0685	0686	0687
1260	0688	0689	0690	0691	0692	0693	0694	0695
1270	0696	0697	0698	0699	0700	0701	0702	0703
1300	0704	0705	0706	0707	0708	0709	0710	0711
1310	0712	0713	0714	0715	0716	0717	0718	0719
1320	0720	0721	0722	0723	0724	0725	0726	0727
1330	0728	0729	0730	0731	0732	0733	0734	0735
1340	0736	0737	0738	0739	0740	0741	0742	0743
1350	0744	0745	0746	0747	0748	0749	0750	0751
1360	0752	0753	0754	0755	0756	0757	0758	0759
1370	0760	0761	0762	0763	0764	0765	0766	0767

	0	1	2	3	4	5	6	7
1400	0768	0769	0770	0771	0772	0773	0774	0775
1410	0776	0777	0778	0779	0780	0781	0782	0783
1420	0784	0785	0786	0787	0788	0789	0790	0791
1430	0792	0793	0794	0795	0796	0797	0798	0799
1440	0800	0801	0802	0803	0804	0805	0806	0807
1450	0808	0809	0810	0811	0812	0813	0814	0815
1460	0816	0817	0818	0819	0820	0821	0822	0823
1470	0824	0825	0826	0827	0828	0829	0830	0831
1500	0832	0833	0834	0835	0836	0837	0838	0839
1510	0840	0841	0842	0843	0844	0845	0846	0847
1520	0848	0849	0850	0851	0852	0853	0854	0855
1530	0856	0857	0858	0859	0860	0861	0862	0863
1540	0864	0865	0866	0867	0868	0869	0870	0871
1550	0872	0873	0874	0875	0876	0877	0878	0879
1560	0880	0881	0882	0883	0884	0885	0886	0887
1570	0888	0889	0890	0891	0892	0893	0894	0895
1600	0896	0897	0898	0899	0900	0901	0902	0903
1610	0904	0905	0906	0907	0908	0909	0910	0911
1620	0912	0913	0914	0915	0916	0917	0918	0919
1630	0920	0921	0922	0923	0924	0925	0926	0927
1640	0928	0929	0930	0931	0932	0933	0934	0935
1650	0936	0937	0938	0939	0940	0941	0942	0943
1660	0944	0945	0946	0947	0948	0949	0950	0951
1670	0952	0953	0954	0955	0956	0957	0958	0959
1700	0960	0961	0962	0963	0964	0965	0966	0967
1710	0968	0969	0970	0971	0972	0973	0974	0975
1720	0976	0977	0978	0979	0980	0981	0982	0983
1730	0984	0985	0986	0987	0988	0989	0990	0991
1740	0992	0993	0994	0995	0996	0997	0998	0999
1750	1000	1001	1002	1003	1004	1005	1006	1007
1760	1008	1009	1010	1011	1012	1013	1014	1015
1770	1016	1017	1018	1019	1020	1021	1022	1023

	0	1	2	3	4	5	6	7
2000	1024	1025	1026	1027	1028	1029	1030	1031
2010	1032	1033	1034	1035	1036	1037	1038	1039
2020	1040	1041	1042	1043	1044	1045	1046	1047
2030	1048	1049	1050	1051	1052	1053	1054	1055
2040	1056	1057	1058	1059	1060	1061	1062	1063
2050	1064	1065	1066	1067	1068	1069	1070	1071
2060	1072	1073	1074	1075	1076	1077	1078	1079
2070	1080	1081	1082	1083	1084	1085	1086	1087
2100	1088	1089	1090	1091	1092	1093	1094	1095
2110	1096	1097	1098	1099	1100	1101	1102	1103
2120	1104	1105	1106	1107	1108	1109	1110	1111
2130	1112	1113	1114	1115	1116	1117	1118	1119
2140	1120	1121	1122	1123	1124	1125	1126	1127
2150	1128	1129	1130	1131	1132	1133	1134	1135
2160	1136	1137	1138	1139	1140	1141	1142	1143
2170	1144	1145	1146	1147	1148	1149	1150	1151
2200	1152	1153	1154	1155	1156	1157	1158	1159
2210	1160	1161	1162	1163	1164	1165	1166	1167
2220	1168	1169	1170	1171	1172	1173	1174	1175
2230	1176	1177	1178	1179	1180	1181	1182	1183
2240	1184	1185	1186	1187	1188	1189	1190	1191
2250	1192	1193	1194	1195	1196	1197	1198	1199
2260	1200	1201	1202	1203	1204	1205	1206	1207
2270	1208	1209	1210	1211	1212	1213	1214	1215
2300	1216	1217	1218	1219	1220	1221	1222	1223
2310	1224	1225	1226	1227	1228	1229	1230	1231
2320	1232	1233	1234	1235	1236	1237	1238	1239
2330	1240	1241	1242	1243	1244	1245	1246	1247
2340	1248	1249	1250	1251	1252	1253	1254	1255
2350	1256	1257	1258	1259	1260	1261	1262	1263
2360	1264	1265	1266	1267	1268	1269	1270	1271
2370	1272	1273	1274	1275	1276	1277	1278	1279

	0	1	2	3	4	5	6	7
2400	1280	1281	1282	1283	1284	1285	1286	1287
2410	1288	1289	1290	1291	1292	1293	1294	1295
2420	1296	1297	1298	1299	1300	1301	1302	1303
2430	1304	1305	1306	1307	1308	1309	1310	1311
2440	1312	1313	1314	1315	1316	1317	1318	1319
2450	1320	1321	1322	1323	1324	1325	1326	1327
2460	1328	1329	1330	1331	1332	1333	1334	1335
2470	1336	1337	1338	1339	1340	1341	1342	1343
2500	1344	1345	1346	1347	1348	1349	1350	1351
2510	1352	1353	1354	1355	1356	1357	1358	1359
2520	1360	1361	1362	1363	1364	1365	1366	1367
2530	1368	1369	1370	1371	1372	1373	1374	1375
2540	1376	1377	1378	1379	1380	1381	1382	1383
2550	1384	1385	1386	1387	1388	1389	1390	1391
2560	1392	1393	1394	1395	1396	1397	1398	1399
2570	1400	1401	1402	1403	1404	1405	1406	1407
2600	1408	1409	1410	1411	1412	1413	1414	1415
2610	1416	1417	1418	1419	1420	1421	1422	1423
2620	1424	1425	1426	1427	1428	1429	1430	1431
2630	1432	1433	1434	1435	1436	1437	1438	1439
2640	1440	1441	1442	1443	1444	1445	1446	1447
2650	1448	1449	1450	1451	1452	1453	1454	1455
2660	1456	1457	1458	1459	1460	1461	1462	1463
2670	1464	1465	1466	1467	1468	1469	1470	1471
2700	1472	1473	1474	1475	1476	1477	1478	1479
2710	1480	1481	1482	1483	1484	1485	1486	1487
2720	1488	1489	1490	1491	1492	1493	1494	1495
2730	1496	1497	1498	1499	1500	1501	1502	1503
2740	1504	1505	1506	1507	1508	1509	1510	1511
2750	1512	1513	1514	1515	1516	1517	1518	1519
2760	1520	1521	1522	1523	1524	1525	1526	1527
2770	1528	1529	1530	1531	1532	1533	1534	1535

2000	1024
to	to
2777	1535
(Octal)	(Decimal)

Octal	Decimal
10000 -	4096
20000 -	8192
30000 -	12288
40000 -	16384
50000 -	20480
60000 -	24576
70000 -	28672

	0	1	2	3	4	5	6	7
3000	1536	1537	1538	1539	1540	1541	1542	1543
3010	1544	1545	1546	1547	1548	1549	1550	1551
3020	1552	1553	1554	1555	1556	1557	1558	1559
3030	1560	1561	1562	1563	1564	1565	1566	1567
3040	1568	1569	1570	1571	1572	1573	1574	1575
3050	1576	1577	1578	1579	1580	1581	1582	1583
3060	1584	1585	1586	1587	1588	1589	1590	1591
3070	1592	1593	1594	1595	1596	1597	1598	1599
3100	1600	1601	1602	1603	1604	1605	1606	1607
3110	1608	1609	1610	1611	1612	1613	1614	1615
3120	1616	1617	1618	1619	1620	1621	1622	1623
3130	1624	1625	1626	1627	1628	1629	1630	1631
3140	1632	1633	1634	1635	1636	1637	1638	1639
3150	1640	1641	1642	1643	1644	1645	1646	1647
3160	1648	1649	1650	1651	1652	1653	1654	1655
3170	1656	1657	1658	1659	1660	1661	1662	1663
3200	1664	1665	1666	1667	1668	1669	1670	1671
3210	1672	1673	1674	1675	1676	1677	1678	1679
3220	1680	1681	1682	1683	1684	1685	1686	1687
3230	1688	1689	1690	1691	1692	1693	1694	1695
3240	1696	1697	1698	1699	1700	1701	1702	1703
3250	1704	1705	1706	1707	1708	1709	1710	1711
3260	1712	1713	1714	1715	1716	1717	1718	1719
3270	1720	1721	1722	1723	1724	1725	1726	1727
3300	1728	1729	1730	1731	1732	1733	1734	1735
3310	1736	1737	1738	1739	1740	1741	1742	1743
3320	1744	1745	1746	1747	1748	1749	1750	1751
3330	1752	1753	1754	1755	1756	1757	1758	1759
3340	1760	1761	1762	1763	1764	1765	1766	1767
3350	1768	1769	1770	1771	1772	1773	1774	1775
3360	1776	1777	1778	1779	1780	1781	1782	1783
3370	1784	1785	1786	1787	1788	1789	1790	1791

	0	1	2	3	4	5	6	7
3400	1792	1793	1794	1795	1796	1797	1798	1799
3410	1800	1801	1802	1803	1804	1805	1806	1807
3420	1808	1809	1810	1811	1812	1813	1814	1815
3430	1816	1817	1818	1819	1820	1821	1822	1823
3440	1824	1825	1826	1827	1828	1829	1830	1831
3450	1832	1833	1834	1835	1836	1837	1838	1839
3460	1840	1841	1842	1843	1844	1845	1846	1847
3470	1848	1849	1850	1851	1852	1853	1854	1855
3500	1856	1857	1858	1859	1860	1861	1862	1863
3510	1864	1865	1866	1867	1868	1869	1870	1871
3520	1872	1873	1874	1875	1876	1877	1878	1879
3530	1880	1881	1882	1883	1884	1885	1886	1887
3540	1888	1889	1890	1891	1892	1893	1894	1895
3550	1896	1897	1898	1899	1900	1901	1902	1903
3560	1904	1905	1906	1907	1908	1909	1910	1911
3570	1912	1913	1914	1915	1916	1917	1918	1919
3600	1920	1921	1922	1923	1924	1925	1926	1927
3610	1928	1929	1930	1931	1932	1933	1934	1935
3620	1936	1937	1938	1939	1940	1941	1942	1943
3630	1944	1945	1946	1947	1948	1949	1950	1951
3640	1952	1953	1954	1955	1956	1957	1958	1959
3650	1960	1961	1962	1963	1964	1965	1966	1967
3660	1968	1969	1970	1971	1972	1973	1974	1975
3670	1976	1977	1978	1979	1980	1981	1982	1983
3700	1984	1985	1986	1987	1988	1989	1990	1991
3710	1992	1993	1994	1995	1996	1997	1998	1999
3720	2000	2001	2002	2003	2004	2005	2006	2007
3730	2008	2009	2010	2011	2012	2013	2014	2015
3740	2016	2017	2018	2019	2020	2021	2022	2023
3750	2024	2025	2026	2027	2028	2029	2030	2031
3760	2032	2033	2034	2035	2036	2037	2038	2039
3770	2040	2041	2042	2043	2044	2045	2046	2047

3000	1536
to	to
3777	2047
(Octal)	(Decimal)

4000 to 4777 (Octal)	2048 to 2559 (Decimal)

Octal	Decimal
10000 -	4096
20000 -	8192
30000 -	12288
40000 -	16384
50000 -	20480
60000 -	24576
70000 -	28672

	0	1	2	3	4	5	6	7
4000	2048	2049	2050	2051	2052	2053	2054	2055
4010	2056	2057	2058	2059	2060	2061	2062	2063
4020	2064	2065	2066	2067	2068	2069	2070	2071
4030	2072	2073	2074	2075	2076	2077	2078	2079
4040	2080	2081	2082	2083	2084	2085	2086	2087
4050	2088	2089	2090	2091	2092	2093	2094	2095
4060	2096	2097	2098	2099	2100	2101	2102	2103
4070	2104	2105	2106	2107	2108	2109	2110	2111
4100	2112	2113	2114	2115	2116	2117	2118	2119
4110	2120	2121	2122	2123	2124	2125	2126	2127
4120	2128	2129	2130	2131	2132	2133	2134	2135
4130	2136	2137	2138	2139	2140	2141	2142	2143
4140	2144	2145	2146	2147	2148	2149	2150	2151
4150	2152	2153	2154	2155	2156	2157	2158	2159
4160	2160	2161	2162	2163	2164	2165	2166	2167
4170	2168	2169	2170	2171	2172	2173	2174	2175
4200	2176	2177	2178	2179	2180	2181	2182	2183
4210	2184	2185	2186	2187	2188	2189	2190	2191
4220	2192	2193	2194	2195	2196	2197	2198	2199
4230	2200	2201	2202	2203	2204	2205	2206	2207
4240	2208	2209	2210	2211	2212	2213	2214	2215
4250	2216	2217	2218	2219	2220	2221	2222	2223
4260	2224	2225	2226	2227	2228	2229	2230	2231
4270	2232	2233	2234	2235	2236	2237	2238	2239
4300	2240	2241	2242	2243	2244	2245	2246	2247
4310	2248	2249	2250	2251	2252	2253	2254	2255
4320	2256	2257	2258	2259	2260	2261	2262	2263
4330	2264	2265	2266	2267	2268	2269	2270	2271
4340	2272	2273	2274	2275	2276	2277	2278	2279
4350	2280	2281	2282	2283	2284	2285	2286	2287
4360	2288	2289	2290	2291	2292	2293	2294	2295
4370	2296	2297	2298	2299	2300	2301	2302	2303

	0	1	2	3	4	5	6	7
4400	2304	2305	2306	2307	2308	2309	2310	2311
4410	2312	2313	2314	2315	2316	2317	2318	2319
4420	2320	2321	2322	2323	2324	2325	2326	2327
4430	2328	2329	2330	2331	2332	2333	2334	2335
4440	2336	2337	2338	2339	2340	2341	2342	2343
4450	2344	2345	2346	2347	2348	2349	2350	2351
4460	2352	2353	2354	2355	2356	2357	2358	2359
4470	2360	2361	2362	2363	2364	2365	2366	2367
4500	2368	2369	2370	2371	2372	2373	2374	2375
4510	2376	2377	2378	2379	2380	2381	2382	2383
4520	2384	2385	2386	2387	2388	2389	2390	2391
4530	2392	2393	2394	2395	2396	2397	2398	2399
4540	2400	2401	2402	2403	2404	2405	2406	2407
4550	2408	2409	2410	2411	2412	2413	2414	2415
4560	2416	2417	2418	2419	2420	2421	2422	2423
4570	2424	2425	2426	2427	2428	2429	2430	2431
4600	2432	2433	2434	2435	2436	2437	2438	2439
4610	2440	2441	2442	2443	2444	2445	2446	2447
4620	2448	2449	2450	2451	2452	2453	2454	2455
4630	2456	2457	2458	2459	2460	2461	2462	2463
4640	2464	2465	2466	2467	2468	2469	2470	2471
4650	2472	2473	2474	2475	2476	2477	2478	2479
4660	2480	2481	2482	2483	2484	2485	2486	2487
4670	2488	2489	2490	2491	2492	2493	2494	2495
4700	2496	2497	2498	2499	2500	2501	2502	2503
4710	2504	2505	2506	2507	2508	2509	2510	2511
4720	2512	2513	2514	2515	2516	2517	2518	2519
4730	2520	2521	2522	2523	2524	2525	2526	2527
4740	2528	2529	2530	2531	2532	2533	2534	2535
4750	2536	2537	2538	2539	2540	2541	2542	2543
4760	2544	2545	2546	2547	2548	2549	2550	2551
4770	2552	2553	2554	2555	2556	2557	2558	2559

5000 to 5777 (Octal)	2560 to 3071 (Decimal)

	0	1	2	3	4	5	6	7
5000	2560	2561	2562	2563	2564	2565	2566	2567
5010	2568	2569	2570	2571	2572	2573	2574	2575
5020	2576	2577	2578	2579	2580	2581	2582	2583
5030	2584	2585	2586	2587	2588	2589	2590	2591
5040	2592	2593	2594	2595	2596	2597	2598	2599
5050	2600	2601	2602	2603	2604	2605	2606	2607
5060	2608	2609	2610	2611	2612	2613	2614	2615
5070	2616	2617	2618	2619	2620	2621	2622	2623
5100	2624	2625	2626	2627	2628	2629	2630	2631
5110	2632	2633	2634	2635	2636	2637	2638	2639
5120	2640	2641	2642	2643	2644	2645	2646	2647
5130	2648	2649	2650	2651	2652	2653	2654	2655
5140	2656	2657	2658	2659	2660	2661	2662	2663
5150	2664	2665	2666	2667	2668	2669	2670	2671
5160	2672	2673	2674	2675	2676	2677	2678	2679
5170	2680	2681	2682	2683	2684	2685	2686	2687
5200	2688	2689	2690	2691	2692	2693	2694	2695
5210	2696	2697	2698	2699	2700	2701	2702	2703
5220	2704	2705	2706	2707	2708	2709	2710	2711
5230	2712	2713	2714	2715	2716	2717	2718	2719
5240	2720	2721	2722	2723	2724	2725	2726	2727
5250	2728	2729	2730	2731	2732	2733	2734	2735
5260	2736	2737	2738	2739	2740	2741	2742	2743
5270	2744	2745	2746	2747	2748	2749	2750	2751
5300	2752	2753	2754	2755	2756	2757	2758	2759
5310	2760	2761	2762	2763	2764	2765	2766	2767
5320	2768	2769	2770	2771	2772	2773	2774	2775
5330	2776	2777	2778	2779	2780	2781	2782	2783
5340	2784	2785	2786	2787	2788	2789	2790	2791
5350	2792	2793	2794	2795	2796	2797	2798	2799
5360	2800	2801	2802	2803	2804	2805	2806	2807
5370	2808	2809	2810	2811	2812	2813	2814	2815

	0	1	2	3	4	5	6	7
5400	2816	2817	2818	2819	2820	2821	2822	2823
5410	2824	2825	2826	2827	2828	2829	2830	2831
5420	2832	2833	2834	2835	2836	2837	2838	2839
5430	2840	2841	2842	2843	2844	2845	2846	2847
5440	2848	2849	2850	2851	2852	2853	2854	2855
5450	2856	2857	2858	2859	2860	2861	2862	2863
5460	2864	2865	2866	2867	2868	2869	2870	2871
5470	2872	2873	2874	2875	2876	2877	2878	2879
5500	2880	2881	2882	2883	2884	2885	2886	2887
5510	2888	2889	2890	2891	2892	2893	2894	2895
5520	2896	2897	2898	2899	2900	2901	2902	2903
5530	2904	2905	2906	2907	2908	2909	2910	2911
5540	2912	2913	2914	2915	2916	2917	2918	2919
5550	2920	2921	2922	2923	2924	2925	2926	2927
5560	2928	2929	2930	2931	2932	2933	2934	2935
5570	2936	2937	2938	2939	2940	2941	2942	2943
5600	2944	2945	2946	2947	2948	2949	2950	2951
5610	2952	2953	2954	2955	2956	2957	2958	2959
5620	2960	2961	2962	2963	2964	2965	2966	2967
5630	2968	2969	2970	2971	2972	2973	2974	2975
5640	2976	2977	2978	2979	2980	2981	2982	2983
5650	2984	2985	2986	2987	2988	2989	2990	2991
5660	2992	2993	2994	2995	2996	2997	2998	2999
5670	3000	3001	3002	3003	3004	3005	3006	3007
5700	3008	3009	3010	3011	3012	3013	3014	3015
5710	3016	3017	3018	3019	3020	3021	3022	3023
5720	3024	3025	3026	3027	3028	3029	3030	3031
5730	3032	3033	3034	3035	3036	3037	3038	3039
5740	3040	3041	3042	3043	3044	3045	3046	3047
5750	3048	3049	3050	3051	3052	3053	3054	3055
5760	3056	3057	3058	3059	3060	3061	3062	3063
5770	3064	3065	3066	3067	3068	3069	3070	3071

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6000	3072	3073	3074	3075	3076	3077	3078	3079
6010	3080	3081	3082	3083	3084	3085	3086	3087
6020	3088	3089	3090	3091	3092	3093	3094	3095
6030	3096	3097	3098	3099	3100	3101	3102	3103
6040	3104	3105	3106	3107	3108	3109	3110	3111
6050	3112	3113	3114	3115	3116	3117	3118	3119
6060	3120	3121	3122	3123	3124	3125	3126	3127
6070	3128	3129	3130	3131	3132	3133	3134	3135
6100	3136	3137	3138	3139	3140	3141	3142	3143
6110	3144	3145	3146	3147	3148	3149	3150	3151
6120	3152	3153	3154	3155	3156	3157	3158	3159
6130	3160	3161	3162	3163	3164	3165	3166	3167
6140	3168	3169	3170	3171	3172	3173	3174	3175
6150	3176	3177	3178	3179	3180	3181	3182	3183
6160	3184	3185	3186	3187	3188	3189	3190	3191
6170	3192	3193	3194	3195	3196	3197	3198	3199
6200	3200	3201	3202	3203	3204	3205	3206	3207
6210	3208	3209	3210	3211	3212	3213	3214	3215
6220	3216	3217	3218	3219	3220	3221	3222	3223
6230	3224	3225	3226	3227	3228	3229	3230	3231
6240	3232	3233	3234	3235	3236	3237	3238	3239
6250	3240	3241	3242	3243	3244	3245	3246	3247
6260	3248	3249	3250	3251	3252	3253	3254	3255
6270	3256	3257	3258	3259	3260	3261	3262	3263
6300	3264	3265	3266	3267	3268	3269	3270	3271
6310	3272	3273	3274	3275	3276	3277	3278	3279
6320	3280	3281	3282	3283	3284	3285	3286	3287
6330	3288	3289	3290	3291	3292	3293	3294	3295
6340	3296	3297	3298	3299	3300	3301	3302	3303
6350	3304	3305	3306	3307	3308	3309	3310	3311
6360	3312	3313	3314	3315	3316	3317	3318	3319
6370	3320	3321	3322	3323	3324	3325	3326	3327

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6410	3336	3337	3338	3339	3340	3341	3342	3343
6420	3344	3345	3346	3347	3348	3349	3350	3351
6430	3352	3353	3354	3355	3356	3357	3358	3359
6440	3360	3361	3362	3363	3364	3365	3366	3367
6450	3368	3369	3370	3371	3372	3373	3374	3375
6460	3376	3377	3378	3379	3380	3381	3382	3383
6470	3384	3385	3386	3387	3388	3389	3390	3391
6500	3392	3393	3394	3395	3396	3397	3398	3399
6510	3400	3401	3402	3403	3404	3405	3406	3407
6520	3408	3409	3410	3411	3412	3413	3414	3415
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6570	3448	3449	3450	3451	3452	3453	3454	3455
6600	3456	3457	3458	3459	3460	3461	3462	3463
6610	3464	3465	3466	3467	3468	3469	3470	3471
6620	3472	3473	3474	3475	3476	3477	3478	3479
6630	3480	3481	3482	3483	3484	3485	3486	3487
6640	3488	3489	3490	3491	3492	3493	3494	3495
6650	3496	3497	3498	3499	3500	3501	3502	3503
6660	3504	3505	3506	3507	3508	3509	3510	3511
6670	3512	3513	3514	3515	3516	3517	3518	3519
6700	3520	3521	3522	3523	3524	3525	3526	3527
6710	3528	3529	3530	3531	3532	3533	3534	3535
6720	3536	3537	3538	3539	3540	3541	3542	3543
6730	3544	3545	3546	3547	3548	3549	3550	3551
6740	3552	3553	3554	3555	3556	3557	3558	3559
6750	3560	3561	3562	3563	3564	3565	3566	3567
6760	3568	3569	3570	3571	3572	3573	3574	3575
6770	3576	3577	3578	3579	3580	3581	3582	3583

6000	3072
to	to
6777	3583
(Octal)	(Decimal)

Octal	Decimal
10000 -	4096
20000 -	8192
30000 -	12288
40000 -	16384
50000 -	20480
60000 -	24576
70000 -	28672

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7000	3584	3585	3586	3587	3588	3589	3590	3591
7010	3592	3593	3594	3595	3596	3597	3598	3599
7020	3600	3601	3602	3603	3604	3605	3606	3607
7030	3608	3609	3610	3611	3612	3613	3614	3615
7040	3616	3617	3618	3619	3620	3621	3622	3623
7050	3624	3625	3626	3627	3628	3629	3630	3631
7060	3632	3633	3634	3635	3636	3637	3638	3639
7070	3640	3641	3642	3643	3644	3645	3646	3647
7100	3648	3649	3650	3651	3652	3653	3654	3655
7110	3656	3657	3658	3659	3660	3661	3662	3663
7120	3664	3665	3666	3667	3668	3669	3670	3671
7130	3672	3673	3674	3675	3676	3677	3678	3679
7140	3680	3681	3682	3683	3684	3685	3686	3687
7150	3688	3689	3690	3691	3692	3693	3694	3695
7160	3696	3697	3698	3699	3700	3701	3702	3703
7170	3704	3705	3706	3707	3708	3709	3710	3711
7200	3712	3713	3714	3715	3716	3717	3718	3719
7210	3720	3721	3722	3723	3724	3725	3726	3727
7220	3728	3729	3730	3731	3732	3733	3734	3735
7230	3736	3737	3738	3739	3740	3741	3742	3743
7240	3744	3745	3746	3747	3748	3749	3750	3751
7250	3752	3753	3754	3755	3756	3757	3758	3759
7260	3760	3761	3762	3763	3764	3765	3766	3767
7270	3768	3769	3770	3771	3772	3773	3774	3775
7300	3776	3777	3778	3779	3780	3781	3782	3783
7310	3784	3785	3786	3787	3788	3789	3790	3791
7320	3792	3793	3794	3795	3796	3797	3798	3799
7330	3800	3801	3802	3803	3804	3805	3806	3807
7340	3808	3809	3810	3811	3812	3813	3814	3815
7350	3816	3817	3818	3819	3820	3821	3822	3823
7360	3824	3825	3826	3827	3828	3829	3830	3831
7370	3832	3833	3834	3835	3836	3837	3838	3839

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7400	3840	3841	3842	3843	3844	3845	3846	3847
7410	3848	3849	3850	3851	3852	3853	3854	3855
7420	3856	3857	3858	3859	3860	3861	3862	3863
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7440	3872	3873	3874	3875	3876	3877	3878	3879
7450	3880	3881	3882	3883	3884	3885	3886	3887
7460	3888	3889	3890	3891	3892	3893	3894	3895
7470	3896	3897	3898	3899	3900	3901	3902	3903
7500	3904	3905	3906	3907	3908	3909	3910	3911
7510	3912	3913	3914	3915	3916	3917	3918	3919
7520	3920	3921	3922	3923	3924	3925	3926	3927
7530	3928	3929	3930	3931	3932	3933	3934	3935
7540	3936	3937	3938	3939	3940	3941	3942	3943
7550	3944	3945	3946	3947	3948	3949	3950	3951
7560	3952	3953	3954	3955	3956	3957	3958	3959
7570	3960	3961	3962	3963	3964	3965	3966	3967
7600	3968	3969	3970	3971	3972	3973	3974	3975
7610	3976	3977	3978	3979	3980	3981	3982	3983
7620	3984	3985	3986	3987	3988	3989	3990	3991
7630	3992	3993	3994	3995	3996	3997	3998	3999
7640	4000	4001	4002	4003	4004	4005	4006	4007
7650	4008	4009	4010	4011	4012	4013	4014	4015
7660	4016	4017	4018	4019	4020	4021	4022	4023
7670	4024	4025	4026	4027	4028	4029	4030	4031
7700	4032	4033	4034	4035	4036	4037	4038	4039
7710	4040	4041	4042	4043	4044	4045	4046	4047
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7730	4056	4057	4058	4059	4060	4061	4062	4063
7740	4064	4065	4066	4067	4068	4069	4070	4071
7750	4072	4073	4074	4075	4076	4077	4078	4079
7760	4080	4081	4082	4083	4084	4085	4086	4087
7770	4088	4089	4090	4091	4092	4093	4094	4095

7000	3584
to	to
7777	4095
(Octal)	(Decimal)

OCTAL-DECIMAL FRACTION CONVERSION TABLES

OCTAL	DEC.	OCTAL	DEC.	OCTAL	DEC.	OCTAL	DEC.
.000	.000000	.100	.125000	.200	.250000	.300	.375000
.001	.001953	.101	.126953	.201	.251953	.301	.376953
.002	.003906	.102	.128906	.202	.253906	.302	.378906
.003	.005859	.103	.130859	.203	.255859	.303	.380859
.004	.007812	.104	.132812	.204	.257812	.304	.382812
.005	.009765	.105	.134765	.205	.259765	.305	.384765
.006	.011718	.106	.136718	.206	.261718	.306	.386718
.007	.013671	.107	.138671	.207	.263671	.307	.388671
.010	.015625	.110	.140625	.210	.265625	.310	.390625
.011	.017578	.111	.142578	.211	.267578	.311	.392578
.012	.019531	.112	.144531	.212	.269531	.312	.394531
.013	.021484	.113	.146484	.213	.271484	.313	.396484
.014	.023437	.114	.148437	.214	.273437	.314	.398437
.015	.025390	.115	.150390	.215	.275390	.315	.400390
.016	.027343	.116	.152343	.216	.277343	.316	.402343
.017	.029296	.117	.154296	.217	.279296	.317	.404296
.020	.031250	.120	.156250	.220	.281250	.320	.406250
.021	.033203	.121	.158203	.221	.283203	.321	.408203
.022	.035156	.122	.160156	.222	.285156	.322	.410156
.023	.037109	.123	.162109	.223	.287109	.323	.412109
.024	.039062	.124	.164062	.224	.289062	.324	.414062
.025	.041015	.125	.166015	.225	.291015	.325	.416015
.026	.042968	.126	.167968	.226	.292968	.326	.417968
.027	.044921	.127	.169921	.227	.294921	.327	.419921
.030	.046875	.130	.171875	.230	.296875	.330	.421875
.031	.048828	.131	.173828	.231	.298828	.331	.423828
.032	.050781	.132	.175781	.232	.300781	.332	.426781
.033	.052734	.133	.177734	.233	.302734	.333	.427734
.034	.054687	.134	.179687	.234	.304687	.334	.429687
.035	.056640	.135	.181640	.235	.306640	.335	.431640
.036	.058593	.136	.183593	.236	.308593	.336	.433593
.037	.060546	.137	.185546	.237	.310546	.337	.435546
.040	.062500	.140	.187500	.240	.312500	.340	.437500
.041	.064453	.141	.189453	.241	.314453	.341	.439453
.042	.066406	.142	.191406	.242	.316406	.342	.441406
.043	.068359	.143	.193359	.243	.318359	.343	.443359
.044	.070312	.144	.195312	.244	.320312	.344	.445312
.045	.072265	.145	.197265	.245	.322265	.345	.447265
.046	.074218	.146	.199218	.246	.324218	.346	.449218
.047	.076171	.147	.201171	.247	.326171	.347	.451171
.050	.078125	.150	.203125	.250	.328125	.350	.453125
.051	.080078	.151	.205078	.251	.330078	.351	.455078
.052	.082031	.152	.207031	.252	.332031	.352	.457031
.053	.083984	.153	.208984	.253	.333984	.353	.458984
.054	.085937	.154	.210937	.254	.335937	.354	.460937
.055	.087890	.155	.212890	.255	.337890	.355	.462890
.056	.089843	.156	.214843	.256	.339843	.356	.464843
.057	.091796	.157	.216796	.257	.341796	.357	.466796
.060	.093750	.160	.218750	.260	.343750	.360	.468750
.061	.095703	.161	.220703	.261	.345703	.361	.470703
.062	.097656	.162	.222656	.262	.347656	.362	.472656
.063	.099609	.163	.224609	.263	.349609	.363	.474609
.064	.101662	.164	.226562	.264	.351562	.364	.476562
.065	.103515	.165	.228515	.265	.353515	.365	.478515
.066	.105468	.166	.230468	.266	.355468	.366	.480468
.067	.107421	.167	.232421	.267	.357421	.367	.482421
.070	.109375	.170	.234375	.270	.359375	.370	.484375
.071	.111328	.171	.236328	.271	.361328	.371	.486328
.072	.113281	.172	.238281	.272	.363281	.372	.488281
.073	.115234	.173	.240234	.273	.365234	.373	.490234
.074	.117187	.174	.242187	.274	.367187	.374	.492187
.075	.119140	.175	.244140	.275	.369140	.375	.494140
.076	.121093	.176	.246093	.276	.371093	.376	.496093
.077	.123046	.177	.248046	.277	.373046	.377	.498046

OCTAL	DEC.	OCTAL	DEC.	OCTAL	DEC.	OCTAL	DEC.
.000000	.000000	.000100	.000244	.000200	.000488	.000300	.000732
.000001	.000003	.000101	.000247	.000201	.000492	.000301	.000736
.000002	.000007	.000102	.000251	.000202	.000495	.000302	.000740
.000003	.000011	.000103	.000255	.000203	.000499	.000303	.000743
.000004	.000015	.000104	.000259	.000204	.000503	.000304	.000747
.000005	.000019	.000105	.000263	.000205	.000507	.000305	.000751
.000006	.000022	.000106	.000267	.000206	.000511	.000306	.000755
.000007	.000026	.000107	.000270	.000207	.000514	.000307	.000759
.000010	.000030	.000110	.000274	.000210	.000518	.000310	.000762
.000011	.000034	.000111	.000278	.000211	.000522	.000311	.000766
.000012	.000038	.000112	.000282	.000212	.000526	.000312	.000770
.000013	.000041	.000113	.000286	.000213	.000530	.000313	.000774
.000014	.000045	.000114	.000289	.000214	.000534	.000314	.000778
.000015	.000049	.000115	.000293	.000215	.000537	.000315	.000782
.000016	.000053	.000116	.000297	.000216	.000541	.000316	.000785
.000017	.000057	.000117	.000301	.000217	.000545	.000317	.000789
.000020	.000061	.000120	.000305	.000220	.000549	.000320	.000793
.000021	.000064	.000121	.000308	.000221	.000553	.000321	.000797
.000022	.000068	.000122	.000312	.000222	.000556	.000322	.000801
.000023	.000072	.000123	.000316	.000223	.000560	.000323	.000805
.000024	.000076	.000124	.000320	.000224	.000564	.000324	.000808
.000025	.000080	.000125	.000324	.000225	.000568	.000325	.000812
.000026	.000083	.000126	.000328	.000226	.000572	.000326	.000816
.000027	.000087	.000127	.000331	.000227	.000576	.000327	.000820
.000030	.000091	.000130	.000335	.000230	.000579	.000330	.000823
.000031	.000095	.000131	.000339	.000231	.000583	.000331	.000827
.000032	.000099	.000132	.000343	.000232	.000587	.000332	.000831
.000033	.000102	.000133	.000347	.000233	.000591	.000333	.000835
.000034	.000106	.000134	.000350	.000234	.000595	.000334	.000839
.000035	.000110	.000135	.000354	.000235	.000598	.000335	.000843
.000036	.000114	.000136	.000358	.000236	.000602	.000336	.000846
.000037	.000118	.000137	.000362	.000237	.000606	.000337	.000850
.000040	.000122	.000140	.000366	.000240	.000610	.000340	.000854
.000041	.000125	.000141	.000370	.000241	.000614	.000341	.000858
.000042	.000129	.000142	.000373	.000242	.000617	.000342	.000862
.000043	.000133	.000143	.000377	.000243	.000621	.000343	.000865
.000044	.000137	.000144	.000381	.000244	.000625	.000344	.000869
.000045	.000141	.000145	.000385	.000245	.000629	.000345	.000873
.000046	.000144	.000146	.000389	.000246	.000633	.000346	.000877
.000047	.000148	.000147	.000392	.000247	.000637	.000347	.000881
.000050	.000152	.000150	.000396	.000250	.000640	.000350	.000885
.000051	.000156	.000151	.000400	.000251	.000644	.000351	.000888
.000052	.000160	.000152	.000404	.000252	.000648	.000352	.000892
.000053	.000164	.000153	.000408	.000253	.000652	.000353	.000896
.000054	.000167	.000154	.000411	.000254	.000656	.000354	.000900
.000055	.000171	.000155	.000415	.000255	.000659	.000355	.000904
.000056	.000175	.000156	.000419	.000256	.000663	.000356	.000907
.000057	.000179	.000157	.000423	.000257	.000667	.000357	.000911
.000060	.000183	.000160	.000427	.000260	.000671	.000360	.000915
.000061	.000186	.000161	.000431	.000261	.000675	.000361	.000919
.000062	.000190	.000162	.000434	.000262	.000679	.000362	.000923
.000063	.000194	.000163	.000438	.000263	.000682	.000363	.000926
.000064	.000198	.000164	.000442	.000264	.000686	.000364	.000930
.000065	.000202	.000165	.000446	.000265	.000690	.000365	.000934
.000066	.000205	.000166	.000450	.000266	.000694	.000366	.000938
.000067	.000209	.000167	.000453	.000267	.000698	.000367	.000942
.000070	.000213	.000170	.000457	.000270	.000701	.000370	.000946
.000071	.000217	.000171	.000461	.000271	.000705	.000371	.000949
.000072	.000221	.000172	.000465	.000272	.000709	.000372	.000953
.000073	.000225	.000173	.000469	.000273	.000713	.000373	.000957
.000074	.000228	.000174	.000473	.000274	.000717	.000374	.000961
.000075	.000232	.000175	.000476	.000275	.000720	.000375	.000965
.000076	.000236	.000176	.000480	.000276	.000724	.000376	.000968
.000077	.000240	.000177	.000484	.000277	.000728	.000377	.000972

OCTAL	DEC.	OCTAL	DEC.	OCTAL	DEC.	OCTAL	DEC.
.000400	.000976	.000500	.001220	.000600	.001464	.000700	.001708
.000401	.000980	.000501	.001224	.000601	.001468	.000701	.001712
.000402	.000984	.000502	.001228	.000602	.001472	.000702	.001716
.000403	.000988	.000503	.001232	.000603	.001476	.000703	.001720
.000404	.000991	.000504	.001235	.000604	.001480	.000704	.001724
.000405	.000995	.000505	.001239	.000605	.001483	.000705	.001728
.000406	.000999	.000506	.001243	.000606	.001487	.000706	.001731
.000407	.001003	.000507	.001247	.000607	.001491	.000707	.001735
.000410	.001007	.000510	.001251	.000610	.001495	.000710	.001739
.000411	.001010	.000511	.001255	.000611	.001499	.000711	.001743
.000412	.001014	.000512	.001258	.000612	.001502	.000712	.001747
.000413	.001018	.000513	.001262	.000613	.001506	.000713	.001750
.000414	.001022	.000514	.001266	.000614	.001510	.000714	.001754
.000415	.001026	.000515	.001270	.000615	.001514	.000715	.001758
.000416	.001029	.000516	.001274	.000616	.001518	.000716	.001762
.000417	.001033	.000517	.001277	.000617	.001522	.000717	.001766
.000420	.001037	.000520	.001281	.000620	.001525	.000720	.001770
.000421	.001041	.000521	.001285	.000621	.001529	.000721	.001773
.000422	.001045	.000522	.001289	.000622	.001533	.000722	.001777
.000423	.001049	.000523	.001293	.000623	.001537	.000723	.001781
.000424	.001052	.000524	.001296	.000624	.001541	.000724	.001785
.000425	.001056	.000525	.001300	.000625	.001544	.000725	.001789
.000426	.001060	.000526	.001304	.000626	.001548	.000726	.001792
.000427	.001064	.000527	.001308	.000627	.001552	.000727	.001796
.000430	.001068	.000530	.001312	.000630	.001556	.000730	.001800
.000431	.001071	.000531	.001316	.000631	.001560	.000731	.001804
.000432	.001075	.000532	.001319	.000632	.001564	.000732	.001808
.000433	.001079	.000533	.001323	.000633	.001567	.000733	.001811
.000434	.001083	.000534	.001327	.000634	.001571	.000734	.001815
.000435	.001087	.000535	.001331	.000635	.001575	.000735	.001819
.000436	.001091	.000536	.001335	.000636	.001579	.000736	.001823
.000437	.001094	.000537	.001338	.000637	.001583	.000737	.001827
.000440	.001098	.000540	.001342	.000640	.001586	.000740	.001831
.000441	.001102	.000541	.001346	.000641	.001590	.000741	.001834
.000442	.001106	.000542	.001350	.000642	.001594	.000742	.001838
.000443	.001110	.000543	.001354	.000643	.001598	.000743	.001842
.000444	.001113	.000544	.001358	.000644	.001602	.000744	.001846
.000445	.001117	.000545	.001361	.000645	.001605	.000745	.001850
.000446	.001121	.000546	.001365	.000646	.001609	.000746	.001853
.000447	.001125	.000547	.001369	.000647	.001613	.000747	.001857
.000450	.001129	.000550	.001373	.000650	.001617	.000750	.001861
.000451	.001132	.000551	.001377	.000651	.001621	.000751	.001865
.000452	.001136	.000552	.001380	.000652	.001625	.000752	.001869
.000453	.001140	.000553	.001384	.000653	.001628	.000753	.001873
.000454	.001144	.000554	.001388	.000654	.001632	.000754	.001876
.000455	.001148	.000555	.001392	.000655	.001636	.000755	.001880
.000456	.001152	.000556	.001396	.000656	.001640	.000756	.001884
.000457	.001155	.000557	.001399	.000657	.001644	.000757	.001888
.000460	.001159	.000560	.001403	.000660	.001647	.000760	.001892
.000461	.001163	.000561	.001407	.000661	.001651	.000761	.001895
.000462	.001167	.000562	.001411	.000662	.001655	.000762	.001899
.000463	.001171	.000563	.001415	.000663	.001659	.000763	.001903
.000464	.001174	.000564	.001419	.000664	.001663	.000764	.001907
.000465	.001178	.000565	.001422	.000665	.001667	.000765	.001911
.000466	.001182	.000566	.001426	.000666	.001670	.000766	.001914
.000467	.001186	.000567	.001430	.000667	.001674	.000767	.001918
.000470	.001190	.000570	.001434	.000670	.001678	.000770	.001922
.000471	.001194	.000571	.001438	.000671	.001682	.000771	.001926
.000472	.001197	.000572	.001441	.000672	.001686	.000772	.001930
.000473	.001201	.000573	.001445	.000673	.001689	.000773	.001934
.000474	.001205	.000574	.001449	.000674	.001693	.000774	.001937
.000475	.001209	.000575	.001453	.000675	.001697	.000775	.001941
.000476	.001213	.000576	.001457	.000676	.001701	.000776	.001945
.000477	.001216	.000577	.001461	.000677	.001705	.000777	.001949

LFI CURVE EXAMPLE