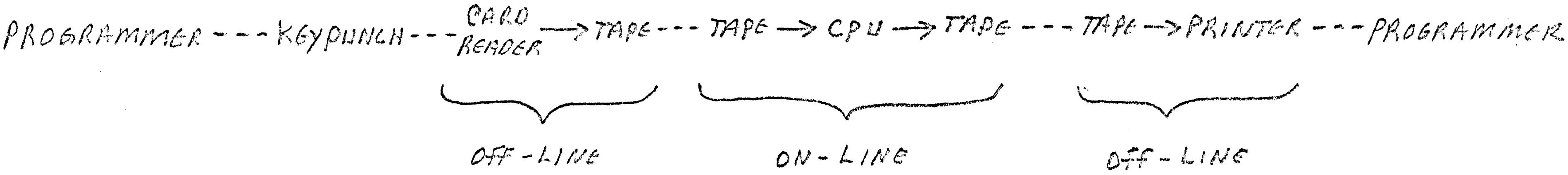
6000 SCOPE 3 HANDOUTS

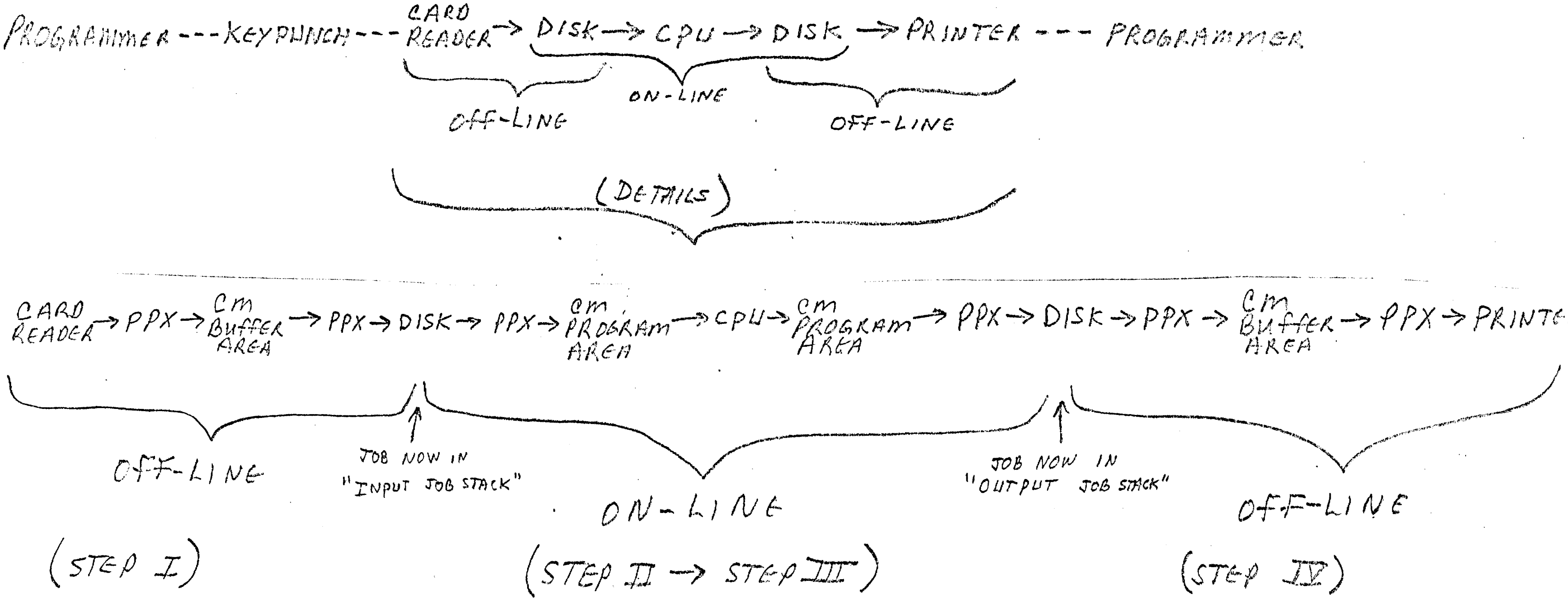
INTRODUCTION

this document is intended primarily as an instructional handout and is intended to be used in the 6000 SCOPE 3.X Operating System courses. It is *not* intended to replace the 6000 Scope 3.1 Reference Manual or the 6000 SCOPE 3.1 I.M.S. manual. Rather it is to be used *with* them.

NON-6000 SYSTEM PROGRAM FLOW



6000 SYSTEM PROGRAM FLOW



PROGRAM FLOW CHART

PROGRAM FLOW STEPS

STEP I - LOAD JOB

A. CARD READER TO DISK OPERATION.
B. RECORD JOB NAME, PRIORITY, FL, AND WHERE PLACED ON DISK. IN CMR.
C. READ NEXT JOB (RETURN TO A)

STEP II - BEGIN JOB

A. SEARCH LIST OF JOBS PLACED ON DISK FOR THE HIGHEST PRIORITY JOB
B. IF FOUND, LOAD CONTROL CARDS TO CONTROL POINT AREA IN CMR.
C. TRANSLATE JOB CARD AND SET UP CONTROL POINT AREA.
D. SET UP CONDITIONS WHICH WILL INDICATE TO MTR TO INITIATE STEP III

STEP III - ADVANCE JOB

A. TRANSLATE NEXT CONTROL CARD AND CAUSE EXECUTION OF IT.
B. WHEN EXECUTION FINISHED, MTR CAUSES A RETURN TO "A".
C. LAST CARD EXECUTED, UNNEEDED FILES ARE DROPPED, EQUIPMENT IS DROPPED, JOB NAME AND PRIORITY ASSIGNED TO THE OUTPUT FILE, CLEAR OUT THE CONTROL POINT AREA.
D. CALL FOR STEP II'S SYSTEM PROGRAM. (RETURN TO STEP II)

STEP IV - DUMP JOB

A. SEARCH FOR A JOB READY TO BE DUMPED
B. IF ONE FOUND, ASSIGN TO CONTROL POINTS "BUFFER POINT" AND DUMP THE JOB
C. DUMP THE DAYFILE FOR THE JOB ON THE PRINTER.
D. DROP THE FILE.

6000 SCOPE 3.1

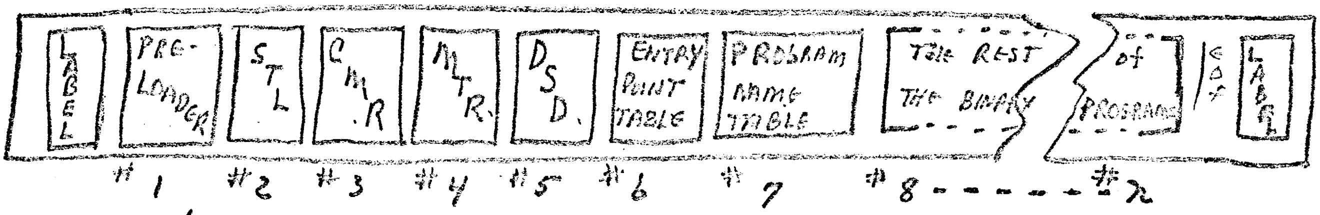
1-1-8

I. 2 FILES MAKE UP THE OPERATING SYSTEM:

A. 1st FILE IS THE BINARY DEAD START PORTION

1. 2 VERSIONS
   a. 6603 DISK FILE
   b. 6638 DISK FILE

2. FORMAT OF BINARY FILE –



(LOGICAL RECORDS)

B. 2nd FILE IS PROGRAM LIBRARY, "OLDPL".

1. CONSISTING OF;
   a. 1st RECORD HAS;
      1) 1st WORD CONTAINS 2 COUNTERS; COUNT OF THE IDENTIFIERS IN THE IDENTIFIER SECTION (BITS 35-18) AND THE COUNT OF THE DECK NAMES (17-00).
      2) A DIRECTORY WHICH CONTAINS A LIST OF ALL IDENTIFIERS USED. ("CORRECTION IDENTIFIERS")
      3) A DECK LIST WHICH CONTAINS A LIST OF ALL DECKS WHICH OCCURR OR HAVE OCCURRED ON THE FILE. ("DECK NAMES CURRENTLY KNOWN")
      4) THE TEXT STREAM WHICH CONTAIN THE CARD IMAGES AND CONTROL INFORMATION, KNOWN AS "CORRECTION HISTORY BYTES".
   b. THE BINARY DECKS OF THE PRODUCT SET, EACH CONSTITUTING A RECORD.

   n

   ENDING IN E.O.F.

PROGRAM LIBRARY CONTENTS

COMMON DECKS

COMFILE	the deck containing definitions of system symbols
FNTSRCH	a routine to search the FNT for a specified file name
READPP	a routine to read a record directly into PP memory
BUFINIT	a routine to initiallize PP memory for a call to READPP
RELOC	a set of macros which,if called,will cause a PP routine to be self-relocating
PPTIME	a routine to enter PP time into the system dayfile
COMCOMP	a micro which defines the COMPASS version number
TRNCOM	a set of declarations for use by the translator subroutines

TEXT DECKS

TAPEDS	program to generate the tape dead-start card
DISCDS	program to generate the disc dead-start card
DUMPDS	program to generate the dead-start dump cards
RECOV	program to generate the recovery dead-start card
PREPP	PP portion of the system pre-loader
PRECP	CP portion of the system pre-loader
STLPP	PP portion of the system dead-start loader
STLCP	CP portion of the system dead-start loader
CMR	central memory resident
MTR	system monitor
DSD	system display
CIO	central input/output package
LDR	relocatable loader
LOD	relocatable loader
MSG	routine to enter messages into the dayfile

RFL	routine to request field length
1AJ	routine to advance control point
1BJ	routine to bring a job to a control point
1LJ	routine to load a job from the card reader
1OT	routine to control printing and punching of output
1SP	6603 stack processor
2BP	routine to check buffer parameters (FET)
2EF	routine to process error flag
2ES	routine to enter a stack request
2RC	routine to read cards
2TR	routine to read 3000 magnetic tapes
2TS	routine to translate control card statements
2TW	routine to write 3000 magnetic tapes
ATS	STITCH routine
CHK	routine to check output file for RUN compiler
CKP	routine to take checkpoint dumps
CLL	STITCH routine
CLO	routine to close a file
CLS	STITCH routine
CPL	STITCH routine
CTS	routine to process COMMON function
DIS	job display
DMP	routine to dump central memory
EXU	STITCH routine

LBC	routine to load binary cards from INPUT
LOC	routine to load octal correctors from INPUT
MDI	routine to move system directory (EDITLIB)
MEM	routine to process MEMORY function
OPE	routine to open a file
PBC	routine to punch binary cards from central memory
RBR	routine to read a binary record
REQ	routine to process a REQUEST card or function
RST	routine to restart a job from a checkpoint file
SRB	routine to enter an expanded disc address into the directory (EDITLIB)
TIM	routine to process a TIME, DATE, CLOCK, or JDATE function
WBR	routine to write a binary record
1BT	routine to initiallize a blank tape
1CO	routine to complete OUTPUT file
1CY	routine to copy a file to the checkpoint file
1DF	routine to dump the dayfile
1LT	routine to load a job from magnetic tape
1MF	routine to open a tape file (multi-file tape)
1MR	routine to open a tape file (multi-reel tape)
1MW	routine to open a tape file
1OD	routine to open a file
1PL	routine to process plotter output (dummy)
1PO	routine to process punch output
1RI	routine to process the ROLLIN type-in

1RO	routine to process the ROLLOUT type-in
1SX	routine to enter stack processor error messages into the dayfile
1TD	routine to dump output files to tape
2CA	checkpoint abort procedure
2CF	routine to close files in preparation for the output queue
2CJ	routine to append the control point dayfile to the primary output file
2DF	routine to drop a file from the system
2LA	relocatable loader overlay
2LB	relocatable loader overlay
2LE	relocatable loader overlay to process error conditions
2LP	routine to process on-line print output
2PC	routine to process punch output
2RT	routine to read 6000 magnetic tapes
2TB	routine to handle backward motion on 3000 magnetic tapes
2TF	routine to handle forward motion on 3000 magnetic tapes
2TJ	routine to translate job cards
2WT	routine to write 6000 magnetic tapes
3OT	routine to process print output from the OUTPUT package
4LB	routine to handle label-processing
7TP	routine to handle write parity errors on 3000 magnetic tapes

LOADER	central memory portion of the relocatable loader
OVERLOD	abbreviated central memory loader for loading overlays
QXX	STITCH routine
EDITLIB	program for producing and editting system libraries
EDITSYM	program for producing and editting program libraries
COPYBCD	program for writing discrete print line images on magnetic tape
CPC	program for communicating requests from central memory to the system
IORANDM	routine for processing SCOPE style indexes
IO	routine to handle blocking/deblocking
COMPARE	routine to compare contents of two files
RESTART	routine to initiate the restarting of a job from a checkpoint file
BKSP	routine to backspace a file one or more logical records
COPY	routine to create a job stack on magnetic tape
COPYBF	routine to copy one or more binary files
COPYN	routine to copy selected records or files
COPYSBF	routine to format a packed display code binary file for printing
REWIND	routine to rewind a file
SYSTEXT	source deck of the system macros

DEFUNCT PP OVERLAYS

Name	Replacement
HLP	EDITLIB includes HLP's function
PBS	Punching in I-mode not necessary
SOS	EDITLIB includes SOS's function
1DS	Function included in DIS
1RF	Dead-start recovery card
2BD	Stack processor
2DT	Stack processor/central memory tables
2RD	Stack processor
2WD	Stack processor
3SD	Dayfile search is not necessary
4SD	Dayfile search is not necessary
7DP	Stack processor

COMFILE

The first of the common decks contained in the SCOPE program library is COMFILE. The purpose of COMFILE is to gather all system parameters together in one centralized location so that they may be easily examined and/or altered. Each parameter is referenced by a system symbol which consists of three parts:

- -- an identifier of one or two characters denoting the category to which the symbol belongs;
- -- "." a period following the identifier to indicate that this symbol is part of COMFILE;
- -- a mnemonic of 1 to 6 characters suggesting the meaning of the symbol.

The definition of symbols of the above form should be avoided when COMFILE is to be called.

The system symbols in COMFILE reference the following categories of parameters:

- -- installation parameters
- -- system table lengths
- -- system locations, words, and bytes
- -- pointer words
- -- PP resident entry points
- -- monitor functions
- -- quantities of system elements (number of tables, devices, etc.)
- -- PP direct locations

The set of system symbols is easily expandable as new symbols are defined. The set is callable from each system routine by use of a single card:

*CALL,COMFILE

When COMFILE is called, a listing of COMFILE may be obtained by defining the symbol called LISTCOMF before the call to COMFILE.

SYSTEM SYMBOL IDENTIFIER DEFINITIONS

C.	Most C.x symbols represent 12-bit byte positions within central memory words, where bytes are numbered from left to right as 0 through 4. C.x symbols are also used to represent first word addresses of PP overlays.
CP.	CP.x symbols represent words or start of programs in the CP resident area.
D.	The D.x symbols represent PP direct locations (low core); they are equated to 6-bit values from 00 through 77_8.
IP.	All IP.x symbols represent installation parameters.
L.	The L.x symbols represent table lengths or lengths of miscellaneous quantities.
LE.	The LE.x symbols represent the lengths of entries within tables.
M.	M.x symbols are equated to the values representing monitor functions.
F.	F.x symbols are equated to error flag values.

CH.	CH.x symbols represent pseudo-channel assignments; e.g., CH.FNT is the File Name Table channel.
N.	N.x symbols represent quantities of things; e.g., N.DEVICE is equated to the number of allocatable devices within the system.
Ø.	Ø.x symbols represent stack processor orders (commands). It should be noted that these orders do not correspond to values used in the code and status FET field: stack processor orders are designed for ease of use by the stack processor.
ØV.	ØV.x symbols represent 3-character display code PP overlay names. There is one such symbol for each overlay; the mnemonic (x) is, in all cases, the 3-character overlay name. The appropriate ØV.x should be referenced whenever an overlay is to be loaded in order to force an entry in the cross reference table.
P.	P.x symbols represent locations of central memory pointer words.
R.	R.x symbols represent PP resident entry points.
S.	S.x symbols represent the right offset of a field within a PP word, i.e. the number of bit positions which must be right shifted to right-justify the field to bit 0.

T. The T.x symbols are equated to the first word addresses of central memory tables. In general, these addresses should be obtained from the contents of the pointer words rather than direct use of T.x symbols.

W.x The W.x symbols are equated to values representing the relative positions of central memory words within tables. For example, assume that the address of a control point area is contained in the PP A-register; then to obtain the word containing the job name, the following code should be written

```
ADN  W.CPJNAM
CRD  D.TO
```

```
*         64/65/6600 SCOPE 3.0                                         COMFILE00001
***********************************************************************COMFILE00002
W.CPRES2  EQU    160B                                                  COMFILE00003
*                                                                      COMFILE00004
*         SCOPE VERSION 3.0 COMMON SYMBOL DEFINITION                   COMFILE00005
*         IN ORDER TO LIST THE CONTENTS OF OF COMFILE, THE             COMFILE00006
*         SYMBOL ≠LISTCOMF≠ SHOULD BE DEFINED PRIOR TO CALLING COMFILE COMFILE00007
*                                                                      COMFILE00008
***********************************************************************COMFILE00009
          IF        =DEF,LISTCOMF,1                                    COMFILE00010
          LIST      =L                                                 COMFILE00011
          EJECT                                                        COMFILE00012
PCPADR   EQU  22000B                                                   COMFILE00013
LCPADR   EQU  42000B                                                   COMFILE00014
T.CPZ     EQU       20B                                                COMFILE00015
T.MON     EQU       21B                                                COMFILE00016
T.STO     EQU       22B                                                COMFILE00017
T.CIDLE   EQU       23B                                                COMFILE00018
T.PIDLE   EQU       24B                                                COMFILE00019
T.PPR     EQU       25B                                                COMFILE00020
T.CLK     EQU       30B                                                COMFILE00021
T.SLAB1   EQU       31B                                                COMFILE00022
T.DATE    EQU       31B                                                COMFILE00023
 T.JDATE  EQU        27B                                               COMFILE00024
T.SLAB2   EQU       32B                                                COMFILE00025
T.SLAB3   EQU       33B                                                COMFILE00026
T.SLAB4   EQU       34B                                                COMFILE00027
T.SLAB5   EQU       35B                                                COMFILE00028
T.SLAB6   EQU       36B                                                COMFILE00029
T.MSP     EQU       37B                                                COMFILE00030
 T.MSC    EQU        40B                                               COMFILE00031
T.CPS     EQU       40B                                                COMFILE00032
T.PPS0    EQU       41B                                                COMFILE00033
T.PPS1    EQU       42B                                                COMFILE00034
T.PPS2    EQU       43B                                                COMFILE00035
T.PPS3    EQU       44B                                                COMFILE00036
T.PPS4    EQU       45B                                                COMFILE00037
T.PPS5    EQU       46B                                                COMFILE00038
T.PPS6    EQU       47B                                                COMFILE00039
T.PPS7    EQU       50B                                                COMFILE00040
T.PPS8    EQU       51B                                                COMFILE00041
T.PPS9    EQU       52B                                                COMFILE00042
T.TMP     EQU       55B                                                COMFILE00043
T.CPT1    EQU       56B                                                COMFILE00044
```

```
LE,DFB3     EQU     100B                                                                   COMFILE00565
LE,DFB4     EQU     100B                                                                   COMFILE00566
LE,DFB5     EQU     100B                                                                   COMFILE00567
LE,DFB6     EQU     100B                                                                   COMFILE00568
LE,DFB7     EQU     40B                                                                    COMFILE00569
L,DFB      EQU   LE,DFB0+LE,DFB1+LE,DFB2+LE,DFB3+LE,DFB4+LE,DFB5+LE,DFB6+LECOMFILE00570
,,DFB7+100B                                                                                COMFILE00571
T,LIB       EQU       T,DFB+L,DFB/10B*10B*10B                                   11/1       COMFILE00572
C,DIRPTR    EQU       0                                                                    COMFILE00573
C,DIRRBA    EQU       2                                                                    COMFILE00574
C,DIRRBN    EQU       3                                                                    COMFILE00575
C,DIRPRU    EQU       4                                                                    COMFILE00576
C,DIRCMA    EQU        1                                                        10/25      COMFILE00577
C,DIRUNT    EQU        1                                                        10/25      COMFILE00578
S,DIRPT     EQU        4                                                                   COMFILE00579
S,DIRPR     EQU       8                                                                    COMFILE00580
C,RBTWPL    EQU     0                                                            11/16     COMFILE00581
C,RBTRBR    EQU     1                                                            11/16     COMFILE00582
S,RBTRBR    EQU     3                                                            11/16     COMFILE00583
C,RBTFB     EQU     1                                                            11/16     COMFILE00584
S,RBTRND    EQU        6                                                                   COMFILE00585
S,RBTREL    EQU        7                                                                   COMFILE00586
C,RBTAL     EQU     2                                                            11/16     COMFILE00587
C,RBTPRU    EQU     3                                                            11/16     COMFILE00588
C,RBTLRB    EQU     4                                                            11/16     COMFILE00589
C,RBTLPR    EQU     0                                                            11/16     COMFILE00590
            EJECT                                                                          COMFILE00591
            LIST      L                                                                    COMFILE00592
            EJECT                                                                          COMFILE00593
```

SYSTEM LIBRARY + DEAD START LOAD PROCESS

2-1 + 2-2

The organization of the dead-start loader is as follows:

The first two records on the system tape are concerned with dead-starting. The first one is PLR (called preloader) and has the job of copying the tape to disc (or some allocatable device). The second is STL which actually loads the system from the allocatable device.

The programs are subdivided in the following way:

PLR The two major divisions are the portion that runs in the peripheral processors which is called PLRPP and the part that is executed by the central processor which is called PLRCP.

PLRPP

This is divided up into a tape-read program which WRITES INTO reads central memory, and a disc-write program which reads the information from central memory and writes it on the disc. At the end of the write program is a set-up program which is written on the disc at the end of preloading and is used to bootstrap in STL from disc.

PLRCP

This program accepts the information from the read program, checksums it, and arranges it in the proper format for the write program.

STL This record contains the PP resident and the recovery package as well as the programs to load. There are also two of these, STLPP and STLCP.

STLPP

This reads the information from disc and transfers it to central memory as well as sending MTR to PPO, DSD to PP9, and the resident to each of the other PP's.

STLCP

This receives the information from the STLPP program, checksums it, compares the checksum, and arranges all programs that are central memory resident in their proper place in central memory. It also inserts the addresses of all library programs into the directory.

Depending on the channel of the card reader, three different settings of the dead-start panel are necessary. One setting is used by people with card reader on channel 0 (if any such exist), another must be used for card reader on channels 1-11B, and the third for channels 12B or 13B.

The setting for channel 0 is:

Word on Panel	Setting	
0001	7700	
0002	E000	select card reader
0003	7700	
0004	1400	select input for EOR
0005	7400	activate channel
0006	7100	input on channel into location zero
0007	0000	

Words 0010 through 0014 are irrelevant.

Note: E is the equipment number of the card reader.

The setting for channels 12B or 13B is:

Word on Panel	Setting	
0001	75xx	
0002	77xx	
0003	E000	select card reader
0004	77xx	
0005	1400	select input to EOR
0006	74xx	activate channel
0007	71xx	input on channel into location zero
0010	0000	

Words 0011 through 0014 are irrelevant.

Note: xx = the card reader channel
E = the equipment number of the card reader

The setting for channel 1-11B is:

Word on Panel	Setting	
0001	1410	load A with 10B
0002	73xx	send part of panel out to another PP
0003	0006	
0004	75xx	disconnect channel
0005	7112	leave this PP on channel 12
0006	0000	
0007	77xx	
0010	E000	select card reader
0011	77xx	
0012	1400	select input to EOR
0013	74xx	activate channel
0014	71xx	input into location zero

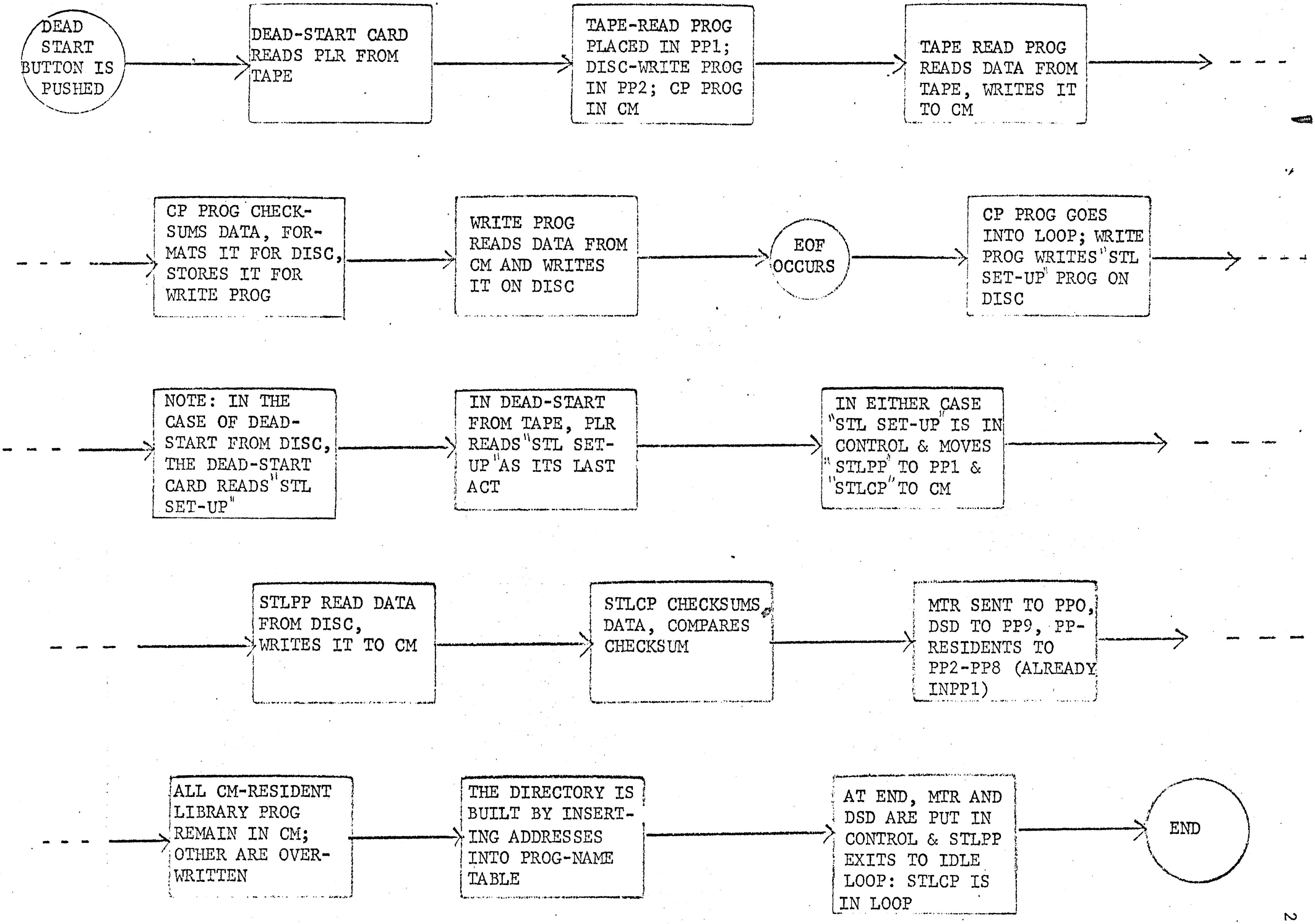
Note: The dead-start process adds a word of zeros at the end of the panel so this is why the last instruction will read into location zero.

A [illegible] setting for dead-starting directly from tape without the use of cards is also provided. [illegible]

Word on Panel	Setting	
0001	75xx	disconnect channel
0002	77xx	
0003	E00u	select tape unit
0004	77xx	
0005	0010	rewind tape
0006	77xx	
0007	1400	select input to EOR
0010	74xx	activate channel
0011	71xx	
0012	0073	read record into location 73B
0013	0112	jump to beginning of record + 7
0014	0007	

Note: This can only be used is the tapes are on channels 12B or 13B.

xx = the channel of the tape
E = the equipment number of the tape
u = the unit of the tape


DEAD START BUTTON IS PUSHED
DEAD-START CARD READS PLR FROM TAPE
TAPE-READ PROG PLACED IN PP1; DISC-WRITE PROG IN PP2; CP PROG IN CM
TAPE READ PROG READS DATA FROM TAPE, WRITES IT TO CM
CP PROG CHECKSUMS DATA, FORMATS IT FOR DISC, STORES IT FOR WRITE PROG
WRITE PROG READS DATA FROM CM AND WRITES IT ON DISC
EOF OCCURS
CP PROG GOES INTO LOOP; WRITE PROG WRITES "STL SET-UP" PROG ON DISC
NOTE: IN THE CASE OF DEAD-START FROM DISC, THE DEAD-START CARD READS "STL SET-UP"
IN DEAD-START FROM TAPE, PLR READS "STL SET-UP" AS ITS LAST ACT
IN EITHER CASE "STL SET-UP" IS IN CONTROL & MOVES "STLPP" TO PP1 & "STLCP" TO CM
STLPP READ DATA FROM DISC, WRITES IT TO CM
STLCP CHECKSUMS DATA, COMPARES CHECKSUM
MTR SENT TO PPO, DSD TO PP9, PP-RESIDENTS TO PP2-PP8 (ALREADY INPP1)
ALL CM-RESIDENT LIBRARY PROG REMAIN IN CM; OTHER ARE OVER-WRITTEN
THE DIRECTORY IS BUILT BY INSERTING ADDRESSES INTO PROG-NAME TABLE
AT END, MTR AND DSD ARE PUT IN CONTROL & STLPP EXITS TO IDLE LOOP: STLCP IS IN LOOP
END

CENTRAL MEMORY LAYOUT

3-1 + 3-2

SUMMARY OF CM RESIDENT AREAS

The Central Memory Resident Pointer Area contains pointers to larger tables contained elsewhere in CM, small tables, and various flags.

The PP Communication Area contains ten 8-word areas, one for each PP, through which PP's communicate with each other and Monitor. The Monitor communication area (T.PPC10) is not used.

The Control Point Area contains seven 200_8-word areas, one for each control point. This area is used to contain the exchange package, job name, and information about the job which is running at that control point.

The CP Resident area contains two programs which run at control point zero (the storage move program, and the idle package); their exchange packages are also kept in the CP Resident area.

The Equipment Status Table contains one entry for each device (allocatable or non-allocatable) attached to the system. Non-allocatable devices are those which may be assigned to a single control point, e.g. magnetic tape unit; allocatable devices may be used by many control points simultaneously.

The File Name Table is composed of as many 3-word entries as there are files in the system. An FNT entry is set up at the time that a file is created; it is not accessible to the user. This table provides a linkage between the user program and all required I/O tables and functions.

The Record Block Reservation area contains at least one Record Block Reservation table (RBR) for each allocatable device attached to the system. Each table contains a series of bits which denote whether or not the record block which it represents is assigned.

The Request Stack area is actually composed of two tables: The Device Status Table (DST) and the request stack itself. The DST contains one 2-word entry for each allocatable device within the system; it is static and its contents are defined at assembly time. The request stack contains entries which are requests for data transfers, device positioning, or logical operations on a file. Each entry is two words in length. The table grows from high memory to low.

The Catalogue and Security Password Index are currently of zero length; they are reserved for future use.

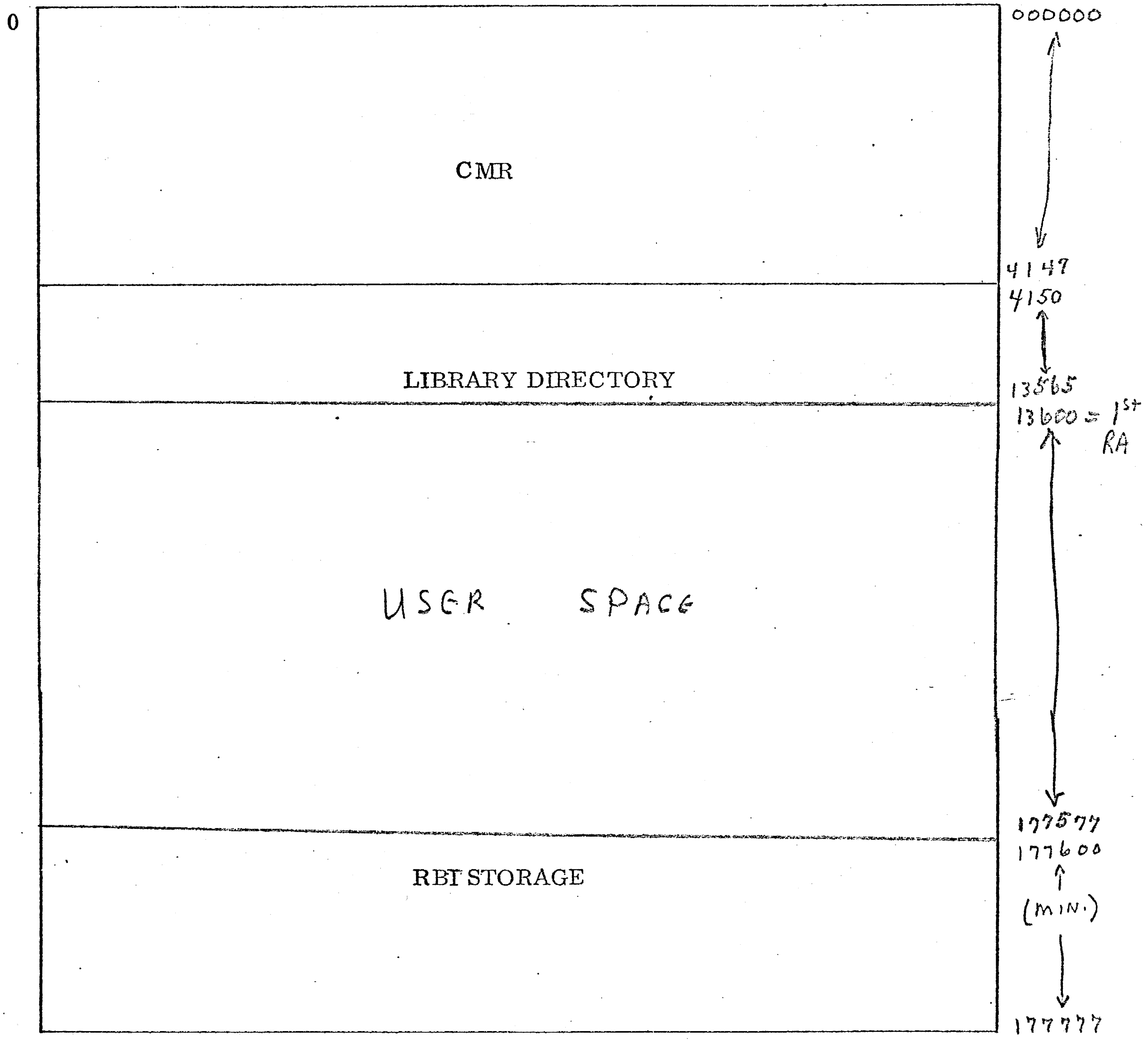
The Installation Area is currently of zero length; it is reserved for installation use.

The Dayfile Buffer area contains eight File Environment Tables and eight buffers, one for the system dayfile and one for each of the seven control points.

The library directory is composed of three sections: The entry point table, containing 1-word entries; the program name table, containing 2-word entries; and the bodies of the CM resident programs. The directory may be expanded or contracted as programs are added or deleted or as program residence is changed.

The Record Block Table area (RBT) is a collection of individual file chains, one for each file on an allocatable device currently recognized by the system. When a file is initiated, a single two-word RBT entry is assigned to that file; additional entries are assigned as needed. Each entry is divided into ten 12-bit bytes, some of which are used as pointers to additional entries, other tables, etc. The remaining bytes each contain the number of a particular record block assigned to the file in the physical order of their assignment. A record block number in an RBT is the ordinal of the bit in an RBR which represents that record block. The RBT empty chain is a pool from which words may be extracted to construct file chains and to which words are returned when the chains are discarded. The RBT expands and contracts by 100_8-word blocks as files are created and released.

Overview Central Memory Allocation (65K)



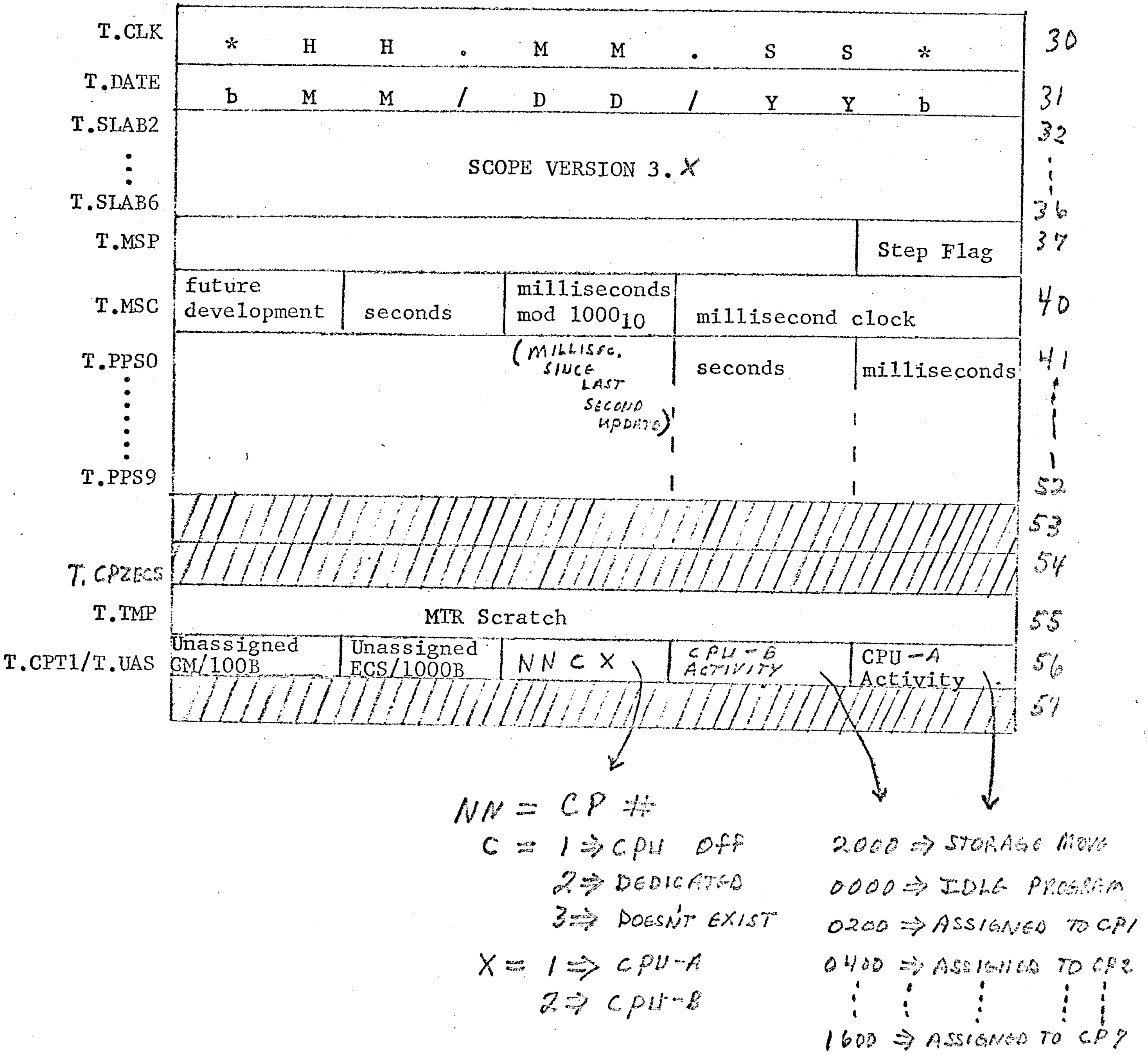
CMR

0	POINTERS
60	PP COMMUNICATION AREA
200	CONTROL POINT AREA
2000	CP RESIDENT
2040	EQUIPMENT STATUS TABLE (EST)
2140	FILE NAME/STATUS TABLE (FNT/FST)
3050	RECORD BLOCK RESERVATION TABLE (RBR)
3120	REQUEST STACK
3430	CATALOGUE*
3430	SECURITY PASSWORD INDEX*
3430	INSTALLATION AREA (INS)
3430	DAYFILE BUFFER (DFB)
4440	

* ZERO LENGTH – TO BE USED IN FUTURE DEVELOPMENT

CENTRAL MEMORY RESIDENT

P.ZERO	ZEROS					0
P.LIB	C.DIRFWA FWA of directory		LWA+1 of directory		dead-start load flag	1
P.RBR/P.RBT	C.RBRAD FWA of RBRs		FWA/2 of empty chain	length/100B of RBT	(LWA+1)/100B of memory	2
P.DFB	FWA/10 of dayfile					3
P.FNT	FWA of FNT	LWA+1 of FNT				4
P.EST	FWA of EST	LWA+1 of EST				5
	▨					6
P.INS	installation use					7
	▨					10
P.CAT	future development					11
P.SP1	future development					12
P.RQS	C.RQSCS stack entry word pair ct.		C.RQSFS FWA/2 of request stack	number of devices	FWA/10B of DSTs	13
T.CST	Channel 0	Channel 4	Channel 10	FST Channel		14
P.CST2	Channel 1	Channel 5	Channel 11	FNT Channel		15
P.CST3	Channel 2	Channel 6	Channel 12	LIB CHANNEL		16
P.CST4	Channel 3	Channel 7	Channel 13	RBT Channel		17
T.CPZ	0003		Storage Move Flag		Machine Field Length	20
T.MON	▨ * MONITOR # 55					21
T.STO	▨					22
T.CIDLE			seconds		milliseconds	23
T.PIDLE			seconds		milliseconds	24
T.PPR	▨					25
	▨					26
T.JDATE	0000 0000 00 Y Y D D D					27



NN = CP #

C = 1 ⇒ CPU OFF
2 ⇒ DEDICATED
3 ⇒ DOESN'T EXIST

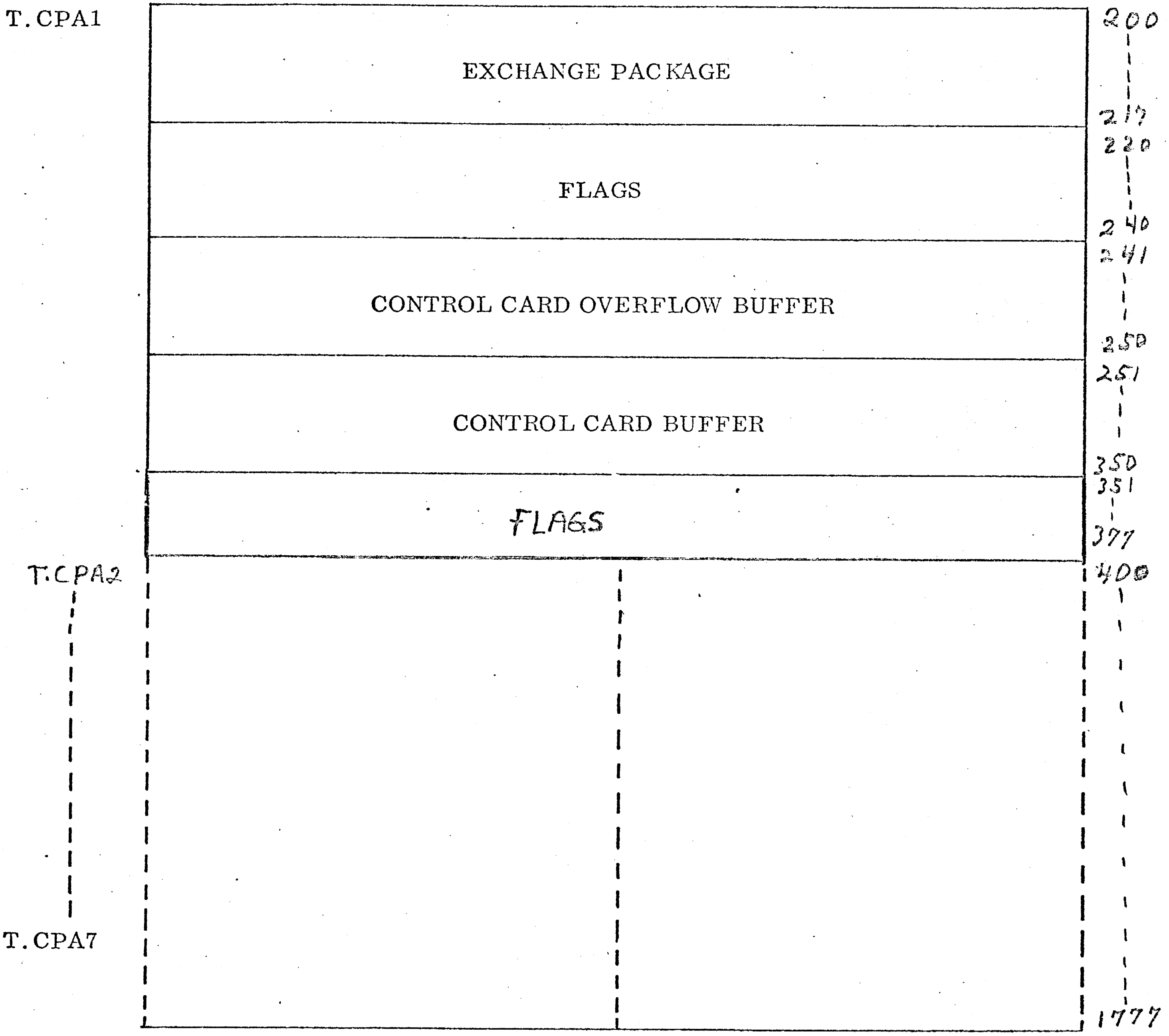
X = 1 ⇒ CPU-A
2 ⇒ CPU-B

2000 ⇒ STORAGE MOVE
0000 ⇒ IDLE PROGRAM
0200 ⇒ ASSIGNED TO CP1
0400 ⇒ ASSIGNED TO CP2
⋮
1600 ⇒ ASSIGNED TO CP7

PERIPHERAL PROCESSOR COMMUNICATION AREAS

T.PPC1	PP NAME OR ZERO	W.PPIR	60
		W.PPOR	61
		W.PPMES1	62
		W.PPMES2	63
		W.PPMES3	64
		W.PPMES4	65
		W.PPMES5	66
		W.PPMES6	67
T.PPC2	⋮		70
T.PPC10	T.PPC10 is not presently used		170

CONTROL POINT AREAS



EXCHANGE PACKAGE

				Words
▨	Program Address(P)	A0(Address Registers)	O O O O O O	0
▨	Reference Address(RA)	A1	B1(Increment Register)	1
▨	Field Length(FL)	A2	B2	2
▨	Exit Mode(EM)	A3	B3	3
RA - ECS		A4	B4	4
FL - ECS		A5	B5	5
▨	M A	A6	B6	6
▨	▨	A7	B7	7
X0 (Operand Registers)				10
X1				11
X2				12
X3				13
X4				14
X5				15
X6				16
X7				17

CONTROL POINT AREA

	59 48	47 36	35 24	23 12	11 00	
W.CPSTAT/ W.CPEF	C.CPSTAT (Status)	C.CPEF (Error Flag)	C.CPSM (Storage Move)	C.CPRA (RA/100B)	C.CPFL (FL/100B)	20
W.CPJNAM	JOB NAME				Next Control Statement	21
W.CPECS/W.CPPRI/ W.CPECS	Priority		Time Limit	ECS RA/1000B	ECS FL/1000B	22
W.CPTIME	millisecond count since last priority RE-EVALUATION		C.CPTIML CPU Time (seconds)		milliseconds	23
W.PPTIME		Loader Flag	PPU Time (seconds)		milliseconds	24
W.CPRCL	PP Recall (Obsolescent)					25
W.SSW	Sense Switches/Lights					26
W.EQP	Equipment Assignments					27
W.CPDFM	Last Dayfile Message					
W.CPERT			C.CPFST (FST Address)	C.CPFP	C.CPERT	40
W.CPTBUF W.CPTBUL	Control Card Overflow Buffer					41 . 50
W.CPCAF W.CPCAL	Control Card Buffer					51 150
W.FSTCC	FST Entry for Next Control Card PRU					151
W.FSTUR	▨	▨	▨	▨	▨	152
W.CPOAE					Op. Assigned Equipment	153
W.CPVRNO	Visual Reel Number					154
W.CPENC	Stack Entry/ Exit Count	PP Job Entry Count				155
W.CPRES1	(USED BY RESPOND)					156
W.CPAR		Auto-Recall Pointer				157
W.RES2	(USED BY RESPOND)					160 161 : 177

FET ADDRESS FOR CHECKING STATUS CODE

CONCORDANCE OF CONTROL POINT FIELDS, 2.0/3.0

Word	Mnemonic	Changed	Comments
20	W.CPSTAT, etc.	no	
21	W.CPJNAM	no	
22	W.CPPRI, etc.	yes	Msg. count removed, Time Limit moved left one byte Operator assigned equipment move, RA/1000B of ECS in byte 3, FL/1000B of ECS in byte 4
23	W.CPTIME	yes	bytes 0 and 1 contain a msec count since last priority re-evaluation (altered by MTR only)
24	W.PPTIME	yes	express flag removed
25	W.CPRCL	no	this work is being phased out in favor of MTR function 37 (see IMS)
26	W.SSW	no	
27	W.EQP	no	
30-37	W.CPDFM	no	
40	W.CPERT	yes	now contains pointers and flags for control card processing in bytes 2, 3, 4
41-50	W.CPTBUF	no	Control Card overflow buffer
51-150	W.CPTBUL	no	Control Card buffer
151	W.FSTCC	yes	FST entry for next control card PRU
152	unused	yes	
153	W.CPOAE	yes	Operator assigned equipment (see 22) in byte 4
154	W.CPVRN ~~unused~~	yes	
155	W.CPENC	yes	I/O stack entry count in byte 0, PP Job Buffer Entry Count in byte 1
156	unused	yes	

CONCORDANCE OF CONTROL POINT FIELDS, [illegible]

Word	Mnemonic	Changed	Comments
157	W.CPAR	yes	Auto Recall pointer in bytes 0-1
160-177	unused	yes	

3-15-1

```
CP.SM     SB7   1
          NG    B3,DOWN
          SB6   -2
          SA1   B2-B7
          SA2   B2+B6
          EQ    LOOP
DOWN      SB6   2
          SA1   B1
          SA2   B1+B7
LOOP      SA4   A1+B6
          SA5   A2+B6
          BX6   X1
          LX7   X2
          SA6   A1+B3
          SA7   A2+B3
          SB1   B1+4
          SA1   A4+B6
          SA2   A5+B6
          BX6   X4
          LX7   X5
          SA6   A4+B3
          SA7   A5+B3
          LT    B1,B2,LOOP
          JP    0
```

STORAGE MOVE PROGRAM

```
         IFNE      IP.MECS,0                                            CMR     00337
*                  MOVE EXTENDED CORE STORAGE                           CMR     00338
*                                                                       CMR     00339
*                  PARAMETERS PASSED IN EXCHANGE PACKAGE                CMR     00340
*                                                                       CMR     00341
*        P         CP.ECSM                                              CMR     00342
*        RA(CM)    0                                                    CMR     00343
*        FL(CM     400000B                                              CMR     00344
*        EM        0                                                    CMR     00345
*        RA(ECS)   0                                                    CMR     00346
*        FL(ECS)   10000000B                                            CMR     00347
*                                                                       CMR     00348
*        B1        RA(ECS) OF CTL PT TO BE MOVED /100B                  CMR     00349
*        B2        RA+FL (ECS) /100B                                    CMR     00350
*        B3        DISPLACEMENT /100B                                   CMR     00351
*        B4        LENGTH OF CM BUFFER AREA                             CMR     00352
*        A0        ADDRESS OF CM BUFFER AREA                            CMR     00353
*                                                                       CMR     00354
 CP.ECSM SX1       B1             INITIALIZE THE X REGISTERS            CMR     00355
         LX1       6                                                    CMR     00356
         SX2       B2                                                   CMR     00357
         LX2       6                                                    CMR     00358
         SX3       B3                                                   CMR     00359
         LX3       6                                                    CMR     00360
         SX5       B4                                                   CMR     00361
         LX5       6                                                    CMR     00362
         NG        X3,SM34        IF DISPLACEMENT IS NEG, SHUTTLE DOWN  CMR     00363
         EQ        SM24      ELSE, SHUTTLE UP                           CMR     00364
         SPACE     3                                                    CMR     00365
*                  SHUTTLE UP LOOP  (ECS)                               CMR     00366
 SM18    IX6       X5-X4          WHEN THE REMAINING PORTION TO BE      CMR     00367
         NG        X6.SM20        MOVED IS LESS THAN THE BUFFER         CMR     00368
         BX5       X4             REDUCE THE BUFFER SIZE                CMR     00369
 SM20    SB5       X5                                                   CMR     00370
         IX0       X2-X5          ECS ADDRESS OF THE MOVE               CMR     00371
         BX2       X0                                                   CMR     00372
         RE        B5+0           READ INTO THE CM BUFFER               CMR     00373
         JP        *                                                    CMR     00374
         IX0       X0+X3          ADJUST THE ECS ADDRESS                CMR     00375
         WE        B5+0           WRITE BACK INTO ECS                   CMR     00376
         JP        *                                                    CMR     00377
 SM24    IX4       X2-X1          CONTINUE TO LOOP UNTIL THE ENTIRE     CMR     00378
         NZ        X4,SM18        BLOCK HAS BEEN MOVED,                 CMR     00379
         JP        0              THEN EXIT                             CMR     00380
```

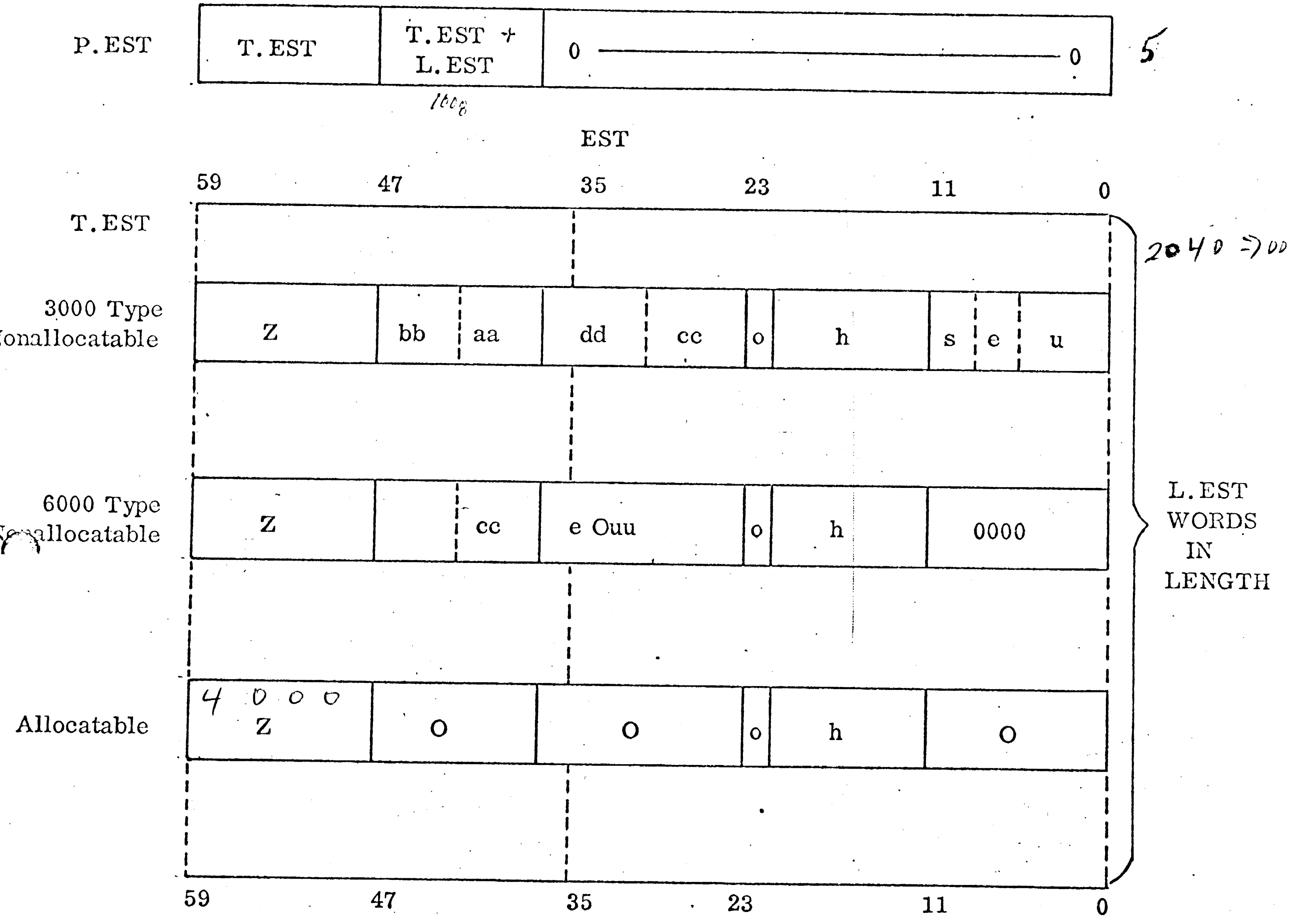
3-15-2

```
               SPACE      2                                                   CMR      00381
    *                     SHUTTLE DOWN LOOP  (ECS)                            CMR      00382
     SM26      IX6        X5-X4                                               CMR      00383
               NG         X6,SM28                                             CMR      00384
               BX5        X4                                                  CMR      00385
     SM28      SB5        X5                                                  CMR      00386
               BX0        X1                                                  CMR      00387
               IX1        X1+X5                                               CMR      00388
               RE        B5+0                                                 CMR      00389
               JP         *                                                   CMR      00390
               IX0        X0+X3                                               CMR      00391
               WE        B5+0                                                 CMR      00392
               JP         *                                                   CMR      00393
     SM34      IX4        X2-X1                                               CMR      00394
               NZ         X4,SM26                                             CMR      00395
               JP         0                                                   CMR      00396
               ENDIF                                                          CMR      00397


               BSSZ       T.EST-*                                             CMR      00399
```

EQUIPMENT STATUS TABLE

POINTER



Z - Status of Entry
aa, bb, cc, dd - Channel Numbers
o - ON/OFF Bit
h - hardware type
s - 6681 number
e - equipment
u - unit

4000 => allocatable Device
6000 => "non allocatable, and unassigned" or "no entry"

0200
0400
0600
1000
1200
1400
1600
} nonallocatable and assigned.

(3.2)
6000 & 3000
Allocatable.

FILE NAME TABLE ENTRY

WORD "1"
(FNT)

	LOCK	TYPE	CONTROL POINT	
FILE NAME				PRIORITY
59 18	17	16 15	14 12	11 00

WORD "2"

READ CARD FILE

EQUIPMENT CODE	RECORD COUNT WITHIN FILE	RECORD TYPE	EST ORDINAL	NOT USED	EOJ	CARD COUNT WITHIN RECORD 1st = 001
59 54	53	[illegible] 36	35 24	23 18	17	16 00

INPUT FILE

EQUIPMENT CODE	NOT USED	FIRST RBT WORD PAIR	ECS FIELD ENTRY/1000	CURRENT RBT ENTRY	CURRENT	RBT BYTE	CM FIELD LENGTH/100
59 54	53 48	47	35 24	23		12	11 00

DISC FILES
(RANDOM ALLOCATABLE FILE)

EQUIPMENT CODE	NOT USED	CK	FIRST RBT WORD PAIR	CURRENT RBT WORD PAIR	CURRENT RBT ENTRY	CURRENT	RBT BYTE	CURRENT PRU NO.
59 54	53 49	48	36	35 24	23 15	14		11 00

TAPE FILES
INDIVIDUAL SEQUENTIAL FILE

EQUIPMENT CODE		X	LABEL	DENSITY	EST ORDINAL OF SECONDARY DEVICE	EST ORDINAL OF PRIMARY DEVICE	CURRENT PRU NO.
59 54	52 53	51	50	49 48	47 36	35 24	23 00

MULTI-FILE FNT/FST ENTRY

EQUIP. CODE	▨	LABEL	TAPE DENSITY	SECONDARY DEVICE EST ORDINAL	PRIMARY DEVICE EST ORDINAL	POSITION # OF THE LAST FILE WRITTEN IN THE SEQUENCE OF FILES.	CURRENT FILE POSITION
59 54		5	49 48	47 36	35 24	23 12	11 00

PUNCH CARD FILE

EQUIPMENT CODE		EST ORDINAL	FLAG USED BY 2PC	EOJ	CARD COUNT
59 54	53 36	35 24	23 18	17	16 00

WORD "3"
(FST 2)

0	FUTURE USE	LAST USED FET ADDRESS	DISPOSITION CODE	SECURITY CODE	LAST CODE AND STATUS
59	58 54	53 36	35 24	23 18	17 00

NOTE: On multi-reel files, the FNT word "3", bits 18 + 19 are always set (File always "CLOSED"), bits 24-35 = 0002 (multi file disposition), and bits 48 and 49 are used for logical security code.

Record type continued.

$002 - 120_8$ ⇒ "Free-form" card record (See Ref. Man. Appendix E)

177 ⇒ Special mode ended.

Record Count within this file.

Equipment Code. See table on Page 3-4 and 3-5 of Ref. Manual. (60_8 ⇒ card reader, etc)

CM Field Length/100_8 for this file.

ECS Field Length/1000_8 for this file.

Current RBT entry. This is a count of the number of full RBT word pairs up to the current position of the file. For example, if the file is positioned in the second RBT word pair, the current RBT entry will be 1. Just as soon as the second RBT pair fills up, this number will roll over to 2.

Current RBT Byte indicates which byte in the RBT word pair contains the RB address.

Current RBT word pair position. If this number = N, the address of the first word of this word pair is 400,000B-2*N.

First RBT word pair associated with this file. If this number = M, the address of the first word of this word pair is 400,000B-2*M.

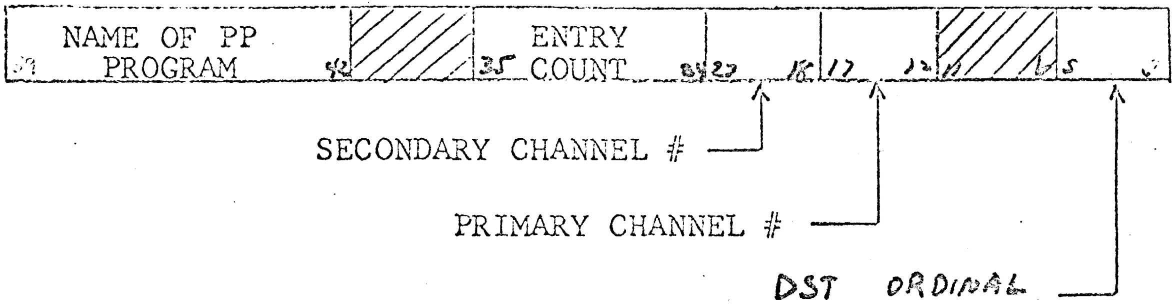
Check point flag. is used with Checkpoint/Restart files.

Current PRU # indicates which sector is currently being used.

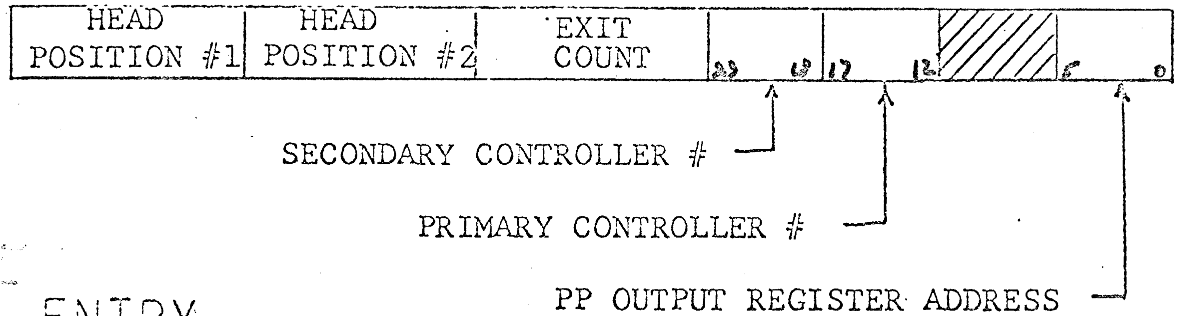
3-18 THRU
3-20

DEVICE STATUS TABLE ENTRY

WORD 1



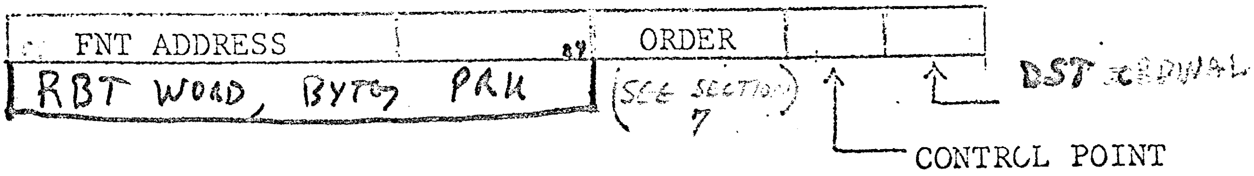
WORD 2



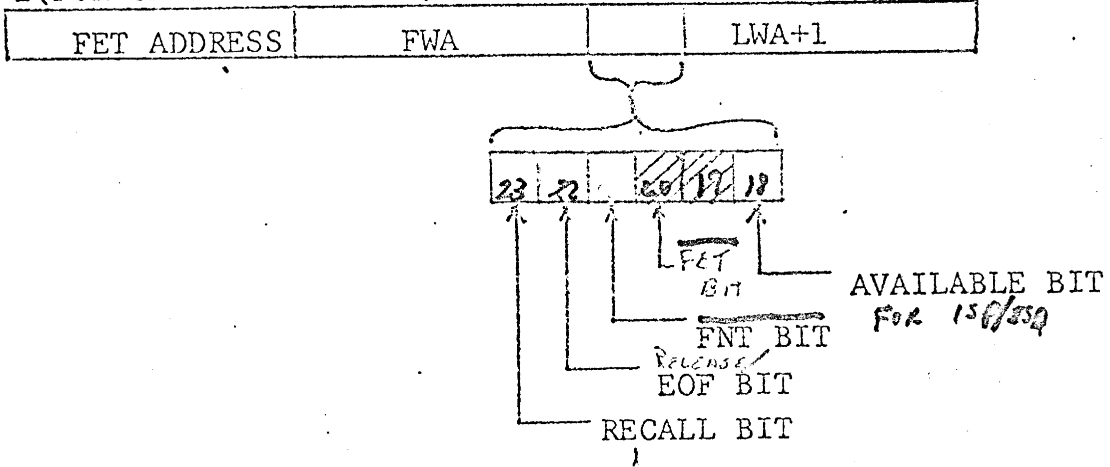
REQUEST

STACK ENTRY

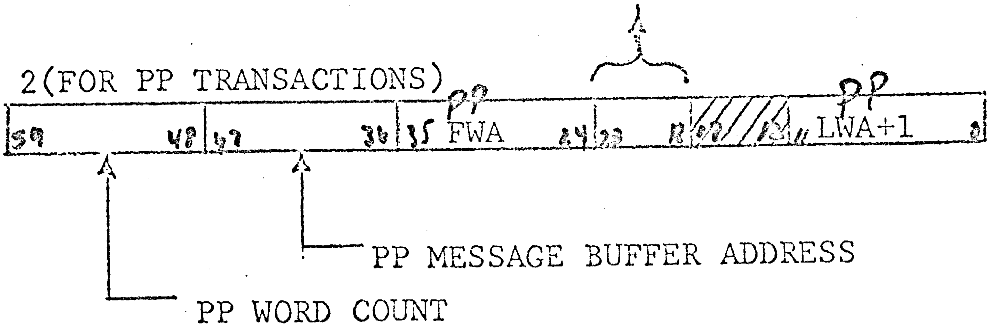
WORD 1



WORD 2(FOR CM TRANSACTIONS)



WORD 2(FOR PP TRANSACTIONS)



Record Block Reservation Tables

A Record Block Reservation (RBR) table serves a dual purpose:

1. It defines record blocks in a specific allocatable area.
2. It identifies those record blocks within that area as available or not available.

A maximum of 2048 record blocks may be defined by one RBR. The area described by an RBR must all be on one device.

The RBR tables in the SCOPE Operating System follow immediately after the FNT/FST area. The pointer to the first word of the first RBR table is found in Word 2, Byte 1 (counting 0-4, left to right) of low core. The second RBR table starts immediately after the first. The total length of each table is 38_{10} CM words. Thus, adding 46 (octal) to the pointer in Word 2, Byte 1 will give the starting address of the second RBR table.

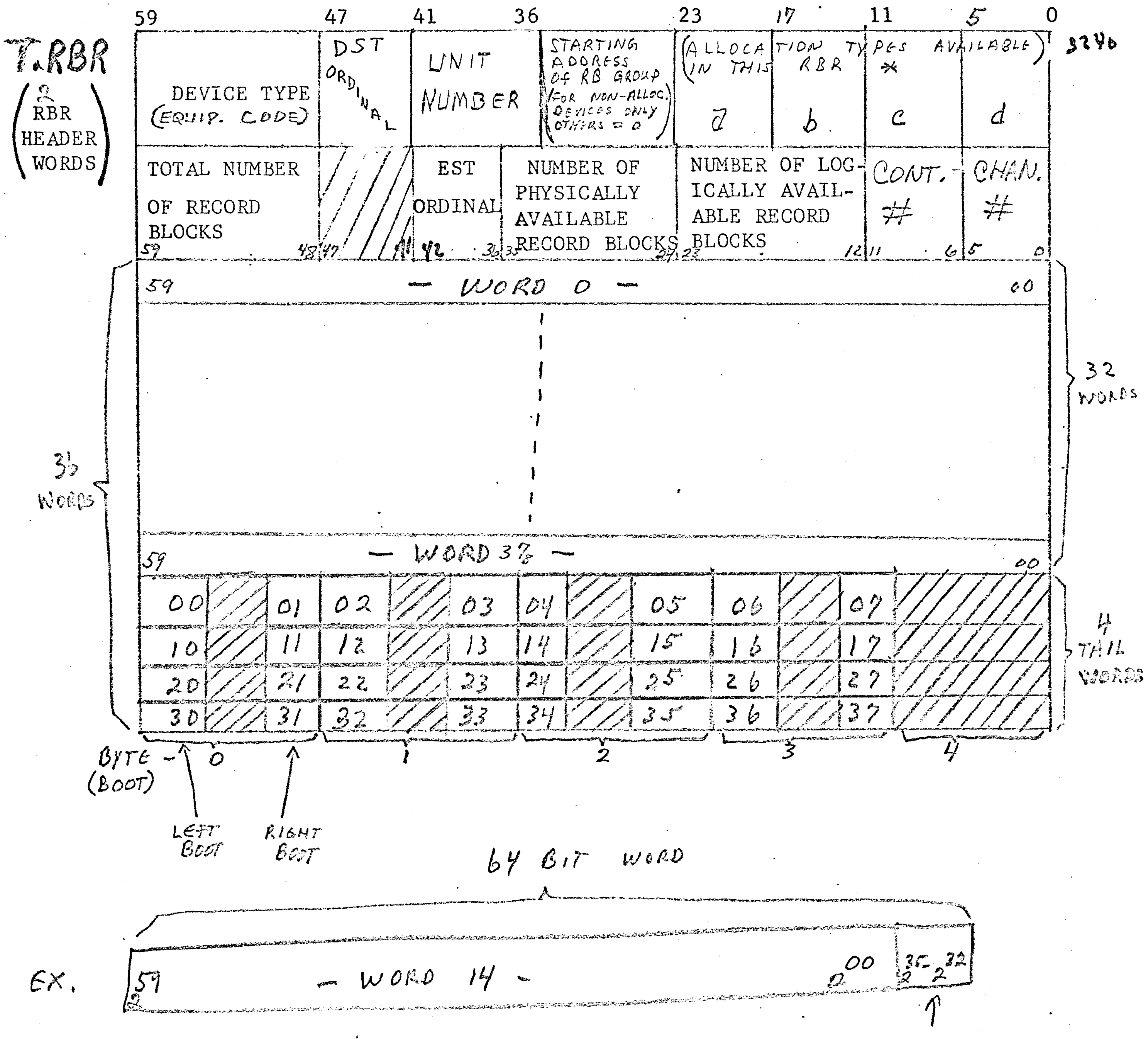
The header words (first two) of each RBR table are comprised of the following fields:

Word

Bits 0 -11: Allocation type link. The ordinal of an RBR which references a device of the same type and which uses the same record block definition. The linkage should be circular.

Bits 12-23: Device link. The ordinal of an RBR which references a device of the same type. The linkage should be circular so that all RBR's referencing the same device type are linked.

RECORD BLOCK RESERVATION TABLE (RBR)



SEE PAGE 3-21-4 for order of reservations.

*. If standard allocation for the device is included, it is listed first, and the last 6-bit field is left zero. If all allocations are non-standard, all 4 fields must be non-zero. (Repeat last allocation type to end).

The allocation type link and device link may be broken up into 2 bytes of the form: * ⇒ (see SYSTEMS BULLETIN #10, Pages 25-27)

aabbccdd=ALLOC

where each term ii specifies a legitimate allocation within the portion of the device indexed by this RBR.

01=50 PRU's/RB.

02=64 PRU's/RB.

00=Free allocation; when the user does not specify allocation in an OPEN call, the file may be assigned to any RBR with some ii=00. In this case, allocation aa is assigned to the file after the RBR is chosen, thus, aa should not be 00.

03=Free allocation; this allocation style is used to permit continuation of a file from one device to another (theoretically).

10=8 PRU's/RB (Used by RESPOND).

aa determines the actual RBR type for physical allocation purposes. ALLOC need not be supplied. Default values are:

for TYPE=1 (bits 48-50)

ALLOC=03020100

for TYPE=2

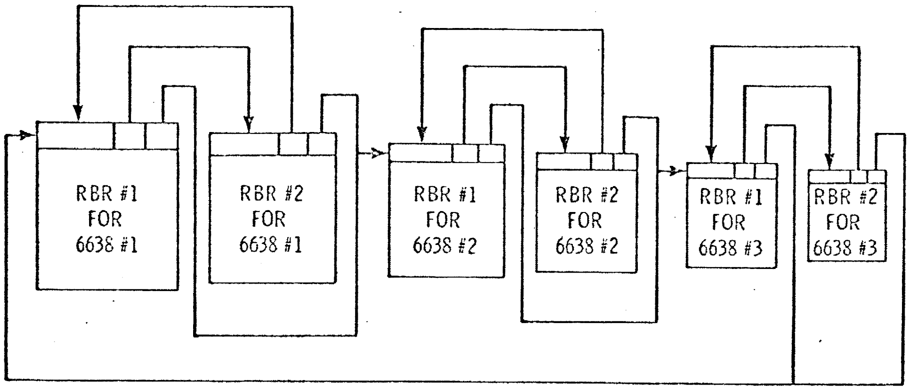
ALLOC=03010100

Bits 24-35: RB group start address - the half-track on which the described area starts.

Bits 36-41: Unit number.

Bits 42-47: Device number. The ordinal in the device status table (DST) of the device to which this RBR refers.

Bits 48-59: Device group. The device type and allocation type used in the area described by this RBR.

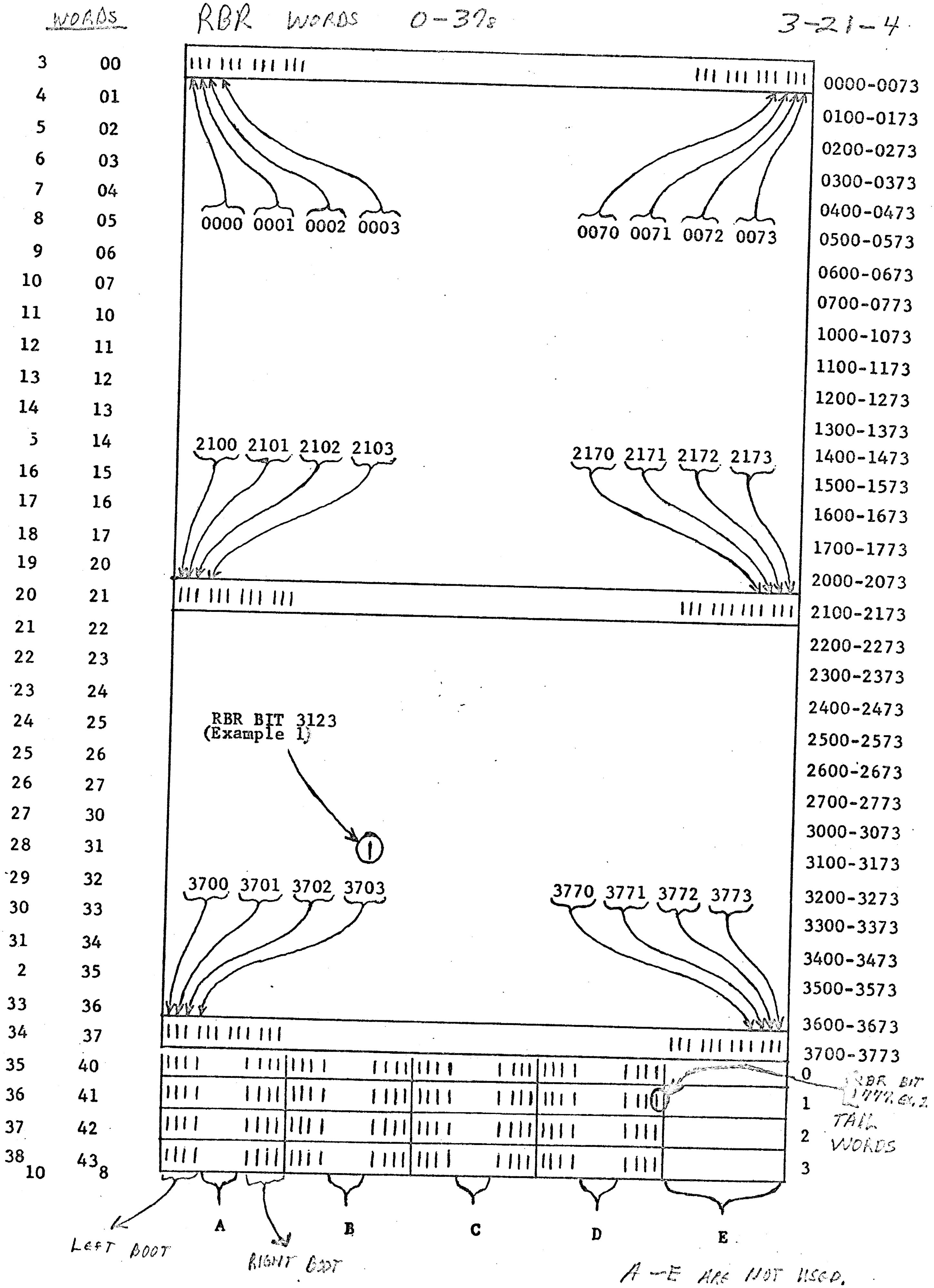


6638 RBR LINKAGES FOR 3 6638's

Word TWO

Bits 0 - 5:	Channel number. The channel used by the device referenced by this RBR.
Bits 6 -11:	Controller number.
Bits 12-23:	Logical availability. The number of record blocks not assigned to files.
Bits 24-35:	Physical availability. The number of usable record blocks. This is normally the same as the total RB count.
Bits 36-41:	EST ordinal.
Bits 42-47:	Not used.
Bits 48-59:	Total RB count. The number of record blocks defined by this RBR.

RBR WORDS 0-37₈

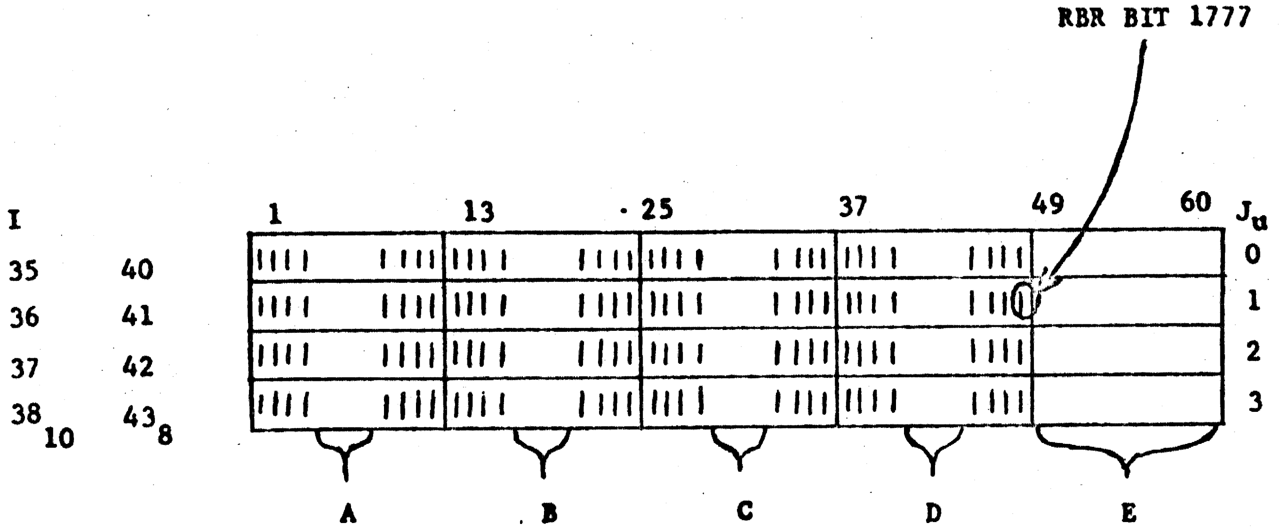


A — E ARE NOT USED.

3-21-5

RBR "TAIL WORDS"

(The last 4 words in an RBR Table.)



The bits designated by A, B, C, D, and E are not used.

A = Bits 52 - 55 (as usually numbered) or 5 - 8 (as numbered above)

B = Bits 40 - 43 (as usually numbered) or 17 - 20 (as numbered above)

C = Bits 28 - 31 (as usually numbered) or 29 - 32 (as numbered above)

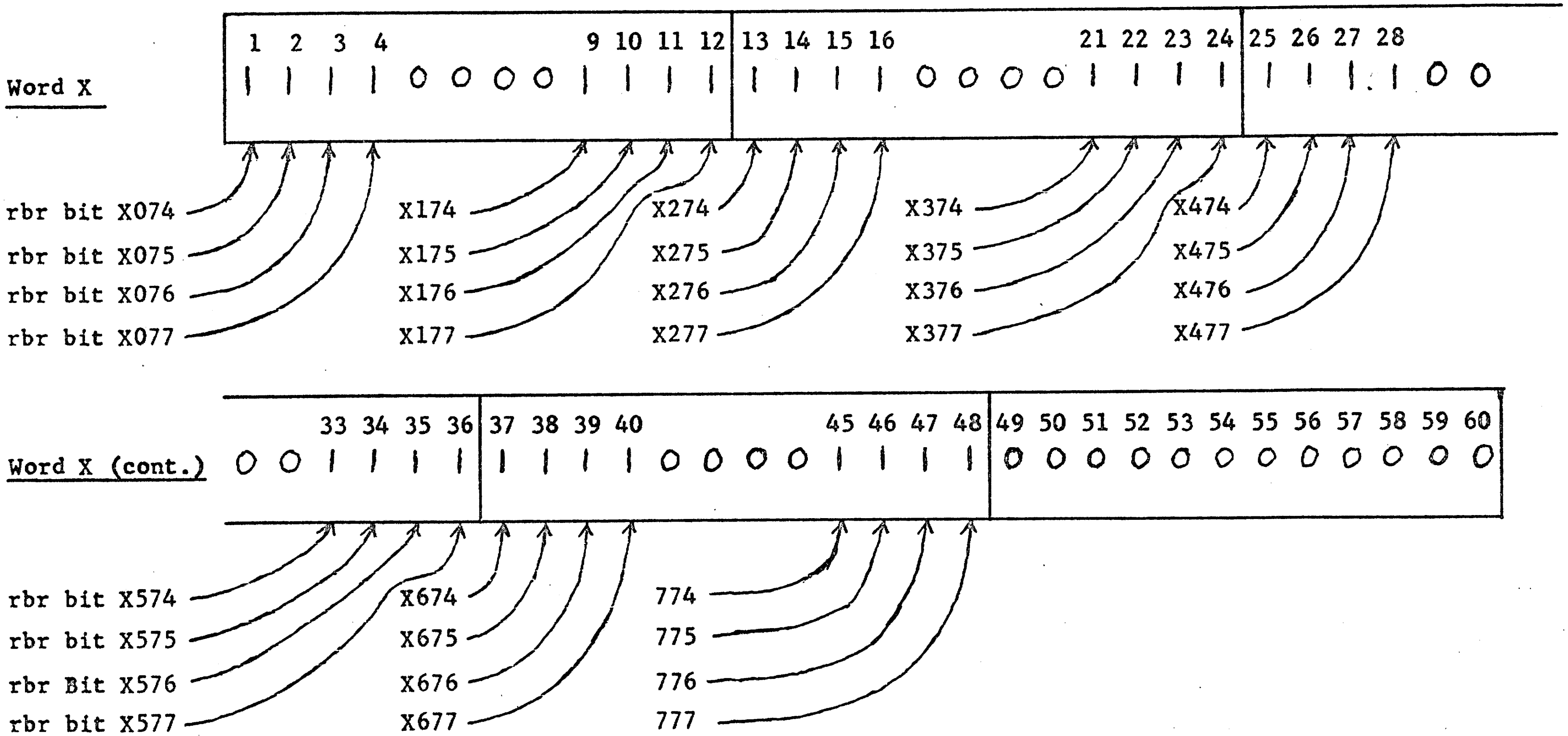
D = Bits 16 - 19 (as usually numbered) or 41 - 44 (as numbered above)

E = Bits 0 - 11 (as usually numbered) or 49 - 60 (as numbered above)

A number corresponding to a bit in the RBR Table may be calculated from and RB number found in one of the 0-7 bytes of an RBT word pair. Suppose the RB number is N (N is always odd). Then the RBR bit number, NRBR, is given by the equation (using truncated integer arithmetic):

$NRBR=N/2=J_u x8^3+J_L x8^2+L_1 x8^1+L_2 x8^0$ (eqn. 1) $J=J_u x8^3+J_L x8^2=$ Main table pointer to words 3-34 (decimal) or 0-37 (octal) of the RBR table. The entire J pointer is used when the last 2 octal digits of NRBR are from 0-73.

DETAIL OF REPRESENTATIVE TAIL WORD



X is 0, 1, 2, or 3, depending on whether we are in tail word 40, 41, 42, or 43.

3-21-6

$L=L_1x8^1+L_2x8^0$=Lower 2 octal digits of RBR bit number. If L is 74-77 (octal) then J_u determines which of the tail words (0-3) the designated RBR bit falls in. Also, J_L determines in which byte in the tail word the bit falls.

For J_L=0 to 1, byte number=1 (counting bytes left to right, 1-5).

For J_L=2 to 3, byte number=2.

For J_L=4 to 5, byte number=3.

For J_L=6 to 7, byte number=4.

A formula for obtaining the exact position of a given bit in one of the tail words (numbering the bits from left to right, 1-60) is given by:

BIT POSITION=LPOSN(J_L+1)+L_2-4 (eqn. 2)

where:

LPOSN(1)=1

LPOSN(2)=9

LPOSN(3)=13

LPOSN(4)=21 These values are decimal.

LPOSN(5)=25

LPOSN(6)=33

LPOSN(7)=37

LPOSN(8)=45

<u>Sample calculation 1</u>:

One of the 0-7 bytes in an RBT word pair contains the RB number 6247. Find the corresponding bit position in the RBR table.

Applying equation 1:

NRBR=6247/2=3123 (dropping the fraction)

L=last 2 digits=23, which is between 0 and 73, and thus the desired bit is in one of the RBR table words from 0 to 37 (octal).

J=31, which points to the 31st (octal) word in the RBR table.

Thus, the desired bit is bit 23 (octal - starting with zero and counting from left to right) of word 31 of the RBR table. The location of this bit is circled on the diagram on Page 12.

Sample calculation 2:

One of the 0-7 bytes in an RBT word pair contains the RB number 3777. Locate the corresponding bit in the RBR table.

Applying equation 1 from page 13:

$J_u \; J_L \; L_1 \; L_2$

NRBR=3777/2=1777

L=77, which implies that the bit is in one of the tail words.

J_u=1, so the bit is in the second tail word (word 41_8).

J_L=7=second digit from left.

L_2=low order digit=7.

Applying equation 2 from page 14:

BIT POSITION=LPOSN(J_L+1)+L_2-4

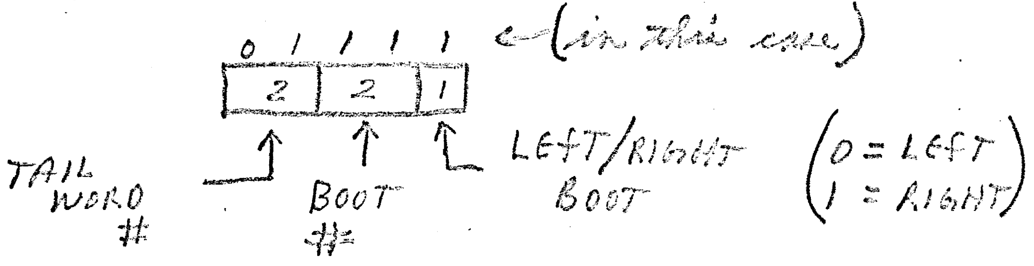
BIT POSITION=LPOSN(8)+7-4

BIT POSITION=45+3=48

3-21-7

Example # 2.

1. Suppose an RBT byte contained 3777.
2. the actual RB address would be 1777.
3. the lower 6 bits = 77. when they equal 74-77, the next 5 bits are broken down as follows;



4. the lower 2 bits of the lower 6 bits indicate the 2^{xx} position in the boot. In this case 11_2 or the right-most bit of the boot. (Remember they are reserved from left to right).

5. Thus actual RB address # 1777 is tail word # 1, boot 3, right boot, bit 3. or 2^{12} in tail word # 1.

Thus, the desired bit is bit 48 (decimal - starting with one and counting from left to right) of the second tail word (word 41). Or, if we count in octal, and start with zero, the bit is number 57 (still counting from left to right). This bit is circled on the diagram on Page 13.

3-21-7

DISCERNING PARITY ERRORS ON DISK

an indication of a parity error on Disk is by an entry into the Dayfile and an entry at the associated control point.

Example:

```
01.23.16. ABC0001. DISK PARITY ERROR
                        RBR     RB      PRU
                        01      0741    012
```

assuming the following configuration –

RBR

00	FILE 0	6638
01	FILE 1	6638

Then – RBR RB PRU
01 0741 012

would be decoded as –

- 6638 file 1
- position 7
- odd half track
- Head group 20_8
- sector 12_8

note – the RB # is actual RB address not as shown in RBT bytes.

Physical Position on the Disk

Another question which arises is how one computes the track number, head group, and whether we are writing on odd or even sectors. These quantities may also be derived from the RB numbers found in the 0-7 bytes of the RBT word pairs. The steps are as follow:

1. Assume the RB number is N (12 bits).
2. Divide N by 2 (shift right by 1), leaving us with an eleven bit quantity, X.
3. Divide X up into three groups as indicated below, thus giving us the desired quantities:

X=	7 bits	3 bits	1
	Track	Head Group	↑ Even/Odd Secters

Thus, the track numbers can go from 0 to 177_8 (0 to 128_{10}) and the head groups can go from 0 to 7. From these numbers, we can calculate the total possible number of half tracks per RBR Table:

Total=(128 tracks/RBR) x (8 head groups) x (2 half-tracks/track)

so:

Total number of half-tracks = 2048

Figures 1-4 on Pages 1-9 of the 6638 manual is somewhat misleading in that it seems to indicate that head groups are specified by two digits. Each RBR Table is for one stack. Thus, if we are going to use only one octal digit to specify a head group, it would seem necessary to supply the File

Unit Number (0 or 1), also. However, this is implicitly, instead, taken care of by supplying the track number. Thus, there are head groups 0-7 for File Unit 0 and 0-7 for File Unit 1 (for stack 0, as well as stack 1). In order to specify any unique location on one stack, it is sufficient to give:

1. The 3 bit head group number,
2. The 7 bit track number, and
3. The 1 bit even/odd sector indicator (0 for even sectors, 1 for odd sectors).

6638 System for Discerning Parity Errors on Disc File

RBR

00 01	File 1 (Bryant Disk File)
02	File 0 (6638)
03	File 1 (6638)

RB

00 00

Upper 6 (six) bits signify position. Lowest bit signifies odd or even halftrack. The remaining bits will be right shifted one and this will give you the Hd group.

PRU

Signifies the sector #.

Example:

RBR	Actual RB	PRU
03	0741	012

would be decoded as 6638 File 1
Position 7
odd halftrack
Hd group 20
sector 12

0741 = 2^{41_8} = $2^{33_{10}}$ - 2^{26} Position

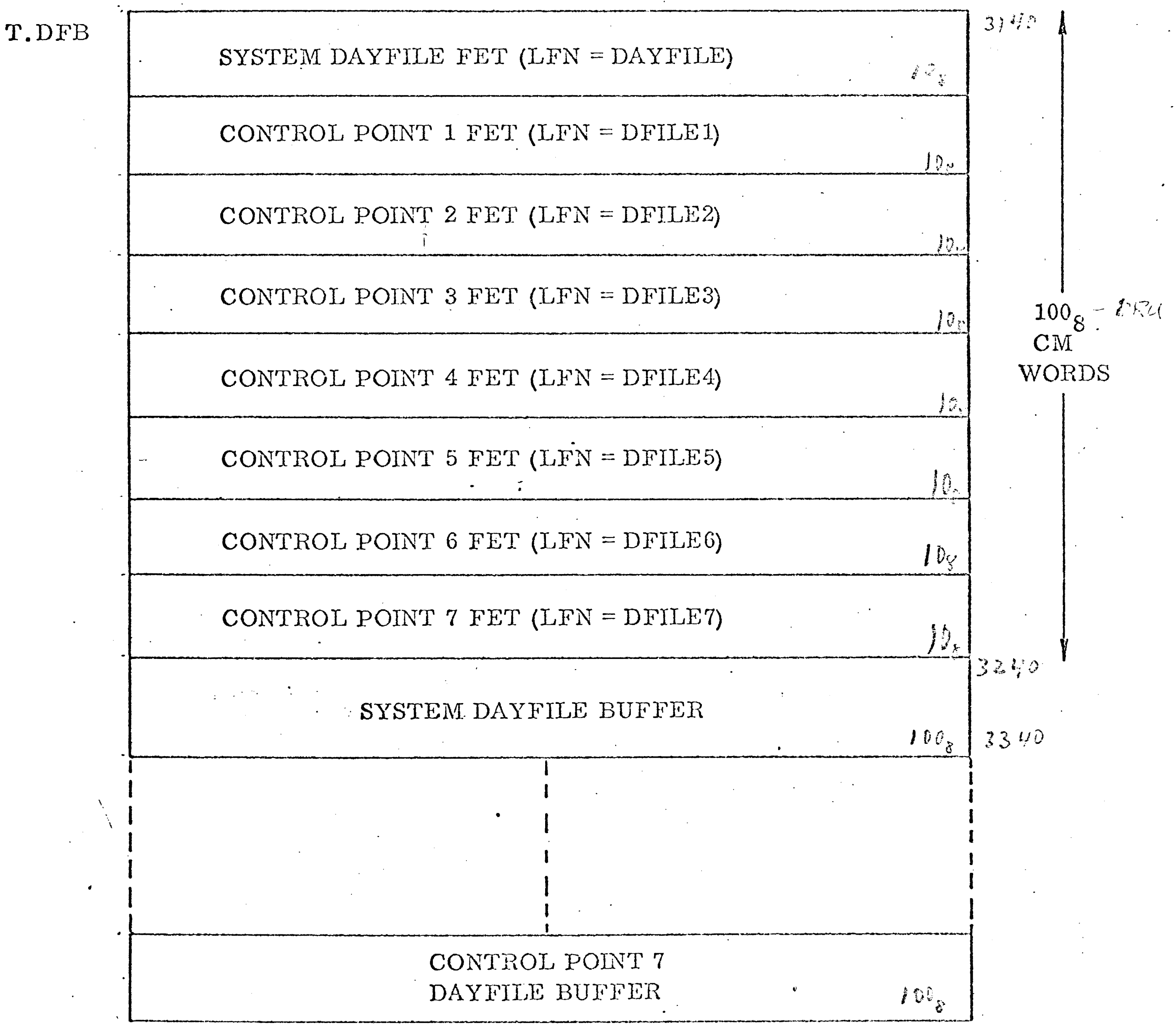
DAYFILE BUFFERS

DAYFILE POINTER

P.DFB	T.DFB/10B	0 ——————— 0

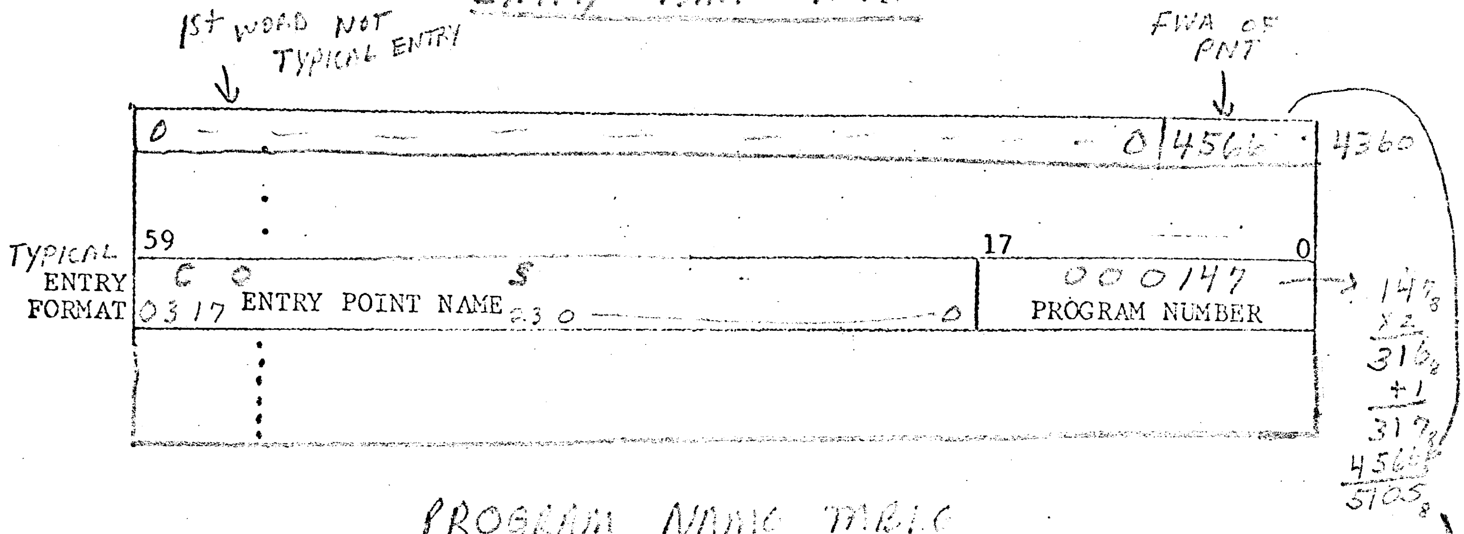
3

DFB

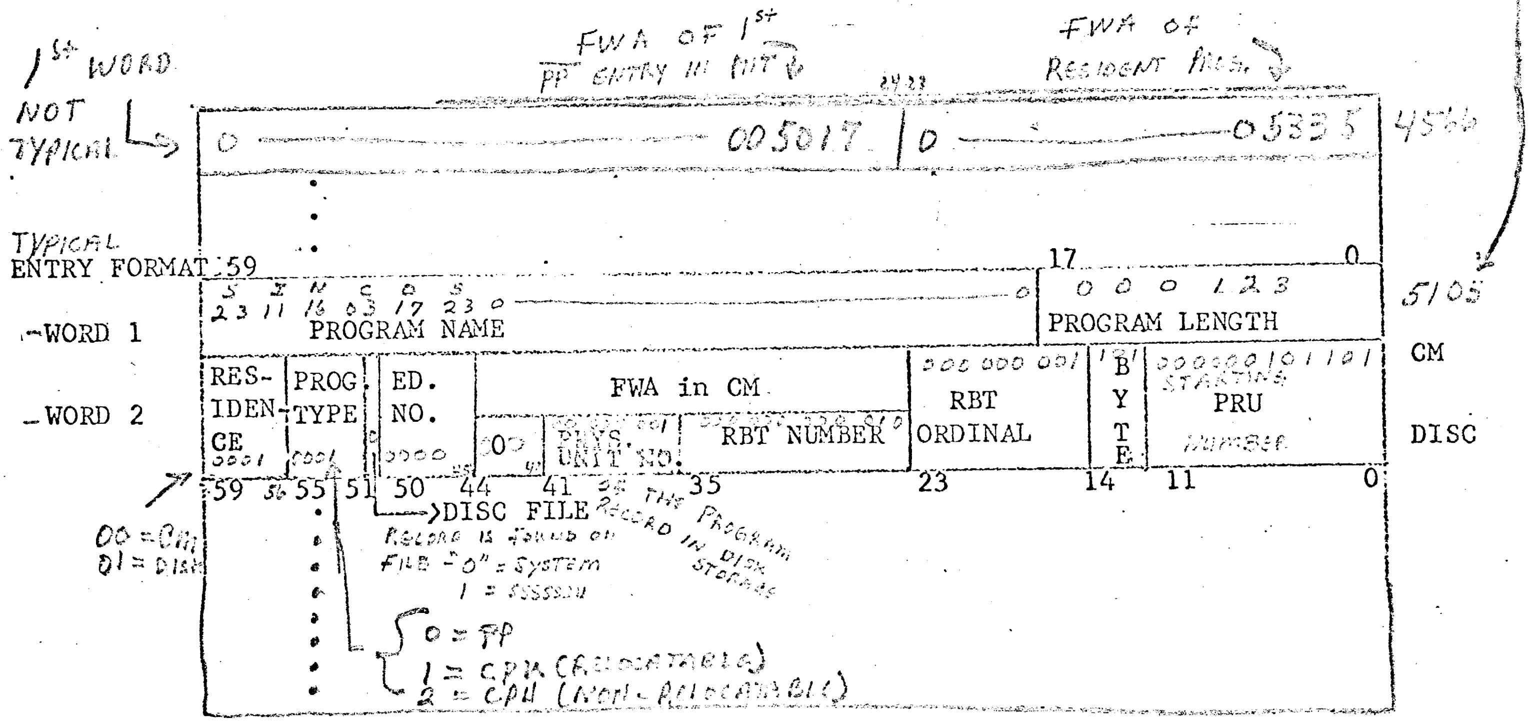


THE FORMAT OF THE CMR DIRECTORY IS THIS --
IN CELL P.DIR (I.E. ABSOLUTE 1)
VFD 24/A,24/B,12/0
WHERE A IS THE ADDRESS OF THE FIRST WORD IN THE DIRECTORY,
AND B IS THE ADDRESS OF THE LAST+1 WORD.
IN CELL A
VFD 60/C
THEN THE ENTRY POINT TABLE LIES IN CELLS A+1 TO C-1 INCLUSIVE.
EACH ENTRY IN THIS TABLE HAS THE FORM
VFD 42/D,18/E
WHERE D IS THE NAME OF THE ENTRY POINT, AND E IS THE NUMBER OF
THE PROGRAM, WHICH WILL BE A CP PROGRAM NOT AN OVERLAY, TO WHICH
IT BELONGS. THE PROGRAM NAME TABLE ENTRY FOR THE PROGRAM CAN BE
FOUND IN CELLS C+1+2E AND C+1+2E+1.
IN CELL C
VFD 36/F,24/G
THEN THE PROGRAM NAME TABLE LIES IN CELLS C+1 TO G-1 INCLUSIVE.
F IS THE ADDRESS OF THE FIRST WORD OF THE FIRST PROGRAM NAME
TABLE ENTRY FOR A NON-PP PROGRAM. THIS HELPS THE PP RESIDENT,
WHICH SEARCHES ONLY FOR PP PROGRAMS IN THE PROGRAM NAME TABLE,
AND NEED SEARCH ONLY FROM C+1 TO F-2
EACH PROGRAM NAME TABLE ENTRY IS TWO WORDS. THE FIRST WORD IS
VFD 42/H,18/K
WHERE H IS THE NAME OF THE PROGRAM, AND K IS ITS LENGTH --
NOT ITS LENGTH AFTER LOADING, BUT ITS LENGTH IN THE LIBRARY.
K DOES NOT INCLUDE THE PREFIX OF THE PROGRAM RECORD, SO
THIS RECORD ON FILE SYSTEM IS ACTUALLY K+3 WORDS LONG.
BUT IF THE PROGRAM IS CENTRAL MEMORY RESIDENT, ITS BODY IN
THE DIRECTORY WILL BE K WORDS LONG.
NOTE THAT NO TWO NON-STITCH PROGRAMS MAY HAVE THE SAME NAME,
EVEN IF OF DIFFERENT TYPES. BUT STITCH PROGRAMS ARE ABSOLUTELY
IGNORED IN CHECKING FOR DUPLICATION.
THE SECOND WORD OF THE PROGRAM NAME TABLE ENTRY HAS TWO POSSIBLE
FORMATS. IF THE PROGRAM IS CENTRAL MEMORY RESIDENT,
VFD 4/M,4/N,1/P,6/Q,21/R,9/S,3/W,12/T
WHERE M IS THE RESIDENCE, 0 FOR CENTRAL MEMORY, N IS THE
PROGRAM TYPE, 0 FOR PP, 1 FOR CP, 2 FOR OVERLAY, AND
4 FOR STITCH, P IS THE DISK FILE IN WHICH THE PROGRAM
RECORD IS TO BE FOUND, 0 FOR ((SYSTEM)) AND 1 FOR
((SSSSSSU)), Q IS THE EDITION NUMBER, R IS THE ADDRESS IN
CMR AT WHICH THE BODY OF THE PROGRAM BEGINS
(IT ENDS AT R+K-1), S IS THE RBT ORDINAL OF THE PROGRAM
RECORD IN DISK STORAGE, W IS THE BYTE NUMBER IN THE RBT WORD
PAIR, AND T IS THE PRU NUMBER AT WHICH IT BEGINS IN DISK STORAGE.
IF THE PROGRAM IS DISK RESIDENT,
VFD 4/M,4/N,1/P,6/Q,3/0,6/U,12/V,9/S,3/W,12/T
WHERE M IS 1 FOR DISK RESIDENCE, N, P, Q, S, T, AND W ARE THE
SAME AS ABOVE, U IS THE PHYSICAL UNIT NUMBER OF THE
PROGRAM RECORD IN DISK STORAGE, AND V IS THE RBT NUMBER,
NOT ORDINAL, OF THE RECORD.
THE PROGRAM NAME TABLE ENDS IWTH THE WORD AT G-1, AND THE BODIES
OF CENTRAL MEMORY RESIDENT PROGRAMS, UNLESS THERE ARE NONE AND
G=B, EXTEND FROM G THROUGH B-1.

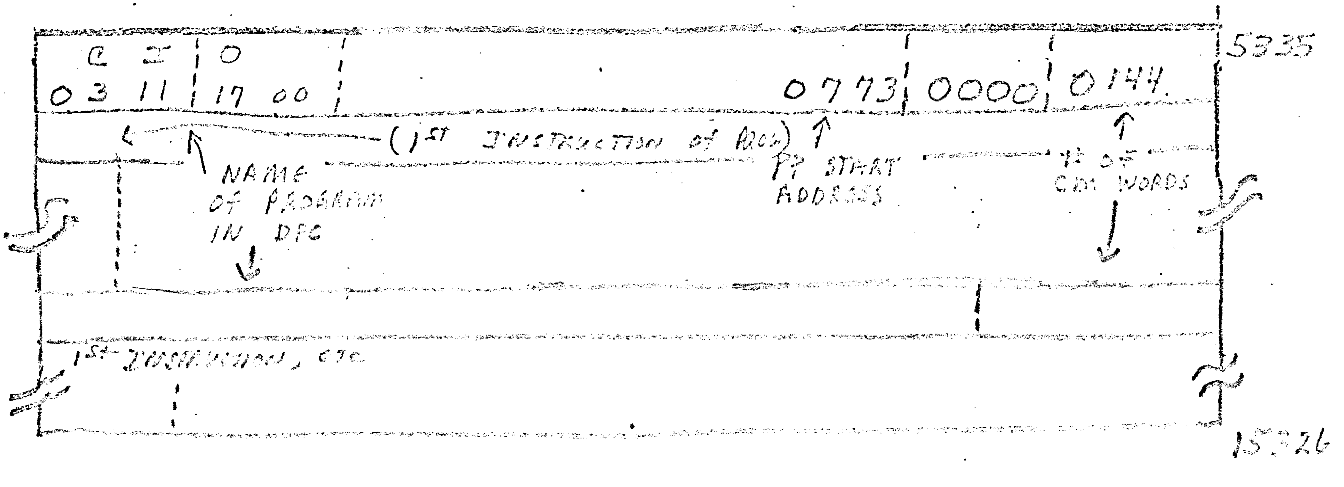
ENTRY POINT TABLE



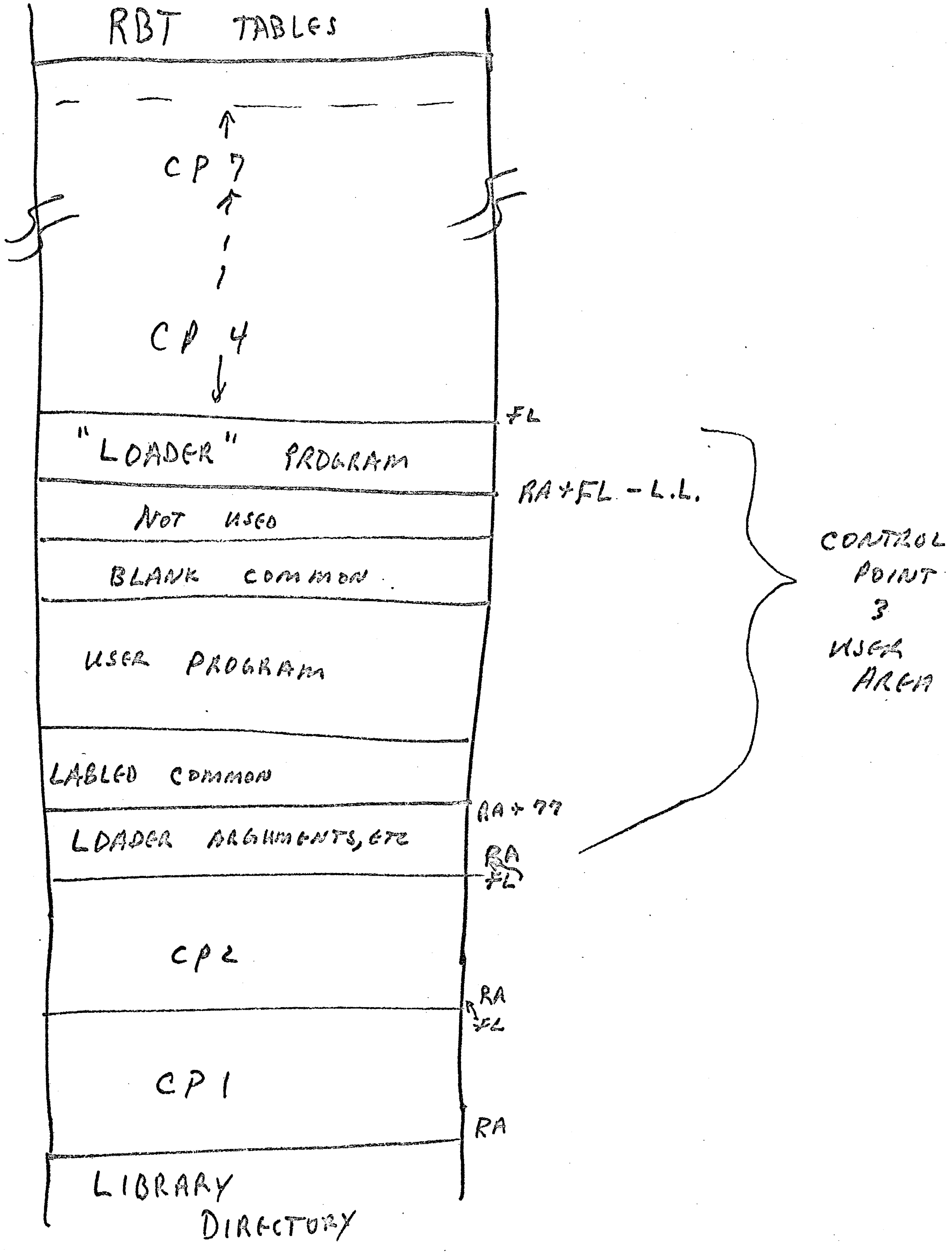
PROGRAM NAME TABLE



CM RESIDENT PROGRAMS



USER SPACE ALLOCATION



Record Block Tables (RBT)

An RBT consists of a series of 12 bit bytes identifying, in logical sequence, the record blocks assigned to a logical file residing on an allocatable device.

A maximum of 8,192 CM words may be occupied by all the RBT's active at any one time. Two CM words at a time are assigned to each RBT as required (Thus, we speak of RBT word pairs); the two words may reference 1 to 8 record blocks (RB's). Two consecutive RBT pairs for a particular file do not have to be contiguous. The first byte of the first word of each RBT pair contains a pointer to the next RBT in the chain. This pointer is the ordinal or relative position of the next RBT. If the pointer is N, the address of the word pair is calculated as:

ADDRESS=(LWA+1 of memory)-2*N=400,000B-2*N.

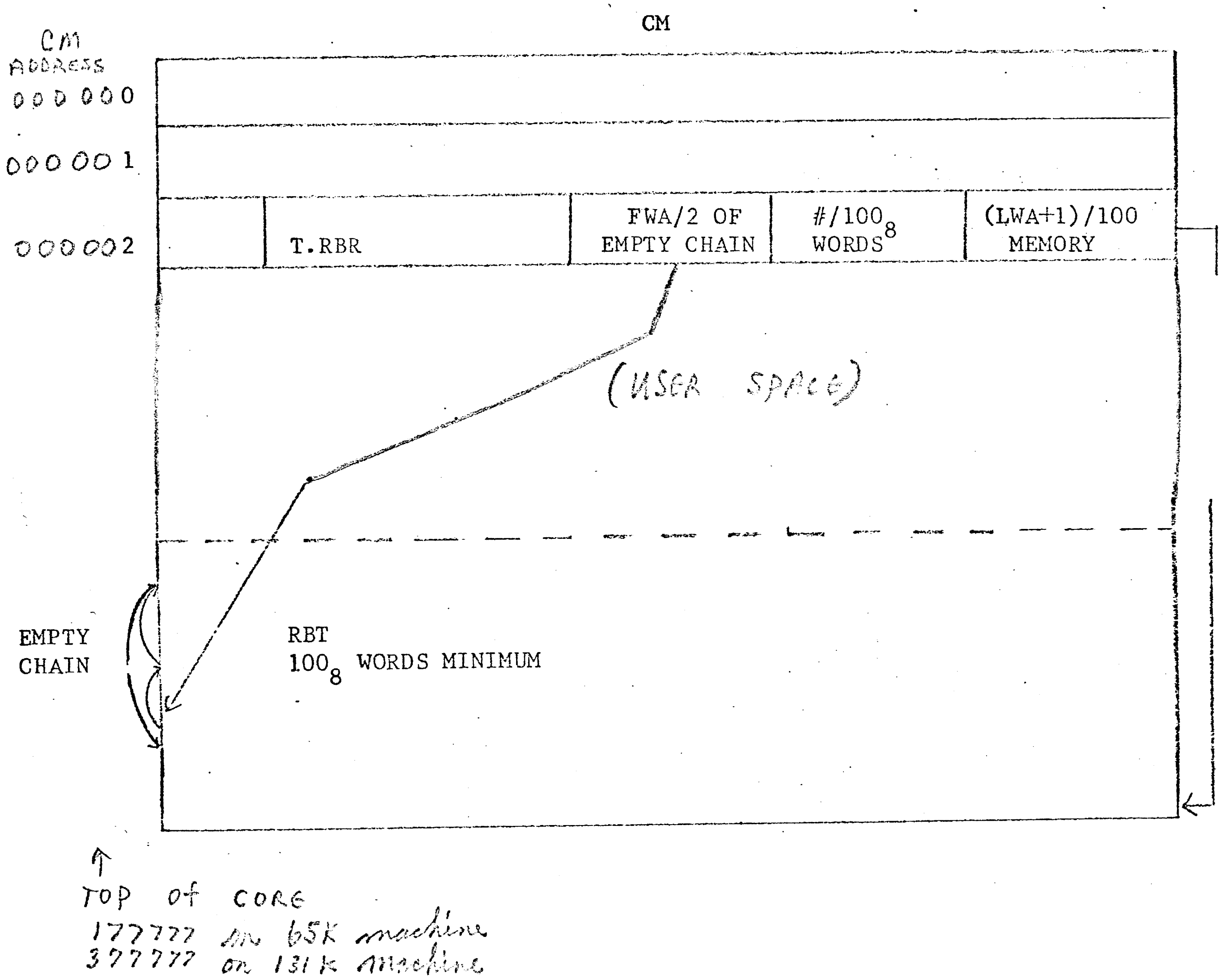
If the pointer is zero, the current RBT ends the chain.

The area reserved for RBT use may be reduced by control point space requirements. The maximum is defined by the number of word pairs referenceable by a twelve bit byte.

The RBT area starts at high core with its first word pair, and works down. The first word of the first RBT is at location 377,776; the first word of the second RBT is at location 377,774; etc. The number of RBT word pairs/100B is found in word 2, byte 3, (starting with 0, left to right) of low core.

The unocccupied RBT pairs are also chained together (blocks of word pairs are added or subtracted in groups of 100B words). The position of the start of the empty chain is found in the middle byte of word 2 of low core.

RBT IN CM



Byte Types That Can Occur in an RBT

RBT Link - (X-byte) The first byte of each RBT CM word pair. If blank, the chain of RBT word pairs assigned to a logical file terminates in the current word pair. If occupied, its contents multiplied by 2 and subtracted from the LWA+1 of central memory gives the address of the next RBT word pair in the chain.

RBR Link - (Y-byte) The high order 9 bits of the 2nd byte of each RBT CM word pair. It identifies the RBR related to the record block group in which the file resides. It may also appear in the third through the tenth byte of each word pair, if the file is contained partially in more than one RB group (We have not found an example of this.).

First RBT Byte - (Y-byte) The first byte used in the RBT word pair is indicated in the low order 3 bits of the 2nd byte of each word pair.

Byte 2 (middle byte) of the first word of a pair is counted as RBT byte 0. Byte 3 is RBT byte 1; byte 4 is RBT byte 2. Byte 0 of word 2 is RBT byte 3, etc. Byte 4 of word 2 is RBT byte 7. See Figure I on Page 25.

If the word pair is the first in an RBT chain the 3-bit "first RBT byte" field (low order 3 bits of the Y-byte) will be set to 2 for sequented files and 4 for random files.

Flag and Allocation Type - (word 1, first pair - "0 byte") Bit 31 contains the release flag; if set, record blocks are to be released after reading.

(RANDOM BIT)
Bit 30 is not clearly defined.(See 2.6.3 (4), Page 26, of SCOPE 3.0 IRS.) Bits 24-29 contain the allocation type as defined in the ERS. 00 and 03 imply no restriction. 01 implies 50 sector record blocks. 02 implies 64 sector RB's.

Next PRU - (bits 12-23, word one - "1 byte") The first word pair in an RBT chain contains the ordinal of the next PRU in which writing is to occur for the referenced logical file. This field may differ from the same field in the FTN, which references the PRU following the last one read or written. This field occurs only in the first word pairs for a logical file.

Last Assigned Record Block - (bits 0-11, word one - "2 byte") - The first word pair for a random file contains the ordinal of the last record block assigned when the file was last written. This field occurs only in the first word pair of a randomly accessed logical file.

Last Assigned PRU - (bits 48-59, word 2 - "3 byte") - The first word pair for a random file contains the ordinal of the last record block assigned when the file was last written. This field occurs only in the first word pair of a randomly accessed logical file.

RB Link - A 12 bit quantity, appearing in one of the 0-7 bytes in an RBT word pair. The upper eleven bits, taken together with the last RBR link, define a unique position on the disk. The lower bit of an RB link is always set to distinguish it from an RBR link (which may also occur in bytes 0-7 when the file is contained partially in more than one RB group). This condition has not been observed yet, however, in our operations at the Los Angeles Data Center. Upon filling one RBR Table, whereupon we expected the system to continue reserving half-tracks, for all files in the process of being written, in the other RBR Table, the system instead hung up. Dividing the RB link by 2 gives the position in the corresponding RBR Table. (See sample calculations on Page 13.)

See figures on following pages.

RBT WORD PAIR FORMATS

59 47 35 23 11 0

Figure I.

X-BYTE	Y-BYTE	0-BYTE	1-BYTE	2-BYTE
3-BYTE	4-BYTE	5-BYTE	6-BYTE	7-BYTE

SAMPLE WORD PAIR

Figure II.

RBT LINK	RBR LINK	BYTE	FLAGS AND ALLOCATION TYPE	NEXT PRU	1ST RB LINK
2ND RB LINK	3RD RB LINK		4TH RB LINK	5TH RB LINK	6TH RB LINK

FIRST RBT PAIR FOR A SEQUENTIAL FILE

Figure III.

RBT LINK	RBR LINK	BYTE	FLAGS AND ALLOCATION TYPE	NEXT PRU	LAST ASSIGNED RB
LAST ASSIGNED PRU	1ST RB LINK		2ND RB LINK	3RD RB LINK	4TH RB LINK

FIRST RBT PAIR FOR A RANDOM FILE

Figure IV.

RBT LINK	RBR LINK	0	NTH RB LINK	N+1ST RB LINK	N+2ND RB LINK
N+3RD RB LINK	N+4TH RB LINK		N+5TH RB LINK	N+6TH RB LINK	N+7TH RB LINK

RBT PAIR INTERMEDIATE IN THE CHAIN (I.E., NOT FIRST OR LAST)

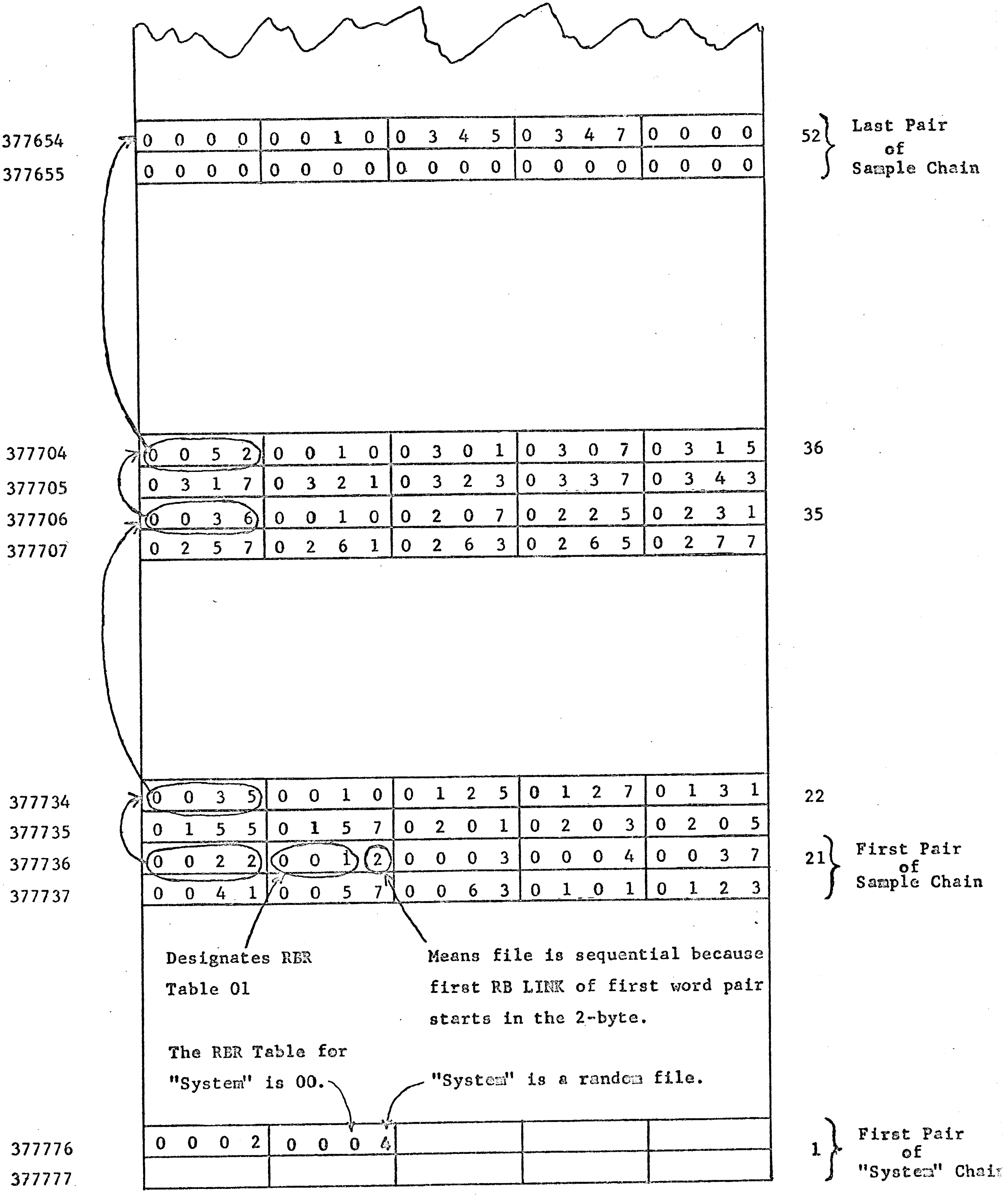
Figure V.

0 0 0 0	RBR LINK	0	MTH RB LINK	M+1ST RB LINK	M+2ND RB LINK
M+3RD RB LINK	LAST RB LINK		0 0 0 0	0 0 0 0	0 0 0 0

LAST RBT PAIR OF A PARTICULAR CHAIN

NOTE: In the last example above, the X-BYTE is zero. The LAST RB LINK may fall in any of the bytes 0-7. The bytes after the LAST RB LINK in the last word pair are all zero.

SAMPLE RBT CHAIN



377654	0000	0010	0345	0347	0000	52	Last Pair of Sample Chain
377655	0000	0000	0000	0000	0000		
377704	0052	0010	0301	0307	0315	36	
377705	0317	0321	0323	0337	0343		
377706	0036	0010	0207	0225	0231	35	
377707	0257	0261	0263	0265	0277		
377734	0035	0010	0125	0127	0131	22	
377735	0155	0157	0201	0203	0205		
377736	0022	0012	0003	0004	0037	21	First Pair of Sample Chain
377737	0041	0057	0063	0101	0123		
377776	0002	0004				1	First Pair of "System" Chai
377777							

Designates RBR Table 01

Means file is sequential because first RB LINK of first word pair starts in the 2-byte.

The RBR Table for "System" is 00.

"System" is a random file.

HYPOTHETICAL FNT/FST ENTRY ASSOCIATED WITH RBT CHAIN ON PREVIOUS PAGE

<table>
<tr><td colspan="4">59</td><td colspan="4">47</td><td colspan="4">35</td><td colspan="4">23</td><td colspan="3">11</td><td>0</td></tr>
<tr><td colspan="14">FILE NAME</td><td>LOCK
TYPE</td><td>C.P.</td><td colspan="4">PRIORITY</td></tr>
<tr><td colspan="3">EQP. CODE</td><td>CK</td><td colspan="4">FIRST RBT PAIR</td><td colspan="4">CURRENT RBT PAIR</td><td colspan="3">CURRENT RBT ENTRY</td><td>BYTE</td><td colspan="4">SECTOR</td></tr>
<tr><td colspan="2"></td><td colspan="6">FET ADDRESS</td><td colspan="4">DISPOSITION CODE</td><td colspan="2">SEC. CODE</td><td colspan="6">LAST CODE AND STATUS</td></tr>
</table>

The designations of the FNT/FST field contents are repeated here for convenience. See pages ff. for details.

Assume that we have rewound the file after writing it and then have read up to RB LINK 0337, SECTOR 52. (This is in word pair 36, byte 6.) The FNT/FST entry might look like that below:

<table>
<tr><td colspan="2">T</td><td colspan="2">A</td><td colspan="2">P</td><td colspan="2">E</td><td colspan="2">1</td><td colspan="10"></td><td></td></tr>
<tr><td>2</td><td>4</td><td>0</td><td>1</td><td>2</td><td>0</td><td>0</td><td>5</td><td>3</td><td>4</td><td>0</td><td>0</td><td>0</td><td>0</td><td>3</td><td>2</td><td>0</td><td>0</td><td>0</td><td>0</td><td>TAPE 1</td></tr>
<tr><td>0</td><td>2</td><td>0</td><td>0</td><td>0</td><td>0</td><td>2</td><td>1</td><td>0</td><td>0</td><td>3</td><td>6</td><td>0</td><td>0</td><td>3</td><td>6</td><td>0</td><td>0</td><td>5</td><td>2</td><td></td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>2</td><td>2</td><td>7</td><td>6</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>2</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td></td></tr>
</table>

From the FNT/FST entry, we can get the following information:

1. The file name is TAPE 1.
2. The lock bit is not set.
3. The type is local (03).
4. The control point is 2.
5. There is no priority associated with the file at this time.
6. The equipment code specifies 6638 Disk, alternate sector half-tracks (02).
7. The first RBT pair is the 21st in the table.

8. The current RBT pair (where file is currently positioned) is 36B.
9. The current RBT entry is 3, i.e., there are 3 completely full RBT word pairs up to (preceding) the current pair in which the file is positioned (the current position is in word pair array 36B).
10. The current byte position in RBT pair 36 is 6.
11. The sector number is 52.
12. The address of the start of the File Environment Table (FET) associated with this file is 2276.
13. There is no disposition code associated with this file.
14. The security code is 02.
15. The last code and status is 11, which says the last operation completed was a read.

Pertinent Disk Tables

The FNT/FST area, RBT (Record Block Table) word pair area, and RBR (Record Block Reservation) tables play important roles in the disk reservation scheme. Low core contains pointers to and information related to these tables.

On the diagrams on the following pages:

A = Pointer to the start of the FNT/FST area.

B = Pointer to the LWA+1 of the FNT/FST area.

C = Length of RBT area/100B. The address of the first word of the RBT area = 400 000B-C*100B.

D = Start of RBR tables area (=B in the current LADC system).

E = Start of the empty chain in the RBT word pairs area (ie., the ordinal of the first word pair of the empty chain). The address associated with the first word of this word pair is 400 000B-2*E.

F = The contents of the second byte of the second word of an FNT/FST entry. F is the ordinal of the first RBT word pair for that file.

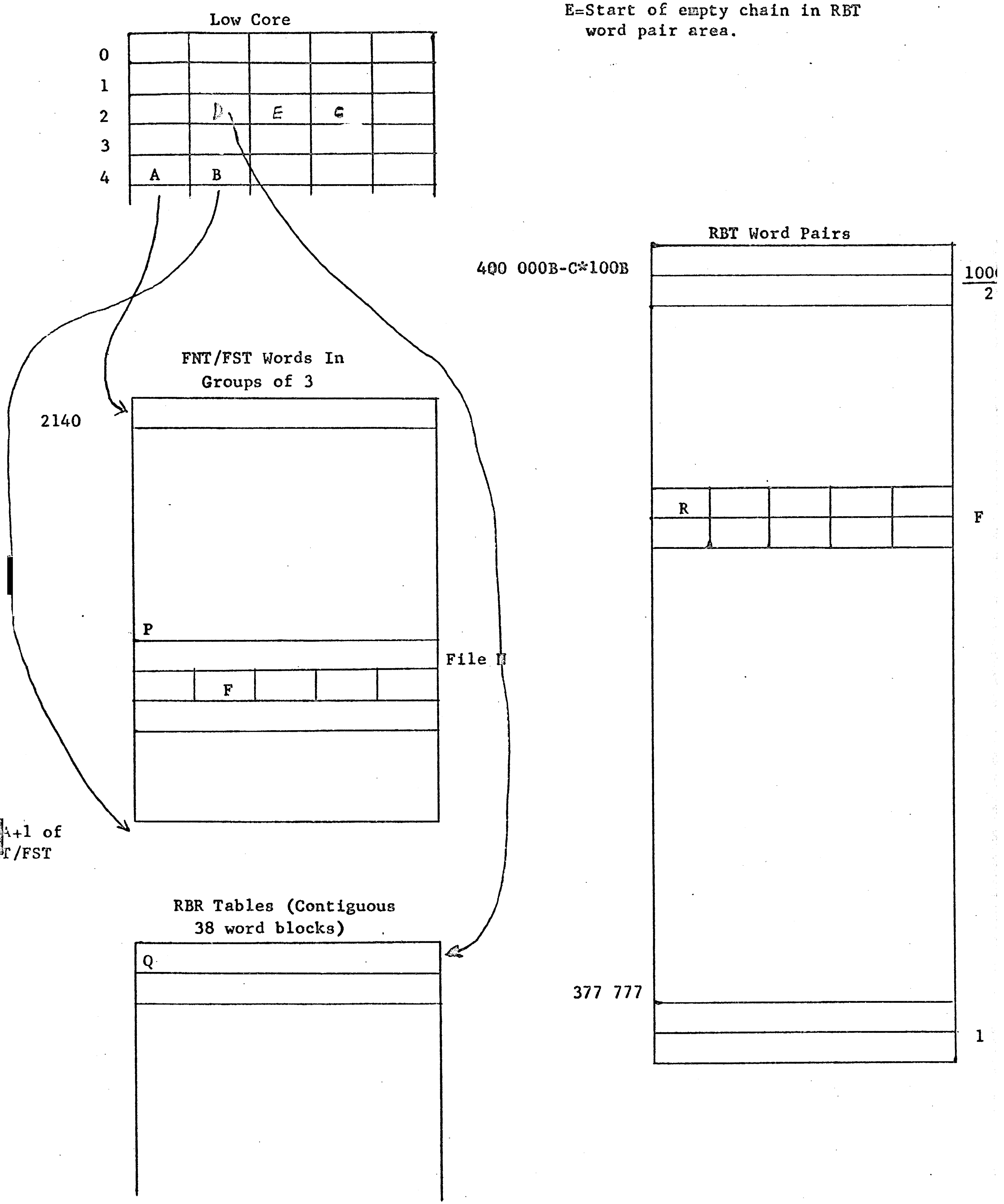
P - Refers to a 3 word FNT/FST entry.

Q - Refers to a 38 word RBR table.

R - Refers to an RBT word pair.

POINTERS AND TABLES

C=Length of RBT area/100B.
E=Start of empty chain in RBT
word pair area.



Program Disk

Purpose

To perform on-line dynamic verification of the SCOPE 3.1 Disk Linkage. Reservation tables or the corresponding tables that are placed in an image area after each dead start by the bootstrap programs L99 and BOO.

Method

This program prints out 20 words of low core, the FNT/FST entries, the RBT area, RBR tables, and the RBT empty chain. It then checks to be sure that there is a bit set in the appropriate RBR Table corresponding to each RBR link in the RBT area. An error message is printed out for each discrepancy found. Each FNT/FST entry is printed out followed by the proper disk number and all of the RB links associated with that file. The final result of the test is displayed on the scope and also goes to the dayfile.

Usage

1. To verify the current DISK Tables - DISK.
2. To verify the IMAGE DISK Tables - DISK (IMAGE)

Restrictions

The CM routines MIORC, MIORF, MBYTE, LBYT, MEMGET, and MEMPUT, and the PP routine MIO are used.

The program currently assumes two disks (2 RBR tables).

Sample Output:

```
LOW CORE AREA


000000      0000 0000 0000 0000 0000

000001      0000 6700 0003 1036 0000

000002      0000 4420 0027 0003 4000

000003      0560 0000 0000 0000 1206

000004      2140 4420 0000 0000 0000

000005      2040 2140 0000 0000 0000

000006      0000 0000 0000 0000 0003

000007      5340 0000 0000 0000 0000

000010      0000 0000 0000 0000 0000

000011      0000 0000 0000 0000 0000

000012      0000 0000 0000 0000 0000

000013      0276 0000 2262 0002 0454

000014      0000 0000 0011 0000 0000

000015      0000 0000 0000 0001 0000

000016      0000 0000 0000 0000 0000

000017      0000 0000 0000 0000 0000
```

FNT/FST AREA

```
002140      0401 3106 1114 0530 0000      DAYFILEX
002141      0000 0041 0041 0002 0007         6 6 B G
002142      0000 0000 0000 0000 0016               N

002143      2331 2324 0515 0020 0000      SYSTEM P
002144      0200 0001 0001 0004 0000      B  A A D
002145      0000 0626 0000 0000 0053        FV     S

002146      0406 1114 0534 0030 0000      DFILE1 X
002147      0000 0114 0114 0002 0005        ALAL B E
002150      0000 0000 0000 0000 0017               O

002151      0406 1114 0535 0030 0000      DFILE2 X
002152      0000 0000 0000 0002 0000             B
002153      0000 0010 0000 0074 1073         H   ≤H>

002154      0406 1114 0536 0030 0000      DFILE3 X
002155      0000 0000 0000 0002 0000             B
002156      0000 0010 0000 0074 1073         H   ≤H>

002157      0406 1114 0537 0030 0000      DFILE4 X
002160      0000 0026 0026 0002 0001         V V B A
002161      0000 0010 0000 0000 0017         H     O

002162      0406 1114 0540 0030 0000      DFILE5 X
002163      0000 0000 0000 0002 0000             B
002164      0000 0010 0000 0074 1073         H   ≤H>

002165      0406 1114 0541 0030 0000      DFILE6 X
002166      0000 0000 0000 0002 0000             B
002167      0000 0010 0000 0074 1073         H   ≤H>

002170      0406 1114 0542 0030 0000      DFILE7 X
002171      0000 0000 0000 0000 0000
002172      0000 0000 0000 0000 0001               A

002173      2205 0104 0100 0031 0000      READA  Y
002174      6000 0000 0000 0000 0000      ≡
002175      0000 0010 0000 0000 0031         H     Y

002176      2205 0104 0300 0031 0000      READC  Y
002177      6000 0000 0000 0000 0000      ≡
002200      0000 0030 0000 0000 0031         X     Y

002201      1116 2025 2400 0034 0000      INPUT  1
002202      0200 0021 0021 0002 0053      B  Q Q B S
002203      0000 0100 0000 0000 0021        A      Q

002204      0130 3132 0000 0020 0000      AXYZ   P
002205      0200 0020 0020 0003 0060      B  P P C ≡
002206      0000 2112 0000 0200 0025        QJ   B U

002207      1407 1700 0000 0034 0000      LGO    1
002210      0200 0022 0022 0002 0003      B  R R B C
002211      0000 0626 0000 0200 0023        FV   B S

002212      2022 1116 2403 0011 0003      PRINTC I C
002213      0200 0025 0030 0011 0026      B  U X I V
```

```
002215      1725 2420 2524 0034 0000      OUTPUT 1
002216      0200 0023 0023 0004 0025      B  S S D U
002217      0000 0114 0000 0200 0025        AL  B  U

002220      0315 2023 0322 0034 0000      CMPSCR 1
002221      0000 0000 0000 0000 0000
002222      0000 3022 0000 0000 0051        XR     (

002223      2323 2323 2323 2634 0000      SSSSSSV1
002224      0000 0024 0024 0002 0001          T T B A
002225      0000 0100 0000 0000 0021        A       Q

002226      2323 2323 2323 3034 0000      SSSSSSX1
002227      0000 0000 0000 0000 0000
002230      0000 0635 0000 0000 0053        F2     $

002234      2323 2323 2323 2420 0000      SSSSSSTP
002235      0000 0034 0034 0004 0056          1 1 D .
002236      0000 0626 0000 0000 0027        FV      W

002237      2323 2323 2323 2520 0000      SSSSSSUP
002240      0000 0040 0040 0006 0057          5 5 F .
002241      0000 0626 0000 0000 0027        FV      W
```

```
CURRENT LENGTH OF RRT AREA = N = 0300B


377500      0000 0000 0022 0023 0000      0140
377501      0000 0000 0000 0000 0000

377502      0140 0000 0022 0023 0000      0137
377503      0000 0000 0000 0000 0000

377504      0137 0000 0022 0023 0000      0136
377505      0000 0000 0000 0000 0000

377506      0136 0000 0022 0023 0000      0135
377507      0000 0000 0000 0000 0000

377510      0135 0000 0000 0000 0000      0134
377511      0000 0000 0000 0000 0000

377512      0134 0000 0000 0000 0000      0133
377513      0000 0000 0000 0000 0000

377514      0133 0000 0000 0000 0000      0132
377515      0012 0012 0012 0012 0012

377516      0132 0000 0000 0000 0000      0131
377517      0002 0002 0002 0002 0000

377520      0131 0000 0000 0000 0000      0130
377521      0002 0002 0002 0002 0002

377522      0130 0000 0000 0000 0000      0127
377523      0002 0002 0002 0002 0002

377524      0127 0000 0000 0000 0000      0126
377525      0000 0000 0000 0000 0000

377526      0126 0000 0000 0000 0000      0125
377527      0002 0002 0002 0002 0002

377530      0125 0000 0000 0000 0000      0124
377531      0002 0002 0002 0002 0002

377532      0124 0000 0000 0000 0000      0123
377533      0002 0002 0000 0000 0000

377534      0123 0000 0000 0000 0000      0122
377535      0002 0002 0002 0002 0002

377536      0122 0000 0000 0000 0000      0121
377537      0002 0002 0002 0002 0002

377540      0121 0000 0000 0000 0000      0120
377541      0002 0002 0002 0002 0002

377542      0120 0000 0000 0000 0000      0117
377543      0002 0002 0002 0002 0002

377544      0117 0000 0000 0000 0000      0116
377545      0012 0000 0000 0000 0000
```

```
377546      0116 0000 0000 0000 0000      0115
377547      0002 0002 0002 0002 0002

377550      0000 0002 0000 0005 0667      0114
377551      0000 0000 0000 0000 0000

377552      0115 0000 0000 0000 0000      0113
377553      0000 0000 0000 0000 0000

377554      0113 0000 0000 0000 0000      0112
377555      0012 0012 0012 0012 0012

377556      0112 0000 0000 0000 0000      0111
377557      0012 0012 0012 0012 0012

377560      0111 0000 0000 0000 0000      0110
377561      0012 0012 0012 0012 0012

377562      0110 0000 0000 0000 0000      0107
377563      0012 0012 0012 0012 0012

377564      0107 0000 0000 0000 0000      0106
377565      0012 0012 0012 0012 0012

377566      0106 0000 0000 0000 0000      0105
377567      0012 0012 0012 0012 0012

377570      0105 0000 0000 0000 0000      0104
377571      0002 0002 0002 0002 0002

377572      0104 0000 0000 0000 0000      0103
377573      0000 0000 0000 0000 0000

377574      0103 0000 0000 0000 0000      0102
377575      0012 0012 0012 0012 0012

377576      0102 0000 0000 0000 0000      0101
377577      0012 0012 0012 0012 0012

377600      0101 0000 0000 0000 0000      0100
377601      0012 0012 0012 0012 0012

377602      0100 0000 0000 0000 0000      0077
377603      0012 0012 0012 0012 0012

377604      0077 0000 0000 0000 0000      0076
377605      0012 0012 0012 0012 0012

377606      0076 0000 0000 0000 0000      0075
377607      0000 0000 0000 0000 0000

377610      0075 0000 0000 0000 0000      0074
377611      0002 0002 0000 0000 0000

377612      0074 0000 0000 0000 0000      0073
377613      0002 0002 0002 0002 0002

377614      0073 0000 0000 0000 0000      0072
377615      0002 0002 0002 0002 0002

377616      0072 0000 0000 0000 0000      0071
377617      0002 0002 0002 0002 0002

377620      0071 0000 0000 0000 0000      0070
377621      0002 0002 0002 0002 0002
```

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```
377622     0070 0000 0000 0000 0000      0067
377623     0012 0000 0000 0000 0000

377624     0067 0000 0000 0000 0000      0066
377625     0002 0002 0002 0002 0002

377626     0066 0000 0000 0000 0000      0065
377627     0002 0002 0002 0002 0002

377630     0065 0000 0000 0000 0000      0064
377631     0002 0002 0002 0002 0002

377632     0064 0000 0000 0000 0000      0063
377633     0002 0002 0002 0002 0002

377634     0063 0000 0000 0000 0000      0062
377635     0002 0002 0002 0002 0002

377636     0062 0000 0000 0000 0000      0061
377637     0002 0002 0002 0002 0002

377640     0061 0000 0000 0000 0000      0060
377641     0002 0002 0002 0002 0002

377642     0060 0000 0000 0000 0000      0057
377643     0002 0002 0002 0000 0000

377644     0057 0000 0000 0000 0000      0056
377645     0002 0002 0002 0002 0002

377646     0056 0000 0000 0000 0000      0055
377647     0000 0000 0000 0000 0000

377650     0055 0000 0000 0000 0000      0054
377651     0000 0000 0000 0000 0000

377652     0054 0000 0000 0000 0000      0053
377653     0002 0002 0002 0002 0002

377654     0053 0000 0000 0000 0000      0052
377655     0000 0000 0000 0000 0000

377656     0052 0000 0000 0000 0000      0051
377657     0000 0000 0000 0000 0000

377660     0051 0000 0000 0000 0000      0050
377661     0012 0012 0012 0012 0012

377662     0050 0000 0000 0000 0000      0047
377663     0012 0012 0012 0012 0012

377664     0047 0000 0000 0000 0000      0046
377665     0012 0012 0000 0000 0000

377666     0046 0000 0000 0000 0000      0045
377667     0012 0012 0012 0012 0012

377670     0045 0000 0000 0000 0000      0044
377671     0012 0012 0012 0012 0012

377672     0044 0000 0000 0000 0000      0043
377673     0012 0012 0012 0012 0012

377674     0043 0000 0000 0000 0000      0042
377675     0000 0000 0000 0000 0000
```

```
377676     0000 0002 0000 0007 0365     0041
377677     0000 0000 0000 0000 0000

377700     0000 0014 0101 0057 0004     0040
377701     0000 0055 0071 0133 0000

377702     0042 0000 0000 0000 0000     0037
377703     0012 0012 0012 0012 0012

377704     0037 0000 0000 0000 0000     0036
377705     0000 0000 0000 0000 0000

377706     0036 0000 0000 0000 0000     0035
377707     0012 0012 0012 0012 0012

377710     0000 0012 0003 0056 0073     0034
377711     0045 0047 0000 0000 0000

377712     0035 0000 0000 0000 0000     0033
377713     0012 0012 0012 0012 0012

377714     0000 0010 0065 0063 0067     0032
377715     0000 0000 0000 0000 0000

377716     0033 0000 0000 0000 0000     0031
377717     0000 0000 0000 0000 0000

377720     0032 0010 0027 0033 0035     0030
377721     0041 0043 0051 0053 0057

377722     0031 0000 0000 0000 0000     0027
377723     0000 0000 0000 0000 0000

377724     0000 0002 0000 0001 0003     0026
377725     0000 0000 0000 0000 0000

377726     0030 0012 0003 0051 0011     0025
377727     0015 0017 0021 0023 0025

377730     0000 0012 0003 0001 0037     0024
377731     0000 0000 0000 0000 0000

377732     0000 0012 0003 0025 0005     0023
377733     0007 0013 0000 0000 0000

377734     0000 0012 0003 0004 0061     0022
377735     0000 0000 0000 0000 0000

377736     0000 0012 0003 0053 0001     0021
377737     0000 0000 0000 0000 0000

377740     0000 0012 0003 0060 0003     0020
377741     0031 0000 0000 0000 0000

377742     0000 0000 0335 0337 0341     0017
377743     0343 0000 0000 0000 0000

377744     0017 0000 0315 0317 0321     0016
377745     0323 0325 0327 0331 0333

377746     0016 0000 0275 0277 0301     0015
377747     0303 0305 0307 0311 0313

377750     0015 0000 0255 0257 0261     0014
377751     0263 0265 0267 0271 0273
```

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```
377752        0014 0000 0235 0237 0241       0013
377753        0243 0245 0247 0251 0253

377754        0013 0000 0215 0217 0221       0012
377755        0223 0225 0227 0231 0233

377756        0012 0000 0175 0177 0201       0011
377757        0203 0205 0207 0211 0213

377760        0011 0000 0155 0157 0161       0010
377761        0163 0165 0167 0171 0173

377762        0010 0000 0135 0137 0141       0007
377763        0143 0145 0147 0151 0153

377764        0007 0000 0115 0117 0121       0006
377765        0123 0125 0127 0131 0133

377766        0006 0000 0075 0077 0101       0005
377767        0103 0105 0107 0111 0113

377770        0005 0000 0055 0057 0061       0004
377771        0063 0065 0067 0071 0073

377772        0004 0000 0035 0037 0041       0003
377773        0043 0045 0047 0051 0053

377774        0003 0000 0015 0017 0021       0002
377775        0023 0025 0027 0031 0033

377776        0002 0004 0100 0024 0163       0001
377777        0024 0005 0007 0011 0013
```

```
RBR TABLE 00


004420      0002 0100 0000 0301 0100
004421      4000 0001 4000 3614 0000


004422      7777 7777 7777 7777 7777
004423      7777 7777 7777 7777 6002
004424      0000 0000 0000 0000 0000
004425      0000 0000 0400 0000 0000
004426      0000 0000 0000 0000 0000
004427      0000 0000 0000 0000 0000
004430      0000 0000 0000 0000 0000
004431      0000 0000 0000 0000 0000
004432      0000 0000 0000 0000 0000
004433      0000 0000 0000 0000 0000
004434      0000 0000 0000 0000 0000
004435      0000 0000 0000 0000 0000
004436      0000 0000 0000 0000 0000
004437      0000 0000 0000 0000 0000
004440      0000 0000 0000 0000 0000
004441      0000 0000 0000 0000 0000
004442      0000 0000 0000 0000 0000
004443      0000 0000 0000 0000 0000
004444      0000 0000 0000 0000 0000
004445      0000 0000 0000 0000 0000
004446      0000 0000 0000 0000 0000
004447      0000 0000 0000 0000 0000
004450      0000 0000 0000 0000 0000
004451      0000 0000 0000 0000 0000
004452      0000 0000 0000 0000 0000
004453      0000 0000 0000 0000 0000
004454      0000 0000 0000 0000 0000
004455      0000 0000 0000 0000 0000
004456      0000 0000 0000 0000 0000
004457      0000 0000 0000 0000 0000
004460      0000 0000 0000 0000 0000
004461      0000 0000 0000 0000 0000


004462      7400 0000 0000 0000 0000
004463      0000 0000 0000 0000 0000
004464      0000 0000 0000 0000 0000
004465      0000 0000 0000 0000 0000
```

RBR TABLE 01

```
004466        0002 0200 0000 0301 0100
004467        4000 0002 4000 3741 0002


004470        7777 7777 7700 0004 0000
004471        0000 0000 0000 0000 0000
004472        0000 0000 0000 0000 0000
004473        0000 0000 0000 0000 0000
004474        0000 0000 0000 0000 0000
004475        0000 0000 0000 0000 0000
004476        0000 0000 0000 0000 0000
004477        0000 0000 0000 0000 0000
004500        0000 0000 0000 0000 0000
004501        0000 0000 0000 0000 0000
004502        0000 0000 0000 0000 0000
004503        0000 0000 0000 0000 0000
004504        0000 0000 0000 0000 0000
004505        0000 0000 0000 0000 0000
004506        0000 0000 0000 0000 0000
004507        0000 0000 0000 0000 0000
004510        0000 0000 0000 0000 0000
004511        0000 0000 0000 0000 0000
004512        0000 0000 0000 0000 0000
004513        0000 0000 0000 0000 0000
004514        0000 0000 0000 0000 0000
004515        0000 0000 0000 0000 0000
004516        0000 0000 0000 0000 0000
004517        0000 0000 0000 0000 0000
004520        0000 0000 0000 0000 0000
004521        0000 0000 0000 0000 0000
004522        0000 0000 0000 0000 0000
004523        0000 0000 0000 0000 0000
004524        0000 0000 0000 0000 0000
004525        0000 0000 0000 0000 0000
004526        0000 0000 0000 0000 0000
004527        0000 0000 0000 0000 0000

004530        0000 0000 0000 0000 0000
004531        0000 0000 0000 0000 0000
004532        0000 0000 0000 0000 0000
004533        0000 0000 0000 0000 0000
```

```
002140     0401 3106 1114 0530 0000     DAYFILEX
002141     0000 0041 0041 0002 0007        6 6 B G
002142     0000 0000 0000 0000 0016              N

                 THE FOLLOWING RBS ARE FOR DISK 00

                 0365

002143     2331 2324 0515 0020 0000     SYSTEM P
002144     0200 0001 0001 0004 0000     B  A A D
002145     0000 0626 0000 0000 0053       FV     $

                 THE FOLLOWING RBS ARE FOR DISK 00

                 0005 0007 0011 0013 0015 0017 0021 0023 0025 0027 0031 0033 0035 0037 0041 0043 0045 0047 0051 0053

                 0055 0057 0061 0063 0065 0067 0071 0073 0075 0077 0101 0103 0105 0107 0111 0113 0115 0117 0121 0123

                 0125 0127 0131 0133 0135 0137 0141 0143 0145 0147 0151 0153 0155 0157 0161 0163 0165 0167 0171 0173

                 0175 0177 0201 0203 0205 0207 0211 0213 0215 0217 0221 0223 0225 0227 0231 0233 0235 0237 0241 0243

                 0245 0247 0251 0253 0255 0257 0261 0263 0265 0267 0271 0273 0275 0277 0301 0303 0305 0307 0311 0313

                 0315 0317 0321 0323 0325 0327 0331 0333 0335 0337 0341 0343

002146     0406 1114 0534 0030 0000     DFILE1 X
002147     0000 0114 0114 0002 0005       ALAL B E
002150     0000 0000 0000 0000 0017              0

                 THE FOLLOWING RBS ARE FOR DISK 00

                 0667

002151     0406 1114 0535 0030 0000     DFILE2 X
002152     0000 0000 0000 0002 0000            B
002153     0000 0010 0000 0074 1073        H   ≤H>

     THERE ARE NO RBT WORD PAIRS FOR THE ABOVE FNT/FST ENTRY

002154     0406 1114 0536 0030 0000     DFILE3 X
002155     0000 0000 0000 0002 0000            B
002156     0000 0010 0000 0074 1073        H   ≤H>

     THERE ARE NO RBT WORD PAIRS FOR THE ABOVE FNT/FST ENTRY

002157     0406 1114 0537 0030 0000     DFILE4 X
002160     0000 0026 0026 0002 0001        V V B A
002161     0000 0010 0000 0000 0017        H     0

                 THE FOLLOWING RBS ARE FOR DISK 00
```

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```
                0003


002162       0406 1114 0540 0030 0000      DFILE5 X
002163       0000 0000 0000 0002 0000             B
002164       0000 0010 0000 0074 1073         H   ≤H>

      THERE ARE NO RBT WORD PAIRS FOR THE ABOVE FNT/FST ENTRY


002165       0406 1114 0541 0030 0000      DFILE6 X
002166       0000 0000 0000 0002 0000             B
002167       0000 0010 0000 0074 1073         H   ≤H>

      THERE ARE NO RBT WORD PAIRS FOR THE ABOVE FNT/FST ENTRY


002170       0406 1114 0542 0030 0000      DFILE7 X
002171       0000 0000 0000 0000 0000
002172       0000 0000 0000 0000 0001                A

      THERE ARE NO RBT WORD PAIRS FOR THE ABOVE FNT/FST ENTRY


002173       2205 0104 0100 0031 0000      READA   Y
002174       6000 0000 0000 0000 0000      ≡
002175       0000 0010 0000 0000 0031         H      Y

      THIS FNT/FST ENTRY IS FOR A NON-ALLOCATABLE DEVICE

      THERE ARE NO RBT WORD PAIRS FOR THE ABOVE FNT/FST ENTRY


002176       2205 0104 0300 0031 0000      READC   Y
002177       6000 0000 0000 0000 0000      ≡
002200       0000 0030 0000 0000 0031         X      Y

      THIS FNT/FST ENTRY IS FOR A NON-ALLOCATABLE DEVICE

      THERE ARE NO RBT WORD PAIRS FOR THE ABOVE FNT/FST ENTRY


002201       1116 2025 2400 0034 0000      INPUT   1
002202       0200 0021 0021 0002 0053      B   Q Q B $
002203       0000 0100 0000 0000 0021        A       Q

                  THE FOLLOWING RBS ARE FOR DISK 01

                  0001


002204       0130 3132 0000 0020 0000      AXYZ    P
002205       0200 0020 0020 0003 0060      B   P P C ≡
002206       0000 2112 0000 0200 0025        QJ  B   U

                  THE FOLLOWING RBS ARE FOR DISK 01

                  0003 0031


002207       1407 1700 0000 0034 0000      LGO     1
002210       0200 0022 0022 0002 0003      B   R R B C
002211       0000 0626 0000 0200 0023        FV  B   S
```

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```
002212      2022 1116 2403 0011 0003      PRINTC I C
002213      0200 0025 0030 0011 0026      B  U X I V
002214      0000 0030 0040 0200 0011        X 5B  I

                THE FOLLOWING RBS ARE FOR DISK 01

                0011 0015 0017 0021 0023 0025 0027 0033 0035 0041 0043 0051 00


002215      1725 2420 2524 0034 0000      OUTPUT 1
002216      0200 0023 0023 0004 0025      B  S S D U
002217      0000 0114 0000 0200 0025        AL  B  U

                THE FOLLOWING RBS ARE FOR DISK 01

                0005 0007 0013


002220      0315 2023 0322 0034 0000      CMPSCR 1
002221      0000 0000 0000 0000 0000
002222      0000 3022 0000 0000 0051        XR     (

       THERE ARE NO RBT WORD PAIRS FOR THE ABOVE FNT/FST ENTRY


002223      2323 2323 2323 2634 0000      SSSSSSV1
002224      0000 0024 0024 0002 0001         T T B A
002225      0000 0100 0000 0000 0021        A      Q

                THE FOLLOWING RBS ARE FOR DISK 01

                0037


002226      2323 2323 2323 3034 0000      SSSSSSX1 .
002227      0000 0000 0000 0000 0000
002230      0000 0635 0000 0000 0053        F2     $

       THERE ARE NO RBT WORD PAIRS FOR THE ABOVE FNT/FST ENTRY


002234      2323 2323 2323 2420 0000      SSSSSSTP
002235      0000 0034 0034 0004 0056         1 1 D ,
002236      0000 0626 0000 0000 0027        FV     W

                THE FOLLOWING RBS ARE FOR DISK 01

                0073 0045 0047


002237      2323 2323 2323 2520 0000      SSSSSSUP
002240      0000 0040 0040 0006 0057         5 5 F .
002241      0000 0626 0000 0000 0027        FV     W

                THE FOLLOWING RBS ARE FOR DISK 01

                0055 0071 0133
```

```
THE RBT PAIRS IN THE EMPTY CHAIN FOLLOW


377722      0031 0000 0000 0000 0000       0027
377723      0000 0000 0000 0000 0000

377716      0033 0000 0000 0000 0000       0031
377717      0000 0000 0000 0000 0000

377712      0035 0000 0000 0000 0000       0033
377713      0012 0012 0012 0012 0012

377706      0036 0000 0000 0000 0000       0035
377707      0012 0012 0012 0012 0012

377704      0037 0000 0000 0000 0000       0036
377705      0000 0000 0000 0000 0000

377702      0042 0000 0000 0000 0000       0037
377703      0012 0012 0012 0012 0012

377674      0043 0000 0000 0000 0000       0042
377675      0000 0000 0000 0000 0000

377672      0044 0000 0000 0000 0000       0043
377673      0012 0012 0012 0012 0012

377670      0045 0000 0000 0000 0000       0044
377671      0012 0012 0012 0012 0012

377666      0046 0000 0000 0000 0000       0045
377667      0012 0012 0012 0012 0012

377664      0047 0000 0000 0000 0000       0046
377665      0012 0012 0000 0000 0000

377662      0050 0000 0000 0000 0000       0047
377663      0012 0012 0012 0012 0012

377660      0051 0000 0000 0000 0000       0050
377661      0012 0012 0012 0012 0012

377656      0052 0000 0000 0000 0000       0051
377657      0000 0000 0000 0000 0000

377654      0053 0000 0000 0000 0000       0052
377655      0000 0000 0000 0000 0000

377652      0054 0000 0000 0000 0000       0053
377653      0002 0002 0002 0002 0002

377650      0055 0000 0000 0000 0000       0054
377651      0000 0000 0000 0000 0000

377646      0056 0000 0000 0000 0000       0055
377647      0000 0000 0000 0000 0000

377644      0057 0000 0000 0000 0000       0056
```

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```
377642      0060 0000 0000 0000 0000      0057
377643      0002 0002 0002 0000 0000

377640      0061 0000 0000 0000 0000      0060
377641      0002 0002 0002 0002 0002

377636      0062 0000 0000 0000 0000      0061
377637      0002 0002 0002 0002 0002

377634      0063 0000 0000 0000 0000      0062
377635      0002 0002 0002 0002 0002

377632      0064 0000 0000 0000 0000      0063
377633      0002 0002 0002 0002 0002

377630      0065 0000 0000 0000 0000      0064
377631      0002 0002 0002 0002 0002

377626      0066 0000 0000 0000 0000      0065
377627      0002 0002 0002 0002 0002

377624      0067 0000 0000 0000 0000      0066
377625      0002 0002 0002 0002 0002

377622      0070 0000 0000 0000 0000      0067
377623      0012 0000 0000 0000 0000

377620      0071 0000 0000 0000 0000      0070
377621      0002 0002 0002 0002 0002

377616      0072 0000 0000 0000 0000      0071
377617      0002 0002 0002 0002 0002

377614      0073 0000 0000 0000 0000      0072
377615      0002 0002 0002 0002 0002

377612      0074 0000 0000 0000 0000      0073
377613      0002 0002 0002 0002 0002

377610      0075 0000 0000 0000 0000      0074
377611      0002 0002 0000 0000 0000

377606      0076 0000 0000 0000 0000      0075
377607      0000 0000 0000 0000 0000

377604      0077 0000 0000 0000 0000      0076
377605      0012 0012 0012 0012 0012

377602      0100 0000 0000 0000 0000      0077
377603      0012 0012 0012 0012 0012

377600      0101 0000 0000 0000 0000      0100
377601      0012 0012 0012 0012 0012

377576      0102 0000 0000 0000 0000      0101
377577      0012 0012 0012 0012 0012

377574      0103 0000 0000 0000 0000      0102
377575      0012 0012 0012 0012 0012

377572      0104 0000 0000 0000 0000      0103
377573      0000 0000 0000 0000 0000

377570      0105 0000 0000 0000 0000      0104
377571      0002 0002 0002 0002 0002
```

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```
377566       0106 0000 0000 0000 0000       0105
377567       0012 0012 0012 0012 0012

377564       0107 0000 0000 0000 0000       0106
377565       0012 0012 0012 0012 0012

377562       0110 0000 0000 0000 0000       0107
377563       0012 0012 0012 0012 0012

377560       0111 0000 0000 0000 0000       0110
377561       0012 0012 0012 0012 0012

377556       0112 0000 0000 0000 0000       0111
377557       0012 0012 0012 0012 0012

377554       0113 0000 0000 0000 0000       0112
377555       0012 0012 0012 0012 0012

377552       0115 0000 0000 0000 0000       0113
377553       0000 0000 0000 0000 0000

377546       0116 0000 0000 0000 0000       0115
377547       0002 0002 0002 0002 0002

377544       0117 0000 0000 0000 0000       0116
377545       0012 0000 0000 0000 0000

377542       0120 0000 0000 0000 0000       0117
377543       0002 0002 0002 0002 0002

377540       0121 0000 0000 0000 0000       0120
377541       0002 0002 0002 0002 0002

377536       0122 0000 0000 0000 0000       0121
377537       0002 0002 0002 0002 0002

377534       0123 0000 0000 0000 0000       0122
377535       0002 0002 0002 0002 0002

377532       0124 0000 0000 0000 0000       0123
377533       0002 0002 0000 0000 0000

377530       0125 0000 0000 0000 0000       0124
377531       0002 0002 0002 0002 0002

377526       0126 0000 0000 0000 0000       0125
377527       0002 0002 0002 0002 0002

377524       0127 0000 0000 0000 0000       0126
377525       0000 0000 0000 0000 0000

377522       0130 0000 0000 0000 0000       0127
377523       0002 0002 0002 0002 0002

377520       0131 0000 0000 0000 0000       0130
377521       0002 0002 0002 0002 0002

377516       0132 0000 0000 0000 0000       0131
377517       0002 0002 0002 0002 0000

377514       0133 0000 0000 0000 0000       0132
377515       0012 0012 0012 0012 0012

377512       0134 0000 0000 0000 0000       0133
```

```
377510       0135 0000 0000 0000 0000        0134
377511       0000 0000 0000 0000 0000

377506       0136 0000 0022 0023 0000        0135
377507       0000 0000 0000 0000 0000

377504       0137 0000 0022 0023 0000        0136
377505       0000 0000 0000 0000 0000

377502       0140 0000 0022 0023 0000        0137
377503       0000 0000 0000 0000 0000

377500       0000 0000 0022 0023 0000        0140
377501       0000 0000 0000 0000 0000
```

```
LLOWING ARE THE RESULTS OF A TEST TO CHECK IF THERE IS AN RBR BIT SET FOR EACH RB INDICATED IN THE RBT WORD PAIRS TABLE.

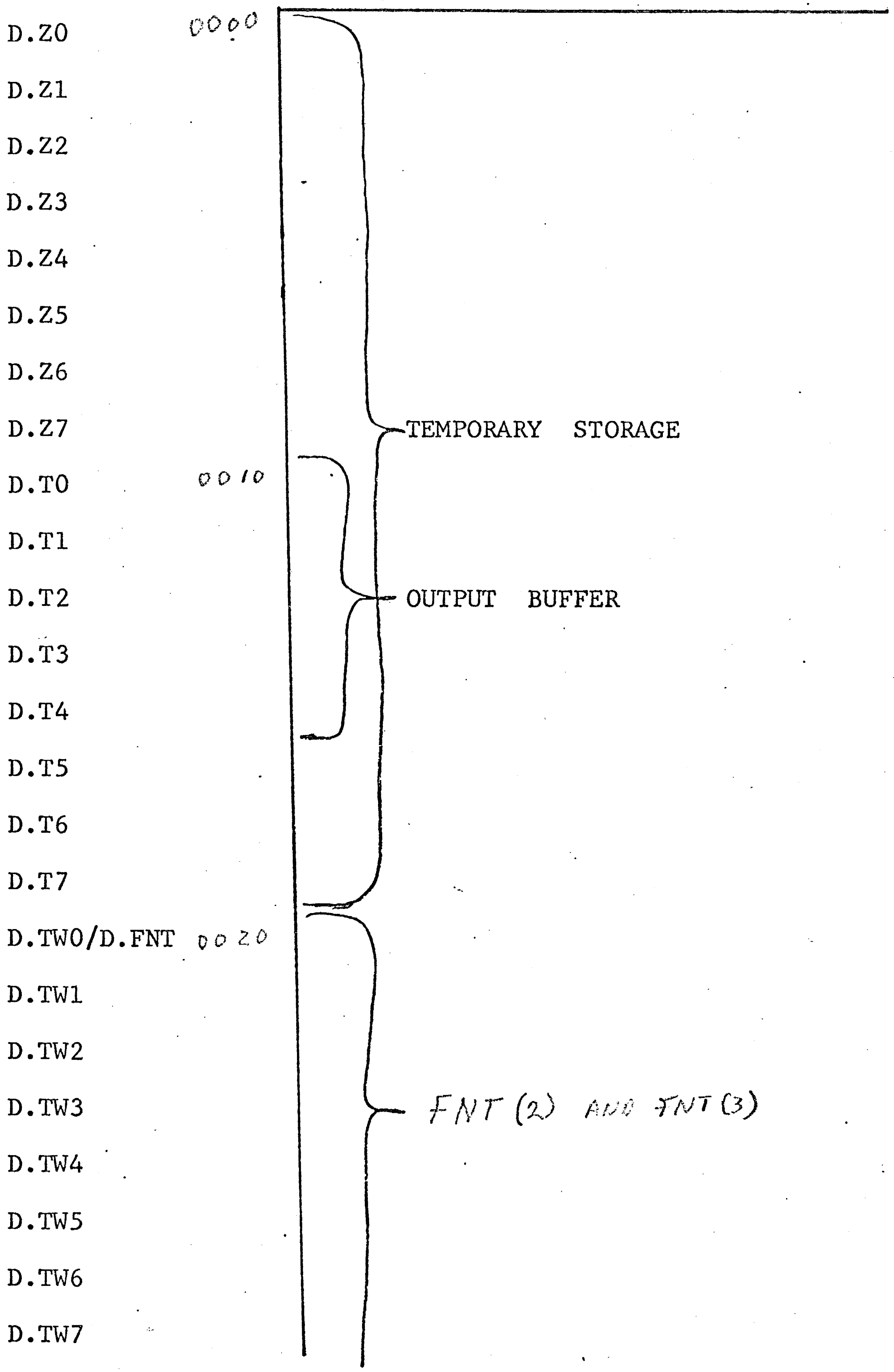
R TEST INITIATED FOR FILE DAYFILEX
R TEST INITIATED FOR FILE SYSTEM P
R TEST INITIATED FOR FILE DFILE1 X
R TEST INITIATED FOR FILE DFILE4 X
R TEST INITIATED FOR FILE INPUT  1
R TEST INITIATED FOR FILE AXYZ   P
R TEST INITIATED FOR FILE LGO    1
R TEST INITIATED FOR FILE PRINTC I C
R TEST INITIATED FOR FILE OUTPUT 1
R TEST INITIATED FOR FILE SSSSSSV1
R TEST INITIATED FOR FILE SSSSSSTP
R TEST INITIATED FOR FILE SSSSSSUP
  9 FILES HAD NO RBT WORD PAIRS ASSOCIATED WITH THEM

 12 FILES TESTED FOR RB - RBR CORRESPONDENCE

HE NUMBER OF FILES IN THE FNT/FST AT THE TIME OF TESTING WAS  21

0 ERRORS IN RB - RBR CORRESPONDENCE TEST.
```

PP RESIDENT


D.Z0
0000
D.Z1
D.Z2
D.Z3
D.Z4
D.Z5
D.Z6
D.Z7
TEMPORARY STORAGE
D.T0
0010
D.T1
D.T2
OUTPUT BUFFER
D.T3
D.T4
D.T5
D.T6
D.T7
D.TW0/D.FNT
0020
D.TW1
D.TW2
D.TW3
FNT (2) AND TNT (3)
D.TW4
D.TW5
D.TW6
D.TW7

D.TH0		
D.TH1		
D.TH2/D.EST	0032	EST
D.TH3		
D.TH4		
D.TH5		
D.TH6		
D.TH7/D.DTS/D.JFL		0037
D.FR0/D.BA	0040	FET ADDRESS RELATIVE TO LOWER 18 BITS OF IR
D.FR1		
D.FR2		
D.FR3		
D.FR4		
D.FR5/D.JECS	0045	ECS FIELD LENGTH REQUIREMENT
D.FR6/D.JPR		Computed PRIORITY
D.FR7/D.JTL/	10_8	JOB TIME LIMIT
D.FF0/D.PPIRB	0050	INPUT REGISTER BUFFER
D.FF1		
D.FF2		
D.FF3		
D.FF4		
D.FF5/D.RA	0055	CENTRAL MEMORY RA/100B
D.FF6/D.FL		CENTRAL MEMORY FL/100B
D.FF7/D.FA		FILE FST ADDRESS (FNT(2) ADDRESS).

D.SX0/D.FIRST	0060	
D.SX1		
D.SX2/D.IN	0062	
D.SX3		
D.SX4/D.OUT	0064	
D.SX5		
D.SX6/D.LIMIT	0066	
D.SX7		
D.SV0/D.PPONE	0070	1
D.SV1/D.HN	0071	100B
D.SV2/D.TH	0072	1000B
D.SV3/D.TR	0073	3
D.SV4/D.CPAD	0074	CONTROL POINT ADDRESS
D.SV5/D.PPIR	0075	INPUT REGISTER ADDRESS
D.SV6/D.PPOR	0076	OUTPUT REGISTER ADDRESS
D.SV7/D.PPMES1	0077	MESSAGE BUFFER ADDRESS

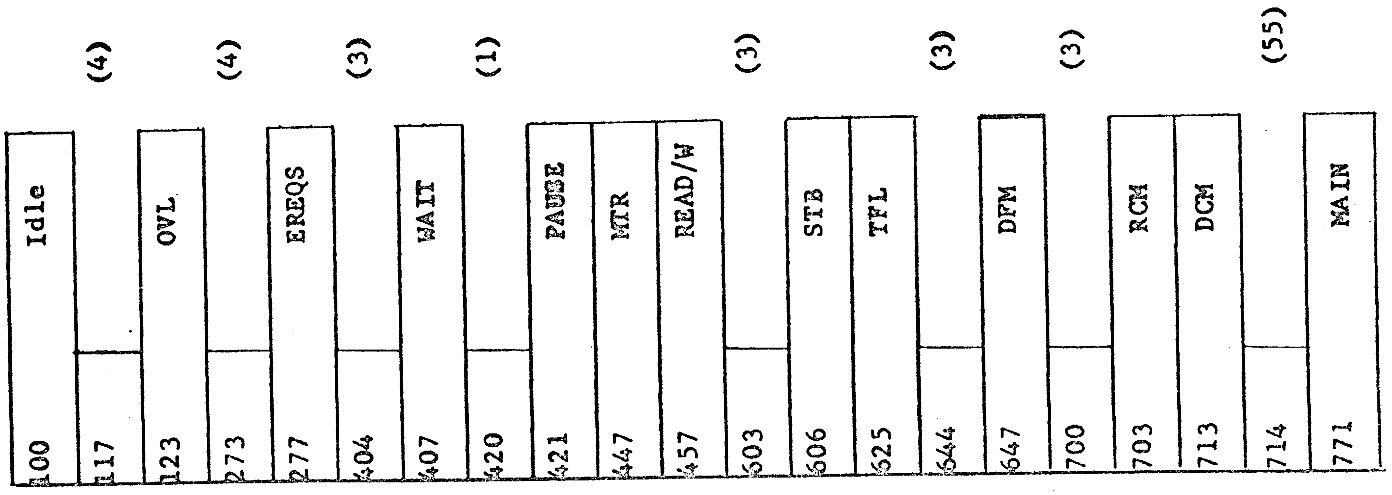
R.IDLE	0100	IDLE LOOP
R.OVLJ	0111	LOAD A PRIMARY OVERLAY & JUMP TO IT
R.OVL	124	LOAD OVERLAYS
R.EREQS	0300	ENTER A REQUEST IN STACK
R.WAIT	0410	WAIT FOR OUTPUT REG. CLEAR
R.PAUSE	0430	PAUSE FOR CM MOVE
R.MTR	0450 (R.PROCESS)	ISSUE A MONITOR REQUEST
R.READP	0460	DISK I/O ROUTINES
R.WRITEP	0470	
R.STBMSK	0611	MASK FOR R.STB = 7700B
R.STB	0620	MASK BITS IN A LIST OF WORDS

R.CPFL	0627	CONTROL POINT FIELD LENGTH/100_8
R.CPRA	0631	CONTROL POINT RELATIVE ADDRESS/100_8
R.TFL	0634	CHECK ADDRESS FOR IN RANGE
R.DFM	0650	ISSUE DAYFILE MESSAGE
R.RCH	0704	REQUEST CHANNEL
R.DCH	0714	DROP CHANNEL
	0772	
	1772	

Reset by R. PAUSE

PP RESIDENT ENTRY POINTS

Comfile Tag	3.0	3.1	Function
R. IDLE	100	100	Idle loop
R.OVLJ	115	111	Enter to load overlay at 1000
R.OVL	124	124	Load PP overlay
R.EREQS	300	300	Enter request stack
R.WAIT	410	410	Wait output register clear
R.PAUSE	430	430	Pause for relocation
R.PROCESS(R.MTR)	450	450	Issue MTR function
R.READP	460	460	Xmit data to stack processor
R.WRITEP	470	470	Get data from stack processor
R.STBMSK	611	611	Channel table mask
R.STB	620	620	Process channel table mods
R.CPFL	627	627	FL
R.CPRA	631	631	RA
R.TFL	634	634	Add RA to ACC, test vs FL
R.DFM	650	650	Process dayfile message
R.RCH	704	704	Reserve channel
R.DCH	714	714	Drop channel
R.STEP	734	-	



PP RESIDENT

4-1-7

Resident Idle Loop

R.IDLE

Calling Sequence

```
LJM     R.IDLE
```

R.IDLE is the idle loop; PP resident continually scans its input register for something to do.

Overlay Load

R.OVL

Calling Sequence

```
Load A register     Load Address
RJM                 R.OVL
```

R.OVL causes an overlay whose name appears in D.T6 & D.T7 (right justified) to be loaded into the PP beginning at the address specified in the A register. R.OVL is used both by PP overlays to load higher level overlays & by PP resident to load the overlay named in the input register. PP resident does not reference the disk directly to load disk resident overlays but makes a call to the stack processor.

Enter Request Stack

R.EREQS

Calling Sequence

```
Store     L (request) in D.TO
RJM       R.EREQS
```

R.EREQS adds the control point number to the already formatted request & searches the central memory request stack for an empty entry. The monitor function, M.EREQS, is called & PP resident iterates until the monitor accepts the request.

Wait

R.WAIT

Calling Sequence

```
RJM     R.WAIT
```

R.WAIT will cause the PP to idle until the output register is clear.

Pause

R.PAUSE

Calling Sequence

```
RJM     R.PAUSE
STD     D.RA
```

R.PAUSE will exit if the PP is attached to control point zero or if the storage move flag is not set. Otherwise, the monitor function, M.PAUSE, will be issued & the PP will pause until monitor has completed the storage move for that control point. In any event, before an exit is made from R.PAUSE, the following information will be set:

(D.TO + C.CPST) = control point status

(D.TO + C.CPEF) = control point error flag

(D.TO + C.CPRA) = control point RA (hundreds)

(D.TO + C.CPFL) = control point FL (hundreds)

A register = control point RA

D.RA should always be reset after a jump to R.PAUSE.

Process Monitor Function

R.MTR

Calling Sequence

Store function parameters in D.T1 to D.T4

Load function code

RJM R.MTR

R.MTR places the function code in D.T0, writes D.T0 through D.T4 to the output register, & waits for the output register to clear.

Transmit Data Via Channel From/To Stack Processor

R.READP/R.WRITEP

Calling Sequence

Load L (request)

RJM R.READP/R.WRITEP

R.READP/R.WRITEP computes the PP word count from the first & last word addresses given in the already formatted request & adds the computed word count, the address of the PP message buffer, & the control point number to the request. The request is entered in the stack & data is transmitted via channel directly to/from PP memory. Upon exit from R.READP/R.WRITEP, the following information will be set:

(D.T3 + C.RWPPLW) = LWA + 1 of data transmitted

(D.T3 + C.RWPPST) = status

(D.T3 + C.RWPPWT) = number of PP words transmitted

Calling Sequence

```
Load     L (list)

RJM      R.STB
```

where "list" has the form

```
     L (byte)
     L (word 1)
     L (word 2)
          :
     L (word n)
     zero
```

An entry point to R.STB called R.STBMSK is the address of the mask "$\overset{a}{\text{e}}$nded" with each word in the list before the word is "exclusive ored" with the byte. This mask is initially 7700B and this value should be restored by any routine which substitutes an alternate mask. R.STB is used primarily to substitute channel numbers in driver overlays.

Test Field Length R.TFL

Calling Sequence

```
Load     relative address

RJM      R.TFL
```

R.TFL is used to insure that a relative address is within the field length. The 18-bit address is added to the control point reference address (RA) & compared with the field length. If the address is out of range, R.TFL will exit with a negative A register; if the address is legal, the A register will contain the absolute CM address (RA + relative address) upon exit. The control point RA & FL are kept locally within PP resident at R.CPRA & R.CPFL, respectively; these locations are initialized when an entry to R.PAUSE is made.

Enter Dayfile Message

R.DFM

Calling Sequence

```
Load     L (message) + flag bits
RJM      R.DFM
```

R.DFM will cause a message to be written from PP memory to the dayfile and/or the console. The flag bits are contained in the high order 6-bits of the A register upon entry to R.DFM & are used to determine the destination(s) of the message. Possible values of the flag bits are described belwo; one or more bits may be on; all are optional.

1 = Dayfile only ("A" display)
2 = control point 0 (system) message
4 = no "A" display

Drop Channel

R.DCH

Calling Sequence

```
Load     channel number
RJM      R.DCH
```

R.DCH will cause the specified channel to be dropped.

Request Channel

R.RCH

Calling Sequence

```
Load      channel number
RJM       R.RCH
```

The channel number(s) contained in the "A" register will be stored in byte D.T1, monitor function M.RCH inserted in D.T0, and D.T0 - D.T4 written to the output register for that PP. Channels will be assigned by MTR on the following priority basis:

D.T0	D.T1	D.T2	D.T3	D.T4
	2 , 1	4 , 3		

If alternate channels are specified MTR will stop looking for alternate channels upon sensing 6 bits of zero. Thus if desiring one alternate channel the programmer must clear D.T2 before entering R.RCH so the search will be terminated at that point. The procedure for requesting channel 12 with alternate channel 13 would be:

```
LDN     0
STD     D.T2
LDC     1312B
RJM     R.RCH
```

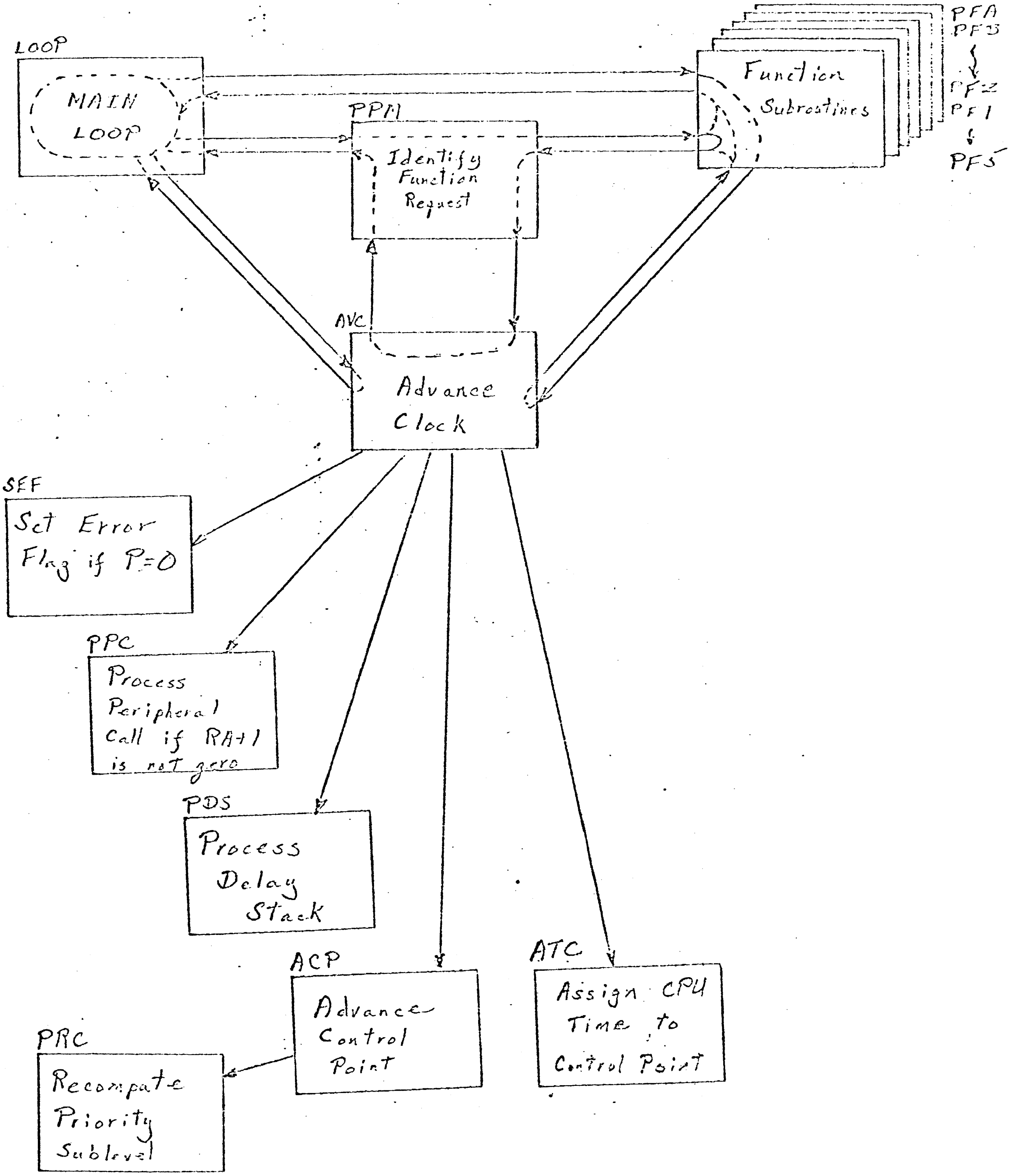
Monitor will stop looking for alternate channels after 4 channels have been investigated.

When R.RCH is used, D.T4 is automatically set nonzero; in this case, the function is not considered complete (i.e., output register is not cleared) until a channel can be assigned. When complete, byte 0 of the output register is cleared & byte 4 is set to 7777B. A channel request may be made directly to the monitor (M.RCH); one other option is allowed in this case. If byte 4 of the output contains zero, the monitor will notify the requesting PP whether or not the channel could be assigned.

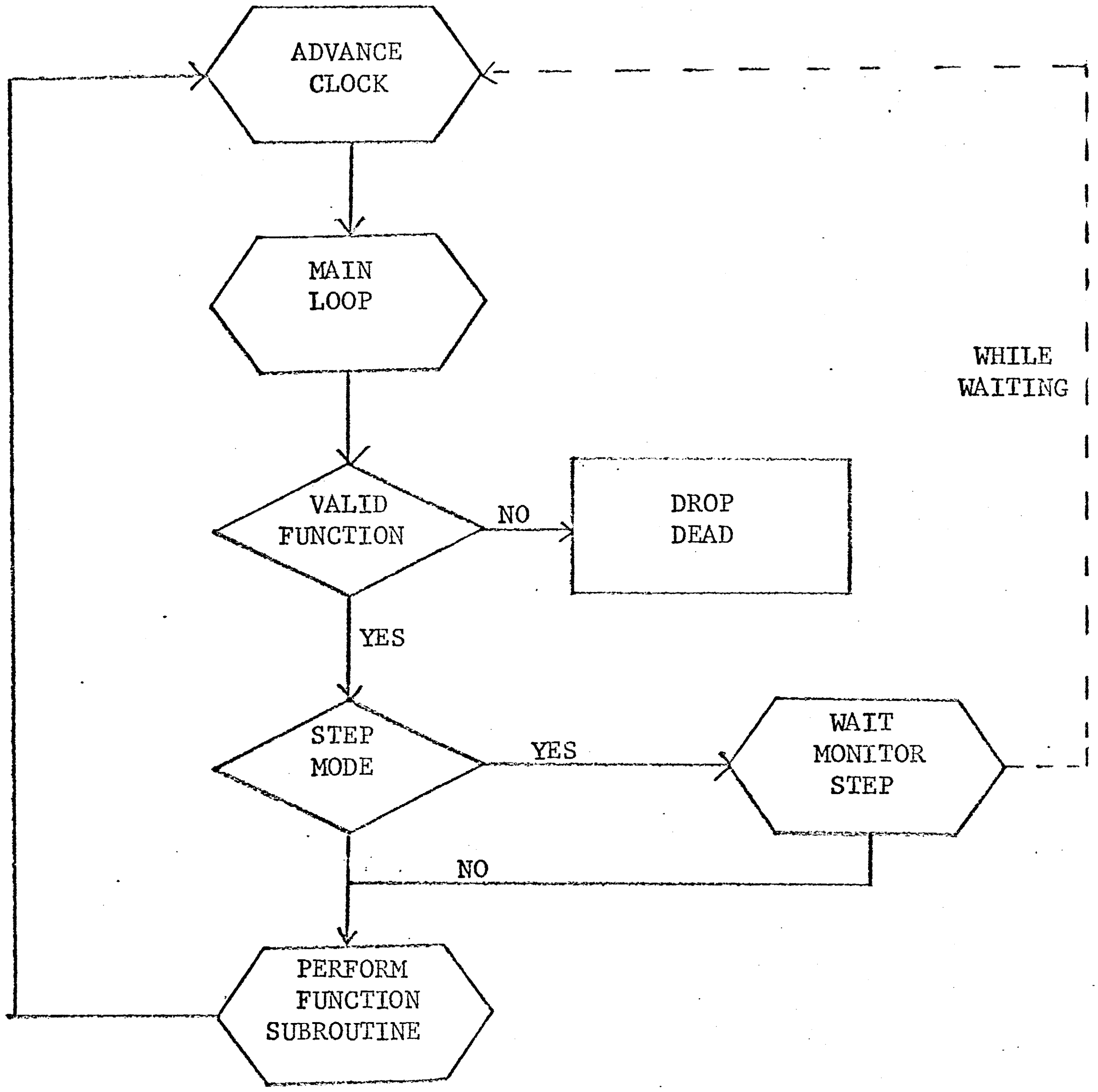
Peripheral Services Request Codes

OPCODE	MNEMONIC	DESCRIPTION	OUTPUT REGISTER
01	M.DFM	Dayfile Message	0001 000X 0000 0000 0000 X=0 Normal X=1 Dayfile Only X=2 CPO Message X=4 No A Display
02	M.RCH	Request Chanel	0002 BBAA CCDD 0000 ZZZZ ZZZZ = 2 Hang Till Free AA = Primary Choice BB = Second Choice DD = Third Choice CC = Fourth Choice
03	M.DCH	Drop Chanel	0003 00XX 0000 0000 0000
04	M.PPTIME	Assign Time	0004 0000 0000 0000 0000
05	M.STEP	STEP	0005 0000 0000 0000 000
06			
07			
10	M.RSTOR	Request Storage	0010 FFFF 0000 00XX 0000 XX=10 request RBT Storage(CP8) (BYTE 2 = Low Unit)
11	M.CDF	Complete Dayfile	0011 0000 0000 0000 0000
12	M.DPP	Drop PP	0012 0000 0000 0000 0000
13	M.ABORT	Abort	0013 0000 0000 0000 0000
14	M.NTIME	Time Limit	0014 TTTT 0000 0000 0000
15	M.RCP	Request CP	0015 0000 0000 0000 0000
16	M.DCP	Drop CP	0016 0000 0000 0000 0000
17	M.PAUSE	Pause	0017 0000 0000 0000 0000
20	M.RPP	Request PP	0020 0000 0000 0000 0000
21	M.RCLCP	Recall CP	0021 0000 0000 0000 0000
22	M.REQP	Request EQP	0022 EEEE 0000 0000 0000
23	M.DEQP	Drop EQP	0023 00EE 0000 0000 0000
24	M.RPRI	Priority	0024 00PP 0000 0000 0000
25	M.REM	Exit Mode	0025 000M 0000 0000 0000
26			
27			
30	M.OPDROP	Operator Drop	0030 00CP 00EE 0000 0000
31	M.RTAPE	ON	0031 00EE 0000 0000 0000
32	M.DTAPE	OFF	0032 00EE 0000 0000 0000
33	M.AEQP	Assign EQPT	0033 00EE 000P 0000 0000
34	M.EREQS	Enter Request	0034 000R 00AA SSSS 0000
35	M.CCPA	Change CP	0035 0000 0000 0000 00CP
36	M.CPUST	Change CPY	0036 0000 0000 0000 0000
37	M.RPJ	Delay PP Call	0037 MMMM MMMM bbbb 0000

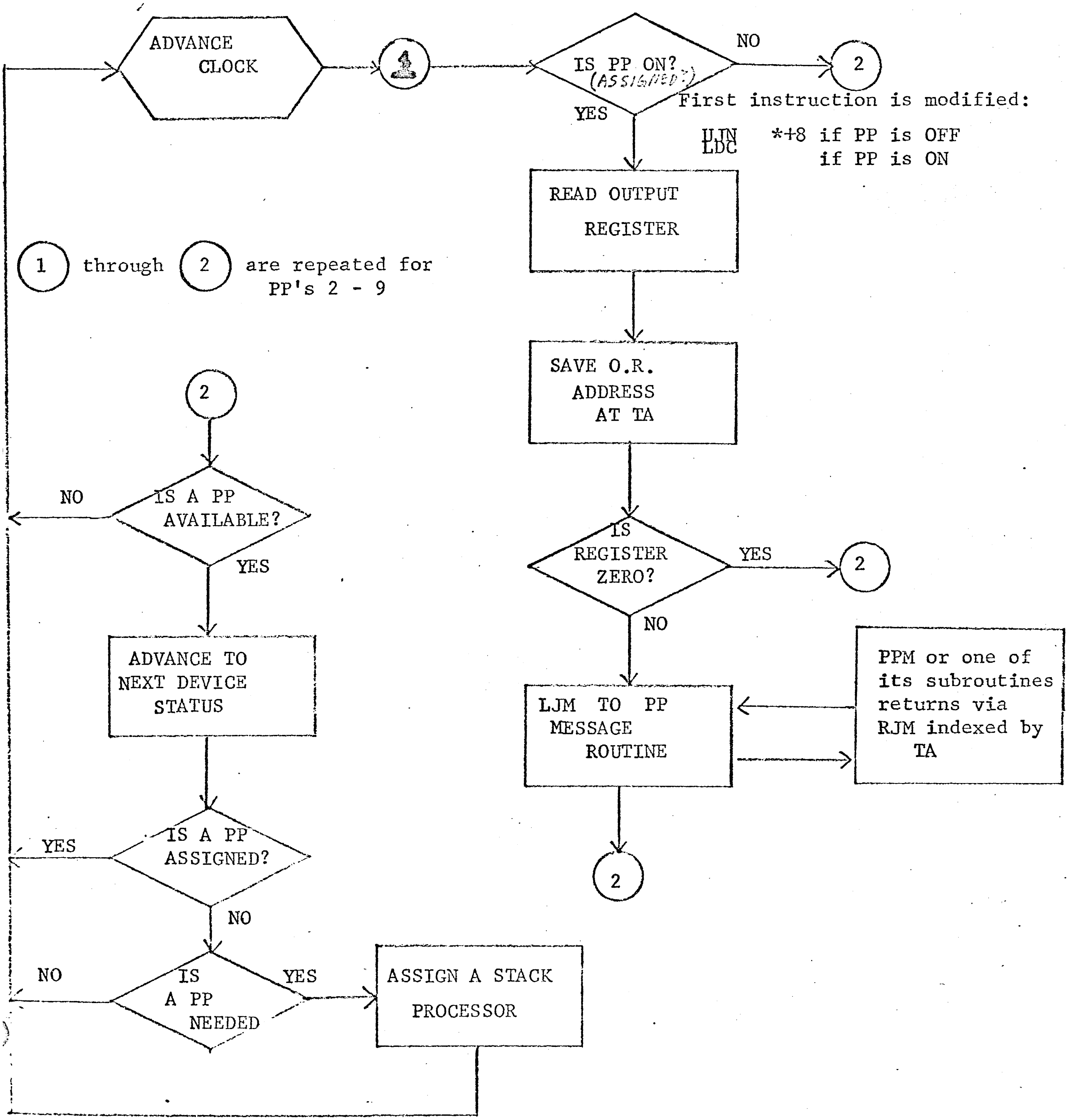
-MONITOR-


LOOP
MAIN LOOP
PPM
Identify Function Request
Function Subroutines
PFA
PFB
PFZ
PF1
PF5
AVC
Advance Clock
SEF
Set Error Flag if P=0
PPC
Process Peripheral Call if RA+1 is not zero
PDS
Process Delay Stack
ACP
Advance Control Point
ATC
Assign CPU Time to Control Point
PRC
Recompute Priority Sublevel

PERIPHERAL PROCESSOR MONITOR FUNCTION



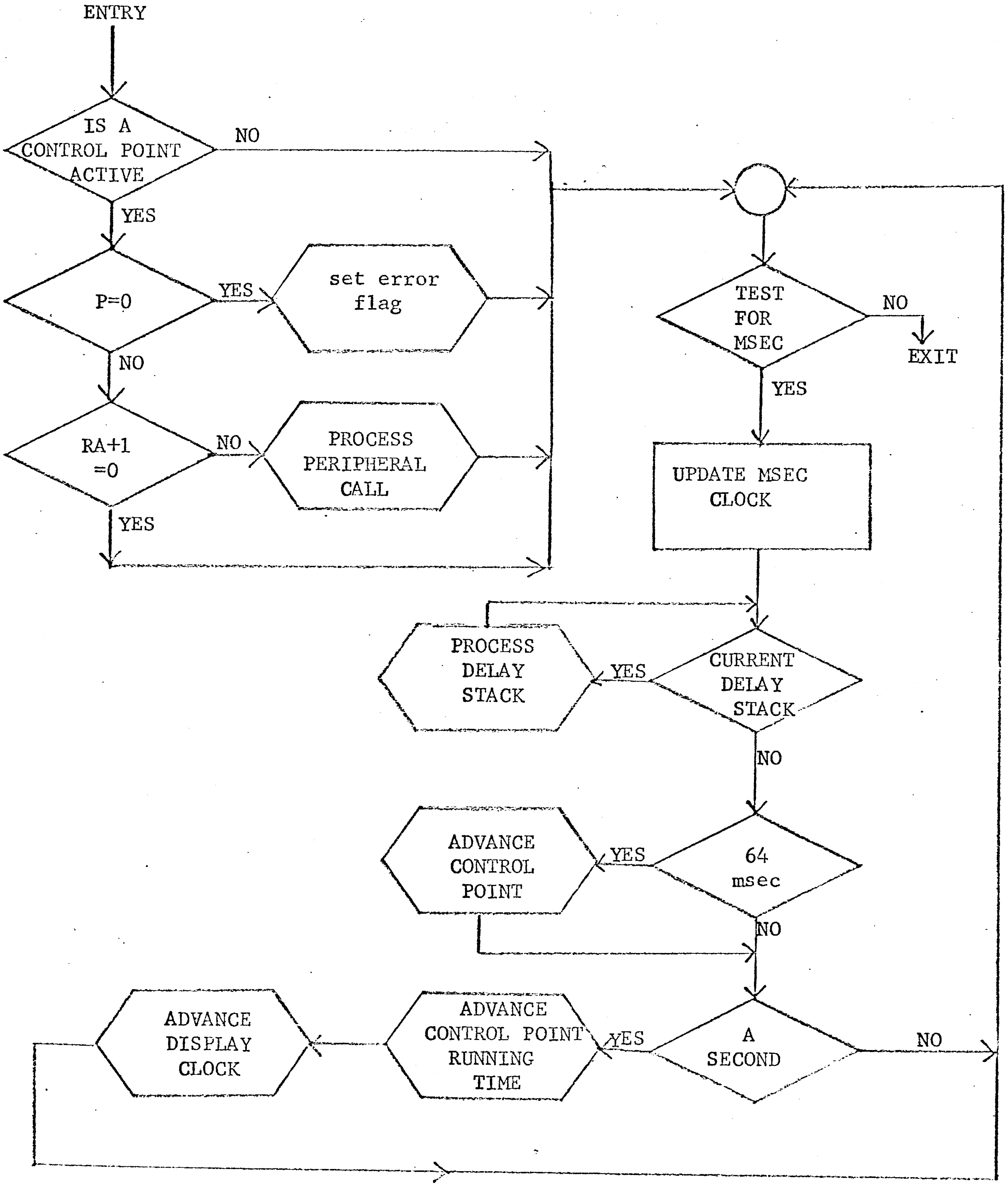
MTR Main Loop



First instruction is modified:
UJN *+8 if PP is OFF
LDC if PP is ON

① through ② are repeated for PP's 2 - 9

ADVANCE CLOCK



CONCORDANCE OF 2.0/3.0 MONITOR FUNCTIONS

Monitor Function	Mnemonic	Changed	Comments
01	M.DFM	yes	byte 1 = (0 normal request (1 dayfile only ("A" display) - same as 2.0 (2 control point 0 (system) message (4 no "A" display flags may be combined - the upper 6 bits are used by DSD
02	M.RCH	yes	byte 4 = alternate command (may be 0) if channel is assigned byte 4 is set to 7777B hang till assignment achieved by setting byte 4 = 2
03	M.DCH	no	
04	M.PPTIME	no	
05	M.STEP	no	
06	assign track	gone	these functions are no-operations
07	release track	gone	
10	M.RSTOR	yes	also used to request ECS, RBT storage byte 3 = (0 request CM only (1 request ECS only (2 request both (10 request RBT storage (CP 8) (other request CM only for byte 3 = 1 or 2, byte 2 = ECS size in 512 word units for byte 3 = 10, byte 2 = requested low limit for RBT
11	M.CDF	no	now handled by DSD

12	M.DPP	no	MTR will check for auto recall ready
13	M.ABORT	no	
14	M.NTIME	no	
15	M.RCP	no	does not override auto recall
16	M.DCP	no	does not clear auto recall
17	M.PAUSE	no	
20	M.RPP	no	not satisfied until after all RPJs (see 37)
21	M.RCLCP	no	does not override auto recall
22	M.REQP	no	however, response byte moved in Control Point area
23	M.DEQP	no	
24	M.RPRI	no	7777B altered to 7776B
25	M.REM	no	
26	Set dayfile pointers	gone	these functions are no-operations
27	Toggle simulator	gone	
30	M.OPDROP M.SEF	yes	byte 2 = value to set error flag (6 for drop)
31	M.RTAPE	no	
32	M.DTAPE	no	

33	M.AEQP	no	
34	M.EREQS	new	enter words 0 and 1 of message buffer in request stack
35	M.CCPA	new	change control point assignment decrement stack count of given Control Point
36	unused		
37	M.RPJ	new	start peripheral job in word 0 of message buffer after given msec delay (may be 0) reply optional

Subject: SCOPE 3.1 Priority System.

The priority of a job in the SCOPE 3.1 system is a twelve bit number. The twelve bits are divided into two fields. The high-order two bits are designated the priority level, the low-order ten bits are the sub-level.

The priority level is obtained from the priority field (P) of the JOB card. The four possible levels and their meaning are:

<u>Level</u>	
0	Normal Priority
1	Normal Expedite (Requires signature of 101 or 595 supervision)
2	Special Expedite (Requires signature of Manager)
3	Panic Expedite (Requires signature of a Director or higher)

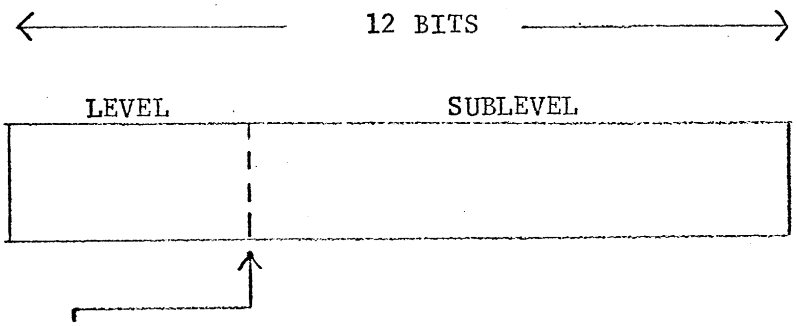
The ten-bit sub-level is initially determined from the time (T) and central memory (CM) estimates. Jobs in the input queue will periodically have their sub-levels increased. Thus the priority increases as a function of time until the job is assigned to a control point. Once a job is at a control point, its sub-level will be re-computed at regular intervals in an attempt to balance the utilization of the CPU between compute-bound and I/O-bound jobs. I/O jobs will tend to have their priorities increased; while the priorities of compute-bound jobs will tend to decrease. The priority sub-levels of jobs in the output queue (PRINT) will be inversely proportional to the amount of output to be printed.

It should be noted that the priority level will never change. That is, a priority 0 will never become a 1 or vice versa.

The following examples demonstrate the initial priority determination. All numbers are expressed in octal.

Job Card Parameters			Priority
P	T	CM	
0	100	60000	1400
0	600	60000	1000 (0000 + 1000)
1	600	60000	3000 (2000 + 1000)
2	600	60000	5000 (4000 + 1000)
0	100	120000	1100
0	600	150000	0440
0	100	40000	1700

PRIORITY



DETERMINED BY:

IP.MPR - THE MAXIMUM PRIORITY LEVEL ASSIGNABLE BY USER.

INSTALLATION OPTIONS AFFECTING PRIORITY (RE) EVALUATION

IP.LV~~G~~F - LEVEL ABOVE WHICH SUBLEVEL WILL REMAIN FIXED.

IP.IQD - DETERMINES DELAY BETWEEN INCREMENTING SUBLEVEL OF A JOB IN THE INPUT QUEUE.

IP.OQD - DETERMINES DELAY BETWEEN INCREMENTING SUBLEVEL OF A JOB IN THE OUTPUT QUEUE.

IP.CPD - DETERMINES DELAY BETWEEN REEVALUATIONS OF SUBLEVEL OF JOBS IN CP.

IP.OSW - PARAMETER IN DYNAMIC REEVALUATION ALGORITHM FOR WEIGHTING THE FORMER SUBLEVEL.

JOB CARD MACROS

WEIGHT	FIELD, RELATION, VALUE, ADDITIVE
OCTAL	FIELD
DECIMAL	FIELD

FIELD mnemonics:

CM = CENTRAL MEMORY REQUIREMENT
T = OVERALL JOB TIME LIMIT
EC = ECS MEMORY REQUIREMENT

RELATION mnemonics:

GE
LE

VALUE units:

VALUE_{CM} = 64 WORDS
VALUE_{T} = 8 SECONDS
VALUE_{EC} = 512 WORDS

INITIAL SUBLEVEL COMPUTATION EXAMPLES

INSTALLATION SPECIFIES:

DECIMAL T

WEIGHT T, LE, 8, 10B

WEIGHT CM, LE, 400B, 4

WEIGHT T, LE, 4, 20B

WEIGHT EC, GE, 100B, 100B

SAMPLE JOB CARDS:

JOB1, T40, CM30000.

SUBLEVEL = 10B + 4 = 14B

JOB2, T20, CM20000.

SUBLEVEL = 10B + 4 + 20B = 34B

JOB3, T8000, CM30000, EC200.

SUBLEVEL = 4 + 100B = 104B

DYNAMIC SUBLEVEL REEVALUATION FORMULA

$$S_{i+1} = \left[(2^{(IP.CPD+6)} - CPT)/ADJ + (2^{IP.OSW} - 1)\ S_i \right] /2^{IP.OSW}$$

WHERE:

S = CURRENT PRIORITY SUBLEVEL

CPT = CENTRAL PROCESSOR TIME USED SINCE LAST EVALUATION

ADJ = ADJUSTMENT FACTOR TO NORMALIZE TIME UNITS

$$ADJ = 2^{(IP.CPD+6) - NBS}$$

WHERE:

NBS = THE NUMBER OF BITS IN THE SUBLEVEL.

PRIORITY SUBLEVEL REEVALUATION EXAMPLE

IF:

IP.MPR = 63, THE PRIORITY LEVEL MAY RANGE FROM 1 to 77_8 AND WILL OCCUPY THE HIGH ORDER 6 BITS OF THE PRIORITY ITEM.

IP.LVF = 61, THE UPPER TWO PRIORITY LEVELS (76_8 AND 77_8) WILL BE FIXED, AND NO RECOMPUTATION OF SUBLEVELS WILL TAKE PLACE.

IP.CPD = 4, THE PRIORITY SUBLEVEL WILL BE RECOMPUTED EACH $2^{(IP.CPD+6)}$ MSEC, OR ABOUT ONCE A SECOND.

IP.OSW = 2, THE OLD SUBLEVEL WILL CARRY A WEIGHT OF $2^{(IP.OSW)} - 1$, OR 3.

ADJ WILL HAVE A VALUE OF $2^{(IP.CPD+6) - NBS} = 2^{(4+6-6)} = 16$.

THUS THE REEVALUATION COMPUTATION WOULD BE:

$$S_{i+1} = (1024 \text{ MS} - \text{CPT})/16 + 3S_i/4$$

Assume four jobs running at the same priority. If all four were demanding all of the CP time, each would receive 25% of the CP time. Job A is I/O bound and cannot use more than 10% of the CP time. That leaves 30% for each of the other three jobs. Job B is also I/O bound but can use 40% of the CP time. C and D can make use of all the CP time they can get. The following chart shows how these jobs would share the CP time. Within the chart the first number is the value of the priority sublevel and the second is the percentage of CP time actually used during the period. The example is in decimal for easier comprehension.

PRIORITY / % CP TIME USED

JOB	FIRST PERIOD	SECOND PERIOD	THIRD PERIOD	FOURTH PERIOD
A	50/10	60/0	70/10	75/10
B	50/40	52/0	64/40	63/40
C	50/50	50/0	62/50	59/50
D	50/0	62/100	46/0	59/0

	FIFTH PERIOD	SIXTH PERIOD	SEVENTH PERIOD	EIGHTH PERIOD
A	78/10	81/10	83/10	84/10
B	62/0	71/40	68/40	66/0
C	56/0	67/50	62/0	71/90
D	69/90	54/0	65/50	61/0

	NINTH PERIOD	TENTH PERIOD	ELEVENTH PERIOD	TWELFTH PERIOD
A	85/10	86/10	87/10	87/10
B	74/40	70/40	67/0	75/40
C	55/0	66/50	62/0	71/50
D	70/50	65/0	73/90	54/0

	THIRTEENTH PERIOD	FOURTEENTH PERIOD	FIFTEENTH PERIOD	TOTALS
A	87/10	87/10	87/10	9.3%
B	71/40	68/0	76/40	26.7%
C	65/50	61/0	70/50	32.7%
D	65/0	73/90	54/0	31.3%

STORAGE MOVE EXAMPLE - All figures $/100_8$

Control Point 5 Requests an FL of 300

Control Point	Before			After		
	RA	FL	UAS	RA	FL	UAS
0	0	142	0	0	142	0
1	142	33	0	142	33	0
2	175	31	0	175	31	0
3	226	0	500	226	0	0
4	726	20	130	226	20	0
5	1076	100	0	246	300	430
6	1176	150	0	1176	150	0
7	1346	0	430	1346	0	430

SYSTEM DISPLAY & DAYFILE PROCESSING.

DSD OPERATOR ENTRY CHANGES

Deletions:

- SIM.
- DATE.
- RECOVER.
- n.EXPRESS.

Additions:

n.STEP.	Places control point n in STEP mode. Only one control point may be in n.STEP at any one time. Former STEP entry still valid for system STEP mode.
n.LOADX.	Loads jobs from non-3.0 tapes.
n.BLANK.	Prepares degaused or blank tapes for use by SCOPE 3.0 by writing blank labels (double tape mark) at start of tape.
n.RECHECK.	Rechecks tape labels following pause for operator action due to label error.
n.VRN,xxxxxx.	Enters visual reel number up to 6 digits long following request for same by system.

Modifications:

n.DAYFILE,uu.	Dumps system dayfile to equipment type specified by parameter uu. May be LP, CP, or MT.

Internal Changes:

n.DIS.	May not be entered when system or a control point is in STEP mode.

The following type-ins will cause DSD to be temporarily assigned to the specified control point while the requested operation is being performed.

n.ENDx.

n.GO.

n.OFFSWx.

n.ONSWx.

n.RECHECK.

n.REPEATx.

n.SUPPRESSx.

Display Changes:

The format of the H display has been modified to display only selected files. The format may be altered by typing in H,xy. where x and/or y may be:

I -- INPUT

O -- OUTPUT

P -- PUNCH

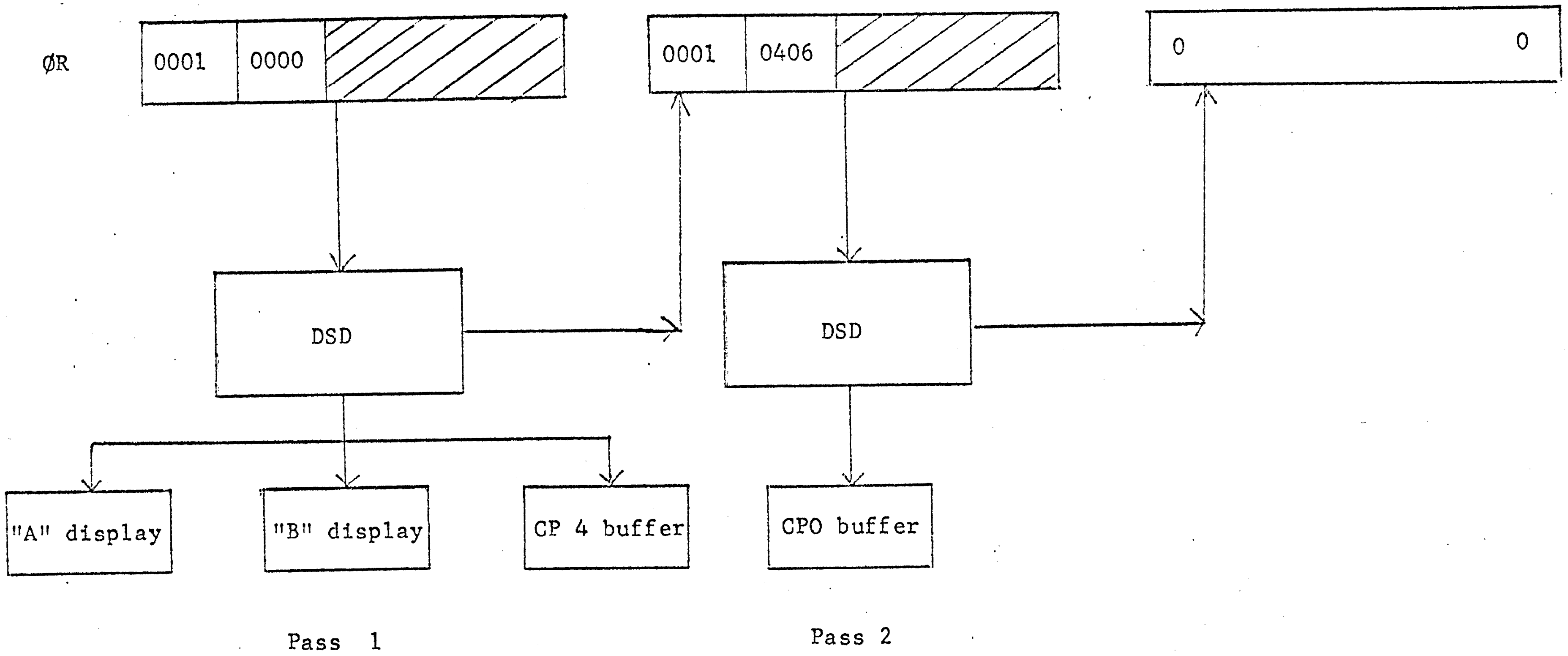
C -- COMMON

L -- LOCKED

FET AT CONTROL POINT 0

DAYFILE		STATUS/CODE
		FIRST
		IN
		OUT
FNT ADDRESS		LIMIT
		MAX

DAYFILE MESSAGE REQUEST PATH (MESSAGE FOR CP 4)



Stack Processor Orders.

Note: These codes are communicated to the stack processor. They are not the codes used in the code/status word.

Order codes requiring a specific request format are indicated. In most cases the format is determined by flag bit settings rather than order code.

O.READ (00): Read into central memory until a short PRU is encountered or the buffer is full(IN=OUT).

O.RDSK (01): Read into central memory until a short PRU is encountered or until the buffer is full. Set the FST to reference the first PRU following the first end-of-record of level x or greater. The level is given in the high-order 6 bits of the order byte. (ie. 1401 would request a read, then would require positioning following an EOR of level 14 or greater)

O.RCMPR (02): Read into central memory after dropping the first three CM words of the first PRU. This is used by STITCH for loading a program from the system library, eliminating the three word header added to system programs by EDITLIB.

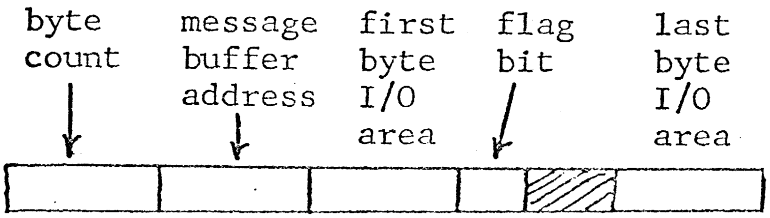
03 : Undefined. Will result in an invalid stack entry message and may abort the control point.

O.WRT (04): Write full PRU's from central memory.

O.WRTR (05): Write from central memory, ending with a short PRU of the level specified in the high-order six bits of the order byte. If an EOF flag bit is found in this order, a zero length PRU of level 17 will be written following the short PRU terminating the record.

06,07 : Undefined.

O.RDP (10) : Read into the requesting PP's memory until a short PRU is encountered, or until the input area is full. For this and other PP I/O orders the format of the second word of the request will be:



O.RDPNP (11): Read into requesting PP after dropping first three cm words of the first PRU. This is used for all PP system program calls.

O.SKP (12): Skip forward n records of level x or greater. The level is specified in the high six bits of the order byte; the number of records to be skipped is given in the third byte of the second word of the order. No data is transmitted

O.SKB (13): Skip backward n records of level x or greater. The level is specified in the high six bits of the order byte; the number of records to be skipped is given in the third byte of the second word of the order. No data is transmitted.

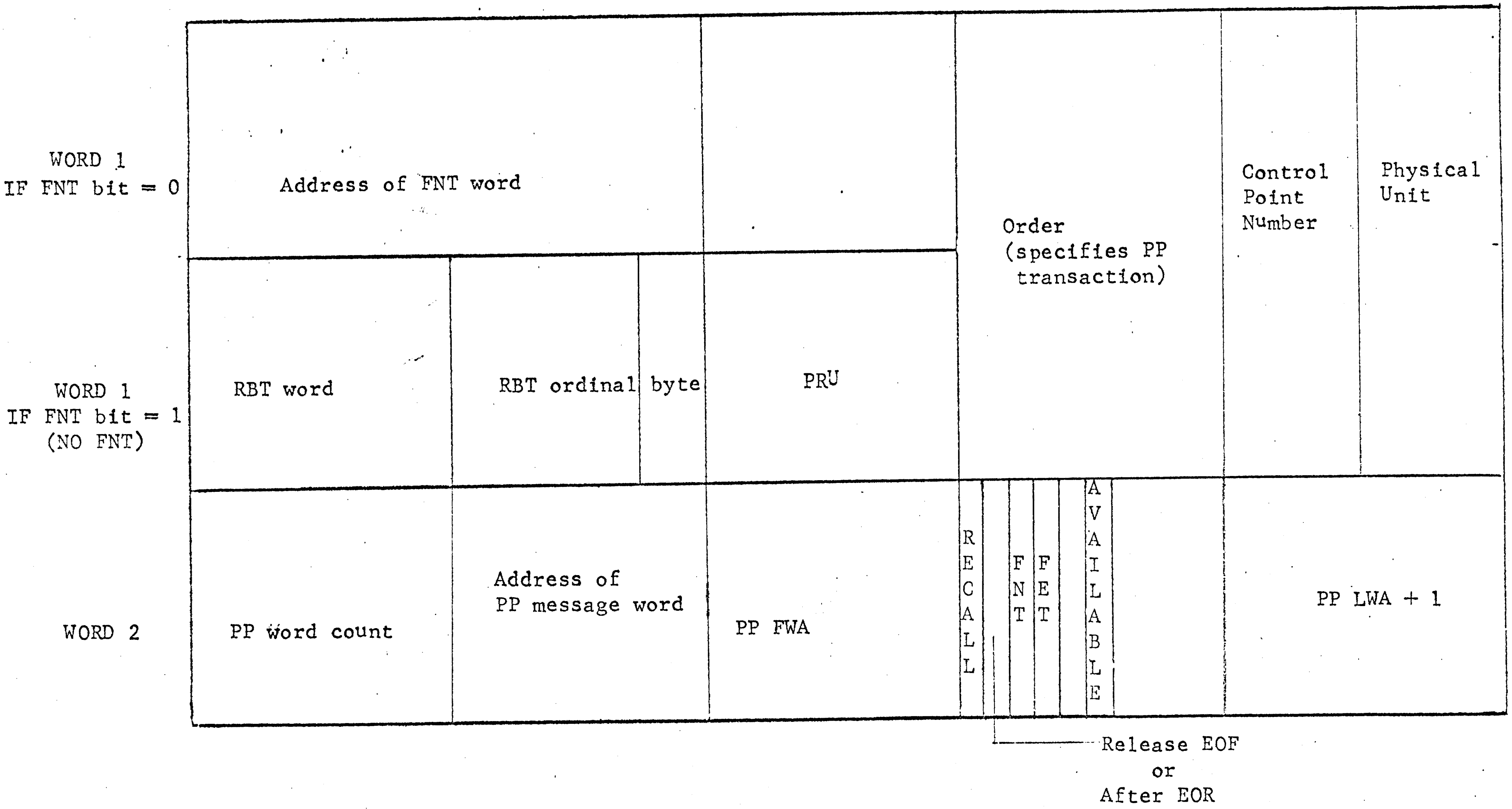
O.WRP (14): Write from requesting PP, full PRU's only.

O.WRPR (15): Write from requesting PP, ending with a short PRU of the level specified in the high order six bits of the order byte. If an EOF flag bit is set in this order, a zero length PRU of level 17 will be written following the short PRU terminating the record.

[illegible]BPRU (16): Backspace n PRU's. The number of PRU's to be backspaced is given in the third byte of the second word of the order. Note that this requests repositioning defined by physical rather than logical units. No data is transmitted.

O.RCHN (17): Release chain. All record blocks assigned to a file are released, and the RBT word pairs containing them are released. The FST is reset to an empty condition, if its address is supplied in the order.
Note: requests 16 and 17 requeire no communication with the device, and therefore are given the highest priority in the search for the next order to be executed. All other requests are assigned priority based on repositioning required.

REQUEST FOR PP TRANSACTION

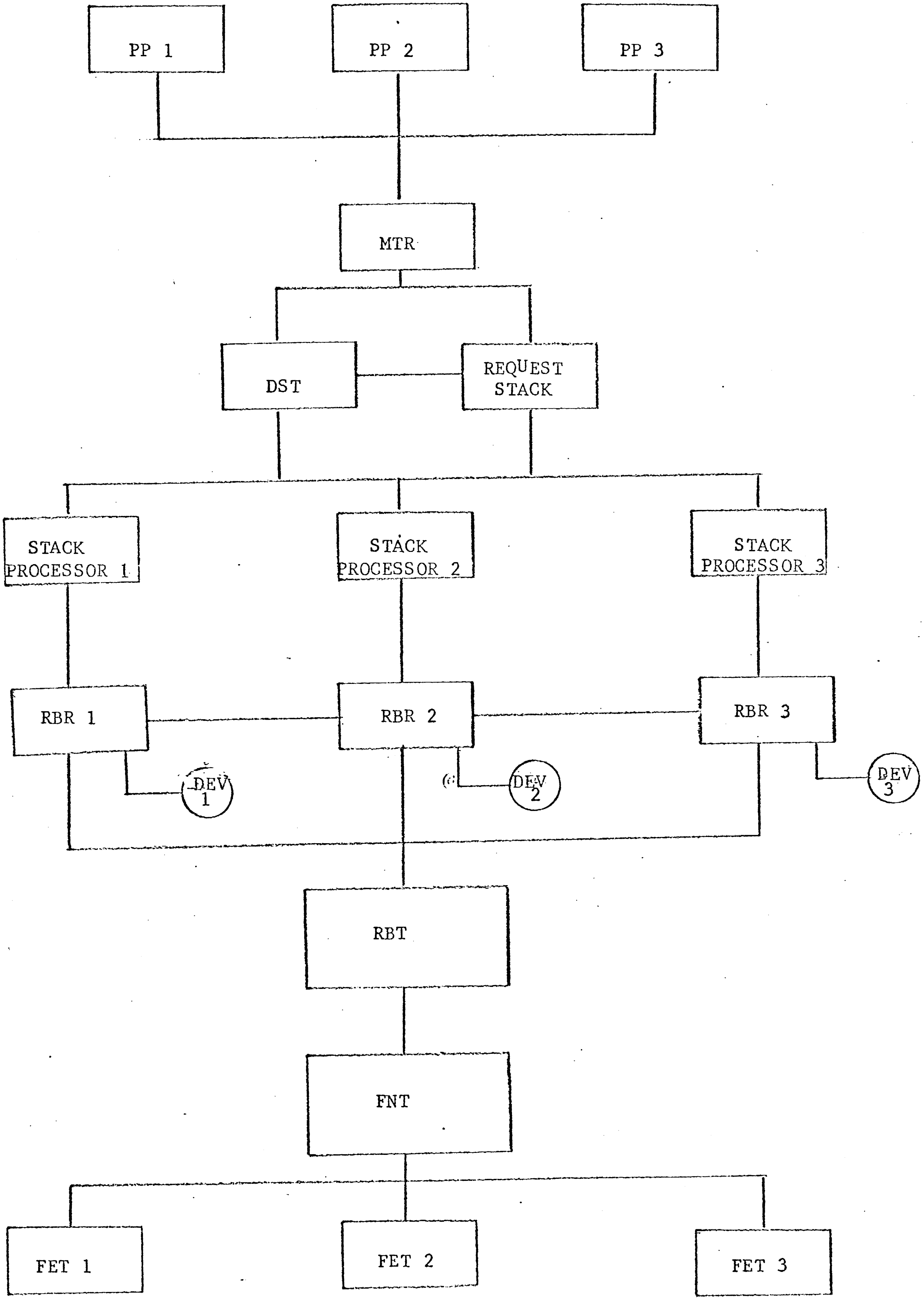


REQUEST FOR CM Transaction

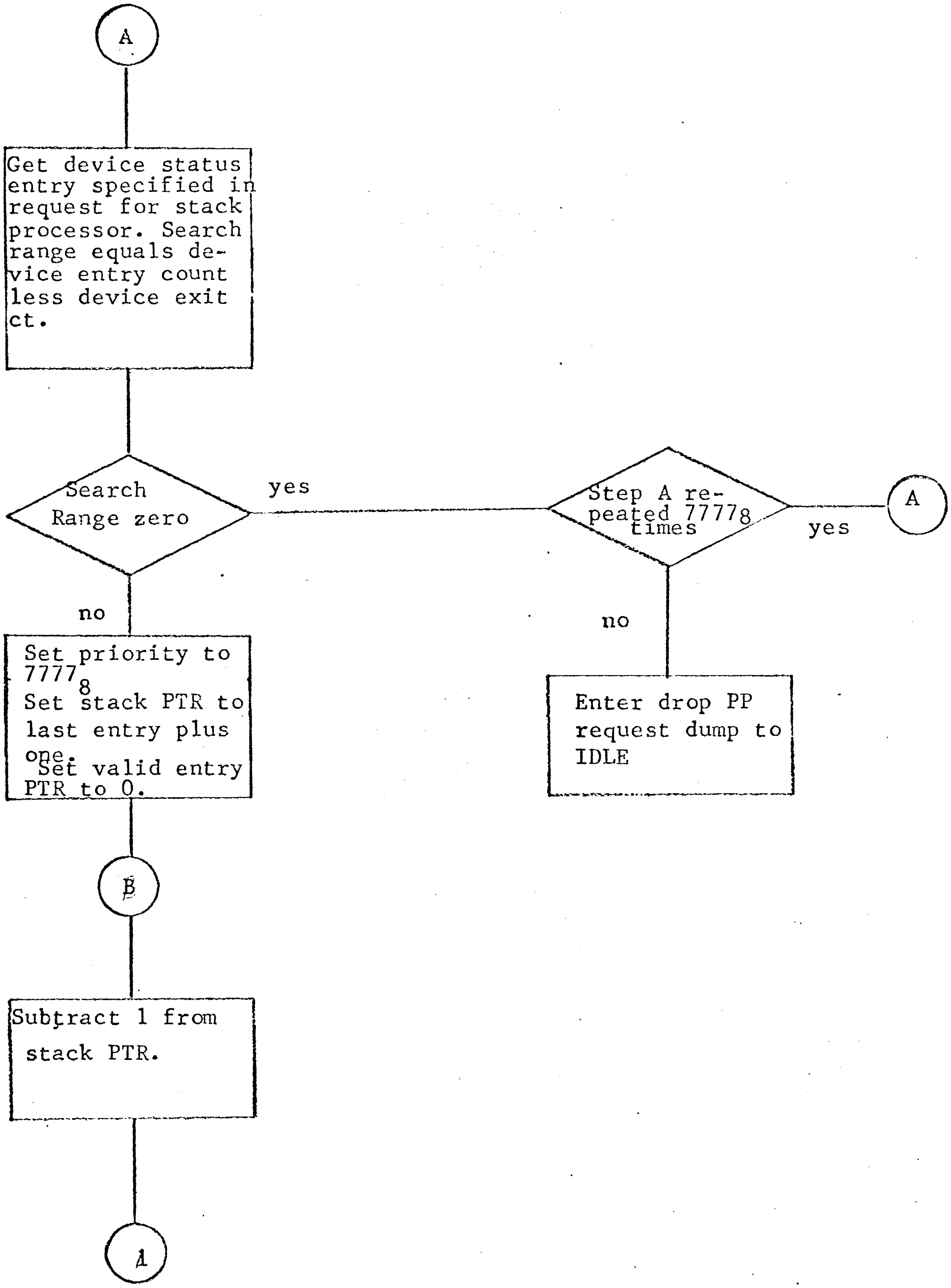
<table>
<tr><td>Word 1
if FNT bit=0</td><td colspan="4">Address of FNT word</td><td></td><td colspan="7" rowspan="2">Order
(specifies CM transaction)</td><td rowspan="2">Control Point Number</td><td rowspan="2">Physical Unit</td></tr>
<tr><td>Word 1
if FNT bit=1
(no FNT)</td><td>RBT word</td><td colspan="2">RBT ordinal</td><td>byte</td><td>PRU</td></tr>
<tr><td>Word 2</td><td colspan="2">FET FWA</td><td colspan="3">FIRST for transmission
or
RECORD (PRU) COUNT-n</td><td>RECALL</td><td></td><td>FNT</td><td>FET</td><td></td><td>AVAILABLE</td><td colspan="3">LAST for transmission</td></tr>
</table>

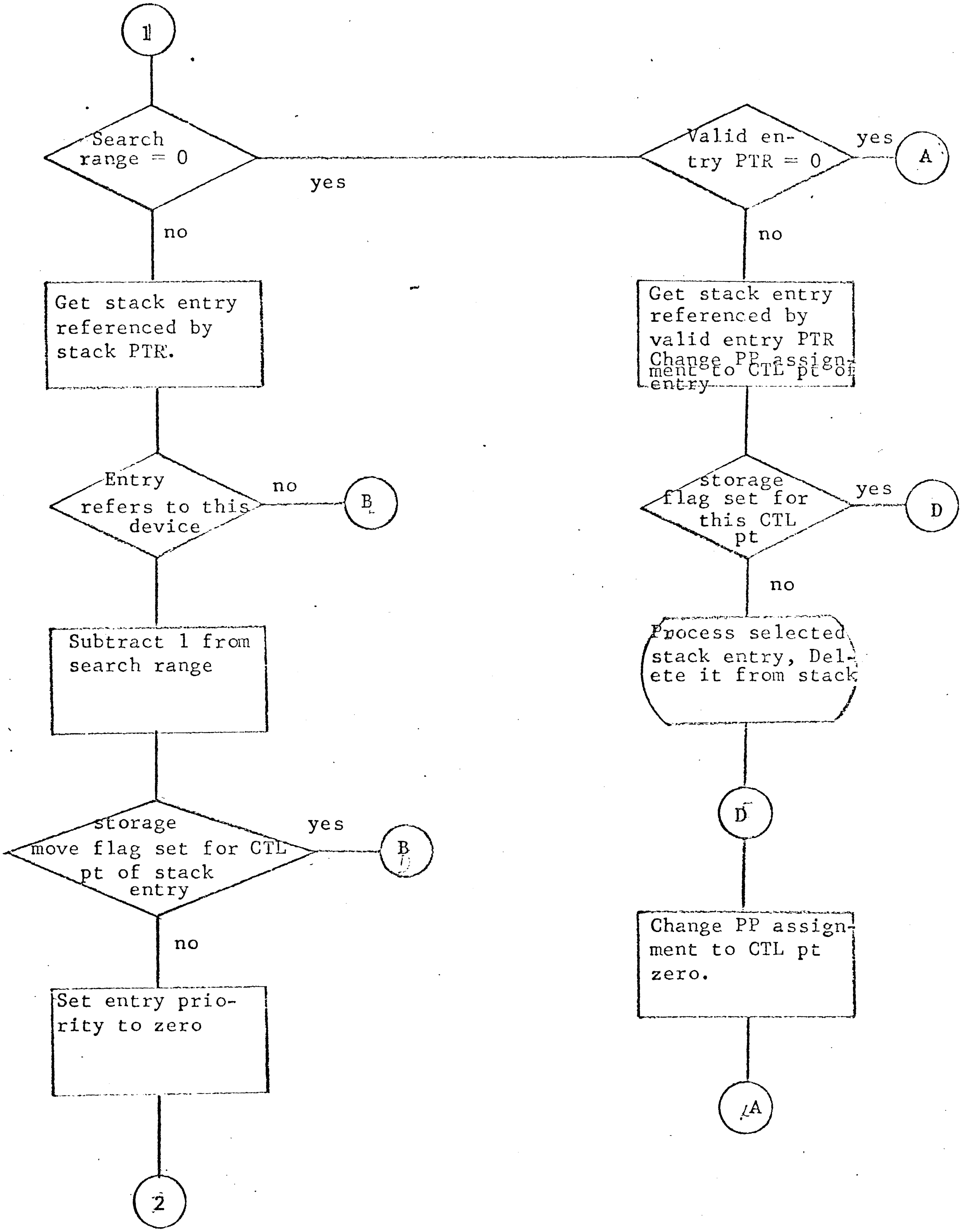
Release EOF
or
After EOR

7-5

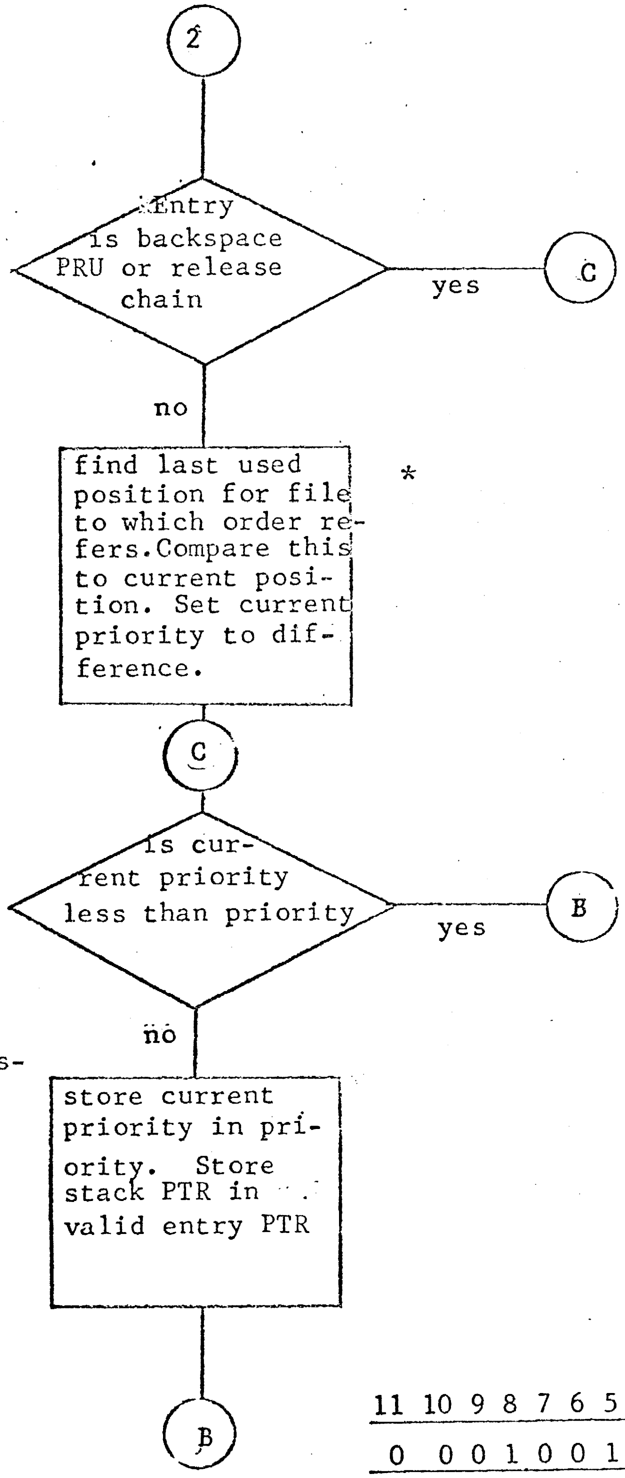

PP 1
PP 2
PP 3
MTR
DST
REQUEST STACK
STACK PROCESSOR 1
STACK PROCESSOR 2
STACK PROCESSOR 3
RBR 1
RBR 2
RBR 3
DEV 1
DEV 2
DEV 3
RBT
FNT
FET 1
FET 2
FET 3

DISK STACK PROCESSING




1
Search range = 0
yes
no
Get stack entry referenced by stack PTR.
Entry refers to this device
no
B
Subtract 1 from search range
storage move flag set for CTL pt of stack entry
yes
B
no
Set entry priority to zero
2
Valid entry PTR = 0
yes
A
no
Get stack entry referenced by valid entry PTR Change PP assignment to CTL pt of entry
storage flag set for this CTL pt
yes
D
no
Process selected stack entry, Delete it from stack
D
Change PP assignment to CTL pt zero.
A

Note: Backspace PRU and release chain orders do not reference disk and therefore require no positioning.



* Current position and last-used position are both used in the format shown below (Fig A). By use of logical minus, and subsequent editing of the result, repositioning is expressed as a binary number. (see example, Fig. B)

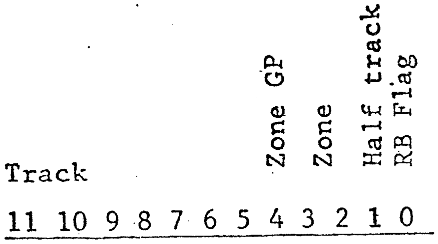


Fig. A

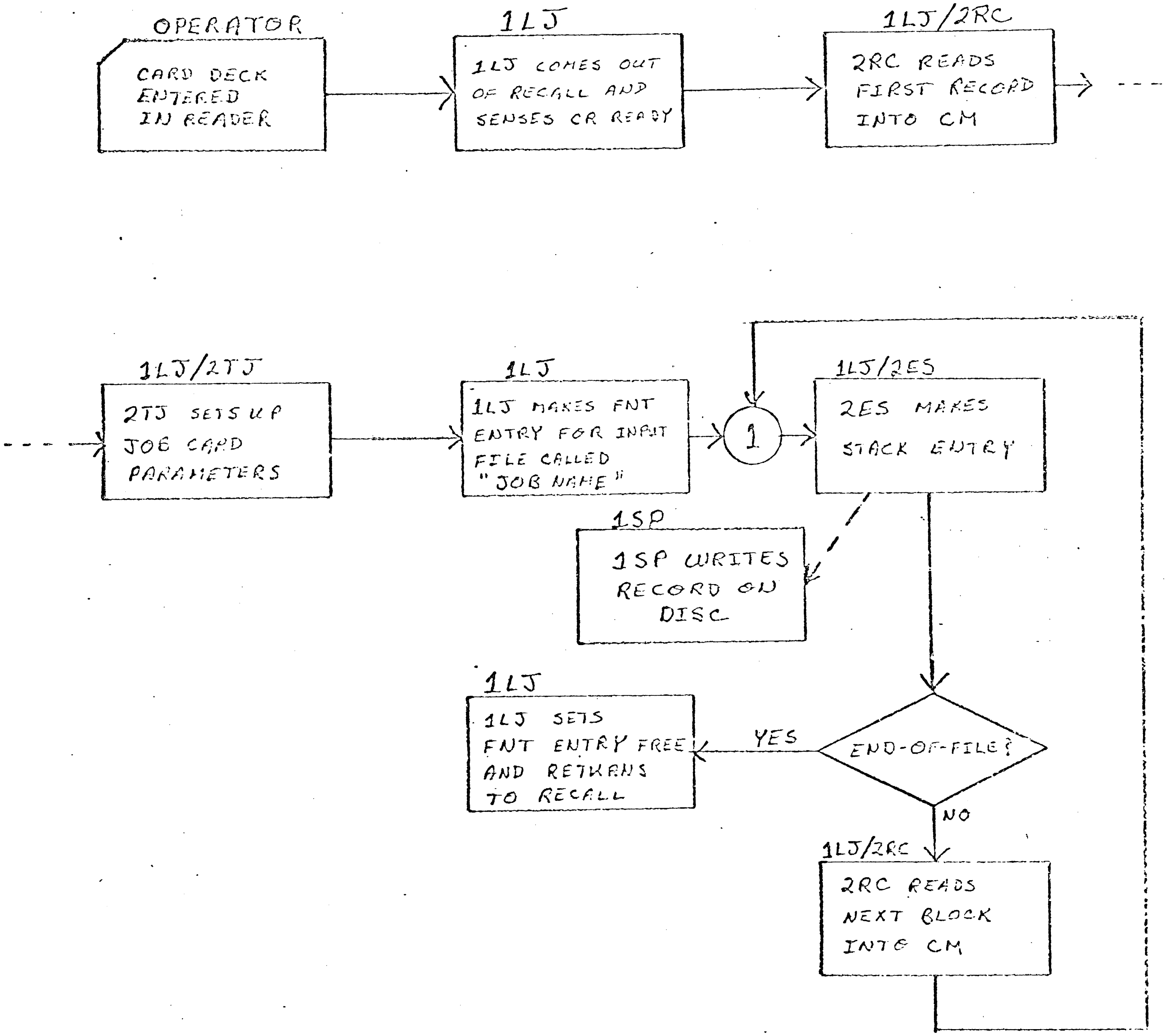
11	10	9	8	7	6	5	4	3	2	1	0	
0	0	0	1	0	0	1	0	1	1	0	1	current position
0	0	0	0	1	0	1	1	1	0	1	1	last used file pos.
0	0	0	1	1	0	0	1	0	1	1	0	logical difference
0	0	0	1	1	0	0						edited current priority

Fig. B

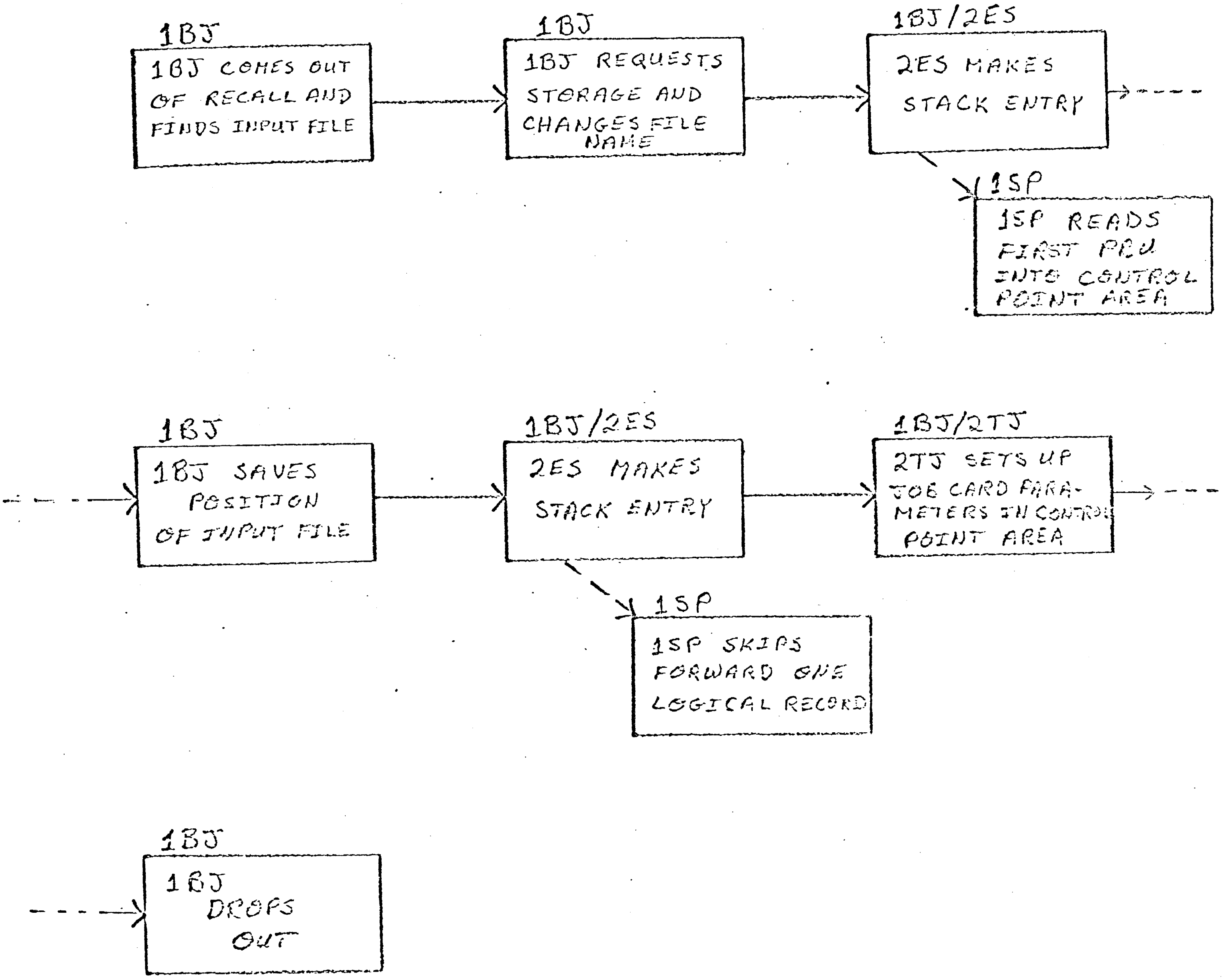
8-1 + 8-2

JOB FLOW

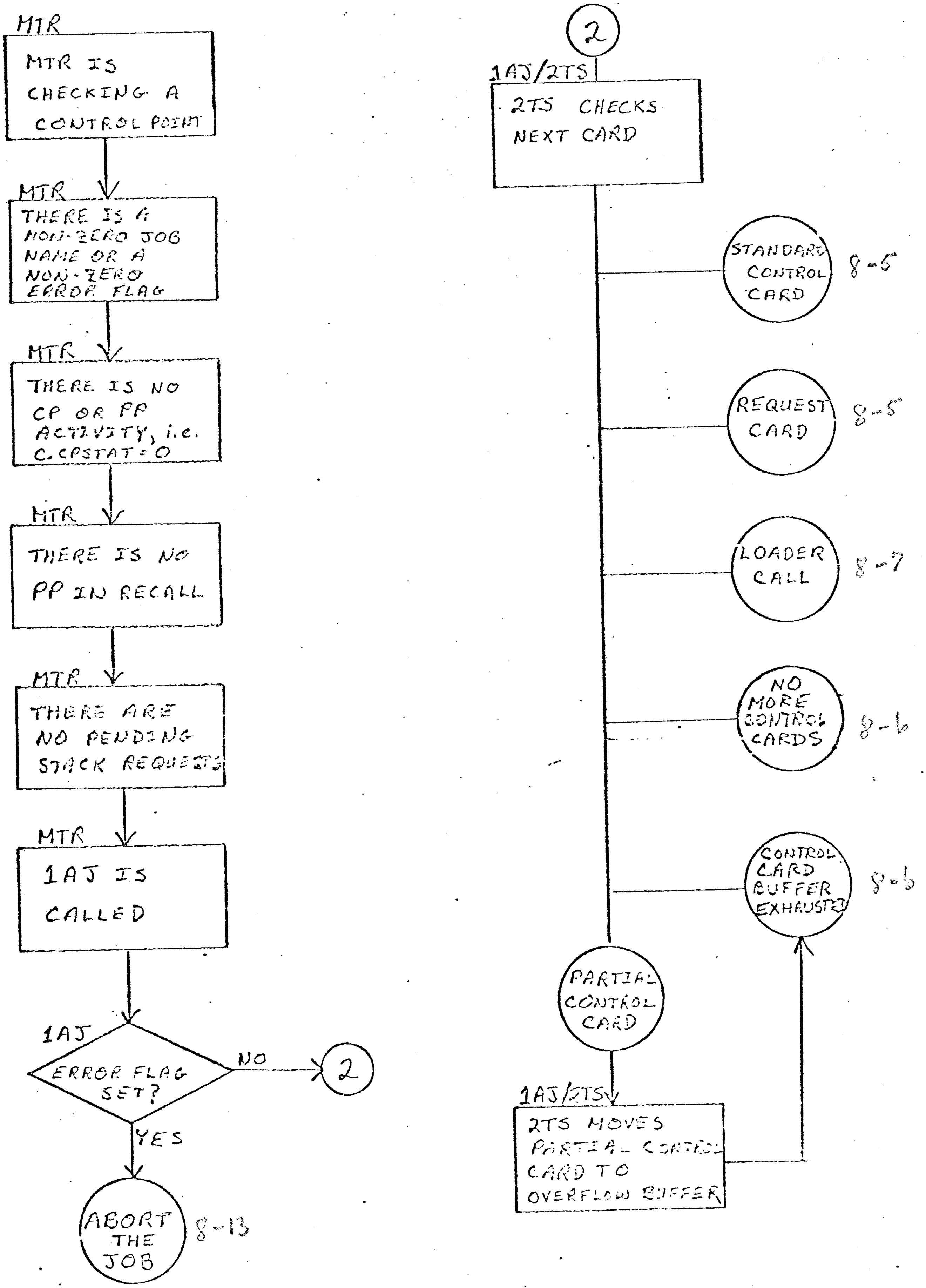
LOAD JOB



BEGINNING A JOB



PROCESSING A JOB
(ADVANCE JOB)



The following paper will describe the major SCOPE 3.0 Peripheral Processor routines involved in getting jobs into, through, and out of a 6000 series computer.

Familiarity with the hardware and with the external characteristics of SCOPE 3.0 is assumed.

The discussions will begin with the system as it stands immediately after completion of a dead-start load. The system monitor (MTR) is in PP0, idling as it waits for a request to process. (It should be realised that MTR will be continually searching for requests while other processes are being performed elsewhere. The actual functions done by MTR will be introduced and described as needed). The system display package is in PP9, initially displaying on the left console the message :

ENTER DATE

MTR &DSD are permanently assigned to PPs 0, and 9, respectively.

Central memory contains the CM resident tables, flags and routines, collectively known as CMR. The major portions of CMR reside in low numbered central memory, although there are some dynamically variable disc tables located in high core. Again relevant tables and flags will be introduced and defined as needed.

The last component of an idling SCOPE 3.0 system is the Peripheral Processor resident program. A copy of PP resident is loaded into each of the pool PPs (PPs 1 through 8). PP resident contains a number of small service routines which are commonly needed by most PP overlays; additionally, PP resident contains an idle loop which is executed initially and whenever the pool PP is not assigned to a specific task. Each of the pool PPs is aware of its own number and each PP has assigned to it a unique 8 word area in CMR known as a PP communication area. Each communication area has a location called a PP input register, one called a PP output register, and six called the PP message buffer. The PP resident idle loop consists primarily of continual examinations of the PP input register; a zero value input register is the idling condition. A non-zero value indicates that this PP is being requested to perform a task and therefore must load an overlay.

PP overlays are listed in the system library directory which is a part of CMR; the location of the overlay is also given. An overlay may be located either on disc or in central memory; the overlays which are frequently needed are usually kept in central memory, since loading speed is maximized. There are two basic types of PP overlays: primary and secondary. Primary overlays are these programs which may be requested through a PP input register; they are loaded by PP resident at 773B (there is a non-executable 5 PP word header appended by COMPASS) and entered by a

LJM 1000B.

Secondary overlays are essentially subroutines of one or more primary overlays; they are loaded into higher PP core when the controlling primary overlay makes a request to a PP resident routine (R.0VL) to do so. The majority of secondary overlays are coded to be loaded at 1773B and entered by a

RJM 2001B.

However, there are several which must be loaded at 2773B, 3773B, etc. Also, there are a few secondary overlays which utilize a set of macros (called REL0C) which have the effect of making the overlay self-relocating; such overlays may be loaded anywhere, providing of course that they do not wrap around the end of memory. This latter condition is not detected by the system; it will eventually be recognised by the operator since the destruction of a PP will (usually) destroy the system ultimately.

All PP overlays have three-character names; there are certain conventions which are followed with respect to the first character when assigning names. Primary overlay names either begin with an alphabetic character or the digit one (1). Alphabetic overlays may be called from a running program, a control card (in some cases), or from within the system; numeric overlays may only be called from within the system, i.e. from a PP. Secondary overlay names usually begin with the digit which is closest to the 1000_8 word block at which the overlay is to be loaded; e.g. 2TR is loaded at 1773B. No conventions have been established for the second and third characters, except that they should have some (be it ever so tenuous) mnenonic value.

Now, to return to the idling system, let us begin to do some processing. To set the system going the operator must type in today's date in the correct format. Until this is done, DSD remains in an idle loop waiting for keyboard input. When the date is received, its legality is checked and DSD enters the value into a flag location in CMR for use by the remainder of the system. DSD then brings up the A (dayfile) display on the left console and the B (control point) display on the right console.

At this point, normally the operator would type in AUT0 to prepare the system for full multiprogramming; for instructional purposes, we shall simplify the procedure and only type in

EAD
ACKAGE

1. READ.

DSD has been cycling through its main loop which consists primarily of refreshing the console displays and checking for keyboard input. When the above command is received, DSD branches to the routine which processes a request for the READ package. It is known to DSD that the name of the PP overlay comprising the READ package is 1LJ (load job) and that 1LJ must be assigned to a pool PP.

1. DSD posts in its output register a request to MTR (DSD also has a PP communication area. Its input register is not used since PP9 is not a pool PP and cannot be assigned tasks by MTR). This particular request will be a "request peripheral processor" (M.RPP). (It will be seen later that M.RPP is a subset of another monitor function and exists only for historical reasons.) DSD's output register will contain the code for M.RPP and the control point number to which the pool PP will be assigned, in this case, 1. As is usual, additional information is given in the PP message buffer; in the case of an M.RPP function, the first word of the message buffer is expected to contain the input register setting for the requested pool PP.

2. Part of MTR's loop consists of checking the output registers of the 8 pool PPs and DSD. A Zero value constitutes no request; a non-zero value indicates some function to be performed. In this case, MTR will pick up the first word of DSD's message buffer, insert the control point number (1), and place the word into the input register of an available PP. In this particular situation, the PP chosen will be PP1 since nothing

else is happening; however, in other cases, any of the other 7 pool PPs might have been selected.

3. The PP resident in PP1 will now notice that its input register is non-zero, specifically that the high order 18 bits contain the display code name of the PP primary overlay which is required to perform the desired task, (1LJ), the next 3 bits are zero, and the next 3 bits contain the control point to which the task is assigned (1). PP resident looks up the name 1LJ in the system library directory, reads the overlay into its own memory and transfers control to 1LJ at 1000_8.

4. 1LJ first performs the initiallization which is common to nearly all primary overlays. The contents of the PP input register are read into PP low core; the control point number is used to compute the address of the control point area. (CMR contains a control point area for each of the seven control points. This area contains information about the state of the job (if any) currently assigned to the control point. Control point area contents will be described as needed during the course of this discussion.) The control point reference address (RA) and field length (FL) are obtained from the control point area. These quantities are retained in PP low core for use by the primary overlay and also any secondary overlays called during the performance of the assigned task.

5. 1LJ enters the job name READ into control point area 1 in order that DSD may display, for the operator's information, the current job. Prior to this time, control point 1 (and all other control points) had a zero job name indicating that the control point was vacant.

6. 1LJ then posts a request (M.RSTØR) in its output register for central memory storage for buffer space. Again, MTR will sence the request and in this case will immediately give control point 1 the necessary storage. Granting this request consists only of setting the desired FL into control point area 1 and resetting the RAs of control points 2 - 7 equal to RA+FL of control point 1.

7. At this point, we shall introduce a table in CMR called the Equipment Status Table

(EST). The EST contains an entry for each I/0 device which is present in the configuration; one word is required for each device. Each entry contains a 2-character display code device type, a flag field to indicate assigned or available, and hardware information (channel number, equipment number etc.) Entries may be ordered whimsically, but the relative position (EST ordinal) with respect to the first word of the EST must be known by the operator in order to assign equipment.

Returning to the job processing, 1LJ now posts a request (M.REQP) in its output register for equipment of type CR (card reader). MTR searches the EST for such a device and will select the first unassigned card reader (lowest numbered ordinal) that it finds. Hence, the order of EST entries must also be known to determine which card reader goes to which READ package. (Note that if a second READ package were assigned to another control point, it would handle the card reader with the next highest EST ordinal, and so on.) Each copy of 1LJ can handle only one card reader. MTR marks the selected card reader EST entry as assigned and returns the EST Ordinal to 1LJ via 1LJ's message buffer.

8. 1LJ then sets up the appropriate hardware instructions to sense the status of its assigned card reader and let's assume first that it is not ready, i.e. the operator has not yet put any job decks in the hopper. The system, in general, tries to keep as many pool PPs available as possible and since it may be a while before the card reader is readies, we introduce a new concept, PP recall. 1LJ uses the old-fashioned form of PP recall for historical reasons only. Old-fashioned PP recall required the use of a location in the control point area, known as the PP recall register. 1LJ writes the contents of its input register into the PP recall register and then issues a monitor request (M. DPP) to return the PP to the pool. MTR examines control point PP recall registeres during its main loop and if one contains a non-zero quantity, the register contents are placed in the input register of an available PP and the recall register is reset to zero.

Modern PP recall requires the use of a monitor function (M.RPJ - request peripheral job) followed by an M.DPP. M.RPJ allows the specification of a time interval which is to elapse before a pool PP is assigned (the time interval may be zero, meaning that assignment should be made as soon as possible). It should be noted that:

(a) M.RPJ can (and should) replace M.RPP, and

(b) M.RPJ would allow two or more PPs at a single control point to enter recall simultaneously; use of the PP recall register does not permit this ability.

MTR maintains a list called the PP delay stack in PP0 memory of PP programs to be called after a specified interval; the delay stack is examined each time the clock is updated. It can be seen that 1LJ could make effective use of the delay stack feature since the event it is awaiting (card reader ready) is measurable in human time; a pool PP would be required less frequently using M.RPJ than by using the PP recall register. But I digress. 1LJ is now said to be in recall; when it is reloaded, it starts anew, i.e., returns to step 4. This is necessary since it cannot rely on being loaded into a properly initiallized PP. However, 1LJ need not repeat all the steps since it can determine that control point 1 already has CM storage and a card reader. Again it tests the status of the card reader, returning to a recall state if it is not ready. This time, we shall assume a ready condition.

9. Other than the test for card reader ready, 1LJ has no I/O driver capability; it must load a secondary overlay. The card reader driver overlay is named 2RC. 2RC is loaded (as are all other secondary overlays) by presetting 2 locations in PP low core with the display code overlay name, entering the load address in the A-register, and executing a RJM to the PP resident routine, R.ØVL. 1LJ then enters 2RC which reads cards until either the central memory buffer is filled or until an end-of-record or end-of-file card is encountered, whichever occurs first. When 2RC has finished processing, it returns to 1LJ.

10. 1LJ then loads 2TJ (translate job card). 2TJ will locate the first card image in the buffer and check its validity as a job card. (You will recall that the first card of the first logical record of a job is required to be a job card.) Additionally, 2TJ will save in PP low core the job name (appending a job count to keep the name unique),

the required field length and priority for later use. Control is returned to 1LJ.

11. Assuming that the job card was indeed valid, 1LJ now loads 2BP (check buffer parameters). 2BP is responsible for checking that various file tables (which are described elsewhere) contain legal values and for setting up PP low core locations in the form required by hardware drivers to be loaded subsequently.(Note: logically, 2BP should have been loaded before 2RC in step 9 above; the reason for not doing so are not known to the author) 2BP is genrally called immediately prior to the loading of any I/Ø driver. It is more important that it be loaded when user I/Ø is involved, however, since one assumes that system routines such as 1LJ are not going to produce erroneous file tables.

12. 1LJ next loads 2ES (enter stack). 2ES is a pseudo I/Ø driver, in a sense. It is loaded and treated as though it actually could read and write an allocatable device (i.e. disc), but it can't. What it does do is to gather together information about the file to be read or written and prepare an entry for a CMR table called the request stack. The necessary information about physical device, file position and so forth is formatted within PP memory and 2ES enters a PP resident subroutine, R.EREQS. R.EREQS in turn searches the request stack for an available location and formats a request to MTR (M.EREQS) to make the entry. (PP resident performs the stack search in order to minimize the monitor loop time; MTR, however, must actually make the entry in order to provide an interlock on the request stack. If two copies of PP resident have simultaneously located the same empty entry, MTR refuses the second M.EREQS function and the rejected PP resident must re-search the stack). When the stack entry has been made, R.EREQS returns control to 2ES which then exits to 1LJ. 1LJ remains in a tight loop, waiting for the central memory buffer to be written to the disc. (The detailed mechanics of disc reading and writing will be covered elsewhere).

13. When the buffer is empty (i.e. the disc operation is complete), 1LJ loads 2BP and then 2RC to refill the buffer from the card reader. Steps 11 through 13 are now repeated

until an end-of-file card has been read and written. It can be seen that there is now an exact logical record-by-logical record copy of an input file on the disc. The only thing that now remains is to dissociate this file from the READ package and make it available for running. This is done by making an entry in another CMR table called the File Name Table or FNT. (The FNT was used during the course of constructing the input file, but in an uninteresting and difficult-to-describe manner, so we shall introduce it here). The FNT contains a 3-word entry for every file known to the system; an entry contains the file name and type, the type of device on which the file resides, location information peculiar to the particular device, current state (busy or not busy), the priority and the control point to which the file belongs. In the case of the input file which we have just constructed, 1LJ will make an FNT entry containing the following items:

- file name; this will be the job name extracted from the job card; this name was made unique by virtue of the fact that 2TJ appended a job count;
- file type: this will be type input. (Other file types will be introduced as needed).

All files in the FNT of type input constitute the input queue.

- device type: this will be disc, either 6603 or 6638.
- location information: during the course of constructing the input file, various disc tables were built in central memeory; the FNT entry contains pointers to these tables.
- current state: this will be not busy
- priority: this will be the priority extracted from the job card as the high order part (called priority level) and zero as the low order part (called sublevel). The use of priority bits is described elsewhere.
- control point assignment: this will be zero, indicating that the file is not assigned to any control point.
- additionally, in the case of a file of type input, the FNT contains the central memory and ECS field lengths requested on the job card.

Having entered the file in the input queue (i.e. made the FNT entry), 1LJ returns to check the status of the card reader (step 8), entering PP recall if there are no more cards in the hopper or constructing another input file if there are.

Let's assume there are 3 more jobs, so 1LJ reiterates the above process 3 more times ultimately reaching the state where it is going in and out of recall. We now have an input queue containing 4 jobs (files) it will be necessary to bring up a package to select one or more jobs for execution. Before we do that, however, to keep life simple and for instructional purposes, let us drop the READ package. This is sometimes done during normal running when there are no more job decks to be entered in order to free up the buffer space that 1LJ has.

ROPPING
IE
AD
CKAGE

1. The operator must initiate the dropping of any control point; this is done by typing x.DRØP where x is the control point number. In this case, he types:

1.DRØP

Again, DSD will detect keyboard input during its main loop and will branch to process the DRØP command. Processing consists of sending a request (M.ØPDRØP) via DSD's output regist to MTR. The M.ØPDRØP also contains a control point number, in this case, 1. The effect of this function is to cause the monitor to set an error flag within the control point area of control point one.

2. Now you will recall that 1LJ is still popping in and out, testing card reader ready. In addition to this already mentioned test, 1LJ also checks the control point 1 error flag. (It also checks the error flag during processing, so that READ may be dropped in the middle of card reading, but this is not too relevant to the current discussion). If at any time 1LJ discovers that the error flag is non-zero, it will drop its PP (via the M.DPP function) <u>without</u> setting the PP recall register. This leaves control point 1 still occupied but inactive, since there is now no way for any more activity to be performed.

3. Meanwhile, MTR has been cycling through its main loop, part of which consists of an Advance Control Point routine. The Advance Control Point routine is entered once every 64 milliseconds and each time it checks the condition of one control point, beginning with 1 cycling up to 7 and returning to 1. A control point is said to require advancing if all of the following conditions are true:

- There is a job name. (This condition is met since the job name READ has not been cleared.
- There is no central processor activity. (The READ package has never initiated any CP activity)
- There is no peripheral processor activity. (1LJ has dropped itself without recall and it was the only PP which was attached to control point 1).
- There are no PP recall requests (either in the delay stack or in the recall register). (1LJ did not set the recall register before it dropped).
- There are no pending entries in the request stack. (The only request stack entries made by 1LJ are during the course of preparing a job for entry into the input queue and there are no more jobs to be prepared).

It can be seen, therefore, that control point 1 must be advanced.

Advancing a control point, from MIR's point of view, consists of calling 1AJ (advance job) into a pool PP and attaching the PP to control point 1.

4. As will be seen later, 1AJ can follow several paths varying in complexity, depending on the state of the control point which is to be advanced. The case currently under investigation, namely that of dropping a system control point (READ) is probably the simplest and involves the following steps.

1AJ checks the error flag which is set. 1AJ then checks the priority of the control point which is given in the control point area; now, since READ is a system control, it has zero priority. This fact greatly simplifies the process as will be seen later. 1AJ requests the loading of the overlay 2EF (error flag). 2EF checks the actual value of the error flag to determine which message to enter into the dayfile. In this case, the value is 6 (F.ERØD) which directs 2EF to write the following message:

hh.mm.ss (Time of Day)	READ (job name)	ØPERATØR DRØP (message)

2EF returns to 1AJ.

5. 1AJ begins a search of the FNT, looking for (in this case) files which are assigned to control point 1. Each time such a file is located, 1AJ will load the overlay 2DF (drop files). 2DF "removes" the file from the FNT; what constitutes removal of a file is

dependent upon the file type.

It should be specially noted that those files which were entered into the input queue were assigned to control point 0 and are therefore not dependent on the existence of their creating READ package). When all files have been removed from the FNT, 1AJ then searches the EST for equipment assigned to control point 1; in this case it will find exactly one equipment, the card reader. Again, 2DF is called to return the card READER to the pool of available equipment.

1AJ then posts an M.RSTOR function to MTR to request that all central memory storage associated with control point 1 be dropped. Control point area 1 is then cleared, i.e. the job name, etc, are set to zero.

We are now faced with a system in an essentially idle condition except that there are four jobs in the input queue. We must now initiate processing. To do so, we will bring up one copy of the next package at, say, control point 3.

1. The procedure for bringing up NEXT is nearly identical with that for bringing up READ and so we shall abbreviate the description. The operator initiates the process by typing 3.NEXT. It is known to DSD that the name of the PP overlay comprising the NEXT package is 1BJ (begin job). DSD requests, again with the M.RPP function, that 1BJ be assigned to a pool PP at control point 3. MTR will select a pool PP and PP resident will load the overlay 1BJ.

2. 1BJ will perform the usual initialization of PP low core (See READ PACKAGE - item 4) and then enters the job name NEXT into the control point area for display purposes.

3. MTR maintains in CMR a location (T.UAS) which contains the current amount of available central memory and ECS. 1BJ reads these quantities into PP low core and then requests the FNT channel. (A slight digression: MTR maintains a channel status table which includes entries for the 12 hardware channels, and several pseudo-channels.

Before a PP can use one of the hardware channels or alter a table represented by a pseudo-channel, it must request the use of the channel from MTR. This is another method of providing a table interlock.) In the case under consideration, the FNT channel really need not be obtained since there is no possible conflict; but a more normal situation would include several copies of 1BJ making identical searches and it is considered desirable to execute each job only once.

4. 1BJ performs a search of the File Name Table, looking first for a file of type input. Having located such a file, it compares the requested CM and ECS field lengths with the currently available storage. If there is adequate storage for the job, then the job priority is compared with the priorities of all other jobs which meet the storage requirements. The job with the highest priority will be selected for execution. Also, during the course of every nth FNT search by 1BJ (where n is an installation parameter), the priority sublevel of all files in the input queue will be incremented by one; the sublevel will not be allowed to overflow into the level, however. Hence, it can be seen (assuming that enough storage is always available) that priority level as declared on the job card is the major determinant of the order of execution and that, within a set of jobs of the same priority level, the length of time the job has been in the job queue will determine the order of execution.
If 1BJ had failed to find a candidate for execution, it would now enter PP recall in the old-fashioned manner, i.e. by setting the PP recall register and dropping out. However 4 jobs are known to be in the input queue and so we carry on.

5. The selected FNT entry must now be altered. The file name is changed from the unique job name to INPUT; the type is changed from input to local; and the control point assignment is set to 3. Also, the fields which contained the ECS and CM field length requirements are altered to the more usual disc position information. The position of the input file, at this point, is logically rewound, i.e. the next record to be read is the first (control card) record.

All this means that the user's input file will be available to him alone (since it's assigned to what will soon be his control point) and that it may be referenced simply by calling for the file named INPUT.

6. 1BJ then sets up control point area 3 for the selected job. The job name is

changed from NEXT to the name of the job to be executed. The priority (with the sublevel field reset to zero) is entered into the control point area with the aid of a monitor function (M.RPRI). The current position of the input file is also saved in the control point area for reasons which may become clear later. 1BJ then calls 2ES to format a disc request to skip forward one logical record on the input file.

(You will recall that this first record contains only control cards and is presumably not of interest to the user's program). 2ES, through PP resident and the monitor, enters the request stack, leaves the INPUT FNT entry busy and then returns to 1BJ. 1BJ loops until the FNT entry becomes not busy (request completed). The INPUT FNT entry is now positioned at the user's first data record.

7. 1BJ now indulges in a game of fake-out-the-system, the object of which is to read the first sector of control cards into a small buffer in the control point area. The method used is, briefly, as follows. Temporarily, the FNT entry for INPUT is set to reflect a rewound condition (this can be done since the initial file position was saved in the control point area). 1BJ then sets up its own PP to look as if it belonged to control point 0 rather than control point 3. (Control point 0 is a convenient fiction invented for just such cases as this. The area occupied by CMR is said to belong to control point 0). This is necessary because it is illegal for a PP attached to one control point to request that data be read into the area belonging to another control point. 1BJ then loads 2ES to format a request, in the usual manner, to read data into the sector-sized buffer in the control point area. 1BJ then awaits completion of the operation and restores the proper values in its PP and in the FNT. However, instead of returning the rewound position of the INPUT file to the control point area, it sets the position of the next sector of control cards; this allows 1BJ to perform the above sneaky operation each time another sector of control cards is required.

8. 1BJ next calls 2TJ to reprocess and skip over the job card which is the first card image in the control card buffer. 2TJ will again check the validity of the job card. (Because 1LJ has no facilities for writing an error message for the user, a job with an erroneous job card will be passed along into the input queue so that 1BJ/2TJ can sense the error and inform the user). On this pass, 2TJ also saves the job time limit in PP low core. 2TJ returns control to 1BJ which then completes the setting up of the control point area, i.e. the job time limit is entered (via the monitor function M.NTIME); the exit mode is set (via the monitor function M.REM); and the required CM and ECS field lengths are requested (M.RSTØR). If the necessary field length cannot be granted, 1BJ goes into recall. There are two noteworthy items which follow from this.

(a) All during the course of the NEXT package discussion, 1BJ was making tests to determine if the next task had already been accomplished; such tests were not mentioned for the sake of clarity.

(b) At first glance, it might seem that 1BJ would always obtain storage since it did first check to see that there was enough storage for the job. However, there is no interlock on the value contained in T.UAS and 2 copies of 1BJ might have decided there was adequate storage for their respective jobs; if the sum of the storage requirements exceed available core, then the second 1BJ to request storage will have to wait. Also, a job at another control point might have requested, and been granted, an expanded filed length after 1BJ has read T.UAS and before 1BJ's request for storage.

However, in this case, storage will be granted and 1BJ will drop out (M.DPP).

9. Referring back to DROPPING THE READ PACKAGE, item 3, it can be seen that the identical condition now exists at control point 3, that is, MTR must advance control point 3. (There is a job name; there is no CP or PP activity; there are no PPs in recall or in the delay stack; and there are no pending requests). 1AJ is now loaded into a pool PP and attached to control point 3.

1AJ first checks the error flag which is now not set, so the overlay 2TS (translate statement) is called. As far as 2TS is concerned, there are several major groups of control card types, each of which will be briefly described below. 2TS reads the next control statement from the control card buffer and proceeds in one of the following ways:

(a) SWITCH, MODE, COMMENT, COMMON, RELEASE.

All of these cards require only simple processing and are handled completely within 2TS. When the requested action has been completed and the control card buffer pointers updated, 2TS drops the PP (M.DPP) without returning to IAJ. This leaves control point 3 ready to be advanced again.

(b) REQUEST

Only a very little initial parameter scanning is done by 2TS. A few parameters are stored in PP low core and 2TS calls REQ (request card processor) by altering the PP input register and returning directly to the PP resident idle loop. (REQ was made into a separate program to avoid duplications since REQ is also callable from a running program) REQ finishes the parameter processing and posts a request for operator action on the console display. It then tests for operator response which naturally will not happen for a period of time measurable in human terms. REQ then simply drops the PP without updating the control card buffer pointer. (The console message remains, however). This has the effect of leaving the control point ready for advancing but insures that the same REQUEST card will be completely reprocessed. This procedure is reiterated until an operator response is received. REQ then completes processing, updates the control card buffer pointers and then drops the PP; this leaves control point 3 ready to be advanced again.

(c) LØAD, EXECUTE, NØGØ and program call card

Minimal parameter scanning is performed and information is left in PP low core and in locations RA + 2 to RA + 100 within central memory. 2TS then calls LØD into the PP by using the PP resident function R.ØVL. (It might be worth noting that this overlay load unconventionally causes a program - LØD - to be loaded at a lower numbered location than its caller, i.e. LØD is loaded over 1AJ. The tacit assumption is made that LØD is not sufficiently long to overwrite the spot in 2TS from which the call is made; this is a reasonable assumption in this case, but it should not be made generally).

It is not the purpose of this discussion to detail the operation of the relocatable loader; adequate documentation appears elsewhere. A few general remarks will be made, however. The loading process is performed by one or more of the following routines: LØD, LDR, 2LA, 2LB, 2LE, and in the central processor, LØADER, & OVERLØD. The number of routines involved depends upon the type and complexity of the load operation. At the end of loader processing whichever of the 5 PP loader routines is in control drops the PP. If neither a PP or CP execution was initiated during the course of processing (e.g. NØGØ card), then the control point is again ready for advancing.

Otherwise, the control point is considered to be profitably occupied and cannot be advanced until PP and CP activity has ceased.

10. Assuming that the job we have selected for execution at control point 3 contains more than 1 sector of control cards, 1AJ/2TS will eventually be faced with the problem of obtaining the second (or nth) sector. And it is a problem; the method used defies detailed description. In brief, 2TS will detect that it has either a partial control card or none at all to process and so it will return control to 1AJ.

(This and the job termination case are the only instances when 1AJ regains control from 2TS.) 1AJ then calls 1BJ into the same PP by the underhanded method of adding one to the second character of the PP input register and returning directly to the PP resident idle loop. (Note well, anyone who is thinking of whimsically changing the name of either 1AJ or 1BJ!). Now referring back to the NEXT PACKAGE, item 7 and accepting on faith that 1BJ knows how to pick its way through the maze, it can be seen that the next sector of control cards will be read into the control point area. After this operation is completed, 1BJ then drops out, leaving it to MTR to advance the control point.

11. Ultimately, 2TS will detect either an EXIT CARD or the end of the control statements and will return to 1AJ for job termination.

MINATION

The following section will occasionally refer back to DROPPING THE READ PACKAGE because some portions of the two procedures are identical. In the current case, however, we are dealing with dropping a user job.

1. Control has just been returned to 1AJ from 2TS. The first decision that is made is that this is the end of the job and not just a request for another control card buffer load. Then the control point priority is tested and it is determined that this is a user job (i.e. it has a

nonzero priority). Next, the control point error flag is checked. Assuming that the job at control point 3 has terminated abnormally for some reason, steps 2, 3 and 4 will be performed; otherwise, 1AJ resumes processing at step 5.

2. 1AJ calls 2CA (checkpoint abort). 2CA checks to see whether or not the job took checkpoint dumps during the course of its execution. If so, all files associated with the job are locked, i.e. left in a state suitable for restarting the job at some later time; if not 2CA simply returns to 1AJ.

3. 2EF is called. In addition to the writing of the error message (see DROPPING THE READ PACKAGE, item 4) 2EF will locate the file named OUTPUT and will insure that there is an end-of-record mark. Also, 2EF will supply a partial core dump of the control point field length. The latter is accomplished through use of the M.RPJ function (without a delay specified) to load DMP (central memory dump program) into another PP. 2EF waits for the dump to be completed by waiting until the input register of the other PP no longer contains the request for DMP. All this additional processing is done because the control point priority is nonzero.

4. 1AJ then uses 2TS to cycle through the remaining control cards to the next EXIT card or to the end of the statements. If an EXIT card is encountered, processing reverts to normal, i.e. the following cards are processed as though no error had occurred. In the latter case, 1AJ ultimately regains control of the JOB TERMINATION point; this time, however, the error flag will not be set and steps 2, 3 and 4 are skipped.

5. At this point, 1AJ records the running time used at control point 3; all further PP time incurred in terminating the job is considered to be system overhead.

6. 1AJ calls 2CJ (complete job day file) which appends to the file OUTPUT all dayfile messages relevant to the job at control point 3. During the course of execution, these messages were being collected in two places: chronologically within the system dayfile for display purposes and as a permanent record of system activity; and in the job dayfile. Messages are collected in this manner to eliminate the problem of extracting messages belonging to one job when the job terminates.

7. 2CF (close files) is called to search the FNT for files associated with this control point. If a file of name OUTPUT, PUNCH, or PUNCHB is located, the file is assigned a disposition code of print, punch Hollerith or punch binary, respectively. Then, all local files associated with control point 3 which have a nonzero disposition code (including those just set to nonzero) are entered into the output queue. A file is considered to be in the output queue when the following changes have been made to the FNT entry:

   (a) the file name is changed to the job name (as recorded in the control point area)

   (b) the control point assignment is cleared, i.e. set to zero

   (c) the priority level (as recorded in the control point area) with a sublevel of 1 has been entered.

   With one exception, files in the output queue are of type local (local to control point zero). The exception is the file which was named OUTPUT during execution; it is set to type output. The reasons for this are obscure.

8. 1AJ now goes through the process described in item 5 of DROPPING THE READ PACKAGE, i.e. in conjunction with 2DF, it releases files and equipment associated with control point 3. Again it should be noted that the files entered in the output queue were dissociated from the control point and hence, are not affected. Storage is released and the control point area is cleared.

9. In the case of dropping a system (zero priority) job, 1AJ then dropped out leaving the control point vacant. Now, since it would be a great nuisance to require the operator to bring up NEXT for each job to be run, 1AJ will automatically bring NEXT back to control point 3. This is done on the theory that once a NEXT package resides at a control point, it ought to remain until the input queue is empty. 1BJ is summoned into the same PP by means of the "adding one" method described in item 10 of NEXT PACKAGE; 1BJ begins processing at item 2.

PUT
KAGE

We will now leave control point 3 to the process of selecting and executing jobs and consider the problem of what to do with the output queue.

1. The procedure for bringing up the OUTPUT package is nearly identical with that for bringing up READ and NEXT, so again we shall abbreviate. The operator initiates the process by typing, say 2.OUTPUT. The name of the PP overlay comprising the OUTPUT package is 10T. 10T will be assigned to a pool PP at control point 2.

10T performs the usual initialization of PP low core (See READ

2. 10T performs the usual initiallization of PP low core (see READ PACKAGE 4), and then enters the job name OUTPUT into the control

point area for display purposes.

3. 10T is capable of simultaneously supervising the printing or punching of as many as six files from the output queue, but since each requires the permanent allocation of a 1000_8 word CM buffer (in addition to the base 100_8), 10T counts the number of printers and punches to minimise buffer space. The EST is searched (directly by 10T) to count the number of equipments of type LP or CP. (Note that these equipments are not reserved at this point). An M.RSTOR function is then issued to MTR for N*1000B + 100B words (maximum 6100B), where N is the number of output devices. This storage will remain assigned for as long as OUTPUT occupies the control point. The base 100_8 words of storage are used to control the ownership of each of the N buffers.

4. 10T then checks for a free buffer; since this is the first time through, there will naturally be at least one. The FNT channel is reserved via a monitor function and the FNT is searched for files in the output queue. During the single pass through the FNT, several things occur.

   (a) The print file, if any, with the highest priority is selected for printing. A buffer is assigned to the file and an equipment of type LP is requested from MTR. If either a buffer or a printer cannot be obtained (as can happen at later stages) the file is simply returned to the output queue.

(b) The punch file, if any, with the highest priority is selected for punching. A buffer and a card punch are assigned as in (a) above. The PP occupied by 10T is capable of processing only print files, so another PP must be brought into play for a punch file. 10T requests (M.RPP) that MTR assign a pool PP to control point 2 for the overlay called 1P0 (punch output).

(c) At an interval selected by the installation, the priority sublevels of all files remaining in the output queue are incremented by one. This insures that for jobs with the same priority level, the output of the eldest in the output queue will be processed first.

(d) Any files selected for processing during this pass must be removed from the output queue; this is accomplished by assigning the FNT entry to, in this case, control point 2.

5. If there were no files selected from the output queue, 10T would set the PP recall register and drop out. However, let us assume a print file has been found. 10T then calls 30T.

6. 30T has a few peculiarities which are worth pointing out. 30T is called only by 10T and in fact, operates as though it were part of 10T. It is merely an accident of history that it is not physically a part of 10T. Before 30T is entered, 10T sets some addresses of 10T subroutines into PP low core in order that 30T may use them. The most noteworthy of these subroutines is the one described in item 4. This subroutine is entered frequently by 30T during its processing to insure that printers

and punches are kept as busy as possible. The punch files are farmed out, as mentioned before, and 30T keeps track of the progress in printing the several files for which it may be responsible at any one time.

7. We shall now largely ignore the fact that the printing of other files may be initiated and concentrate on the processing of a single file. However, because several files may be printed at once, the technique used by 1LJ (i.e. that of alternating 2BP/2ES and 2BP/2RC) is not possible for 10T/30T. The reading of the disc file must be done elsewhere.

The PP overlay CIO was designed primarily to deal with user I/Q; however, it may also be called from another PP program provided that user-type parameters are supplied. 10T requests from monitor (M.RPP) the assignment of a PP for CIO, supplying for the input register an address within the base 100_8 word area as well as the name, CIO. (As mentioned previously, space is reserved within this area for information about each print file; the first five words for each file are known as a File Environment Table.(FET). The FET format used by 10T is identical to that specified for user I/O). CIO independently begins to fill the proper buffer with data from the disc output file and 30T loops waiting for completion of the read operation. (During this loop it may also be printing data from other buffers or checking for new files to print or punch). When the buffer is full (or when an-end-of record or end-of-file is read), 30T begins to print the data on the printer selected for this buffer, interspersing this process with operations on other buffers and

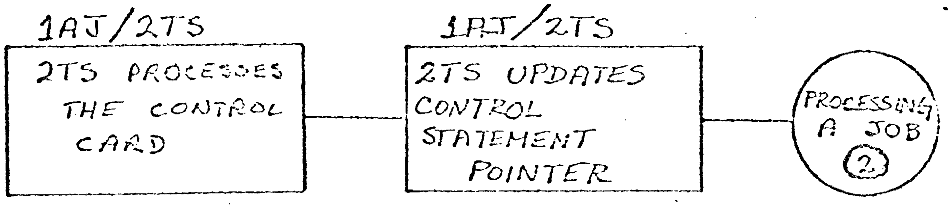
and printers. The printing of the entire file proceeds in this manner. When the end-of-file is reached, 30T calls 1CO (complete output) into another PP.

8. 1CO is given the buffer number and the EST ordinal of the printer used. The printer is released (via a monitor function) back to the pool of available equipment. The buffer number is used to locate the relevant FET, and hence the file name; the buffer is then made available for another print or punch file. 1CO then loads 2DF to remove the now defunct disc output file. 1CO then drops out.
(SEE # 6 ON PAGE 19 FOR DAYFILE HANDLING INFORMATION)

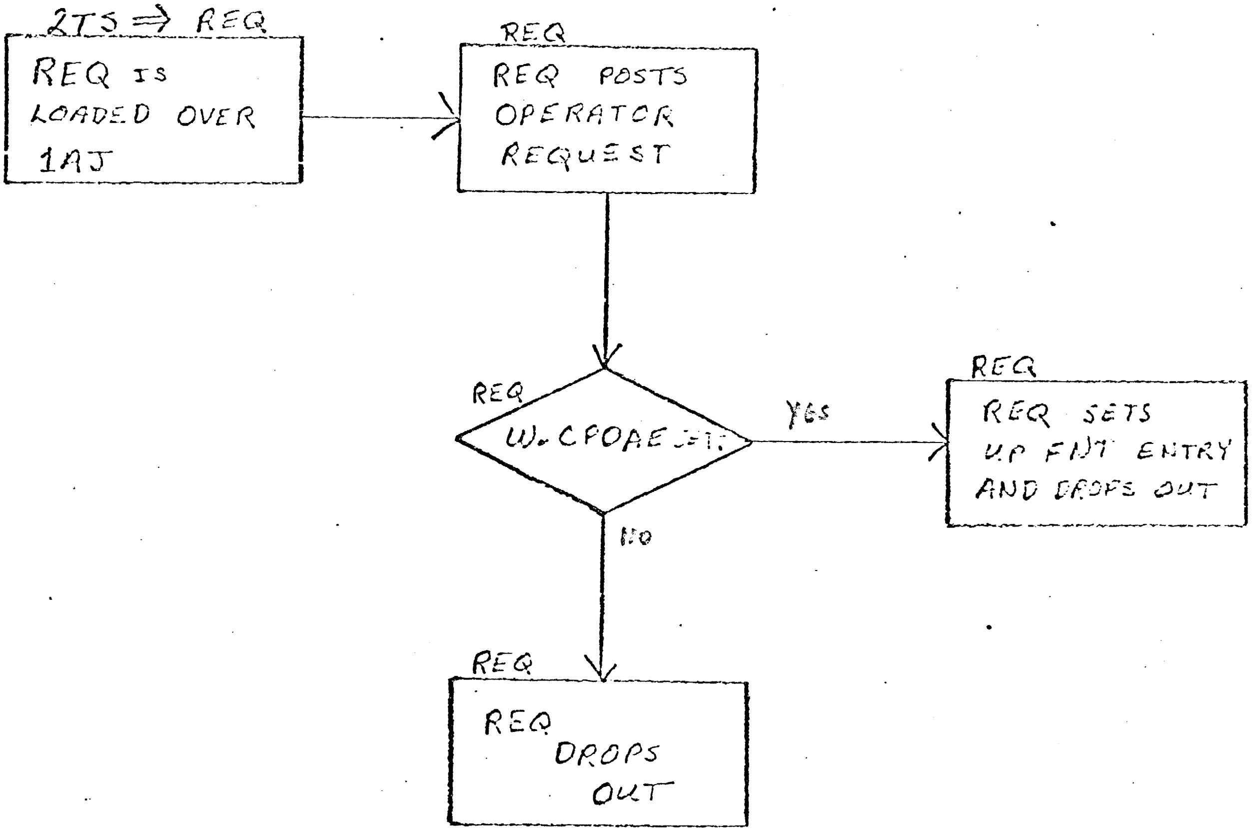
9. Meanwhile, (assuming that a punch file was found) 1PO has been punching cards by alternately calling 2BP/2ES to read the disc file into its CM buffer and 2BP/2PC (punch cards) to punch data from the buffer. CIO is not required since 1PO only handles one punch file at a time; another PP and another copy of 1PO would be required if two punches were to operate simultaneously. When the end-of-file is reached, 1PO itself performs the actions described in (8) above, calling 2DF to remove the disc punch file. 1PO then drops out.

29th September, 1967.

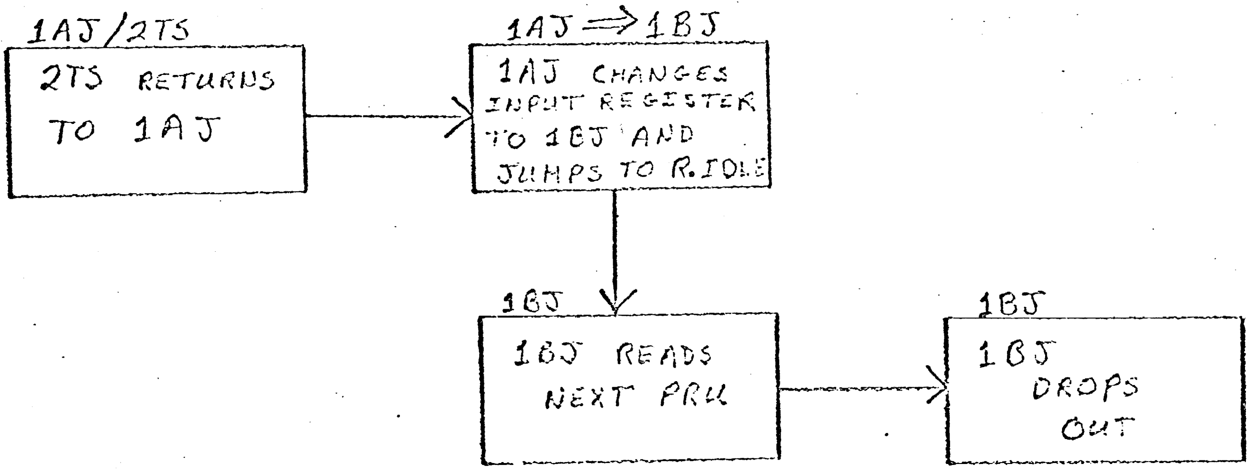
STANDARD CONTROL CARD



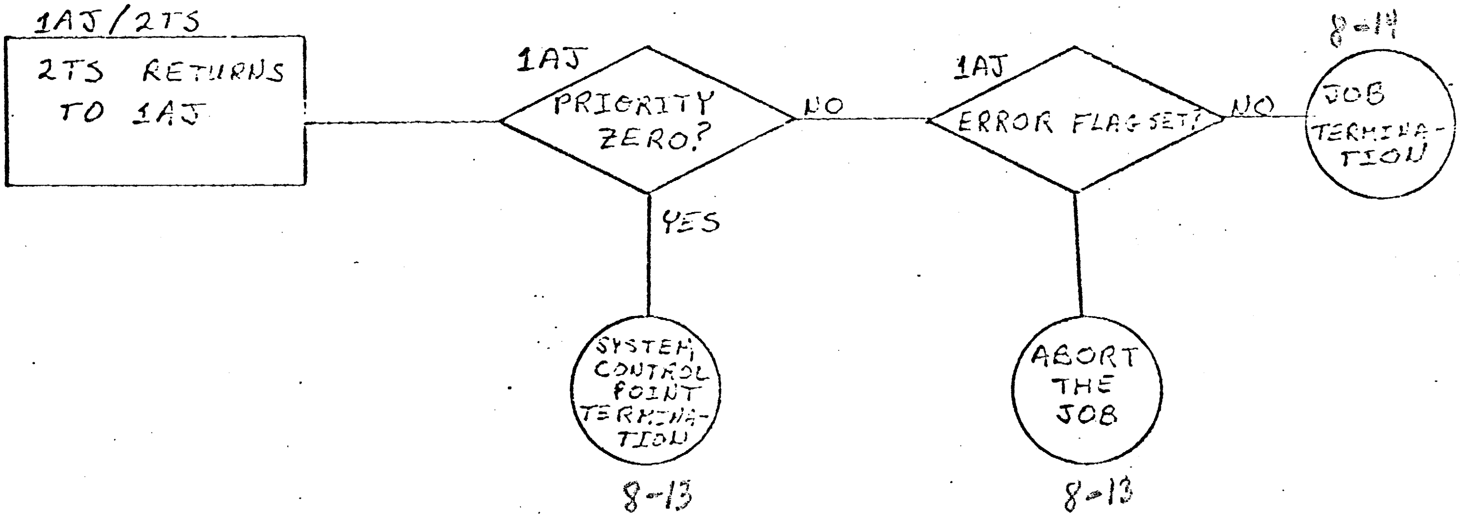
REQUEST CARD



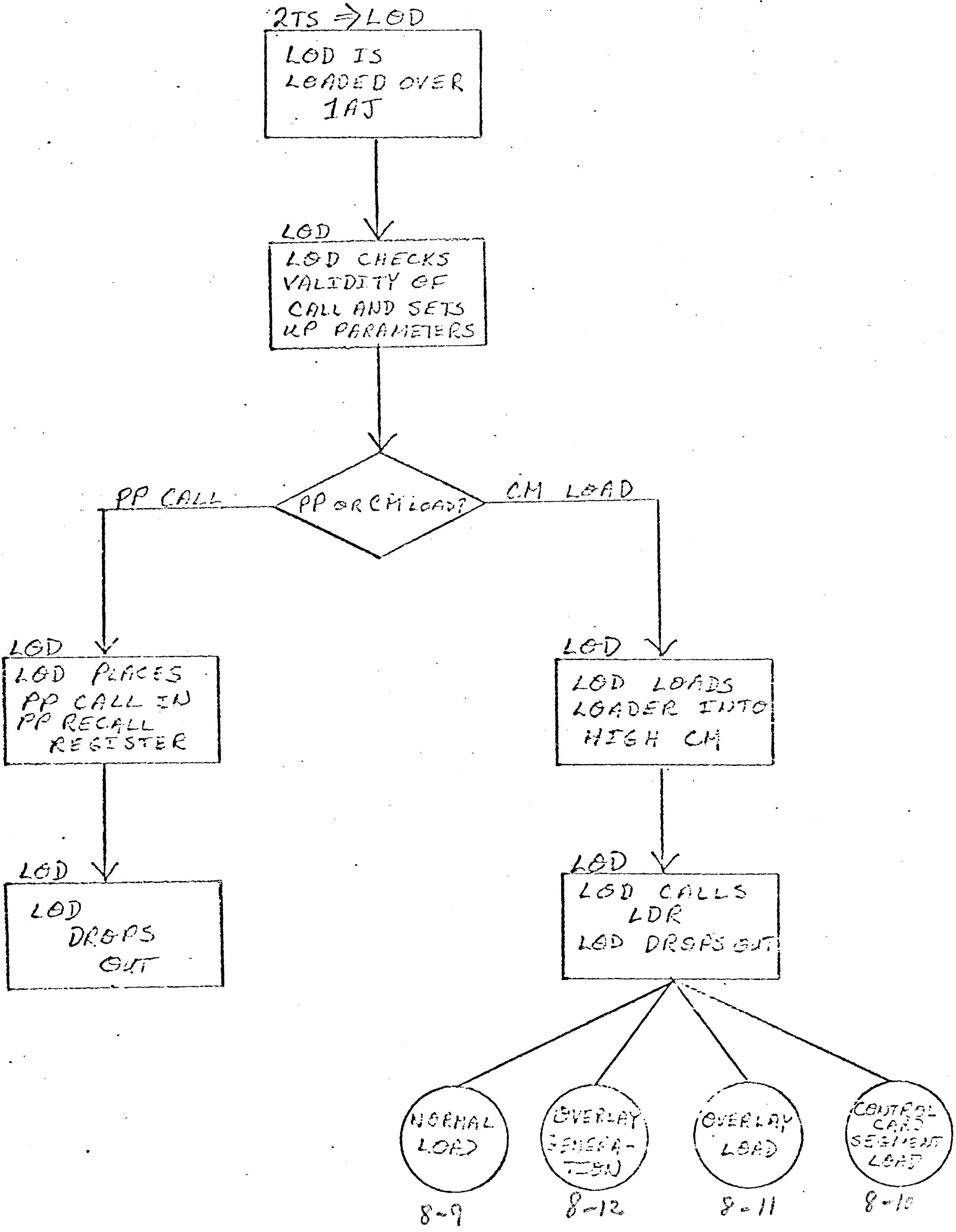
CONTROL CARD BUFFER EXHAUSTED



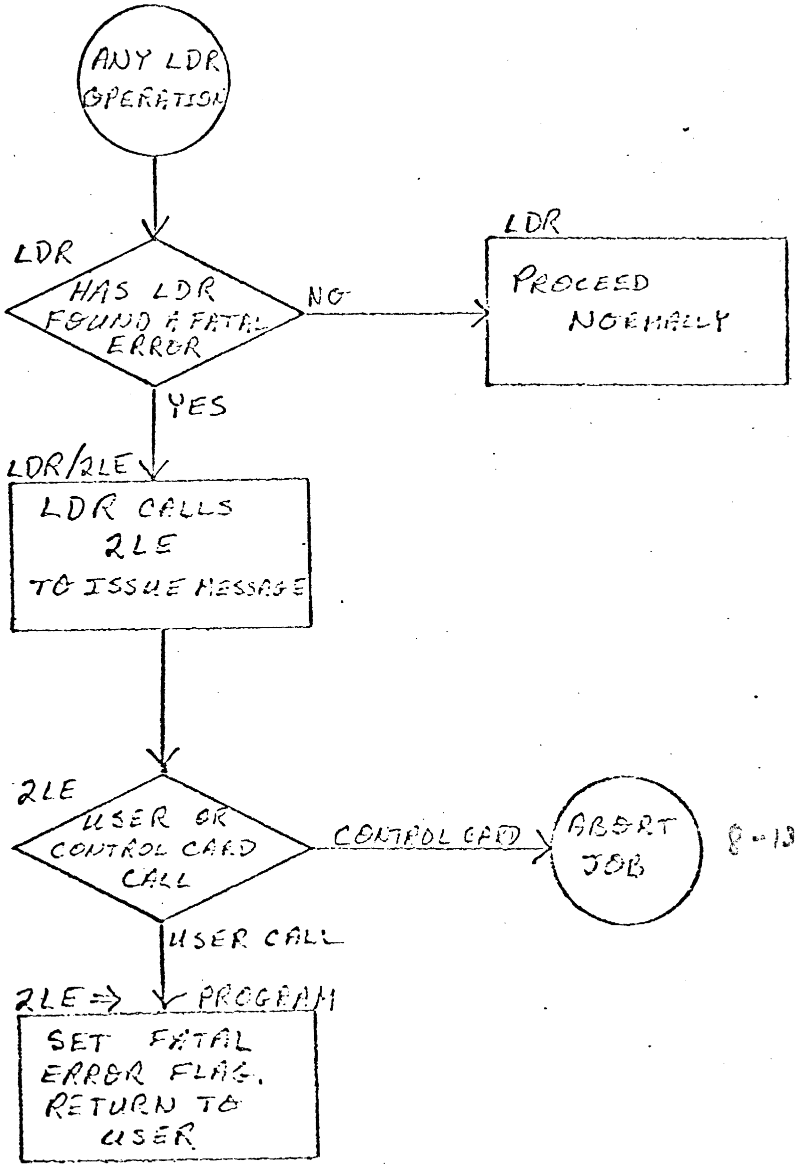
NO MORE CONTROL CARDS



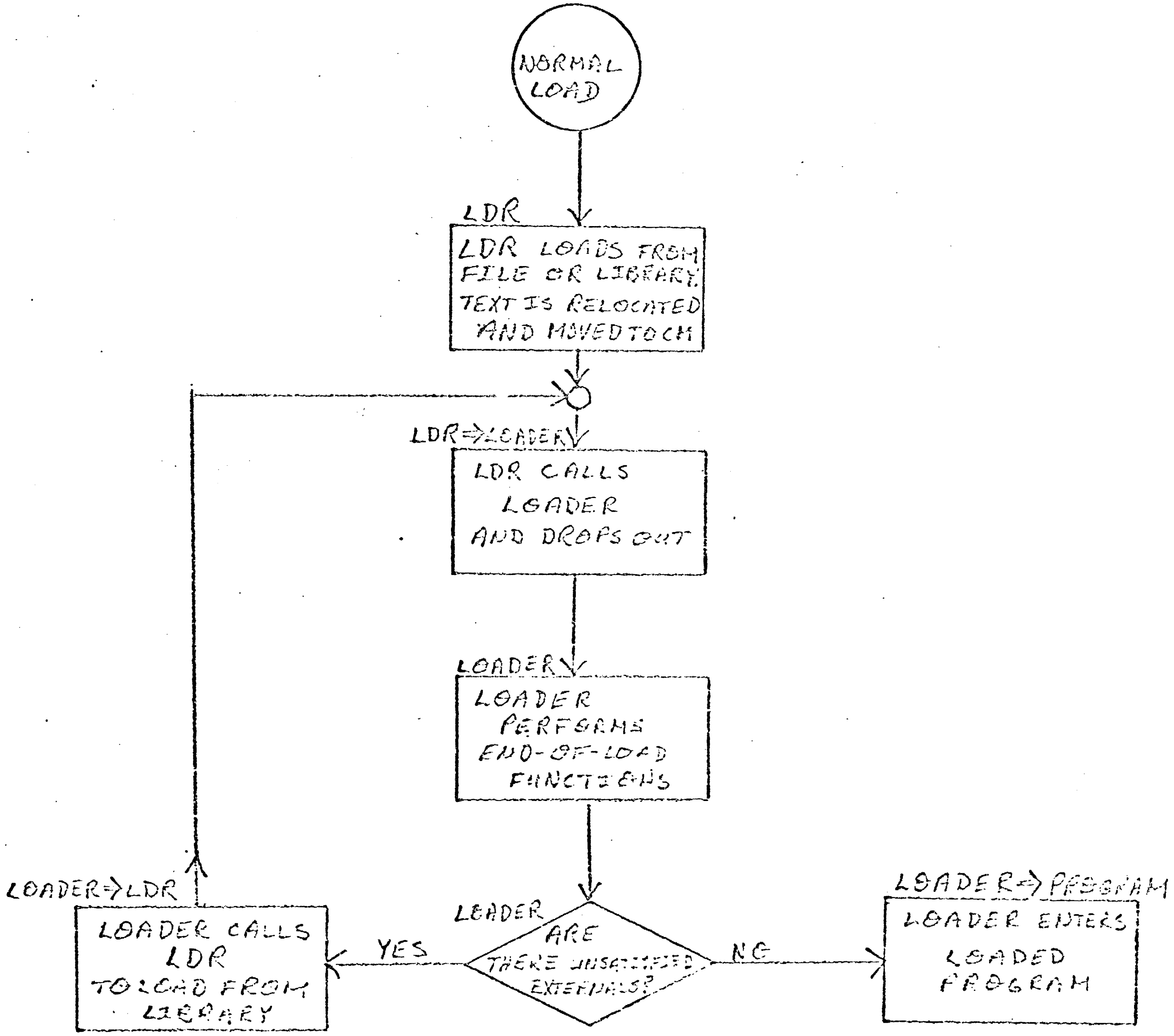
LOADER CALL


2TS ⇒ LOD
LOD IS LOADED OVER 1AJ
LOD
LOD CHECKS VALIDITY OF CALL AND SETS UP PARAMETERS
PP CALL
PP OR CM LOAD?
CM LOAD
LOD
LOD PLACES PP CALL IN PP RECALL REGISTER
LOD
LOD LOADS LOADER INTO HIGH CM
LOD
LOD DROPS OUT
LOD
LOD CALLS LDR LOD DROPS OUT
NORMAL LOAD
OVERLAY GENERATION
OVERLAY LOAD
CONTROL CARD SEGMENT LOAD
8-9
8-12
8-11
8-10

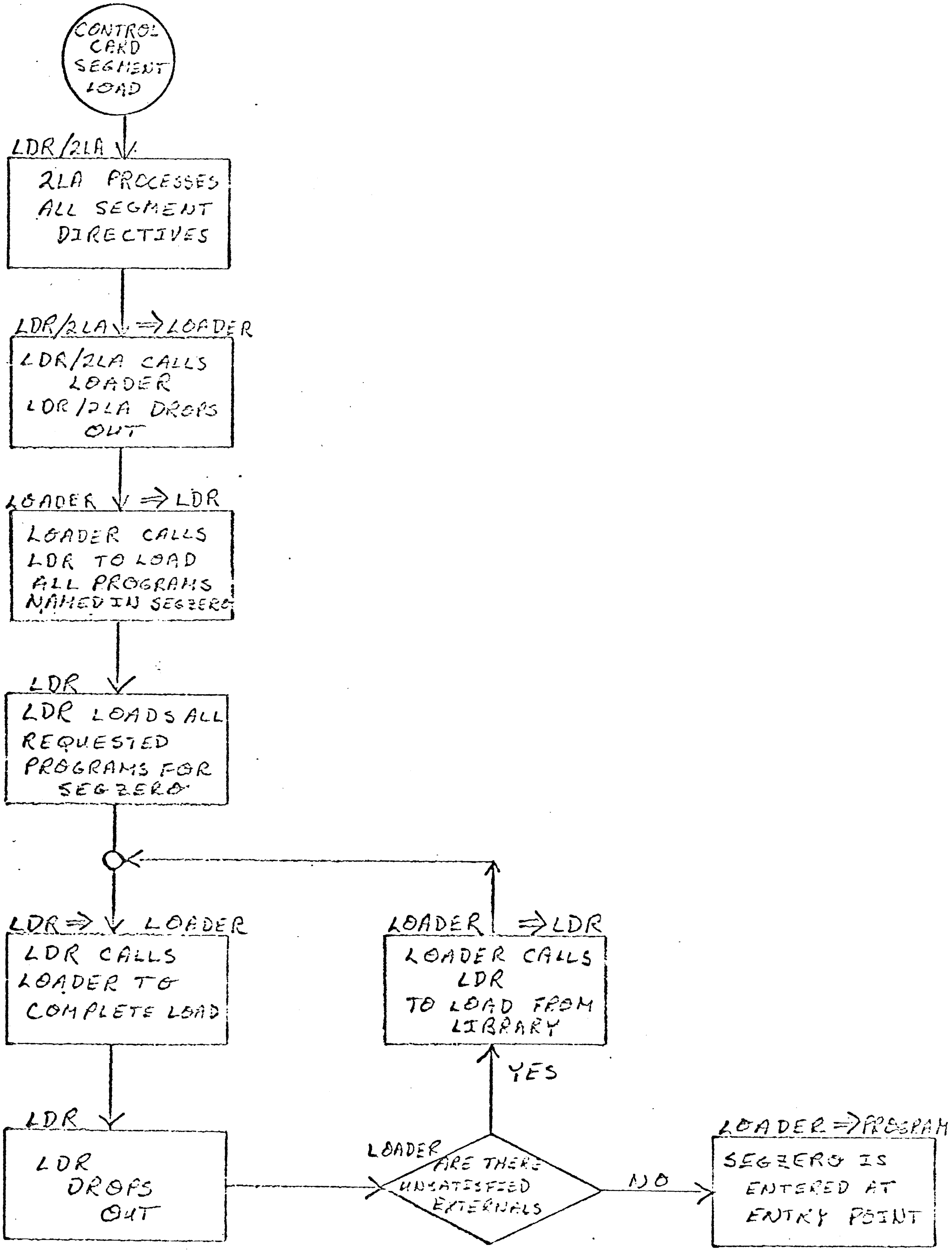
LOADER CALL (CONTINUED)



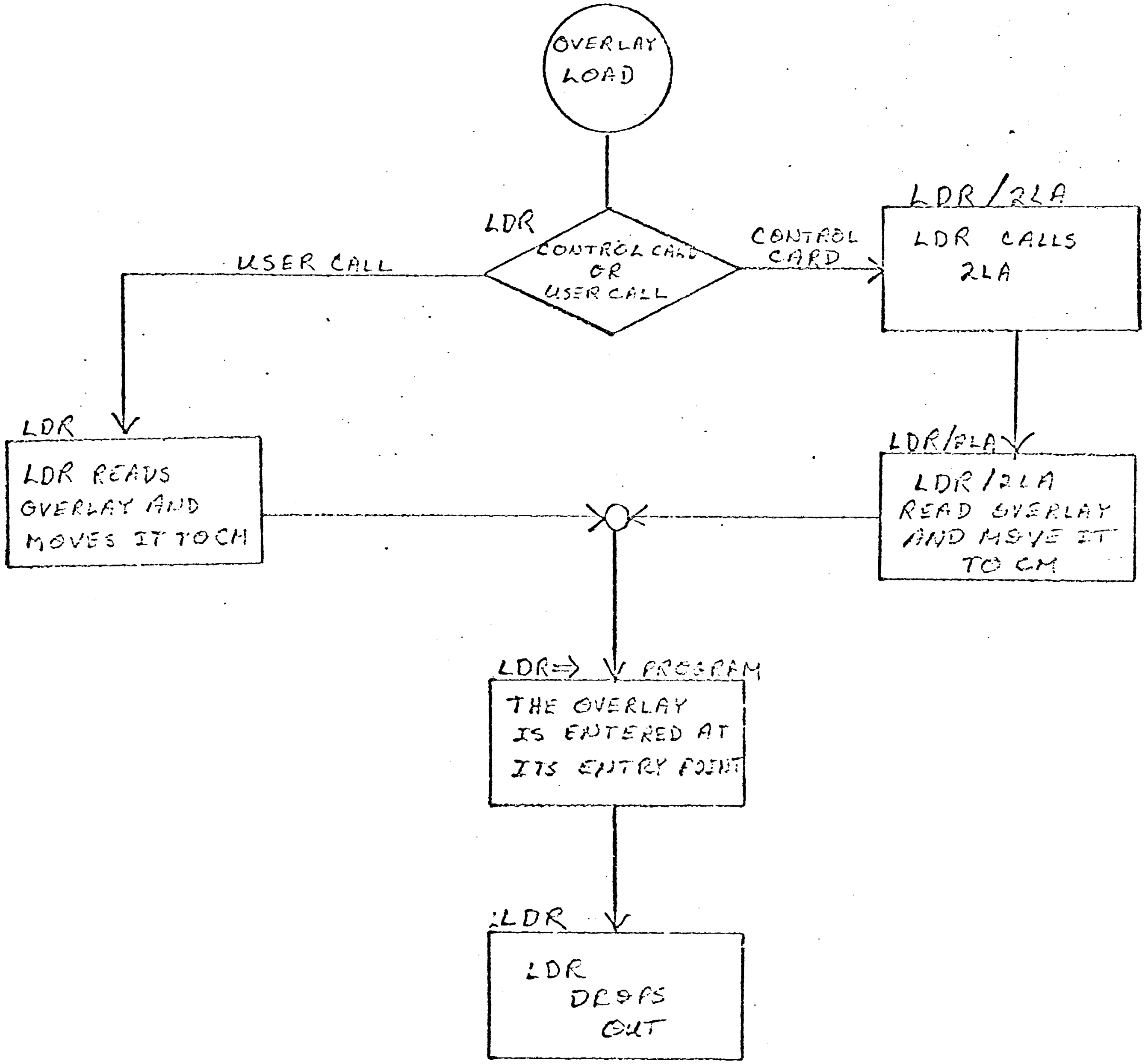
LOADER CALL (CONTINUED)



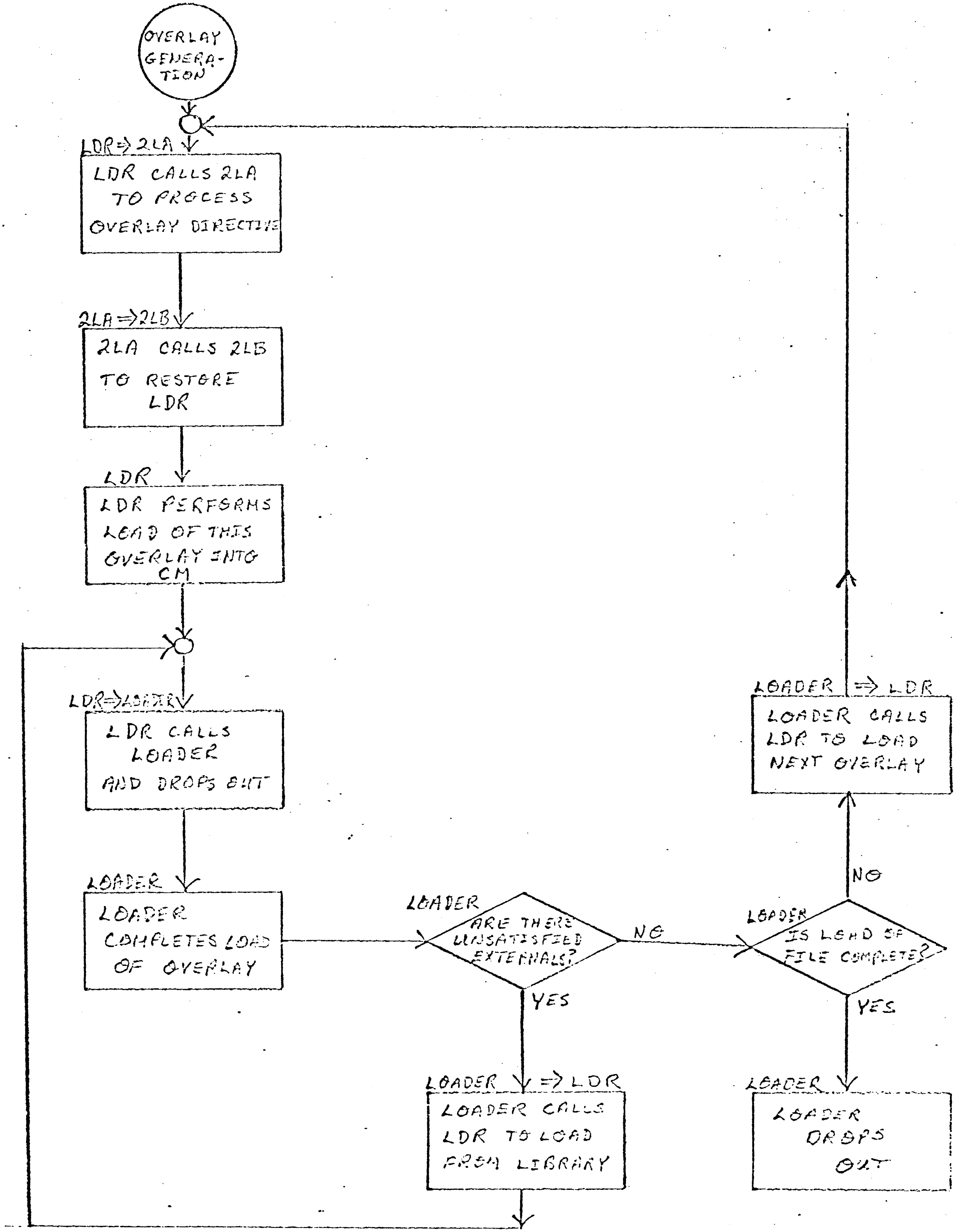
LOADER CALL (CONTINUED)



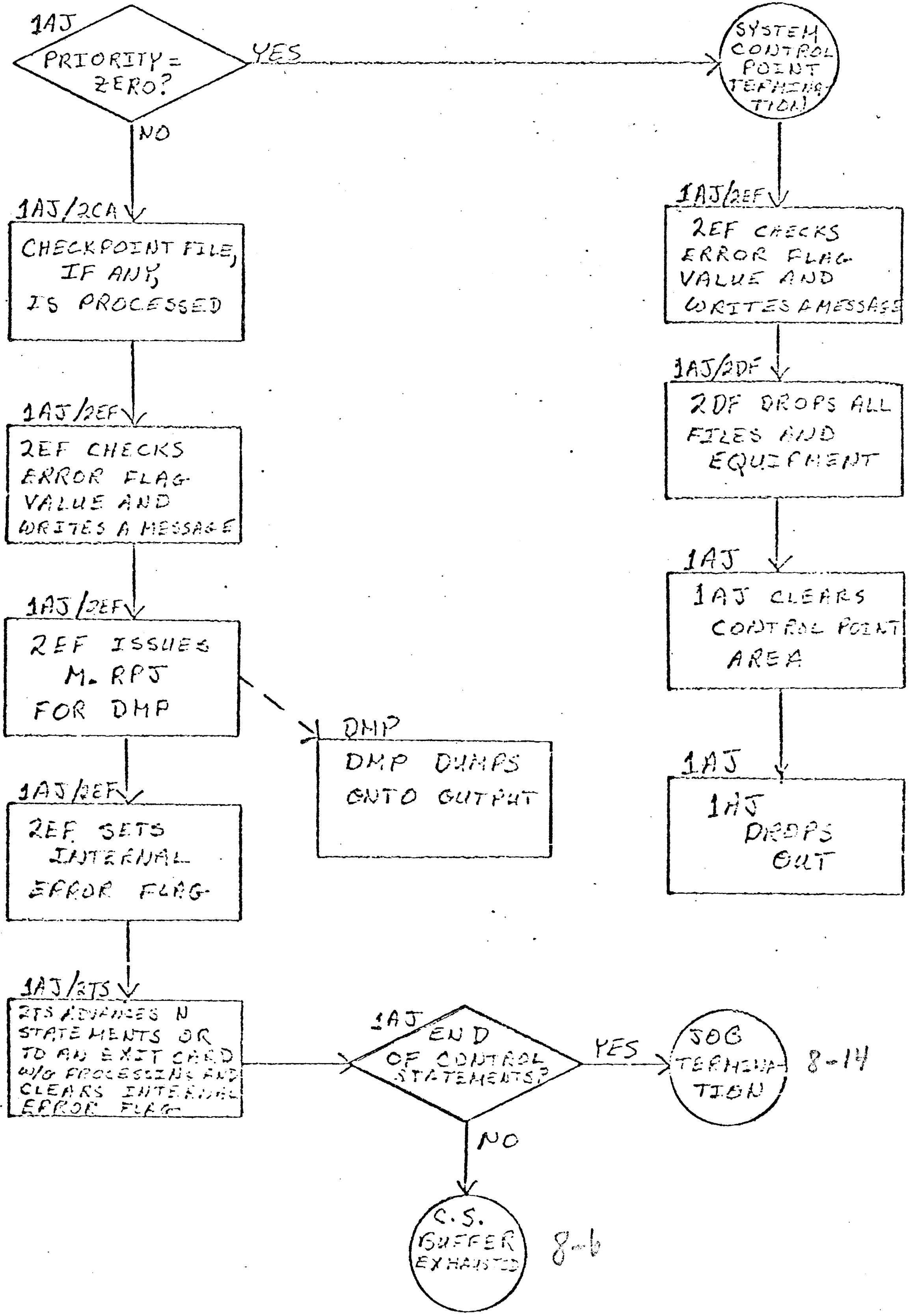
LOADER CALL (CONTINUED)



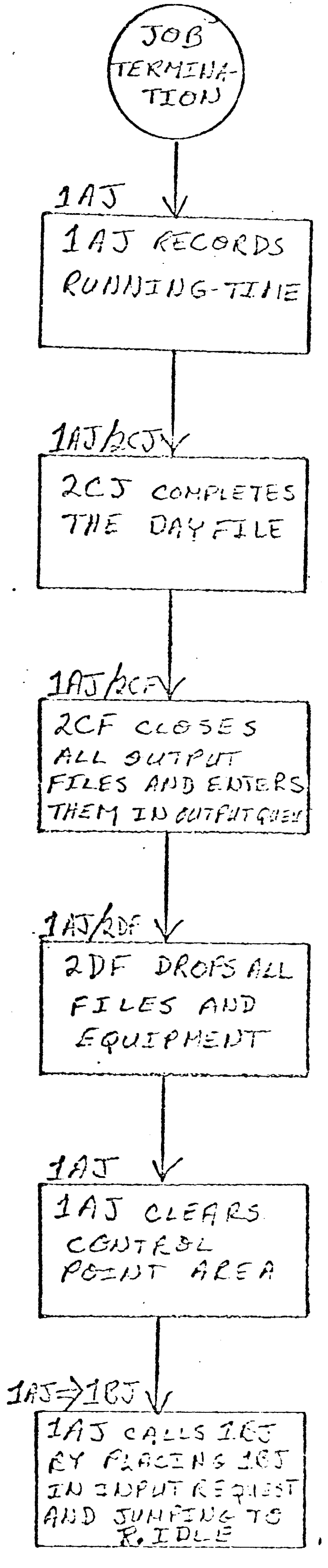
LOADER CALL (CONTINUED)



ABORTING A JOB

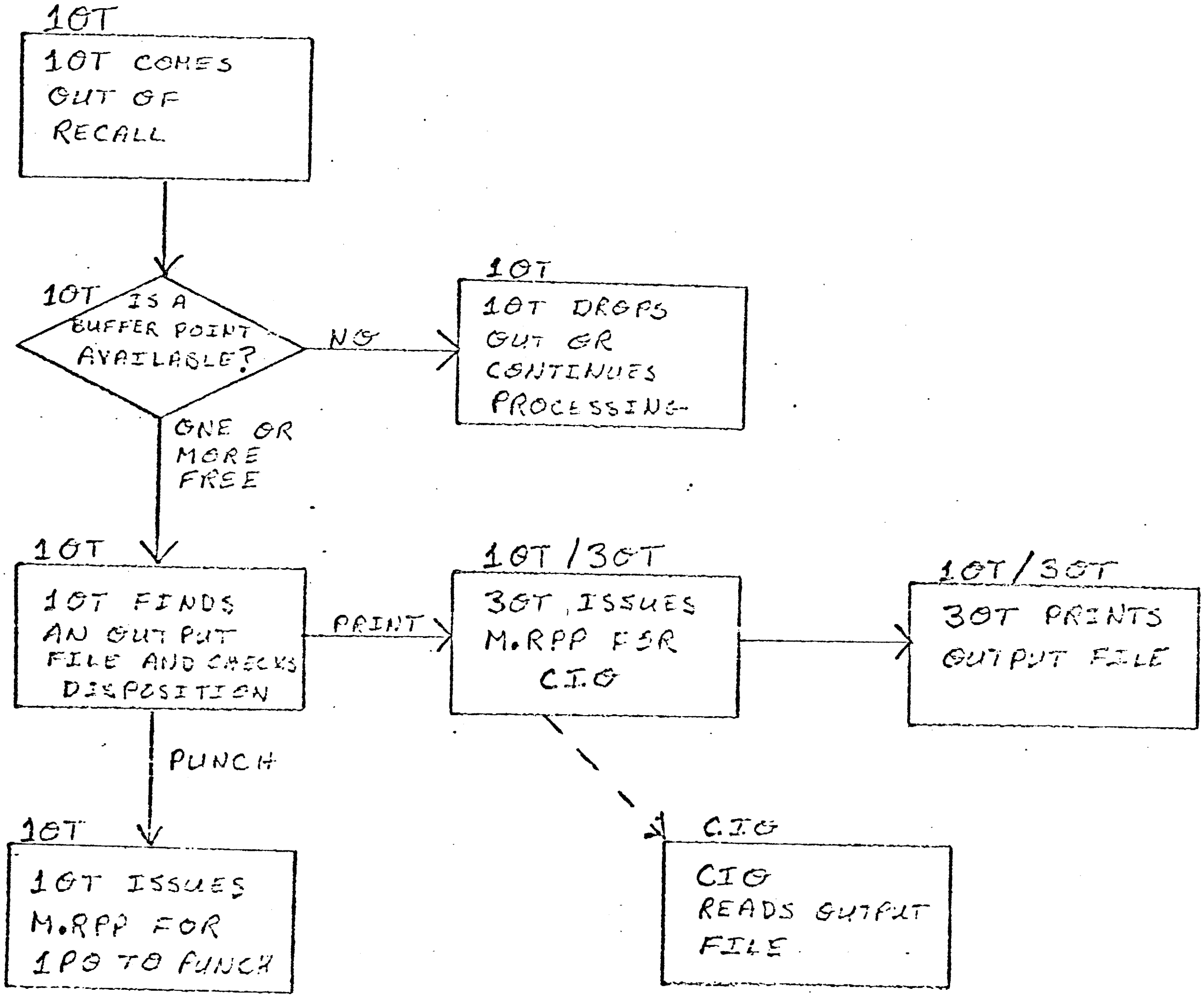


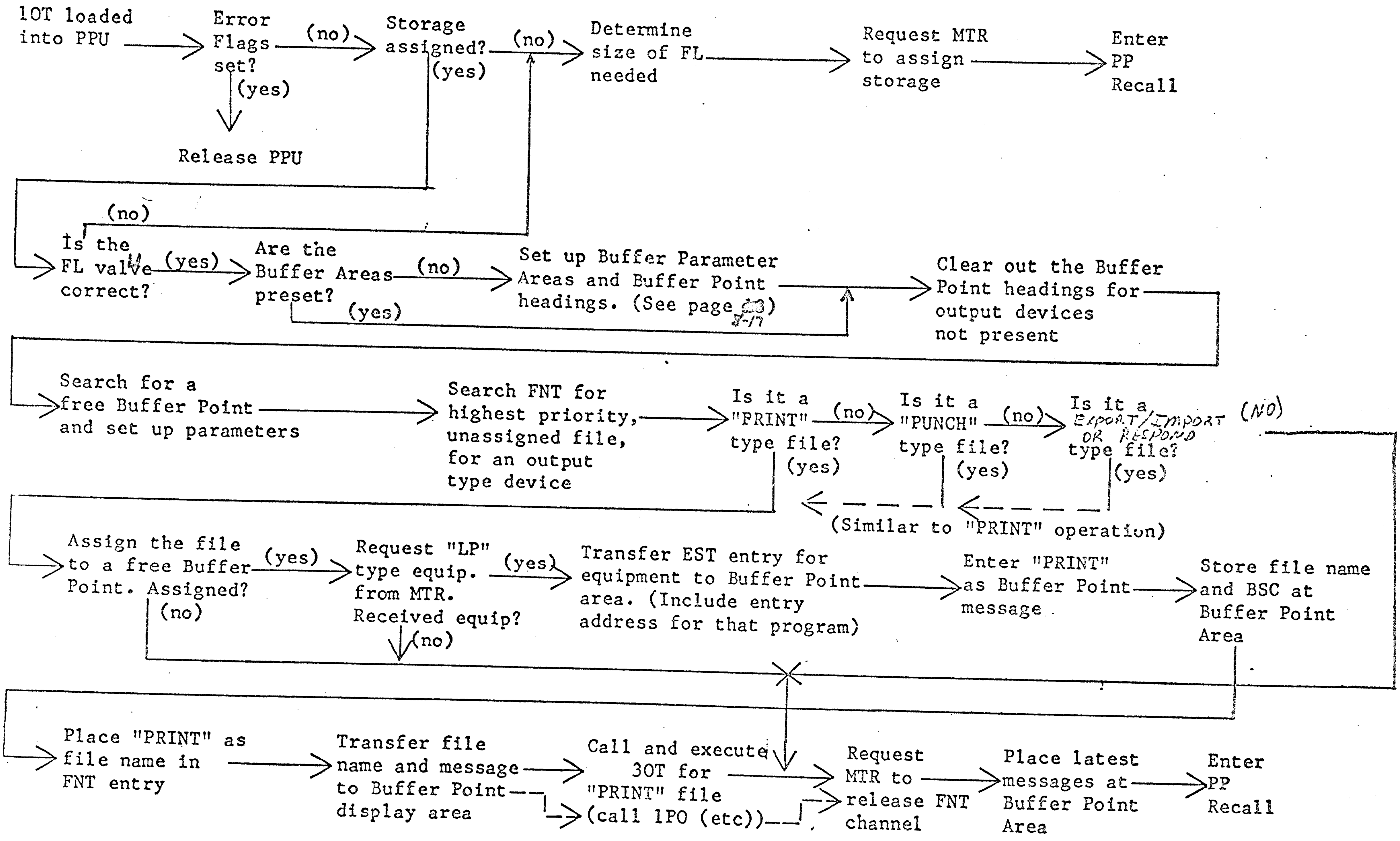
ABORTING A JOB (CONTINUED)



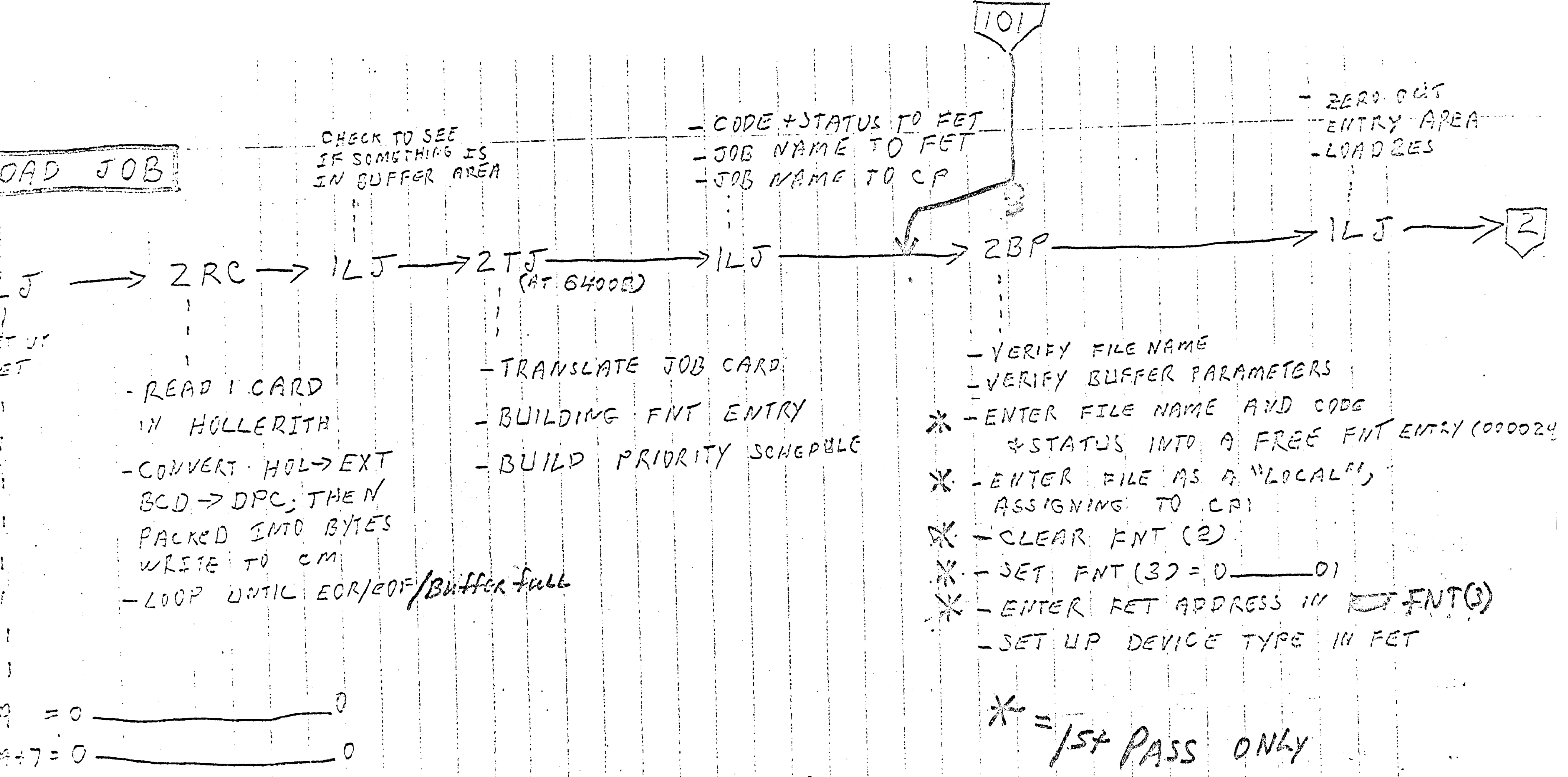
PROCESSING OUTPUT FROM A JOB

(DUMP JOB)





"OUTPUT" SIMPLIFIED FLOW CHART



T UP
ET

CHECK TO SEE IF SOMETHING IS IN BUFFER AREA

- READ 1 CARD IN HOLLERITH
- CONVERT HOL→EXT BCD→DPC; THEN PACKED INTO BYTES WRITE TO CM
- LOOP UNTIL EOR/EOF/Buffer full

- TRANSLATE JOB CARD
- BUILDING FNT ENTRY
- BUILD PRIORITY SCHEDULE

- CODE + STATUS TO FET
- JOB NAME TO FET
- JOB NAME TO CP

- VERIFY FILE NAME
- VERIFY BUFFER PARAMETERS
- * - ENTER FILE NAME AND CODE + STATUS INTO A FREE FNT ENTRY (000024
- * - ENTER FILE AS A "LOCAL", ASSIGNING TO CP1
- * - CLEAR FNT (2)
- * - SET FNT (3) = 0 ——— 01
- * - ENTER FET ADDRESS IN FNT(3)
- SET UP DEVICE TYPE IN FET

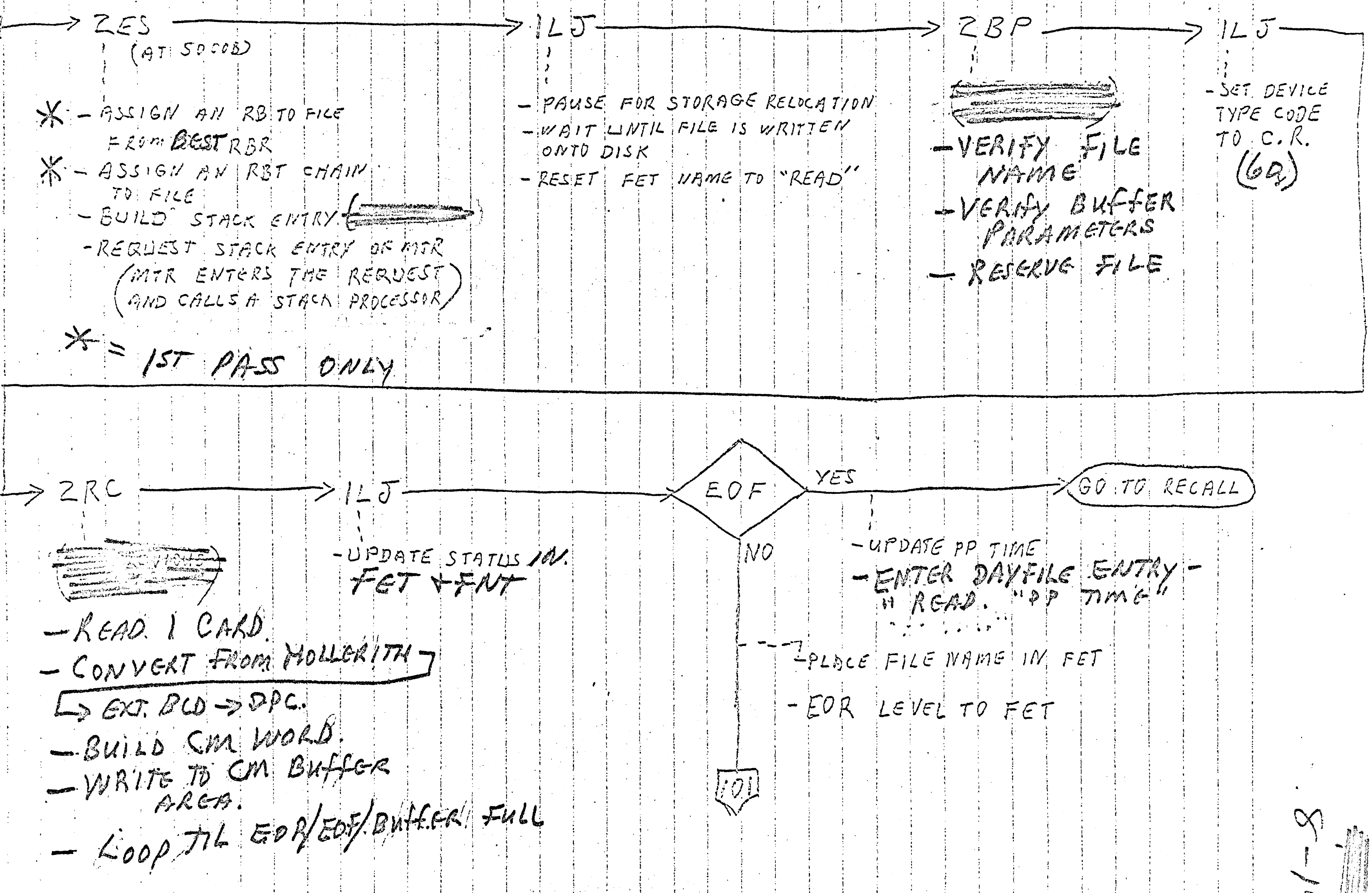
- ZERO OUT ENTRY AREA
- LOAD 2ES

* = 1st PASS ONLY

A = 0 ——— 0
A+7 = 0 ——— 0
+10 = ABC ——— REQ WRITE
11 = 000 004 01 ——— 0100 = FIRST
12 = 0 ——— 205 = IN
13 = 0 ——— 00100 = OUT
14 = 0 ——— 3100 = LIMIT
15 =
UNCHANGED
:
20 =
21 3100
22 3100
23 3100
24 3300
3100

RA+100 = 1ST CARD (10 CHAR)
101 = ABC, P7, T100, CM400000.
102 = 0 ——— 0

8/8-8 4/-8



2ES (AT 50008)

- * - ASSIGN AN RB TO FILE FROM BEST RBR
- * - ASSIGN AN RBT CHAIN TO FILE
- BUILD STACK ENTRY [redacted]
- REQUEST STACK ENTRY OF MTR (MTR ENTERS THE REQUEST AND CALLS A STACK PROCESSOR)

* = 1ST PASS ONLY

1LJ

- PAUSE FOR STORAGE RELOCATION
- WAIT UNTIL FILE IS WRITTEN ONTO DISK
- RESET FET NAME TO "READ"

2BP

[redacted]

- VERIFY FILE NAME
- VERIFY BUFFER PARAMETERS
- RESERVE FILE

1LJ

- SET DEVICE TYPE CODE TO C.R. (60)

2RC

[redacted]

- READ 1 CARD.
- CONVERT FROM HOLLERITH
  - EXT. BCD → DPC.
- BUILD CM WORD.
- WRITE TO CM BUFFER AREA.
- LOOP TIL EOR/EOF/BUFFER FULL

1LJ

- UPDATE STATUS IN FET + FNT

EOF — YES

- UPDATE PP TIME
- ENTER DAYFILE ENTRY - " READ. "PP TIME"

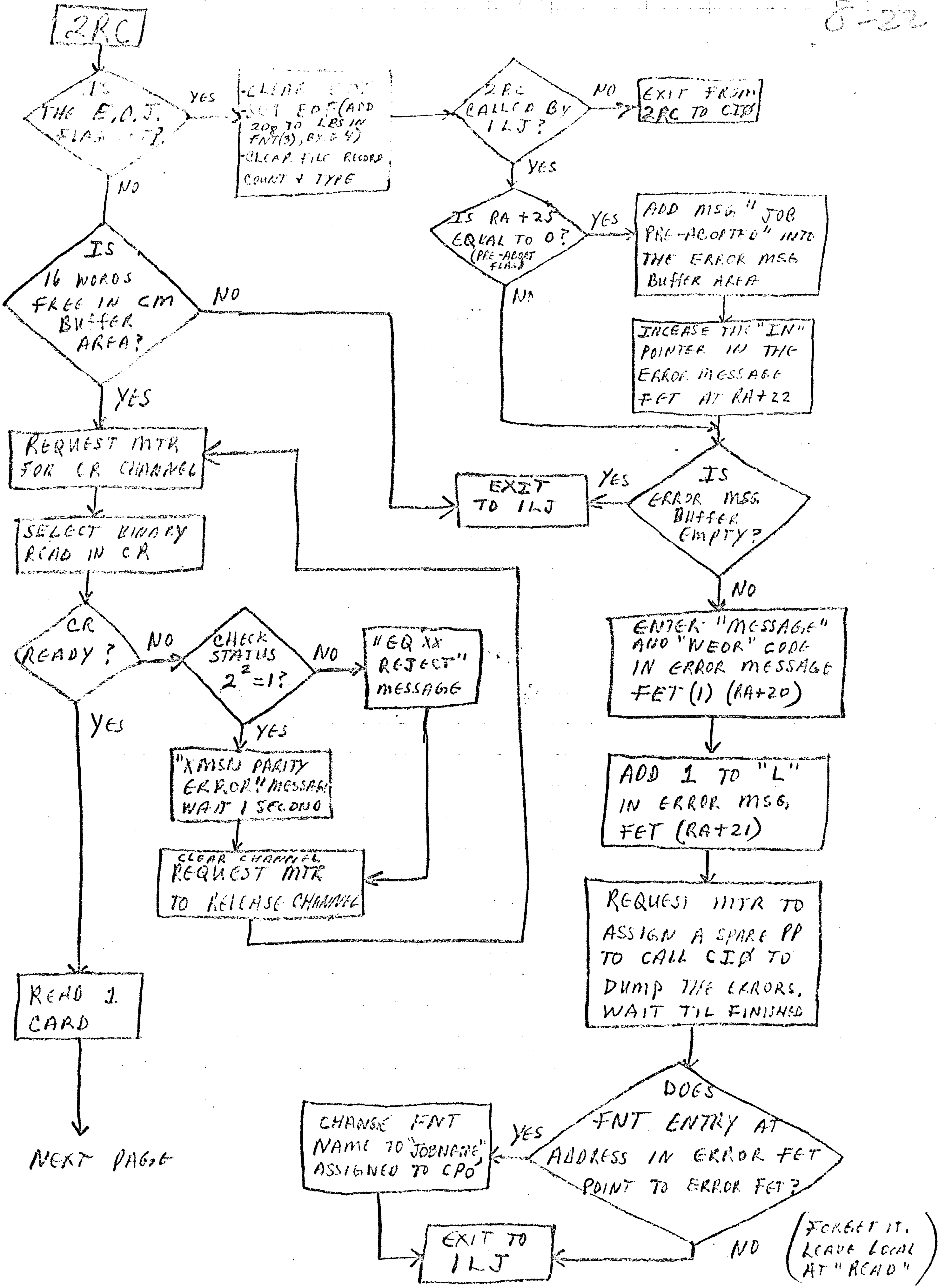
EOF — NO

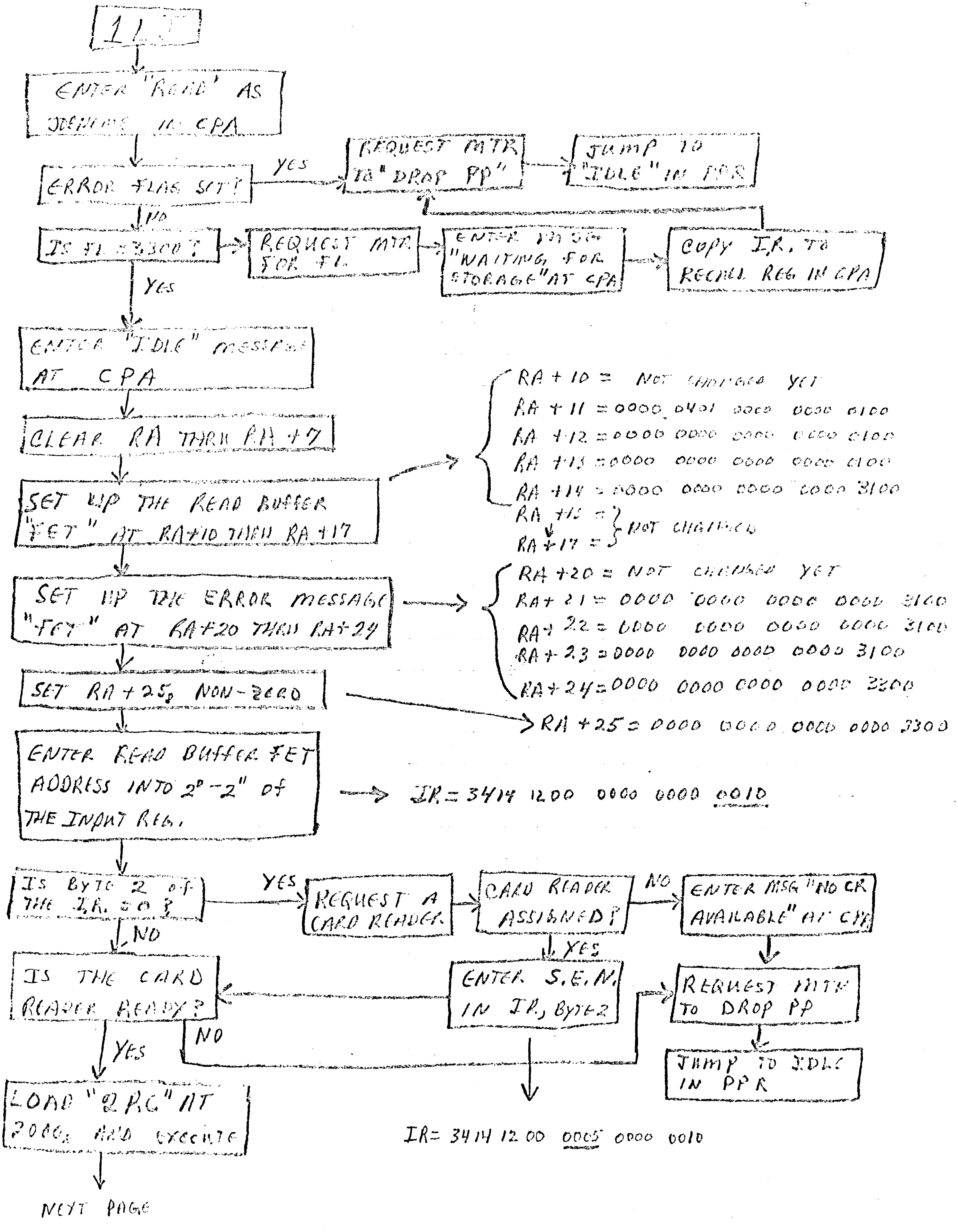
- PLACE FILE NAME IN FET
- EOR LEVEL TO FET

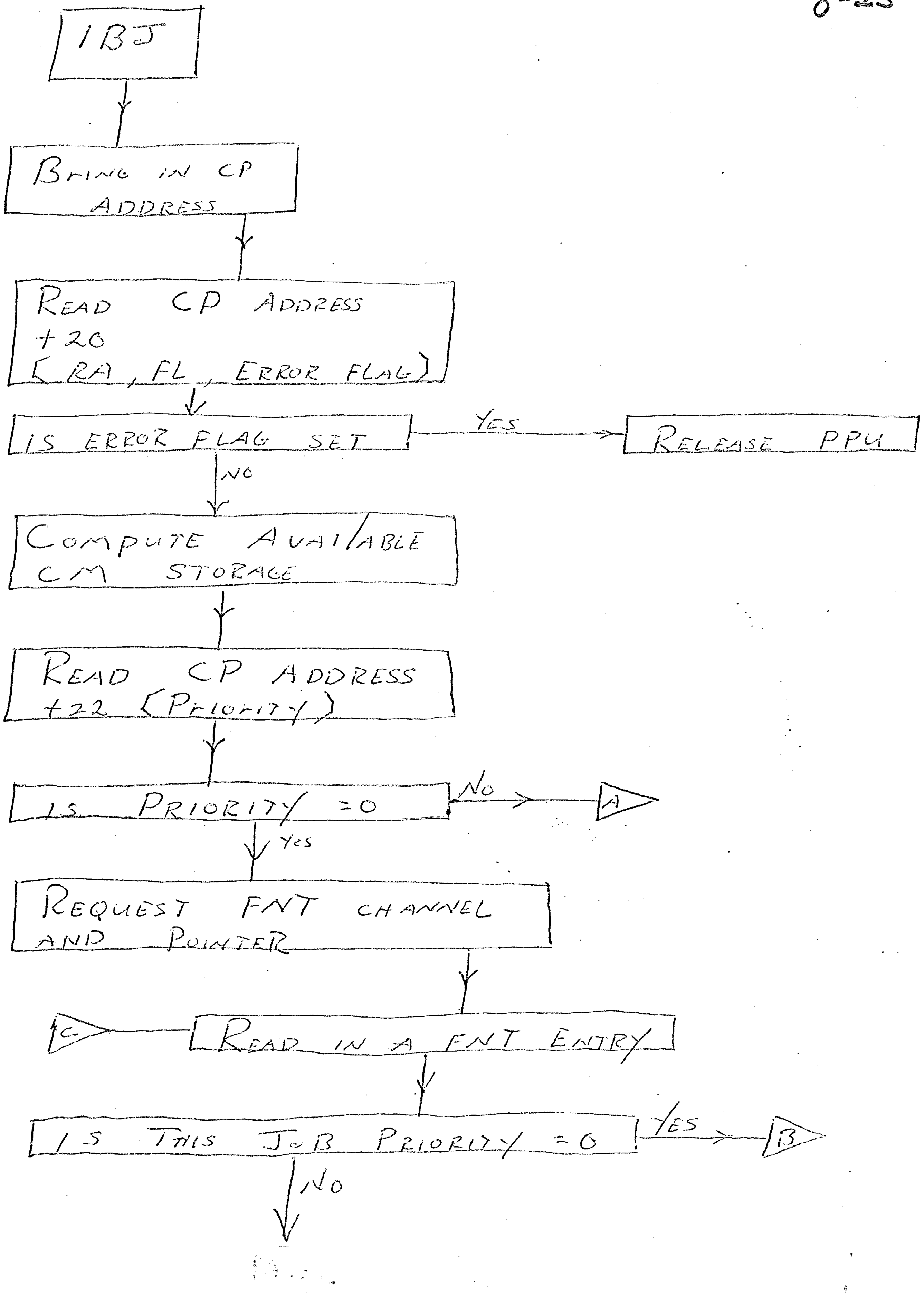
8-20

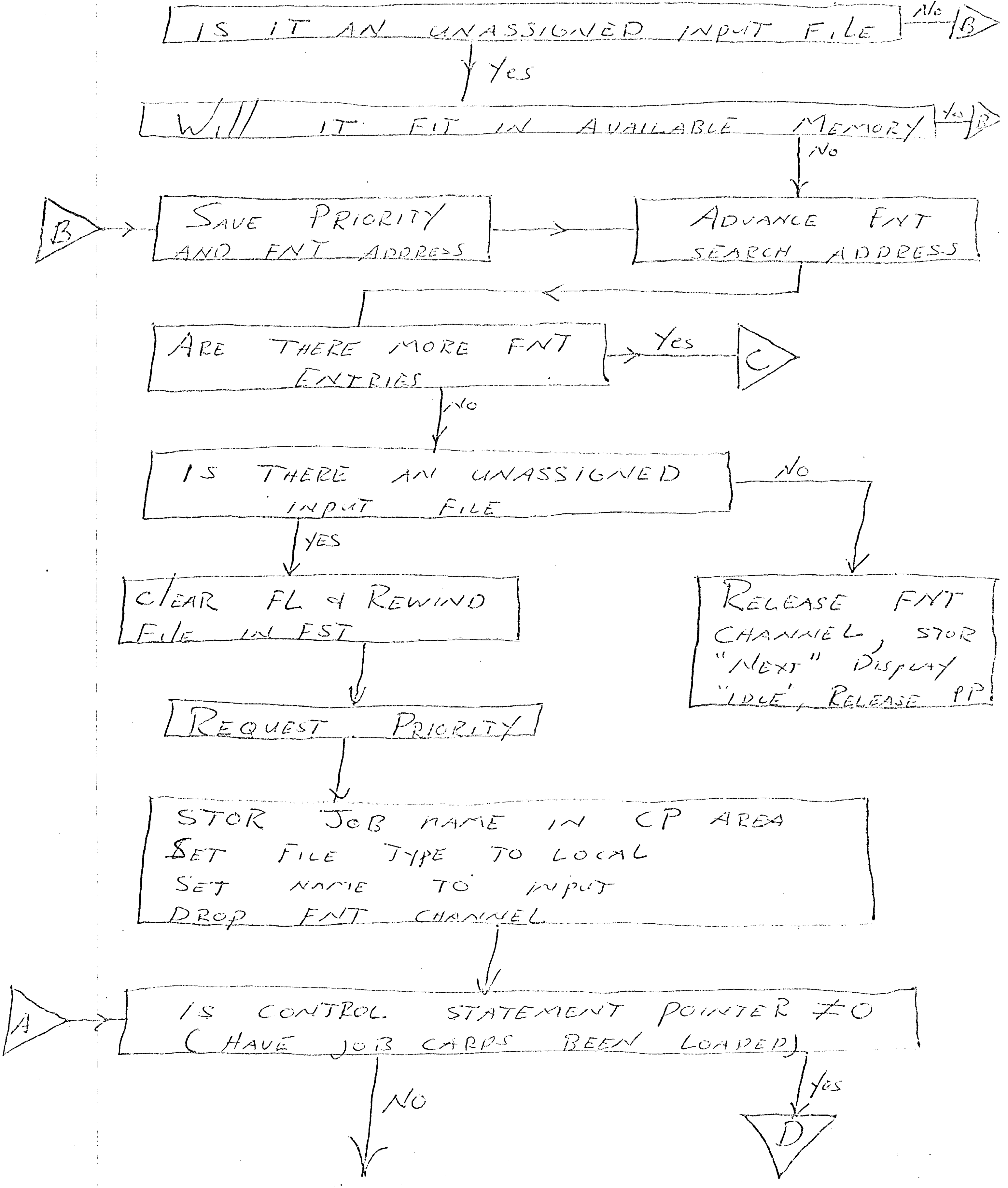
2ES Parameters

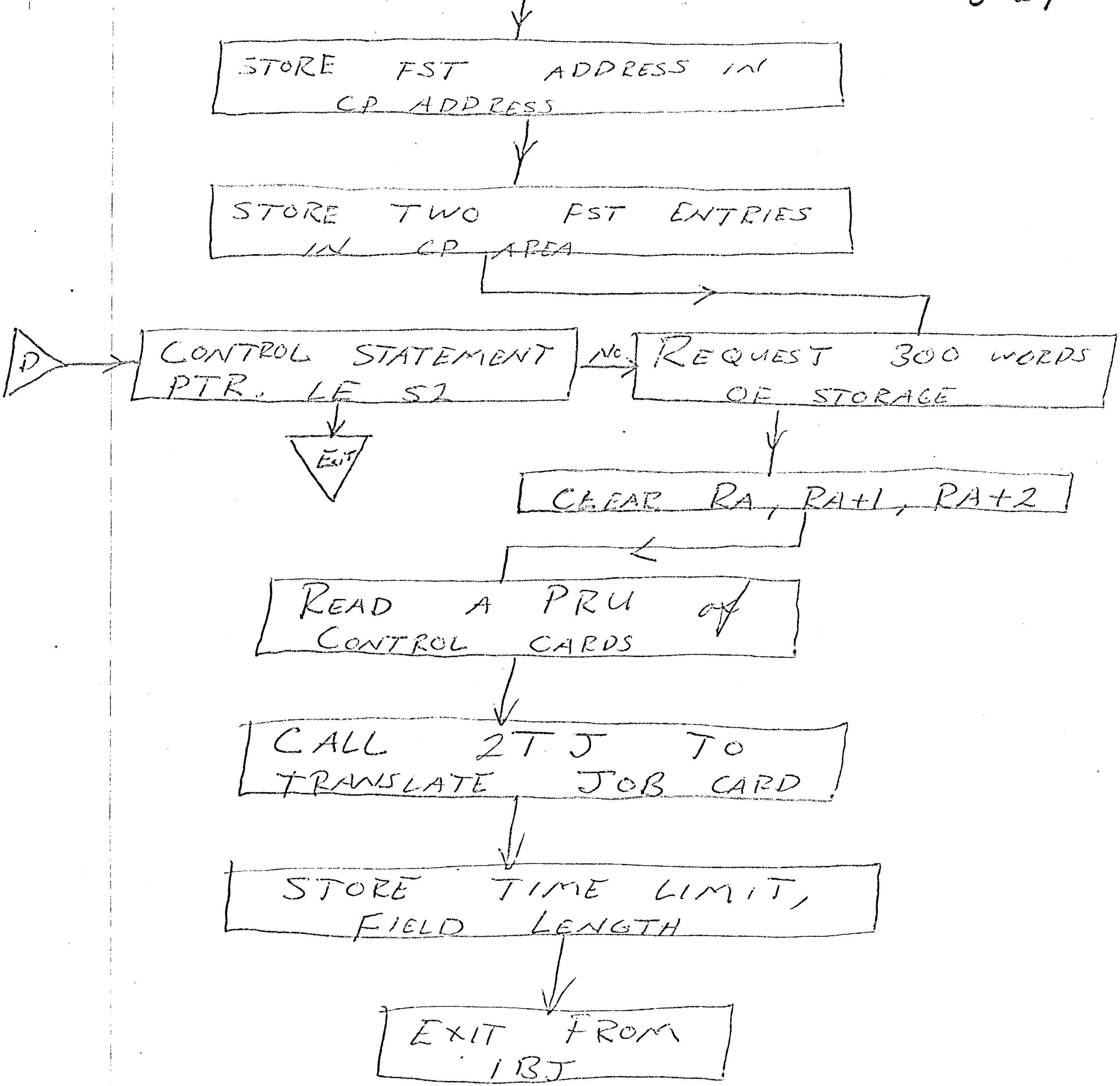
	PP Call		
D.FNT	20		
	21		
	22	FNT(2)	
	23		
	24		
	25		
	26	FNT(3)	
	27		
	30	level number in low 6 bits	Also to FNT(3)
	31	OP Code	
D.EST	32	Flags 4=NOFET, 1=PP AVAIL	
	33	CP RECALL 1=RECALL, 0=NO RECALL	(Ignored if D.CPAD=0)
D.BA	40	First word of FET,	2nd word of FET
	41	If NO FET BIT	If open function
	42	Is not set	(for random bit)
	43		
	44		
D.FR5	45	Last buffer status	
D.PPIRB	50		
	51		
	52	Number of records	
	53	FET address	
	54		
D.FA	57		
D.FIRST	60	First	
	61		
D.LIMIT	66	Limit	
	67		
D.CPAD	74	Control point address	

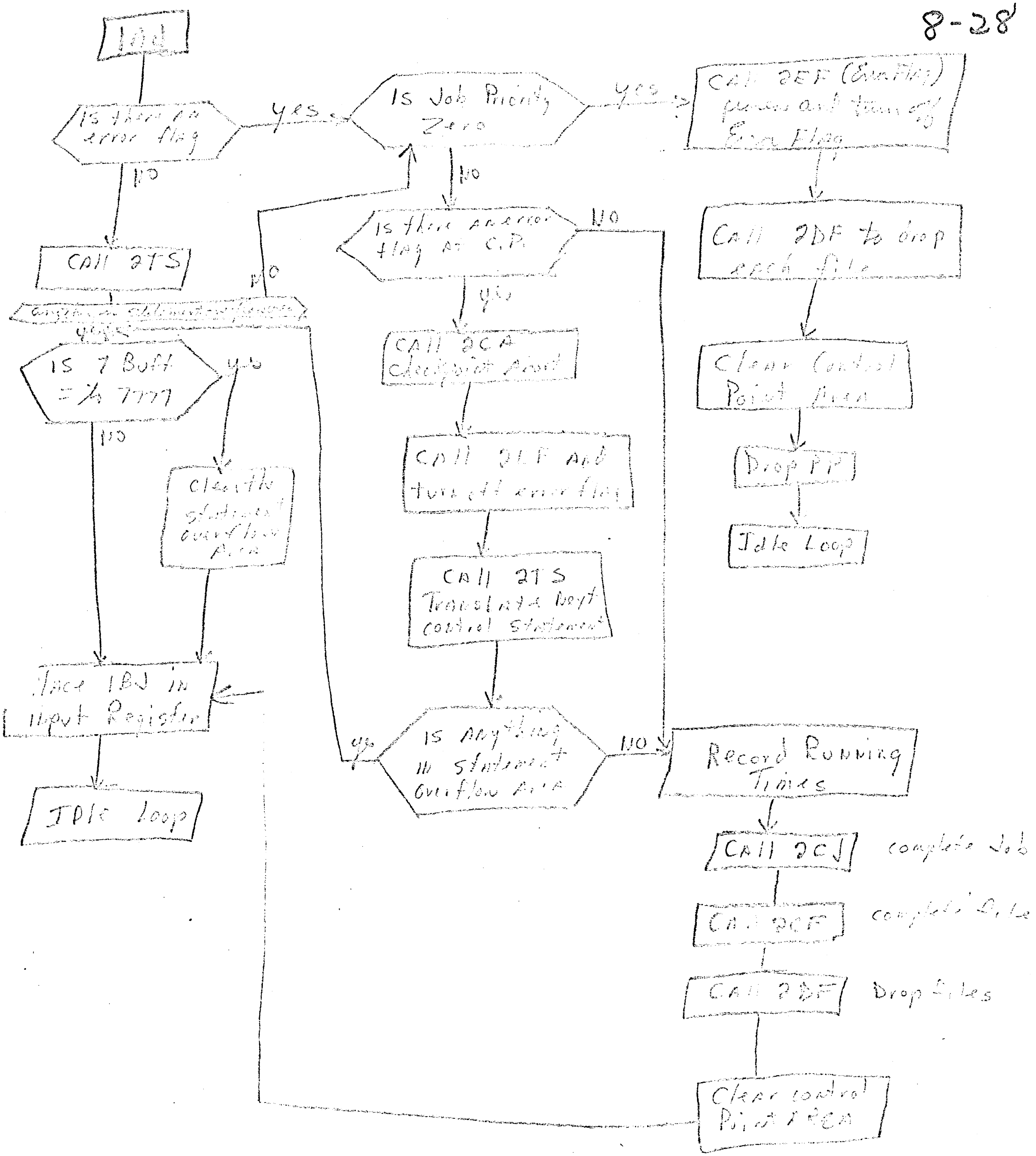

2RC
IS THE E.O.T. FLAG SET?
YES
-CLEAR EOT
-SET EOF (ADD 20_8 TO LBS IN FNT(3), BY & 4)
-CLEAR FILE RECORD COUNT & TYPE
2RC CALLED BY ILJ?
NO
EXIT FROM 2RC TO CIO
YES
IS RA+25 EQUAL TO 0? (PRE-ABORT FLAG)
YES
ADD MSG "JOB PRE-ABORTED" INTO THE ERROR MSG BUFFER AREA
INCEASE THE "IN" POINTER IN THE ERROR MESSAGE FET AT RA+22
NO
NO
IS 16 WORDS FREE IN CM BUFFER AREA?
NO
YES
REQUEST MTR FOR CR CHANNEL
SELECT BINARY READ IN CR
CR READY?
NO
CHECK STATUS $2^2=1$?
NO
"EQ XX REJECT" MESSAGE
YES
"XMSN PARITY ERROR!" MESSAGE WAIT 1 SECOND
CLEAR CHANNEL REQUEST MTR TO RELEASE CHANNEL
YES
READ 1 CARD
NEXT PAGE
EXIT TO ILJ
YES
IS ERROR MSG BUFFER EMPTY?
NO
ENTER "MESSAGE" AND "WEOR" CODE IN ERROR MESSAGE FET(1) (RA+20)
ADD 1 TO "L" IN ERROR MSG, FET (RA+21)
REQUEST MTR TO ASSIGN A SPARE PP TO CALL CIO TO DUMP THE ERRORS, WAIT TIL FINISHED
DOES FNT ENTRY AT ADDRESS IN ERROR FET POINT TO ERROR FET?
YES
CHANGE FNT NAME TO "JOBNAME" ASSIGNED TO CP0
NO
EXIT TO ILJ
(FORGET IT. LEAVE LOCAL AT "READ")


11
ENTER "READ" AS JOBNAME IN CPA
ERROR FLAG SET?
YES
REQUEST MTR TO "DROP PP"
JUMP TO "IDLE" IN PPR
NO
IS FL ≥ 3300?
REQUEST MTR FOR FL
ENTER MSG "WAITING FOR STORAGE" AT CPA
COPY I.R. TO RECALL REG IN CPA
YES
ENTER "IDLE" MESSAGE AT CPA
CLEAR RA THRU RA+7
SET UP THE READ BUFFER "FET" AT RA+10 THRU RA+17
RA + 10 = NOT CHANGED YET
RA + 11 = 0000 0401 0000 0000 0100
RA + 12 = 0000 0000 0000 0000 0100
RA + 13 = 0000 0000 0000 0000 0100
RA + 14 = 0000 0000 0000 0000 3100
RA + 15 =
RA + 17 =
NOT CHANGED
SET UP THE ERROR MESSAGE "FET" AT RA+20 THRU RA+24
RA + 20 = NOT CHANGED YET
RA + 21 = 0000 0000 0000 0000 3100
RA + 22 = 0000 0000 0000 0000 3100
RA + 23 = 0000 0000 0000 0000 3100
RA + 24 = 0000 0000 0000 0000 3300
SET RA + 25₈ NON-ZERO
RA + 25 = 0000 0000 0000 0000 3300
ENTER READ BUFFER FET ADDRESS INTO 2⁰-2¹ OF THE INPUT REG.
IR = 3414 1200 0000 0000 0010
IS BYTE 2 OF THE I.R. = 0?
YES
REQUEST A CARD READER
CARD READER ASSIGNED?
NO
ENTER MSG "NO CR AVAILABLE" AT CPA
REQUEST MTR TO DROP PP
JUMP TO IDLE IN PPR
YES
ENTER S.E.N. IN IR, BYTE 2
IR = 3414 12 00 0005 0000 0010
NO
IS THE CARD READER READY?
NO
YES
LOAD "2RG" AT 2000₈ AND EXECUTE
NEXT PAGE


IBJ
BRING IN CP ADDRESS
READ CP ADDRESS +20 (RA, FL, ERROR FLAG)
IS ERROR FLAG SET
YES
RELEASE PPU
NO
COMPUTE AVAILABLE CM STORAGE
READ CP ADDRESS +22 (PRIORITY)
IS PRIORITY =0
NO
A
YES
REQUEST FNT CHANNEL AND POINTER
C
READ IN A FNT ENTRY
IS THIS JOB PRIORITY =0
YES
B
NO


IS IT AN UNASSIGNED INPUT FILE
No
B
Yes
Will IT FIT IN AVAILABLE MEMORY
Yes
B
No
B
SAVE PRIORITY AND FNT ADDRESS
ADVANCE FNT SEARCH ADDRESS
ARE THERE MORE FNT ENTRIES
Yes
C
No
IS THERE AN UNASSIGNED INPUT FILE
No
YES
CLEAR FL & REWIND FILE IN FST
RELEASE FNT CHANNEL, STOR "NEXT" DISPLAY "IDLE", RELEASE PP
REQUEST PRIORITY
STOR JOB NAME IN CP AREA
SET FILE TYPE TO LOCAL
SET NAME TO INPUT
DROP FNT CHANNEL
A
IS CONTROL STATEMENT POINTER ≠ 0 (HAVE JOB CARDS BEEN LOADED)
NO
Yes
D


STORE FST ADDRESS IN CP ADDRESS
STORE TWO FST ENTRIES IN CP AREA
D
CONTROL STATEMENT PTR. LE S1
NO.
EXIT
REQUEST 300 WORDS OF STORAGE
CLEAR RA, RA+1, RA+2
READ A PRU of CONTROL CARDS
CALL 2TJ TO TRANSLATE JOB CARD
STORE TIME LIMIT, FIELD LENGTH
EXIT FROM 1BJ


Idle
Is there an error flag
yes
NO
Is Job Priority Zero
yes
CALL 2EF (Error Flag) process and turn off Error Flag
NO
CALL 2TS
anything in statement overflow area
yes
NO
Is there an error flag at C.P.
NO
yes
CALL 2DF to drop each file
Is 7 Buff = to 7777
yes
NO
CALL 2CA checkpoint abort
Clear Control Point Area
Clear the statement overflow Area
CALL 2EF And turn off error flag
Drop PP
Idle Loop
CALL 2TS Translate Next control Statement
Place IBJ in Input Register
yes
Is Anything in Statement Overflow Area
NO
Record Running Times
IDle loop
CAll 2CJ
complete Job
CAll 2CF
complete file
CAll 2DF
Drop files
Clear control Point Area

D 8-29

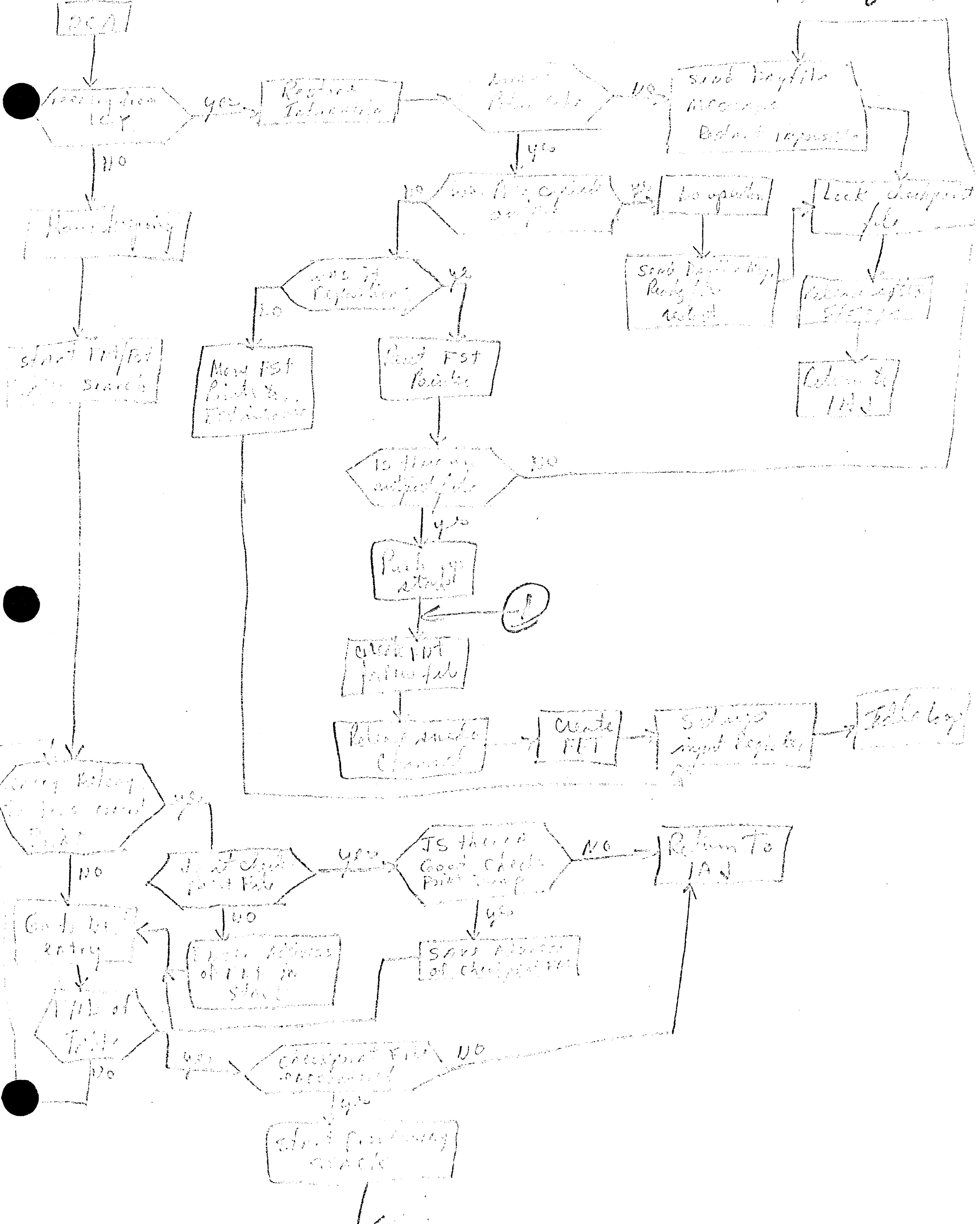
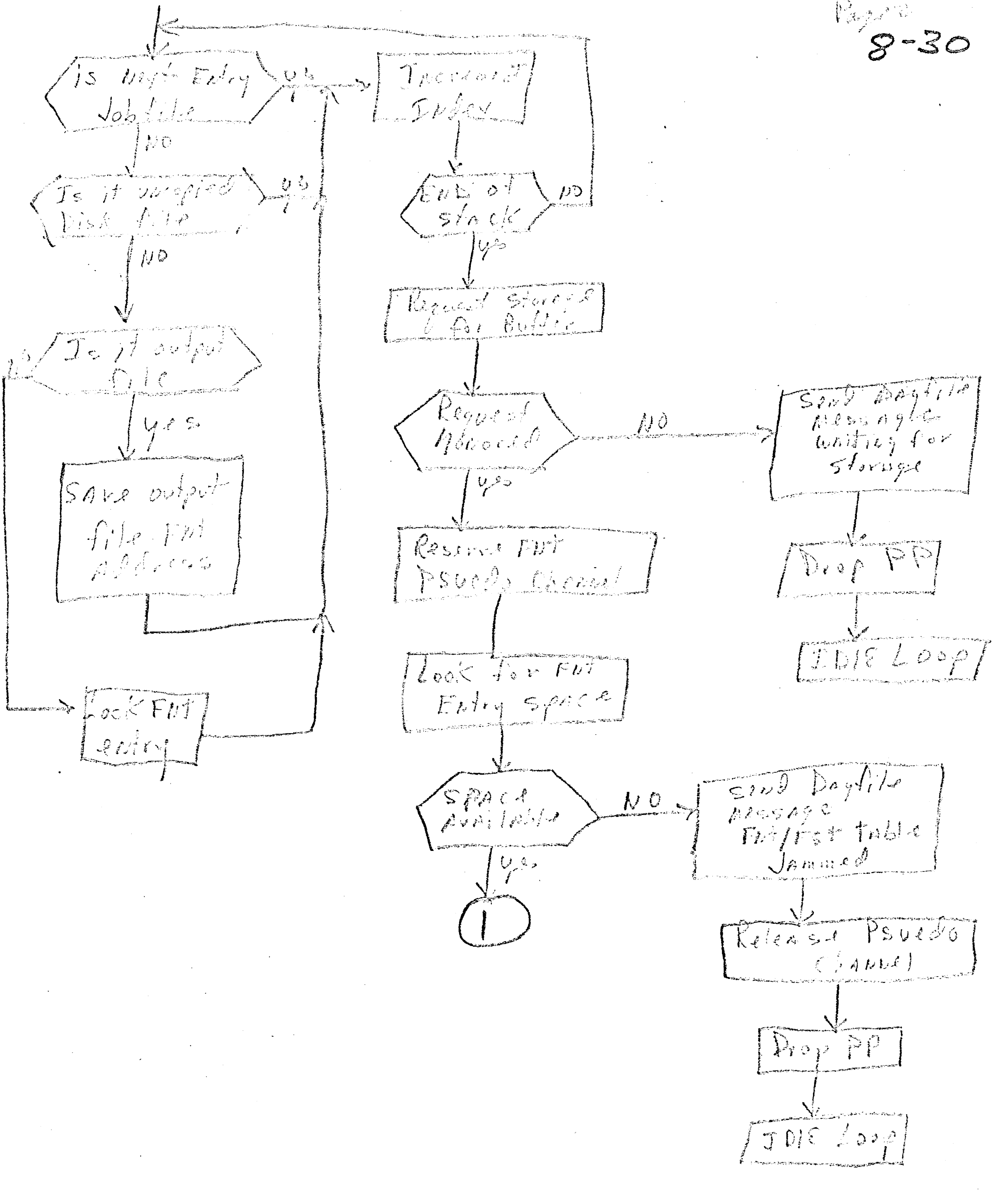
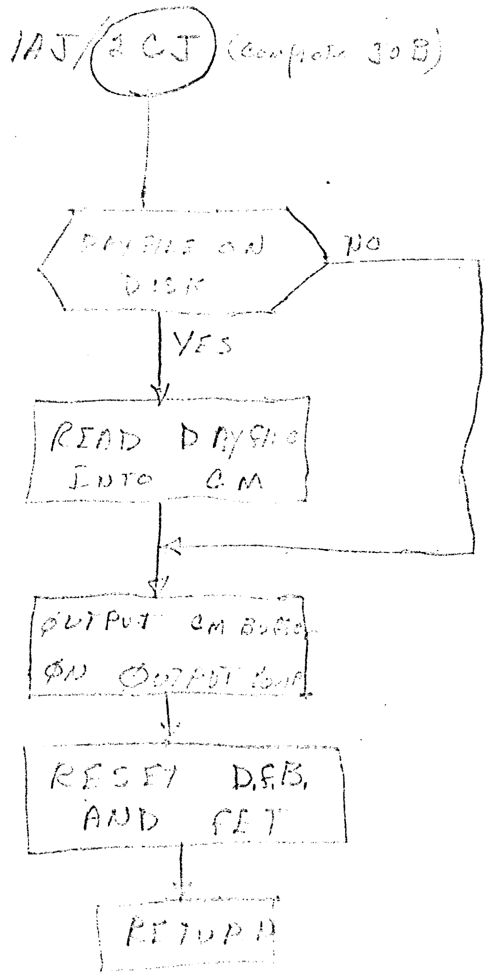
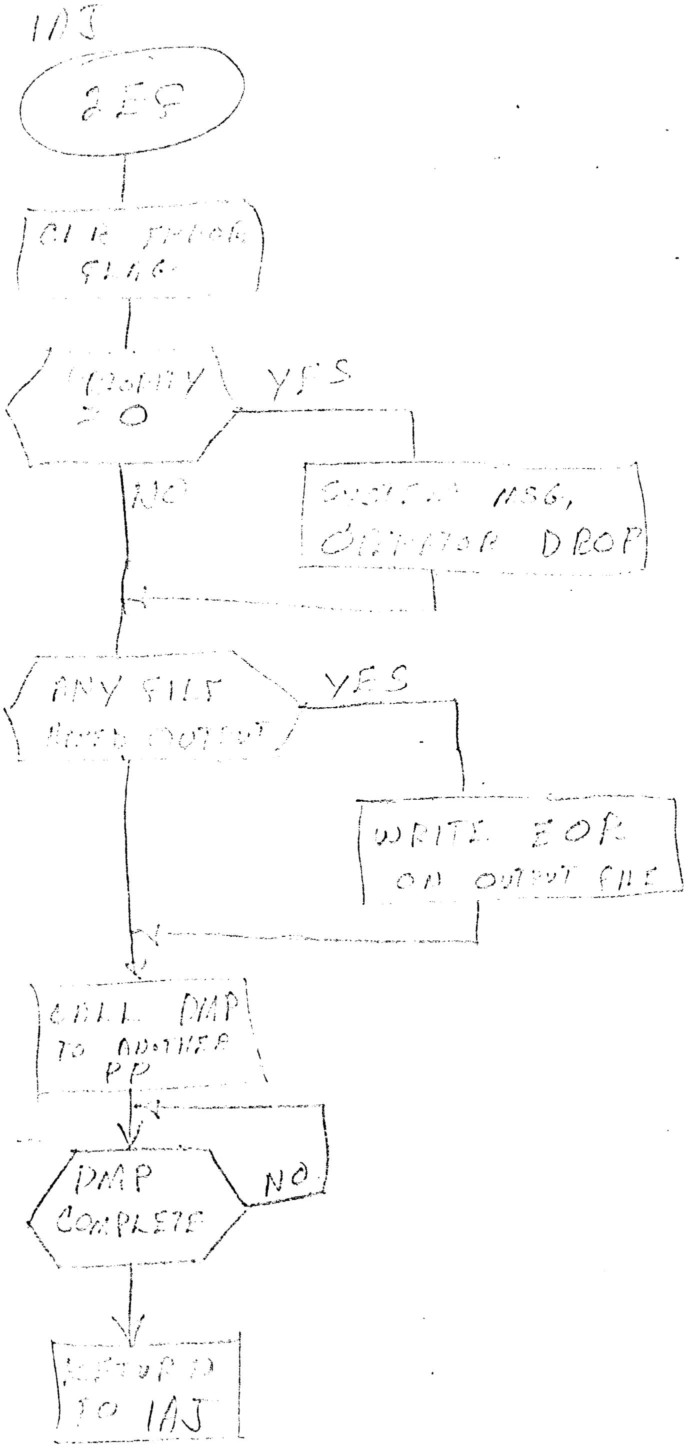

DCA
Recovery from ICP
yes
Restore Information
NO
Send Dayfile Message Restart Impossible
yes
Was it a critical output?
yes
No operation
Lock checkpoint file
NO
Send Dayfile Msg Ready for restart
Release Dayfile Message
Return to IAJ
Housekeeping
Was it Repositioned?
yes
NO
Start FNT/FST Table Search
Move FST Pointers to Information
Reset FST Pointer
Is there any output file
NO
yes
Push up stack
1
Check FNT for input file
Release and Channel
Create FET
Set up input Register
Table buy
Entry Belong to this control point
yes
NO
Is it Check Point File
yes
Is there a Good Check-Point Dump
NO
Return To IAJ
NO
yes
Go to next entry
Enter Address of FET in Stack
Save Address of Checkpoint FET
End of Table
NO
yes
Checkpoint File processed
NO
yes
Start Processing search

Figure 8-30


Is next Entry Jobfile
yes
NO
Is it unopied Disk file
yes
NO
Is it output file
no
yes
Save output file FNT Address
Lock FNT entry
Increment Index
End of stack
NO
yes
Request storage & for Buffer
Request Honored
NO
Send Dayfile Message waiting for storage
Drop PP
IDIE Loop
yes
Reserve FNT Pseudo Channel
Look for FNT Entry space
Space Available
NO
Send Dayfile message FNT/FST table Jammed
Release Pseudo Channel
Drop PP
IDIE Loop
yes
1

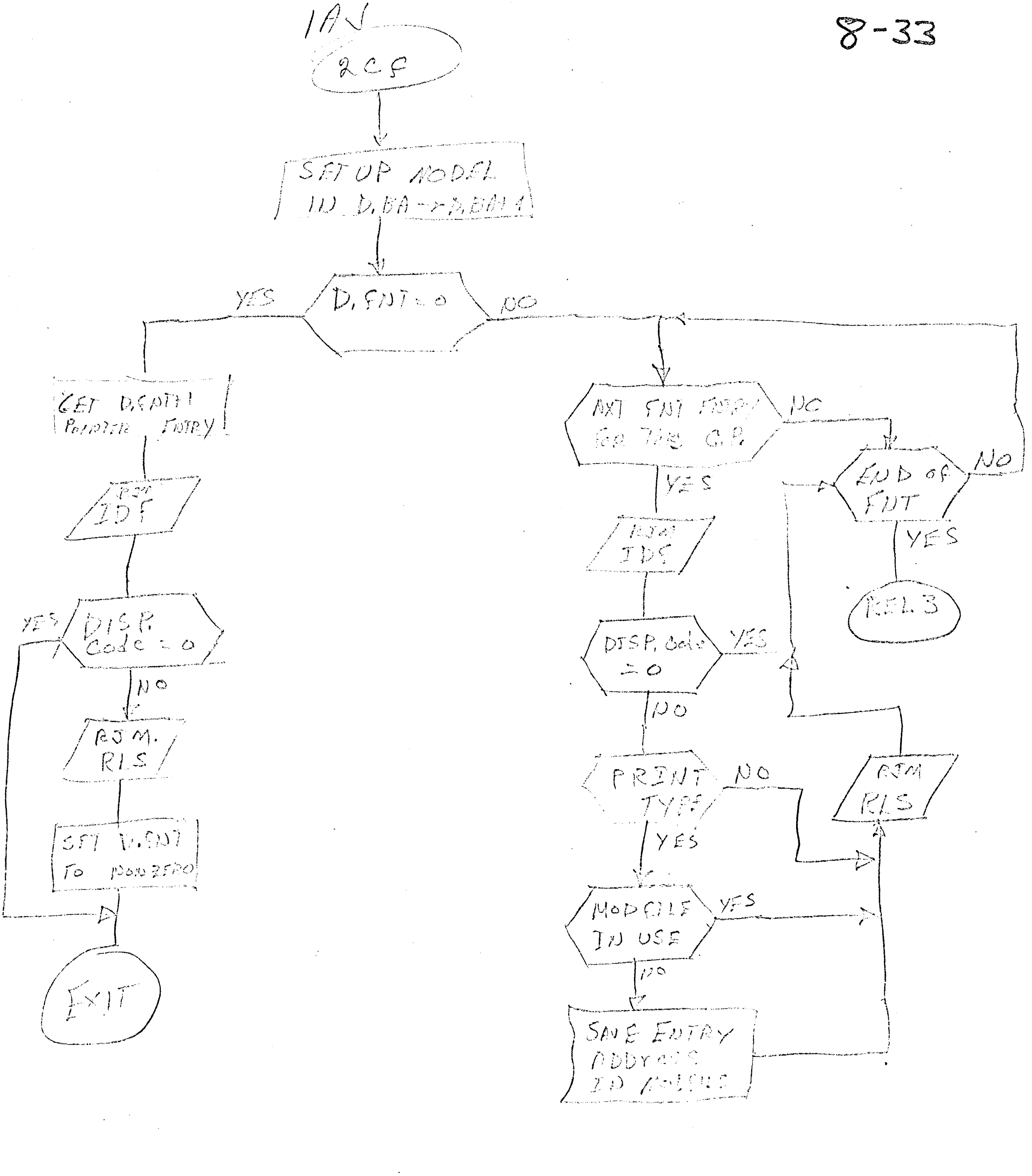
1 A


1AJ/2CJ (Complete JOB)
DAYFILE ON DISK
NO
YES
READ DAYFILE INTO CM
OUTPUT CM BUFFER ON OUTPUT BUF
RESET D.F.B. AND FET
RETURN

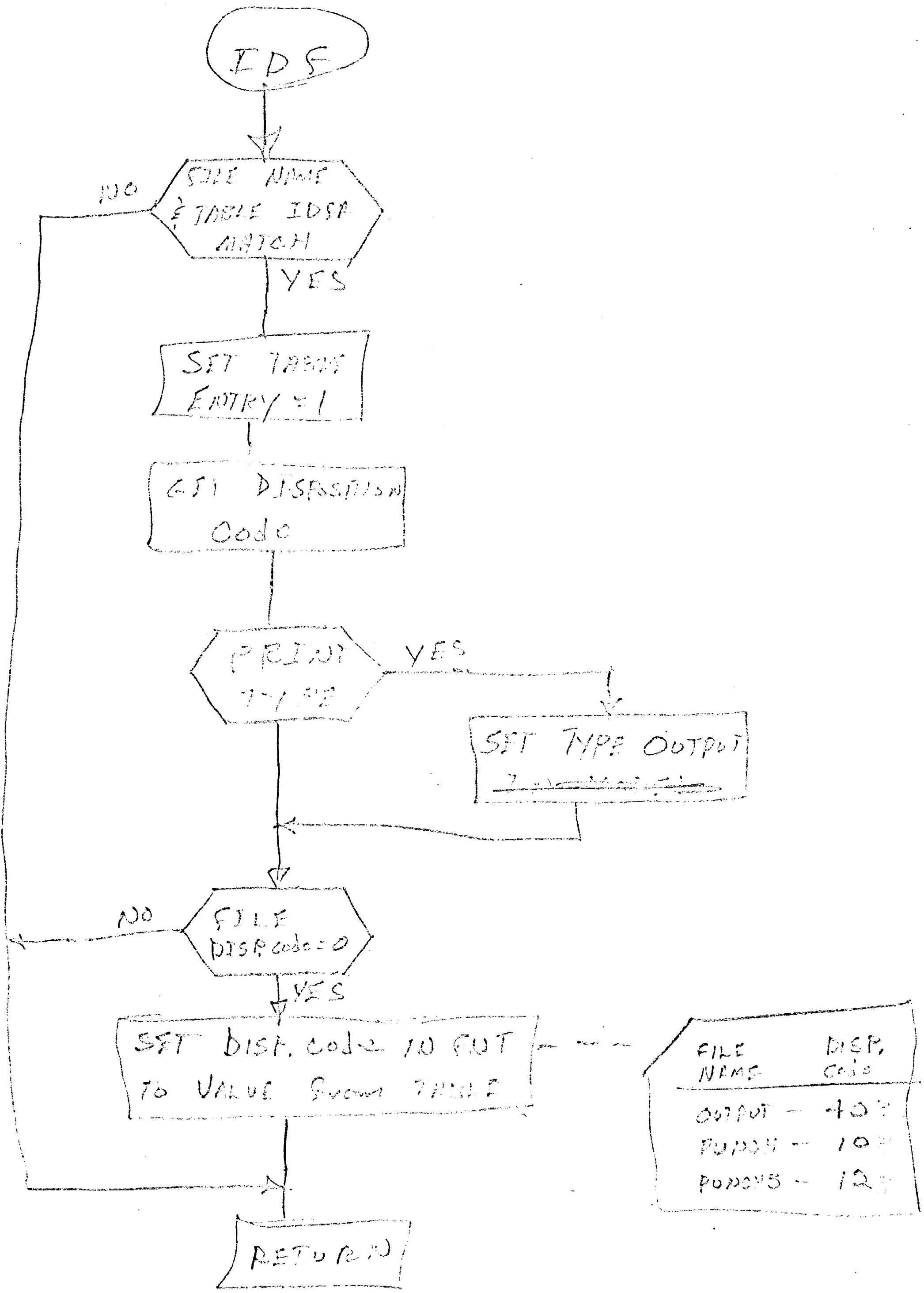

IAJ
2EF
CLR ERROR FLAG
ERROR ≠ 0
YES
NO
SYSTEM MSG, OPERATOR DROP
ANY FILE NEED OUTPUT
YES
WRITE EOR ON OUTPUT FILE
CALL DMP TO ANOTHER PP
DMP COMPLETE
NO
RETURN TO IAJ

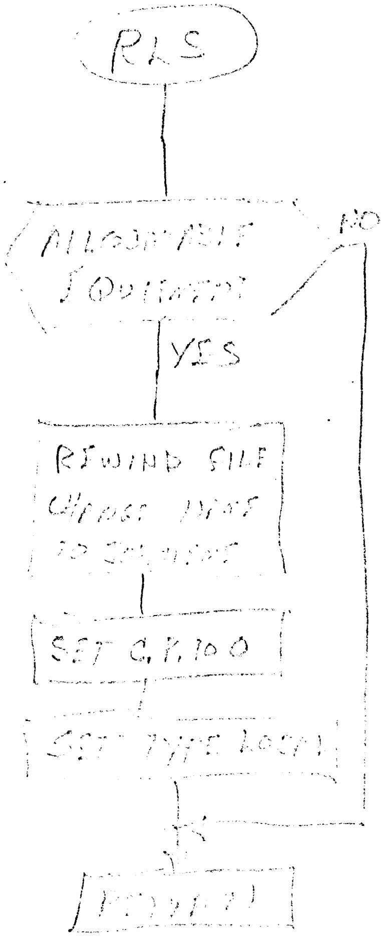
1/3

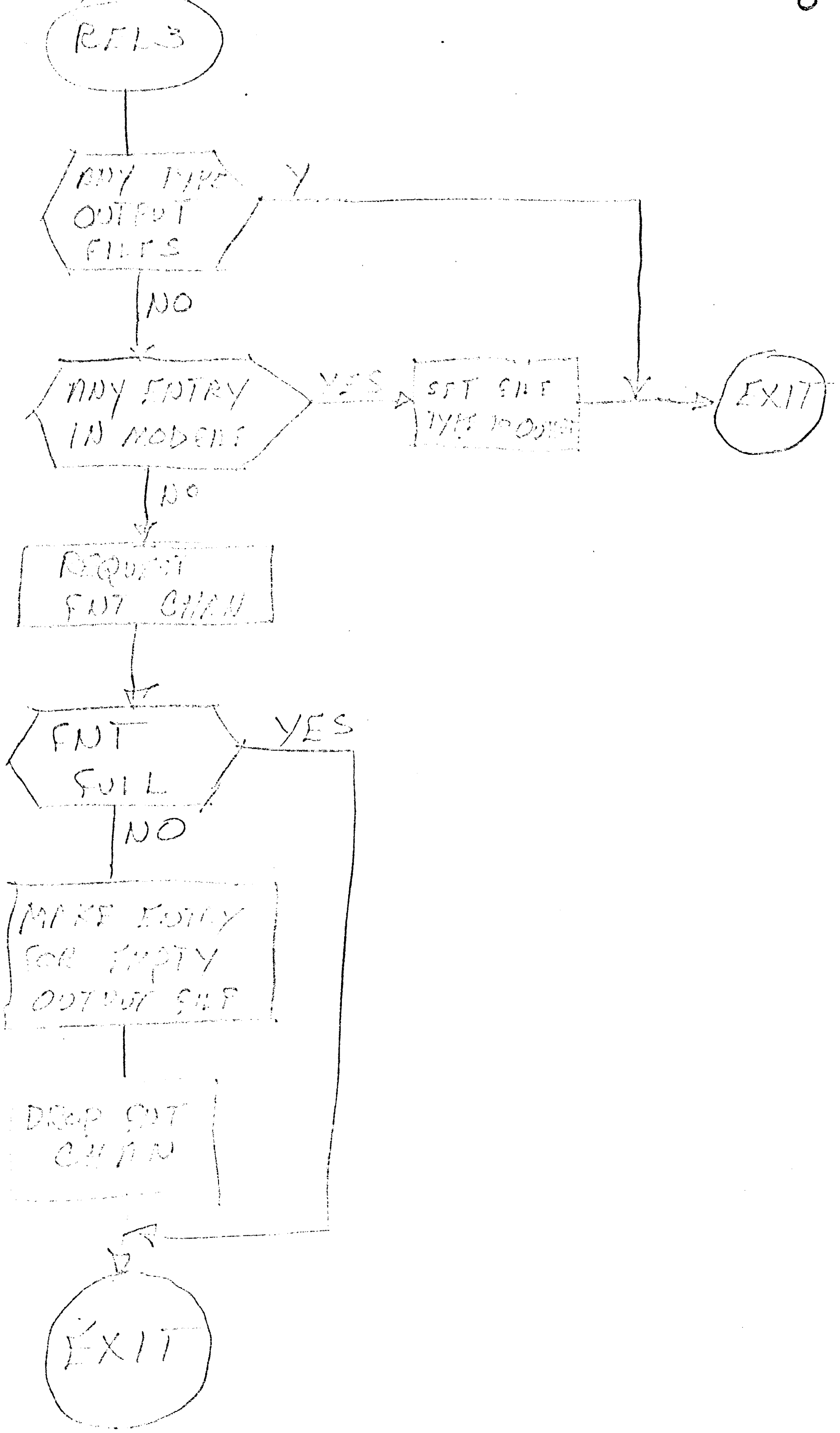
8-33

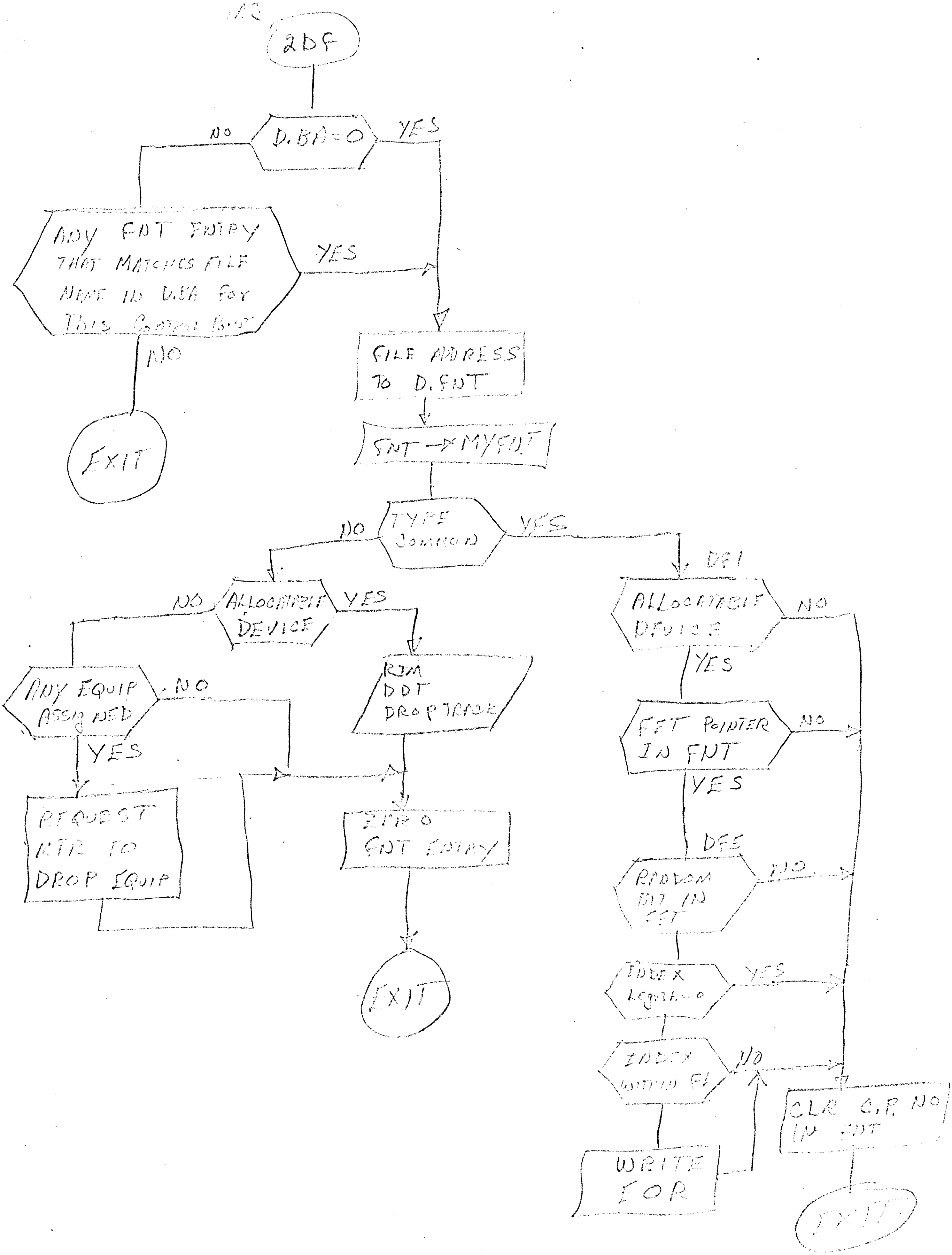


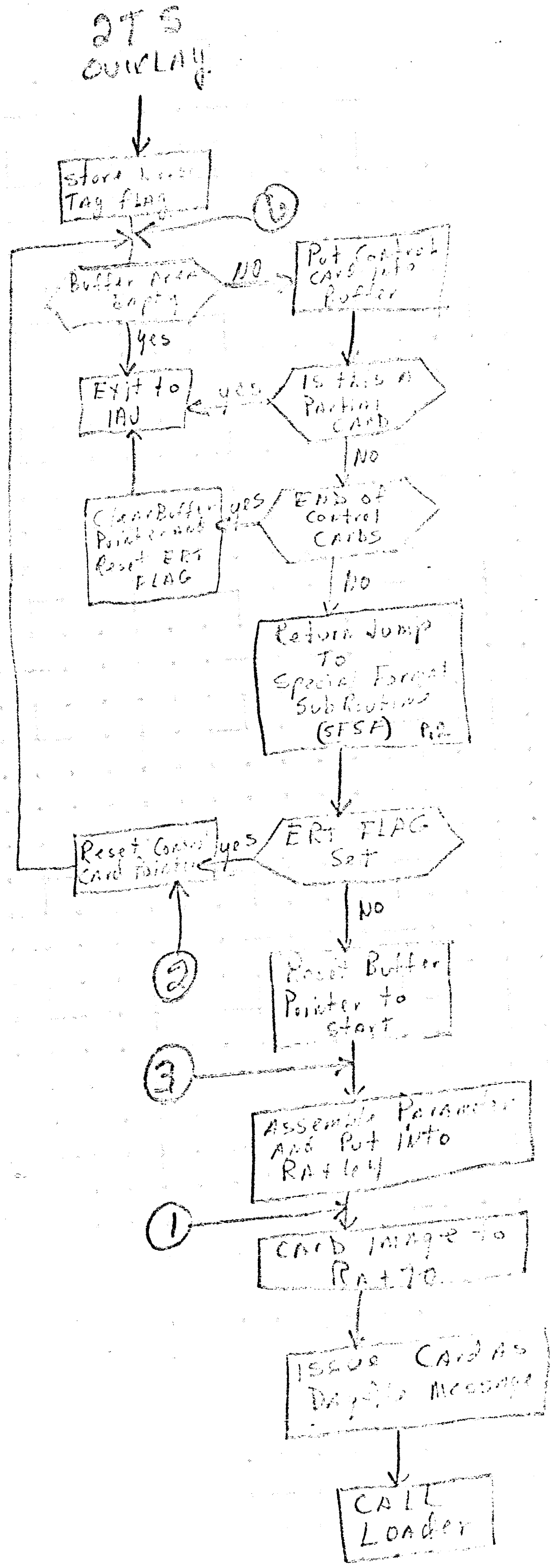
1AJ
2CF
SET UP MODEL
IN D.BA->D.BM+1
D.FNT=0
YES
NO
GET D.FNTH
POINTER ENTRY
RJM
IDF
DISP.
Code = 0
YES
NO
RJM.
RLS
SET D.FNT
TO NONZERO
EXIT
NXT FNT ENTRY
FOR THE C.P.
NO
YES
END OF
FNT
NO
YES
REL3
RJM
IDF
DISP. Code
= 0
YES
NO
PRINT
TYPE
NO
YES
RJM
RLS
MODFILE
IN USE
YES
NO
SAVE ENTRY
ADDRESS
IN MODFILE

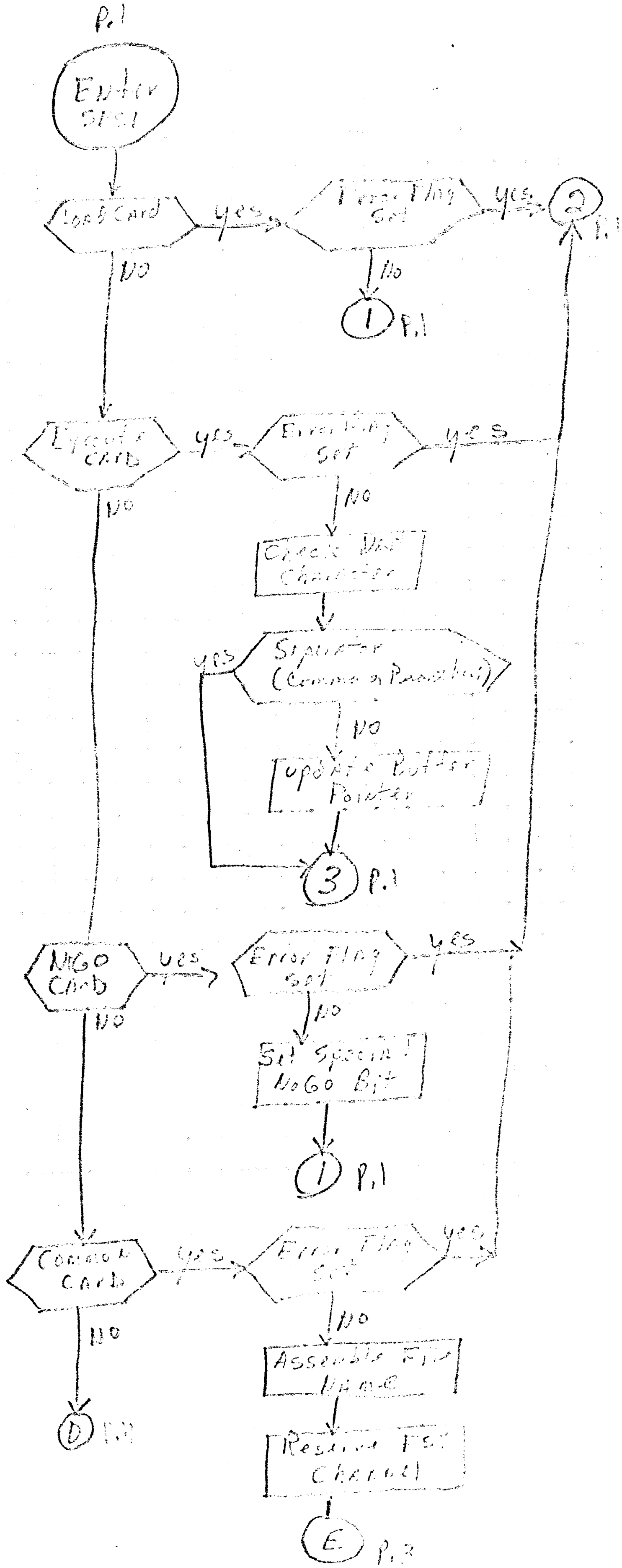

IDF
FILE NAME & TABLE IDSA MATCH
NO
YES
SET TABLE ENTRY = 1
GET DISPOSITION Code
PRINT TYPE
YES
SET TYPE OUTPUT
NO
FILE DISP code = 0
YES
SET DISP. code IN FET TO VALUE from TABLE
FILE NAME
DISP. Code
OUTPUT - 40
PUNCH - 10
PUNCHB - 12
RETURN


RLS
ALLOCATABLE EQUIPMENT
NO
YES
REWIND FILE
SET C,R,100
SET TYPE LOCAL


REL3
ANY TYPE OUTPUT FILES
Y
NO
ANY ENTRY IN MODELS
YES
NO
EXIT
REQUEST FNT CHAN
FNT FULL
YES
NO
MAKE ENTRY FOR EMPTY OUTPUT FILE
DROP FNT CHAN
EXIT

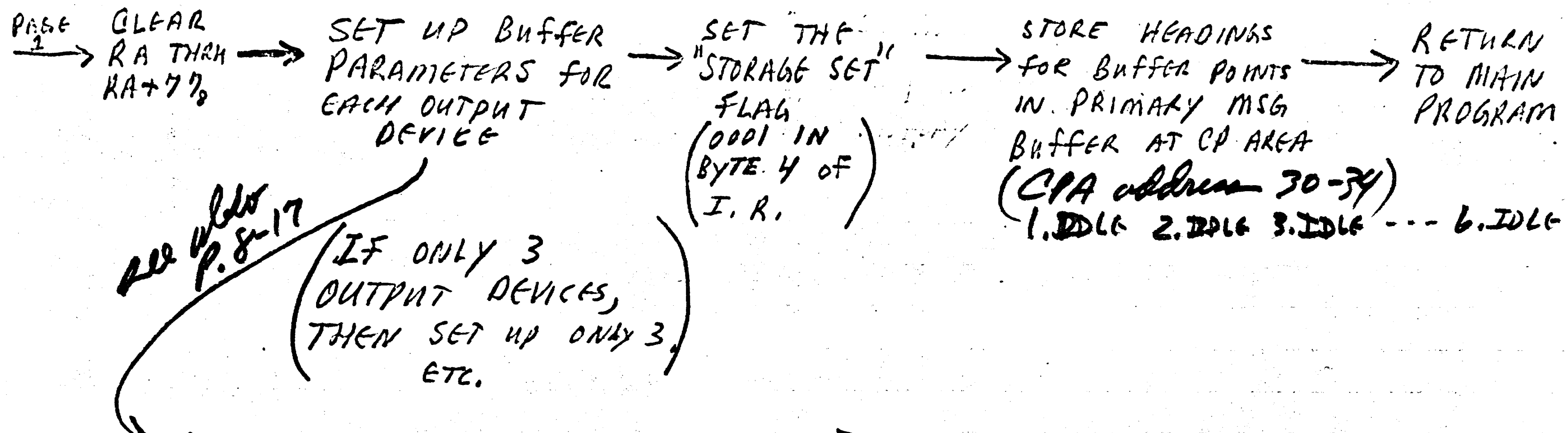

A3
2DF
D.BA=0
NO
YES
ANY FNT ENTRY THAT MATCHES FILE NAME IN D.BA FOR THIS CONTROL POINT
YES
NO
EXIT
FILE ADDRESS TO D.FNT
FNT → MYFNT
TYPE COMMON
NO
YES
DF1
ALLOCATABLE DEVICE
NO
YES
ANY EQUIP ASSIGNED
NO
YES
RJM DDT DROP TRACK
REQUEST MTR TO DROP EQUIP
ZERO FNT ENTRY
EXIT
ALLOCATABLE DEVICE
NO
YES
FET POINTER IN FNT
NO
YES
DF5
RANDOM BIT IN FET
NO
INDEX LENGTH=0
YES
INDEX WITHIN FL
NO
WRITE EOR
CLR C.P. NO IN FNT
EXIT


2TS OVERLAY
Store
Tag FLAG
Buffer Area Empty
NO
yes
Put Control CARD into Buffer
Exit to IAJ
yes
IS this A Partial CARD
NO
Clear Buffer Pointer and Reset ERT FLAG
yes
END of Control CARDS
NO
Return Jump To Special Format SubRoutine (SFSA)
ERT FLAG Set
yes
Reset Control Card Pointer
NO
2
Reset Buffer Pointer to start
3
Assemble Parameter And Put Into RA+64
1
CARD IMAGE TO RA+70.
ISSUE CARD AS Display Message
CALL Loader


P.1
Enter SPS1
Load Card
yes
Error Flag Set
yes
2
P.1
No
No
1
P.1
Execute CARD
yes
Error Flag Set
yes
NO
NO
Check Next Character
Separator (Comma or Parenthesis)
yes
NO
Update Buffer Pointer
3
P.1
NOGO CARD
yes
Error Flag Set
yes
NO
NO
Set Special NoGo Bit
1
P.1
Common Card
yes
Error Flag Set
yes
NO
NO
Assemble File Name
Reserve FST Channel
D
P.2
E
P.3

PRESET STORAGE SUBROUTINE

10T TRANSIENT PROGRAM SCOPE 3



RA+11 = 0——0100 ⇒ FIRST
RA+12 = 0——0100 ⇒ IN
RA+13 = 0——0100 ⇒ OUT
RA+14 = 0——01100 ⇒ LIMIT

OUTPUT DEVICE #1 AT BUFFER POINT #1

RA+21 = 0——01100 ⇒ FIRST
RA+22 = 0——01100 ⇒ IN
RA+23 = 0——01100 ⇒ OUT
RA+24 = 0——02100 ⇒ LIMIT

OUTPUT DEVICE #2 AT BUFFER POINT #2

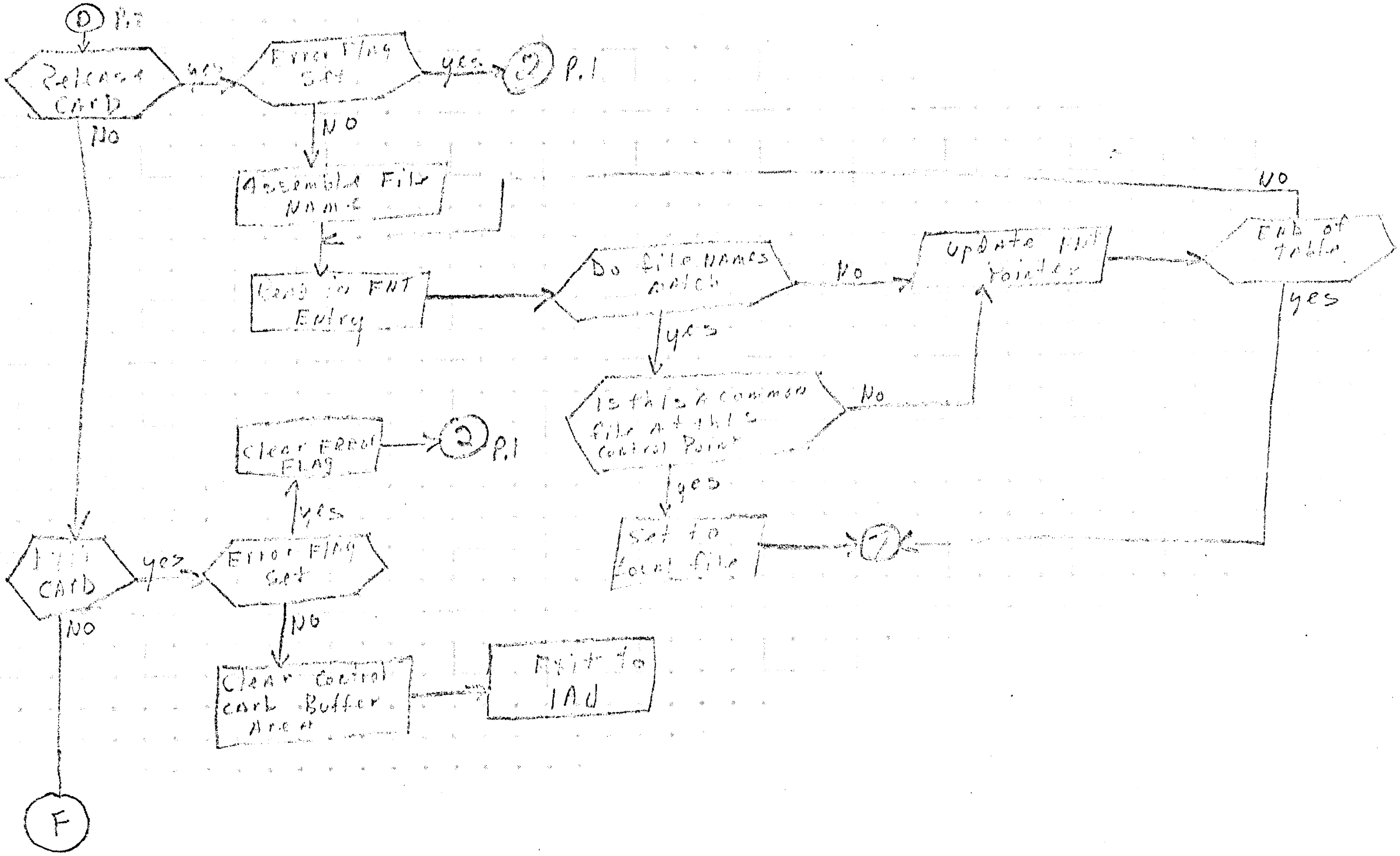
#3

#4

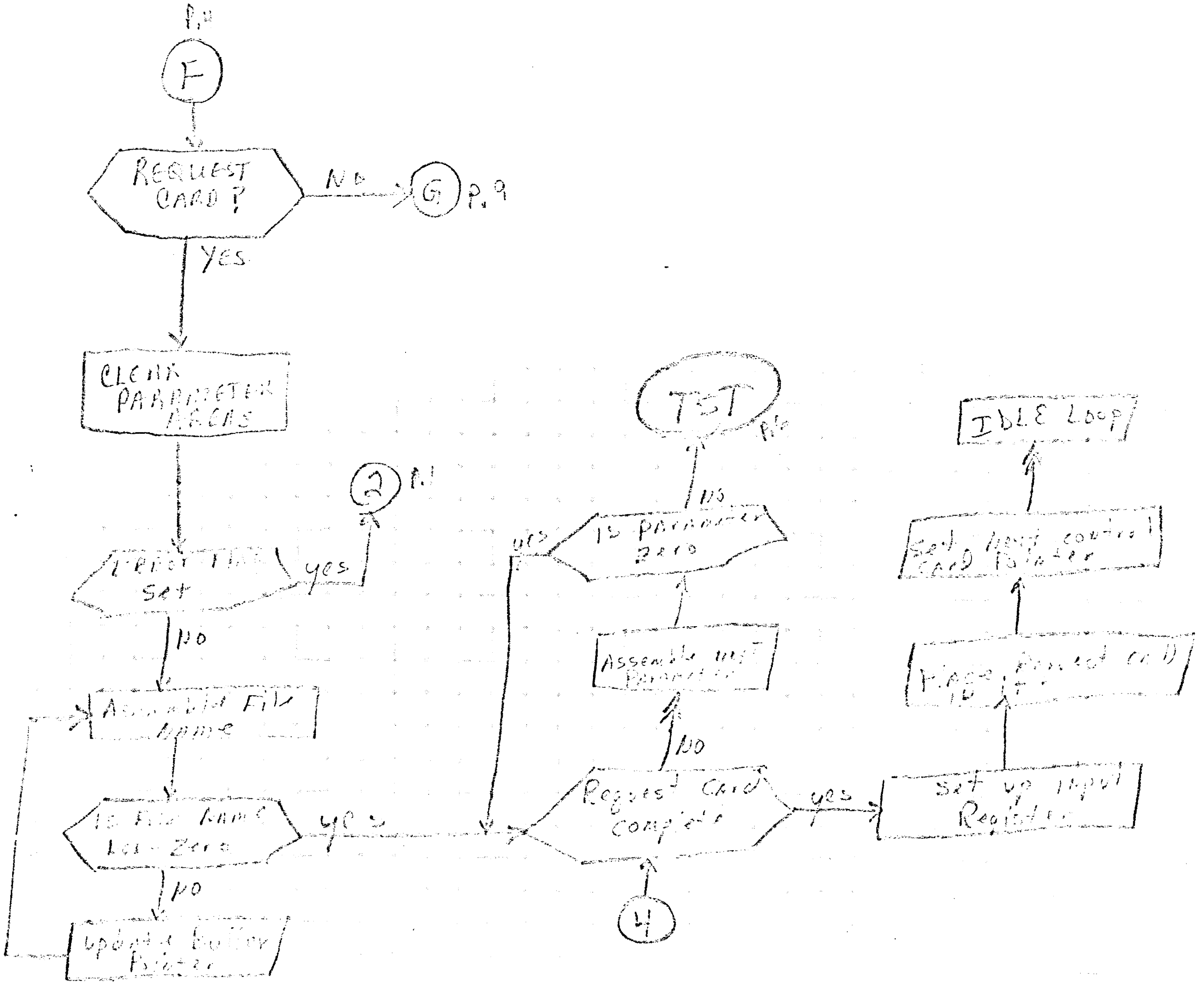
#5

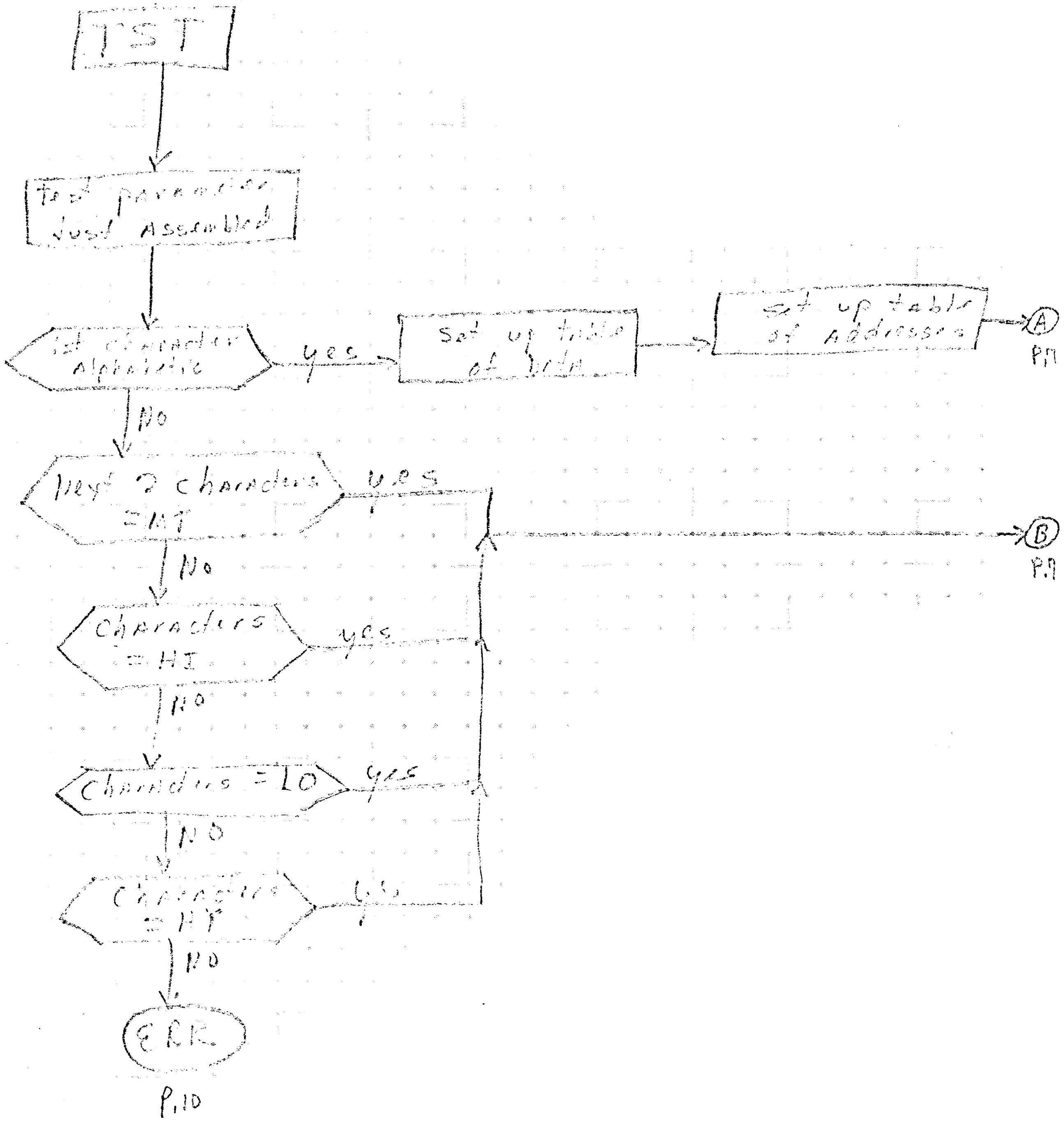
RA+61 = 0——05100 ⇒ FIRST
RA+62 = 0——05100 ⇒ IN
RA+63 = 0——05100 ⇒ OUT
RA+64 = 0——06100 ⇒ LIMIT

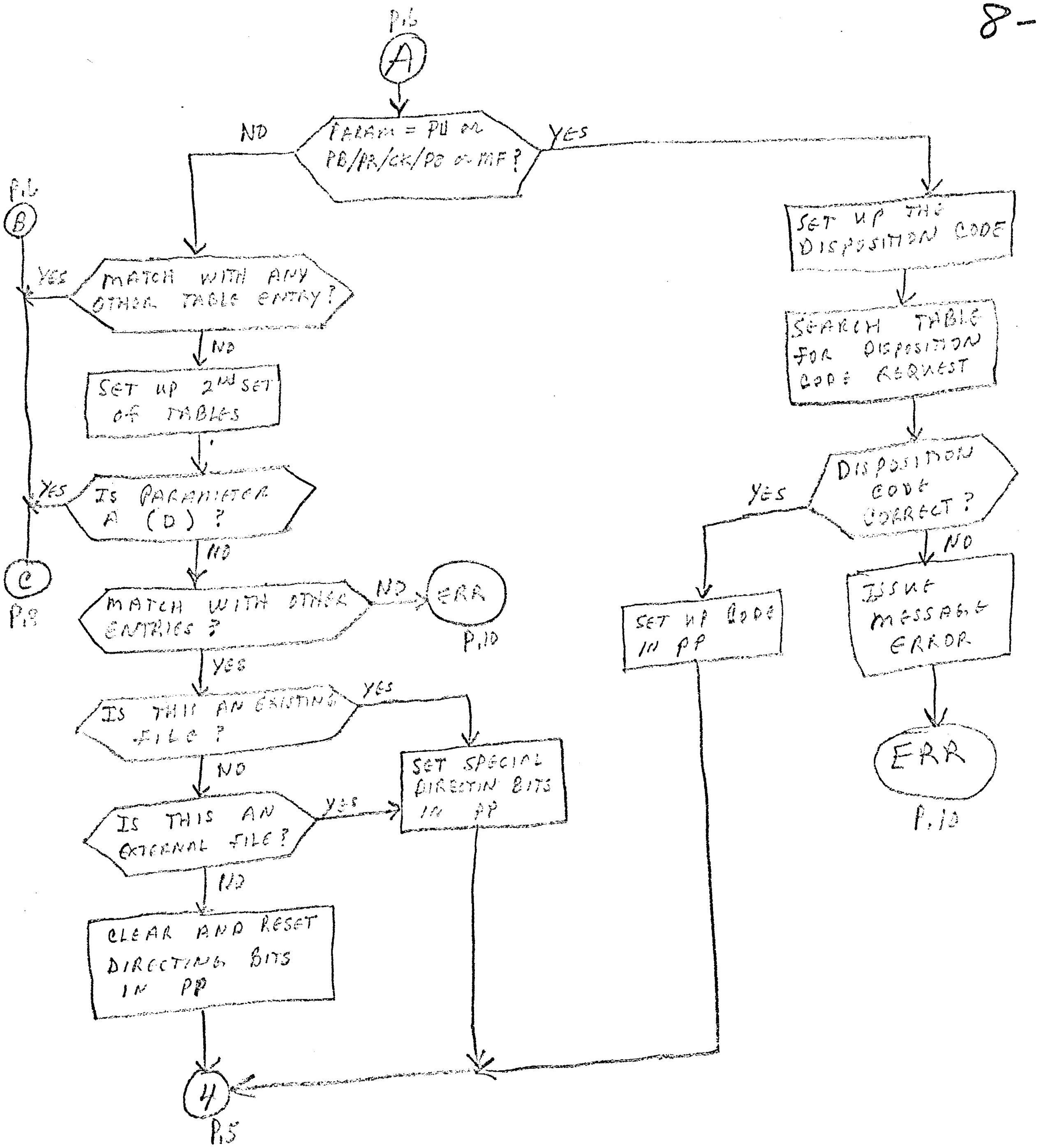
OUTPUT DEVICE #6 AT BUFFER POINT #6

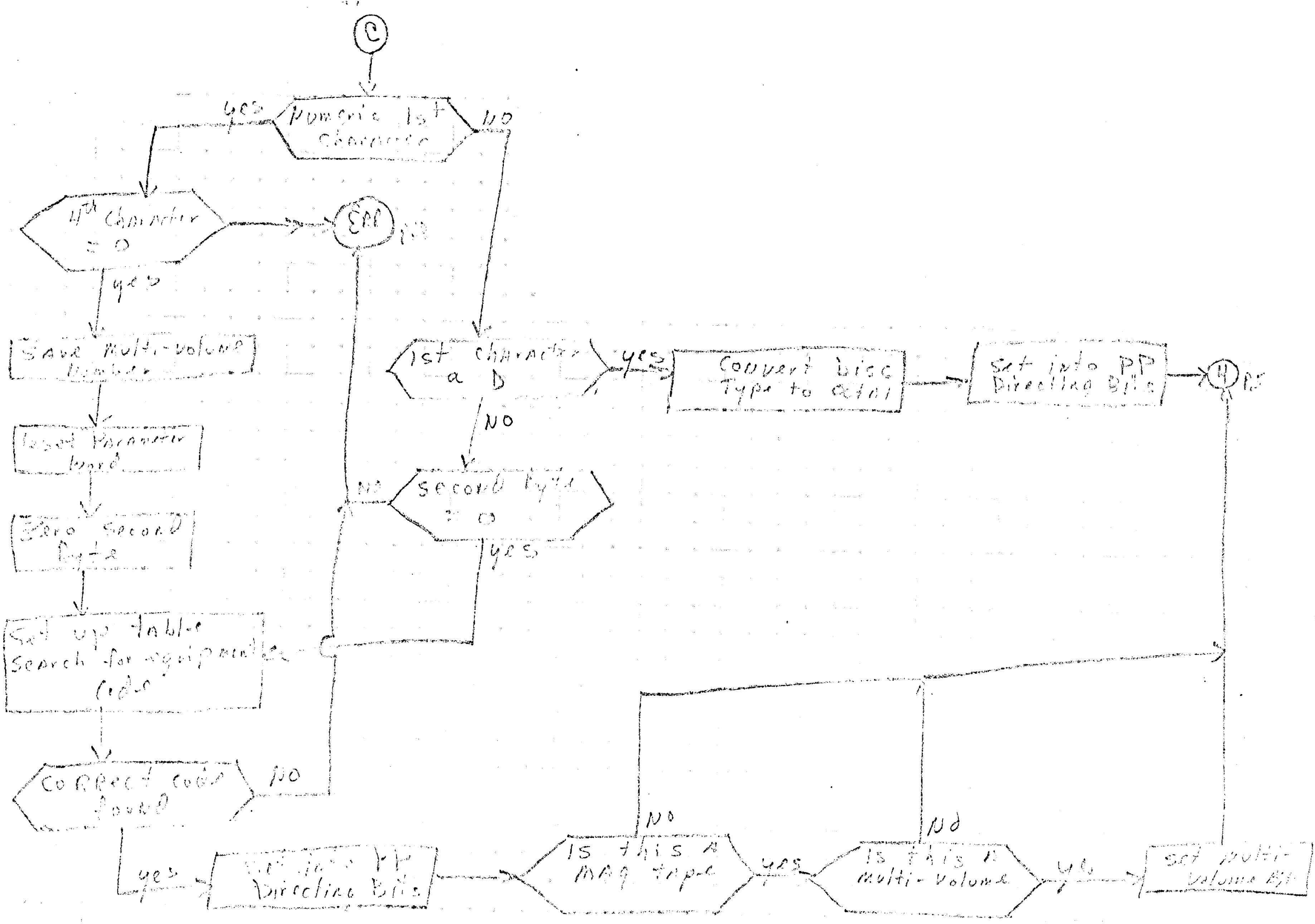


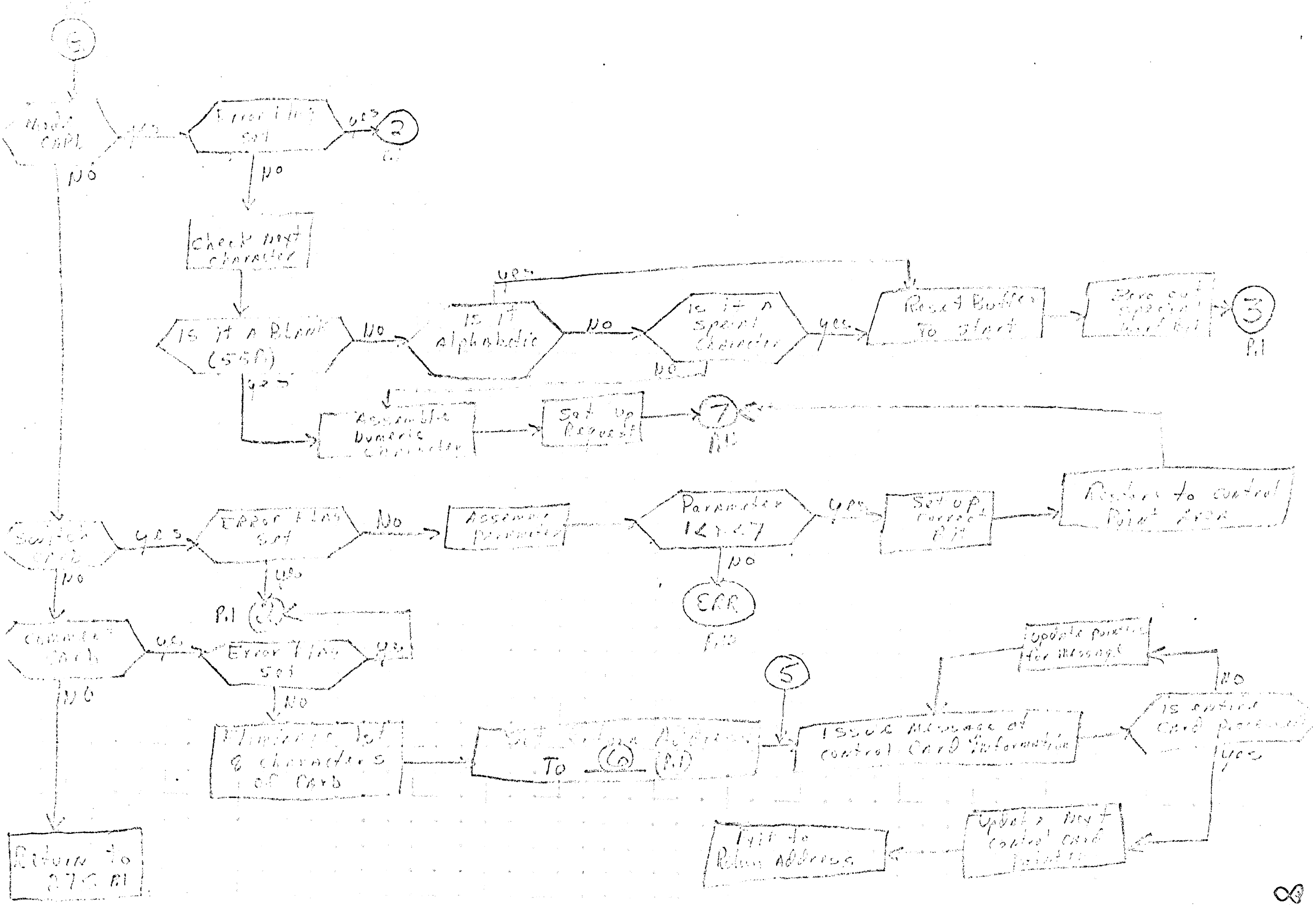
① P.2
Release CARD
yes
Error Flag Set
yes
② P.1
NO
No
Assemble File NAME
to FNT Entry
Do file names match
No
Update FNT Pointer
End of table
NO
yes
yes
Is this a common file at this control point
No
yes
Set to local file
⑦
Clear Error Flag
② P.1
yes
FILE CARD
yes
Error Flag Set
NO
NO
Clear Control card Buffer Area
Exit to IAU
F

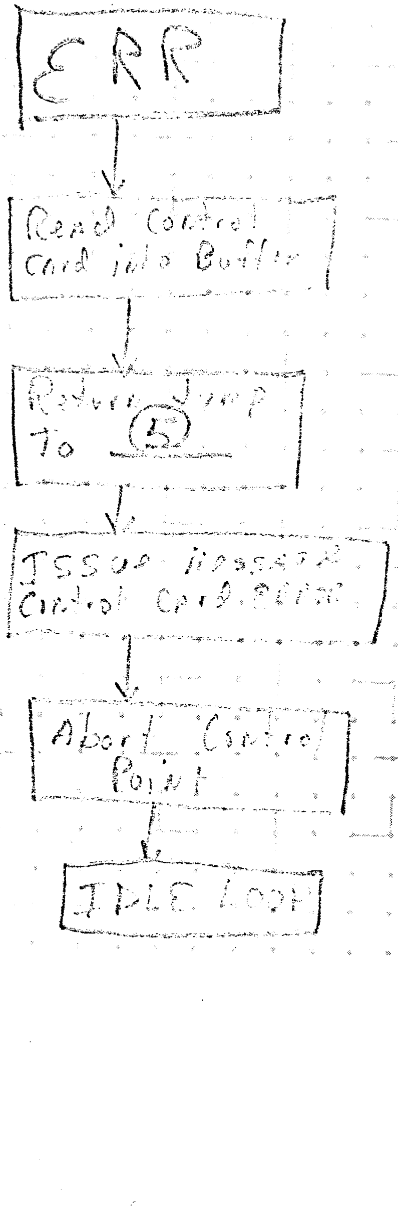

P.8
F
REQUEST CARD?
NO
G
P.9
YES
CLEAR PARAMETER AREAS
Error Flag Set
yes
2
P.
NO
Assemble File Name
Is File Name Less Zero
yes
NO
Update Buffer Pointer
TST
P.6
NO
Is Parameter Zero
yes
Assemble next Parameter
NO
Request Card Complete
yes
4
Set up Input Registers
Place Request Card ID
Set Next control Card Pointer
IDLE Loop

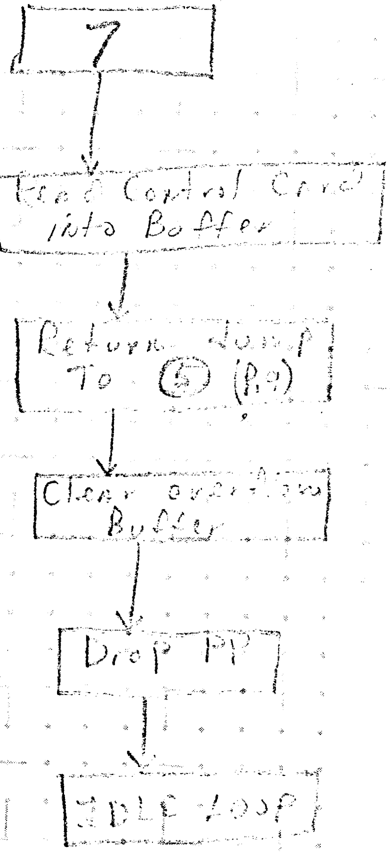

TST
Test parameter
Just Assembled
1st character
Alphabetic
yes
Set up table
of data
Set up table
of Addresses
A
P.11
NO
Next 2 characters
=MT
yes
B
P.11
No
Characters
=HI
yes
NO
Characters =LO
yes
NO
Characters
=HY
yes
NO
ERR.
P.10


P.6
A
PARAM = PU or PB/PR/CK/PO or MF?
NO
YES
P.6
B
YES
MATCH WITH ANY OTHER TABLE ENTRY?
NO
SET UP 2ND SET OF TABLES
YES
IS PARAMETER A (D)?
NO
C
P.8
MATCH WITH OTHER ENTRIES?
NO
ERR
P.10
YES
IS THIS AN EXISTING FILE?
YES
NO
SET SPECIAL DIRECTIN BITS IN PP
IS THIS AN EXTERNAL FILE?
YES
NO
CLEAR AND RESET DIRECTING BITS IN PP
4
P.5
SET UP THE DISPOSITION CODE
SEARCH TABLE FOR DISPOSITION CODE REQUEST
DISPOSITION CODE CORRECT?
YES
NO
SET UP CODE IN PP
ISSUE MESSAGE ERROR
ERR
P.10

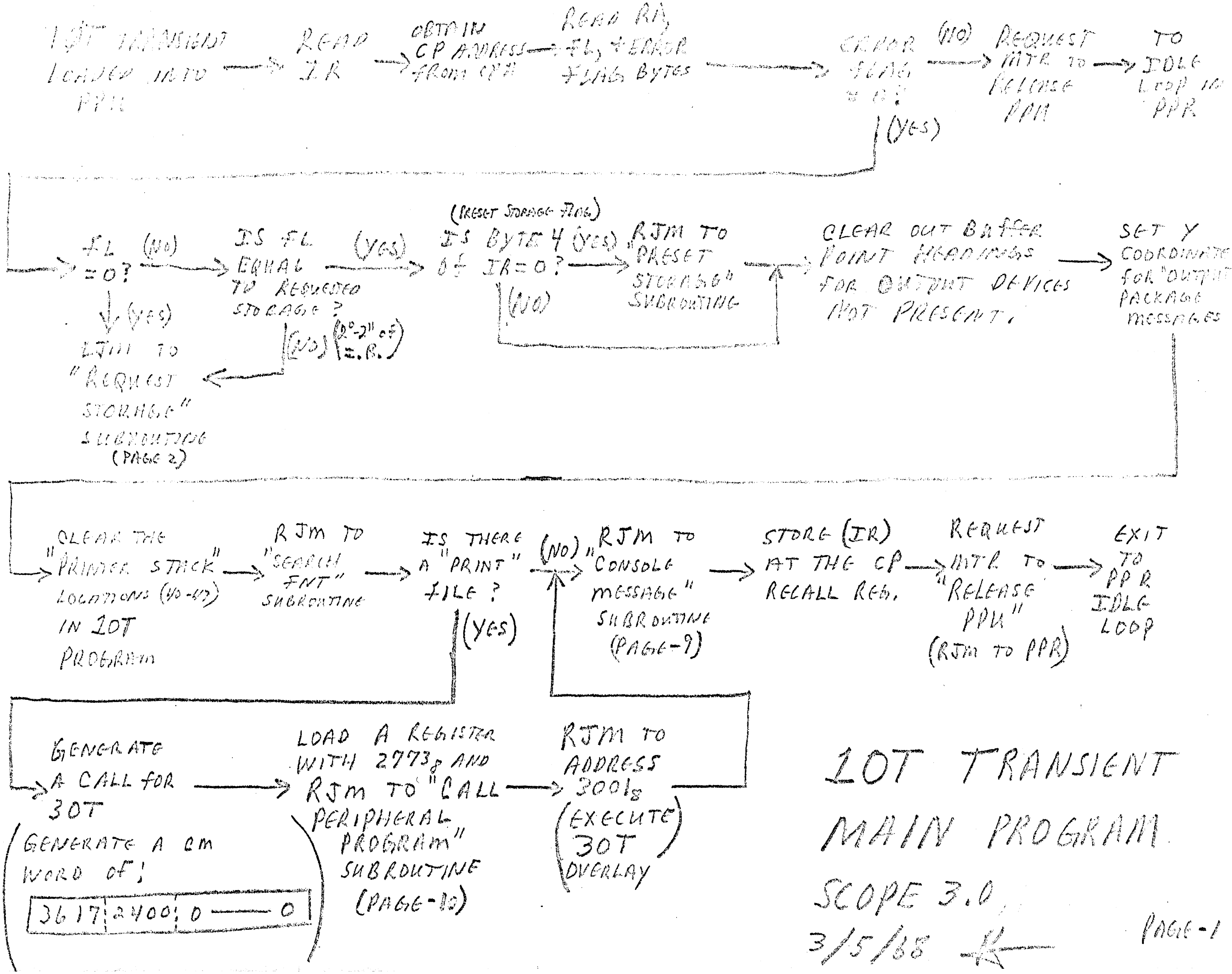

C
Numeric 1st character
yes
NO
4th character = 0
ERR
NO
yes
Save multi-volume number
Reset Parameter Word
Zero Second Byte
Set up table search for equipment code
Correct code found
NO
yes
Set into PP Directing Bits
Is this A MAG tape
yes
NO
Is this A multi-volume
yes
NO
Set multi-volume Bit
1st character a D
yes
NO
Convert Disc Type to octal
Set into PP Directing Bits
H
Second byte = 0
NO
yes


5
Mode CAPL
yes
Error Flag Set
yes
2
NO
No
Check next character
Is it A Blank (55A)
No
yes
Is it alphabetic
yes
No
Is it a Special Character
yes
No
Reset Buffer to start
Zero out Special Bit
3
P.1
Assemble Numeric Character
Set up Request
7
Switch card
yes
Error Flag Set
No
Assemble Parameter
Parameter 1<X<7
yes
Set up correct Bit
Return to control Point Area
NO
ERR
yes
No
P.1
2
Comment Card
yes
Error Flag Set
yes
NO
No
Eliminate 1st 8 characters of Card
Set Return Address To 6 (P.1)
5
Issue Message of control Card Information
Update pointer for Message
NO
Is entire Card Processed
yes
Update next control card pointer
Exit to Return Address
Return to 27S P1


ERR
Read Control Card into Buffer
Return Jump To ⑤
Issue Message Control Card Error
Abort Control Point
IDLE LOOP


7
Read Control Card into Buffer
Return Jump To ⑤ (P.9)
Clear overflow Buffer
Drop PP
IDLE LOOP

1OT MAIN PROGRAM

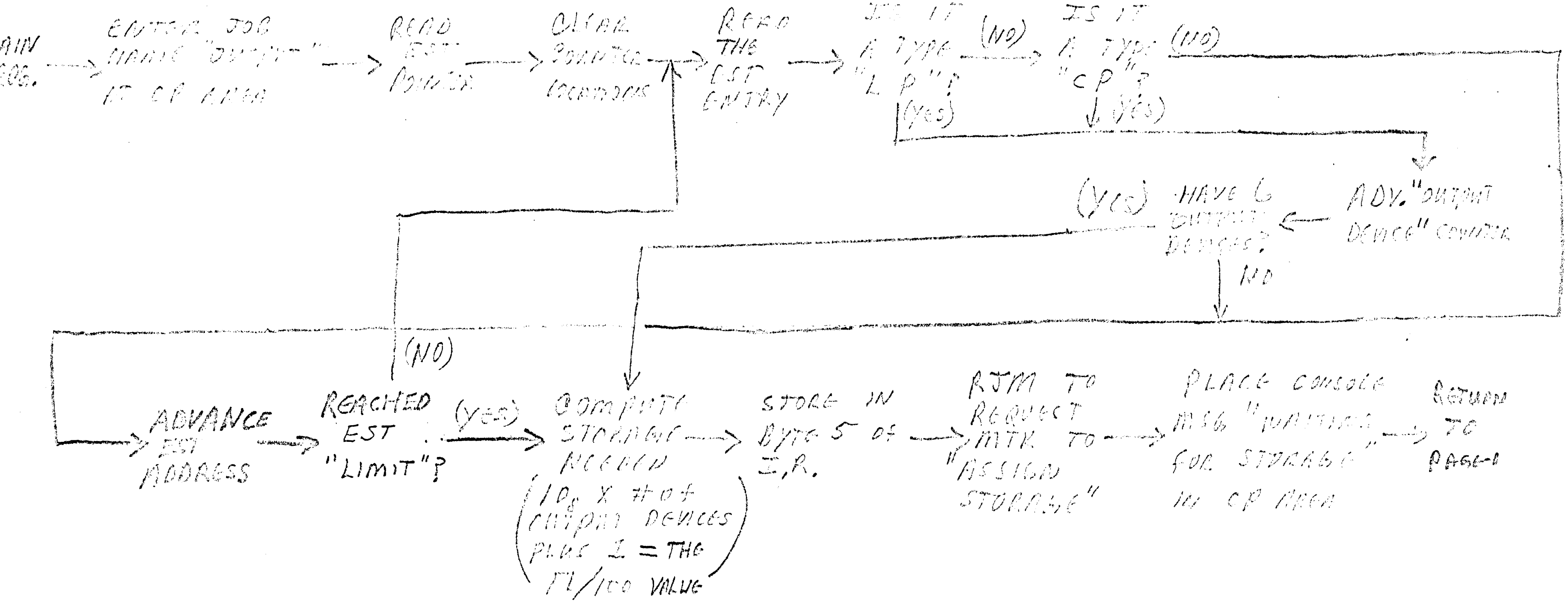


1OT TRANSIENT
MAIN PROGRAM
SCOPE 3.0
3/5/65 R ←

PAGE-1

8-47

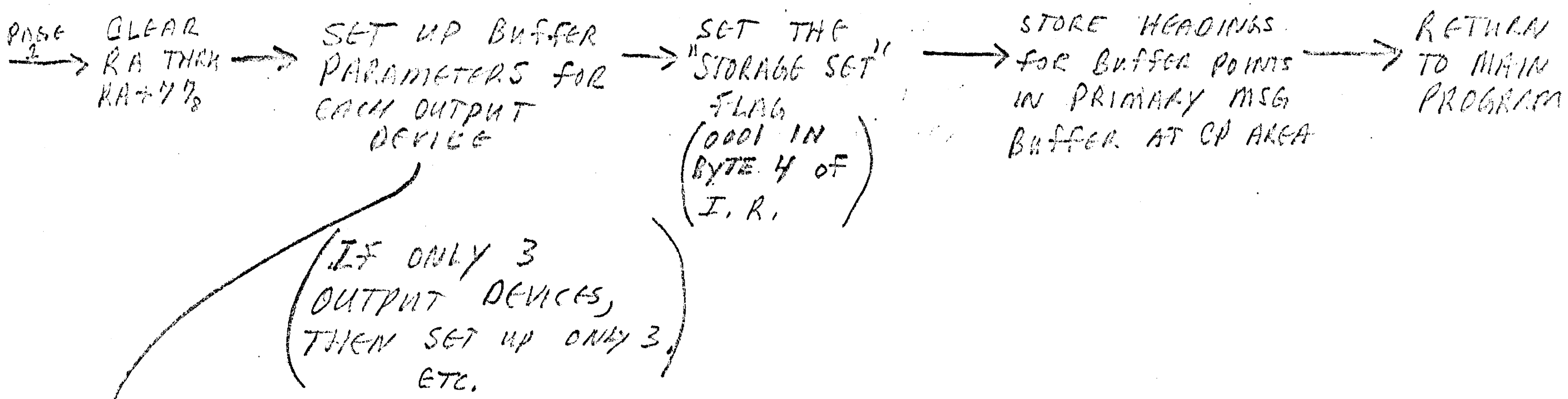
REQUEST STORAGE SUBROUTINE FOR [illegible] TRANSIENT PROGRAM SCOPE 3



8-48

PRESET STORAGE SUBROUTINE

10T TRANSIENT PROGRAM SCOPE 3



RA+11 = 0——0100 ⇒ FIRST
RA+12 = 0——0100 ⇒ IN
RA+13 = 0——0100 ⇒ OUT
RA+14 = 0——01100 ⇒ LIMIT
} OUTPUT DEVICE #1 AT BUFFER POINT #1

RA+21 = 0——01100 ⇒ FIRST
RA+22 = 0——01100 ⇒ IN
RA+23 = 0——01100 ⇒ OUT
RA+24 = 0——02100 ⇒ LIMIT
} OUTPUT DEVICE #2 AT BUFFER POINT #2

#3

#4

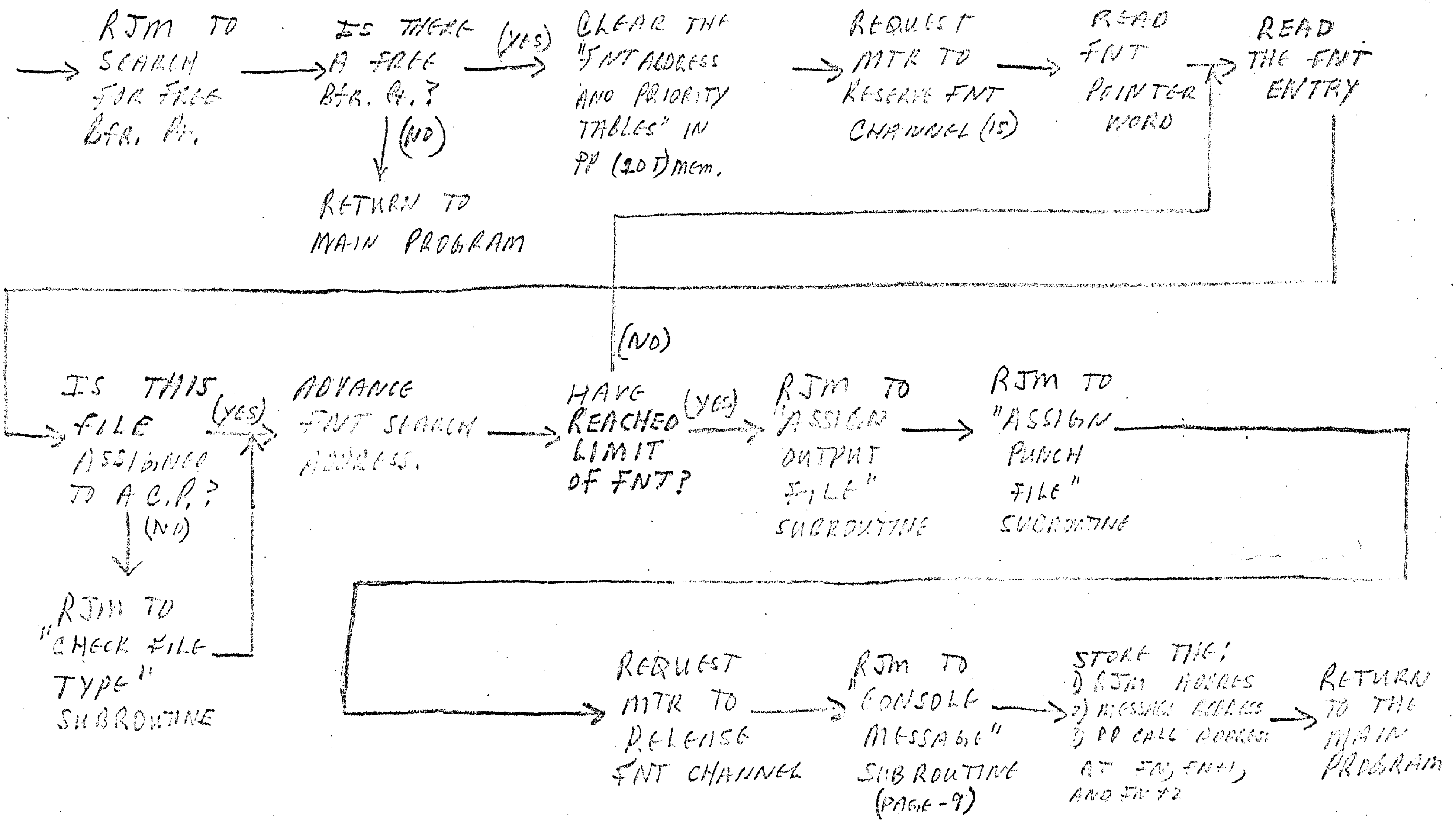
#5

RA+61 = 0——05100 ⇒ FIRST
RA+62 = 0——05100 ⇒ IN
RA+63 = 0——05100 ⇒ OUT
RA+64 = 0——06100 ⇒ LIMIT
} OUTPUT DEVICE #6 AT BUFFER POINT #6

677-8

SEARCH FNT SUBROUTINE

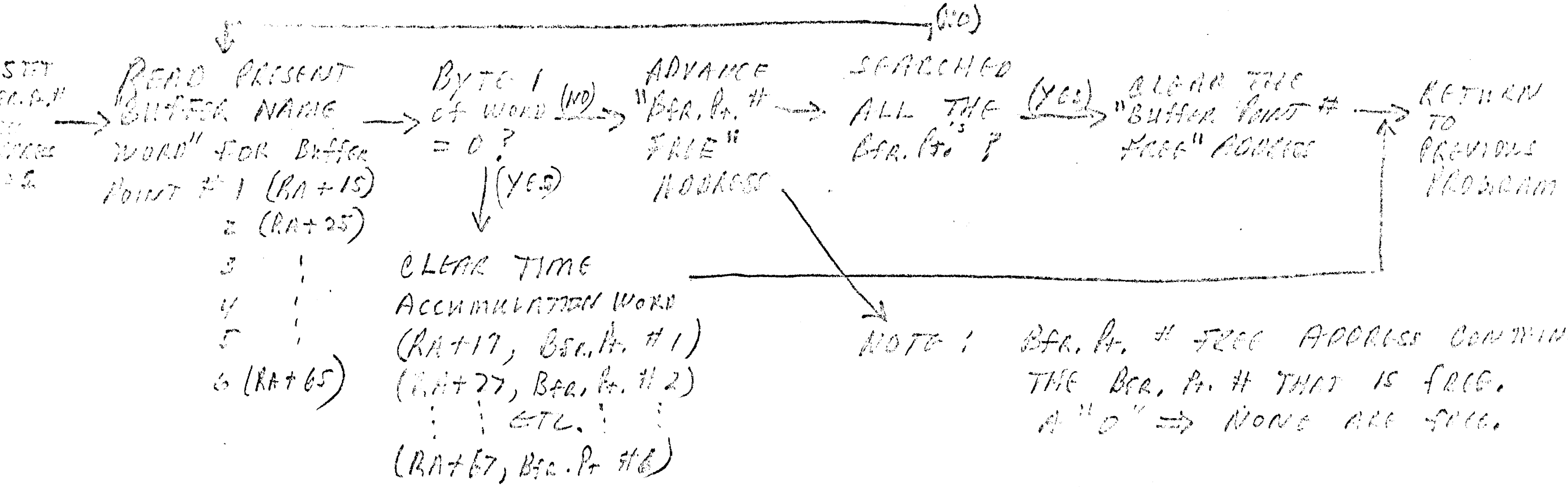
1OT TRANSIENT PROGRAM, SCOPE 3



09-8

SEARCH FOR FREE BUFFER SUBROUTINE

IOT TRANSIENT PROGRAM, SCOPE 3

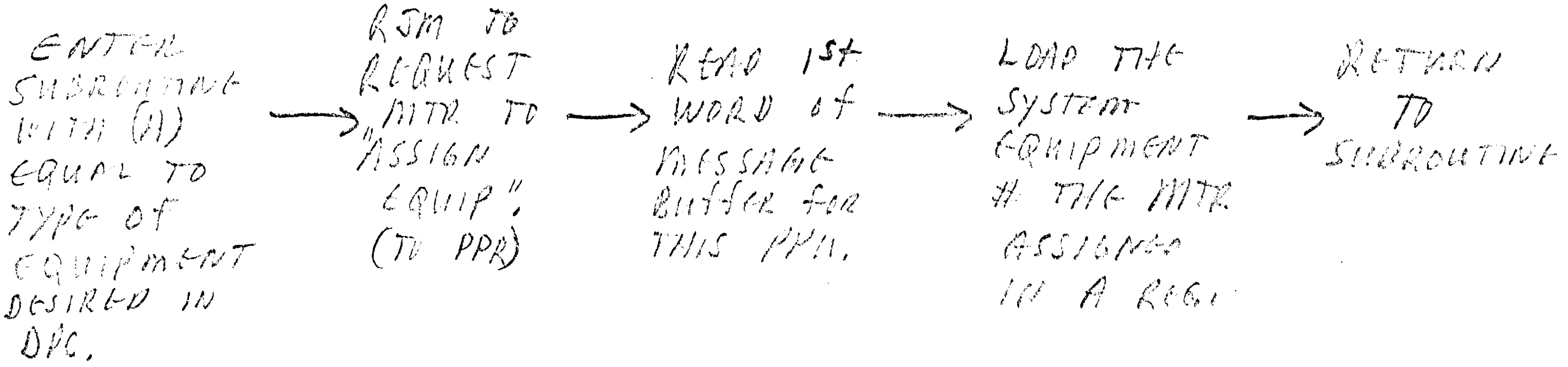


NOTE: BFR. PT. # FREE ADDRESS CONTAINS THE BFR. PT. # THAT IS FREE. A "0" ⇒ NONE ARE FREE.

REQUEST EQUIPMENT SUBROUTINE

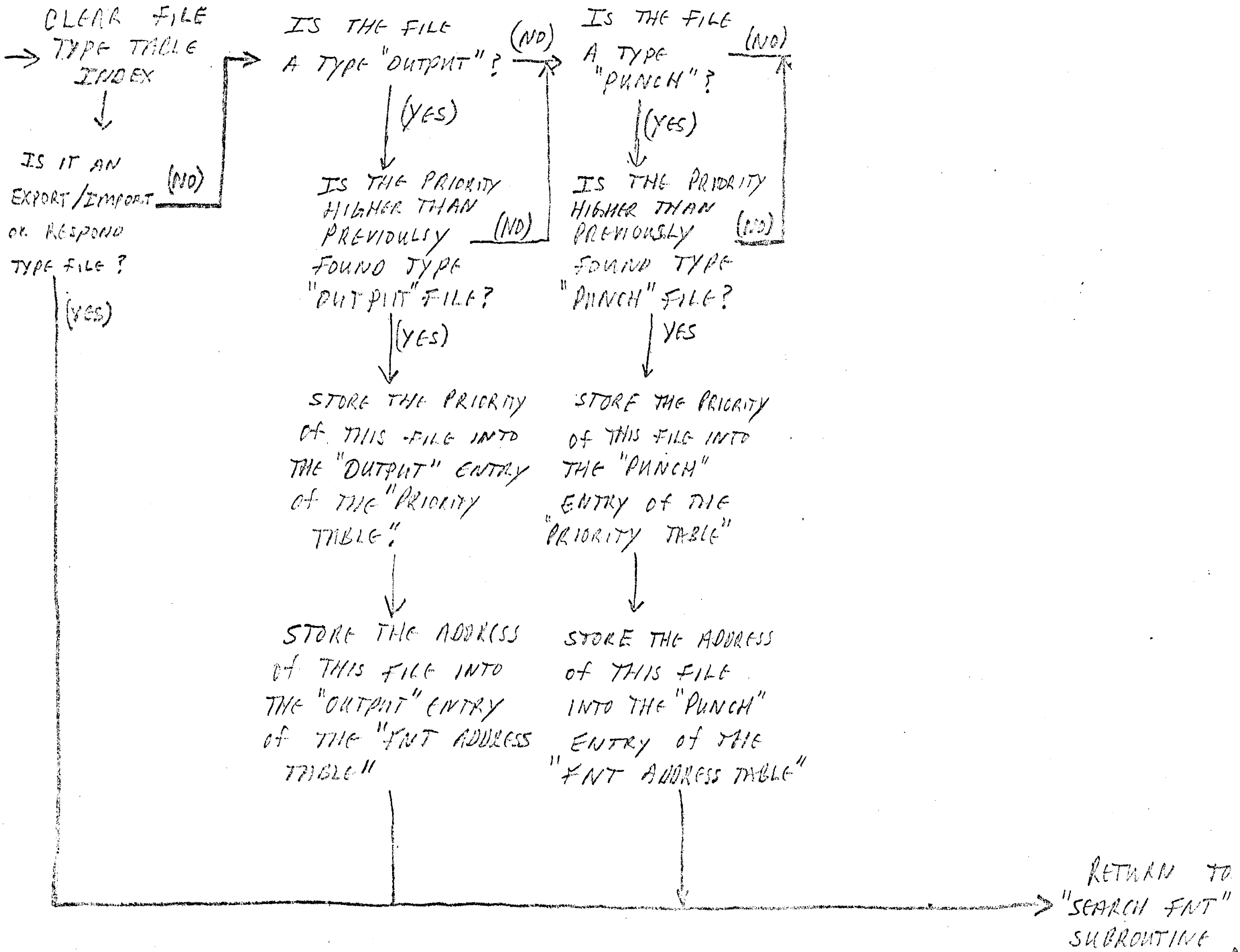
IOT TRANSIENT PROGRAM, SCOPE 2.0, PSR # 47

4/20/67

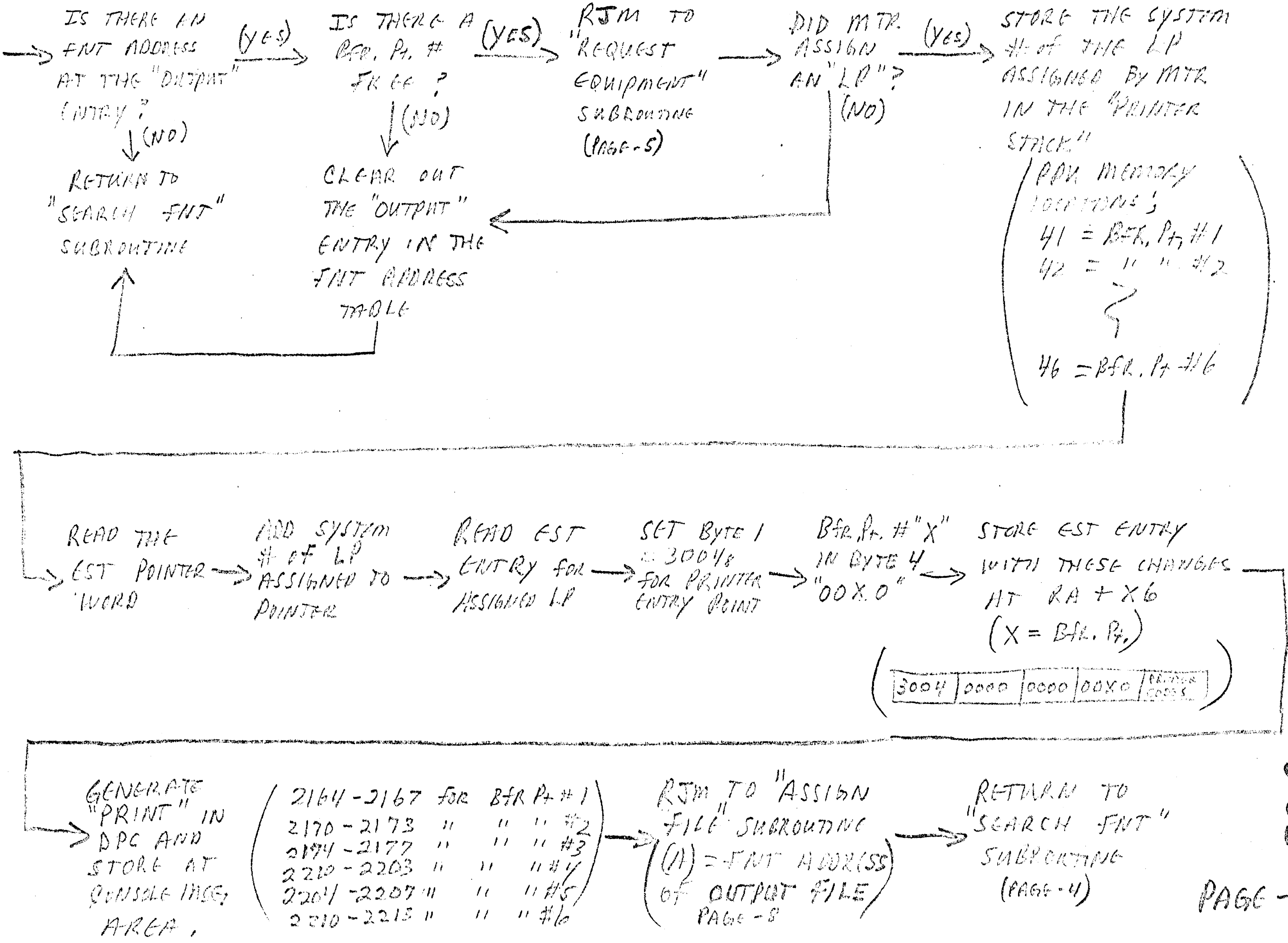


19-8

CHECK FILE TYPE SUBROUTINE | 1DT TRANSIENT PROGRAM

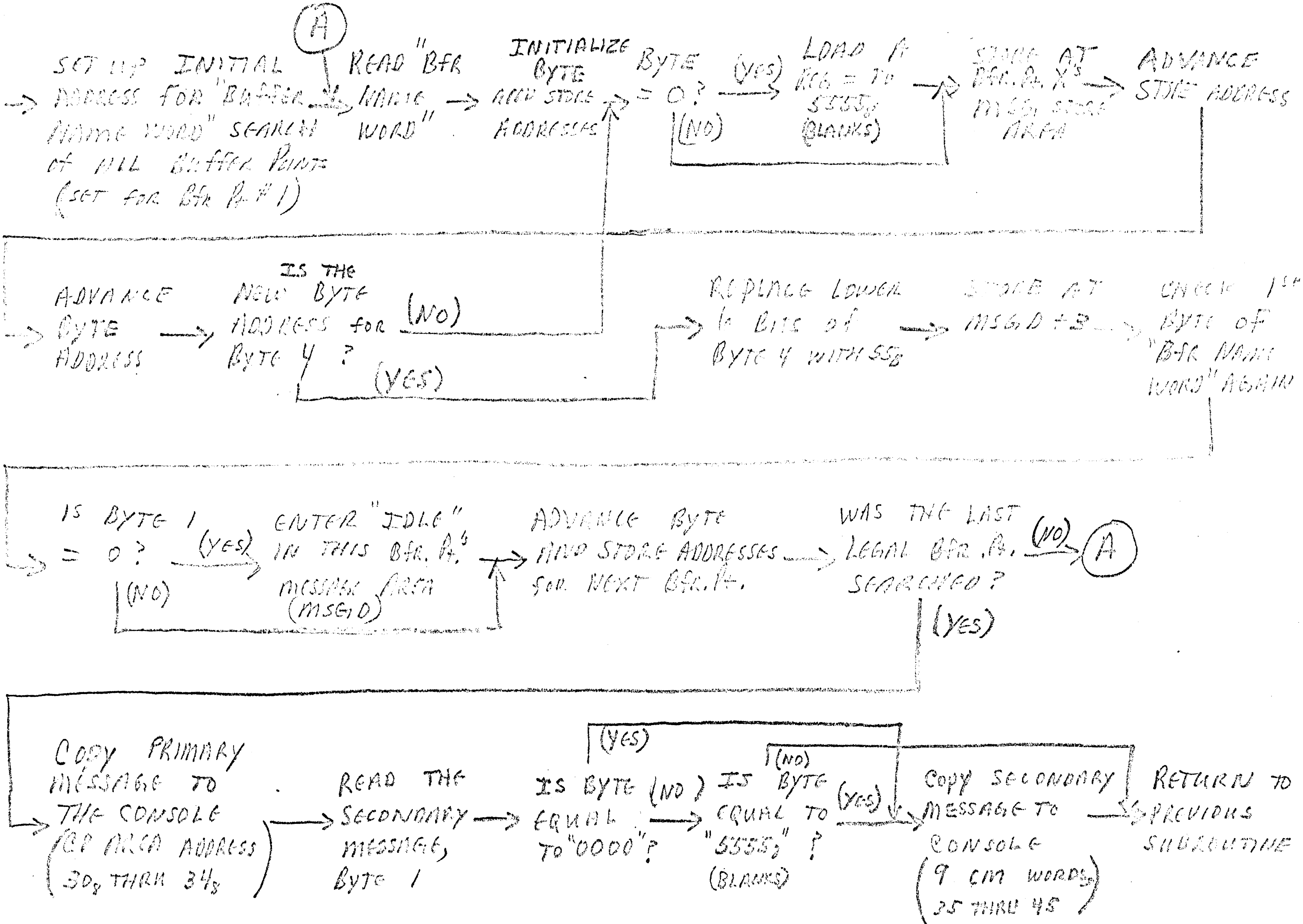


ASSIGN OUTPUT FILE SUBROUTINE 1DT TRANSIENT PROGRAM, SCOPE 3
(ASSIGN "PRINT" FILE)

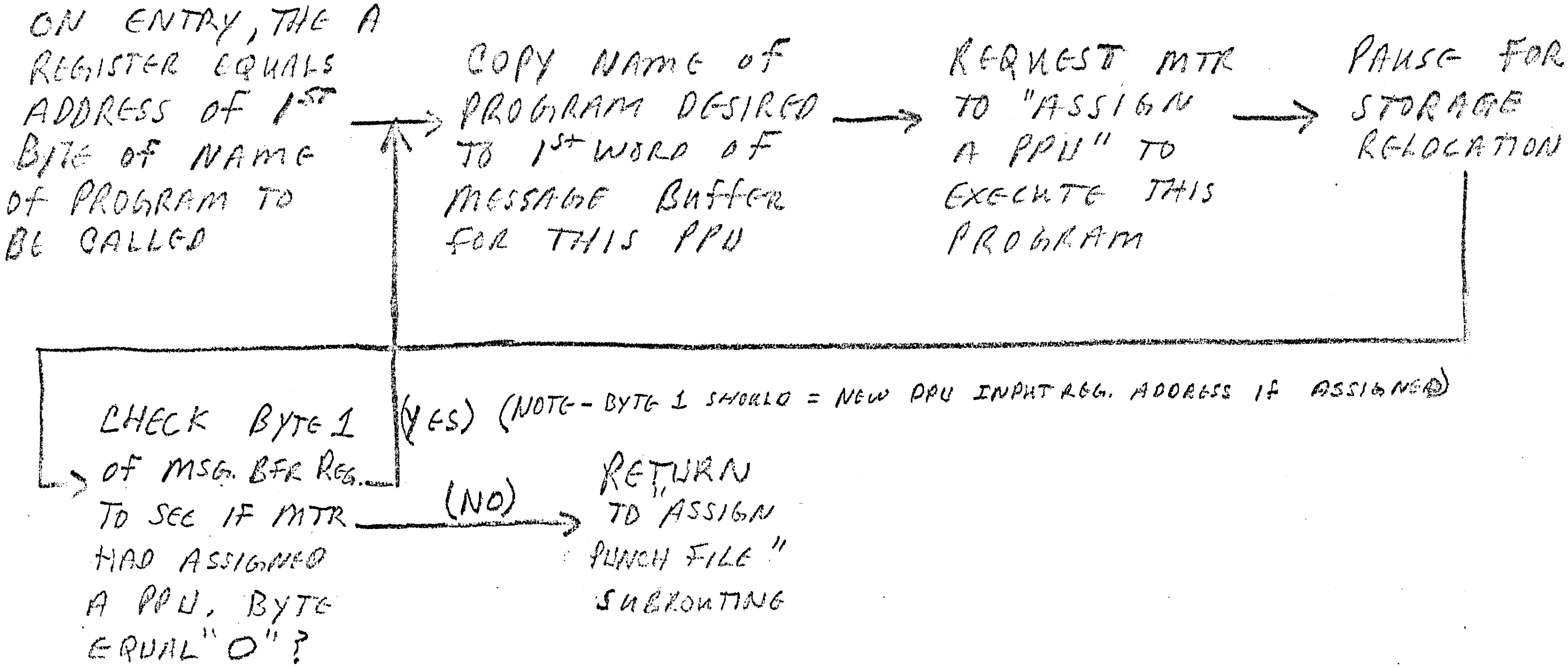


8-53

CONSOLE MESSAGE SUBROUTINE | IOT TRANSITION PROGRAM, SCOPE 3



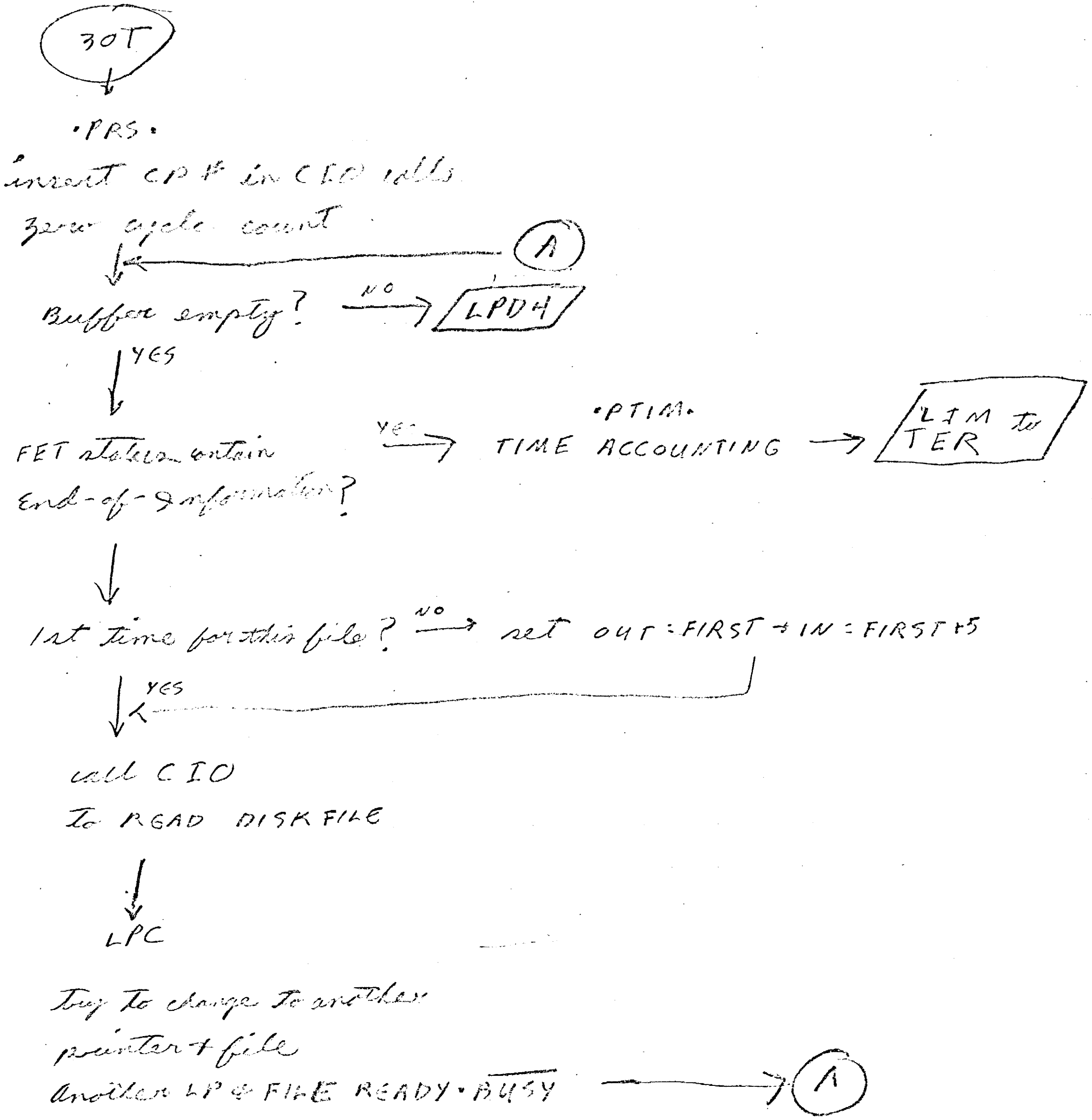
CALL PERIPHERAL PROGRAM 10T TRANSIENT PROGRAM, SCOPE 3



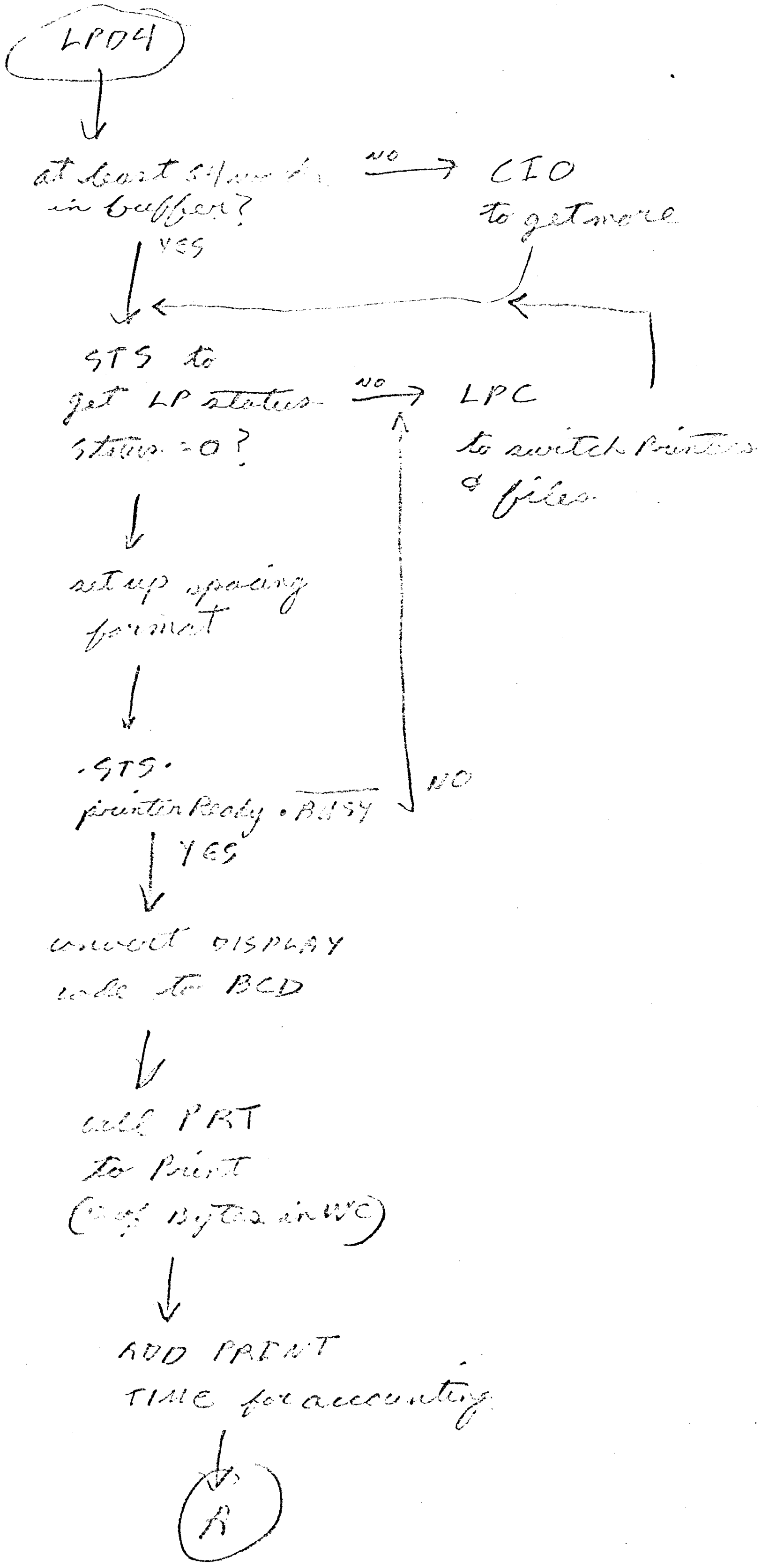
9-5-8

8-57
1/3

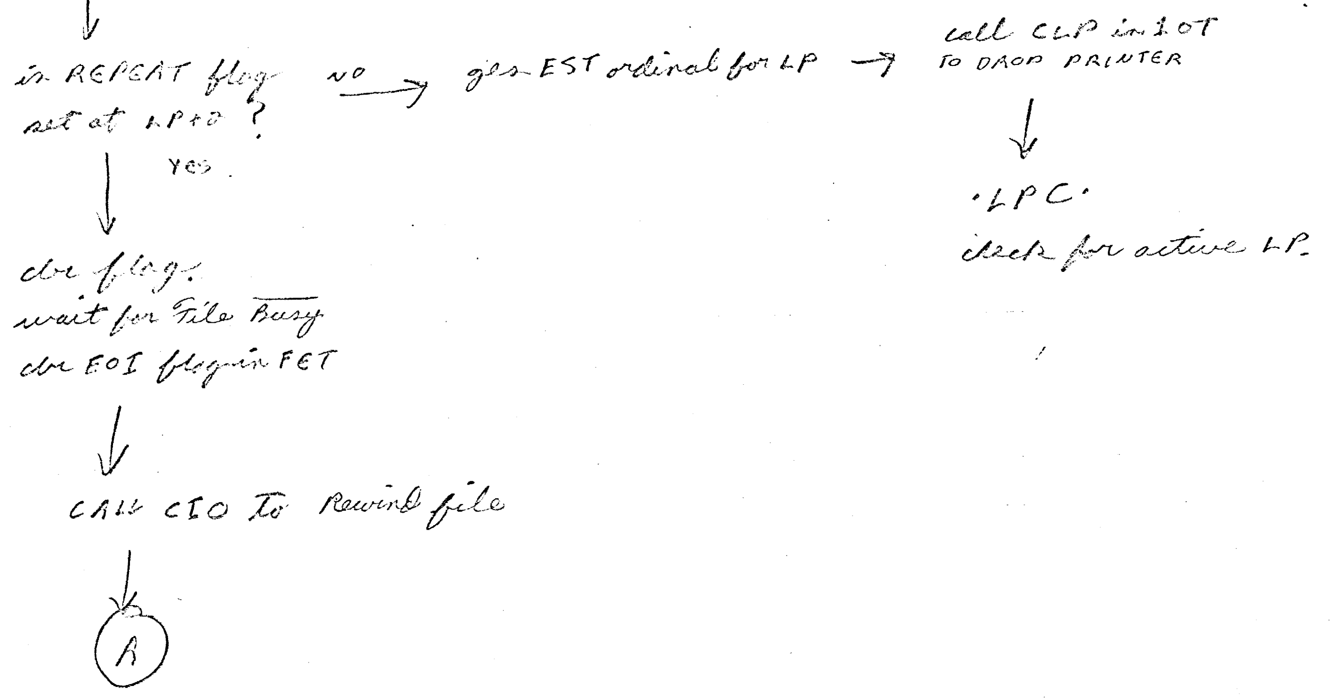
30T

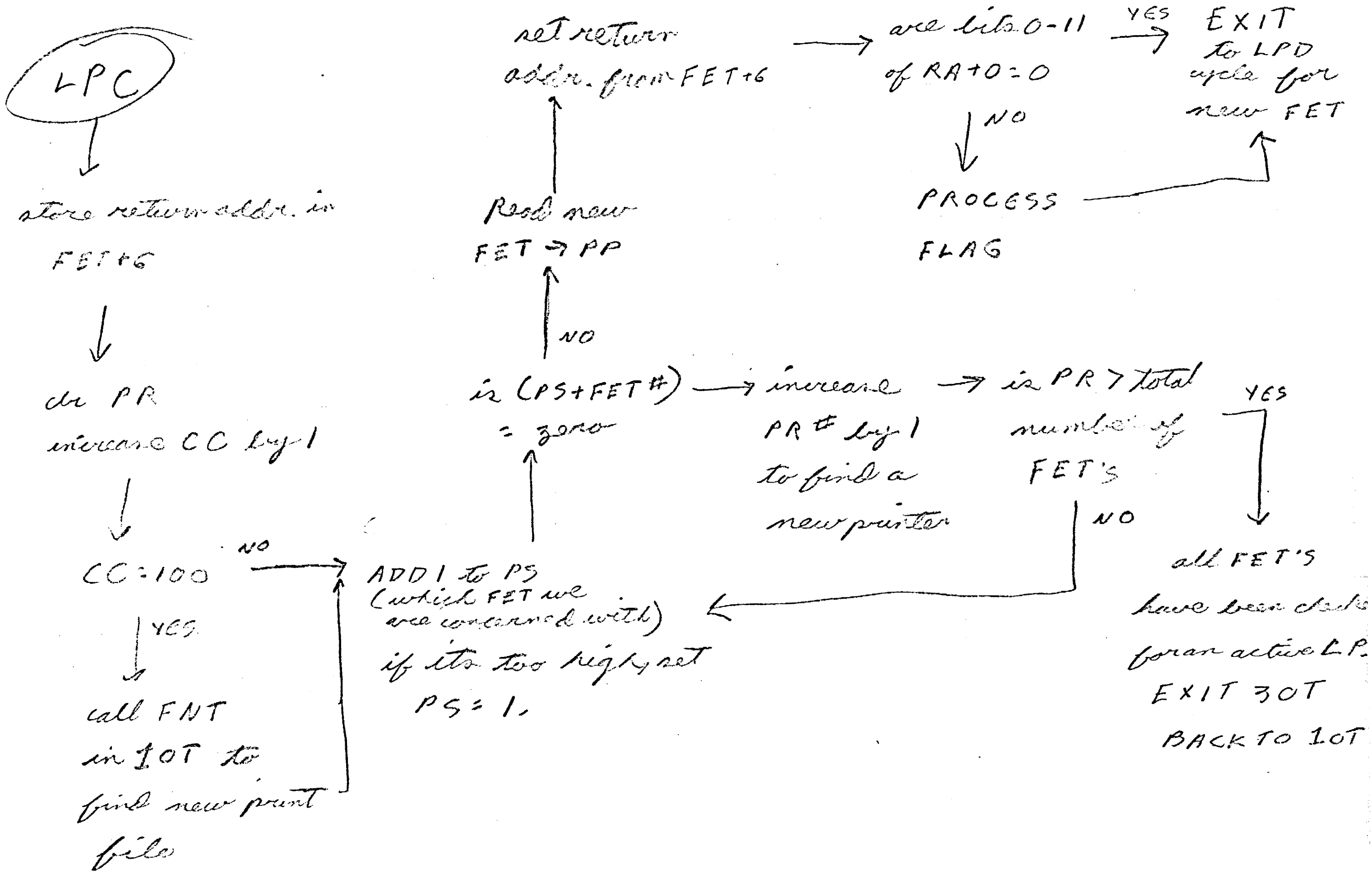


30T
•PRS•
insert CP # in CIO calls
zero cycle count
A
Buffer empty?
NO
LPDH
YES
FET status contain
End-of-Information?
YES
•PTIM•
TIME ACCOUNTING
LIM to TER
1st time for this file?
NO
set OUT = FIRST + IN = FIRST +5
YES
call CIO
To READ DISK FILE
LPC
Try to change to another
printer + file
Another LP & FILE READY • BUSY
A


LP04
at least 54 words in buffer?
NO
CIO to get more
YES
STS to get LP status status = 0?
NO
LPC to switch Printers & files
set up spacing format
·STS· printer Ready ·$\overline{\text{BUSY}}$
NO
YES
convert DISPLAY code to BCD
call PRT to Print (# of Bytes in WC)
ADD PRINT TIME for accounting
R

8-57
3/3


TER
is REPEAT flag set at LP+0 ?
NO
get EST ordinal for LP
call CLP in 1OT TO DROP PRINTER
·LPC·
check for active LP.
YES
clr flag.
wait for File Busy
clr EOI flag in FET
CALL CIO to Rewind file
A


LPC
store return addr. in FET+6
clr PR
increase CC by 1
CC=100
NO
YES
call FNT in 1OT to find new print file
ADD 1 to PS (which FET we are concerned with)
if its too high, set PS=1.
is (PS+FET#) = zero
NO
Read new FET → PP
set return addr. from FET+6
are bits 0-11 of RA+0=0
YES
EXIT to LPD cycle for new FET
NO
PROCESS FLAG
increase PR# by 1 to find a new printer
is PR > total number of FET's
YES
NO
all FET'S have been check for an active LP.
EXIT 3OT BACK TO 1OT

6000 SCOPE LOADER

(SEE ALSO APPENDIX D of SCOPE 3.1 REFERENCE MANUAL)

<table>
<tr><td>RA</td><td colspan="9">ERROR EXIT.</td></tr>
<tr><td>RA+1</td><td colspan="9">COMMUNICATIONS</td></tr>
<tr><td>RA+2
RA+63</td><td colspan="9">PARAMETERS FROM THE "PROGRAM CALL" CARD UPON AVAILABLE TO USER DURING EXECUTION FOR FILE NAMES AND OTHER USAGE</td></tr>
<tr><td>RA+64</td><td colspan="8">PROGRAM CALL OR FILE NAME</td><td>NUMBER OF PARAMETERS</td></tr>
<tr><td>RA+65</td><td></td><td>FWA SEGMENT TABLE</td><td colspan="6">35 28 24 18</td><td>CORE NEXT</td></tr>
<tr><td>RA+66</td><td></td><td>FWA LOADER TABLES</td><td colspan="2">DEBUG CONTROL BITS(31-28)</td><td colspan="3">U</td><td>V</td><td>FWA PROGRAM</td></tr>
<tr><td>RA+67</td><td></td><td>W</td><td></td><td colspan="2">X</td><td>Y</td><td colspan="2"></td><td>FWA LOADER</td></tr>
<tr><td>RA+70
RA+77</td><td colspan="9">CARD IMAGE OF CARD WHICH CALLED FOR EXECUTION</td></tr>
</table>

U (4 BITS) LDR DIRECTIVES

V (6 BITS) LEVEL OF INCOMING OVERLAY

W SEGMENT LOAD - ADDRESS OF LOWEST LINKAGE TABLE

OVERLAY LOAD - ADDRESS OF BLANK COMMON

X (5 BITS)

E	D	C	B	A

A RSS BIT

B NO MAP BIT

C REQUEST EXIT FLAG

D END OF LOAD

E PARTIAL MAP BIT

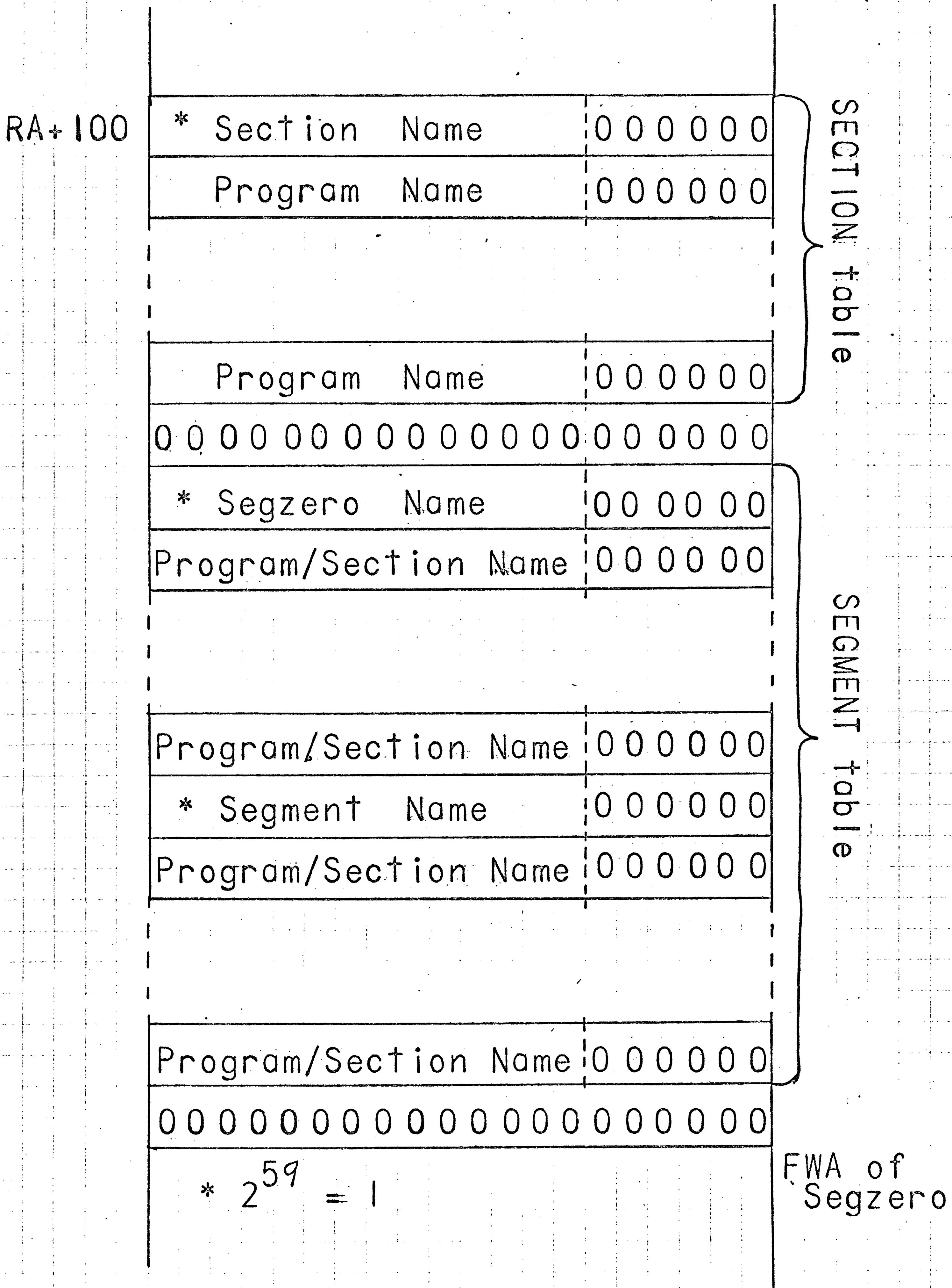
Y (3 BITS) LAST CONTROL CARD

0 PROGRAM CALL

1 LOAD

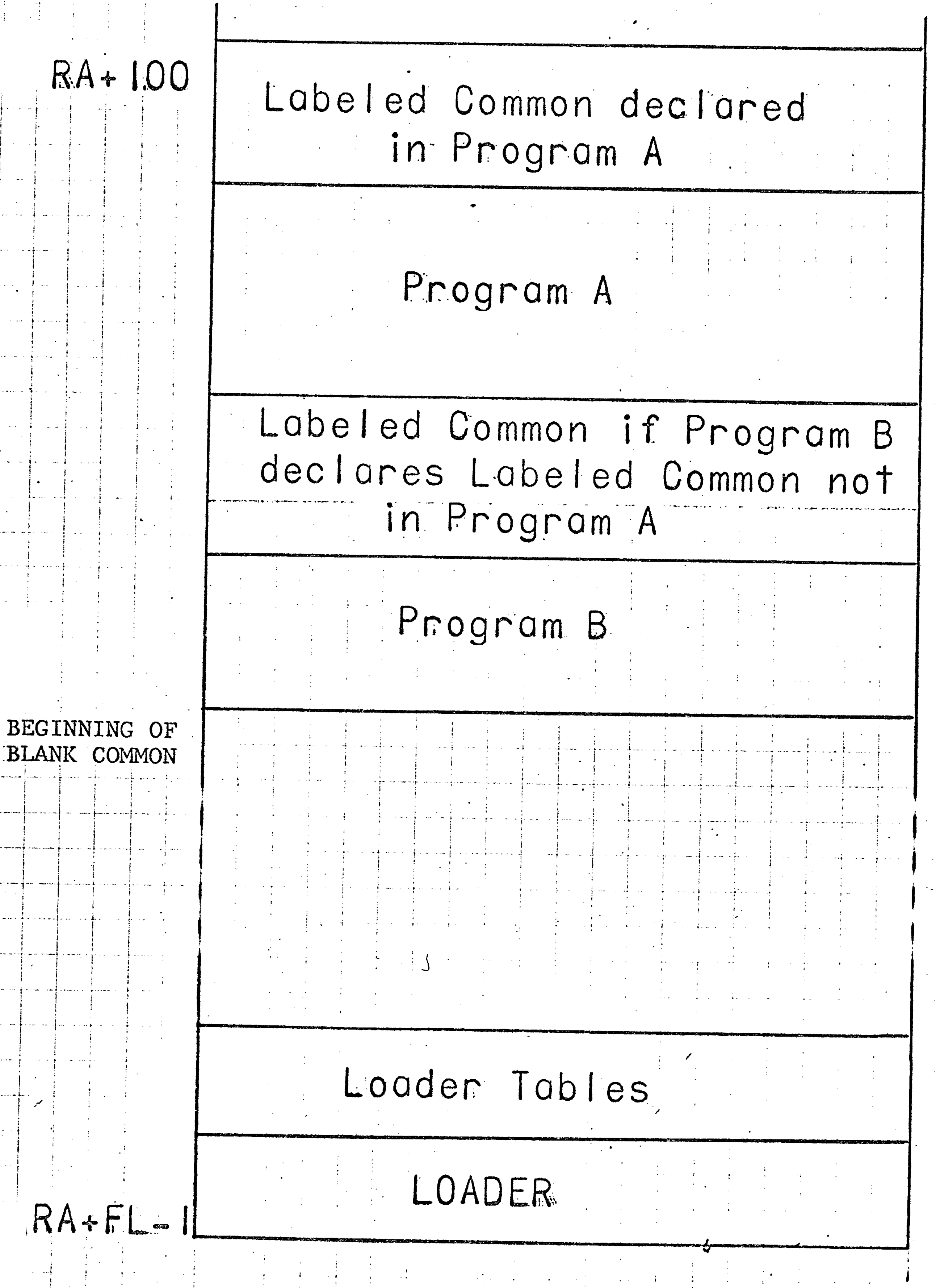
2 EXECUTE

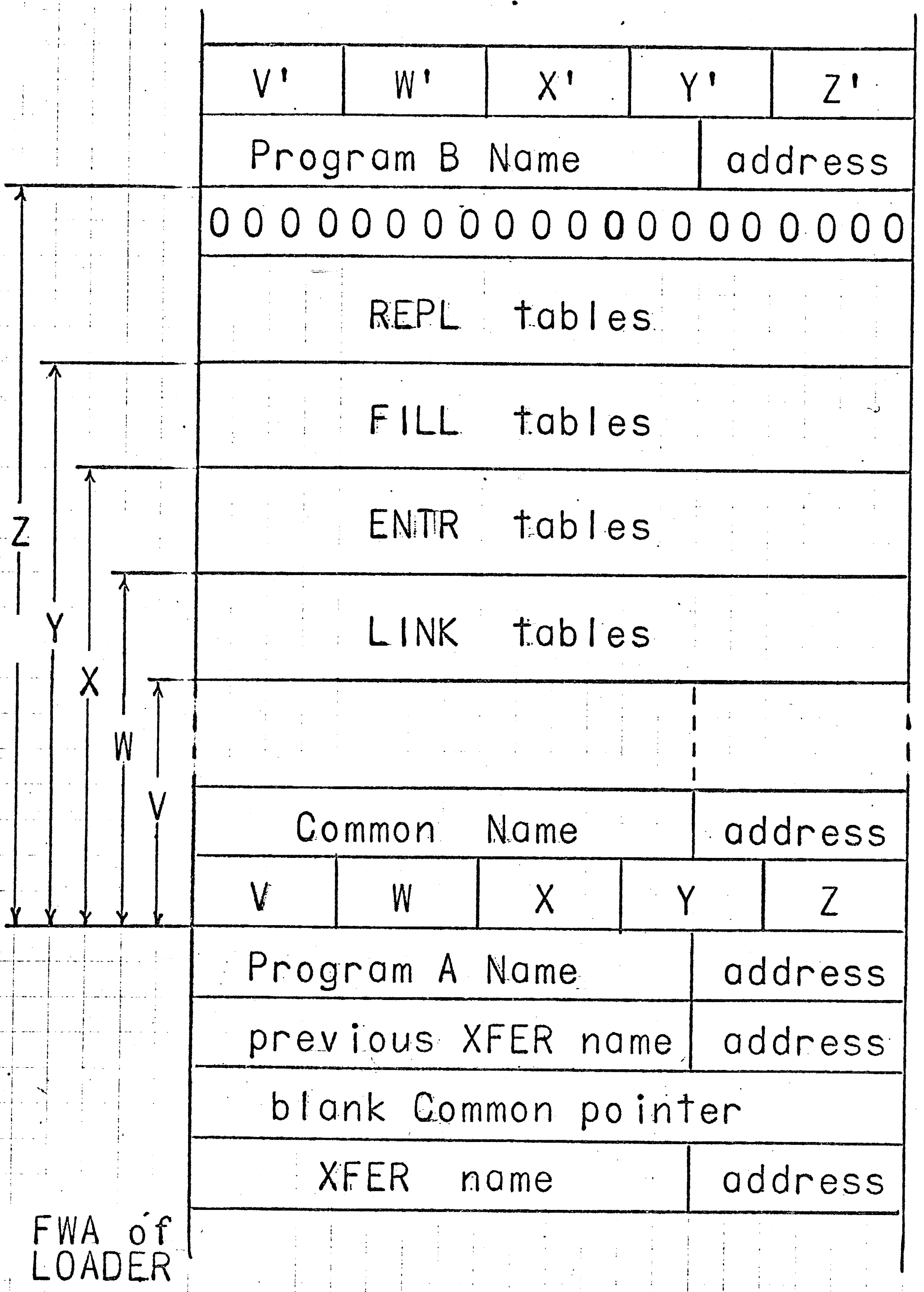
4 NOGO

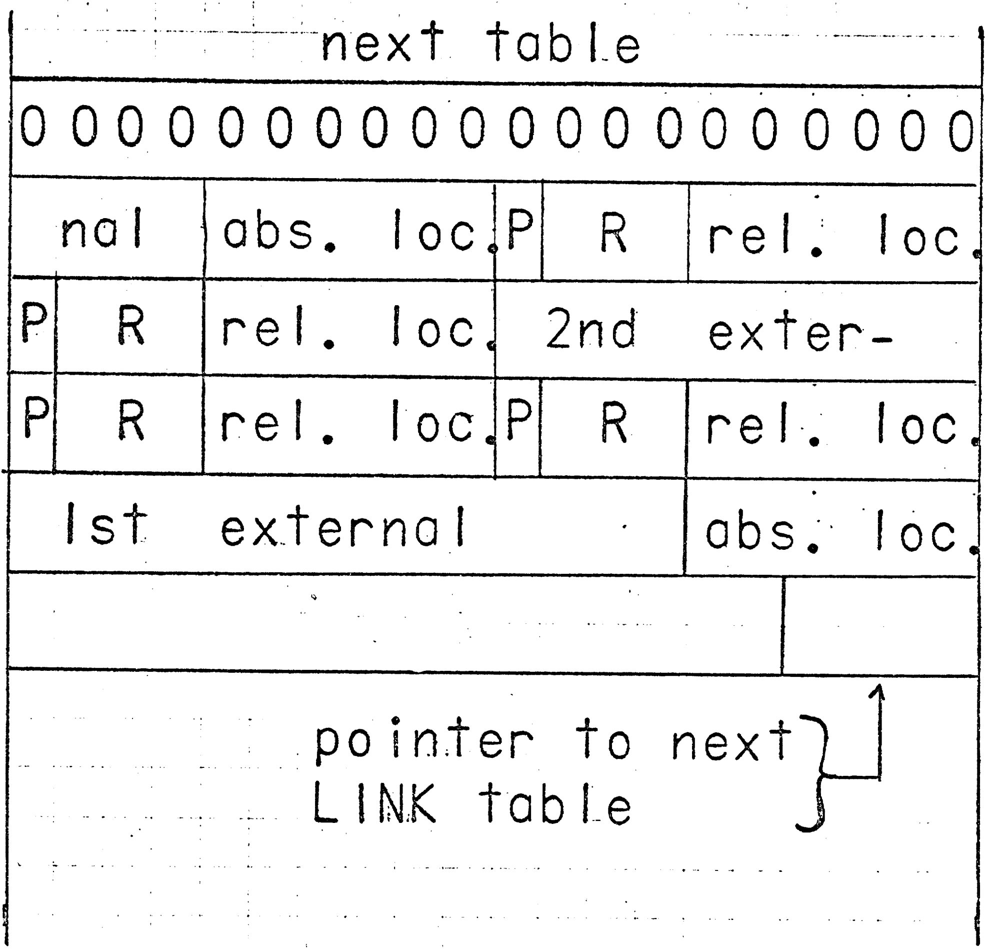


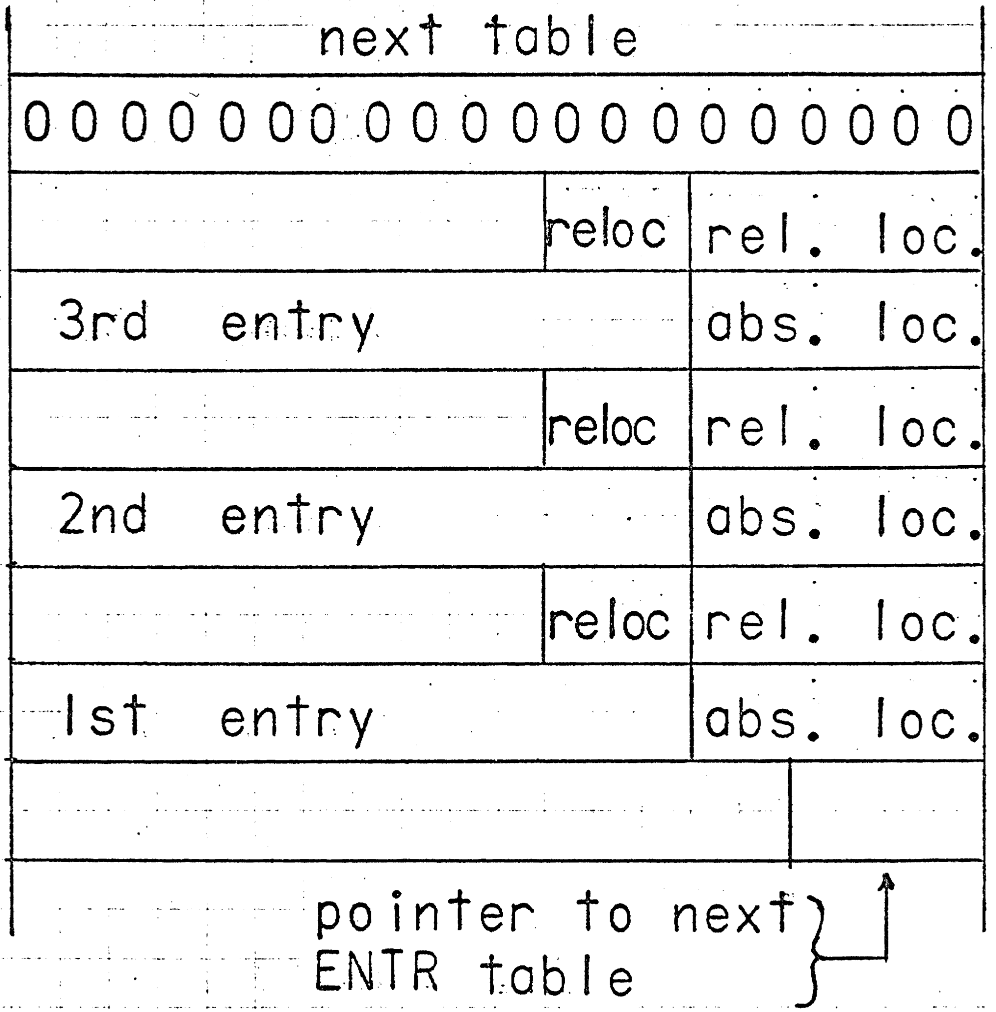
* Section Name	000000
Program Name	000000
Program Name	000000
00000000000000	000000
* Segzero Name	000000
Program/Section Name	000000
Program/Section Name	000000
* Segment Name	000000
Program/Section Name	000000
Program/Section Name	000000
00000000000000	000000

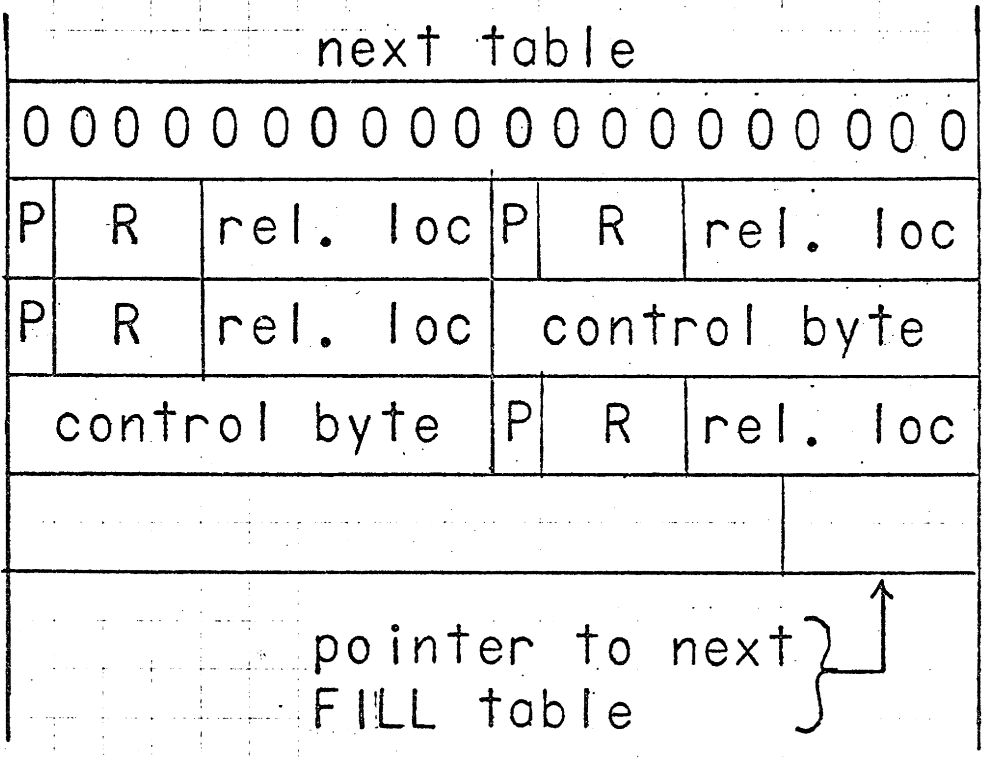
$* \ 2^{59} = 1$


RA+100
Labeled Common declared in Program A
Program A
Labeled Common if Program B declares Labeled Common not in Program A
Program B
BEGINNING OF BLANK COMMON
Loader Tables
LOADER
RA+FL-1


V'
W'
X'
Y'
Z'
Program B Name
address
0000000000000000000
REPL tables
FILL tables
ENTR tables
LINK tables
Common Name
address
V
W
X
Y
Z
Program A Name
address
previous XFER name
address
blank Common pointer
XFER name
address
Z
Y
X
W
V
FWA of LOADER


next table
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
nal
abs. loc.
P
R
rel. loc.
P
R
rel. loc.
2nd exter-
P
R
rel. loc.
P
R
rel. loc.
1st external
abs. loc.
pointer to next LINK table


next table
0000000000000000000
reloc
rel. loc.
3rd entry
abs. loc.
reloc
rel. loc.
2nd entry
abs. loc.
reloc
rel. loc.
1st entry
abs. loc.
pointer to next ENTR table


next table
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
P
R
rel. loc
P
R
rel. loc
P
R
rel. loc
control byte
control byte
P
R
rel. loc
pointer to next
FILL table

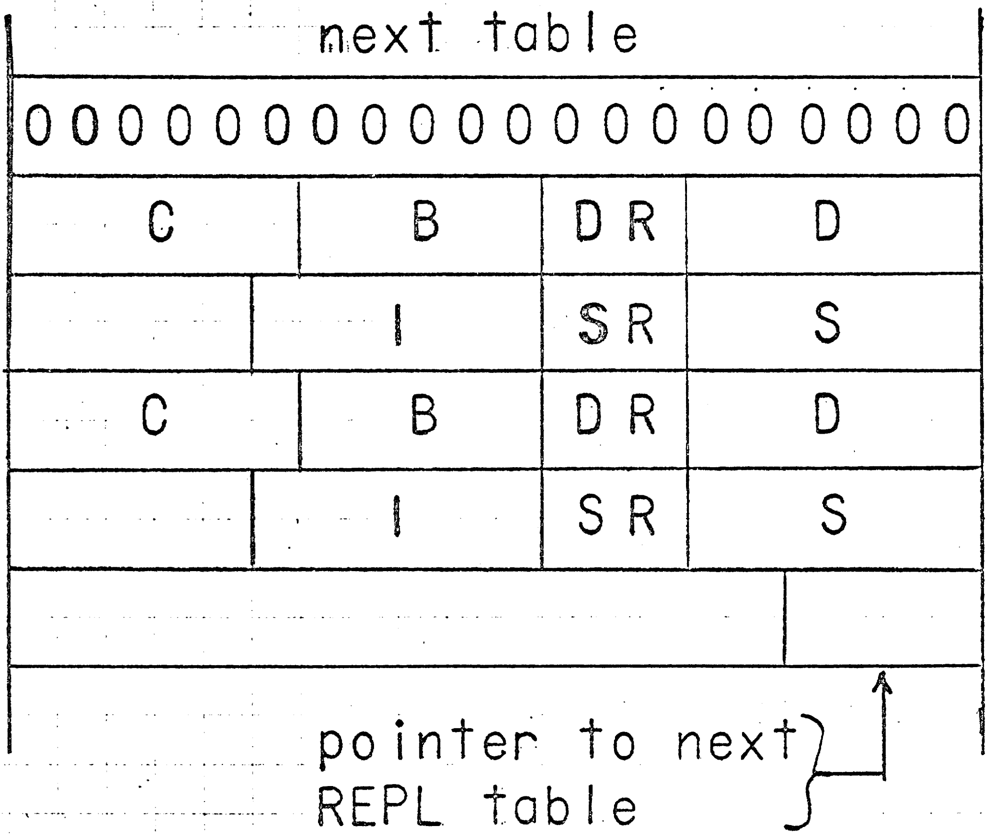

next table
00000000000000000000
C
B
DR
D
I
SR
S
C
B
DR
D
I
SR
S
pointer to next REPL table

TABLE FORMAT

CN	00	WC	000	LR	L

CN	Code Number - identifies type of table
WC	Word Count - number of words in table (total table length = WC+ 11)

LR and L used only with TEXT table

LABLE TABLE

<table>
<tr><td>77</td><td>00</td><td>0016</td><td>000</td><td>000</td><td>000000</td></tr>
<tr><td colspan="5">Program Name</td><td>000000</td></tr>
<tr><td colspan="6">00000000000000000000</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td colspan="6">00000000000000000000</td></tr>
</table>

PIDL TABLE

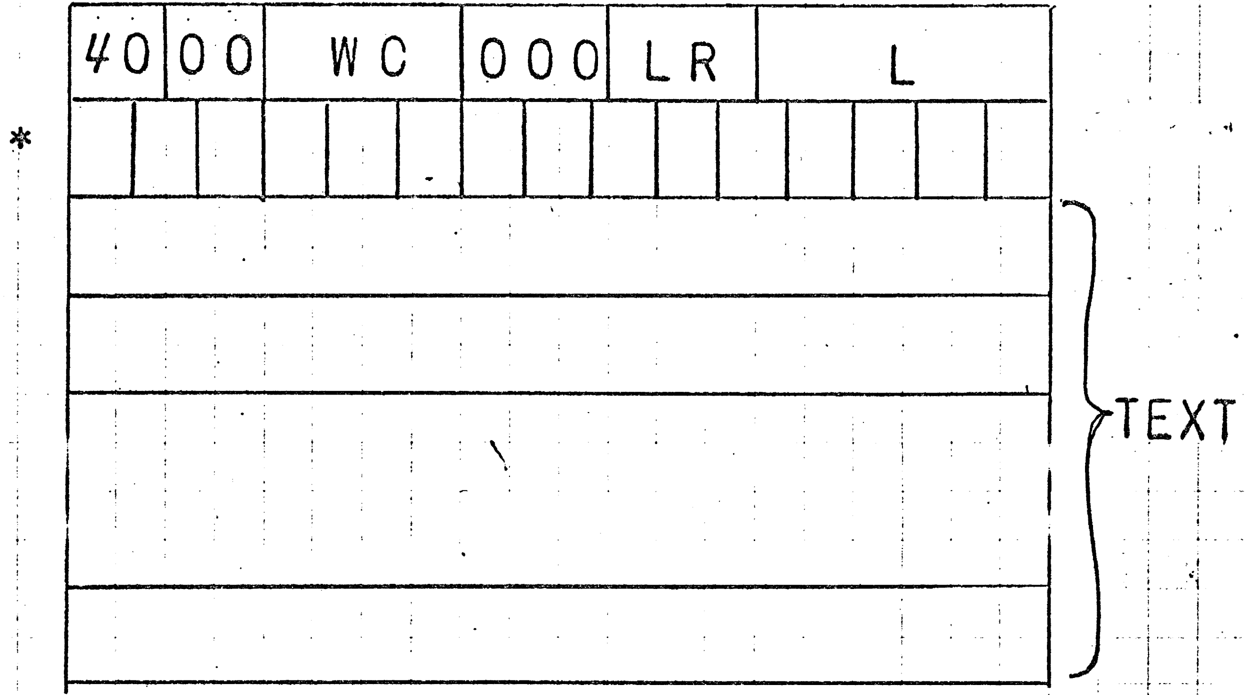
<table>
<tr><td>34</td><td>00</td><td>WC</td><td>000</td><td>000</td><td>000000</td></tr>
<tr><td colspan="5">PROGRAM NAME</td><td>PROGRAM LENGTH</td></tr>
<tr><td colspan="5">COMMON NAME</td><td>BLOCK LENGTH</td></tr>
<tr><td colspan="5">COMMON NAME</td><td>BLOCK LENGTH</td></tr>
<tr><td colspan="5"></td><td></td></tr>
<tr><td colspan="5">COMMON NAME</td><td>BLOCK LENGTH</td></tr>
</table>

First entry must be the program name

Blank Common same as any common (name is 55555555555555)

All names left justified with zero fill

TEXT TABLE



* Relocation bytes (4 bits)

WC limited to maximum of 16 more text requires more TEXT tables

LR specifies area into which text is to be loaded

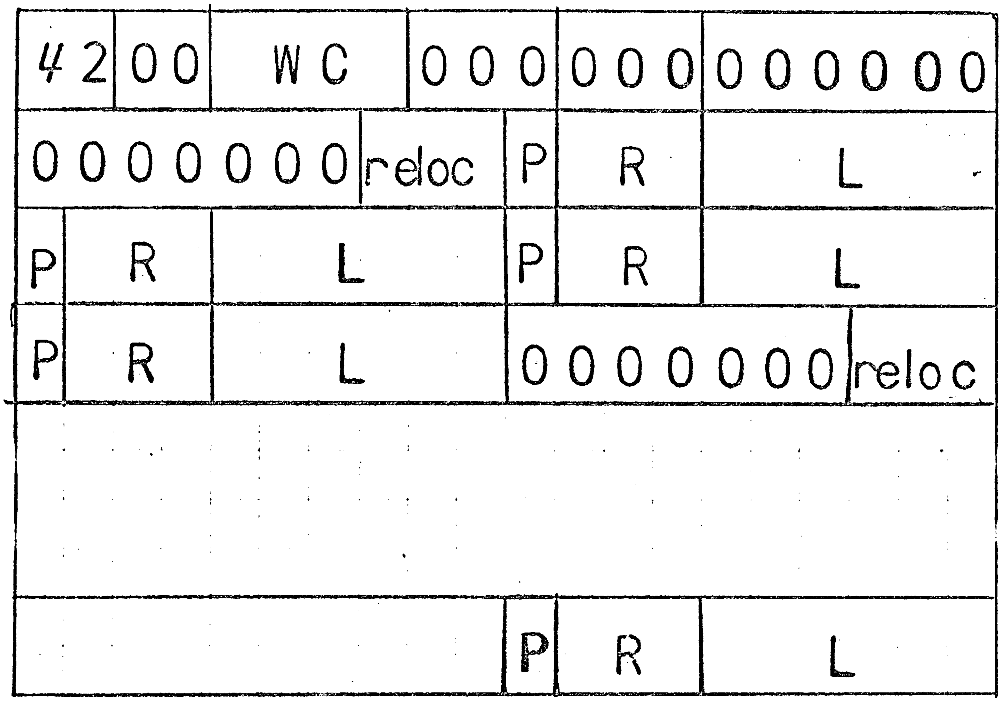
0 = absolute (relative to RA)
1 = program
3 - n = common

L first word address for text within LR area

RELOCATION BYTES

1000	upper+
1100	upper-
1010	upper+ lower+
1011	upper+ lower-
1110	upper- lower+
1111	upper- lower-
0010	lower+
0011	lower-
0100	middle+
0110	middle-
0000	no relocation

FILL TABLE



reloc - relocation

0 absolute
1 program
2 negative prog.
3-n common

R - area

0 absolute
1 program

3-n common

L - first word address in area

P - position in address
100 lower
101 middle
110 upper

```
         IDENT  PROG
         ORG    2
P1       VFD    30/5LINPUT,12/0,18/BE1
P2       VFD    36/6LOUTPUT,6/0,18/BE2
P3       VFD    42/7LSCRATCH,18/BE3
         USE    /ALPHA/
AL1      BSS    2000B
AL2      BSS    2000B
         USE    /BETA/
BE1      BSS    5
BE2      BSS    5
BE3      BSS    5
         USE    //
BUFFER   BSS    2000B
         USE
         SA1    P1-2
         SB1    A1
         MX3    42
LOOP     SA1    A1+B1
         ZR     X1,OUT
         BX6    X1*X3
         SA6    X1
```

```
          ZR        LOOP
          USE       /BETA/
          ORG       0
          VFD       30/5LINPUT,30/0
          VFD       60/ALI
          VFD       60/AL2
          VFD       36/6LOUTPUT, 24/0
          VFD       60/AL2
          VFD       60/AL2+2000B
          VFD       42/7LSCRATCH,18/0
          VFD       60/BUFFER
          VFD       60/BUFFER+2000B
          USE       *
OUT
```

```
  3 4 0 0 0 0 0 4 0 0 0 0 0 0 0 0 0 0 0 0
  2 0 2 2 1 7 0 7 0 0 0 0 0 0   length
  0 1 1 4 2 0 1 0 0 1 0 0 0 0 0 0 4 0 0 0
  0 2 0 5 2 4 0 1 0 0 0 0 0 0 0 0 0 0 1 7
  5 5 5 5 5 5 5 5 5 5 5 5 5 5 0 0 2 0 0 0
 ----------------------------------------
  4 0 0 0 0 0 0 7 0 0 0 0 0 1 0 0 0 0 0 2
* 0 0 0 0 4 1 0 4 0 0 0 0 0 0 0 0 0 0 0 0
  1 1 1 6 2 0 2 5 2 4 0 0 0 0 0 0 0 0 0 0
  1 7 2 5 2 4 2 0 2 5 2 4 0 0 0 0 0 0 0 5
  2 3 0 3 2 2 0 1 2 3 0 3 1 0 0 0 0 0 1 2
  5 1 1 0 0 0 0 0 0 0 6 4 1 1 0 4 3 3 5 2
  5 4 1 1 1 0 3 0 1 0 0 0 0 1 0 1 1 6 1 3
  5 3 6 1 0 0 4 0 0 0 0 0 0 0 5 4 6 0 0 0
 ----------------------------------------
  4 0 0 0 0 0 1 2 0 0 0 0 0 4 0 0 0 0 0 0
  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
  1 1 1 6 2 0 2 5 2 4 0 0 0 0 0 0 0 0 0 0
  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 0 0 0
  1 7 2 5 2 4 3 0 2 5 2 4 0 0 0 0 0 0 0 0
  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 0 0 0
```

```
*     0 | 0 | 0 | 0 | 4 | 1 | 0 | 4 | 0 | 0
      000000000000100001000100000000
        no|  no|  no| up|mid|mid|  no|
```

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0
2	3	0	3	2	2	0	1	2	4	0	3	1	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
4	2	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	3	4	0	0	4	0	0	0	0	0	1
4	0	0	4	0	0	0	0	0	2	4	0	0	4	0	0	0	0	0	4
4	0	0	4	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	4
4	0	0	1	0	0	0	0	0	2	4	0	0	1	0	0	0	0	0	3
4	0	0	1	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	5
4	0	0	4	0	0	0	0	0	7	4	0	0	4	0	0	0	0	1	0
4	0	0	0	x	x	x	x	0	0	0	0	0	1	0	0	0	0	1	0

LINK TABLE

<table>
<tr><td colspan="2">44</td><td>00</td><td>WC</td><td colspan="2">000</td><td>000</td><td>000000</td></tr>
<tr><td colspan="7">name of external</td><td>000000</td></tr>
<tr><td>P</td><td colspan="2">R</td><td colspan="2">L</td><td>P</td><td>R</td><td>L</td></tr>
<tr><td>P</td><td colspan="2">R</td><td colspan="2">L</td><td colspan="3">name of ext-</td></tr>
<tr><td colspan="3">ernal</td><td colspan="2">000000</td><td>P</td><td>R</td><td>L</td></tr>
<tr><td colspan="8"></td></tr>
<tr><td>P</td><td colspan="2">R</td><td colspan="2">L</td><td>P</td><td>R</td><td>L</td></tr>
</table>

P position in word
- 4 lower
- 5 middle
- 6 upper

R area
- 0 absolute
- 1 program
- 3-n common

L location reference made from

ENTR TABLE

<table>
<tr><td>36</td><td>00</td><td>WC</td><td>000</td><td>000</td><td>000000</td></tr>
<tr><td colspan="5">name of entry point</td><td>000000</td></tr>
<tr><td colspan="4">000000000000</td><td>R</td><td>L</td></tr>
<tr><td colspan="5">name of entry point</td><td>000000</td></tr>
<tr><td colspan="4">000000000000</td><td>R</td><td>L</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td colspan="5">name of entry point</td><td>000000</td></tr>
<tr><td colspan="4">000000000000</td><td>R</td><td>L</td></tr>
</table>

R area
  0 absolute
  1 program
  3-n common

L location in area

```
          IDENT   GREEK
          ENTRY   ALPHA,BETA,GAMMA
          EXT     ALEPH,BETH,GIMMEL
ALPHA     DATA    0
          RJ      ALEPH
DELTA     SX6     B7
          SA6     A0
          RJ      GIMMEL
          SA1     A0
          JP      ALPHA
BETA      DATA    0
SA1       BETA
          BX6     X1
          SA6     ALPHA
          RJ      BETH
          JP      DELTA
GAMMA     DATA    0
          SA1     GAMMA
          BX6     X1
          SA6     GIMMEL
          JP      GIMMEL+1
```

```
  3 4 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0
  0 7-2 2 0 5 0 5 1 3 0 0 0 0     length
-------------------------------------------
  3 6 0 0 0 0 0 6 0 0 0 0 0 0 0 0 0 0 0 0
  0 1 1 4 2 0 1 0 0 1 0 0 0 0 0 0 0 0 0 0
  0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0
  0 2 0 5 2 4 0 1 0 0 0 0 0 0 0 0 0 0 0 0
  0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 4
  0 7 0 1 1 5 1 5 0 1 0 0 0 0 0 0 0 0 0 0
  0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 1 0
-------------------------------------------
  4 4 0 0 0 0 0 6 0 0 0 0 0 0 0 0 0 0 0 0
  0 1 1 4 0 5 2 0 1 0 0 0 0 0 0 0 0 0 0 0
  6 0 0 1 0 0 0 0 0 1 0 2 0 5 2 4 1 0 0 0
  0 0 0 0 0 0 0 0 0 0 4 0 0 1 0 0 0 0 0 6
  0 7 1 1 1 5 1 5 0 5 1 4 0 0 0 0 0 0 0 0
  4 0 0 1 0 0 0 0 0 2 6 0 0 1 0 0 0 0 1 2
  4 0 0 1 0 0 0 0 1 2 0 0 0 0 0 0 0 0 0 0
-------------------------------------------
  4 0 0 0 x x x x 0 0 0 0 0 1 0 0 0 0 0 0
* 0 0 0 0 2 0 1 0 4 2 0 0 4 0 x x x x x x
  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
  0 1 0 0 0 0 0 0 0 0 4 6 0 0 0 4 6 0 0 0
  7 6 6 7 0 5 4 6 0 0 0 1 0 0 0 0 0 0 0 0
  5 4 1 0 0 0 2 0 0 0 0 0 0 0 0 4 6 0 0 0
  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0


*  0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 4 | 2 | 0 | 0 | 4 | 0
 000000000000010000001000100010000000100000
   no | no | no |mid | no | up | up | up | no | up | no
```

9-23

5	1	1	0	0	0	0	0	0	4	1	0	6	1	0	4	6	0	0	0
5	1	6	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
0	2	0	0	0	0	0	0	0	2	4	6	0	0	0	4	6	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	1	1	0	0	0	0	0	1	0	1	0	6	1	0	4	6	0	0	0
5	1	6	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1

REPL TABLE

<table>
<tr><td>43</td><td>00</td><td colspan="3">WC</td><td>000</td><td>000</td><td>000000</td></tr>
<tr><td colspan="3"></td><td colspan="3">I</td><td>SR</td><td>S</td></tr>
<tr><td colspan="4">C</td><td colspan="2">B</td><td>DR</td><td>D</td></tr>
<tr><td colspan="8"></td></tr>
<tr><td colspan="3"></td><td colspan="3">I</td><td>SR</td><td>S</td></tr>
<tr><td colspan="4">C</td><td colspan="2">B</td><td>DR</td><td>D</td></tr>
</table>

SR	source area
S	address in area
B	block size
DR	destination area
D	address in area
C	number of replications
I	replication interval

SR and DR
- 0 absolute
- 1 program
- 3-n common

XFER TABLE

4 6	0 0	0 0 0 1	M M	D D	Y Y
name					000000

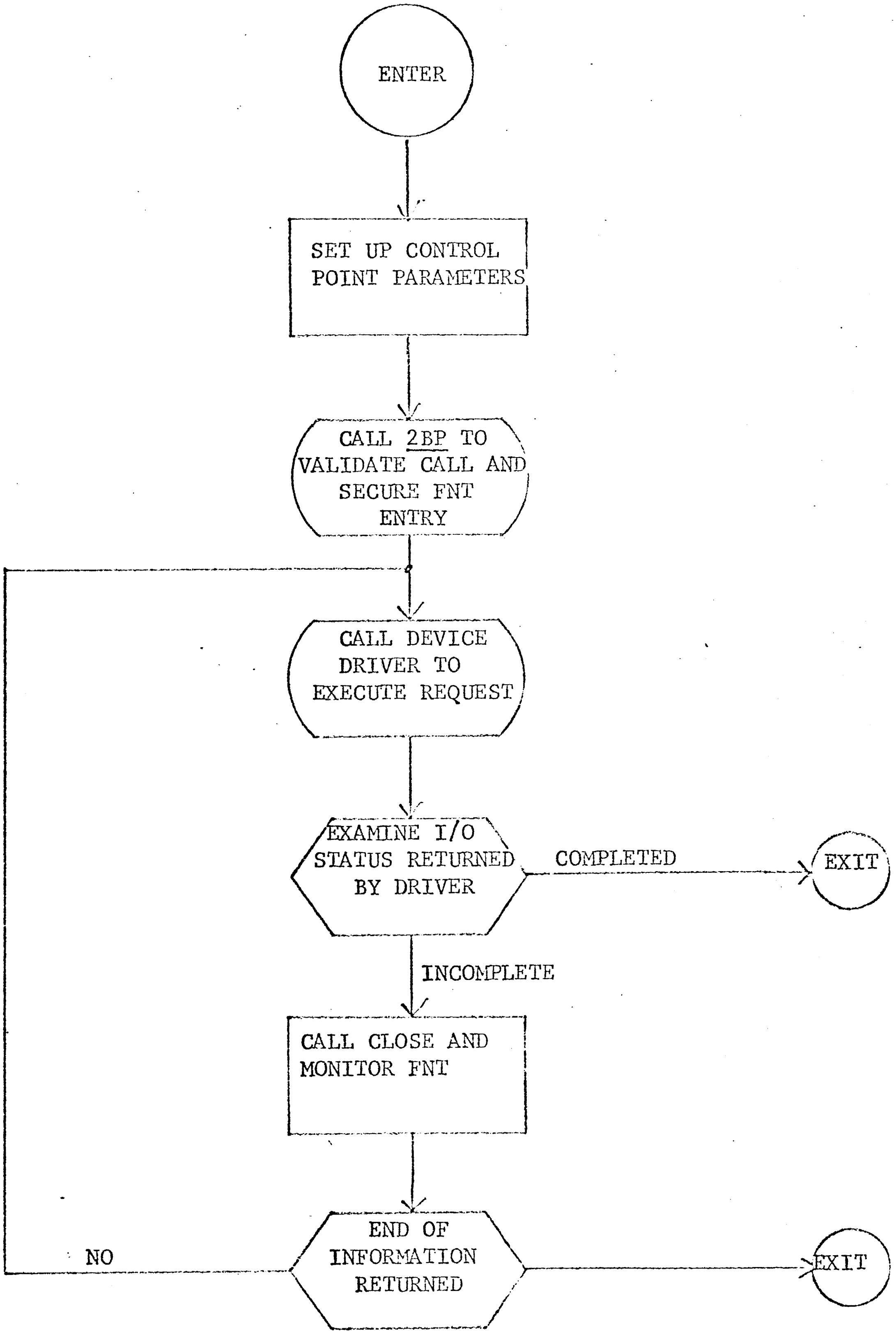
ABSOLUTE OVERLAY

50	00	L1	L2	LOAD ADDRESS	ENTRY ADDRESS

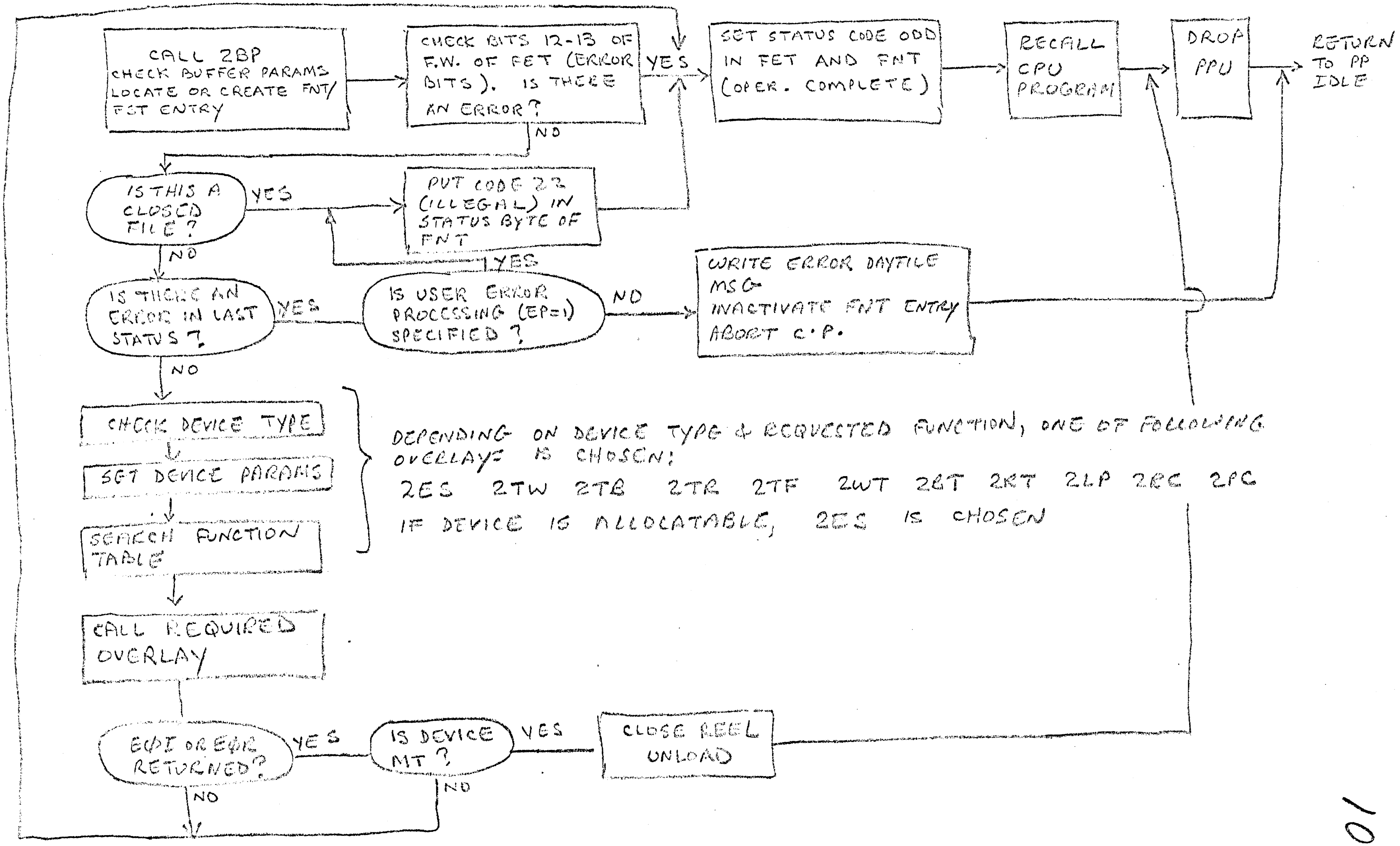
words 2 through end of logical record are absolute text

CI0 CIO

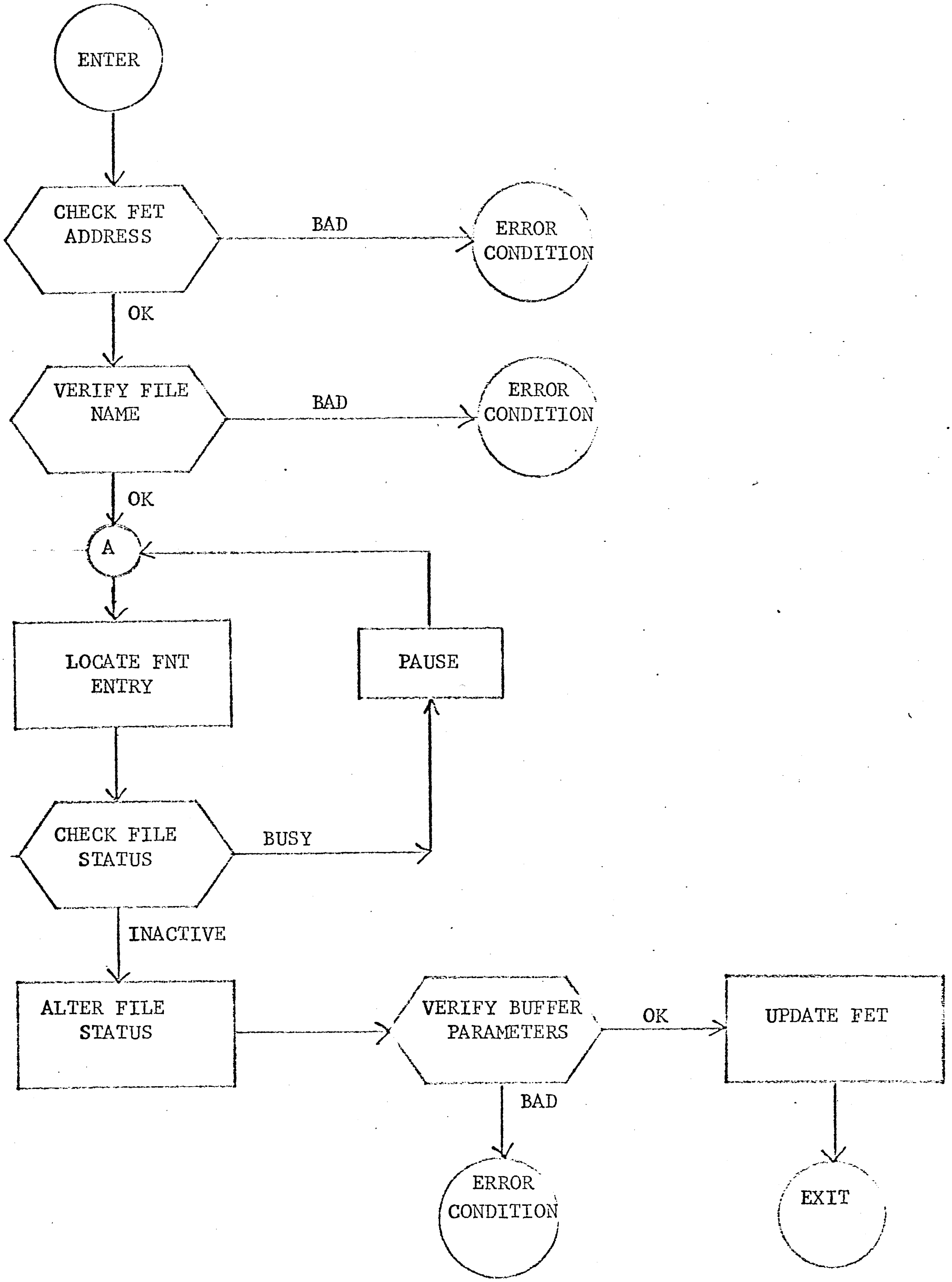
10-1


ENTER
SET UP CONTROL POINT PARAMETERS
CALL 2BP TO VALIDATE CALL AND SECURE FNT ENTRY
CALL DEVICE DRIVER TO EXECUTE REQUEST
EXAMINE I/O STATUS RETURNED BY DRIVER
COMPLETED
EXIT
INCOMPLETE
CALL CLOSE AND MONITOR FNT
END OF INFORMATION RETURNED
NO
EXIT

CIO (CIRCULAR I/O)



2BP


ENTER
CHECK FET ADDRESS
BAD
ERROR CONDITION
OK
VERIFY FILE NAME
BAD
ERROR CONDITION
OK
A
LOCATE FNT ENTRY
PAUSE
CHECK FILE STATUS
BUSY
INACTIVE
ALTER FILE STATUS
VERIFY BUFFER PARAMETERS
OK
UPDATE FET
BAD
ERROR CONDITION
EXIT

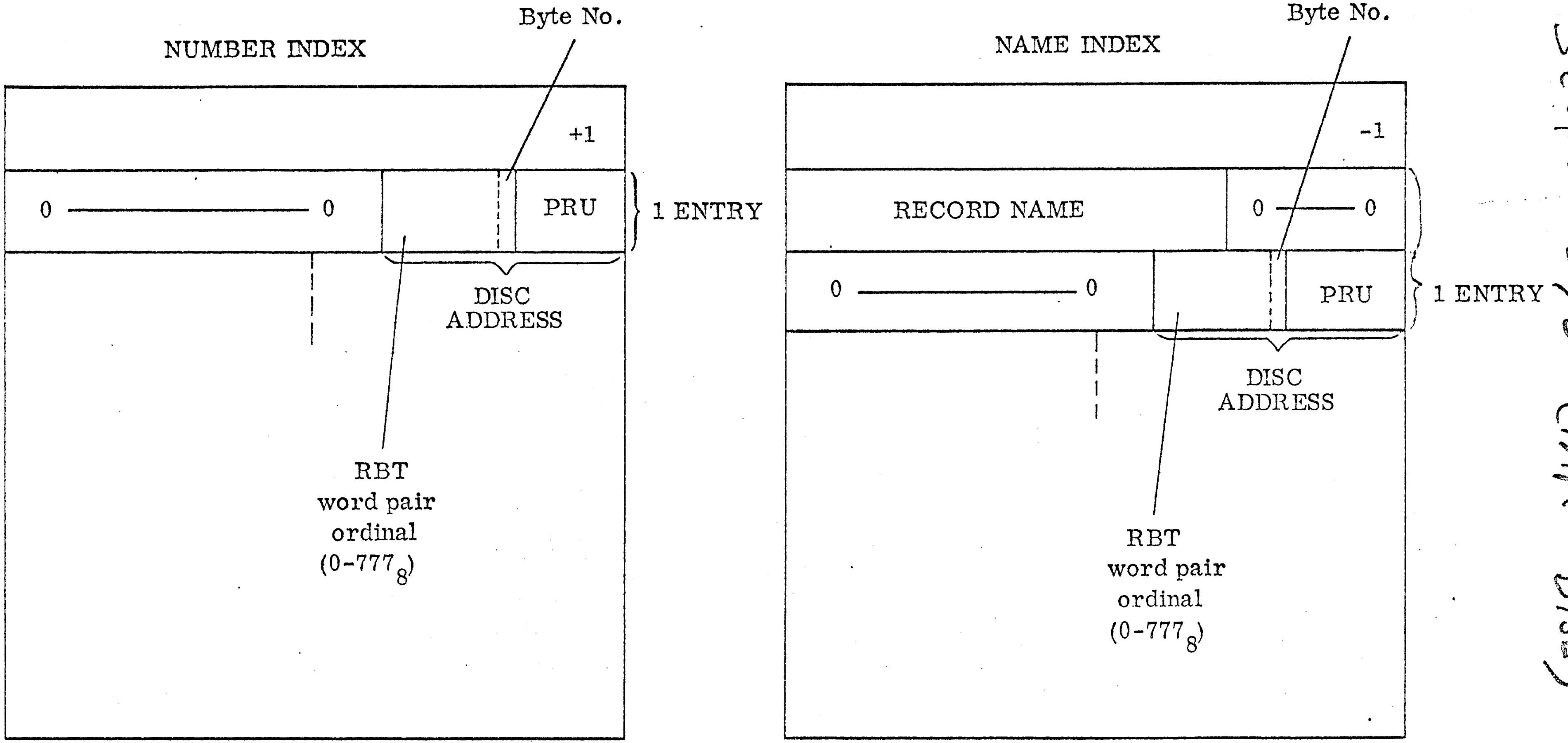
10-3

FILE ENVIRONMENT TABLE

Bits 59 47 44 35 32 29 23 17 0 Words

<table>
<tr><td colspan="10">logical file name (lfn)</td><td>code and status</td><td>1</td></tr>
<tr><td>device type</td><td>r</td><td>n</td><td>u
p</td><td>e
p</td><td></td><td colspan="3">disposition code</td><td>ℓ</td><td>FIRST</td><td>2</td></tr>
<tr><td colspan="10">0</td><td>IN</td><td>3</td></tr>
<tr><td colspan="10">0</td><td>OUT</td><td>4</td></tr>
<tr><td>FNT pointer</td><td colspan="6">record block size</td><td colspan="3">physical record unit size</td><td>LIMIT</td><td>5</td></tr>
<tr><td></td><td colspan="7">working storage fwa</td><td colspan="2"></td><td>working storage lwa+1</td><td>6</td></tr>
<tr><td colspan="8"></td><td colspan="3">record request/return information</td><td>7</td></tr>
<tr><td>record number</td><td colspan="7"></td><td colspan="2">index length</td><td>index address</td><td>8</td></tr>
<tr><td></td><td colspan="7">EOI address</td><td colspan="2"></td><td>error address</td><td>9</td></tr>
<tr><td colspan="11">Label file name (first 10 chars)</td><td>10</td></tr>
<tr><td colspan="11">Label file name (last 10 chars)</td><td>11</td></tr>
<tr><td>edition number</td><td colspan="8">retention cycle</td><td colspan="2">creation date</td><td>12</td></tr>
<tr><td colspan="5">position number</td><td colspan="4">multi-file name</td><td colspan="2">reel number</td><td>13</td></tr>
</table>

RANDOM ACCESS FILE INDEXES


NUMBER INDEX

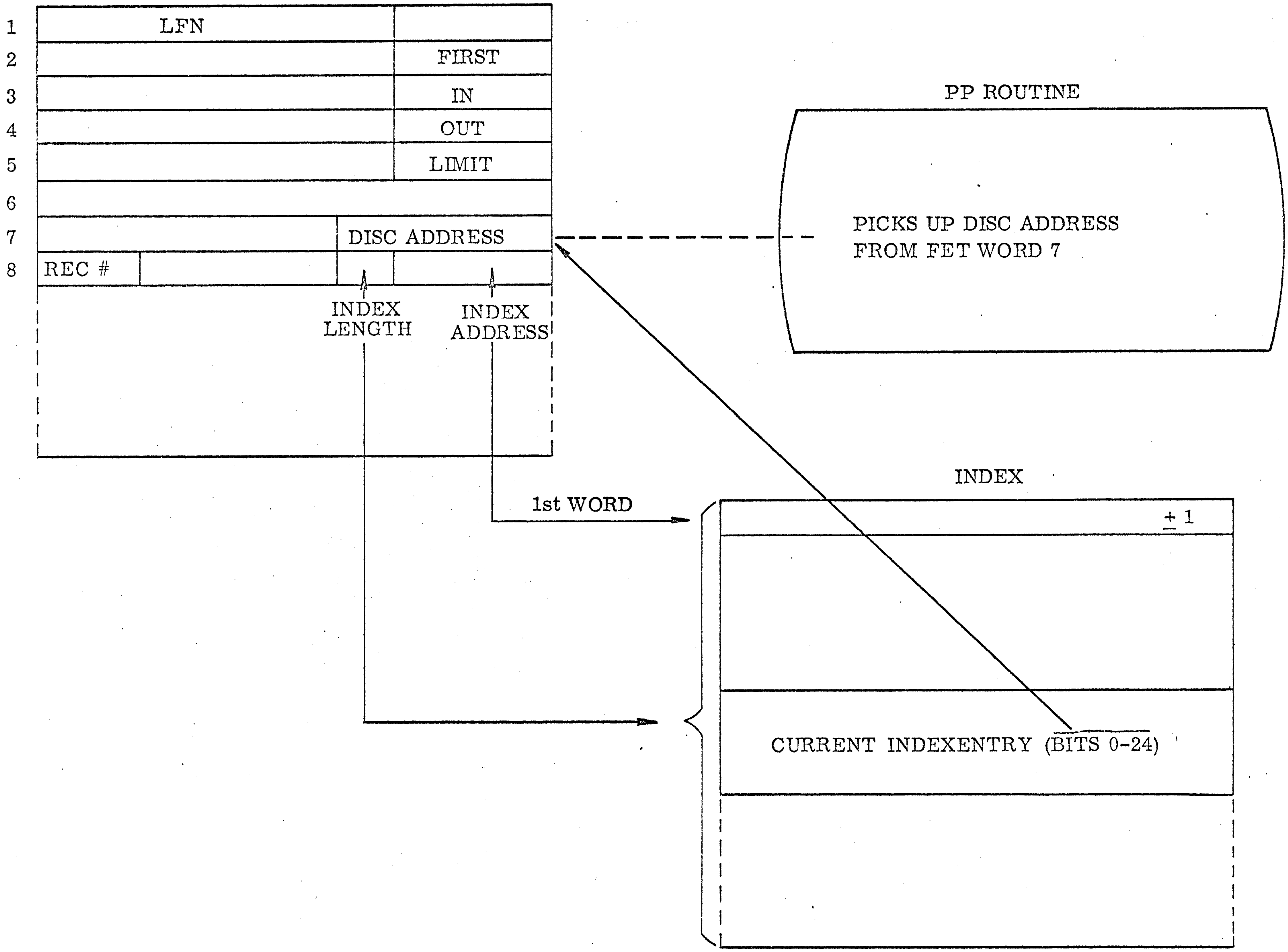
NAME INDEX

SCOPE I/O (TAPE + DISC)

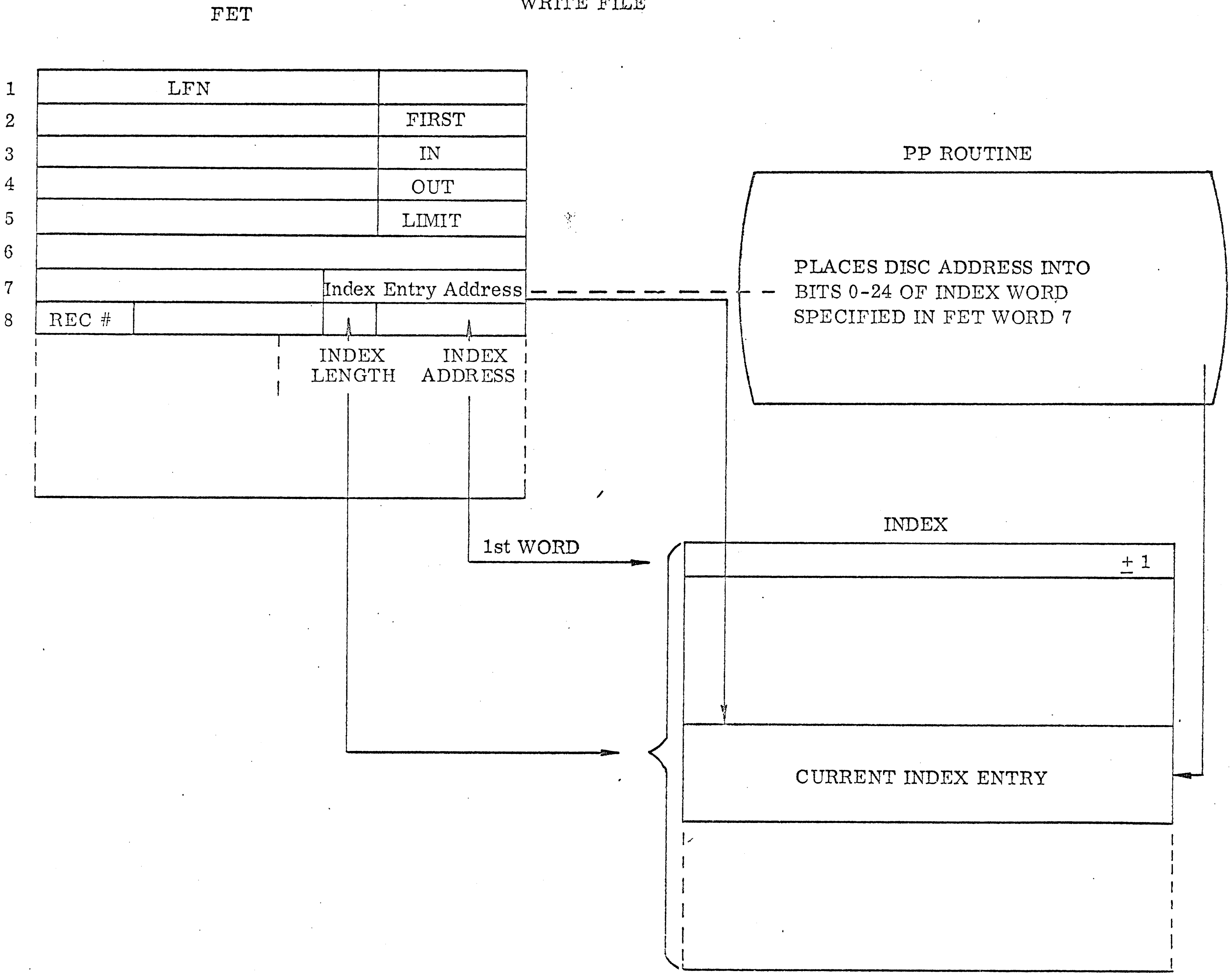
4

10-4

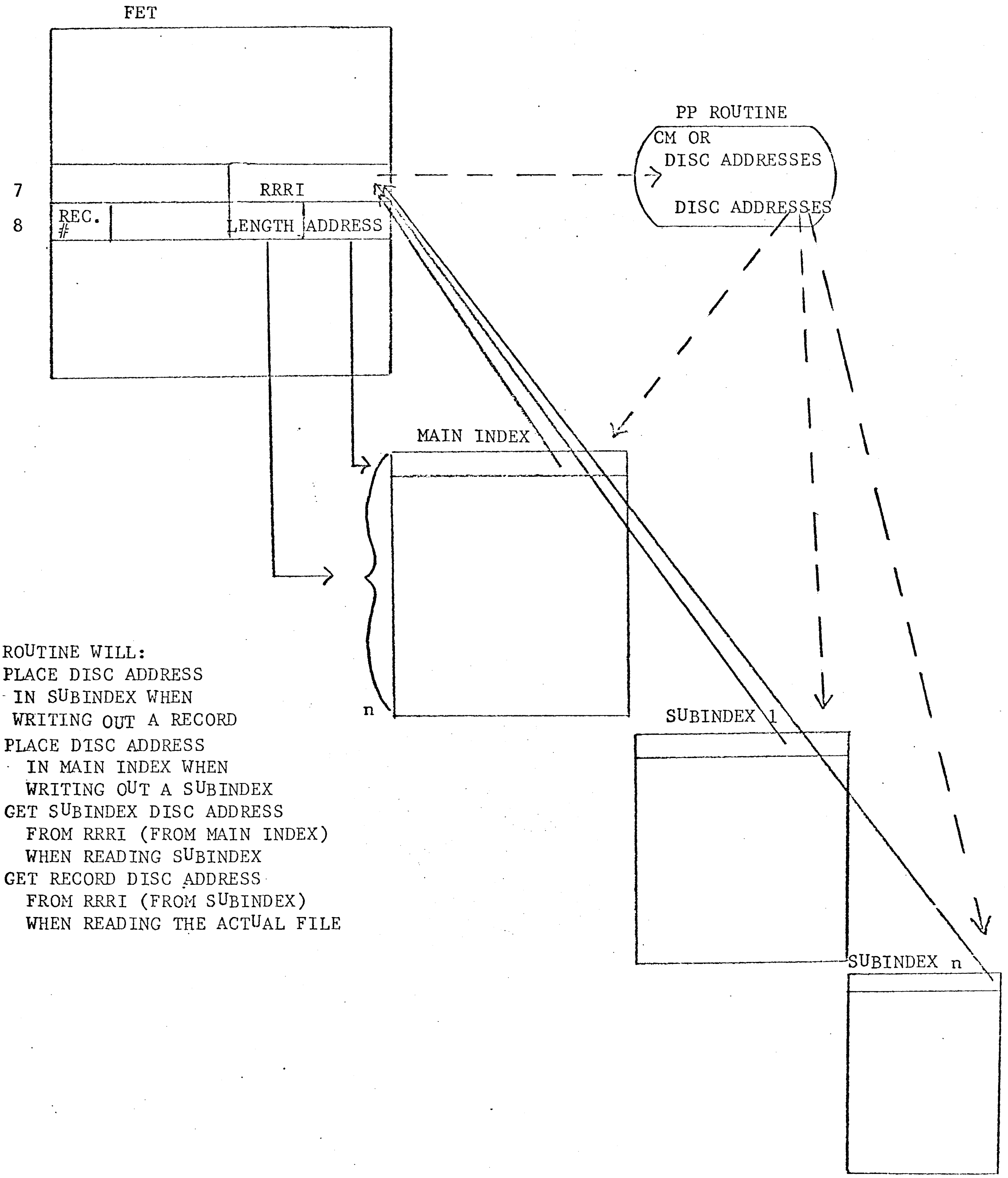
READ FILE


1
2
3
4
5
6
7
8
LFN
FIRST
IN
OUT
LIMIT
DISC ADDRESS
REC #
INDEX LENGTH
INDEX ADDRESS
PP ROUTINE
PICKS UP DISC ADDRESS
FROM FET WORD 7
INDEX
1st WORD
± 1
CURRENT INDEXENTRY (BITS 0-24)

WRITE FILE


FET
1
LFN
2
FIRST
3
IN
4
OUT
5
LIMIT
6
7
Index Entry Address
8
REC #
INDEX LENGTH
INDEX ADDRESS
PP ROUTINE
PLACES DISC ADDRESS INTO BITS 0-24 OF INDEX WORD SPECIFIED IN FET WORD 7
1st WORD
INDEX
± 1
CURRENT INDEX ENTRY

MULTI INDEX



PP ROUTINE WILL:
- PLACE DISC ADDRESS IN SUBINDEX WHEN WRITING OUT A RECORD
- PLACE DISC ADDRESS IN MAIN INDEX WHEN WRITING OUT A SUBINDEX
- GET SUBINDEX DISC ADDRESS FROM RRRI (FROM MAIN INDEX) WHEN READING SUBINDEX
- GET RECORD DISC ADDRESS FROM RRRI (FROM SUBINDEX) WHEN READING THE ACTUAL FILE

MAJOR TAPE ROUTINES

CIO:	GENERAL CHECKING AND ROUTING ROUTINE FOR ANY INPUT/ OUTPUT REQUEST.
2TR:	READ DRIVER FOR ½" MAGNETIC TAPE TRANSPORTS.
2TW:	WRITE DRIVER FOR ½" MAGNETIC TAPE TRANSPORTS.
2TB:	POSITION BACKWARD ROUTINE FOR ½" MAGNETIC TAPE.
2TF:	POSITION FORWARD ROUTINE FOR '" MAGNETIC TAPE.
4LB:	READ AND WRITE ROUTINE FOR ½" MAGNETIC TAPE WHICH PROCESSES LABEL INFORMATION.
OPEN:	GENERAL FILE INITIALIZING ROUTINES. FOR LABELED TAPES, OPEN CALLS THE APPROPRIATE ROUTINES TO POSITION TAPE AND READ OR WRITE LABELS.
CLOSE:	GENERAL FILE TERMINATING ROUTINE. FOR LABELED TAPES, CLOSE CALLS THE APPROPRIATE ROUTINES TO POSITION TAPE AND READ OR WRITE LABELS.

NOTES:

DIFFERENCE IN PHYSICAL AND LOGICAL TAPE MARKS

	HOW WRITTEN	HOW RECORDED	WHEN WRITTEN	ACTION ON READING
PHYSICAL EOF (TAPE MARK)	DEVICE FUNCTION	1 CHAR. 17_8 EVEN PARITY and 6" gap	IN CONJUNCTION WITH TAPE LABEL [before & after]	EOI & EOF RETURNED TO CIO
LOGICAL EOF	DATA WRITE	8 CHAR. BIN | BCD 0000 | 2020 0000 | 2020 0017 | 2017	WRITEF	SETS EOF BITS IN CODE & STATUS

SINGLE REEL FILE

VOL1
HDR1
TAPE MARK
DATA
TAPE MARK
EOF1
TAPE MARK
TAPE MARK

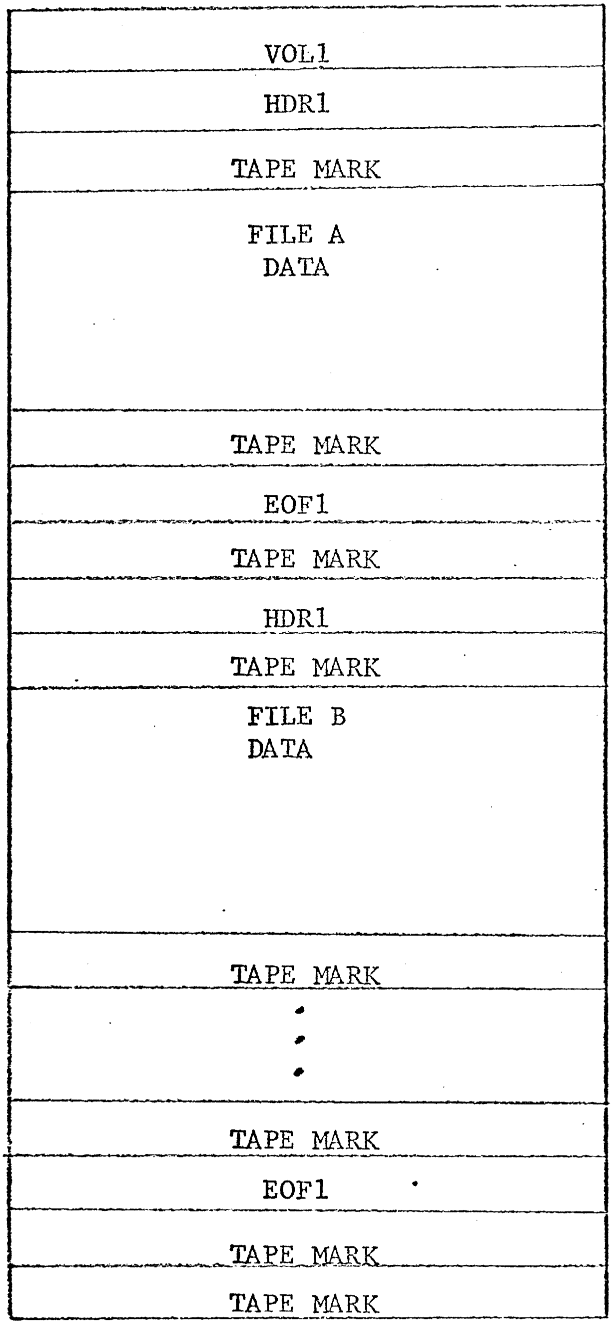
MULTI-REEL FILE

VOL1
HDR1
TAPE MARK
FIRST VOLUME DATA
TAPE MARK
EOV1
TAPE MARK
TAPE MARK

•
•
•

VOL1
HDR1
TAPE MARK
LAST VOLUME DATA
TAPE MARK
EOF1
TAPE MARK
TAPE MARK

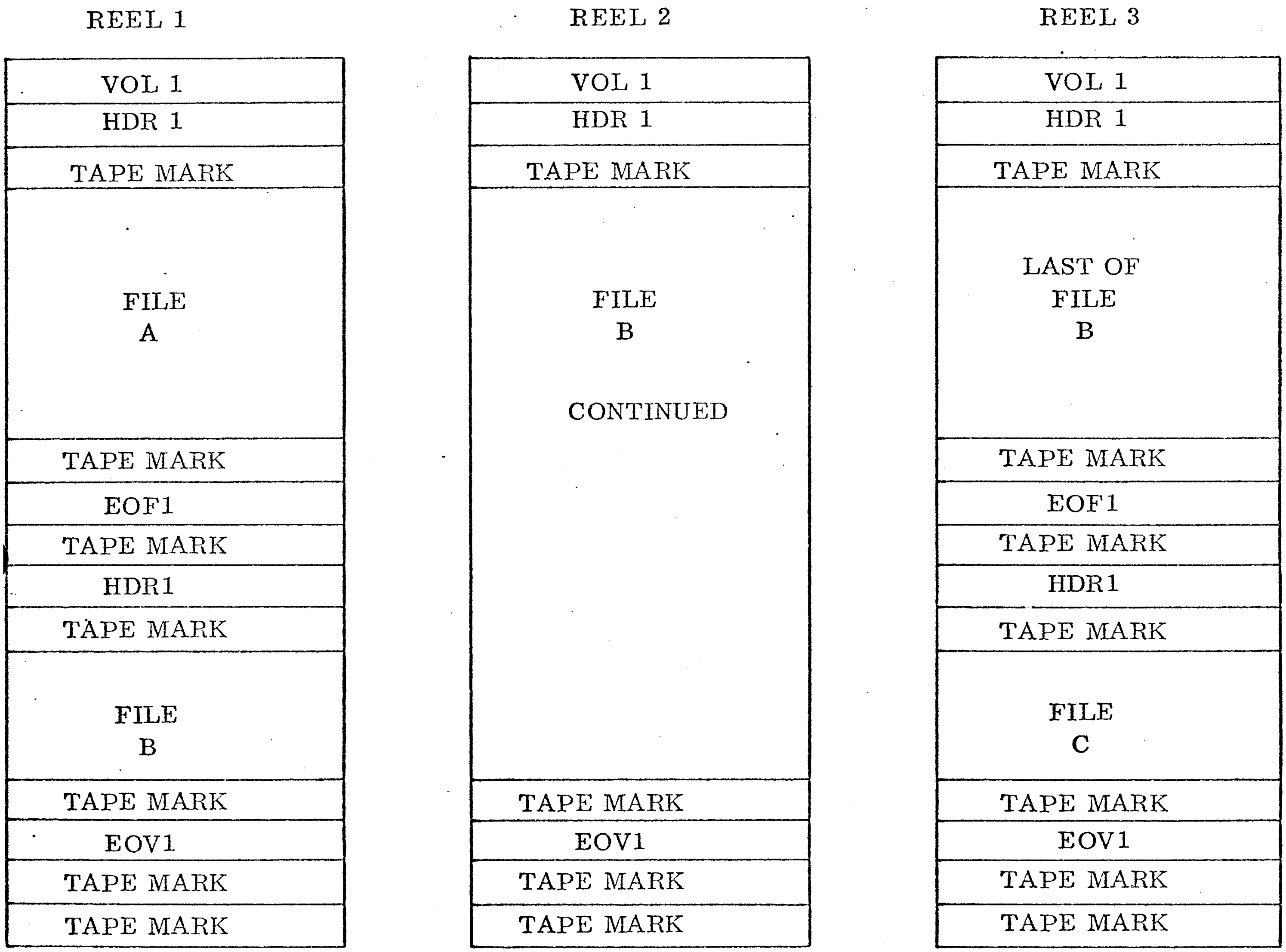
MULTI-FILE REEL



NOTES:

10-12

MULTI-REEL MULTI-FILE



LABELS - 80 CHARACTERS

VOLUME HEADER LABEL

3 CHAR.	1 CHAR.	6 CHAR.	1 CHAR.	1 CHAR.	60 CHAR.
V O L	1	VISUAL REEL NUMBER (VRN)	BLANK NON BLANK	BLANK 0 1 2	19 SPACES FOR OPERATING SYSTEM 49 SPACES FOR FUTURE STAN.
LABEL IDENT.	LABEL NUMBER		SECURITY	DENSITY	

FILE HEADER LABEL

1 3 CHAR.	1 CHAR.	20 CHAR.
H D R	1	FILE LABEL NAME
LABEL IDENTIFIER LABEL		

21	25 3 CHAR.	28 4 CHAR.	32 4 CHAR.	36 3 CHAR.	
	MULTI FILE IDENTIFICATION (MFN)	REEL NUMBER	MULTI-FILE POSITION NUMBER	RESERVED "SPACES"	ED. NO.

41	42	43 5 CHAR.	48	49 5 CHAR.	54	55 6 CHARS.
		CREATION DATE YYDDD		EXPIRATION DATE YYDDD		BLOCK COUNT "ZEROS"
	"SPACE"		"SPACE"		SECURITY	

61	20 CHARACTERS
RESERVED FOR FUTURE STANDARDIZATION "SPACES"	

10-14

FILE AND VOLUME TRAILER LABELS

1 3 CHAR	1 CHAR.	20 CHAR. 20
EOF or EOV	1	FILE LABEL NAME →

LABEL IDENTIFIER LABEL #

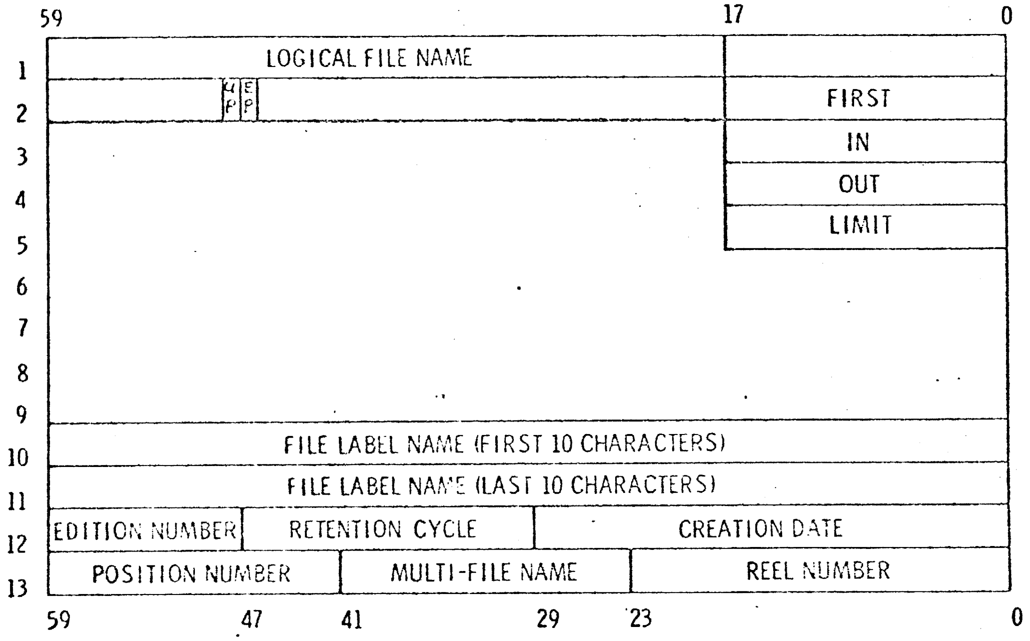
21	25 3 CHAR.	28 4CHAR.	36 3CHAR.		40
→	MULTI FILE IDENTIFICATION (MFN)	REEL NUMBER	MULTI FILE POSITION NUMBER	RESERVED "SPACES"	ED. NO.

41	42	43 5 CHAR.	48	49 5 CHAR.	54	55 6 CHAR. 60
→	SPACE	CREATION DATE YYDDD	SPACE	EXPIRATION DATE YYDDD	SECURITY	BLOCK COUNT NON ZERO = PRU COUNT

61 20 CHARACTERS 80
← RESERVED FOR FUTURE STANDARDIZATION → "SPACES"

10-15

FET TAPE LABEL INFORMATION



7-23 → 7-25

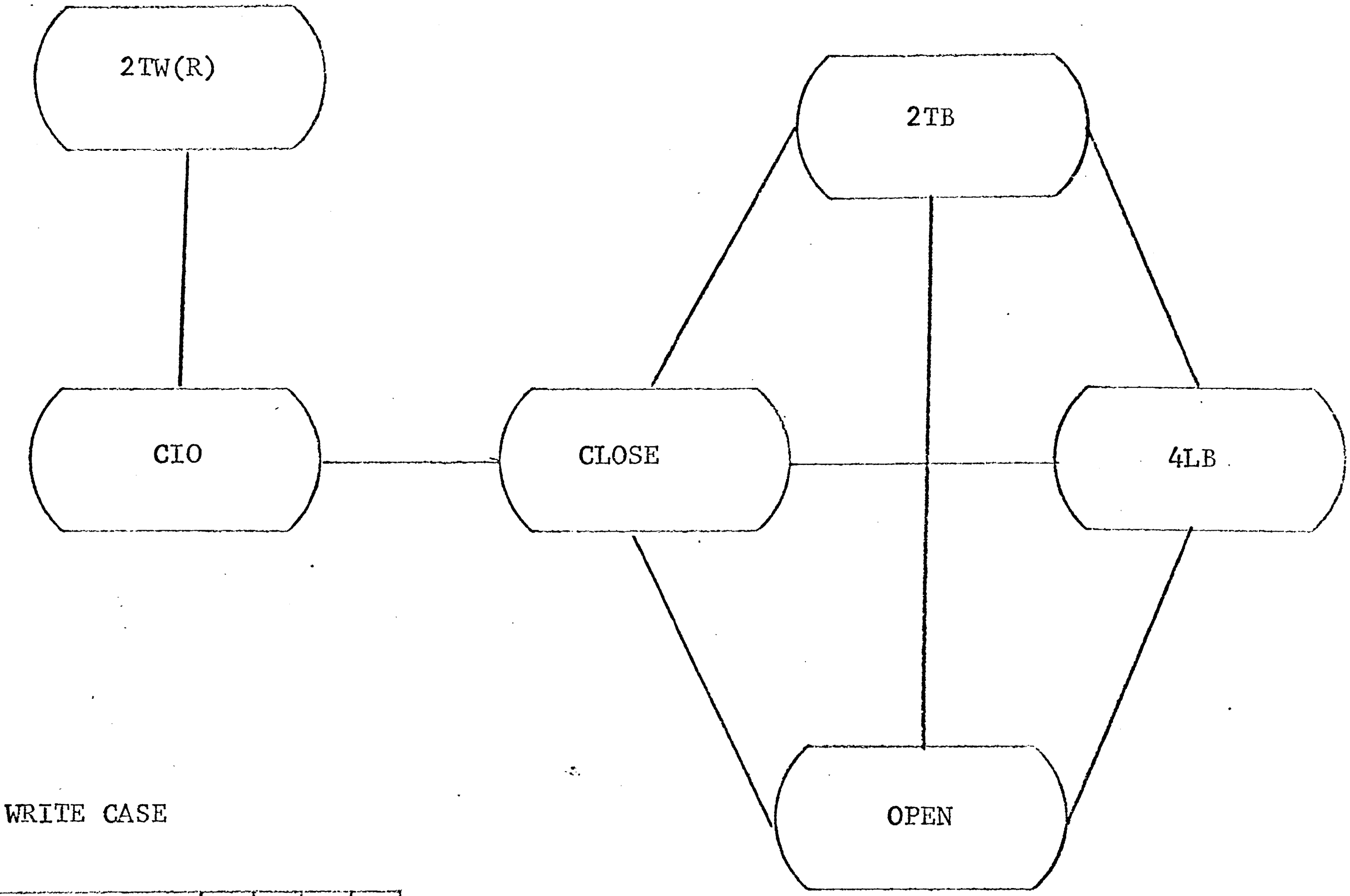
LABEL REQUESTS

REQUEST, LFILE, N, 2LD

REQUEST, MFI, MF, N.

[redacted]
10-16

END OF TAPE PROCESSING



A. WRITE CASE

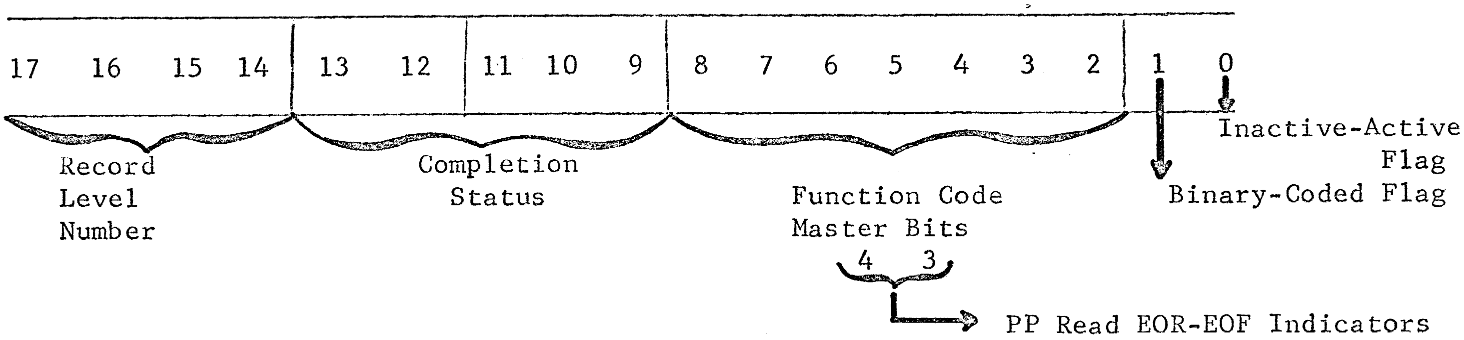
LABELLED TAPE	Y	N	Y	N
UP BIT SET	N	N	Y	Y
	1	2	3	4

B. READ CASE

LABELLED TAPE	Y	N	Y	N
UP BIT SET	N	N	Y	Y
	5	6	7	8

FET-FNT

Code & Status



COMPLETION STATUS (BITS 9-13)

01 = EOI on For. or Back. Read
02 = End-of-Reel on For. or Back. Operation when up bit is set.
04 = Unrec. parity error
10 = Device of buffer capacity exceeded.
20 = Open function redundant
21 = Close function redundant
22 = Illegal function
23 = Index full
24 = FNT full

ADDITIONAL STACK

ORDER CODES

02 = Read-CM-Program (3 wrds lost)
10 = PP Read
11 = PP Overlay Read
14 = PP Write No EOR
15 = PP WRite EOR
17 = Release Chain

FUNCTION CODE (Bits 0 — 8)	Bits 2 — 8	Stack Order Code
*00X = Illegal	00-01	--
*010 = Read	02	00
*014 = Write	03	04
020 = Read-Skip	04	01
*024 = Write-EOR	05	05
*034 = Write EOF	07	05
*040 = Backspace	10	13
044 = Backspace PRU	11	16
*050 = Rewind	12	
*054 = Rewind	13	
*060 = Unload	14	
*064 = Unload	15	
100 = Open	20	
114 = Evict	114	
240 = Skip-For.	50	12
640 = Skip-Back.	150	13

INACTIVE-ACTIVE (BIT 0)

*0 = Active
*1 = Inactive

BINARY-CODED (BIT 1)

*0 = Coded
*1 = Binary

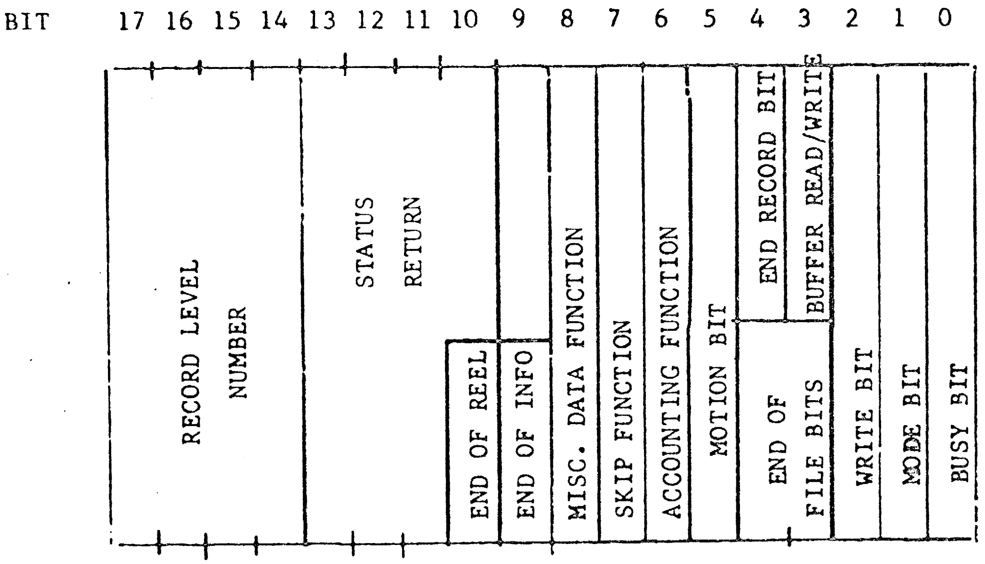
PP READ (BITS 3-4)

*10 = EOR Read
*11 EOF Read

* Identical Meaning in Scope 2.0

2.0/3.0 CIO operation code comparison

CODE	2.0 USAGE	3.0 USAGE	3.0 SYSTEM MACRO FORM	
00	NOT USED	READ PHYSICAL REC.	RPHR	LFN,RECALL
04	NOT USED	WRITE PHYSICAL REC.	WPHR	LFN,RECALL
10	READ	READ	READ	LFN,RECALL
14	WRITE	WRITE	WRITE	LFN,RECALL
20	NOT USED	READ SKIP	READSKP	LFN,1,RECALL
24	WRITE RECORD	WRITE RECORD	WRITER	LFN,1,RECALL
30	SEARCH FILE FORW.	ILLEGAL		
34	WRITE END FILE	WRITE END FILE	WRITEF	LFN,RECALL
40	BACKSPACE	BACKSPACE	BKSP	LFN,RECALL
44	BACKSPACE	BACKSPACE PHYSICAL	BKSPRU	LFN,N,RECALL
50	REWIND	REWIND	REWIND	LFN,RECALL
60	UNLOAD	UNLOAD	UNLOAD	LFN,RECALL
114	NOT USED		EVICT	LTN,RECALL
130	SEARCH FILE FORWARD	ILLEGAL		
240	NOT USED	SKIP FORWARD	SKIPF	LFN,N,1,RECALL
640	NOT USED	SKIP BACKWARDS	SKIPB	LFN,N,1,RECALL



LAST CODE AND STATUS
Found in FET(1) and FNT/FST(3)

BIT	USE		SYMPTOM
0	BUSY BIT	0	BUSY
		1	FREE
1	MODE BIT	0	CODED
		1	BINARY
2	WRITE BIT	0	READ
		1	WRITE
3,4	END OF FILE BITS	0	NO EOF
		3	EOF
4	END OF RECORD BIT	0	NO EOR
		1	EOR
5	MOTION BIT	0	FORWARD
		1	REVERSE
6	ACCOUNTING BIT	0	NO OPEN/CLOSE
		1	OPEN/CLOSE ACTION
7	SKIP FUNCTION BIT	0	NO SKIP
		1	SKIP
9	END OF INFO BIT	0	NO EOI
		1	EOI

STATUS-OPCODE BREAKDOWN-3.0 CIO CALL

10	END OF TAPE BIT	0	NO END OF TAPE
		1	END OF TAPE
9-13	STATUS RETURN	04	UNRECOVERABLE PART
		10	CAPACITY ERROR
		20	OPEN REDUNDANT
		21	CLOSE REDUNDANT
		22	ILLEGAL FUNCTION
		23	INDEX FULL
		24	FNT FULL

6000 PROGRAMMING

14-1A

-EXAMPLES-

1. BASIC DECK STRUCTURE

2. SIMPLE FORTRAN JOB.

JOB CARD
REQUEST CARDS
COMPILE (OR ASSEMBLE) CARD(S)
EXECUTION CARDS
ERROR CONTROL CARDS
7-8-9
PROGRAM EXAMPLE (INPUT, OUTPUT)
.
.
.
.
END
7-8-9
DATA

7-8-9
6-7-8-9

SEE FOLLOWING EXAMPLES FOR FORTRAN AND ASSEMBLER RUNS.

FORTRAN CALL FOR A COMPASS SUBROUTINE

6000 SCOPE 3

12/18/67

COL 7

```
      ________
      ________
      ________
      ________
      ________
      CALL START (IFRØMW, ITØW, NUMW)
      ________
      ________
      ________
      STØP
      END
```

YOUR PROGRAM IN FORTRAN STATEMENTS

RETURN TO THIS STATEMENT

COL 7

PARAMETERS GO TO B1, B2, ---B6
IF # of PARAMETERS IS > 6, SPACE MUST BE LEFT BEFORE HEADER WORD DEFINITION, BUT AFTER THE ENTRY STATEMENT.

MUST MATCH

COL 11

```
          IDENT  WMØVE
          ENTRY  START
          (BSSZ  X)
          VFD    42/5LWMØVE, 18/3
START     BSSZ   1
          ____   (1ST INSTRUCTION)
          ____
          ____
          ____
          ____   (LAST INSTRUCTION)
          EQ     START
          END
```

COL 11

- GENERATE HEADER WORD
- RESERVE WORD FOR RETURN JUMP

YOUR SUBROUTINE IN COMPASS

- UNCONDITIONAL JUMP TO THE RETURN JUMP

IDENT AND END CARDS MUST BE IN COL 11, OTHERS DON'T HAVE TO BE.

DØN'T USE A TRANSFER ADDRESS ON THE END CARD BECAUSE IT WOULD TRANSFER CONTROL TO SUBROUTINE AT "START" AT END OF COMPILE/ASSEMBLER.

Dec 16, 1967
14-Dc

to run a Compass program on 6000 SCOPE 3 without using the Fortran compiler —

```
                     7
                     8
                     9     Col 11
                             ↓
(1st card) →               IDENT   NAME
                           ENTRY   MOVE       ← "PERIPH" CARD IF
                  MOVE     (1st instruction)     PROGRAM IS PP TYPE
                           —
                           —
                           —
                           |
                           |
                           |
                           |
                           —
                           —
                           —
                           (Last instruction) (NOT A "PS")
                           ENDRUN        (STORES "END" IN RA+1)
                 AREAB     DATA  47 -- etc
                           —
                           —
                           —
                           —
                           —      }  DATA, Common area, etc.
                           —
                           —
                           —
                           —
(Last card) →              END  MOVE    ← TERMINATE ASSEMBLER
                                          AND LOOKS FOR TRANSFER
                                          ADDRESS, (MUST HAVE)
                     7
                     8
                     9
```

CORE DUMPS AND RELATED DEBUGGING AIDS

Robert W. Bartlett

Control Data Corporation

When a program terminates abnormally, the SCOPE monitoring system provides a one page dump of information consisting of:

1. The contents of all 24 operating registers
2. The contents of 7 core memory locations whose addresses are in registers A1 thru A7
3. A 200B word dump of the 100B words before and after the core address where the error was detected
4. A variable number of words beginning at location 000000 which contain system information, including the names and buffer parameter addresses of all files referenced by the program.

Only in rare instances will the average applications programer be able to make use of items (3) and (4) in the above list. Rather, he should typically make use of the following tools:

A. Items (1) and (2) above
B. A core map of routines, entry points, and references
C. A compilation listing of applicable routines

The concerted use of these tools should allow the programer to pinpoint the FORTRAN statement that was executing when the error occurred. In addition, it is often possible to determine the current value of several variables used in the statement. From then on, the programer's intimate knowledge of his own program should allow him to deduce what combination of faulty input, or coding, or logic caused this particular error to occur at this particular place. Let us now discuss in greater detail what can be found in these three debug tools.

A. One page dump (Figure 4)

The 24 operating registers consist of:

8 address registers (A0 thru A7) - 18 bits each
8 increment registers (B0 thru B7) - 18 bits each
8 operand registers (X0 thru X7) - 60 bits each

The contents of the A registers should correspond to addresses of memory locations within the field length of the job. An address in an A register equal to or greater than the field length specified on the job card would normally be associated with a mode 1 arith error.

To the right of the A and B register contents on the dump is a list of contents of memory locations specified by the associated A registers. For example, the contents of memory location 123B referenced in address register A3 are listed as C(A3)= 1721 6000 0000 0000 0000.

The contents of the X registers correspond to the values of operands involved in arithmetic or alpha-numeric operations. The programer's eye should be trained to recognize the following error indications in the C and X lists.

+ Indefinite	1777	----	----	----	----
+ Infinity	3777	----	----	----	----
- Infinity	4000	----	----	----	----
- Indefinite	6000	----	----	----	----

B. Core map (Figure 3)

From the core map of the attached sample program (figure 1), we can learn the following things which are true of core maps in general.

The first two lines tell us that the job loaded between addresses 100B and 2060B and that storage for BLANK COMMON begins at 2056B and runs for a length of 2 words.

The table headed - PROGRAM----ADDRESS - tells us that program DMPREAD began loading at address 103B and subroutine SYSTEM began at address 1143B. To the right of this table are the names and beginning addresses of the labeled common blocks associated with each routine. For example, the labeled common block named BLOK loaded at address 100B preceeding the program (DMPREAD) that first declared it.

The table headed --ENTRY-----ADDRESS- tells us that program DMPREAD has an entry point named DMPREAD at address 104B. The remaining eight entry points all belong to subroutine SYSTEM since they all occur at locations greater than the loading address of SYSTEM at 1143B. They are:

Q8NTRY	at location	1144B
SYSTEM	at location	1307B
SYSTEMC	at location	1254B
SYSTEMP	at location	1302B
END	at location	1200B
STOP	at location	1227B
EXIT	at location	1221B
ABNORMAL	at location	1237B

In addition we notice that entry point Q8NTRY is referenced by location 105B found in DMPREAD and the entry point END is referenced by location 116B also found in DMPREAD. Since DMPREAD began loading location 103B, these calls are actually from relative address 2 and 13B in DMPREAD.

The table headed ---- UNSATISFIED EXTERNALS----- tells us that we forgot to load the subroutine SUB with this run. This subroutine is called from relative location 11B in DMPREAD, and the program would have quit on a mode 1 arith error at that point if other errors had not caused us to exit sooner.

C. Compilation listing (Figure 1)

The numbers along the left hand side of the compilation listing are the relative locations within the program at which the corresponding FORTRAN statements begin execution. For example, the set of machine language instructions necessary to perform the calculation AO = BO+CO**2 begins execution at relative location 6 in DMPREAD or at absolute location 111B in memory since DMPREAD begins at location 103B according to the core map.

On the page of information below the compilation listing is the following useful information. (Figure 2)

The list headed BLOCK NAMES AND LENGTHS tells us there are two common blocks associated with program DMPREAD. Block 01 is blank COMMON (the block name has been left blank) which is 2 words long, and block 02 is labeled COMMON which is 3 words long and is named BLOK.

The names and relative storage locations of variables used in program DMPREAD are:

AO at relative address 26B and absolute address 131B
C0 at relative address 25B and absolute address 130B
CO at relative address 01 in common block 02 and absolute address 101B
BO at relative address 01 in common block 01 and absolute address 2057B
BN, CN, and CP do not appear among the list of variables because they do not appear in any executable statement within the program.

Now that we know what can be found in core dumps, core maps, and compilation listings, let us see how they can be used together to find the source of error in the attached example. (Figure 1) But before we start let us list the three distinct arith errors that occur.

MODE1 Trying to reference an address that is equal to or greater than the field length.

MODE2 Trying to operate with an infinite operand (3777-------------------or 4000----------------)

MODE4 Trying to operate with an indefinite operand (1777-------------------or 4000----------------)

MODE3, MODE5, MODE6, MODE7 are algebraic combinations of these three i.e. MODE5 means MODE1 and MODE4.

Thus we will begin debugging by reading the DAYFILE message (figure 5) telling us that we have a MODE4 arith error at address 115B. Looking at the core map we see that program DMPREAD begins at location 103B and subroutine SYSTEM begins at address 1143B. Therefore, the error occurred in program DMPREAD and is in fact at relative address twelve in DMPREAD.

```
 000115B
-000103B
    =12B
```

If we now look at the listing for program DMPREAD, we see that location 12 corresponds on the processing of the END card. To escape from this dilemma, we must apply the following rule of thumb corrections to 6400 and 6600 addresses.

6600 Subtract 3 from error address
6400 Subtract 1 from error address

Then we find that the error occurred at relative address 7 while processing the FORTRAN statement AO=BO+CO**2.

000012B
-000003B
=7B

This is because the machine is looking ahead toward execution of future instructions before it discovers the error condition from the previous operation. Because of parallel operation the 6600 is looking further ahead than the serial operating 6400.

Now, knowing the logic of his program and the statement where the error showed up, the programer might be in a position to say to himself as follows:

> "The value of BO or CO must be indefinite since arith errors MODE1 thru 7 only occur during arithmetic operations on specious operands. But CO is equal to 3.0 and BO is equal to CO and both are good values. Oops - wait a minute there is a mispunch, BO = C0 and C0 is not previously defined on the left hand side of an arithmetic replacement statement. It is good that SETINDF (LRC programing manual, Q1.001) helped me to catch this mistake or there is no telling what answers I would have gotten on this or other machines."

In a longer program where the logic was not as easy to trace back, the debugging programer might go on to look at the register dumps for clues. Indeed, in our example we see that the contents of the memory locations referenced in address registers A1, A4, and A6 have the distinctive 1777 byte characteristic of indefinite operands.

```
C (A1) = Contents of 002057 = 1777 0000 0000 0000  0130B
C(A4) = Contents  of 000130 = 1777 0000 0000 0000  0130B
C(A6) = Contents of  000131 = 1777 0000 0000 0000  0000B
```

Making use of the core map and doing the familiar octal subtractions, we find that A4 and A6 are referencing the 25th and 26th locations in DMPREAD, and A1 is referencing the 01 element in BLANK COMMON.

A4	A6	A1
000130B	000131B	002057B
-000103B	-000 103B	002056B
=25B	=26B	=1B

Then looking at the list of variable assignments on the page below the compilation listing for DMPREAD, we see that

A1 is referencing BO - 000001C01
A4 is referencing C0 - 000025
A6 is referencing AO - 000026

By some thunderbolt technique we should soon discover that C0 is unwanted and undefined.

Final mention should be made of the use of a library routine called SETINDF as an aid in debugging this example. The control card SETINDF. placed after the RUN(S) and before LGO. Writes the indefinite indicator 1777 into the upper byte of every memory location from address 100B up to your field length. In addition, it writes each memory location's own address into the bottom half of each word. For example, core address 200B contains 1777 0000 0000 0000 0200B. Thus, when your program references a variable that has not been defined, the preset indefinite value will be used and should soon cause a MODE4 arith error to occur. An indefinite value caused by arithmetic operations of the machine will look like 1777 0000 0000 0000 0000B, i.e. the 1777 indefinite flag will be followed by all zeroes to the right. Thus, the telltale 130 in C(A4) and C(A1) should have sent us immediately looking for the undefined variable C0.

```
                PROGRAM DMPREAD(OUTPUT=1001)
000003          COMMON BN , BO
000003          COMMON /BLOK/ CN , CO , CP
000003          CO = 3.0
000005          BO = CO
000006          AO = BO+CO**2
000011          CALL SUB
000012          END
```

Figure 1 Compilation Listing of Sample Program

```
PROGRAM LENGTH INCLUDING I/O BUFFERS
001040
FUNCTION ASSIGNMENTS

STATEMENT ASSIGNMENTS

BLOCK NAMES AND LENGTHS
       -  000002    BLOK    -  000003
VARIABLE ASSIGNMENTS
AO     -  000026    BO      -  000001C01 CO      -  000001C02 CO      -  000025
START OF CONSTANTS
000014
START OF TEMPORARIES
000022
START OF INDIRECTS
000025
UNUSED COMPILER SPACE
006600
```

Figure 2 Program Information

```
CORE MAP  11.42.26. NORMAL              CONTROL                                           000100    002060    002056    000002
        ---TIMF---LOAD MODE --L1--L2-----TYPE---------------USER---+*---CALL-------------FWA LOAD--LWA LOAD--BLNK COMN--LENGTH--
        FWA LOADER  035045  FWA TABLES  034771
        -PROGRAM----ADDRESS-                    --LABELED---COMMON--
        DMPREAD     000103                                BLOK        000100
        SYSTEM      001143
        --ENTRY-----ADDRESS-                                        REFERENCES
        DMPREAD     000104
        QBNTRY      001144            DMPREAD     000105

        SYSTEM      001307

        SYSTEMC     001254
        SYSTEMP     001302
        END         001200            DMPREAD     000116

        STOP        001227

        EXIT        001221
        ABNORML     001237
        ----UNSATISFIED EXTERNALS-----                              REFERENCES
        SUB                                       000114
```

Figure 3 Core Map

```
DMPX.

 P     000000   A0   040000   B0   000000
 RA    073500   A1   002057   B1   000103   C(A1)=  1777  0000  0000  0000  0130
 FL    040000   A2   000117   B2   000002   C(A2)=  0000  0000  0000  0000  0027
 EM    070000   A3   000123   B3   001143   C(A3)=  1721  6000  0000  0000  0000
                A4   000130   B4   000000   C(A4)=  1777  0000  0000  0000  0130
                A5   000101   B5   035227   C(A5)=  1721  6000  0000  0000  0000
                A6   000131   B6   000000   C(A6)=  1777  0000  0000  0000  0000
                A7   000136   B7   000001   C(A7)=  0000  0000  0000  0000  1143
  X0   7777  7777  7777  7700  0000
  X1   1777  0000  0000  0000  0130
  X2   1723  4400  0000  0000  0000
  X3   1721  6000  0000  0000  0000
  X4   1777  0000  0000  0000  0130
  X5   1721  6000  0000  0000  0000
  X6   1777  0000  0000  0000  0000
  X7   1777  0000  0000  0000  0000
000014    00000 00000 00000 00000  000021→14071 70000 00000 00047          00000 00000 00000 22676  000025→00000 00000 00000 32357
000024    00000 00000 00000 00000  000031→11162 02524 00000 00021          00000 00000 00000 36767         00000 00000 00000 37015
000035    00000 00000 00000 40000         00000 00000 00000 00000  000055→00000 00000 00000 22676.         00000 00000 00000 00002
000057    00000 00000 00000 32300
000060    00000 00000 00000 00003  000062→00000 00000 00000 00000          00000 00000 00000 40000
000064    14071 70000 00000 00000         00000 00000 00000 02060          00034 77100 00000 00103         00000 00000 60000 35045
000070    14071 75700 00000 00000         05301 12457 55000 00000          22052 12505 23245 52401         20054 15610 11575 55522
000074    11145 62301 26052 42056         03040 35522 05051 45516          00000 00000 00000 40000         00000 00000 00000 00000
000100    17770 00000 00000 00100         17216 00000 00000 00000          17770 00000 00000 00102         04152 02205 01040 00101
000104    61100 00103 61200 00117         01000 01144 00000 00000          51300 00123 10630 46000         51600 00101 51400 00130
000110    10640 51600 02057 46000         51500 00101 40255 46000          51100 02057 30712 24007         51600 00131 46000 46000
000114    01000 40000 07000 00103         51300 00124 10730 46000          01000 01200 07000 00103         00000 00000 00000 00027
000120    00000 00000 00000 00000         00000 00000 00000 10000          17252 42025 24000 00111         17216 00000 00000 00000
000124    00000 00000 00000 00000  000126→17770 00000 00000 00126          17770 00000 00000 00127
000130    17770 00000 00000 00130         17770 00000 00000 00000          17252 42025 24000 00135         00000 00000 00000 00142
000136    00000 00000 00000 01143         00000 00000 00000 00000  000141→00000 00000 00000 10000         17770 00000 00000 00142
000143    17770 00000 00000 00143
000144    17770 00000 00000 00144         17770 00000 00000 00145          17770 00000 00000 00146         17770 00000 00000 00147
000150    17770 00000 00000 00150         17770 00000 00000 00151          17770 00000 00000 00152         17770 00000 00000 00153
000154    17770 00000 00000 00154         17770 00000 00000 00155          17770 00000 00000 00156         17770 00000 00000 00157
000160    17770 00000 00000 00160         17770 00000 00000 00161          17770 00000 00000 00162         17770 00000 00000 00163
000164    17770 00000 00000 00164         17770 00000 00000 00165          17770 00000 00000 00166         17770 00000 00000 00167
000170    17770 00000 00000 00170         17770 00000 00000 00171          17770 00000 00000 00172         17770 00000 00000 00173
000174    17770 00000 00000 00174         17770 00000 00000 00175          17770 00000 00000 00176         17770 00000 00000 00177
000200    17770 00000 00000 00200         17770 00000 00000 00201          17770 00000 00000 00202         17770 00000 00000 00203
000204    17770 00000 00000 00204         17770 00000 00000 00205          17770 00000 00000 00206         17770 00000 00000 00207
000210    17770 00000 00000 00210         17770 00000 00000 00211          17770 00000 00000 00212         17770 00000 00000 00213
000000    00040 00115 00000 00000         00000 00000 00000 00000          17252 42025 24000 00132         00000 00000 00000 00000
```

Figure 4 Core Dump

```
14.35.41. PTB1967. READ.
14.35.42. PTB1967. PP 000 SEC.
15.00.06. PTB1967. PTB1967.
15.00.06. PTB1967.                     LRC COMPUTER COMPLEX
15.00.06. PTB1967.
15.00.06. PTB1967. JOB,01,100,40000.        P9970,12234,2,
15.00.06. PTB1967. R W BARTLETT           ,  CDC     ,
15.00.07. PTB1967. RUN(S)
15.00.11. PTB1967. SETINDF.
15.00.11. PTB1967. LGO.
15.00.13. PTB1967. ARITH ERROR.
15.00.13. PTB1967. MODE = 4. ADDRESS = 000115
15.00.13. PTB1967. CP  000.106 SEC.
15.00.13. PTB1967. PP  002.453 SEC.
15.00.22. PTB1967. PRINT-PP 000 SEC.
06/01/67. - SCOPE 2.0 - LRC 6600 - B -05/17/67.
```

Figure 5 Dayfile

14-11

```
VER 1          SETINDF                                                 061067L006

                                                        IDENT       SETINDF
                                   000013      PROGRAM LENGTH

                                               BLOCKS

                          000000   000013      PROGRAM*   LOCAL

                                               ENTRY POINTS

                                                  000006 SETINDF

                                                        ENTRY       SETINDF
       000000   56620                            SET    SA6         B2
                     36661                              IX6         X6+X1
                          66221                         SB2         B2+B1
       000001   0723000000 +                            LT          B2,B3,SET
                          7170051604                    SX7         51604B
       000002   20752                                   LX7         42
                     56710                              SA7         B1
                          10644                         BX6         X4
                               54640                    SA6         A4
       000003   36661                                   IX6         X6+X1
                     54661                              SA6         A6+B1
                          36661                         IX6         X6+X1
                               54661                    SA6         A6+B1
       000004   36661                                   IX6         X6+X1
                     54661                              SA6         A6+B1
                          36661                         IX6         X6+X1
                               54661                    SA6         A6+B1
       000005   23052411160406000000                    VFD     42/0HSETINDF,18/0
       000006   46000                            SETINDF NO
                     6110000001                         SB1         1
                               76110                    SX1         B1
       000007   6120000005 +                            SB2         SETINDF-1
                          76220                         SX2         B2
                               64300                    SB3         A0
       000010   5140000000 +                            SA4         SET
                          74040                         SX0         A4
       000011   7140001777                              SX4         1777B
                          20460                         LX4         48
                               36642                    IX6         X4+X2
       000012   36440                                   IX4         X4+X0
                     0200000000 +                       JP          SET
       000013                                           END         SETINDF
```

14-13

6000 SCOPE 3

CREATE EDITSYM LISTING OF A SIMPLE PROGRAM

PAGE-1 →

TEST006

PAGE-2 →

TEST006

PAGE-3 IS BLANK

PAGE-4 →

EDITSYM CONTROL CARDS

*DECK,TRYIT

PAGE-5 THRU 8 ARE THE FOLLOWING PAGES.

PAGE-9 IS BLANK

PAGE-10 IS THE "IDENT TRY COMP" PAGE

PAGE-12 IS THE "CORE MAP"

PAGE-13 IS THE "DMPX"

PAGE-14 IS THE "DAYFILE"

```
EDITSYM LIST                                                                                      PAGE NO.     00001

          PROGRAM TRYIT(INPUT,OUTPUT)                                                      TRYIT00001
          COMMON I,J,K,L,M                                                                 TRYIT00002
          READ 10,I,J,K,L                                                                  TRYIT00003
       10 FORMAT(4(I5,/))                                                                  TRYIT00004
          CALL TEST(I,J,K,L,M)                                                             TRYIT00005
          PRINT 11,M                                                                       TRYIT00006
       11 FORMAT(1H1,I7)                                                                   TRYIT00007
          STOP                                                                             TRYIT00008
          END                                                                              TRYIT00009
               IDENT TRYCOMP                                                               TRYIT00010
               ENTRY TEST                                                                  TRYIT00011
               LIST L,R                                                                    TRYIT00012
               VFD 42/7LTRYCOMP,18/5      .GENERATE THE HES                                TRYIT00013
     TEST      BSSZ 1          .RESERVE A WORD FOR THR RETURN JUMP INSTRUCTION             TRYIT00014
               SA1 B1          .LOAD THE FIRST CONSTANT FRON I (B1)                        TRYIT00015
               SA2 B2                                                                      TRYIT00016
               SA3 B3                                                                      TRYIT00017
               SA4 B4                                                                      TRYIT00018
               IX5 X1-X2       .DIFF OF I AND J TO X5                                      TRYIT00019
               ZR X5,ADD       .JUMP TO K+L IF X5 IS ZERO                                  TRYIT00020
               PL X5,SUB       .JUMP TO K-L IF X5 IS POSITIVE                              TRYIT00021
               IX6 X4-X3       .SUB L-K                                                    TRYIT00022
               EQ STORE                                                                    TRYIT00023
     ADD       IX6 X3+X4       .ADD K TO L                                                 TRYIT00024
               EQ STORE                                                                    TRYIT00025
     SUB       IX6 X3-X4       .SUBTRACT K FROM L                                          TRYIT00026
     STORE     SA6 B5                                                                      TRYIT00027
               EQ TEST         .RETURN TO THE RETURN JUMP INSTRUCTIOM                      TRYIT00028
               END                                                                         TRYIT00029
```

```
                 PROGRAM TRYIT(INPUT,OUTPUT)                                    TRYIT00001

 000000  0               L00002
 000001  6110 L00002     L00001
         6120 C00001
 000002  0100 S00100

                 COMMON I,J,K,L,M                                               TRYIT00002
                 READ 10,I,J,K,L                                                TRYIT00003

 000003  6130 N00001
         6120 C00006
 000004  67202
         66100
 000005  0100 S00200     L00005
         0700 L00002
 000006  66200
         6110 V00001
 000007  0100 S00200
 000010  66200
         6110 V00002
 000011  0100 S00200
 000012  66200
         6110 V00003
 000013  0100 S00200
 000014  66200
         6110 V00004
 000015  0100 S00200
 000016  6110 77776
         0100 S00200

              10 FORMAT(4(I5,/))                                                TRYIT00004
                 CALL TEST(I,J,K,L,M)                                           TRYIT00005

 000017  6110 V00001
         6120 V00002
 000020  6130 V00003
         6140 V00004
 000021  6150 V00005
 000022  0100 S00300     L00007
         0705 L00002

                 PRINT 11,M                                                     TRYIT00006

 000023  6130 N00002
         6120 C00012
 000024  67202
         66100
 000025  0100 S00400     L00012
         0700 L00002
 000026  66200
         6110 V00005
 000027  0100 S00400
 000030  6110 77776
         0100 S00400

              11 FORMAT(1H1,I7)                                                 TRYIT00007
```

```
                STOP                                                 TRYIT00008
000031  5130 C00015
        10733
000032  0100 S00500    L00014
        0700 L00002
                END                                                  TRYIT00009
000033  5140 C00016
        10744
000034  0100 S00600    L00015
        0700 L00002
```

```
PROGRAM LENGTH INCLUDING I/O BUFFERS
004121
FUNCTION ASSIGNMENTS
STATEMENT ASSIGNMENTS
10       = 000044    11       = 000050
BLOCK NAMES AND LENGTHS
        = 000005
VARIABLE ASSIGNMENTS
I        = 000000C01 J        = 000001C01 K        = 000002C01 L        = 000003C01
M        = 000004C01
START OF CONSTANTS
000035
START OF TEMPORARIES
000053
START OF INDIRECTS
000055
UNUSED COMPILER SPACE
043600
```

```
VER 1.1   TRYCOMP                                                                   02/05/68      PAGE NO.      1
                                                          IDENT TRYCOMP                                          TRYITO
                                    000011     PROGRAM LENGTH

                                               BLOCKS

                          000000    000011     PROGRAM*    LOCAL

                                               ENTRY POINTS

                                                  000001 TEST

                                                          ENTRY TEST                                               TRYIT00011
                                                          LIST L,R                                                 TRYIT00012
          000000  24223103171520000005                    VFD 42/7LTRYCOMP,18/5     .GENERATE THE HES               TRYIT00013
          000001                                 TEST     BSSZ 1          .RESERVE A WORD FOR THR RETURN JUMP INSTRUCTION   TRYIT00014
          000002  56110                                   SA1 B1          .LOAD THE FIRST CONSTANT FRON I (B1)     TRYIT00015
                       56220                              SA2 B2                                                   TRYIT00016
                             56330                        SA3 B3                                                   TRYIT00017
                                   56440                  SA4 B4                                                   TRYIT00018
          000003  37512                                   IX5 X1-X2       .DIFF OF I AND J TO X5                   TRYIT00019
                       0305000006 +                       ZR X5,ADD       .JUMP TO K+L IF X5 IS ZERO               TRYIT00020
          000004  0325000007 +                            PL X5,SUB       .JUMP TO K-L IF X5 IS POSITIVE           TRYIT00021
                             37643                        IX6 X4-X3       .SUB L-K                                 TRYIT00022
          000005  0400000010 +                            EQ STORE                                                 TRYIT00023
          000006  36634                          ADD      IX6 X3+X4       .ADD K TO L                              TRYIT00024
                       0400000010 +                       EQ STORE                                                 TRYIT00025
          000007  37634                          SUB      IX6 X3-X4       .SUBTRACT K FROM L                       TRYIT00026
          000010  56650                          STORE    SA6 B5                                                   TRYIT00027
                       0400000001 +                       EQ TEST         .RETURN TO THE RETURN JUMP INSTRUCTIOM   TRYIT00028
          000011                                          END                                                      TRYIT00029

                                   053330      UNUSED STORAGE            20 STATEMENTS        4  SYMBOLS
```

```
VER 1.1   TRYCOMP                                                                02/05/68      PAGE NO.      2
                   SYMBOLIC REFERENCE TABLE

    ADD        0000006      PROGRAM*           000003
    STORE      0000010      PROGRAM*           000005,    000006
    SUB        0000007      PROGRAM*           000004
    TEST       0000001      PROGRAM*           000010
```

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```
CORE MAP *00.37.38.  NORMAL              CONTROL                                                 000100    010513    010506    000005
         ---TIME---LOAD MODE --L1--L2-----TYPE----------------USER---♦♦---CALL-------------FWA LOAD--LWA LOAD--BLNK COMN--LENGTH--
         FWA LOADER  074614  FWA TABLES  074403
         -PROGRAM-""-ADDRESS-                    --LABELED---COMMON--
         TRYIT       000100
         TRYCOMP     004221
         SYSTEM      004232                                SCOPE2      004232
         INPUTC      005207
         OUTPTC      006306
         SIO$        007640
         GETBA       010467
         --ENTRY--""-ADDRESS-                                        REFERENCES
         TRYIT       000101
         TEST        004222            TRYIT       000122

         QBNTRY      004233            TRYIT       000102

         SYSTEM      004433            INPUTC      005246    006117
                                       OUTPTC      006322    007451

         SYSTEMC     004400
         SYSTEMP     004426
         END         004324            TRYIT       000134

         STOP        004353            TRYIT       000132

         EXIT        004345
         ABNORML     004363            INPUTC      005247    006120
                                       OUTPTC      006323    007452

         INPUTC      005211            TRYIT       000105    000107    000111    000113    000115    000116

         KRAKER      005313
         OUTPTC      006310            TRYIT       000125    000127    000130

         KODER       006444
         BKSPRU.     010136
         FI7BAK.     010147
         POSFIL.     010205            OUTPTC      006340

         RDPRU.      010215
         DAT.        010237            INPUTC      005265    005233    005256
                                       OUTPTC      006362    006376    006343

         CIO1.       010103
         OPEN.       007642            SYSTEM      004704
                                       INPUTC      005231
                                       OUTPTC      006330

         SIO.        007755            INPUTC      005261
                                       OUTPTC      006375

         GETBA       010467            INPUTC      005217
                                       OUTPTC      006316

         ----UNSATISFIED EXTERNALS-----                              REFERENCES
```

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14-21

```
DMPX.

 P    000000   A0   000000   B0   000000
 RA   123200   A1   006271   B1   010475   C(A1)=   0000   0000   0000   0000   0000
 FL   100000   A2   000077   B2   010476   C(A2)=   0000   0000   0000   0000   0000
 EM   070000   A3   005263   B3   010477   C(A3)=   1116   2025   2400   0000   0000
               A4   000156   B4   010500   C(A4)=   0203   0000   0000   1000   0176
               A5   000173   B5   010501   C(A5)=   7777   7777   7777   7777   7777
               A6   006271   B6   000001   C(A6)=   0000   0000   0000   0000   0000
               A7   000162   B7   006252   C(A7)=   0000   0000   0000   0000   0004
 X0   7777   7777   7777   7777   7773
 X1   0000   0000   0000   0000   0000
 X2   0000   0000   0000   0000   0000
 X3   1116   2025   2400   0000   0000
 X4   7777   7777   7777   7700   0000
 X5   0000   0000   0000   0000   0000
 X6   0000   0000   0000   0000   0000
 X7   0000   0000   0000   0000   0004
000000     00011 00001 00000 00000    000001= 00000 00000 00000 00000
000004     00000 00000 00000 00000    000006→17252 42025 24000 00120
000010     00000 00000 00000 10000    000011= 00000 00000 00000 00000
000016     00000 00000 00000 00000    000020→04000 12227 00000 00000
000023     00000 00000 00000 31056    000025→22560 62000 01000 75410
000043     15112 32311 16070 00000
000044     55555 55555 55555 55555    000050→55555 55524 22311 12433
000053     23312 32405 30240 00000
000054     00000 00000 00000 00000    000055= 00000 00000 00000 31027
000060     00000 00000 00000 00004    000062→00000 00000 00000 00000
000064     14071 70000 00000 00000    000065= 00000 00000 00000 10502
000070     14071 75700 00000 00000    000071= 00000 00000 00000 00000


000002= 11162 02524 00000 00155    000003= 17252 42025 24000 02177
000007= 00000 00000 00000 00006
000014→00000 00000 00001 00000    000015= 14071 70000 00000 00000
000021= 14071 70000 00000 00047    000022= 02030 00000 00100 31027
000026= 00000 00000 00000 00000    000042→55051 60455 03012 20455

000051= 33333 54455 55555 50000    000052= 00000 00000 00000 00000

000056= 00000 00000 00000 00002    000057= 00000 00000 00000 75277
000063= 00000 00000 00001 00000
000066= 00074 40700 00000 00100    000067= 00000 00000 60000 74614
000076→00000 00000 00001 00000
```

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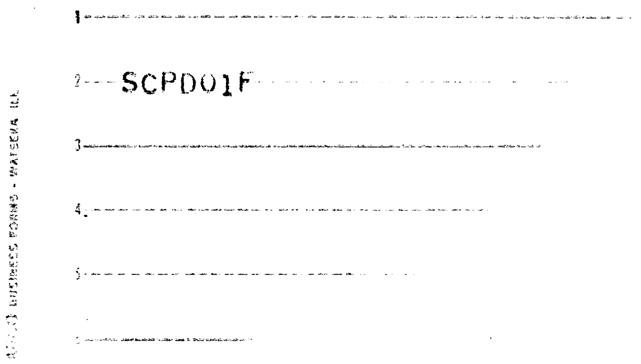
```
02/05/68  SCOPE V3.1 6500-00 131K 11/21/67
00.50.49.TEST006
00.50.49.TEST,P17,T100,CM100000.
00.50.49.EDITSYM(I,C,L,,NPL)      .GENERATE AN EDITSYM LISTING OF THE
00.50.49.PROGRAM
00.50.52.RUN(M,,,COMPILE)
00.51.03.LGO.
00.51.06.ARITH ERROR.
00.51.06.MODE = 1.  ADDRESS =100001
00.51.06.CP  005.159 SEC.
00.51.06.PP  014.537 SEC.
```

6000 SCOPE 3.1 – USING "UPDATE". 14-22

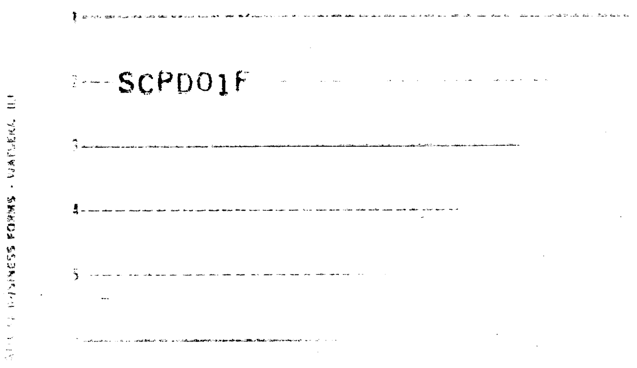
the following listing illustrates the results of using UPDATE to obtain an assembly of a system program for later modifications.

the 1st Page is –



SCPD01F

the 2nd Page is –



SCPD01F

the 3rd page is blank

the following pages are the 4th and on.

```
#[illegible]T,RAK                              02/08/68   PAGE [illegible]O.  00001
              #IDENT,RAK
              #COMPILE.MSG'
```

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```
CORRECTION IDENTIFIERS               02/08/68  PAGE   NO.  00002

              COMPILE  1SP1SQ   FNTSRCH  READPP   BUFINIT  RELOC
              PPTIME   COMCOMP  TRNCOM   TAPEDS   DISCDS   DUMPDS
              RECOV    PREPP    PRECP    STLPP    STLCP    CMR
              MTR      DSD      CIO      LDR      MSG      OPE
              1AJ      1BJ      1LJ      1OT      1SP      1SQ
              2BP      2DF      2ES      2TR      2TS      2TW
              7SD      ATS      CHK      CKP      CLL      CLO
              CLS      CPL      CTS      DIS      DMP      EXU
              LBC      LOC      LOD      MDI      MEM      PBC
              RBR      REQ      RFL      RST      SRB      TIM
              WBR      1BT      1CO      1CY      1OF      1EE
              1LT      1MF      1MR      1MW      1PL      1PO
              1RI      1RO      1SX      1TD      2BT      2CA
              2CF      2CJ      2EF      2LA      2LB      2LE
              2LP      2PC      2PC      2RT      2TB      2TF
              2TJ      2WT      3OT      4LB      5DT      7TP
              LOADER   OVERLOD  QXX      EDITLIB  EDITSYM  COPYBCD
              COPYL    CPC      IORANDM  IO       COMPARE  RESTART
              BKSP     COPY     COPYBF   COPYN    COPYSBF  REWIND
              UPDATE   CVRT     ACGOER   DBLE     EXP      GETBA
              IBAIEX   LEGVAR   LOCF     SINCOS   SNGL     SQRT
              SYSTEM   TAN      XRCL     ALNLOG   ASINCOS  ATAN
              ATAN2    BACKSP   BUFFEI   BUFFEO   CABS     CBAIEX
              CCOS     CEXP     CLOG     CSIN     CSQRT    DABS
              DATAN    DBADEX   DBAIEX   DEXP     DISPLA   DLNLOG
              DMOD     DSIGN    DSINCOS  DSQRT    DUMP     DVCHK
              ENDFIL   IDINT    IFENDF   INPUTB   INPUTC   INPUTN
              INPUTS   IOCHEC   IOCHEK   LENGTH   OUTPTB   OUTPTC
              OUTPTN   OUTPTS   OVERFL   OVERLAY  PAUSE    RANF
              RBAIEX   RBAREX   REMARK   REWINM   SCOPE2B  SECOND
              SEGMENT  SIO$     SLITE    SLITET   SSWTCH   START
              TANH     TIME     COMPASS  CVDEL    RUN      RUN1
              QBDIAGP  TRANS    SYSTEXT  SCOP31A  SCOP31B  IPARAMS
              SCPTEXT  SCOP31C  SCOP31E  SCOP31D  SERLO    87S0019
              86C0186  86S0351  86S0204  86S0248  86S0257  86S0259
              86S0275  86S0297  86S0393  86S0412  87S0445  86S0449
              87S0480  87S0481  87S0482  87S0483  87S0524  87S0525
              87S0527  86S0528  86S0529  86S0530  87S0531  86S0532
              86S0533  86C0534  86F0535  91S0025  91S0041  89S0123
              89S0253  89S0273  89S0365  91S0366  91S0402  89S0432
              89S0446  87S0456  89S0458  89S0485  86S0495  89S0541
              89S0550  87S0552  90S0582  89S0583  87S0588  87S0589
              87S0590  87S0592  89S0595  89S0597  89S0598  89S0605
              89S0607  89S0614  91S0664  91S0666  91S0667  91S0668
              91S0669  91S0671  91S0672  91S0674  91S0675  91S0676
              87F0333  87F0403  90F0466  86C0214  86C0217  86C0237
              86C0244  86C0263  86C0281  86C0314  87C0490  87C0567
              87C0568  87C0569  87C0580  91C0652  91C0663  91C0665
              94S0747  SYSALT   91S0670  RAK
```

```
DECK NAMES CURRENTLY KNOWN          02/08/68   PAGE   NO. 00003

          COMPILE   1SP1SQ    ENTSRCH   READPP    BUFINIT   RELOC
          PPTIME    COMCOMP   TRNCOM    TAPEDS    DISCDS    DUMPDS
          RECOV     PREPP     PRECP     STLPP     STLCP     CMR
          MTR       DSD       CIO       LDR       MSG       OPE
          1AJ       1BJ       1LJ       1OT       1SP       1SQ
          2BP       2DF       2ES       2TR       2TS       2TW
          7SB       ATS       CHK       CKP       CLL       CLO
          CLS       CPL       CTS       DIS       DMP       EXU
          LRC       LOC       LOD       MDI       MEM       PBC
          RBR       REQ       RFL       RST       SRB       TIM
          WBR       1BT       1CO       1CY       1DF       1EE
          1LT       1MF       1MR       1MW       1PL       1PU
          1RI       1RU       1SX       1TD       2BT       2CA
          2CF       2CJ       2EF       2LA       2LB       2LE
          2LF       2PC       2RC       2RT       2TB       2TF
          2TJ       2WT       3OT       4LB       5DT       7TP
          LOADER    OVERLOD   QXX       EDITLIB   EDITSYM   COPYBCD
          COPYL     CPC       IORANDM   IO        COMPARE   RESTART
          BKSP      COPY      COPYBF    COPYN     COPYSBF   REWIND
          UPDATE    CVRT      ACGOER    DBLE      EXP       GETBA
          IBAIEX    LEGVAR    LOCF      SINCOS    SNGL      SQRT
          SYSTEM    TAN       XRCL      ALNLOG    ASINCOS   ATAN
          ATAN2     BACKSP    BUFFEI    BUFFEO    CABS      CBAIEX
          CCOS      CEXP      CLOG      CSIN      CSQRT     DABS
          DATAN     DBADEX    DBAIEX    DEXP      DISPLA    DLNLOG
          DMOD      DSIGN     DSINCOS   DSQRT     DUMP      DVCHK
          ENDFIL    IDINT     IFENUF    INPUTB    INPUTC    INPUTN
          INPUTS    IOCHEC    IOCHEK    LENGTH    OUTPTB    OUTPTC
          OUTPTN    OUTPTS    OVERFL    OVERLAY   PAUSE     RANF
          RBAIEX    RBAREX    REMARK    REWINM    SCOPE2B   SECOND
          SEGMENT   SIO$      SLITE     SLITET    SSWTCH    START
          TANH      TIME      COMPASS   CVDEL     RUN       RUN1
          QBD1AGP   TRANS     SYSTEXT   IPARAMS   SCPTEXT   DSLCOM
          CPSYS
```

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```
#YANK,SCOP31E                                                    SERLO  00001
```

```
COMMON DECKS ENCOUNTERED                 02/08/68   PAGE    NO.  00005
          DSLCOM    IPARAMS   ISPISO    FNTSRCH   READPP    BUFINIT
          RELOC     PPTIME    COMCOMP   TRNCOM
```

(4-27)

```
LIST OF DECKS WRITTEN ONTO COMPILE FILE 02/08/68  PAGE  NO. 00006
          MSG
```

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```
                                       IDENT  MSG,C.PPFWA                                          MSG       00002
                      001157    PROGRAM LENGTH

                                BLOCKS

              000000  001157    PROGRAM*   ABSOLUTE
                                       PERIPH                                                      MSG       00003
                                *                                                                  MSG       00005
                                *      .         ***FUNCTION***                                    MSG       00006
                                *                                                                  MSG       00007
                                *      .MSG IS USED TO ENTER MESSAGES FROM A CENTRAL MEMORY PROGRAM MSG      00008
                                *      .INTO THE DAYFILE                                           MSG       00009
                                *                                                                  MSG       00010
                                *                                                                  MSG       00011
                                *                                                                  MSG       00012
                                *      .         ***REVISIONS***                                   MSG       00013
                                *                                                                  MSG       00014
                                *      .REVISION 1.                                                MSG       00015
                                *      .         8/2/66. TO PUT THE DAYFILE MESSAGE COUNTER IN     MSG       00016
                                *      .         MSG INSTEAD OF MTR.                               MSG       00017
                                *      REVISION 2. (M. C. STEELE)                                  MSG       00018
                                *                CONVERSION TO SCOPE 3.0                           MSG       00019
                                *                                                                  MSG       00020
                                *      .         ***ENTRY AND EXIT INFORMATION***                  MSG       00021
                                *      .ENTRY                                                      MSG       00022
                                *      .         BITS 0-17 OF RA+1 SPECIFY THE ADDRESS OF THE MESSAGE MSG    00023
                                *      .         TO BE ENTERED. BITS 24-35 SPECIFY WHETHER THE     MSG       00024
                                *      .         MESSAGE WILL BE ENTERED IN THE DAYFILE OR MERELY  MSG       00025
                                *      .         DISPLAYED ON THE SCOPE. IF THESE BITS ARE ZERO,MESS. MSG    00026
                                *      .         WILL BE ENTERED IN DAYFILE  NONZERO-JUST DISPLAYED. MSG     00027
                                *                                                                  MSG       00028
                                *      .EXIT                                                       MSG       00029
                                *      .         NONE                                              MSG       00030
                                *                                                                  MSG       00031
                                *                                                                  MSG       00032
                                *      .         ***REGISTER AND BUFFER FORMATTING***              MSG       00033
                                *                                                                  MSG       00034
                                *      .BITS 42-59 OF IR SPECIFY THE PROGRAM NAME,BITS 36-38 SPECIFY MSG     00035
                                *      .CONTROL POINT,BITS 24-35 SPECIFY WHETHER MESSAGE WILL BE   MSG       00036
                                *      .ENTERED INTO DAYFILE OR JUST DISPLAYED,BITS 0-17 SPECIFY   MSG       00037
                                *      .ADDRESS OF MESSAGE.                                        MSG       00038
                                *                                                                  MSG       00039
                                *      .MSG PLACES THE RECEIVED MESSAGE INTO THE MESSAGE BUFFER    MSG       00040
                                *                                                                  MSG       00041
                                *                                                                  MSG       00042
                                *                                                                  MSG       00043
                                       SST                                                         SCOP31C   00260
```

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```
1000                                    ORG     C.PPFWA                                         MSG      00046
1000    1401                            LDN     1                                               SCOP31A  00419
1001    3470                            STD     D.PPONE                                         SCOP31A  00420
1002    3075                            LDD     D.PPIR                                          SCOP31A  00421
1003    6050                            CRD     D.PPIRB         READ INPUT REGISTER             SCOP31A  00422
1004    3053                            LDD     D.PPIRB+3       OBTAIN ARGUMENT ADDRESS         MSG      00048
1005    1237                            LPN     37B                                             SCOP31A  00423
1006    3464                            STD     D.OUT                                           MSG      00049
1007    1014                            SHN     12                                              MSG      00050
1010    3154                            ADD     D.PPIRB+4                                       MSG      00051
1011    3465                            STD     D.OUT+1                                         MSG      00052
1012    0200 0634                       RJM     R.TFL           COMPARE TO FIELD LENGTH         MSG      00053
1014    0732                            MJN     MS3             SENSE ARGUMENT OUT OF BOUNDS    SCOP31A  00424
1015    6040                            CRD     D.BA            READ POSSIBLE INDIRECT ARGUMENT SCOP31A  00425
1016    3051                            LDD     D.PPIRB+1                                       MSG      00055
1017    1220                            LPN     20B                                             MSG      00056
1020    3462                            STD     D.IN            RECALL BIT                      MSG      00057
1021    0412                            ZJN     MSGA            NO RECALL,ARGUMENT DIRECT       MSG      00058
1022    3042                            LDD     D.BA+2                                          MSG      00065
1023    1377                            SCN     77B                                             MSG      00066
1024    1006                            SHN     6                                               MSG      00067
1025    3341                            LMD     D.BA+1                                          MSG      00068
1026    1006                            SHN     6                                               MSG      00069
1027    3465                            STD     D.OUT+1         REAL MESSAGE ADDRESS            MSG      00070
1030    1063                            SHN     -12                                             MSG      00071
1031    1237                            LPN     37B                                             SCOP31A  00426
1032    3464                            STD     D.OUT                                           MSG      00072
1033    1410                    MSGA    LDN     8                                               SCOP31A  00427
1034    3401                            STD     D.Z1            CM WORD COUNTER                 SCOP31A  00428
1035    3404                            STD     D.Z4                                            SCOP31A  00429
1036    2000 1155                       LDC     BUF-1                                           SCOP31A  00430
1040    3402                            STD     D.Z2            LOCAL BUFFER POINTER            SCOP31A  00431
1041    3064                    MS1     LDD     D.OUT           PICK UP A WORD OF THE MESSAGE   MSG      00079
1042    1014                            SHN     12                                              SCOP31A  00432
1043    3165                            ADD     D.OUT+1                                         MSG      00083
1044    0200 0634                       RJM     R.TFL                                           SCOP31A  00433
1046    0732                    MS3     MJN     MS4             SENSE ADDRESS OUT OF RANGE (STEP) SCOP31A  00434
1047    6170 1156               MS3A    CRM     BUF,D.PPONE     READ NEXT CM WORD OF MESSAGE    SCOP31A  00435
1051    1405                            LDN     5                                               SCOP31A  00436
1052    3403                            STD     D.Z3            BYTE COUNTER                    SCOP31A  00437
1053    5500 1050                       RAM     MS3A+1          ADVANCE BUFFER READ ADDRESS     SCOP31A  00438
1055    3002                    MS2     AOD     D.Z2            ADVANCE BYTE ADDRESS            SCOP31A  00439
1056    4002                            LDI     D.Z2                                            SCOP31A  00440
1057    1071                            SHN     -6                                              MSG      00088
1060    1760                            SBN     60B     .CHAR. ILLEGAL IF GREATER THAN 60       MSG      00089
1061    0617                            PJN     MS4                                             SCOP31A  00441
1062    4002                            LDI     D.Z2            TEST SECOND CHARACTER OF BYTE   MSG      00091
1063    1277                            LPN     77B                                             MSG      00092
1064    1760                            SBN     60B                                             MSG      00093
1065    0613                            PJN     MS4     .JUMP IF ILLEGAL                        MSG      00094
1066    3703                            SOD     D.Z3                                            SCOP31A  00442
1067    0505                            NJN     MS2             SENSE LESS THAN 5 BYTES PROCESSED SCOP31A  00443
1070    3701                            SOD     D.Z1                                            SCOP31A  00444
1071    0415                            ZJN     MS5             SENSE 40 BYTES PROCESSED        SCOP31A  00445
1072    4002                            LDI     D.Z2                                            SCOP31A  00446
1073    0453                            ZJN     MS3A            SENSE END OF MESSAGE-FILL WITH ZEROES SCOP31A  00447
1074    3665                            AOD     D.OUT+1                                         MSG      00102
```

```
      1075     1063                          SHN     -12                                           MSG     00103
      1076     3564                          RAD     D.OUT               IF NOT,GET ADDRESS OF NEXT WORD   MSG     00104
      1077                                   UJK     MS1                                           SCOP31A 00448
      1100     2000 1142         MS4         LDC     MSG1        .MESSAGE FORMAT ERROR             MSG     00113
      1102     0200 0650                     RJM     R.DFM        PROCESS DAYFILE MESSAGE          MSG     00114
      1104     1413              MS12        LDN     M.ABORT                                       MSG     00115
      1105     0322                          UJN     MS7         .ABORT CP                         MSG     00116
      1106     3052              MS5         LDD     D.PPIRB+2    IS THIS FOR DISPLAY ON SCOPE ONLY  MSG     00117
      1107     0524                          NJN     MS9         .YES, JUMP                        MSG     00118
      1110     2000 1156                     LDC     BUF                                           SCOP31A 00449
      1112     0200 0650                     RJM     R.DFM               OUTPUT DAYFILE MESSAGE    SCOP31A 00450
      1114     3062              MS10        LDD     D.IN                                          MSG     00123
      1115     0411                          ZJN     MS10A               NO RECALL                 MSG     00124
      1116     3644                          AOD     D.BA+4              SET COMPLETEION BIT FOR CPC   MSG     00125
      1117     3053                          LDD     D.PPIRB+3                                     MSG     00126
      1120     1237                          LPN     37B                                           SCOP31A 00451
      1121     1014                          SHN     12                                            SCOP31A 00452
      1122     3154                          ADD     D.PPIRB+4                                     MSG     00130
      1123     0200 0634                     RJM     R.TFL               RELOCATE ADDRESS          SCOP31A 00453
      1125     6240                          CWD     D.BA                TELL CPC                  MSG     00131
      1126     1412              MS10A       LDN     M.DPP                                         MSG     00132
      1127     0200 0450         MS7         RJM     R.PROCES            SEND REQUEST TO OUTPUT REGISTFR   MSG     00133
      1131     0100 0100                     LJM     R.IDLE              EXIT TO IDLE LOOP         MSG     00134
      1133     3051              MS9         LDD     D.PPIRB+1           EXTRACT CP NUMBER         SCOP31A 00454
      1134     1207                          LPN     L.CPNUM                                       SCOP31A 00455
      1135     1007                          SHN     7                                             SCOP31A 00456
      1136     1630                          ADN     W.CPDFM                                       MSG     00140
      1137     6304 1156                     CWM     BUF,D.Z4            WRITE MESSAGE FOR DISPLAY ONLY    SCOP31A 00457
      1141     0352                          UJN     MS10        .EXIT                             MSG     00142
                                 *                                                                 MSG     00143
      1142     1505              MSG1        DIS     ,*MESSAGE FORMAT ERROR.*                      MSG     00144
      1156     0000              BUF         DATA    0                                             MSG     00145
      1157                                   END                                                   MSG     00146

                    030274     UNUSED STORAGE          139 STATEMENTS       475  SYMBOLS
```

```
                  SYMBOLIC REFERENCE TABLE
      BUF        0001156                 001036,   001047,   001110,   001137
      CH.DMP     0000023
      CH.FNT     0000015
      CH.FST     0000014
      CH.LIB     0000016
      CH.RBT     0000017
      CP.ECSM    0002034
      CP.IDLE    0002000
      CP.JOBN    0002020
      CP.MOVE    0002000
      CP.SM      0002023
      C.CPAR     0000001
      C.CPECFL   0000004
      C.CPEF     0000001
      C.CPERT    0000004
      C.CPFL     0000004
      C.CPFP     0000003
      C.CPFST    0000002
      C.CPNCSP   0000004
      C.CPNUM    0000001
      C.CPOUT    0000003
      C.CPPRI    0000000
      C.CPRA     0000003
      C.CPSM     0000002
      C.CPSTAT   0000000
      C.CPTIML   0000002
      C.DFBMS    0000001
      C.DIRCMA   0000001
      C.DIRFWA   0000000
      C.DIRPRU   0000004
      C.DIRPTR   0000000
      C.DIRRBA   0000002
      C.DIRRBN   0000003
      C.DIRUNT   0000001
      C.FCIB     0000000
      C.FCPNUM   0000003
      C.FCS      0000003
      C.FDC      0000002
      C.FEQP     0000000
      C.FFRBA    0000001
      C.FLBL     0000003
      C.FLOCK    0000003
      C.FLPRU    0000004
      C.FLRBEB   0000003
      C.FLRBWP   0000002
      C.FNAME    0000000
      C.FPDEV    0000002
      C.FPRI     0000004
      C.FSC      0000003
      C.FSDEV    0000001
      C.FTYPE    0000003
      C.PPFWA    0001000                 000000
      C.PPSWA    0002000
      C.PPTWA    0003000
      C.PP4WA    0004000
      C.PP5WA    0005000
      C.PP7WA    0007000
```

```
C.RBRA      0000003
C.RBRAD     0000000
C.RBRLAV    0000003
C.RBRTPA    0000000
C.RBRUNT    0000001
C.RBTAL     0000002
C.RBTFB     0000001
C.RBTLPR    0000000
C.RBTLRB    0000004
C.RBTPRU    0000003
C.RBTRBR    0000001
C.RBTWPL    0000000
C.RQSCS     0000000
C.RQSFS     0000002
C.RSTA      0000002
C.RSTRA     0000001
C.RSTU      0000004
C.RSTWP     0000003
C.RWPPCC    0000003
C.RWPPCF    0000000
C.RWPPLW    0000002
C.RWPPST    0000003
C.RWPPWC    0000004
C.RWPPWI    0000001
C.STAICP    0000002
C.STCPU     0000004
C.STEI      0000004
C.STFB      0000003
C.STU       0000003
C.STPFW     0000002
C.STPLW     0000004
C.STPMS     0000001
C.STPPRU    0000002
C.STPRBA    0000000
C.STPRBN    0000001
C.STPWC     0000000
D.BA        0000040            001015,  001022,  001025,  001116,  001125
D.CPAD      0000074
D.DTS       0000037
D.EST       0000032
D.FA        0000057
D.FF0       0000050
D.FF1       0000051
D.FF2       0000052
D.FF3       0000053
D.FF4       0000054
D.FF5       0000055
D.FF6       0000056
D.FF7       0000057
D.FIRST     0000060
D.FL        0000056
D.FNT       0000020
D.FR0       0000040
D.FR1       0000041
D.FR2       0000042
D.FR3       0000043
D.FR4       0000044
```

```
                 SYMBOLIC REFERENCE TABLE

D.FR5      0000045
D.FR6      0000046
D.FR7      0000047
D.HN       0000071
D.IN       0000062                 001020,  001114
D.JECS     0000045
D.JFL      0000037
D.JPR      0000046
D.JTL      0000047
D.LIMIT    0000066
D.OUT      0000064                 001006,  001011,  001027,  001032,  001041,  001043,  001074,  001076
D.PPIR     0000075                 001002
D.PPIRB    0000050                 001003,  001004,  001010,  001016,  001106,  001117,  001122,  001133
D.PPMES1   0000077
D.PPONE    0000070                 001001,  001047
D.PPOR     0000076
D.RA       0000055
D.SV0      0000070
D.SV1      0000071
D.SV2      0000072
D.SV3      0000073
D.SV4      0000074
D.SV5      0000075
D.SV6      0000076
D.SV7      0000077
D.SX0      0000060
D.SX1      0000061
D.SX2      0000062
D.SX3      0000063
D.SX4      0000064
D.SX5      0000065
D.SX6      0000066
D.SX7      0000067
D.TH       0000072
D.TH0      0000030
D.TH1      0000031
D.TH2      0000032
D.TH3      0000033
D.TH4      0000034
D.TH5      0000035
D.TH6      0000036
D.TH7      0000037
D.TR       0000073
D.TW0      0000020
D.TW1      0000021
D.TW2      0000022
D.TW3      0000023
D.TW4      0000024
D.TW5      0000025
D.TW6      0000026
D.TW7      0000027
D.T0       0000010
D.T1       0000011
D.T2       0000012
D.T3       0000013
D.T4       0000014
D.T5       0000015
```

```
                    SYMBOLIC REFERENCE TABLE

      D.T6      0000016
      D.T7      0000017
      D.Z0      0000000
      D.Z1      0000001                        001034,   001070
      D.Z2      0000002                        001040,   001055,   001056,   001062,   001072
      D.Z3      0000003                        001052,   001066
      D.Z4      0000004                        001035,   001137
      D.Z5      0000005
      D.Z6      0000006
      D.Z7      0000007
      F.ERAR    0000002
      F.ERCP    0000004
      F.EROD    0000006
      F.ERPCE   0000005
      F.ERPP    0000003
      F.ERTL    0000001
      LE.FNT    0000003
      L.CPNUM   0000007                        001134
      L.PPHDR   0000005
      MSGA      0001033                        001021
      MSG1      0001142                        001100
      MS1       0001041                        001077
      MS10      0001114                        001141
      MS10A     0001126                        001115
      MS12      0001104
      MS2       0001055                        001067
      MS3       0001046                        001014
      MS3A      0001047                        001053,   001073
      MS4       0001100                        001046,   001061,   001065
      MS5       0001106                        001071
      MS7       0001127                        001105
      MS9       0001133                        001107
      M.ABORT   0000013                        001104
      M.AEQP    0000033
      M.CCPA    0000035
      M.CDF     0000011
      M.CPUST   0000036
      M.DCH     0000003
      M.DCP     0000016
      M.DEQP    0000023
      M.DFM     0000001
      M.DPP     0000012                        001126
      M.DTAPE   0000032
      M.EREQS   0000034
      M.NTIME   0000014
      M.OPDROP  0000030
      M.PAUSE   0000017
      M.PPTIME  0000004
      M.RCH     0000002
      M.RCLCP   0000021
      M.RCP     0000015
      M.REM     0000025
      M.REQP    0000022
      M.RPJ     0000037
      M.RPP     0000020
      M.RPRI    0000024
      M.RSTOR   0000010
```

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```
                  SYMBOLIC REFERENCE TABLE

    M.RTAPE   0000031
    M.SEF     0000030
    M.STEP    0000005
    N.CP      0000007
    OV.ATS    0012423
    OV.CHK    0031013
    OV.CIO    0031117
    OV.CKP    0031320
    OV.CLL    0031414
    OV.CLO    0031417
    OV.CLS    0031423
    OV.CPL    0032014
    OV.CTS    0032423
    OV.DIS    0041123
    OV.DMP    0041520
    OV.EXU    0053025
    OV.LBC    0140203
    OV.LDR    0140422
    OV.LOC    0141703
    OV.LOD    0141704
    OV.MOI    0150411
    OV.MEM    0150515
    OV.MSG    0152307
    OV.OPE    0172005
    OV.PBC    0200203
    OV.RBR    0220222
    OV.REQ    0220521
    OV.RFL    0220614
    OV.RST    0222324
    OV.SRB    0232202
    OV.WBR    0270222
    OV.1AJ    0340112
    OV.1BJ    0340212
    OV.1BT    0340224
    OV.1CO    0340317
    OV.1CY    0340331
    OV.1DF    0340406
    OV.1EE    0340505
    OV.1EI    0340511
    OV.1IX    0341130
    OV.1LJ    0341412
    OV.1LT    0341424
    OV.1MR    0341522
    OV.1MW    0341527
    OV.1OD    0341704
    OV.1OT    0341724
    OV.1PO    0342017
    OV.1RI    0342211
    OV.1RO    0342217
    OV.1RQ    0342221
    OV.1SP    0342320
    OV.1TD    0342404
    OV.1XP    0343020
    OV.2BP    0350220
    OV.2BT    0350224
    OV.2CA    0350301
    OV.2CF    0350306
```

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SYMBOLIC REFERENCE TABLE

```
OV.2CJ    0350312
OV.2DF    0350406
OV.2EF    0350506
OV.2ES    0350523
OV.2LA    0351401
OV.2LB    0351402
OV.2LE    0351405
OV.2LP    0351420
OV.2PC    0352003
OV.2RC    0352203
OV.2RQ    0352221
OV.2RT    0352224
OV.2TB    0352402
OV.2TF    0352406
OV.2TJ    0352412
OV.2TR    0352422
OV.2TS    0352423
OV.2TW    0352427
OV.2WT    0352724
OV.3OT    0361724
OV.4LB    0371402
OV.5DT    0400424
OV.7TP    0422420
O.BPRU    0000016
O.RCHN    0000017
O.RCMPR   0000002
O.RDP     0000010
O.RDPNP   0000011
O.RDSK    0000001
O.READ    0000000
O.SKB     0000013
O.SKF     0000012
O.WRP     0000014
O.WRPR    0000015
O.WRT     0000004
O.WRTR    0000005
P.CAT     0000011
P.CST2    0000015
P.CST3    0000016
P.CST4    0000017
P.DFB     0000003
P.EST     0000005
P.FNT     0000004
P.INS     0000007
P.LIB     0000001
P.RBR     0000002
P.RBT     0000002
P.RQS     0000013
P.SPI     0000012
P.ZERO    0000000
R.CPFL    0000627
R.CPRA    0000631
R.DCH     0000714
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R.EREQS   0000300
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R.IDLE    0000100                  001131
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                  SYMBOLIC REFERENCE TABLE

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  R.OVL      0000124
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  R.RCH      0000704
  R.READP    0000460
  R.RWP      0000505
  R.RWPP     0000530
  R.STB      0000620
  R.STBMSK   0000611
  R.STEP     0000734
  R.TFL      0000634                001012,   001044,   001123
  R.WAIT     0000410
  R.WRITEP   0000470
  S.DIRPR    0000010
  S.DIRPT    0000004
  S.FNTEQP   0000006
  S.FNTLK    0000005
  S.FNTTYP   0000003
  S.RBRUNT   0000006
  S.RBTRBR   0000003
  S.RBTREL   0000007
  S.RBTRNU   0000006
  S.STF      0000006
  S.STFA     0000000
  S.STFEOF   0000004
  S.STFETP   0000002
  S.STFNTP   0000003
  S.STFPRI   0000005
  S.STFREL   0000004
  T.CIDLE    0000023
  T.CLK      0000030
  T.CPA1     0000200
  T.CPA2     0000400
  T.CPA3     0000600
  T.CPA4     0001000
  T.CPA5     0001200
  T.CPA6     0001400
  T.CPA7     0001600
  T.CPS      0000040
  T.CPT1     0000056
  T.CPZ      0000020
  T.CP8      0002000
  T.CST      0000014
  T.DATE     0000031
  T.JDATE    0000027
  T.MON      0000021
  T.MSC      0000040
  T.MSP      0000037
  T.PIDLE    0000024
  T.PPC1     0000060
  T.PPC2     0000070
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  T.PPC4     0000110
  T.PPC5     0000120
  T.PPC6     0000130
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14-38

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                 SYMBOLIC REFERENCE TABLE

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     T.PPC8    0000150
     T.PPC9    0000160
     T.PPR     0000025
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     T.PPS1    0000042
     T.PPS2    0000043
     T.PPS3    0000044
     T.PPS4    0000045
     T.PPS5    0000046
     T.PPS6    0000047
     T.PPS7    0000050
     T.PPS8    0000051
     T.PPS9    0000052
     T.SLAB1   0000031
     T.SLAB2   0000032
     T.SLAB3   0000033
     T.SLAB4   0000034
     T.SLAB5   0000035
     T.SLAB6   0000036
     T.STATCP  0000056
     T.STO     0000022
     T.TMP     0000055
     T.UAS     0000056
     W.CPAR    0000157
     W.CPCAF   0000051
     W.CPCAL   0000150
     W.CPDFM   0000030                001136
     W.CPECS   0000022
     W.CPEF    0000020
     W.CPENC   0000155
     W.CPERT   0000040
     W.CPFL    0000020
     W.CPJNAM  0000021
     W.CPOAE   0000153
     W.CPOUT   0000153
     W.CPPRI   0000022
     W.CPRCL   0000025
     W.CPRES1  0000156
     W.CPRES2  0000160
     W.CPSM    0000020
     W.CPSTAT  0000020
     W.CPTBUF  0000041
     W.CPTBUL  0000050
     W.CPTIME  0000023
     W.CPTIML  0000022
     W.CPVRNO  0000154
     W.EQP     0000027
     W.FSTCC   0000151
     W.FSTNR   0000152
     W.FTYPE   0000000
     W.PPIR    0000000
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     W.PPMES2  0000003
     W.PPMES3  0000004
     W.PPMES4  0000005
     W.PPMES5  0000006
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14-37

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W.PPMES6  0000007
W.PPOR    0000001
W.PPTIME  0000024
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W.RBRTPA  0000000
W.RBRUNT  0000000
W.RWPPCW  0000002
W.SSW     0000026
W.STCPU   0000000
W.STEI    0000000
W.STFB    0000001
W.STO     0000000
W.STPFW   0000001
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W.STPRBA  0000000
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01.25.36.SCPDOC,P17,T500,CM60000.
01.25.52.REQUEST(OLDPL)
01.25.52. (53 ASSIGNED)
01.25.52.REWIND(OLDPL)
01.25.53.UPDATE(Q)
01.26.13. UPDATING FINISHED
01.26.13.COMPASS(I=COMPILE,S=SCPTEXT)
01.26.23.CP  013.068 SEC.
01.26.23.PP  041.638 SEC.
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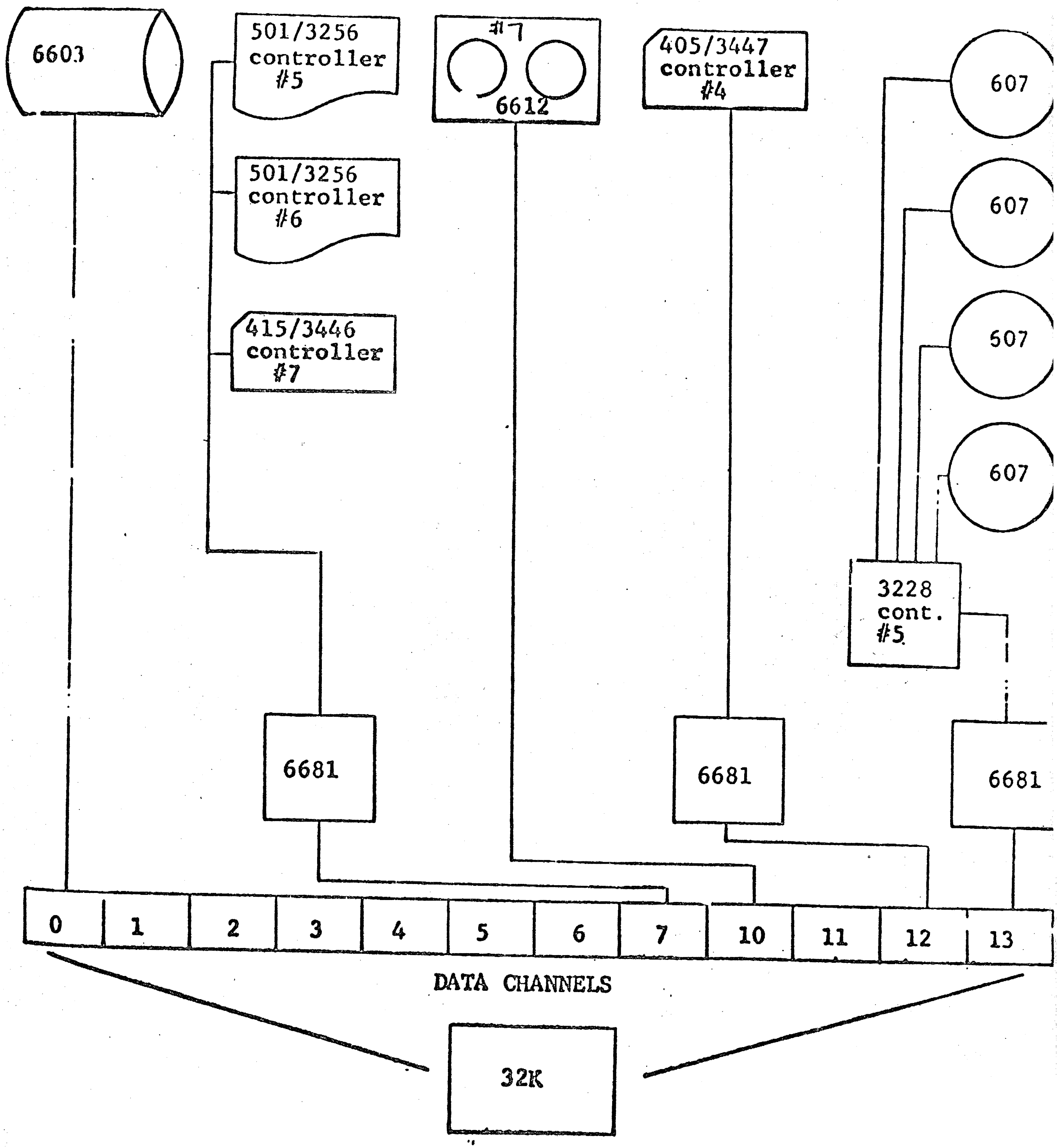
14-[illegible]

UNIVERSITY OF ARIZONA

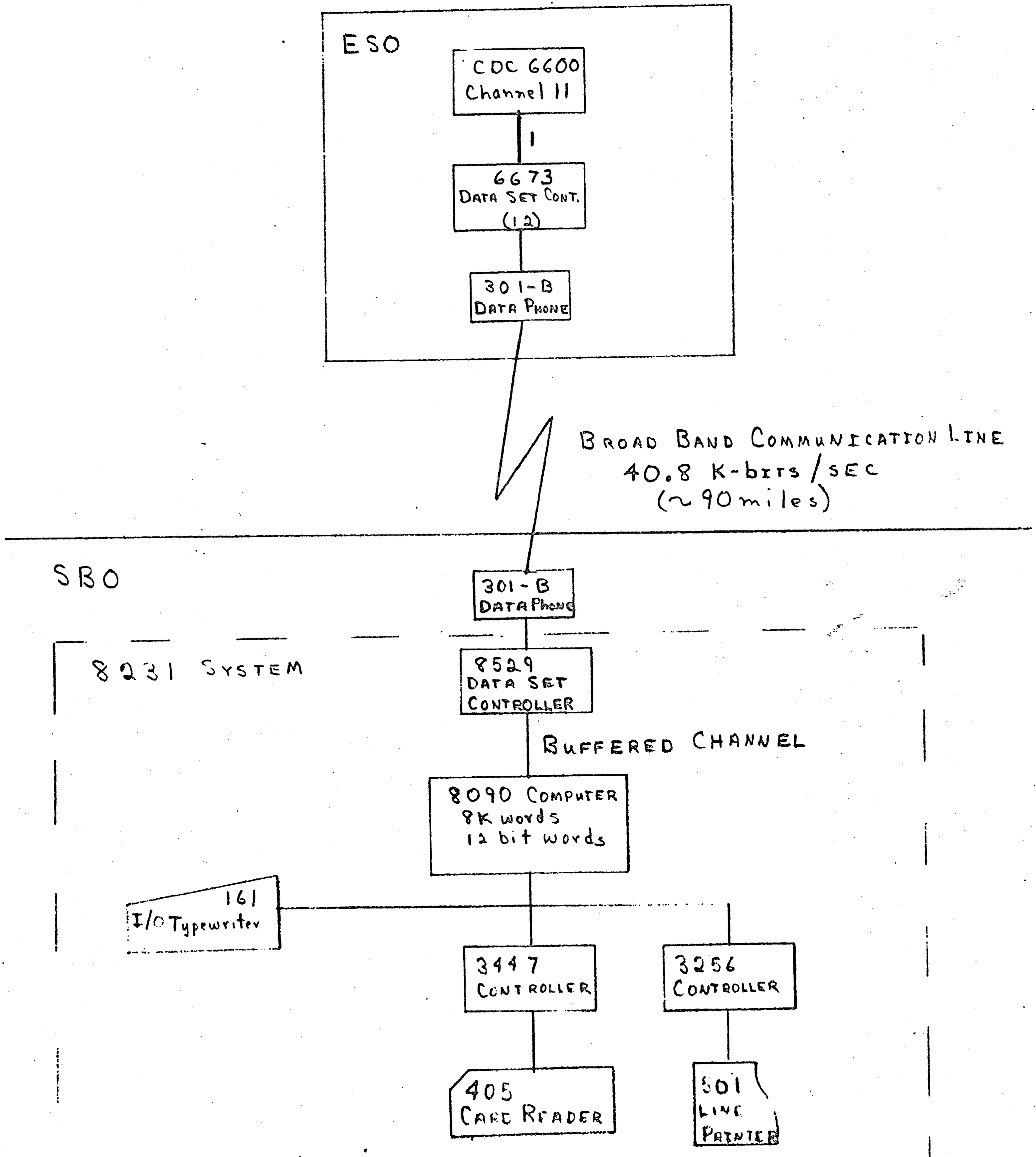
6400



3/1/68
RKV
2 of 2

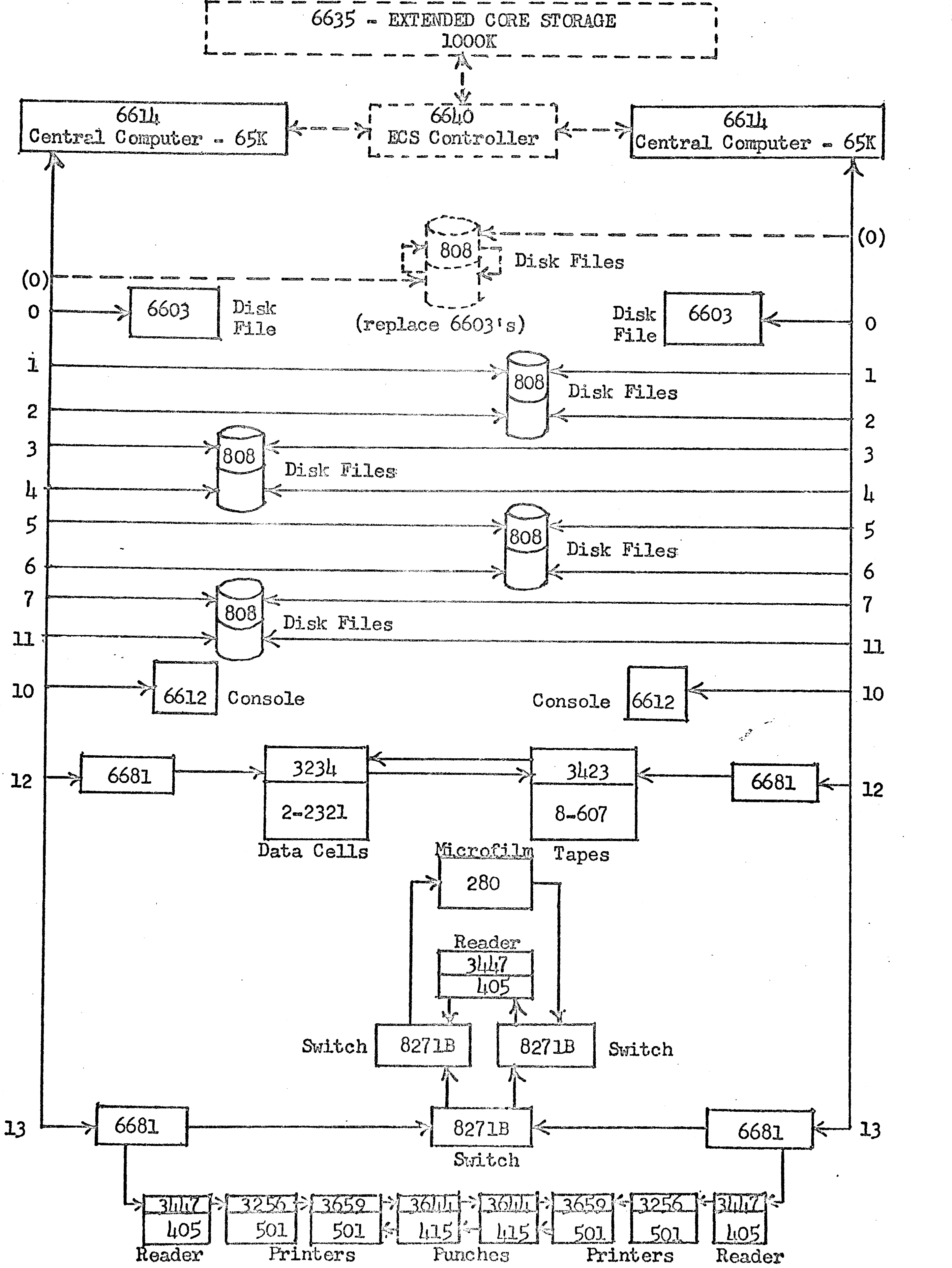
AEROSPACE CONFIGURATION

SBO REMOTE



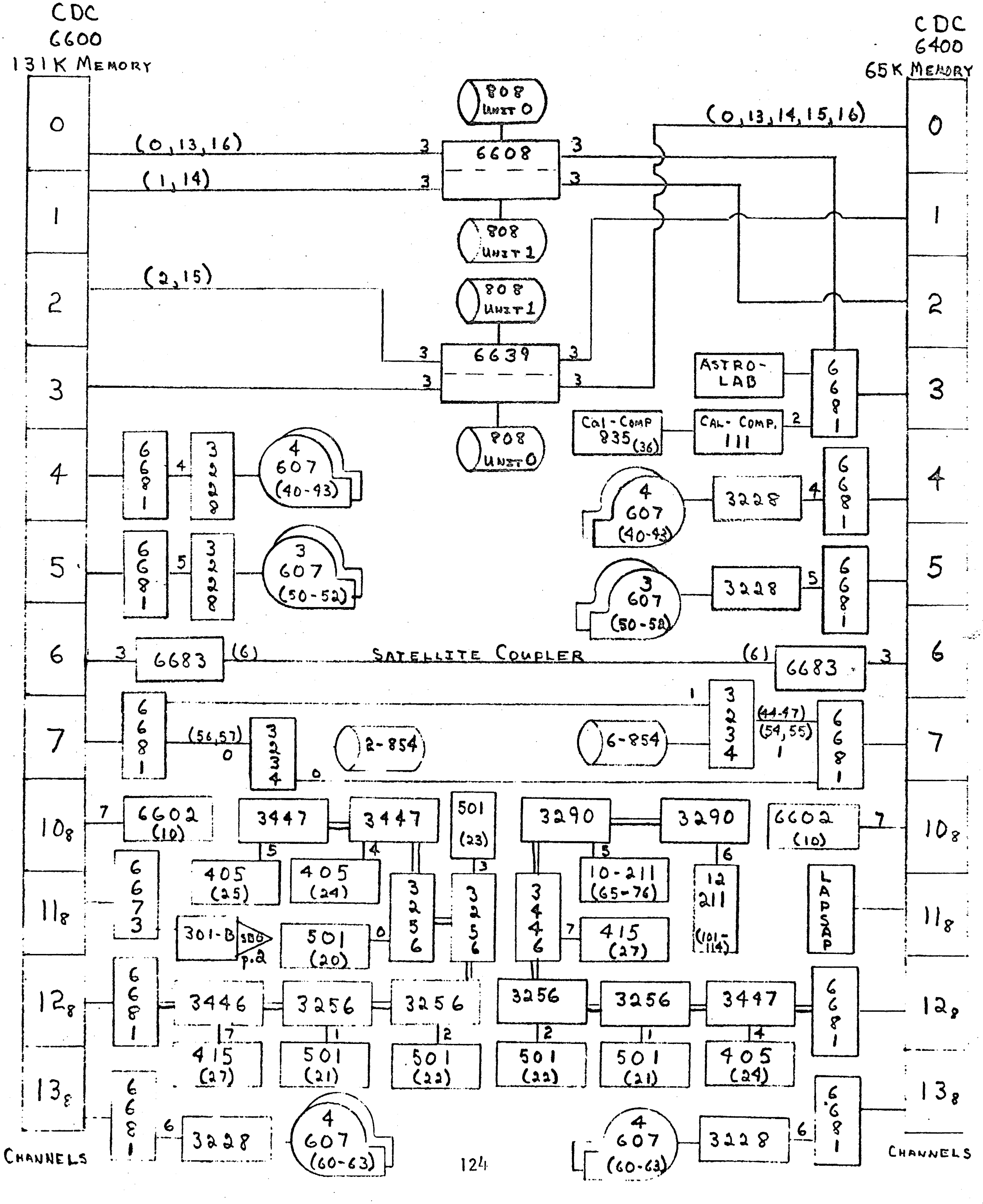
Attachment

BETTIS ATOMIC POWER LABORATORY

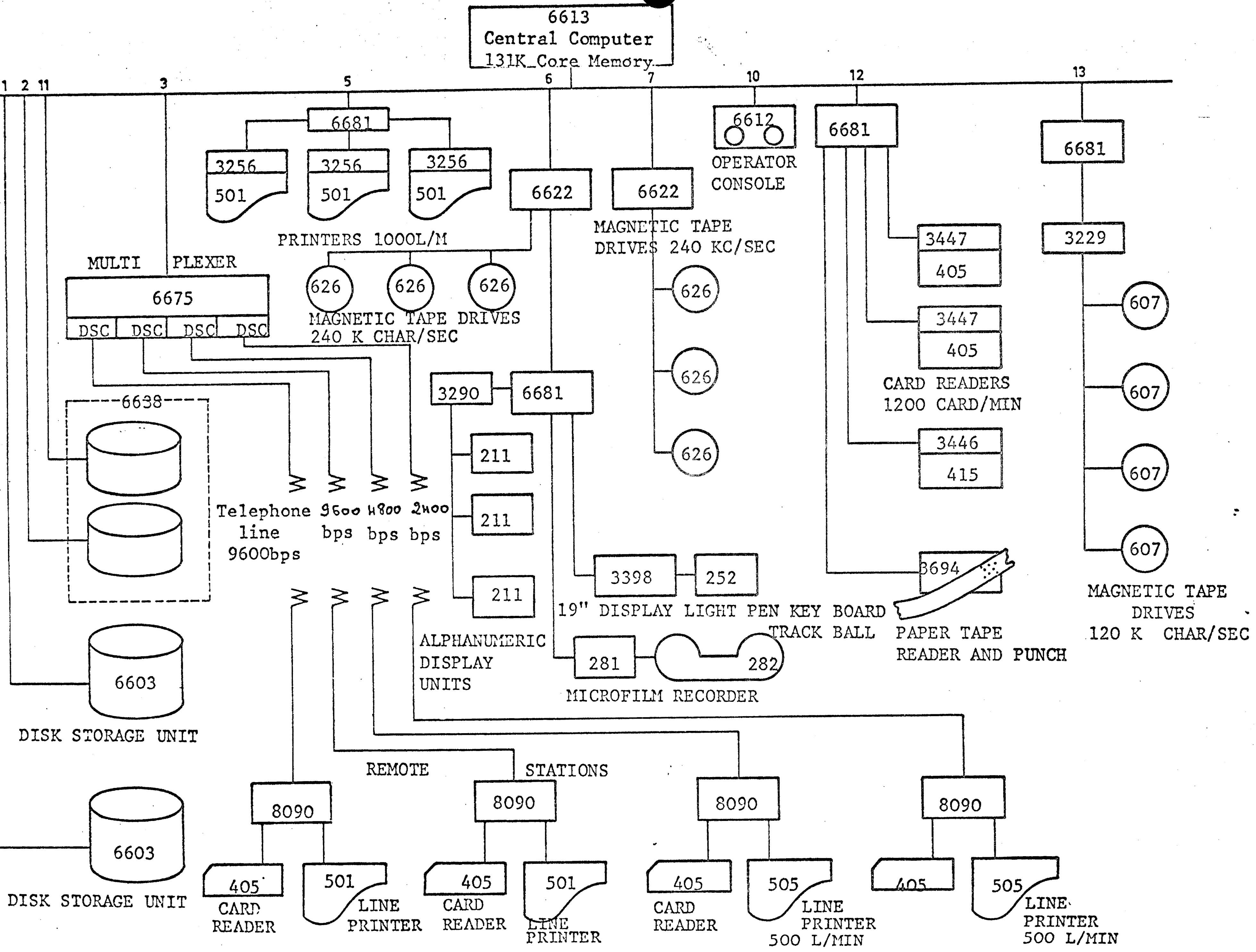


3/1/68
RKV
1 of 2

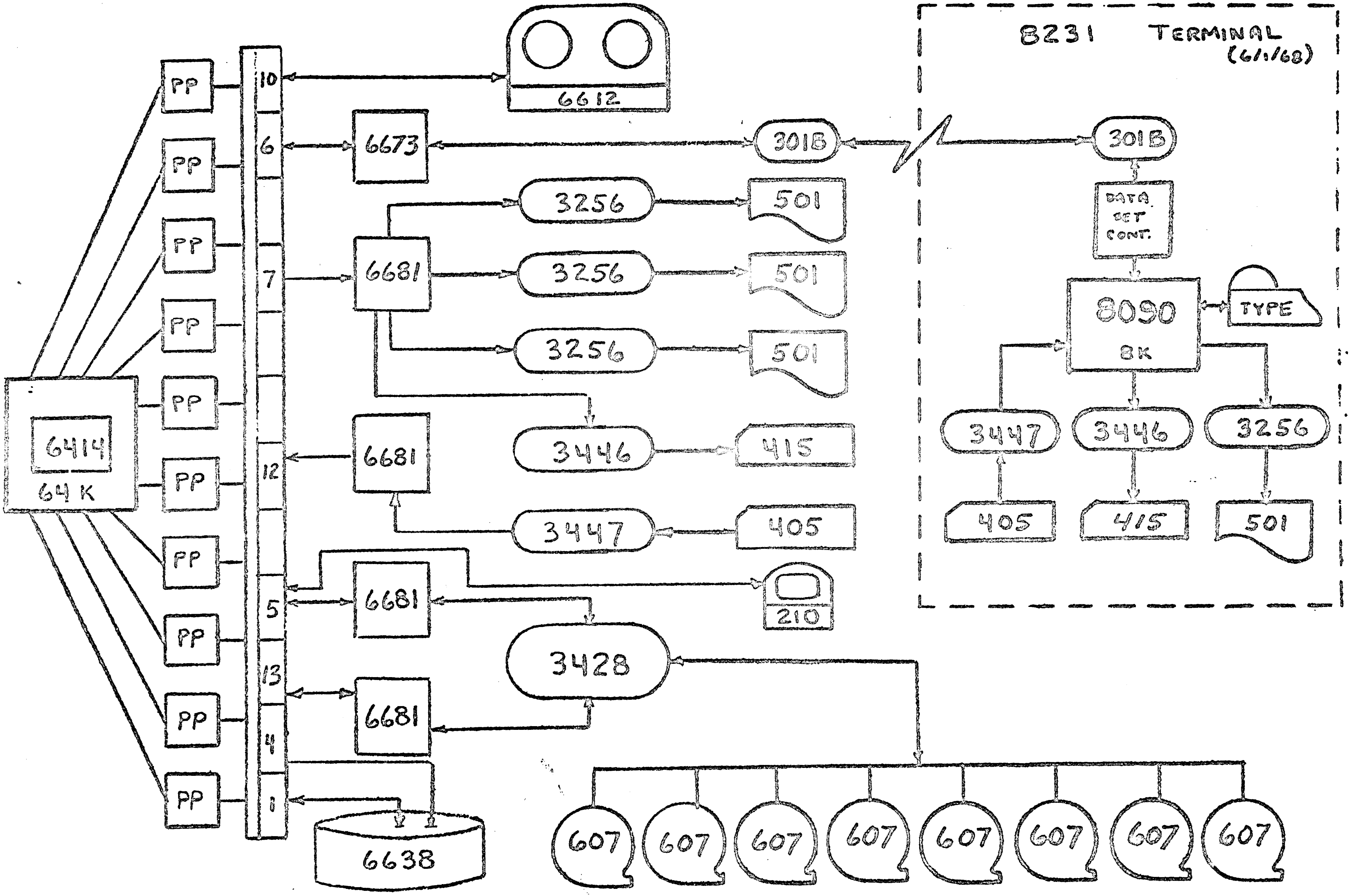
AEROSPACE CONFIGURATION



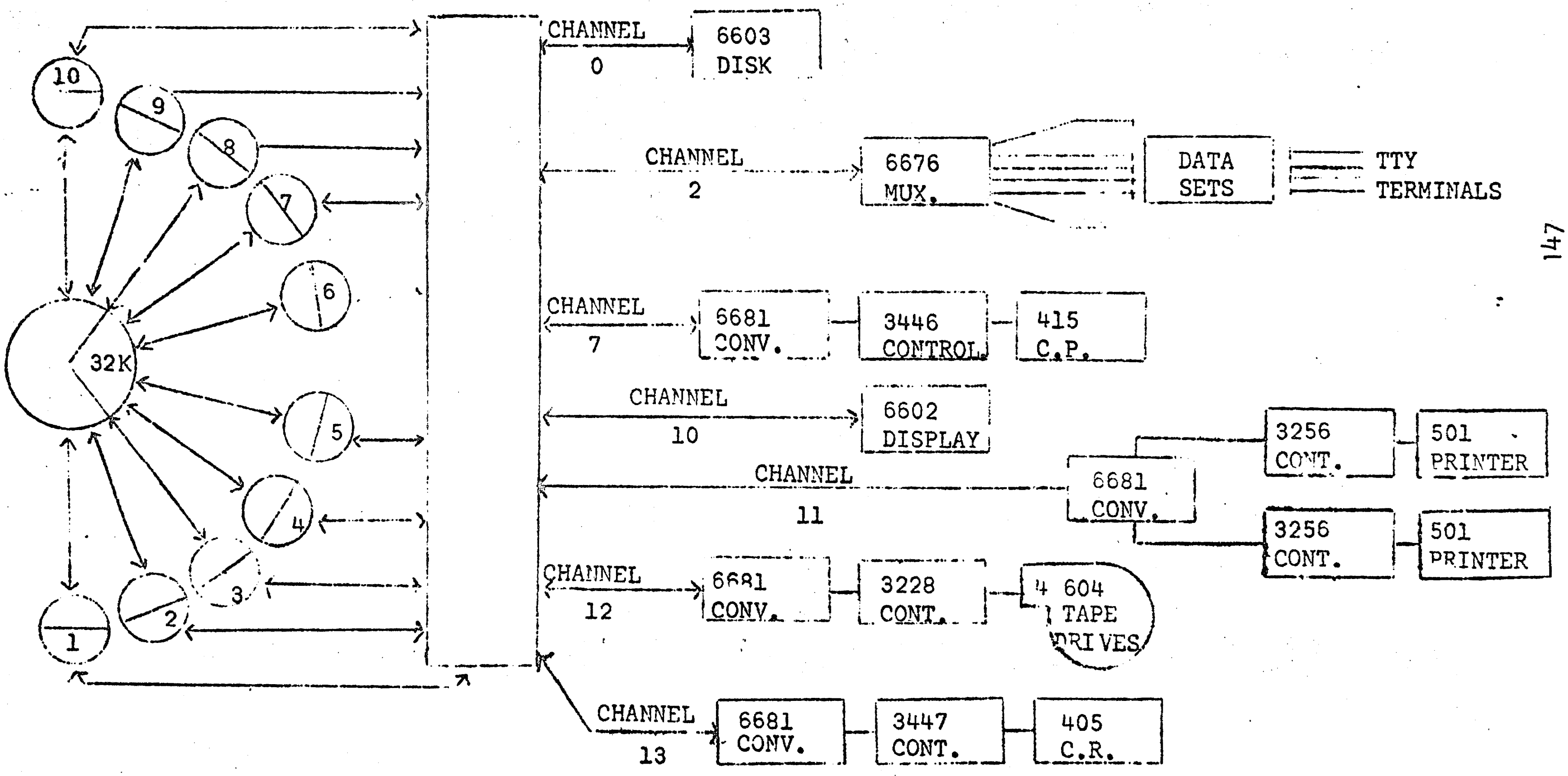
ELECTRICITE DE F[illegible]CE



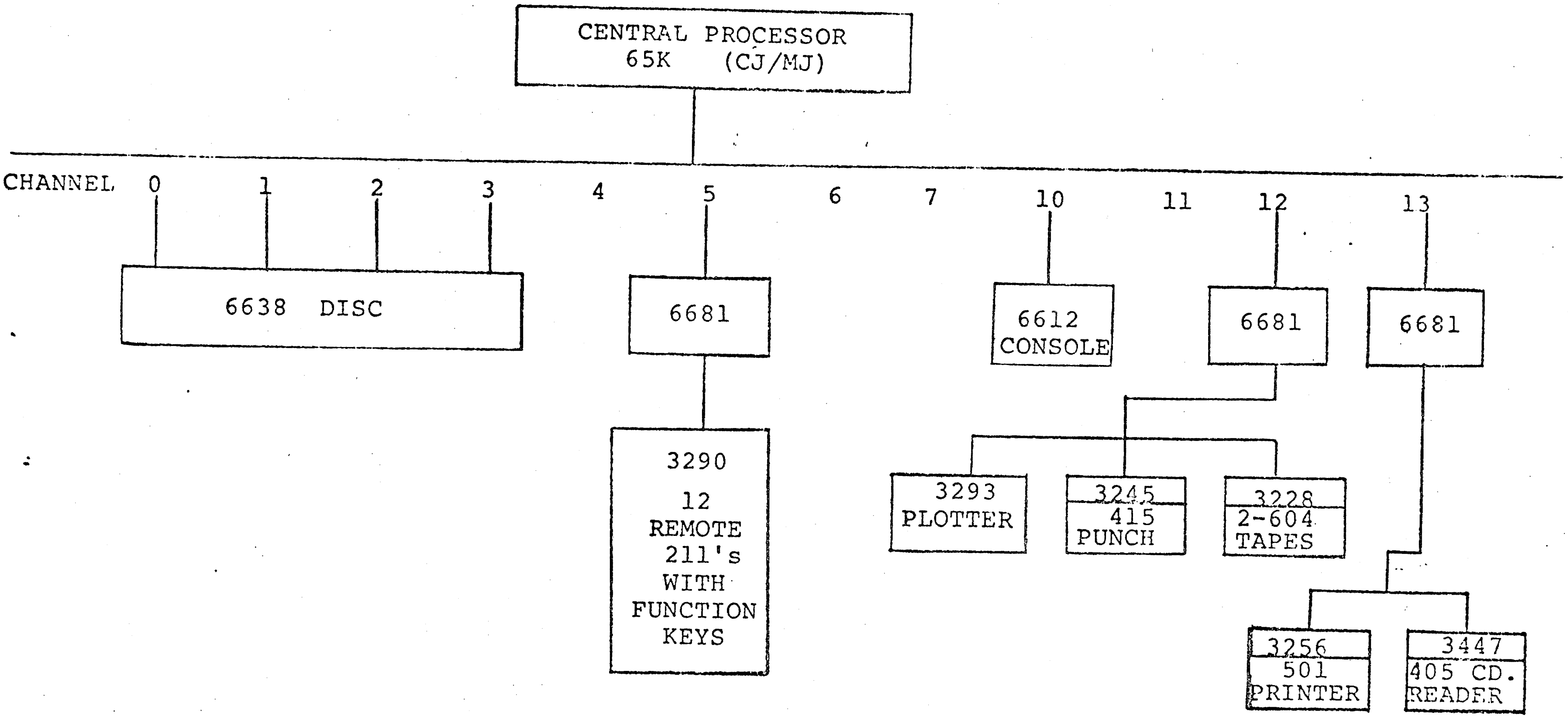
CDC 6400 Scientific Computer System

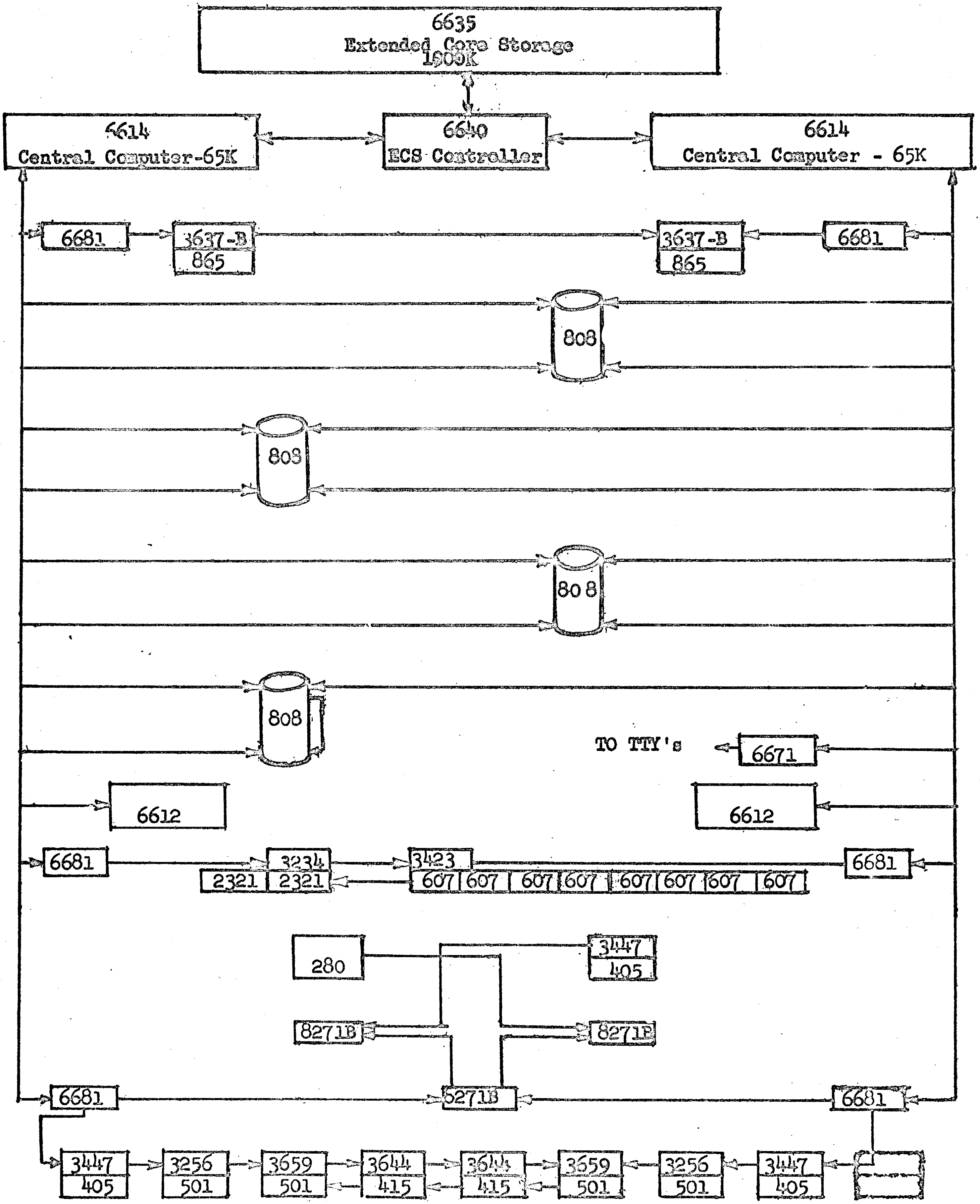


FSU CONFIGURATION

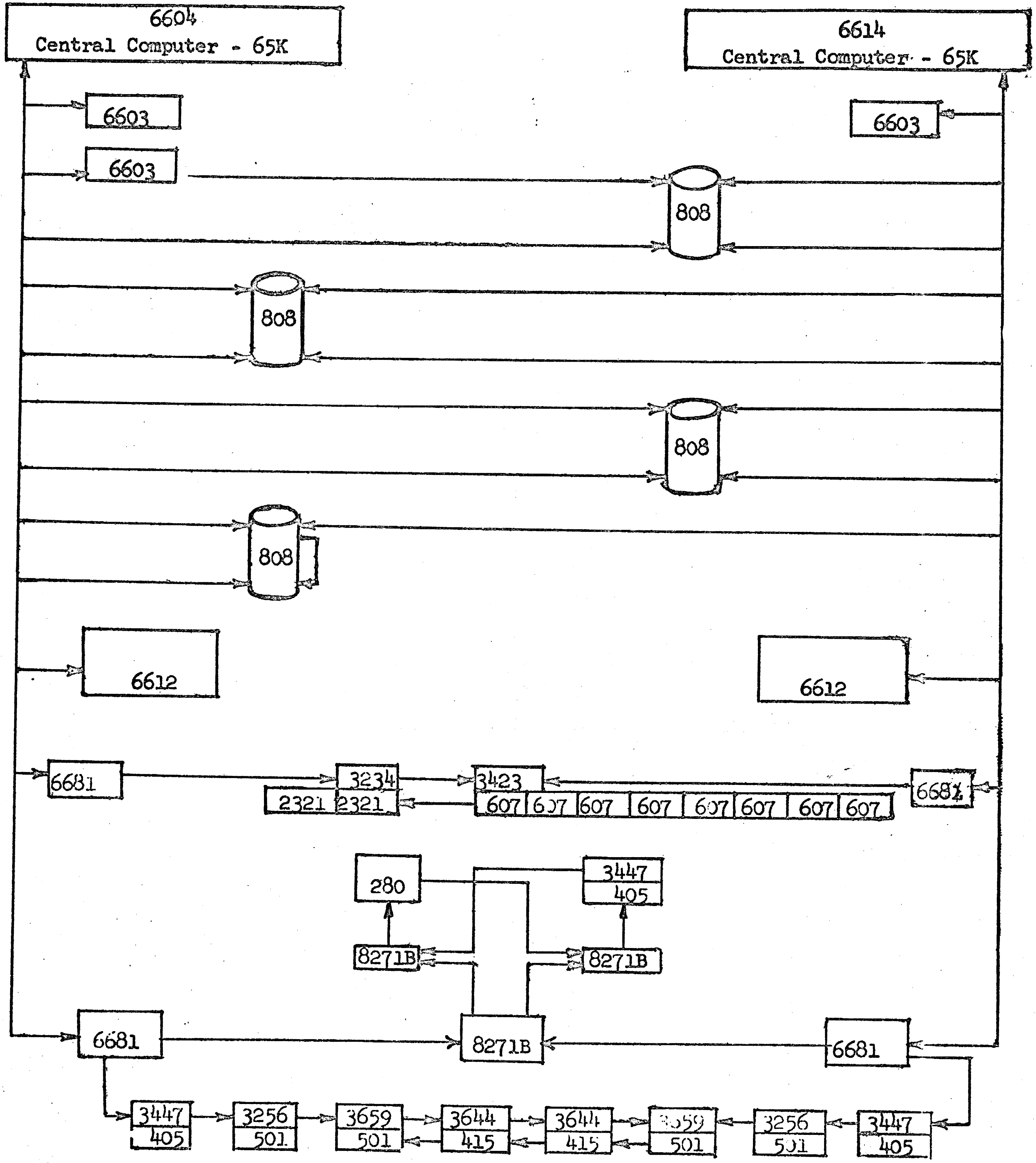


IDA COMPUTER FACILITY



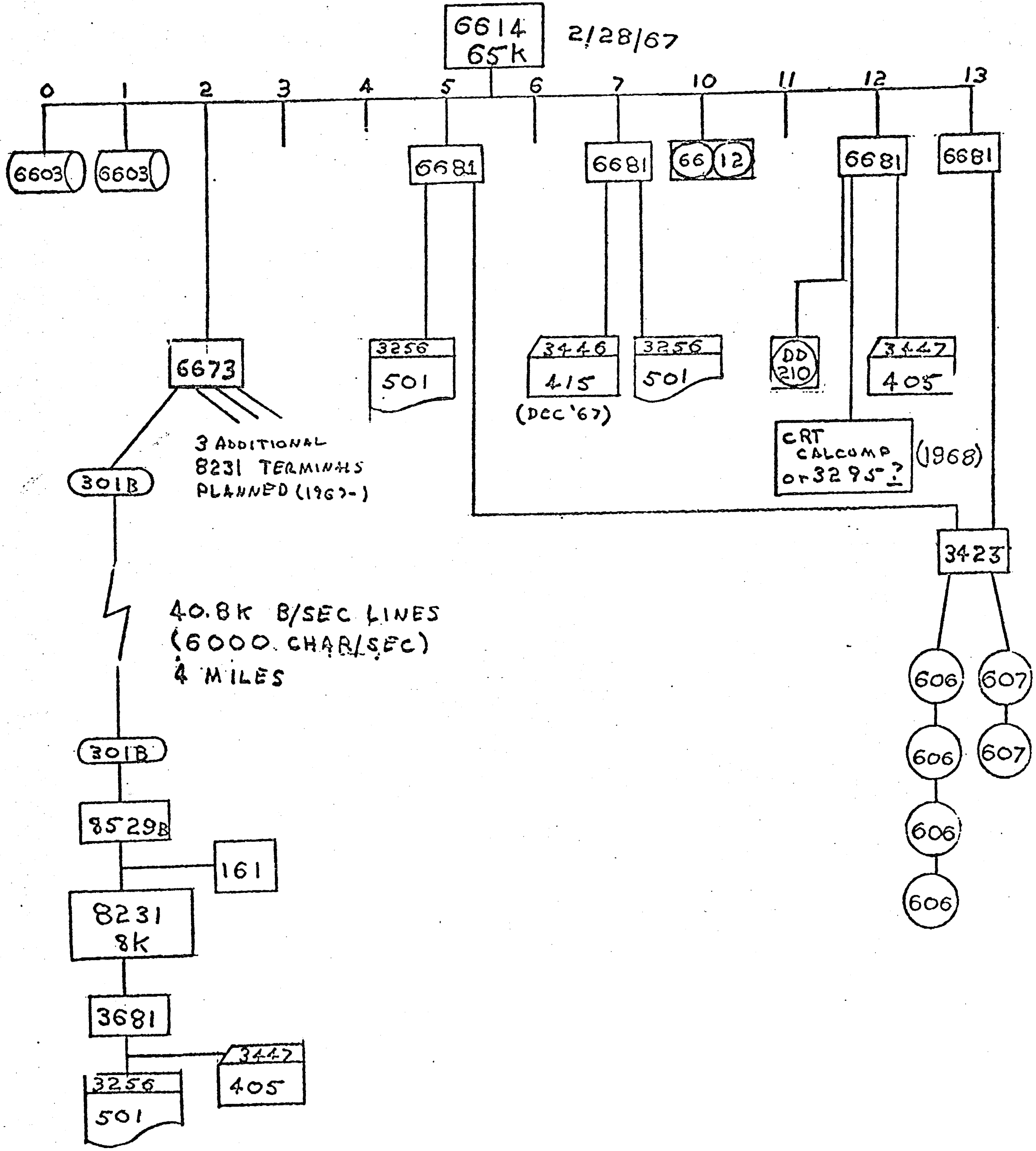


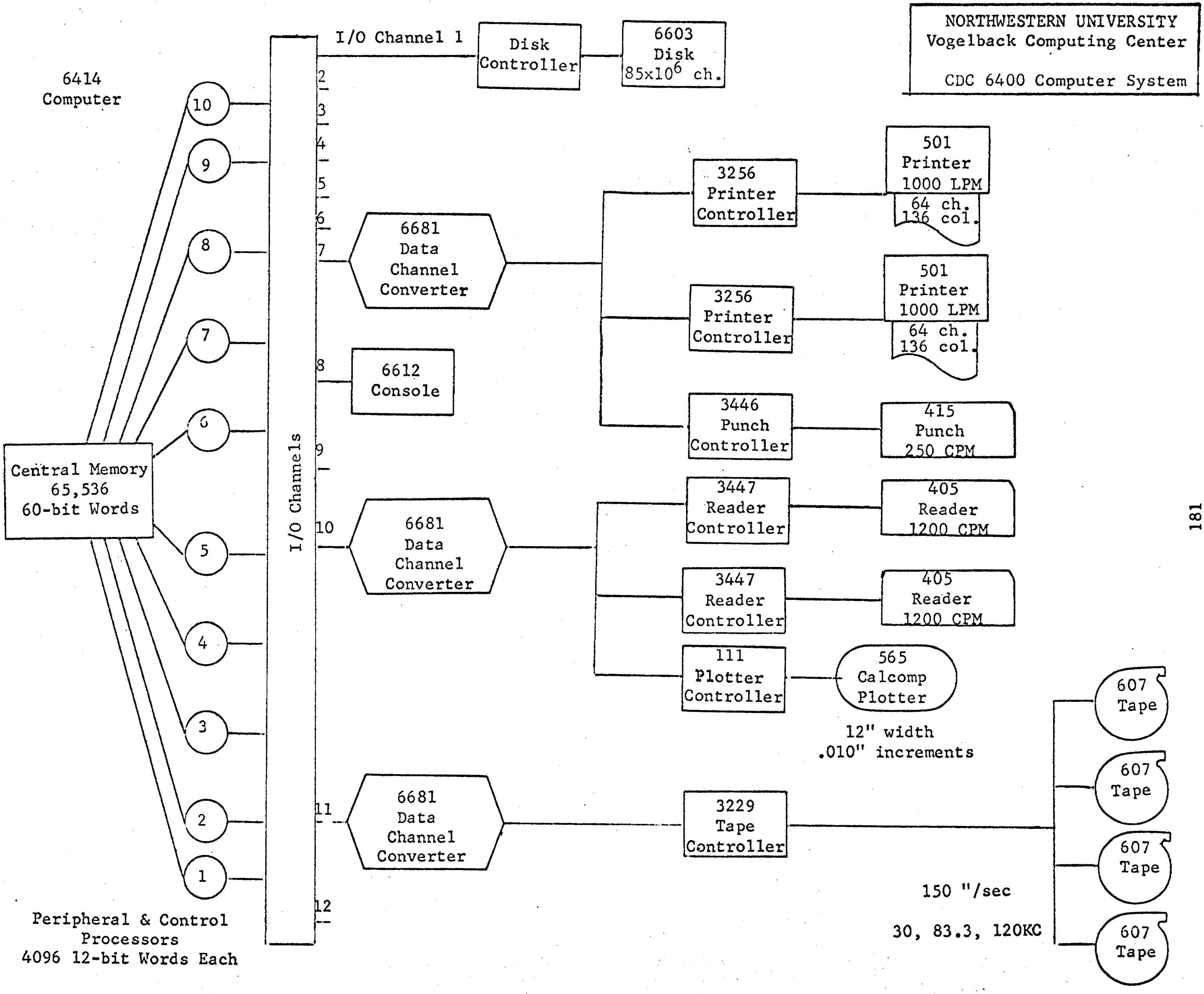
KNOLLS ATOMIC POWER LABORATORY PLANNED CONFIGURATION



KNOLLS ATOMIC POWER LABORATORY CURRENT CONFIGURATION

UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA

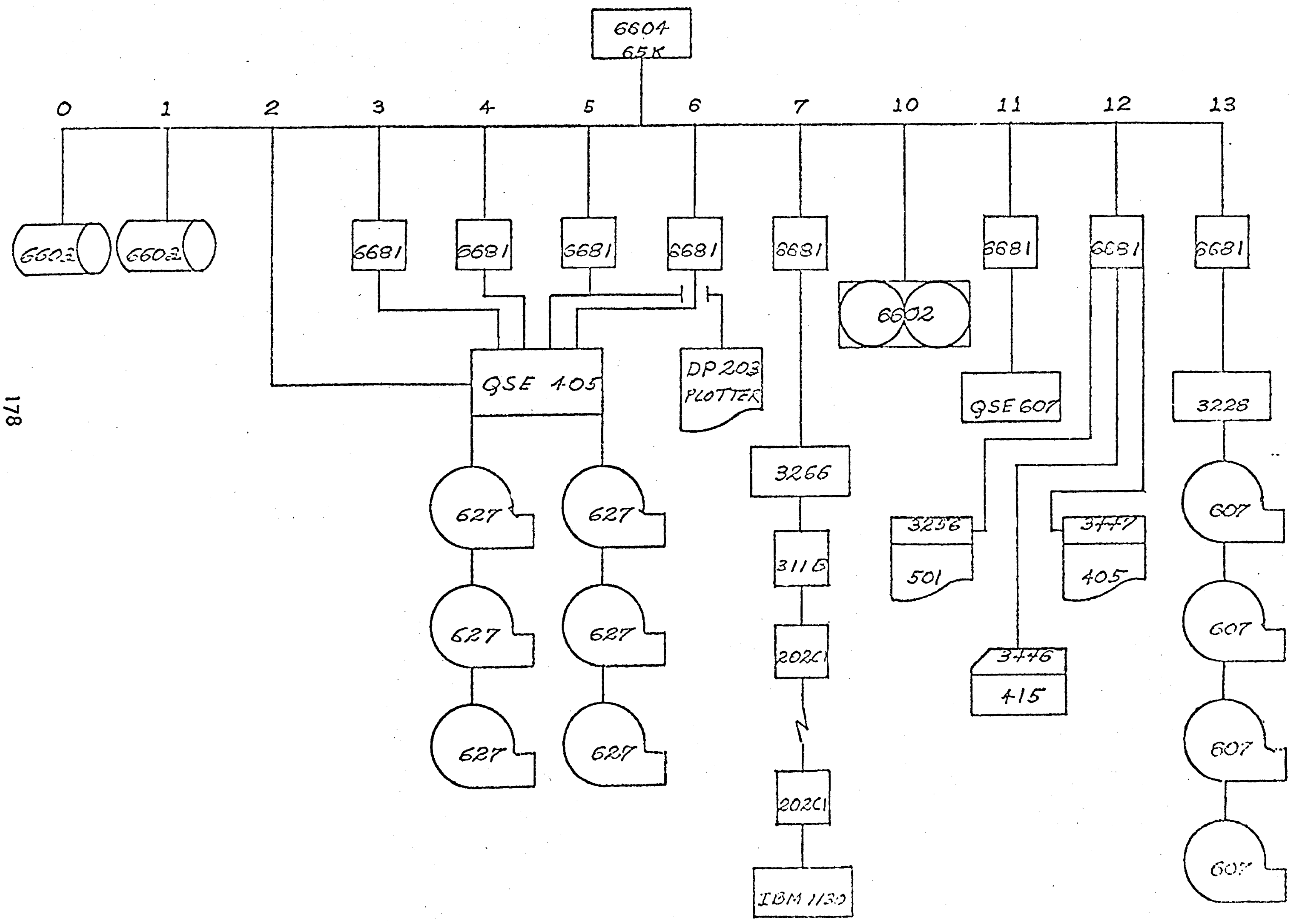



NORTHWESTERN UNIVERSITY
Vogelback Computing Center

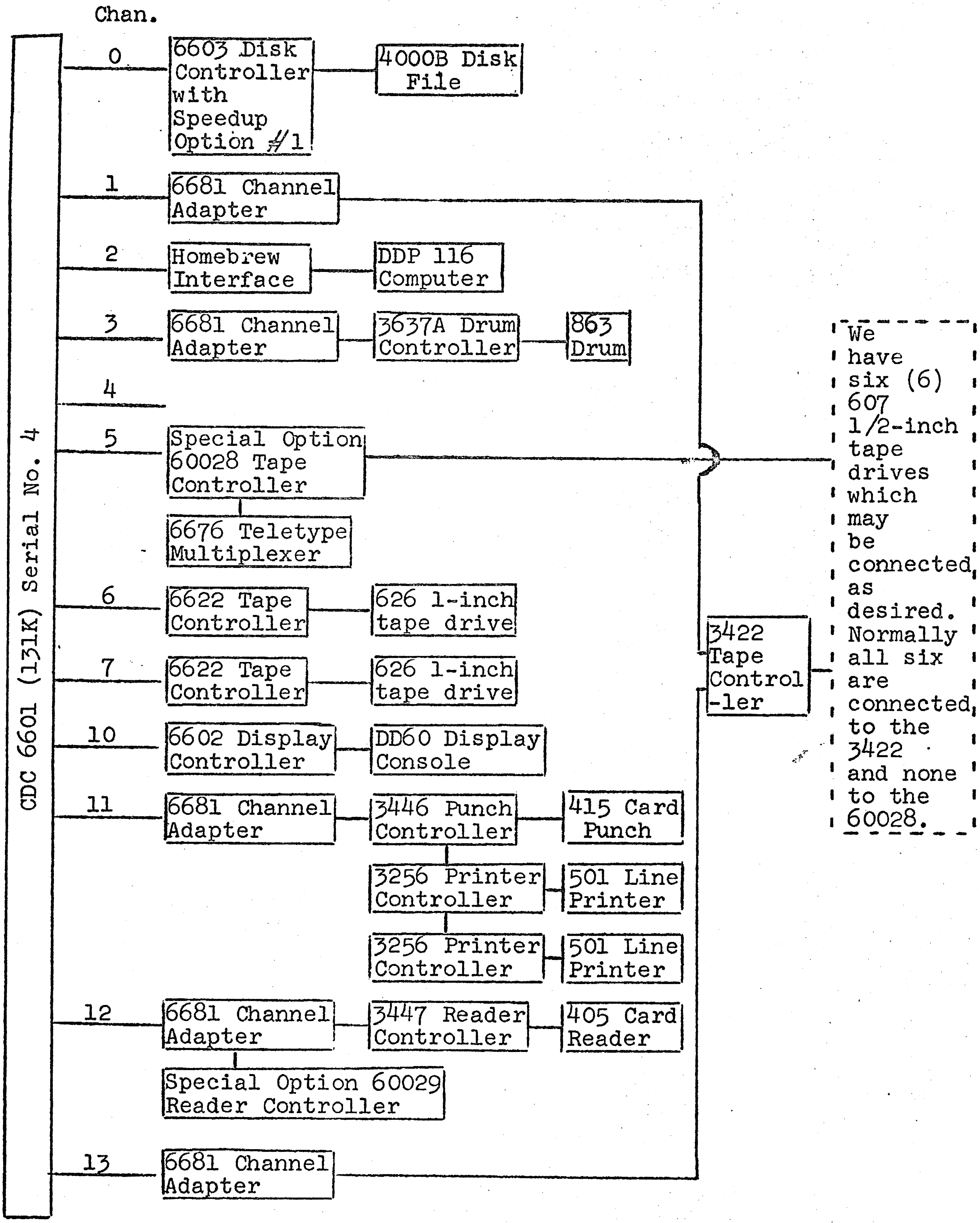
CDC 6400 Computer System

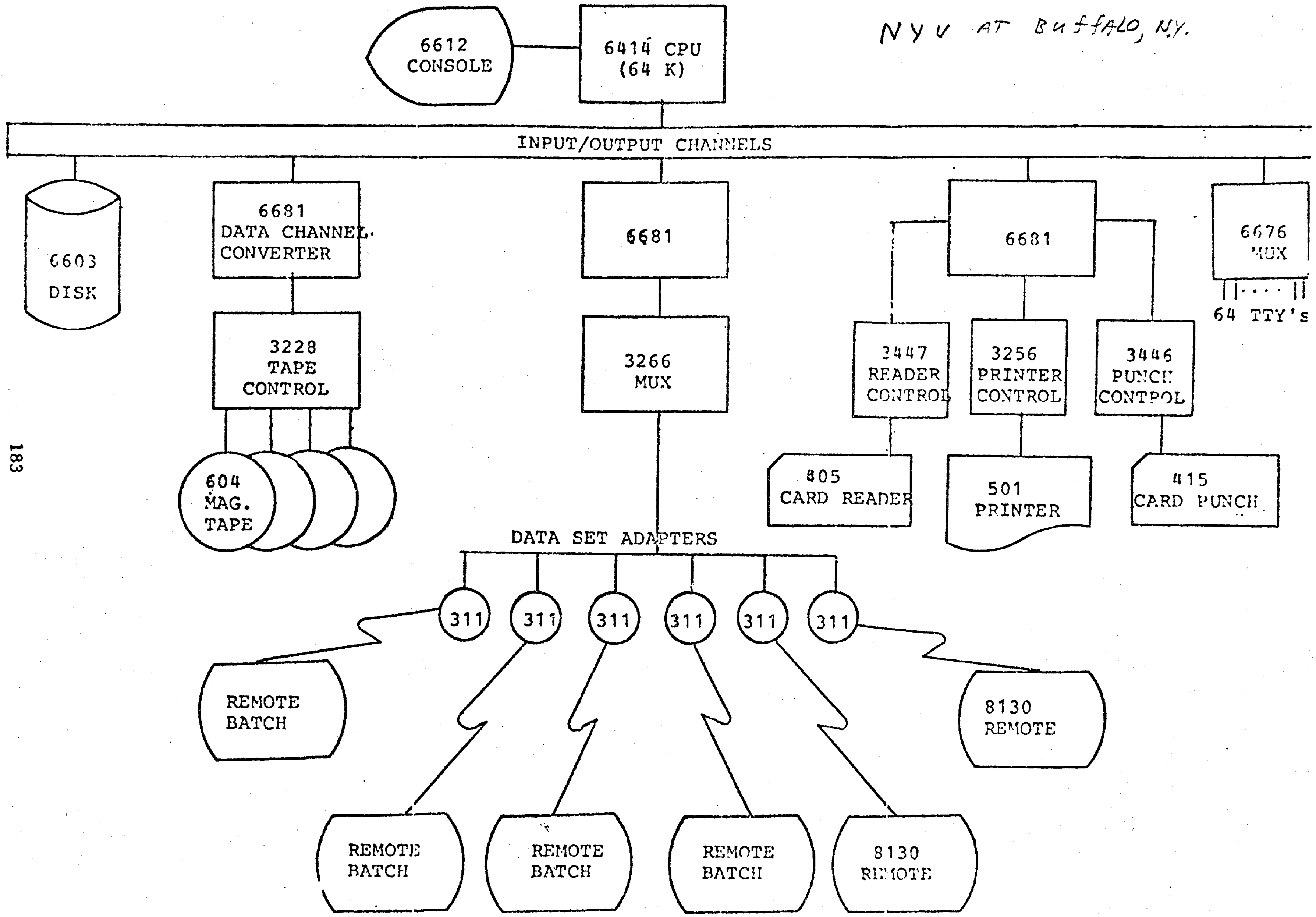
MOBIL OIL CORPORATION (MOGS)

Geophysical Services Center
1930 Proctor Street
Dallas, Texas



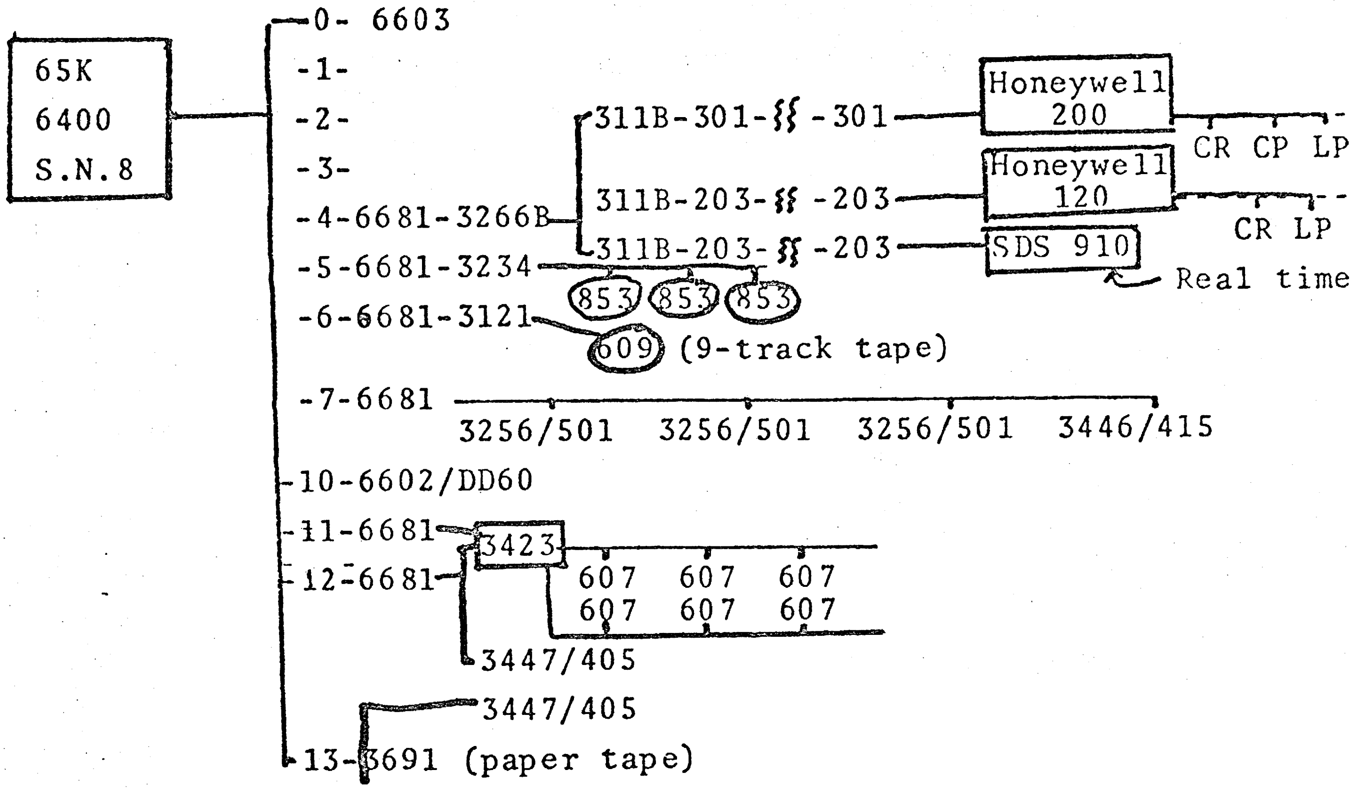
NYU -- Courant Institute CDC 6600 Channel Configuration (3/5/68)





NYU AT Buffalo, N.Y.

SAO CONFIGURATION



WESTINGHOUSE TELE-COMPUTER CENTER

CDC INSTALLATION