SYSTEM ANALYST DOS-M COURSE

JANUARY 1971

SYSTEM ANALYST DOS-M COURSE OUTLINE

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I. INTRODUCTION

A. Minimum Hardware Requirements

1. Why DOSM?
2. DOS/DOSM minimum hardware [SLIDE 1]
3. Cost Comparison
4. Comparison to competitor - (IBM 1130) [SLIDE 1A]
5. DOSM Hardware options [SLIDE 1B]

B. Advantages and Disadvantages [SLIDE 2]

1. ADVANTAGES (Special Points)

   a. Another cabinet and power supply needed when number of drives is expanded to 3 or 4.

   b. User could operate in his own instrument driver environment if no MP (Memory Protect).

   c. If User does not want EAU or clock, he is not forced to have it. Gains one more I/O channel without TBG option.

   d. Easy creation of System Backup (which will not be hardware protected) on Cartridge.

   e. Multiple System Discs with different configurations on separate drives.

   f. Exchange of user files between systems even though systems may be configured differently.

   g. Hardware protection scheme using DISC PROTECT OVERRIDE SWITCH and PCI (Protected Cylinder Indicator).

   h. Operation with USER DISCS Labeled to avoid using incorrect cartridge.

   i. Minimum core resident system reduced from DOS (DVRØ5 and DVR31 changes).

2. DISADVANTAGES (Special Points)

a. Three bootstraps (cover details later). Method of System Start-up.

b. No plans at present for moving head RTE or TSB. Some talk for ISS system (ISS disc cost about $ 35,000 and has about 12 million word storage).

c. Better to lose sale rather than deliver an 8K system that will "strangle" customer's programs (during loading or execution). Just because JOBPR will fit is not any indication that system will be adequate.

C. IOMEC Overall Description

1. CONTROLLER [SLIDE 3]

a. Interface between computer and drive(s).

b. Interface cards on computer side.

(1) Identical electronically except for positions of jumper wires.

(2) Signals inverted from positive-true/ ground-false logic to ground-true/ positive-false to be compatable with controller.

(3) DATA CHANNEL - Transfers data, status, and addressing information. DMA controls data; program controls status and addressing.

(4) COMMAND CHANNEL - Transfers commands, drive selection, and drive attention bits (LSB). All under program control.

2. DRIVE (Maximum of 4 per controller)
   a. Fixed Disc and Removable Cartridge.
   b. Movable heads and their numbers.
   c. Power ON/OFF.
   d. Cartridge LOCK/UNLOCK and light.
   e. READY light.
   f. Physical description of PACK.
      (1) Opening at rear for heads entry.

      (2) Opening underneath for forced air.

      (3) Rim markers for TRACK/SECTOR origins.

3. DISC
   a. Physical storage capacity breakdowns [SLIDE 4].
   b. Physical layout [SLIDE 5].
   c. Addressing [SLIDE 6].
      (1) Physical (Drive, Cylinder, Head, Sector).
      (2) Logical (Subchannel, Track, Sector).
          Software inverts (complements) lower order bit of subchannel # for higher order bit of head #.
   d. Sector Address and Data Fields [SLIDE 7].

      (1) INITIALIZE WRITE COMMAND is used for controller to construct and write the Sector Address Field with PCI=DCI=Ø (only disc formatting seciton of generator does this).
      (2) WRITE PROTECTED COMMAND is used for controller to set PCI=1 in Sector address field (only generator does this).
      (3) WRITE DEFECTIVE COMMAND is used for controller to set DCI=1 in Sector Address Field Only $EX2Ø makes this call (DVR31 will accept under system operation).

(Continued)

(4) Controller does not send back any status on PCI or DCI if DISC PROTECT OVERRIDE SWITCH is "ON" (i.e. UP). This switch must be "ON" when executing (1), (2), or (3) on the preceding page!

D. DOSM Software and Relationship to Discs

1. Components [SLIDES 8A, 8B, 8C, 8D].
2. Disc to Memory Transfers [SLIDE 9].
3. DOSM General Core Layout [SLIDE 10A].
   a. EQT Format [SLIDE 10B].
   b. DRT Format [SLIDE 10C].
   c. INT Table Format [SLIDE 10D]
4. Discs Layout
   a. Concept of "SYSTEM" and "USER" Discs.
   b. Oversimplified "SYSTEM " disc layout [SLIDE 11A].
   c. More detailed "SYSTEM" disc layout [SLIDE 11B].
   d. User disc layout [SLIDE 11C].
   e. Label Sectors
      (1) System Disc [SLIDE 12A].
      (2) User Disc [SLIDE 12B].

E. System Startup Operation Example with block diagrams.

1. Execution of Configured Supplied Bootstrap [SLIDE 13A.1].
   a. Loads Disc Resident Bootstrap into high core, relocating it as necessary.
   b. Transfers control to start of DRB just loaded.

(Continuation)

E. SYSTEM Startup Operation Example with block diagrams.

2. Execution of Disc Resident Bootstrap [SLIDE 13A.2].

   a. Loads Core Resident System from System Disc in four parts.

   b. Configures continuator section of DVRØ5 and DVR31.

   c. Transfers control to $STRT in DISC MONITOR by JMP 3,I.

3. Disc Monitor First Entry [SLIDE 13A.3].

   a. $STRT calls $MDLD to transfer control to $EXI2 (System Startup).

   b. $MDLD makes decision whether to load $EXI2 from Disc (if Disc Resident) then transfers control to $EXI2.

4. Execution of $EXI2 [SLIDE 13A.4].

   a. Sets (MP FENCE ADDRESS = UMFWA) with OTA 5.

   b. Reads System Buffer Sector to Base Page.

   c. Builds new System Buffer Sector and writes back on disc if not valid one (i.e., does not end with "SB").

   d. Calls $SYIO to output "INPUT :DATE,XXXXXX,H,M" on System TTY.

   e. Sets input request code = "DA" and transfers control to $TYPE for System K.B. Input.

5. Execution of $TYPE for System K.B. Input [SLIDE 13A.5].

   a. Calls $SYIO to output (CR) (LF) @.

   b. Calls $SYIO to input 72 characters into JOB INPUT BUFFER.

   c. $SYIO calls $TEST routine to force :DA input.

   d. If :DA not inputted, calls $SYIO to output "IGNORED" and goes to b. above.

   e. If :DA inputted, transfers control to $JLOD to load and branch to JOBPR.

6. Execution of $JLOD to load JOBPR [SLIDE 13A.6].

   a. $JLOD calls DISCX twice to read in JOBPR (MAIN and Base Page) and then transfers control to JOBPR main entry point.

   b. Each call to DISCX results in call to $DISC which in turn calls $SYIO to read DISC.

7. Execution of JOBPR to Update System Buffer Sector [SLIDE 13A.7].

   a. Date routine in JOBPR reads System Buffer Sector from Disc to its own internal buffer by JSB EXEC call.

   b. Updates DATE, LU TABLE entries, and Default User Label in System Buffer Sector.

   c. Writes updated System Buffer Sector back on Disc by JSB EXEC call.

8. Execution of JOBPR to report Default USER DISC SUBCHANNEL # and LABEL [SLIDE 13A.8].

   a. Date Routine continues by executing EXEC call to request CURRENT USER DISC SUBCHANNEL # and LABEL.

   b. $EXI7 is used just as if :UD directive had been entered.

c. Point out that if GENERATION CODE or PROPRIETARY CODE do not agree with System Disc, ERROR MESSAGE may be printed here.

d. At end JOBPR then calls $TYPE for System TTY to output (CR) (LF) and @ and to input from Keyboard.

9. Summary of 1-8 above.

a. JOBPR is a USER PROGRAM and must do all I/O by JSB EXEC.

b. At end of 8 above, the JOBPR remains in memory until :PROG,X entered or :OFF given in response to * (here $CLER loads JOBPR fresh).

c. No part of Core Resident System ever does any I/O by JSB EXEC; always does by $SYIO.

d. MP and Interrupt System "ON" when in USER AREA. MP and Interrupt System "OFF" when in System Area.

f. DOSM I/O REQUEST PROCESSING [LARGE CHART].

II. OPERATIONAL DIFFERENCES FROM DOS

A. System Startup

1. Bootstrap rather than BBDL (at X776Ø).

   a. DOS procedure using BBDL.

   b. DOSM procedure using Bootstrap [SLIDES 14A & 14B].

      (1) Configure and execute.

      or (2) Configure, punch configured bootstrap, load configured bootstrap.

   c. No "FR" or "CO" entry statement as in DOS.

B. NEW DIRECTIVES

1. :OFF [SLIDE 15].

   a. Does not clear Job Binary Area.

2. :IN [SLIDE 16A & 16B]

   a. Can prepare discs for use in DOSM that were formatted by other software

   b. DISC PROTECT OVERRIDE SWITCH must be "ON" to purge a protected Disc (PCI=1).

3. :UD [SLIDES 17A, 17B].

4. :DD [SLIDE 18].

   a. No SDUMP with DOSM; do not need!

   b. Source Disc for User Area is current user disc.

5. :SS [SLIDES 19A, 19B].

   a. Duplicate file handling

6. Example Slides using the above directives. [SLIDES 20A, 20B, 20C].

C. Operational Difference Summary [SLIDES 21A, 21B, 21C, 21D].

III. PROGRAMMING DIFFERENCES FROM DOS

A. New EXEC call to change user disc [SLIDES 22A, 22B, 22C].

1. :EJOB resets changes made.

2. Error messages if incorrect SYSTEM GENERATION or SYSTEM PROPRIETARY CODE, but assignment still made.

B. DOS/DOSM EXEC calls with negative request codes [SLIDE 23A].

C. DOSM Disc I/O with EXEC calls [SLIDE 23B].

D. EXEC calls difference summary [SLIDE 24].

E. Other important points.

1. If MP option not used the following are valid.

a. All I/O instructions and HALT

b. Base page modifications.

c. Special interaction with DISC MONITOR (DISCM).

2. LOADR is unaffected by :SS condition. File searches it initiates are for only current user disc. Order of scanning is:

a. JOB BINARY (if any programs in it)
b. USER FILES (if any given)
c. PAPER TAPE (if specified)
d. DISC RESIDENT RELOCATABLE LIBRARY

IV. INSTALLATION

A. Introduction to System Generation.

1. Binary tapes needed [SLIDES 30A, 30B].

2. Preliminary Considerations

   a. Medium of input

      (1) Paper tape.

      (2) Magnetic tape (restrictions with FORTRAN IV in 8K).

      (3) Combination

   b. Core size [SLIDE 31] -- GENERAL (Projecture #1)

      (1) Speed of System Operation needed.

      (2) Core Resident versus Disc Resident EXEC Modules and I/O Drivers.

      (3) System Modules size breakdown [SLIDE 32] (Projecture #2).

         a. Minimum System Analysis using slides 31 and 32.

   c. Particular needs for given application.

   d. System and User Disc subchannel declaration.

      (1) More efficient (time wise) if System and User Discs are on different drives, depending on what System is doing.

   e. Other System Discs considerations.

      (1) If both generated so that linkage and DISCM are in same place, then user main programs LOADED on one system would "RUN" and be compatable with the other. Location of EXEC entry in DISCM must be same; # links must be enough; Etc...

f. Hardware required for Generation.

3. Starting System Generator

a. SIO Configuration - loading Generator.

b. All equipment to be used "ON".

c. Disc Drive for Generated system "READY".

d. Disc Protect Override Switch "ON".

e. Starting Generator (S.A. = 1ØØ octal).

(1) Switch 15 DOWN for Straight Generation.

(2) Switch 15 UP only for User Disc Formatting.

4. Brief description of the four PHASES and ability to restart at any one at 1ØØ octal.

B. System Generation Procedure and Example

1. Initialization Phase [SLIDE 4ØA].

a. Responses to questions about the System (in general) to be generated.

b. System Generation Code - maximum 4 decimal positive digits. Written in Label Sector of System Disc.

c. # Sectors/Track - Actually # Sectors/Physical track which is 12 for low density disc.

d. System Disc Size - actually # cylinders.

e. First System Sector - System uses first 3 sectors on track Ø of System Disc.

f. 2114 question - only for DMA considerations (only one DMA Channel available on 2114B).

g. Program Input, Library Input questions - Unimportant whether PT or MT entered here

(1) MT may not be used for FORTRAN IV in 8K.

(2) DF also valid entry for disc file input. (SIO driver for IOMEC available later).

h. Parameter Input question - only applies to PARAMETER INPUT PHASE.

3. Program Input and Parameter Input Phases [SLIDE 40B].

a. Input device selected via S.R. switches Ø-1.

$ØØ_2$ - PROGRAM INPUT
$1Ø_2$ - LIBRARY INPUT
$Ø1_2$ - TERMINATE LOADING

b. Restrictions

(1) DISCM should be loaded first for intersystem compatability.

(2) Main Programs (like FTN) must be loaded prior to segments (like FTNØ1, FTNØ2, ... etc.)

(3) If generating 8K system with FORTRAN IV no Compilers, or Assembler may be loaded at this time. (Must be loaded using LOADR during System operation).

c. If undefined externals exist (message printed), may load module forgot by setting S.R. accordingly as in a. above and pressing "RUN".

d. During PARAMETER INPUT PHASE, be sure to declare other routines ($SRCH, $LBL, etc...) core resident too if certain EXEC modules are declared core resident. Generator will not flag if omitted.

e. LINKAGE QUESTIONS

(1) #SYSTEM LINKS - only used by Core Resident System.

(2) #USER LINKS - only used by User Programs

(3) To make DISCM start at 2ØØØ octal (page boundary) respond with 177 and 5ØØ respectively.

f. Switch 15 must be up for Subroutines (indented two spaces) and entry points (preceeded by "*") to be printed in memory allocation listing.

3. Disc Loading Phase (class follows Xerox of Generation).

TOPIC	[SLIDE] MAIN PROJECTOR	[SLIDE] AUXILIARY PROJECTOR
a. Links	AP-1	
b. Loc. 4-Start of Links	AP-1	AP-6
c. Core Res Prog & Links	AP-1	AP6-13
d. Equip. Table	AP-1,AP-2	AP-14
e. DRT + Int. Tables	AP-1,AP-3	AP-14
f. Disc Res. Exec Mod. TABLE	AP-1,AP-4	AP-14
g. Disc Res Exec. Mod.	AP-1	AP-5
h. Disc Res. I/O Drivers	AP-1	AP-5
i. Disc Res User Prog.	AP-1	AP-5
j. Value of A-Reg. at end (do on slide 40J)		
k. Listing of :EQ & :LU [SLIDE AP-5]		

C. Formatting User Discs or Cartridges [SLIDE 41].

1. Example printout [SLIDE 42].

V. INTERNAL SYSTEM ORGANIZATION

A. Format for Disc Files

(1) Absolute (Core Image) [SLIDE 43].

(2) Relocatable [SLIDE 44].

(3) ASCII Source Statements [SLIDES 45A, 45B].

(4) ASCII or Binary Data.

a. System simply reserves space - does not set initial file contents to any value(s).

B. Disc Layout for Generation Example

TOPIC	MAIN PROJECTURE	AUX. PROJECTURE
Overall Disc Layout	5Ø	-----
System Label Sector	5I	AD-I
Disc Resident Bootstrap	5Ø	AD-I
System Directory	5Ø,52	AD-I→AD-3
Core Res. Sys. (#2)	5Ø,53	AD-3→AD-IØ
Core Res. Sys. (#3)	5Ø,54,55	AD-IØ
Disc Res. Programs	5Ø,56	AD-IØ→AD-24
Core Res. Sys. (#4)	5Ø,57,58	AD-25
Core Res. Sys. (#I)	5Ø,58	AD-26→AD-27
User Label Sector	5Ø,59	AD-28
User Directory	5Ø,6Ø,6I	AD-28→AD-29

C. Detailed Description of System Base Page Communication Area. (Found in Appendix A of Operators' Manual). Description starts on next page. Slides AP-I (General Core Layout) and AP-6 (Low Core of Memory Dump) will be used to relate values where possible.

DOS-M BASE PAGE LOCATIONS

LOCATION (S)	TYPE	CONTENTS
3	--	Start address for System Start-up (branched to indirect by Disc Resident Bootstrap following loading of Core Resident System).
4-37	--	JSB N,I where N is a Base Page Location containing the Central Interrupt Controller ($CIC) address.
4Ø	DEC	-64 (177ØØ)
41	DEC	-1Ø (177766)
42	DEC	-9 (177767)
43	DEC	-8 (17777Ø)
44	DEC	-7 (177771)
45	DEC	-6 (177772)
46	DEC	-5 (177773)
47	DEC	-4 (177774)
5Ø	DEC	-3 (177775)
51	DEC	-2 (177776)
52	DEC	-1 (177777)
53	DEC	Ø (Ø)
54	DEC	1 (1)
55	DEC	2 (2)
56	DEC	3 (3)
57	DEC	4 (4)
6Ø	DEC	5 (5)
61	DEC	6 (6)
62	DEC	7 (7)
63	DEC	8 (1Ø)

LOCATION	TYPE	CONTENTS	
64	DEC	9	(11)
65	DEC	10	(12)
66	DEC	17	(21)
67	DEC	64	(100)
70	OCT	17	(17)
71	OCT	37	(37)
72	OCT	77	(77)
73	OCT	177	(177)
74	OCT	377	(377)
75	OCT	177400	(177400)
76	OCT	3777	(3777)
77	OCT	177700	(177700)

LOCATION	LABEL	CONTENTS
100	UMLWA	Last word address of user available memory. Will always be one less than contents of location 123.
101	JBINS	Start TRACK/SECTOR of job binary area. =0 if job binary area not assigned. =-1 if this area overflows during compilation or assembly. = TRACK/SECTOR at end-of-disc for area assigned.
102	JBINC	Current TRACK/SECTOR of job binary area. Only set by compilers or assembler using this area.
103	TBG	Time Base Generator I/O Channel address. Will be 0 if TBG not on system.
104	CLOCK	Minutes part of System Time Clock.
105	CLOCK+1	Tenths of seconds part of System Time Clock.
106	CLEX	Minutes part of execution Time Clock. Bit 15 is set "ON" to turn this clock off.
107	CLEX+1	Tenths of seconds part of Execution Time Clock.
110	CXMX	Maximum allowable execution time. Set by :RUN Directive time parameter or to 5 if not given.

LOCATION	LABEL	CONTENTS
111	BATCH	Logical Unit # of Batch Input Device. Set by :BATCH Directive.
112	SYSTY	Logical Unit # of System Teletype.
113	DUMPS	Abort/Post Mortem dump flags. Bit 15 --- Abort dump flag. Bit Ø --- Post mortem dump flag. Bit will be on if condition set. These bits will be set by :ADUMP and :PDUMP Directives and cleared by either their execution, :OFF Directive, or new :JOB Directive.
114	SYSDR	System Directory start TRACK/SECTOR. Set to where system is declared as starting during generation.
115	SYSBF	System Buffer TRACK/SECTOR. Since always on track boundary, sector part will always be Ø.
116	SECTR	Number of logical sectors per disc track.
117	EQTAB	Start Address of Equipment Table.
12Ø	EQT#	Number of entries in entire Equipment Table.. Each entry is 17 words.
121	LUTAB	Start address of Logical Unit Table.
122	LUT#	Number of entries in Logical Unit Table.
123	JBUF	Start address of Job Input Buffer.
124	JFILS	Start TRACK/SECTOR address of source file. Set by execution of :JFILE Directive.

LOCATION	LABEL	CONTENTS
125	JFILC	Current TRACK/SECTOR address of source file. Updated as Compiler or Assembler accesses the source file.
126-14Ø	RONBF RONBF+1 ⋮ RONBF+1Ø	Multi-purpose 11 word buffer used by system when user program is executing. Some uses are: (1) Saving of two 5 word user File directory entries to increase system efficiency when user program is running on only one subchannel. System looks here first for Directory entry before searching Disc Directory. (2) Contains actual parameter valves (P1,P2,...) following :PROG, and :GO directives. (3) Information is passed to $EX20 (Parity Error Processor) by these locations.
141-153	EXPG ⋮ EXPG+1Ø	Directory Entry for currently executing USER program. For MAIN programs having segments: The first 2 1/2 words will always be those of the MAIN program's Directory entry (File Name in ASCII) with the remaining 8 1/2 words equal to the segment currently executing Directory entry information.
154	DISCO	Bits 11-15 (Disc Data Channel select code). Bits Ø-1Ø (Last Track on System).
155	SYSSC	System Disc Subchannel number. Will always be equal to S.C. bootstrapped down from.

LOCATION	LABEL	CONTENTS
156	SCCNT	Number of Subchannels on System -1.
157	UDNTS	Next TRACK/SECTOR address on Current User Disc.
16Ø	SYNTS	Next TRACK/SECTOR address on System Disc. Will always equal the start of Work Area.
161	CUDSC	Current User Disc subchannel number.
162	CRFLG	Current Disc request flag.(Ø for System Disc; ≠Ø for Current User Disc). DVR31 always clears on completion of Disc request and examines on entry to see what disc to access.
163	CUDLA	Current User Disc TRACK/SECTOR address last accessed. Only used by DVR31.
164	SDLA	System Disc TRACK/SECTOR address last accessed. Only used by DVR31.
165	CUMID	Computer identification code. (≠Ø if computer is 2114B thus only having one DMA channel).
166-17Ø	DBUFR	System Disc Request Parameter Buffer. DBUFR = TRACK/SECTOR DBUFR+1 = BUFFER ADDRESS DBUFR+2 = NUMBER OF WORDS (Set by System prior to Disc I/O for DVR31 to use).

LOCATION	LABEL	CONTENTS
171-173	UBUFR	Current User Disc Request Paramenter Buffer. UBUFR = TRACK/SECTOR UBUFR+1 = BUFFER ADDRESS UBUFR+2 = NUMBER OF WORDS (set by System prior to Disc I/O for DVR31 to use).
174	TSONE	Last referenced TRACK/SECTOR address +1. Set by DVR31. Could be used by User program accessing the WORK AREA to see what next available TRACK/SECTOR address is.
175	GUDSC	Default User Disc Subchannel number. Always follows System Disc Subchannel number when Default User Disc is on same subchannel as System. (like when :DD executed), otherwise it stays where started W.R.T. Bootstrapped System.
176	SYSCD	System Generation Code.
177	JFLSC	Current Source File Subchannel number. Set by :JFILE Directive.
200	DISCL	User label TRACK/SECTOR address. =Ø if Current User Disc is not on System Disc. If Current User Disc is on System Disc this Disc address = System Buffer Sector address. Incrementing this Disc address by one sector always gives the start of the User Directory TRACK/SECTOR address on the Current User Disc.

LOCATION	LABEL	CONTENTS
201	INTAB	Start address of Interrupt Table.
202	INT#	Number of Interrupt Table entries.
203-223	EQT1 EQT2 ⋮ EQT17	Addresses of Current Equipment Table Entry
224	RQCNT	Number of request parameters in current EXEC call. JSB EXEC and DEF RTN are not counted.
225	RQRTN	Request return address in current EXEC call.
226-235	RQP1 RQP2 ⋮ RQP8	Addresses of current request parameters. RQP1 is for the request code address etc.
236	NABRT	Illegal request code abort/no abort option parameter. ≠Ø if set. Set by N parameter in :RUN Directive.
237	XA	A Register contents at time of interrupt.
240	XB	B Register contents at time of interrupt.
241	XEO	E (Bit 15) and O (Bit Ø) Register contents at time of interrupt.
242	XSUSP	Address at time of interrupt (P-Register)
243	EXLOC	Start address of EXEC MODULE DOUBLET TABLE

LOCATION	LABEL	CONTENTS
244	EX#	Number of entries in EXEC MODULE DOUBLET TABLE.
245	EXMOD	EXEC MODULE currently in EXEC MODULE overlay area. = Ø if none resident. = +N if module #N resident and available. = -N if module #N resident and BUSY.
246	EXMAN	EXEC MODULE overlay area low Main Core Address.
247	EXMAN+1	EXEC MODULE overlay area high Main Core Address.
25Ø	EXBAS	EXEC MODULE Base Page linkage low address.
251	EXBAS+1	EXEC MODULE Base Page linkage high address.
252	IODMN	START ADDRESS OF I/O Driver Main overlay area.
253	IODBS	Start address of I/O Driver Base Page overlay area.
254	UMFWA	Start address of User Main Area.
255	UBFWA	Start address of User Base Page Linkage Area.
256	UBLWA	Last word address of User Base Page Linkage Area.
257	CHAN	Current DMA channel number assigned. = Ø if no DMA in use.

LOCATION	LABEL	CONTENTS
26Ø	OPATN	Operator attention flag. = Ø for not set. ≠ Ø if desired. Set by System TTY Driver.
261	OPFLG	System TTY busy flag. = Ø if not busy. ≠ Ø if busy.
262	SWAP	Job Processor resident flag. BIT 15 = 1 if System TTY is Batch Device. BIT Ø = 1 if Job Processor is in core.
263	JOBPM	Job Processor start TRACK/SECTOR address.
264	JOBPM+1	# of words in MAIN section of Job Processor.
265	JOBPB	# of words in Base Page Linkage for Job Processor.
266	EJOBF	End-of-Job flag used only by Job Processor. = "blanks" if re-entry of :DATE allowed = Ø if in a job. = 1 if between jobs. = -1 if end-of-job.
267	RTRK	Real Time simulation track #.
27Ø-467	$BUF $BUF+1 • • • $BUF+127	128 Word System I/O Buffer. Used only by Monitor and EXEC modules.
47Ø	$GOPT	Point of suspension return address. Contains return address when $IDCD (location 471 below) = GO

LOCATION	LABEL	CONTENTS
471	$IDCD	Input request code check characters. = Ø for no special restrictions. ≠ Ø for special restrictions placed on what can be entered via system TTY keyboard (like DA, GO, etc...).
472-473	$MDBF	2 Word EXEC Module Data Buffer.
474-5Ø2	TEMP TEMP+1 ⋮ TEMP+6	System Temporary.
5Ø3	TEMPØ	System Temporary.
5Ø4	TEMP1	System Temporary.
5Ø5	TEMP2	System Temporary.
5Ø6	TEMP3	System Temporary.
5Ø7	TEMP4	System Temporary.
51Ø	TEMP5	System Temporary.
511	MSECT	Negative # of logical SECTORS per TRACK.
512	VADR	Address of last instruction that caused a memory protect violation.
513	IODMD	I/O Driver Overlay Area resident flag. = Ø if no I/O Driver in this area. ≠ Ø if an I/O Driver is in this area. The value (if not Ø) will be: + (Address of resident Driver's first EQT entry) if area is available OR - (Address of resident Driver's first EQT entry) if this area is not available

514	RCODE	Current request code value. Will always be positive.
515	SXA	Operator attention A Register save.
516	SXB	Operator attention B Register save.
517	SXEO	Operator attention E (Bit 15) and O (Bit Ø) Register save.
52Ø	SXSUS	Operator attention return address save (P-Resister).
521	SEQTI	Operator attention EQT Table address save.
522	DSCLB	Disc TRACK/SECTOR Address of Disc Resident Relocatable Library. Used by Relocating Loader.
523	DSCL#	Number of sectors in Disc Resident Relocatable Library.
524	LSTCH	Last Disc referenced flag. = Ø if current user program (to be executed by :PROG or :RUN) is on System Disc. ≠ Ø if current user program (to be executed by :PROG or :RUN) is on Current User Disc.
	NOTE:	$EXIO (Program Load) uses to see how to set CRFLG flag (location 162).
525	FLFLG	User file table validity flag. (= Ø if invalid; ≠ Ø if valid). $EXII uses to see if OK to use $BUF area for user file directory entry storage.

LOCATION	LABEL	CONTENTS
526	XFLG	Transfer Address for Disc Not Ready condition. = Ø to process Not Ready condition normally. ≠ Ø to transfer to this address if Not Ready condition present. A good use is to ignore "NOT READY" Drives when doing multiple Drive System Searches.
527	SSFLG	System Search Flag Values it can have are: a. ASCII "NO" if :SS Directive not allowed. b. Ø for only current user Disc (:SS,99 condition). c. -X for full System Search (:SS) where X= # subchannels on system -1. d. +X for Selected System Search Bits Ø-7 are used to represent Subchannels Ø-7 respectively. Bit ON=OK, Bit OFF=not OK.
53Ø-531	CHARC	System Temporary.

VI. INTERNAL SYSTEM OPERATION

A. IOMEC Command Sequences

1. Seek Record [SLIDE 69A]
2. Read Data [SLIDE 69B]
3. Write Data [SLIDE 69C]
4. Check Data [SLIDE 69D]
5. Status Check [SLIDE 69E]
6. Constants and Storage [SLIDE 69F] -- Second Projector

B. Supplied DOS-M Bootstrap Listing Study ("A" Version)

1. Configuration Section (Start Address =2) [SLIDES 70D - 70F]
   a. Data Channel In Switches Ø-5
   b. Configure DMA Control Word
   c. Loop to Configure all D.C. and C.C. Instructions
   d. Switch 15 Down -- HALT
      Switch 15 UP -- Punch Configured Bootstrap in absolute tape format.
2. Execution Section (Start Address =100B or 5) [SLIDES 70A-70C]
   a. Loads Disc Resident Bootstrap form Track Ø Sectors 1 & 2 on Subchannel specified to memory locations 15400 - 15777 octal.
   b. Sets locations in DRB as follows:

      15771 ← Ø.
      15772 ← Head # (Bits 8-9).
      15776 ← System Disc Drive #.
      15773, 15774 ← Data Channel I/O select code for Run Time Disc.
      15775 ← Command Channel I/O select code for Run Time Disc.

   c. Uses address in ASPBF of DRB (which was set earlier during generation) to see what page LWAM declared in adjusts for one page lower for relocation of Disc Resident Bootstrap.
   d. Adjusts DEF's in DRB for correct page (ASPBF, DEFDY, and DVADR).
   e. Relocates entire DRB to new page -- only does page relative move.

f. Transfers control to relocated DRB to have it bring in Core Resident DOS-M System from Disc.

C. Disc Resident Bootstrap (DRB) Listing Study [SLIDES 71A - 71F]

1. Configures all Disc I/O instructions (within locations 15643-15724 octal) according to Data Channel already setup in location 15773 by supplied bootstrap.
2. Calls PLOAD routine four times to load in the four sections of Core Resident System defined in ASPBF through ASPBF+11 (3 words per load). SLOAD reads a sector at a time. Note how DMA Control Word does not have to be output again here because it was already outputted by Supplied Bootstrap in loading DRB.
3. Examine Equipment Table of CRS just loaded to accomplish the following:
   a. For DVRØ5 - configure all I/O instructions in this System TTY driver.
   b. For DVR31 - modify its EQT entry for "RUN TIME DISC" channels. Configure all I/O instructions in this driver. Configure DMA control word in this driver. Set + and - # sectors per track locations in this driver.
4. Set RUN TIME DISC channel in DISCO (base page location 154B; bits 15-11).
5. Set RUN TIME DISC Interrupt Table entries in correct interrupt table entry and also put correct entry in interrupt table where Generator Disc Channel entries were.
6. Set new I/O channels in Equipment Table for devices swapped with RUN TIME DISC.
7. Set RUN TIME SYSTEM Subchannel in Base Page location 155 octal from information passed by Supplied Bootstrap.
8. Set User Label TRACK/SECTOR Disc Address (Base Page location 2ØØ octal) according to Base Page locations 155 and 175 octal.
9. Set Next TRACK/SECTOR Address on Current User Disc (Base Page Location 157 octal).
10. Set Current User Disc Subchannel # (location 161) equal to Default User Disc Subchannel # (location 175).
11. Branch to location 3 indirect to start DOS-M System.

D. DOS-M System Halts [SLIDE 72]

These Halts are only during System Operation following successful bootstrap.

E. DOS-M I/O Request Processing Example

1. Materials used

   a. Tape Recording of step by step execution

   b. Large chart of DOS-M I/O Request Processing

   c. Foldout flowcharts on DOS-M (next section)

   d. Slides

      (1) Equipment Table Format; # 10B

      (2) Device Reference Table Format; # 10C

      (3) Interrupt Table Format; # 10D

2. Procedure

   a. Using the above tape recording and materials, trace an example I/O Request Operation (b below) through all major steps that occur from the initial EXEC call until the I/O operation is complete.

   b. The example I/O operation will be:

```
      JSB EXEC          (Call to Executive Supervisor)
      DEF RTN           (Define Return Address)
      DEF RCODE         (Define Request Code Address)
      DEF CONWD         (Define Control Word Address)
      DEF BUFA          (Define Buffer Start Address)
      DEF BUFL          (Define Buffer Length Address)
RTN (Return Point)
        .
        .
        .
RCODE DEC 1             (Read Operation R.C.)
CONWD OCT 5             (Logical Unit 5)
BUFA  BSS 36            (36 word or 72 char. Buffer)
BUFL  DEC -72           (72 character length)
```

DOS-M FLOWCHARTS TABLE OF CONTENTS

DISC MONITOR

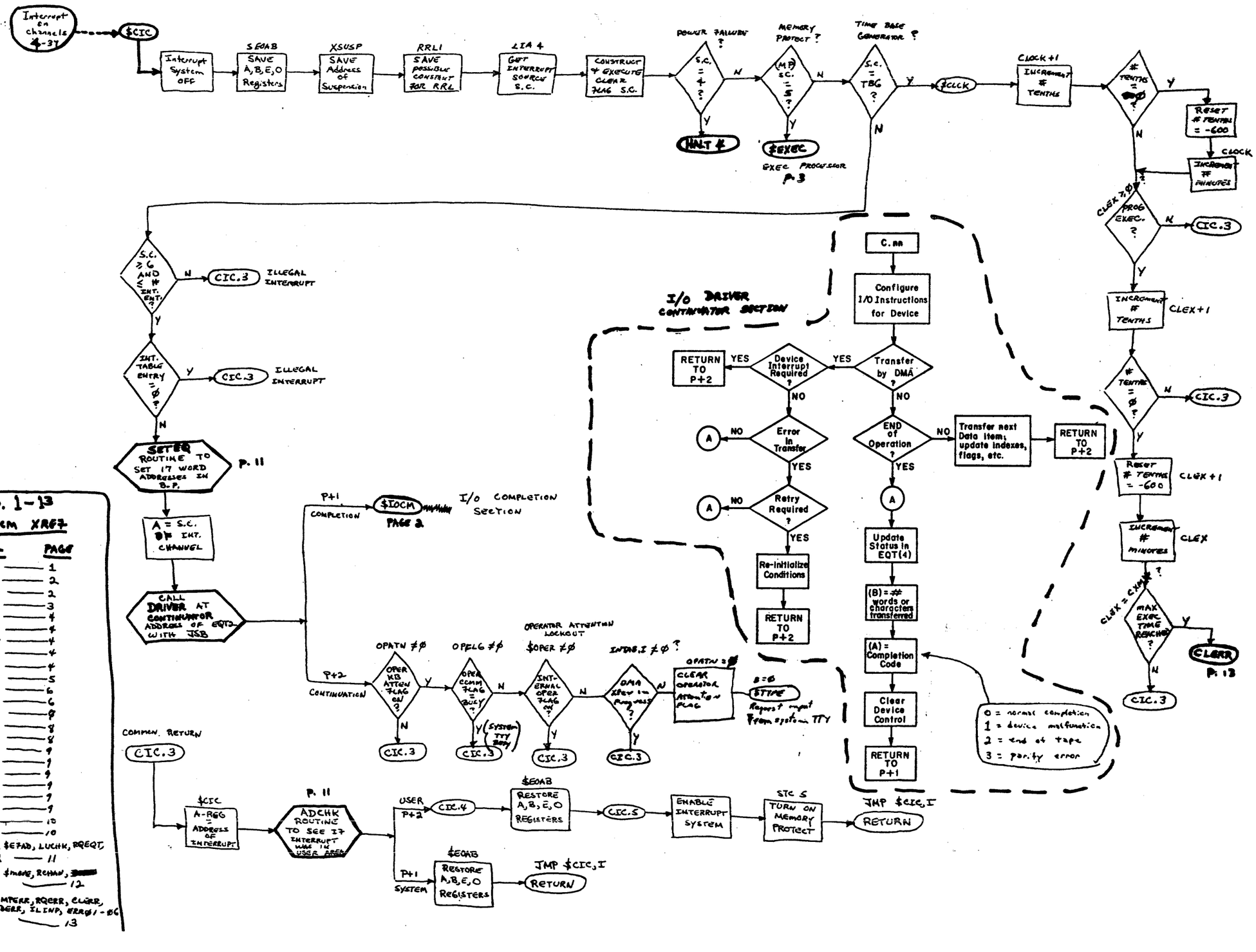
EXECUTIVE MODULES

EXECUTIVE MODULES (continued)

SYSTEM SUBROUTINES

DRIVERS

CENTRAL INTERRUPT CONTROL PROCESSOR ($CIC)



P. 1-13

DISCM XREF

LABEL	PAGE
$CIC	1
$IOCM	2
$IOBQ	2
EXEC	3
$WAIT	4
$BLOP	4
$MBSY	4
$DMA	4
$EBSY	4
$TYPE	5
$SYIO	6
DRIVR	6
$TEST	8
$JLOD	8
$MDLD	8
$LDVR	9
DISCK	9
$GDTK	9
$DISC	9
$LDEX	9
$STAT	9
$IRLI	10
$CLER	10
ADCHK, $EFAD, LUCHK, RREQT, SETEQ	11
$DMAX, $MASK, RCHAN, [redacted]	12
ERRTN, MTERR, RQERR, CLERR, ERR, BGER, ILINP, ERR0/1-BC	13

INPUT/OUTPUT COMPLETION SECTION ($IOCM)

ENTERED FROM $EEC
WITH
A = STATUS FROM DRIVER
B = # CHAR./WORDS XMITTED

$IOCM

SAVE
EQT13,I ← A
CHAR+1 ← A
EQT14,I ← B

RCHAN
ROUTINE TO RELEASE DMA CHAN
E.T.E. ← #

P. 12

ICDMD = EQT1 ?
Y
+ FOR AVAIL
SET ICDMD = EQT1

LSB SWAP ≠ Ø
JCB PROG. IN CORE ?
Y
IOCØ4

NO PROGRAM RUNNING IF EXPG = Ø
DIR. ENTRY FOR CUR. PROG. (WORD 1 = Ø ?)
Y
IOCØ4

EQT8,I = 1
R.Q. (PRG) = INPUT ?
Y
N
IOCØ4

CONVERT BATCH L.U. TO EQT TABLE ADDRESS

BATCH DEVICE = CURRENT DEVICE ?
THIS ADDR. = EQT1 ?
Y
N
IOCØ4

1ST CHAR. OF REQ. B-7 = :
Y
N
IOCØ4

P. 11
ADCHK ROUTINE TO SEE IF REQUESTED RTN IS Ø#/ERR

Pt2 USER
Pt1 SYSTEM
IOCØ8

MOVE INPUT DATA FROM USER BUFFER TO $OB INPUT BUF.
P. 12

CONVERT ASCII LOC TO CHAR. IF NUMB REQ.
+ SAVE IN CHARC

SET AV FIELD IN EQT TABLE = ØØ

SAVE REQ. RETURN ADDRESS AT SUSP ADDR
XSUSP ← EQT9,I

ILINP
P. 13
ILLEGAL USER INPUT DATA

1. JOBPR IN CORE
2. NO PROGRAM RUNNING
3. Request ≠ 1
4. Batch device ≠ current device
5. 1ST character ≠ :
6. Return is to system

IOCØ4

EQT13,I ≠ Ø
DID MALFUNCTION OCCUR ?
N
Y
IOC1Ø

EQT4,I
SET AV FIELD IN EQT TABLE = ØØ

CONTROL WORD BIT OFF ?
WAIT TILL DONE REQ. ?
Y
N
IOC 2Ø

TEMP2
SAVE REQUESTED RETURN ADDRESS

P. 11
ADCHK ROUTINE TO SEE IF REQ. RETURN IS USER/SYS.

Pt1 SYSTEM
IOCØ8
EQT4,I
A = DRIVER STATUS
B = XMISSION LOC
RETURN REQ.
TEMP2,I

Pt2 USER
PATCH FLAG = "PA" ?
Y
IOCØ4
EQT1 → $LEQT
SAVE EQT TABLE location to return to in IOC
$LWAIT
P. 4.

N
OPERATOR ATTEN FLAG ON ?
Y
IOCØ7

SYSTEM TTY BUSY
WORD 4 BIT 15 OF EQT SET = Ø ?
Y
N

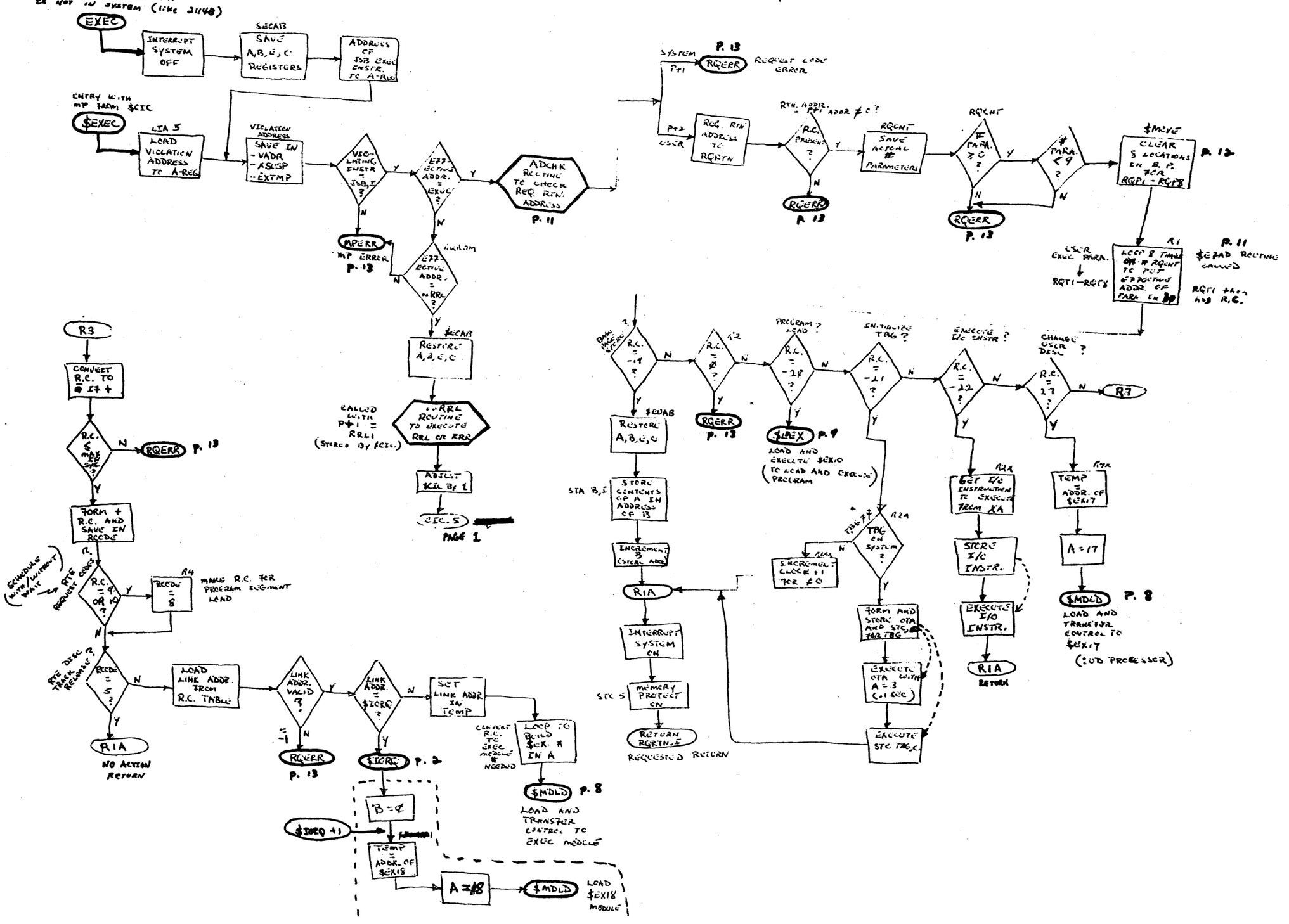
OPERATOR ATTEN FLAG ON ?
ENT LEGAL OPER FLAG ON ?
$CYLR FC ?
Y
IOCØ6
CLEAR OPR ATTEN FLAG
OPATN = Ø
EQT4,I
A = DRIVER STATUS
B = XMISSION LOC
INTERRUPT SYSTEM ON
STC Ø
MEMORY PROTECT ON
STC 5
TEMP3,I
RETURN REQ.

N
SET RETURN A & B REGISTER VALUES
XA = DRIVER STATUS
XB = XMISSION LOC
EQT4,I
SET REQ. RETURN ADDR AT SUSP ADDR
X SUSP ← EQT7,I
CLEAR OPER. ATTEN. FLAG
OPATN = Ø
B = Ø
$TYPE
P. 5
REQUEST INPUT FROM SYSTEM TTY

$IORQ
B = Ø
$IORQ+1
TEMP = DC718
A = 18
$MDLD
P. 8
LOAD $EXIX (I/O INITIATION PROCESSER)

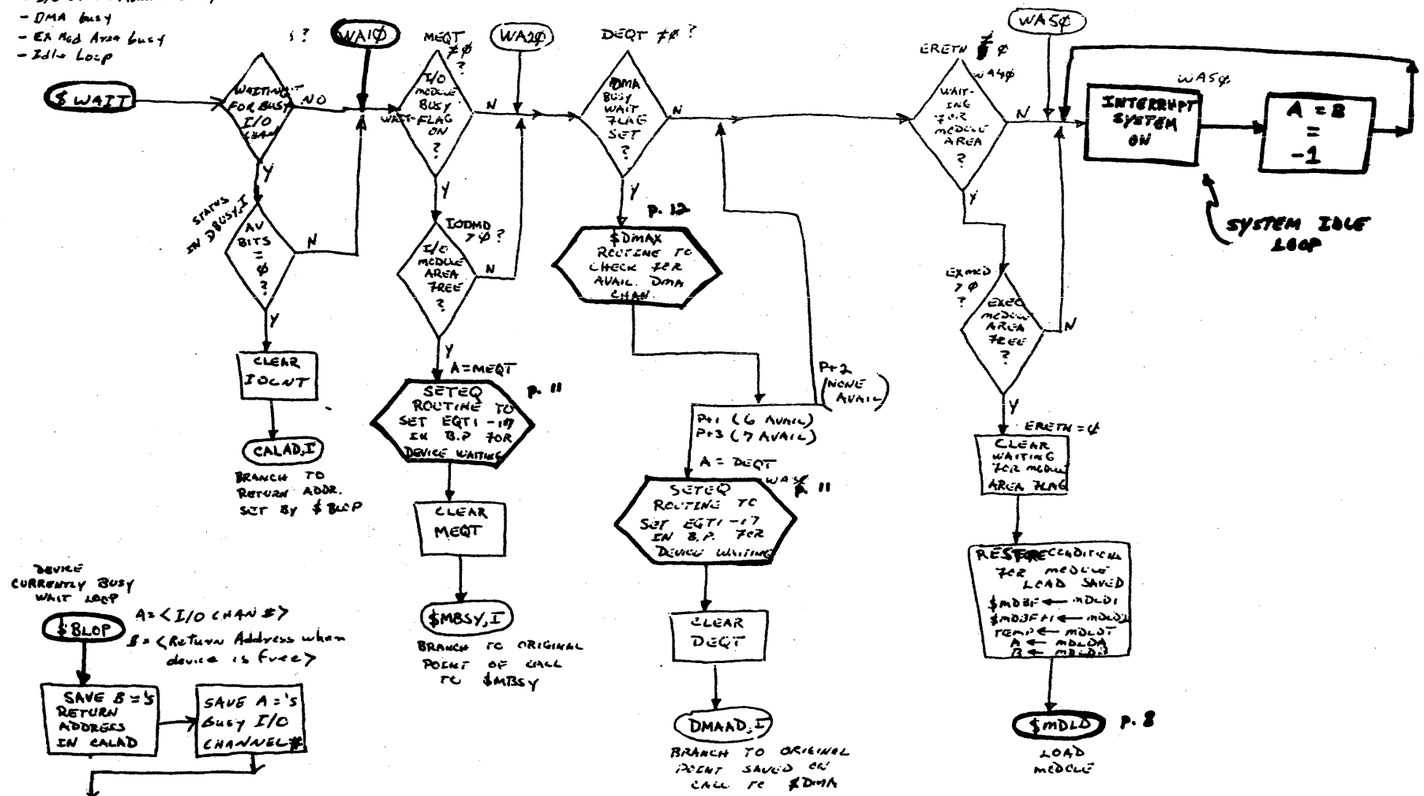
IOC1Ø
PARITY ERROR ?
= 3 ?
N
IERR
P. 13
I/O ERROR
Y
DISK ?
Y
DERR
P. 13
SPECIAL ERROR
N
A = 3
IERR
P. 13
I/O ERROR

IOC 2Ø
I/O DRIVER CALLING ?
N
Y
I/O DRIVER AREA BUSY ?
ICDMD FLAG < Ø ?
N
WAIØ
P. 4
GO LOAD IN MODULE
Y
ICC 3Ø
COMPLETE CHANNEL = WAITING REQUEST COMM
Y
$WAIT
P. 4
TRANSFER TO CT
N
ICC4Ø
DCØT FC :
DRIVER WAITING FOR DMA ?
Y
$DMAX
P. 12
ROUTINE TO SEE IF DMA CHAN AVAIL
Pt3 BOTH BUSY
WA3Ø
P. 4
Pt1 Ø AVAIL
Pt3 1 AVAIL
N
CIC 3
Page 1

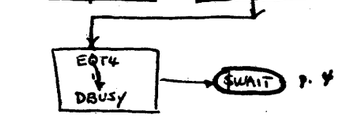

ENTERED DIRECTLY IF MP IS NOT IN SYSTEM (like 31148)
EXEC
INTERCEPT SYSTEM OFF
SECAB
SAVE A,B,E,C REGISTERS
ADDRESS OF JOB EXEC INSTR. TO A-REG
ENTRY WITH MP FROM $CIC
$EXEC
LIA 5
LOAD VIOLATION ADDRESS TO A-REG
VIOLATION ADDRESS
SAVE IN -VADR -ASUSP -EXTMP
VIO-LATING INSTR = JSB,I ?
E77 EFFECTIVE ADDR. = EXEC ?
ADCHK ROUTINE TO CHECK REQ. RTN. ADDRESS
P. 11
MPERR
MP ERROR
P. 13
E77 EFFECTIVE ADDR. = =RRL ?
$ECAB
RESTORE A,B,E,C
=RRL ROUTINE TO EXECUTE RRL OR ERR
CALLED WITH P+1 = RRL1 (STORED BY $CIC)
ADJUST $CIC BY 1
$CIC, 5
PAGE 1
R3
CONVERT R.C. TO @ I7 +
R.C. ≤ MAX FMP SVC ?
RQERR
P. 13
FORM + R.C. AND SAVE IN RCODE
SCHEDULE WITH/WITHOUT WAIT
RTE REQUEST CODES
R.C. = 9 OR 10 ?
R4
RCODE = 8
MAKE R.C. FOR PROGRAM SEGMENT LOAD
RTE DISC TRACK RELEASE ?
RCODE = 5 ?
LOAD LINK ADDR. FROM R.C. TABLE
LINK ADDR. VALID ?
LINK ADDR. = $IORQ ?
SET LINK ADDR IN TEMP
CONVERT R.C. TO EXEC MODULE # NEEDED
LOOP TO BUILD $EX.# IN A
$MDLD
P. 8
LOAD AND TRANSFER CONTROL TO EXEC MODULE
R1A
NO ACTION RETURN
$IORQ
P. 2
B = 4
$IORQ+1
TEMP = ADDR. OF $EXIS
A = 18
$MDLD
LOAD $EX18 MODULE
SYSTEM PT1
RQERR
REQUEST CODE ERROR
P. 13
PT2 USER
REQ. RTN ADDRESS TO RQRTN
RTN. ADDR. - PT1 ADDR ≠ 2 ?
R.C. PRESENT ?
RQERR
P. 13
RQCNT
SAVE NUMBER OF PARAMETERS
RQCNT
IF PARA. ≥ 0 ?
PARA. < 9 ?
RQERR
P. 13
$MOVE
CLEAR 5 LOCATIONS IN B, P, 7CA, RQP1 - RQP5
P. 12
USER EXEC PARA.
RQP1 - RQP5
R1
LOOP 8 TIMES OR # RQCNT TO PUT E77 EFFECTIVE ADDR. OF PARA IN BP
P. 11
$E77AD ROUTINE CALLED
RQP1 THEN HAS R.C.
R.C. = -1 ?
$EQAB
RESTORE A,B,E,C
STA B,I
STORE CONTENTS OF A IN ADDRESS OF I3
INCREMENT B (STORE ADDR)
R1A
INTERRUPT SYSTEM ON
STC 5
MEMORY PROTECT ON
RETURN RQRTN
REQUESTED RETURN
R.C. = 0 ?
RQERR
P. 13
R.C. = -24 ?
PROGRAM LOAD ?
$LOEX
P. 9
LOAD AND EXECUTE $EX10 TO LOAD AND EXECUTE PROGRAM
R.C. = -21 ?
INITIALIZE TBG ?
INCREMENT CLOCK + 1 FOR TBG
R2A
TBG ON SYSTEM ?
FORM AND STORE OTA AND STC FOR TBG
EXECUTE OTA WITH A = 3 (=1 SEC)
EXECUTE STC TBG,C
R.C. = -22 ?
EXECUTE I/O INSTR. ?
R1A
GET I/O INSTRUCTION TO EXECUTE FROM KA
STORE I/O INSTR.
EXECUTE I/O INSTR.
RIA
RETURN
R.C. = 17 ?
CHANGE USER DESC ?
R3
R2A
TEMP = ADDR. OF $EXI7
A = 17
$MDLD
P. 8
LOAD AND TRANSFER CONTROL TO $EXI7 (:UD PROCESSOR)

$WAIT, $BLOP, $MBSY, $DMA, $EBSY

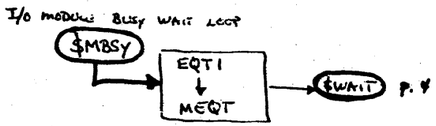
System Idling
- Busy I/O CHAN
- I/O Device Module busy
- DMA busy
- EA Mod Area busy
- Idle Loop



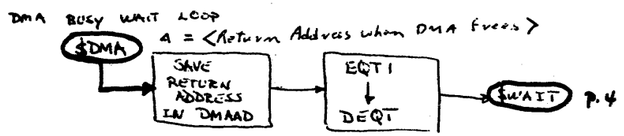
Device currently busy wait loop



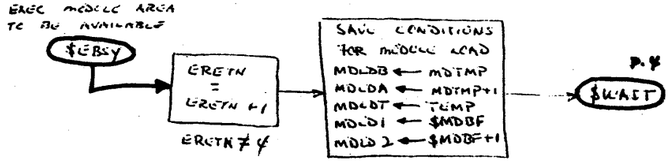
I/O module busy wait loop

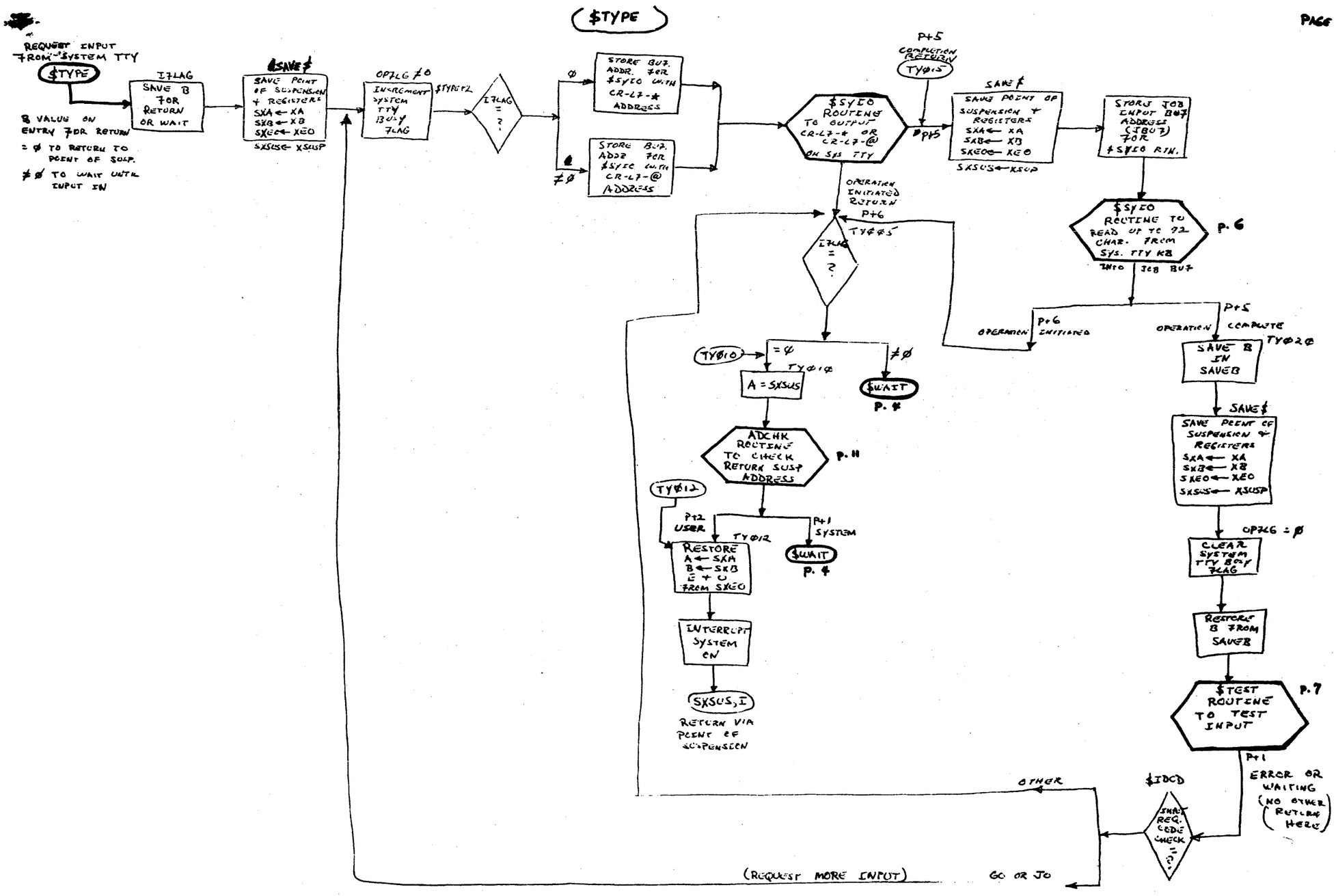


DMA busy wait loop



WAIT FOR EXEC MODULE AREA TO BE AVAILABLE




$TYPE
REQUEST INPUT FROM SYSTEM TTY
$TYPE
I7LAG
SAVE B FOR RETURN OR WAIT
B VALUE ON ENTRY FOR RETURN
= Ø TO RETURN TO POINT OF SUSP.
≠ Ø TO WAIT UNTIL INPUT IN
$SAVE$
SAVE POINT OF SUSPENSION + REGISTERS
SXA ← XA
SXB ← XB
SXEO ← XEO
SXSUS ← XSUSP
OP7LG ≠ Ø
INCREMENT SYSTEM TTY BUSY FLAG
$TYP#12
I7LAG = ?
Ø
≠ Ø
STORE BUF. ADDR. FOR $SYIO WITH CR-L7-* ADDRESS
STORE BUF. ADDR FOR $SYIC WITH CR-L7-@ ADDRESS
$SYIO ROUTINE TO OUTPUT CR-L7-* OR CR-L7-@ ON SYS TTY
P+5 COMPLETION RETURN
TY#15
P+5
SAVE$
SAVE POINT OF SUSPENSION + REGISTERS
SXA ← XA
SXB ← XB
SXEO ← XEO
SXSUS ← XSUSP
STORE JOB INPUT BUF ADDRESS (JIBUF) FOR $SYEO RTN.
$SYEO ROUTINE TO READ UP TO 72 CHAR. FROM SYS. TTY KB
p. 6
INIO
JOB BUF
OPERATION INITIATED RETURN
P+6
TY#5
I7LAG = ?
P+6 OPERATION INITIATED
P+5 OPERATION COMPLETE
TY#20
SAVE B IN SAVEB
SAVE$
SAVE POINT OF SUSPENSION + REGISTERS
SXA ← XA
SXB ← XB
SXEO ← XEO
SXSUS ← XSUSP
OP7LG = Ø
CLEAR SYSTEM TTY BUSY FLAG
RESTORE B FROM SAVEB
$TEST ROUTINE TO TEST INPUT
p. 7
P+1 ERROR OR WAITING (NO OTHER RETURNS HERE)
$IOCD
INPUT REQ. CODE CHECK = ?
OTHER
TY#10
= Ø
≠ Ø
TY#18
A = SXSUS
$WAIT
p. 4
ADCHK ROUTINE TO CHECK RETURN SUSP ADDRESS
p. 11
TY#12
P+2 USER
P+1 SYSTEM
TY#12
RESTORE A ← SXA B ← SXB E + U FROM SXEO
$WAIT
p. 4
INTERRUPT SYSTEM ON
SXSUS, I
RETURN VIA POINT OF SUSPENSION
(REQUEST MORE INPUT)
GO OR JO

$SYIO, DRIVR

SYSTEM I/O REQUESTS

$SYIO

SET A = LU OF REQUEST CALL (P+2)

LUCHK ROUTINE TO CHECK FOR LEGAL LU ... MEAN EQT TO EQT1 -17 IF LEGAL — P. 11

AV OF EQT4,I ≠ 0 ?

DEVICE BUSY ? — N / Y

ET CODE OF EQT4,I = 31 ?

DEVICE = DISK ? — N / Y

SET A = CHAN # FROM EQT3,I

SET B = ADDRESS OF ISB $SYIO

$BLOP P.4

DEVICE BUSY WAIT LOOP

$DMAX TO CHECK DMA CHANNEL AVAIL. — P. 12

P+1 (6 AVAIL)

P+2 P+3

SET A = ADDRESS OF ISB $SYIO

$DMA P.4

SET PARAMETERS IN EQUIPMENT TABLE

SET -R.C. IN EQT8,I

SET CW IN EQT9,I

SET BUF ADDRESS IN EQT10,I

SET # WORDS/CHAR IN EQT11,I

SET COMPLETION RETURN ADDR. IN EQT9,I

SET RTN FROM $SYIO TO P+6

DRIVR ROUTINE TO CALL FOR I/O OPERATION — THIS PAGE

P+2 OPERATION REJECTED

P+1 OPERATION INITIATED

RETURN P+6

RETURNS P+2

A = 1 READ/WRITE ILLEGAL FOR DEVICE
2 CONTROL REQ. ILLEGAL FOR DEVICE
3 EQUIP. MALFUNCTION OR NOT READY
4 IMMEDIATE COMPLETION
5 DMA UNAVAILABLE
6 DRIVER REQUIRES WAIT

INITIATE I/O DRIVER

DRIVR

EQT3,I < 0 ?

DMA REQ. ? — Y / N

DVR02

CHAN = 6

CURRENT DMA CHANNEL = 6

$DMAX TO CHECK FOR AVAIL. DMA CHANNEL — P. 13

P+1 (6 AVAIL)

DVR01

FOR DMA

SET EQT1 IN INTERRUPT TABLE

DVR02

SAVE BITS 6-15 OF I/O CW IN B

EQT5,I

A = # REQUEST CODE

USER REQ READ ?

R.C. = 14 ? — N / Y

A = 1

USER REQ WRITE ?

R.C. = 15 ? — N / Y

A = 2

DVR03

IOR A+B FOR CW.

STORE CW IN EQT7,I

DVR05

A = CHANNEL #

EQT3,I bits 0-5

*** CALL DRIVER INITIATION SECTION BY JSB (EQT1,I) IN B-REG ***

P+1 (SET E = 0)

(SAVE A IN TEMP5)

A ≠ 0

OPER REJECTED ? — N / Y

DEVICE NOT READY ?

A = 3 ? — Y / N

DVR06

E = 1

R 12 RCHAN ROUTINE TO RELEASE DMA CHAN.

B = 0

E = 1 ? (NO DEVICE NOT READY ?) — Y / N

This PAGE NRPAR ROUTINE TO CHECK IF EXII OR EXI7 ACTIVE

P+1

A = TEMP5

A = SAVED STATUS FROM DRIVER

DVR09 TO RETURN P+2

E = 0

EQT4,I (BIT 15)

SET AV FIELD = 2 TO INDICATE DEVICE BUSY

OPERATION INITIATED P+1 RETURN

IODMD = -IODMD

SET CUR. RES. I/O MODULE FLAG = - ITS VALUE

EQT3,I(14) = 1 ?

CUR. DRIVER DISK RESIDENT ? — Y / N

XFLG = 0 ?

NRPAR

ENTRY ADDR. FOR DISC NOT READY = 0 ? — N / Y

BRANCH

JMP (A = XFLG), I

RETURN P+1

EQT4,I (8-12)

EQT TYPE CODE = 31 ? — Y / N

DVR07

A = 5

DVR09

RETURN P+2 REJECT

P+3 (7 AVAIL)

CHAN = 7

DVR01

$TEST

ENTRY: B = # WORDS INPUT TO TEST IF DESIRED INPUT HAS BEEN INPUT

$TEST

RETURN TO CALLER IF NOT CORRECT INPUT

SAVE # WORDS INPUT IN -$MDB7 -CHARC

SET RTN ADDRESS ($TEST) IN $MDB7+1

JOB INPUT BUF

FIRST CHAR = "?

Y

TE@2

N

SET SYS TTY BUSY FLG ≠ 0

OPFLG ≠ 0

$SYIO ROUTINE TO OUTPUT "IGNORED" ON SYS. TTY

P.6

OPERATION INITIATED P+0

OPERATION COMPLETE P+5

$IDCD

INPUT REQ. CODE = GO ?

Y

B ≠ 0

$TYPE REQUEST INPUT FROM SYS. TTY

N

ADCHR ROUTINE TO CHECK SAVED SUS. ADDRESS (SXSUS)

P. 11

P+1 (SYSTEM)

P+2 (USER)

PAGE 1 $CIC3 ETC.

TY$12 PAGE 5

CLEAR SYS. TTY BUSY FLAG

OPFLG

SAVE

SAVE $

SXA ← XA
SXB ← XB
SXEQ ← XEQ
SXSUS ← XSUS

RETURN P+1

SET A = B = THE FIRST 2 WORDS IN JOB INPUT BUF

.. RRL ROUTINE TO DOUBLE REGISTER SHIFT A AND B TO LEFT

PA7LG

FIRST TWO CHAR (A) TO PAUSE FLAG

$IDCD

INPUT REQ. CODE = DA ?

Y

INPUT FIRST TWO CHAR = DA ?

DATE ?

N

TE@2

TE@@

Y

A = 0

LOAD JOB PROCESSOR

$JLOD

P. 8

ABRT ?

INPUT = AB ?

N

Y

TE@@

ASSIGN BATCH DEVICE AS SYSTEM TTY

BATCH = SYSTY

B = @

ABORT

$ABRT

TEMP+1 = B

EXECUTION TIME CLOCK OFF

CLOCK BIT IS ON

P. 10

$CLER ROUTINE TO CLEAR ALL I/O, RESIDENT DMA, FLAGS...

JOBPR IN CORE FLAG = @

SCHAP = @

EXEC MODULE REQ. FLAG = @

EXMOD = @

TEMP = DE715

RESTORE B WITH TEMP+1

A = 15

$MDLD

P. 8

LOAD EXEC MODULE 15 (ABORT AND POST MORTEM DUMP PROCESSOR)

PAUSE ?

INPUT = PA ?

N

Y

$GOPT = XSUSP

$IDCD

INPUT REQ. CODE = GO

$TYPE

P. 5

TYPE ?

INPT = TY ?

N

Y

EXPG

DIR. ENTRY FOR CLR. PROG ≠ @ ?

N

TE6@

Y

BIT 15 OF SWAP = 1

RETURN

P+1

OFF ?

INPUT = OF ?

N

Y

TE99

$IDCD

INPUT REQ. CODE = GO ?

N

TE22

Y

GO ?

INPUT = GO ?

N

TE25

Y

CLEAR INPUT REQ. CODE

$IDCD = @

SVEQT = @ ?

Y

GO PROCESS POSSIBLE GO PARA.

TEMP = DE716

A = 16

$MDLD

P. 8

LOAD $EXEC

N

TE19

SVEQT = @

GO ?

INPUT = GO ?

Y

TY@10

P. 5

N

SETEQ ROUTINE P.11 TO SET 17 WORD EQT ADDRESS IN E.P.

TEMP2 = EQT7,I

IOC@6

P. 2

TE22

$IDCD

INPUT REQ. CODE = JO ?

Y

N

JOB ?

INPUT = JO ?

Y

TE6@

N

ENTER ?

INPUT = EN ?

Y

N

TE@2

$IDCD

INPUT REQ. CODE = @ ?

Y

N

TE@2

WAITING FOR INPUT

WAITING FOR ANY INPUT ?

JOB PROC. IN CORE ?

Y

N

DIR. ENTRY FOR CLR. PROC ≠ @ ?

EXPG

Y

USER PROG RUNNING

N

TE6X

TE25

LU ?

INPUT = LU ?

N

Y

UP ?

INPT = UP ?

N

Y

TEMP = DE714

A = 14

B = CHARC

P. 8

$MDLD

LOAD EXEC MODULE 14 (:UP, :DN, :LU PROCESSOR)

DU ?

INPUT = DU ?

N

Y

EQ ?

INPUT = EQ ?

N

Y

TEMP = DE709

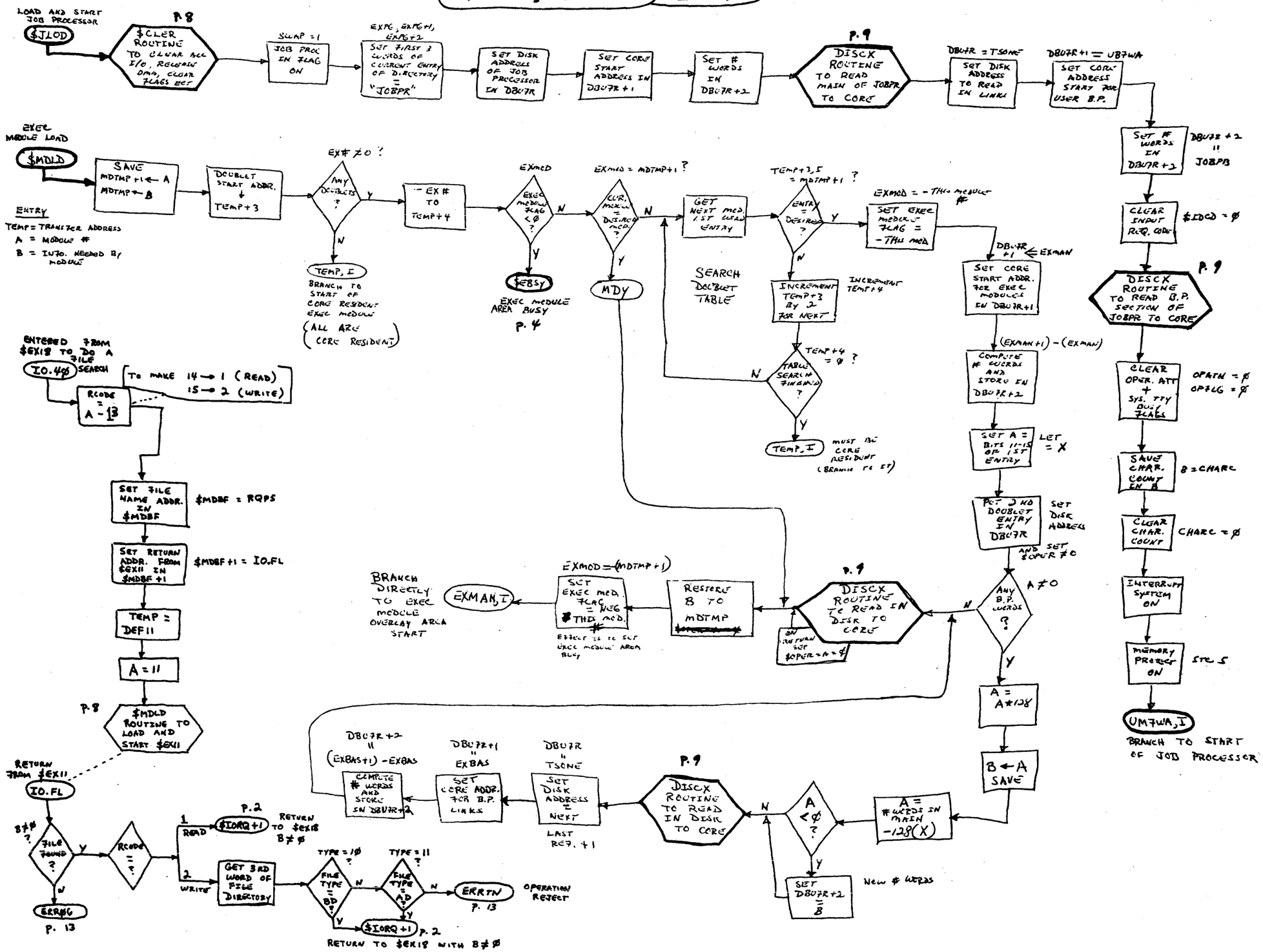
A = 9

$MDLD

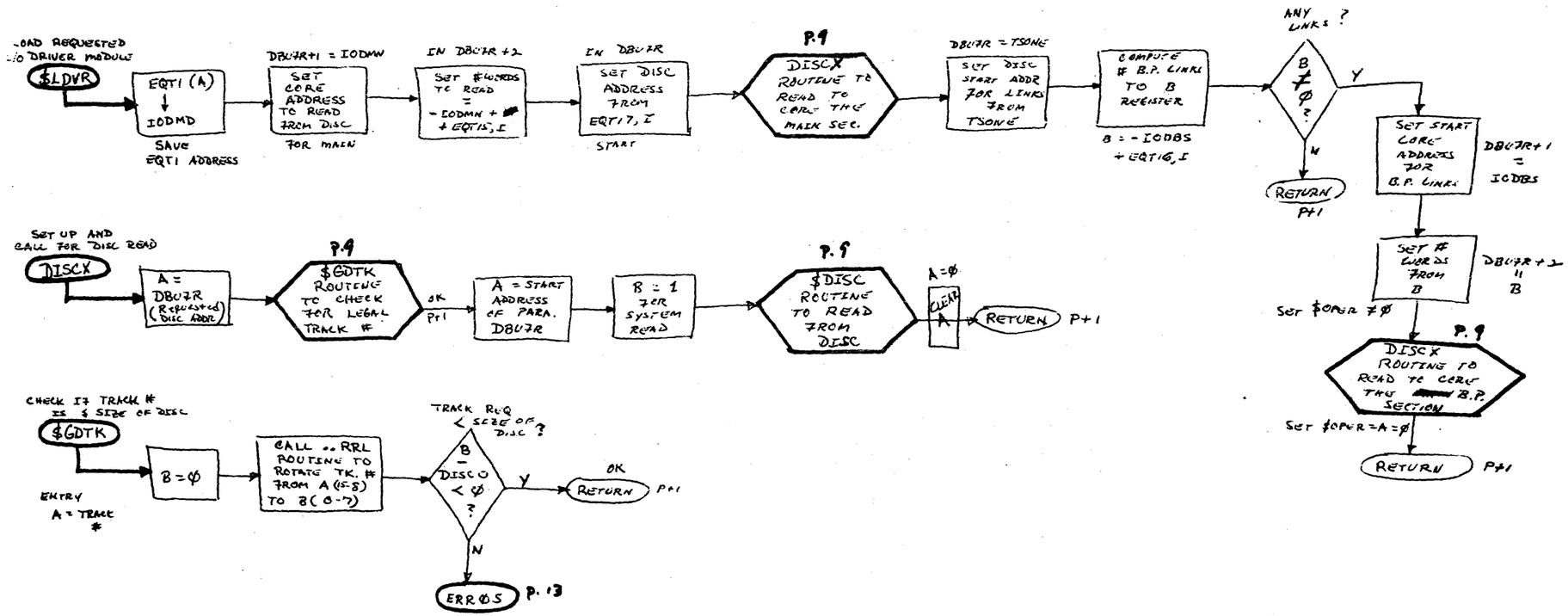
P. 8

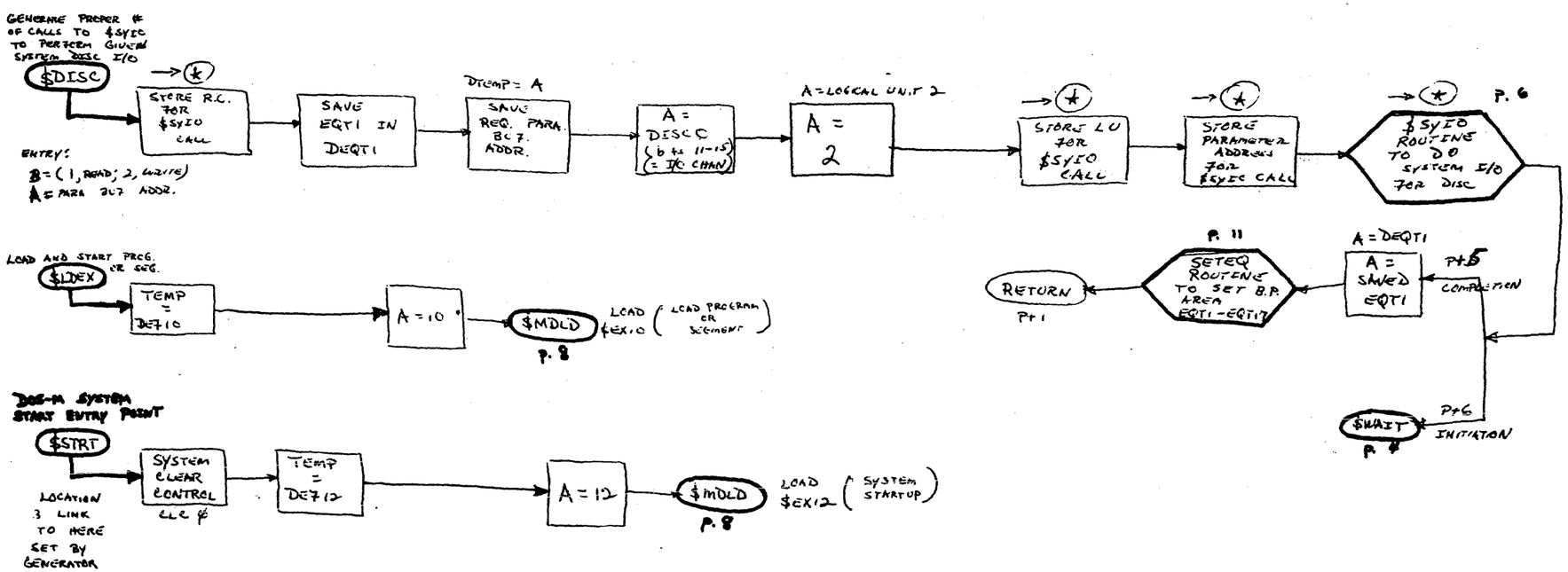
LOAD EXEC MODULE 9 (:EQ PROCESSOR)

$JLOD , $MDLD I0.40

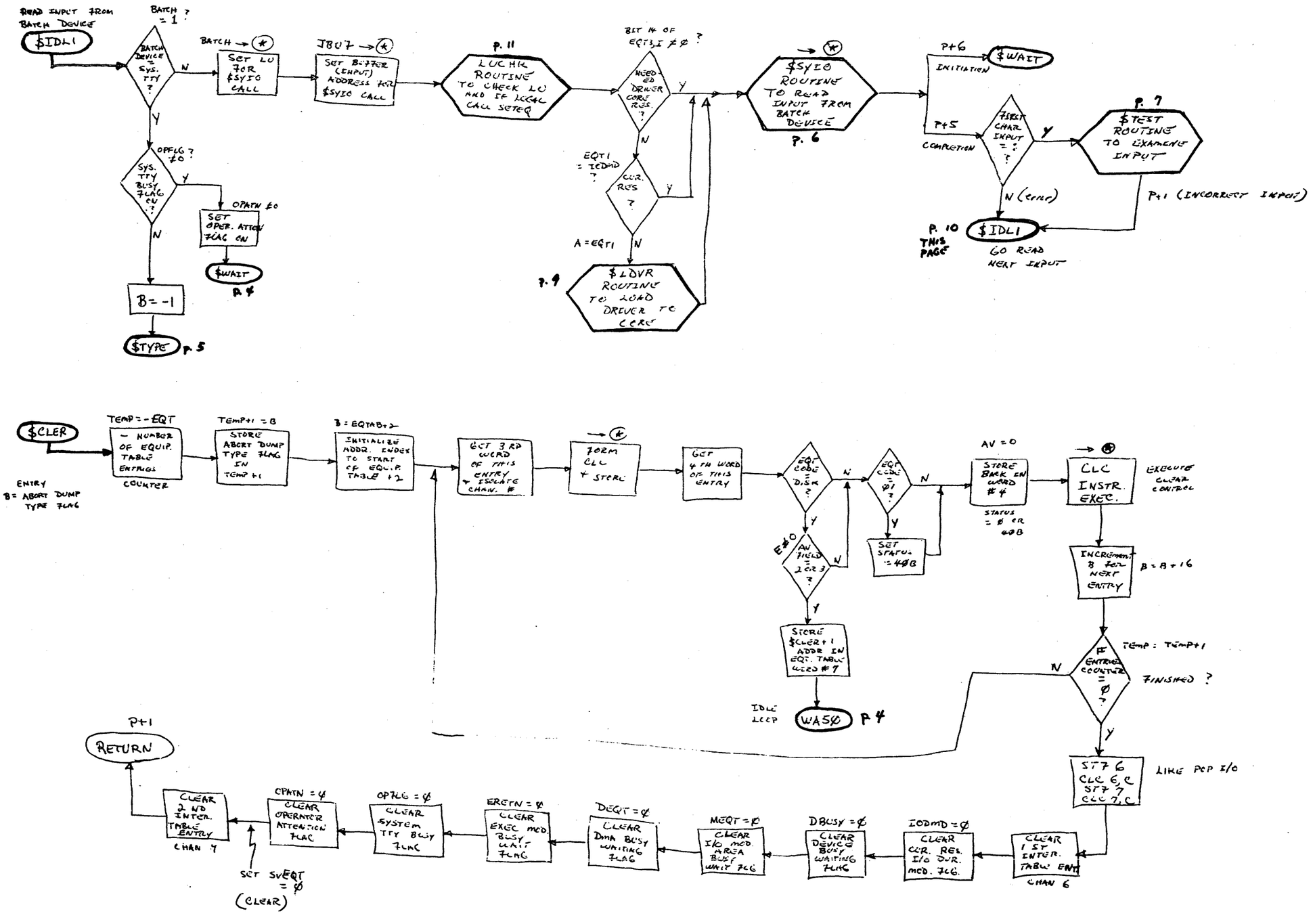


($LDVR, DISCX, $GDTK, $DISC) $LDEX, $STRT

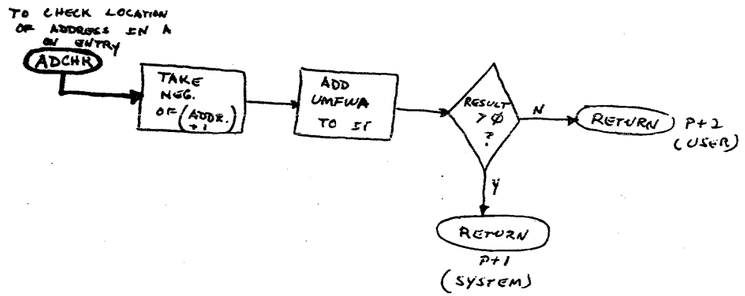


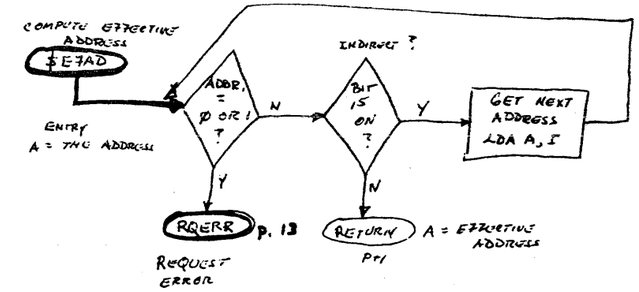


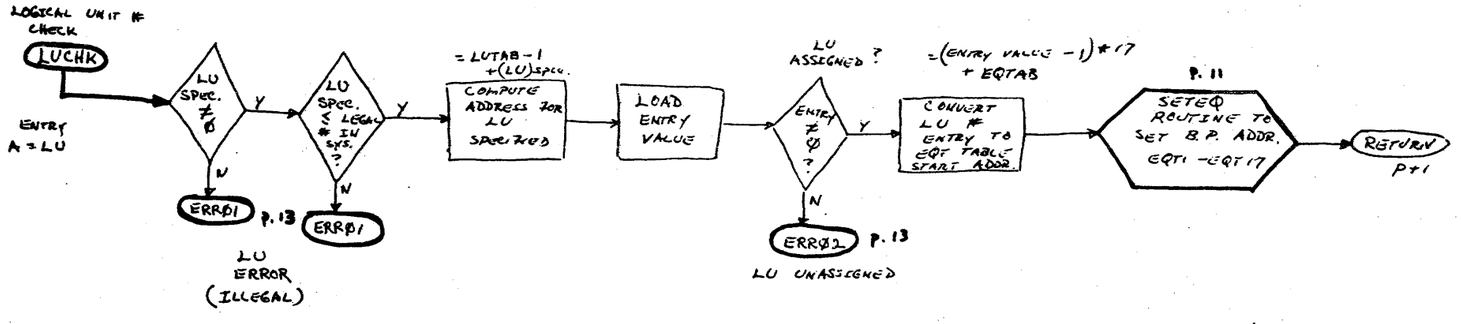
$IDLI, $CLER

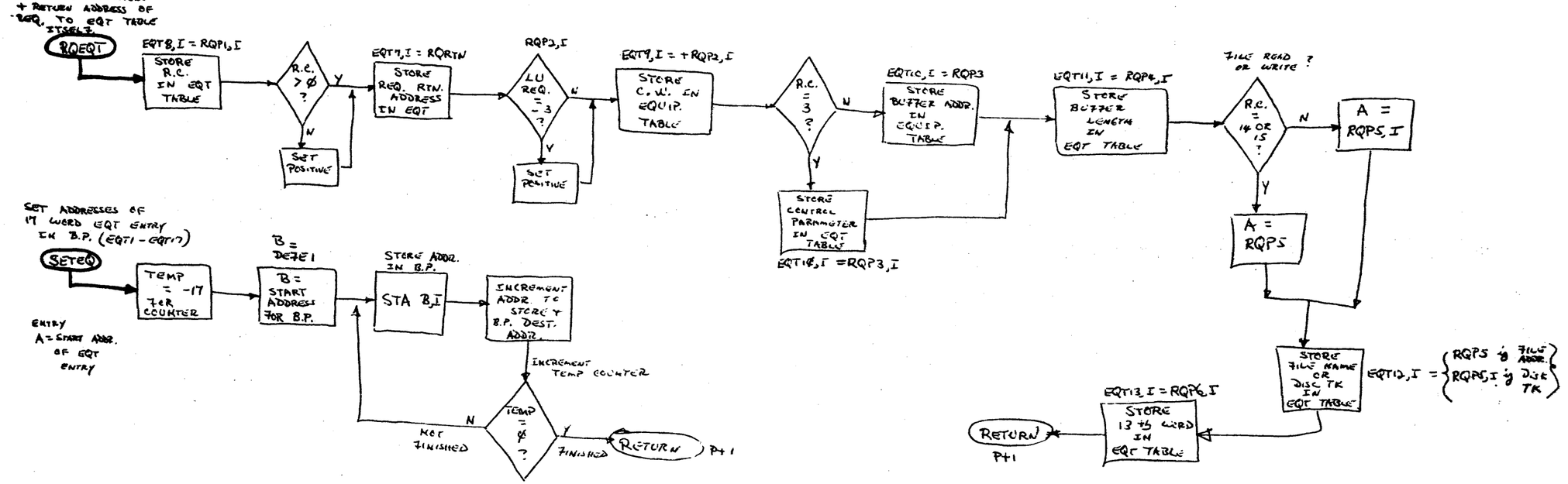

READ INPUT FROM BATCH DEVICE
$IDLI
BATCH DEVICE = SYS. TTY ?
BATCH = 1 ?
N
Y
BATCH → (*)
SET LU FOR $SYIO CALL
JBUF → (*)
SET BUFFER (INPUT) ADDRESS FOR $SYIO CALL
P. 11
LUCHK ROUTINE TO CHECK LU AND IF LEGAL CALL SETEQ
BIT 14 OF EQT5,I ≠ 0 ?
NEEDED DRIVER CORE RES. ?
EQT1 = IOCMD ?
CUR. RES ?
A = EQT1
P. 9
$LOVR ROUTINE TO LOAD DRIVER TO CORE
(*)
$SYIO ROUTINE TO READ INPUT FROM BATCH DEVICE
P. 6
P+6
$WAIT
INITIATION
P+5
COMPLETION
FIRST CHAR INPUT = : ?
P. 7
$TEST ROUTINE TO EXAMINE INPUT
N (error)
P+1 (INCORRECT INPUT)
P. 10 THIS PAGE
$IDLI
GO READ NEXT INPUT
OPFLG ≠ 0 ?
SYS. TTY BUSY FLAG ON ?
OPATN ≠ 0
SET OPER. ATTEN FLAG ON
$WAIT
P. 4
B = -1
$TYPE
P. 5
$CLER
ENTRY
B = ABORT DUMP TYPE FLAG
TEMP = -EQT
- NUMBER OF EQUIP. TABLE ENTRIES
COUNTER
TEMP+1 = B
STORE ABORT DUMP TYPE FLAG IN TEMP+1
B = EQTAB+2
INITIALIZE ADDR. INDEX TO START OF EQUIP TABLE +2
GET 3 RD WORD OF THIS ENTRY & ISOLATE CHAN. #
FORM CLC & STORE
GET 4 TH WORD OF THIS ENTRY
EQT CODE = DISK ?
EQT CODE = 01 ?
E≠0
AV FIELD = 2 OR 3 ?
STORE $CLER+1 ADDR IN EQT. TABLE WORD #7
IDLE LOOP
WAIT
P. 4
AV = 0
STORE BACK IN WORD # 4
STATUS = 0 OR 40B
SET STATUS = 40B
CLC INSTR. EXEC.
EXECUTE CLEAR CONTROL
INCREMENT B FOR NEXT ENTRY
B = B + 16
IF ENTRIES COUNTER = 0 ?
TEMP = TEMP+1
N
FINISHED ?
Y
ST 7 6
CLC 6,C
ST 7 7
CLC 7,C
LIKE PCP I/O
CLEAR 1 ST INTER. TABLE ENT
CHAN 6
IOCMD = 0
CLEAR CUR. REG. I/O DUR. MOD. FLG.
DBUSY = 0
CLEAR DEVICE BUSY WAITING FLAG
MEQT = 0
CLEAR I/O MOD. AREA BUSY WAIT FLG
DEQT = 0
CLEAR DMA BUSY WAITING FLAG
ERETN = 0
CLEAR EXEC MOD. BUSY WAIT FLAG
OPTLG = 0
CLEAR SYSTEM TTY BUSY FLAG
OPATN = 0
CLEAR OPERATOR ATTENTION FLAG
CLEAR 2 ND INTER. TABLE ENTRY
CHAN 4
SET SVEQT = 0 (CLEAR)
P+1
RETURN

UTILITY SUBROUTINES



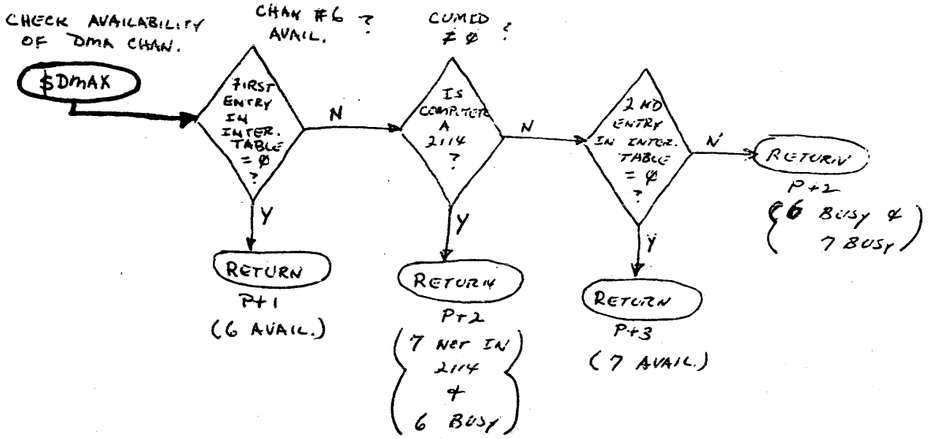




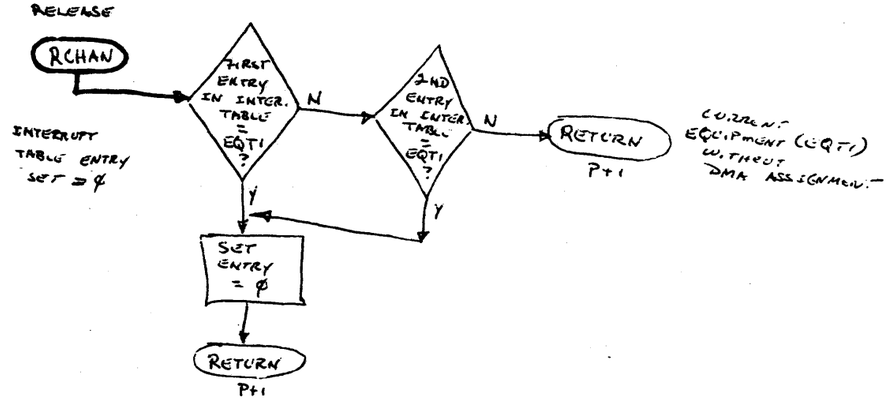


UTILITY SUBROUTINES

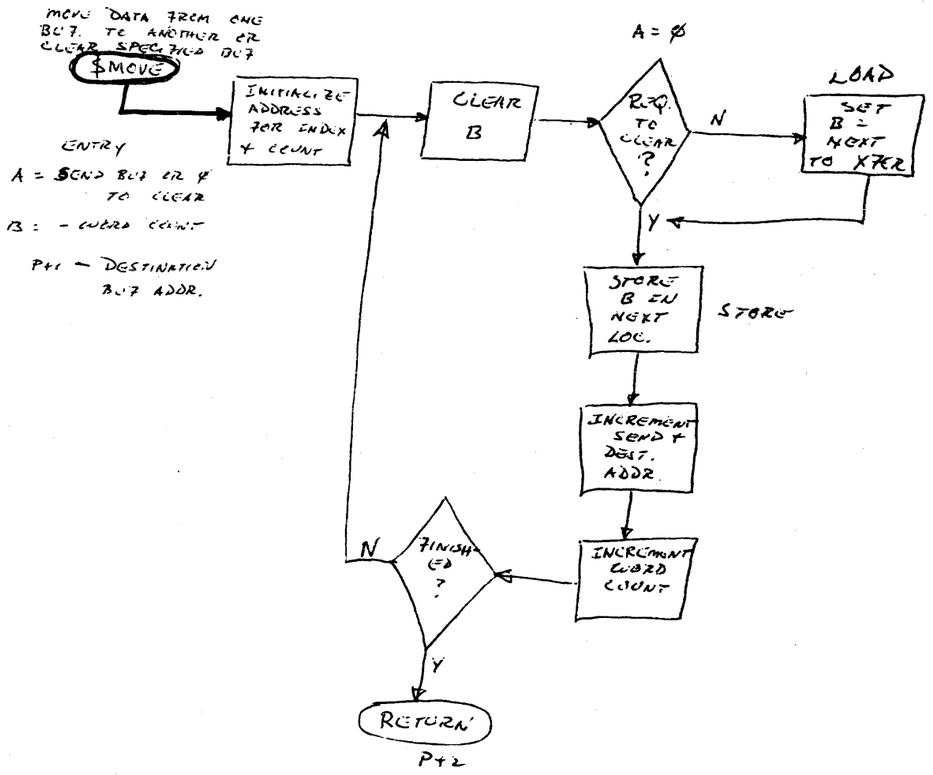
CHECK AVAILABILITY OF DMA CHAN.

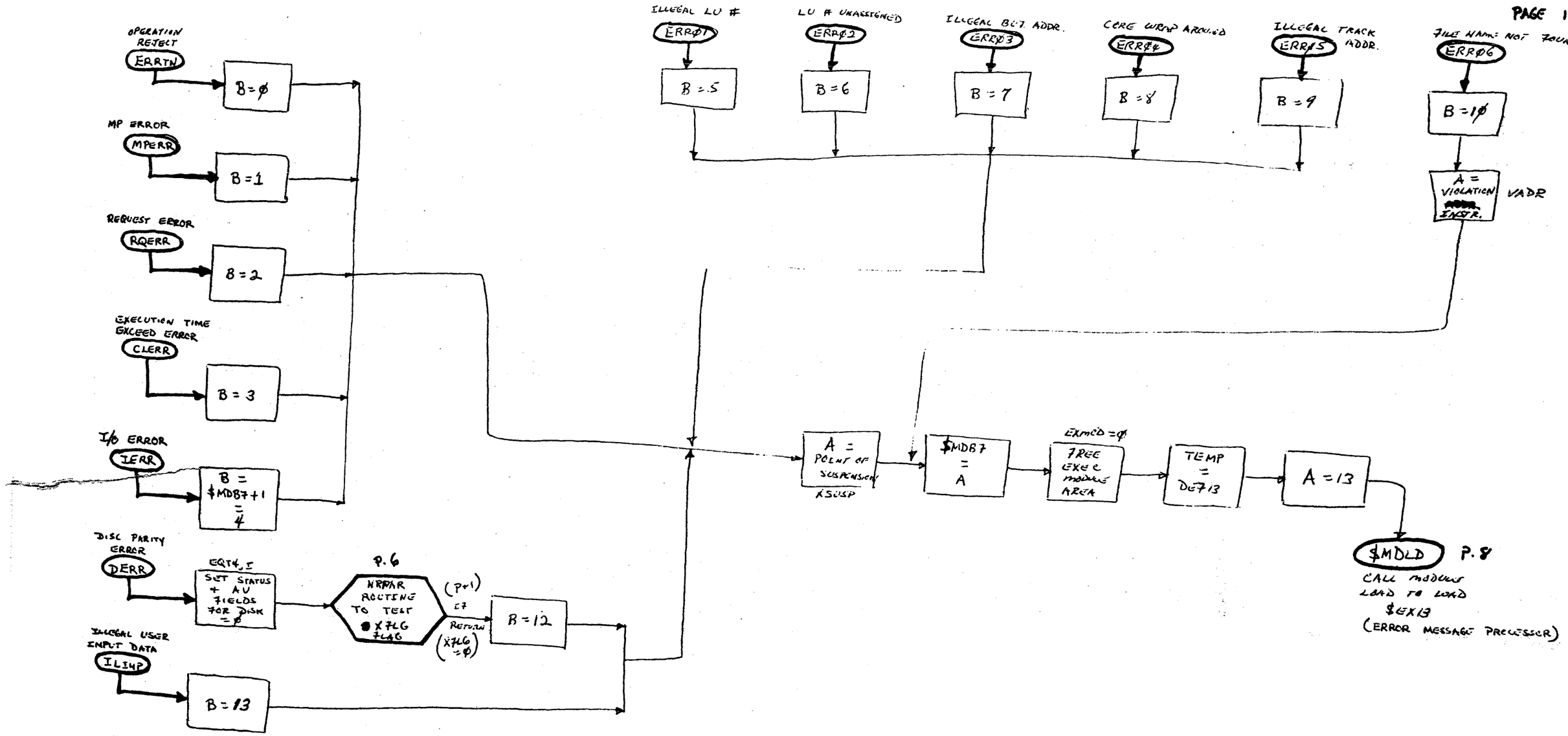


DMA CHANNEL RELEASE



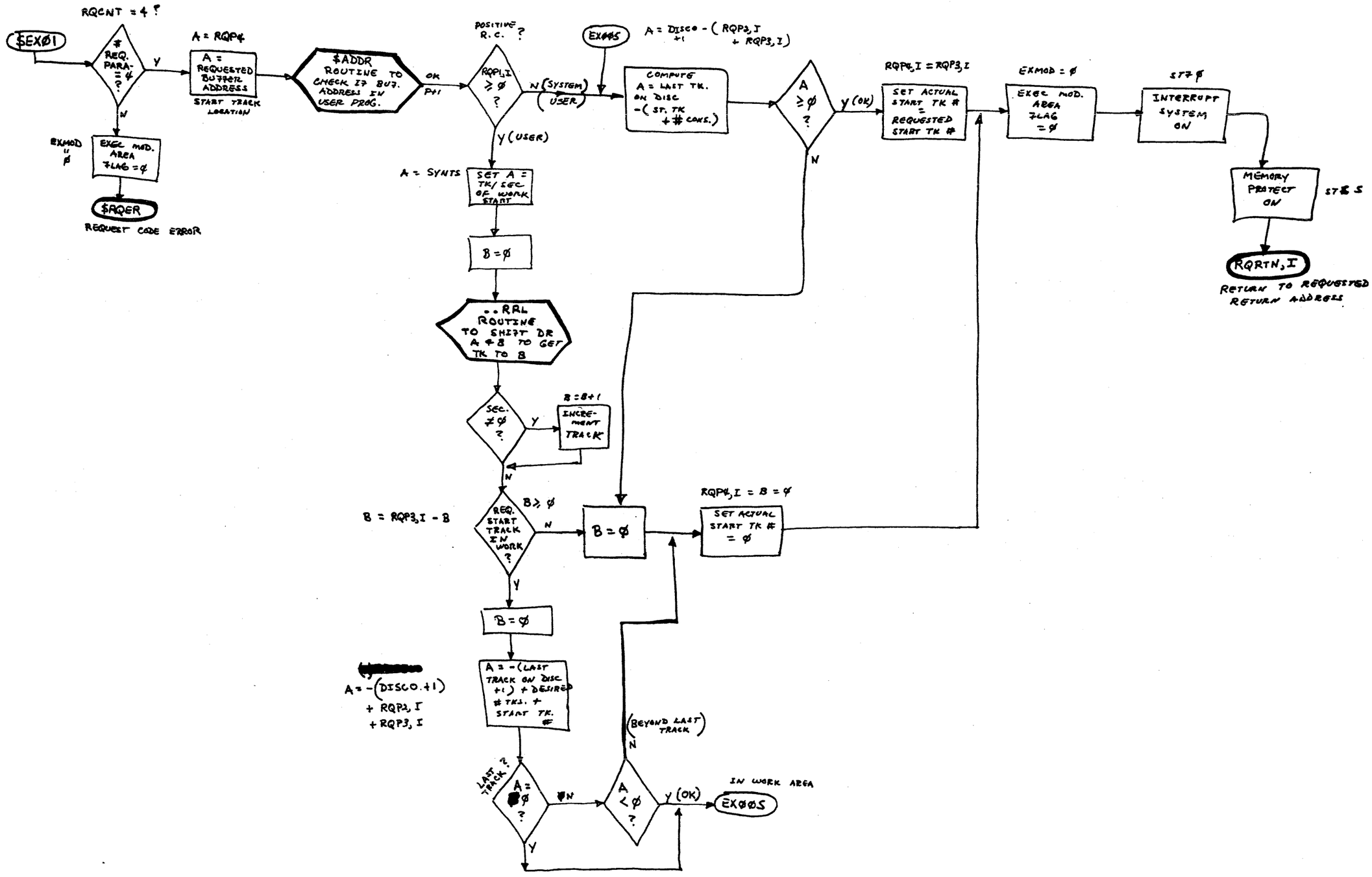
MOVE DATA FROM ONE BUF. TO ANOTHER OR CLEAR SPECIFIED BUF



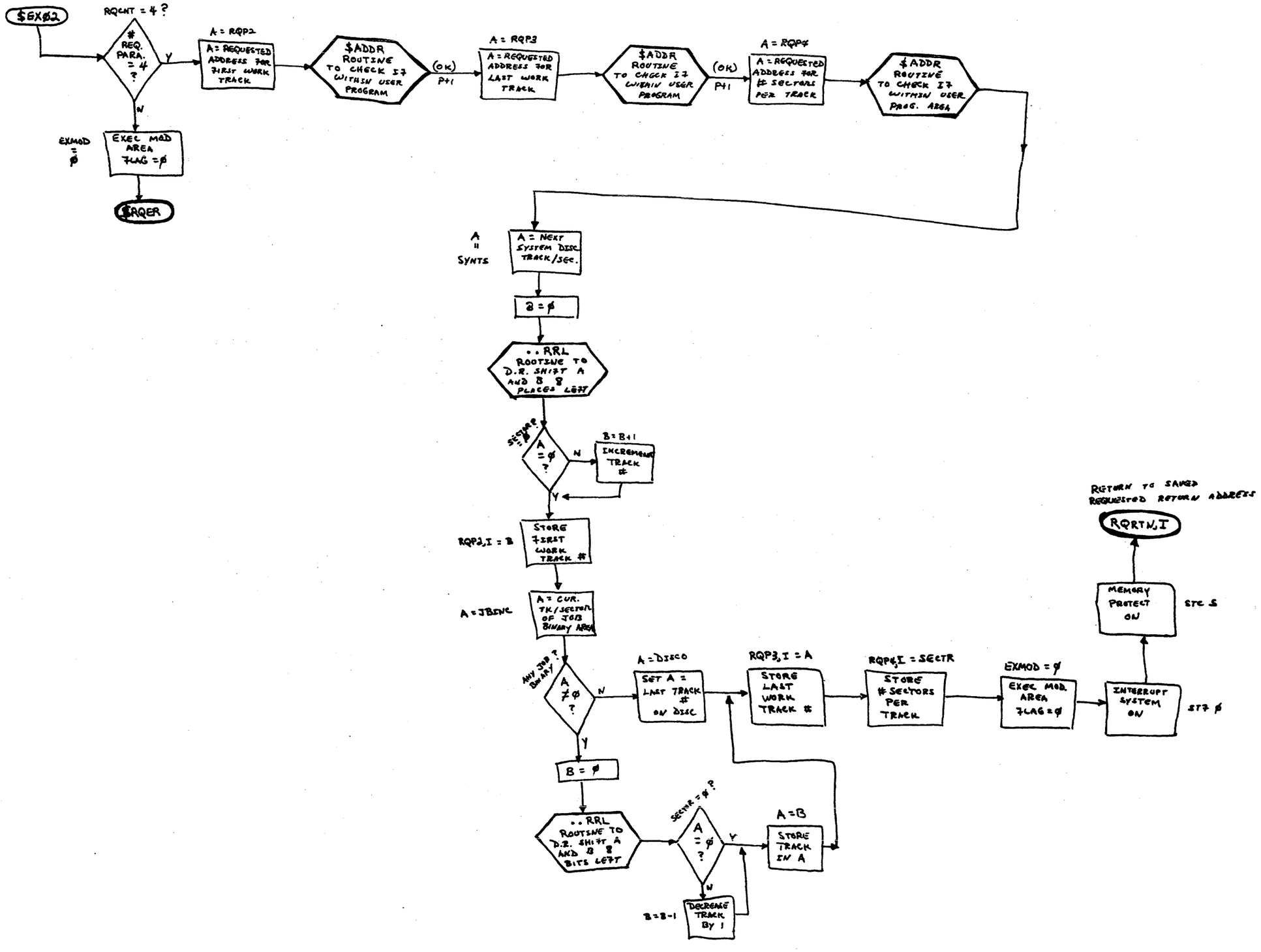


ERROR ENTRY POINTS

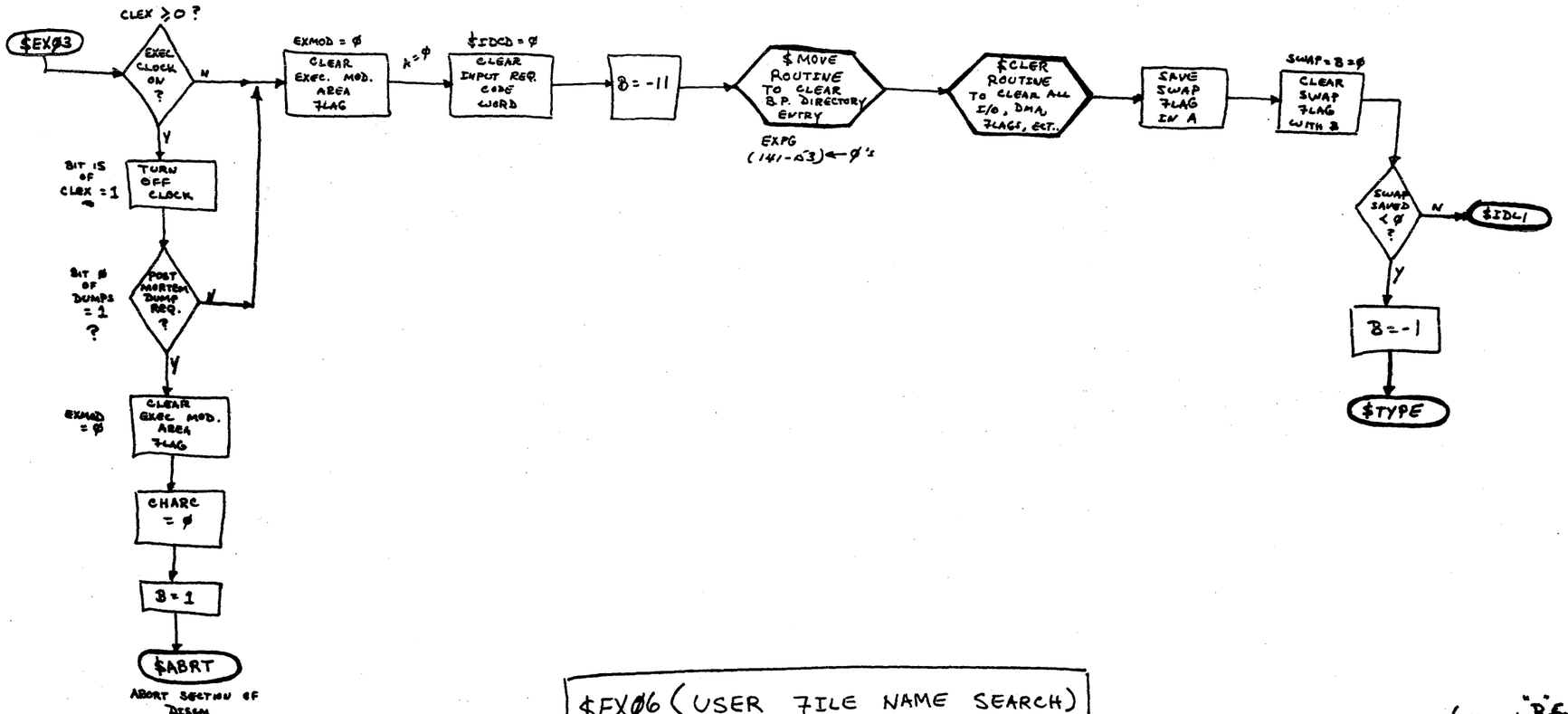
$EXØ1 (DISC TRACK STATUS)



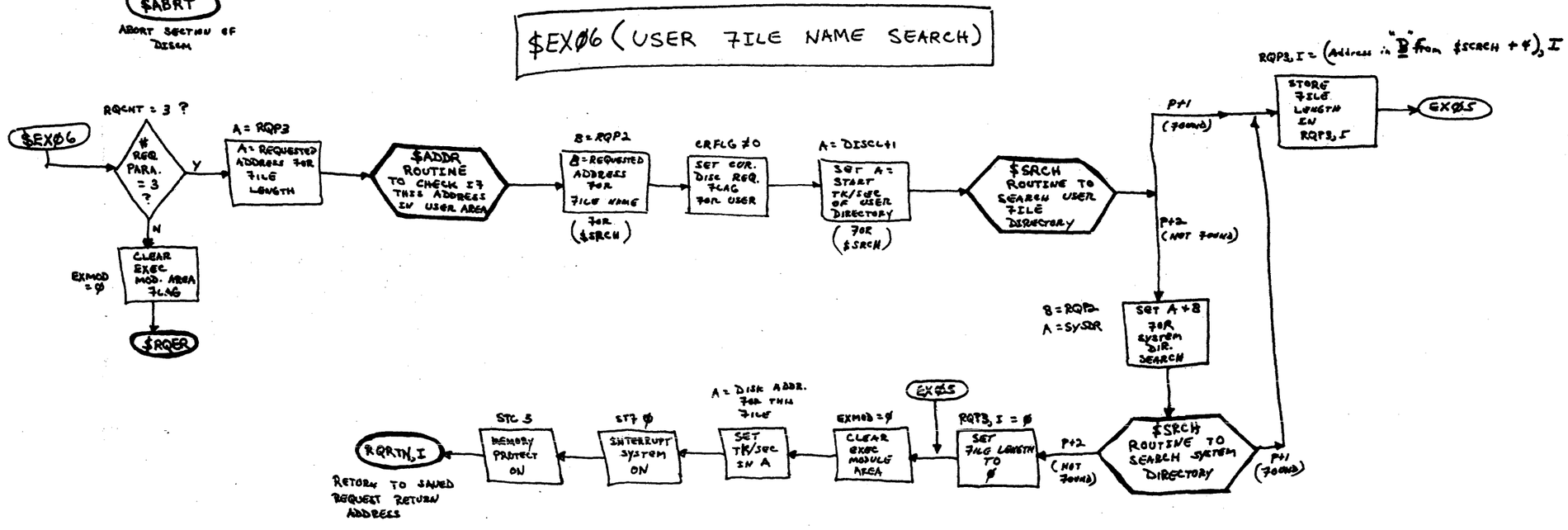
$EX02 (DISC WORK TRACK LIMITS)

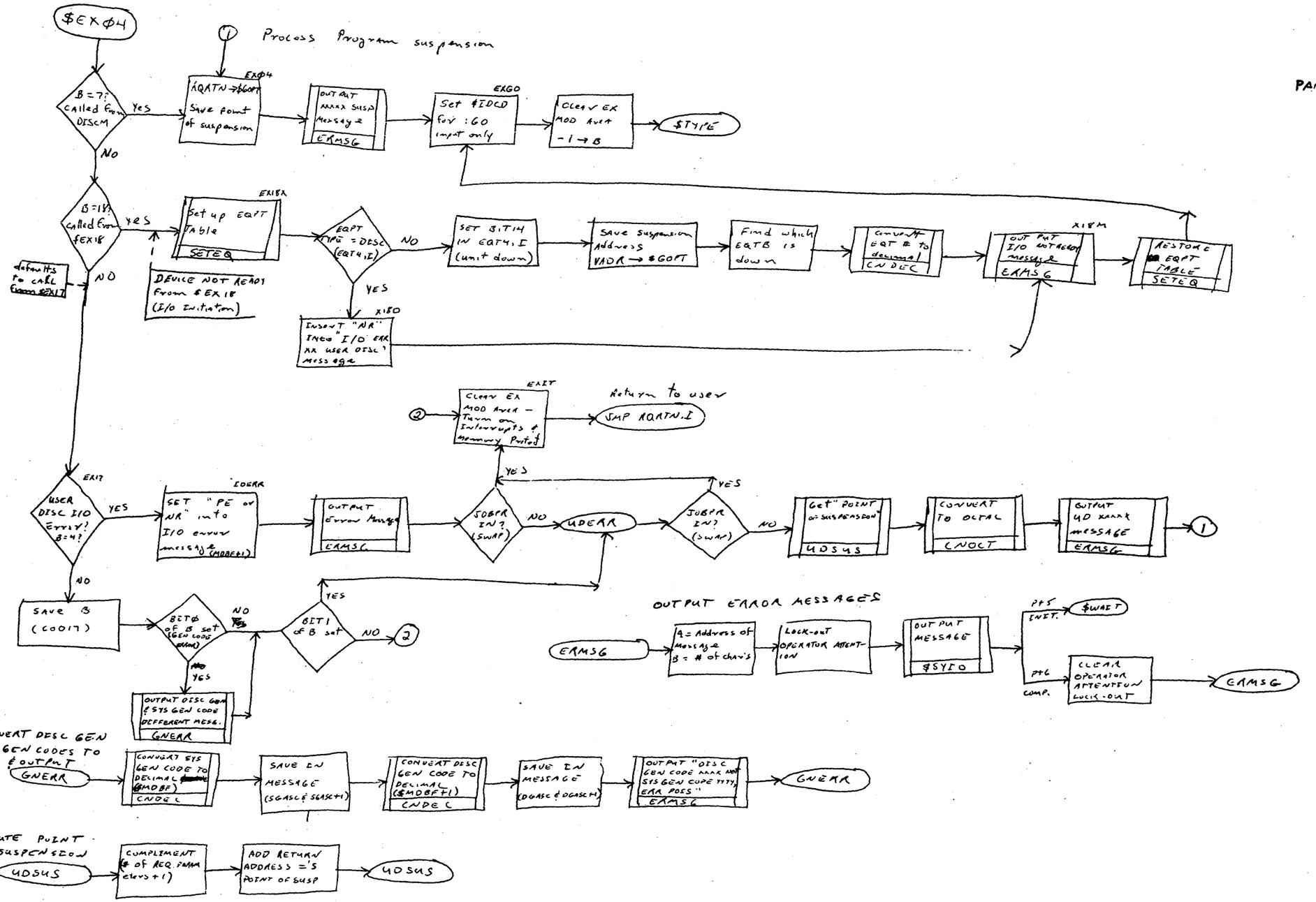


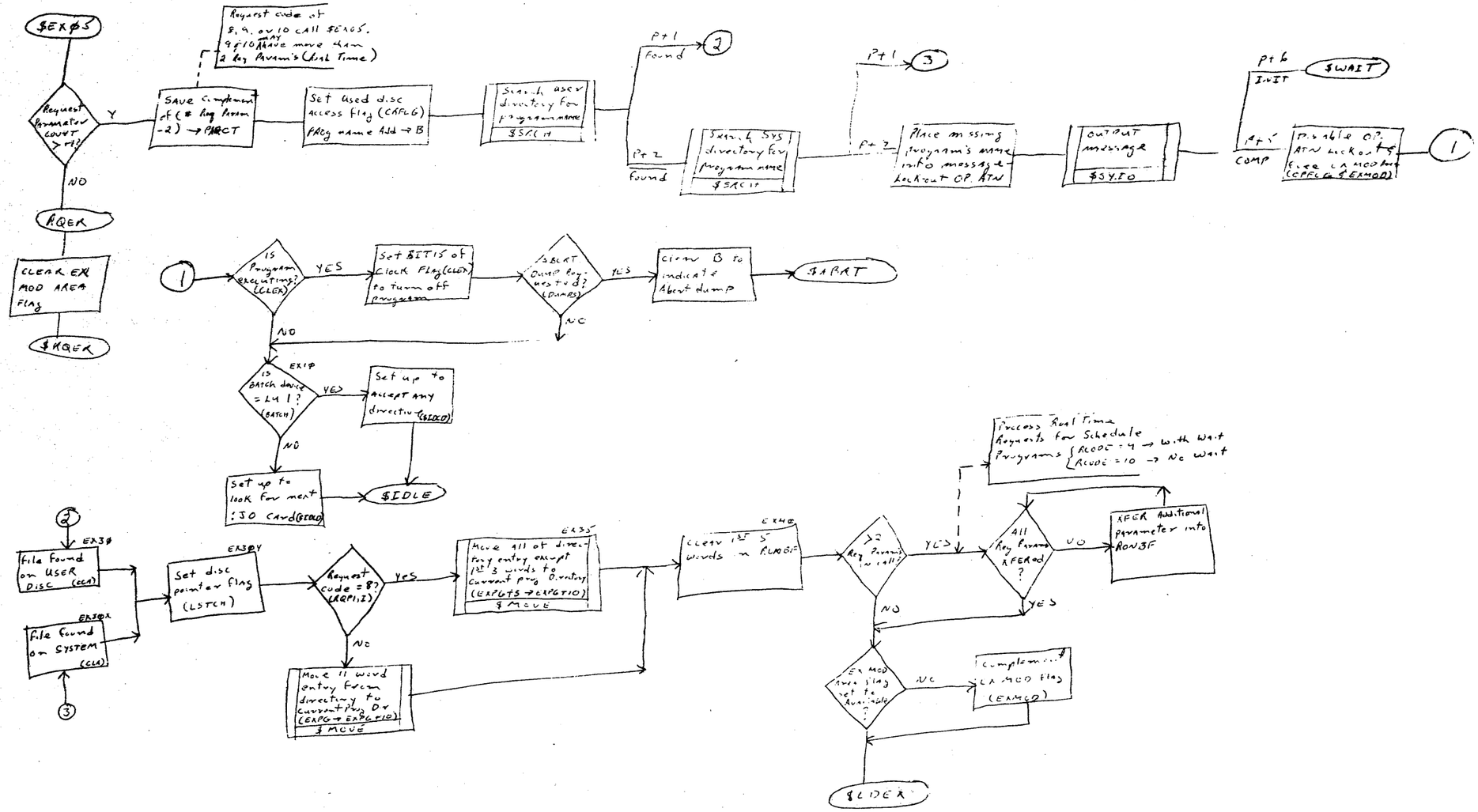
$EXØ3 (PROGRAM COMPLETION)



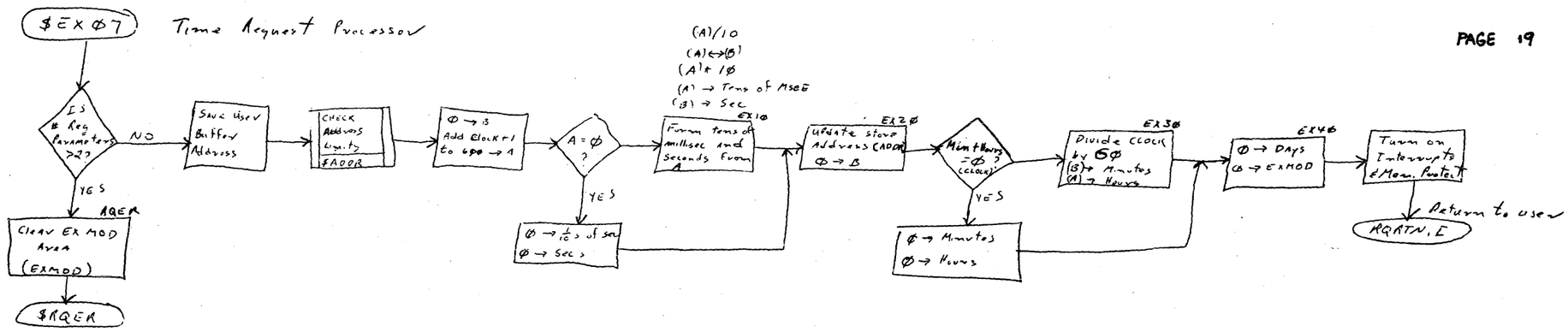
$EXØ6 (USER FILE NAME SEARCH)



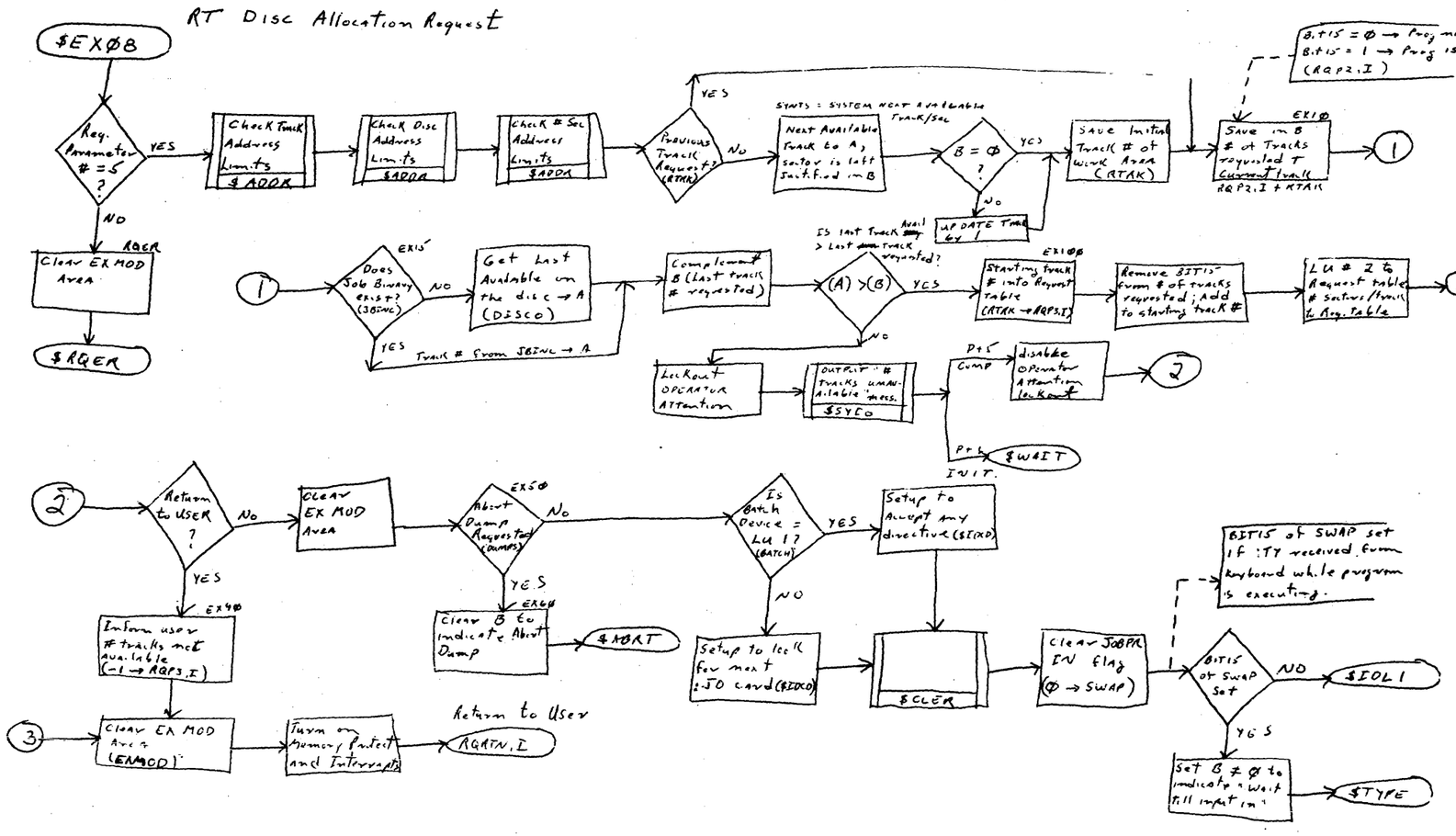

$EXΦ4
Process Program suspension
B=7? called from DISCM
Yes
No
EXΦ4
XQATN → $GOFT
Save point of suspension
OUTPUT xxxxx SUSP Message
ERMSG
EXGO
Set $IDCD for :GO input only
Clear EX MOD Area -1 → B
$TYPE
B=18? called from EX18
EX18A
Set up EQPT Table
SETEQ
EQPT TYPE = DESC (EQT4,I)
NO
YES
SET BIT14 IN EQT4,I (unit down)
Save suspension address XADR → $GOFT
Find which EQTB is down
Convert EQT # to decimal
CN DEC
X18M
OUT PUT I/O NOTIFICATION Message
ERMSG
RESTORE EQPT TABLE
SETEQ
Return to HIS to call from $EXIT
DEVICE NOT READY From $EX18 (I/O Initiation)
X18O
INSERT "NR" INTO "I/O ERR XX USER DISC" Message
EXIT
Clear EX MOD Area - Turn on Interrupts & Memory Protect
Return to user
JMP XQATN,I
EXIT?
USER DISC I/O Error? B=4?
YES
NO
IOERR
SET "PE or NR" into I/O error message (MDBE81)
OUTPUT Error Message
ERMSG
JOBPR IN? (SWAP)
NO
YES
UDERR
JOBPR IN? (SWAP)
NO
YES
Get "POINT of SUSPENSION"
UDSUS
CONVERT TO OCTAL
CNOCT
OUTPUT UD xxxxx message
ERMSG
SAVE B (C0017)
BIT Φ of B set (GEN CODE ERROR)
NO
YES
BIT 1 of B set
NO
OUTPUT DISC GEN & SYS GEN CODE DIFFERENT MESG.
GNERR
OUTPUT ERROR MESSAGES
ERMSG
A = Address of Message B = # of char's
LOCK-OUT OPERATOR ATTENTION
OUT PUT MESSAGE
$SYIO
PTS INIT.
$WAIT
PTC COMP.
CLEAR OPERATOR ATTENTION LOCK-OUT
ERMSG
CONVERT DISC GEN & SYS GEN CODES TO ASCII & OUTPUT
GNERR
CONVERT SYS GEN CODE TO DECIMAL ($MDBF)
CNDEC
SAVE IN MESSAGE (SGASC & SGASC+1)
CONVERT DISC GEN CODE TO DECIMAL ($MDBF+1)
CNDEC
SAVE IN MESSAGE (DGASC & DGASC+1)
OUTPUT "DISC GEN CODE xxxx not SYS GEN CODE yyyy, ERR POS"
ERMSG
GNERR
COMPUTE POINT OF SUSPENSION
UDSUS
COMPLEMENT (# of REQ. PARM CWDS + 1)
ADD RETURN ADDRESS ='S POINT OF SUSP
UDSUS


$EXØS
Request code of 8, 9, or 10 call $EXØS. (9 & 10 may have more than 2 Req Param's (Wait Time)
Request Parameter count > 1?
Y
NO
Save complement of (# Req Param -2) → PARCT
Set Used disc access flag (CAFLG)
PARQ name Add → B
Search user directory for program name
$SRCH
Pt 1 Found
Pt 2 Found
Search Sys directory for program name
$SRCH
Pt 1
Pt 2
Place missing program's name into message & lockout CP ATN
OUTPUT message
$SYSIO
Pt 6
INIT
$WAIT
Pt 5
COMP
Disable CP ATN lockout & Reset CA MOD bit (CAFLG & EXMOD)
1
AQER
CLEAR EX MOD AREA FLAG
$RQER
1
IS Program EXECUTING? (CLCK)
YES
Set BIT15 of CLOCK FLAG (CLCK) to turn off program
ABORT Queue Request? (QUMES)
YES
NO
Clear B to indicate Abort dump
$ABRT
NO
EXIP
IS BATCH device = LU 1? (BATCH)
YES
Set up to accept any directive (CLCCO)
NO
Set up to look for next :JOB card (BCRD)
$IDLE
2
EX3Ø
File Found on USER DISC (CCU)
EX3ØX
File Found on SYSTEM (CCU)
3
EX3ØY
Set disc pointer flag (LSTCH)
Request code = 8? (LRQP1,2)
YES
NO
EX3S
Move all of directory entry except 1st 3 words to Current prog Directory (EXPGTS → EXPGTIO)
$MOVE
Move 11 word entry from directory to current prog Dir (EXPG → EXPGTIO)
$MOVE
EXMØ
CLEAR 1ST 5 words in RUMBUF
≥2 Req Params in call?
YES
NO
Process Real Time Requests for Schedule Programs { RCODE = 9 → with Wait RCODE = 10 → No Wait
All Req Params XFERed ?
NO
YES
XFER Additional parameter into RQN3F
EX MOD area flag set to Available ?
NO
Complement EX MOD flag (EXMCD)
$LDER

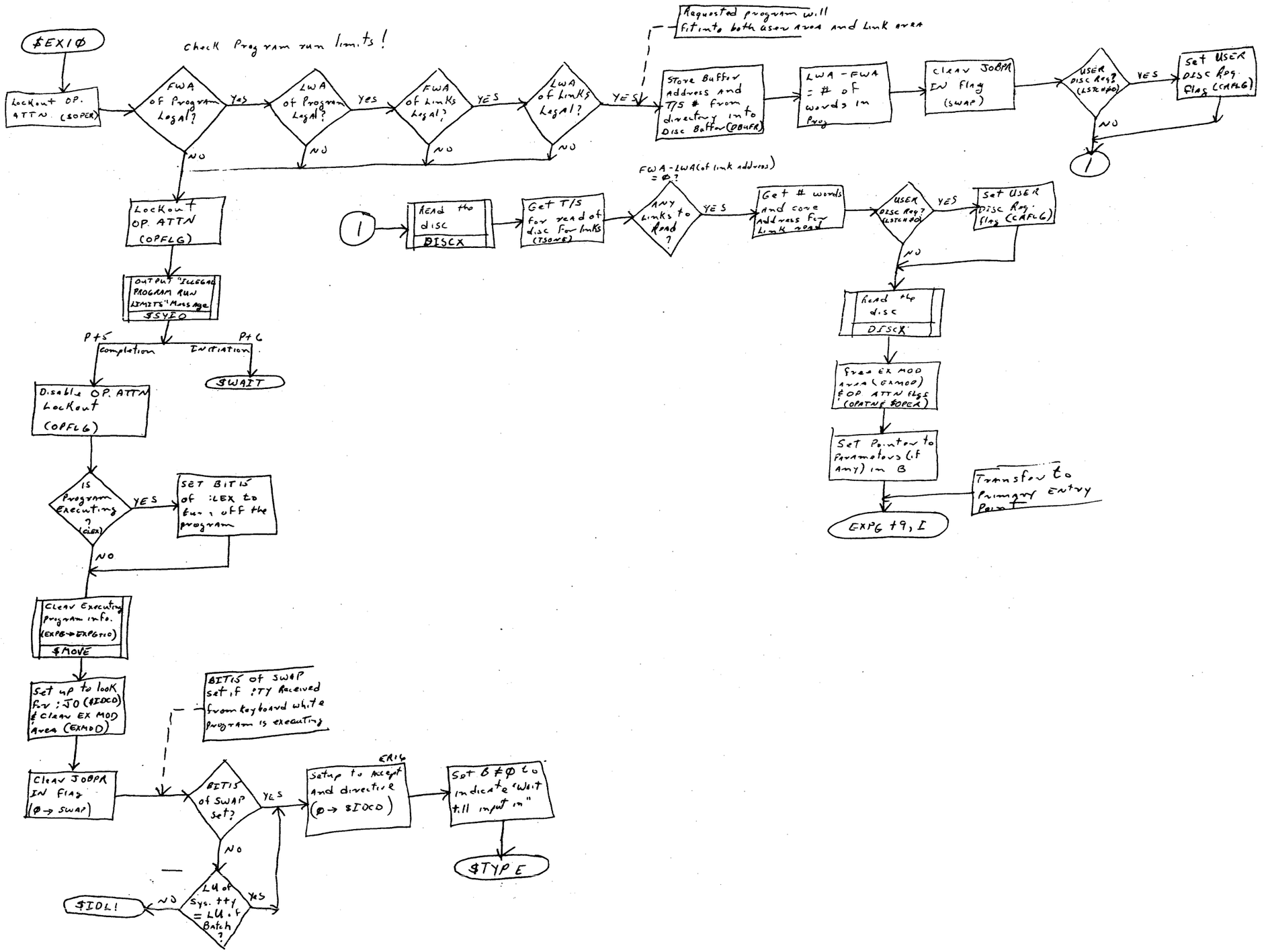
Time Request Processor



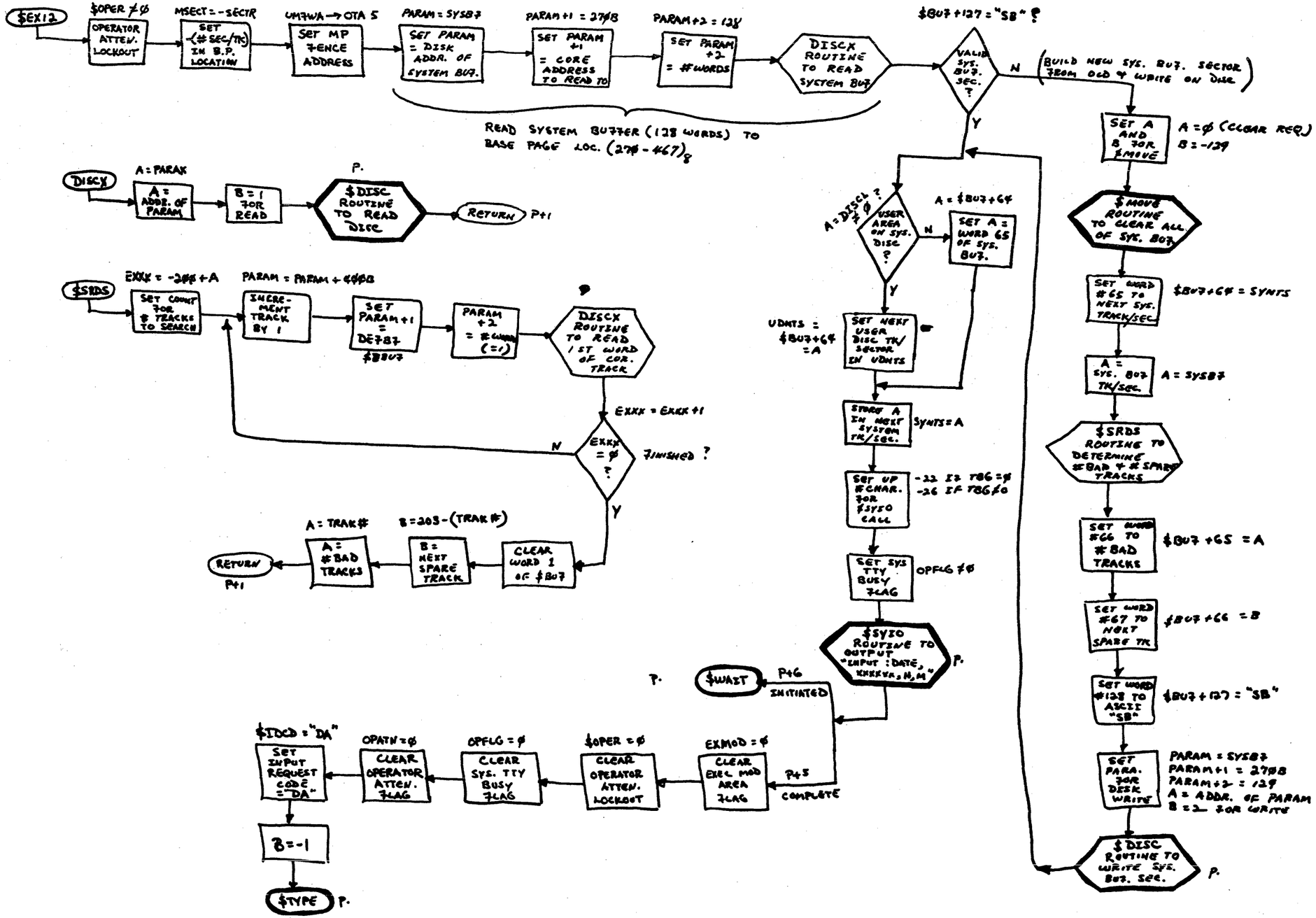
RT Disc Allocation Request

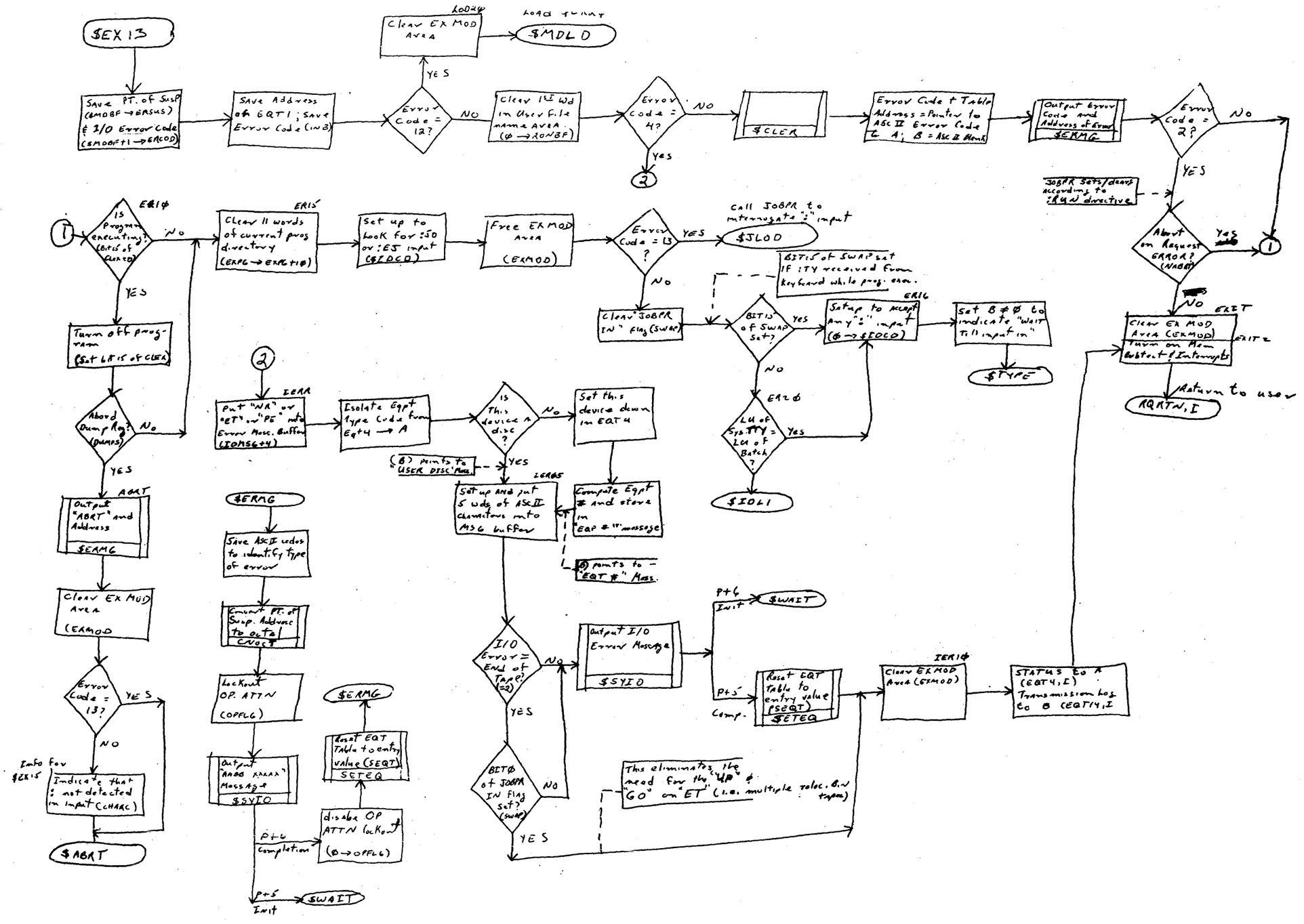


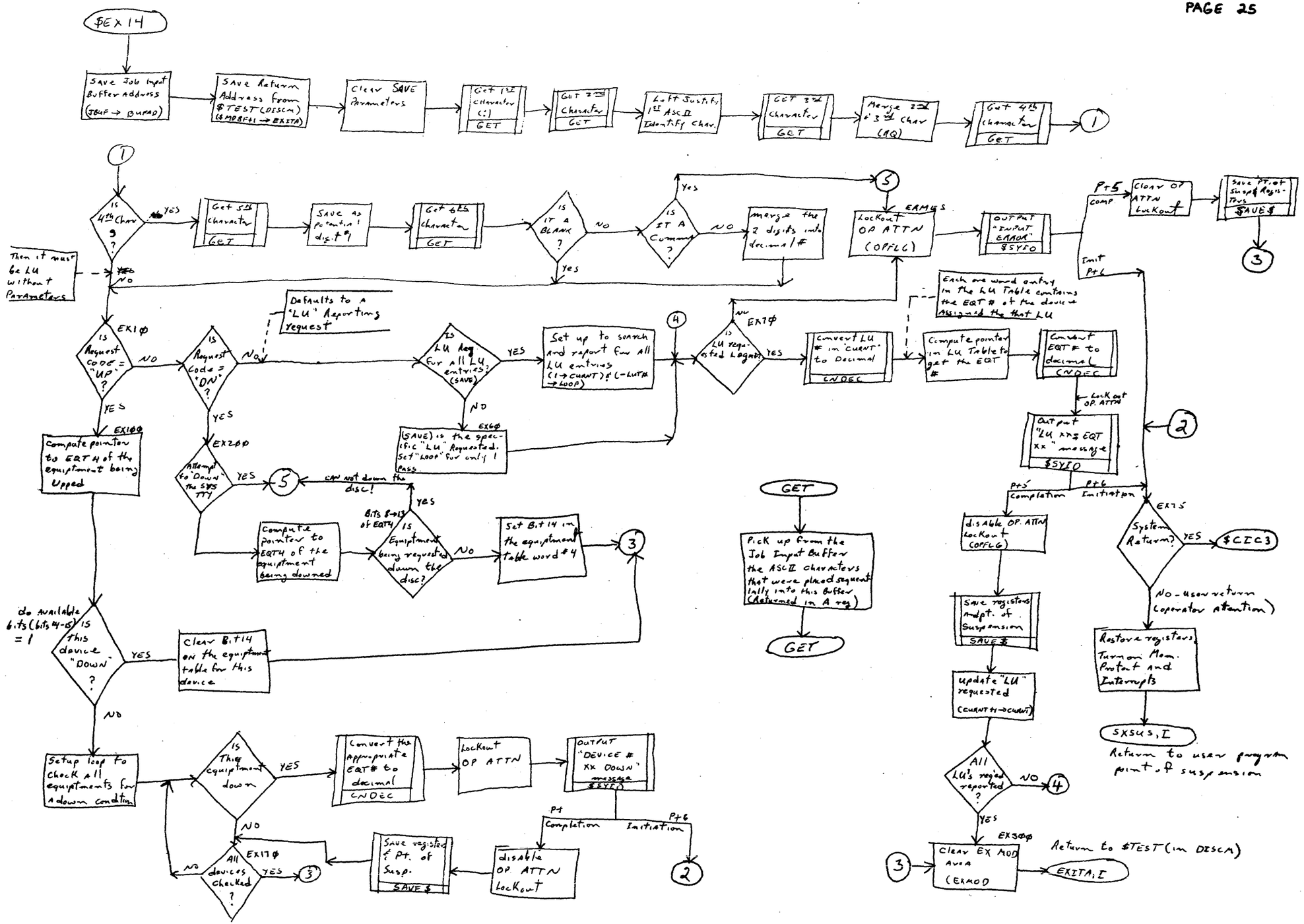
Load and Execute Program

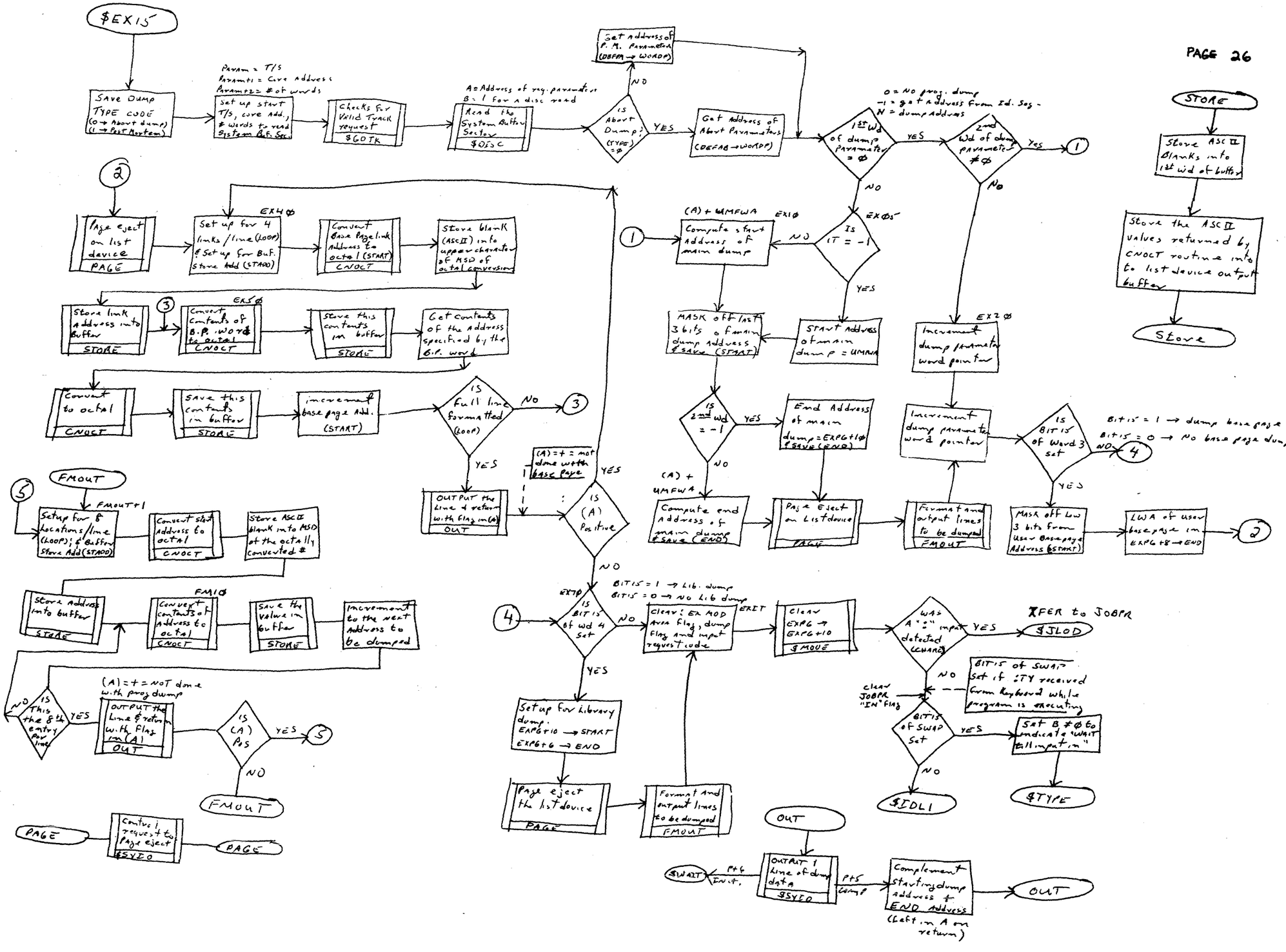


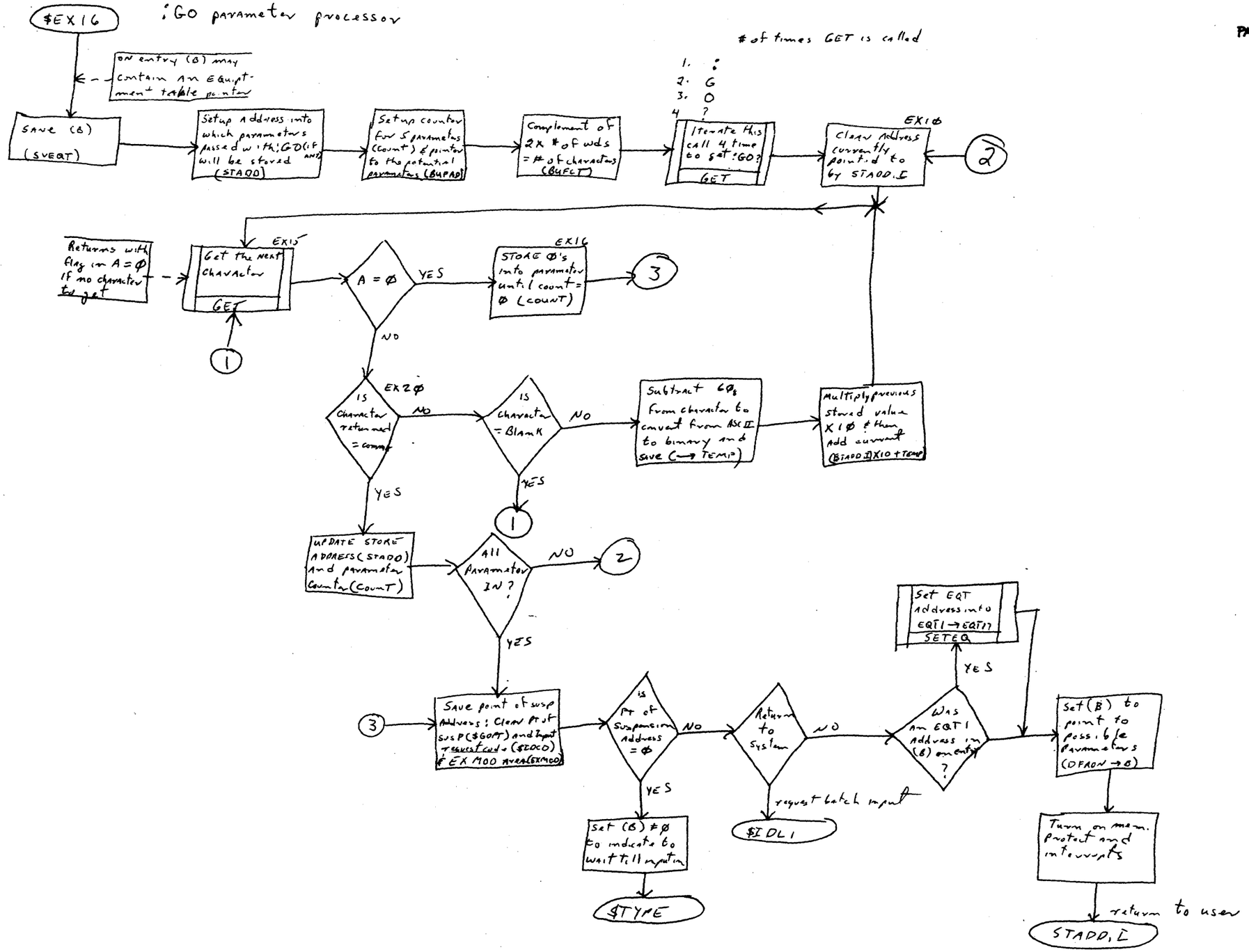
$EX12 (SYSTEM STARTUP)



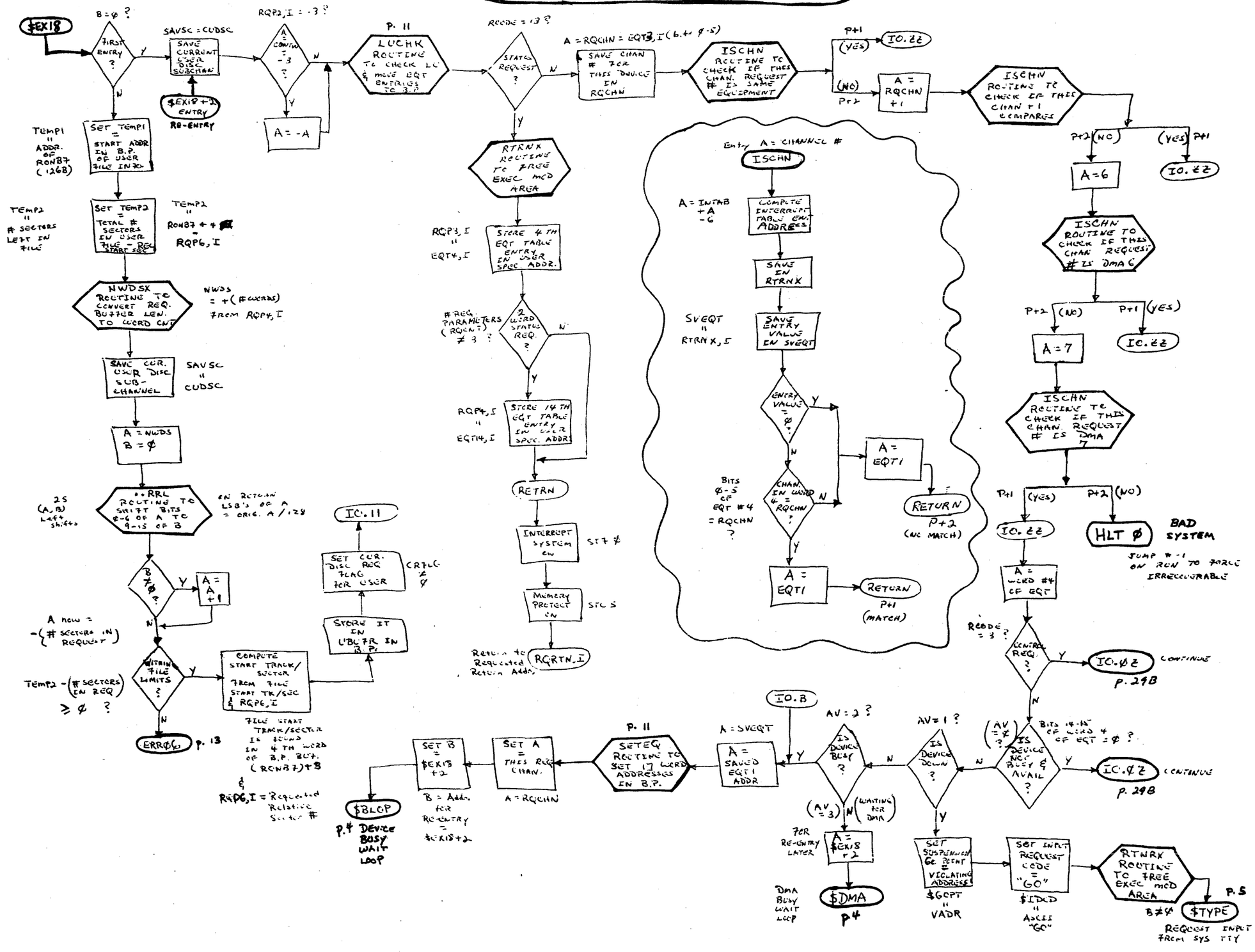

$EX13
Save PT. of Susp (CMODF → ERSUS)
& I/O Error Code (CMODF+1 → ERCOD)
Save Address of EQT 1 ; Save Error Code (in B)
Error Code = 12?
NO
YES
Clear EX MOD Area
LOOKUP
LOAD TYPE
$MDLD
Clear 1st Wd in User file name AREA (Ø → ZONBF)
Error code = 4?
NO
YES
2
$CLER
Error Code & Table Address = Pointer to ASCII Error Code & A; B = ASCII Blanks
Output Error Code and Address of Error
$ERMG
Error Code = 2?
NO
YES
JOBPR sets/clears according to ;RUN directive
About on Request ERROR? (NABORT)
Yes
NO
1
EXIT
Clear EX MOD Area (EXMOD)
Turn on Mem Protect & Interrupts
EXIT
Return to user
RQRTN, I
1
IS Program executing? (BIT15 of Quart)
ERI0
No
YES
Turn off program (Set LB IS of CLEA)
About Dump Req? (DUMPS)
No
YES
ABRT
Output "ABRT" and Address
$ERMG
Clear EX MOD Area (EXMOD)
Error Code = 13?
YES
NO
Info for $EX15
Indicate that ; not detected in input (CHARC)
$ABRT
ERI5
Clear 11 words of current prog directory (ERPG → ERPG+10)
Set up to look for ;SO or ;EJ input (SEJDCO)
Free EXMOD Area (EXMOD)
Error Code = 13 ?
YES
No
call JOBPR to interrogate ";" input
$JLOD
Clear "JOBPR IN" flag (SWAP)
BIT15 of SWAP set? IF ;TY received from keyboard while prog. exec.
YES
No
ERI6
Setup to accept any ";" input (Ø → $EDCO)
Set B ≠ Ø to indicate "WAIT Till input in"
$TYPE
2
ERR
Put "NR" or "ET" or "PE" into Error Mess. Buffer (IOMSG+4)
Isolate Eqpt type Code from Eqt4 → A
IS This device a disc?
No
YES
(B) points to "USER DISC" Mess.
Set this device down in EQT4
ERR5
Set up and put 5 wds of ASCII characters into MSG buffer
Compute Eqpt # and store in "Eqp # ??" message
(B) points to "EQT #" Mess.
ERI Ø
LU of SysTTY = LU of Batch ?
Yes
$IOLI
$ERMG
Save ASCII codes to identify type of error
Convert PT. of Susp. Address to octal (CVOCT)
Lockout OP. ATTN (OPFLG)
Output "ABRT XXXXX" Message
$SYIO
P+6 Completion
disable OP ATTN lockout (Ø → OPFLG)
$ERMG
Reset EQT Table to entry value (SEQT)
SETEQ
P+5 Init
$WAIT
I/O Error = End of Tape? (=2)
No
YES
BITØ of JOBPR IN flag set? (SWAP)
No
YES
Output I/O Error Message
$SYIO
P+6 Init
$WAIT
P+5 Comp.
Reset EQT Table to entry value (SEQT)
$ETEQ
This eliminates the need for the "UP" "GO" on "ET" (i.e. multiple telec. driver types)
IERI Ø
Clear EXMOD Area (EXMOD)
STATUS Eq # (EQT4,I) Transmission log Eq Ø (EQT14,I

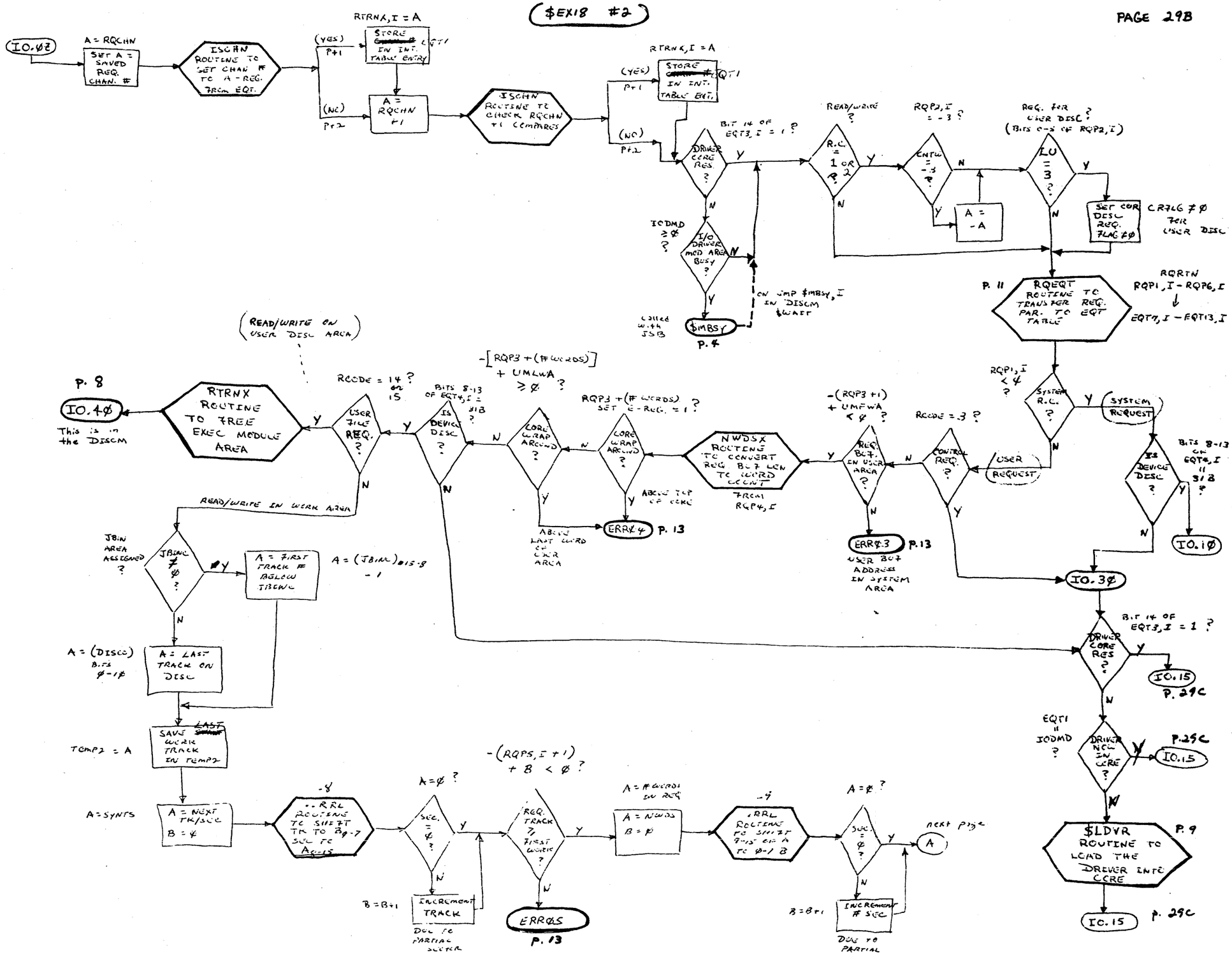

$EX14
Save Job Input Buffer Address (JBUF → BUFAD)
Save Return Address from $TEST (DISCM) (&MDBFE1 → EXITA)
Clear SAVE Parameters
Get 1st character (:)
GET
GET 2nd Character
GET
Left Justify, 1st ASCII Identify Char.
GET 3rd character
GET
Merge 2nd & 3rd Char (AQ)
Get 4th character
GET
1
1
Is 4th Char 3 ?
YES
Get 5th character
GET
Save as potential dig.# 1
Get 6th character
GET
Is IT A BLANK ?
NO
YES
Is IT A Comma ?
YES
NO
merge the 2 digits into decimal / #
5
EAM4S
Lockout OP ATTN (OPFLG)
OUTPUT "INPUT" $SYIO
Pt5 comp.
Clear OP ATTN LuKout
Save Print Simpool Registers AVE
3
Pt6 Init
Then it must be LU without Parameters
NO
Defaults to a "LU" Reporting request
Each one word entry in the LU Table contains the EQT # of the device assigned the that LU
Is Request code = "UP" ?
EX1Φ
NO
YES
Is Request Code = "DN" ?
NO
YES
Is LU Req for ALL LU entries? (SAVE)
YES
NO
Set up to search and report for ALL LU entries (1→CURNT) & (-LUT#→LOOP)
4
Is LU requested Logged?
EX7Φ
NO
YES
Convert LU # in CURNT to Decimal
CNDEC
Compute pointer in LU Table to get the EQT #
Convert EQT # to decimal
CNDEC
Lock out OP. ATTN
Output "LU xx EQT xx" message
$SYIO
2
EX1ΦΦ
Compute pointer to EQT # of the equipment being Upped
EX2ΦΦ
Attempt to "Down" the SYS TTY
YES
5
can not down the disc!
(SAVE) is the specific "LU" Requested. Set "LOOP" for only 1 pass
EX6Φ
Pt5 Completion
Pt6 Initiation
EX7$
System Return?
YES
$CIC3
NO - user return (operator attention)
Restore registers, Turn on Mem. Protect and Interrupts
SXSUS,I
Return to user program point of suspension
Bits 8-13 of EQT4
Is Equipment being requested down the disc?
YES
NO
Compute pointer to EQT4 of the equipment being downed
Set Bit 14 in the equipment table word #4
3
do available bits (bits 4-5) = 1
Is this device "DOWN" ?
YES
Clear Bit 14 on the equipment table for this device
NO
Setup loop To Check All equipments for a down condition
Is This equipment down
YES
Convert the appropriate EQT# to decimal
CNDEC
LocKout OP ATTN
OUTPUT "DEVICE # XX DOWN" message
$SYIO
Pt5 Completion
Pt6 Initiation
NO
All devices Checked ?
EX17Φ
NO
YES
3
Save registers & Pt. of Susp.
SAVE$
disable OP ATTN LocKout
2
GET
Pick up from the Job Input Buffer the ASCII characters that were placed sequentially into this Buffer (Returned in A reg)
GET
disable OP. ATTN LocKout (OFFLG)
Save registers and pt. of Suspension
SAVE$
update "LU" requested (CURNT4→CURNT)
All LU's req'd reported ?
NO
4
YES
EX3ΦΦ
3
Clear EX MOD Area (EXMOD
Return to $TEST (in DISCM)
EXITA,I

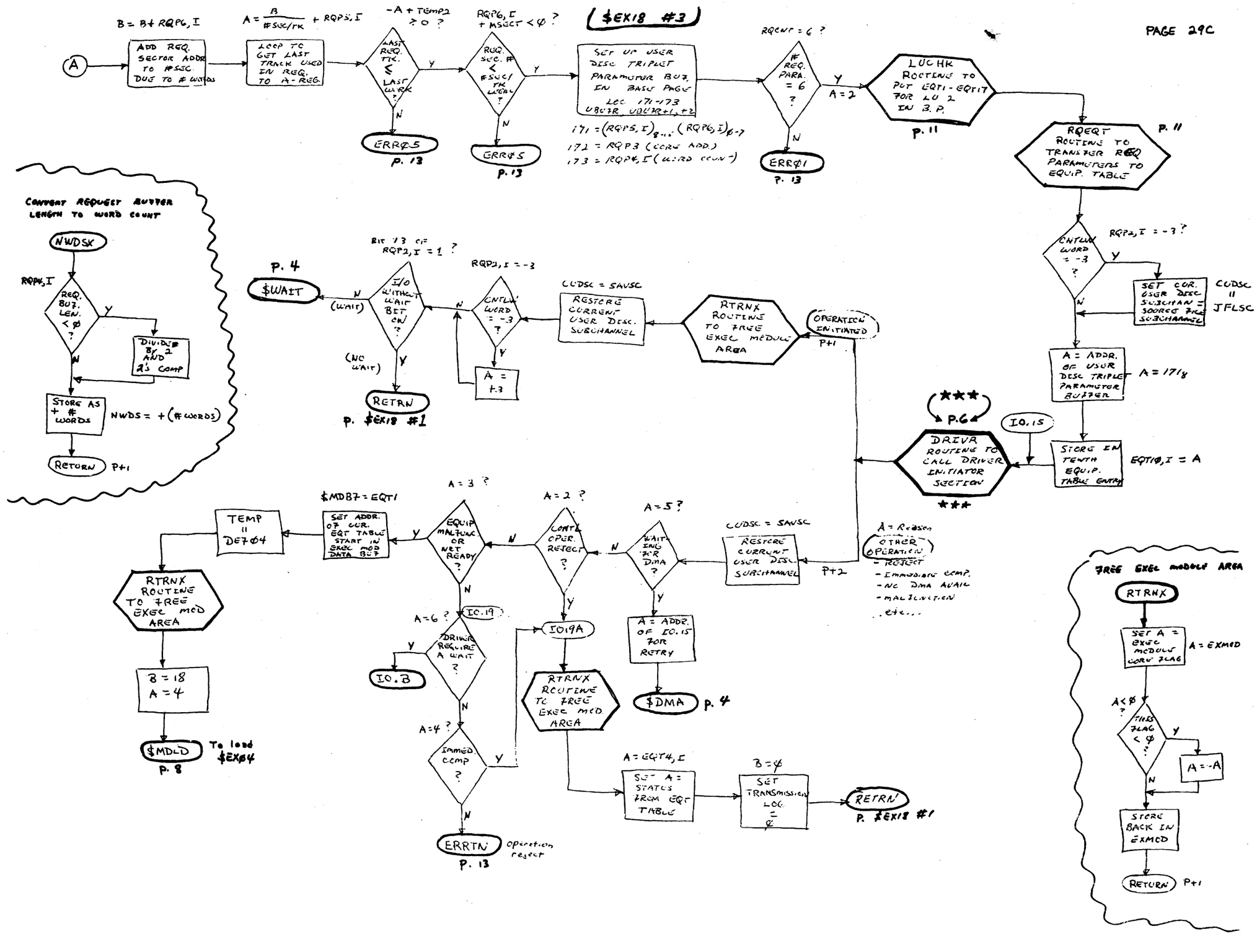

$EXIS
Save Dump TYPE code (0→ Abort dump) (1→ Post Mortem)
Param = T/S
Param+1 = Core Address
Param+2 = # of words
Set up start T/S, core Add., # words to read System Buf. Sec.
Checks for Valid Track request
$GOTK
A=Address of req. parameters
B=1 for a disc read
Read the System Buffer Sectors
$DISC
Is Abort Dump? (TYPE) = Ø
NO
YES
Set Address of P.M. Parameters (DBFM→WORDP)
Get Address of Abort Parameters (CBFAB→WORDP)
0 = NO prog. dump
-1 = get address from Id. Seg -
N = dump Address
1st Wd of dump parameter = Ø
YES
2nd Wd of dump parameter ≠ Ø
YES
NO
NO
EXØ5
Is IT = -1
YES
NO
(A) + UMFWA
EXIØ
Compute start Address of main dump
MASK off last 3 bits of main dump address & save (START)
START Address of main dump = UMFWA
EX2Ø
Increment dump parameter word pointer
Is 2nd wd = -1
YES
NO
End Address of main dump = EXPG+1Ø & SAVE (END)
(A) + UMFWA
Compute end Address of main dump & SAVE (END)
Page Eject on List device
PAGE
Increment dump parameter word pointer
Format and output lines to be dumped
FMOUT
Is BIT 15 of Word 3 set
YES
NO
Bit is = 1 → dump base page
Bit is = 0 → No base page dump
4
Mask off LWA 3 bits from User Base page Address (START)
LWA of user base page in EXPG+8 → END
2
STORE
Store ASCII Blanks into 1st wd of buffer
Store the ASCII values returned by CNOCT routine into to list device output buffer
Store
1
2
Page eject on list device
PAGE
Set up for 4 links/line (LOOP) & Set up for Buf. Store Add (STADD)
EX4Ø
Convert Base Page link address to octal (START)
CNOCT
Store blank (ASCII) into upper character of MSD of octal conversion
Store link Address into buffer
STORE
3
Convert contents of B.P. word & to octal
EX5Ø
CNOCT
Store this contents in buffer
STORE
Get contents of the Address specified by the B.P. word
Convert to octal
CNOCT
Save this contents in buffer
STORE
increment base page Add. (START)
Is Full line formatted (LOOP)
NO
YES
3
OUTPUT the Line & return with Flag in (A)
OUT
(A) = + = not done with base Page
YES
Is (A) Positive
NO
4
EXTP
Is BIT 15 of wd 4 Set
BIT 15 = 1 → Lib. dump
BIT 15 = Ø → NO Lib dump
NO
YES
Clear: EX MOD Area flag, dump flag and input request code
EXIT
Clear EXPG → EXPG+10
$MOVE
Setup for Library dump: EXPG+10 → START EXPG+6 → END
Page eject the list device
PAGE
Format and output lines to be dumped
FMOUT
WAS A ":" input detected (CHARG)
YES
$JLOD
XFER to JOBPR
NO
clear JOBPR "IN" Flag
BIT 15 of SWAIT Set if :TY received from keyboard while program is executing
BIT 15 of SWAP Set
YES
Set B ≠ Ø to indicate "WAIT for input"
NO
$IDLI
$TYPE
5
FMOUT
FMOUT+1
Setup for 8 locations/line (LOOP); & Buffer Store Add (STADD)
Convert start address to octal
CNOCT
Store ASCII blank into MSD of the octally converted #
Store Address into buffer
STORE
FMIØ
Convert contents of address to octal
CNOCT
Save the value in buffer
STORE
Increment to the next address to be dumped
(A) = + = NOT done with prog dump
IS This the 8th entry per line
NO
YES
OUTPUT the Line & return with Flag in (A)
OUT
Is (A) Pos
YES
NO
5
FMOUT
PAGE
Control request to Page eject
$SYEO
PAGE
OUT
OUTPUT 1 Line of dump data
$SYEO
P+6 Init.
$WAIT
P+5 Comp
Complement Starting dump address & END Address
(Left in A on return)
OUT


$EX16
;GO parameter processor
On entry (B) may contain an Equipment table pointer
SAVE (B) (SVEQT)
Setup Address into which parameters passed with ;GO (if any) will be stored (STADD)
Setup counter for 5 parameters (COUNT) & pointer to the potential parameters (BUFAD)
Complement of 2X # of wds = # of characters (BUFCT)
# of times GET is called
1. :
2. G
3. O
4. ?
Iterate this call 4 time to get ;GO?
GET
EX10
Clear Address currently pointed to by STADD,I
2
Returns with flag in A = Ø if no character to get
EX15
Get the next character
GET
1
A = Ø
YES
EX16
STORE Ø's into parameter until (count = Ø (COUNT)
3
NO
EX20
IS character returned = comma
NO
IS character = Blank
NO
Subtract 60₈ from character to convert from ASCII to binary and save (→ TEMP)
Multiply previous stored value X10 & then Add current (BUFDD,I)X10 + TEMP
YES
YES
1
UPDATE STORE ADDRESS (STADD) And parameter Counter (COUNT)
All Parameters IN?
NO
2
YES
3
Save point of susp Address; Clear PT of susp ($GOAT) and Input request code ($IOCO) & EXMOD AREA(EXMOD)
Is PT of Suspension Address = Ø
NO
YES
Set (B) ≠ Ø to indicate to wait till input
$TYME
Return to System
NO
request batch input
$IDLE
Was an EQT Address in (B) on entry ?
YES
Set EQT Address into EQT1 → EQT17
SETEQ
Set (B) to point to poss. b/e parameters (DFADD → B)
Turn on mem. protect and interrupts
return to user
STADD,I

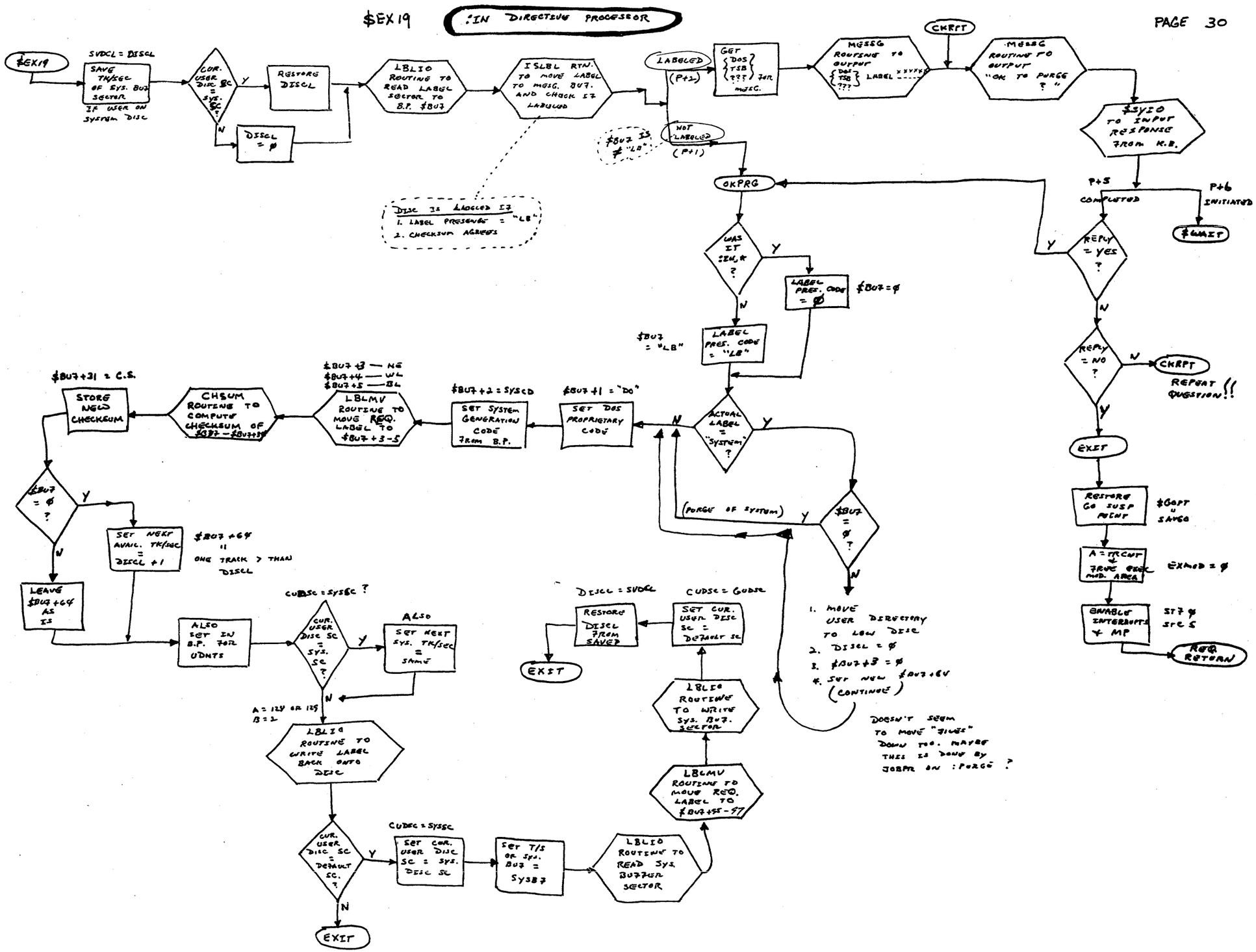
$EX18 (INPUT/OUTPUT CONTROL PROCESSOR) #1




IO.ØZ
A = RQCHN
SET A = SAVED REQ. CHAN. #
ISCHN ROUTINE TO SET CHAN # TO A-REG. FROM EQT.
(YES) P+1
(NO) P+2
RTRNX, I = A
STORE #, EQT1 IN INT. TABLE ENTRY
A = RQCHN +1
ISCHN ROUTINE TO CHECK RQCHN +1 COMPARES
STORE #, EQT1 IN INT. TABLE ENT.
BIT 14 OF EQT3, I = 1 ?
DRIVER CORE RES. ?
READ/WRITE ?
R.C. = 1 OR 2 ?
RQP3, I = -3 ?
ENTW = -3 ?
A = -A
REQ. FOR USER DISC ? (Bits 0-3 of RQP2, I)
LU = 3 ?
SET CUR DISC REQ. FLAG ≠ Ø
CR7LG ≠ Ø FOR USER DISC
IODMD ≥ Ø ?
I/O DRIVER MOD AREA BUSY ?
ON JMP $MBSY, I IN DISCM $WAIT
Called with JSB
$MBSY
P. 4
P. 11
RQEQT ROUTINE TO TRANSFER REQ. PAR. TO EQT TABLE
RQRTN
RQP1, I - RQP6, I
EQT7, I - EQT13, I
RQP1, I < Ø ?
SYSTEM R.C. ?
SYSTEM REQUEST
USER REQUEST
RCODE = 3 ?
CONTROL REQ. ?
REQ. BUF. IN USER AREA ?
-(RQP3 +1) + UMEMA < Ø ?
ERR#3 P. 13
USER BUF ADDRESS IN SYSTEM AREA
BITS 8-13 OF EQT4, I = 31B ?
IS DEVICE DISC ?
IO.1Ø
IO.3Ø
B.IT 14 OF EQT3, I = 1 ?
DRIVER CORE RES ?
IO.15
P. 29C
EQT1 = IODMD ?
DRIVER NOT IN CORE ?
P. 29C
IO.15
$LDVR ROUTINE TO LOAD THE DRIVER INTO CORE
P. 9
IC. 15
P. 29C
READ/WRITE ON USER DISC AREA
-[RQP3 + (# WORDS)] + UMEMA ≥ Ø ?
RQP3 + (# WORDS) SET E-REG. = 1 ?
CORE WRAP AROUND ?
NWDSX ROUTINE TO CONVERT REQ BUF LEN TO WORD COUNT
FROM RQP4, I
ABOVE TOP OF CORE
ERR#4 P. 13
ABOVE LAST WORD OF USER AREA
RCODE = 14 OR 15 ?
USER FILE REQ. ?
RTRNX ROUTINE TO FREE EXEC MODULE AREA
P. 8
IO.4Ø
This is in the DISCM
READ/WRITE IN WORK AREA
JBIN AREA ASSIGNED ?
JBINC ≠ Ø ?
A = FIRST TRACK OF ALLOW TIBENT
A = (JBINC)bits 15-8 - 1
A = (DISCC) bits Ø-1Ø
A = LAST TRACK ON DISC
SAVE WORK TRACK IN TEMP2
TEMP2 = A
A = SYNTS
A = NEXT TK/SEC B = Ø
.RRL ROUTINE TO SHIFT TK TO Bø-7 SEC TO A6-15
A = Ø ?
SEC. = Ø ?
B = B+1
INCREMENT TRACK
DUE TO PARTIAL SECTOR
-(RQPS, I + 1) + B < Ø ?
REQ. TRACK = FIRST TRACK ?
ERRØ5 P. 13
A = # WORDS IN REQ
A = NWDS B = Ø
.RRL ROUTINE TO SHIFT THIS SEC # TO Ø-1 B
INCREMENT # SEC
DUE TO PARTIAL
next Page
A


$EXI8 #3
A
ADD REQ. SECTOR ADDR TO #SEC DUE TO # WORDS
B = B + RQP6, I
LOOP TO GET LAST TRACK USED IN REQ. TO A-REG.
A = B / #SEC/TK + RQP5, I
LAST REQ. TK. ≤ LAST WORK ?
-A + TEMP2 ≥ 0 ?
ERR#5
p. 13
REQ. SEC. # ≤ #SEC/TK UNDER ?
RQP6, I + MSECT < 0 ?
ERR#5
p. 13
SET UP USER DESC TRIPLET PARAMETER BUF. IN BASE PAGE
Loc 171-173
UBUFR, UBUFR+1, +2
171 = (RQP5, I)8-15 . (RQP6, I)0-7
172 = RQP3 (CORE ADD.)
173 = RQP4, I (WORD COUNT)
# REQ. PARA. = 6 ?
RQCNT = 6 ?
ERR#1
p. 13
A = 2
LUCHK
ROUTINE TO PUT EQT1 - EQT17 FOR LU 2 IN B.P.
p. 11
RQEQT
ROUTINE TO TRANSFER REQ PARAMETERS TO EQUIP. TABLE
p. 11
CNTLW WORD = -3 ?
RQP2, I = -3 ?
SET CUR. USER DESC. SUBCHAN = SOURCE REQ SUBCHANNEL
CUDSC = JFLSC
A = ADDR. OF USER DESC TRIPLET PARAMETER BUFFER
A = 1718
IO.15
STORE IN TENTH EQUIP. TABLE ENTRY
EQT10, I = A
***
p.6
DRIVR
ROUTINE TO CALL DRIVER INITIATOR SECTION
***
OPERATION INITIATED
P+1
RTRNX
ROUTINE TO FREE EXEC MODULE AREA
CUDSC = SAVSC
RESTORE CURRENT USER DESC. SUBCHANNEL
CNTLW WORD = -3 ?
RQP2, I = -3
A = -3
I/O WITHOUT WAIT BIT ON ?
Bit 13 of RQP2, I = 1 ?
(NO WAIT)
RETRN
p. $EXI8 #1
(WAIT)
$WAIT
p. 4
A = Reason
OTHER OPERATION
- REJECT
- Immediate comp.
- NO DMA AVAIL
- MALFUNCTION
. etc...
P+2
WAITING FOR DMA ?
A = ADDR. OF IO.15 FOR RETRY
$DMA
p. 4
A = 5 ?
CONTL OPER. REJECT ?
A = 2 ?
IO.19A
RTRNX ROUTINE TO FREE EXEC MOD. AREA
A = EQT4, I
SET A = STATUS FROM EQT TABLE
B = 0
SET TRANSMISSION LOG. = 0
RETRN
p. $EXI8 #1
A = 3 ?
EQUIP MALFUNC OR NOT READY ?
$MDB7 = EQT1
SET ADDR. OF CUR. EQT TABLE START IN EXEC MOD DATA BUF
TEMP 11 DE704
RTRNX ROUTINE TO FREE EXEC MOD AREA
B = 18
A = 4
$MDLD
To load $EXB4
p. 8
A = 6 ?
IO.19
DRIVER REQUIRE A WAIT ?
IO.8
A = 4 ?
IMMED. COMP ?
ERRTN
Operation reject
p. 13
CONVERT REQUEST BUFFER LENGTH TO WORD COUNT
NWDSK
RQP4, I
REQ. BUF. LEN. < 0 ?
DIVIDE BY 2 AND 2's COMP
STORE AS + # WORDS
NWDS = + (# WORDS)
RETURN
P+1
FREE EXEC MODULE AREA
RTRNX
SET A = EXEC. MODULE CORE FLAG
A = EXMOD
A < 0 ?
FILES FLAG < 0 ?
A = -A
STORE BACK IN EXMOD
RETURN
P+1

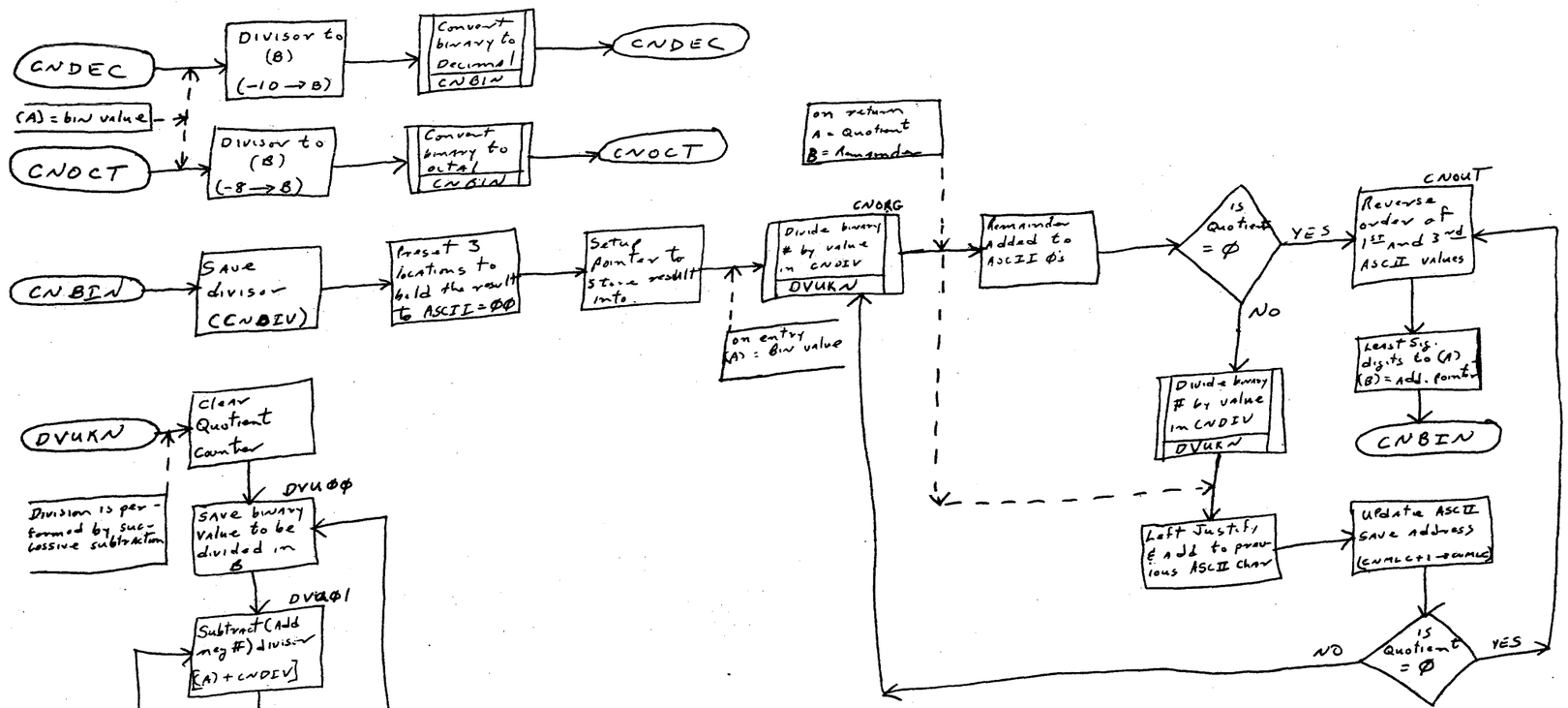
$EX19 — :IN DIRECTIVE PROCESSOR



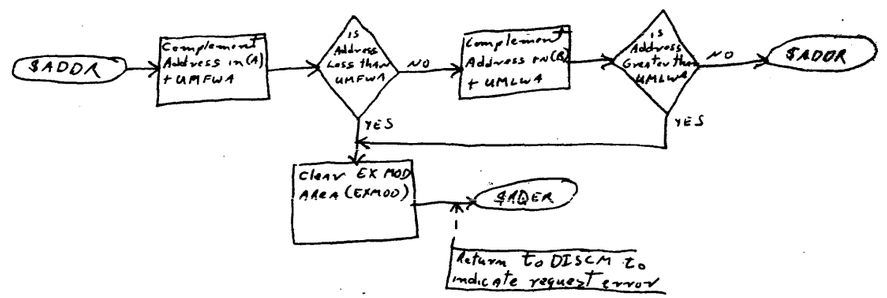
ASCII → Convert Binary to ASCII Octal or Decimal

Calling sequence: LDA <Value in binary>
JSB CNDEC/CNOCT

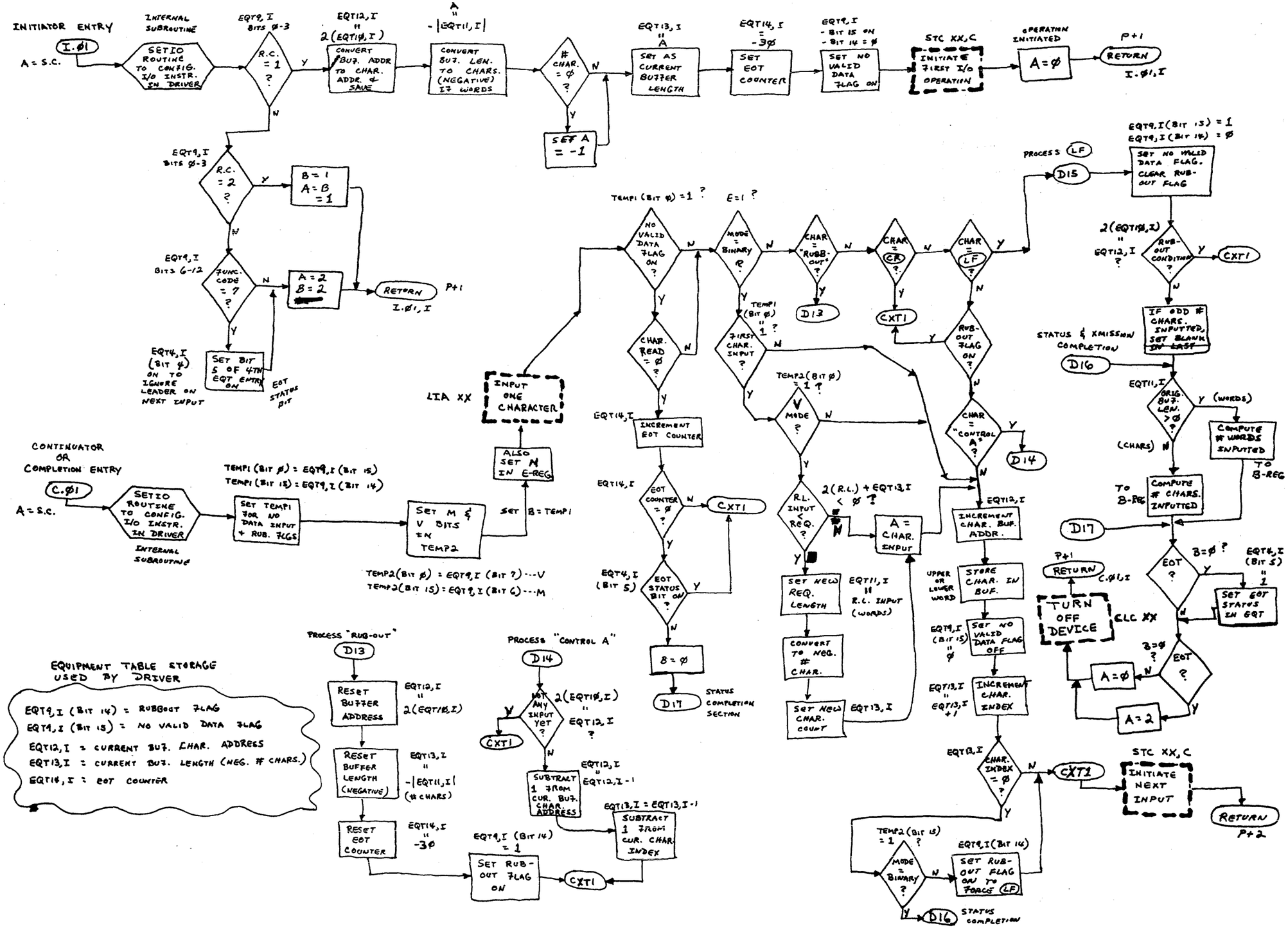
Return: (A) Least significant 2 digits
(B) Address of most significant digits



$ADDR - checks if buffer address limits are within the user Program area limits



DOS/DOS-M READER DRIVER (DVR01) "A"-VERSION



DOS/DOSM MINIMUM HARDWARE COST COMPARISON

DOS

PROVIDES MINIMUM HARDWARE CONFIGURATION CONSISTING OF:

		PRICE 115V 60Hz	PRICE 230V 50Hz
1.	2116B Computer with 8192 Word Memory	$20,000	$20,000
2.	Direct Memory Access, Accessory No. 12578A	3,000	3,000
3.	Extended Arithmetic Unit, Accessory No 12579A	3,000	3,000
4.	Memory Parity Check, Accessory No. 12591A	1,000	1,000
5.	Time Base Generator, Accessory Kit No. 12539A	1,000	1,000
6.	Memory Protect, Accessory Kit No. 12581A	2,000	2,000
7.	Teleprinter Input/Output consisting of:		
	HP 2752A Teleprinter (Modified Teletype ASR-33) with	1,250	1,450
	HP 12531B Teleprinter Input/Output Interface Kit	750	750
8.	Teleprinter Input/Output, consisting of:		
	HP 2754B Heavy-Duty Teleprinter (modified Teletype ASR-35) with	3,850	4,250
	HP 12531B Teleprinter Input/Output Interface Kit	750	750
9.	Disc Memory consisting of:		
	HP 2770A Disc Memory (368,640 words non-expandable)	17,000	17,200
	HP 2772A Disc Memory Power Supply	2,500	2,700
	HP 12606A Disc Memory Interface Kit	4,000	4,000
10.	2886A Single-Bay Cabinet	900	900
	TOTAL COST	$61,000	$62,000

(Four-Year Lease @ $1,690/month)

DOSM

PROVIDES MINIMUM HARDWARE CONFIGURATION CONSISTING OF:

		PRICE 115V 60 Hz	PRICE 230V 50 Hz
1.	2114B Computer with 8K memory	$13,000	$13,100
2.	Direct Memory Access, Accessory Kit No. 12607A	1,500	1,500
3.	Memory Parity Check with Interrupt, Accessory Kit No. 12598A	1,000	1,000
4.	System Console, consisting of:		
	HP 2752A Teleprinter (Modified Teletype ASR-33) with	1,250	1,450
	HP 12531B Teleprinter Input/Output Interface Kit	750	750
5.	System Input, consisting of:		
	HP 2748A Punched Tape Reader with	1,500	1,600
	HP 12597A-002 Punched Tape Interface Kit	600	600
6.	Cartridge Disc Memory System, consisting of:		
	HP 2870A Disc Drive (includes HP 12536A Disc Cartridge)		
	HP 2871A Disc Controller	13,500	13,650
	HP 2881A Power Supply		
	HP 2882A Cabinet		
	HP 12557A Disc Interface Kit	2,500	2,500
	TOTAL COST	$35,600	$36,150

(Five-Year Lease @ $765/Month)

HP DOSM/IBM 1130 COST COMPARISON

HP DOS-M		IBM 1130	
MINIMUM SYSTEM (WITH PAPER TAPE)	PURCHASE	MINIMUM SYSTEM (WITH PAPER TAPE)	PURCHASE
2114B (2.0 MICROSEC)	$ 8,500	1131-2A (3.6 MICROSEC)	$ 34,610
OPTION 4 (8K MEMORY TOTAL)	4,500	TTY/PRINTER CONSOLE	
12591A MEMORY PARITY CHECK	1,000	4K CORE, 500K DISC	
12067A DIRECT MEMORY ACCESS	1,500	1134 PAPER TAPE READER (60 CHARACTERS/SEC)	1,270
2870A CARTRIDGE DISC DRIVE	8,700	3623 P.T. READER ATTACHMENT	450
2871A DISC CONTROLLER	2,800	1055 PAPER TAPE PUNCH (14.8 CHARACTER/SEC)	900
12557A DISC INTERFACE	2,500	7923 P.T. PUNCH ATTACHMENT	900
2882A DISC CABINET	600		$ 38,130
2881A DISC POWER SUPPLY	1,400	(WITH CAFD I/O)	
2752A TELEPRINTER ASR-33	1,250	1131-2A AS SHOWN ABOVE	34,610
12551B TELEPRINTER INTERFACE	750	1442 CARD READER/PUNCH (160 COLUMNS/SEC)	12,750
2784A PAPER TAPE READER (500 CHARACTERS/SEC)	1,500	4419 CARD READER/PUNCH ATTACHMENT	1,525
12597A P.T. READER INTERFACE	600	3630 1442 INTERFACE	225
	$ 35,600		$ 49,110
TYPICAL SYSTEM	PURCHASE	TYPICAL SYSTEM	PURCHASE
2114B (2.0 MICROSEC)	$ 8,500	1131-3B (2.2 MICROSEC)	$ 58,050
OPTION 4 (8K MEMORY TOTAL)	4,500	TTY/PRINTER CONSOLE	
12591 MEMORY PARITY CHECK	1,000	8K CORE, 500K DISC	
2870A CARTRIDGE DISC DRIVE	8,700	1134 PAPER TAPE READER (60 CHAR/SEC)	1,270
2871A DISC CONTROLLER	2,800	3623 P.T. READER ATTACHMENT	450
12557A DISC INTERFACE	2,500		
2882A DISC CABINET	600		
2881A DISC POWER SUPPLY	1,400		
2752A TELEPRINTER ASR-33	1,250	1055 PAPER TAPE PUNCH (14.8 CHAR/SEC)	900
12551B TELEPRINTER INTERFACE	750	7923 P.T. PUNCH ATTACHMENT	900
2748A PAPER TAPE READER (500 CHAR/SEC)	1,500	1132 LINE PRINTER	11,350
12597A P.T. READER INTERFACE	600	82 LPM ALPHAMERIC	
2753A PAPER TAPE PUNCH (120 CHAR/SEC)	3,300	110 LPM NUMERIC	
12597A P.T. PUNCH INTERFACE	600	2310 DISC DRIVE	12,150
2767A LINE PRINTER (80 COL. 356-1110 LPM)	10,000	500K WORDS	
12653A LINE PRINTER INTERFACE	2,500		
	$ 52,000		$ 85,070

DOSM HARDWARE OPTIONS

1. ADDITIONAL MEMORY
   16,384 OR 32,768 WORDS ON 2116B

2. ADDITIONAL I/O CHANNELS
   EXTENDERS ARE AVAILABLE FOR 2114B OR 2116B

3. TIME BASE GENERATOR (TBG)

4. EXTENDED ARITHMETIC UNIT (EAU)
   AVAILABLE ONLY ON 2116B

5. MEMORY PROTECT (MP)
   AVAILABLE ONLY ON 2116B

6. PHOTOREADER

7. PAPER TAPE PUNCH

8 LINE PRINTER (2778A CDC OR 80 COLUMN D.P.)

9. MARK SENSE CARD READER

10. MAGNETIC TAPE (3030A OR 7970A)

11. CALCOMP PLOTTER

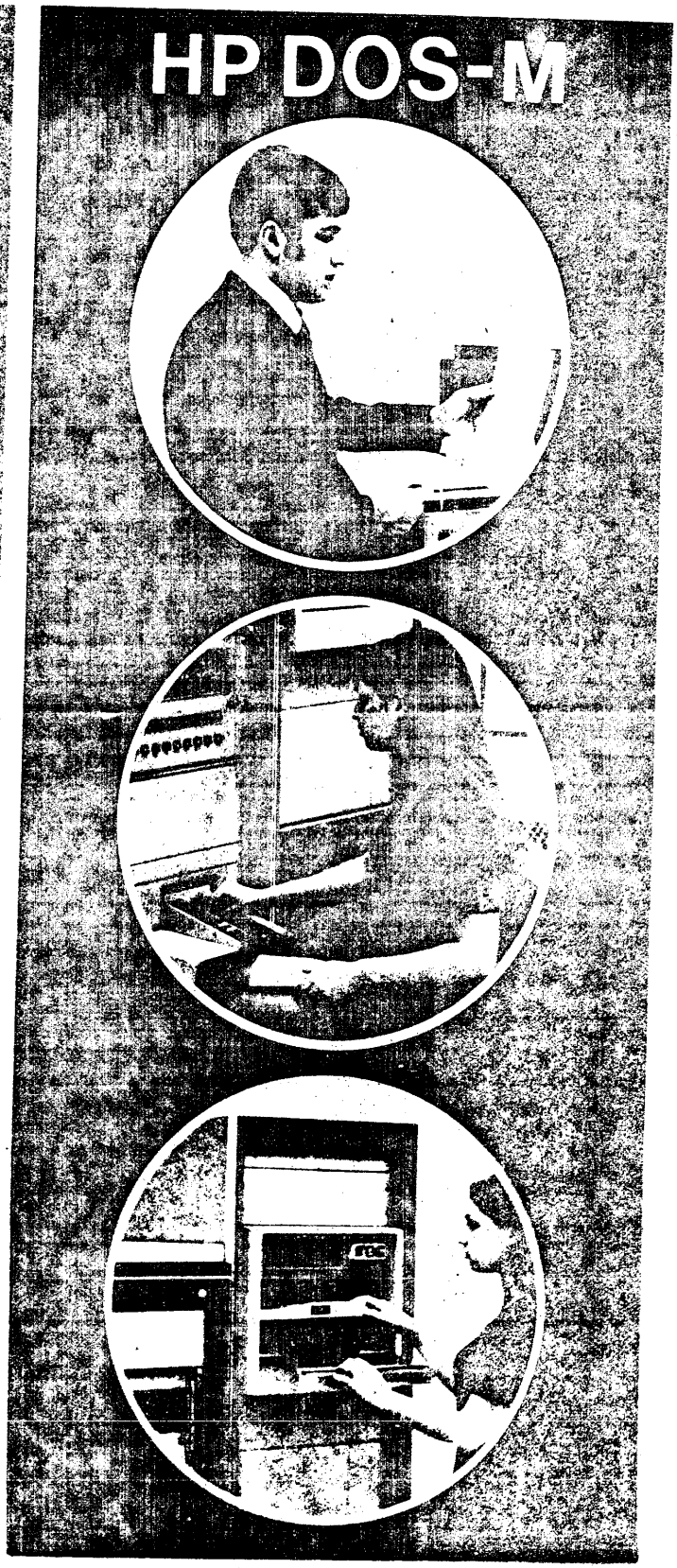
12. UP TO THREE ADDITIONAL DRIVES

HP DOS-M vs IBM 1130

SALES AMPLIFIER 101A

NOW THERE'S A BETTER WAY

The HP DOS-M (Disc Operating System) has a significant price/performance advantage over the IBM 1130. Read on to find out why!



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HEWLETT hp PACKARD

INTRODUCTION

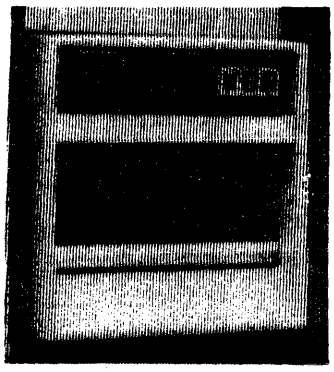
The IBM 1130 is a desk size, word-oriented computer intended primarily for small scale scientific applications. It can also serve as a low cost processor for certain business applications that do not require high I/O speeds. IBM announced the 1130 system in 1965, and the initial customer deliveries were made an November, 1965.

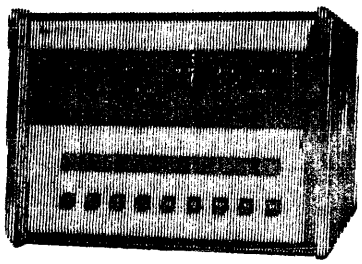
Since the initial introduction, a number of software and hardware announcements have followed (i.e., a 2.2 microsecond cycle time versus 3.6, more peripheral flexibility, commercial subroutine packages, etc.).

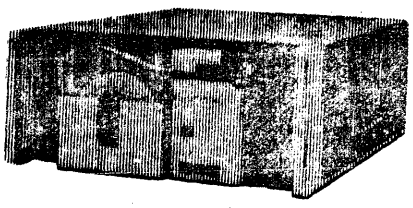
It is purported that IBM has between 6500 and 7500 units in the field.

HP DOS-M VS IBM 1130

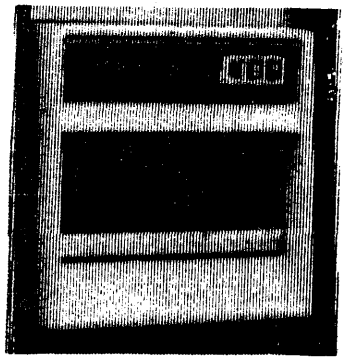
COMPARISON	DOS-M	IBM 1130
DISC STORAGE		
1. MAXIMUM ON LINE	4.8 million words	2.5 million words
2. AVERAGE RANDOM ACCESS TIME	90 milliseconds	790 milliseconds
CORE STORAGE		
1. CYCLE TIME	2 microseconds on the 2114B 1.6 microseconds on the 2116B	2.2 to 3.6 microseconds depending on the CPU model
2. MEMORY SIZE	8K in the 2114B Expandable to 32K in the 2116B	Expandable from 4K to 32K
IMPLICATIONS:	**DOS-M requires much less time than the 1130 to retrieve information from core or disc. This significantly decreases the amount of overhead involved in system and user program execution. The quantity of disc storage available on line may be expanded to 4.8 million words – (approximately twice the amount available on the 1130).**	
I/O DEVICE INTERFACING		
1. NUMBER OF DEVICES	A maximum of 24 peripherals may be interfaced to a DOS-M.	A maximum of 11 peripherals may be attached to an 1130.
2. KINDS OF DEVICES	Instrumentation devices may be easily interfaced to the system.	Non-IBM devices are *extremely difficult* to interface to this system.
3. DEVICES OF THE SAME TYPE	The user may attach several peripherals of the same type to the system. Note: 4 discs (max)	Normally only one peripheral of each type may be included in the system. Note: 5 discs (max) 2 printers (max)
IMPLICATIONS:	**The DOS-M system is capable of supporting a much more varied range of peripherals than the 1130. Each HP system may be custom configured to the peripheral needs of the user.**	

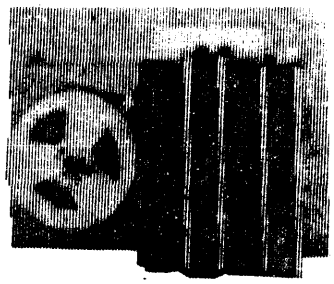


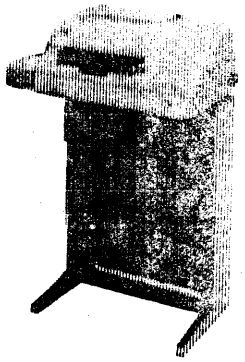




COMPARISON	DOS-M	IBM 1130
SYSTEM PROTECTION		
1. **HARDWARE DISC PROTECT**	Standard	None
2. **SOFTWARE SYSTEM PROTECT**	Yes	Yes
IMPLICATIONS:	**Hardware disc protect insures the integrity of DOS-M; the 1130 system, on the other hand, can be destroyed by user software. (Users have called the 1130 crash prone.)**	
SYSTEM BACK UP		
1. **BACK UP CREATION (minimum configuration)**	DOS-M system programs, user programs, and data files may be copied from the fixed portion of the disc to the disc cartridge. This back up cartridge may then be removed, stored off line, and replaced with a scratch cartridge.	IBM supplies 1130 users with a card copy of the 1130 operating system. Back up for user programs or data files, however, must be obtained by copying them from disc to punched cards. (IBM 1130s may use paper tape I/O instead of card I/O, but such systems are rare.)
2. **RESTORATION FROM BACK UP (minimum configuration)**	System restoration may be accomplished by copying the contents of the back up cartridge onto the fixed portion of the disc. The back up cartridge may then be removed and replaced with a scratch cartridge.	In a minimum 1130 system, the user must restore system software, user programs, and user files by copying information from punched cards to disc.
IMPLICATIONS:	**On a minimum 1130 system, back up for user programs and data files may only be created on punched cards. DOS-M, on the other hand, *does not require card punch hardware* but is capable of creating a spare copy of disc resident information quickly, efficiently, and in an easily storable form – a cartridge disc pack.** **If a one disc 1130 system fails, the software must be copied from card to disc – at least a 30 minute process. A DOS-M system, however, may be restored by copying software from disc to disc.** **Each user at a DOS-M installation may keep an off line copy (disc pack) of a system custom configured to his needs – system programs, user programs, source files, and data files.**	







COMPARISON — DOS-M — IBM 1130

✚ SYSTEMS FEATURES

1. SOURCE FILE CAPABILITY	User may store copies of source programs in named disc files on line.	none
2. SOURCE FILE EDITING	User may insert, delete, or replace disc file source statements on line.	none

IMPLICATIONS:

The ability of DOS-M to store and edit disc source programs on line makes the system extremely useful for software development work. Once source statements have been stored on disc, they may be edited and recompiled directly from disc. All source program editing on the 1130, however, must be done off line; recompilation requires the user to reload his card deck or source tape.

3. DATA FILE ADDRESSING	DOS-M allows the user to read or write data on disc by file name and relative sector or by actual track and sector address. Both addressing methods may be used in Fortran or Assembly language.	The 1130 system allows Fortran users to address data files by number in READ or WRITE statements. Assembly language disc I/O subroutines require actual track and sector addresses and therefore cannot make use of symbolic file addressing.

IMPLICATIONS:

The ability of DOS-M to address information on disc by file name makes file handling more mnemonic and simpler to use.

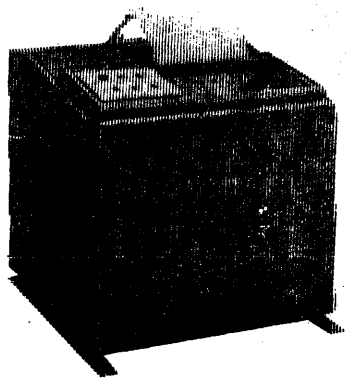
4. USER PROGRAM SEGMENTATION AND OVERLAY	The user must segment his program and code segment overlay requests.	Fortran *subprograms* may behave as automatically called overlay segments if the original program size exceeds available core. This "Automatic Segmentation" is not available if the main program is written in Assembly language. User controlled segmentation is also available.

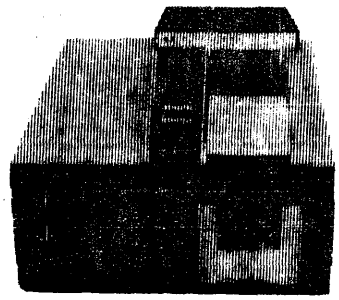
IMPLICATIONS:

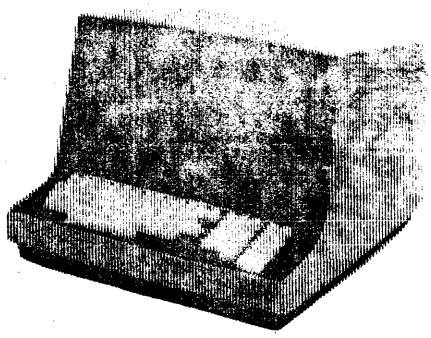
"Automatic Segmentation" is a strong feature of the 1130. It should be noted, however, that it will not segment main programs but treats subroutines as segments. If the main program and overlay area are larger than available core, the user must segment his program.

The use of the "Automatic Segmentation" feature may increase a program's execution time very substantially – (in direct proportion to the number of time consuming overlay requests) due to the slow (790 millisecond access time) disc.

Assembly language system development work may not use the "Automatic Segmentation" feature.







COMPARISON	DOS-M	IBM 1130
5. RESIDENT MONITOR (size)	3500_{10} locations	From 480_{10} to 930_{10} locations.
IMPLICATIONS:	**The limited size of the 1130 monitor leaves more core available for user program execution but requires that the bulk of the system be kept on disc. By making only a small portion of the system core resident, the 1130 incurs greater disc transfer overhead during system program execution.**	
	Since program segmentation may be used with the 1130 and DOS-M, the amount of user available core is seldom critical. Indeed, the whole purpose of a disc operating system is to use mass storage to extend limited core storage.	
6. PROGRAM DEBUGGING FACILITIES	The DOS-M system permits the user to dump an octal core image of his program. Dumps may be taken whether the program terminates normally or aborts execution. An additional debug package allows the user to monitor his program's execution on line.	There are several core dump routines available for the 1130. Some of these programs must be called by the user during the execution of his program, while others must be loaded off line and executed.
IMPLICATIONS:	**The core dump on abnormal program termination and the debug package of DOS-M make it very useful in a software development environment. All core dumps and debug facilities do not require any modification of the user's in line code. All on line 1130 core dumps, however, require that the user either place calls to dump routines** ***into his program code,*** **or use an** ***off line*** **dump routine.**	
7. I/O DEVICE REFERENCE TECHNIQUES	I/O devices are referenced using logical unit numbers. These numbers correspond to various I/O *functions* – system input, list, punch, etc.	The 1130 references peripherals with a set of numbers assigned to each type of I/O device which may be attached to the system.
	Logical unit assignments may be changed on line to associate any appropriate system device with a given logical unit number.	Unit reference number assignments are permanently determined. In a Fortran program, however, the user may substitute a variable unit reference number which will be determined at execution time.
IMPLICATIONS:	**DOS-M programs coded with logical unit numbers may be executed on any other DOS-M system regardless of hardware configuration. If 1130 programs use constant logical unit numbers, they may not be compatible with other 1130 hardware configurations. (Devices associated with fixed logical unit numbers cannot be changed on line in the 1130 system.)**	

SUPPORTING SOFTWARE

1. TRANSLATORS	Assembly language FORTRAN II or IV ALGOL	Assembly language FORTRAN IV subset RPG COBOL (available Feb. 1971) APL
2. USER APPLICATION PACKAGES	under development	petroleum exploration and engineering type composition civil engineering coordinate geometry math pack - 20 Fortran subroutines electric field theory elasticity fluid flow etc. Statistical system numerical surface techniques countour map plotting commercial subroutine package (21 Fortran subroutines)
3. SOFTWARE COST	All presently available system software is furnished free of charge with a DOS-M system. The pricing structure on applications packages will be announced as they become available.	All IBM 1130 software developed prior to "unbundling" (June 23, 1969) is available without charge. Recently developed software, however, will be rented on a monthly basis. (The 1130 COBOL compiler will rent for $75/month.)

IMPLICATIONS:

The quantity of applications software available is one of the strongest features of the IBM 1130. The majority of these programs are available free of charge. It should be noted, however, that OEMs will be primarily interested in the quality of the operating system itself and the ease with which the system may be used to develop specific user-oriented applications packages.

DATA COMMUNICATIONS

At this time no data communications software capability is available with the DOS-M. All hardware cards needed to implement this capability are presently available, however, and may be used by a customer to develop his own applications software.

The 1130 may act as a remote job entry work station for a larger IBM 360 operating system. In this capacity, the 1130 sends jobs via telephone lines to the larger system and outputs results sent back. If the 1130 has at least 16K of core, job output can be buffered on the disc and dumped after the remote job entry processing is terminated.

IMPLICATIONS:

The 1130 system's ability to communicate with a larger computer is certainly a powerful feature. It should be noted, however, that all programs and job control language sent to a 360 system must be 360 operating system compatible. (If an 1130 user has an assembly language program which he wishes to run with remote job entry, the program must be in IBM 360 assembly language and must have the appropriate 360 job control language statements associated with it.)

PRICING STRUCTURE

IMPLICATIONS

Although the DOS-M system purchase price is significantly (15 to 65%) less than that of a comparable 1130 system, IBM offers a variety of attractive lease/rental plans including 30 and 90 day cancellation options. This can be a significant advantage in the educational market. IBM does *not*, however, offer an educational *discount* on the 1130 system.

HP DOS-M

PRICE COMPARISON

IBM 1130

MINIMUM SYSTEM (with paper tape)	PURCHASE
2114B (2.0 microsec)	$8,500
Option 4 (8K memory total)	4,500
12591A Memory Parity Check	1,000
12067A Direct Memory Access	1,500
2870A Cartridge Disc Drive	8,700
2871A Disc Controller	2,800
12557A Disc Interface	2,500
2882A Disc Cabinet	600
2881A Disc Power Supply	1,400
2752A Teleprinter ASR-33	1,250
12531B Teleprinter Interface	750
2748A Paper Tape Reader (500 characters /sec)	1,500
12597A P.T. Reader Interface	600
	$35,600

MINIMUM SYSTEM (with paper tape)	PURCHASE
1131-2A (3.6 microsec) TTY/Printer Console 4K core, 500K disc	$34,610
1134 Paper Tape Reader (60 characters/sec)	1,270
3623 P.T Reader Attachment	450
1055 Paper Tape Punch (14.8 character/sec)	900
7923 P.T. Punch Attachment	900
	$38,130
(with card I/O)	
1131-2A as shown above	$34,610
1442 Card Reader/Punch (160 columns/sec)	12,750
4419 Card Reader/Punch Attachment	1,525
3630 1442 Interface	225
	$49,110

HP DOS-M

PRICE COMPARISON

IBM 1130

TYPICAL SYSTEM	PURCHASE
2114B (2.0 microsec)	$8,500
Option 4 (8K memory total)	4,500
12591A Memory Parity Check	1,000
12067A Direct Memory Access	1,500
2870A Cartridge Disc Drive	8,700
2871A Disc Controller	2,800
12557A Disc Interface	2,500
2882A Disc Cabinet	600
2881A Disc Power Supply	1,400
2752A Teleprinter ASR-33	1,250
12531B Teleprinter Interface	750
2748A Paper Tape Reader (500 char/sec)	1,500
12597A P.T. Reader Interface	600
2753A Paper Tape Punch (120 char/sec)	3,300
12597A P.T. Punch Interface	600
2767A Line Printer (80 col. 356-1110 lpm)	10,000
12653A Line Printer Interface	2,500
	$52,000

TYPICAL SYSTEM	PURCHASE
1131-3B (2.2 microsec) TTY/Printer Console 8K core, 500K disc	$58,050
1134 Paper Tape Reader (60 char/sec)	1,270
3623 P.T. Reader Attachment	450
1055 Paper Tape Punch (14.8 char/sec)	900
7923 P.T. Punch Attachment	900
1132 Line Printer 82 LPM Alphameric 110 LPM Numeric	11,350
2310 Disc Drive 500K words	12,150
	$85,070


HEWLETT
PACKARD

FROM WALL STREET JOURNAL OCT. 29, 1970

IBM Enters the Mini-Computer Market As It Unveils 2 New Models, Its Cheapest

By a WALL STREET JOURNAL Staff Reporter

NEW YORK — International Business Machines Corp. introduced two small computers for office and industrial applications.

The two are the least expensive that the world's largest computer maker has offered, and one of them, at least, puts IBM into competition for the first time with makers of what have come to be called mini-computers.

Digital Equipment Corp. of Maynard, Mass., has been the dominant manufacturer of mini-computers, which generally are priced under $20,000 and as low as $5,000. Such computers have been used largely for calculations by scientists and engineers, but they are being applied increasingly to industrial processes and some small-business uses. Other leading manufacturers include Honeywell Inc., Varian Associates Inc., Hewlett-Packard Co. and Data General Corp.

Trading in Digital Equipment's stock on the American Stock Exchange yesterday reacted sharply to IBM's announcement. Digital Equipment closed at $61.875, down 37½ cents a share. During the day it traded as low as $57.50. IBM, traded on the New York Stock Exchange, closed at $298.50, up $5.50 a share.

The new IBM model that can be considered a mini-computer is the System 7, designed specifically to monitor and control industrial and laboratory processes. It may be purchased for a minimum of $16,060 or rented for $352 a month and up. First deliveries to customers are scheduled for November 1971.

In Maynard, a Digital Equipment spokesman said the System 7 appeared to be priced too high to be a mini-computer by his company's standard. He added that Digital Equipment products had competed very well with IBM's previous process-control model and that "we think we will continue to do well."

The System 7, operating unattended, can measure and analyze or control processes in petroleum and chemical plants, electric-utility substations, steel mills and laboratories and in a variety of other industries. It can take as many as [illegible] readings a second from instruments, analyze them and, if desired, forward the data to a larger central computer.

As do several mini-computers already on the market, the System 7 has a main memory made of integrated electronic circuits, rather than of the usual magnetic cores.

The System 7 isn't designed for business data processing or for direct use by an engineer or scientist, IBM said. However, F. G. Rodgers, president of IBM's Data Processing division, was asked if the System 7 would be available for purchase as a component by other assemblers of control systems, who currently represent a large share of the market for mini-computers. "We'll be delighted to sell this to anybody," Mr. Rodgers replied.

IBM's other new computer is the System 3 Model 6, an extension of the System 3 small-scale computer, since designated the Model 10, that was introduced in 1969. System 3 computers are aimed for the most part at businesses that haven't previously used computers. IBM has said that more than 1,000 System 3 computers have been delivered this year.

Designed for business data processing, a typical Model 6 can be purchased for $48,[illegible] or rented for $1,0[illegible] a month. First deliveries of the Model 6, in contrast to those of the System 7, are scheduled within 60 days. IBM demonstrated the first production units of the Model 6 in more than [illegible] cities yesterday.

The Model 6 can be used for accounting functions, including the processing of standard ledger cards, and also for engineering calculations in a "conversational" mode, IBM said. It stores data on magnetic disks and can communicate with other IBM computers.

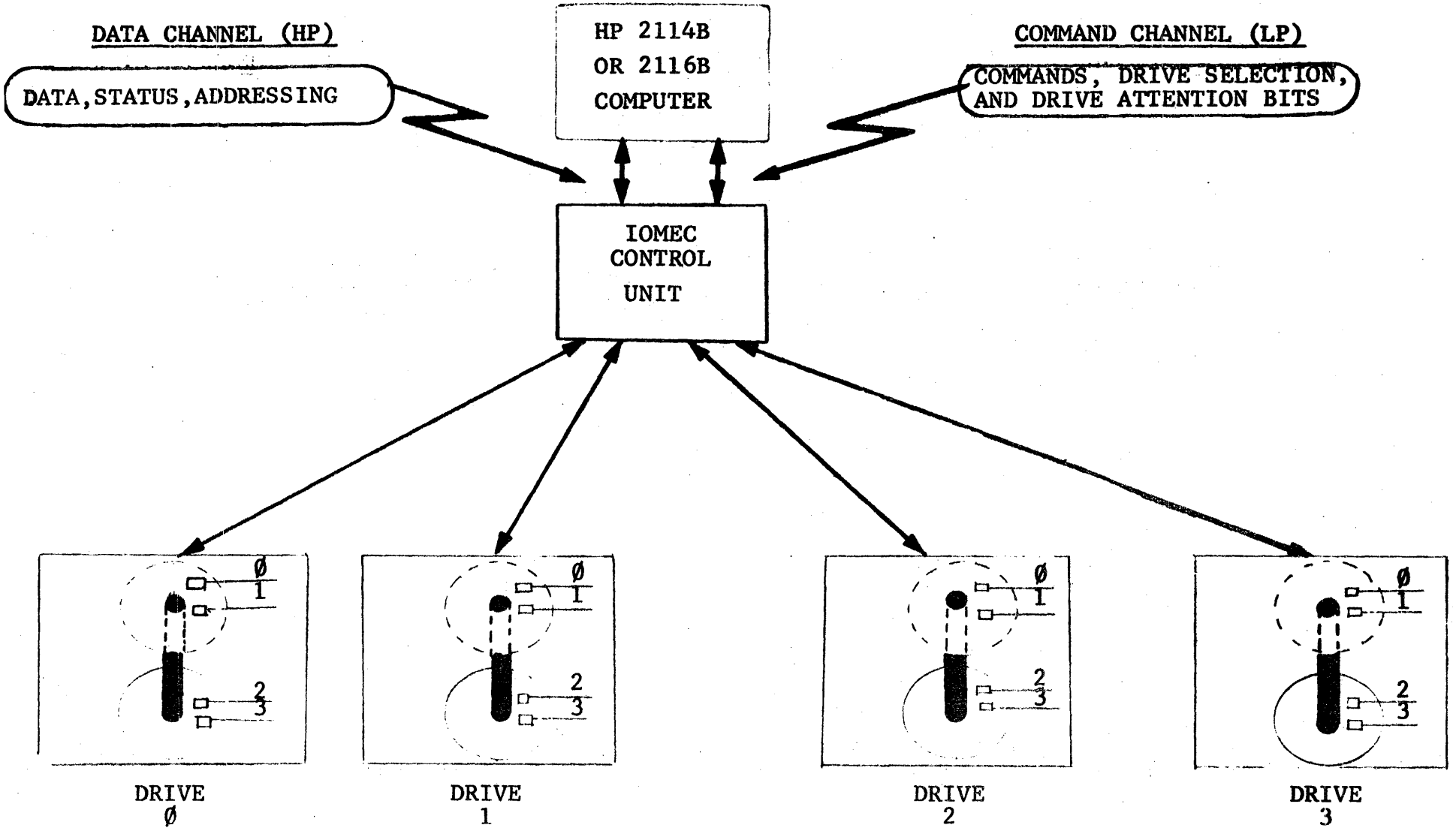
The two new computers aren't part of the System 370 family of medium and large general-purpose computers announced by IBM in June. Both of [illegible] computers are being produced at a plant in Boca Raton, Fla. The System 3 Model 6 also is in production in Vimercate, Italy.

DOSM ADVANTAGES AND DISADVANTAGES WITH RESPECT TO DOS

ADVANTAGES	DISADVANTAGES
1. Lower initial system cost.	1. Slower Disc average access time (about 100 milliseconds).
2. Lower Disc expandable cost.	2. Cumbersome and somewhat confusing system bootstrap.
3. Flexibility in options (EAU, TBG, MP) selection.	3. No other HP Disc based system (RTE, TSB).
4. Use of 2114B or 2116B.	4. Overselling 8K feature.
5. Flexibility in Disc Storage medium with removeable cartridge.	
6. Disc content protection.	
7. Disc labeling capability.	
8. Lower core resident system.	
9. Interdisc file(s) transfer.	

[SLIDE 2]

COMPUTER/DISC CONTROL/DISC DRIVES LAYOUT



[SLIDE 3]

PHYSICAL ALLOCATION FOR EACH DRIVE

203 CYLINDERS
4 TRACKS PER CYLINDER
12 SECTORS PER TRACK
128 WORDS PER SECTOR

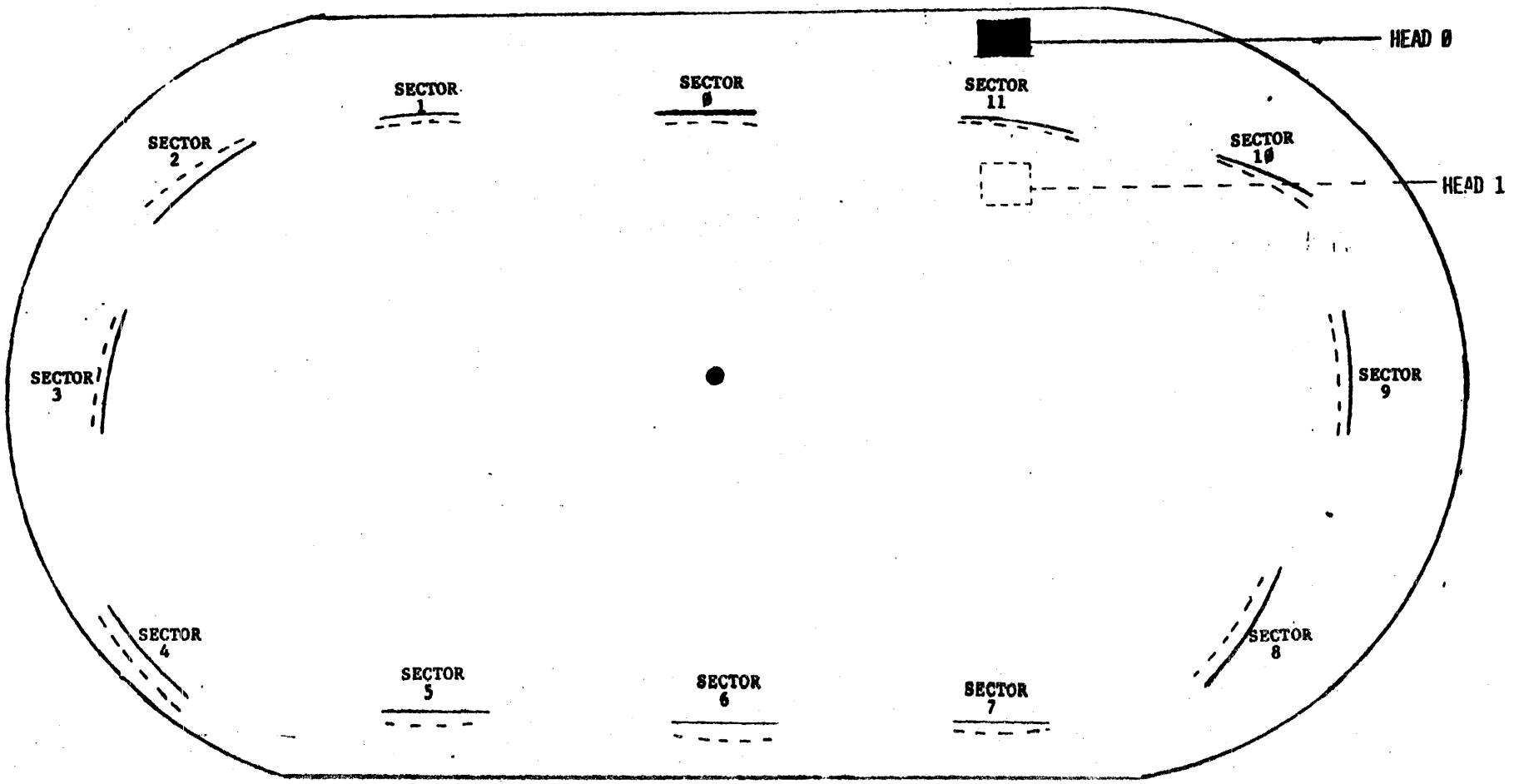
∴ TOTAL WORD CAPACITY PER DRIVE IS
203 X 4 X 12 X 128 = 1,247,232 WORDS

PHYSICAL ALLOCATION FOR EACH DISC

203 CYLINDERS
2 TRACKS PER CYLINDER
12 SECTORS PER TRACK
128 WORDS PER SECTOR

∴ TOTAL WORD CAPACITY PER DISC IS
203 X 2 X 12 X 128 = 623,616 WORDS

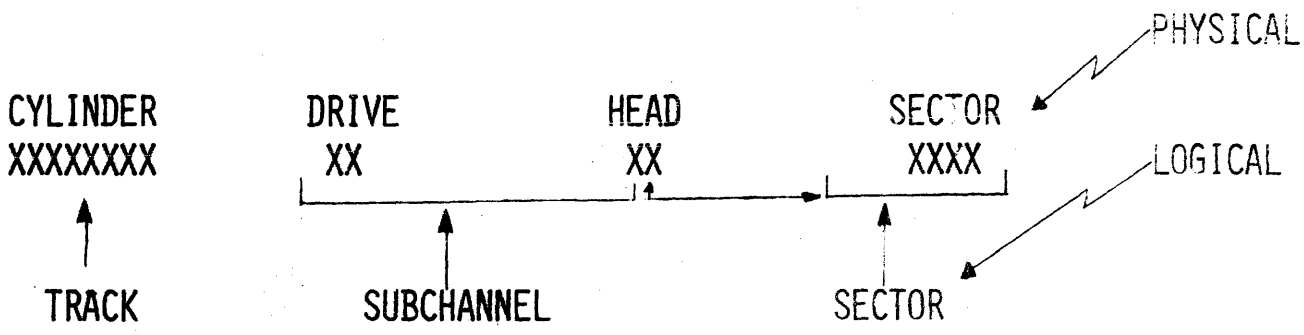
TWO PHYSICAL TRACKS ON CARTRIDGE DISC



"TOP" SURFACE IS ONE PHYSICAL TRACK (12 SECTORS) FOR THIS POSITION OF HEAD Ø
"BOTTOM" SURFACE IS ONE PHYSICAL TRACK (12 SECTORS) FOR THIS POSITION OF HEAD 1
THERE ARE 202 OTHER POSITIONS (CYLINDERS) THESE HEADS MAY BE MOVED TO!

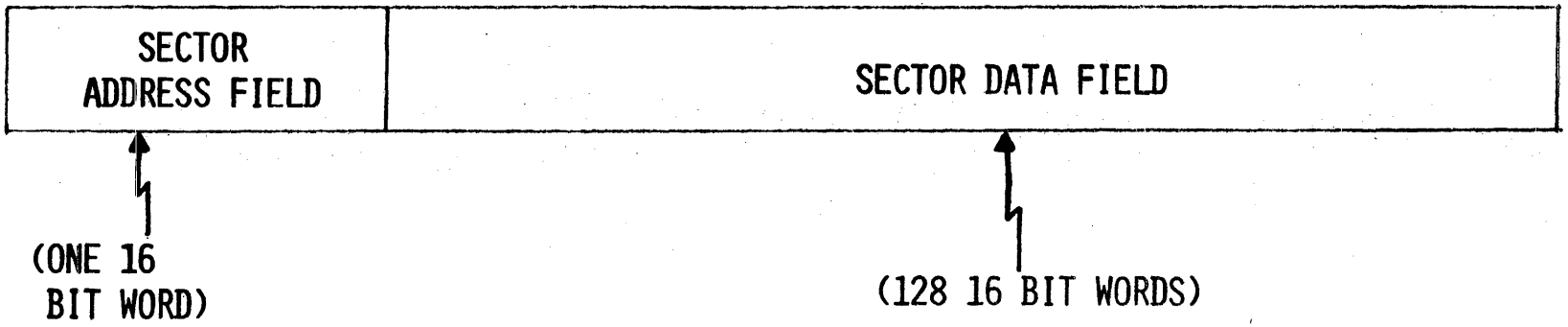
[SLIDE 5]

DISC ADDRESSING



SUBCHANNEL	DRIVE	HEADS	ADDRESSED DISC
000	00	10 11	FIXED DISC DRIVE Ø HEADS 2 & 3
001		00 01	CARTRIDGE DISC DRIVE Ø HEADS Ø & 1
010	01	10 11	FIXED DISC DRIVE 1 HEADS 2 & 3
011		00 01	CARTRIDGE DISC DRIVE 1 HEADS Ø & 1
100	10	10 11	FIXED DISC DRIVE 2 HEADS 2 & 3
101		00 01	CARTRIDGE DISC DRIVE 2 HEADS Ø & 1
110	11	10 11	FIXED DISC DRIVE 3 HEADS 2 & 3
111		00 01	CARTRIDGE DISC DRIVE 3 HEADS Ø & 1

CONTENTS OF EACH SECTOR



1. SECTOR ADDRESS FIELD CONTAINS:
   - 8 BITS FOR CYLINDER #
   - 2 BITS FOR HEAD #
   - 4 BITS FOR ITS SECTOR #
   - 1 BIT USED FOR DCI (DEFECTIVE CYLINDER INDICATOR)
   - 1 BIT USED FOR PCI (PROTECTED CYLINDER INDICATOR)

2. SECTOR DATA FIELD CONTAINS DATA TRANSFERRED TO AND FROM COMPUTER

NOTE: BOTH FIELDS ARE CYCLIC CHECKED BY CONTROLLER

DOSM SOFTWARE COMPONENTS (PART 1)

PROGRAM	NAME(S)	GENERAL FUNCTION(S)
System Generator ⊛	DSGEN	DOSM System Generation User Disc and Cartridge Formatting
System Bootstrap ⊛	BOOTSTRAP	Preparation of configured System bootstrap
Disc Monitor	DISCM	Interrupt Processing ($CIC) Executive Processor (EXEC) I/O Processor ($IORQ)
Executive Modules	$EXØ1	Disc Work Track Status
	$EXØ2	Disc Work Track Limits
	$EXØ3	Program Completion
	$EXØ4	Program Suspension
	$EXØ5	Program Segment Load
	$EXØ6	User File Name Search
	$EXØ7	Current Time Processor
	$EXØ8	Real-Time Disc Allocation
	$EXØ9	Execution Time :EQ Processor
	$EX1Ø	Load and Execute Program
	$EX11	System File Name Search
	$EX12	System Startup
	$EX13	Error Message Processor
	$EX14	Execution Time :UP, :DN, :LU Processor
	$EX15	Abort and Post Mortem Dump
	$EX16	:GO Parameter Processor
	$EX17	:UD Processor
	$EX18	I/O Initiation Processor
	$EX19	:IN Processor
	$EX2Ø	Disc Parity Error Processor
Executive Module Subroutines	$LBL	Service Routines for Label Checking
	$SRCH	Search System or User Directory
	$ADDR	Buffer Address Validity Check
	ASCII	Convert Binary to ASCII
	DUMRX	RTE simulation routines
Special DOSM Drivers	DVRØ5	System Teleprinter Driver
	DVR31	Moving Head Disc Driver

⊛ This is an ABSOLUTE program executed in a separate process from the DOSM system

DOSM SOFTWARE COMPONENTS (PART 2)

PROGRAM	NAME(S)	GENERAL FUNCTION(S)
Job Processor	JOBPR	Directive Processing File Management
Relocating Loader	LOADR	Relocates relocatable binary code created by Assembler or Compilers.
Assembler	ASMB ASMBD ASMB1 ASMB2 ASMB3 ASMB4 ASMB5	Translates Assembly language source code into binary. EAU or NON-EAU options included. (MAIN SECTION) (6 SEGMENTS)
HP Basic FORTRAN Compiler	FTN FTNØ1 FTNØ2 FTNØ3 FTNØ4	Translates HP Basic FORTRAN source code into NON-EAU relocatable binary. (MAIN SECTION) (4 SEGMENTS)
ALGOL Compiler ⊛	ALGOL ALGL1	Translates HP ALGOL source code into Non-EAU relocatable binary. (MAIN SECTION) (1 SEGMENT)
FORTRAN IV Compiler (4K user)	FTN4	Translates ASA FORTRAN IV source code into Non-EAU relocatable binary. Consists of one MAIN section and 18 SEGMENTS.
FORTRAN IV Compiler (10K user)	FTN4	Translates ASA FORTRAN IV source code into NON-EAU relocatable binary. Consists of one MAIN section and 2 SEGMENTS.
CROSS REFERENCE TABLE GENERATOR	XREF	Generates Cross Reference Table for Assembly Language Source Code.

⊛ Requires minimum 16K environment

DOSM SOFTWARE COMPONENTS (PART 3)

DOS AND DOSM DRIVERS

EQUIPMENT TYPE CODE (DVR__)	DEVICE	DOS ONLY	DOSM ONLY	BOTH	DMA
ØØ	Teleprinter			X	
Ø1	Photoreader			X	
Ø2	Punch			X	
Ø5	Teleprinter		X		
1Ø	Plotter			X	
12	2778A CDC Line Printer			X	
15	Mark Sense Card Reader			X	X
16	Data Products Line Printer (8Ø column) 2767			X	
22	3Ø3Ø Mag. Tape			X	X
23	797Ø Mag. Tape			X	X
3Ø	Fixed Head Disc	X			X
31	Moving Head Disc (IOMEC)		X		X
32	Moving Head Disc (ISS) 11 platters per		X		X

Equipment Type Code Numbering Convention

ØØ - Ø7 Paper Tape Devices — Odd # for INPUT, Even # for OUTPUT

1Ø - 17 Unit Record Devices

2Ø - 37 Mass Storage Devices

DOSM SOFTWARE COMPONENTS (PART 4)

LIBRARIES

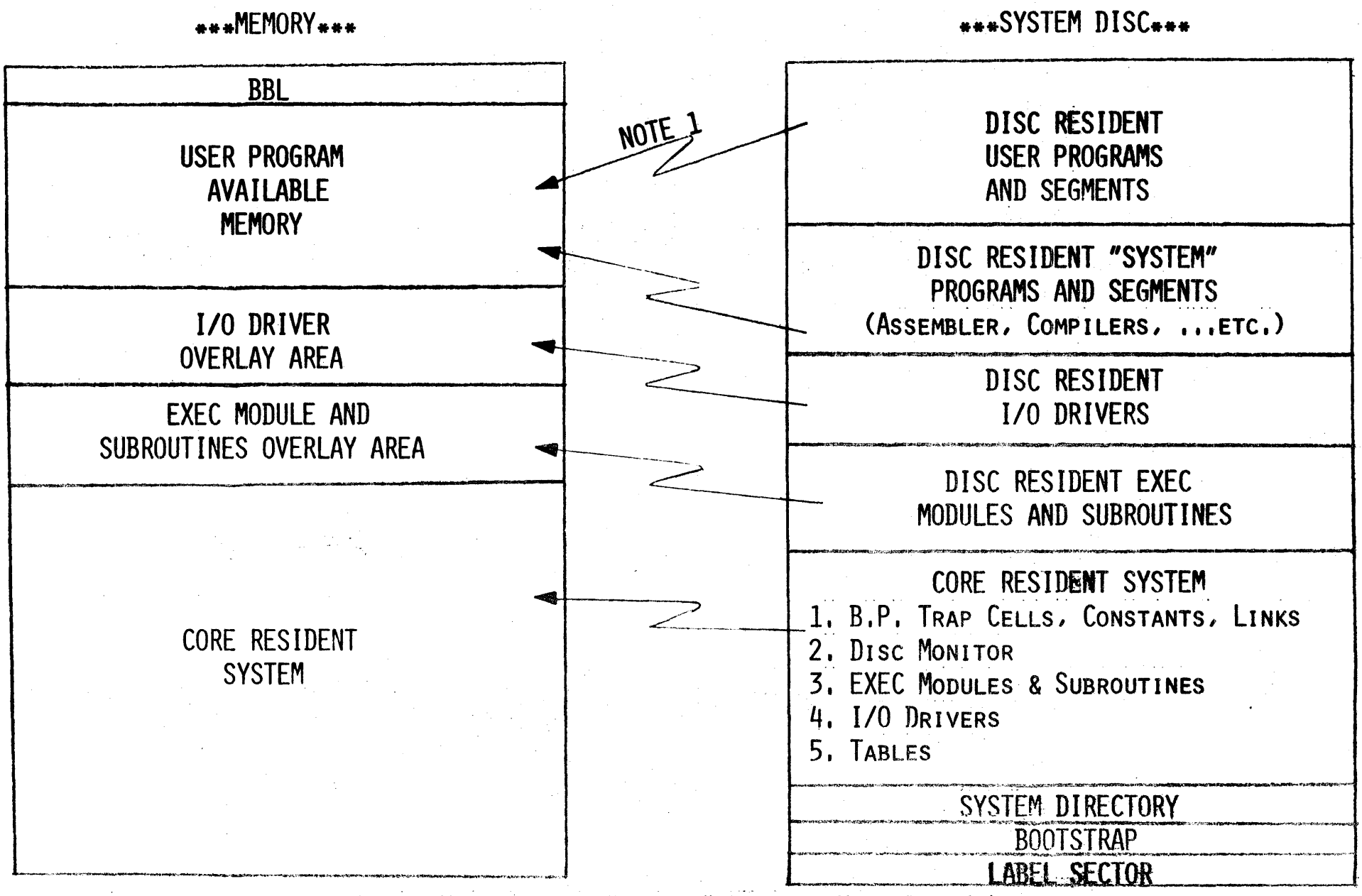
NAME	RELOCATABLE LIBRARY TYPE
F2N.V	NON-EAU RTE/DOS/DOSM (no Formatter)
F2E.V	EAU RTE/DOS/DOSM (no Formatter)
F4D.V	RTE/DOS/DOSM FORTRAN IV with FORTRAN IV Formatter (Double Precision)
_____	RTE/DOS/DOSM HP FORTRAN Formatter (no Double Precision)
_____	RTE/DOS/DOSM Plotter

where V = the revision letter (A, B, C ....)

NOTES:

1. System must include F2N.V or F2E.V even if FORTRAN IV library (F4D.V) is to be included. This is because the FORTRAN IV library references routines whose entry points are in F2N.V and F2E.V libraries.
2. RTE/DOS/DOSM HP FORTRAN Formatter is seperate from F2N.V and F2E.V due to FORTRAN IV library (F4D.V) containing a formatter.

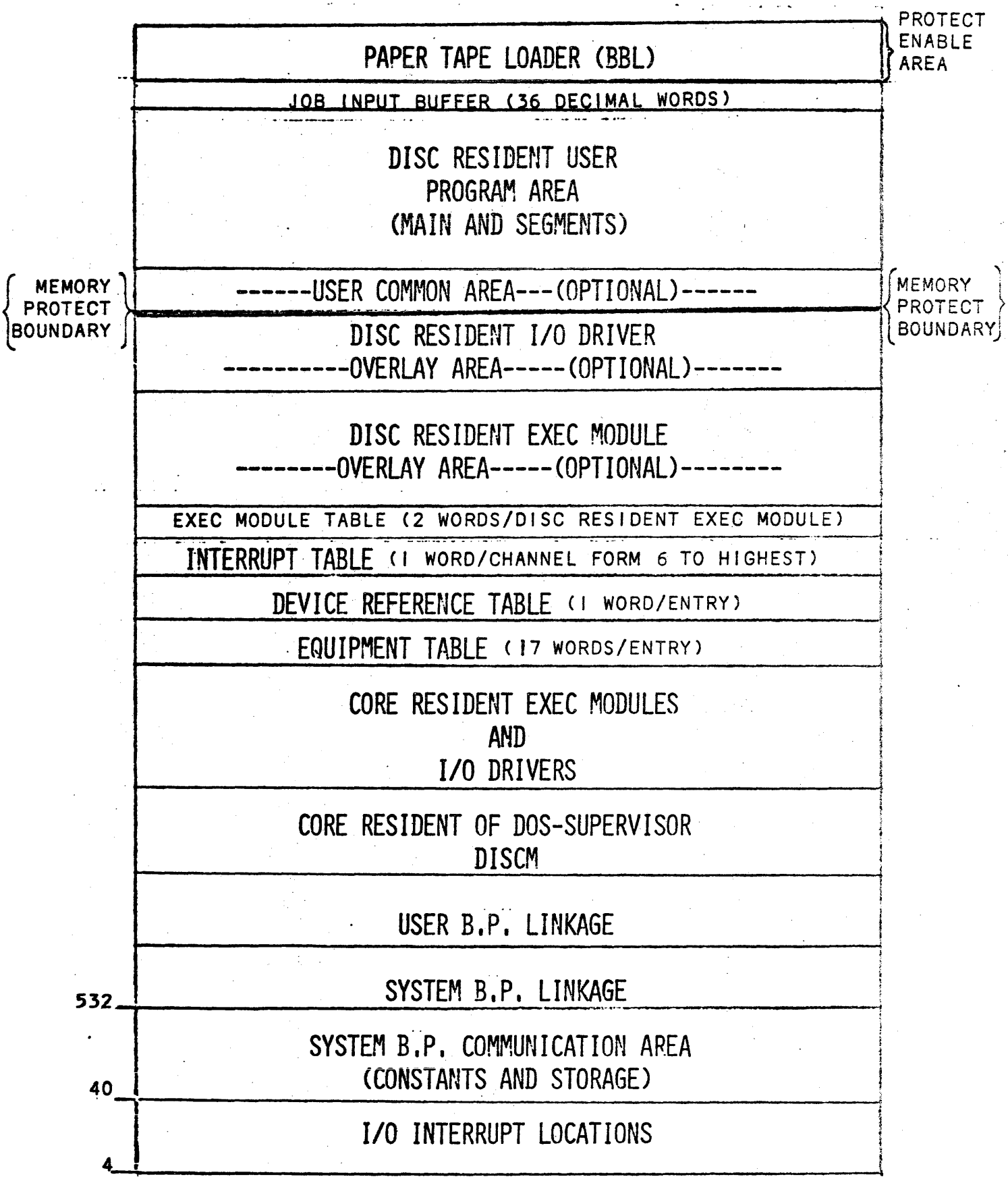
DOSM DISC TO MEMORY TRANSFERS (GENERAL)



NOTE 1: MAY BE FROM "SYSTEM" DISC OR USER DISC(S)

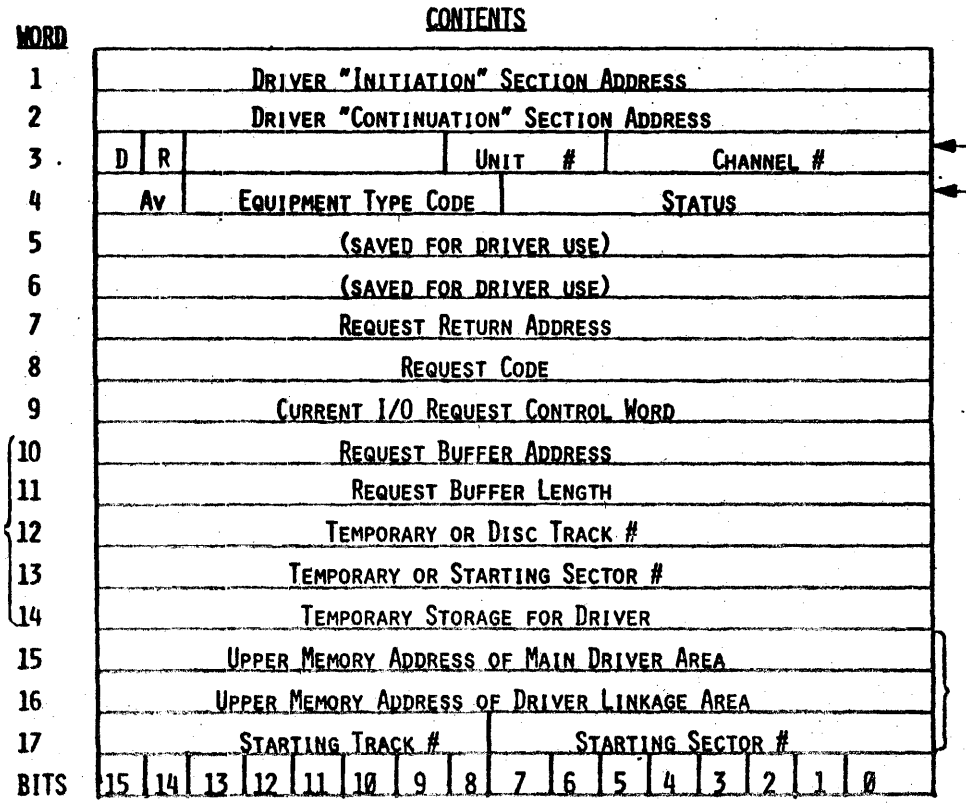
[SLIDE 9]

DOSM GENERAL CORE LAYOUT



[SLIDE 10A]

EQUIPMENT TABLE ENTRY FORMAT



D = 1 if DMA channel required.
R = 1 if driver type is core-resident.
Unit # May be used for sub-channel addressing.
Channel # I/O select code for device (lower number if multiboard interface.)

Av = Ø - Unit not busy and available
= 1 - Unit disabled (down)
= 2 - Unit busy
= 3 - Unit waiting for an available DMA channel

(This field set by system)

Status - Actual or simulated unit status at end of operation. (Driver must set this field)

Equipment Type Code - Identifies type of device and associated software driver. Assigned equipment type codes in octal ar

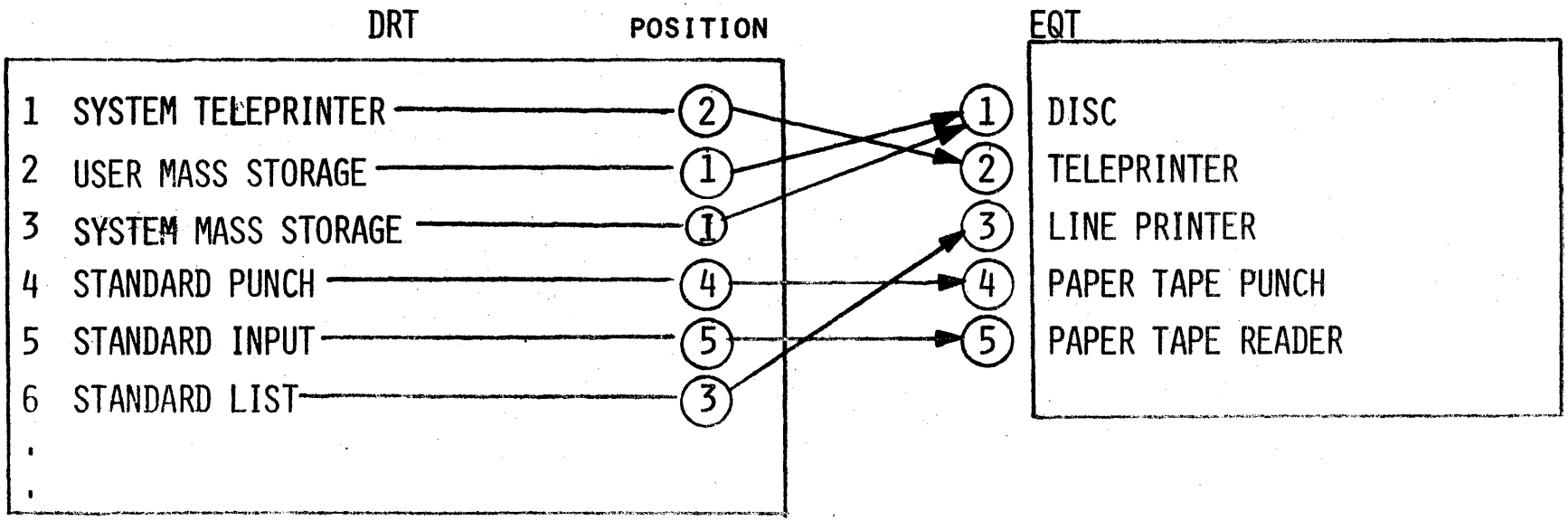
Ø0-07	**Papter Type Devices**
Ø0	Teleprinter
Ø1	Punched Tape Reader
Ø2	High Speed Punch
Ø5	Teletype (System)
1Ø-17	**Unit Record Devices**
1Ø	Reserved for Plotter
12	Line Printer
15	Mark Sense Card Reader
20-37	**Magnetic Tape/Mass Storage and other devices capable of both input and output.**
22	3030 Magnetic Tape
31	Moving-Head Disc

For equipment type codes 1 through 17, odd number indicate input devices and even number indicate output devices (except Ø5, which is both input and output).

[SLIDE 1ØB]

THE DEVICE REFERENCE TABLE

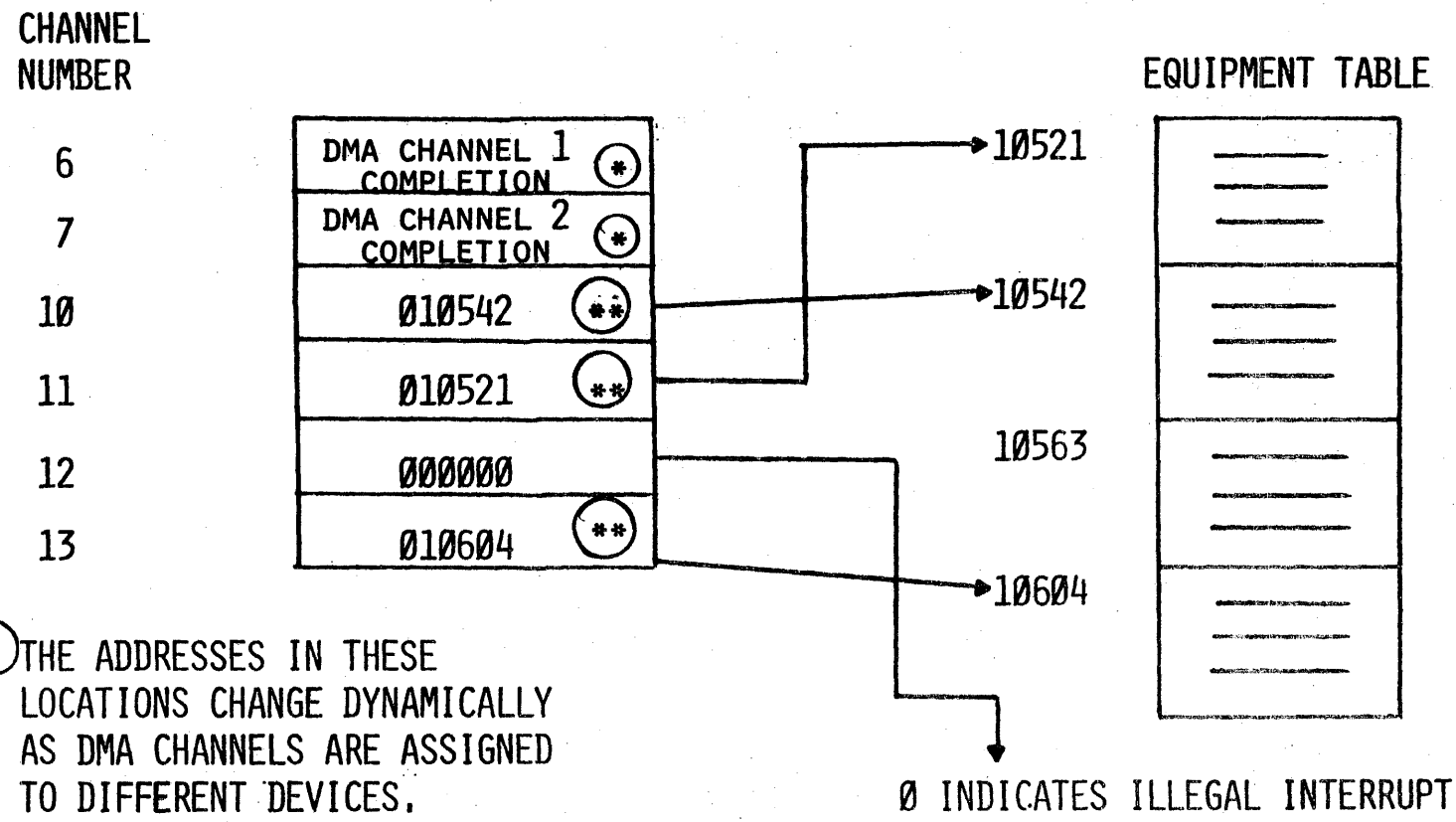
THE DEVICE REFERENCE TABLE PROVIDES FOR LOGICAL ADDRESSING OF PHYSICAL UNITS DEFINED IN THE EQUIPMENT TABLE. THE DRT CONSISTS OF ONE WORD ENTRIES CORRESPONDING TO THE RANGE OF USER-SPECIFIED LOGICAL UNITS (1 TO N, WHERE $N \leq 63$). THE CONTENTS OF THE WORD CORRESPONDING TO A LOGICAL UNIT IS THE RELATIVE POSITION OF THE EQT ENTRY DEFINING THE PHYSICAL UNIT.



[SLIDE 10C]

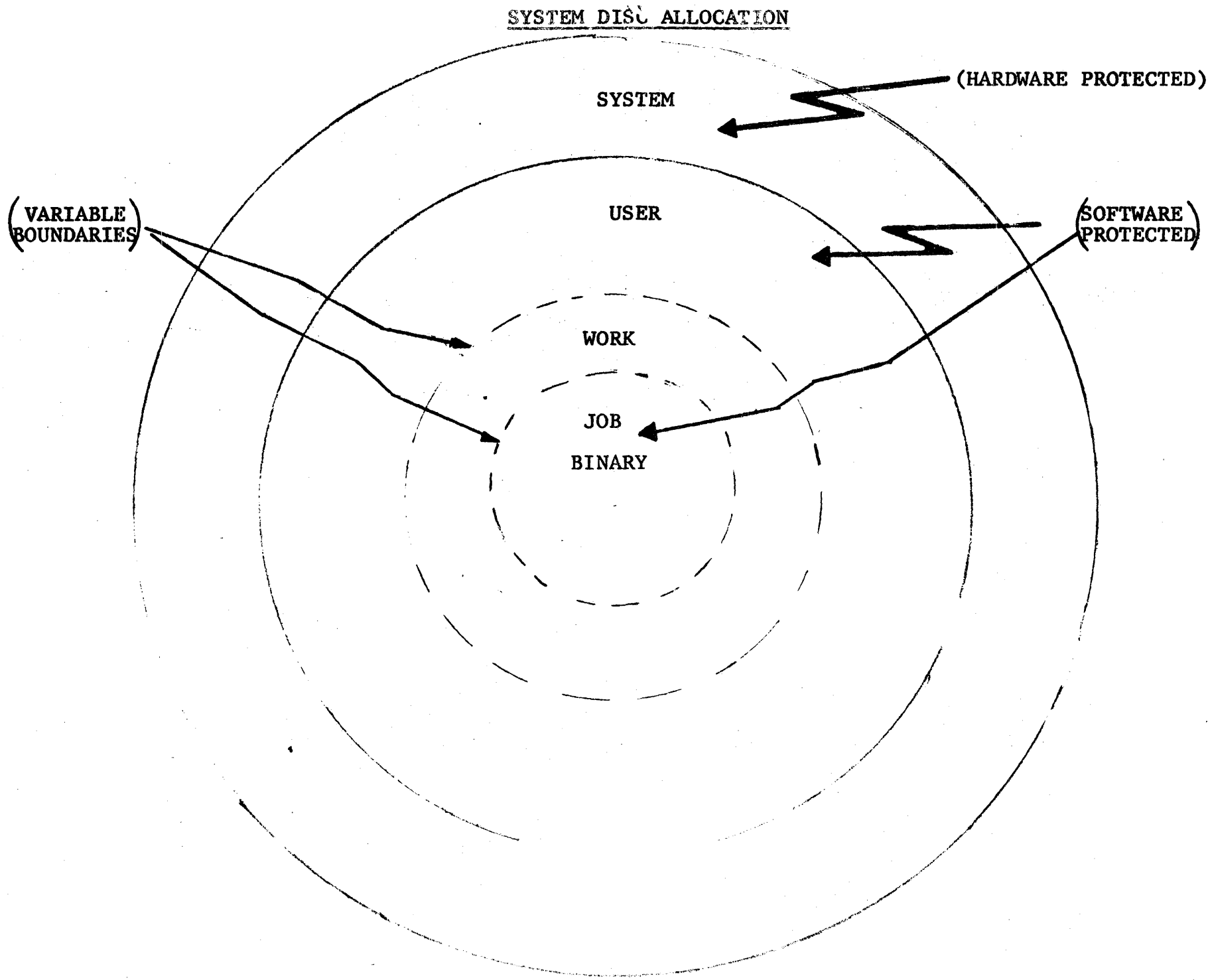
THE INTERRUPT TABLE

THE INTERRUPT TABLE CONTAINS A ONE WORD ENTRY FOR EACH I/O DEVICE. THESE ENTRIES CONTAIN THE ADDRESSES OF EQUIPMENT TABLE ENTRIES FOR DEVICES ASSOCIATED WITH THESE CHANNELS.



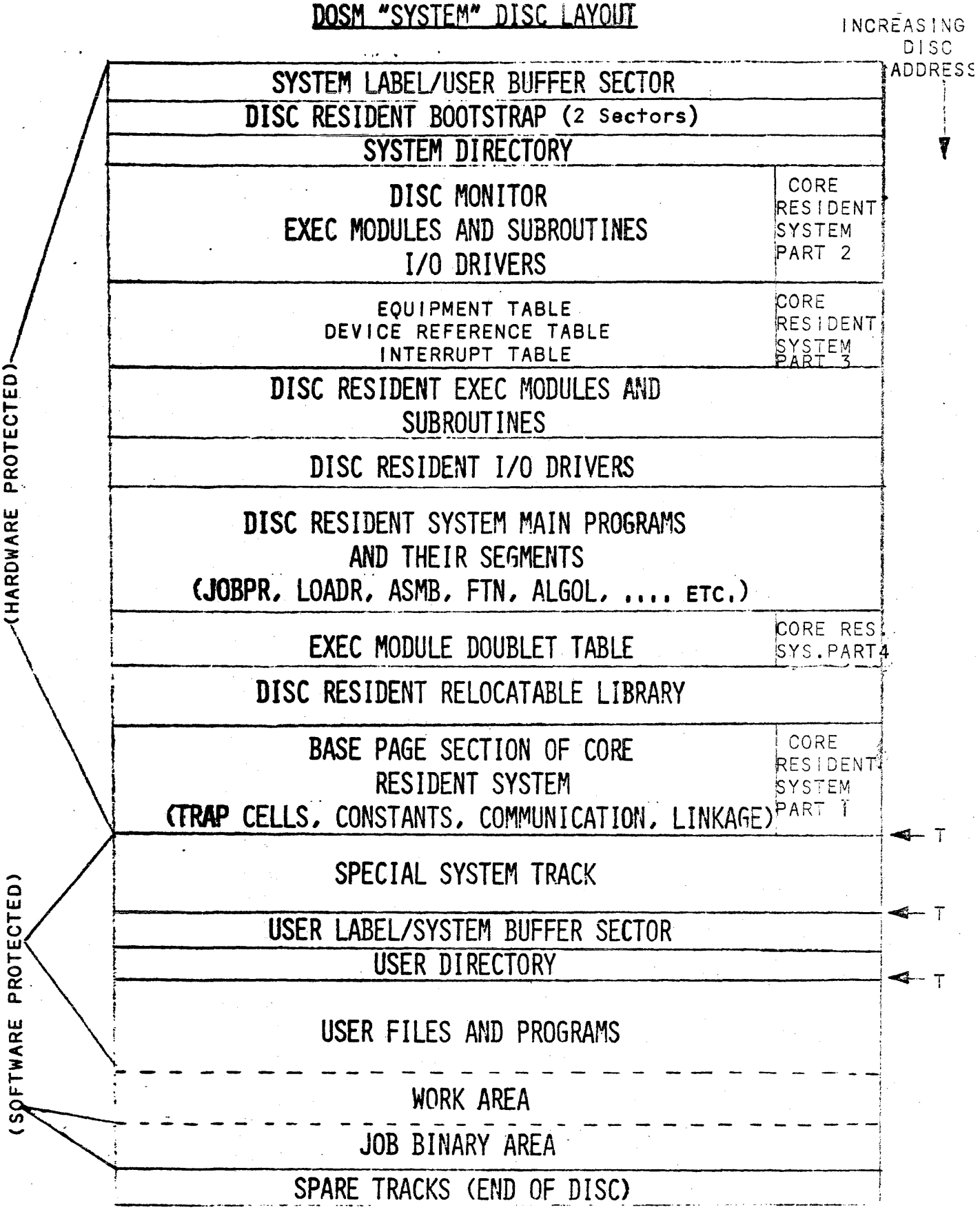
(*) THE ADDRESSES IN THESE LOCATIONS CHANGE DYNAMICALLY AS DMA CHANNELS ARE ASSIGNED TO DIFFERENT DEVICES.

(**) THE ADDRESSES IN THESE LOCATIONS CHANGE DYNAMICALLY AS DIFFERENT EQT ENTRIES ARE USED FOR GIVEN I/O CHANNEL.


SYSTEM DISC ALLOCATION
(HARDWARE PROTECTED)
SYSTEM
USER
VARIABLE BOUNDARIES
SOFTWARE PROTECTED
WORK
JOB
BINARY

[SLIDE 11A]

DOSM "SYSTEM" DISC LAYOUT

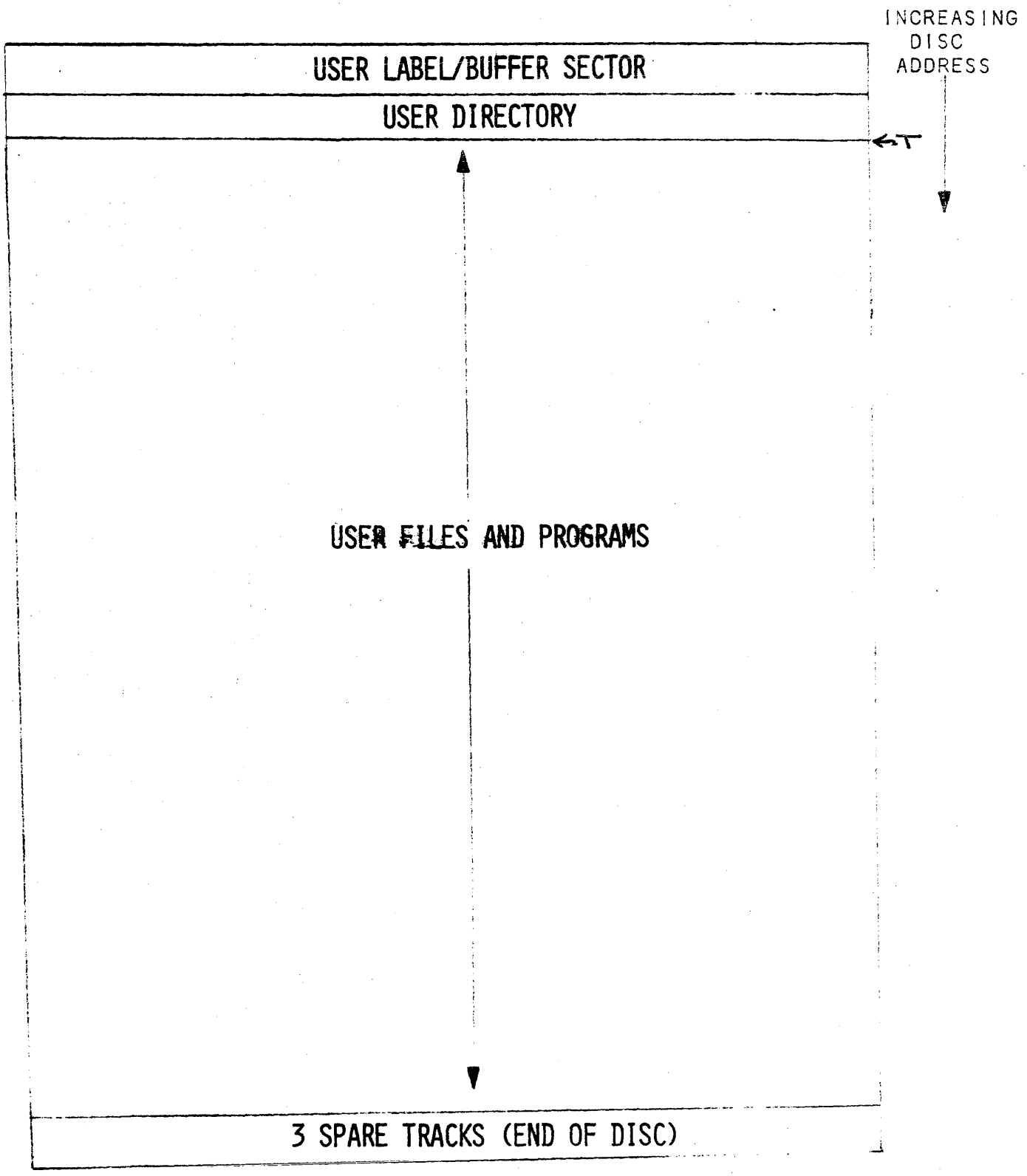


T = STARTS ON TRACK BOUNDARY

[SLIDE 11B]

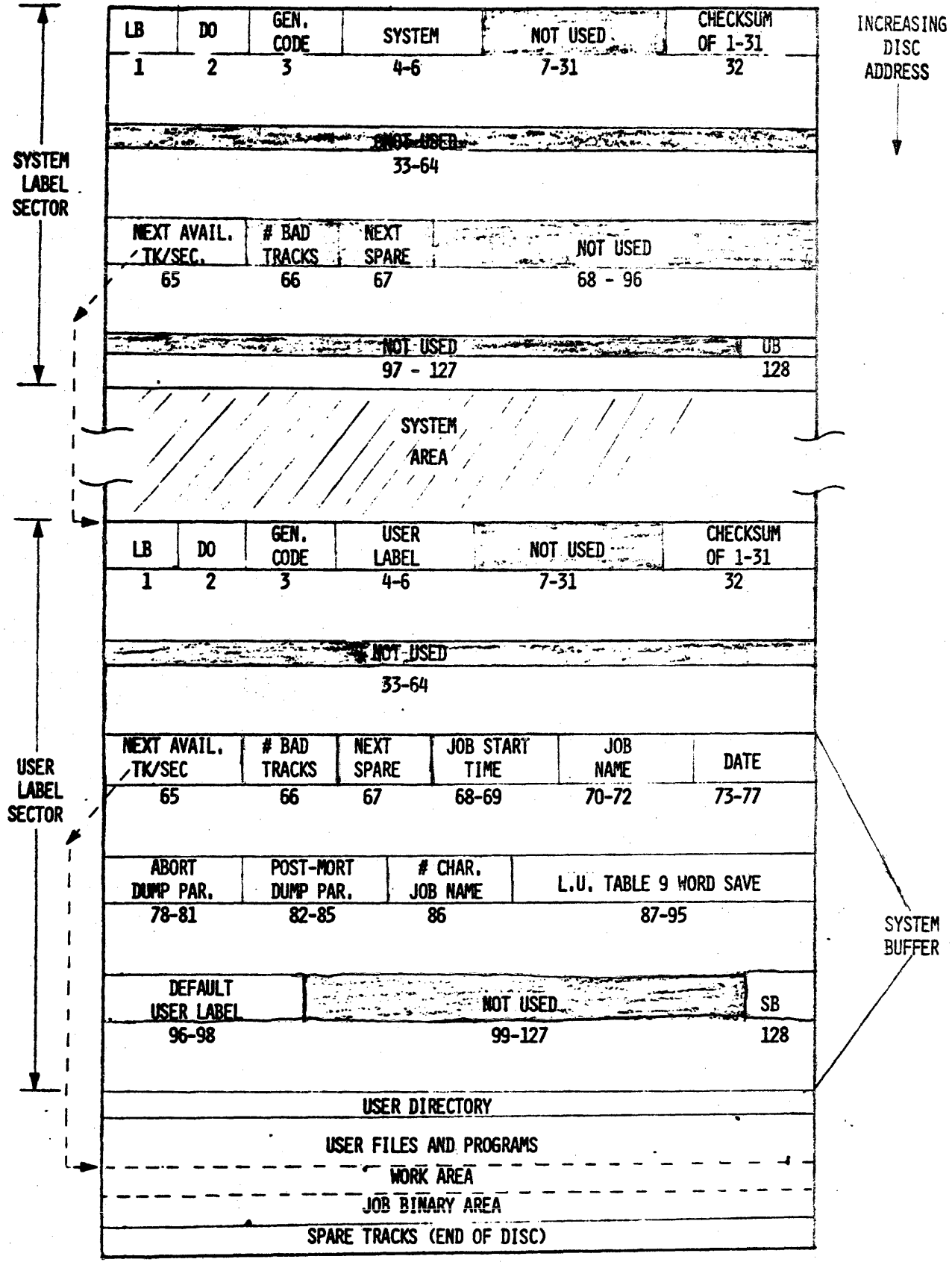
(PURE)

DOSM "USER" DISC LAYOUT



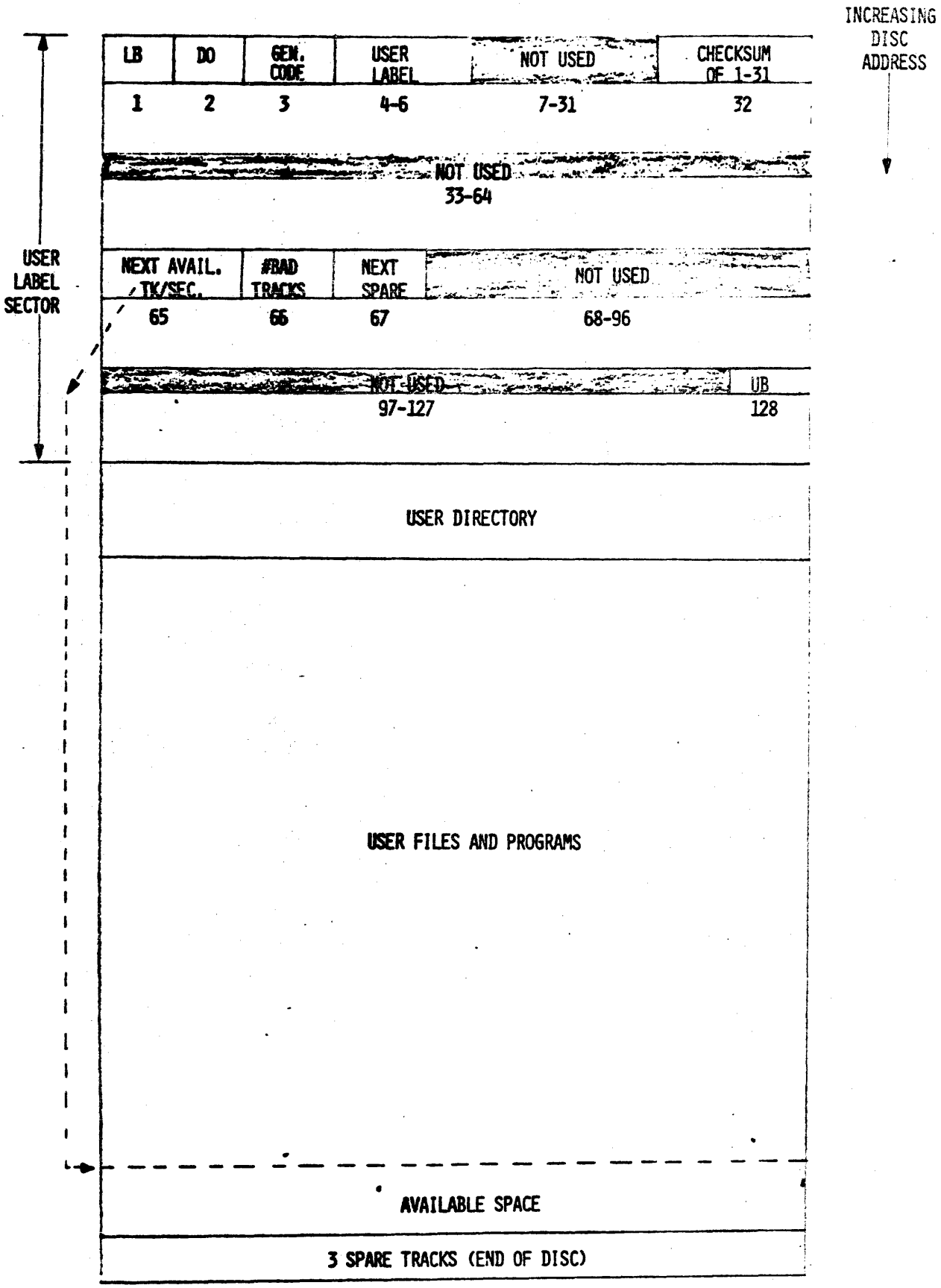
[SLIDE 11C]

"SYSTEM" DISC (LABEL SECTORS DESCRIPTION)

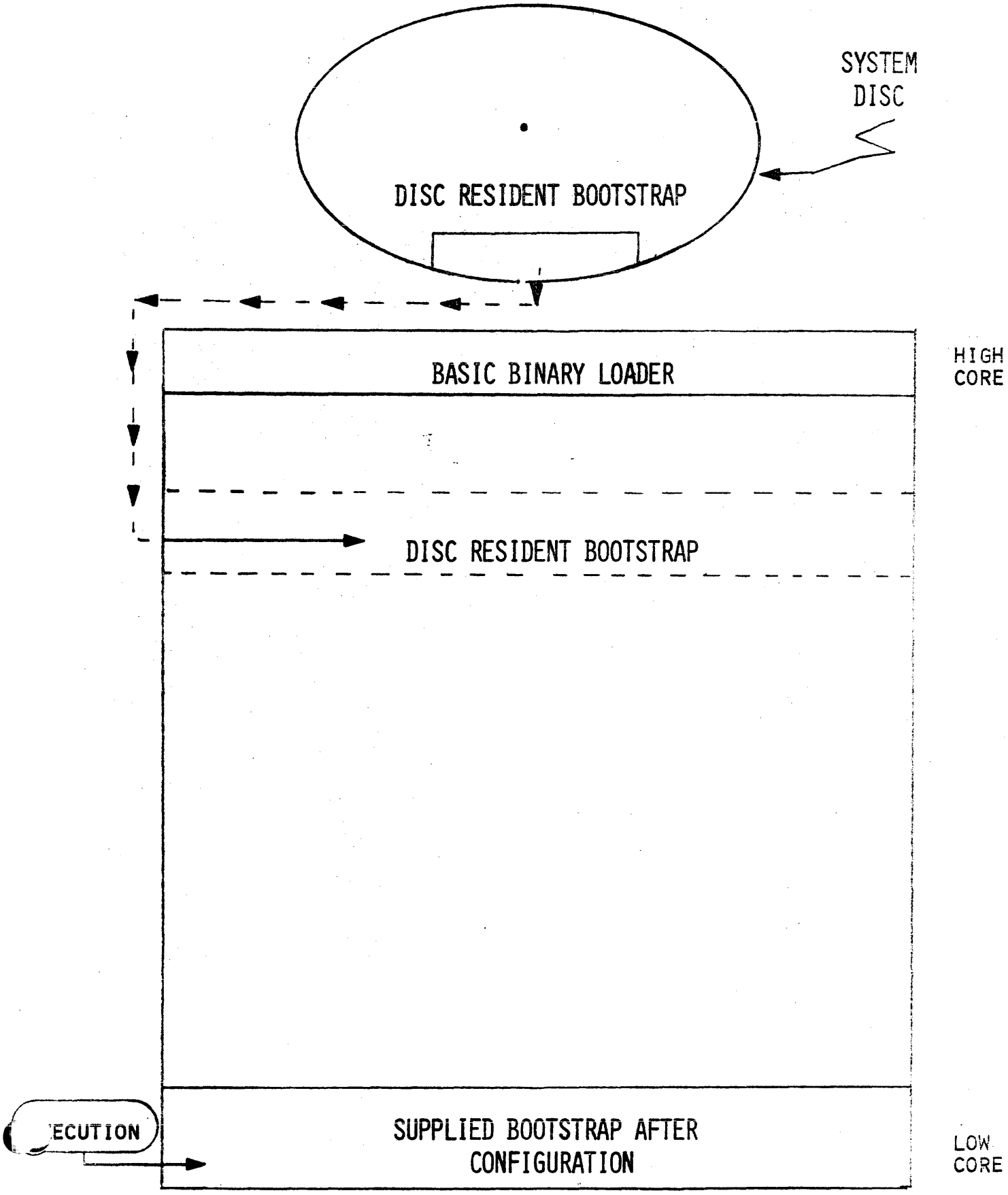


[SLIDE 12A]

"USER" DISC (LABEL SECTOR DESCRIPTION)

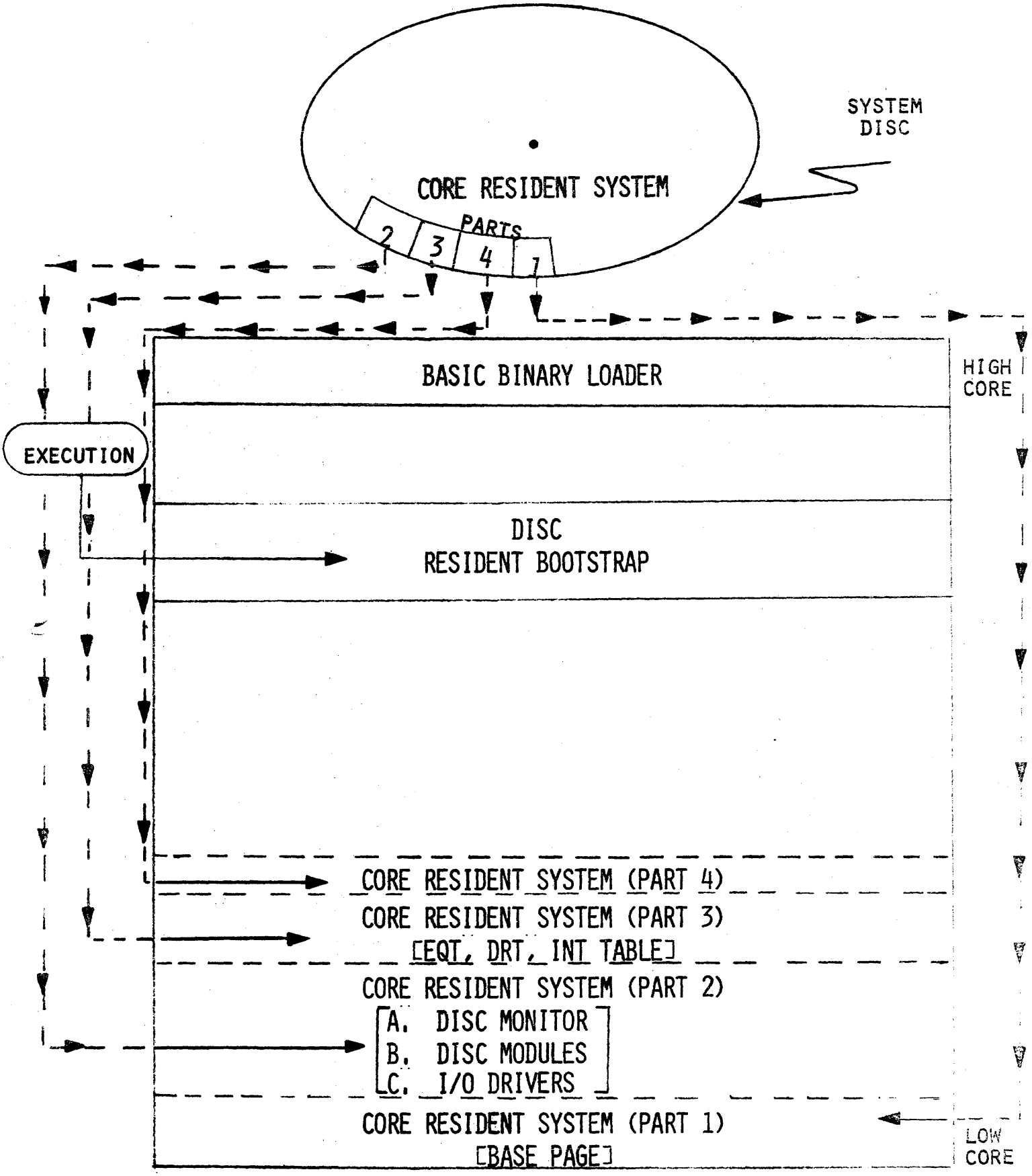


SYSTEM STARTUP (PART 1)
(EXECUTION OF CONFIGURED BOOTSTRAP)

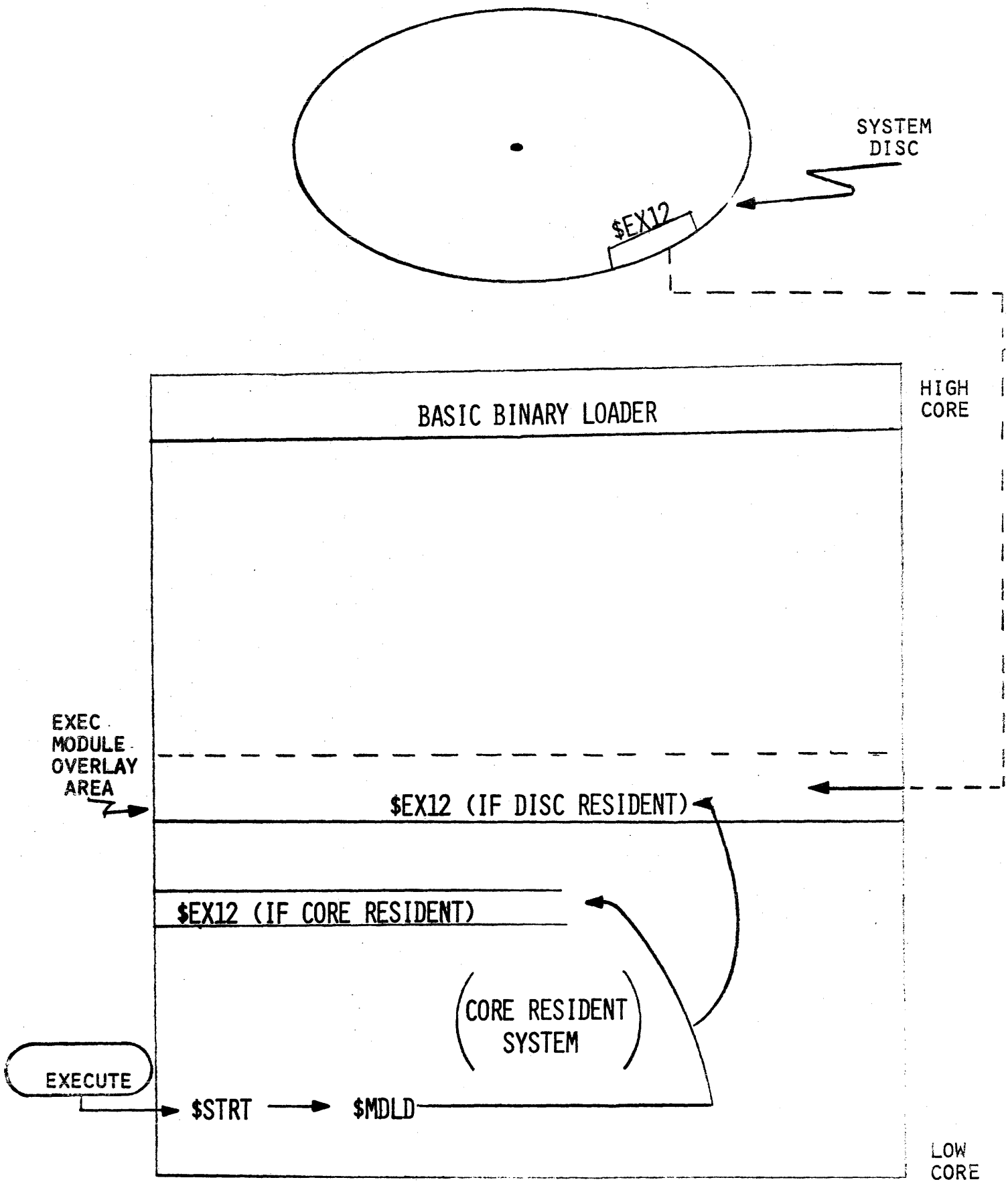


[SLIDE 13A.1]

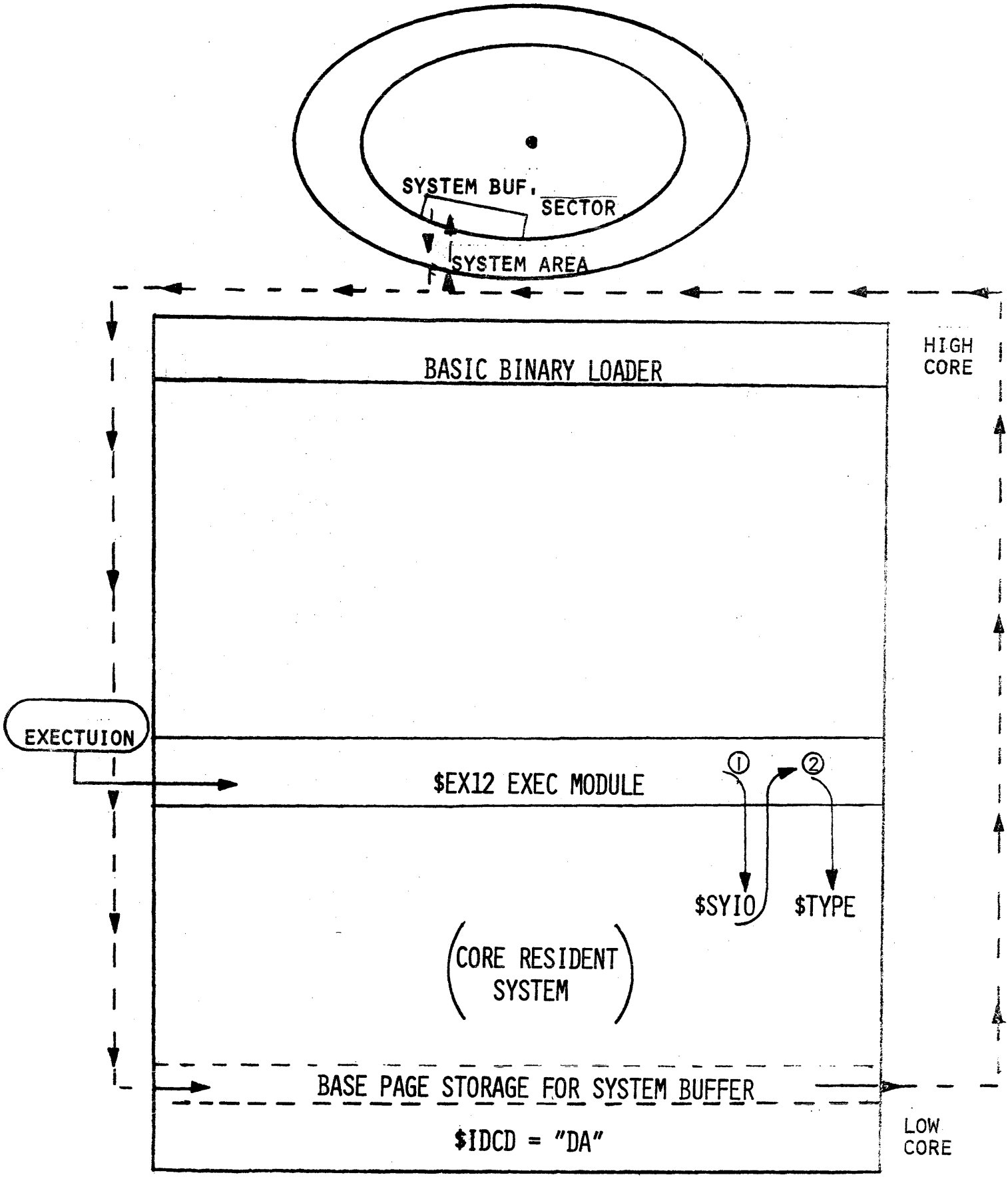
SYSTEM STARTUP (PART 2)
(EXECUTION OF DISC RESIDENT BOOTSTRAP)



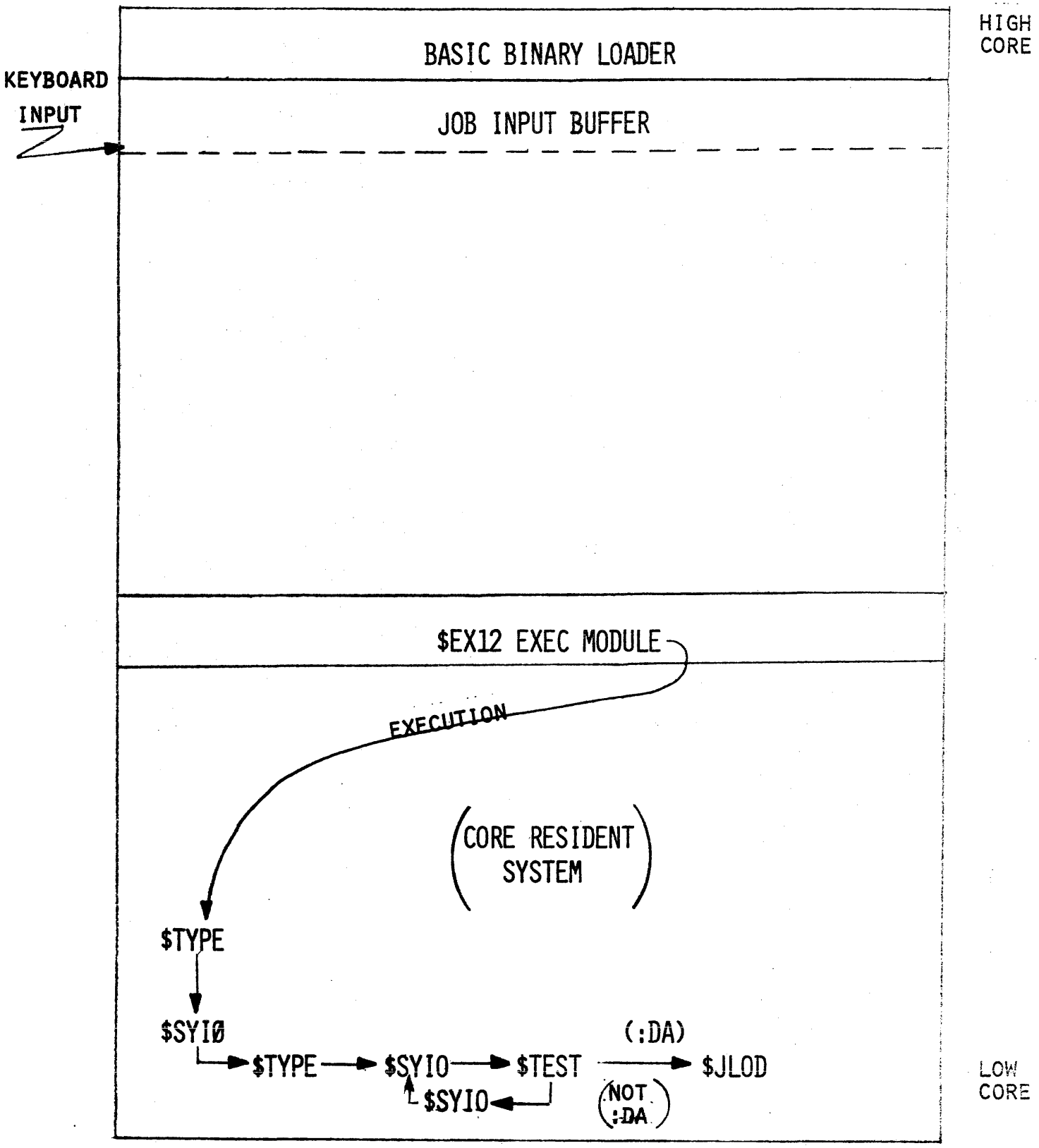
SYSTEM STARTUP (PART 3)
(DISC MONITOR FIRST ENTRY)



SYSTEM STARTUP (PART 4)
(EXECUTION OF $EX12 EXEC MODULE)

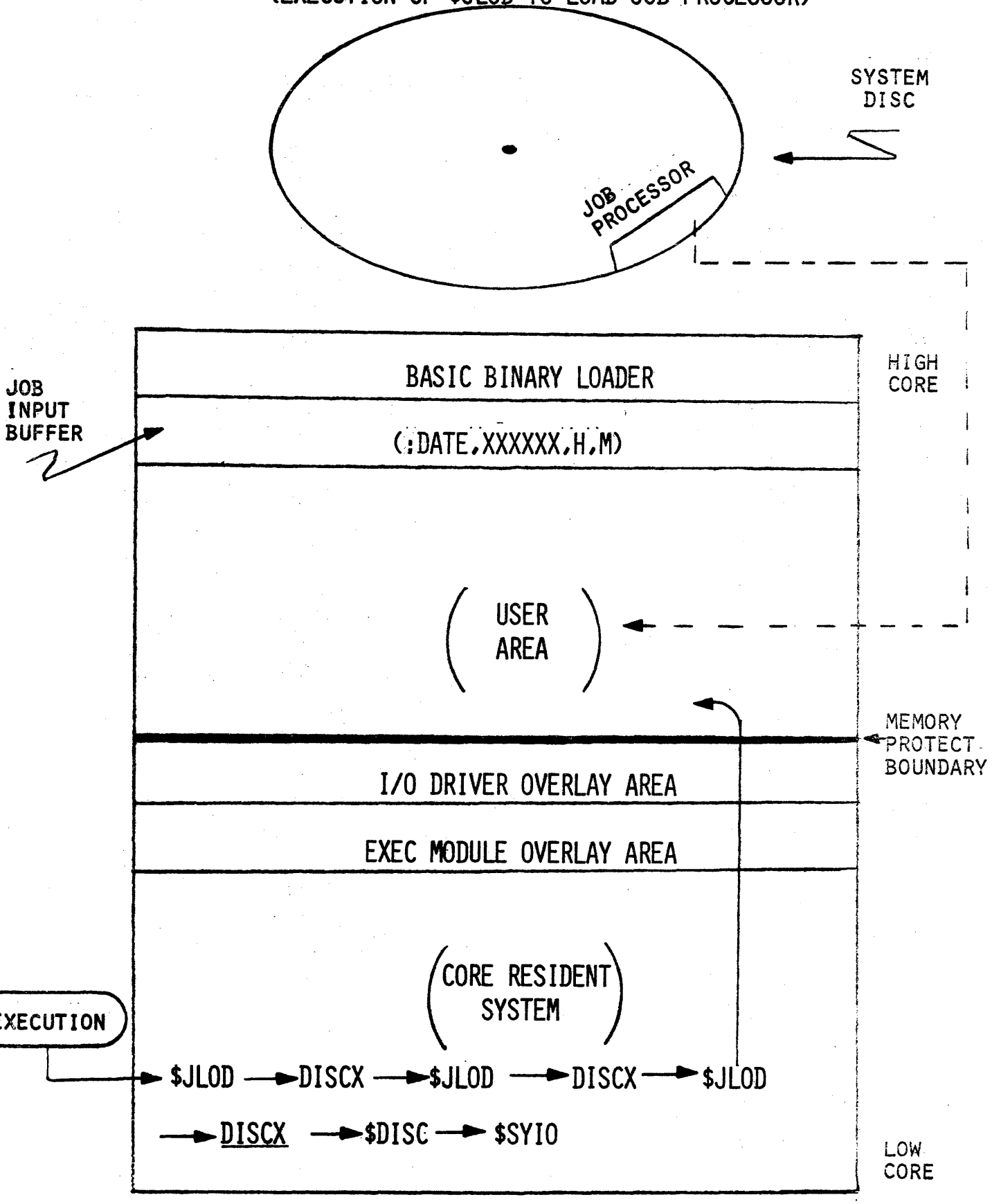


SYSTEM STARTUP (PART 5)
(EXECUTION OF $TYPE FOR ":DATE" INPUT)

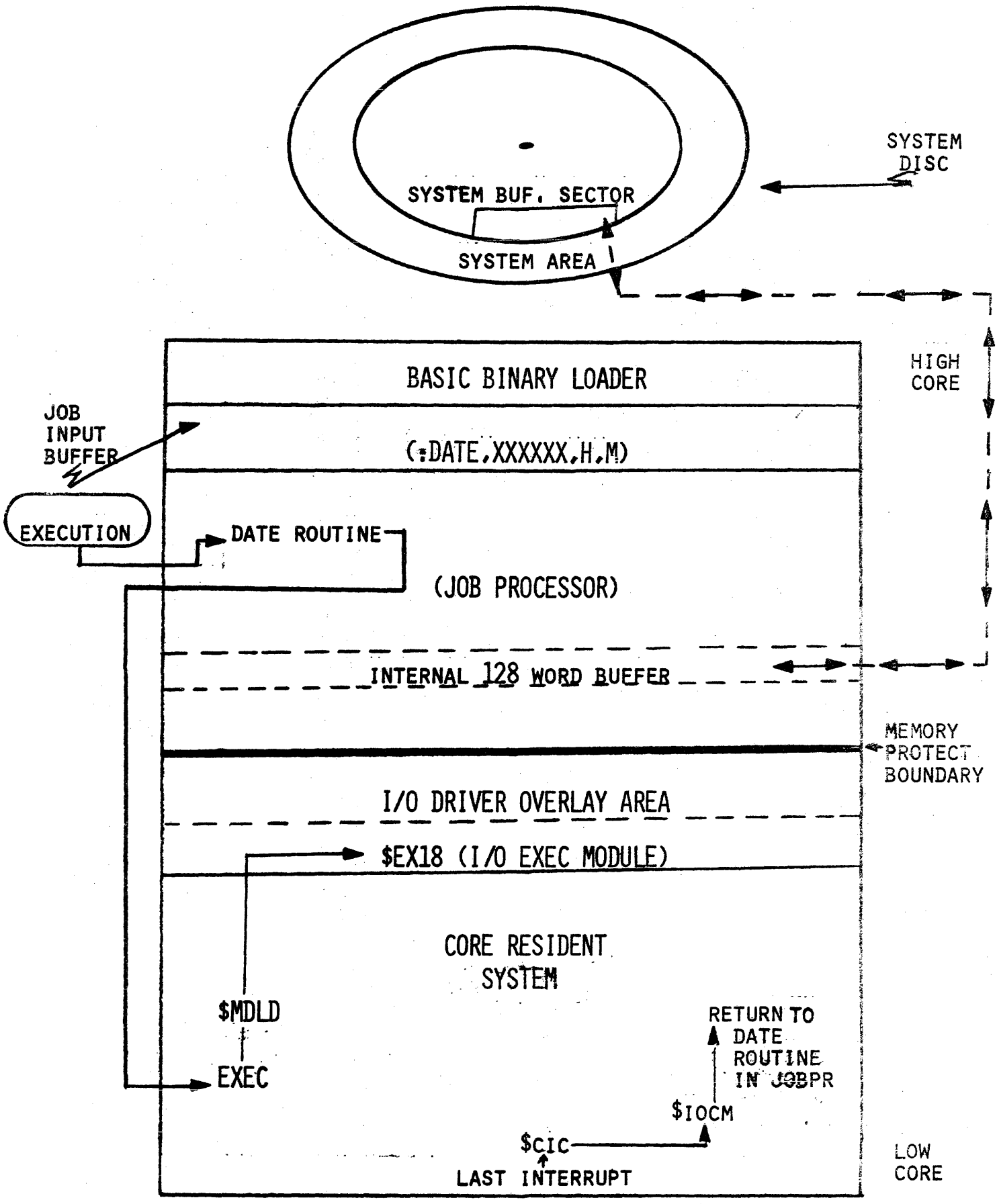


[SLIDE 13A.5]

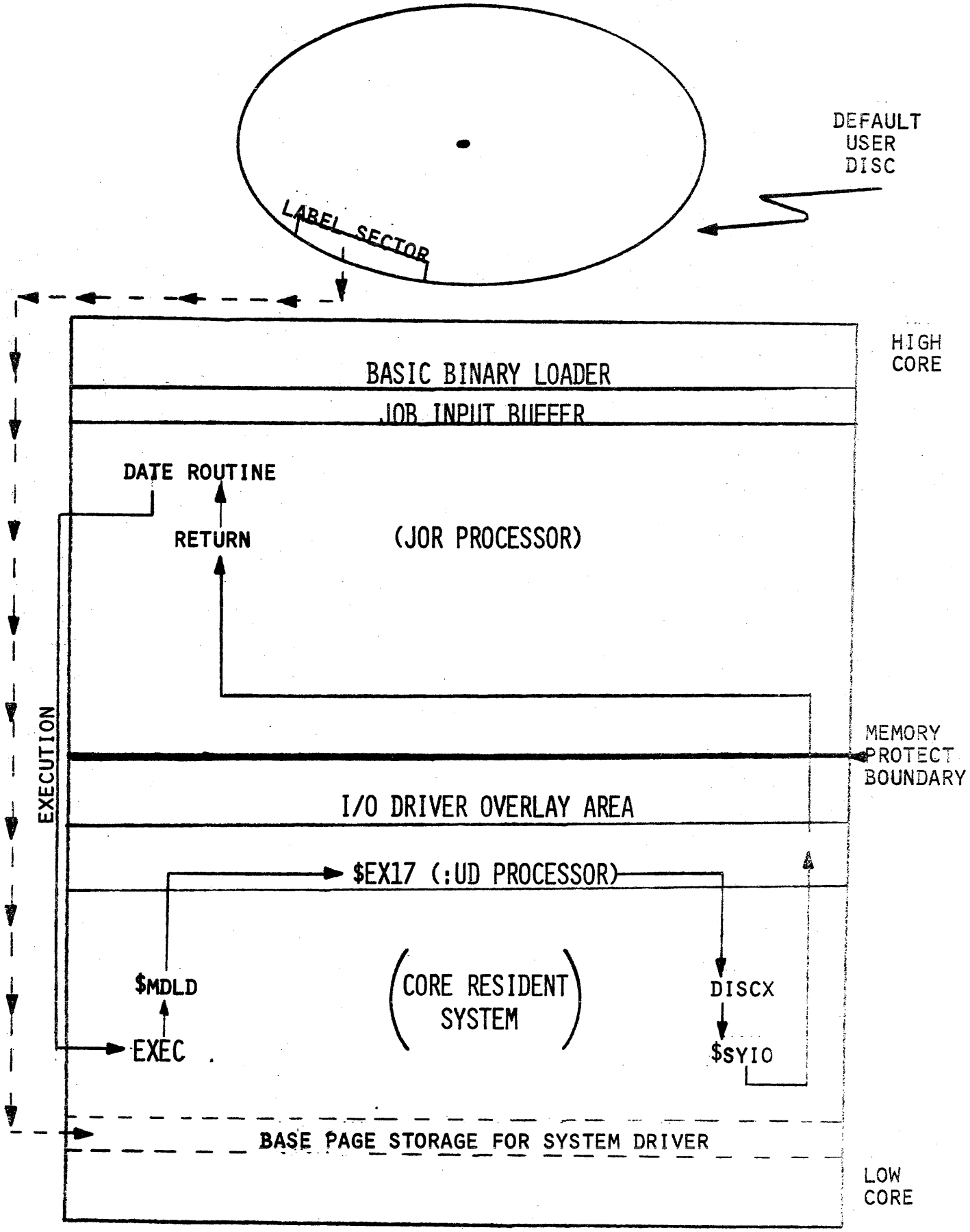
SYSTEM STARTUP (PART 6)
(EXECUTION OF $JLOD TO LOAD JOB PROCESSOR)



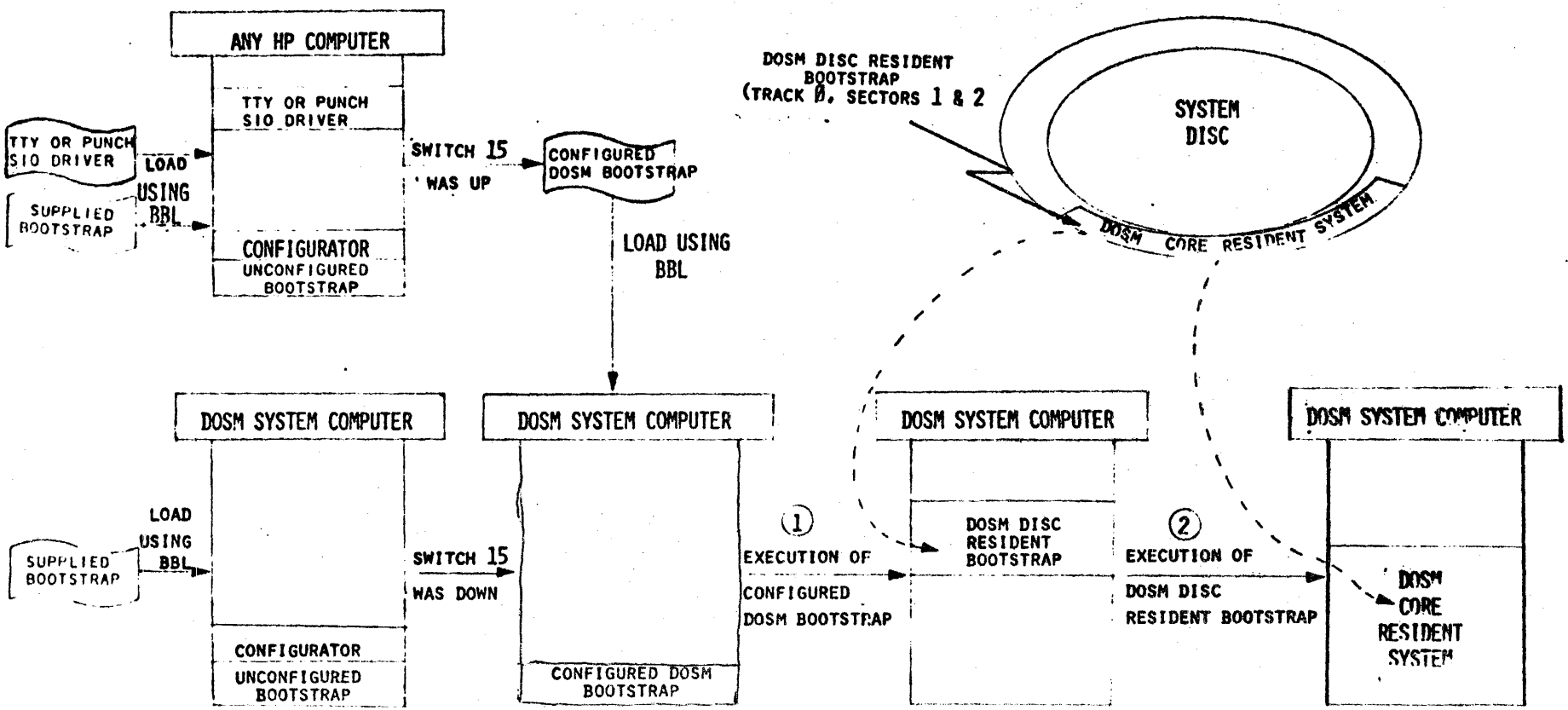
SYSTEM STARTUP (PART 7)
(EXECUTION OF JOBPR TO UPDATE SYSTEM BUFFER SECTOR)



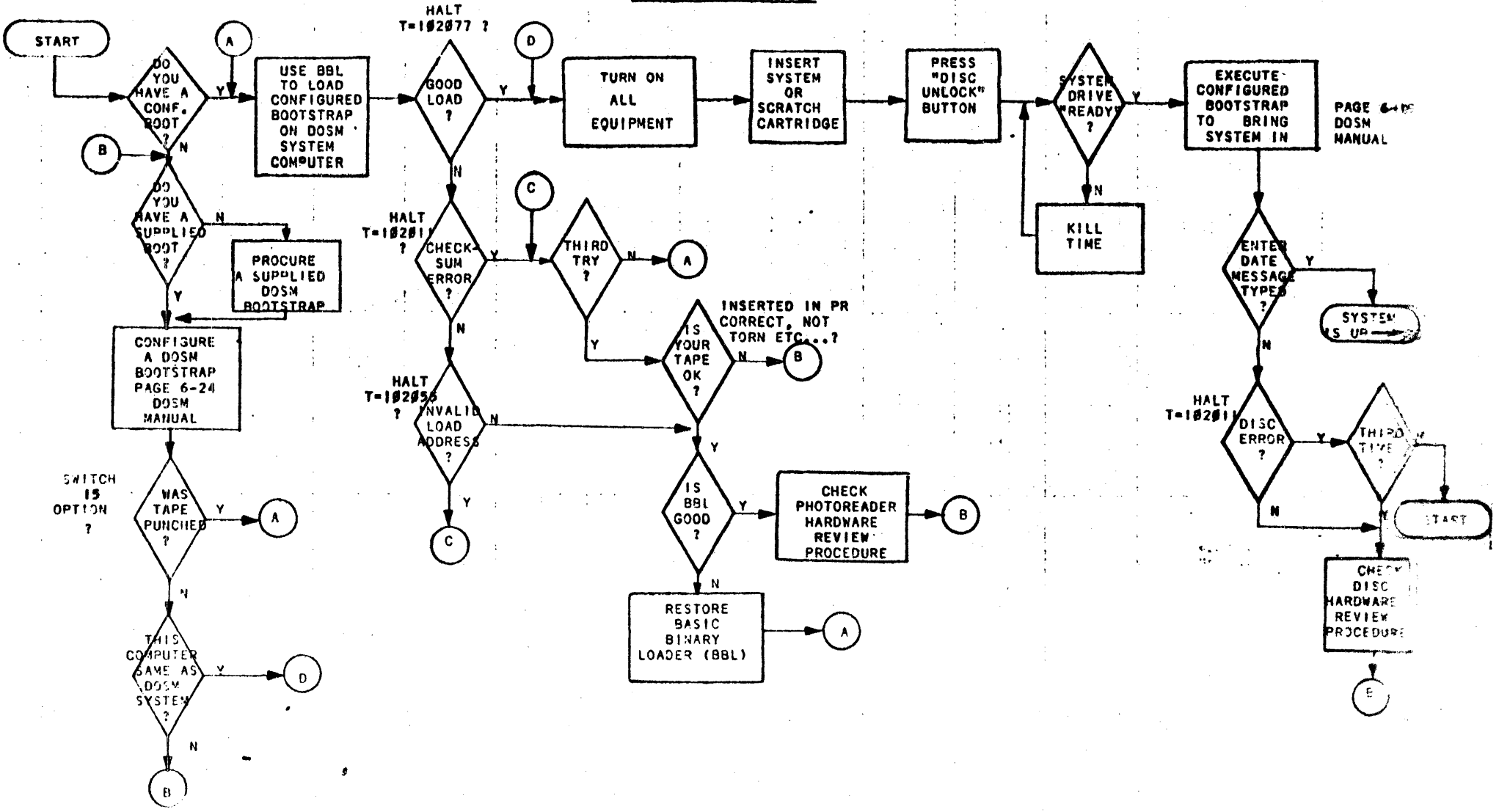
SYSTEM STARTUP (PART 8)
(REPORTING OF DEFAULT USER DISC SUBCHANNEL AND LABEL)



BOOTSTRAPPING DOSM UP FROM DISC



DOSM SYSTEM START-UP



OFF DIRECTIVE

PURPOSE: TO ABORT CURRENTLY EXECUTING USER PROGRAM OF SYSTEM OPERATION WITHOUT TERMINATING THE JOB.

FORMAT: :OFF

NOTES:

1. RETURNS SYSTEM TO KEYBOARD MODE.
2. CAN BE USED TO TERMINATE UNDESIRED LISTS, EDITS, DISC-TO-DISC DUMPS, PROGRAM LOOPS, LOADER OPERATIONS, ASSEMBLIES, AND COMPILATIONS.
3. CANCELS ANY :DD, :AD, OR :PD DIRECTIVES, UNLESS A PROGRAM IS RUNNING, IN WHICH CASE A PENDING :AD IS EXECUTED.
4. MUST NEVER BE GIVEN DURING A PURGE (:PURGE DIRECTIVE) OR FOLLOWING /E IN AN EDIT LIST.

INITIALIZE DIRECTIVE

PURPOSE: TO LABEL OR UNLABEL THE CURRENT USER DISC.

FORMAT: :IN,LABEL

WHERE THE LABEL IS A SIX-CHARACTER NAME TO BE WRITTEN IN WORDS 4-6 OF THE LABEL SECTOR ON THE CURRENT USER DISC. A "*" IS ENTERED TO UNLABEL THE DISC. THE FIRST LETTER OF LABEL MUST NOT BE "CONTROL@".

NOTES:

1. IF THE CURRENT USER DISC IS ALREADY LABELED, DOSM PRINTS THE FOLLOWING MESSAGE:

   {TSB / DOS / ???} LABEL XXXXXX (WHERE XXXXXX IS EXISTING LABEL)

   OK TO PURGE?

   THE OPERATOR THEN ANSWERS "YES" OR "NO".

2. :IN,* EXECUTION PURGES ALL FILES ON THE CURRENT USER DISC AS FOLLOWS BELOW:

   A. LABEL PRESENCE CODE SET = Ø.
   B. FIRST AVAILABLE TK/SEC SET TO START OF USER AREA (IF USER DISC) OR START OF SYSTEM DIRECTORY TRACK +1 (IF SYSTEM DISC).
   C. SETS FIRST WORD IN DIRECTORY = Ø TO INDICATE END-OF-DIRECTORY.
   D. * SET IN FIRST CHARACTER OF LABEL FIELD.
   E. SETS SYSTEM GENERATION CODE AND PROPRIETARY CODE = TO THAT ON SYSTEM LABEL SECTOR.
   F. GENERATES NEW CHECKSUM.

INITIALIZE DIRECTIVE - NOTES CONTINUED:

3. :IN,NEWLB PURGES UNPROTECTED SYSTEM AND MOVES ANY USER FILES DOWN TO LOW DISC IF THE CURRENT USER DISC IS LABELED "SYSTEM" AND IS NOT HARDWARE PROTECTED (I.E., IT WAS CREATED WITH :DD,X DIRECTIVE).

4. SYSTEM GENERATION CODE AND SYSTEM PROPRIETARY CODE ARE SET EQUAL TO THOSE IN THE CURRENT SYSTEM.

CHANGE USER DISC DIRECTIVE (PART 1)

PURPOSE: TO CHANGE SUBCHANNEL ASSIGNMENT FOR THE CURRENT USER DISC.

FORMAT: :UD [, [LABEL] [,N]]

WHERE LABEL IS A SIX-CHARACTER LABEL OR
*IF UNLABELED DISC.

AND N IS THE SUBCHANNEL NUMBER.

NOTES:

1. SIX BASIC FORMS ARE POSSIBLE (PART 2).
2. IF THE DISC ON SUBCHANNEL #N HAS A SYSTEM PROPRIETARY CODE NOT EQUAL TO "DO", THE ASSIGNMENT IS STILL MADE AND THE SYSTEM PRINTS THE FOLLOWING:

   {TSB / ???} DISC

3. IF THE DISC ON SUBCHANNEL #N HAS A SYSTEM GENERATION CODE NOT EQUAL TO THAT OF THE CURRENT SYSTEM, THE ASSIGNMENT IS STILL MADE AND THE SYSTEM PRINTS THE FOLLOWING:

   DISC GEN CODE XXXX NOT SYS GEN CODE YYYY ERR POSS

4. USER DISC SUBCHANNEL ASSIGNMENTS MADE BY THIS DIRECTIVE ARE ONLY TEMPROARY; THE USER DISC SUBCHANNEL ASSIGNMENT IS RESET TO THAT SPECIFIED DURING SYSTEM GENERATION AT THE END OF EACH JOB.
5. USED IMMEDIATELY FOLLOWING :DD (DISC DUMP) DIRECTIVE TO SPECIFY DESTINATION DISC.

CHANGE USER DISC DIRECTIVE (PART 2)

EXAMPLE	ACTION
:UD (WITHOUT LABEL OR SUBCHANNEL)	INTERROGATES THE CURRENT USER DISC SUBCHANNEL AND PRINTS ITS LABEL ON THE SYSTEM TELEPRINTER: SUBCHAN = n LBL = label (or UNLBL)
:UD,,n (NO LABEL)	IF n IS LABELED, DOS-M PRINTS: LBL = label (OR UNLBL) NO ASSIGNMENT IS MADE.
:UD,label (NO SUBCHANNEL)	DOS-M SEARCHES FOR THE label, STARTING WITH THE HIGHEST NUMBER SUBCHANNEL (DETERMINED AT SYSTEM GENERATION). IF label IS FOUND, DOS-M MAKES IT THE USER DISC AND PRINTS: SUBCHAN = n IF label IS NOT FOUND, DOS-M PRINTS: DISC NOT ON SYS
:UD,label,n	IF n IS LABELED WITH THE SPECIFIED label, DOS-M ASSIGNS n AS THE USER DISC. IF n IS UNLABELED OR HAS A DIFFERENT label, DOS-M PRINTS: LBL = label (OR UNLBL) OPERATOR CAN THEN REISSURE :UD,label,n WITH THE CORRECT LABEL.
:UD,*,n	IF n IS UNLABELED, DOS-M ASSIGNS n AS THE USER DISC. IF n IS LABELED, DOS-M MAKES NO ASSIGNMENT AND PRINTS: LBL = label
:UD,*	ASSIGNS THE HIGHEST NUMBER UNLABELED DISC AS THE USER DISC AND PRINTS: SUBCHAN = n IF THERE ARE NO UNLABELED DISC, DOS-M PRINTS: DISC NOT ON SYS

DISC-TO-DISC DUMP DIRECTIVE

PURPOSE: To dump onto another subchannel

1. An entire Disc using :DD
2. The System Area (including system buffer) using :DD,X.
3. All or specified files of the User Area (optionally assigning some new file names) using

   :DD,U[,FILE 1 [,(FILE A)],FILE 2[,(FILE B)],....]

where X specifies the System Area
U specifies the User Area
FILE 1, FILE 2, ... specify the files to be dumped
FILE A, FILE B, ... specify the optional new names for FILE 1, FILE 2, ...

NOTES:

A. Renamed files may be intermixed with unchanged files in 3. above.

B. The destination disc must be specified by the :UD directive immediately following the :DD directive. For :DD,:DD,X the following :UD directive must be :UD,*,n where n is not the System Disc.

C. When the destination disc for a :DD,U is a System Disc (other than current system), the user files are dumped in the user area following the System files.

D. If files of the source disc will not completely fit on the destination disc, the system will transfer as many WHOLE FILES as possible and print: TRAC # TOO BIG.

SYSTEM SEARCH DIRECTIVE (PART 1)

PURPOSE: TO SPECIFY A LIST OF DISC SUBCHANNELS TO BE SEARCHED BY SYSTEM FOR FILE NAMES OTHER THAN THE CURRENT USER DISC.

FORMATS:

```
:SS
```

ALL ACTIVE SUBCHANNELS ARE SEARCHED IN THE FOLLOWING ORDER:

1. CURRENT USER DISC SUBCHANNEL
2. HIGHEST ACTIVE SUBCHANNEL IN SYSTEM
3. NEXT HIGHEST ACTIVE SUBCHANNEL IN SYSTEM

. . .

LOWEST ACTIVE SUBCHANNEL IN SYSTEM

```
:SS,N1,N2,N3,....
```

ALL ACTIVE SUBCHANNELS (WITHIN N1,N2,N3,...LIST) ARE SEARCHED IN THE FOLLOWING ORDER:

1. CURRENT USER DISC SUBCHANNEL
2. LOWEST NUMBERED ACTIVE SUBCHANNEL SPECIFIED IN N1,N2,N3,...LIST.
3. NEXT LOWEST NUMBERED ACTIVE SUBCHANNEL SPECIFIED IN N1,N2,N3,...LIST.

. . .

HIGHEST NUMBERED ACTIVE SUBCHANNEL SPECIFIED IN N1,N2,N3,...LIST.

```
:SS,99
```

ONLY THE CURRENT USER DISC SUBCHANNEL IS SEARCHED. THIS IS THE DEFAULT CONDITION. EVERY JOB STARTS OUT IN THIS CONDITION.

SYSTEM SEARCH DIRECTIVE (PART 2)

NOTES:

1. THIS IS AN OPTIONAL DIRECTIVE VALID ONLY IF "YES" WAS RESPONSE TO ALLOW :SS? QUESTION DURING SYSTEM GENERATION.

2. THE :SS CONDITION SET APPLIES TO ALL EXEC CALLS AND DIRECTIVES THAT REQUIRE A FILE SEARCH.

3. CURRENT USER DISC SUBCHANNEL NUMBER IS CHANGED TO THE SUBCHANNEL CONTAINING THE FILE THAT INITIATED THE FILE SEARCH. THIS IS REPORTED BY SYSTEM EACH TIME IT CHANGES WITH TTY PRINTOUT, SUBCHAN = n IF THE JOB PROCESSOR IS IN CORE (I.E. NO OTHER USER PROGRAM EXECUTING).

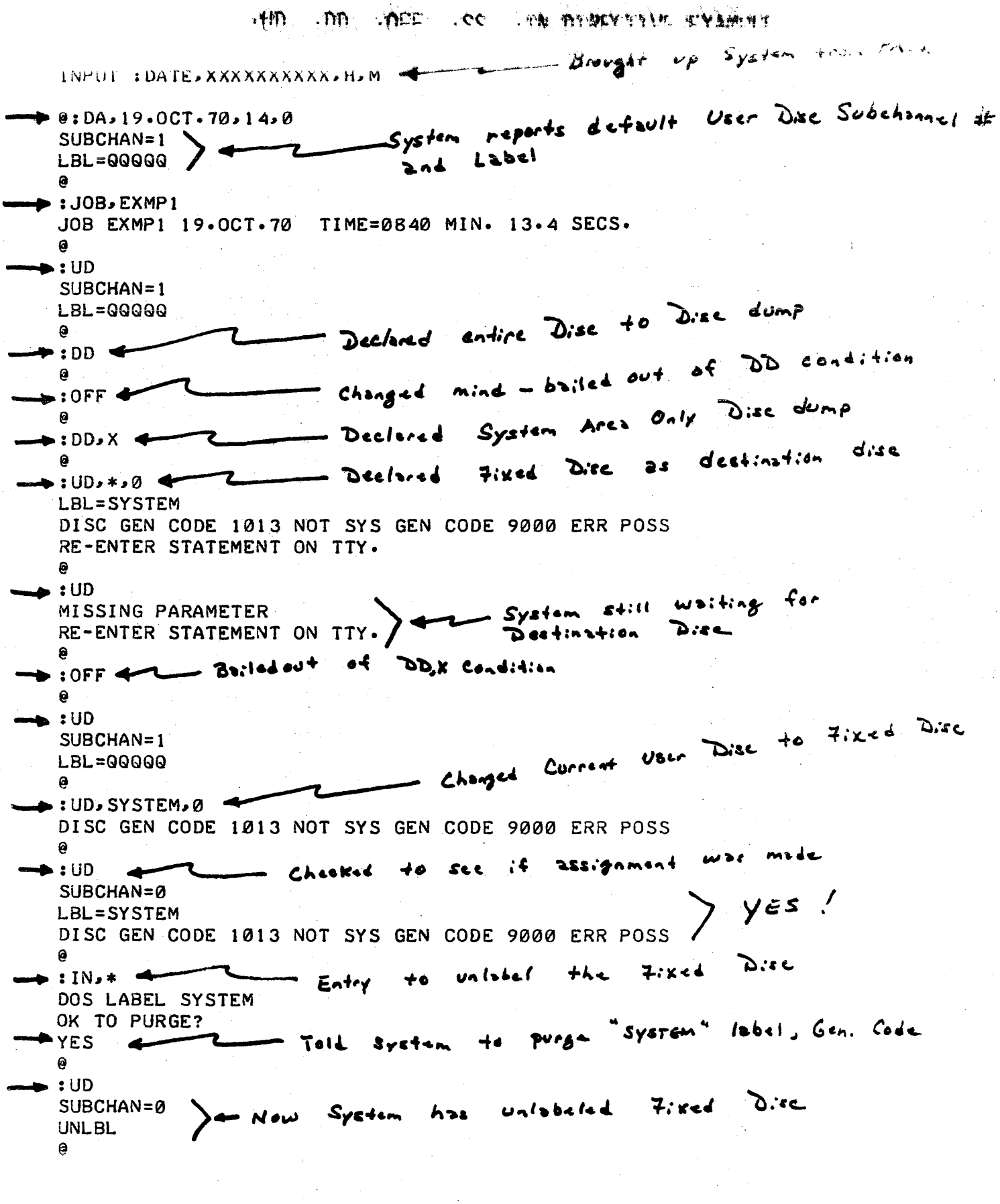
4. IF SEARCH DOES NOT FIND THE DESIRED FILE, THE CURRENT USER DISC SUBCHANNEL NUMBER IS RESTORED TO ITS VALUE BEFORE SEARCH.

5. IF SEARCH IS INTERRUPTED BEFORE COMPLETION, THE CURRENT USER DISC SUBCHANNEL NUMBER WILL BE ON WHATEVER SUBCHANNEL NUMBER THE SYSTEM WAS SEARCHING WHEN INTERRUPTION OCCURRED.

6. :LIST,U DIRECTIVE DOES NOT STOP ON DUPLICATE FILE NAMES, BUT CONTINUES SEARCHING AND PRINTING USER DIRECTORY. AT COMPLETION, THE CURRENT USER DISC SUBCHANNEL IS RESTORED TO NUMBER BEFORE THIS DIRECTIVE ENTERED.

7. MORE THAN ONE :SS CONDITION MAY BE SET DURING A JOB. EACH ONE SET REMAINS IN EFFECT UNTIL A NEW ONE IS ENTERED OR THE JOB IS ENDED.

8. :SS CONDITIONS SET ARE NOT FOLLOWED BY RELOCATING LOADER (LOADR) OR TO DISC DUMPS INITIATED BY :DD DIRECTIVE.


INPUT :DATE,XXXXXXXXXX,H,M
Brought up System from DISC
@:DA,19.OCT.70,14,0
SUBCHAN=1
LBL=QQQQQ
System reports default User Disc Subchannel # and Label
@
:JOB,EXMP1
JOB EXMP1 19.OCT.70 TIME=0840 MIN. 13.4 SECS.
@
:UD
SUBCHAN=1
LBL=QQQQQ
@
:DD
Declared entire Disc to Disc dump
@
:OFF
Changed mind - bailed out of DD condition
@
:DD,X
Declared System Area Only Disc dump
@
:UD,*,0
Declared Fixed Disc as destination disc
LBL=SYSTEM
DISC GEN CODE 1013 NOT SYS GEN CODE 9000 ERR POSS
RE-ENTER STATEMENT ON TTY.
@
:UD
MISSING PARAMETER
RE-ENTER STATEMENT ON TTY.
System still waiting for Destination Disc
@
:OFF
Bailed out of DD,X Condition
@
:UD
SUBCHAN=1
LBL=QQQQQ
@
:UD,SYSTEM,0
Changed Current User Disc to Fixed Disc
DISC GEN CODE 1013 NOT SYS GEN CODE 9000 ERR POSS
@
:UD
Checked to see if assignment was made
SUBCHAN=0
LBL=SYSTEM
DISC GEN CODE 1013 NOT SYS GEN CODE 9000 ERR POSS
YES !
@
:IN,*
Entry to unlabel the Fixed Disc
DOS LABEL SYSTEM
OK TO PURGE?
YES
Told System to purge "System" label, Gen. Code
@
:UD
SUBCHAN=0
UNLBL
Now System has unlabeled Fixed Disc
@

[SLIDE 20A]

```
:UD,QQQQQ,1 <-- Reassign USER DISC
@
:UD <-- Checked to make sure assignment made
SUBCHAN=1
LBL=QQQQQ
@
:DD,X <-- Declared System area only Disc dump
@
:UD,*,0 <-- Declared Destination Disc
@
:UD
SUBCHAN=0
LBL=SYSTEM
@
:UD,,0 <-- Checked Label on Subchannel # 0 (Fixed Disc)
LBL=SYSTEM
@
:UD
SUBCHAN=0
LBL=SYSTEM
@
:LI,U <-- Incorrect Statement Entered
MISSING PARAMETER
RE-ENTER STATEMENT ON TTY.
@
:LI,U,1 <-- List USER Directory
NAME TYPE SCTRS DISC ORG PROG LIMITS   B.P. LIMITS   ENTRY LIBR.  P-BIT
SUBCHAN=0
@                    NOTHING ON Fixed Disc to be listed
:SS <-- Set System Search for all active subchannels
@
:LI,U,1
NAME TYPE SCTRS DISC ORG PROG LIMITS   B.P. LIMITS   ENTRY LIBR.  P-BIT
SUBCHAN=0
SUBCHAN=1
XREF  UM  0013  T023 000 12000 14750   01002 01036   12000 14071
@T1   SS  0001  T023 013
WEOT  UM  0002  T023 014 12000 12013   01002 01003   12000 12013

*:OFF <-- Bailed out of long listing
@
:SS,99 <-- Reset default System Search
@

:LI,U,1 <-- List User Directory
NAME TYPE SCTRS DISC ORG PROG LIMITS   B.P. LIMITS   ENTRY LIBR.  P-BIT
SUBCHAN=1
XREF  UM  0013  T023 000 12000 14750   01002 01036   12000 14071

*:OFF <-- Bailed out
@
:UD
SUBCHAN=1 } <-- Note how Current user Disc is still 1
LBL=QQQQQ
@
```

[SLIDE 20B]

```
:UD
SUBCHAN=1
LBL=QQQQQ
@
:DD,U
@
:UD,SYSTEM,0
XREF
EOT1
WEOT
XREFR
DISCM
EXECS
DVR05
DVR31
LIBRY
DVR02
DVR01
DVR22
LODR
JOBP
ASMBL
ASMD
ASM3
ASM4
ASM5
FRTN
FTN1
FTN2
FTN3
FTN4
ASM1
ASM2
SIO1
BASC1
BOOT
FTNH
EOF
FSPCE
RWIND
D.00S
TSRTS
TSRTR
CLEAR
@
:UD
SUBCHAN=0
LBL=SYSTEM
@
:LI,U,1
NAME TYPE SCTRS DISC ORG PROG LIMITS   B.P. LIMITS   ENTRY LIBR.  P-BIT
SUBCHAN=0
XREF  UM  0013  T024 000 12000 14750   01002 01036   12000 14071
EOT1  SS  0001  T024 013
WEOT  UM  0002  T024 014 12000 12013   01002 01003   12000 12013

*:ABORT
JOB ABORTED!
END JOB EXMP1 RUN=0011 MIN. 52.2 SEC.  EXEC=0000 MIN. 00.0 SEC.

@
```

Declared User Area only Disc Dump

Destination Disc

System Reported Each User File Name Transfered as transfer done

List user Directory

Bailed out and aborted

[SLIDE 20C]

OPERATIONAL DIFFERENCE SUMMARY (PART 1)

CONDITION	DOS	DOSM
SYSTEM START-UP	Outputs the following: **INPUT FR = FRESH; CO = CONTINUATION**	Does not output this message. Outputs INPUT :DATE,XXXXXXXXXX,H,M (H and M are omitted if system does not have Time Base Generation)
:OFF Directive	Does not exit. Must use :ABORT to terminate the current job.	New Directive to abort without terminating current job.
:DD Directive	Does not exist. SDUMP program must be used to create backup copies on Mag. Tape	New Directive to perform disc to disc dumps. Backup copy may be put on cartridge disc.
:SS Directive	Does not exist.	New Directive to enable multi-disc file searching.
:IN Directive	Does not exist. Discs are not labeled.	New Directive to label or unlabel discs.
:UD Directive	Does not exist.	New Directive to change current user disc.
System Recognition of Operator Attention by outputting *	Following are valid entries at this time: :ABORT, :DN, :EQ, :LU, :TYPE, :UP	Following are valid entries at this time: :OFF, :PAUSE, :ABORT, :DN, :EQ, :LU, :TYPE, :UP
:JOB Directive	Current time is always printed on the System Teleprinter and List device along with the job name and date. TBG is System requirement.	Current Time is only printed on the system Teleprinter and list device when Time Base Generator is in system. TBG is an option.

OPERATIONAL DIFFERENCE SUMMARY (PART 2)

CONDITION	DOS	DOSM
:EJOB Directive	Not Applicable	System resets :SS condition to be only standard user disc.
	System condenses User file. Only one User File Area.	System condenses all user discs following :SS condition.
	Not Applicable	User Disc subchannel assignment reset to standard subchannel # unless standard is "NOT READY" or new cartridge has been inserted with different label.
	Message is printed on System Teleprinter and standard List device with job name, execution and run times. TBG is a System Requirement.	Execution and Run times are not printed if the Time Base Generator is not in the system. TBG is optional.
:PROG Directive	Not Applicable Only one user area in system.	File Search for program specified follows :SS condition. User files are searched first, then system files.
:RUN Directive	Optional "time parameter" always used. TBG is System requirement.	"Time parameter" is ignored if Time Base Generator is not in system. TBG is optional.
	Not Applicable. Only one user area in system.	File search for User program follows :SS condition.

OPERATIONAL DIFFERENCE SUMMARY (PART 3)

CONDITION	DOS	DOSM
:TRACKS DIRECTIVE	REQUIRES THAT THE OPERATOR INFORM SYSTEM OF THE FAULTY TRACKS ON A FRESH START-UP FOLLOWING THE DATE DIRECTIVE.	DOES NOT INCLUDE THIS OPTION BECAUSE A RECORD IS MAINTAINED IN THE LABEL SECTOR ON EACH DISC FOR NUMBER OF FAULTY TRACKS, THE ADDRESS OF NEXT SPARE TRACK, ETC...
	REPORTS TRACK NUMBERS THAT ARE FAULTY.	REPORTS TOTAL NUMBER OF TRACKS THAT HAVE BEEN REPLACED BY SPARES.
:STORE DIRECTIVE	CHECKS USER AREA FOR DUPLICATE FILE NAMES.	CHECKS ALL ACTIVE SUBCHANNELS (ACCORDING TO :SS CONDITION) FOR DUPLICATE FILE NAME. STORE ACUALLY DONE ON CURRENT USER DISC.
	ONE SECTOR = 64 WORDS	ONE SECTOR = 128 WORDS
:JFILE DIRECTIVE	SOURCE FILE SPECIFIED IS IN ONE USER AREA.	SOURCE FILE SPECIFIED MAY BE ON ANY ACTIVE SUBCHANNEL (ACCORDING TO :SS CONDITION).
:EDIT DIRECTIVE	SOURCE FILE SPECIFIED IS IN ONE USER AREA.	SOURCE FILE SPECIFIED MAY BE ON ANY ACTIVE SUBCHANNEL (ACCORDING TO :SS CONDITION).
	UPDATED OR NEW SOURCE FILE IS STORED IN ONLY ONE USER AREA.	IF NEW FILE NAME IS SPECIFIED, THIS FILE IS STORED ON SAME SUBCHANNEL AS OLD FILE.
:PURGE DIRECTIVE	FILES SPECIFIED ARE ONLY IN ONE USER	FILES SPECIFIED MAY BE ON ANY ACTIVE SUBCHANNEL (ACCORDING TO :SS CONDITION). ALL ASSOCIATED USER DISCS ARE REPACKED FOR EFFICIENTY. USE :IN,* TO PURGE ALL USER FILES ON A GIVEN USER DISC.

OPERATIONAL DIFFERENCE SUMMARY (PART 4)

CONDITION	DOS	DOSM
:LIST DIRECTIVE	DOSE NOT HAVE P-BIT FIELD FOR DIRECTORY LISTINGS.	HAS ALL FIELDS OF DOS WITH ADDITIONAL FIELD, P-BIT. ENTRY UNDER THIS FIELD WILL BE "T" TO INDICATE THAT THE ASSOCIATED FILE IS TEMPORARY AND WILL BE PURGED AT :EJOB IF NOT STORED WITH :STORE.
	USER DIRECTORY IS ONLY ON ONE DISC.	USER DIRECTORY LISTING HAS SUBCHANNEL NUMBERS PRECEEDING USER FILES ON THAT SUBCHANNEL.
	NOT APPLICABLE	CURRENT USER DISC SUBCHANNEL NUMBER IS RESTORED FOLLOWING :LIST,U.
	SOURCE FILE SPECIFIED IS ON ONE USER AREA.	SOURCE FILE SPECIFIED MAY BE ON ANY ACTIVE SUBCHANNEL (ACCORDING TO :SS CONDITION).
:DUMP DIRECTIVE	USER FILES ONLY ON ONE DISC.	FILE SPECIFIED MAY BE ON ANY ACTIVE SUBCHANNEL (ACCORDING TO :SS CONDITION)
:SA OR :SO DIRECTIVES	CALLED DISC DUMP	CALLED SECTOR DUMP TO DISTINGUISH FROM :DD (DISC DUMP).
	DUMP IS TO SYSTEM TELEPRINTER (LU # 1)	DUMP IS TO STANDARD LIST DEVICE (LU #6).
	ANY PORTION OF DISC(S) ON SYSTEM MAY BE DUMPED.	DUMP ANY PORTION OF CURRENT USER DISC EVEN IF USER AREA IS ON SYSTEM DISC.
:DATE DIRECTIVE	HOURS AND MINUTES ENTRIES ARE ALWAYS MEANINGFUL. TBG IS SYSTEM REQUIREMENT	IF TIME BASE GENERATOR IS NOT PRESENT IN SYSTEM, HOURS AND MINUTES ARE SET TO ZERO.

CHANGE USER DISC EXEC CALL

(GENERAL FORMAT)

PURPOSE

To change the subchannel assignment for the user disc.

ASSEMBLY LANGUAGE

```
     EXT EXEC
      .
      .
      .
     JSB EXEC                  (Transfer control to DOS-M)
     DEF *+3 (or 4)            (Point of return from DOS-M)
     DEF RCODE                 (Request Code)
     DEF LABEL                 (Disc Label)
     DEF SUBCH                 (Disc Subchannel; optional)
     RETURN POINT
      .
      .
      .
RCODE DEC 23                   (Request Code = 23)
LABEL ASC 3, xxxxxx            (Label = xxxxxx)
SUBCH DEC (Ø to 7)
```

FORTRAN

```
     IRCDE = 23
     DIMENSION LABEL (3)
     LABEL (1) = xx
     LABEL (2) = xx
     LABEL (3) = xx
     ICHNL = M      (Ø THROUGH 7)
     CALL EXEC (IRCDE, LABEL, ICHNL)
```

CHANGE USER DISC EXEC CALL -- FORM # 1

(LABEL AND SUBCHANNEL SPECIFIED)

CALLING SEQUENCE:

```
      JSB EXEC          TRANSFER CONTROL TO EXEC
      DEF *+4           DEFINE RETURN POINT
      DEF RCODE         DEFINE REQUEST CODE LOCATION
      DEF LABEL         DEFINE LABEL LOCATION
      DEF SUBCH         DEFINE SUBCHANNEL LOCATION
      (RETURN POINT)
       .
       .
       .
RCODE DEC 23            23 FOR REQUEST CODE
LABEL ASC 3,xxxxxx      6 CHARACTER DISC LABEL OR "*"
SUBCH DEC N             N = Ø-7 FOR SUBCHANNEL #
```

SYSTEM ACTION	OPERATOR ACTION
CHECKS IF SUBCHANNEL N IS LABELED AS SPECIFIED IN CALL (LABEL NAME OR "*")	NONE REQUIRED
MATCH - MAKES ASSIGNMENT AND RETURNS	NONE REQUIRED
NO MATCH - PRINTS MESSAGE: LBL = (LABEL NAME FOUND ON SUBCHANNEL N) OR UNLBL IF "*" xxxxx SUSP WHERE xxxxx IS NAME OF EXECUTING PROGRAM.	1. IF CORRECTLY LABELED DISC ON HAND: MOUNT IN DRIVE AND "READY" DRIVE. THEN ENTER :GO FOR SYSTEM TO EXECUTE AT START OF EXEC CALL. OR 2. IF NO PROPERLY LABELED DISC ON HAND: ENTER: :ABORT OR :OFF

CHANGE USER DISC EXEC CALL — EXAM # 2

(ONLY LABEL SPECIFIED)

CALLING SEQUENCE:

```
JSB EXEC          TRANSFER CONTROL TO EXEC
DEF *+3           DEFINE RETURN POINT
DEF RCODE         DEFINE REQUEST CODE LOCATION
DEF LABEL         DEFINE LABEL LOCATION
(RETURN POINT)
  .
  .
  .
RCODE DEC 23      23 FOR REQUEST CODE
LABEL ASC 3,xxxxxx  6 CHARACTER LABEL OR "*"
```

SYSTEM ACTION	OPERATOR ACTION
SEARCHES FOR LABEL OR "*" DISC STARTING WITH THE HIGHEST SUBCHANNEL NUMBER.	NONE REQUIRED
MATCH - MAKES ASSIGNMENT AND RETURNS	NONE REQUIRED
NO MATCH - PRINTS MESSAGE: DISC NOT ON SYST xxxxx SUSP WHERE xxxxx IS NAME OF EXECUTING PROGRAM.	1. IF PROPERLY LABELED DISC ON HAND: MOUNT IN DRIVE AND "READY" DRIVE. THEN ENTER :GO FOR SYSTEM TO EXECUTE AT START OF EXEC CALL. OR 2. IF NO APPROPRIATELY LABELED DISC ON HAND: ENTER: :ABORT OR :OFF

[SLIDE 22C]

DOS/DOSM GENERAL PURPOSE EXEC CALLS WITH NEGATIVE REQUEST CODES

REQUEST CODE	FUNCTION	CALLING SEQUENCE
-19	BASE PAGE STORE (STA B,I)	LDA "VALUE TO STORE" LDB "DESTINATION ADDRESS" JSB EXEC DEF *+2 DEF RCODE (RETURN WITH B = FORMER VALUE +1) . . . RCODE DEC - 19
-20	TO LOAD AND START EXECUTION OF A PROGRAM WHOSE DIRECTORY ENTRY IS IN LOCATIONS 141-153 OCTAL	STORE DIRECTORY ENTRY OF DESIRED PROGRAM IN LOCATIONS 141-153B JSB EXEC DEF *+2 DEF RCODE (RETURN) . . . RCODE DEC - 20
-21	TO INITIALIZE TBG (IF IN SYSTEM) FOR .1 SECOND TIMED INTERRUPTS	JSB EXEC DEF *+2 DEF RCODE (RETURN) . . . RCODE DEC - 21
-22	TO EXECUTE AN I/O INSTRUCTION	LDA "I/O INSTRUCTION" JSB EXEC DEF *+2 DEF RCODE (RETURN) . . . RCODE DEC - 22

DOSM DISC I/O WITH EXEC CALLS
(ABSOLUTE DISC ADDRESSING)

GENERAL CALLING SEQUENCE:

```
        JSB EXEC   (TRANSFER TO EXEC)
        DEF RTN    (DEFINE RETURN ADDRESS)
        DEF RCODE  (SEE BELOW)
        DEF CNTLW  (SEE BELOW)
        DEF BUFFR  (DEFINE BUFFER ADDRESS)
        DEF BUFFL  (DEFINE BUFFER LENGTH)
        DEF TRCK   (DEFINE TRACK #)
        DEF SECT   (DEFINE SECTOR #)
RTN     (RETURN POINT)
```

RCODE	CNTLW	DISC AREA ADDRESSED
+1 (READ) +2 (WRITE)	2	"WORK AREA" ON SYSTEM DISC ONLY. SYSTEM CHECKS FOR LEGALITY OF TRCK/SECT IN CALL.
-1 (READ) -2 (WRITE)	2	"ANY AREA" ON SYSTEM DISC. SYSTEM DOES NOT CHECK FOR LEGALITY OF TRCK/SECT IN CALL.
	3	"ANY AREA" ON CURRENT USER DISC. SYSTEM DOES NOT CHECK FOR LEGALITY OF TRCK/SECT IN CALL.
	-3	"ANY AREA" ON CURRENT JOB FILE (JFILE) DISC. SYSTEM DOES NOT CHECK FOR LEGALITY OF TRCK/SECT IN CALL.

NOTE: SYSTEM WILL HALT (WITH T-REG. =102031 OCTAL) IF DISC PROTECT OVERRIDE SWITCH IS "OFF" (DOWN) AND REQUEST MADE TO WRITE ON A SECTOR THAN IS FLAGGED PROTECTED (PCI=1).

BINARY TAPES NEEDED FOR SYSTEM GENERATION (PART 1)

PROGRAM(S)	# TAPES	COMMENTS
SYSTEM GENERATOR	1	OPERATES IN SIO ENVIRONMENT, THEREFORE THE FOLLOWING SIO DRIVERS MAY BE NEEDED: TELETYPE, PHOTOREADER, PUNCH (IF SIO DUMP TO BE USED), AND MAGNETIC TAPE. GENERATOR CONTAINS DISC I/O DRIVER INTERNAL TO ITSELF, THEREFORE, NO SIO DISC DRIVER NEEDED.
DISC MONITOR (CORE RESIDENT SYSTEM)	1	ALWAYS MADE CORE RESIDENT BY GENERATOR. GOOD PRACTICE TO LOAD AS FIRST PROGRAM FOR SYSTEM COMPATABILITY BETWEEN PROGRAMS LOADED ON OTHER SYSTEMS.
EXECUTIVE MODULES AND SUBROUTINES	1	MUST BE INCLUDED IN SYSTEM GENERATION. CONTAINS $EX01 - $EX20 EXEC MODULES AND SUBROUTINES $LBL, $SRCH, $ADDR, ASCII, DUMRX. ALL EXEC MODULES ARE PROGRAM TYPE 1 (SYSTEM DISC RESIDENT), BUY MAY BE MADE SYSTEM CORE RESIDENT DURING GENERATION (PROGRAM TYPE 0). CAUTION: IF CERTAIN EXEC MODULES ARE MADE SYSTEM CORE RESIDENT, THEIR ASSOCIATED SUBROUTINES MUST ALSO BE DECLARED CORE RESIDENT.
I/O DRIVERS	1 PER DRIVER	DVR31 (IOMEC DISC DRIVER) MUST ALWAYS BE INCLUDED. IT IS DECLARED PROGRAM TYPE 0 (SYSTEM CORE RESIDENT) AND MUST NOT BE REDECLARED. DVR05 DVR00 ONE OF THESE DRIVERS MUST BE INCLUDED. BOTH ARE DECLARED PROGRAM TYPE 0 (SYSTEM CORE RESIDENT). THE ONE TO BE USED AS SYSTEM TELETYPE MUST NOT BE REDECLARED AS DISC RESIDNET. DVR05 IS SHORTED IN CORE REQUIREMENTS. ALL OTHER DRIVERS ARE DECLARED PROGRAM TYPE 4 (DISC RESIDENT I/O DRIVER) AND MAY BE REDECLARED PROGRAM TYPE 0 IF DESIRED.
JOB PROCESSOR	1	MUST ALWAYS BE INCLUDED IN GENERATION. MUST ALWAYS BE DISC RESIDENT.
RELOCATING LOADER	1	DOES NOT HAVE TO BE INCLUDED IN SYSTEM GENERATION, BUT IF NOT INCLUDED NO PROGRAMS COULD BE RELOCATED INTO CORE IMAGE ABSOLUTE FORM BY THE SYSTEM THAT IS GENERATED. DECLARED PROGRAM TYPE 3 (USER MAIN) AND MAY NOT BE MADE CORE RESIDENT. MUST ALWAYS BE DISC RESIDENT.

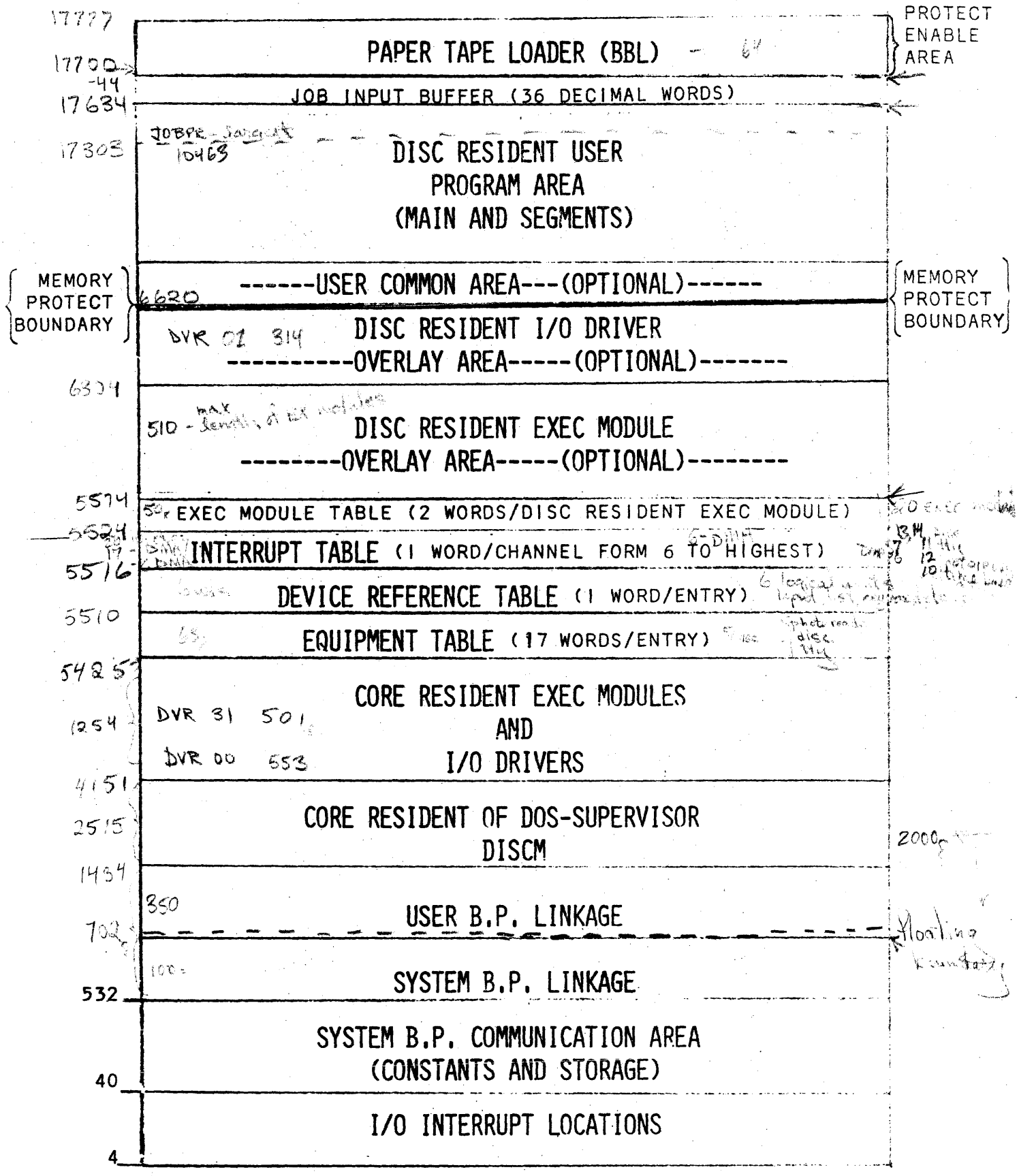
BINARY TAPES NEEDED FOR SYSTEM GENERATION (PART 2)

PROGRAM(S)	# TAPES	COMMENTS
EXTENDED ASSEMBLER	7	DOES NOT HAVE TO BE INCLUDED IN SYSTEM GENERATION. ONE TAPE IS THE MAIN PROGRAM (TYPE 3) AND SIX TAPES ARE SEGMENTS (PROGRAM TYPE 5). THE MAIN PROGRAM (ASMB) MUST BE LOADED PRIOR TO ITS SEGMENTS. MUST ALWAYS BE DISC RESIDENT.
HP BASIC FORTRAN COMPILER	5	DOES NOT HAVE TO BE INCLUDED IN SYSTEM GENERATION. ONE TAPE IS THE MAIN PROGRAM (TYPE 3) AND FOUR TAPES ARE SEGMENTS (PROGRAM TYPE 5). THE MAIN PROGRAM (FTN) MUST BE LOADED PRIOR TO ITS SEGMENTS. MUST ALWAYS BE DISC RESIDENT.
HP ALGOL COMPILER	2	DOES NOT HAVE TO BE INCLUDED IN SYSTEM GENERATION. ONE TAPE IS THE MAIN PROGRAM (TYPE 3) AND ONE SMALL TAPE IS THE ONLY SEGMENT (PROGRAM TYPE 5). THE MAIN PROGRAM (ALGOL) MUST BE LOADED PRIOR TO THE SEGMENT. MUST ALWAYS BE DISC RESIDENT. REQUIRES 16K MINIMUM CORE.
HP FORTRAN IV COMPILER	19	DOES NOT HAVE TO BE INCLUDED IN SYSTEM GENERATION. ONE TAPE IS THE MAIN PROGRAM (TYPE 3) AND 18 OTHER TAPES ARE ITS SEGMENTS (PROGRAM TYPE 5). THE MAIN PROGRAM (FTN4) MUST BE LOADED PRIOR TO THE 18 SEGMENTS. MUST ALWAYS BE DISC RESIDENT.
CROSS REFERENCE TABLE GENERATOR	1	DOES NOT HAVE TO BE INCLUDED IN SYSTEM GENERATION. DELARED PROGRAM TYPE 3 (USER DISC RESIDENT MAIN). MUST BE DISC RESIDENT.
LIBRARIES	5	THE LIBRARIES INCLUDED DURING SYSTEM GENERATION WILL DEPEND ON THE PARTICULAR SYSTEM THAT IS BEING GENERATED AND WILL VARY ACCORDINGLY. FACTORS THAT WILL HELP DETERMINE ARE: 1. IS EAU TO BE USED. 2. IS FORTRAN IV COMPILER TO BE INCORPORATED INTO SYSTEM. 3. IS PLOTTING EQUIPMENT TO BE USED.
ANY USER PROGRAMS TO BE MADE A PERMANENT PART OF SYSTEM	?	SAME CONVENTIONS MUST BE FOLLOWED IN SEGMENTATION. USER MAIN MUST BE LOADED PRIOR TO SEGMENTS ETC. LIBRARY PROGRAMS MUST BE DECLARED TYPE 6 OR 7.

NOTE: IF THE FORTRAN IV LIBRARY IS TO BE INCLUDED IN AN 8K SYSTEM, CERTAIN RULES MUST BE FOLLOWED:

1. THE SYSTEM MUST BE GENERATED WITHOUT ANY COMPILERS OR AN ASSEMBLER.
2. A MAGNETIC TAPE SIO DRIVER CANNOT BE USED WITH DSGEN.
3. THE COMPILERS AND ASSEMBLER MUST BE LOADED INTO THE SYSTEM DURING OPERATION (USING THE LOADER).

DOSM GENERAL CORE LAYOUT



SYSTEM SOFTWARE SIZE BREAKDOWN ("A" VERSIONS)

PROGRAM NAME	LENGTH (OCTAL)	LENGTH (DECIMAL)	EXTERNAL ROUTINES
DISCM	2515	1357	-----
$EX01	62	50	$ADDR
$EX02	50	40	$ADDR
$EX03	35	29	-----
$EX04	315	205	ASCII
$EX05	156	110	$SRCH
$EX06	37	31	$ADDR, $SRCH
$EX07	157	111	$ADDR
$EX08	143	99	$ADDR
$EX09	261	177	ASCII
$EX10	156	110	-----
$EX11	164	116	$SRCH
$EX12	172	122	-----
$EX13	342	226	ASCII
$EX14	360	240	ASCII
$EX15	272	186	ASCII
$EX16	133	91	-----
$EX17	373	251	$LBL
✓ $EX18	510	328	-----
$EX19	320	208	$LBL
$EX20	306	198	ASCII
$LBL	73	59	
$SRCH	304	196	
$ADDR	15	13	
ASCII	72	58	
DUMRX	64	52	
✓ DVR00 tty (punch capability)	553	363	
✓ DVR01 photo reader	314	204	
DVR02	202	130	
DVR05	250	168	
DVR10	135	93	
DVR12	527	343	
DVR15	325	213	
DVR22	634	412	
DVR23	566	374	
DVR30	252	170	
✓ DVR31 Disc	501	321	
✓ JOBPR	10463	4403	
LOADR	7032	3610	

DOSM SYSTEM GENERATION EXAMPLE
("A" VERISION TAPES USED)

```
    SYS GEN CODE?
→ 9000        written in label field of the system disc for ident.   (decimal #)
    SYS DISC CHNL?   select code of disc controller
→ 14                                                                 (octal #)
    # SECTORS/TRACK?   12 for 2770 (one disc)
→ 12
    SYS DISC SIZE?   # tracks
→ 200
    # DRIVES?
→ 1
    FIRST SYSTEM TRACK?
→ 0
    FIRST SYSTEM SECTOR?
→ 3
    SYS DISC SUBCHNL?
→ 1
    USER DISC SUBCHNL?
→ 1
    TIME BASE GEN CHNL?   — if type of TBG is not present
→ 12
    IS 2114?
→ NO
    LWA MEM?   last word of available core memory - [basic binary loader (BBL) starts in 37700]
→ 37677
    ALLOW :SS?   (system search directive)
→ YES
    PRGM INPT?   [type of 1st input unit for relocatable prog. module]   [DF - disc file, TY - teletype, PT - paper tape, MT - mag. tape]
→ PT
    LIBR INPT?   [type of optional input unit for RPMs]   } for prog. input phase
→ PT
    PRAM INPT?   [type of input unit for parameters in param input phase]   [PT or TY]
→ TY
```

INITIALIZATION PHASE

[SLIDE 40A]

```
*EOT
*EOT
*EOT
*EOT
*EOT
*EOT
*EOT
*EOT
*EOT
*EOT
*EOT
*EOT
*EOT
*EOT
*EOT
*EOT
*EOT
*EOT
*EOT
*EOT
*EOT

NO UNDEF EXTS
```

~ signifies end of tape when reading off it

01 [illegible] files
00 prgm input
10 library input

PROGRAM INPUT PHASE

input all progs to be made permanent part of DOS M (must input main before segments)

```
ENTER PROG PARAMETERS
→ $EX01,0
→ $EX02,0
→ $EX06,0
→ $EX11,0
→ $EX17,0
→ $EX18,0
→ $ADDR,0
→ $LBL,0
→ $SRCH,0
  /E
```

— Disc Work Tracks Status Limits
" "
— User file name search
System file name search - for file read/write
(Lib Processor)
I/O Initiation processor
Buffer addr validity check
Service routine for label checking
Search system & user directory

PARAMETER INPUT PHASE (from TY in this e

```
  # SYSTEM LINKS?
→ 177

  # USER LINKS?
→ 400
```

# of system linkages required in base page (130 min required)

# of user linkages in B.P. (320 min ")

[SLIDE 40B]

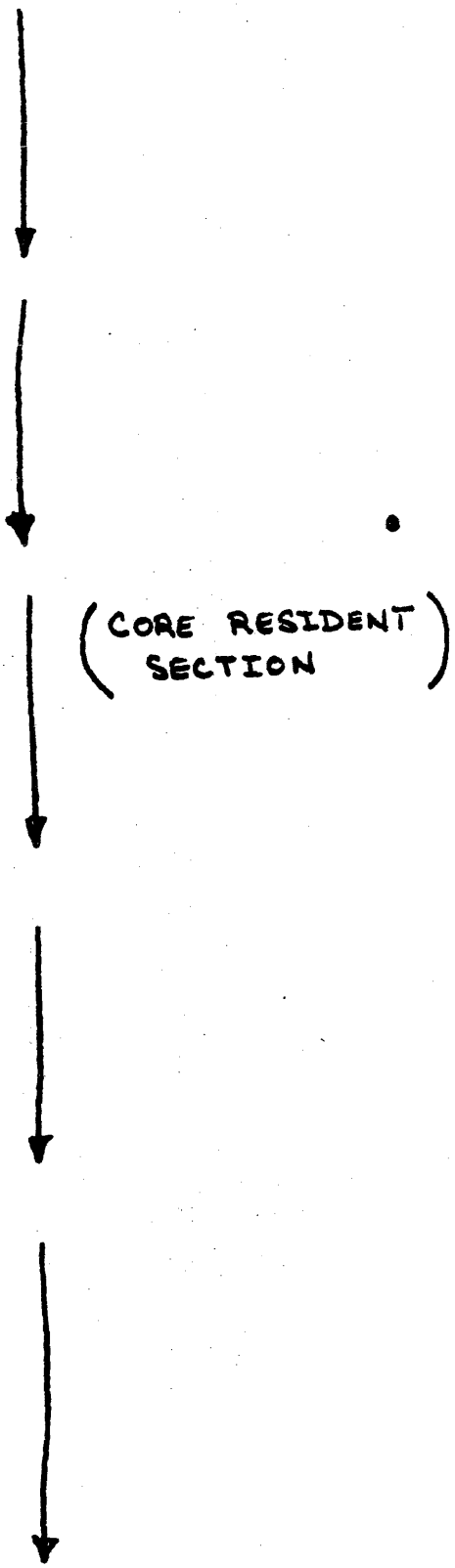
SYSTEM

	relative starting location
DISCM	01634
*$CIC	01634
*$STRT	04160
*$LDEX	04154
*EXEC	02214
*$DISC	03400
*$IDL1	03511
*$MDLD	03020
*$RQER	02635
*$JLOD	03744
*$MOVE	03361
*$TYPE	03426
*$SYIO	04165
*$BFND	04267
*$EFAD	02507
*$ABRT	04010
*$WAIT	03244
*SETEQ	03345
*$BLOP	03177
*SCIC3	01714
*SAVE$	03563
*$CLER	04044
*$OPER	02212
*ERR01	02653
*ERR03	02657
*ERR04	02661
*ERR05	02663
*ERR06	02665
*LUCHK	02553
*$DMA	03214
*$MBSY	03207
*$LDVR	03143
*RQEQT	02576
*DRIVR	02700
*ERRTN	02631
*IO.40	02521
*$GDTK	03130
*DISCX	03117
*..RRL	04243
*DEF04	02445
*DEF19	04302
*DEF20	04303
$EX01	04314
*$EX01	04314
$EX02	04376
*$EX02	04376
$EX06	04446
*$EX06	04446
$EX11	04505
*$EX11	04505
$EX17	04671

entry points

DISC LOADING PHASE

(CORE RESIDENT SECTION)



[SLIDE 40C]

DISC LOADING PHASE (CON'T)

```
   *$EX17   04671

$EX18       05264
   *$EX18   05264

$ADDR       05774
   *$ADDR   05774

$SRCH       06011
   *$SRCH   06011
   *$CMPR   06266

$LBL        06315
   *LBLIO   06354
   *ISLBL   06336
   *LBLMV   06330
   *CHSUM   06315
   *MESSG   06372

DVR05       06410
   *I.05    06410
   *C.05    06464

DVR31       06660
   *I.31    06660
   *C.31    06743
```

(CORE RESIDENT SECTION)

```
* EQUIPMENT TABLE ENTRY
11,DVR05,R   teleprinter (12) TBG
13,DVR01     photoreader
14,DVR31,R,D IOMEC disc
16,DVR02
22,DVR22,D
/E
```

BUILD EQT TABLE

```
* DEVICE REFERENCE TABLE
 1 = EQT #?   system teleprinter
1
 2 = EQT #?   mass storage (IOMEC disc)
3
 3 = EQT #?   System mass storage
3
 4 = EQT #?   Standard punch device
4
 5 = EQT #?   Standard input device (photoreader)
2
 6 = EQT #?   Standard list device (teleprinter)
1
 7 = EQT #?   mag tape
5
 8 = EQT #?
/E
```

BUILD DRT TABLE

IT generated: 0 - no interrupt

```
* INTERRUPT TABLE
11,1
13,2
15,3
16,4
23,5
/E
```

6 0 14 0
9 0 15 addr 21 0
10 0 16 addr 22 0
11 addr EXT1 17 0 23 addr
12 TBG 20 0
13 addr EXT2

14 locations in memory

BUILD INTERRUPT TABLE

EXEC SUPERVISOR MODULES

```
$EX03       07567
   *$EX03   07567

$EX04       07567
   *$EX04   07567
  ASCII     10104
   *CNDEC   10104
   *CNOCT   10110

$EX05       07567
   *$EX05   07567

$EX07       07567
   *$EX07   07567

$EX08       07567
   *$EX08   07567

$EX09       07567
   *$EX09   07567
  ASCII     10050
   *CNDEC   10050
   *CNOCT   10054

$EX10       07567
   *$EX10   07567

$EX12       07567
   *$EX12   07567

$EX13       07567
   *$EX13   07567
  ASCII     10131
   *CNDEC   10131
   *CNOCT   10135

$EX14       07567
   *$EX14   07567
  ASCII     10147
   *CNDEC   10147
   *CNOCT   10153

$EX15       07567
   *$EX15   07567
  ASCII     10061
   *CNDEC   10061
   *CNOCT   10065
```

Main entry pt. subroutine

DISC LOADING PHASE (CON'T)

(DISC RESIDENT SECTION)

DISC LOADING PHASE (CON'T)

```
$EX16       07567
   *$EX16   07567

$EX19       07567
   *$EX19   07567

$EX20       07567
   *$EX20   07567


  ASCII     10075
   *CNDEC   10075
   *CNOCT   10101

I/O DRIVER MODULES

DVR01       10241
   *I.01    10241
   *C.01    10313

DVR02       10241
   *I.02    10241
   *C.02    10320

DVR22       10241
   *I.22    10241
   *C.22    11001

LWA SYS  11075    last addr +1 of supervisor

FWA USER?         1st wd of user prog. area
12000

USER SYSTEM PROGRAMS

LOADR       12000
   *LOADR   12000

JOBPR       12000
   *JOBPR   12000

ASMB        12000
   *ASMB    16522
   *?ASCN   13700
   *?ASMB   12554
   *?BNCN   14510
   *?BPKU   15326
   *?CHOP   12646
   *?CHPI   15610
   *?DCOD   15616
   *?ENDS   15230
   *?ERPR   15150
```

(DISC RESIDENT SECTION)

*?GETC 15654
*?MOVE 13437
*?MSYM 14775
*?RLUN 16375
*?AFLG 16430
*?LSTL 14717
*?LUNI 16436
*?RFLG 16425
*?% 16446
*?ASM1 13371
*?LABE 13407
*?OKOL 15307
*?ORRP 14603
*?PNLE 16443
*?SETM 15674
*?SUP 15303
*?LPER 15306
*?PERL 15271
*?LOUT 15336
*?LTFL 15275
*?DRFL 16433
*?LTSA 15560
*?LTSB 15561
*?ORGS 15301
*?CNTR 15370
*?TSTR 16434
*?ASII 16452
*?ICSA 15146
*?FLGS 16422
*?BFLG 16423
*?LFLG 16424
*?TFLG 16426
*?X 16445
*?MESX 12505
*?ASCI 16451
*?LINC 15110
*?LINS 14765
*?LIST 14653
*?LUNP 16440

*?OPLK 12600
*?OPER 15640
*?PKUP 15321
*?PLIT 15406
*?PNCH 13632
*?PRNT 15033
*?RSTA 13105
*?LWA 16444
*?RDSC 16401
*?WEOF 16021
*?WRIF 16102
*?LGFL 16432
*?SEGM 12541
*?SYMK 13506
*?V 15633

DISC LOADING PHASE (CON'T)

(DISC RESIDENT SECTION)

[SLIDE 40G]

```
   *?ARTL   15472
   *?LST    15274
   *?PLIN   16435
   *?PCOM   15112
   *?SECT   16420
   *?NEAU   12443
   *?HA38   15347
   *?XRFI   12540

ASMBD       17120
   *ASMBD   17442

ASMB1       17120
   *ASMB1   17366
   *?LITI   20030
   *?CMQ    17560
   *?INSR   17726
   *?HA3Z   17527
   *?ENP    17662
   *?EXP    17645

ASMB2       17120
   *ASMB2   17351
   *?ART    20021
   *?BREC   17475
   *?LKLI   20535
   *?SKPR   17441
   *?SPCR   17444

ASMB3       17120
   *ASMB3   17630

ASMB4       17120
   *ASMB4   17366
   *?INS?   17541

ASMB5       17120
   *ASMB5   17351

FTN         12000
   *%WLIC   13042
   *%FTN0   12000
   *%WPRN   12735
   *%ERRR   12701
   *%RDIS   12557

   *%WDIS   12244
   *%SEGN   12224
   *%WTRA   12236
   *%WSEC   12237
   *%RTRA   12347
   *%RSEC   12350
   *%RBFA   12352
   *%LUNO   12203
   *%LUNI   12204
```

DISC LOADING PHASE (CON'T)

(DISC RESIDENT SECTION)

[SLIDE 40H]

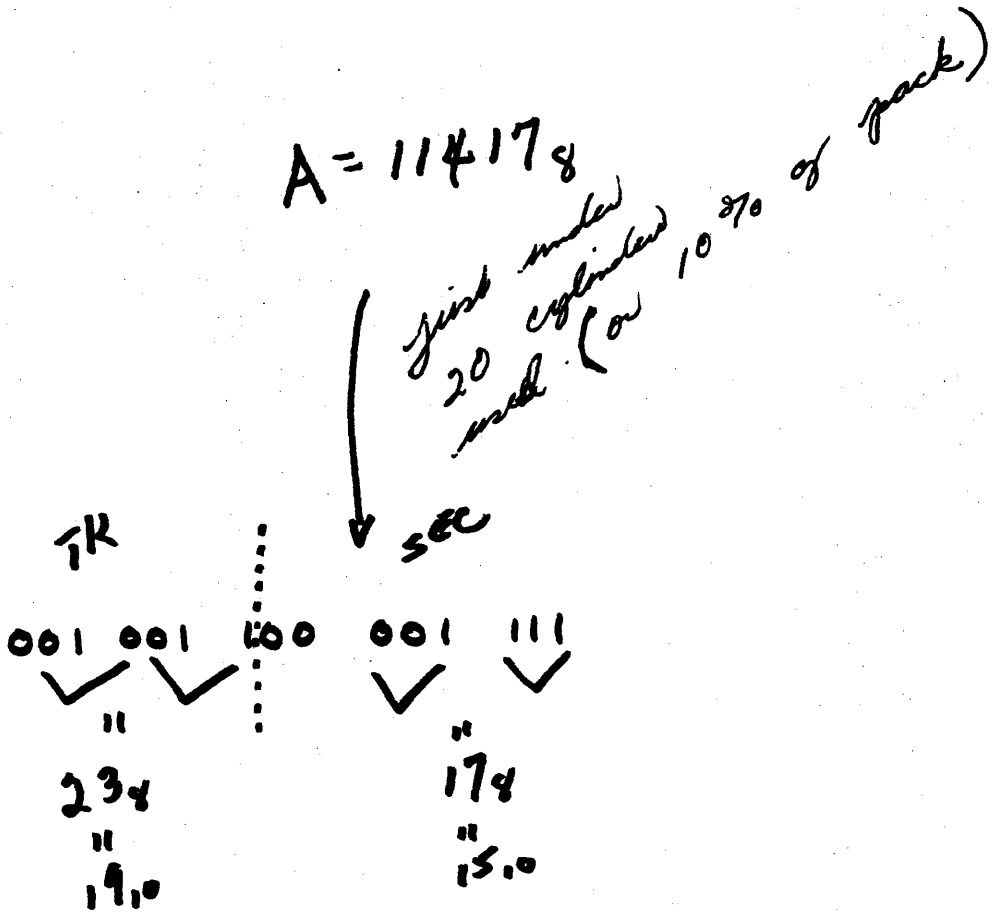
DISC LOADING PHASE (CONT)

```
    *%TYP   12227
    *%WLIN  13017
    *%WPAG  13043
    *%TILT  13074
    *%RDSI  13044
    *%WDSI  13056
    *%WOUT  12334
    *%RBFW  12623
    *%LABL  12733
    *%CONA  12734
    *%ENDP  13105
    *%WDLU  12241
    *%RDLU  12346
    *%RFLG  12554
    *%WBFW  12341
    *%WBFA  12232
    *%HEDN  13010
    *%DUP8  12373
    *%NXDV  12402
    *%NELM  12352
    *%STYP  12433
    *%LGO   12202

FTN01       13127
    *%FTN1  16550
   SREAD    21241
    *%READ  21241
    *%JFIL  21707
    *%RDSC  21663
   .OPSY    21774
    *.OPSY  21774
   DUMRX    22034
    *$LIBR  22034
    *$LIBX  22062

FTN02       13127
    *%FTN2  13741

FTN03       13127
    *%FTN3  15117

FTN04       13127
    *%FTN4  13702
   %WRIT    17515
    *%WRIT  17700
    *%WRIF  17577
    *%WBUF  17777
   FADSB    20213
    *.FAD   20213
```

(DISC RESIDENT SECTION)

[SLIDE 40]

```
  *.FSB    20222
 .OPSY     20363
  *.OPSY   20363
 .FLUN     20423
  *.FLUN   20423
 .PACK     20444
  *.PACK   20444
 DUMRX     20560
  *$LIBR   20560
  *$LIBX   20606
 .ZRLB     20644
  *.ZRLB   20644
 DLDST     20705
  *.DLD    20705
  *.DST    20715

*SYSTEM STORED ON DISC
```



[SLIDE 40J]

FORMATTING USER DISCS OR CARTRIDGES

PURPOSE: To format a USER DISC or CARTRIDGE anytime a new disc is added or an old SYSTEM DISC is to be reused as a USER DISC.

WHAT SYSTEM DOES: Creates an Unlabeled Disc ready for use in DOSM System by

1. Writing new Label Sector on sector Ø with
   A. First two words as Ø,DO
   B. Generation Code # entered by operator
   C. Three label words as *Y,ST,EM
   D. # bad tracks as Ø
2. Writing new bootstrap on sectors 1 and 2
3. Clearing all PCI and DCI on all sectors

OPERATION PROCEDURE:

1. All equpment on. "READY" Drive.
2. DISC PROTECT OVERRIDE SWITCH "ON".
3. Load Configured System Generator (DSGEN) into memory using BBL.
4. LOAD ADDRESS 1ØØ octal.
5. Switch 15 "UP".
6. PRESET and RUN.
7. Answer requests printed on TTY.
8. System Generator halts with T=1Ø2ØØ7 at end. Press "RUN" to do another Disc (with switch 15 still "UP") OR put switch 15 down and press "RUN" to begin SYSTEM GENERATION proper.

FORMATTING USER DISCS EXAMPLE

```
    SYS GEN CODE?
→9000

    SYS DISC CHNL?
→14

    # SECTORS/TRACK?
→12

    USER DISC SUBCHNL?
→0
    TURN ON DISC PROTECT OVERRIDE - PRESS RUN

    USER DISC SUBCHNL?
→1
```

FORMATTED FIXED DISC

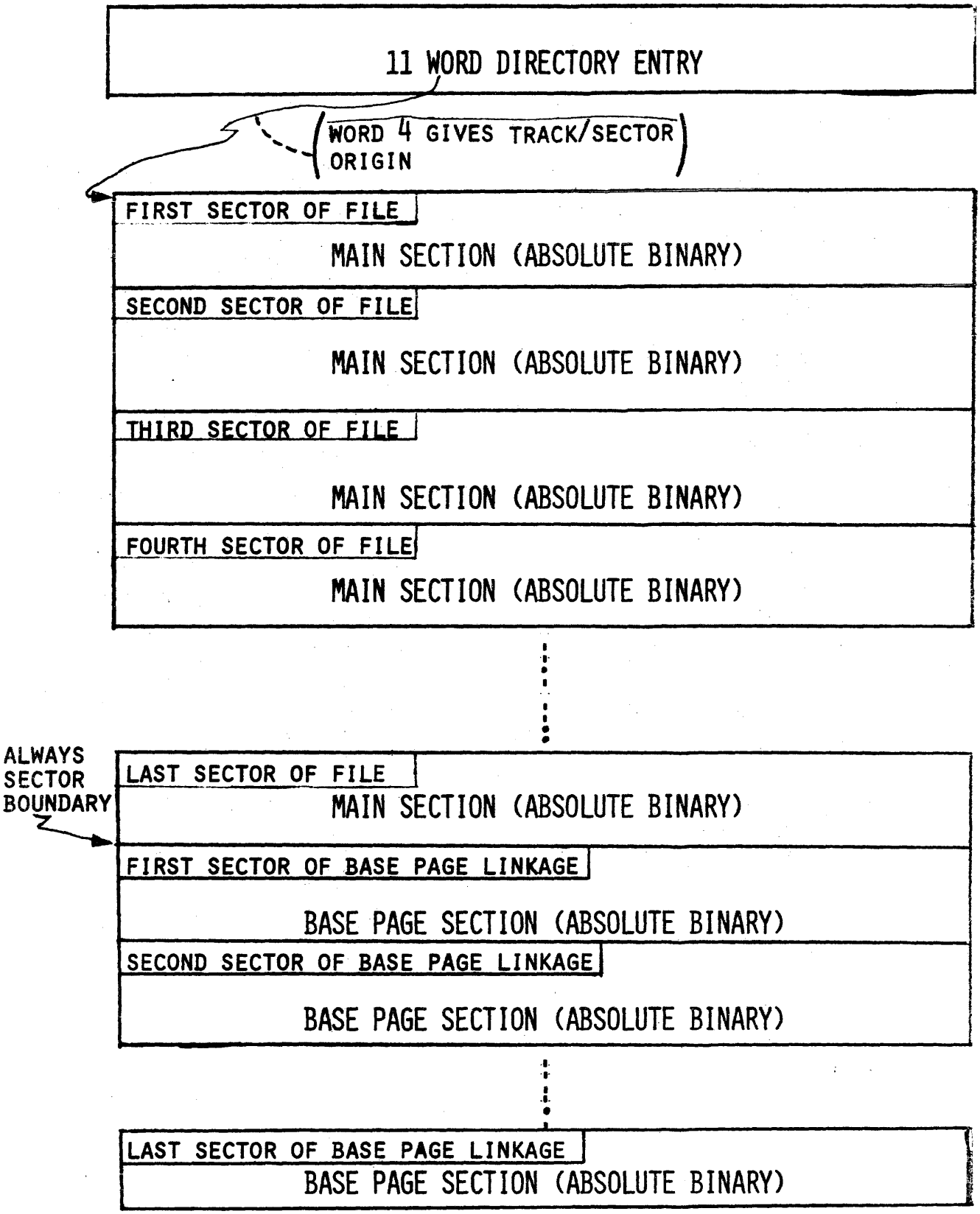
FORMATTED CARTRIDGE

```
    SYS GEN CODE?
→9000

    SYS DISC CHNL?
→14

    # SECTORS/TRACK?
→12

    SYS DISC SIZE?
→200

    # DRIVES?
→1

    FIRST SYSTEM TRACK?
→0
    FIRST SYSTEM SECTOR?
→3

    SYS DISC SUBCHNL?
→1

    USER DISC SUBCHNL?
→1

    TIME BASE GEN CHNL?
→12

    IS 2114?
→NO

    LWA MEM?
→37677

    ALLOW :SS?
→YES

    PRGM INPT?
→PT

    LIBR INPT?
→PT
```

WENT DIRECTLY INTO STANDARD SYSTEM GENERATION BY PUTING SWITCH IS DOWN AND PRESSING "RUN"

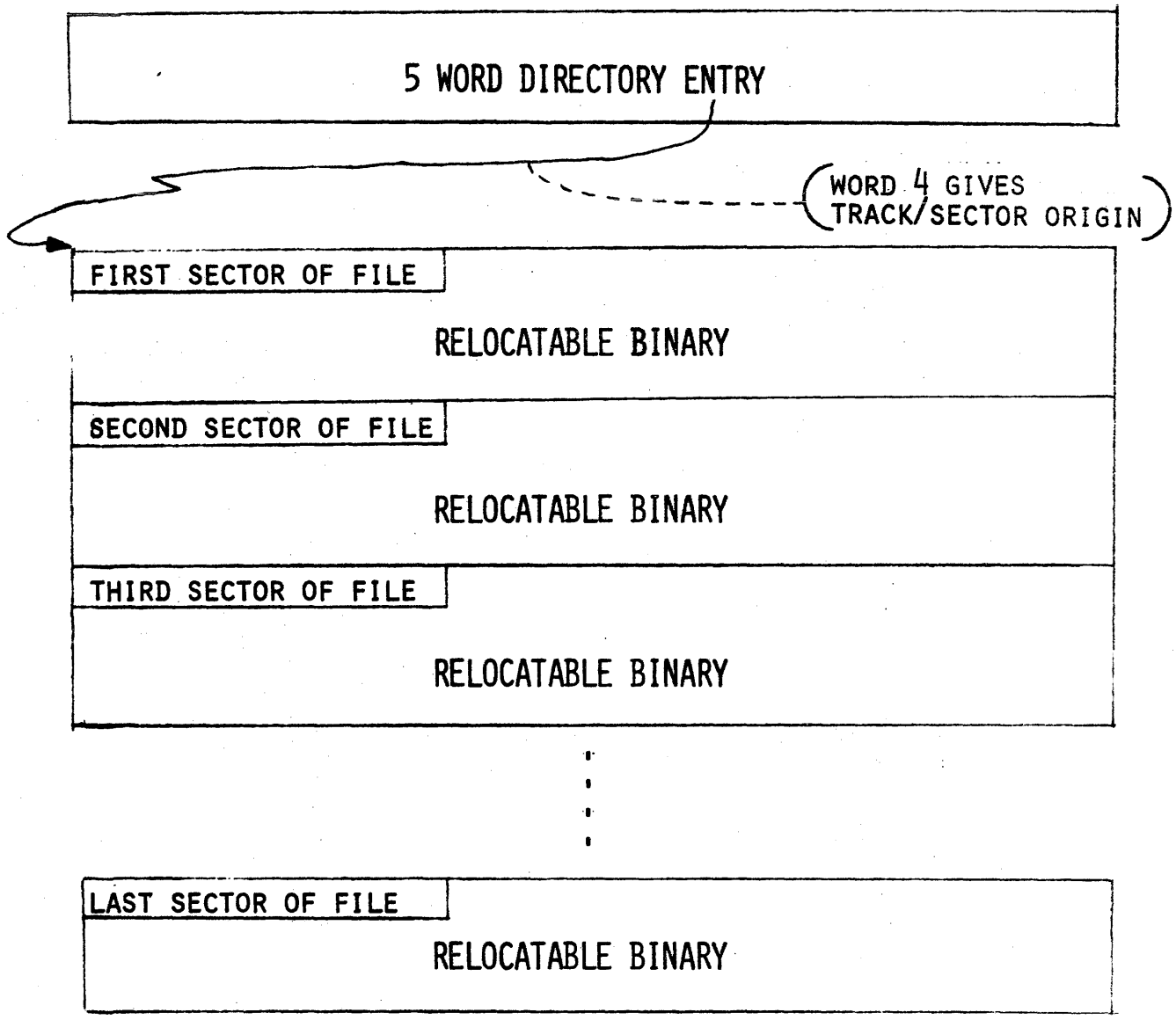
DOSM ABSOLUTE DISC FILE FORMAT

(ENTRY TYPES 1, 2, 3, 4, AND 5)



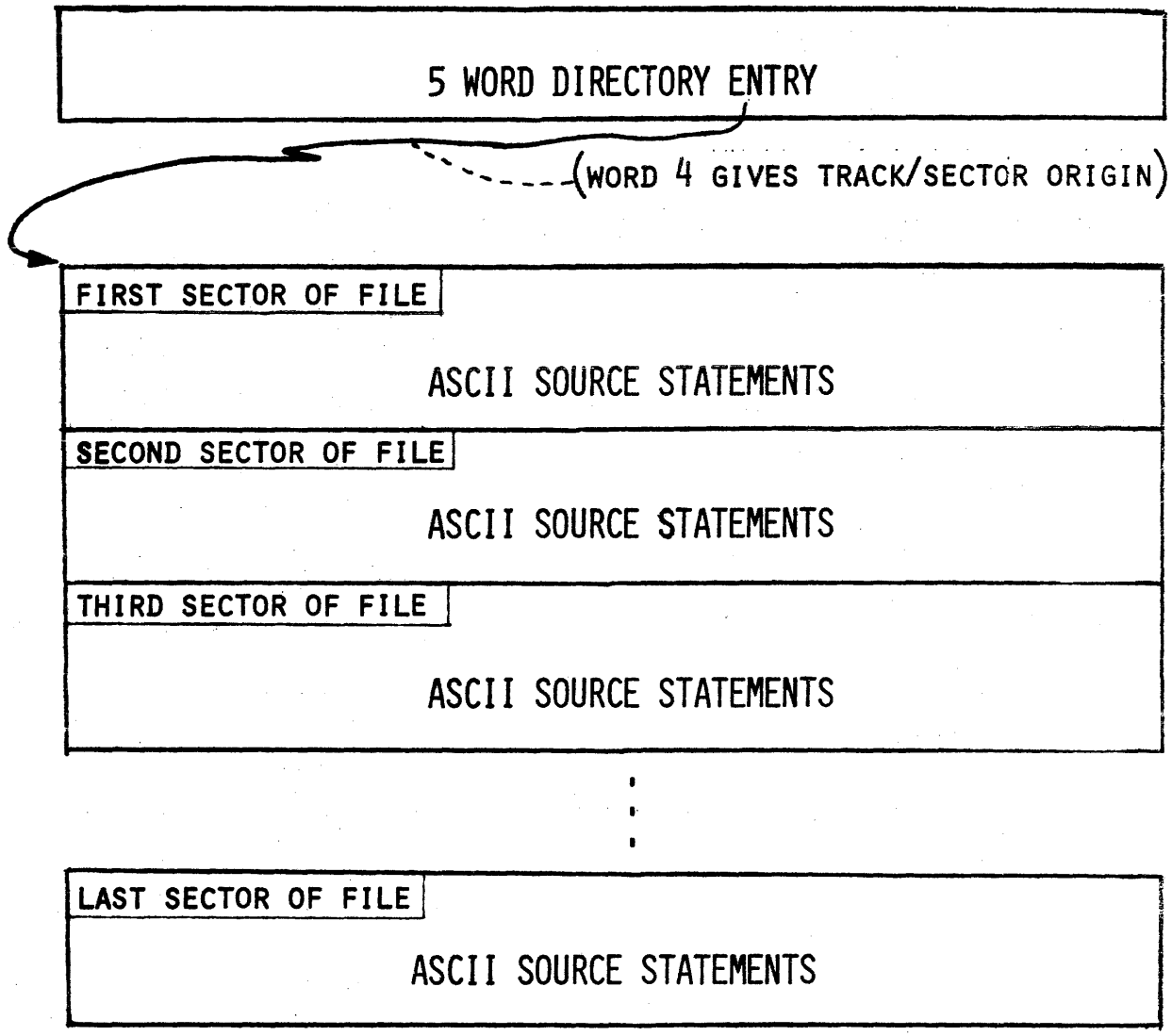
DOSM RELOCATABLE DISC FILE FORMAT

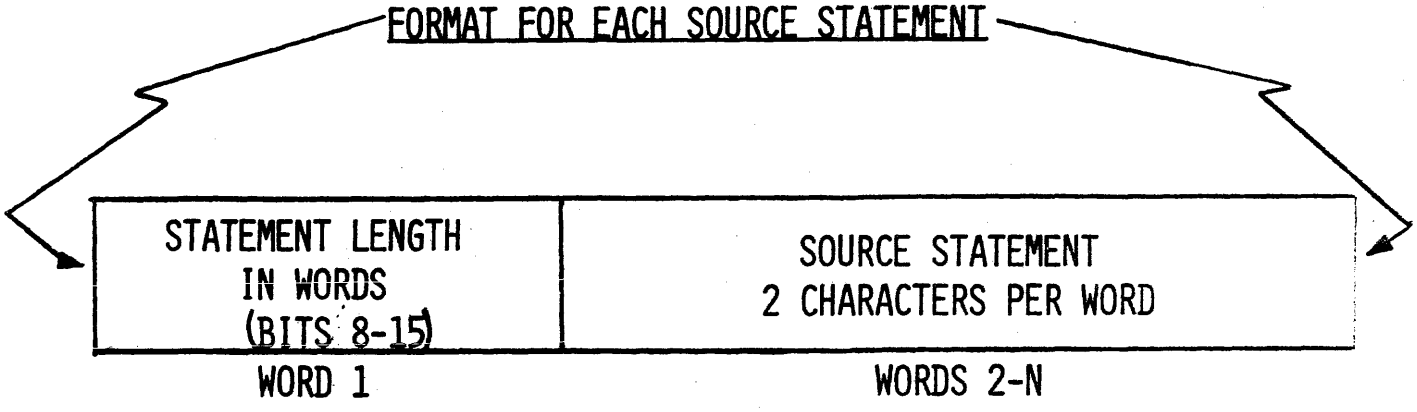
(ENTRY TYPES 6, 7 AND 8)



NOTE: "NAM" RECORD LENGTH FOR RTE/DOS/DOSM SYSTEMS IS 17 WORDS IN LENGTH WHICH IS INCOMPATABLE TO "NAM" RECORD LENGTH OF 9 WORDS OF BCS SYSTEMS.

DOSM ASCII SOURCE STATEMENT DISC FILE FORMAT
(ENTRY TYPE 9)





[SLIDE 45A]

ASCII SOURCE FILE FORMAT EXAMPLE

```
INPUT :DATE,XXXXXXXXXX,H,M

@:DA,27.OCT.70,9,15
SUBCHAN=1
LBL=QQQQQ
@
:JOB,ASCII
JOB ASCII 27.OCT.70  TIME=0555 MIN. 16.0 SECS.
@
:ST,S,SORSE,1

AAAA
BBBBB
CCCCCC
DDDDDDD
::
0004 LINES
@
:LIST,U,1,SORSE
NAME TYPE SCTRS DISC ORG PROG LIMITS   B.P. LIMITS   ENTRY LIBR.  P-BIT
USCHAN=1
SORSE SS  0001  T055 003
@
:SO,55,3
001 001000 040501 040501 001400 041102 041102 041040 001400
    041503 041503 041503 002000 042104 042104 042104 042040
    000000 177777 020000 036164 000000 041456 031062 020000
    036164 000000 046117 040504 051000 036155 000000 163252
    041120 051000 036146 000000 040523 046502 020000 036137
    000000 037501 051503 047000 036137 000000 037501 051515
    041000 036137 000000 037502 047103 047000 036137 000000
    037502 050113 052400 036137 000000 037503 044117 050000
    033403 000000 000312 000024 177767 040523 041511 044440
    031067 027117 041524 027067 030040 000000 000000 000000
    000000 000000 000000 000000 000000 000005 000001 000003
    000003 000004 000002 000001 000005 000000 000000 020473
    050521 050421 044456 031461 020000 037515 051531 046400
    036137 000000 037522 046125 047000 036137 000000 037501
    043114 043400 036137 000000 037514 051524 046000 036137
    000000 037514 052516 044400 036137 000000 037522 051502

@
```

SOURCE FILE CREATED

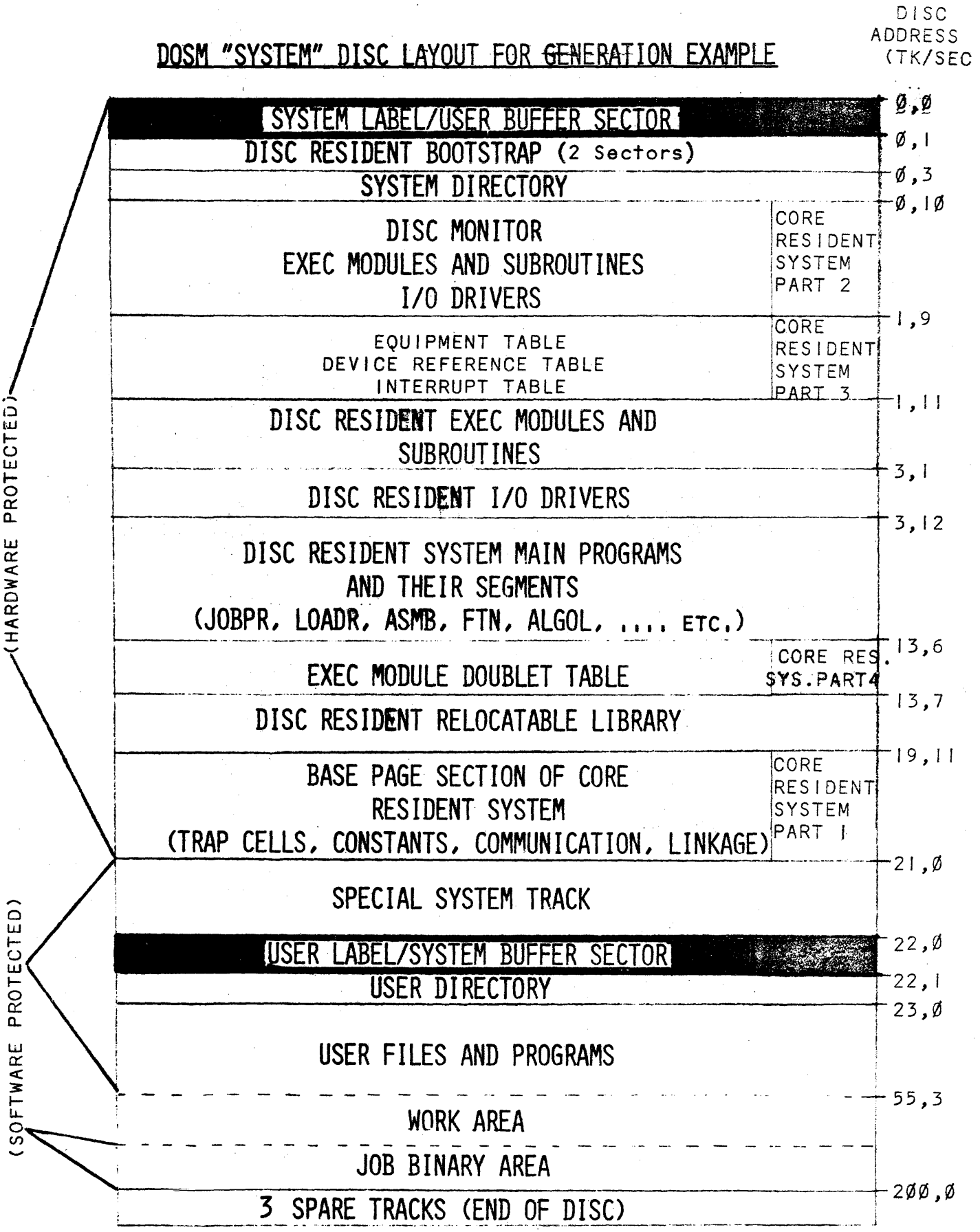
3 WORDS

3 WORDS

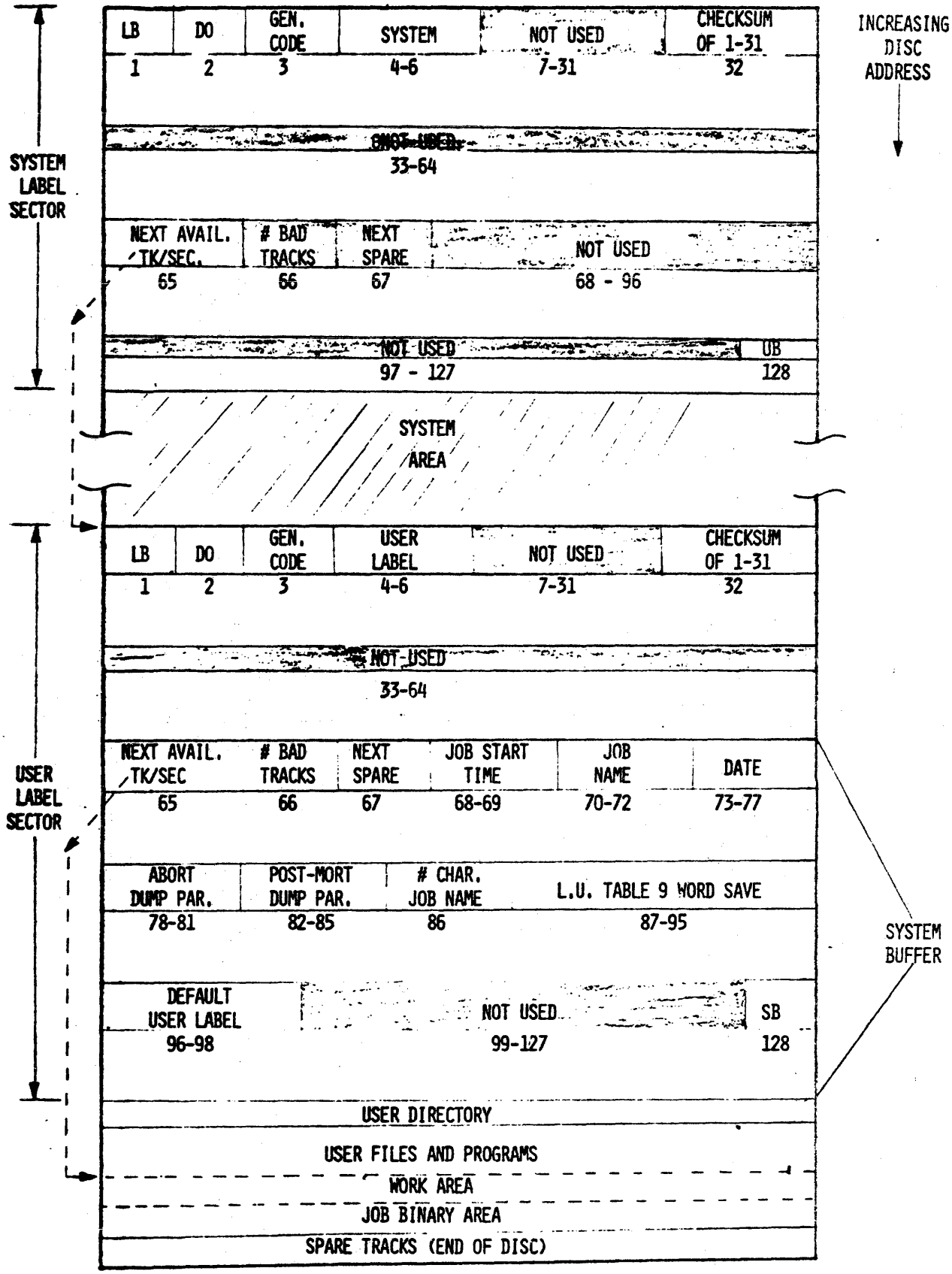
2 WORDS

EOF

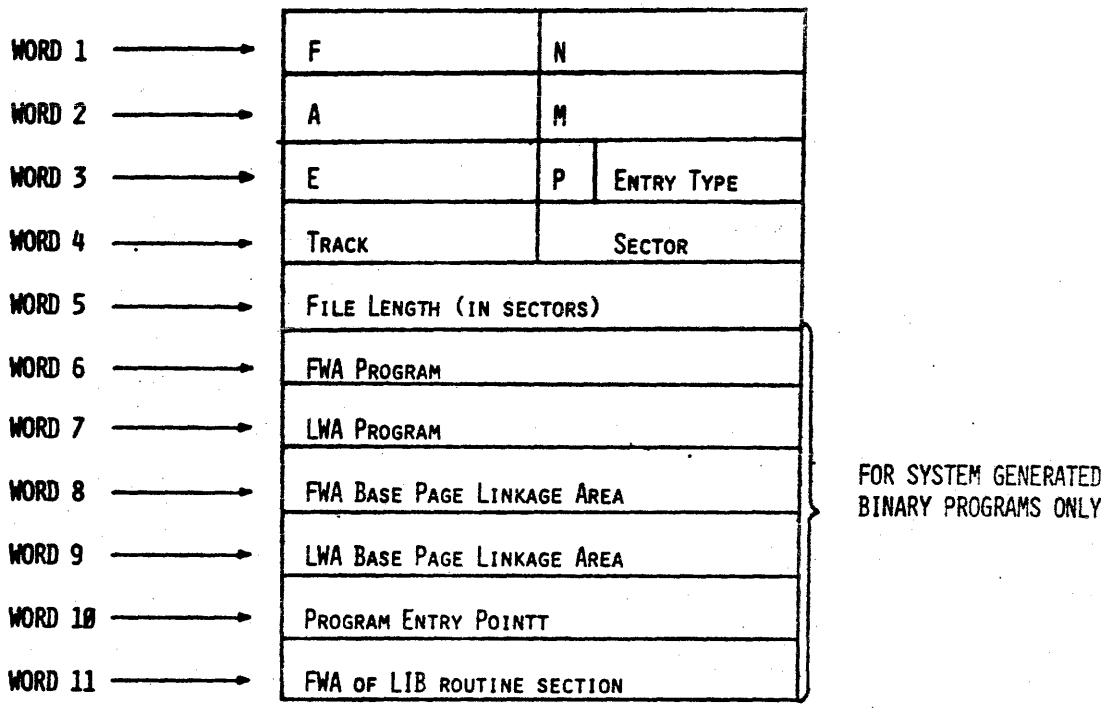
DOSM "SYSTEM" DISC LAYOUT FOR ~~GENERATION~~ EXAMPLE



"SYSTEM" DISC (LABEL SECTORS DESCRIPTION)



DIRECTORY ENTRY FORMAT



ENTRY TYPE	FILE
0	SYSTEM RESIDENT
1	DISC RESIDENT EXECUTIVE SUPERVISOR MODULE
2	CURRENTLY UNUSED
3	USER PROGRAM, MAIN
4	DISC RESIDENT DEVICE DRIVER
5	USER PROGRAM, SEGMENT
6,7	LIBRARY
10_8	RELOCATABLE BINARY
11_8	ASCII SOURCE STATEMENTS
12_8	BINARY DATA
13_8	ASCII DATA

'P' BIT

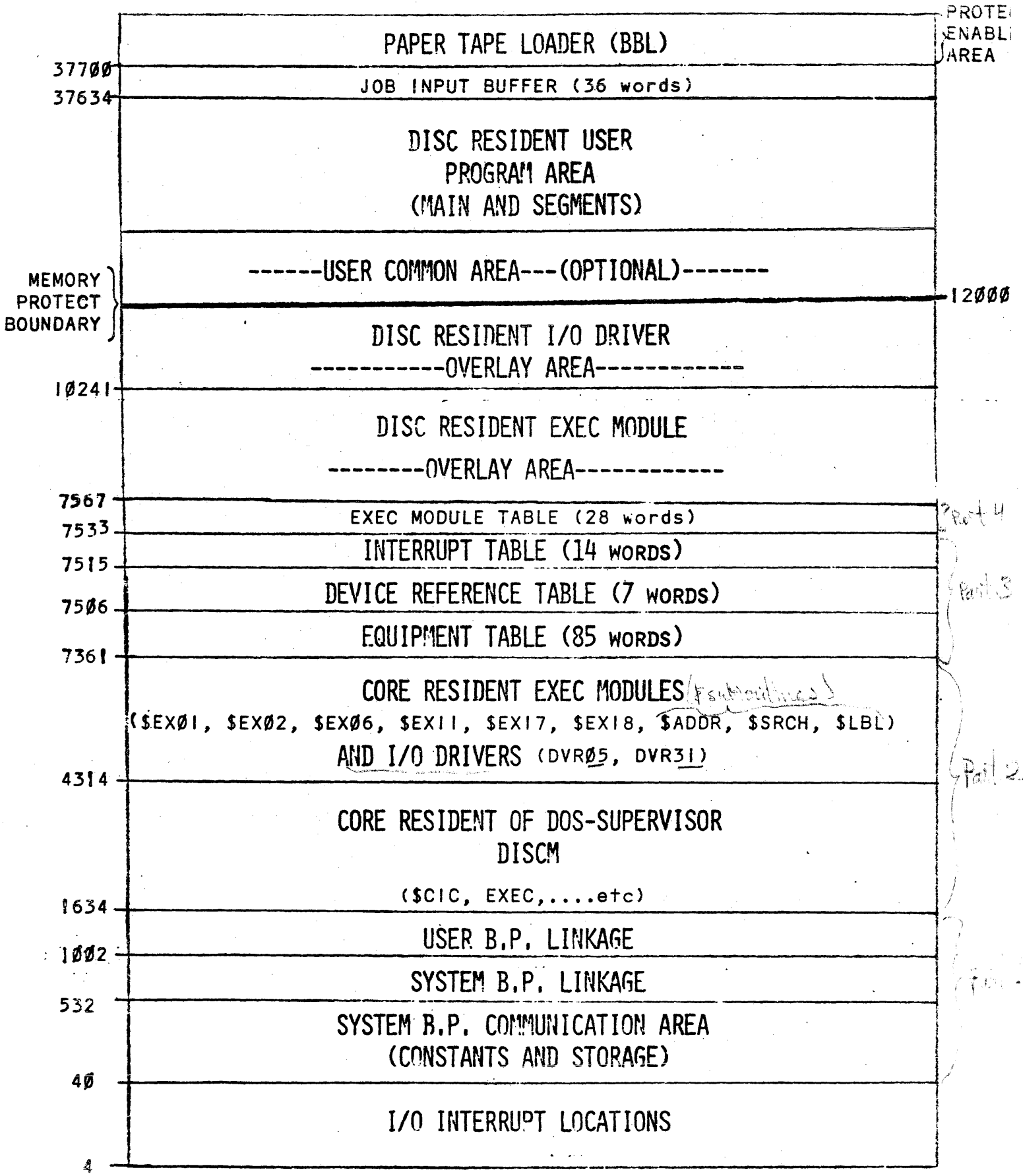
0 = NO ACTION

1 = PURGE THIS ENTRY AT THE END OF THE JOB OR FOLLOWING ANY EXECUTION OF :PU DIRECTIVE. THIS BIT IS SET BY THE LOADER AND CLEARED BY A :STORE,P,[file-name] REQUEST.

THE LAST DIRECTORY ENTRY IN EACH SECTOR IS FOLLOWED BY A WORD CONTAINING '-1' UNLESS THE GIVEN SECTOR IS EXACTLY FILLED WITH ENTRIES.

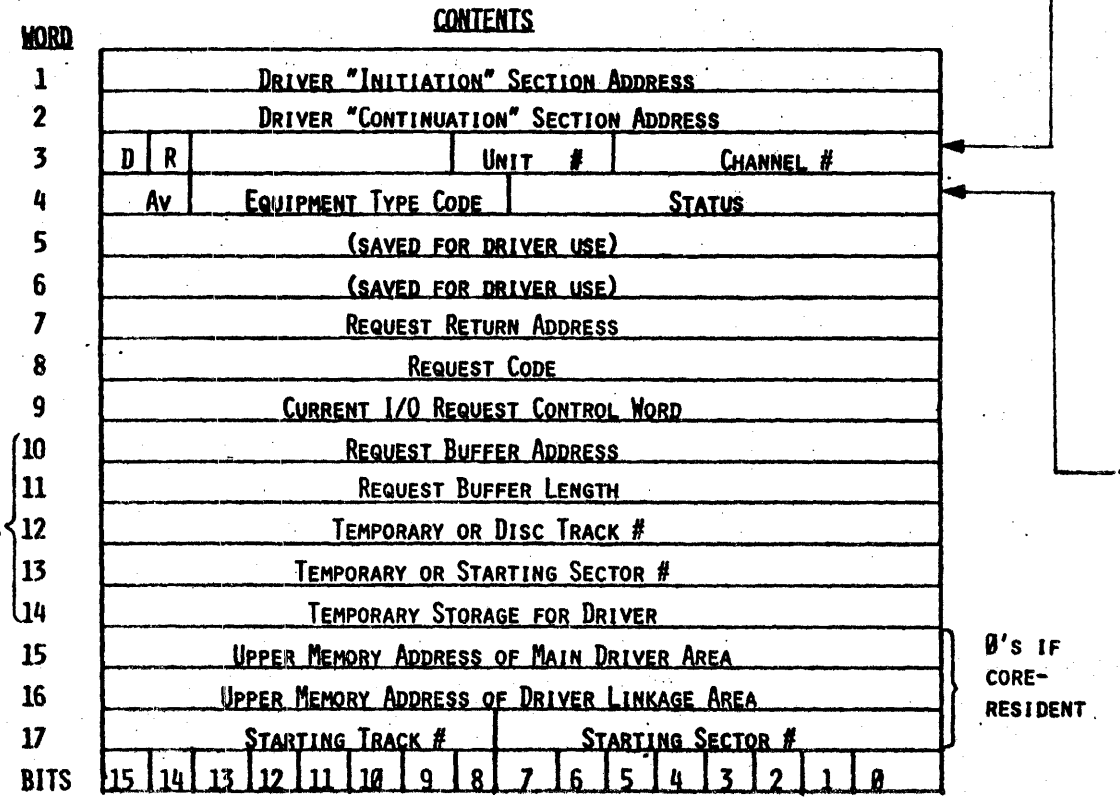
THE LAST ENTRY IN THE DIRECTORY IS FOLLOWED BY A WORD CONTAINING ZERO.

CORE MAP FOR DOSM SYSTEM GENERATION EXAMPLE (16K)



[SLIDE 53]

EQUIPMENT TABLE ENTRY FORMAT



D = 1 if DMA channel required.
R = 1 if driver type is core-resident.
Unit # May be used for sub-channel addressing.
Channel # I/O select code for device (lower number if multiboard interface.)

Av = Ø - Unit not busy and available
= 1 - Unit disabled (down)
= 2 - Unit busy
= 3 - Unit waiting for an available DMA channel (this field set by system)

Status - Actual or simulated unit status at end of operation (Driver must set this field)

Equipment Type Code - Identifies type of device and associated software driver. Assigned equipment type codes in octal are

Ø0-07	Papter Type Devices
Ø0	Teleprinter
Ø1	Punched Tape Reader
Ø2	High Speed Punch
Ø5	Teletype (System)
10-17	Unit Record Devices
10	Reserved for Plotter
12	Line Printer
15	Mark Sense Card Reader
20-37	Magnetic Tape/Mass Storage and other devices capable of both input and output.
22	3030 Magnetic Tape
31	Moving-Head Disc

For equipment type codes 1 through 17, odd number indicate input devices and even number indicate output devices (except 05, which is both input and output).

DEVICE REFERENCE TABLE FORMAT

EACH ENTRY IN THIS TABLE REQUIRES ONLY ONE WORD IN MEMORY. THE VALUE OF EACH ENTRY (DECIMAL NUMBER, 1-63) ASSOCIATES A LOGICAL UNIT NUMBER WITH AN EQUIPMENT TABLE ENTRY FOR THE SYSTEM IN THE FOLLOWING MANNER:

SEQUENCE IN MEMORY TABLE	LOGICAL UNIT #	FUNCTION
1	1	SYSTEM TELEPRINTER
2	2	USER MASS STORAGE
3	3	SYSTEM MASS STORAGE
4	4	STANDARD PUNCH DEVICE
5	5	STANDARD INPUT DEVICE
6	6	STANDARD LIST DEVICE
7-63	7-63	ANY DEVICE

INTERRUPT TABLE FORMAT

EACH ENTRY IN THIS TABLE REQUIRES ONLY ONE WORD IN MEMORY AND IS ASSOCIATED WITH EACH I/O CHANNEL IN THE COMPUTER (STARTING WITH LOCATION 6) WHICH CAN CAUSE AN INTERRUPT. EACH LOCATION IN THIS TABLE HAS AN ENTRY VALUE. MEMORY LOCATIONS ARE ASSOCIATED IN CONSECUTIVE INCREASING ORDER WITH AN I/O CHANNEL. TABLE VALUES ARE ZERO FOR AN I/O CHANNEL NOT REQUIRING INTERRUPT. I/O CHANNELS REQUIRING INTERRUPT CONTAIN THE START ADDRESS OF THE EQUIPMENT TABLE ENTRY OF THE ASSOCIATED DEVICE.

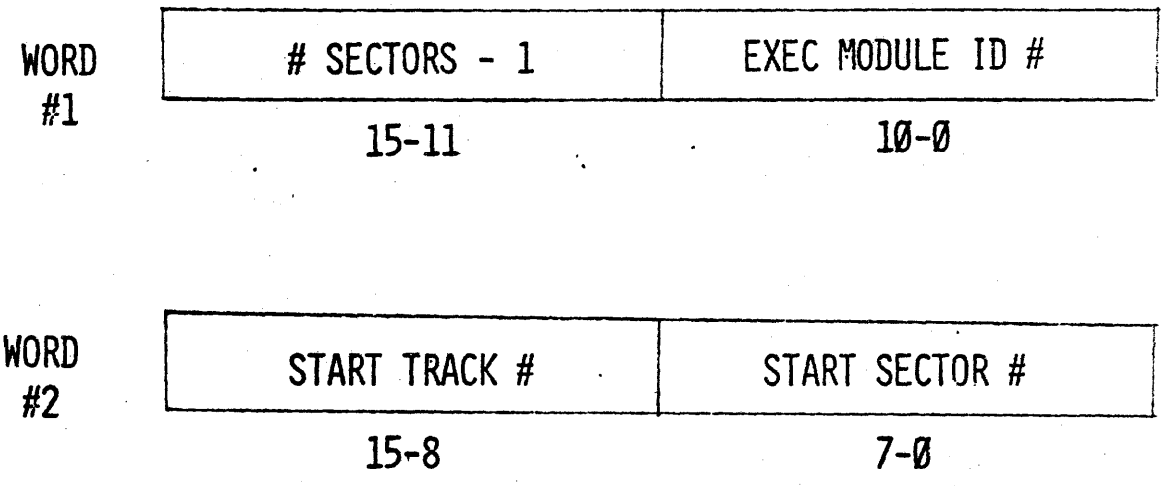
SYSTEM DIRECTORY LISTING FOR GENERATION EXAMPLE

NAME	TYPE	SCTRS	DISC	ORG	PROG LIMITS		B.P. LIMITS		ENTRY	LIBR.	P-BIT
SUBCHAN=1											
$EX03	XS	0002	T001	011	07567	07624	00732	00733	07567	07624	
$EX04	XS	0004	T001	013	07567	10176	00732	00741	07567	10176	
$EX05	XS	0002	T001	017	07567	07745	00732	00733	07567	07745	
$EX07	XS	0002	T001	019	07567	07746	00732	00733	07567	07746	
$EX08	XS	0002	T001	021	07567	07732	00732	00733	07567	07732	
$EX09	XS	0003	T001	023	07567	10142	00732	00763	07567	10142	
$EX10	XS	0002	T002	002	07567	07745	00732	00733	07567	07745	
$EX12	XS	0002	T002	004	07567	07761	00732	00733	07567	07761	
$EX13	XS	0004	T002	006	07567	10223	00732	00754	07567	10223	
$EX14	XS	0004	T002	010	07567	10241	00732	00751	07567	10241	
$EX15	XS	0003	T002	014	07567	10153	00732	00763	07567	10153	
$EX16	XS	0002	T002	017	07567	07722	00732	00733	07567	07722	
$EX19	XS	0003	T002	019	07567	10107	00732	01000	07567	10107	
$EX20	XS	0003	T002	022	07567	10167	00732	00761	07567	10167	
DVR01	DR	0003	T003	001	10241	10555	01000	01002	10241	10555	
DVR02	DR	0003	T003	004	10241	10443	01000	01002	10241	10443	
DVP22	DR	0005	T003	007	10241	11075	01000	01002	10241	11075	
LOADF	UM	0032	T003	012	12000	21032	01002	01425	12000	21032	
JOBPR	UM	0038	T004	020	12000	22463	01002	01414	12000	22463	
ASMB	UM	0023	T006	010	12000	17120	01002	01362	16522	17120	
ASMBD	US	0004	T007	009	17127	17647	01362	01363	17442	17647	
ASMB1	US	0006	T007	013	17366	20542	01362	01424	17366	20542	
ASMB2	US	0007	T007	019	17345	20550	01362	01410	17351	20550	
ASMB3	US	0003	T008	002	17473	17771	01362	01363	17630	17771	
ASMB4	US	0004	T008	005	17366	20027	01362	01371	17366	20027	
ASMB5	US	0006	T008	009	17345	20425	01362	01404	17351	20425	
FTN	UM	0006	T008	015	12000	13127	01002	01047	12000	13127	
FTN01	US	0031	T008	021	13254	22120	01047	01502	16550	22120	
FTN02	US	0025	T010	004	13254	21027	01047	01356	13741	21027	
FTN03	US	0024	T011	005	13254	20600	01047	01277	15117	20600	
FTN04	US	0025	T012	005	13254	20750	01047	01360	13702	20750	
LIBRY	LB	0147	T013	007							

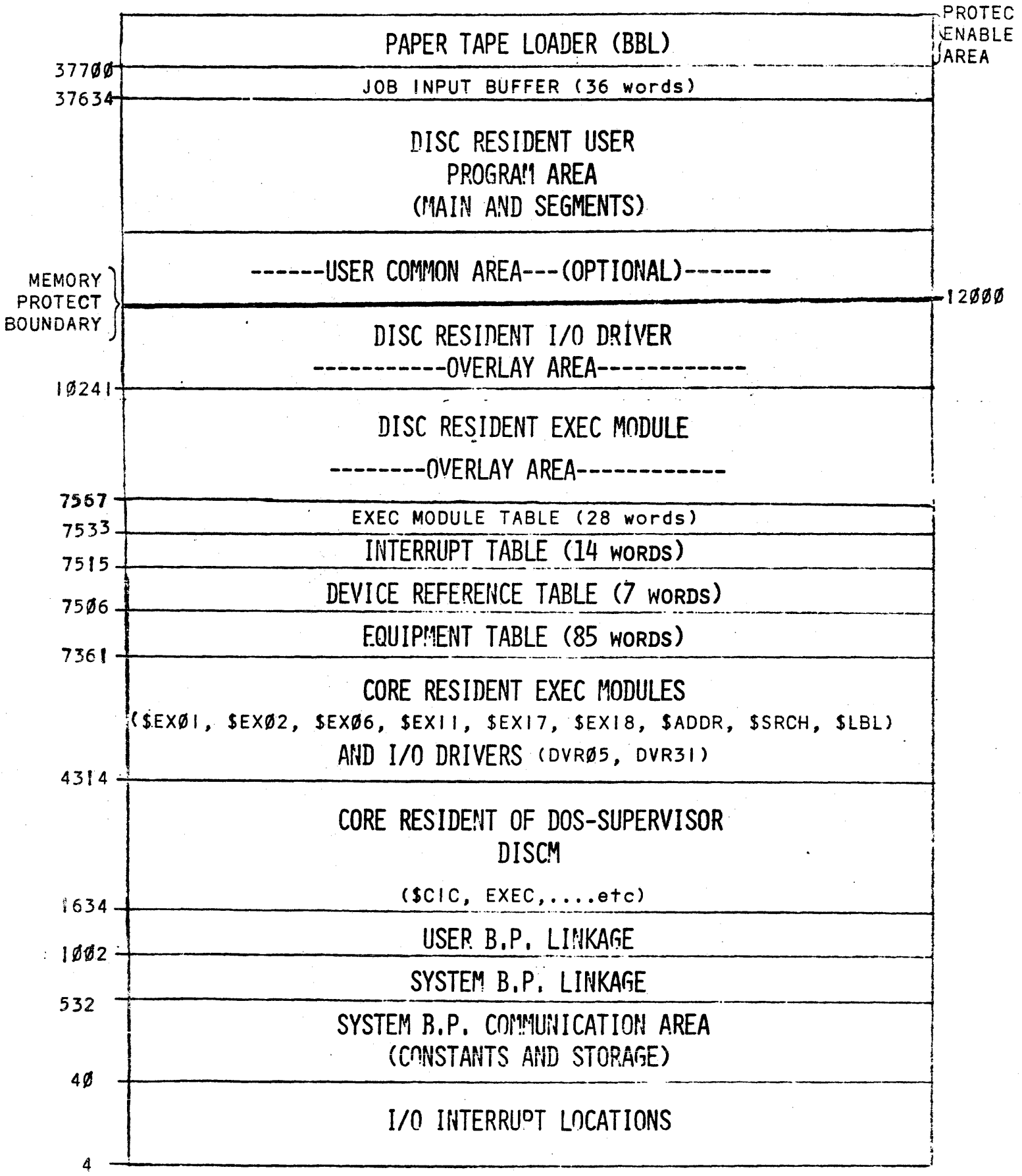
[SLIDE 56]

EXEC MODULE DOUBLET TABLE FORMAT

(TWO WORDS PER DISC RESIDENT EXEC MODULE)

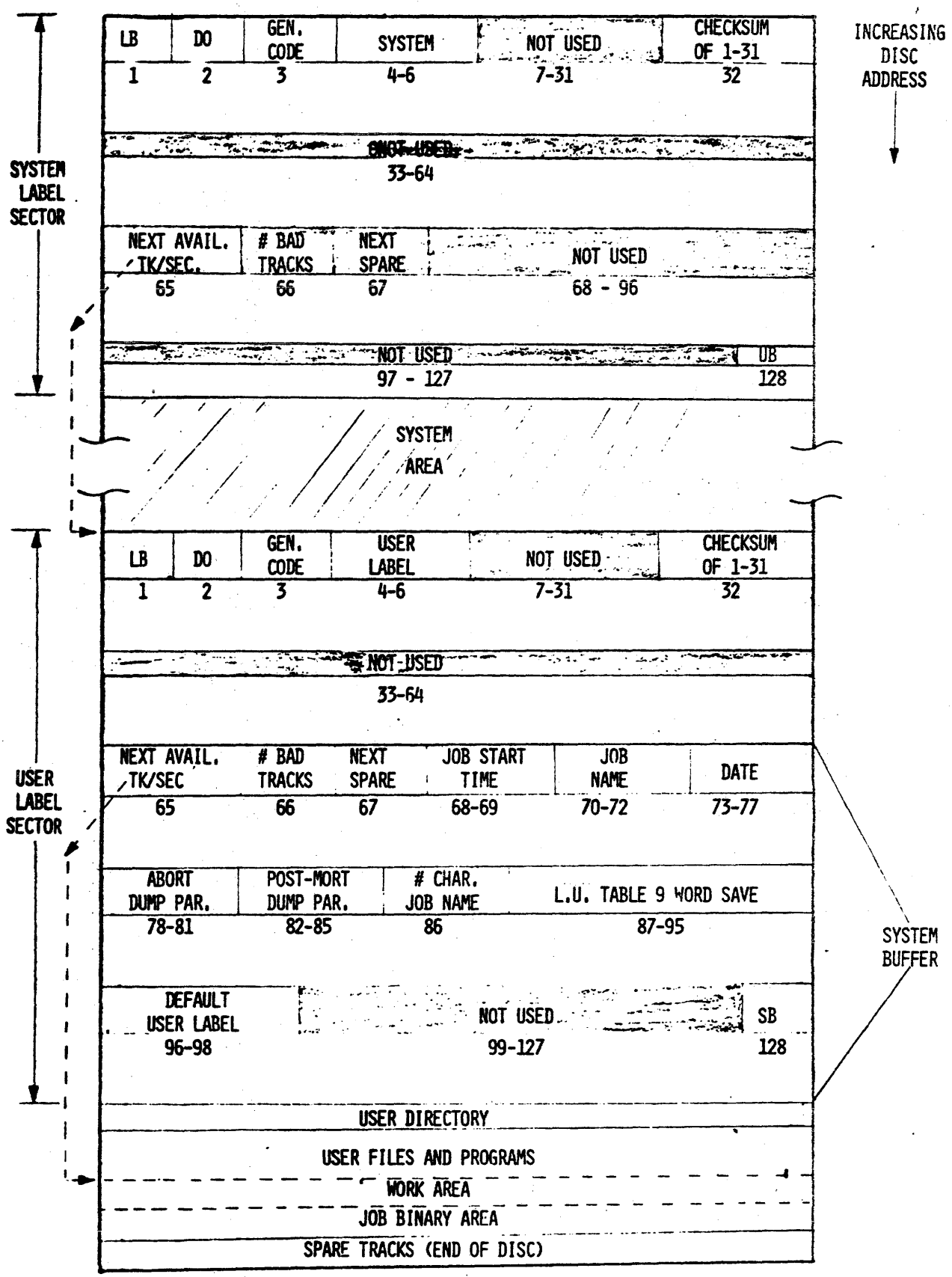


CORE MAP FOR DOSM SYSTEM GENERATION EXAMPLE (16K)



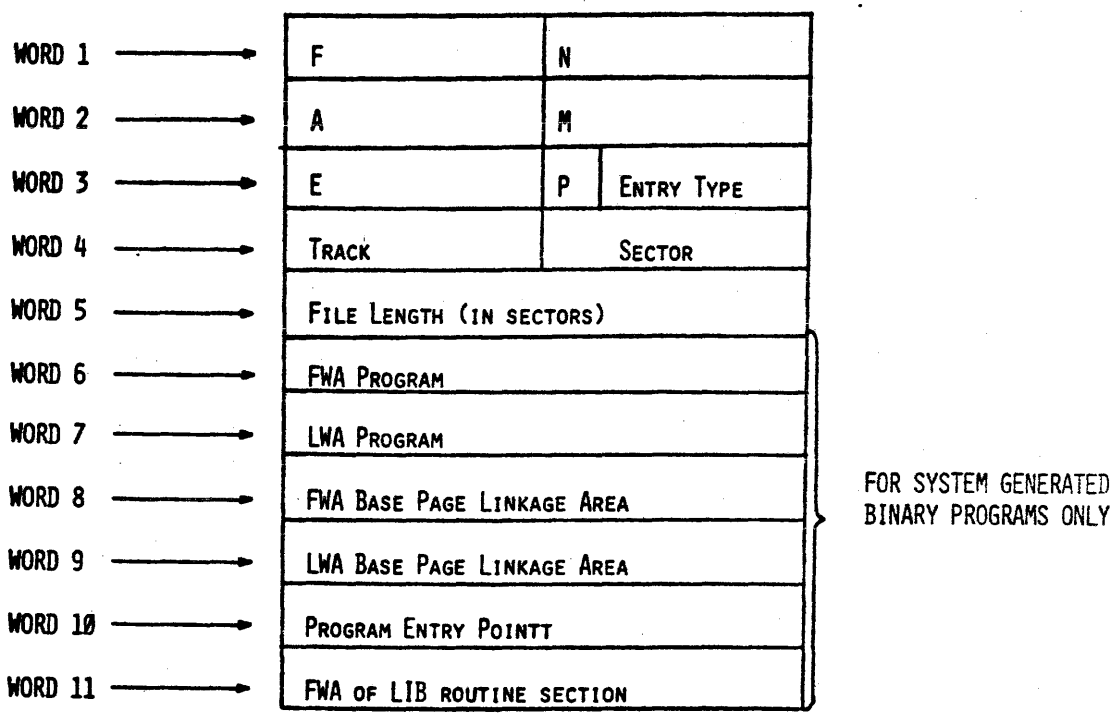
[SLIDE 58]

"SYSTEM" DISC (LABEL SECTORS DESCRIPTION)



[SLIDE 59]

DIRECTORY ENTRY FORMAT



ENTRY TYPE	FILE
0	SYSTEM RESIDENT
1	DISC RESIDENT EXECUTIVE SUPERVISOR MODULE
2	CURRENTLY UNUSED
3	USER PROGRAM, MAIN
4	DISC RESIDENT DEVICE DRIVER
5	USER PROGRAM, SEGMENT
6,7	LIBRARY
10_8	RELOCATABLE BINARY
11_8	ASCII SOURCE STATEMENTS
12_8	BINARY DATA
13_8	ASCII DATA

'P' BIT

0 = NO ACTION

1 = PURGE THIS ENTRY AT THE END OF THE JOB OR FOLLOWING ANY EXECUTION OF :PU DIRECTIVE. THIS BIT IS SET BY THE LOADER AND CLEARED BY A :STORE,P,[file-name] REQUEST.

THE LAST DIRECTORY ENTRY IN EACH SECTOR IS FOLLOWED BY A WORD CONTAINING '-1' UNLESS THE GIVEN SECTOR IS EXACTLY FILLED WITH ENTRIES.

THE LAST ENTRY IN THE DIRECTORY IS FOLLOWED BY A WORD CONTAINING ZERO.

USER DIRECTORY LISTING IN GENERATION EXAMPLE SYSTEM

NAME	TYPE	SCTRS	DISC	ORG	PROG LIMITS		B.P. LIMITS		ENTRY	LIBR.	P-BIT
SUBCHAN=1											
XREF	UM	0013	T023	000	12000	14750	01002	01036	12000	14071	
EOT1	SS	0001	T023	013							
WEOT	UM	0002	T023	014	12000	12013	01002	01003	12000	12013	
XREFR	RB	0016	T023	016							
DISCM	RB	0020	T024	008							
EXECS	RB	0063	T025	004							
DVR05	RB	0003	T027	019							
DVR31	RB	0005	T027	022							
LIBRY	RB	0143	T028	003							
DVR02	RB	0002	T034	002							
DVR01	RB	0003	T034	004							
DVR22	RB	0007	T034	007							
LODR	RB	0049	T034	014							
JOBP	RB	0065	T036	015							
ASMBL	RB	0040	T039	008							
ASMD	RB	0004	T041	000							
ASM3	RB	0004	T041	004							
ASM4	RB	0006	T041	008							
ASM5	RB	0010	T041	014							
FRTN	RB	0008	T042	000							
FTN1	RB	0048	T042	008							
FTN2	RB	0045	T044	008							
FTN3	RB	0042	T046	005							
FTN4	RB	0031	T047	023							
ASM1	RB	0012	T049	006							
ASM2	RB	0011	T049	018							
SIO1	SS	0005	T050	005							
BASC1	SS	0009	T050	010							
BOOT	SS	0021	T050	019							
FTNH	SS	0001	T051	016							
EOF	UM	0001	T051	017	12000	12013	01002	01002	12000	12013	
FSPCE	UM	0001	T051	018	12000	12013	01002	01002	12000	12013	
RWIND	UM	0001	T051	019	12000	12013	01002	01002	12000	12013	
D.00S	SS	0067	T051	020							
TSRTS	SS	0006	T054	015							
TSRTR	RB	0005	T054	021							
CLEAR	BD	0001	T055	002							

[SLIDE 61]

```
0004*
0005* ***** SEEK RECORD *****
0006*
0007  00002 000000  SEEK  NOP
0008  00003 064155        LDB CYL        CYLINDER (TRACK) NUMBER
0009  00004 100610        OTB DC         OUTPUT CYL# TO DATA CHNL      NOTE 1
0010  00005 103710        STC DC,C
0011  00006 060136        LDA SKCMD      LOAD SEEK COMMAND
0012  00007 054154        CPB LSTSK      * IF CYL# = LAST CYL# ACCESSED,
0013  00010 030151        IOR MSIGN      *    CHANGE CMND TO ADDRS RECORD
0014  00011 074154        STB LSTSK      * UPDATE LAST SEEK INDICATOR
0015  00012 030157        IOR DRV        INCLUDE DRIVE#                NOTE 2
0016  00013 100711        CLC CC
0017  00014 102611        OTA CC         OUTPUT SEEK/ADDRESS COMMAND
0018  00015 103711        STC CC,C         TO CMND CHNL
0019  00016 102310        SFS DC         <-- WAIT FOR CYL# ACCEPTANCE
0020  00017 024016        JMP *-1
0021  00020 060156        LDA RDSCT      HEAD:BITS 15-8; SECTOR:BITS 7-0
0022  00021 102610        OTA DC         OUTPUT HEAD/SECTOR TO DATA CHNL
0023  00022 103710        STC DC,C                NOTE 3
0024  00023 102311        SFS CC         * IN INTERRUPT MODE, EXIT HERE
0025  00024 024023        JMP *-1        *    AND RETURN ON INTERRUPT
0026  00025 014121        JSB STAT       <-- (CHECK STATUS)
0027  00026 124002        JMP SEEK,I
0028*
0029* NOTE: EITHER A SEEK (03002008) OR AN ADDRESS RECORD (13000008)
0030*       COMMAND MUST BE ISSUED PRIOR TO ANY OTHER DISC COMMAND
0031*       EXCEPT STATUS CHECK. ADDRESS RECORD MAY BE ISSUED ONLY
0032*       IF THE HEAD (ON THE SELECTED DRIVE) IS ALREADY IN POSITION
0033*       FOR THE CURRENT ACCESS; IT WILL EXECUTE FASTER THAN A
0034*       SEEK UNDER THESE CONDITIONS. THE CODING IN THE EXAMPLE
0035*       FOR CHECKING THIS CONDITION IS APPLICABLE ONLY TO A SINGLE
0036*       DRIVE SYSTEM. IN A MULTI-DRIVE ENVIRONMENT, PROVISION
0037*       MUST BE MADE TO MAINTAIN AND CHECK THE HEAD POSITION
0038*       INDICATOR FOR EACH DRIVE.
0039*
```

NOTE 1 : BITS 0-7 = CYLINDER # ; BITS 8-15 = 0

NOTE 2 : BITS 4-0 = COMMAND CODE ; BITS 0-1 = DRIVE #

NOTE 3 : BITS 8-9 = HEAD # ; BITS 0-2 = SECTOR #

```
0041*
0042*****  READ DATA  *****
0043*
0044  00027 000000  READ  NOP
0045  00030 060152        LDA DMACW      LOAD DMA CONTROL WORD,
0046  00031 030153        IOR DCHNL        INCLUDE DATA CHNL#,
0047  00032 102606        OTA 6            AND OUTPUT TO DMA CHNL
0048  00033 102702        CLC 2
0049  00034 060160        LDA CORAD      LOAD CORE BUFFER ADDRESS,
0050  00035 030151        IOR MSIGN        INCLUDE DIRECTION BIT,
0051  00036 102602        OTA 2            AND SET IN MEMORY ADDRESS REG
0052  00037 102702        STC 2
0053  00040 060161        LDA WDCNT      LOAD NEG # OF WORDS
0054  00041 102602        OTA 2            AND SET IN WORD COUNT REG
0055  00042 103710        STC DC,C       SET DATA CHNL FOR INPUT      NOTE 1
0056  00043 060140        LDA RDCMD      LOAD READ COMMAND
0057  00044 030157        IOR DRV        INCLUDE DRIVE#
0058  00045 100711        CLC CC                                      NOTE 2
0059  00046 102611        OTA CC         OUTPUT READ COMMAND TO CMND CHNL
0060  00047 103706        STC 6,C        START DMA
0061  00050 103711        STC CC,C       START DATA TRANSFER
0062  00051 100706        CLC 6          INHIBIT DMA INTERRUPT
0063  00052 102311        SFS CC         * IN INTERRUPT MODE, EXIT HERE
0064  00053 024052        JMP *-1        *   AND RETURN ON INTERRUPT
0065  00054 014121        JSB STAT       (CHECK STATUS)
0066  00055 124027        JMP READ,I
```

NOTE 1 : PREPARE DATA CHANNEL TO RECEIVE DATA FROM CONTROLLER

NOTE 2 : BITS 12-15 = READ COMMAND ; BITS 0-1 = DRIVE #

[SLIDE 69B]

```
0069*
0070****** WRITE *****
0070*
0071  00056 000000  WRITE NOP
0072  00057 060152        LDA DMACW       LOAD DMA CONTROL WORD,
0073  00060 030153        IOR DCHNL         INCLUDE DATA CHNL#,
0074  00061 102006        OTA 6             AND OUTPUT TO DMA CHNL
0075  00062 106702        CLC 2
0076  00063 060160        LDA CORAD       LOAD CORE BUFFER ADDRESS
0077  00064 102602        OTA 2             AND SET IN MEMORY ADDRESS REG
0078  00065 102702        STC 2
0079  00066 060161        LDA WDCNT       LOAD NEG # OF WORDS
0080  00067 102602        OTA 2             AND SET IN WORD COUNT REG
0081  00070 102110        STF DC          SET DATA CHANNEL FOR OUTPUT
0082  00071 060144        LDA WRCMD       LOAD WRITE COMMAND
0083  00072 030157        IOR DRV         INCLUDE DRIVE#
0084  00073 106711        CLC CC
0085  00074 102611        OTA CC          OUTPUT WRITE CMND TO CMND CHNL
0086  00075 103706        STC 6,C         START DMA
0087  00076 103711        STC CC,C        START DATA TRANSFER
0088  00077 106706        CLC 6           INHIBIT DMA INTERRUPT
0089  00100 102311        SFS CC          * IN INTERRUPT MODE, EXIT HERE
0090  00101 024100        JMP *-1         *   AND WAIT FOR INTERRUPT
0091  00102 014121        JSB STAT <-(CHECK STATUS)
0092  00103 124056        JMP WRITE,I
0093*
0094* NOTE: THE *WRITE* SEQUENCE ABOVE MAY BE USED,
0095*       WITH THE APPROPRIATE COMMAND, AS FOLLOWS:
0096*
0097*         COMMAND (OCTAL)      FUNCTION
0098*
0099*              0100000         WRITE DATA
0100*              0110000         INITIALIZE DATA
0101*                                (USED TO  INITIALIZE ADDRESS
0102*                                 FIELDS OF A NEW DISC)
0103*              0104000         FLAG DEFECTIVE CYLINDER
0104*              0114000         FLAG PROTECTED CYLINDER
0105*
0106*       ALL EXCEPT WRITE DATA REQUIRE THAT THE
0107*         DISC PROTECT OVERRIDE SWITCH BE TURNED ON
0108*
0109*       ALL OF THESE COMMANDS ACTUALLY WRITE DATA IN
0110*         THE SECTOR(S) BEING PROCESSED. IF THE WCR
0111*         GOES TO ZERO BEFORE THE END OF THE SECTOR
0112*         IS REACHED, THE REMAINDER OF THE SECTOR
0113*         WILL BE FILLED WITH ZEROS; THUS IF ZERO
0114*         WORDS ARE SPECIFIED, THE ENTIRE SECTOR IS
0115*         WRITTEN WITH ZEROS.
0116*
0117*       FLAG CYLINDER PROTECTED OR DEFECTIVE ARE SUBSETS
0118*         OF THE INITIALIZE DATA COMMAND, AND WRITE THE
0119*         ADDRESS FIELD(S) OF THE SECTOR(S) BEING PROCESSED.
0120*
```

```
0122*
0123***** CHECK DATA *****
0124*
0125  00104 000000  CHECK NOP
0126  00105 000162        LDA SCTRS     LOAD SECTOR COUNT TO BE CHECKED
0127  00106 102610        OTA DC          AND OUTPUT TO DATA CHANNEL
0128  00107 103710        STC DC,C                                  NOTE
0129  00110 000141        LDA CHCMD     LOAD CHECK DATA COMMAND       1
0130  00111 030157        IOR DRV       INCLUDE DRIVE#
0131  00112 100711        CLC CC
0132  00113 103611        OTA CC,C      OUTPUT CHECK COMMAND          NOTE 2
0133  00114 103711        STC CC,C        TO CMND CHNL
0134  00115 102311        SFS CC        * IN INTERRUPT MODE, EXIT HERE
0135  00116 024115        JMP *-1       *   AND RETURN ON INTERRUPT
0136  00117 014121        JSB STAT <--- (CHECK STATUS)
0137  00120 124104        JMP CHECK,I
```

NOTE 1 ; A = +(# SECTORS TO BE CHECKED) BITS 0-4

NOTE 2 : BITS 12-15 = CHECK DATA COMMAND

BITS 0-1 = DRIVE #

THE CONTROLLER EXECUTES THIS COMMAND MUCH AS IT DOES READ DATA ; HOWEVER, NO TRANSFER OF DATA OCCURS. RESULTS OF CHECK MAY BE OBTAINED WITH STATUS COMMAND CALL.

```
0139*
0140*****  STATUS CHECK  *****
0141*
0142  00121 000000  STAT  NOP
0143  00122 103100        CLF 0           (TURN OFF INTERR SYS IF IT'S ON)
0144  00123 103710        STC DC,C        SET DATA CHANNEL FOR INPUT
0145  00124 060157        LDA DRV         LOAD DRIVE#
0146  00125 100711        CLC CC
0147  00126 102611        OTA CC          OUTPUT STATUS COMMAND
0148  00127 103711        STC CC,C          TO CMND CHANNEL
0149  00130 102310        SFS DC
0150  00131 024130        JMP *-1
0151  00132 100711        CLC CC
0152  00133 102510        LIA DC          GET STATUS FROM DATA CHNL
0153  00134 102160        STF 0           (RESET INTERR SYS IF IT WAS ON)
0154  00135 124121        JMP STAT,I
0155*
0156*  NOTE: IOMEC STATUS BITS
0157*
0158*          15 - ATTENTION - OPERATION COMPLETED
0159*          14 - FIRST SEEK - DRIVE HAS GONE FROM NOT READY TO READY
0160*          13 - OVERRUN - LATE DATA TRANSFER - HARDWARE FAILURE
0161*          12 - READ/WRITE UNSAFE - HARDWARE FAILURE
0162*          11 - ACCESS UNSAFE - HARDWARE FAILURE
0163*          10 - ACCESS HUNTING - HARDWARE FAILURE
0164*           9 - SEEK INCOMPLETE - HARDWARE FAILURE
0165*           8 - SEEK CHECK - SOFTWARE ERROR (E.G., CYL# > 202)
0166*           7 - (NOT USED)
0167*           6 - NOT READY (ALSO SET WHEN BITS 11 AND/OR 12 SET)
0168*           5 - END OF CYLINDER - SOFTWARE ERROR - ATTEMPTED TO
0169*                 WRITE PAST THE END OF A CYLINDER
0170*           4 - ADDRESS ERROR - ADDRESS ISSUED DOES NOT AGREE WITH
0171*                 DISC ADDRESS - HARDWARE FAILURE OR DISC NOT
0172*                 INITIALIZED - OR - IF BIT 3 IS ALSO ON, THEN
0173*                 THE CYLINDER BEING PROCESSED HAS BEEN FLAGGED
0174*                 DEFECTIVE.
0175*           3 - FLAGGED CYLINDER - SET IF CYLINDER BEING PROCESSED
0176*               HAS BEEN FLAGGED PROTECTED OR (IF BIT 4 IS ALSO SET )
0177*               DEFECTIVE - OR - INITIALIZE DATA COMMAND HAS BEEN
0178*               ISSUED WITH DISC PROTECT OVERRIDE SWITCH OFF
0179*           2 - DRIVE BUSY - SEEK IN PROCESS
0180*           1 - DATA ERROR - CYCLIC CHECK INCORRECT
0181*           0 - ANY ERROR - TURNED ON WHEN ANY OF THE ABOVE EXCEPT
0182*                 BIT 15 OR, ON A READ OR CHECK DATA, BIT 3, IS SET.
0183*
0184* NOTE: ANY HARDWARE FAILURE WHICH DOES NOT SET BIT 6 MAY BE
0185*         RECOVERABLE ON RETRY.
0186*
```

```
0188*
0189*****  DATA CONSTANT AND STORAGE AREA *****
0190*
0191  00010            DC     EQU 10B          DATA CHANNEL (HIGH PRIORITY)
0192  00011            CC     EQU 11B          COMMAND CHANNEL (LOW PRIORTY)
0193*
0194  00136 030000     SKCMD  OCT 030000       SEEK RECORD COMMAND
0195  00137 130000     ADCMD  OCT 130000       ADDRESS RECORD COMMAND
0196  00140 020000     RDCMD  OCT 020000       READ DATA COMMAND
0197  00141 060000     CHCMD  OCT 060000       CHECK DATA COMMAND
0198  00142 000000     STCMD  OCT 000000       STATUS CHECK COMMAND
0199  00143 050000     RFCMD  OCT 050000       REFINE SECTOR COMMAND
0200*
0201  00144 000000     WRCMD  NOP              STORAGE FOR CURRENT WRITE CMND
0202*
0203  00145 010000     WDCMD  OCT 010000       WRITE DATA COMMAND
0204  00146 110000     INCMD  OCT 110000       INITIALIZE DATA COMMAND
0205  00147 111000     PCCMD  OCT 111000       FLAG PROTECTED CYLINDER CMND
0206  00150 110400     DCCMD  OCT 110400       FLAG DEFECTIVE CYLINDER CMND
0207*
0208  00151 100000     MSIGN  OCT 100000       BIT 15
0209  00152 120000     DMACW  OCT 120000       DMA CONTROL WORD
0210*
0211  00153 000010     DCHNL  OCT 10           DISC DATA CHNL# (HP)
0212  00154 000313     LSTSK  DEC 203          LAST SEEK IND. (INIT. > 202)
0213*
0214  00155 000000     CYL    NOP              CYLINDER#
0215  00156 000000     HDSCT  NOP              HEAD#(15-8), SCTR#(7-0)
0216  00157 000000     DRV    NOP              DRIVE#
0217  00160 000000     CORAD  NOP              CORE BUFFER ADDRESS
0218  00161 000000     WDCNT  NOP              NEG #WORDS TO BE TRANSFERRED
0219  00162 000000     SCTRS  NOP              POS #SCTRS TO BE CHECKED
0220*
0221                          END
** NO ERRORS*
```

[SLIDE 69F]

DOS-M SUPPLIED BOOTSTRAP ("A" VERSION)

```
0001                    ASMB,L,A
0002*
0003  00002                   ORG 2B
0004  00002 024223            JMP CONFG      <- GO CONFIGURE BOOTSTRAP
0005*
0006  00005                   ORG 5B
0007  00005 102501  BOOT      LIA 1          GET SYSTEM SUBCHNL
0008  00006 010200            AND M7
0009  00007 000065            CLE,ERA
0010  00010 070166            STA DRV#       SET DRIVE#
0011  00011 006400            CLB
0012  00012 106600            OTB DC         OUTPUT TRK#
0013  00013 103700            STC DC,C         FOR SEEK
0014  00014 030204            IOR SEEK
0015  00015 102601            OTA CC         OUTPUT SEEK CMND
0016  00016 103701            STC CC,C         TO COMMAND CHNL
0017  00017 102300            SFS DC         <- WAIT FOR TRACK # RECEIVED
0018  00020 024017            JMP *-1
0019  00021 060206            LDA HDSCT
0020  00022 002040            SEZ            SUBCHNL ON REMOVABLE PACK?
0021  00023 010200            AND M7           -YES, SET HEAD# = 0
0022  00024 102600            OTA DC         OUTPUT HEAD/SCTR
0023  00025 103700            STC DC,C         TO DATA CHNL
0024  00026 010203            AND M1774
0025  00027 070170            STA HDMSK
0026  00030 060207            LDA DMACW
0027  00031 102606            OTA 6          OUTPUT DMA CNTRL WORD
0028  00032 106702            CLC 2
0029  00033 060210            LDA MEMAD
0030  00034 102602            OTA 2          OUTPUT BFR ADDRS
0031  00035 102702            STC 2
0032  00036 060173            LDA N256
0033  00037 102602            OTA 2          OUTPUT WORD COUNT
0034  00040 102301            SFS CC         WAIT FOR SEEK
0035  00041 024040            JMP *-1          TO COMPLETE
0036  00042 014056            JSB STAT       <- CHECK STATUS
0037  00043 060205            LDA READ
0038  00044 030166            IOR DRV#
0039  00045 106701            CLC CC
0040  00046 102601            OTA CC         OUTPUT READ COMMAND
0041  00047 103700            STC DC,C       SET DATA CHNL FOR READ
0042  00050 103706            STC 6,C        START DMA
0043  00051 103701            STC CC,C       START READ OPERATION
0044  00052 102301            SFS CC         WAIT FOR READ
0045  00053 024052            JMP *-1          TO COMPLETE
0046  00054 014056            JSB STAT       <- CHECK STATUS
0047*
0048  00055 024110            JMP RELOC      GO RELOCATE BOOTSTRAP
0049*
0050  00056 000000  STAT      NOP
0051  00057 103700            STC DC,C
0052  00060 060166            LDA DRV#
0053  00061 106701            CLC CC
0054  00062 102601            OTA CC         OUTPUT STATUS CMND
0055  00063 103701            STC CC,C         TO COMMAND CHNL
0056  00064 102300            SFS DC
```

BOOTSTRAP PROPER

SET-UP DMA

```
0057  00065 024064          JMP *-1
0058  00066 102500          LIA DC <-------- GET STATUS
0059  00067 000010          SLA              ANY ERROR?
0060  00070 102011          HLT 11B           -YES
0061  00071 124056          JMP STAT,I
0062*
0063  00100                 ORG 100B         BOOTSTRAP START ADDRESS
0064  00100 024005          JMP BOOT
0065  00105                 ORG 105B
0066  00105 000222  DFEND   DEF CHSUM
0067*
0068  00110                 ORG 110B
0069*
0070  00110 002400  RELOC   CLA
0071  00111 170212          STA CLER1,I
0072  00112 170213          STA CLER2,I
0073  00113 060170          LDA HDMSK
0074  00114 170214          STA ABHDM,I     SAVE HEAD# FOR DISC-RES. BOOT
0075  00115 060166          LDA DRV#
0076  00116 170220          STA ABDRV,I
0077  00117 060165          LDA CHAN
0078  00120 170215          STA ACHNL,I     SAVE DISC I/O CHNLS
0079  00121 170216          STA ADCHN,I
0080  00122 002004          INA               FOR DISC-RESIDENT
0081  00123 170217          STA ACCHN,I       BOOTSTRAP
0082*
0083  00124 064221          LDB SPPNT
0084  00125 144221          ADB SPPNT,I                          ASPBF
0085  00126 160001          LDA B,I          GET ADDRESS OF [redacted]
0086  00127 010202          AND M76K         ISOLATE PAGE BITS
0087  00130 040176          ADA N2KB         SUBTRACT 1 PAGE
0088  00131 070171          STA PGMSK
0089  00132 160001          LDA B,I
0090  00133 010201          AND M1777
0091  00134 030171          IOR PGMSK                ASPBF
0092  00135 170001          STA B,I          ADJUST [redacted] ADDRESS
0093  00136 044175          ADB N1
0094  00137 160001          LDA B,I
0095  00140 010201          AND M1777
0096  00141 030171          IOR PGMSK
0097  00142 170001          STA B,I          ADJUST DEFDY
0098  00143 044175          ADB N1
0099  00144 160001          LDA B,I
0100  00145 010201          AND M1777
0101  00146 030171          IOR PGMSK
0102  00147 170001          STA B,I          ADJUST DVADR
0103  00150 060211          LDA DBOOT
0104  00151 010201          AND M1777
0105  00152 030171          IOR PGMSK
0106  00153 070172          STA RELBT        SET TRANSFER ADDRESS
0107  00154 064173          LDB N256
0108  00155 074167          STB WDCNT
0109  00156 164211  MVMOR   LDB DBOOT,I     *
0110  00157 174000          STB A,I          *
0111  00160 002004          INA              * RELOCATE
0112  00161 034211          ISZ DBOOT        * BOOTSTRAP
```

BOOTSTRAP PR. ER.

```
0113  00162 034167          ISZ WDCNT      *
0114  00163 024156          JMP MVMOR      *
0115*
0116  00164 124172          JMP RELBT,I    <-TRANSFER TO DISC-RES. BOOTSTRAP
0117*
0118  00000           DC     EQU 0          DISC DATA CHANNEL
0119  00001           CC     EQU 1          DISC CMND CHANNEL
0120  00165 000000    CHAN   NOP
0121  00166 000000    DRV#   NOP
0122  00167 000000    WDCNT  NOP
0123  00170 000000    HDMSK  NOP
0124  00171 000000    PGMSK  NOP
0125  00172 000000    RELBT  NOP
0126  00173 177400    N256   DEC -256
0127  00174 177405    N251   DEC -251
0128  00175 177777    N1     DEC -1
0129  00176 176000    N2KB   OCT -2000
0130  00177 177700    N100   OCT -100
0131  00200 000007    M7     OCT 7
0132  00201 001777    M1777  OCT 1777
0133  00202 076000    M76K   OCT 76000
0134  00203 177400    M1774  OCT 177400
0135  00204 030000    SEEK   OCT 030000
0136  00205 020000    READ   OCT 020000
0137  00206 001001    HDSCT  OCT 001001
0138  00207 120000    DMACW  OCT 120000
0139  00210 115400    MEMAD  OCT 115400
0140  00211 015400    DBOOT  OCT 15400
0141  00212 015771    CLER1  OCT 15771
0142  00213 015772    CLER2  OCT 15772
0143  00214 015772    ABHDM  OCT 15772
0144  00215 015773    ACHNL  OCT 15773
0145  00216 015774    ADCHN  OCT 15774
0146  00217 015775    ACCHN  OCT 15775
0147  00220 015776    ABDRV  OCT 15776
0148  00221 015777    SPPNT  OCT 15777
0149*
```

BOOTSTRAP PROPER

[SLIDE 70C]

BOOTSTRAP CONFIGURATOR

```
0151*
0152  00222 000000  CHSUM NOP
0153*
0154  00223 102501  CONFG LIA 1          GET DISC DATA CHANNEL
0155  00224 010337        AND B77
0156  00225 070165        STA CHAN
0157  00226 030207        IOR DMACW
0158  00227 070207        STA DMACW      CONFIGURE DMA CNTRL WORD
0159  00230 060337        LDA B77
0160  00231 003000        CMA
0161  00232 040327        ADA DEFBT
0162  00233 070330        STA CNTR
0163  00234 064327        LDB DEFBT
0164  00235 006004  CLOOP  INB            *
0165  00236 160001        LDA B,I        *
0166  00237 002021        SSA,RSS        * CONFIGURE ALL
0167  00240 024247        JMP CNEXT      *
0168  00241 010340        AND MASK       *   DISC I/O
0169  00242 002002        SZA            *
0170  00243 024247        JMP CNEXT      *   INSTRUCTIONS
0171  00244 160001        LDA B,I        *
0172  00245 040165        ADA CHAN       *   IN BOOTSTRAP
0173  00246 170001        STA B,I        *
0174  00247 034330  CNEXT ISZ CNTR
0175  00250 024235        JMP CLOOP
0176*
0177  00251 102501        LIA 1
0178  00252 002020        SSA            PUNCH CONFIGURED BOOTSTRAP?
0179  00253 024256        JMP *+3         -YES
0180*
0181  00254 102077        HLT 77B        -NO (HALT IRREGOUGRABLE)
0182  00255 024254        JMP *-1
0183*
```

[SLIDE 70D]

PUNCH CONFIGURATED BOOTSTRAP

```
0185  00256 060334          LDA .2
0186  00257 070326          STA ABSAD      SET BOOTSTRAP START ADDRESS
0187  00260 003004          CMA,INA
0188  00261 040105          ADA DFEND
0189  00262 070331          STA TEMP       SAVE BOOTSTRAP END ADDRESS
0190  00263 001727          ALF,ALF
0191  00264 010203          AND M1774
0192  00265 070325          STA RCLNG      SET PUNCH RECORD LENGTH
0193*
0194  00266 002400          CLA
0195  00267 070002          STA 2B
0196  00270 070003          STA 3B
0197  00271 070004          STA 4B
0198  00272 060331          LDA TEMP
0199  00273 003004          CMA,INA
0200  00274 070330          STA CNTR       SET COUNTER FOR CHECKSUM
0201  00275 060326          LDA ABSAD
0202  00276 064334          LDB .2
0203  00277 140001  KLOOP   ADA B,I        *
0204  00300 006004          INB            * GENERATE
0205  00301 034330          ISZ CNTR       *   CHECKSUM
0206  00302 024277          JMP KLOOP      *   FOR BBL
0207  00303 070222          STA CHSUM      *
0208*
0209  00304 060332  PMORE   LDA N50
0210  00305 064341          LDB AFDFR
0211  00306 114103          JSB HSPDR,I    PUNCH LEADER
0212*
0213  00307 060333          LDA N2
0214  00310 064324          LDB SHREC
0215  00311 114103          JSB HSPDR,I    PUNCH RECORD LENGTH, ABS ADDRS
0216*
0217  00312 060331          LDA TEMP
0218  00313 003004          CMA,INA
0219  00314 002004          INA
0220  00315 064336          LDB .4
0221  00316 114103          JSB HSPDR,I    PUNCH BOOTSTRAP
0222*
0223  00317 060332          LDA N50
0224  00320 064341          LDB AFDFR
0225  00321 114103          JSB HSPDR,I    PUNCH TRAILER
0226*
0227  00322 102077          HLT 77B
0228  00323 024304          JMP PMORE
0229*
0230  00324 000325  SHREC   DEF *+1
0231  00325 000000  RCLNG   NOP
0232  00326 000000  ABSAD   NOP
0233  00000         A       EQU 0B
0234  00001         B       EQU 1B
0235  00103         HSPDR   EQU 103B
0236  00327 000005  DEFBT   DEF BOOT
0237  00330 000000  CNTR    NOP
0238  00331 000000  TEMP    NOP
0239  00332 177716  N50     DEC -50
0240  00333 177776  N2      DEC -2
```

```
0241   00334 000002   .2      OCT 2
0242   00335 000003   .3      OCT 3
0243   00336 000004   .4      OCT 4
0244   00337 000077   B77     OCT 77
0245   00340 070036   MASK    OCT 070036
0246*
0247   00341 000342   AFDFR   DEF *+1
0251                          LST
0252*
0253                          END
**   NO ERRORS*
```

DOS-M DISC RESIDENT BOOTSTRAP


```
0350  15400                ORG 15400B
0351*
0352*  THE FOLLOWING LOADER PERMITS LOADING OF THE RESIDENT PORTIONS
0353*  OF THE DISC MONITOR SYSTEM. THE LOADER IS LOCATED ON SECTORS 1 & 2
0354*  TRACK 0 OF THE SYSTEM DISC.  IT IS GENERATED BY THE SYSTEM
0355*  GENERATOR AND CONSISTS OF:
0356*
0357*  (1) THE INSTRUCTIONS REQUIRED FOR LOADING THE SYSTEM
0358*  (2) THE DISK AND CORE ADDRESSES SPECIFYING LOADING
0359*
0360*
0361*  THE ADDRESSES REQUIRED FOR LOADING ARE THE FOLLOWING:
0362*
0363*  (A) BASE PAGE LINKAGES
0364*      (1) LOW CORE ADDRESS
0365*      (2) HIGH CORE ADDRESS
0366*      (3) DISK ADDRESS OF ABSOLUTE CODE
0367*
0368*  (B) SYSTEM, R1 RESIDENT MAIN
0369*      (1) LOW CORE ADDRESS
0370*      (2) HIGH CORE ADDRESS
0371*      (3) DISK ADDRESS OF ABSOLUTE CODE
0372*
0373*  RELEASED "A" VERSION 10-70
0374*
0375*
0376*
0377  15400 000000  START NOP
0378  15401 06/731        LDB DEFDY
0379  15402 01/570        JSB CNFGR     CONFG. BOOTSTRAP I/O INSTR.
0380  15403 06/732        LDB ASPBF     GET APPRS OF DISC SPEC. BFR
0381  15404 077762        STB SPCAD     SET CURRENT SPBUF ADDRESS
0382  15405 01/613        JSB PLOAD     LOAD BP LINKAGES
0383  15406 01/613        JSB PLOAD     LOAD MAIN SYSTEM
0384  15407 01/613        JSB PLOAD     LOAD I/O TABLES
0385  15410 01/613        JSB PLOAD     LOAD EXEC DOUBLETS
0386*
0387  15411 064120        LDB BEQT#     GET # OF EQUIPMENT
0388  15412 00/004        CMB,INB         TABLE ENTRIES AND
0389  15413 07/310        STB CNTR        STORE NEGATIVE
0390  15414 064117        LDB BEQTB     GET FWA OF EQUIPMENT TABLE
0391  15415 044055  CNFG1  ADB .2
0392  15416 160001        LDA B,I       A = 3RD WORD OF EQT entry
0393  15417 044051        ADB .2N
0394  15420 010072        AND M.77
0395  15421 075773        STA CHANL     SAVE I/O CHANNEL#
0396  15422 055774        CPA RUND1       =RUN TIME DISC DATA CHNL?
0397  15423 077763        STB SWP1        -YES, SAVE
0398  15424 055775        CPA RUND2       =RUN TIME DISC CMND CHNL?
0399  15425 077764        STB SWP2        -YES, SAVE
0400  15426 077304        STB EQCUR     SAVE CURRENT EQPT TABLE ADDRESS
0401  15427 044056        ADB .3
0402  15430 160001        LDA B,I       A = 4TH WORD OF EQT Entry
0403  15431 001727        ALF,ALF
0404  15432 013752        AND M.377
0405  15433 075305        STA EWPCD     SAVE EQPT TYPE CODE
```

LOAD CORE RESIDENT SYSTEM

DOS-M DISC RESIDENT BOOTSTRAP


```
0406  15434 050060          CPA .5          =SYSTEM TELETYPE?
0407  15435 02/460          JMP CNFG4        -YES
0408  15436 053765          CPA DISK        =DISC ?
0409  15437 02/445          JMP CNFG3        -YES
0410  15440 06/304 CNFG2    LDB EQCUR
0411  15441 044066          ADB .17D        INCR TO NEXT EQPMT TABLE ENTRY
0412  15442 03/310          ISZ CNTR        CHECKED ALL ENTRIES?
0413  15443 02/415          JMP CNFG1        -NO
0414  15444 02/505          JMP CNFG7        -YES
0415  15445 044052 CNFG3    ADB .1N
0416  15446 160001          LDA B,I
0417  15447 023773          XOR CHANL
0418  15450 033774          IOR RUND1
0419  15451 170001          STA B,I         SET DISC EQPT TABLE AT RUN TIME
0420  15452 063773          LDA CHANL
0421  15453 073302          STA GEND1       SAVE DISC I/O CHN2 AT GEN. TIME
0422  15454 002004          INA
0423  15455 073303          STA GEND2        SAVE GEN. DISC CMND CHNL
0424  15456 063774          LDA RUND1
0425  15457 073773          STA CHANL       SET CHAN= RUN TIME DISC CHNL
0426  15460 06/304 CNFG4    LDB EQCUR
0427  15461 160001          LDA B,I
0428  15462 073730          STA DVADR       SAVE DRIVER ENTRY POINT
0429  15463 164000          LDB A,I         GET CONFIGURATION STOP POINT
0430  15464 01/570          JSB CNFGR  <-- CONF. ALL I/O INST. IN DRIVER
0431*
0432  15465 063305          LDA EQPCD       GET EQPMT TYPE CODE
0433  15466 050060          CPA .5           =SYSTEM TELETYPE?
0434  15467 02/440          JMP CNFG2        -YES
0435  15470 006004          INB              -NO, MUST BE DISC
0436  15471 160001          LDA B,I
0437  15472 033773          IOR CHANL       CONFIGURE DMA CNTRL WORD
0438  15473 170001          STA B,I          AND STORE
0439  15474 006004          INB
0440  15475 063747          LDA #SPIK       * SET + AND -
0441  15476 170001          STA B,I         *  SECTORS/TRACK
0442  15477 006004          INB             *     IN
0443  15500 003004          CMA,INA         *  DISC DRIVER
0444  15501 170001          STA B,I         *
0445  15502 06/304          LDB EQCUR       SAVE ADDRESS OF
0446  15503 07/311          STB EQDSK         DISC EQPMT TABLE
0447  15504 02/440          JMP CNFG2
0448*                                       CONTINUE
0449  15505 060154 CNFG7    LDA BDSCO       *
0450*
0451  15506 001722          ALF,RAL         *
0452  15507 013767          AND M.740       * SET RUN TIME
0453  15510 033774          IOR RUND1       *   DISC CHANNEL
0454  15511 001727          ALF,ALF         *   IN *DISCO*
0455  15512 001723          ALF,RAR         *
0456  15513 070154          STA BDSCO       *
0457*
0458  15514 063763          LDA SWP1        *
0459  15515 06/302          LDB GEND1       * SET NEW ENTRIES
0460  15516 01/606          JSB INSWP       *   IN SYS GEN. TIME
0461  15517 063764          LDA SWP2        *   DISC CHANNEL
```

DOS-M DISC RESIDENT BOOTSTRAP


```
0462  15520 067303          LDB GEND2      *   INTERRUPT TABLE LOCATIONS
0463  15521 017606          JSB INSWP      *
0464*
0465  15522 002400          CLA            *
0466  15523 067774          LDB RUND1      * SET RUN TIME
0467  15524 017606          JSB INSWP      *   DISC CHANNELS
0468  15525 063311          LDA EQDSK      *     IN
0469  15526 067775          LDB RUND2      *   INTERRUPT TABLE
0470  15527 017606          JSB INSWP      *
0471*
0472  15530 067763          LDB SWP1       *
0473  15531 006003          SZB,RSS        *
0474  15532 027540          JMP SWAP2      * SET NEW I/O CHANNELS
0475  15533 044055          ADB .2         *
0476  15534 160001          LDA B,I        *   IN EQUIPMENT TABLE ENTRIES
0477  15535 023774          XOR RUND1      *
0478  15536 033302          IOR GEND1      *   OF DEVICES
0479  15537 170001          STA B,I        *
0480  15540 067764  SWAP2   LDB SWP2       *   SWAPPED
0481  15541 006003          SZB,RSS        *
0482  15542 027546          JMP SWPSC      *   WITH RUN TIME DISC
0483  15543 023775          XOR RUND2      *
0484  15544 033303          IOR GEND2      *
0485  15545 170001          STA B,I        *
0486*
0487  15546 063776  SWPSC   LDA BDRV#
0488  15547 001200          RAL
0489  15550 067772          LDB BHMSK
0490  15551 006003          SZB,RSS  <-- PACK BOOTSTRAPPED UP ?
0491  15552 002004          INA      <-- yes! set S.C. add...
0492  15553 064155          LDB BSYSC
0493  15554 070155          STA BSYSC      SET RUN TIME SYS SUBCHNL
0494  15555 054175          CPB BUDSC
0495  15556 070175          STA BUDSC
0496  15557 006400          CLB
0497  15560 050175          CPA BUDSC      SYS SC = USER SC?
0498  15561 064115          LDB BSYBF       -YES,
0499  15562 074200          STB BDSCL         SET DISCL
0500  15563 047757          ADB .400
0501  15564 074157          STB BUNIS        = SYSTEM NEXT TRK/SCTR
0502  15565 064175          LDB BUDSC
0503  15566 074161          STB BCDSC                          GO START SYSTEM
0504*
0505  15567 124003          JMP 3B,I       GO START DOS  <--
0506*
0507  15570 000000  CNFGR   NOP
0508  15571 057730          CPB DVADR      DONE CONFIGURING THIS DRIVER?
0509  15572 127570          JMP CNFGR,I     -YES
0510  15573 037730          ISZ DVADR       -NO, INCR TO NEXT INSTRUCTION
0511  15574 163730          LDA DVADR,I    LOAD INSTRUCTION
0512  15575 002021          SSA,RSS        *
0513  15576 027571          JMP CNFGR+1    * CHECK IF INSTRUCTION
0514  15577 013766          AND MASK       *   IS I/O
0515  15600 002002          SZA            *   FOR DEVICE (EXCLUDING DMA)
0516  15601 027571          JMP CNFGR+1    *
0517  15602 163730          LDA DVADR,I     -YES,
```

DOS-M DISC RESIDENT BOOTSTRAP


```
0518  15603 043773          ADA CHANL        CONFIGURE INSTRUCTION
0519  15604 173730          STA DVADR,I      AND STORE
0520  15605 027571          JMP CNFGR+1
0521*
0522  15606 000000  INSWP NOP              *
0523  15607 044045          ADB .6N          * THIS SUBROUTINE
0524  15610 044201          ADB BINTB        *   IS USED TO SWAP
0525  15611 170001          STA B,I          *   INTERRUPT TABLE ENTRIES
0526  15612 127606          JMP INSWP,I      *
0527*
0528  15613 000000  PLOAD NOP                DISC READ ROUTINE
0529  15614 167762          LDB SPCAD,I      GET LOW CORE ADDRESS
0530  15615 037762          ISZ SPCAD        INCR CURRENT SPBUF ADDRESS
0531  15616 163762          LDA SPCAD,I      GET HIGH CORE ADDRESS
0532  15617 037762          ISZ SPCAD        INCR CURRENT SPBUF ADDRESS
0533  15620 003304          CMA,CCE,INA      COMPLEMENT, SET DIRECTION BIT
0534  15621 040001          ADA B            SET A = TOTAL WORD COUNT
0535  15622 005225          RBL,ERB          SET DIRECTION BIT IN CORE ADDR
0536  15623 106702          CLC 2
0537  15624 106602          OTB 2            SET MEMORY ADDRESS REGISTER
0538  15625 167762          LDB SPCAD,I      GET DISK ADDRESS OF ABSOLUTE COD
0539  15626 037762          ISZ SPCAD        INCR CURRENT SPBUF ADDRESS
0540*
0541  15627 002021  SLOAD SSA,RSS           SKIP - MORE SECTORS TO LOAD
0542  15630 127613          JMP PLOAD,I      RETURN - THIS SECTION LOADED
0543  15631 043754          ADA P,128        ADJUST FOR NEXT COUNT
0544  15632 073761          STA RECNT        SET REMAINING COUNT
0545  15633 002020          SSA              SKIP - LESS THAN 128 WORDS
0546  15634 002400          CLA
0547  15635 043753          ADA N,128        SET A = CURRENT SECTOR COUNT
0548  15636 102702          STC 2
0549  15637 102602          OTA 2            SET WORD COUNT REGISTER
0550  15640 060001          LDA B            LOAD CURRENT DISK ADRS INTO A,
0551  15641 001767          ALF,CLE,ALF        ROTATE TO LO BITS,
0552  15642 013752          AND M,377          AND ISOLATE TRK#
0553  15643 102600  DSKA    OTA 0            OUTPUT TRK#
0554  15644 103700          STC 0,C            TO DATA CHANNEL
0555  15645 063755          LDA SKCMD        LOAD SEEK COMMAND
0556  15646 033776          IOR BDRV#        INCLUDE DRIVE #
0557  15647 106701          CLC 1
0558  15650 102601          OTA 1            OUTPUT SEEK/ADDRESS CMND
0559  15651 103701          STC 1,C            TO COMMAND CHANNEL
0560  15652 102300          SFS 0            CHECK DATA CHNL FLAG,
0561  15653 027652          JMP *-1            LOOP UNTIL SET
0562  15654 060001          LDA B            LOAD CURRENT DISK ADDRESS INTO A
0563  15655 013752          AND M,377          ISOLATE SECTOR#
0564  15656 043751          ADA #SPTK        ADD NEG #SCTRS/TRK
0565  15657 002021          SSA,RSS          CHECK IF SCTR# > #SCTRS/TRK
0566  15660 033757          IOR .400           -YES, SET LOWER HEAD#
0567  15661 002020          SSA
0568  15662 043747          ADA #SPTK          -NO, ADD #SCTRS/TRK BACK IN
0569  15663 033772          IOR BHMSK        INCLUDE SYS HEAD# MASK
0570  15664 102600          OTA 0            OUTPUT HEAD/SECTOR
0571  15665 103700          STC 0,C            TO DATA CHANNEL
0572  15666 102301          SFS 1            CHECK CMND CHNL FLAG,  > WAIT FOR SEEK
0573  15667 027666          JMP *-1            WAIT UNTIL SET       >
```

DOS-M DISC RESIDENT BOOTSTRAP


```
0574  15670 01/714          JSB BSTAT
0575  15671 063756         LDA RDCMD      LOAD READ COMMAND
0576  15672 033776         IOR BDRV#      INCLUDE DRIVE#
0577  15673 102601         OTA 1          OUTPUT COMMAND FOR READ
0578  15674 103700         STC 0,C
0579  15675 106701         CLC 1
0580  15676 103706         STC 6,C        INITIATE DMA
0581  15677 103701         STC 1,C        INITIATE DATA TRANSFER
0582  15700 102301         SFS 1          CHECK CMND CHNL FLAG,
0583  15701 02/700         JMP *-1          WAIT UNTIL SET
0584  15702 01/714         JSB BSTAT
0585  15703 060001         LDA B          LOAD CURRENT DISC ADDRESS INTO A
0586  15704 013752         AND M.377        AND ISOLATE
0587  15705 053750         CPA #SPCY      CHECK IF LAST SECTOR ON CYL
0588  15706 002001         RSS             -YES
0589  15707 002405         CLA,INA,RSS     -NO
0590  15710 063760         LDA #MASK
0591  15711 044000         ADB A          INCR TO NEXT DISC ADDRESS (TRACK)
0592  15712 063761         LDA RECNT      GET REMAINING COUNT
0593  15713 02/627         JMP SLOAD      LOAD NEXT SECTOR
0594*
0595  15714 000000 BSTAT   NOP
0596  15715 103700         STC 0,C
0597  15716 063776         LDA BDRV#
0598  15717 106701         CLC 1          OUTPUT STATUS COMMAND
0599  15720 102601         OTA 1
0600  15721 103701         STC 1,C
0601  15722 102300         SFS 0
0602  15723 02/722         JMP *-1
0603  15724 102500 DSKY    LIA 0          GET STATUS
0604  15725 000010         SLA
0605  15726 102031         HLT 31B
0606  15727 12/714         JMP BSTAT,I
0607*                                     DATA AREA
0608*
0609  15730 015642 DVADR   DEF DSKA-1
0610  15731 015724 DEFDY   DEF DSKY
0611*
0612  15732 015733 ASPBF   DEF *+1        CONTAINS 4 Entries (3 words each) for loading CRS.
0613  15733 000000         BSS 12
0614*
0615  15747 000000 #SPTK   NOP            #SCTR/TRK (physical)
0616  15750 000000 #SPCY   NOP            #SCTR/CYL - 1
0617  15751 000000 #SPTN   NOP            NEG # SCTRS/TRK (physical)
0618  15752 000377 M.377   OCT 377
0619  15753 17/600 N.128   DEC -128
0620  15754 000200 P.128   DEC 128
0621  15755 030000 SKCMD   OCT 030000     SEEK COMMAND
0622  15756 020000 RDCMD   OCT 020000     READ COMMAND
0623  15757 000400 .400    OCT 400        LOWER HEAD# BIT
0624  15760 000351 #MASK   OCT 351        INCR. TRK# MASK
0625  15761 000000 RECNT   OCT 0          CURRENT REMAINING COUNT
0626  15762 000000 SPCAD   OCT 0          CURRENT DISK SPEC. BUFFER ADDR
0627*
0628  15300        SPBF    EQU 15300B
0629  15302        GEND1   EQU SPBF+2
```

STATUS SUBRTN.

DOS-M DISC RESIDENT BOOTSTRAP


```
0630  15303           GEND2 EQU SPBF+3
0631  15304           EGCUR EQU SPBF+4
0632  15305           EGPCD EQU SPBF+5
0633  15310           CNTR  EQU SPBF+8
0634  15311           EGDSK EQU SPBF+9
0635*
0636  00053           #     EQU 53B
0637  00045           .6N   EQU #-6
0638  00051           .2N   EQU #-2
0639  00052           .1N   EQU #-1
0640  00055           .2    EQU #+2
0641  00056           .3    EQU #+3
0642  00060           .5    EQU #+5
0643  00066           .17D  EQU #+11
0644  00071           M.37  EQU #+14
0645  00072           M.77  EQU #+15
0646*
0647  00100           #     EQU 100B
0648  00115           BSYBF EQU #+13
0649  00117           BEQTB EQU #+15
0650  00120           BEQT# EQU #+16
0651  00154           BDSCU EQU #+44
0652  00155           BSYSC EQU #+45
0653  00157           BCNTS EQU #+47
0654  00160           BSNTS EQU #+48
0655  00161           BCDSC EQU #+49
0656  00175           BCDSC EQU #+61
0657  00200           BDSCL EQU #+64
0658  00201           BINTB EQU #+65
0659*
0660  15763 000000    SWP1  NOP
0661  15764 000000    SWP2  NOP
0662  15765 000031    DISK  OCT 31
0663  15766 070036    MASK  OCT 070036
0664  15767 177740    M.740 OCT 177740
0665*
0666  15777           END   EQU 15777B
0667  15772           BPMSK EQU END-5
0668  15773           CHANL EQU END-4
0669  15774           RCND1 EQU END-3
0670  15775           RCND2 EQU END-2
0671  15776           BDRV# EQU END-1
0672*
0673  15777                 ORG 15777B
0674  15777 177733          ABS ASPBF-*
0675*
0676                        END DSGEN
** NO ERRORS*
```

BASE PAGE COMMUNICATION AREA LOCATIONS

HALTS IN DOS-M DURING SYSTEM OPERATION

T-REGISTER CONTENTS	PROGRAM LOCATION	CAUSE OF HALT	RECOVERY ACTION
102000	$EX18	System was unable to use Interrupt Table to match channel # in Equipment Table for given I/O request.	Check Interrupt Table entries and patch if possible. Regenerate correct system. Irrecoverable halt.
102004	DISCM	Power UP or DOWN with DOS-M System in core with P.F. option present	Bootstrap System back up from Disc and Restart.
102011	$EX20	Disc Parity Error. Halt occurs after printing messages on System TTY to inform operator where error occurred. (TRACK #, SECTOR #, and Sub-channel #).	Turn ON "Disc Protect Override Switch" and press "RUN" for System to assign next spare track.
102077	$EX20	Follows message telling operator to turn OFF "Disc Protect Override Switch" after spare track assignment.	Turn OFF "Disc Protect Override Switch" and press "Run". System aborts job that was running.
102031	DVR31	Trying to write on cylinder that has been flagged protected with "Dics Protect Override Switch" OFF.	Press "Run" to exit driver with no action taken on Disc.

DISC DUMP FOR DOSM GENERATION EXAMPLE

	LB	DO	9000	SY	ST	EM		
0,0								
001	046102	042117	021450	051531	051524	042515	044456	031461
	020000	036173	000723	041456	031461	020000	036173	000724
	044456	031062	020000	036154	000000	041456	031062	020000
	036154	000000	046117	040504	001000	036165	000000	171573 C.S.
	041120	051000	036146	000000	040523	046502	020000	036137
	000000	037501	051503	047000	036137	000000	037501	051515
	041000	036137	000000	037502	047103	047000	036137	000000
	037502	050113	052400	036137	000000	037503	044117	050000
TK 332 SEC 0	013000	000000	000312	044120	044400	035137	000000	037504
	041517	042000	036137	000000	037505	047104	051400	036137
	000000	037505	051120	051000	036137	000000	037515	051531
	051400	036137	000000	037507	042524	041400	036137	000000
	037515	047526	042400	036137	000000	037515	051531	046400
	036137	000000	037522	046125	047000	036137	000000	037501
	043114	043400	036137	000000	037514	051524	046000	036137
	000000	037514	052516	044400	036137	000000	037522	052502 UB
0,1								
002	000000	067731	017570	067732	077762	017613	017613	017613
	017613	064120	007004	077310	064117	044055	160001	044051
	010072	073773	053774	077763	053775	077764	077304	044056
	160001	001727	013752	073305	050060	027460	053765	027445
	067304	044056	037310	027415	027505	044062	160001	023773
	033774	170001	063773	073302	002004	073303	063774	073773
	067304	160001	073730	164000	017570	063305	050060	027440
	006004	160001	033773	170001	006004	063747	170001	006004
	003004	170001	067304	077311	027440	060154	001722	013767
	033774	001727	001723	070154	063763	067302	017606	063764
	067303	017606	002400	067774	017606	063311	067775	017606
	067763	006003	027540	044055	160001	023774	033302	170001
	067764	006003	027546	023775	033303	170001	063776	001200
	067772	006003	002004	064155	070155	054175	070175	006400
	050175	064115	074200	047757	074157	064175	074161	124003
	000000	057730	127570	037730	163730	002021	027571	013766
0,2								
003	002002	027571	163730	043773	173730	027571	000000	044045
	044201	170001	127606	000000	167762	037762	163762	037762
	003304	040001	005225	106702	106602	167762	037762	002021
	127613	043754	023761	002020	002400	043753	102702	102602
	060001	001767	013752	102600	103700	063755	033776	106701
	102601	103701	102300	027652	060001	013752	043751	002021
	033757	002020	043747	033772	102600	103700	102301	027666
	017714	063756	033776	102601	103700	106701	103706	103701
	102301	027700	017714	060001	013752	053750	002001	002405
	063760	044000	063761	027627	000000	103700	063776	106701
	102601	103701	102300	027722	102500	000010	102031	127714
	015642	015724	037733	000002	000732	011413	001634	007361
	000012	007361	007567	000411	007533	007567	006406	000014
	000027	177764	000377	177600	000200	030000	020000	000400
	000351	000000	000000	000000	000000	000031	070036	177740
	015771	046511	000000	000015	000015	000016	000000	177733
0,3								
004	022105	054060	031401	000413	000002	007567	007624	000732
	000733	007567	007624	022105	054060	032001	000415	000004
	007567	010176	000732	000741	007567	010176	022105	054060
	032001	000421	000002	007567	007745	000732	000733	007567
	007745	022105	054060	031401	000423	000002	007567	007746
	007562	000733	007567	007746	022105	054060	034001	000422
	000002	007567	007732	000732	000733	007567	007732	022105
	054060	034001	000427	000003	007567	010142	000732	000763

SYSTEM LABEL / USER BUFFER SECTOR

DISC RESIDENT BOOTSTRAP

MEMORY BOUNDS & DISC ADDRESSES FOR C.R. SYSTEM

$EXP3 / $EXP4 / $EXP5 / $EXP7 / $EXP2 / $EXP1 SYSTEM DIRECTORY

SYSTEM
DIRECTORY

```
    007567  013142  022105  054061  030001  001002  000002  007567  $EX10
    007745  000732  000733  007567  007745  022105  054061  031001
    001004  000002  007567  007761  000732  000733  007567  007761  $EX12
    022105  054061  031401  001006  000004  007567  010223  000732  $EX13
    000754  007567  010223  022105  054061  032001  001012  000004  $EX14
    007567  010241  000732  000751  007567  010241  022105  054061
    032401  001016  000003  007567  010153  000732  000763  007567  $EX15
    010153  177777  000000  000000  000000  000000  000000  000000
                    LAST DIRECTORY ENTRY THIS SECTOR
0,4
005 022105  054061  033001  001021  000002  007567  007722  000732  $EX16
    000733  007567  007722  022105  054061  034401  001023  000003  $EX19
    007567  010107  000732  001000  007567  010107  022105  054062
    030001  001026  000003  007567  010167  000732  000761  007567  $EX20
    010167  042126  051060  030404  001401  000003  010241  010555  DVR01
    001000  001032  010241  010555  042126  051060  031004  001404  DVR02
    000003  010241  010443  001000  001002  010241  010443  042126
    051062  031004  001407  000005  010241  011075  001000  001002  DVR22
    010241  011075  046117  040504  051003  001414  000040  012000  LOADR
    021032  001002  001425  012000  021032  045117  041120  051003  JOBPR
    002024  000046  012000  022463  001002  001414  012000  022463
    040523  046502  020003  003012  000027  012000  017120  001002  ASMB
    001352  016522  017120  040523  046502  042005  033411  000004  ASMBD
    017127  017647  001352  001363  017442  017647  040523  046502
    030405  003415  000006  017366  020542  001362  001424  017366  ASMB1
    020542  177777  000000  000000  000000  000000  000000  000000
                    LAST DIRECTORY ENTRY THIS SECTOR
0,5
006 040523  046502  031005  003423  000007  017345  020550  001362  ASMB2
    001410  017351  020550  040523  046502  031405  004002  000003  ASMB3
    017473  017771  001362  001363  017630  017771  040523  046502
    032005  004005  000004  017366  020027  001362  001371  017366  ASMB4
    020027  040523  046502  032405  004013  000006  017345  020425  ASMB5
    001362  001404  017351  020425  043124  047040  020003  004017  FTN
    000006  012040  013127  001002  001047  012000  013127  043124
    047060  030405  004025  000037  013254  022120  001047  001502  FTN01
    016550  022120  043124  047060  031005  005004  000031  013254  FTN02
    021027  001047  001356  013741  021027  043124  047060  031405
    005405  000030  013254  020600  001047  001277  015117  020600  FTN03
    043124  047060  032005  006005  000031  013254  020750  001047  FTN04
    001360  013702  020750  046111  041122  054406  006407  000223  LIBRY
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
          LAST DIRECTORY ENTRY
0,6
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    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000  not used
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
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    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
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```
ϕ,7
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    000000 000000 000000 000000 000000 000000 000000 000000
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    000000 000000 000000 000000 000000 000000 000000 000000
ϕ8
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    000000 000000 000000 000000 000000 000000 000000 000000
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    000000 000000 000000 000000 000000 000000 000000 000000
    000000 000000 000000 000000 000000 000000 000000 000000
ϕ9
010 000000 000000 000000 000000 000000 000000 000000 000000
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    000000 000000 000000 000000 000000 000000 000000 000000
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    000000 000000 000000 000000 000000 000000 000000 000000
ϕ,10
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    033635 073646 000000 100504 054057 102004 054060 124630
    054103 027754 044045 074000 002020 027714 003000 040202
    002020 027714 044201 160001 002003 027714 114552 102504
    164204 114001 027776 060260 002003 027714 060261 002002
    027714 160557 164201 006003 002002 027714 074260 124544
    063634 017746 002001 027722 017726 127634 017726 102100
    102705 127634 000000 060241 103101 000036 102101 060237
    064240 127726 000000 070237 074240 001520 102201 002004
```

NOT USED
"B" VERSION
GENERATOR
WILL NOT
WRITE

DISCM

CRS_2

CRS2

DISCM

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034107 027714 063775 070107 034106 060108 050113 124531
027714 176650 170217 070531 174200 017331 060513 003004
050203 070513 060202 000010 116020 050141 002003 026070
160212 002020 003004 050054 002001 026070 007400 044111
044121 003400 140001 114632 040117 050203 002001 026070
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Ø,11

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012 160214 160000 010075 150633 002001 026070 160211 114634
026070 060123 072052 160214 066207 017361 002052 160220
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170206 160211 070242 026651 160217 002002 026152 160206
012211 170206 160213 012210 002002 026163 160211 070505
164220 114634 026150 164635 154636 026204 060260 002003
026143 003400 140121 114632 040117 040056 160000 002020
026143 052212 002002 026141 160206 070237 164220 074240
160211 070242 006400 074260 027426 006400 074260 164220
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026641 160206 110637 150640 026644 060056 026641 063213
002003 026171 060513 002021 027256 160205 010072 053204
027244 063220 002003 124554 017003 027271 124554 027271
060203 072213 027244 177734 020000 037777 000000 000000
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Ø,12

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002400 017361 000226 064224 007004 036424 062266 070505
162424 016507 170505 034505 036424 006006 026274 160226
052500 002001 026325 114642 170001 006004 102100 102705
124225 052477 026320 026633 114642 114577 000000 134532
124643 002003 026635 052501 124534 052502 026346 052503
026340 052504 026425 026352 060237 072342 000000 026312
034105 026312 060103 002003 026344 032505 072357 060103
032506 072360 060056 000000 000000 026312 002021 003004
042461 002020 026635 160226 002020 003004 070514 050064
026400 050065 002001 026402 060063 070514 050060 026312
042436 160000 050052 026635 052437 026431 070474 062462
070475 002404 064514 154475 027020 002004 034475 026417
000000 160644 070474 060056 027020 006400 160645 070474
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Ø,13

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000021 000006 000007 000010 000022 000013 000004 176000
001777 114000 002214 004243 177755 177754 177753 177752
000027 102500 103700 000000 002003 026635 050054 026635
001275 002001 126507 160000 025510 140646 070514 060232
070472 066552 074473 160647 070474 062471 027020 006003
026665 060514 050055 002001 026432 060001 040055 160000
010071 050065 026432 052471 026432 026631 002533 000000
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026653 044121 160001 002003 026655 040052 114632 040117
017345 126553 000000 164226 174212 006020 007004 060225
170211 160227 050050 003004 170213 050230 054056 160230
170214 160231 170215 060232 154650 026625 154651 026625
160232 170216 160233 170217 126576 006400 026670 064054
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Ø,14

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CRS1

DISCM

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160654 070474 160653 027020 000000 160205 002021 026723
000001 170202 017003 026701 000717 160205 110537 150640
026717 034257 026721 060060 026774 060203 170001 160213
010077 070001 160212 002020 003004 150650 026740 150651
026742 030001 170213 026744 002404 026735 060055 026735
160205 010072 164203 114001 070510 002102 026766 160205
001222 000010 026762 060513 003004 070513 160206 130655
170206 126700 000056 002356 017331 006440 016776 060510
036700 126700 000000 060526 002003 126776 124000 000000
064201 002400 150001 027017 060165 002002 027016 006004
150001 037003 037003 127003 073116 077115 060243 070477
060244 002003 124474 003004 070506 060245 002020 027222
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044247 074170 150477 001722 010071 034477 164477 074166
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002021 074170 017117 060174 070166 064250 074167 007004
044251 074170 017117 072212 057115 063116 003004 070245
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017400 002400 127117 000166 000000 006400 114577 177770
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017117 072212 100143 073004 077266 000244 073205 027244
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073221 060203 073220 027244 000000 000000 037236 063115
073240 063116 073237 060474 073241 060472 073242 060473
017 073243 027244 000000 000000 000000 000000 000000 000000
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000036 102101 060515 064516 102100 102705 124520 017563
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073532 064123 077533 016553 160205 001222 000010 027530
060203 050513 002001 017143 114545 000001 003532 003533
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CRS2

DISCM

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027452 002470 070261 017563 127575 160001 006004 164001

Ø,18
Ø1C 114577 177770 170635 064471 154660 027677 150661 124662
150636 124665 150664 124666 150666 124662 154656 002001
027702 150656 004401 027714 074471 062213 002002 027670
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006002 027607 064262 004010 027714 064141 006003 027743
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064530 027020 150657 027743 150676 027743 027607 002400
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070143 060263 070166 060254 070167 060264 070170 017117
060174 070166 060255 070167 060265 070170 002400 070471
017117 002400 070261 070260 064530 070530 102100 102705
124254 060112 070111 006400 074475 060105 032150 070166
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064242 074470 062126 050471 124702 070471 170703 124544

Ø,19
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032152 170001 107700 140707 034474 000053 102106 107706
102107 107707 064201 002400 170001 070513 170710 170711
170712 170713 070261 070260 170703 006004 170001 126044
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042116 042101 052131 047506 044507 047117 051105 042040
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062271 070474 060065 124540 106700 062273 070474 062310
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Ø,2Ø
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100617 100620 100621 100622 100623 100624 100625 100626
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003000 140227 140230 002003 026353 002021 026365 164230
144227 007004 060154 010074 002004 040001 002020 026337
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070245 124541 060224 040047 002002 026443 060227 114715
060230 114715 060231 114715 060160 006400 114577 177770
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Ø,21
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$EXØ1

$EXØ2

$EXØ6

CRS2

CRS2

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066573 114717 026562 034162 060200 002004 066664 114716
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062664 064046 114543 000126 026556 000400 066667 114543
000270 034162 060200 002004 066664 114716 026630 026555
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160001 070200 066641 026567 076664 062663 040043 052647
026644 072641 040043 064043 114543 000000 062641 026632
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027006 026772 060262 006002 017230 017126 027101 160227
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127200 000000 006400 060161 050155 064115 074200 063227
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070203 060074 070163 073263 127250 000000 000000 000000
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000000 160205 010072 073334 017315 027356 063334 002004
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$EXØ6

$EX11

$EX17

$EX18

CRS2 $EX18

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      010056 002003 027411 050054 027402 050055 027376 063375
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      063410 070471 017766 124544 043517 063334 017315 173766
      063334 002004 017316 173766 160205 001222 000010 027427
      064513 004000 114572 000010 000054 022436 000055 017435
1,1
026 027443 160227 050050 003004 010072 050056 034162 114571
      160226 002021 027462 160206 013456 053457 027565 027667
      017766 124574 037400 014400 000016 000017 000514 050056
      027667 044230 007000 044254 005021 124561 017756 044230
      002040 124562 007004 044100 005020 124562 160206 013456
      053457 002001 027667 060514 053460 027454 053461 027454
      050102 002003 027523 001727 010074 040052 027525 060154
      010076 070505 060160 006400 114577 177770 002002 006004
      160232 010074 170232 003000 040001 002021 124563 063755
      006400 114577 177767 002002 006004 144233 002400 044511
      006020 027563 002004 027553 160232 003004 040505 002020
      124563 160233 040511 002021 124563 160232 001727 130233
      070171 060230 070172 160231 070173 060224 040045 002002
      124560 050055 114565 114571 064177 160227 050050 074161
      063753 170214 114572 027654 067314 074161 050060 027642
      050055 027650 050056 002001 027645 060203 070472 160600
1,2
027 070474 017766 067641 060057 124540 000022 063644 124566
      005616 050057 002001 124573 017766 160206 006400 027310
      017766 063314 070161 160227 050050 003004 013666 002003
      124551 027310 020000 160205 001222 000010 027616 060203
      050513 027616 114570 027616 160233 003004 067754 074504
      044057 140001 070505 027636 000161 073314 006400 063755
      114577 177747 006002 002004 003004 040505 002020 124564
      064504 044056 160001 006400 114577 177770 077756 001727
      140233 070505 040511 002020 027744 037756 070505 027736
      067756 005727 060505 030001 070171 034162 027575 000171
      000126 000000 000000 164231 005121 027764 005100 007004
      077755 127756 000000 060245 002020 003004 070245 127756
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      026006 124723 002400 070245 124541 000000 072125 076126
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1,3
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      002041 026054 062130 052107 026054 016202 026054 016136
      036130 066131 026040 047117 060156 003000 072130 062130
      003000 052107 026072 016202 026072 016136 036130 026063
      026111 062124 066110 114543 006123 060161 052107 026115
      002400 070126 026115 000000 177765 062107 016202 000000
      036011 060115 040025 006404 016252 056100 126011 000000
      000000 000000 000000 000000 000000 000000 000000 000000
      000000 000001 000000 062125 016244 062264 072124 062126
      066124 016265 026075 066124 044055 160001 010073 040045
      002020 044061 044056 076124 007000 144546 006020 026172
      162124 002003 126136 050052 002001 026143 036125 062125
      010073 003004 040116 000002 026137 126136 000000 070161
      060074 070163 062237 070526 002400 070200 016244 062241
      050273 050274 052242 060275 052243 002001 026226 060370
      070200 016244 060370 070157 060200 002004 072125 036202
1,4
029 002400 070526 126202 006240 026234 051531 051524 042515
      000000 066123 074102 006404 016252 126244 000000 070166
      062264 070147 062263 070170 062265 114536 126252 000200
```

$ADDR

$SRCH

```
000270 041166 000000 072127 160001 152127 002001 026313
006004 036127 160001 152127 002001 026313 006004 036127
152127 010075 072127 160001 010075 052127 002001 036266
126266 000000 032327 072334 003400 056370 120001 006004
036334 026322 126315 177740 000000 072334 064056 114643
000000 126330 000000 064000 062352 016330 060270 052353
002001 126336 016315 050327 036336 126336 000273 046102
000000 070170 076334 064200 074166 062370 070167 062371
066334 034162 114536 126354 000270 000166 000000 072401
076402 034261 114545 000002 000001 000000 000000 006405
124561 000000 170261 126322 000543 100065 052156
026431 032633 002311 001425 102600 016446 000015 016464
102700 002400 170220 126410 006424 120213 052577 026436

030 060057 126410 164214 006021 007004 174217 005300 174214
060055 026415 000000 164214 005200 174216 164215 007324
005010 007004 001310 026462 006003 007400 174217 126466
000000 062464 052430 026476 160206 002020 026476 034260
036464 126464 164213 005332 026611 102500 010073 050073
026541 052422 026537 050065 026562 006020 026537 050054
026544 164216 004065 134216 002041 001727 072446 000074
002340 001727 110001 032446 170001 160213 001421 134217
000040 001405 170213 036664 026606 016446 160213 026535
016553 044052 174216 160217 040052 170217 026537 000000
160214 001000 150216 026537 164216 126553 005421 174213
016553 004065 160001 010075 032534 002040 170001 160217
164215 002004 000021 001100 006020 007300 044000 106700
001521 102600 103700 002400 126464 062464 052430 026621
102500 010074 050074 026601 070260 002400 150216 026574
150217 026645 160216 134216 000065 004010 062630 160000

031 006051 001727 010074 134217 026643 052657 026574 102600
026537 062422 150220 060065 170220 052422 026643 006400
174216 026643 004000 000134 007332 064162 060155 006062
060161 073360 000065 073347 002441 053344 073352 060164
006002 062163 073353 063347 017211 000400 010067 002102
026737 160213 010056 001510 026714 067145 063336 026727
063337 002341 026726 160213 010077 001225 053340 026726
060057 126660 067332 077052 073346 060041 170220 062736
072743 026764 006737 060056 006400 074162 126660 000000
063347 106601 006003 026755 002400 004033 026755 002004
026751 017211 027115 067333 106606 164217 124001 006764
164214 006004 160001 002003 027071 073354 006004 160001
002021 003005 001100 002003 003400 073355 044051 160001
010075 073350 120001 073351 003004 040116 001727 001300
043355 002020 027034 001727 001200 010074 003004 040116
050116 062701 043350 070174 002400 006004 170001 027051

032 044055 003004 170001 043355 073355 044052 003004 043354
170001 044052 063350 042701 170001 017126 017241 067354
063346 053336 047343 106702 106602 067355 000000 017162
017241 063346 053337 017172 026764 060200 002302 000040
060162 067353 002041 002003 074164 002041 002002 074163
002400 070162 164215 005020 007004 126743 000000 063112
170217 002400 036743 126743 000000 033347 106701 102601
103701 127120 000000 063351 043335 002021 032701 002020
043334 033352 070001 063350 001767 017143 127126 000000
102600 103700 053353 002300 073353 063341 001225 017120
102300 027154 106600 103700 017112 127143 000000 102702
106602 103706 017120 106706 017112 127162 000000 017126
```

$LBL

DVR05

DVR31

CRS2 & CRS3

DVR31

```
      063356  003004  040073  001727  001200  010071  102600  103700
      063342  017120  017112  017241  127172  000000  102106  103700
      106701  102601  103701  102300  027217  102500  073357  010074
      073356  003007  001284  002440  027237  102206  010075  033356
(,8
033   170206  037211  127211  070525  127211  000000  063357  002111
      127241  001422  001727  000010  027262  001723  000312  027305
      057340  127241  134220  027276  001200  002021  002405  060056
      006400  074142  067360  074125  067351  074130  067350  074127
      005727  126743  053252  006500  017143  002400  006500  017143
      027051  001332  027315  067346  067336  027264  027313  102031
      027104  017126  067345  106702  106602  063336  007400  103700
      017162  063350  010075  073350  034525  027051  102100  120000
      000000  000000  020000  010000  110400  030000  060000  100000
      001000  107350  000000  000000  000000  000000  000000  000000
      000000  000000  000000  000000  000000  000000  000000  000000
      000000  000000  000000  000000  000000  000000  000000  000000
      000000  000000  000000  000000  000000  000000  000000  000000
      000000  000000  000000  000000  000000  000000  000000  000000
      000000  000000  000000  000000  000000  000000  000000  000000
      000000  000000  000000  000000  000000  000000  000000  000000
1,9
034   006410  006403  040011  002400  000000  000000  000000  000000
      000000  000000  000000  000000  000000  000000  000000  000000
      000000  010241  010313  000013  000440  000000  000000  000000
      000000  000000  000000  000000  000000  000000  000000  010555
      001002  001401  006660  006743  130014  014400  000000  000000
      000000  000000  000000  000000  000000  000000  000000  000000
      000000  000000  000000  010241  010320  002010  001000  000000
(     000000  000000  000000  000000  000000  000000  000000  000000
      000000  010443  001002  001404  010241  011001  100022  011000
      000000  000000  000000  000000  000000  000000  000000  000000
      000000  000000  011075  001002  001407  000001  000003  000034
      000004  000002  000001  000035  000006  000007  000000  007361
      000000  007402  000000  007423  007444  000000  000000  000000
      000000  007465  000000  000000  000000  000000  000000  000000
      000000  000000  000000  000000  000000  000000  000000  000000
      000000  000000  000000  000000  000000  000000  000000  000000
1,10
035   030400  000195  050221  001260  000132  160001  002003  002004
      072000  001656  000000  001272  133730  072000  001647  000000
      001300  066000  001276  016000  000063  062002  133320  072000
      001432  160000  001250  072000  001443  026000  000000  177750
      000000  000400  001301  020102  042507  044516  000000  020047
      042105  041105  043447  020114  000000  050105  051101  052111
      047516  000000  000000  000000  000000  000000  000000  000000
      000000  000000  000000  000000  000000  000000  000000  000000
      000000  000000  000000  000000  000000  000000  000000  000000
      000000  000000  000000  000000  000000  000000  000000  000000
      000000  000000  000000  000000  000000  000000  000000  000000
      000000  000000  000000  000000  000000  000000  000000  000000
      000000  000000  000000  000000  000000  000000  000000  000000
      000000  000000  000000  000000  000000  000000  000000  000000
(
036   060106  002020  027604  033622  070106  060113  002011  027604
      002400  070245  070530  006404  124550  067623  002400  070245
      070471  114543  000141  114556  006400  060262  074262  002021
      124537  007400  124544  100000  177765  000000  000000  000000
```

NOT USED

EQUIPMENT TABLE CRS3

DEVICE REG. & INT. TABLES CRS3

NOT USED

START DRS

$EX03

DKS

	000000	000000	000000	000000	000000	000000	000000	000400
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000400
(	000000	000000	000000	000000	000000	000000	000000	000000
	000000	003000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
1,12	← B.P. LINKAGE FOR $EXØ3							
037	007567	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
(038	054062	027575	057574	027633	027711	000022	060225	070470
	060141	073626	060142	073627	060143	010075	033620	073630
	063625	064041	114735	063624	070471	002400	070245	007400
	124544	000040	040000	037777	000031	043517	007626	020040
	020040	020040	051525	051520	060472	114552	160206	001727
	010073	053623	027704	160206	013622	033621	170206	060512
	070470	002404	064117	054203	027657	002004	044066	027652
	114733	073702	063671	067746	114735	060472	114552	027612
	000012	030040	007672	064457	047440	042522	051040	047122
	020105	050524	021440	020040	020040	063676	073773	063766
	027662	000000	054057	027765	077710	004010	114736	063710
	001110	027726	006400	074245	102100	102705	124225	060262
	002002	027721	114737	160740	114734	073754	160001	073752
	006004	160001	073753	063747	064041	114735	027575	177754
	007750	052504	020040	020040	020040	020040	060473	073773
	063766	067746	114735	060262	002002	027721	027726	007767
1,14								
039	044457	047440	042522	051040	020040	020125	051505	051040
	042111	051503	000000	060472	114733	072047	006004	160001
	072046	060473	114733	072034	006004	160001	072033	062023
	066022	016066	126001	177716	010024	042111	051503	020107
	042516	020103	047504	042440	000000	000000	020116	047524
	020123	054523	020107	042516	020103	047504	042440	000000
	000000	020105	051122	020120	047523	051440	000000	060224
	002004	003000	040225	070225	072065	126055	000000	000000
(	072075	076076	034261	114545	000002	000001	000000	000000
	010101	124504	002400	070261	126066	000000	064041	016114
	126104	000000	064043	016114	126110	000000	076175	066153
	076147	076150	076151	066146	076152	016154	146152	176152
	002003	026140	016154	005727	146152	176152	036152	002002

$EXØ4

ASCII ↓

ASCII

	026124	066151	062147	072151	076147	066146	126114	010147
	000000	000030	000000	000000	030060	000000	006400	076174
	070001	042175	036174	002021	026157	006020	026160	066175
040	007004	044000	062174	040050	126154	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
1,16 041	007567	010104	010110	010066	010001	010055	010065	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
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	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
1,17 042	060051	040224	002020	027725	003004	073741	064227	034162
	060200	002004	114716	027656	064227	060114	114716	027654
	064227	160001	073730	006004	160001	073731	006004	160001
	010075	073732	034261	114545	000002	000001	007730	177762
	037631	124551	102400	070261	070245	060106	002020	027646
	033737	070106	060113	002021	027646	006400	124550	063740
	064111	054054	002400	070471	124537	002400	027657	003400
	070524	160226	050063	027670	060001	067744	114543	000141
	027675	044056	060001	064043	114543	000144	002400	070126
	070127	073130	070131	070132	063741	002003	027720	067742
	063743	073730	160001	160000	173730	037730	006004	037741
	027711	060245	002020	003004	070245	124534	002400	070245
	124541	000000	000000	000000	046511	051523	044516	043440
	100000	045117	000003	000230	000126	177765	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
1:	007567	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000

BASE PAGE LINKS FOR $EXØ4

$EXØ5

B.P. LINK FOR $EXØ5

NOTE: $EXØ5 uses $SRCH but not needed here because CORE RES.

DRS

```
000000 000000 000000 000000 000000 000000 000000 000000
000000 000000 000000 000000 000000 000000 000000 000000
000000 000000 000000 000000 000000 000000 000000 000000
000000 000000 000000 000000 000000 000000 000000 000000
000000 000000 000000 000000 000000 000000 000000 000000
000000 000000 000000 000000 000000 000000 000000 000000
000000 000000 000000 000000 000000 000000 000000 000000
000000 000000 000000 000000 000000 000000 000000 000000
000000 000000 000000 000000 000000 000000 000000 000000
000000 000000 000000 000000 000000 000000 000000 000000
```

1,19

```
044 060051 040224 002002 027647 060227 070475 114715 006400
   063744 040105 002002 027607 170475 034475 170475 027622
   017652 000065 070474 074000 001723 040001 040001 170475
   034475 060474 170475 034475 005400 060104 002002 027633
   170475 034475 170475 027640 017652 007745 174475 034475
   170475 034475 002400 170475 070245 102100 102705 124225
   002400 070245 124541 000000 077735 167652 164001 037652
   006003 027733 006120 007204 077736 007004 077737 067740
   077741 064051 077742 077743 067735 006021 027703 037743
   007200 002002 003005 006004 002040 037742 047737 006021
   027733 047736 000066 005600 047737 006021 002005 047736
   037741 027711 003006 002020 002001 027733 103101 037742
   003004 037743 127652 007005 102101 127652 000000 000000
   000000 177760 000000 000000 000000 001130 000074 000000
   000000 000000 000000 000000 000000 000000 000000 000000
   000000 000000 000000 000000 000000 000000 000000 000000
```

B.P. LINK FOR $EX07

```
   007567 000000 000000 000000 000000 000000 000000 000000
   000000 000000 000000 000000 000000 000000 000000 000000
   000000 000000 000000 000000 000000 000000 000000 000000
   000000 000000 000000 000000 000000 000000 000000 000000
   000000 000000 000000 000000 000000 000000 000000 000000
   000000 000000 000000 000000 000000 000000 000000 000000
   000000 000000 000000 000000 000000 000000 000000 000000
   000000 000000 000000 000000 000000 000000 000000 000000
   000000 000000 000000 000000 000000 000000 000000 000000
   000000 000000 000000 000000 000000 000000 000000 000000
   000000 000000 000000 000000 000000 000000 000000 000000
   000000 000000 000000 000000 000000 000000 000000 000000
```

NOTE: ... $ENC ... $ADDR ... NOT ... HERE

1,21

```
045 060224 040046 002002 027714 060230 114715 060231 114715
   060232 114715 060267 002002 027613 060160 006400 114577
   177770 002002 076004 074267 160227 001665 040267 070001
   060112 001727 010074 002003 060154 010076 007004 040001
   002021 027701 034261 114545 000002 000001 007720 177756
   007641 124551 002400 070261 160227 002021 027655 003400
   170230 002400 070245 102100 102705 124225 060113 006400
   074265 002020 027677 063717 064111 054054 002400 070471
   114555 006400 060262 074262 002021 124537 007400 124540
   006400 124550 060267 170230 164227 005665 040001 071267
   060265 170231 060116 170232 027650 002400 070245 124541
   045117 021440 052122 040503 045523 020125 047101 053101
   044514 040502 045105 000000 000000 000000 000000 000000
   000000 000000 000000 000000 000000 000000 000000 000000
```

$EX08

[SLIDE AD 177]

DRS

1,22 ← BASE PAGE LINK FOR $EXØ8

1,23

$EXØ9

ASCII

2,20

2,21

BASE PAGE LINKAGES FOR $EXØ9

DRS

```
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
```

2,2

$EX10

```
051 134557  050254  003004  040146  002020  027660  060147  003004
    040100  002020  027660  060255  003004  040150  002020  027660
    060151  003004  040256  002020  027660  060146  070167  060144
    070166  060146  003004  040147  070170  002400  070262  064524
    006002  034162  114576  060174  070166  060150  003004  040151
    002003  027650  070170  060150  070167  064524  006002  034162
    114576  002430  070245  170557  070260  067724  102100  102705
    124152  034251  114545  000002  000001  007725  177746  007670
    124551  002400  070261  060106  002020  027677  033743  070106
    002400  067744  114543  000141  063742  070471  002400  070245
    006400  060252  074262  002021  027720  002400  070471  007400
    124544  060112  050111  027714  124537  000126  044514  046105
    043501  045040  050122  047507  051101  046440  051125  047040
    046111  046511  052123  045117  100000  177765  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
```

2,3 ← BASE PAGE LINKAGE FOR $EX10

```
    007567  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
```

2,4

$EX12

```
053 134557  060116  003004  070511  060254  102605  060115  073726
    063751  073727  063754  073730  017671  060467  053747  027634
    002400  067757  114543  000270  060160  070370  060115  017676
    070371  074372  063747  070467  060115  073726  063751  073727
    063755  073730  063731  064051  114536  060200  002042  027641
    060370  027643  060370  070157  070160  067756  060103  002003
    077655  034261  114545  000002  000001  007732  177746  007660
    124551  002400  070245  170557  070260  070261  063750  070471
    002400  124544  000000  063731  006404  114536  127671  000000
    073726  001727  043753  073725  063726  043752  073726  063751
    073727  060052  073730  017671  037725  027703  002400  070270
    067760  060525  003004  044000  060525  127676  000000  000000
    000000  000000  007726  044516  050125  052040  035104  040524
    042454  054130  054130  054130  054130  054130  026110  026115
    051502  042101  000270  000400  177470  000200  000201  177752
```

DRS

```
    177577  000313  000000  000000  000000  000000  000000  000000
2,5        ← BASE PAGE LINK FOR $EX12
054 007567  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
2,6
055 060472  170735  060473  073723  060203  073722  074270  057732
    027626  002400  070126  054057  027736  114556  064270  047700
    160001  067717  114736  064270  054055  002001  027634  060236
    002003  027634  002400  070245  102100  102705  124225  160602
    070474  063733  006400  074245  124540  006400  060106  002020
    027645  033721  070106  060113  002020  124737  002400  067734
    114543  000141  063720  070471  002400  070245  064270  057731
    002001  027653  064530  124542  006400  060262  074262  002021
    027674  002400  070471  007400  124544  060112  050111  027670
    124537  007701  047522  046520  051121  052115  000000  046125
    046115  044502  041527  044524  043111  042104  000000  044505
    020040  045117  100000  000000  000000  000000  000000  037777
    040000  000031  000015  000014  000024  177765  177757  063723   $EX13
    140740  160000  170741  160206  001727  010072  164742  053730
    027770  160206  013726  033727  170206  064117  007004  044203
    002404  006303  027765  002004  047735  027760  114733  170743
2,7
056 164744  060046  073724  160745  073725  160001  173725  006004
    037725  134746  124747  160750  050055  002001  026011  060202
    000010  026022  114545  000002  000001  010027  177756  010020
    124551  160751  114552  002400  070245  160206  164220  124752
    044457  047440  042522  051040  000000  020040  020040  020040
    020040  020040  020040  020040  010034  010045  020125  050524
    021440  000000  020040  010053  020125  051505  051040  042111
    051503  010063  047122  042524  050105  062076  066077  015100
    006400  074245  060270  150753  002001  074530  124550  040502
    051124  000000  072034  076035  062130  114734  072041  160001
    072037  006004  160001  072040  034251  114545  000002  000001
    010034  177762  010123  124551  002400  070261  160751  114552
    126100  000000  000000  064041  016141  126131  000000  064043
    016141  126135  000000  076222  066200  076174  076175  076176
    066173  076177  016201  146177  176177  002003  026165  016201
    005727  146177  176177  036177  002002  026151  066176  062174   ASCII
2,8
057 072175  076174  066173  126141  010174  000000  000000  000000
    000000  030060  000000  006400  076221  070001  042222  036221
    002021  025204  006020  026205  066222  007004  044000  062221
    040052  126201  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
```

DRS

```
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
2,9
058 007567  010131  010135  010130  010100  010064  010060  010033
    010052  010050  010044  010043  007724  007774  007723  007722
    007623  007731  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
2,10
059 064123  004066  077745  060473  073751  002400  073753  073754
    017725  017725  001727  073752  017725  033752  073752  017725
    053756  002001  027632  017725  010070  073753  017725  053755
    027632  053756  124734  010070  073754  063753  001723  043753
    043753  043754  073753  063752  053757  027766  053760  124735
    063753  002002  027650  002004  073747  064122  007004  077750
    027653  073747  003400  073750  063747  003004  040122  002020
    124734  063747  114733  073762  063747  040052  040121  160000
    114733  073765  034261  114545  000002  000001  007761  177766
    007716  060520  003000  040254  002021  124554  060517  103101
    000036  102101  060515  064516  102100  102705  124520  002400
    070261  114555  037747  037750  027653  124736  000000  067745
    004065  160001  002041  001727  010074  005600  006004  077745
    127725  000000  070001  001700  040001  127740  000000  000000
    000000  000000  000000  000000  000000  000000  000040  000054
    052520  042116  046125  000000  020105  050524  000000  063753
2,11
060 114737  040052  017740  040117  040056  073746  160000  001222
    010056  050054  002001  026007  160740  012104  170740  026136
    060120  003004  170741  002404  170742  064117  060001  044066
    174743  040056  160000  001222  010056  050054  026033  160743
    134742  134741  026015  026136  160742  114733  072056  034261
    114545  000002  000001  010052  177761  010046  124744  002400
    070261  114555  026026  042105  053111  041505  020043  054130
    020104  047527  047040  160745  016110  150121  026123  040052
    114746  040117  040056  170743  160000  012106  052107  026123
    160740  012104  032105  170740  026136  037777  040000  037400
    014400  000000  002003  026123  002020  026123  064120  007000
    144745  006021  026123  126110  034261  114545  000002  000001
    010141  177765  010133  124744  002400  070261  114555  002400
    070245  124747  044516  050125  052040  042522  051117  051040
    000000  064041  016157  126147  000000  064043  016157  126153
    000000  076240  066216  076212  076213  076214  066211  076215
```

BASE PAGE LINKAGES FOR $EX13

$EX14

ASCII

DRS

ASCII

2,12

```
061  016217  146215  176215  002003  026203  016217  005727  146215
     176215  036215  002002  026167  066214  062212  072214  076212
     066211  126157  010212  000000  000000  000000  000000  030060
     000000  004400  076237  070001  042240  036237  002021  026222
     006020  026223  066240  007004  044000  062237  044052  126217
     000000  000000  000000  000000  000000  000000  000000  000000
     000000  000000  000000  000000  000000  000000  000000  000000
     000000  000000  000000  000000  000000  000000  000000  000000
     000000  000000  000000  000000  000000  000000  000000  000000
     000000  000000  000000  000000  000000  000000  000000  000000
     000000  000000  000000  000000  000000  000000  000000  000000
     000000  000000  000000  000000  000000  000000  000000  000000
     000000  000000  000000  000000  000000  000000  000000  000000
     000000  000000  000000  000000  000000  000000  000000  000000
```

2,13

BASE PAGE LINKAGES FOR $EX14

```
062  007567  010147  010123  010062  010136  010110  107746  007750
     007747  007746  007700  007753  007740  107751  010153  000000
     000000  000000  000000  000000  000000  000000  000000  000000
     000000  000000  000000  000000  000000  000000  000000  000000
     000000  000000  000000  000000  000000  000000  000000  000000
     000000  000000  000000  000000  000000  000000  000000  000000
     000000  000000  000000  000000  000000  000000  000000  000000
     000000  000000  000000  000000  000000  000000  000000  000000
     000000  000000  000000  000000  000000  000000  000000  000000
     000000  000000  000000  000000  000000  000000  000000  000000
     000000  000000  000000  000000  000000  000000  000000  000000
     000000  000000  000000  000000  000000  000000  000000  000000
     000000  000000  000000  000000  000000  000000  000000  000000
```

2,14

$EX15

```
063  174734  060115  170735  160735  170737  160740  170741  160735
     114575  160742  006004  114536  160734  002020  002400  164743
     002002  164744  174745  006004  160746  002002  027622  164001
     006003  027644  027624  050052  027626  040254  027627  060254
     110747  170750  134745  160746  050052  027637  040254  027640
     060153  170751  114752  017744  002001  134745  134745  160746
     002021  027710  060255  110747  170750  060151  170751  114752
     060047  170753  063776  170754  160750  114733  160001  010074
     130755  170001  114756  160757  114733  114756  160757  001265
     160000  114733  114756  134759  134753  027672  017772  002021
     027657  134745  160746  002021  027723  060153  110747  170750
     060147  170751  114752  017744  002400  070245  070113  070471
     164760  114545  000141  002400  064530  006002  124542  060262
     074262  002021  124537  007400  124544  000000  060043  170753
     063776  170754  160750  114733  160001  010074  130755  170001
     114756  160757  114733  114756  134750  134753  027760  017772
```

2,15

ASCII

```
064  002021  027745  127744  000000  114545  000002  000006  000333
     177570  010002  124551  062047  003004  042052  124761  000000
     162937  172051  036051  160001  172051  036051  006004  160001
     172051  036051  006004  160001  172051  036051  126006  000000
     114545  000003  001106  177777  000000  010036  124551  126026
     020040  020000  000000  000000  000000  000000  010042  000000
     000000  000000  000000  000000  177765  000200  000270  000405
     000411  177770  000000  064041  016071  126061  000000  064043
```

DRS

ASCII

```
    016071  125065  000000  076152  066130  076124  076125  076126
    066123  076127  016131  146127  176127  002003  026115  016131
    005727  146127  176127  036127  002002  026101  066126  062124
    072126  076124  066123  126071  010124  000000  000000  000000
    000000  030060  000000  006400  076151  070001  042152  036151
    002021  026134  006020  026135  066152  007004  044000  062151
    040052  126131  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
```

2,16

BASE PAGE LINKAGES FOR $EX15

```
065 007567  010065  010041  010042  010055  010043  010054  010044
    010045  010056  010057  010046  110046  010060  010047  010052
    010026  010050  010051  010040  010006  110047  010053  107772
    010061  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
```

2,17

$EX16

```
066 000000  077721  063710  073716  060046  073717  060123  000066
    073714  060472  001200  003004  073715  017672  017672  017672
    017672  002400  173716  017672  002002  027623  037716  037717
    002001  027645  173716  027615  053711  027642  053713  027612
    010074  043712  073720  163716  070001  001723  040001  040001
    043720  173716  027612  037716  037717  027610  060470  073716
    006400  074470  074471  074245  007400  002003  124544  003000
    040254  002021  124537  063721  002002  114552  002400  067710
    102100  102705  127716  000000  063715  002003  127672  067714
    004065  160001  012041  001727  010074  037714  037715  127672
    127672  000126  000054  177724  000040  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
```

2,18 ← BASE PAGE LINK FOR $EX16

```
067 007567  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
```

DRS

2,19

```
068 060200 170733 064161 002400 170734 170735 054155 160733
    070201 160736 006404 114720 160737 114721 002001 027705
    164740 160227 010075 150741 006400 074270 160742 050273
    060274 150743 060275 150744 027742 160745 070271 060176
    070272 060227 164746 114724 060470 170747 114725 070327
    060203 140750 064270 006002 060370 070370 070157 064161
    054155 070160 160736 064270 006003 160751 074470 064055
    114720 060161 050175 006405 124752 060155 070161 060115
    070200 160736 114720 060227 164753 114724 160736 064055
    114720 060175 070161 160733 070200 124752 060271 170754
    164755 150745 164756 150757 164760 154755 160761 174762
    160763 164764 114722 160765 164766 114722 114545 000001
    000401 010106 177776 007734 124551 160767 150770 027607
    150771 124752 027722 006003 027624 160733 170772 070200
    001727 170773 170735 160736 006404 114720 060370 170774
    060511 002004 170775 134772 134734 160772 070200 160736
```

$EX19

2,20

```
060 006404 114720 160734 070200 160736 064055 114720 160735
    140773 072035 036036 124776 002400 070200 062046 006404
    114720 062030 003004 042033 070370 002400 070273 072030
    124777 062105 070470 062035 006400 074245 102100 102705
    124225 000000 000000 000000 000000 000000 000000 000000
    000273 000427 020040 025000 000400 177764 177760 000200
    000201 037477 037440 054505 047117 046102 052123 041040
    042117 051440 051531 051524 042515 010073 010066 000000
    000000 045101 041105 046040 000000 000000 000000 010477
    047513 020124 047440 050125 051107 042477 000000 000000
    000000 000000 000000 000000 000000 000000 000000 000000
    000000 000000 000000 000000 000000 000000 000000 000000
    000000 000000 000000 000000 000000 000000 000000 000000
    000000 000000 000000 000000 000000 000000 000000 000000
    000000 000000 000000 000000 000000 000000 000000 000000
```

2,21

```
070 007567 010030 010032 010035 010046 010064 010054 010042
    010061 010062 010063 010057 010037 010105 010043 010047
    010020 010040 010066 010051 010060 010055 010056 010050
    010067 010065 010045 010076 010044 010106 010052 010053
    010031 010034 010033 010036 007762 007607 000000 000000
    000000 000000 000000 000000 000000 000000 000000 000000
    000000 000000 000000 000000 000000 000000 000000 000000
    000000 000000 000000 000000 000000 000000 000000 000000
    000000 000000 000000 000000 000000 000000 000000 000000
    000000 000000 000000 000000 000000 000000 000000 000000
    000000 000000 000000 000000 000000 000000 000000 000000
    000000 000000 000000 000000 000000 000000 000000 000000
    000000 000000 000000 000000 000000 000000 000000 000000
    000000 000000 000000 000000 000000 000000 000000 000000
```

BASE PAGE LINKAGES FOR $EX19

2,22

```
071 060127 073775 001727 114733 170734 006004 160001 010074
    130735 170736 060126 070161 114733 130735 170737 060130
    114733 170740 160741 164742 017737 160743 164744 017737
    160745 170746 160747 067777 017737 102011 002400 070200
    006404 017755 164750 050273 060274 150751 060275 150752
    002001 027645 050370 070200 006404 017755 064161 060370
    070157 054155 070160 050154 010074 064372 054000 027733
    005727 077774 044075 074372 034371 064055 017755 064511
    077776 067767 074526 063775 006404 017755 064511 060370
```

$EX20

DR5

$EX2Ø

```
017755 063775 073166 063773 070167 002404 073170 067770
074526 063772 164753 034162 114536 037774 037775 037776
027670 160754 170746 160747 067777 017737 102077 006400
074245 074526 074525 124550 160755 164756 017737 027726
000000 073746 077747 034261 114545 000002 000001 000000
000000 017752 124551 002403 070261 127737 000000 070166
063771 073167 160757 070170 063772 034162 114536 127755
```

2,23

```
072 007766 007714 000270 000166 007774 000000 000000 000000
    177732 177750 177756 177764 000200 010403 036400 047040
    043106 051531 051524 042515 010014 050101 051111 052131
    020105 051122 047522 010023 051503 020040 026040 020124
    051113 020040 020040 026040 020123 041524 051075 000400
    010040 052125 051116 020117 020040 020104 044523 041440
    050122 047524 042503 052040 047526 042522 051111 042105
    020123 053511 052103 044040 010064 051520 040522 042440
    052122 045440 047526 042522 043114 047527 000000 064041
    016105 126075 000000 064043 016105 126101 000000 076166
    066144 076140 076141 076142 066137 076143 016145 146143
    176143 002033 026131 016145 005727 146143 176143 036143
    002002 026115 066142 062140 072142 076140 066137 126105
    010140 000000 000000 000000 000000 030060 000000 006400
    076165 070001 042166 036165 002021 026150 006020 026151
    056156 007004 044000 062165 040052 126145 000000 000000
```

3,0

```
073 007567 010075 010031 010005 010030 010024 010036 010013
    010002 010022 010000 010006 010043 010037 010010 010011
    010012 010004 010007 010063 010001 010003 010101 000000
    000000 000000 000000 000000 000000 000000 000000 000000
    000000 000000 000000 000000 000000 000000 000000 000000
    000000 000000 000000 000000 000000 000000 000000 000000
    000000 000000 000000 000000 000000 000000 000000 000000
    000000 000000 000000 000000 000000 000000 000000 000000
    000000 000000 000000 000000 000000 000000 000000 000000
    000000 000000 000000 000000 000000 000000 000000 000000
    000000 000000 000000 000000 000000 000000 000000 000000
    000000 000000 000000 000000 000000 000000 000000 000000
    000000 000000 000000 000000 000000 000000 000000 000000
    000000 000000 000000 000000 000000 000000 000000 000000
```

BASE PAGE LINKAGES FOR $EX2Ø

ASCII

3,1

```
074 000000 016530 160213 010056 050054 026267 006404 050055
    026265 160213 001727 001222 010074 050062 002001 026264
    160206 032542 170206 006004 060001 126241 160214 001200
    170216 160215 002020 026277 001000 003004 002003 003400
    170217 062547 170220 160213 012541 032545 170213 102700
    002400 126241 000000 016530 160213 001200 072550 001727
    072551 020266 066550 102500 004010 002002 026340 134220
    026425 160206 012542 002002 026425 006400 026516 002440
    026355 010073 050073 026430 052553 026425 050065 026464
    006023 026425 050054 026451 026376 006011 026376 066551
    006411 026376 070001 001000 140217 002021 026375 060001
    170215 001000 003004 170217 060001 164216 004065 134216
    002041 001727 072552 060074 002040 001727 110001 032552
    170001 160213 012541 170213 134217 026425 062551 002020
    026503 160213 032546 170213 102700 036313 126313 164214
    001200 170216 160215 002020 026440 001000 003004 002003
```

DVR01

3,2

```
075 003400 170217 062547 170220 160213 032546 170213 026425
```

DRS

DVR01

```
    160214  001200  150216  026425  160216  040052  170216  160217
    040052  170217  026425  160213  012541  032545  170213  160214
    001200  150216  026425  164216  004065  160001  010075  032542
    002040  170001  160217  164215  006020  026514  005000  044000
    004031  006004  026516  007004  044000  160206  010075  006003
    032542  170206  002400  006003  060055  106700  126313  000000
    032554  072324  042543  072310  072425  032544  072526  126530
    037777  000040  001200  004000  100000  040000  177742  000000
    000000  000000  000015  102500  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
3,3                         BASE PAGE LINKS FOR DVR01
076 010241  010313  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
3,4
077 000000  016420  160213  010056  050054  126241  050055  026300
    160213  001727  001222  010073  050063  026263  050064  026267
    060055  126241  062442  170216  002400  026276  160214  002021
    003004  002203  003400  170216  060065  170217  026313  160214
    001200  170216  160215  002020  026310  001000  003004  170217
    002400  170220  062441  072320  026322  002400  126241  000000
    016420  160213  070001  001727  001200  072440  002400  150216   DVR02
    026402  004010  026360  150217  026364  164216  134216  004065
    160001  062041  001727  010074  066440  134217  026354  006020
    026354  052436  026402  102600  102700  036320  126320  160217
    134216  000000  026354  062440  002020  026402  164220  062435
    056435  060065  170220  056435  026377  026354  006400  174216
    026354  102500  070001  160206  010075  030001  170206  002400
    006002  060055  164215  006020  007004  106700  126320  000000
    032437  072402  040067  072354  042433  072355  032434  072416
    126420  000040  001100  004000  000015  000137  102500  000000
3,5
078 010315  177610  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
```

DRS

```
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
3,6                 <- BASE PAGE LINKS FOR DVR02
079    010241  013327  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
3,7
080    000000  164207  005600  064257  005623  174207  016700  073001   DVR22
       002001  015536  160213  010056  050056  026401  004033  026252
       000031  026346  005310  026546  016524  016550  076550  007007
       026376  044045  160214  006121  026330  072536  060045  072524
       072612  060257  067037  050062  067046  076521  160213  001727
       001226  002541  063055  170001  006004  036612  026314  066521
       162536  170001  036536  006004  036550  026321  062521  016633
       066261  063030  016657  010266  016557  067056  062345  016657
       010336  064064  063034  016657  010342  150215  026372  016612
       060050  170217  016550  160214  016633  067057  063035  016657
       010353  016557  134217  002001  026567  067056  062361  016657
       010366  160213  010067  002002  026440  060057  126241  016536
       160213  013050  053061  026376  004033  026400  053062  026422
       053063  026440  053064  026445  053065  026452  050067  026476
       026531  016625  067056  063031  016657  010423  002400  170207
       006401  006404  063001  002020  026376  002400  127001  016524
3,8
081    064056  063036  016657  010441  016625  067066  063031  016657
       010446  016521  010067  002003  026462  064056  062475  016657
       010456  067067  107627  016521  001323  001310  026472  102727
       026427  067063  062475  016657  010462  005310  026546  016612
       064064  062510  016657  010501  067070  063033  016657  010505
       016521  013071  002003  026432  067056  063032  016657  010515
       000000  102527  126521  000000  016521  013072  002103  126524
       067001  060055  006021  127001  126241  000000  005727  006020
       026546  067063  062536  016657  110536  060056  126241  000000
       164215  006321  007005  005100  076524  126550  000000  016521
       013071  002002  126557  160213  002011  026573  016521  001727
       002020  026606  102502  002002  033073  003004  016550  044000
       037004  160215  002020  005000  026436  164215  006020  007004
       026436  000000  016521  013072  002303  126612  160207  001623
       170207  002340  026531  126612  020000  016521  010067  002002
       026427  126625  000000  036635  177777  106702  001225  102602
3,9
082    062557  033074  102606  102702  062524  142602  126633  003400
       072635  162657  001275  160000  067063  002001  000000  170216
```

[SLIDE AD-23]

DRS

DVR22

```
       107627  016521  001323  001310  026650  002400  052635  103726
       102727  036635  103706  063001  002007  126241  124000  000000
       072557  064000  062706  016775  072706  106726  002004  072711
       106727  062670  016775  072670  006004  062463  016775  072463
       072661  062470  016775  072470  072671  062522  016775  072522
       064257  062643  016775  072643  073013  040047  072640  072646
       062673  016775  072673  062747  016775  072747  106706  040047
       044047  072636  062573  016775  072573  062644  016775  072644
       016521  010074  070001  160206  010075  030001  170206  016521
       070001  003400  072635  126700  000000  010077  030001  126775
       000000  164207  005265  006002  050001  027022  074257  040052
       016700  002400  102606  160216  004050  002405  124000  006400
       127001  070001  063026  016775  073026  106700  026674  010335
       010427  010500  010511  010265  010362  010431  011040  020040
3,10
   083 020040  020040  020040  020040  020040  011047  020040  020040
       020040  020040  020040  020040  020040  000041  000023  017700
       000600  000200  000300  000400  000500  000201  000101  000035
       000022  000040  140000  060000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
3,11                   BASE PAGE LINKS FOR DVR22
   084 010241  011001  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
       000000  000000  000000  000000  000000  000000  000000  000000
3,12
   085 160001  002002  131003  171004  006004  160001  002003  026012   LOADR
       131005  171006  006004  160001  171007  006004  160001  171010
       006004  160001  171011  002400  171012  171013  171014  060527
       161015  026035  171016  002400  165017  115020  060255  171021
       171022  003004  171023  040256  171024  141025  171026  002004
       171027  171030  161025  003004  040255  171031  060045  040100
       171032  171033  161024  003004  171034  165025  002400  170001
       006004  135034  026067  114535  012101  000066  020677  015171
       020771  161035  003004  141036  070001  040051  002020  027307
       161036  002004  001727  073037  161035  003004  141036  001100
       141035  001727  171037  001727  064155  054161  026132  060154
                                                                         FOR 32
```

13,6

EXEC MODULE DOUBLET TABLE CRS4

```
001 004003 000413 014004 000415 004005 000421 004007 000423
    004010 000425 010011 000427 004012 001002 004014 001004
    014015 001006 014016 001012 010017 001016 004020 001021
    010023 001023 010024 001026 000000 000000 000000 000000
    000000 000000 000000 000000 000000 000000 000000 000000
    000000 000000 000000 000000 000000 000000 000000 000000
    000000 000000 000000 000000 000000 000000 124112 037236
    037567 037135 037405 016000 036514 036515 001633 007777
    006000 002266 004134 004000 004150 005010 005035 005071
    005152 003123 003151 002135 006000 000471 000513 000534
    010132 010144 010072 010030 010000 011135 011210 000765
    011005 011114 001461 010021 005177 003136 007660 010755
    015400 015600 015732 006004 006160 005324 003525 005334
    001160 001163 001177 001211 001223 012246 002151 000522
    000523 000673 007726 012000 000207 001350 015747 015750
```

13,7

RELOCATABLE LIBRARY

```
002 010400 020000 167137 040523 041511 044440 000072 000000
    000000 000006 000143 000000 000000 000000 000000 000000
    000000 005400 040002 170452 041516 042105 041400 000000
    041516 047503 052000 000004 036000 060135 140462 000000
    001320 000000 064041 016000 000010 126000 000000 000000
    013212 064043 016000 000010 126000 000004 000000 076000
    000071 133332 066000 000047 076000 000043 076000 000044
    076000 000045 066000 000042 133320 076000 000046 016000
    000050 146000 000046 176000 000046 002003 132132 026000
    000034 016000 000050 005727 146000 000046 176000 000046
    121320 036000 000046 002002 026000 000020 056000 000045
    010400 060106 121765 000035 133332 062000 000043 072000
    000045 076000 000043 066000 000042 126000 000010 020000
    000043 021000 060122 052445 000046 000012 000000 030060
    000000 006400 076000 000070 013212 070001 042000 000071
    036000 000070 002021 026000 000053 013200 006020 026000
```

13,8

FOR TOTAL OF 147 SECTORS

```
003 000054 066000 000071 007004 044000 121200 062000 000070
    040052 126000 000050 003000 060101 060172 000071 000000
    000000 002000 120000 120000 000000 000000 000000 000000
    000000 000000 000000 000000 000000 000000 000000 000000
    000000 000000 000000 000000 000000 000000 000000 000000
    000000 000000 000000 000000 000000 000000 000000 000000
    000000 000000 000000 000000 000000 000000 000000 000000
    000000 000000 000000 000000 000000 000000 000000 000000
    000000 000000 000000 000000 000000 000000 000000 000000
    000000 000000 000000 000000 000000 000000 000000 000000
    000000 000000 000000 000000 000000 000000 000000 000000
    000000 000000 000000 000000 000000 000000 000000 000000
    000000 000000 000000 000000 000000 000000 000000 000000
    000000 000000 000000 000000 000000 000000 000000 000000
```

13,9

```
004 010400 020000 005144 042125 046522 054040 000064 000000
    000000 000006 000143 000000 000000 000000 000000 000000
    000000 005400 040002 142464 022114 044502 051000 000000
    022114 044502 054000 000026 035400 060136 033267 000000
    013320 000000 072000 000056 152000 000000 036000 000000
    002002 133200 026000 000010 036000 000061 026000 000024
    002004 002004 121332 076000 000057 005500 076000 000060
    066000 000000 046000 000062 001212 164001 174000 066000
```

CRS,

```
19,11
001 124003  004160  114532  114532  114532  114532  114532  114532   JSB $CIC
    114532  114532  114532  114532  114532  114532  114532  114532
    114532  114532  114532  114532  114532  114532  114532  114532
    114532  114532  114532  114532  114532  114532  177700  177766
    177767  177770  177771  177772  177773  177774  177775  177776
    177777  000000  000001  000002  000003  000004  000005  000006   CONSTANTS
    000007  000010  000011  000012  000021  000100  000017  000037
    000077  000177  000377  177400  003777  177700  037633  000000
    000000  000012  000000  000000  000000  000000  000000  000001
    000001  000000  000003  013000  000030  007361  000005  007506
    000007  037634  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  060307  000001  000001  013400  013400  000001
    000000  000377  000377  000000  000000  000000  000000  000000
    000000  000000  000003  000001  021450  000000  013000  007515
19,12
002 000016  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000   BASE
    000000  000000  000000  000000  000000  000000  000000  000000   PAGE
    000000  007533  000016  000000  007567  010241  000732  001000
    010241  001000  012000  001002  001633  000000  000000  000000   COMMUNICATION
    000000  002024  010453  000412  000000  000000  000000  000000   AREA
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
19,13
003 000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  177750
    000000  000000  000000  000000  000000  000000  000000  000000
    006407  000120  000001  000000  000000  000000  114532  114532
    001634  004160  004154  002214  003400  003511  003020  002635
    003744  003361  003426  004165  004267  002507  004010  003244   DISCM
    003345  003177  001714  003563  004044  002212  002653  002657   ENTRY
    002661  002663  002665  002553  003214  003207  003143  002576   POINTS
    002700  002631  002521  003130  003117  004243  002445  004302   LINKAGE
19,14
004 004303  004314  004376  000000  000000  000000  004446  000000   EXEC MODULES
    000000  000000  000000  004505  000000  000000  000000  000000   ENTRY LINKS
    000000  004671  005264  000000  000000  002322  002222  002637
    004262  004151  001746  004034  004125  004304  004305  001736
    001726  001723  004300  004301  004307  004272  004312  004313   DISCM
    004310  004311  004274  004150  004126  004127  004135  004124   PAGE
    004005  004024  004136  004035  004137  004277  004131  004132   BOUNDARY
    004133  004134  004270  004275  004130  004145  004146  004147   LINKS
```

CRS,

DISCM PAGE LINKS

EXEC MODULES LINKS

	003607	002213	003743	103575	003325	002463	003204	003213
	003220	003236	003003	005774	006011	006266	006354	006336
	006372	006374	006330	006315	006410	006464	006660	006743
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
	000000	000000	000000	000000	000000	000000	000000	000000
19,15								
005	023776	154025	117770	060413	115164	041036	102074	012576
	025574	053370	126760	004446	151114	130736	070402	161004
	150516	127742	066412	155024	140566	110042	026612	055424
	133050	074626	000162	000344	000710	001620	003440	007100
	016200	034400	071000	162000	152506	133722	076352	003432
	007064	016150	034320	070640	161500	151706	132322	073352
	166724	164356	157442	146612	122132	052772	125764	062456
	145134	120776	050502	121204	051116	122234	053176	126374
	063476	147174	125076	060702	141604	112116	032742	065704
	153610	136126	102762	014452	031124	062250	144520	117746
	046422	115044	040616	101434	011576	023374	046770	115760
	042446	105114	020736	041674	103570	016066	034154	070330
	160660	150246	127222	065152	152324	133356	075442	001612
	003424	007050	016120	034240	070500	161200	151106	130722
	070352	160724	150356	127442	065612	153424	135556	102042
	012612	025424	053050	126120	062746	145714	122336	103216
19,16								
006	002502	175321	012410	165774	052040	124100	056706	135614
	102136	013002	026004	054010	130020	066546	155314	141336
	111402	031512	063224	146450	123026	056162	134344	077416
	005542	013304	026610	055420	133040	074606	000122	000244
	000510	001220	002440	005100	012200	024400	051000	122000
	052506	125214	061136	142274	113276	035302	072604	165410
	161526	151762	132452	073632	167464	165656	162242	153212
	135132	100772	010472	021164	042350	104720	020346	040714
	101630	012166	024354	050730	121660	052246	124514	057736
	137674	106276	023302	046604	115410	041526	103254	015236
	032474	065170	152360	133446	075622	002152	004324	010650
	021520	043240	106500	023706	047614	117430	045566	113354
	035436	073074	166170	163066	154662	140252	107232	025172
	052364	124750	060426	141054	110636	030202	060404	141010
	110526	027762	057744	137710	106326	023362	046744	115710
	042326	104654	020236	040474	101170	011066	022154	170601
4,17								
007	110660	067143	060514	117671	111166	031062	062144	144310
	117326	045362	112744	034416	071034	162070	152666	134262
	077252	005232	012464	025150	052320	124640	050206	140414
	107536	026002	054004	130010	066526	155254	141236	111202
	031112	062224	144450	117626	046162	114344	037416	077034
	004576	011374	022770	045760	113740	036406	075014	000536
	001274	002570	005360	012740	025700	053600	127400	065506
	153214	135136	101002	010512	021224	042450	105120	020746
	041714	103630	016166	034354	070730	161660	152246	133222
	075152	001032	002064	004150	010320	020640	041500	103200
	015106	032214	064430	151060	130646	070222	160444	147616
	126142	063012	146024	122556	054042	130104	066716	155634
	142176	113102	034712	071624	163450	155626	142162	113052
	034632	071464	163150	156026	140562	110052	026632	055464
	133150	075026	000562	001344	002710	005620	013440	027100
	056200	134400	077606	005722	013644	027510	057220	127110

REMAINDER OF TRACK 19 NOT USED

21,23

```
061 026000 000273 162000 000164 002002 026000 000061 002004
    120132 072000 000160 004122 007004 076000 000161 026000
    000064 121320 072000 000160 003400 072000 000151 062000
    000160 003004 001320 040122 002000 026000 000334 062000
    000160 055400 060147 112466 000072 113200 016004 072000
    000171 062000 000160 040052 040121 011210 160000 016004
    072000 000176 034261 016001 000202 000002 000001 000172
    177766 000127 000010 000020 003000 040254 002021 026002
    000000 060517 103101 000036 102101 060515 000000 064516
    102100 102705 124520 002400 011302 070261 016003 036000
    000160 036000 000161 026000 000064 121200 026000 000347
    000000 056000 000156 004065 017000 060123 011144 000141
    000000 160001 002041 001727 010074 005600 013200 006004
    076000 000156 126000 000136 000000 070001 001200 001700
    040001 126000 000151 000000 000000 000000 000000 000000
    000000 000000 035000 050143 112160 000166 000000 000040
```

22,0 LB DO [illegible] Q8 Q10 Q9

```
062 045103 042117 021450 050521 050521 050421 044456 031461
    020000 036173 000723 041456 031461 020000 036173 000724
    044456 031062 020000 036164 000000 041456 031062 020000
    036164 000000 046117 040504 051000 036155 000000 163252  C.S.
    041120 051000 036146 000000 040523 046502 020000 036137
    000000 037501 051503 047000 036137 000000 037501 051515
    041000 036137 000000 037502 047103 047000 036137 000000
    037502 050113 052400 036137 000000 037503 044117 050000
    033103 000000 000312 000003 177250 046040 020040 020040
    042040 020040 020040 020040 020040 000000 000000 000000
    000000 000000 000000 000000 000000 000001 000001 000003
    000003 000004 000002 000001 000005 000000 000000 050521
    050521 050421 044456 031461 020000 037515 051531 046000
    036137 000000 037522 046125 047000 036137 000000 037501
    043114 043000 036137 000000 037514 051524 046000 036137  SB
    000000 037514 052516 044400 036137 000000 037522 051502
```

USER LABEL/ SYSTEM BUFFER SECTOR

FK55 20° 3

22,1

```
063 054122 042506 020003 013400 000015 012000 014750 001002  XRET
    001036 012000 014071 042517 052061 020011 013415 000001  EOT!
    053505 047524 020003 013416 000002 012000 012013 001002
    001003 012000 012013 054122 042506 051010 013420 000020
    042111 051503 046410 014010 000024 042530 042503 051410
    014004 000077 042126 051060 052410 015423 000003 042126
    051063 030410 015426 000005 046111 041122 054410 016003
    000217 042126 051060 031010 021002 000002 042126 051060
    030410 021004 000003 042126 051062 031010 021007 000007
    046117 042122 020010 021016 000061 045117 041120 020010
    022017 000101 040523 046502 046010 023410 000050 040523
    046504 020010 024404 000004 040523 046463 020010 024404
    000004 040523 046464 020010 024410 000006 040523 046465
    020010 024416 000012 043122 052116 020010 025000 000010
    043124 047061 020010 025010 000060 043124 047062 020010
    026010 000055 043124 047063 020010 027005 000052 177772
```

LAST DIRECTORY ENTRY THIS SECTOR

USER DIRECTORY

ETC

22,2

```
064 043124 047064 020010 027427 000037 040523 046461 020010
    030406 000014 040523 046462 020010 030422 000013 051511
    047461 020011 031005 000005 041101 051503 030411 031012
    000011 041117 047524 020011 031023 000025 043124 047110
    020011 031420 000001 042517 043040 020003 031421 000001
    012000 012013 001002 001002 012000 012013 043123 050103
    042403 031422 000001 012000 012013 001002 001002 012000
    012013 051127 044516 042003 031423 000001 012000 012013
```

END OF USER DIRECTORY

USER DIRECTORY

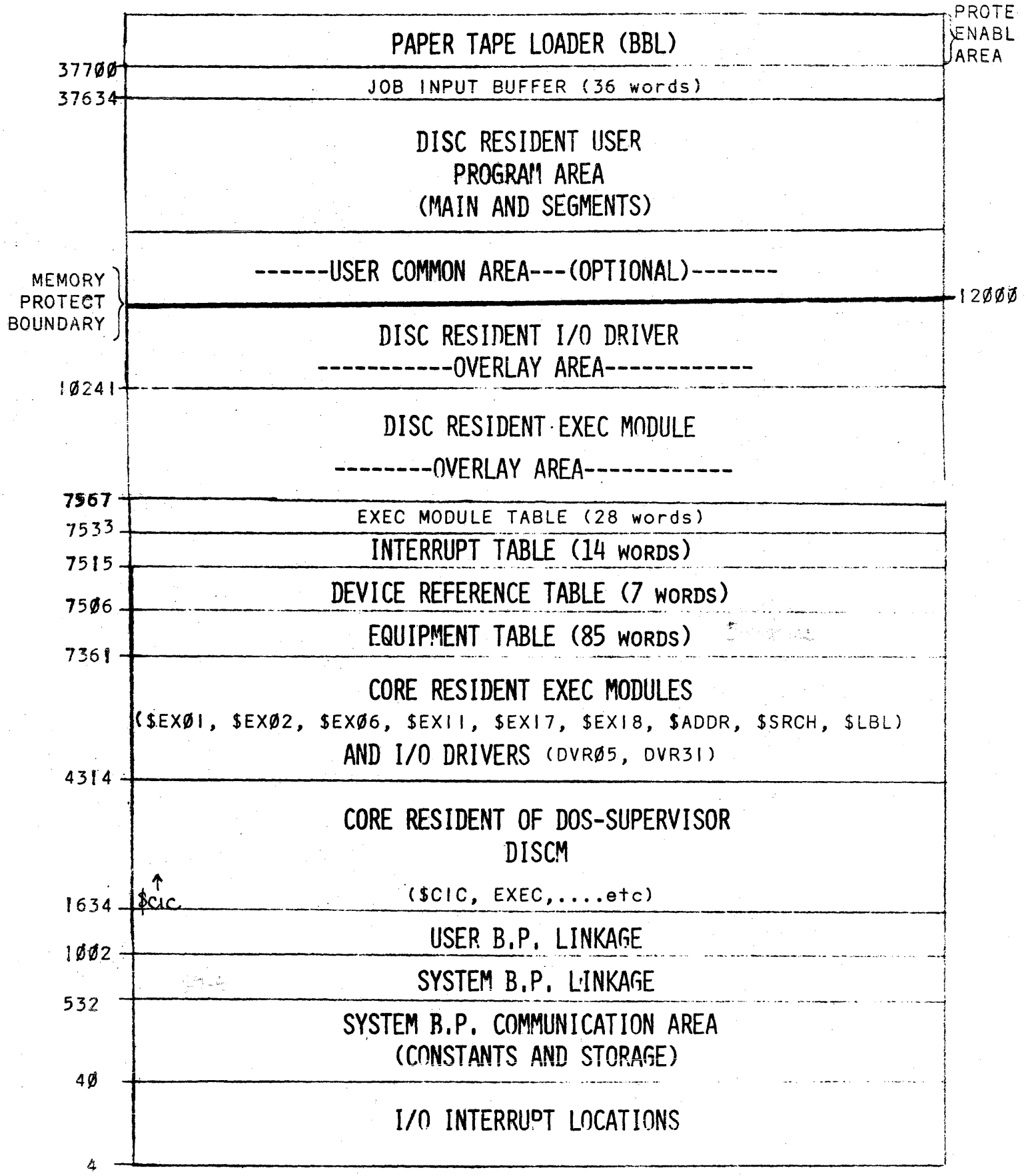
END

```
    001002  001002  012000  012013  042056  030060  051411  031424
    000103  052123  051124  051411  033017  000006  052123  051124
    051010  033025  000005  041514  042501  051012  033402  000001
    000000  020010  024400  000004  040523  046463  020010  024404
    000003  040523  040464  020010  004410  000000  040523  040465
    020010  024416  000012  043122  052116  020010  025000  000010
    043124  047061  020010  025010  000060  043124  047062  020010
    024010  000055  043124  047063  020010  027005  000052  177777
22,3
065 000257  162000  000257  012120  050052  026000  000050  040254
    026000  000051  060153  132210  072000  000263  016000  000237
    016000  000155  002001  036000  000257  132120  036000  000257
    162000  000257  002021  026000  000121  060255  132132  012000
    000271  072000  000260  060151  072000  000263  016000  000237
    013320  060047  072000  000261  062000  000207  072000  000262
    035000  050136  017074  000074  130012  062000  000260  016012
    160001  010074  032000  000251  013312  170001  016000  000217
    162000  000260  016012  016000  000217  120112  162000  000260
    001265  150000  016012  016000  000217  133320  036000  000260
    036000  000261  026000  000103  016000  000203  002021  133212
    026000  000070  036000  000257  162000  000257  002021  026000
    000134  013212  060153  012000  000271  072000  000260  060147
    072000  000263  035000  060143  044350  000132  132000  016000
    000237  016000  000155  002400  070245  070113  013000  070471
    066000  000264  016007  000141  002400  001000  064530  006402
22,4
066 026005  060262  074262  010100  002021  026004  007400  026010
    000000  013332  060043  072000  000261  062000  000207  072000
    000262  062000  000260  100120  016012  160001  010074  032000
    000251  170001  133132  016000  000217  162000  000260  016012
    016000  000217  036000  000260  035400  060140  044452  000175
    133212  036000  000261  026000  000171  016000  000203  002021
    026000  000156  121000  126000  000155  000000  016002  000002
    000006  000312  000333  177670  000213  026011  062000  000260
    013212  003004  042000  000263  120000  000203  000000  062000
    000250  132132  172000  000262  036000  000262  160001  172000
    000262  036000  000262  001320  006004  160001  172000  000262
    036000  000262  006004  012000  160001  172000  000262  014300
    060116  153075  000235  132100  036000  000262  126000  000217
    000000  016002  000003  000030  001106  177777  000000  000247
    026011  120000  126000  000237  020040  020000  000000  011400
    060114  102330  000256  020000  000253  000000  000000  000000
22,5
067 000000  000000  000000  177765  000200  000270  000405  000000
    000411  177770  002000  120000  120000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
    000000  000000  000000  000000  000000  000000  000000  000000
```

[illegible] LAST DIRECTORY ENTRY THIS SECTOR

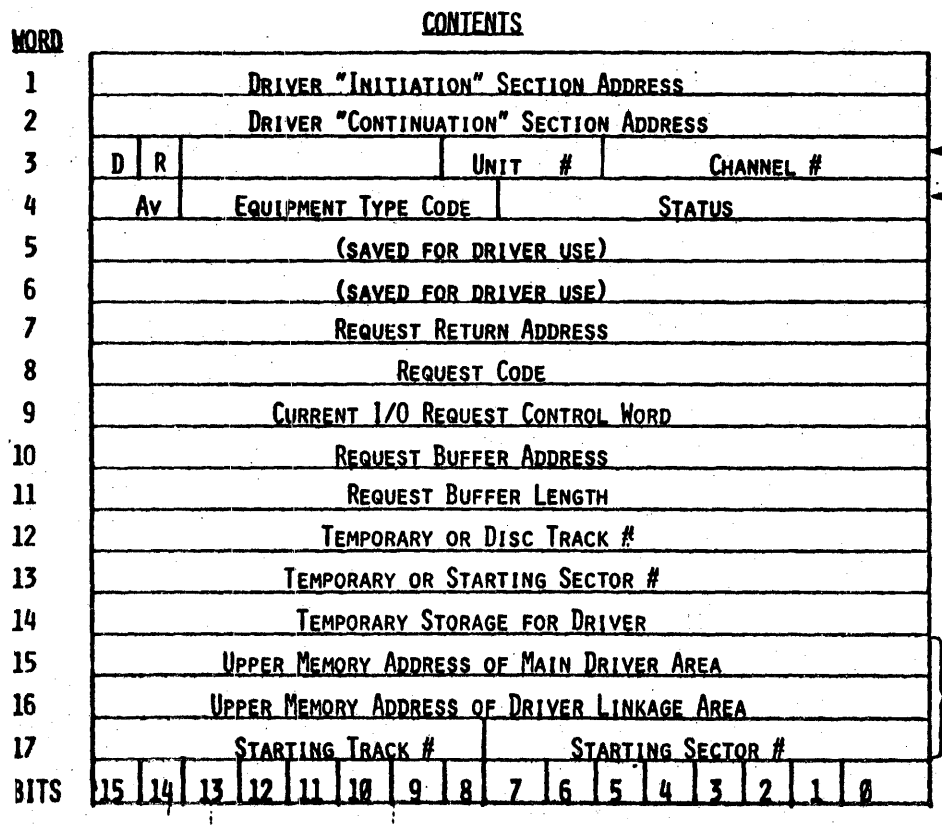
REST OF TRACK 22 IS RESERVED FOR USER DIRECTORY ENTRIES

CORE MAP FOR DOSM SYSTEM GENERATION EXAMPLE (16K)



[SLIDE AP-1]

EQUIPMENT TABLE ENTRY FORMAT



D = 1 if DMA channel required.
R = 1 if driver type is core-resident.
Unit # May be used for sub-channel addressing.
Channel # I/O select code for device (lower number if multiboard interface.)

Av = Ø - Unit not busy and available
= 1 - Unit disabled (down)
= 2 - Unit busy
= 3 - Unit waiting for an available DMA channel

(This field set by system)

Status - Actual or simulated unit status at end of operation. (Driver must set this field)

Equipment Type Code - Identifies type of device and associated software driver. Assigned equipment type codes in octal are

Ø0-07	**Papter Type Devices**
Ø0	Teleprinter
Ø1	Punched Tape Reader
Ø2	High Speed Punch
Ø5	Teletype (System)
10-17	**Unit Record Devices**
10	Reserved for Plotter
12	Line Printer
15	Mark Sense Card Reader
20-37	**Magnetic Tape/Mass Storage and other devices capable of both input and output.**
22	3030 Magnetic Tape
31	Moving-Head Disc

For equipment type codes 1 through 17, odd number indicate input devices and even number indicate output devices (except Ø5, which is both input and output).

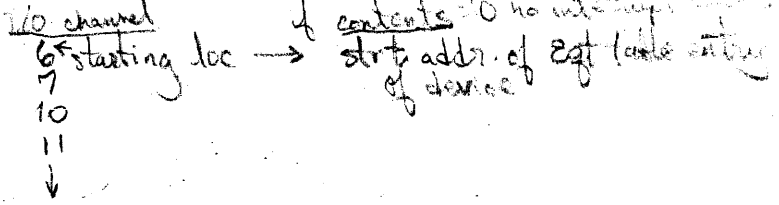
DEVICE REFERENCE TABLE FORMAT

EACH ENTRY IN THIS TABLE REQUIRES ONLY ONE WORD IN MEMORY. THE VALUE OF EACH ENTRY (DECIMAL NUMBER, 1-63) ASSOCIATES A LOGICAL UNIT NUMBER WITH AN EQUIPMENT TABLE ENTRY FOR THE SYSTEM IN THE FOLLOWING MANNER:

SEQUENCE IN MEMORY TABLE	LOGICAL UNIT #	FUNCTION
1	1	SYSTEM TELEPRINTER
2	2	USER MASS STORAGE
3	3	SYSTEM MASS STORAGE
4	4	STANDARD PUNCH DEVICE
5	5	STANDARD INPUT DEVICE
6	6	STANDARD LIST DEVICE
7-63	7-63	ANY DEVICE

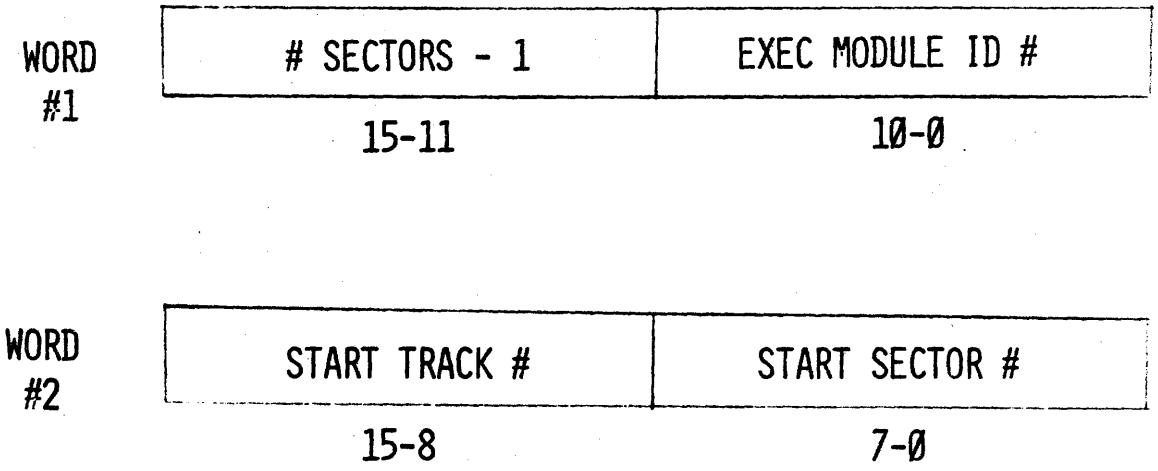
INTERRUPT TABLE FORMAT

EACH ENTRY IN THIS TABLE REQUIRES ONLY ONE WORD IN MEMORY AND IS ASSOCIATED WITH EACH I/O CHANNEL IN THE COMPUTER (STARTING WITH LOCATION 6) WHICH CAN CAUSE AN INTERRUPT. EACH LOCATION IN THIS TABLE HAS AN ENTRY VALUE. MEMORY, LOCATIONS ARE ASSOCIATED IN CONSECUTIVE INCREASING ORDER WITH AN I/O CHANNEL. TABLE VALUES ARE ZERO FOR AN I/O CHANNEL NOT REQUIRING INTERRUPT. I/O CHANNELS REQUIRING INTERRUPT CONTAIN THE START ADDRESS OF THE EQUIPMENT TABLE ENTRY OF THE ASSOCIATED DEVICE.



EXEC MODULE DOUBLET TABLE FORMAT

(TWO WORDS PER DISC RESIDENT EXEC MODULE)



SYSTEM DIRECTORY LISTING FOR DOSM GENERATION EXAMPLE

NAME	TYPE	SCTRS	DISC	ORG	PROG LIMITS		B.P. LIMITS		ENTRY	LIBR.	P-BIT
SUBCHAN=1											
$EX03	XS	0002	T001	011	07567	07624	00732	00733	07567	07624	
$EX04	XS	0004	T001	013	07567	10176	00732	00741	07567	10176	
$EX05	XS	0002	T001	017	07567	07745	00732	00733	07567	07745	
$EX07	XS	0002	T001	019	07567	07746	00732	00733	07567	07746	
$EX08	XS	0002	T001	021	07567	07732	00732	00733	07567	07732	
$EX09	XS	0003	T001	023	07567	10142	00732	00763	07567	10142	
$EX10	XS	0002	T002	002	07567	07745	00732	00733	07567	07745	
$EX12	XS	0002	T002	004	07567	07761	00732	00733	07567	07761	
$EX13	XS	0004	T002	006	07567	10223	00732	00754	07567	10223	
$EX14	XS	0004	T002	010	07567	10241	00732	00751	07567	10241	
$EX15	XS	0003	T002	014	07567	10153	00732	00763	07567	10153	
$EX16	XS	0002	T002	017	07567	07722	00732	00733	07567	07722	
$EX19	XS	0003	T002	019	07567	10107	00732	01000	07567	10107	
$EX20	XS	0003	T002	022	07567	10167	00732	00761	07567	10167	
DVR01	DR	0003	T003	001	10241	10555	01000	01002	10241	10555	
DVR02	DR	0003	T003	004	10241	10443	01000	01002	10241	10443	
DVR22	DR	0005	T003	007	10241	11075	01000	01002	10241	11075	
LOADR	UM	0032	T003	012	12000	21032	01002	01425	12000	21032	
JOBPR	UM	0038	T004	020	12000	22463	01002	01414	12000	22463	
ASMB	UM	0023	T006	010	12000	17120	01002	01362	16522	17120	
ASMBD	US	0004	T007	009	17127	17647	01362	01363	17442	17647	
ASMB1	US	0006	T007	013	17366	20542	01362	01424	17366	20542	
ASMB2	US	0007	T007	019	17345	20550	01362	01410	17351	20550	
ASMB3	US	0003	T008	002	17473	17771	01362	01363	17630	17771	
ASMB4	US	0004	T008	005	17366	20027	01362	01371	17366	20027	
ASMB5	US	0006	T008	009	17345	20425	01362	01404	17351	20425	
FTN	UM	0006	T008	015	12000	13127	01002	01047	12000	13127	
FTN01	US	0031	T008	021	13254	22120	01047	01502	16550	22120	
FTN02	US	0025	T010	004	13254	21027	01047	01356	13741	21027	
FTN03	US	0024	T011	005	13254	20600	01047	01277	15117	20600	
FTN04	US	0025	T012	005	13254	20750	01047	01360	13702	20750	
LIBRY	LB	0147	T013	007							

EQUIPMENT TABLE LISTING

```
:EQ
EQT 01 CH 11 DVR05 0 R U0 S0
EQT 02 CH 13 DVR01 0 0 U0 S0
EQT 03 CH 14 DVR31 D R U0 S0
EQT 04 CH 16 DVR02 0 0 U0 S0
EQT 05 CH 22 DVR22 D 0 U0 S0
@
```

LOGICAL UNIT TABLE LISTING

```
:LU
LU01 EQT01
LU02 EQT03
LU03 EQT03
LU04 EQT04
LU05 EQT02
LU06 EQT01
LU07 EQT05
@
```

MEMORY DUMP FOR DOSM SYSTEM GENERATION EXAMPLE

CORE DUMP: 000004-007566

```
000000:                                  114532   114532   114532   114532
000010: 114532   114532   114532   114532  114532   114532   114532   114532
000020: 114532   114532   114532   114532  114532   114532   114532   114532
000030: 114532   114532   114532   114532  114532   114532   114532   114532
000040: 177700   177766   177767   177770  177771   177772   177773   177774
000050: 177775   177776   177777   000000  000001   000002   000003   000004
000060: 000005   000006   000007   000010  000011   000012   000021   000100
000070: 000017   000037   000077   000177  000377   177400   003777   177700
000100: 037633   000000   000000   000012  000000   000000   000000   000000
000110: 000000   000001   000001   000000  000003   013000   000030   007361
000120: 000005   007506   000007   037634  000000   000000   000000   000000
000130: 000000   000000   000000   000000  000000   000000   000000   000000
000140: 000000   000000   000000   000000  000000   000000   000000   000000
000150: 000000   000000   000000   000000  060307   000001   000001   033403
000160: 033403   000001   000000   000377  000026   000000   001005   000000
000170: 000046   000000   000000   000000  013001   000001   021450   000000
000200: 013000   007515   000016   007361  007362   007363   007364   007365
000210: 007366   007367   007370   007371  007372   007373   007374   007375
000220: 007376   007377   007400   007401  000000   000000   000000   000000
000230: 000000   000000   000000   000000  000000   000000   000000   177777
000240: 177777   077777   003327   007533  000016   000000   007567   010241
000250: 000732   001000   010241   001000  012000   001002   001633   000006
000260: 000000   000001   000000   002024  010463   000412   000000   000000
000270: 046102   042117   021450   050521  050521   050421   044456   031461
000300: 020000   036173   000723   041456  031461   020000   036173   000724
000310: 044456   031062   020000   036164  000000   041456   031062   020000
000320: 036164   000000   046117   040504  051000   036155   000000   163252
000330: 041120   051000   036146   000000  040523   046502   020000   036137
000340: 000000   037501   051503   047000  036137   000000   037501   051515
000350: 041000   036137   000000   037502  047103   047000   036137   000000
000360: 037502   050113   052400   036137  000000   037503   044117   050000
000370: 033403   000000   000312   001534  177610   020040   020040   020040
000400: 030471   027117   041524   027067  030040   000000   000000   000000
000410: 000000   000000   000000   000000  000000   000000   000001   000003
000420: 000003   000004   000002   000001  000005   000000   000000   050521
000430: 050521   050421   044456   031461  020000   037515   051531   046400
000440: 036137   000000   037522   046125  047000   036137   000000   037501
000450: 043114   043400   036137   000000  037514   051524   046000   036137
000460: 000000   037514   052516   044400  036137   000000   037522   051502
000470: 000000   042101   000000   000000  000000   000000   000000   007552
000500: 177771   000000   000000   000000  000000   003463   000000   000000
000510: 000000   177750   000000   000000  000000   177777   177777   077777
000520: 003327   000000   006407   000120  000001   000000   000000   000000
000530: 114532   000000   001634   004160  004154   002214   003400   003511
000540: 003020   002635   003744   003361  003426   004165   004267   002507
000550: 004010   003244   003345   003177  001714   003563   004044   002212
000560: 002653   002657   002661   002663  002665   002553   003214   003207
000570: 003143   002576   002700   002631  002521   003130   003117   004243
000600: 002445   004302   004303   004314  004376   000000   000000   000000
000610: 004446   000000   000000   000000  000000   004505   000000   000000
000620: 000000   000000   000000   004671  005264   000000   000000   002322
000630: 002222   002637   004262   004151  001746   004034   004125   004304
000640: 004305   001736   001726   001723  004300   004301   004307   004272
000650: 004312   004313   004310   004311  004274   004150   004126   004127
000660: 004135   004124   004005   004024  004136   004035   004137   004277
000670: 004131   004132   004133   004134  004270   004275   004130   004145
000700: 004146   004147   003607   002213  003743   103575   003325   002463
000710: 003204   003213   003220   003236  003003   005774   006011   006266
```

TRAP CE
JSB $CI
CONSTANT
CURRENT EQT TABL ADDRGSSES
SYSTEM I/O BUFFER
DISCM ENT POINT LINKS
EXEC ENT POINTS
DISCM PAGE LINKS

DISC RESIDENT I/O DRIVER B.P. LINKAGE

EXEC SUBROUTINE LINKS

EXEC MO
DISC RE
LINKAGE

USER BASE PAGE LINKAGE

000720:	006354	006336	006372	105774	006330	006315	006410	006464	
000730:	006660	006743	007567	000000	000000	000000	000000	000000	
000740:	000000	000000	000000	000000	000000	000000	000000	000000	
000750:	000000	000000	000000	000000	000000	000000	000000	000000	
000760:	000000	000000	000000	000000	000000	000000	000000	000000	
000770:	000000	000000	000000	000000	000000	000000	000000	000000	
001000:	010241	011001	012000	017624	020315	022175	022202	015126	
001010:	021023	015342	015465	014302	014733	022213	115037	014623	
001020:	015442	015754	020307	015124	015216	015221	014035	014711	
001030:	020431	020432	014364	020433	020434	020435	015101	015557	
001040:	021237	015623	014027	021051	022017	020443	020444	020445	
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$FIC DISCM
Core resident

[SLIDE AP-7]

DISCM

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002210: 020000 037777 000000 000000 000000 103100 114641 062214
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[SLIDE AP-8]

DISCM

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DISCM

$EXØ1

$EXØ2

$EXØ6

$EX11

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005330: 002001 037315 060203 127315 000000 160205 010072 073334
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005350: 027356 060062 017315 027356 102000 027354 006004 160001
005360: 064514 054056 027411 001222 010056 002003 027411 050054
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005410: 043517 063334 017315 173766 063334 002004 017315 173766
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005430: 050054 027435 050055 027435 027443 160227 050050 003004
005440: 010072 050056 034162 114571 160226 002021 027462 160206
005450: 013456 053457 027565 027667 017766 124574 037400 014400
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$EX11

$EX17

$EX18

$EX18

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005510: 053460 027454 053461 027454 060102 002003 027523 001727
005520: 010074 040052 027520 060154 010076 070505 060160 006400
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005560: 140232 003004 040505 002020 124563 160233 040511 002021
005570: 124563 160232 001727 130233 070171 060230 070172 160231
005600: 070173 060224 040045 002002 124560 060055 114565 114571
005610: 064177 160227 050050 074161 063753 170214 114572 027654
005620: 067314 074161 050060 027642 050055 027650 050056 002001
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005660: 050050 003004 013666 002003 124551 027310 020000 160205
005670: 001222 000010 027616 060203 050513 027616 114570 027616
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005710: 060161 073314 006400 063755 114577 177747 006002 002004
005720: 003004 040505 002020 124564 064504 044056 160001 006400
005730: 114577 177770 077756 001727 140233 070505 040511 002020
005740: 027744 037756 070505 027736 067756 005727 060505 030001
005750: 070171 034162 027575 000171 000126 000000 000000 164231
005760: 006121 027764 005100 007004 077755 127756 000000 060245
005770: 002020 003004 070245 127765 000000 003000 070001 040254
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006010: 124541 000000 072125 070126 060161 072107 060152 072123
006020: 002400 070162 072130 060115 040075 064055 016252 016136
006030: 062123 002003 026114 064527 056057 026111 006020 026060
006040: 004065 006043 026111 076131 002041 026054 062130 052107
006050: 026054 016202 026054 016136 036130 066131 026040 047117
006060: 060156 003000 072130 062130 003000 052107 026072 016202
006070: 026072 016136 036130 026063 026111 062124 066110 114543
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006120: 016252 066100 126011 000000 000000 000000 000000 000000
006130: 000000 000000 000000 000000 000000 000000 000000 062125
006140: 016244 062264 072124 062126 066124 015266 026075 066124
006150: 044055 160001 010073 040045 002020 044061 044056 076124
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$ADDR

$SRCH

$LBL

DVRØS

DVR05

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006430: 006424 120213 052577 026436 060057 126410 164214 006021
006440: 007004 174217 005300 174214 060055 026415 006422 164214
006450: 005200 174215 164215 007324 005010 007004 001310 026462
006460: 006003 007400 174217 126446 001676 062464 052430 026476
006470: 160206 002020 026476 034260 036464 126464 164213 005332
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006520: 002041 001727 072446 060074 002340 001727 110001 032446
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006550: 040052 170217 026537 000000 160214 001000 150216 026537
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006570: 032534 002046 170001 160217 164215 002004 006021 001100
006600: 006020 007300 044000 166711 001521 102511 103711 002400
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007010: 003004 040116 001727 001300 043355 002020 027034 001727
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007030: 002400 006004 170001 027051 044055 003004 170001 043355
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007050: 170001 017126 017241 067354 063346 053336 047343 106702
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007070: 026764 060200 002302 000040 060162 067353 002041 002003
007100: 074164 002041 002002 074163 002400 070162 164215 006020
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007140: 001767 017143 127126 007142 102614 103714 053353 002300
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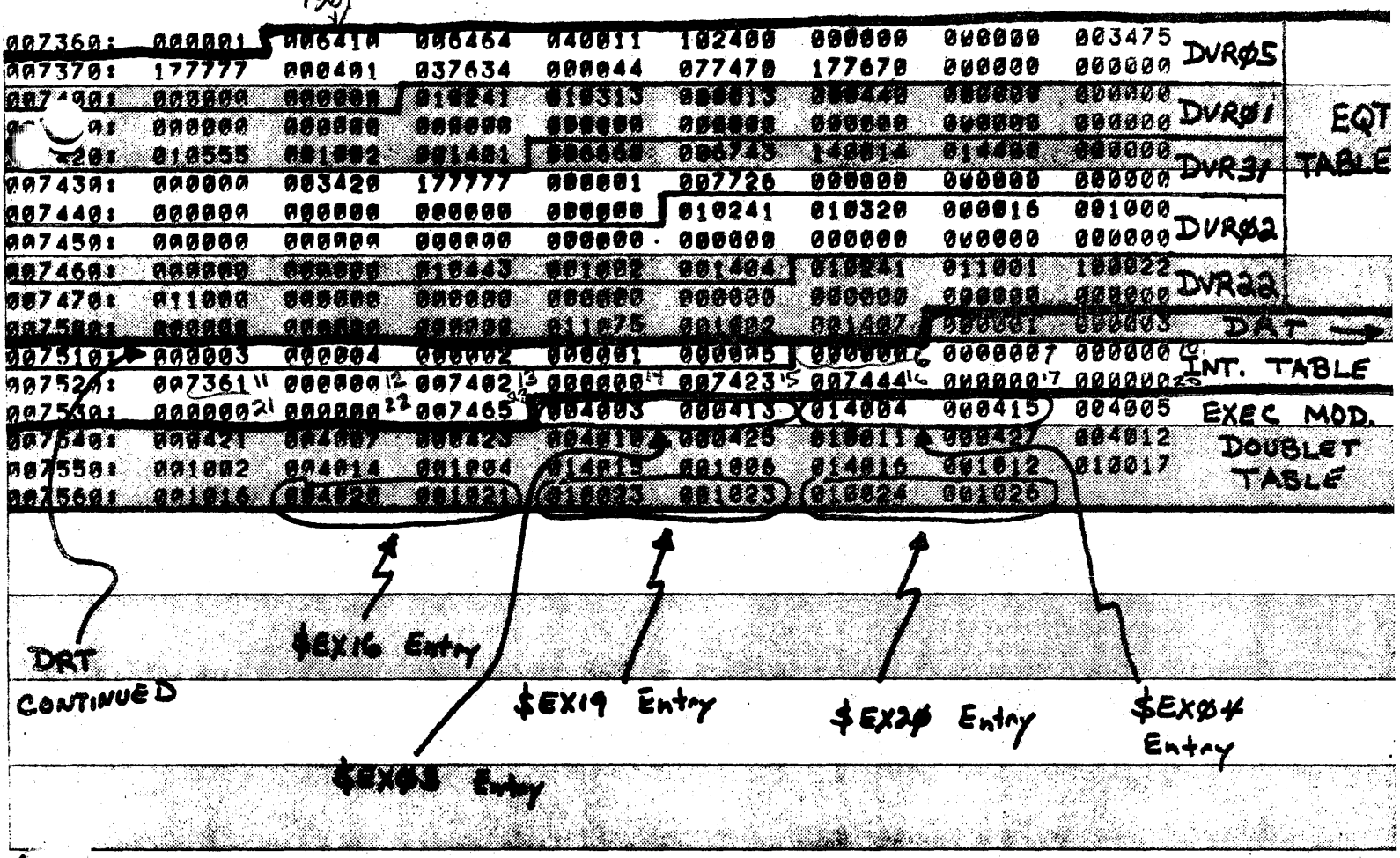
[SLIDE AP-13]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007450: 000000 000000 000000 000000 000000 000000 000000 000000 DVR22
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007470: 011000 000000 000000 000000 000000 000000 000000 000000
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007540: 000421 004007 000425 004010 000425 010011 000427 004012 DOUBLET
007550: 001002 004014 001004 014015 001006 014016 001012 010017 TABLE
007560: 001016 014020 001021 010023 001023 010024 001026
DRT
CONTINUED
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$EX19 Entry
$EX20 Entry
$EX04 Entry
$EX03 Entry