



Systems Reference Library

IBM 7090/7094 IBSYS – IOEX Programming Systems Analysis Guide

This manual was prepared by the Programming Systems Department to provide detailed information on the internal logic of the IBM 7090/7094 Basic Monitor. It is intended for technical personnel who are responsible for diagnosing the system operation, or for adapting the programming system to special usage. The charts and detailed descriptions herein are based on Version 2 of the system.

Preface

Certain knowledge is a prerequisite for the full utilization of this manual. The reader should have a basic knowledge of the 7090 FAP language. Familiarity with the information contained in the following manuals is necessary to understand the material contained in this manual:

IBM 7090/7094 Operating Systems, Basic Monitor (IBSYS), Form C28-6248.

IBM 709/7090 Programming Systems: FORTRAN Assembly Program (FAP), Form C28-6235.

IBM 7090 Data Processing System, Form A22-6528.

Contents

			Chart
	Page	Chart	Page
Basic Monitor Supervisor — IBSUP	7	AA	8
Trap Supervisor — IOEX	9	AB, AC	10, 11
Storage Map — IBSUP, IOEX, DUMP	12	,	,
· · · · · · · · · · · · · · · · · · ·			
Chart Descriptions — IBSUP	14	D	22.25
Cold Start and Initialization Routine IBSYS — \$IBSYS Card Routine	14 16	BA, BB BC	36, 37 38
IBRES — \$RESTORE Card Subroutine	17	BD	39
Control Card Interpretation Routines —	11	DD	99
IBCDIN/IBTPIN	18	BE	40
IBATC/IBDTC—\$ATTACH/\$DETACH Card Routines	19	BF	41
IBATC Routine	19		
IBDTC Routine	19		
IBXCC - \$EXECUTE Card Routine	19	BG	42
Non-Data Select Routines	20	ВН	43
IBREW – \$REWIND Card RoutineIBWEF – \$ENDFILE Card Routine	20 20		
IBRUN — \$REMOVE Card Routine	20		
Miscellaneous Card Routines and Error Print-Out	20		
Routines	21	BJ	44
IBSTP – \$STOP Card Routine	21	,	
IBDAT – \$DATE Card Routine	21		
IBCCC – \$CARDS Card Routine	21		
IBPAC – \$PAUSE Card Routine	21		
IBTCC – \$TAPE Card Routine	21		
IBLIS – \$LIST Card Routine	21		
IBUNL – \$UNLIST Card Routine	21		
Miscellaneous Error Routines IBSWC — \$SWITCH Card Routine	$\frac{21}{22}$	вк	45
IBUNT — \$UNITS Card Routine	22	BL	46
IBREL/IBASC – \$RELEASE/\$AS Card Routines	23	BM	47
IBREL Routine	23	D.1.1	
IBASC Routine	$\frac{-3}{24}$		
IBEDT — \$IBEDT Card Routine	24	BN	48
Restore Nucleus, System Interrupt, and Dump			
Caller Routines	26	BP	49
CALIB1 — Restore Nucleus Routine	26		
SYSRPT — System Interrupt Routine	27		
DUMP — Dump Caller Routine	$\begin{array}{c} 27 \\ 27 \end{array}$	BR	50
Disk Loader Waiting Loop and Disk Channel Routines	28	BS	50 51
CALPOW – Disk Loader Waiting Loop	28	Do	01
CAL8Y – Load System Record	29		
CAL5Y – Write Checkpoint Record	29		
CAL6Y Load SLTABL	29		
CAL7Y — Read Checkpoint Record	29		
System Return and Print Tape Positions Routines	29	BT	52
IBRET – System Return Routine	29		
TPPS – Print Tape Positions Routine	30	DIT	70
Skip Job Routines IBNJB Routine	30 30	BU	53
IBNJ2 Routine	31		
Locate Desired System and Validate Channel and	ΟŢ		
Unit Designation	31	BV	54
IFIND – Locate Desired System Routine	31	•	
IBVAL — Validate Channel and Unit Designation			
Routine	32		

	Page	Chart	Chart Page
INITUS – Initialize System Tape Usage Routine SYUCU – Symbolic Unit Conversion Routine	33 33	BW BX	55 56
RSYUR — Remove Unit from Availability Chain Routine and Sample Availability Chain RYSUR Routine Sample Availability Chain	35 35 35	ВҮ	57
Chart Descriptions — IOEX			
ACTV/(ACTIV — Activate Channel Routine SAVE/XTRAP — Trap Supervisor BG1 — Initiate Next Channel Operation Routine Read Redundancy Recovery Routine Write Redundancy Recovery Routine Redundancy Subroutines RED50 — Increment Redundancy Count Subroutine RED10 — Print Redundancy Error Message	58 59 61 62 63 64 64	CA, CB CC, CD, CE CF, CG CH CJ CK	75, 76 77, 78, 79 80, 81 82 83
Subroutine NRTST — Noise Record Test Subroutine RDUN — Permit Write Redundancy Trap Subroutine NDSEL — Non-Data Select Routine	64 64 64	CL	85
Select Routine for Non-Data Operations (Except NDWEF) Select Routine for NDWEF Disk Recovery Routines Issue Seek Routines ISSK1 — Issue Seek One Routine	65 67 67 69	CM CN CP, CR CS	86 87 88, 89 90
ISSEK — Issue Multiple Seeks Routine Machine Pause and Stop Routines PAUSE/PAWS Routines STOP Routine	69 70 70 70	CT	91
TEST — File Validity Test Subroutine Perform SNS and Form Disk Order Subroutines DATNS — Performs SNS Routine FDAMT — Form Disk Order Routine	71 71 71	CU CV	92 93
On-Line Print, Punch, and CVPRT Routines (PROUT and (PUNCH Routines (CVPRT Routine	72 72 72 74	CW	94
Appendix A — On-Line Messages			95
During IOEX Operation During IOEX Operation			95 97
Appendix B — Assembly Parameters Machine and System Definitions Unit Definitions Intermediate Definitions			100 100 100 100
Appendix C — Channel Information and Operation Tables			102
Appendix D — Key Switches and Storage Locations			103
Appendix E — Abbreviations			107
Appendix F — Glossary			108
Appendix G — Autochart Reference Tables			110
Table A — Labels Table B — Entry Connection References Table C — Subroutine Usage			110 112 113
Appendix H — Sample Autochart Symbols			114

List of Illustrations

	P	age
Chart AA.	Basic Monitor, Overall Flow	8
Chart AB.	IOEX Main Routines, Overall Flow	10
Chart AC.	IOEX Auxiliary Routines, Overall Flow	11
Figure 1.	Storage Map: IBSUP, IOEX, DUMP	13
Figure 2.	Format of an Entry in SYSNAM Table	
Chart BA.	Cold Start and Initialization, Sheet 1	36
Chart BB.	Cold Start and Initialization, Sheet 2	37
Chart BC.	IBSYS Routine for \$IBSYS Card	38
Chart BD.	IBRES Routine for \$RESTORE Card	39
Chart BE.	Control Card Interpretation Routine, IBCDIN/IBTPIN	40
Chart BF.	IBATC Routine \$ATTACH CardIBDTC Routine for \$DETACH Card	41
Chart BG.	IBXCC Routine for \$EXECUTE Card	42
Chart BH.	IBREW Routine for \$REWIND Card	43
Chart BJ.	Miscellaneous Card Routines and Error Routines: IBSTP/\$STOP	44
Chart BK.	IBSWC Routine for \$SWITCH Card	45
Chart BL.	IBUNT Routine for \$UNITS Card	46
Chart BM.	IBREL Routine for \$RELEASE CardIBASC Routine for \$AS Card	47
Chart BN.	IBEDT Routine for \$IBEDT Card	48
Chart BP.	CALIB1 Routine for Restoring Nucleus SYSRPT Routine for Processing Interrupt Request DUMP Routine for Providing Core Dump	49
Chart BR.	SYSLDR (CALIB3) Routine for Loading Records from	50
Chart BS.	Disk Loader, Wait Loop, and Channel Routines: CALPOW, CAL8Y, CAL5Y, and CAL6Y	51
Chart BT.	IBRET Routine for System Return TPPS Routine for Printing Tape Positions	52
Chart BU.	IBNJB and IBNJ2 Routines for Processing Skip Job Request	53
Chart BV.	IFIND Routine for Locating and Positioning System TapeIBVAL Routine for Validating and Locating a UCB	54
Chart BW.	INITUS Routine for Initializing System Tape Usage	55
Chart BX.	SYUCU Routine for Conversion of a Symbolic Unit to a Unit Address	56
Chart BY.	RSYUR Routine for Removing a Unit from Availability Chain Sample Chaining Layout	57
Figure 3.	Recovery Actions Taken for Specific Disk Errors	68
Chart CA.	ACTV Routine, Sheet 1	75
Chart CB.	ACTV Routine, Sheet 2	76
Chart CC.	SAVE/XTRAP Routines, Sheet 1	77
Chart CD.	SAVE/XTRAP Routines, Sheet 2	78
Chart CE.	SAVE/XTRAP Routines, Sheet 3	79

	Page
Chart CF.	BG1 Routine to Initiate Next I/O Operation, Sheet 1
Chart CG.	BG1 Routine to Initiate Next I/O Operation, Sheet 2 81 (Includes OUT Routine)
Chart CH.	Read Redundancy Recovery Routine 82
Chart CJ.	Write Redundancy Recovery Routine
Chart CK.	Redundancy Recovery Subroutines: RED50, RED10, NRTST, RDUN. 84
Chart CL.	NDSEL Routine for Non-Data Select Operations 85
Chart CM.	Select Routines for Non-Data Operations except NDWEF
Chart CN.	Select Routine for NDWEF 87
Chart CP.	DKRCV Routine for Disk Recovery, Sheet 1
Chart CR.	DKRCV Routine for Disk Recovery, Sheet 2
Chart CS.	ISSEK/ISSK1 Routines for Issuing a Seek on Disk 90
Chart CT.	PAUSE/PAWS Routines for Machine Pauses 91 STOP Routine for Machine Halts
Chart CU.	TEST Routine for Checking Validity of File Designation
Chart CV.	DATNS Routine for Performing a SNS Operation 93 FDAMT Routine for Formation of a Disk Order
Chart CW.	PUNCH Routine for On-Line Punching 94 PROUT Routine for On-Line Printing
Figure 4.	Intermediate Machine Definitions

Basic Monitor Supervisor — IBSUP

IBSYS is a basic supervisory program used to coordinate a sequence of jobs which might involve distinct and independent operating systems. This coordination is achieved through the use of a common input-output trap supervisor (IOEX), and a series of Unit Control Blocks (UCB'S) which contain the statistics and control information for all the I/O units in use by the system.

IBSUP is that portion of the Basic Monitor which is in control on initial loading, and between each system that is run. IBSUP consists of a group of small routines, each performing one specific function as directed by one control card that has been read in. Chart AA shows the overall flow within IBSUP. Unless a system stop or a transfer to another system is desired, control returns to read in another card and perform the function requested by this card.

The control cards are divided into four categories:

- 1. Operational: SEXECUTE, SIBSYS, SPAUSE, SCARDS, STAPE, SRESTORE, and SSTOP.
- 2. Unit Assignment, Physical Attachment: \$ATTACH, \$DETACH.

Logical Assignment: \$AS, \$RELEASE, and \$SWITCH.

- 3. Tape Manipulation: sendfile, srewind, and sremove.
- 4. Miscellaneous: *DATE, **, *UNITS, *UNLIST, *LIST, *IBEDT, and *ID.

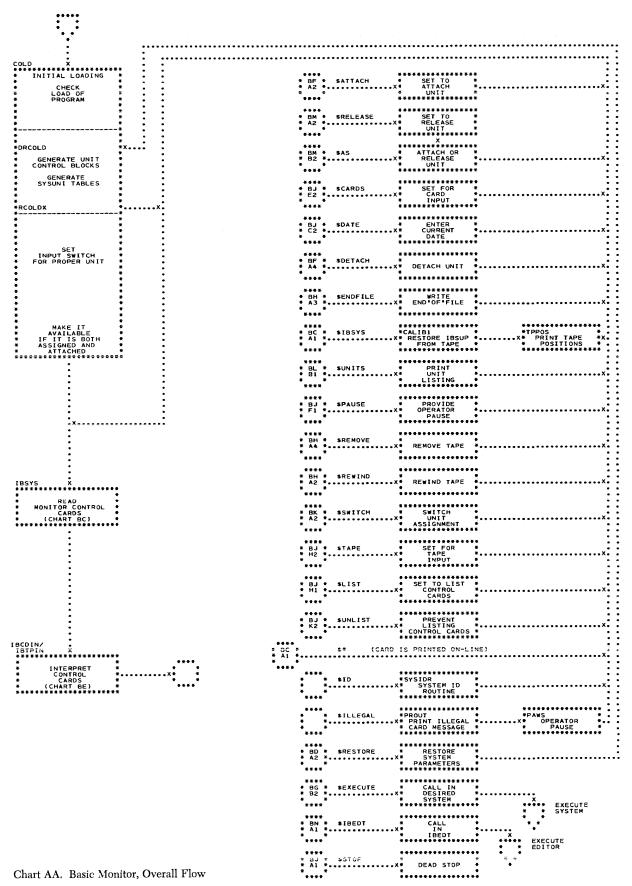
Operational control cards perform functions concerning the overall operation of the IBSYS system while IBSUP is in control. They indicate the location of the input control cards, provide a temporary or permanent stop, and cause restoration of the IBSYS system or readin of another system.

Unit assignment control cards indicate which units are physically available, and which logical function is to be handled by a particular physical unit.

The tape manipulation control cards perform nondata select operations on logical units, and maintain the proper tape position indicators in the individual UCB for the unit receiving the operation.

The miscellaneous control cards perform a variety of accounting type functions, and can call in an editor to perform required system tape maintenance.

For a detailed description of the exact function of each card, refer to the *IBM Reference Manual*, *IBM* 7090/7094 Operating Systems, Basic Monitor (IBSYS), Form C28-6248.



The IOEX portion of the Basic Monitor, shown on Charts AB and AC, consists of a trap supervisor for data channel operations, and a series of subroutines to perform specific functions that might be required by a user. The subroutines initiate or give priority to movement of data, perform non-data select operations, convert data from one form to another, print or punch data on-line, and provide temporary or permanent halts to the program. The trap supervisor processes all data channel traps received, and maintains operation on any channel as long as activity is requested for any unit on that channel.

Communication between the user's program and the trap supervisor is through the use of Unit Control Blocks (UCB'S) associated with each physical 1/0 unit in the system. The user indicates that an operation is requested for a unit by placing the address of a select routine in word 2 of the UCB. Later, in the SEL-routine, the user will indicate to the trap supervisor that this operation is complete by clearing word 2 of the UCB. A complete description of each portion of the UCB with its associated meaning may be found in the IBM Reference Manual, IBM 7090/7094 Operating Systems, Basic Monitor (IBSYS), Form C28-6248.

A user may initiate activity on a channel through the use of the CACTIV subroutine. If the request does not call for priority (word 1 of the calling sequence has a prefix of PZE) and the channel is already active, no action is necessary, and control returns immediately to the user's program. If the channel is dormant, however, the user's select routine will be entered to activate the channel before returning to the user's program. If the user requests priority by using a prefix of MZE in the first word of the calling sequence, there are two possible courses of action for IOEX: (1) If the routine is entered at non-trap time, control remains in the routine, if necessary, until the desired select routine has been entered. (2) If the routine is entered at trap time, the unit is given priority by placing the

location of the proper UCB in the channel priority cell, and the return to the user's program is made immediately.

If a user wishes to perform some non-data select operation on a unit, he uses the (NDSEL subroutine. This initiates the operation with priority through the use of the (ACTIV subroutine with a prefix of MZE in the calling sequence.

The trap supervisor first saves all machine registers and machine status conditions so that they may be restored upon exit from the routine. The channel and unit causing the trap are determined, and the 1/0 operation just performed is checked for errors. If errors are found, recovery is attempted in a manner prescribed by the type of error and assembly configuration. When a successful operation has been performed, the next waiting 1/0 operation will be initiated by the user's SEL+ routine. First, a test is made to determine if one should be started on the same unit that just completed the operation. If none is required on this unit, each UCB subsequent to this one is checked to determine if a request is waiting for that unit. This test is made through the entire block of UCB's for this channel by returning to the start of the UCB's for the channel and continuing the test. In this manner, any UCB prior to the one for the unit that has just completed an operation will also be checked. The first UCB found with an address of a select routine in word 2 will have the requested operation started before leaving the trap supervisor. If no ucb requests an operation, the channel is allowed to become dormant, and will require an entry to (ACTIV to start it in operation again. Before returning to the point interrupted by the data channel trap, the machine registers and status conditions previously saved are restored.

The remaining subroutines in IOEX perform specific conversions of data, on-line printing or punching of Hollerith data, or machine pauses and stops. These are explained in detail, along with their usage, in the reference manual, Form C28-6248.

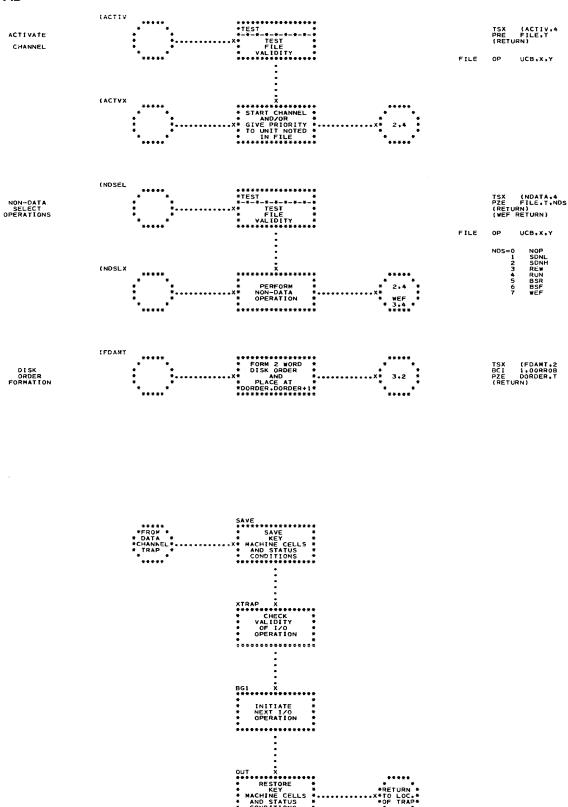


Chart AB. IOEX Main routines, Overall Flow

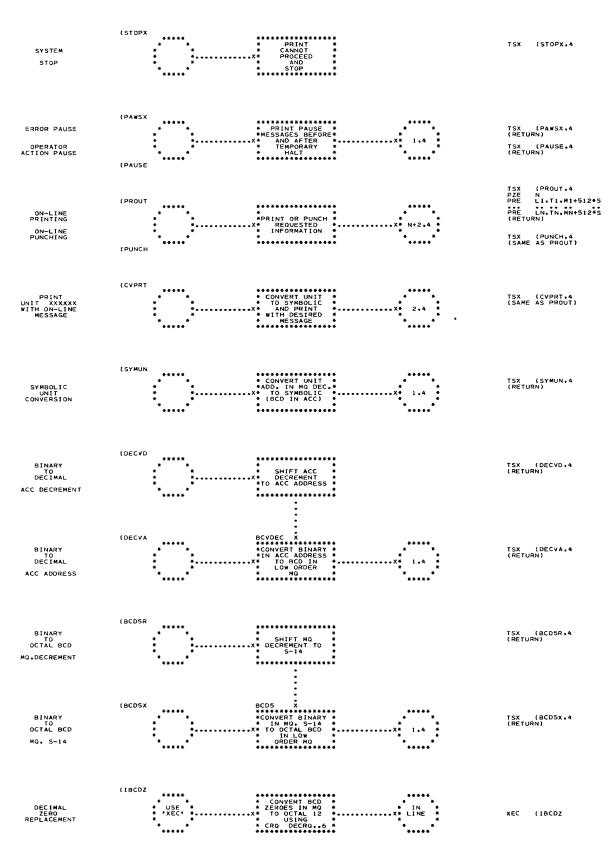


Chart AC. IOEX Auxiliary Routines, Overall Flow

Storage Map — IBSUP, IOEX, DUMP

The storage map, Figure 1, shows the relative location of the various routines in the Basic Monitor and IOEX. The actual memory locations shown are not necessarily correct for all compiled systems. Minor changes in assembly parameters, which might be made by a specific user, may change many of these locations to a slight degree. The system origin sysorc and the following three tables within the nucleus should remain the same: table of one word entries, systra to systwt; system units table, syslb1 to sysut4; and the IOEX communications table, (ACTIV to (IBCDZ.)

The first column shows the contents of storage required for IOEX and the nucleus. This load is in storage during the execution of any system operating under

the Basic Monitor system. The lower half of this column is an exploded view of the contents of the nucleus, and shows the locations of its cells when the system is operating. The lines that extend to the right indicate the location of the nucleus in IBSUP prior to being relocated to its operating position.

The second column shows the contents of storage when the IBSUP portion of Basic Monitor is in control. It also shows the original location of the nucleus as it is loaded from tape or disk.

The third column shows the approximate limits of the system dump program, and the short block of locations used to store the machine cells and status conditions prior to entry to the dump program.

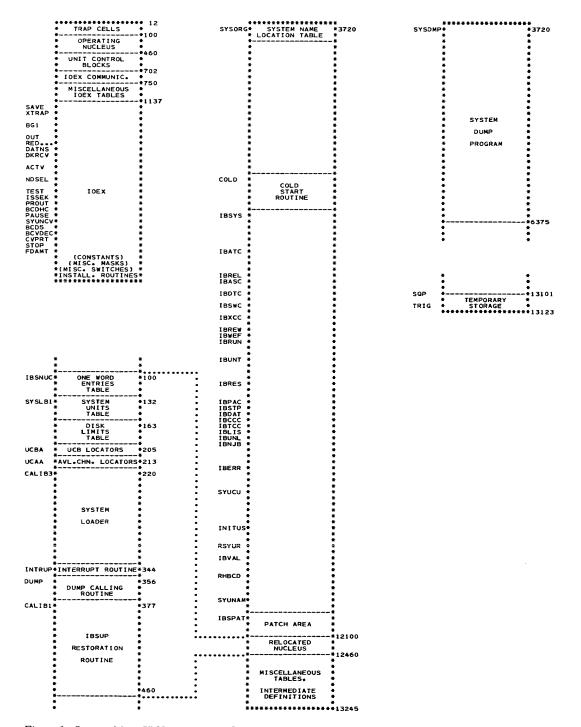


Figure 1. Storage Map: IBSUP, IOEX, and Dump

Cold Start and Initialization Routine

This routine is used for the initial loading, or whenever a srestore control card is read in, or a direct transfer is made to IBRES (Block BD01.) Entry is at location COLD (Block BA01) for an initial load or at DRCOLD (Block BA05) for restoration.

On initial loading, a check is made for proper readin of the program, preliminary housekeeping is performed, and the input switch is set for the proper input unit. This unit is made available if it is assigned and attached. The original value of SYSLB1 and the disk limits are stored for future reference in CLDLB1 and CLDLB1+1.

For both initial loading and restoration, a set of Unit Control Blocks (UCB's) is generated. One block of four words is generated for each existing card machine, tape drive, disk access arm, and Hypertape drive.

The SYSUNI table is set up so that each entry will have as its address the address of the UCB for the unit assigned to that entry.

After any use of the routine, the exit is to IBSYS (Block BC01).

Block BA01: Location 0 is cleared to provide a stop if a redundancy is encountered while reading in the Basic Monitor. Location COLD is also cleared to indicate that cold start has been executed.

Block BA02: All channels are tested for tape redundancies. If one is found, control transfers to location 0 and halts.

Blocks BA03 and BA04: If there are no redundancies, the nucleus is moved from the temporary area where it was initially loaded to the normal working area. The value in the entry keys is placed in location IBKEYS. All sense switches are tested and their settings stored as individual bits in location IBSSWS.

Block BA05: Location sysorg+101 is tested to determine if the system is loaded on disk. If this location is zero, indicating that the system is not on disk, control transfers to RCOLD at Block BA07.

Block BA06: If the system is on disk, SYSLB1 and its associated disk limit location are set up for disk operation.

Block BA06.5: The value of syslb1 and the disk limits (in case the original system was on disk) are stored for future reference in CLDLB1 and CLDLB1 + 1.

Block BA07: All UCB's are preset as follows: words 1 and 3 are set to MZE; words 2 and 4 are set to PZE. If the routine is being used by IBRES, word 3 is not altered, since this would destroy the file and record count.

Block BA08: IR2 is set to 3, which is the maximum number of card machine UCB's possible for one channel.

Blocks BA09 and BA10: The MQ is loaded with a word containing indicators for all the card machines that are on all channels. The sense indicators are loaded from a table (AAMT) that contains indicators for the attached units and their model types.

Block BA11: The address for the first card machine on this channel is picked up for use in generating word 1 of the UCB. The sign of the MQ is tested to determine if this card machine exists. If it does not exist, no UCB is generated for this unit. The sense indicators are tested to determine if the unit is attached. If it is not attached, a 1 bit is on'ed to the accumulator in position 1 to indicate that the unit is not attached. The constructed Unit Control Word (UCW) is stored in word 1 of the UCB, and IR4 is stepped to point to the start of the next ucb. The unit address is stepped for the next card machine on this channel, and the model and attachment bits are shifted for the next test. IR2 is tested to determine if all card machines have been checked for this channel. If there are more to be checked, the entire operation within this block is repeated.

Block BA12: When all ucb's for card machines have been generated for this channel, the model and attachment bits are stored temporarily to allow the tape, disk, and Hypertape ucb's to be generated.

Block BAI3: The number of tapes on this channel is extracted from NTONCH and placed in IRI. The first tape unit address is placed in the accumulator. IRI is tested for zero to determine if there are any tapes on this channel. If there are none, control transfers to GNXDI (Block BAI4).

Subroutine GNXUN is used to generate word 1 for one UCB, and IRI is again tested to determine if there are any more tape units remaining. If there are, control returns to subroutine GNXUN and the process is repeated until the UCB's for all existing tape units have been generated.

Block BA14: The sense indicators are loaded with the model type and attachment bits for disk units on

interface 1, access 0. IR1 is set to the number of moddules for interface 1, access 0. The address for the first module on interface 1, access 0 is picked up from location pfwc1.

IR1 is tested to determine if there are any modules with this access arm. If there are none, control transfers to GNXD2 (Block BA15). Subroutine GNSEK is used to generate a UCB for disk. This routine generates information for word 1 and word 3 of the UCB.

IR1 is tested to determine if there are any more modules on this access arm; if there are, control returns to subroutine gnsek.

Block BA16: The method used in block BA14 is repeated for interface 2, access 0.

Block BAI8: The sense indicators are loaded with the attachment bits for the Hypertape units on interface 1. IR1 is loaded with the number of units on interface 1. The unit address for the first Hypertape unit on interface 1 is taken from location HTWC1.

IR1 is tested to determine if there are any Hypertape units on interface 1. If there are none, control exits immediately to GNXH2 (Block BA19). Subroutine GNXUN is used to generate word 1 for one UCB. IR1 is tested to determine if there are any more tape units on interface 1. If there are, control returns to subroutine GNXUN.

Block BA19: The method used in block BA18 is repeated for the Hypertape units on interface 2.

Block BA20: All unit addresses are incremented by 1000_8 for the next channel. The starting location for the availability chain is incremented by 1. Location CHN is incremented by 1 and its value left in IR1.

Block BA21: IR1 is tested to determine if all channels have been processed. If they have not, control returns to IBCDE at block BA08.

Block BA22: When all channels have been processed, the set density instructions in IOEX are changed to NOP's to prevent any density changes until the units are referred to by IBSYS.

Block BA23: IR2 is set to the complement of the location of the first unit in the system units table (SYSUNI). The contents of IR2 become a pointer to this location. IR1 is set to the number of entries in the SYSUNI table.

Block BA24: One entry in the sysuni table is picked up. It is presently in the form: PRE CHAN,, UNIT. IR2 is saved.

Block BA25: Subroutine IBVAL is used to validate the channel and unit picked up in block BA24. On exit from IBVAL, the accumulator will be zero if the channel and unit are not valid. If they are valid, the accumulator will contain the location of the UCB for that unit. The sense indicators will contain the contents of the first word of that UCB, and IR2 will be set to the com-

plement of the accumulator address to point to the UCB.

Blocks BA26 and BA27: Position 1 of the sense indicators is tested to determine if the unit is attached. If it is, control transfers to TUEF2 (Block BA28). If not, the accumulator is cleared.

Block BA28: IR2 is restored and the address of the UCB is placed in the sysuni table.

Blocks BA29 and BA30: Positions 5 and 12 of the sense indicators are tested to determine if the unit is disk. If it is, control transfers to Block BA31. If the unit is not disk, subroutine RSYUR removes this unit from the availability chain.

Block BA31: IR2 is restored to point to the present sysum. IR1 is saved because it is used for subroutine linkage in Block BA32.

Blocks BA32 and BA33: Subroutine INITUS is used to initialize system tape usage. IR1 is restored and IR2 is decremented to point to the next entry in the SYSUNI table.

Blocks BA34 and BB01: IR1 is tested to determine if all units have been processed. If they have not all been processed, control returns to IUEF1 (Block BA24). When all units have been processed, the set density instructions in IOEX are restored.

Blocks BB02 and BB03: The SYSNAM table is moved from the area where it was loaded to the normal working area. All entries in this relocated table are rearranged to fit the format that will be used by IBSYS. (See Figure 2.)

Block BB04: If cold-start has been entered from IBRES, control now returns to IBSYS; if not, control passes to Block BB05.

Block BB05: The input switch is cleared to indicate that control is to come from cards. Sense switch 1 is tested; if it is down, control goes directly to Block BB06. If sense switch 1 is up, the input switch is set to indicate that the input is to come from tape, and control passes to Block BB06.

Block BB06: The designation for SYSCRD is picked up. The input switch is then tested to determine whether card or tape is being used for input. If card input is

```
Original format as loaded with IBSUP:
BCI 1, SYSNAM
PZE TFILES, INDEX, NFILES

Altered format after COLD START:
BCI 1, SYSNAM
PZE INDEX, NFILES

INDEX 1 to 4 to indicate SYSLB1 to SYSLB4

NFILES Number of files IBSUP must skip before scatter loading the first record of the next file.

TFILES Total number of files in the system named.
```

Figure 2. Format of an Entry in the SYSNAM Table

indicated (input switch is zero), control goes immediately to Block BB07. If tape is indicated (input switch is not zero), the designation for SYSIN1 is picked up and control passes to Block BB07.

Block BB07: The input switch is tested again; if tape is specified, control goes immediately to Block ввов. If card input is specified, the interrupt switch is set, and control passes to Block ввов.

Block BB08: The accumulator contains either the location of the UCB for SYSCRD or SYSIN1, depending upon the setting of the input switch. This location is placed into IR2 in complement form to act as a pointer to the UCB. IR2 is tested to determine if there is any unit assigned. If not, control transfers to Block BB10. If any unit is assigned, the sense indicators are loaded with the contents of the UCB and tested to determine if the unit is attached. If the unit is not attached, control transfers to Block BB10.

Block BB09: Because the unit is assigned and attached, the sign position of the sense indicators is reset to 0 to indicate that the unit is available. The sense indicators are replaced into word 1 of the UCB. The sign position of word 3 of the UCB is cleared to indicate a positive tape position, and control transfers to IBNJB (Block BU01).

Blocks BB10 to BB12: Sense switch 1 is tested to determine if the initial input was from cards or tape. If the switch is up, control transfers to IBNOIN (Block BC15) for an on-line print-out, indicating that no assignment was made and that clarification is needed in the card reader. If sense switch 1 is down, subroutine PROUT is used to print an on-line message to indicate a complete failure. Subroutine STOP is used for a dead-stop halt from which there is no recovery.

Blocks BB13 to BB17: This is one entry point to a closed subroutine to generate a UCB. The initial address for a disk unit is placed in the decrement of word 1 of the UCB. The access and module are extracted from this address and expanded to BCD characters in the form "OAM". All BCD zeros are converted to octal 12. The BCD designation for "SOAM" is formed and stored in word 3 of the UCB. The original address which was stored in word 1 is placed in the accumulator and control passes to GNXUN (Block BB18) to complete the generation of word 1.

Blocks BB18 to BB23: This is the second entry point to this closed subroutine. It is used whenever a UCB for a Hypertape unit is required and only word 1 must be generated. IR2 is saved since it is also required for the subroutine exit during the operation of the subroutine. The sense indicators at this time contain the model and attachment bits from AAMT. If the unit is not attached, position 1 of the accumulator is set to

1. If the unit type is model IV, position 2 of the accumulator is set to 1.

The new word is stored in word 1 of the UCB. The tape address is placed into IR2 and incremented by 1. The sense indicators are tested again to determine if the unit is attached. If it is, its address is entered into the availability chain. The model and attachment bits are shifted left one place for the next unit to be tested, and the next unit address is placed into the accumulator decrement. IR2 is restored and the subroutine exits to the calling program via 1, 2.

IBSYS — \$IBSYS Card Routine

IBSYS receives control from a cold-start operation and at the completion of all major control card routines except IBSTP (\$STOP) and IBXCC (\$EXECUTE).

The system input unit is initialized and word 2 of the UCB is set to the proper select routine for either card or tape input, as required. Subroutine ACTV in IOEX is used to start an I/O operation for this unit and the program waits for a trap. When a trap occurs, the select routine posts this operation as complete and sets up the trap-wait location to exit to the proper control card interpretation routine.

Blocks BC01 to BC04: IR2 is set for card input, and the input switch is checked to determine which input unit is desired. If the input switch is set, IR2 is reset for tape input. IR4 is set to point to the UCB for the required input unit.

Block BC05: IR4 is checked to determine if there is an input unit. If there is no input unit, control transfers to ibnoin (Block BC15).

Blocks BC06 to BC08: If there is an input unit, subroutine initus is used to initialize system tape usage. Location ibwat is set to transfer to itself in order to wait for the trap. In is set to point to word 1 of the ucb.

Blocks BC09 to BC12: Word 2 of the UCB is tested for zero to determine if the unit is dormant. If it is not, the program loops until it becomes dormant. When the unit becomes dormant, the decrement of word 2 of the UCB is set to the address of the tape select routine (IBOF). The address of the unit is tested to determine if it is a card machine or a tape unit. If the address is for a card machine, the decrement of word 2 is reset to the address of the card select routine (IBON). If the unit was not a card machine, control transfers directly to ACTV.

Blocks BC13 and BC14: Subroutine ACTV in IOEX is used to start an I/O operation on this unit, and the program waits for a trap.

Block BC15: This block is entered if no input unit had been specified. The MQ is loaded with the BCD

designation for sysin1. Control transfers to IFND5 for a print-out which states that there has been no assignment made for this unit and clarification is needed in the card reader.

Block BC16: IBON is the start of the select routine provided by IBSYS for ACTV (in IOEX) to use in reading control cards on-line. There is also a similar routine, IBOF (Block BC25), provided for reading control cards from the off-line input tape.

The sign of the accumulator is used to tell the routine if it is being used to start an 1/0 operation (sign is plus), or to post the operation as complete following a channel trap (sign is minus). The sign of the accumulator is tested; if it is plus, control transfers to IBSPL (Block BC30).

Block BC17: This block is entered when posting completion of an I/O operation (sign of accumulator is minus). XTRAP (in IOEX) will have set the necessary bits in the indicators for the test to be made by the select routine. Position 1 of the sense indicators is tested to determine if an end-of-file was encountered on the last operation. If there was no end-of-file, control transfers to IBONC at Block BC23.

Block BC18: Following an end-of-file indication, the interrupt switch (RUPSW) is tested. If RUPSW is not zero, control transfers to Block BC24.

Blocks BC19 to BC22: If the interrupt switch is zero, IR4 is saved and subroutine PROUT is used to print an on-line message that more control cards are needed. Subroutine PAUSE is used to provide a pause to allow the operator to reply by adding the required cards before continuing. When START is depressed, IR4 is restored and the program returns to ACTV.

Block BC23: This block is entered from Block BC17 when there has been no end-of-file condition in the card reader. IR2 is set to IBCDIN to indicate the routine required for interpreting the card information previously read in. Control then transfers to Block BC28.

Block BC24: This block is entered from Block BC18 if an end-of-file from the card reader occurs during an interrupt operation. IR2 is set to indicate that this routine is to be used instead of one of the control card interpretation routines. (IBRET causes return of control to the current system when IBWAT is next encountered.) Control then transfers to Block BC28.

Block BC25: This is the entry point to the select routine provided for ACTV to use in reading control cards from the off-line input tape.

The sign of the accumulator is tested; if it is plus, control transfers to IBSPL at Block BC30.

Block BC26: When posting is required (accumulator is minus), IR2 is set to IBTPIN to indicate the routine required to interpret the card information read in from tape.

Block BC27: Position 1 of the sense indicators is tested to determine if there had been an end-of-file while reading from tape. If there had been an end-of-file, control returns to ACTV.

Blocks BC28 and 29: The contents of IR2 are stored in IBWAT to set it for the proper exit after ACTV returns control to IBSYS. Word 2 of the UCB is cleared, indicating that activity on this unit has ceased. Control is returned to ACTV.

Blocks BC30 to BC33: Entry is made here from each select routine when the sign of the accumulator was plus, indicating that a posting operation was not desired. IR2 is set to -L(UCB) to act as a pointer to the UCB. The fort command is picked up from word 2 of the UCB and placed in the RCHX table for use in reading a card image. The unit address is picked up from word 1 of the UCB, shifted right 18 places, and stored in the RDS instruction for use in selecting the I/O unit required. The RDS instruction is executed; then the instruction in the RCHX table is executed indirectly to start the I/O operation. Control is returned to ACTV.

IBRES — \$RESTORE Card Subroutine

IBRES receives control whenever a user desires to restore the Basic Monitor to the configuration specified by the original assembly parameters. The user indicates this by placing a srestore card in his deck of monitor control cards. If the user had previously changed the unit assignment of one or more units, or detached one or more units, their original assignment would be restored when this card is processed. A frequent use of this procedure would be between stacked jobs on one input tape. After each job, control would be returned to iBSYS through use of a SIBSYS card (or a similar card that is unique to the previous system being run), and this would be followed by a srestore card. The srestore card does not have to follow immediately, but should be placed before the next job that is to be run. This insures that any changes made in the system by one user will be nullified so that the next user will be working with the original system at the start of his job. The next user may then make changes or not, as he requires for his job. The nucleus is restored, and part of cold-start is used to reinitialize the system.

Blocks BD01 to BD03: The original value of SYSLB1 is picked up from CLDLB1 where it had been stored by the cold-start routine. Subroutine IBVAL is used to check the validity of this unit designation which was originally in the form PZE CHAN,, UNIT. If the unit is valid, the location of the UCB for this unit is formed and this address is stored in SYSLB1. The original disk limits are picked up from CLDLB1+1 and restored to

the proper disk limit location in case syslb1 was on disk.

Blocks BD04 and BD05: IR2 is set to point to SYSLB1 to be used by subroutine INITUS, which initializes the system tape (or disk).

Blocks BD06 to BD08: SYSLDR is set to load in the system from the proper unit, and the exits from Calib1 are set to return to IBRS1 instead of SYSTRA-2. Subroutine Calib1 is used to restore IBSUP to core. It will use Calib3 (SYSLDR) if the system is on disk, and the return to IBRS1, (Block BD09) will then be from SYSLDR instead of from Calib1.

Blocks BD09 to BD11: Location RCLD + 3 is set to NOP to prevent cold-start from destroying the tape position (word 3 of the UCB) during execution of that routine. The interrupt switch status is saved in its position in upper core along with the status of sense switch 1. The setting of the input switch is saved in location IBSINP (non-relocated . . . i.e., upper core).

Blocks BD12 to BD14: The nucleus, except for the cold-start location is moved to lower core. Location COLD is cleared to indicate that cold start has been executed. Location RCOLDX is set to transfer to IBSYS at that point in the cold-start routine. Control transfers to DRCOLD at Block BA05.

Control Card Interpretation Routines — IBCDIN/IBTPIN

This routine is entered from IBWAT after XTRAP has posted completion of a control card read-in. It has two entry points, IBCDIN and IBTPIN. IBCDIN is used if control cards are being read on-line, and IBTPIN is used if they are being read off-line. The setting of the list switch determines if the cards will be printed on-line, unless the card is a \$STOP, \$PAUSE, \$LIST OR IS AN Illegal card. \$STOP, \$PAUSE and \$LIST cards are always printed. In the case of an illegal card, the card is always printed out along with a message indicating an illegal card; the list switch is then cleared, causing all future cards to be listed until a \$UNLIST card is read.

Comment cards (\$*) are printed if the list switch is on (zero) and control returns to ibsys for another card. Fid cards cause a transfer of control to the installation accounting routine, if there is one present, and eventual return to ibsys. All other legal card types cause a transfer to a specific routine as determined by a table look-up for the matching card type. A subsequent transfer, using the index value obtained from the table look-up, is executed to select the desired routine.

Block BE01: This is the entry when reading control cards on-line. Subroutine RHBCD is used to convert the

12-bit Hollerith card image starting at IBMAC, into a 6-bit BCD image starting at ICARD (also referred to as CARD).

Block BE02: Location IBNCT is tested for zero to check for a skip-job request. If IBNCT is zero, control transfers to IBNJ2 (Block BU15) to allow processing of the control card.

Block BE02.5: When a skip-job request is not indicated, the list switch is tested to determine if the control cards are to be printed. This switch is normally clear (off) unless a sunlist card has been previously read in. If it is found to be set (on), control transfers to Block BE04 to bypass the print subroutine.

Block BE03: When the list switch is off, subroutine PROUT is used to print the control card on-line.

Block BE04: The first word of the card image is picked up for use in comparing for a legal operation code.

Block BE05: IR4 is set to the length of the control operation table and a comparison is made with one entry in this table. If a comparison is found, IR4 is used as an index into a table of transfer instructions that will transfer control to the routine needed to process that control card. If no comparison is found, the next entry is checked by using IR4 to step through the table. If IR4 goes to 1 and no comparison is found, the exit from this table look-up routine is to Block BE06 for further checking of the card type.

Block BE06: Initially the first two characters of the card are checked to determine if this is a comment card; i.e., \$*. If the card is a comment card, control transfers to IBSYS, Block BC01.

Block BE07: If the card type was not found in the control operation table and the card is not a comments card, the first three characters are tested to determine if a request is being made for the installation id routine, i.e., sid card. If the columns match, control transfers to sysidre, Block BE10.

Block BE08: At this point, since there has been no comparison with any op code in the table, nor a comparison with a comment card nor a system in request card, the card is deemed illegal. The list switch is checked to determine if the card has been printed. If it has been printed, control transfers to Block BE11.

Block BE09: Because the illegal card has not been printed, the list switch is turned off and control transfers to IBTPIN (Block BE02). This action allows the illegal card to be printed during another pass through the valid card search routine. This time when Block BE08 is encountered, control transfers to Block BE11.

Block BE10: This routine is entered from Block BE07 upon detection of a \$1D card, and is a calling sequence for the installation accounting routine. It consists of a

TSX SYSIDR, 4 followed by PZE ICARD,, 12. The installation accounting routine returns control to the location following the calling sequence routine via a TRA 2, 4. Control then returns to IBSYS for another card.

Blocks BE11 and BE12: This routine is entered after detection and printout of an illegal card. Subroutine PROUT is used to print a message indicating an illegal card, and subroutine PAWS is used to provide an operator pause before returning to IBSYS.

IBATC/IBDTC — \$ATTACH/\$DETACH Card Routines

IBATC sets up a specific UCB to indicate that the unit is attached, and also inserts the unit into the availability chain for the proper channel unless the unit specified is a card machine. The routine checks for the validity of the unit specified, sets the proper model bit in the UCB, and stores the location of the UCB in LATUN. (LATUN is used by IBASC to assign this unit to a specific system unit.)

IBDTC sets up a specific UCB to indicate that the unit is not attached and removes the unit from the availability chain of the associated channel. The routine checks for the validity of the unit specified, and removes any reference in the SYSUNI table that points to this unit.

IBATC Routine

Blocks BF01 to BF03: This is the entry point for the ibatc routine. Subroutine syucu converts the symbolic designation on the card to a channel-unit designation in the form: PZE CHAN,, UNIT. An illegal designation causes the subroutine to return to 1, 4 and control transfers to ibat1 (Block BJ12). If the unit is legal, the subroutine returns to 2, 4. Subroutine ibval is then used to check the validity of the unit, and form the location of the UCB for that unit in the accumulator. The contents of the accumulator (21-35) are stored in latur. If the subroutine finds that the unit is not valid, the return will be made with the accumulator cleared.

Block BF04: The accumulator is checked to see if the unit is valid. If it is not valid, the accumulator is cleared and control transfers to IBAT1 (Block BJ12).

Blocks BF05 to BF07: For a valid unit, the model type is extracted from location LATUN and placed in the sense indicators. The sign position of the sense indicators is set to 1 and position 1 is set to 0 to indicate that the unit is attached and in the availability chain. The contents of the sense indicators are stored in UCB word 1.

Block BF08: Positions 10 and 11 of the sense indicators are checked to determine if the unit is a card machine. If a card machine is indicated, control transfers to issys to read in another control card.

Blocks BF09 to BF12: The channel number is extracted from the sense indicators, and placed in IR1 in complement form. Subroutine RSYUR is used to remove the unit from the availability chain of the indicated channel if it is already entered in the chain. This is a precautionary measure to eliminate redundant references because the next step is to insert the unit at the beginning of the same chain. Control then transfers to IBSYS.

IBDTC Routine

Blocks BF13 and BF14: This is the entry point for the ibdte routine. Subroutine syucu is used to convert the symbolic designation on the card to the channel-unit designation in the form: PZE CHAN,, UNIT. An illegal designation causes the subroutine to return to 1, 4 and control then transfers to ibat1 (Block BJ12). A legal designation causes the subroutine to return to 2, 4. Subroutine ibval is used to check the validity of the unit specified and to form the location of the UCB for that unit in the accumulator.

Block BF15: The accumulator is checked to determine if the unit specified is valid. If the unit is not valid, control transfers to IBAT1 (Block BJ12).

Blocks BF16 to BF19: For a valid unit the address of the UCB is stored in LUCAC to be used in removing any references to this unit from the SYSUNI table. The sign position and position 1 of the sense indicators are set to 1 to indicate that the unit is not available and not attached. The sense indicators are then stored in word 1 of the UCB. Subroutine RYSUR is used to remove the unit from the availability chain of the proper channel.

Blocks BF20 to BF24: IR4 is set to the number of entries in the SYSUNI table. Each entry of the SYSUNI table is compared to LUCAC to determine if there had been any reference to this unit. Any entry in the table that is equal to LUCAC is deleted. Control transfers to IBSYS to read in another control card after all the entries in the system units table have been checked.

IBXCC — \$EXECUTE Card Routine

IBXCC is the routine used to set up the proper system loader to read in a desired operating system and transfer control to it when it is read into storage. If SYSLB1 is on tape, the tape is positioned properly and CALIB2 is given control to load the system. Control is transferred to it if it is found and loaded without error. If SYSLB1 is on disk, the system name is compared with entries in the DSYSNM table. When an equal compare is found, the location of the system on disk is taken from this table.

Control is given to SYSLDR (CALIB3) to read in the system and transfer control to it if it is loaded without error.

Blocks BG01 to BG03: TR2 is set to point to SYSLB1, and the cold-start switch (COLD) is tested to determine if cold-start has been executed. If COLD is not zero, indicating that cold-start has not been executed, control transfers to Block BG04. If COLD is zero, subroutine INITUS is used to initialize system tape usage on SYSLB1 before control is passed to Block BG04.

Blocks BG04 and BG05: IR2 is set to point to SYSUT4 as an indication to subroutine INITUS, which is then used to initialize system tape usage for this tape.

Block BG06: SYSORG+101 is tested to determine if SYSLB1 is on disk. If disk operation is indicated, control transfers to DFIND at Block BG11.

Block BG07: When syslbi is not on disk, subroutine ifind is used to position the system tape in front of the first record for the desired system. Upon return from ifind, ir2 is set to point to the sysumi entry that contains the location of the ucb for the desired unit.

Block BG08 to BG10: Block BG08 is entered from Block BG07 and also from the IBEDT routine (Block BN09). IR2 and the decrement of SYSLDR are set to point to the location of the UCB. The complement of the channel number minus 1 is placed in IR1. The I/O commands in the loader (CALIB2) are set to the desired values; control then transfers to CALIB2.

Block BGII: The system name (disk operation) is extracted from the card image at ICARD+2 and ICARD+3 and positioned in the accumulator for comparison with entries in the DSYSNM table.

Block BG12: The DSYSNM table is searched for a comparison with the desired system name. The table contains two words for each system entry. The first word of each pair contains the system name in BCD. The second word is in the format: PZE "DORG. When a comparison is found between the desired system name and a name in the table, control transfers to Block BC13. If the system is not included in this table, control transfers to IFND2 (Block BV11).

Blocks BG13 to BG16: The system name that has been used for comparison is stored in SYSCUR as the current system under consideration. The second word of the two-word pair is picked up from the DSYSNM table (IR4 remained set to the relative location of the desired word when a valid comparison was found), and the decrement portion of this word (DORG) is placed in the decrement of SYSPOS. The contents of IR4 are stored in the address of SYSPOS. The decrement of SYSLDR is set to the location of SYSLB1 and control transfers to SYSLDR with the decrement of the TSX instruction set to 2. This indicates that the location denoted by the decrement of SYSPOS is to be loaded.

Non-Data Select Routines

Chart BH shows the flow of the non-data routines used to rewind, unload or write an end-of-file on a desired system tape. If an illegal system unit name was designated, an on-line message is printed to give the operator an opportunity to correct the card or skip to the next job. If a tape is rewound, the density is set as indicated by the sign of the sysum entry for that system unit.

IBREW — \$REWIND Card Routine

Block BH01: This is the entry point for the *REWIND routine (IBREW). IR1 is set to 3 to indicate a rewind operation and control transfers to Block BH04.

IBWEF — \$ENDFILE Card Routine

Block BH02: This is the entry point for the SENDFILE routine (IBWEF). IR1 is set to 7 to indicate a write end-of-file operation and control transfers to Block BH04.

IBRUN — \$REMOVE Card Routine

Block BH03: This is the entry point for the SREMOVE routine (IBRUN). IR1 is set to 4 to indicate an unload operation and control passes to Block BH04.

Block BH04: IR1 is stored in IBRN3 as part of the NDSEL calling sequence. The system unit name is picked up from the card image (locations ICARD+2 and ICARD+3) and positioned in the accumulator for comparison with the SYUNAM table.

Block BH05: The system unit name in the accumulator is compared to the entries in the SYUNAM table until a comparison is found. If no comparison can be found, control transfers to IBAS1 (Block BJ13).

Block BH06: When the system unit name is in the SYUNAM table, the SYSUNI entry for the unit is tested to determine if the unit is assigned. If the unit is not assigned (SYSUNI entry is zero), control transfers to IBSYS (Block BC01).

Blocks BH07 and BH08: If the unit is assigned, the sign of word 1 of the UCB is reset to 0 to indicate that the unit is available. Subroutine NDSEL is used to perform the desired function as specified in its calling sequence. This calling sequence has been previously set up at Block BH04.

Block BH09: IR1 is set to the complement of the location of the UCB to act as a pointer to this location. Word 3 of the UCB is picked up to find the present position of the system tape.

Block BH10: The tape position in the accumulator is checked to determine if the tape is unloaded (accumulator minus), or not at load point (accumulator nonzero). If either condition is present, control transfers to IBSYS (Block BC01).

Blocks BH11 and BH12: At this point (accumulator zero) the tape must be at load point, but not unloaded. This would be the result of a rewind operation. The density mode is taken from the SYSUNI entry (sign position), and placed in the NDSEL calling sequence. Subroutine NDSEL sets the density as required for this tape. Control then transfers to IBSYS (Block BC01).

Miscellaneous Card Routines and Error Print-Out Routines

Chart BJ shows the general error print routine, and also seven of the shorter main routines used in monitor operation.

IBSTP — \$STOP Card Routine

Blocks BJ01 to BJ02: This is the entry point for the IBSTP (SSTOP) routine. It is used whenever there are no more jobs to be processed on the input tape and operation is to be terminated on the monitor system. The list switch, LSTSW, is tested to determine if the card has been printed. If LSTSW is set, indicating that control cards are not being printed, subroutine PROUT is used to print this control card. In either case, subroutine PROUT is used to print the on-line message "END OF JOBS." Subroutine STOP will cause the on-line print-out "CANNOT PROCEED," and then provide a final stop. This stop is a permanent one, because depressing START will have no effect.

IBDAT — \$DATE Card Routine

Blocks BJ03 and BJ04: This is the entry point for the IBDAT (SDATE) routine. The date is picked up from ICARD+2 and ICARD+3, positioned in the MQ and stored in SYDATE. (SYDATE is also defined and referred to as SYSDAT.) Control returns to IBSYS (Block BC01).

IBCCC — \$CARDS Card Routine

Blocks BJ05 and BJ06: This is the entry point for the IBCCC (SCARDS) routine. The input switch, IBSINP, is cleared to set the card read-in routine to read from the on-line card reader. The interrupt switch is set and control returns to IBSYS (Block BC01).

IBPAC — \$PAUSE Card Routine

Blocks BJ07 to BJ07.5: This is the entry point for the IBPAC (SPAUSE) routine. The list switch, LSTSW, is tested to determine if the card has been printed. If the card has not been printed, subroutine PROUT is used to print the card on-line. In either case, subroutine PAUSE will provide the print-out "OPERATOR ACTION PAUSE," and then a halt to allow the operator to perform some manual intervention. When START is depressed, there

is a second on-line print-out, "ACTION COMPLETED," and control returns to IBSYS.

IBTCC — \$TAPE Card Routine

Block BJ08: This is the entry point for the IBTCC (STAPE) routine. The input switch is set to non-zero to indicate to the control card read-in routine that the cards are to be read in from tape. Control returns to IBSYS.

IBLIS — \$LIST Card Routine

Blocks BJ09 to BJ09.5: This is the entry point for the IBLIS (\$LIST) routine. The list switch, LSTSW, is tested to determine if this card has been printed. If this card has not been printed, subroutine PROUT is used to print the card on-line. In either case, LSTSW is cleared (set to OFF) to indicate that control cards are to be printed on-line. This switch is normally off upon initial loading, and must be turned on by the use of the SUNLIST card. Control returns to IBSYS.

IBUNL — **\$UNLIST Card Routine**

Block BJ10: This is the entry point for the IBUNL (SUNLIST) routine. The list switch, LSTSW, is set to non-zero (set to on) to indicate that control cards are not to be printed on-line. Control returns to IBSYS.

Miscellaneous Error Routines

Block BJ11: This is the entry point for the error printout routine used to print the following message: "MIXED HARDWARE SWITCH INVOLVING SYSLB1 IS ILLEGAL." Control transfers to IBERR (Block BJ14) after loading the MQ with the location of the calling sequence command used to locate and print this message.

Block BJ12: This is the entry point for the error printout routine used to print the following message: "ILLEGAL UNIT SPECIFIED." Control transfers to IBERR (Block BJ14) after loading the MQ with the location of the calling sequence command used to locate and print this message.

Block BJ13: This is the entry point for the error printout routine used to print the following message: "ILLEGAL SYSUNI DEFINITION." Control transfers to IBERR (Block BJ14) after loading the MQ with the location of the calling sequence command used to locate and print this message.

Block BJ14: This is the entry point for the general error print routine. It is used by the following routines: IBSW1, IBAT1, IBAS1, IFIND, and IBEDT. Upon entry to this routine, the MQ must contain the location of the calling sequence command to be used by subroutine PROUT in printing the message. The list switch, LSTSW, is tested. If it is non-zero (ON), control transfers to Block BJ19 to turn the switch off prior to the transfer to IBTPIN.

Blocks BJ15 to BJ18: When the list switch is initially off, the MQ is stored in the prout calling sequence. Subroutine prout is used to print the desired message online with the following message on the next line: "PROVIDE CLARIFICATION AND RESTART IN THE CARD READER." Subroutine pause is used to provide a temporary stop for the operator to perform the desired manual intervention. Upon depressing START, the input switch, IBSINP, is cleared to simulate a scards card. Control returns to IBSYS.

Block BJ19: The list switch, LSTSW, is cleared (turned off), and control transfers to IBTPIN to print the control card on-line. IBTPIN will exit to the desired control card routine again, repeating the checks made before and return to the error print-out routine a second time. On the second pass through these routines, at Block BJ14, the program will find the list switch, LSTSW, off, and control will not be transferred to Block BJ19. The duplicate passage through these routines is required to force the print-out of the control card in error when the SUNLIST card has been used.

IBSWC — \$SWITCH Card Routine

IBSWC is used to switch the unit references for two system units. A check is made to determine if both the designated units are valid and also to determine if an illegal switch is being attempted. An illegal switch would be an attempt to switch a tape unit with disk or disk with tape when either unit is SYSLB1. Either error condition will cause a pause to allow the operator to correct the card or skip to the next job.

Blocks BK01 to BK04: Each sysuni designated on the card is picked up from the card and compared with the sysuni table. If both units were not found in the table, control would transfer to IBAS1 (Block BJ04) for a print-out indicating that an illegal sysuni was specified.

Block BK05: If both units are found in the SYSUNI table, they are compared to SYSLB1. This comparison or check is made in the following manner. IR2 and IR4 were used when checking to see if both units were valid. Each IR is now tested to determine if the unit was found in the table at a point higher than SYSLB1. If neither unit specified was SYSLB1, control transfers to IBSW2 (Block BK10).

Blocks BK06 to BK09: Word 1 of the UCB's for both specified unit is checked to determine if a request is being made to switch syslb1 with another unit that is not of the same type. If a mixed switch is requested, control transfers to IBSW1 (Block BJ11) for an error print-out indicating this condition.

Blocks BK10 and BK11: When the unit types are the same, the entries in the disk limit table are switched

using the index values contained in IR2 and IR4. The same values are also used to switch the UCB addresses in the SYSUNI table.

Blocks BK14 and BK15: The address of the SYSUNI entry for the first unit is computed and set in IR2. Subroutine INITUS is used to initialize the system tape usage for that unit.

Blocks BK14 and BK15: The address of the SYSUNI entry for the second unit is computed and set in IR2. Subroutine INITUS is used to initialize the system tape usage for that unit. Control then returns to IBSYS.

IBUNT — \$UNITS Card Routine

This routine prints all the sysuni names with their unit assignments and assigned densities. It also lists all attached units not assigned or reserved, and all intersystem reserve units. It is used primarily to varify unit assignments after making specialized changes for a specific system run. The routine contains a series of loops to examine each entry in the sysuni table, and then each ucb.

Block BL01: This is the entry point for the routine. Subroutine PROUT is used to print the heading on-line.

Block BL02: IR2 is set to count the entries in the SYSUNI table, and the first entry in this table is picked up and placed into IR1 in complement form.

Block BL03: IR1 is tested to determine if a unit has been assigned to this sysum function. If so, control transfers to Block BL05.5.

Blocks BL04 and BL05: If no unit has been assigned to the referenced sysuni function, a word of BCD blanks is stored in temporary message storage. The BCD designation "NONE" is picked up and control transfers to RUBC3 (Block BL10).

Blocks BL05.5 and BL06: If a unit is assigned to the SYSUNI function, the sense indicators are loaded with word 1 of the UCB and are tested to determine if the unit is a disk unit. If it is not a disk unit, control transfers to IBMP4 (Block BL07). If the unit is a disk unit, DORG and DEND are picked up from the disk limits table and converted to BCD. These limits are stored in the print image, and the BCD designation for "THRU" is picked up before transferring control to IBMP5 (Block BL08).

Block BL07: If the referenced unit is tape, the old density designation is blanked out in the print image and the density of this unit is tested. After the test, either the image "HIDEN" or blanks are loaded into the MQ.

Blocks BL08 and BL09: The MQ is stored in the print image. This places the configuration for blanks, "HIDEN,"

or "THRU" in the image as required for a particular tape or disk unit. Word 1 of the UCB is picked up and subroutine syuncy is used to convert this unit address to its symbolic form.

Blocks BL10 and BL11: Entry is made to this block with either the symbolic designation of the unit or the BCD designation for "NONE" in the accumulator. The designation is stored in the temporary message storage area, and subroutine PROUT is used to print the completed message.

Block BL12: IR2 is tested to determine if all entries in the SYSUNI table have been printed. If all entries have not been printed, control returns to IBUNT (Block BL02).

Blocks BL13 and BL14: When all entries in the sysuni table have been printed, subroutine prout is used to print a heading for the attached units not assigned or reserved. IR2 is set to the number of UCB's and MAPSW is cleared. MAPSW is used to determine if there have been any units printed in this table. It is set whenever a unit is printed.

Block BL15: The sense indicators are loaded with the unit status bits from word 1 of the UCB.

Blocks BL16 and BL17: The sense indicators are tested to determine which units are not assigned to a sysum function and are attached but not reserved. If a unit does not meet these conditions, control transfers to IBMPT (Block BL22).

Blocks BL18 to BL21: When a unit is attached but not assigned or reserved, the unit address is loaded into the MQ from word 1 of the UCB. Subroutine SYUNCV is used to convert this address to a symbolic designation for the unit. This symbolic designation is then stored in the print image, and MAPSW is set to indicate that there has been data printed under this heading. Subroutine PROUT is used to print this symbolic designation.

Block BL22: This block is entered under the following conditions: (1) after a unit is printed, (2) when a unit is assigned to a sysum function, (3) when a unit is reserved and not attached. In is tested to determine if all ucb's have been processed. If In equals 4 or less, all units have been processed. If they have not, control returns to IBMP1 (Block BL15) to pick up the next unit (ucb word 1).

Blocks BL23 and BL24: When all units have been processed, MAPSW is tested to determine if there has been any data printed under the heading. If MAPSW is not zero, indicating that data has been printed, control transfers to IBMP2 to clear MAPSW. If no data has been printed (MAPSW=0), subroutine PROUT is used to print the word "NONE."

Blocks BL25 and BL26: MAPSW is cleared (if set) prior to the print-out of the next heading. The contents of MAPSW are then used to determine if any data is

printed under the heading. Subroutine PROUT is used to print the intersystem reserve heading.

Block BL27: IR2 is again loaded with the number of UCB's and the sense indicators are loaded with the unit status bits from word 1 of a UCB.

Block BL28: Position 3 of the sense indicators is tested to determine if the unit is an intersystem reserve unit. If the unit is not, control transfers to IBMTX (Block BL33).

Blocks BL29 to BL32: When a unit is an intersystem reserve unit, the unit address is loaded into the MQ from word 1 of the UCB. Subroutine SYUNCV is used to convert this to a symbolic designation which is stored in the print image. MAPSW is set to indicate that there has been printing under this heading, and subroutine PROUT is used to print the image on-line.

Block BL33: IR2 is tested to determine if all UCB's have been processed. If IR2 is equal to or less than 4, all units have been processed. If they have not, control returns to IBMP3 (Block BL27) to pick up word 1 of the UCB for the next unit.

Blocks BL34 and BL35: When all units have been processed, MAPSW is tested to determine if there has been a print-out under this heading. If one or more units have been printed, control transfers to IBSYS. If no units have been printed, subroutine PROUT is used to print the word "NONE," and control returns to IBSYS.

IBREL/IBASC — \$RELEASE/\$AS Routines

Chart BM shows two routines which differ only in the entry point and one operation. IBASC is used to assign the last attached unit specified in location LATUN to a specific system unit function. IBREL is used to release the specified system unit.

In IBREL, the unit previously assigned to that system unit function is entered into the availability chain for that channel. Because LATUN is cleared, IBREL does not assign a new unit to the sysuni function.

IBASC must also remove the newly assigned unit from the availability chain for the associated channel.

In both routines, a check is made for the validity of the unit specified on the card. An invalid unit will cause an error message print-out.

IBREL Routine

Block BM01: This is the entry point for the IBREL routine. Location LATUN is cleared and control passes into the IBASC routine. LATUN is the location where the designation for the last unit attached would normally be stored. When the IBASC routine is entered with this location set to zero, it causes the sysuni entry for the

specified function to be cleared to indicate that there is no unit assigned to that function.

IBASC Routine

Block BM02: This is the entry point for the IBASC routine. It is also entered from IBREL with location LATUN cleared. The system name is picked up from ICARD+2 and ICARD+3, and positioned in the accumulator for comparison with the SYUNAM table.

Block BM03: The SYUNAM table is searched for an entry that will compare with the one specified on the control card. If none can be found, control will transfer to ibasi (Block bji3) to print an on-line message indicating an illegal sysuni function.

Block BM04 to BM06: If the system name is found in the SYUNAM table, the previous assignment for this function is picked up from the SYSUNI table and stored in IBASX for later use in IBAS3 (Blocks BM24 through BM26.) The unit specified in LATUN is either the address of the UCB following a SATTACH card, or zero if the card presently being processed is a SRELEASE card. This unit is placed in the SYSUNI table, and the sense indicators are loaded indirectly from this SYSUNI entry. This sets the contents of UCB word 1 into the sense indicators.

Blocks BM07 and BM08: Positions 4 and 11 of the sense indicators are tested to determine if the unit is disk. If the unit is disk, control transfers to Block BM09; if not, subroutine RSYUR is used to remove the unit from the availability chain for the channel.

Block BM09: ICARD+3 is loaded into the MQ. The density specification is extracted from the contents of the MO and loaded into the accumulator.

Blocks BM10 to BM11.5: The density specification is compared to the BCD designation "L." If the specification is greater than or equal to "L," low density is indicated and the accumulator prefix is set to plus. If the specification is less than "L," high density is indicated and the accumulator prefix is set to minus.

Block BM12: The prefix of the accumulator is stored in the sysum table. This will cause the sysum entry to be minus for a high density unit and plus for a low density unit.

Blocks BM13 and BM14: TR2 is set to point to the sysum entry, and subroutine initus is used to initialize the tape usage for this unit.

Blocks BM15 and BM16: IR2 is set to the relative location of the desired unit within the sysuni table. The sense indicators are loaded indirectly from this sysuni location to give the contents of word 1 of the desired UCB.

Block BM17: Positions 4 and 11 are again tested to determine if the unit under consideration is disk. If it is not, control transfers to IBAS3 (Block BM24).

Blocks BM18 to BM23: When the unit is disk, the origin and number of cylinders are loaded into the MQ from the BCD designation on the control card. Location IBDSK is cleared for use as a temporary storage cell in building up the binary equivalent of the origin and number of cylinders. The origin is converted to binary, multiplied by 40, and stored in the address of the disk limit table entry for that unit. The number of cylinders is converted to binary and multiplied by 40. The value of the last cylinder is computed and stored in the decrement of the disk limit table entry for that unit.

Blocks BM24 to BM26: When control is given to IBAS3, the contents of IBASX are tested for zero to determine if there had been any previous unit assigned to the system unit function. If no unit had been assigned (IBASX equals zero), control transfers to IBSYS. If a unit has been assigned, the address portion of IBASX is compared to all the addresses in the sysuni table to determine if the unit is still in use by any other system unit function. If the unit is still in use, control transfers to IBSYS. If the unit is not in use, word 1 of the UCB is tested to determine if it is a card machine. If the unit is a card machine, control transfers to IBSYS. At this point, if the unit is not a card machine, provisions are made to enter it at the top of the availability chain for the correct channel.

Blocks BM27 to BM30: The no-repositioning flag is reset and the sign is set to indicate that the unit is not assigned. The word is replaced in the UCB. The channel number is extracted from the unit address and placed in IR1 in complement form. Subroutine RSYUR is used to remove the unit from the availability chain. This is done to eliminate any chance of the unit appearing in the availability chain twice. The unit is placed at the beginning of the availability chain and control transfers to IBSYS.

IBEDT — \$IBEDT Card Routine

The IBEDT routine (Chart BN) is used to call in and execute the system editor from SYSLBI. If the system is on disk, an SEXECUTE EDITOR card is simulated. If the system is not on disk, the tape is positioned to the EDITOR and the EDITOR is read in. Control then transfers into the IBXCC routine to cause execution of the EDITOR. This chart also shows the select routine used by IBEDT.

Block BN01: This is the entry point for this routine. SYSORG+101 is tested to determine if the system is on disk. If the system is not on disk, control transfers to EDT5 (Block BN03).

Block BN02: If syslb1 is on disk, the BCD designation for the EDITOR is placed into the card image to simulate

an SEXECUTE EDITOR card and control is transferred to IBXCC (Block BG01) for execution.

Block BN03: If syslb1 is on tape, IR2 is loaded with the complement of the location of syslb1. This becomes an indirect reference to the UCB for the desired system tape. The desired tape position counter, RCT3, is incremented by 1 to indicate to routine RCTPO to set-up for reading the next file.

Blocks BN04 to BN06: Subroutine RCTPO is used to position the system tape to the next file on the tape. IR1 is set to the complement of the location of the UCB, and the select word (EDT1) is stored in word 2 of the UCB. This word contains the location of the select routine (RCT7) in the decrement and the location of the I/O command in the address.

Blocks BN07 and BN08: Subroutine (ACTIV is used to read the first record of the file. Word 2 of the UCB is tested to determine when the record has been read in. Control remains in a loop until word 2 of the UCB is cleared. When the word is finally cleared by the trap supervisor in IOEX, control will be allowed to leave the loop and continue to Block BN09.

Block BN09: The second word of the record read-in is compared with "IBEDT." If there is an equal compare (EDITOR found), control transfers to IBXC1 (Block BC08).

Block BN10: If the second word of the record does not equal "IBEDT," it is then compared to "*EOT." If there is still an unequal comparison, control transfers back to IBEDT to check the next file for the EDITOR.

Block BN11: At this point the EDITOR has not been found up to the end of the system tape and therefore must be missing from the tape. The EDITOR name is deposited into an error message and control transfers to IBERR (Block BJ14) for an error print-out.

Blocks BN12 and BN13: This is the entry point for the general tape positioning routine. It is entered with IR2 set to the complement of a location which contains the address of the UCB for the desired unit. The decrement of the accumulator contains the file position number to be compared to the file position contained in the UCB. IR4 is saved, and the desired tape position is stored in RCT3. Subroutine INITUS is used to initialize system tape usage for this tape.

Blocks BN14 and BN15: Location RCT3 is tested to determine if the desired tape position is zero. If it is, subroutine NDSEL is used to rewind the tape and control returns to RCT2 to exit from the routine.

Block BN16: When the desired tape position is not zero, IR1 is set to point to the location of the UCB.

Block BN17: The desired tape position in RGT3 is compared to word 3 of the UCB, which is the actual tape position at this time. If the tape positions are the same, control transfers to RGT2 (Block BN23) to exit from the

routine. If the actual tape position is less, control transfers to RGT4 (Block BN19).

Block BN18: Because the tape is neither at the desired location nor at a point before the desired location, it is beyond the desired location. Subroutine NDSEL is used to backspace the tape one file, and control transfers back to Block BN17 for another comparison.

Block BN19: If the actual tape position is less than the desired position, word 2 of the UCB is tested to determine if the unit is dormant. This is done to make sure that the tape has completed any movement due to a previous attempt to use the routine to skip forward. The program loops within routine RCT4 until word 2 of the UCB is set to zero by IOEX. After the trap supervisor clears word 2 of the UCB, it regains control and returns to the testing loop. At this time, control passes to Block BN20.

Blocks BN20 and BN21: Location RGT5 is set to provide a waiting loop when subroutine ACTV is being used. The select word, RGT6, is stored in word 2 of the UCB and control is transferred to ACTV in IOEX.

Block BN22: RCT5 contains a transfer to itself to act as a waiting loop to allow ACTV to move the tape ahead one record. The select routine will change the contents of RCT5 to a transfer to RCT1 (Block BN16). When the trap supervisor gains control at the end of the tape movement, it returns to RCT5. Control is then transferred to RCT1 (Block BN16) to compare this tape position with the desired tape position again.

Block BN23: After the tape is rewound (desired position equals zero) or after the desired tape position is found, IR4 is restored and control exits to the calling program via 1, 4.

Blocks BN24 and BN25: This is the select routine to be used by RCTPO in forward spacing a tape one file. IR2 is set to point to the UCB for the desired unit. The accumulator is tested to determine if IOEX is using the routine to post the completion of an I/O operation or to initiate one. If it is posting, the accumulator is minus, and control is transferred to RCT8 (Block BN29).

Blocks BN26 to BN28: If an 1/0 operation is to be initiated (accumulator plus), RCTX, 1 is set to zero to indicate no redundancy checking. The location of the 1/0 command is placed into RCHX, 1. The binary select address is generated from word 1 of the UCB and stored in the RDS instruction. The RDS and RCHX, 1 instructions are executed. Control exits to the calling program (IOEX) via 1, 4.

Blocks BN29 to BN32: If a posting operation is indicated, the tape position is picked up from word 3 of the UCB. This position is compared with the desired tape position in RCT3. If the actual position is less than the desired position, control transfers back to IOEX,

which will initiate another 1/0 operation to skip the next record on the tape. If the actual position is equal to or greater than the desired position, word 2 of the UCB is cleared to indicate that activity has ceased on this unit at this time. The waiting cell in RCTPO is changed to a transfer to RCT1. Control exits to IOEX via 1, 4.

Restore Nucleus, System Interrupt, and Dump Caller Routines

Chart BP shows the routine used to call IBSUP into memory (CALIB1). It also includes the two routines that utilize this routine in performing their functions, the system interrupt routine (SYSRPT OF INTRUP), and the system dump routine (SYSDMP OF DUMP).

CALIB1 will load in one record from SYSLB1 if SYSLB1 is not disk. If syslb1 is disk, sysldR will be used to load in one record. In either of these cases, the record must be in the self-loading format with the desired 1/0 command at the beginning of each block of data within the record. Ten attempts will be made to read the record properly. If these are all unsuccessful, the program transfers to location 0, which will have a halttransfer to the restart point in case the operator desires to try again. The record will be checked as it is being read in (as well as at the end of the read-in), and the channel will be immediately stopped if a redundancy is encountered. This eliminates passing a long tape record across the read head when the error is found near the beginning of the record. The tape position is updated, and the program tests the dump switch, DMPSW, to determine whether to transfer control to IBSYS or return to read in the next record (SYSDMP) and eventually transfer control to it.

SYSRPT checks sense switch 1; if the switch is down, it sets the interrupt switch and transfers control to CALIB1 to return control to IBSYS after reloading IBSUP.

SYSDMP saves the present contents of core, all key registers, and status indications. The dump switch, DMPSW, is set and control is given to CALIBI to load in IBSUP and eventually the system dump routine.

CALIB1 — Restore Nucleus Routine

Block BP01: Word 1 of the UCB for the system unit is tested to determine if the system unit is disk. If the system unit is disk, control transfers to Block BP19.

Blocks BP02 and BP03: If SYSLB1 is not disk, IR2 is set to point to the location of the UCB. The necessary I/O commands for tape unit A1 are generated and stored in their respective locations in the routine. The system tape is then rewound and the tape position indicator in word 3 of the UCB is set to zero.

Block BP04: The channel is tested to determine if it is busy. If it is busy, the program will loop here until the channel completes the present operation.

Blocks BP05 and BP06: When the channel becomes "not busy," traps are disabled and location zero is set for the restart entry. IR4 is set to 10 to allow this number of rereads after a redundant read occurs. The operator also has the option of using this routine as a restart entry point after 10 consecutive, unsuccessful attempts to read a record. An additional 10 rereads are initiated by depressing START. This operation may be repeated more than once.

Blocks BP07 to BP10: The channel is started in operation and tested for redundancies. If any are found during the read operation, control transfers immediately to Block BP16 to stop the channel. This test for redundancies is followed by a test for channel in operation. As long as the channel is in operation, and no redundancies occur, control will remain alternately with these two instructions. When the channel finally completes the operation, it is again tested for redundancies.

If redundancies are encountered after the operation is completed, control transfers to Block BP17 for possible retries at reading the record.

Blocks BP11 and BP12: When the channel operation is completed without encountering redundancies, the tape position in word 3 is incremented by 1. The dump switch, DMPSW, is tested to determine if this routine is being used by the dump routine. If it is, control transfers back to CALIB2 (Block BP04) to read in the dump program.

Blocks BP13 to BP15: When the dump routine is not required, the enable switch, ENBSW, is tested to determine if trapping is to be enabled. If ENBSW is non-zero, control transfers directly to SYSTRA. If ENBSW is zero, traps are enabled before control is transferred to SYSTRA.

Block BP16: Block BP16 will be entered if a redundancy is encountered while reading in the record. The channel will be stopped immediately to eliminate wasted time in passing the rest of the record over the read head.

Blocks BP17 and BP18: Any time a redundancy is encountered, the tape will be backspaced. IR4 is tested to determine if the reread has been tried 10 times. If 10 rereads have not been tried, control returns to CAL3 (Block BP07) for another attempt. After 10 attempts, control will transfer to location 0 and halt. The operator may now decide to attempt 10 more rereads by depressing START.

Block BP19: If SYSLB1 is on disk, the decrement of SYSTCH is set to the disk origin as obtained from the

disk limits table. Control is then given to sysldr to load in the system from disk.

SYSRPT — System Interrupt Routine

Block BP21: Entry is made to this block by using the communication cell SYSRPT. If sense switch 1 is up, control transfers to Block BP25 to clear INTSW and exit to the calling program.

Blocks BP22 to BP24: If sense switch 1 is down, INTSW is tested to determine if this interrupt is to be permitted. If INTSW is non-zero, control returns to the calling program at 1, 4. If INTSW is zero, indicating that the interrupt is to be permitted, RUPSW is set. IBSINP is cleared to indicate that the input unit is to be the card reader. Control then transfers to CALIB1 to reload IBSUP, and take the next control card from the card reader. The operator should then have cards that indicate the next course of action for the system in the on-line card reader.

Block BP25: INTSW is cleared to indicate that future requests for interrupts may be honored. Control returns to the calling program at 1, 4.

DUMP — Dump Caller Routine

Blocks BP26 to BP29: The dump routine first starts to put out a save record on the save tape. (This is initialized to sysut4.) This save record consists of location 0 through the end of the storage cells for the machine registers which are to be printed out by sysdem.

Location 0 is cleared and traps are disabled. Transfer trap status is saved, and transfer trapping mode is disabled if it was in effect. At DMPTO, the channel is checked to see if the save record has been written. Until it has been completely written, the program loops at this point.

Blocks BP30 to BP32: After the save record has been written, DMPSW is set to indicate that a dump is requested. (This will cause Calibi to load in the dump routine before transferring control to SYSTRA.) When the SYSDMP record is read in, SYSTRA will be set to transfer to the dump program. SYSDMP will be inserted in SYSCUR to indicate that the dump is the current system, and ENBSW will be set to non-zero to indicate that trapping is not to be enabled before entering the dump program. The key registers and status conditions are saved within the dump program. Control transfers to Calibi to reload IBSUP and SYSDMP, and transfer control to SYSDMP.

CALIB3/SYSLDR — System Loader

CALIB3 is entered from the SYSLDR entry in the communications table in the nucleus. The value of the decrement of the TSX instruction used to transfer to

SYSLDR determines which one of the three options will be used in loading from the system library unit. If the decrement is equal to 0, the next record in sequence will be loaded. If the decrement is 1, the desired sysrec name is taken from the calling sequence, (see inset on Chart BR). SLTABL is scanned to locate the track address and the system record is loaded. If the decrement is 2, the location previously placed in syspos is loaded.

If this routine is entered for a system that is not disk, the next record in sequence is loaded, using the CALIB2 entry on Chart BP. If the dump switch is on when an entry is made into this routine, two records will be loaded. When a dump is requested, the dump caller will properly position the system tape or set up the disk commands to read two records; therefore, the dump routine should be used to provide a dump.

Blocks BR01 and BR02: The unit address is picked up from the first word of the UCB and tested to determine if the system unit is disk. If the system unit is not disk, control transfers to CALIB2, which will load in one record from the system tape and transfer control to it. If the system is on disk, location 0 is cleared to provide an error halt. The data channel is reset and the designation sysrec is picked up from the calling sequence and saved in case it is required later.

Block BR03: The value of "N" from the calling sequence is placed into IR4, where it is tested to determine which of the three options has been requested. If N equals 0, control transfers to CAL2Y (Block BR19) to load the next record. If N equals 2, control transfers to CAL3Y (Block BR20) to load the location indicated in SYSPOS.

Blocks BR04 and BR05: If N equals 1, the designated sysrec is loaded. Location 0 is loaded with the address for a restart at this point in the program. The channel is reset and started with the channel program at Cal5y. This will seek the spare surfaces on disk and write a checkpoint record. Subroutine Calpow tests for an I/O Check, Sequence Check, Unusual End or Adapter Check during the operation of the channel. If none occurs, control will pass to Cal10y. If any of these conditions occur, control will return to Cal9y to start the channel for another attempt at writing the checkpoint record.

Blocks BR06 and BR07: Location 0 is reset to the new restart location. The channel is reset and started with the program at CAL6Y. This will read in the SLTABL, which contains the table for comparison with SYSREC and the appropriate track addresses for each entry in this table. Subroutine CALPOW will determine if the read-in was valid before allowing the search of SLTABL.

Blocks BR08 to BR10: The SLTABL is scanned for the entry denoted as SYSREC, and the track address for this

record is then obtained from this table. Location 0 is reset for restart purposes. The channel is reset and started with the program at CALTY. This will restore core to its previous status using the checkpoint record written earlier. Subroutine CALPOW will allow control to pass to DECVD when the record has been read in successfully.

Blocks BR11 to BR13: Subroutine CDECVD is used to convert the track address found in SLTABL to BCD. Subroutine FDAMT generates the required disk orders to load in this record, and these orders are stored in the proper locations.

Blocks BR14 and BR15: Location 0 is reset for restart purposes and the channel is reset and started with the program at CAL8Y. This will seek the desired record, read in its bootstrap for the scatter load routine and transfer control to this scatter load routine. Meanwhile, subroutine CALPOW will determine if the record has been read in correctly and will initiate additional attempts if required.

Block BR16: When a complete record has been read in, systch will have been loaded with a bit in position 3. This is tested to determine if the record is complete, or if it has bridged two cylinders and requires an additional read for completion. Systch will have the track address for the next record in either case. If an additional read is required, control will transfer to Block BR22 to set up the address of the next record desired.

Blocks BR17 and BR18: When a complete record has been read in, the dump switch is tested to determine if a dump is requested. If it is, control transfers to Block BR21. If a dump is not requested, IR2 is set to point to the location of the UCB for SYSLB1, and control transfers to SYSTRA-2 (Block BP14).

Block BR19: The sense indicators are loaded with the contents of systch which has the track address for the next record to be loaded (N equals 0).

Block BR20: The system position in syspos is loaded into the sense indicators to indicate the next record to be loaded (N equals 2).

Block BR21: When a dump is requested or when N equals 0 or 2, bit 3 of systch is reset to 0 to make certain that only one record will be loaded (unless that record changes the value of this bit in systch).

Block BR22: The contents of the sense indicators are placed into the accumulator. This will be the address of the next record desired in binary form. This could be the result of a dump request requiring a second read, a system that bridges two cylinders, or a request for the record denoted by SYSPOS or SYSTCH. Control passes to Block BR11 for conversion of this address to BCD and subsequent read-in of the desired record.

Disk Loader Waiting Loop and Disk Channel Routines

Chart BS shows the waiting loop routine CALPOW, and the four channel routines: CAL5Y, CAL6Y, CAL7Y, and CAL8Y. These channel routines write a checkpoint record on the spare disk surfaces, read SLTABL from its disk location, read the checkpoint record back from disk, and read the desired record into the scatter load routine.

CALPOW tests for an I/O Check, Sequence Check, Unusual End, or an Adapter Check while waiting for the disk operation to be completed. If any of these are found, control is returned to the main program at such a point as to cause the channel program to be restarted for another try. After a successful read, control will pass to the location following the one which called this subroutine.

CAL5Y seeks the spare surfaces on the disk, and writes a checkpoint record on these surfaces. This will insure that the area used when reading in the SLTABL will be restored after this table is used.

CAL6Y reads in the SLTABL for comparison with the BCI designation in SYSREC in the calling sequence for SYSLDR. This table consists of two word entries containing the BCI designation for each system record, and the corresponding binary track address for that record.

CAL7Y restores the checkpoint record written by CAL5Y.

CAL8Y issues a seek for the desired sysrec, and causes it to be read into its proper storage locations using the scatter load routine.

CALPOW — Disk Loader Waiting Loop

Block BS01: An SDCX instruction is executed which causes the contents of the diagnostic channel to be stored in ISSEH. The contents of the channel check register are stored in positions 6 through 11 of this location by the SDCX command. The sense indicators are loaded from ISSEH so that they may be tested.

Block BS02: Bit positions 6, 7, 8, and 11 of the sense indicators are tested to determine if there has been an I/O, Sequence, or Adapter Check or an Unusual End. If there has been any one or more of these conditions, control passes to Block BS05 to modify IR2 for an error exit.

Block BS03: When no error conditions exist, the channel is tested to see if the operation is complete. Until the operation is complete, the program will loop back to Block BS02 and continue to check for error conditions.

Block BS04: When the channel operation is completed, the channel is reset. Control transfers back to the main program at either the location immediately after that which called the subroutine (1, 2 - no error)

or the location immediately prior to the location which called the subroutine (-1, 2 - error found). In the latter case, this will cause the channel operation to be restarted and another attempt made.

Block BS05: IR2, which is being used for the return linkage, is modified to provide the error exit, and control passes to IBLAST (Block BS04) for eventual return to the main program.

CAL8Y — Load System Record

Blocks BS06 and BS07: This is the channel program used to load in a desired system record. Unusual End and Attention Interrupts are inhibited and a seek is issued for the sysrec desired.

Blocks BS08 to BS10: The channel check register is tested to determine when the seek is completed. On completion, a "control read" is given to indicate to the file control a "prepare to verify for cylinder" operation. Control transfers to the scatter load routine which loads the record into its proper storage locations.

CAL5Y — Write Checkpoint Record

Blocks BS11 and BS12: This is the start of the channel program used to write a checkpoint record on the spare surfaces on disk. Unusual End and Attention Interrupts are inhibited, and a seek is issued for the spare surfaces.

Blocks BS13 and BS14: The channel check register is tested to determine when the seek is complete. On completion, a "control write" is given to indicate to the file control a "prepare to verify for cylinder" operation.

Blocks BS15 and BS16: A "copy and disconnect" is given to cause the checkpoint record to be written, (or the SLTABL to be read, or the checkpoint record to be read if entry was made to either CAL6Y or CAL7Y). The channel waits until the operation is completed and then disconnects.

CAL6Y — Load SLTABL

Block BS17: This is the start of the channel program to read SLTABL into core when the calling sequence for SYSLDR requests that a specific SYSREC is to be loaded. A "control read" is given to indicate to the file control a "prepare to verify for cylinder" operation, and control transfers to Block BS15 for the "copy and disconnect."

CAL7Y — Read Checkpoint Record

Block BS18: This is the start of the channel program to read the checkpoint record that was written by CAL5Y. A "control read" is given to indicate to the file control a "prepare to verify for cylinder" operation, and control passes to Block BS15 for the "copy and disconnect."

System Return and Print Tape Positions Routines

Chart bt shows the ibret routine, used to return control to the current system, as specified by syspos. If the position indicated in syspos is valid, a sexecute (sysnam) card will be simulated, and control will be given to the execute routine to locate and bring in this system. If this position is not valid, a message will be printed on-line indicating that the current system name is missing and the operator should restore with an SEXECUTE (SYSNAM) card in the card reader.

Also on Chart BT is shown the routine used to print the positions for all output units when IBSYS is given control after executing a system other than the dump or the editor. If the previous system was the dump, control will be given to IBRET without printing the tape positions. If the return was from the editor, the tape positions will not be printed but control will be given to IBSYS.

IBRET — System Return Routine

Blocks BT01 and BT02: This is the entry point for the ibret routine. The dump switch is cleared, and the current system position is picked up from syspos. This position is tested for zero; if it is found to be zero, control transfers to DMPER (Block BT07) for an error print-out.

Blocks BT03 to BT06: If a valid system position is specified in syspos, the unit address is checked to determine if the current system unit is disk. If the unit specified is disk, control transfers to sysldr with N equal to 2 to indicate that the system denoted in syspos is to be loaded. If the system is not on disk, the syunam table is searched for an entry which has the matching system position. This table contains two word entries comprised of the system name and its location. If a match cannot be found, control transfers to DMPER (Block BT07) for an error print-out. If the match is found, the system name is picked up from the table and a dummy sexecute (Sysnam) card is simulated. Control then transfers to IBXCC (Block BG01).

Blocks BT07 to BT09: If the system position is invalid, subroutine prout is used to print the following error message: Current system name missing, restore with sexecute sysnam in syscrd. Subroutine pause is used to provide an operator action pause. When the operator has completed his operation and depresses start on the console, the input switch will be cleared to indicate that the input is to come from the card reader. Control then transfers to ibres (Block BD01). The operator must have a stape card in his on-line deck in order to have the monitor return to tape input if he was using this prior to the error print-out.

TPPS — Print Tape Positions Routine

Blocks BT10 and BT11: The system name table is moved from its position immediately after the system origin to a working area. The tag bits of each second word entry in the table are moved to the address part of the word and the tag positions are cleared.

Blocks BT12 and BT13: During the loading of the dump program, the dump switch is set to MZE. This is interpreted as being off, since the other tests of the dump switch check to see if it is zero and do not check the sign position. The sign is tested here to determine if the dump program has just been executed. If the sign is minus, control transfers to IBRET (Block BT01) without printing the peripheral tape positions. When the return is not from the dump program, the interrupt switch is set to plus.

Blocks BT14 and BT15: The original value of INTSW is tested for a minus condition which indicates a return from the editor. In this case, control transfers to IBSYS (Block BC01), without printing the tape positions. If the return is not from the editor, the UCB address for SYSOU1 is picked up from the system units table.

Blocks BT16 to BT19: This address is tested to determine if there has been a unit assigned to this function. If no unit has been assigned, control transfers to Block BT25. For an assigned unit, subroutine syuncy is used to convert this binary address to a symbolic address in the form of channel and unit. This symbolic designation is stored in the print line for this system unit. The file number is picked up from word 3 of the UCB and subroutine BCVDEC is used to convert it to decimal. The file number is placed into the print line and the record number is picked up from word 3 of the UCB. Subroutine BCVDEC is used to convert the record number to decimal and this BCD designation is placed into the print line.

Blocks BT20 and BT21: IRI is tested to determine if all three units have been processed. If all three units have not be processed, control transfers to Block BT22. When all three units have been processed, subroutine PROUT is used to print the heading line and the three lines of information. Control then transfers to IBNJB (Block BU01).

Blocks BT22 to BT24: When the three units have not been processed, the unit address for sysppi is picked up. IRI is tested to determine if this unit has been processed (second unit). If it has not been processed, control transfers to TPOSI (Block BT16). If the sysppi unit has been processed, the unit address for sysini is picked up. Control then transfers to Block BT16. If there is a unit assigned to sysppi and/or sysini, the symbolic conversion is made and is stored in the print image.

Block BT25: This block is entered whenever it is found that there is no unit assigned for a particular sysum function. The BCD designation for NO is picked up and placed into the print line in place of the normal symbolic designation. Control transfers to RNXPO (Block BT21) to determine if all units have been processed prior to the message print-out.

Skip Job Routines

Chart BU shows the routine used to allow the operator to skip jobs on an input tape. The operator places sense switch 6 down, and places the number of the next job desired in the entry keys. If the input unit is sysin1, this sense switch will be interrogated. The following three conditions must be met in order for the request to be honored: (1) the input unit must be sysin1; (2) sense switch 6 must be down and (3) the unit assigned to sysini must be tape. If all conditions are not met, control transfers to IBSYS. The operator's entry is then checked to see if it is valid. A request of zero causes return of control to ibsys. A high request (greater than 15) causes an on-line print-out, and a pause for operator clarification. After a valid request, sysini is rewound and subroutine PROUT is used to print an on-line message telling the operator to place sense switch 6 up. Subroutine PAUSE is then used to provide a pause for the operator to perform this action. When the operator depresses start, control transfers to ibsys.

IBTPIN will transfer control to IBNJ2 on each entry while IBNCT is not zero. This routine will save the most recent sexecute card and keep count of all SID cards that are encountered. Each SID card will cause IBNCT to be reduced by 1. When IBNCT goes to 1, the SEXECUTE card will be simulated. The proper system will be called in after backspacing the input tape over the last SID card read in. A SSTOP card encountered before the count goes to zero causes an on-line print-out and a transfer to IBSTP for a permanent stop.

IBNJB Routine

Block BU01: The input switch is tested to determine whether the input unit is SYSIN1. If the input is not SYSIN1, control transfers to IBSYS.

Blocks BU02 to BU04: When the input unit is sysin1, sense switch 6 is tested to see if the operator has requested that jobs be skipped. If this switch is up, indicating that he does not want to skip jobs, control transfers to ibsys. If sense switch 6 is down, the unit address for sysin1 is tested to make certain that the actual device attached as sysin1 is a tape unit. If a non-tape unit is attached, control transfers to ibsys. When sysin1 is tape, the job number is picked up from the entry keys.

Blocks BU05 to BU07: The job number is tested to determine if the number entered was zero. If zero is specified, control transfers to IBSYS. If the number was not zero, it is stored in IBNCT. Subroutine ©DECVA is used to convert this number to decimal, and the result is stored in the print image. Subroutine PROUT is used to print this image informing the operator that the request has been acknowledged.

Blocks BU08 and BU09: On the initial pass through the skip job routine, IBNJS is zero, indicating that the job request has been read the first time. A test is then made to determine if the job number stored in IBNCT is greater than 15. If the job number is 15 or less, control transfers to IBNJ1 (Block BU10) to rewind SYSIN1.

After IBNJs is tested the first time, it is made non-zero. Therefore, when the location is tested during a second pass through the routine, control is transferred directly to IBNJ1 regardless of the job number stored in IBNCT.

Blocks BU10 to BU12: If the initial request was less than 15, or after a second request for a number greater than 15, subroutine PROUT is used to print an on-line message telling the operator to place sense switch 6 up, and subroutine PAUSE is used to provide time for the operator to perform this operation. When the operator depresses START, control transfers to IBSYS (Block BC01).

Blocks BU13 and BU14: On the first pass through the skip job routine when the job number exceeds 15, operator clarification is required. Subroutine PROUT is used to print an on-line message which indicates to the operator the job number requested and asks for clarification of the job number. Subroutine PAUSE provides time for operator intervention so that the entry keys may be checked. The operator has the option of making no change to the entry or of changing the job number. When START is depressed, control returns to Block BU02 for a second pass through the routine.

IBNJ2 Routine

Blocks BU15 and BU16: When a skip job request is indicated in IBSYS (IBNCT is not zero), the first word in the input card image is picked up and compared to SEXECUTE. If the comparison is low, indicating that the card read-in is not one of the cards requiring special attention, control transfers to IBSYS to get another card. If there is an equal comparison, routine IBNJ3 is used to save the indicated system for subsequent execution. If the comparison is high, additional checks are made.

Blocks BU17 to BU19: The card image is next compared to \$\$500. If it is a \$\$500 card, control transfers to IBNJ4 (Block BU24) for a message print-out prior to a stop procedure. When the card is not \$\$500, it is compared to \$\$100. If the comparison is not equal, control

transfers to IBSYS to get another card. If a \$ID card is indicated, the count in IBNCT is reduced by 1.

Blocks BU20 to BU23: IBNCT is now tested to determine if the count has been reduced to zero. If the count has not been reduced to zero, control transfers to IBSYS for another card. When the count has been reduced to zero, subroutine NDSEL is used to backspace the input tape over the card just read. Subroutine PROUT is used to print the name of the system to be executed, and a SEXECUTE SYSNAM card will be simulated from the information previously stored. Control transfers to IBXCC (Block BC03) to call in and execute this system.

Block BU24: The block is entered if a sstop card is encountered before the desired number of jobs have been skipped. Subroutine PROUT is used to print an online message to the operator indicating that a sstop card was found prematurely. Control transfers to IBSTP to provide a permanent stop to the system.

Block BU25: This block is entered when a SEXECUTE card is encountered during skipping. The system name is saved in order to simulate this card when the desired SID card is located. Control then transfers to IBSYS to get another card.

Locate Desired System and Validate Channel and Unit Designation

The IFIND routine shown on Chart BV scans the system name table for the system specified on an input card. If the name is found in the table, this name will be stored in SYSCUR as the current system name. If a unit has been assigned to this function, the system position will be stored in SYSPOS. Subroutine RGTPO will position the proper system tape in front of the desired system, and the routine will return to the main program with IR2 set to the location of the SYSUNI entry for the required system.

IBVAL checks the channel and unit specified in the accumulator in the form PZE CHANNEL, , UNIT. If the designation is valid, the routine will exit to the main program with IR2 set to point to the UCB. The sense indicators are loaded with the contents of word 1 of the UCB and the accumulator contains the address of the UCB. Specification of an invalid or non-existent unit or channel causes an exit with the accumulator set to zero.

IFIND — Locate Desired System Routine

Blocks BV01 to BV03: IR1 and IR4 are saved. They are reloaded with the location and length of the system name table. A comparison of the name specified in the input card image is made with each entry in the system name table. If no equal comparison is found, control transfers to IFND2 (Block BV11).

Blocks BV04 and BV05: If the name is found in the system name table, the name used for comparison is stored in SYSCUR as the current system name. The second word of the entry in the system name table is checked to determine if a unit was assigned to this system. If no unit was assigned, control transfers to IFND2 (Block BV11).

Blocks BV06 and BV07: If a unit is assigned to the system, the system position is picked up from the second word of the entry in the table and stored in syspos. The file position is also saved temporarily to be used in setting up the parameters for subroutine RCTPO. The location of the sysuni entry for the required library unit is calculated, and this entry is checked to determine if a unit has been assigned. If no unit has been assigned, control transfers to IFND5 (Block BV13).

Blocks BV08 to BV10: If a unit has been assigned to the sysum entry, the file number is placed in the decrement of the accumulator. Subroutine RCTPO is used to position the required library unit in front of the desired system. IR1 and IR4 are restored and control returns to the main program at one location after the instruction that called this subroutine.

Blocks BV11 and BV12: If the system name specified on an input card is not contained in the system name table or if no unit is assigned to a valid specified system, the system name is stored in the following error message, ****** UNKNOWN SYSTEM. The address of the message is placed in the MQ and control transfers to IBERR (Block BJ14) for an error print-out.

Blocks BV13 and BV14: If no unit has been assigned to the sysum entry, the system name is stored in the error message, ****** NO ASSIGNMENT MADE. The address of the message is placed in the MQ and control transfers to IBERR (Block BJ14) for an error print-out.

IBVAL — Validate Channel and Unit Designation Routine

Blocks BV15 and BV16: IR1 and IR4 are saved and IR1 is loaded with the complement of the channel number. The contents of IR1 are tested to determine if a valid channel (1 through the highest available) has been specified. If an invalid channel is specified (greater than the highest number available), control transfers to Block BV31 prior to returning to the main program.

Blocks BV17 to BV20: If the specified channel is legitimate, the unit designation is loaded into IR2 to be checked for validity. If the designation is greater than 16, indicating a possible disk or Hypertape unit, control transfers to IBV7 (Block BV25) for additional checking. When the designation is 16 or less, IR2 is tested again to

determine whether it is greater than zero and less than 10. A unit designation equal to zero is illegal and causes a transfer of control to Block BV31 prior to returning to the main program. A unit designation greater than 10 indicates a possible card machine and control transfers to IBV3 (Block BV26) for additional checking. A unit designation less than 10 indicates a tape unit. The total number of units available on the channel is calculated. The number of card units available is added to the unit location desired. This new value is in IR2 and is transferred to IR4 in complement form. The total number of units available is added to IR4; if the result is between zero and 12, a valid tape unit exists on the channel. If the unit does not exist (1R4 greater than 12), control transfers to Block BV31 prior to returning to the main program.

Blocks BV21 and BV22: If a valid tape unit exists on the channel, the location of the UCB is calculated and placed in IR2 in complement form. This location also remains in the address portion of the accumulator in true form.

Block BV23: The contents of word 1 of the UCB are loaded into the sense indicators.

Block BV24: This is the exit from the IBVAL routine. IR1 and IR4 are restored and control returns to the main program.

Block BV25: If a possible disk unit is indicated, the desired address is compared with the first word of each UCB for this channel. If a valid comparison cannot be found, control transfers to Block BV31 to exit from the routine. If a valid comparison is found, control transfers to Block BV30 with IR2 set to point to the desired UCB.

Blocks BV26 to BV29: Entry is made to IBV3 with IR2 equal to some value between 1 and 6 indicating a possible card machine. (The value in IR2 is the result of an initial setting of 11 to 16 because the transfer to IBV3 caused IR2 to be reduced by 10.) IR2 is now tested to determine if it is greater than 3. If it is greater than 3 (indicating an original value of 14 to 16 which is illegal), control transfers to Block BV31 to exit from the routine. When the contents of IR2 (1, 2, or 3) indicate a legal card device, the number of devices and the address of the first UCB are picked up from the proper UCB locator. The address is placed in 1BV4 to be used in checking for the desired unit and the number of devices is placed in IR4. IR4 is then tested to determine if there are any card devices on the channel. If there are none, control transfers to Block BV31. If there are legal card devices on the channel, the unit number in IR2 is used to form the unit address to be used for comparison with each ucp. These ucp's for the card machines on the channel are tested to determine if the machine indicated in IR2 exists. If it does not exist, control transfers to BV31.

Block BV30: If a legal card device or disk unit is indicated, the location of the UCB is placed in the accumulator. Control then transfers to Block BV23.

Block BV31: This block is entered whenever there has been an illegal unit specified or an illegal channel specified. The accumulator is cleared and control transfers to Block BV24 to exit from the routine.

INITUS — Initialize System Tape Usage Routine

Subroutine INITUS is used to initialize the routines requiring the following system tapes: SYSLB1, SYSOU1/2, SYSCK1/2, and SYSUT4. It will also initialize the loader for disk if syslb1 is assigned to disk.

Entry to the subroutine is made with IR2 pointing to an indirect reference to the UCB for the unit desired. If IR2 is pointing to a reference word with a zero address, indicating that there is no unit assigned, a further check will be made to determine if the unit should be a dump tape. If the unit being initialized is a dump tape and no unit has been assigned, SYSDMP and location 00002 will be altered to bypass dump requests. An online message will also be printed to inform the operator that dumps cannot be taken.

For a unit that is assigned to tape, the density will be set as indicated by the sign of the sysum entry. The 1/0 addresses in the routines requiring this unit will be set for the proper unit.

If the unit is syslb1 and assigned to disk, the disk orders will be generated and the channel codes will be set up for disk in SYSLDR.

The return from this subroutine is via 1, 1.

Blocks BW01 to BW03: Entry is made with IR2 pointing to a UCB locator in the SYSUNI table. If the address of this locator is zero, indicating that there is no unit assigned, control transfers to INITL3 (Block BW09). If a unit is assigned, the availability and no-repositioning flags are reset. Bits 4 and 11 of the unit address are checked to determine if the unit is disk. If the unit is disk, control transfers to DINLB1 (Block BW18).

Blocks BW04 to BW06: If a tape unit is assigned, subroutine NDSEL is used to set the density of the desired unit according to the sign of the entry in the SYSUNI table. IR2 is tested to determine if the unit being referenced is syslb1. If the unit is syslb1, control transfers to INITL1 (Block BW15). If the unit is not SYSLB1, IR2 is tested next to determine if the unit is SYSUT4. If the unit is sysur4, control transfers to INITL2 (Block BW16).

Blocks BW07 and BW08: If the assigned tape unit is neither SYSLB1 nor SYSUT4, IR2 is tested to determine if the unit could be one of the system output units (i.e., SYSOU1, SYSOU2, SYSCK1, or SYSCK2). If it is not one of the output units, control returns to the calling program via 1, 1. If the assigned unit is any one of the output units, the no-repositioning flag is set and control returns to the calling program via 1, 1.

Blocks BW09 to BW14: If a unit is not assigned, IR2 is tested to determine if the unit is either sysou1 or SYSUT4. If it is neither of these units, control returns to the calling program via 1, 1. If it is one of these units, IR2 is tested to determine which one it is. If the unit is sysoui, subroutine PROUT will be used to print an online message indicating that sysou1 is unassigned, and no dump can be taken. If the unit is sysur4, a similar message is printed. Location sysdmp in the communications table, and location 00002 are modified to bypass the dump and transfer directly to the loader. Control then exists to the calling program via 1, 1.

Block BW15: This block is entered from Block BW05 if the unit specified is sysLB1. All the 1/0 commands in the loader (CALIB1) will be set up to reference this unit and control will exit to the calling program via 1, 1.

Blocks BW16 and BW17: These blocks are entered from Block BW06 if the assigned tape unit is SYSUT4. All the I/O commands in the dump caller are set up to reference this unit. The linkage to the dump caller is placed in SYSDMP in the communications table, and in location 00002. Control exits to the calling routine via 1, 1.

Blocks BW18 to BW22: These blocks are entered if the unit assigned is disk. If the assigned disk unit is not syslb1, control exits to the calling routine via 1, 1 without performing any setup operations. If the unit is syslb1, IR1 and IR2 are saved. The disk orders for the system loader are generated and stored in the SYSLDR routine. The sms masks and the channel codes are setup in sysldr, and irl and ire are restored. Control exits to the calling program via 1, 1.

SYUCU — Symbolic Unit Conversion Routine

Chart BX shows the SYUCU routine used to convert the symbolic unit designated in columns 16 to 18 of the input card image to the form: PRE CHAN, ,UNIT. Exit is made from this routine with this new form in the accumulator and in location LATUN. The return is made via 2, 4 for a normal return, and via 1, 4 for an error return if the unit specified is illegal.

A prefix of MZE indicates a model IV or VI tape drive. If the unit is one that is attached to a 7909 channel, the unit address is in a compressed form. This compressed form indicates the channel, device, interface, access, and module.

Blocks BX01 to BX05: The symbolic unit designation is picked up from the input card image and placed in the MQ. The channel letter (if the unit is tape or disk) is placed in IR1. If the unit is a card machine, IR1 will contain either an "R" or a "P". IR1 is tested to determine if the value of the channel letter is less than an "A". If it is, indicating that the channel designated is numeric or one of certain special characters, control exits to the calling program via 1, 4.

In the process of testing R1 for a channel designation lower than "A", R1 is reduced by an octal 20 if the channel designation was "A" or higher. R1 is now tested to determine if the present value lies above 26 octal, which would indicate an original letter of "P" or higher. If the letter was "P" or higher, control transfers to syuc5 (Block Bx12) to check and determine if a card machine was specified. If the specified designation is lower than "P", IR1 will contain a number from 1 to 26 for the letters "A" through "O" which might have appeared on the input card. A channel specification higher than "H" but lower than "O" will be permitted by this routine, but will be indicated as an error by the IBVAL routine which is called immediately after this routine returns to the main program.

The second character of the symbolic designation is placed in IR2. IR2 is tested to determine if this character is numeric. If the character is not numeric, control transfers to SYUC6 (Block BX17).

Blocks BX06 to BX09: IR2 is tested to determine if the unit specified is 0. If the unit is 0, IR2 is reset to 10. The model designation is picked up from the input card image and tested to determine if the model type specified is model II or v. If it is model II or v, control transfers to SYUC3 (Block BX10). If it is not model II or v, the "P" bit is set in the accumulator, to indicate model IV, and control transfers to Block BX11.

Block BX10: The accumulator is cleared. This is required to remove any prefix or tag. The only case where a prefix should be present is if the unit specified is not a model II or v tape unit. In this case, this one instruction will be bypassed.

Block BX11: The contents of LATUN are set up as follows: The prefix is taken from the accumulator and would be minus for a model IV or VI tape drive. The decrement is taken from IR2 which contains the unit number; and the address is taken from IR1 which contains the channel number. Control exits to the calling program via 2, 4 for a normal return in this case.

Blocks BX12 to BX16: IR1 is tested to determine if a "P" or an "R" was specified as the first character to

indicate a designation of a card machine. If neither was specified, control exits to the calling program via 1, 4. If a "P" or an "R" is specified, the second character of the designation is compared with the characters "R" "U", and "D". If no comparison is found, control exits to the calling program via 1, 4. If a valid letter is found, the unit number will be calculated and placed in IR2, (i.e., 11 for RDX, 12 for PUX, and 13 for PRX). The channel letter is then shifted out and reduced by an octal 20 and placed in IR1. Again, an invalid letter that is higher than "H" will not be detected now, but will be found in the IBVAL routine used later in the calling program. A numeric or special character lower than "A" in the BCD representation within the machine will cause the error exit to be taken and a return to the calling program via 1, 4. Otherwise, control transfers to syuc3 (Block BX10) to set up a normal exit via 2, 4.

Blocks BX17 to BX19: If a possible disk or Hypertape unit is indicated, the channel number is stored temporarily in syuc6 (address), after being shifted left 5 places. The characters denoting access are shifted into the accumulator, and IR2 is tested to determine if the type unit specified is greater than "D". If the type is greater than "D", control transfers to syuc7 (Block BX23). If the type is not greater than "D", IR2 is tested to determine if the exact character is "D". If it is not a "D", control exits to the calling program via 1, 4.

Blocks BX20 to BX22: If the type unit specified is "D" (disk), IR1 is loaded from the address portion of the accumulator. It is tested to determine if an access greater than 1 was specified. If there was a specification other than 0 or 1, control exits to the calling routine via 1, 4. If the access designated was legal, the designation will be or'ed with the channel designation temporarily stored in syuce. The next word from the input card image is loaded into the мо and the first character denoting the module is shifted into the accumulator, and then loaded into IR2. IR2 is tested to determine if a proper module has been designated. Any character higher than a "9" will cause an exit to the calling program via 1, 4. A legal character will be on'ed with the compressed disk address being constructed in SYUC6. The interface designation is tested in the MQ. and, if required, the interface bit will be on'ed to the word in the accumulator. Additional bits are added to the constructed word to indicate a 7909 channel and a disk device. This constructed word is now in IR2 and control transfers to syuc3 (Block BX10).

Blocks BX23 to BX25: IR2 contains the second character of the symbolic unit designation. At this point it is known that the character is higher than a "D". IR2 is tested to determine if the character is an "H". If the character is not an "H", control exits to the calling pro-

gram via 1, 4. If the character is an "H" (Hypertape), the unit number is in the accumulator and is loaded into 1R2. IR2 is tested to determine if a legal tape number has been specified. If a legal tape number (0 through 9) has not been specified, control exits to the calling program via 1, 4. For a legal tape number, the number will be appended onto the channel number that is temporarily stored in syuc6. The character denoting interface is tested in the MQ, and, if required, the interface bit will be on'ed to the compressed address now in the accumulator. This compressed address is placed into 1R2 and then incremented to add the bit denoting a 7909 channel. Control then transfers to syuc3 (Block BX10).

RSYUR — Remove Unit from Availability Chain Routine and Sample Availability Chain

Chart BY shows the RSYUR routine which removes a unit from the availability chain. It is entered with the location of the UCB for the unit to be removed located in the address of the accumulator. All index registers are preserved, and if the accumulator address is zero, the exit will be taken from the routine with no work performed.

Chart BY also shows the makeup of a typical channel availability chain.

RSYUR Routine

Blocks BY01 to BY03: Index registers 1, 2, and 4 are saved, and the location of the desired UCB is saved in the compare cell, RSY5. RSY5 is tested to determine if there was an address specified in the accumulator on entry. If the accumulator address had been zero, control returns immediately to the calling program via 1, 4. If there is a valid address in RSY5, the address of the desired UCB is loaded into IR2 to obtain the unit address. The channel is extracted from this address, and used to calculate the availability chain locator for the desired channel.

Blocks BY04 to BY06: The address in the availability chain locator (i.e., UCAA for channel A) is compared

with the address stored in RSY5. If the addresses are equal, control transfers to RSY3 (Block BY07) to remove the unit reference from the chain. If the addresses are unequal, the address just compared to RSY5 is loaded into IR4 to be used in obtaining the next UCB in the chain. This address is tested to determine if the end of the chain has been reached (i.e., last address is zero). If we are at the end of the chain, control transfers to RSY2 (Block BY08). If the end of the chain has not been reached, control returns to RSY1 for another comparison of this new address with the address in RSY5.

Block BY07: When a UCB is found which has an address which compares with the one desired, the address of the unit immediately after the one to be removed is picked up and placed in the prior UCB or the locator. The prior UCB or locator was originally pointing to the unit that is being removed.

Block BY08: After finding the specified unit in the availability chain or after checking all units in the chain without success, the index registers are restored and control exits to the calling program via 1, 4.

Sample Availability Chain

The sample on Chart By shows the chaining of addresses in the availability chain locators and the availability chain itself.

UCWAV indicates the location of a table of availability chain locators (i.e., UCAA, UCBB, etc.). This table is comprised of one entry for each channel, and its length may be found in the decrement of UCWAV.

The address portion of each entry in the locator table contains the address of the first ucb in the availability chain. The address portion of word 1 of this ucb contains the address of the next ucb in the chain. The address portion of word 1 of the last ucb in the chain is zero. If the chain contains no entries, the address portion of the locator (i.e., ucaa) is zero.

Within the chain, the addresses of the uce's will not necessarily be in the order in which they appear in memory.

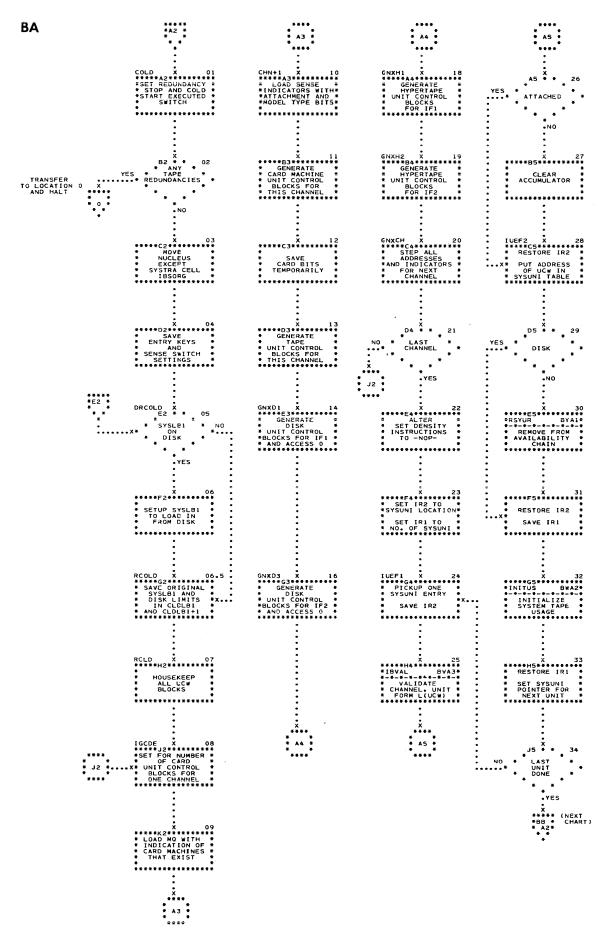


Chart BA. Cold Start and Initialization, Sheet 1

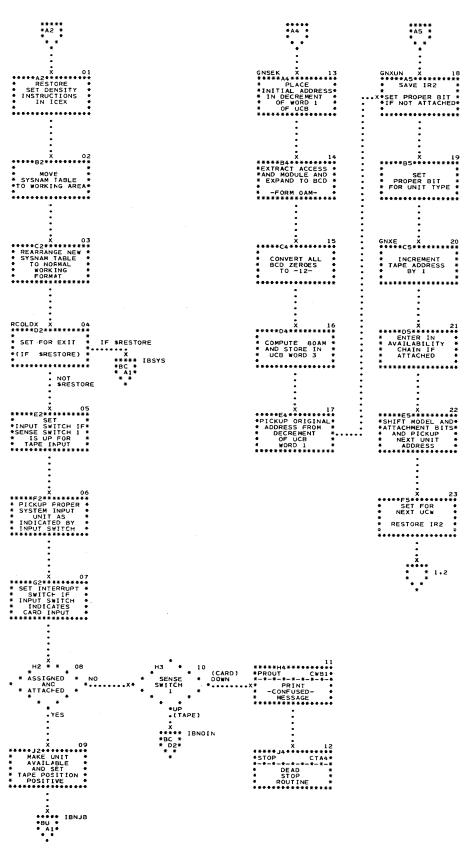


Chart BB. Cold Start and Initialization, Sheet 2

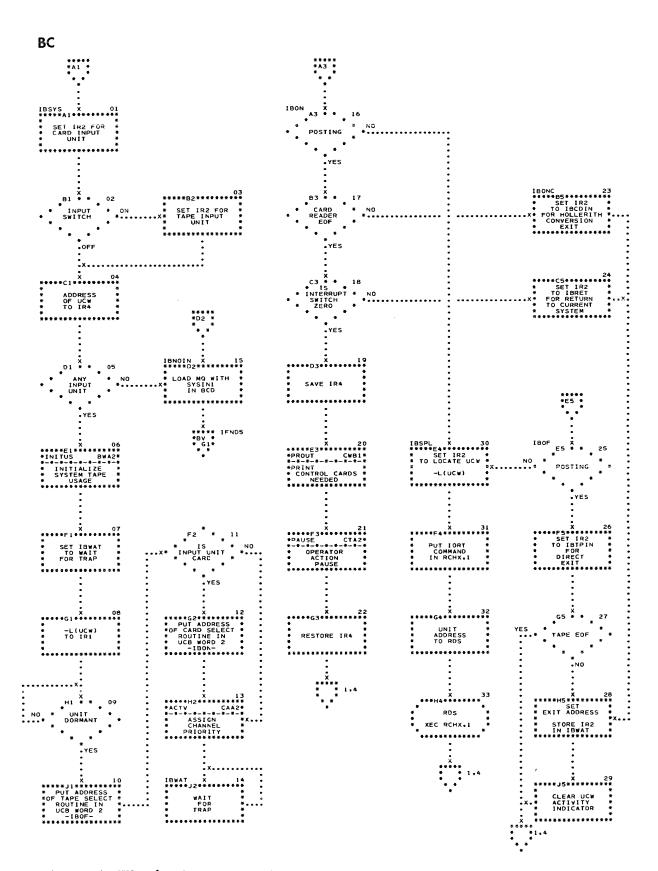


Chart BC. \$IBSYS card routine

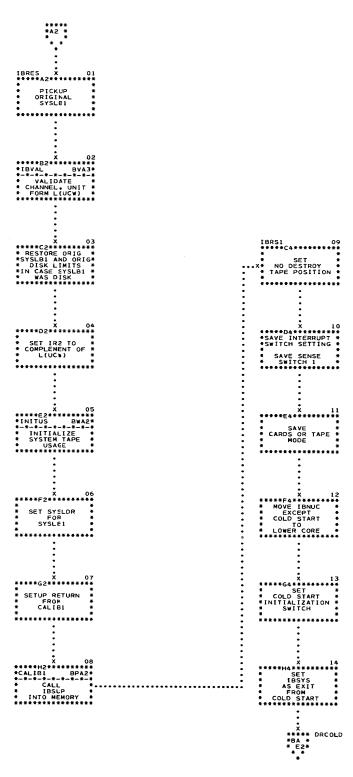


Chart BD. \$RESTORE card routine



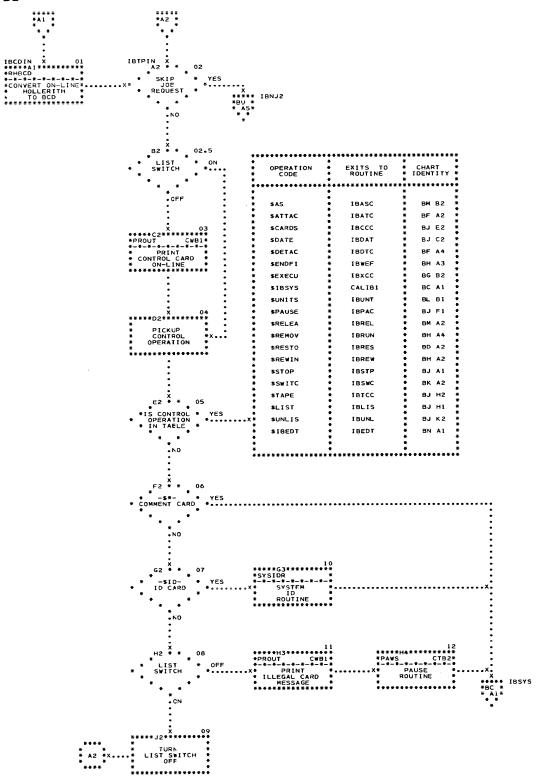
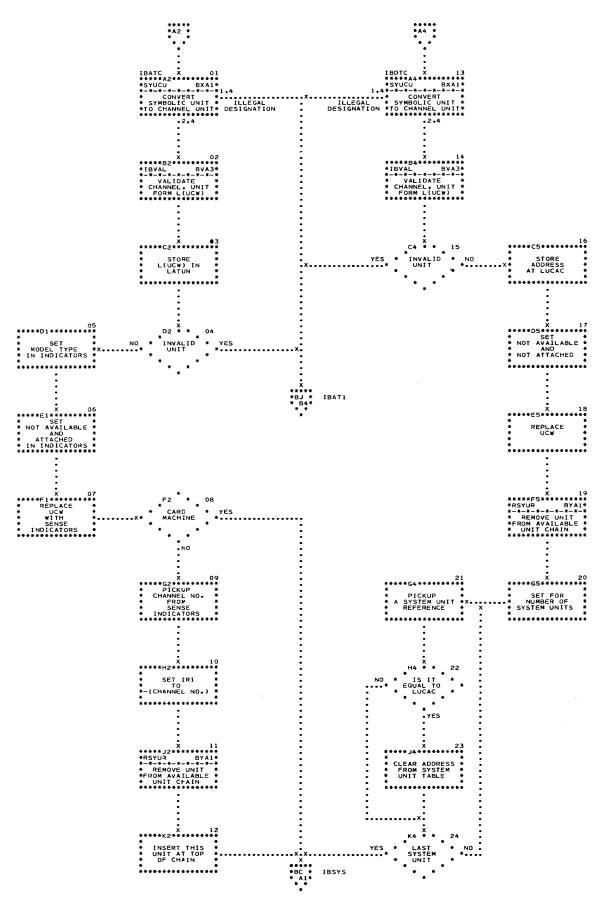


Chart BE. Control card interpretation routine, IBCDIN/IBTPIN





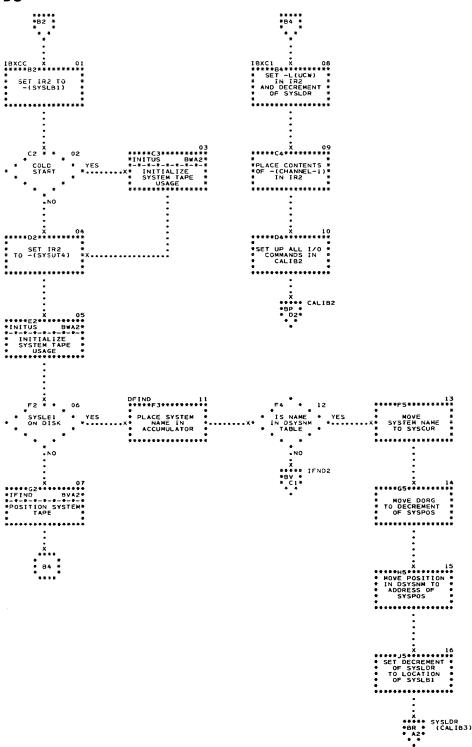
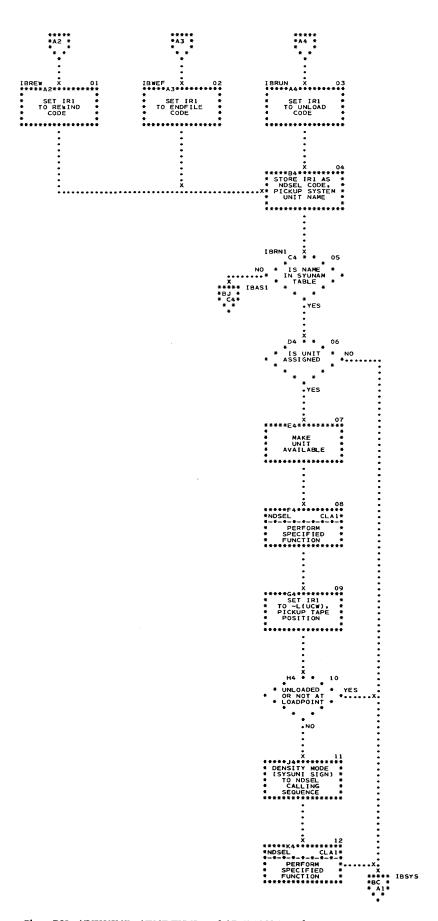


Chart BG. \$EXECUTE card routine



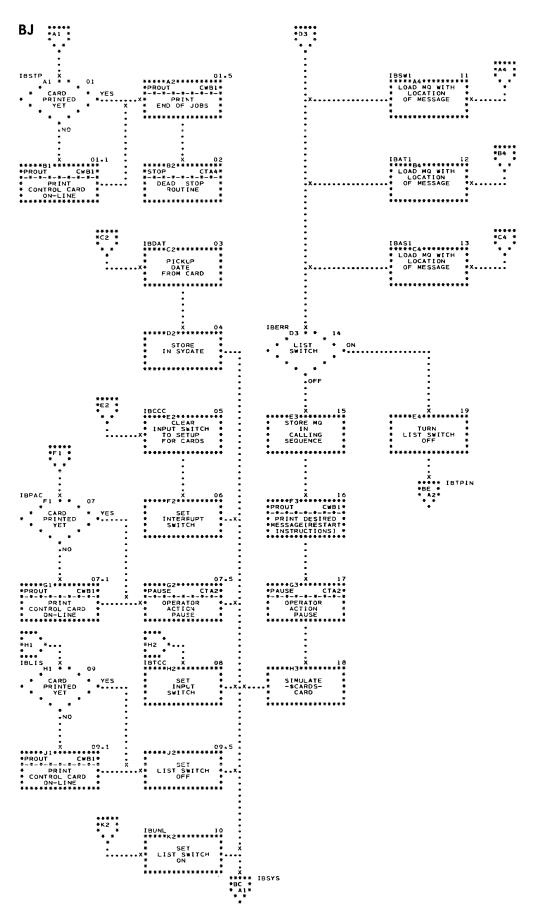


Chart BJ. Miscellaneous card routines and error routines

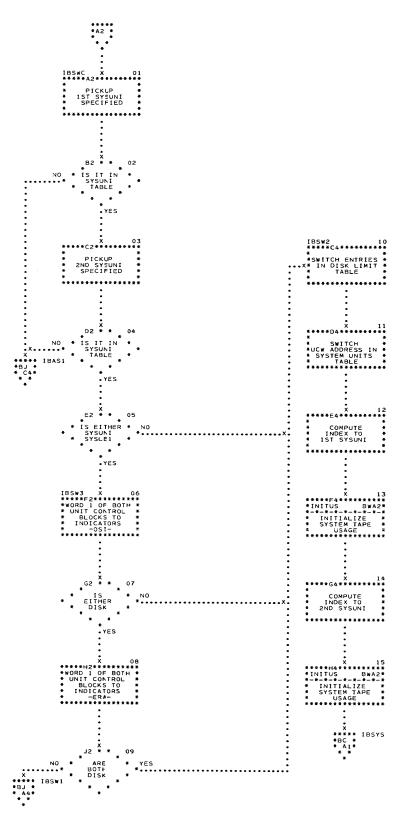


Chart BK. \$SWITCH card routine

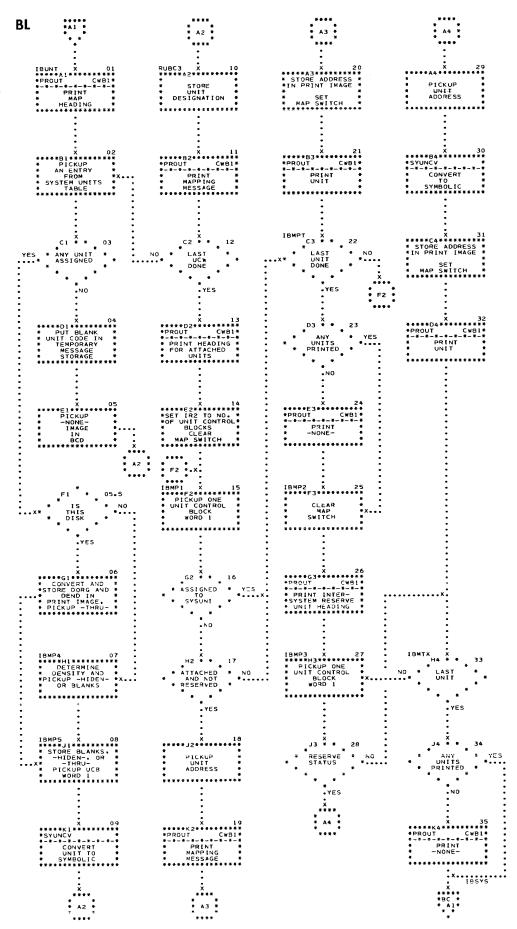


Chart BL. \$UNITS card routine

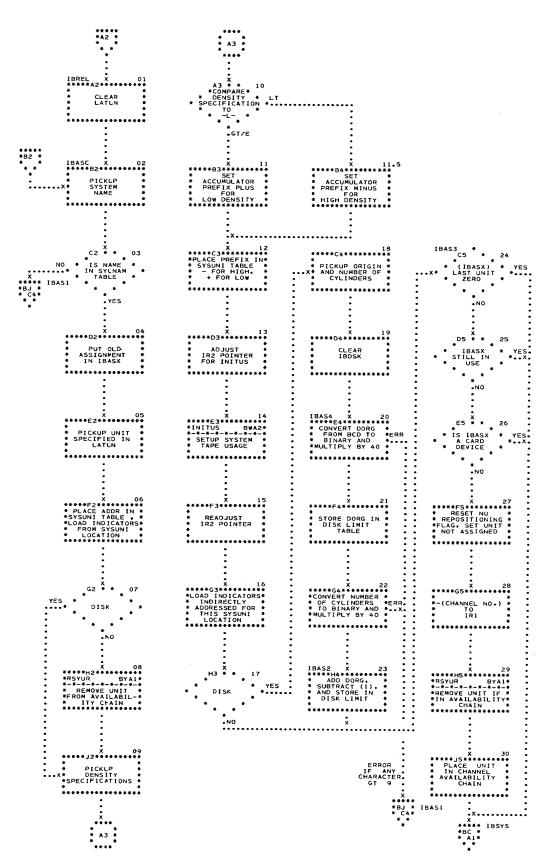
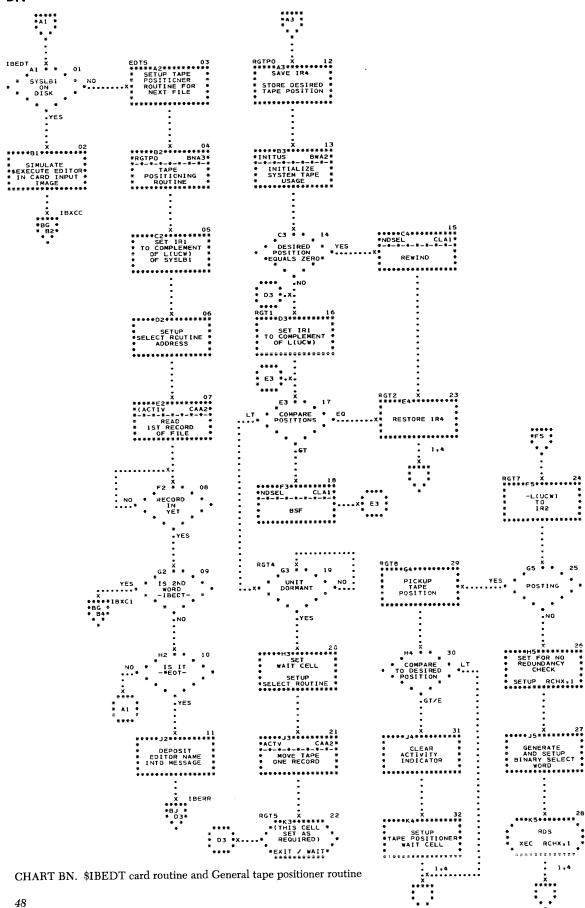
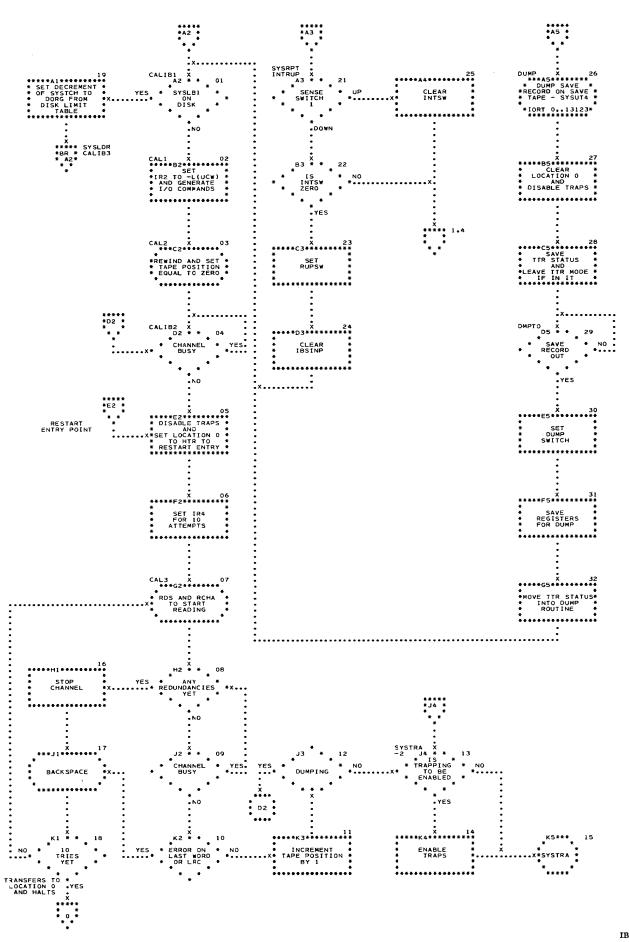


Chart BM. \$RELEASE and \$AS card routines





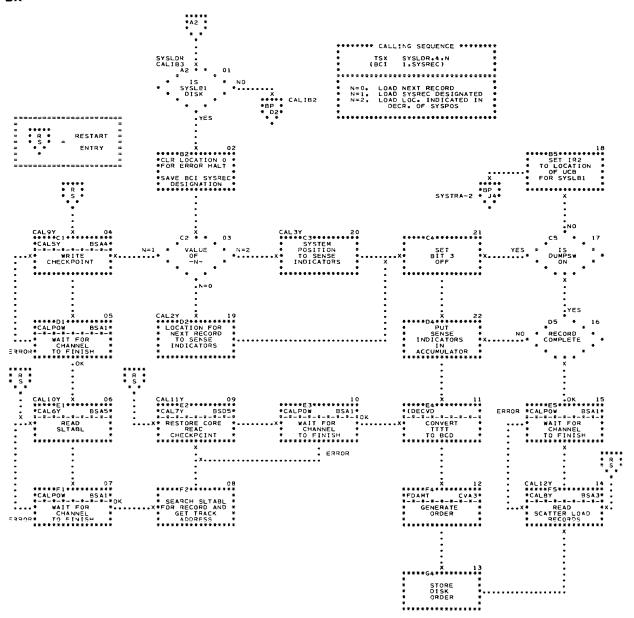


Chart BR. SYSLDR (CALIB3) routine

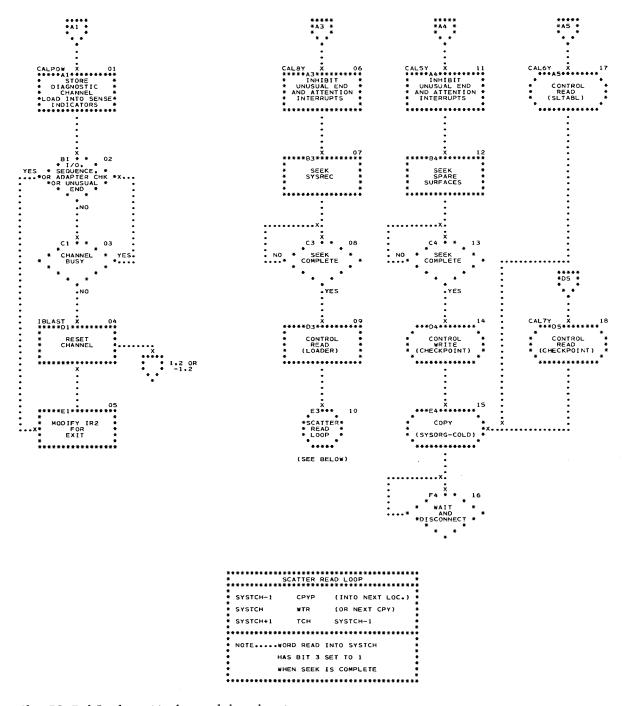


Chart BS. Disk Loader, waiting loop, and channel routines

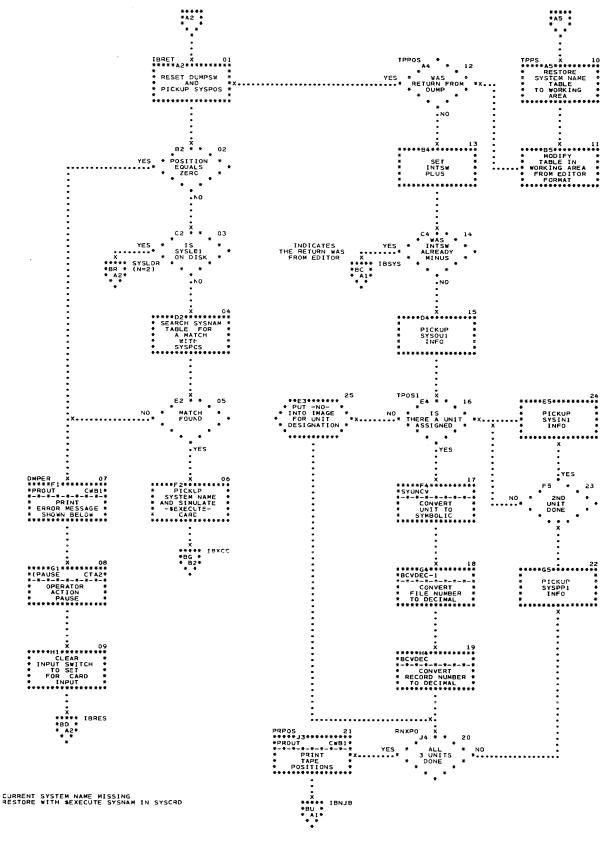


Chart BT. IBRET and TPPS routines

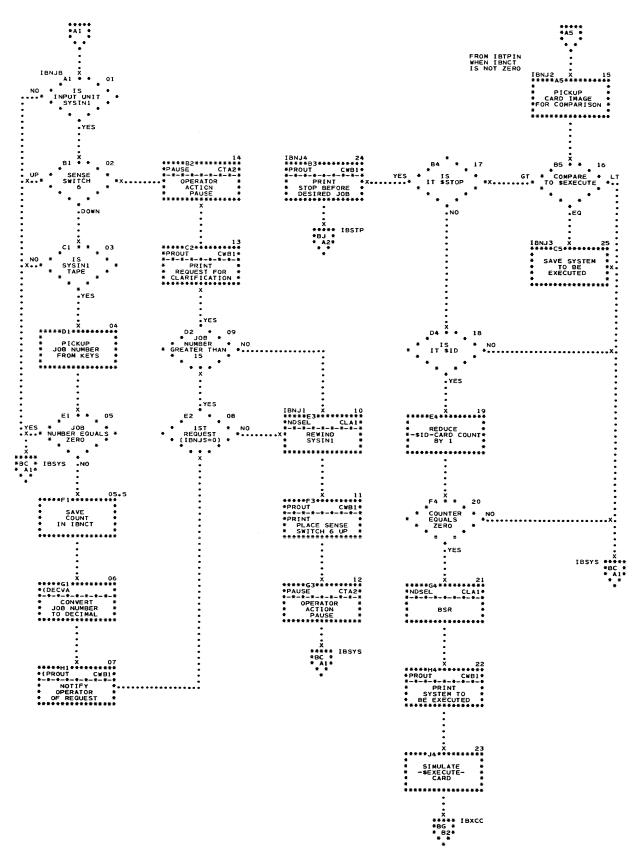


Chart BU. IBNJB and IBNJ2 (Skip Job) routines

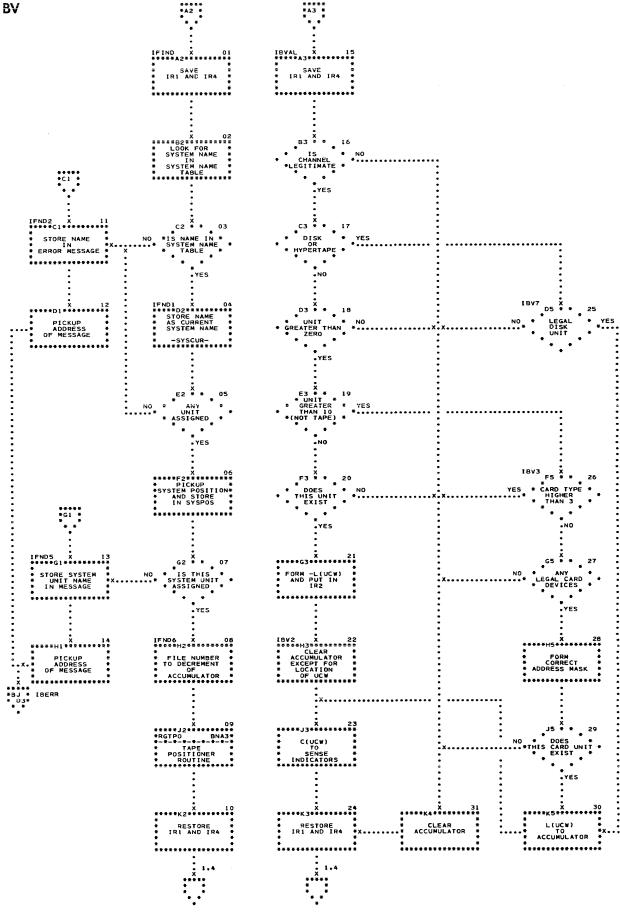


Chart BV. IFIND and IBVAL routines

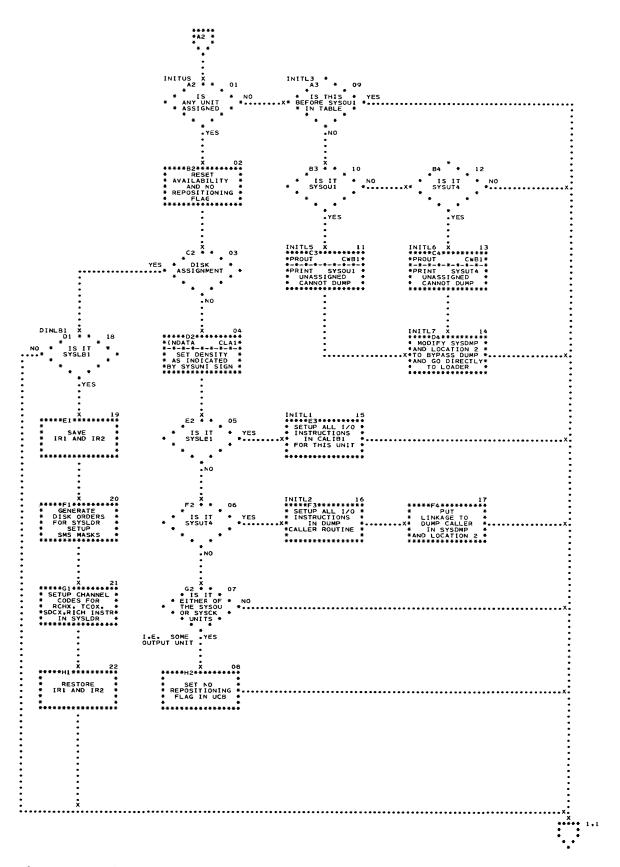


Chart BW. INITUS routine

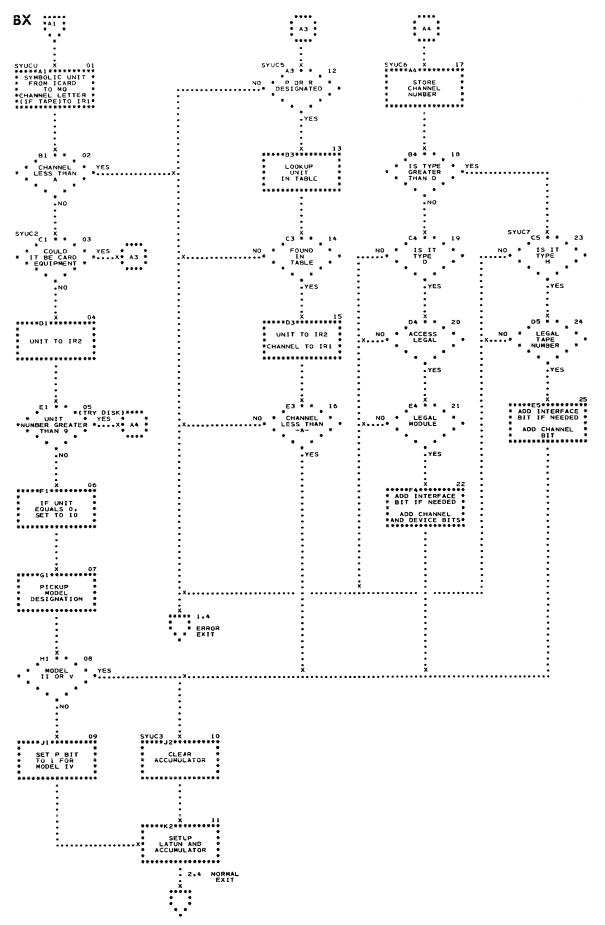


Chart BX. SYUCU symbolic convert routine

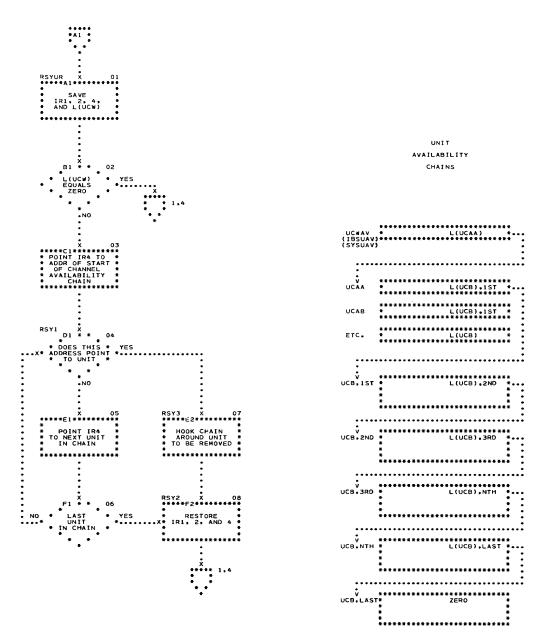


Chart BY. RSYUR routine and sample chain layout

ACTV/(ACTIV — Activate Routine

Charts CA and CB describe the activate subroutine used to initiate an I/O operation on a unit assigned to the specific file designated in the calling sequence.

Block CA01: Subroutine TEST is used to check for a valid file. If the unit is unavailable or is an illegal unit, there will be no return to the ACTV routine. A message showing the illegal unit reference will be printed online, and the program will halt using the STOP subroutine.

Blocks CA02 and CA03: On a return to ACTV, traps are disabled and IR1 is stored in the proper exit routine (ACTX1 for the non-trap exit, and ACTY1 for the trap exit).

Blocks CA04 to CA06: The channel number is extracted from word 1 of the UCB and IR1 is loaded with — (channel number -1). IR2, IR4, and the sense indicators are saved. IR2 is set to -L (UCB).

Block CA07: The channel activity cell (CHXAC) is tested to determine if the channel is dormant. If it is not, control transfers to ACT6 (Block CB01).

Block CA08: If the channel is dormant, word 1 of the UCB is loaded into the sense indicators. Bit position 4 of the indicators is tested to determine if this is a 7909 channel. If it is a 7909 channel, control transfers to ACT4 (Block CA12).

Blocks CA09 and CA10: If the dormant channel is not a 7909 channel, word 2 of the UCB is picked up. The location of the select routine is placed in IR4, which is tested to determine if there is a select routine specified. If there is not, control transfers to ACTX2 (Block CB14).

Block CAII: If a select routine is specified, the I/O indicators (TCOX, TRCX, and TEFX) are tested. RCTX is set to non-zero to indicate normal redundancy mode and control passes to ACT3 (Block CA16).

Block CA12: If the dormant channel is a 7909 channel, word 3 of the UCB is tested to determine if the AF flag is on. If the flag is on, control transfers to ACT5 (Block CB07).

Blocks CA13 to CA15: After the channel checks are made and a select routine is indicated, the select routine address is placed in IR4. The contents of IR4 are tested to determine if an address is present. If no select routine is specified, control transfers to ACTX2 (Block CB14). If an address is present, RCTX is cleared, and control transfers to ACT3 (Block CA16).

Blocks CA16 and CA17: If a select routine is specified, URRX is set to zero to reset the redundancy count. The channel activity cell (CHXAC) is set to the location of the UCB. IR4 is stored in the exit address as the exit to the user's select routine, and control is given to this routine as a subroutine. The normal return from the select routine is via 1, 4 to Block CA18. (For an explanation of the other two returns that may be made from a select routine, refer to the IBM Reference Manual, Basic Monitor (IBSYS), Form C28-6248).

Block CA18: Subroutine RDUN is used to permit redundancy trapping if the operation is a write operation. The return from this subroutine is via 2, 4 to ACTX2 (Block CB14).

Block CA19: This is entered if the return from the select routine was via 2, 4. The channel activity cell, CHXAC, is cleared and control passes to ACTX2 (Block CB14).

Block CB01: This block is entered from Block CA07 if the channel is in use. The prefix of word 1 of the calling sequence is checked to determine if the entry is PZE or MZE. If the entry is PZE, control transfers to ACTX2 (Block CB14).

Block CB02: If the entry is MZE, the address of the UCB is picked up and stored in CHXSP to give that unit priority on this channel.

Block CB03: This block is entered from Blocks CB02 and CB11. IR2, IR4, and the sense indicators are restored in preparation for returning to the using program.

Blocks CB04 and CB05: TRPSW is tested to determine if this is trap time. If TRPSW is not zero, indicating trap time, control transfers to ACTY1 (Block CB16). If this is non-trap time, traps are enabled. CHXAC is checked to determine when XTRAP has entered SEL+ or when the channel becomes dormant. The program loops, making these checks until either condition occurs. Control then transfers to ACTX1 (Block CB06).

Block CB06: This is the non-trap exit from ACTV. IR1 is restored, traps are enabled, and control is returned to the using program via 2, 4.

Blocks CB07 and CB08: Entry is made to these blocks from Block CA12 if the AF flag is on for a dormant 7909 channel. CHXAC is set to the address of the UCB to indicate channel activity. Word 1 of the calling sequence is checked to determine the type of entry to ACTV. If the entry is PZE, control transfers to ACT5A (Block CB12).

Blocks CB09 to CB11: If the entry to ACTV is an MZE entry, the address of the UCB is stored in CHXSP to give

this unit priority. Subroutine ISSK1 is used to issue one seek. STCX is executed to allow the channel to proceed and enable attention interrupts. Control then transfers to ACTS (Block CB03).

Blocks CB12 and CB13: With a PZE entry to ACTV, subroutine ISSEK is used to issue seeks as required. STCX is executed to allow the channel to proceed and enable attention interrupts.

Block CB14: At ACTX2, the sense indicators, IR2, and IR4, are restored in preparation for returning to the using program.

Block CB15: TRPSW is tested to determine if this is trap time or non-trap time. If TRPSW is zero, control passes to ACTX1 for a non-trap exit. If TRPSW is not zero, control transfers to ACTY1 for the trap exit.

Block CB16: IR1 is restored and control is returned to the using program at 2, 4 (trap exit).

SAVE/XTRAP — Trap Supervisor

This routine monitors traps occurring on the data channels as a result of the completion of an 1/0 operation or as a result of a redundancy on a channel when redundancy trapping is enabled. An attempt is made to recover when errors are detected, and the position of the tape is updated in the UCB if tape movement is involved.

Block CC01: This entry point is used whenever there is an illegal channel trap from a non-existent channel. Location goof is set to non-zero to indicate this error condition.

Blocks CC02 to CC03: FRSW1 is tested to determine if the trap is the result of an operation that was forced on the on-line printer or punch. If FRSW1 is not zero, control transfers to PRT3 to complete the operation which may have been interrupted by the use of PUNCHO or PROUTO. If FRSW1 is zero, DCHSW is tested to determine if the trap is the result of an invalid address recovery or a no-record-found recovery from disk. If DCHSW is non-zero, indicating a disk recovery, control transfers to DUEN9 (Block CR17). If DCHSW is zero, the machine registers are saved along with the transfer trapping mode and overflow conditions.

Blocks CC04 to CC06: These blocks are entered either from Block cc03 or from the prout routine to complete the processing of a channel A trap which had been interrupted, or from the exit routine out if channel A had been active when an entry was made to prout. The trap code word is placed into the accumulator and sense indicators. If Frsw2 is zero, indicating an initial trap on a channel without the concurrent use of prout, the address portion of this code word is stored in exit

as the exit address from XTRAP. If FRSW2 is non-zero, the address of the code word is not moved, and control transfers directly to Block cco7.

Blocks CC07 and CC08: \mathbb{R}^2 is loaded with the contents of location coof. If \mathbb{R}^2 is not zero (result of an illegal-channel trap), control transfers to \mathbb{T}^{3} . A message is printed to indicate an illegal unit reference followed by a dead stop. If \mathbb{R}^2 is zero, \mathbb{R}^1 is set to - (channel number -1).

Blocks CC09 and CC10: CHXAC is tested to determine if there is activity on the channel. If there is no activity, control transfers to END9 (Block CE22). If the channel is active, the trap switch is set and the channel results are moved from ACOMM to COMM.

Blocks CC11 to CC13: FRSW2 and FRSW3 are both tested for a zero condition. If both are zero, indicating that there is not a wait to print an on-line message, the channel information will be stored in COMM by the use of the indirectly addressed store channel instruction. If either or both (FRSW2 and FRSW3) are not zero, the store channel instruction will be bypassed.

Block CC14: TRPSW is set to point to the UCB at this time and is now used to pick up the actual unit address from word 1. Bit position 4 of this word is tested to determine if the unit is disk. If a disk address is present, control passes to Block CD01. If a non-disk address is present, control transfers to NDEND at Block CC15.

Blocks CC15 to CC18: A test for an I/O Check is made. If there was no I/O Check, control transfers immediately to END2 (Block CC19). If there was an I/O Check, subroutine MWR is used to print I/O CHECK 7607 and subroutine PAWS is used to allow an operator action pause. At the completion of the pause, the contents of TRPSW are replaced in the accumulator and control passes to END2 (Block CC19).

Block CC19: R2 is set to -L(UCW1). The sense indicators contain the trap code word which includes the trap type in bits 15, 16, and 17. The remainder of the left half of the indicators is cleared and the sign is set to one.

Block CC20: Bits 15 and 16 of the sense indicators are tested to determine if the trap resulted from either an EOF or a redundant write. If neither condition is present, control passes to Block CE01. If either condition is present, control transfers to END10 (Block CC21).

Block CC21: Bit 16 of the sense indicators is tested to determine if the trap resulted from a redundant write. In this case, control transfers to RED22 (Block CJ01).

Blocks CC22 and CC23: At this point the trap must be the result of an EOF. Bit 1 of the sense indicators is set to one to indicate this fact, and the redundancy indicator is turned off. The old tape position is saved in LTPOS, and the record count is set to 777777. Control now passes to END5 (Block CE11).

Blocks CD01 to CD03: These blocks receive control from Block CC14 if this is a trap from a 7909 channel. DCHSW is set to L(UCB), and the "store diagnostic channel" command is executed. The sense indicators are loaded with the data obtained from the SDCX instruction, and position 35 is reset to 0. (The contents of the six-position channel check condition register are presently in positions 6 through 11.) Positions 6, 7, and 11 are tested to determine if there has been an I/O, Sequence, or Adapter Check. If any of these conditions are present, control transfers to DEND1 (Block CD09).

Block CD04: When none of the check conditions is present, bits 8, 9, and 10 of the sense indicators are tested to determine if there has been an Unusual End or an Attention Interrupt. If neither condition is present, control transfers to DEND2 (Block CD16).

Blocks CD05 to CD07: If either an Unusual End or an Attention Interrupt is indicated, COMM is examined to determine if this is a systwt trap. If it is a systwt trap, control transfers directly to subroutine DATNS. If it is not a systwt trap, bit 35 of the sense indicators is set to 1 before transfer to DATNS. This subroutine is used to perform an SNS sequence and to obtain the sense data words from the channel being tested.

Block CD08: Bit 8 of the sense indicators is again tested to determine if there has been an Unusual End. If there has been an Unusual End, control transfers to DKRCV (Block CP01); otherwise, control passes to DEND2 (Block CD16).

Blocks CD09 to CD15: These blocks are entered from Block CD03 if there has been an I/O, Sequence or an Adapter Check. The error bits are placed in adjacent positions in the accumulator and MQ, and packed to eliminate the unused bits. Each error bit is tested in turn, and an error message is printed by subroutine PROUT for each bit that is found on. The I/O Check indicator is turned off if it was on, and subroutine PAUSE gives the operator a chance to correct the difficulty. Control then transfers to Block CD08 for an Unusual End check.

Blocks CD16 and CD17: Entry to DEND2 is made if no Unusual End is indicated. The sign of the accumulator is set minus for entry into subroutine ISSEK. This subroutine is used to issue any pending seeks.

Blocks CD18 to CD21: Bit 35 of the sense indicators is tested to determine if this is a systwt trap. If it is not, control transfers to END9 (Block CE22). If this is a systwt trap, the Unusual End test word (DUELL) is reset to zero, and IR2 is set to point to the UCB. The first four bytes of SNS data are placed into the sense indicators in positions 12 through 35. (Positions 0 through 5 contain the 7909 control counter and positions 6 through 11 contain the contents of the channel check

register.) Control transfers to END14 (Block CE12) to enter SEL-.

Block CE01: This block is entered from Block CC20 if there has not been an EOF or redundancy encountered while writing. The accumulator contains the contents of the channel activity cell, and is tested to determine if any blank tape has been written. If the sign is minus (indicating that blank tape has been written), control transfers to END13 (Block CE20).

Block CE02: If blank tape has not been written, the MQ is loaded with the second word of the UCB and the sign of the MQ is tested. If the sign is plus (indicating a read operation), control transfers to RED12 (Block CH01).

Blocks CE02.5 to CE04: For a write operation, bit 3 of the sense indicators is set to 1. An ETT instruction is executed. If the end-of-tape marker has been sensed, bit 18 in word 1 of the UCB and bit 1 of the sense indicators are set to 1.

Block CE05: After the end-of-tape test, subroutine NRTST is used to check the word count and determine if the record was a noise record. If the record is a noise record, the sign bit of the sense indicators will be set to 0.

Block CE06: The proper bit for redundancy trap on this particular channel is turned off in TRAP.

Block CE07: This block is entered from Block CE06 and also from Block CH05 in the event that a read redundancy is found to be a noise record. The contents of the sense indicators are saved in RWIND for later use.

Blocks CE08 to CE10: These blocks are entered from Block CE07 and also from Blocks CHB2 and CHC2 in the read redundancy-recovery routine whenever no redundancy is found or redundancy is disabled. The tape position is picked up from word 3 of the UCB. The sense indicators are tested to determine if the operation is read or write. If the operation is a read operation, control transfers directly to END5 (Block CE11). If the operation is a write operation, bit positions 19 and 20 are masked out of the record count and control transfers to END5.

Block CE11: This block is entered from Blocks CE09 and CE10 as described above, and also from Block CC23 on an end-of-file condition. The record count is incremented by I and stored in word 3 of the UCB.

Block CE12: The address of the user's select routine is picked up from word 2 of the ucb and placed in the subsequent transfer instruction to allow IOEX to transfer control to that routine.

Block CE13: This is the user's select routine which has three possible returns. The first return (1, 4) is the normal return which transfers control to END9 at Block CE22. The second return (2, 4) transfers control to END11 (Block CE14). This return is used for both reading and

writing when the record in question is considered to be a noise record. The third return (3, 4) to Block CE23 is used for reading when the normal redundancy recovery procedure is to be used.

Blocks CE14 to CE16: When the record in question is considered to be a noise record, DCHSW is tested to determine if this is a disk operation. If it is, control transfers to END9 (Block CE22). If this is not a disk operation, the contents of the sense indicators are restored from RWIND. Position 3 of the sense indicators is tested to determine if this is a write operation. If it is, control transfers to END12 (Block CE21).

Blocks CE17 to CE19: If a write operation is not indicated, subroutine RED10 is used to print the file and record location and NOISE RECORD DISCARDED. The redundancy count is reset to zero. The noise record bit is added to word 3 of the UCB and the record count is reduced by 1.

Block CE20: The contents of the channel activity cell are picked up. Control transfers to BG1+1 to read the next record from this unit if priority is still assigned to this unit, or to search for another unit that is waiting and initiate an I/O operation on that unit.

Block CE21: During a write operation, subroutine RED10 is used to print the file and record count and the message short record written.

Block CE22: The redundancy count is set to zero as required, and control passes to BG1 (Block CF01).

Blocks CE23 and CE24: These blocks are entered when return 3 (3, 4) is taken by the user's select routine. DCHSW is tested to determine if the unit in use is disk. If the unit is disk, control transfers to Block CE20 to eventually re-enter the SEL+ routine. If the unit in use is not disk, the record count in word 3 of the UCB is reduced by 1, and control transfers to Block CH06, to enter the read-redundancy-recovery routine after the noise record test.

BG1 — Initiate Next Channel Operation Routine

Charts CF and CC show the routine used to initiate the next operation on a channel. It is entered from the trap supervisor (XTRAP) when it is desired to start another operation after a prior operation has been completed.

The channel priority cell is checked to determine if the next operation is to be initiated on a specific unit. If the priority cell is not set to indicate a specific unit, a search is made for another unit on this channel which is awaiting an 1/0 operation. When it is determined which unit is to be the next one requiring an 1/0 operation, SEL+ is entered for that unit. If no unit requires an 1/0 operation and there are no pending seeks to be

issued for disk, the activity cell is cleared, and operation ceases on that channel.

The key registers and status conditions are restored before returning to the point interrupted by the data channel trap. If there are any seeks remaining to be issued, they will be issued and the activity cell will not be cleared before restoring the machine registers and status conditions.

Block CF01: The address of the priority UCB is picked up from the channel priority cell, CHXSP, for the proper channel.

Blocks CF01.5 and CF02: The disk channel switch, DCHSW, is tested to determine if the trap resulted from an operation on a 7909 channel. If a 7909 channel caused the trap (DCHSW is not zero), control exits to Block CF03. If the trap was not from a 7909 channel, the checkpoint switch (CHPSW) will be tested to determine if the program is in the process of checkpoint. If a checkpoint is in process, control transfers to BG3 (Block CF17). If a checkpoint is not in process, control transfers to Block CF03.

Blocks CF03 to CF08: At this point the accumulator contains the contents of the priority cell for the desired channel. If this address is zero, indicating that priority was not assigned to a unit at this time, control transfers to BG2 (Block CF09) to search for a unit which can be given priority. If the priority cell was not zero, it will be used to locate the address of the select routine being used by that unit. If the location of the select routine is not zero, control transfers to Block CF10. If the location of the select routine is zero, the priority cell and word 2 of the UCB are cleared.

Block CF09: IR2 is set to point to the UCB for the unit that just completed an operation. The accumulator is set to zero except for the "P" bit. Control passes to Block CG01 to search the UCB's for a unit with an I/O operation waiting to be performed.

Blocks CF10 to CF12: DCHSW is tested to determine if the channel is a 7909 channel. If this is not a 7909 channel (DCHSW is zero), control transfers to BG5 (Block CF13). If it is a 7909 channel (DCHSW is not zero), word 3 of the UCB is tested to determine if the activity flag is on for this unit. If the activity flag is on, control transfers to BG6 (Block CF20). If the flag is not on, the accumulator is cleared in preparation for entering SEL+.

Blocks CF13 to CF16: These blocks will be entered with the accumulator cleared for a 7909 channel, and not cleared for a 7607 channel. The contents of the accumulator are stored in the redundancy check control cell for the proper channel. Clearing this cell suppresses redundancy checking and recovery while reading. The trap switch and channel activity cell are both set, and the user's select routine is entered. The normal return

from the select routine is via 1, 4. Subroutine RDUN is used to set up the trap indicators in TRAP to allow redundancy trapping on a write operation. If the operation is a read operation, redundancy trapping is not permitted and TRAP is not altered. A non-data select operation returns from the select routine via 2, 4, and control transfers to BG1 (Block CF01) to initiate another operation on the same channel. Upon return from RDUN, control transfers to Block CG01 to restore the key registers and status conditions and then return to the program at the point interrupted by the data channel trap.

Blocks CF17 to CF19: These blocks are entered if a checkpoint has just been processed on a 7607 channel, or at the unsuccessful completion of the search for a unit awaiting priority. The activity cell is cleared and DCHSW is tested to determine if there are any more seeks waiting to be issued. If DCHSW is zero and/or plus, indicating that there are no more seeks to be issued, control transfers to Block CCO1 to return eventually to the point interrupted by the channel trap. If there are seeks remaining to be issued, the activity cell is reset.

Blocks CF20 and CF21: Subroutine ISSEK is used to issue any pending seeks. Attention interrupts are enabled before transferring control to Block CG01 to return to the trapped location.

Block CG01: This block is entered when it is necessary to search the UCB's for a waiting unit. The disk channel switch, DCHSW, is tested to determine if this is a 7909 channel. If it is a 7909 channel (DCHSW is not zero), control transfers to Block CG07, and IR2 is decremented to permit testing the activity flag.

Block CG02: If a 7909 channel is not indicated, word 2 of the UCB is tested to determine if there is an address of a select routine present. If word 2 is not zero, indicating that there is an address of a select routine, control transfers to Block CG06.

Blocks CG03 to CG05: If word 2 is zero, IR2 is tested to determine if the last UCB has been tested. If the last UCB has not been tested, control returns to Block CG01 to test the next one. When IR2 is reduced to 4 or less, indicating that the last UCB has been tested, the accumulator is tested to determine if the entire set of UCB's for this channel have been tested. If all the UCB's have not been tested, IR2 is reset to initiate another search from the beginning of the table and control returns to Block CC01. If the accumulator is minus, indicating that this second attempt has already been performed, control transfers to Block CF17.

Block CG06: This block is entered when an address of a select routine is found in word 2 of a UCB. The actual location of the UCB is stored into the priority cell and control transfers to Block CF01.

Blocks CG07 to CG09: The activity flag in ucв word 3 for a 7909 channel is tested to determine if a seek

has already been issued for this unit and the seek has not responded with an attention signal. If an attention signal is still awaited, the sign of DCHSW is set to minus and IR2 is stepped to test the next unit and control transfers to Block CCO3. If an attention signal is not awaited, IR2 is reset to test for a select routine in this UCB, and control transfers to Block CCO2.

Blocks CG10 to CG13: The trap switch and DCHSW are cleared. The sense indicators and IR1 are restored. FRSW1 is tested to determine if the program may return to the point interrupted by the trap at this time. If FRSW1 is not zero, control transfers to Block CG14. Otherwise, FRSW2 is cleared, and the remaining index registers, together with the original contents of the accumulator and MQ, are restored. The overflow indicator and trap transfer status are restored. Traps are restored to their original state, and control returns to the point interrupted by the original data channel trap.

Blocks CG14 to CG16: FRSW1 is cleared and FRSW2 is tested to determine if the program must return to complete processing the trap that was interrupted by an on-line message. If FRSW2 is not zero, control returns to XTRAP, Block CC04, to complete processing of the first trap. If FRSW2 is zero, FRSW3 is cleared, and control transfers to PRTX2. Block CW32.

Read Redundancy Recovery Routine

The read redundancy-recovery routine for tape performs the following major operations: determines whether a record was a noise record and returns to the trap supervisor if it was a noise record; performs a tape cleaner operation on the tape every ten times if the noise record bit is off; and continues trying to recover until the maximum number of tries as indicated in RDUNRT has been reached.

The tape cleaner operation will not be performed if the record count is less than 2 in this particular file.

Blocks CH01 to CH05: The proper TRC instruction is picked up from the TRCX table, and inserted in this routine. (As assembled, the listing shows a TRCA, but the operation code will be modified for the proper channel by this procedure.) The TRC instruction is executed to determine if there has been a tape redundancy. If there has not been any redundancy, control transfers to END16 (Block CE08). If there has been a redundancy, the redundancy check control cell for this channel in table RCTX is tested to determine if redundancy recovery is disabled. If the entry in RCTX is zero, indicating that redundancy recovery is disabled, control transfers to END16 (Block CE08). If redundancy recovery is allowed, subroutine NRTST is used to determine if the record in question is a noise record. If bit 0

in the sense indicators is on upon return from this subroutine, a noise record is indicated and control transfers to END15 (Block CE07).

Blocks CH06 to CH09: When a record is not noise, subroutine RED50 is used to increment the redundancy count and set up RED14 and the accumulator with the unit address for recovery procedures. IR2 will contain the count of the number of redundancies upon exit from this subroutine. The unit address is placed in the read select instruction for recovery procedures, and IR2 is tested to determine if the limit for the number of retries has been reached. This limit is indicated by RDUNRT. If this limit has not been passed, control passes to RED14 (Block CH14), to backspace the tape. Otherwise, the record count is incremented by 1.

Blocks CH10 to CH12: Bits S and 1 of word 3 of the UCB are tested to determine if the redundancy message is to be suppressed. If either bit is on, control transfers to Block CH13. If both bits are off, the message will be printed. Subroutine RED10 is used to print the redundancy message that indicates the tape unit number as well as the tape position where the error was encountered. The permanent redundancy bit is set in the URRX table.

Block CH13: Bit 2 of the sense indicators is set to 1 to indicate to SEL- that there has been a permanent redundancy, and control transfers to END14 (Block CE12).

Blocks CH14 to CH16: The tape is backspaced over the record that caused the redundancy. IR2, which contains the count of the number of redundancies, is reduced by 10 until it is 10 or less. IR2 is then tested to determine if this retry is the first attempt, or some multiple of ten plus one. If IR2 does not meet these conditions, control transfers to END13 (Block CE20).

Blocks CH17 to CH21: On the first entry, or any entry that is a multiple of ten plus one, word 3 of the UCB is picked up. This word contains the tape position with the noise record indication in the sign position. The sign is tested to determine if there has been a noise record. If there has been one, control transfers to END13 (Block CE20). For no noise record, the record count in UCB word 3 is placed in IR4 and tested to determine if the count is less than or equal to 1. For a record count less than or equal to 1, control transfers to END13 (Block CE20) to bypass the tape cleaner operation.

If IR4 is greater than 1, a tape cleaning operation may be attempted depending on the record count. IR4 is further tested to determine if the record count is in complement form indicating that the tape is positioned at an end-of-file mark. The tape cleaner operation will be bypassed, and control transfers to END13 (Block CE20).

Blocks CH22 to CH25: If a tape cleaner operation is specified, a BSR instruction is executed twice and then

an RDS is executed twice. The channel is tested to determine when this operation is completed. When the channel is no longer busy, the redundancy indicator in the channel is turned off (using a TRC instruction) and control transfers to END13 (Block CE20). The purpose of this series of instructions is to move the tape backwards in an attempt to bring the bad area of the tape into the vacuum column and dislodge any particles that might have caused the read redundancy.

Write Redundancy Recovery Routine

The write redundancy recovery routine first backspaces the tape over the bad record, and then writes an erase area and checks it for redundancies. If redundancies are found while writing the erase area, a message is printed on-line for the operator. If no erase redundancies are found, the routine rewrites the record that could not be written earlier. This series of operations is repeated until the record can be written properly or until an EOT condition is sensed. After each 25 erase areas are written, a message is printed on-line for the operator.

Blocks CJ01 to CJ05: The accumulator is tested to determine if there had been a redundancy encountered during an erase operation. If the accumulator is minus, indicating a redundant erase, control transfers to RED20 (Block CJ18). If the redundancy was not encountered during an erase operation, the sign of the accumulator is set minus, and the accumulator stored in the channel activity cell for the proper channel. Subroutine RED50 is used to increment the redundancy count. Upon exit from this subroutine, the accumulator and RED14 contain the unit address and IR2 contains the redundancy count. The unit address is placed in RED6 for recovery operations to follow.

Blocks CJ06 to CJ09: The tape is backspaced over the bad record and IR2 is tested to determine if this is the first redundancy. If this is the first redundancy, control transfers to Block CJ10. If this is not the first redundancy, the EOT indicator in the channel is tested. If the EOT has been sensed, control transfers to RED9 (Block CJ15). If the EOT has not yet been reached, the redundancy count in IR2 is reduced by 25 until it is 25 or less.

Blocks CJ10 and CJ11: IR2 is tested to determine if the count remaining is exactly 25. This would be the case on every 25th redundancy encountered. If IR2 is not exactly 25, control transfers to RED5 (Block CJ12). If the count is 25, an on-line message is printed for the operator, indicating that 25 erases occurred during a recovery attempt.

Blocks CJ12 to CJ14: The address of an instruction which will cause a blank area of tape to be written is stored in the RCHX table. Traps are disabled, the tape unit is selected, and the RCHX instruction is executed to write the blank tape. Bit 17 in the URRX table entry for this channel is set to 1 to indicate that an erase area has been written. Control transfers to out (Block CG10).

Blocks CJ15 to CJ17: These blocks are entered when an EOT is sensed during an attempt to recover from a redundant write. The unit address is picked up from the UCB, and subroutine CVPRT is used to print this tape address and a message to the operator indicating that the end of tape has been reached. The STOP subroutine is used to bring the program to a dead stop.

Block CJ18: This block is entered from Block CJ01 if a redundancy was encountered attempting to write an erased area. Subroutine RED10 is used to print an on-line message to the operator to inform him of his problem and control transfers to END13 (Block CE20).

Redundancy Subroutines

Chart CK shows four subroutines used by the redundancy recovery routines. Subroutine RED50 is used to increment the redundancy count, and set up the 1/0 commands for the proper unit and channel in operation. Subroutine RED10 is used to print an on-line error message to the operator informing him of an error, and giving the tape unit number and the position of the error on the tape. Subroutine NRTST is used to compute the length of the record in question, and determine if it is a noise record. If the word count is less than or equal to 2, it is considered to be a noise record, and the noise record indicator is reset in the sense indicators. Subroutine RDUN is used to set the proper bit in the TRAP cell to allow redundancy trapping on a write operation.

RED50 — Increment Redundancy Count Subroutine

Blocks CK01 to CK03: The redundancy count in the URRX table is incremented by one, returned to the table, and also placed in IR2. The unit address is obtained from the UCB and placed in RED14 and the accumulator. Control exits to the calling program via 1, 4.

RED10 — Print Redundancy Error Message Subroutine

Blocks CK04 to CK13: IR2 and IR4 are saved. The address of the available part of the message is obtained from the RED10 calling sequence and placed in IR2. The variable part of the message is then obtained and placed into the print image for the error message. The file position is picked up from word 3 of the UCB, converted to BCD by subroutine BCVDEC, and stored in the

print image. The record position is next picked up from word 3 of the UCB, converted to BCD by subroutine BCVDEC, and stored in the print image. The tape unit number is picked up from word 1 of the UCB. Subroutine CVPRT is entered with the tape number in the left half of the MQ. This subroutine converts the tape number to its symbolic unit designation, and prints the error message desired with this tape designation. Upon return from CVPRT, IR2 and IR4 are restored, and control returns to the calling program via 1, 4.

NRTST — Noise Record Test Subroutine

Blocks CK14 to CK16: This is the entry point for the NRTST subroutine. This subroutine checks the length of a record just read or written to determine if it was a noise record. IR4 is saved and the channel data is picked up from COMM. Then the original I/O command is subtracted from this.

Blocks CK17 to CK19: The resulting word count is placed in IR4 and tested to determine if it is less than or equal to 2. If it is less than or equal to 2, bit position 0 of the sense indicators is cleared to indicate a noise record condition. If the word count is greater than 2, the sense indicators are not changed. Control exits to the calling program via 1, 4.

RDUN — Permit Write Redundancy Trap Subroutine

Blocks CK20 to CK23: IR4 is saved. The location of the UCB is picked up from CHXAC and used to obtain word 2 of the UCB for the unit now in use. The sign of word 2 is tested to determine if this is a read or a write operation. If the operation is a read operation (sign is 0), control transfers to Block CK24. If the operation is a write operation (sign is 1), a bit is or'd to the TRAP cell to allow redundancy trapping on this one particular channel.

Block CK24: IR4 is restored, and control returns to the calling program via 1, 4.

NDSEL — Non-Data Select Routine

Chart CL shows the non-data select routine that is used to perform on a tape unit specific operations that do not cause the transfer of data. A test is made for the validity of the UCB as specified by the FILE designation, in the calling sequence. If the unit reference is illegal, the program will come to a halt after printing the reason for the halt. An attempt to perform a non-data operation on a disk file will not cause the error halt, but will cause an exit from the routine with no operation performed.

Block CL01: Subroutine TEST is used to test the validity of the file specified in the calling sequence. An invalid UCB address will cause an error halt, and

the subroutine will not return to the non-data select routine.

Blocks CL02 to CL07: This may also be used as an entry point if it is not desired to test for a valid file designation. Traps are disabled, and word 1 of the UCB is picked up. The trap switch, TRPSW, is tested to determine if this non-data select request is during trap time or non-trap time. If TRPSW is zero, indicating that it is non-trap time, IR1, IR2, and the sense indicators are saved for the non-trap exit. Location WEF1 is set to the location of the UCB. If the trap switch is not zero, the save and setup instructions for the non-trap exit are bypassed. In either case, however, IR1, IR2, and the sense indicators are saved for the trap exit, and location WEF2 is set to the location of the UCB.

Blocks CL08 to CL11: IR2 is set to the non-data select code as indicated in the calling sequence. The exit address is calculated for all operations except the write end-of-file operation. IR2 is tested to determine if the operation requested is wef. If it is a wef operation, the exit address is modified for this particular use of the subroutine. (IR1 contains the proper exit address at this time.) If the operation is not wef, no change is made to the previously calculated address in IR1.

Blocks CL12 to CL14: Following the write end-offile check, IR2 is tested to determine if the operation requested is NOP. If the operation is NOP, control transfers to Block CL31 to return to the calling program. If the operation is not NOP, the unit address from word 1 of the UCB is loaded into the sense indicators and tested to determine the type of unit. If the unit is card or disk, control transfers to Block CL31 for an exit to the calling program.

Blocks CL15 and CL16: For a tape unit, TRAPSW is tested to determine if this operation is during trap time or non-trap time. If this operation is during trap time, control transfers to Block CL17. If this operation is during non-trap time, word 2 of the UCB is tested to determine if the unit is active. If word 2 is zero, indicating that the unit is not active, control transfers to NDS4 (Block CL20).

Blocks CL17 to CL19: If the unit is active, subroutine active is used to assign channel priority to this unit. The subroutine is entered in such a manner to bypass testing for the validity of the file, since this has already been done when the non-data select routine was entered initially. Word 2 of the UCB is tested to determine when the unit activity has ceased. Until the unit activity has ceased, control remains within this test loop. When all activity on this unit has ceased, traps are disabled.

Blocks CL20 to CL22: IR2 is tested to determine if the operation is WEF. If the operation is WEF, control transfers to Block CL23. If the operation is not WEF, bit 18 of the sense indicators is tested to determine if

the end-of-tape marker has been sensed. If an end-of-tape marker has not been sensed, control transfers to to Block CL23. Otherwise, IR1 is reset to the location of the error exit that is to be taken when a WEF operation is requested at the end of tape.

Blocks CL23 to CL27: TRPSW is tested to determine if the program is in trap time. If trpsw is not zero, indicating trap time, control transfers to Block CL28. Otherwise, the non-data operation code is stored in UCB word 2 with the address of the select routine for this operation. Subroutine ACTV is entered at a point which bypasses the file validity check and assigns channel priority to the required unit. Upon return from ACTV, the contents of IR1 are stored as the exit address. IR2, IR4, and the sense indicators are restored, and control will return to the calling program via either 1, 4, or 2, 4 as computed earlier. (The normal return is 1, 4 for all except wef operations. This operation exits to 2, 4 normally and 1, 4 if an eot has been sensed.)

Blocks CL28 to CL30: A comparison of the channel presently in trap time and the channel required for the unit designated to receive the non-data operation is made. If both channels are not the same, control transfers to NDERR (Block CL33). If both channels are the same, the non-data code is placed in the accumulator, and IR2 is set to point to an indirect reference to the UCB. A direct entry is made to the select routine at Block CM02 to initiate the non-data operation requested.

Blocks CL31 and CL32: IR1 is stored as the exit address as previously calculated. IR1, IR2, the sense indicators, and trap status are restored. Control exits to the calling program at either 1, 4 or 2, 4 as required for the particular operation and conditions.

Blocks CL33 to CL35: If the unit channel and trap channel are not the same, the unit address is picked up to be used in the print-out of an error message for the operator. Subroutine CVPRT is used to print an on-line error message indicating that there was an illegal non-data select at trap time. The symbolic designation for the requested tape unit is also printed out with this message. After the message is printed out, subroutine stop causes a dead stop.

Select Routine for Non-Data Operations (Except NDWEF)

Chart CM shows the select routine used for all the non-data operations initiated by NDSEL except for the NDWEF operation which is shown on Chart CN. Portions of the chart are shown within boxes. One or the other of these boxes will not effectively exist in any particular program, depending on the value given to the symbol "IBM" on the EQU card at the beginning of the symbolic

deck. The following instructions will overlay the undesired instructions in one box as a result of the BSS pseudo-instruction with the symbol IBM in its variable field. The instructions which are conditional pertain to the set density operations that are not legal on the IBM 709 computer. If the computer for which the program was assembled is an IBM 709, a test is made for either of the set density operations. Control exits without performing these operations if either of the operations is requested. The instructions pertaining to their execution are overlaid so that space is not lost in the assembly due to unrequired instructions.

Block CM01: IR2 is set to point to the UCB, and word 2 of the UCB is picked up. The original word 2 of the UCB is cleared.

Blocks CM02 to CM05: IR4 is saved, and the non-data code is placed in IR4. The unit address is obtained from word 1 of the UCB and positioned in the accumulator address. IR4 is tested to determine if the non-data code is SDNL. If the non-data code is SDNL, control transfers to Block CM06. If the non-data code is any code other than SDNL, a bit is or'd to position 31 of the accumulator to force the binary address which is required for all other non-data operations.

Block CM06 to CM09: The unit address is stored in the non-data select table, SELX. Block CM07 is only present if the program was compiled with IBM EQU 709. In this block, IR4 is tested to determine if the non-data code is either of the set density operations. If either of the set density operations has been requested, control transfers to NDSX4 (Block CM28). If the non-data code is neither of the set density operations, (or if Block CM07 does not exist in this assembly), IR4 is tested to determine if the non-data code is WEF. If the non-data code is WEF, control transfers to the WEF select routine at NDWEF (Block CN01). If the operation is not WEF, the desired operation in the SELX table is executed.

Blocks CM10 to CM13: This block is entered after the desired operation has been executed, or from the alternate select routine for a WEF operation as shown on Chart CN. Word 1 of the UCB is placed in the sense indicators, and word 3 is placed in the accumulator. A long right shift with a count of zero is executed to save the noise record indication in the sign position of the MQ.

The sign of the accumulator is made plus in case the sign was previously set minus to indicate a noise record condition. The next instruction is an execution into an indexed table of instructions. Each of the instructions in this table will perform a different function that is required for the non-data operation being performed.

Any of the tape movement operations will cause the new tape position to be calculated. Either of the set density operations will cause a transfer to a routine which will properly set the density indicators in word 1 of the UCB. An SDNL operation causes a transfer of control to UPD6 (Block CM22) and an SDNH operation causes a transfer of control to UPD7 (Block CM24). A tape movement operation causes the new tape position to be calculated and left in the accumulator.

Blocks CM14 to CM16: The accumulator is tested to determine if the operation resulted in a minus tape position. If the tape position is not minus, control transfers to Block CM17. If the tape position is minus, this position is tested to determine if it is also zero, which indicates that the tape is rewound and unloaded. If the tape is rewound and unloaded, control transfers to Block CM18. If the tape is not rewound and unloaded, the accumulator is cleared.

Block CM17: The accumulator is tested to determine if the tape is positioned at load point. If the tape is at load point, control transfers to Block CM19.

Blocks CM18 and CM19: At this point it is known that the tape is positioned at some point other than the beginning of the tape, and that it is not unloaded. The end-of-tape indicator is turned off, if it is on. The noise record indication which was stored in the sign of the MQ is replaced in the accumulator, using a long left shift with a count of zero.

Blocks CM20 and CM21: The calculated tape position in the accumulator is replaced in word 3 of the UCB. A test is made to determine if the tape is rewound but not unloaded. If the tape is rewound but not unloaded, control transfers to UPD3 (Block CM26).

If the tape is not rewound, control transfers to NDSX4 (Block CM28). (If the program is compiled for a system with IBM EQU 709, Block CM21 and the test do not appear. Control will pass from Block CM20 directly to Block CM27 in this case.)

Blocks CM22 and CM23: The bit indicating current density is cleared. (This indicates low density.) The operation code in IR4 is tested to determine if the operation was an SDNL. If the operation was an SDNL, control transfers to Block CM25.

Block CM24: This block is entered if the non-data operation code is SDNH. The density bit indicating density at current position is set to 1 to indicate high density.

Block CM25: With the indicator for the density at the current position set up, the tape position in word 3 of the UCB is tested to determine if the tape is at load point. If the tape is not at load point, control transfers to Block CM27.

Block CM26: If the tape is at load point, the density bit in position 19, which indicates load point density,

is set equal to bit 20, which indicates the density at the current position.

Block CM27: Word 1 of the UCB is restored from the sense indicators with the corrected density indications if they had been made.

Block CM28: IR4 is restored and control exits to the calling program via 2, 4.

Select Routine for NDWEF

Chart CN shows the select routine used for WEF operation. It is entered from the select routine shown on Chart CM for a WEF operation. The routine writes an end-of-file on a desired tape and checks for a redundancy. If a redundancy is encountered, the tape is backspaced, and another attempt is made. On all except the first attempt, a check is made for an end-of-tape condition. Every 25th time that an attempt is made, an on-line message is printed for the operator indicating that there have been 25 erases during a write.

Block CN01: This block is entered from the non-data select routine with the unit address in the accumulator. This address is stored in the I/O command requiring it. The TRC operation code for the proper channel is picked up from the TRCx table, and inserted in the TRC instruction in this routine. IR4 is set to count 26 attempts.

Blocks CN02 to CN05: The WEF instruction is executed, and the proper entry in the TCOX table is set to loop within this program until the channel is not busy. When the channel is not busy, the channel redundancy check indicator is tested. If a redundancy has occurred while writing the end-of-file, control transfers to WEF7 (Block CN09).

Blocks CN06 to CN08: If no redundancy occurs, the end-of-tape indicator in the channel is tested. If the indicator is on, bit 18 in word 1 of the UCB is set to indicate Eot. If the indicator is off, this step is bypassed. IR4 is reset to the non-data operation code, and control returns to NDS5 (Block CM10) in the regular non-data select routine.

Blocks CN09 to CN11: These blocks are entered if there has been a redundancy on writing an end-of-file. The tape is backspaced and IR4 is tested to determine if this is the first time the error has occurred. If this is the first time the error has occurred, control transfers to Block CN15, bypassing the end-of-tape test. If this is not the first time the error has occurred, the end-of-tape indicator in the channel is tested. If the end-of-tape has been sensed, control transfers to WEF8 (Block CN15).

Blocks CN12 to CN14: These blocks are entered on the first attempt or on any other attempt to write an end of file if an EOT was not sensed. IR4 is tested to determine if 25 attempts have been made. When 25 attempts have been made, subroutine RED10 prints an on-line message indicating that there have been 25 erases during write. IR4 is then reset for 25 more attempts. If 25 attempts had not been made, the print-out is bypassed and IR4 is not reset. Control returns to WEF4+1 (Block CN02).

Blocks CN15 to CN17: These blocks are entered when an EOT is sensed on any attempt after the first attempt to write an end-of-file. The tape unit address is placed in the MQ. Subroutine CVPRT is used to convert this unit address to a symbolic designation for the unit and print a message indicating an end-of-tape sensed during an erase. Subroutine STOP is then used to provide a dead stop halt.

Disk Recovery Routines

Charts CP and CR show the recovery routines used when errors are encountered using disk. One of four corrective actions is used to recover from an error. Action 1 attempts the same command sequence one additional time; if the same error occurs the second time SEL is entered with the appropriate indication in the sense indicators.

Action 2 attempts the same command sequence up to four times. Two seeks are then issued to recalibrate the arm. The original seek issued by the user is repeated and up to four more attempts are made to perform the operation. If the same error occurs on the fourth attempt after the second seek, SEL- is entered with the appropriate indication in the sense indicators.

Action 3 attempts the same command sequence up to four times. If the same error occurs after the fourth attempt, SEL- is entered with the appropriate indication in the sense indicators.

Action 4 issues a seek to move the arm from the CE track. The original seek requested by the user is reissued, and SEL+ is re-entered once to attempt the command sequence again. If the same error occurs, SEL—is entered with the appropriate indication in the sense indicators.

Figure 3 shows the recovery action taken for each type of error encountered.

Blocks CP01 to CP05: These blocks are entered from XTRAP when an Unusual End is received during a disk operation. Bit 35 of the sense indicators is set to 0, and the redundancy count from URRX, 1 is placed in IR2. The SNSDTA bits are picked up and masked out as indicated by the the contents of RCTX, 1 which contains the address of a mask of the bit positions that are to be ignored. If RCTX, 1 is 0, all the bit positions in

Type of Error	Action	Abbreviations	
Invalid sequence Invalid code Format check No record found Invalid address	1 1 2 4	I'SEQ I'CDE FRMCK NOREC I'ADR	Program Check
Response check Data compare check Parity/cyclic check	3 3 3	RSPCK DCOMP P/CCK	Data Check
Access inoperative Access not ready Disk circuit check Control unit circuit check] [[]	INOPR NTRDY DKCRK CUCRK	Exceptional Condition Check

Figure 3. Recovery Actions for Specific Disk Errors

SNSDTA will be checked. After masking out the undesired bits, the accumulator is checked to determine if any bits remain. If no bits remain, control transfers to DEND2 (Block CD16). If any error bits remain, the sense indicators are saved in DUESI and the masked SNSDTA bits are placed into the sense indicators. The present error bits are compared with the previous error bits in DUELL; if they are not the same, the accumulator is set to zero.

Blocks CP06 to CP09: The sense indicators are checked to determine into which category the error falls. If any of the data check error bits are set, control transfers to DATCK (Block CP17) to take Action 3. If any of the exceptional condition error bits are set, control transfers to EXCND (Block CP10) to take Action 1. If the proper bit indicating an invalid address is set, control transfers to NGADR (Block CR09) to take Action 4. If the bit indicating no record found is set, control transfers to NOREC (Block CR01) to take Action 2. Error conditions that are not detected by any of the previous tests (invalid sequence, invalid code, or format check) allow control to pass to EXCND (Block CP10) to take Action 1.

Blocks CP10 and CP11: This is the entry point when Action 1 is required. The error indications are checked to determine if the errors are the same as those obtained on the last attempt. If the errors are the same, control transfers to Block CP20.

Block CP12: This block is entered whenever the errors found during any corrective action are not the same as those found on the previous attempt. URRX, 1 is reset to 0.

Blocks CP13 and CP14: The SNSDTA bits are masked against those requiring any corrective action, and the result stored in DUELL. DUELL is the location where the previous error indications are stored.

Blocks CP15 and CP16: The redundancy count in URRX, 1 is incremented by 1, and the accumulator sign is set to minus. Subroutine ISSEK is entered to clear out any error conditions; upon return from this subroutine, control transfers to END13 (Block CE20).

Blocks CP17 to CP19: These blocks are entered to take Action 3. The mask for the data check bits is picked up and placed in the MQ. The accumulator is tested to determine if the errors are the same as the last time. If the errors are not the same as the last time, control transfers to Block CP12 to store the new error information and issue another seek. If the errors are the same, IR2, which contains the error count, is tested to determine if there have been four attempts to correct the same error. If there have been four attempts, control transfers to DUEN2 (Block CP21) for an error message print-out. If there have not been four attempts, control passes to DUEN1 (Block CP13) to issue another seek.

Block CP20: This block is entered whenever Action 1 is required, and the errors are the same as those last obtained. IR2 is tested to determine if this is the first error. If this is the first error, control transfers to DUEN1 (Block CP13) to issue another seek.

Blocks CP21 to CP23: These blocks are entered whenever it is necessary to print an on-line error message. The unit address is converted using subroutine syuncy, and stored in the message image. Word 2 of the ucb is tested to determine if this operation is a read or write operation, and the appropriate message is added to the error message. The track address is picked up from words 3 and 4 of the ucb and stored in the error message.

Blocks CP24 to CP27: The snsdta bits are compressed to remove those bits in the word that have no meaning. These compressed bits are examined one bit at a time, and a composite error message is built up containing all the error indications found. Subroutine PROUT is used to print this message, and the sense indicators are restored before returning control to the trap supervisor at DEND2 (Block CD16).

Blocks CR01 to CR08: This is the entry point to perform Action 2. The mask for the bit that indicates norecord-found is loaded into the Mo. The accumulator is tested to determine if the errors are the same as those that occurred on the last attempt. If the errors are different, control transfers to Block CP12 for another seek and an entry into SEL+. If the errors are the same. IR2 is tested to determine if there have been less than four errors. With less than four errors, control transfers to duent (Block CP13) to eventually re-enter sel+. If the error count is four or greater, IR2 is tested to determine if the count is eight or greater. When such a count is indicated, control transfers to DUEN2 (Block CP21) for an error message print-out. If the count is less. than eight, IR2 is next tested to determine if there are more than four errors. Because prior tests have determined there were not less than four errors nor greater

than seven errors, this test will indicate if there are exactly four or from five to seven errors. If the error count is from five to seven, control transfers to DUEN1 (Block CP13) to clear out the error indications and eventually return to SEL+. If there were exactly four errors, the original track address is saved and an illegal address placed in the UCB. IR4 is set to zero to cause two seeks to be issued before reissuing the original seek requested by the user. Control then transfers to DUEN7 (Block CR13).

Blocks CR09 to CR12: This is the entry point to perform Action 4, which is required for an invalid address type of error. The mask for the bit indicating invalid address is placed in the MQ. The accumulator is tested to determine if the errors are the same as those that occurred on the last attempt. If the errors are different, control transfers to Block CP12 for another seek and an entry into SEL+. If the errors are the same, IR2 (which contains the number of recovery entries into SEL+ as found in URRX, 1) is tested to determine if the count equals zero. If the count is zero, control transfers to DUEN1 (Block CP13) for a return to SEL+. If more than one recovery attempt has been made, IR4 is set to two to indicate that another seek is to be issued to recalibrate the arm. IR2 is set to point to the UCB.

Blocks CR13 and CR14: Words 3 and 4 of the UCB are set to minus. The sign of word 3 (minus) indicates to IOEX that a seek is requested by the user. The sign of word 4 (minus) indicates to IOEX that the track address is already contained in words 3 and 4 in BCD. Therefore, IOEX does not have to convert the binary address specified by the address in word 4. IR4 is saved and subroutine ISSK1 is entered to issue one seek.

Blocks CR15 and CR16: Attention interrupts and traps are enabled on this one channel, and the main program loops, waiting for the interrupt.

Blocks CR17 to CR19: This is the point at which control is returned from the SAVE routine after an interrupt. Subroutine DATNS is used to process all attentions received. The AF flag is turned off by this routine for each attention received. The desired AF flag is tested to determine if the proper attention signal was received. If the desired signal was not received, control transfers to DUENS (Block CR15) to enable interrupts again and wait for the next trap. If the desired AF flag is now off, IR4 is reset to the value of "K". The value of "K" is used to determine if the proper number of seeks have been issued in an attempt to recalibrate the arm before reissuing the original seek requested by the user.

Blocks CR20 to CR22: IR4 is tested to determine if the value of "K" is greater than 4. This would occur after the second seek is received during an invalid address recovery. In this case, control transfers to Block CP15 to reissue the original seek and try the operation again.

If "K" is not greater than 4, IR4 is tested to determine if "K" is equal to 0. "K" would be equal to 0 if the recovery attempt is for a no-record-found error. If "K" is not zero, indicating that the first recalibrate seek has been issued for a no-record-found recovery, control transfers to DUE10 (Block CR23). If "K" is equal to zero, the original track address is replaced in words 3 and 4 of the UCB.

Block CR23: If "K" is less than 4 and greater than or equal to 0, it is incremented by 3; and control transfers to DUEN7 (Block CR13) to eventually issue another seek.

Issue Seek Routines

The issue seek routines will issue one seek for an arm whose UCB is indicated, or will issue seeks for all arms on the channel that have their AF flag on and their PF flag off. The sign of word 4 of the UCB indicates to the routine the status of the track address contained in the UCB. If the sign of word 4 is +, the binary number contained in the address of word 4 is converted to BCD to form the track address. If the sign is —, the routine considers that the track address has already been converted to BCD and appears in words 3 and 4 of the UCB. Upon exit from the routine, the sign of UCB word 4 will always be reset to +.

ISSK1 - Issue One Seek Routine

Block CS01: This is the entry point for one seek. IR1 is saved, the STCX instruction is picked up from the STCX table, and IR1 is set to 1.

ISSEK - Issue Multiple Seeks Routine

Blocks CS02 to CS05: This is the entry point if the user desires to issue seeks for all arms with their AF flag on and PF flag off. IR2 and IR4 are saved; IR4 is set to the location of the channel program, which is in the accumulator at this time for an ISSK1 entry. The accumulator is tested to determine if the entry is from ISSK1 or ISSEK. If the accumulator is plus, the entry is from ISSK1 and control transfers to ISS1 (Block CS06). If the accumulator is minus, the entry is from ISSEK. IR1 is saved, and IR2 is set to point to the first disk UCB for this channel. IR4 is set to the location of the channel program, and IR1 to the number of arms on the channel.

Blocks CS06 to CS11: The seek request flag, AF, and the seek issued flag, PF, are picked up from word 3 of the UCB for both the ISSK1 and ISSEK routines.

These flags are tested for the following condition: AF ON, and PF OFF. If this exact condition is not met, control transfers to ISSK (Block CS15). If this condition is met, word 4 of the UCB is picked up. The sign of

word 4 is tested to determine if the track address contained in this UCB is already converted to BCD. If the sign is 1, indicating that the address is already in BCD, control transfers to ISS3 (Block CS12). If the address has to be converted, subroutine BCDEC is used to perform the conversion, and the resulting BCD address is stored in words 3 and 4 of the UCB. The two high-order characters are placed in word 3 and the two low-order characters are placed in word 4.

Blocks CS12 to CS14: Word 4 of the UCB is set to plus, and TR2 is saved. A CTL instruction with its address set to the location of word 3 of the UCB is generated, and placed in the channel sequence. The PF flag is turned on.

Blocks CS15 to CS18: IR1 is tested to determine if there are any more UCB's to check. If there are more UCB's to be checked, (as on an ISSEK entry), control transfers to ISS1 (Block CS06) to check the AF and PF flags of this UCB. Otherwise, the WTR instruction is placed into the channel sequence as the last instruction. IR1 is restored, and the desired SDCX (store diagnostic channel) instruction is placed in ISS7. The desired STCX instruction is placed in the RCHX table.

Blocks CS19 to CS24: The RCHX instruction is executed, and the TCOX instruction in the TCOX table is set to return to this routine. The TCOX instruction is executed to determine when the channel completes its operation. When the operation is complete, the SDCX instruction is performed to store the results of this operation in ISSEH. The contents of ISSEH are picked up and the bits indicating an unusual end condition are extracted from this word. The accumulator is then tested to determine if there was an unusual end, control transfers to ISS8 (Block CS25). Otherwise, IR2 and IR4 are restored and control returns to the calling program via 1, 4.

Blocks CS25 to CS28: On an unusual end, the old setting of the enable switch, ENBSW, is saved in ISSEH temporarily, and ENBSW is set. Subroutine PROUT is used to print an on-line message indicating an unusual end during a seek. Subroutine PAUSE then provides a temporary stop to allow for operator intervention. When the operator depresses START, the original setting of ENBSW is restored. Control returns to ISS6 (Block CS19) to attempt the command sequence again.

Machine Pause and Stop Routines

Chart cr shows the two routines in 10EX used to provide a temporary stop for operator action, and a dead stop from which there is no normal recovery. Subroutine PAUSE has two entry points: one for each of two possible on-line messages that may be printed before and after the temporary stop is received. Subroutine

STOP prints one on-line message indicating that the program cannot proceed, and transfers to a "halt-transfer" instruction which transfers to its own location.

PAUSE/PAWS Routines

Block CT01: This is the entry point labeled PAUSE. A message will be printed which accompanies a request for operator intervention. Traps are disabled, and the entry switch is set to provide the desired message print-out.

Blocks CT02 to CT06: This is the entry point labeled PAWS. A message will be printed which accompanies a notice to the operator of some difficulty that might require termination of the program. The operator generally can either ignore the problem and continue with the program or delete the job. Traps are disabled, IR4 is saved, and the setting of the enable switch (ENBSW) is saved. (Disabling traps is redundant if the entry was at PAUSE, but is provided at both entries to prevent a trap from interrupting the sequence once it has started). ENBSW is cleared to prevent the trap supervisor from enabling traps when the print-out is completed. The entry switch, PSTSW, is tested to determine which entry was used. The address of the desired message is placed in the PROUT calling sequence and subroutine PROUT is used to print this message on-line. A "halt-proceed" causes a temporary program stop to allow the operator to check what has been printed and take any action that might be indicated.

Blocks CT07 to CT10: When the operator depresses START, subroutine PROUT is used to print the second line of the message. The original setting of ENBSW and IR4 are restored. The entry switch, PSTSW, is cleared and ENBSW is tested to determine if traps should be enabled upon exit from this subroutine. If ENBSW is zero, TRPSW is tested. If TRPSW is also zero, traps are enabled. If TRPSW is not zero or if ENBSW is not zero, traps are not enabled. Control exits to the calling program via 1, 4.

STOP Routine

Blocks CT11 to CT14: This is the entry for the STOP routine, which is used to provide a halt from which there is no normal recovery. Traps are disabled, IR4 is saved, and the enable switch, ENBSW, is set. Subroutine PROUT is used to print the on-line message CANNOT PROCEED.

After returning from subroutine PROUT, ENBSW is cleared, IR4 is restored and control transfers to a "halt-transfer" instruction which will retain control each time START is depressed. The only recovery from this halt would be to manually transfer to one of the locations in the nucleus that would restart the program. One typical use would be to manually transfer to location 115, which would call the DUMP program and restore IBSYS after completion of the dump.

TEST — File Validity Test Subroutine

Subroutine TEST, shown on Chart CU, is used to test the validity of a file specified in an ACTV or NDSEL calling sequence. The address of the UCB specified is checked to determine if it lies within the range of the valid addresses. If the UCB address specified is valid, control returns to either ACTV+1 or NDSEL+1. If the unit specified was invalid, the address of the reference is converted to BCD and printed on-line with a message indicating an illegal unit reference. Subroutine STOP provides a dead stop halt, because this is a condition from which there is no normal recovery.

Blocks CU01 to CU04: Traps are disabled and IR1 is saved on entry to this subroutine. The address of the UCB is picked up from the file reference in the calling sequence, and placed in IR1. IR1 is then compared with the upper and lower limits of the valid UCB addresses to determine if the specified UCB lies within this range. If the UCB address is not within this range, control transfers to TST1 (Block CU08).

Blocks CU05 to CU07: If a valid ucb address is indicated, the availability flag in word 1 of the ucb is tested to determine if the unit is available. If the unit is not available, control transfers to TST1 (Block CU08). If the unit is available, the exit address is calculated using the value set in IR4 by the original transfer to ACTV or NDSEL. IR1 is restored and control returns to either ACTV+1 or NDSEL+1, as determined earlier.

Blocks CU08 to CU13: The effective address of 1, 4 is calculated using the value of IR4 as set by the original transfer to active or ndsel. This address is then converted to bcd using subroutine bcd5, and stored into the error message. Ends is set, and subroutine mwr is used to print an on-line message indicating an illegal unit reference at the location determined. (MWR is another entry label which provides the entry to subroutine prout.) Subroutine stop provides a dead stop, because the error indicated would not normally allow the program to continue to completion. The operator at this time might be instructed to transfer to location 115 to provide a dump of the program. The dump program would return control to ibsys after completion of the dump to enable the next job to be processed.

Perform SNS and Form Disk Order Subroutines

The daths routine on Chart cv is used to perform an sns on a particular channel. IRI contains the complement of the channel number minus one on entry to the routine. The subroutine will check the attention bits received by the sns routine, and turn off both the AF

and PF flags for all arms which received an attention bit.

The FDAMT routine on Chart cv is used to form a disk address and generate the disk order to locate this address. The calling sequence for the routine is shown on the chart along with the values required in IR4 and the MQ at entry time. The results at exit are also shown on the chart in the same block.

DATNS — Perform SNS Routine

Blocks CV01 to CV09: IR4 is saved to be used in returning to the calling program. IR2 is set to twice the value in IR1, to be used in locating the channel interrupt cell. The channel interrupt cell is set to transfer to the second entry point in the channel sense program. The proper STCX instruction is executed for this channel to start the SNS operation. The TCOX instruction is set to return to this routine, and then executed. When the channel is no longer busy, the channel interrupt cell is restored, and the attention bits that were received are packed and placed in the high-order position of the MQ. IR2 is set to point to the first disk UCB for this channel, and IR4 is set to the number of arms attached to this channel.

Blocks CV10 to CV13: Each attention bit is checked individually. If an attention signal was received, the AF and PF flags are turned off for that UCB. After the last bit is tested, IR4 is restored and control returns to the calling program via 1, 4.

FDAMT — Form Disk Order Routine

Blocks CV14 to CV20: This is the entry point for the FDAMT routine. The last four characters in the first word of the calling sequence are masked off in the calling sequence itself. The first two characters in the MQ are shifted off which leaves the BCD track address in the high-order positions of the MQ. The unit address is picked up from word 1 of the UCB and placed in the accumulator address.

The access and module are shifted into the MQ. The interface number is masked off and added to word 1 of the calling sequence. The access is shifted back into the accumulator, and zone bits are added to the module designation before shifting the access back into the MQ. The MQ now contains the BCD representation for AMTITIT.

Blocks CV21 to CV26: A croo instruction is executed to convert all BCD zeros to 12. The 12 is the configuration required in the channel for a zero. The address of the second word of the disk order is calculated and placed in the instruction which will store this part of the order. All except the first two characters of the

original disk order are masked out. The characters denoting AMTT are shifted into the accumulator and added to the first two characters in the first word of the order. The two last characters of the track address are shifted into the accumulator, and combined with the characters denoting RROX in the calling sequence. This result is stored in the second word of the disk order. The character shown as "X" will appear in the second word of the disk order but is ignored by the channel. Control returns to the calling program via 3, 2.

On-Line Print, Punch, and CVPRT Routines

Chart cw shows the routine used to print a line or punch a card on-line. In addition, this chart shows one of the smaller routines used by PROUT and the CVPRT routine used to print an error message concerning a particular tape unit.

Subroutine PROUT causes an immediate print-out of the desired on-line message before returning to the calling program. If the printer channel is active, the subroutine will wait for the trap on this channel only, and then print the message without processing the prior trap. After the message has been printed, the original trap will be processed.

Subroutine CVPRT generates a PROUT calling sequence for a desired message print-out. The tape number in the left half of the MQ is converted to its symbolic form and the phrase TAPE XX is appended to the error message. Subroutine PROUT is used to print the completed message.

FRSW1, FRSW2, and FRSW3 are switches used for communication between the PROUT subroutine and XTRAP. They indicate that the PROUT routine is to be completed prior to processing a trap, and that there are one or more traps to be processed before returning to the original program that called the PROUT subroutine. There are four cases where the PROUT subroutine may be used with some configuration of channel A and another channel either active or trapped.

Case A consists of an entry to PROUT with channel A dormant. Traps are disabled on entry to the routine, so it does not matter if any other channel is active. The PROUT request is processed and control returns to the calling program after enabling the traps that had been disabled.

Case B consists of an entry to prout with channel A active and also trapped. This situation is handled in exactly the same manner as case A.

Case C consists of an entry to PROUT under the following conditions: (1) channel A active and not trapped, and (2) no other channel trapped. FRSW1 is set and traps are enabled on channel A only. The pro-

gram then waits for the trap on channel A. When this trap is received, the channel information is saved in ACOMM, and the PROUT request is processed before completing the processing of the channel A trap. After the PROUT request has been processed, FRSW3 is set and control returns to the SAVE routine to complete the processing of the trap which was forced on channel A. After processing the trap, FRSW1 is cleared and because FRSW2 is not set, FRSW3 is also cleared. Control returns to PROUT so that PROUT may return to the program that originally made the PROUT request.

Case D consists of an entry to PROUT with channel A active and another channel trapped. FRSW1 is set and traps are enabled on channel A only. The program then waits for the trap on channel A. When this trap is received, the channel information is saved in ACOMM, and the PROUT request is processed before completing the processing of the channel A trap. After the PROUT request has been processed, FRSW2 is set and the subroutine exits to complete processing of the original channel trap (not channel A). When exiting from XTRAP at the completion of the original trap, FRSW1 is cleared, and because FRSW2 is not zero, control returns to XTRAP to process the channel A trap that had to be forced. XTRAP will now use the information that was saved in ACOMM at the time the trap was forced. At the completion of this trap processing, FRSW2 is cleared, and the normal exit from XTRAP in OUT will be taken.

(PROUT and (PUNCH Routines

Block CW01: This is the entry point for the (PUNCH routine. Traps are disabled and the punch switch, PUNSW, is set.

Blocks CW02 to CW07: This is the entry point for the (PROUT routine. Traps are disabled, and the exit address is computed using the value in IR4 and the value contained in the first word of the calling sequence. The exit address is stored as the regular exit address if FRSW3 is zero. If FRSW3 is not zero, indicating that there is another on-line message to be printed, the original setting of the exit address will not be changed. The value of IR2 will also be saved in the proper exit location as indicated by FRSW3. IR2 is then set to the number of calling sequence words as indicated in the first word of the calling sequence. FRSW1 is tested to determine if it is necessary to wait for a trap on the printer channel before starting the message print-out. If it is not necessary to wait for a trap, control transfers to Block cw12. If it is necessary to wait for a trap, the channel activity cell, CHXAC, is tested to determine if there is any activity on the printer channel. If there is no present activity on this channel, control transfers to Block CW12. If there is activity, the contents of TRPSW

are compared with CHXAC to determine if the printer channel is the channel that is trapped. If the printer channel is the channel that is trapped, control transfers to Block CW12.

Blocks CW08 to CW10: If the printer channel is not the channel that is trapped but is active at this time, FRSW1 is set and traps are enabled on the printer channel only. The main program waits for the channel trap. When the trap routine SAVE is entered following a trap, FRSW1 is tested; because it is now not zero, control will return to the PROUT subroutine without processing the data channel trap.

Block CW11: This is the point at which control is returned from the SAVE routine when it finds FRSW1 not zero. The printer channel information is temporarily saved in ACOMM.

Block CW12: This block is entered after a trap on the printer channel or whenever it was not necessary to force a trap on the printer channel. The accumulator is cleared.

Blocks CW13 and CW14: Subroutine SPRT is used to generate the desired SPR or SPU instruction. Upon exit from this subroutine the accumulator will contain the desired instruction if the SPR specified in the calling sequence was not zero.

The accumulator is zero if no spr was specified in the calling sequence. The channel is tested to determine if the channel is busy. While the channel is busy, control remains in this test.

Block CW15: When the channel becomes not busy; one calling sequence word is picked up from the calling program. IR2 will cause this instruction to step to each successive word as it is required.

Blocks CW16 and CW17: Subroutine BCDHC is used to convert the BCD image specified to the line or card image form. There are two returns from this subroutine. The return at 1, 4 indicates that the line image is not full, and the return at 2, 4 indicates that the line has been completed. If the return is made to 1, 4, IR2 is tested to determine if all calling sequence words have been converted. If all have not been converted, control returns to Block cw15 to pick up another calling sequence word.

Blocks CW18 to CW21: When the return from BCDHC is made to 2, 4 or the last calling sequence word has been converted, the print indicator, PRINT, is cleared. PRINT is used by subroutine BCDHC to indicate the column where the next portion of the image is to start. When PRINT is cleared on an entry to BCDHC, that subroutine clears the print image, and resets its counters to start on a new line. After PRINT is cleared, the PUNSW is tested to determine if the entry was to PROUT or PUNCH. Either the printer or punch is selected for writing as determined by the results of this test. The

location of the SPR instruction is tested to determine if an SPR instruction is required for this line of print. If this location is zero, it is skipped. If this location is not zero, the instruction will be executed. (Subroutine SPRT places the desired instruction in the SPR location.) The image is printed or punched as required, and IR2 is tested to determine if there are any more calling sequence words in the list. If there are more in the list, control transfers to PRTI (Block CW13) to set up the next SPR instruction and convert the next line.

Blocks CW22 to CW25: When the list of calling sequence words is completed, subroutine SPRT is used to set up the last SPR instruction one more time. Upon return from SPRT, the accumulator is tested to determine if an SPR instruction was requested. If none was requested, control transfers to Block CW16. Otherwise, PUNSW is tested again, and either the printer or punch reselected as determined by the setting of PUNSW. The SPR instruction is executed, and the channel is tested to cause a loop until the channel is not busy.

Blocks CW26 to CW29: Punsw is cleared to indicate that future entries to this subroutine will be considered entries to (PROUT unless they enter at (PUNCH and set PUNSW. FRSW1 is tested to determine if there might have been traps forced on the printer channel at the beginning of this subroutine. If FRSW1 is zero (no forced trap), control transfers to PRTX2 (Block CW32), to set up the exit to the calling program. If FRSW1 is not zero, TRPSW is tested to determine if the subroutine is being used during trap time. If TRPSW is not zero, indicating trap time, control transfers to Block CW30 to set up the proper exit. During non-trap time, FRSW3 is set, and control transfers to SAVE1 (Block CC03) to complete the processing of the printer channel trap which had been previously interrupted.

Blocks CW30 and CW31: During trap time, FRSW3 is tested to determine if there is another on-line message waiting to be printed. If FRSW3 is not zero, indicating another message is waiting, control transfers to PRTAX (Block CW34), to set up the exit to the calling program. If no additional message is waiting, FRSW2 is set.

Blocks CW32 and CW33: IR2 is restored, and trap status is restored to the condition it was when the subroutine was originally entered. Control transfers to the calling program at the point immediately after the last word of the calling sequence (N+2, 4).

Block CW34: If there is an on-line message waiting to be printed, IR2 is restored, and control transfers to the main routine which called PROUT. In this case, traps would not be restored since this use of PROUT is during a time when traps should not be enabled. The return is to the location immediately after the last word of the calling sequence (N+2, 4).

Blocks CW35 to CW39: This is the SPRT subroutine used by PROUT. It is entered with the calling sequence word in the accumulator. The location SPR is cleared to remove the old instruction. The accumulator is shifted right to move the BCD image location and word count out of the accumulator, and leave the desired SPR code right adjusted. The accumulator is tested to determine if any SPR code was requested. If none was requested, control exits to the PROUT subroutine via 1, 4. If some SPR code is present, PUNSW is tested to determine if the resulting code is to be used for the printer or punch. As a result of this test, the basic sense instruction is added to the specific code to produce the desired sense instruction for that particular unit. The instruction thus generated is stored in the SPR location to be executed when necessary.

(CVPRT Routine

Blocks CW40 to CW44: This is the CVPRT subroutine used to print a tape error message on-line. It is entered with the tape unit address in the left half of the MQ. IR4 is saved, and the PROUT calling sequence is generated. Subroutine syuncv is used to convert the tape address to the symbolic form of channel/unit (i.e., A1, B4, C0, H4; RDA, PUG, PRE, RDH, PUF; CD00/0, AD00/1, BD00/1, HD00/1, DD00/0, EF00/1. This symbolic form is stored in the message image following the word UNIT. The message is printed along with the message indicated in the CVPRT calling sequence by subroutine PROUT. At the completion of subroutine PROUT, IR4 is restored, and control returns to the calling program via 2, 4.

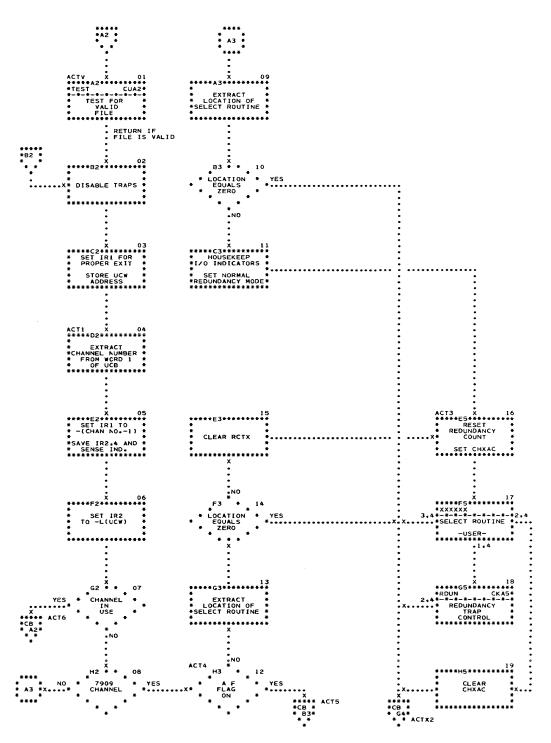


Chart CA. ACTV routine, Sheet 1

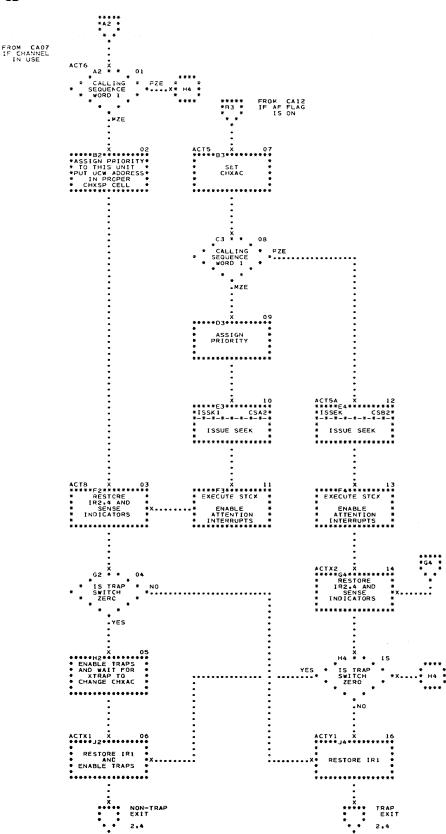


Chart CB. ACTV routine, Sheet 2

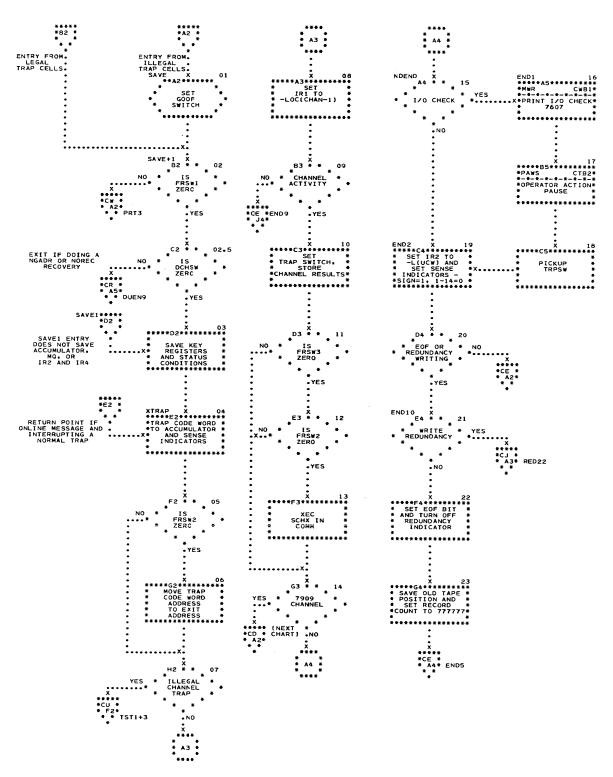


Chart CC. SAVE and XTRAP routines, Sheet 1

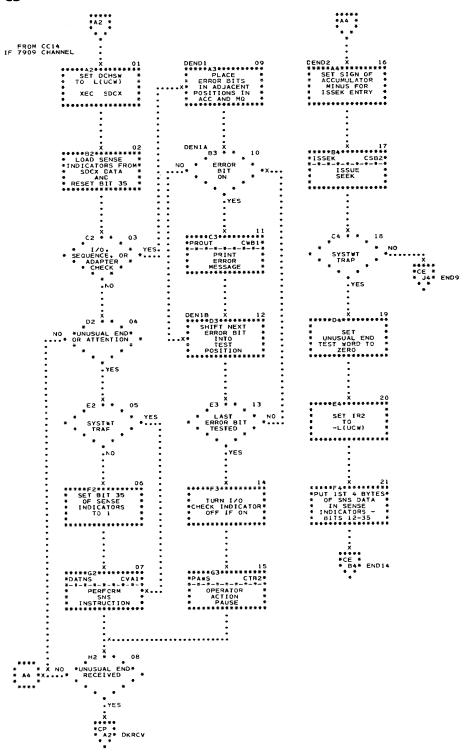


Chart CD. SAVE and XTRAP routines, Sheet 2

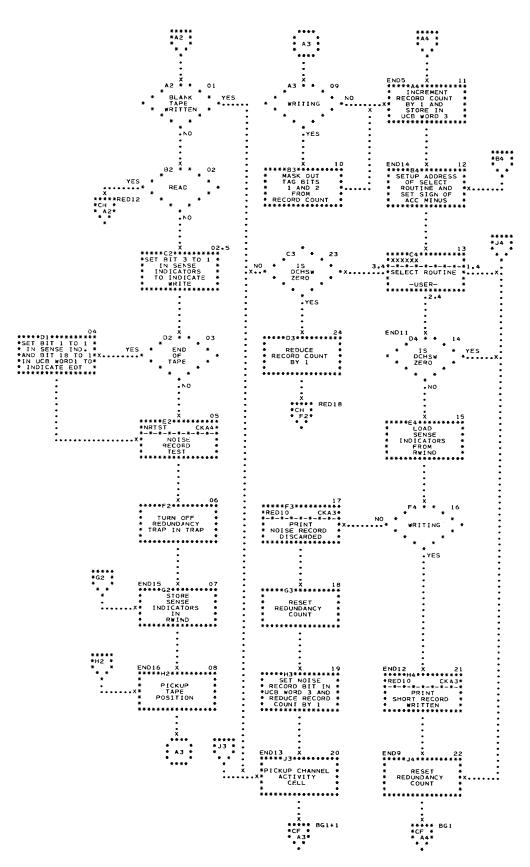


Chart CE. SAVE and XTRAP routines, Sheet 3

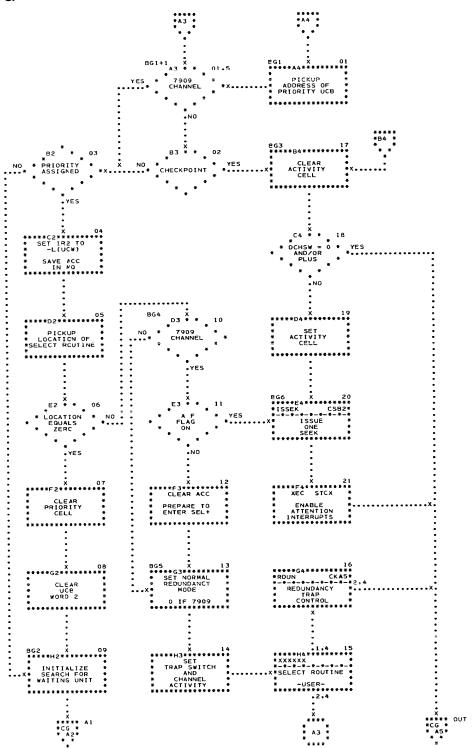


Chart CF. BG1 routine, Initiate Channel Operation, Sheet 1

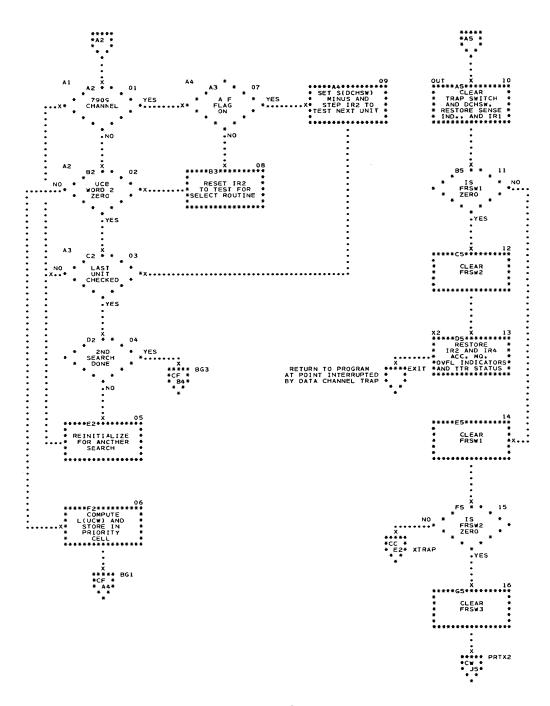


Chart CG. BG1 routine, Initiate Channel Operation, Sheet 2

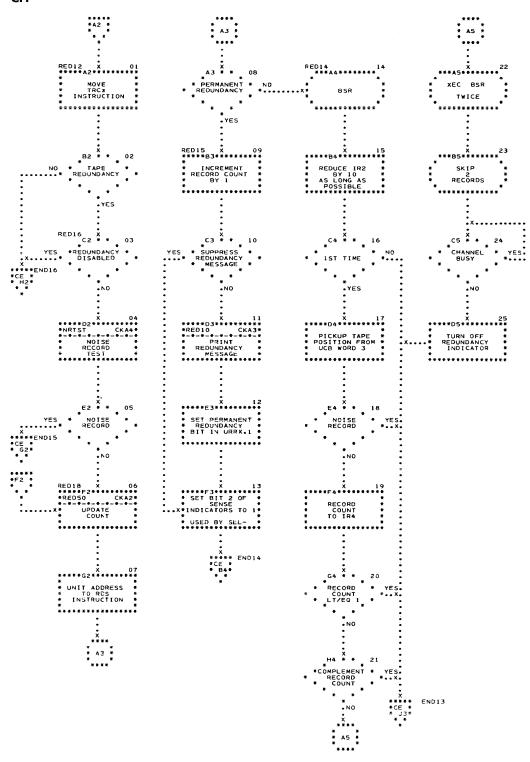


Chart CH. Read Redundancy Recovery routines

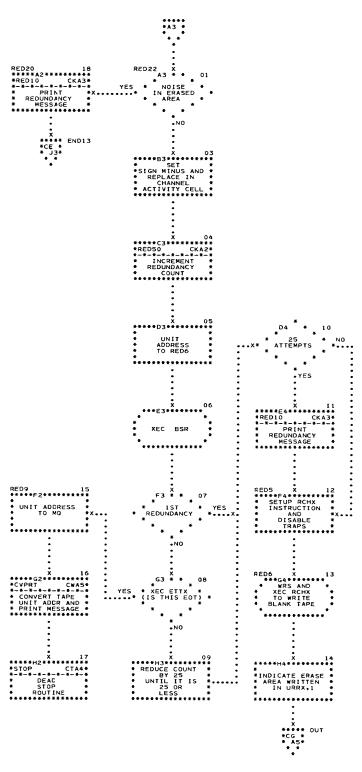


Chart CJ. Write Redundancy Recovery routines

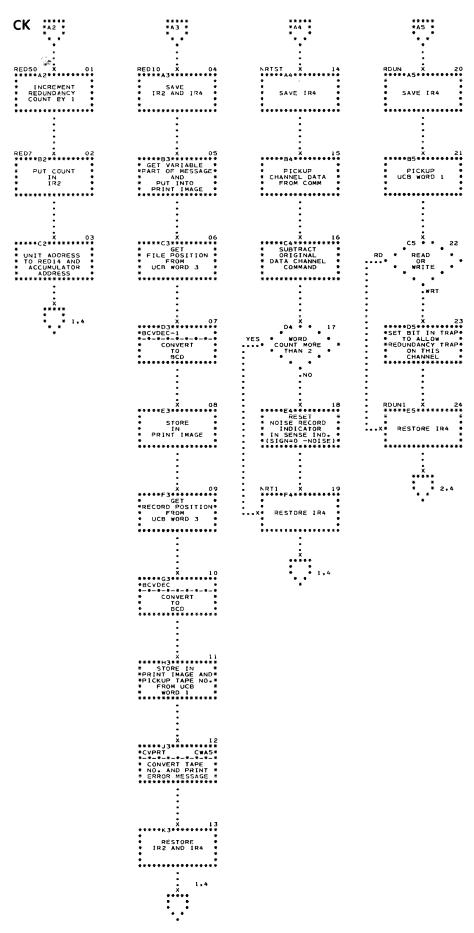


Chart CK. Redundancy Recovery Subroutines

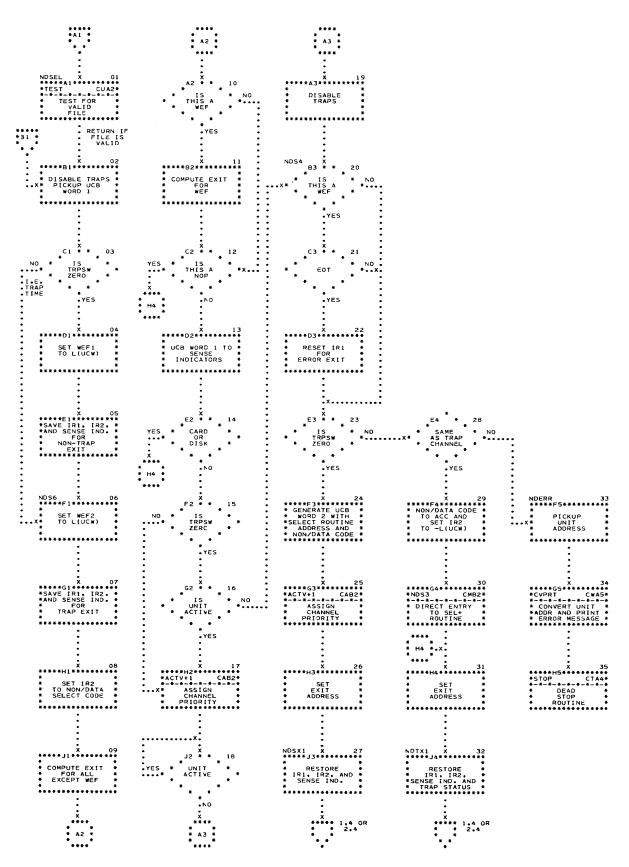


Chart CL. NDSEL, Non-Data Select routines

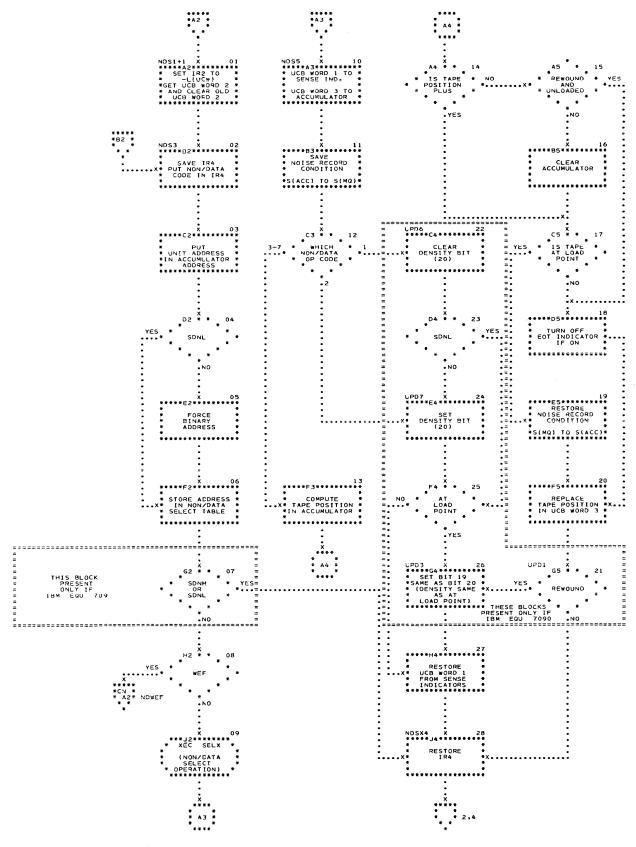


Chart CM. Select routines for NDSEL, except NDWEF

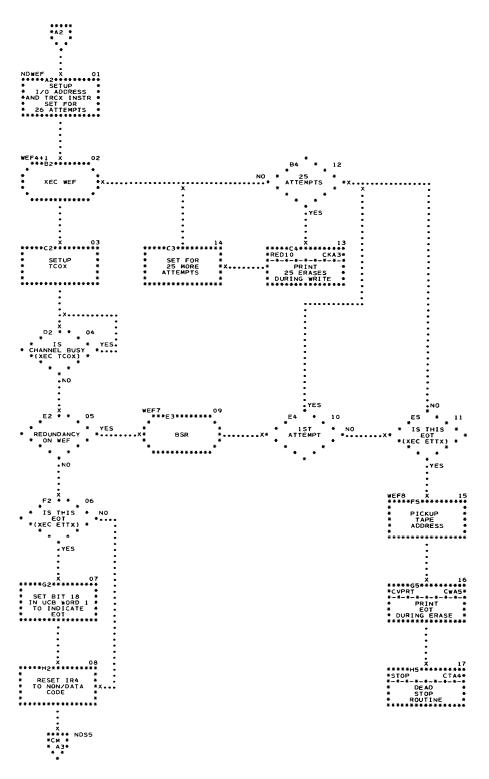


Chart CN. Select routine for NDWEF operation

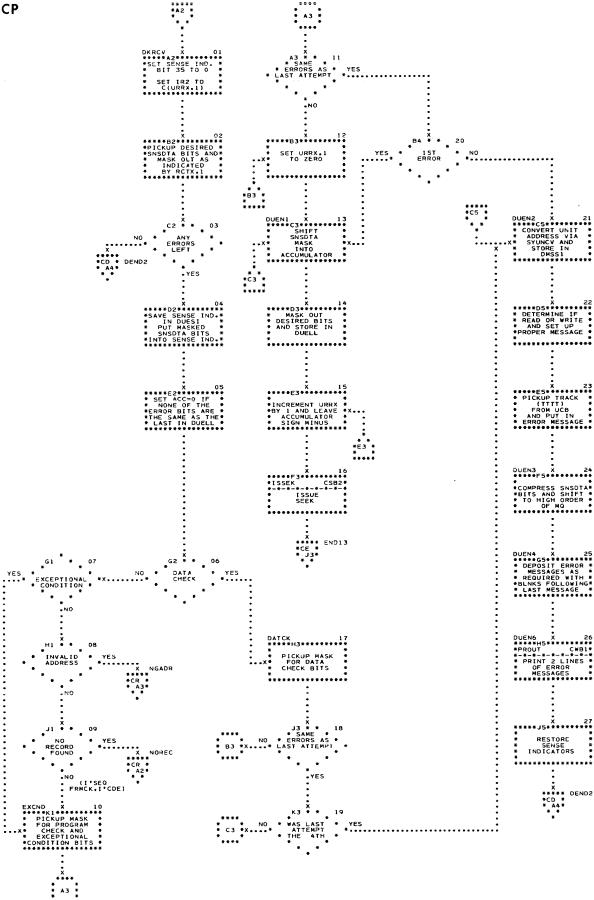


Chart CP. DKRCV, disk recovery routine, Sheet 1

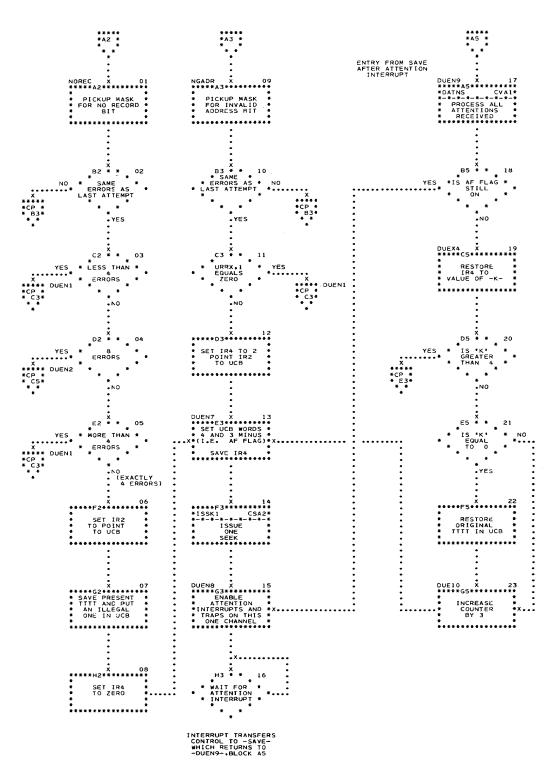
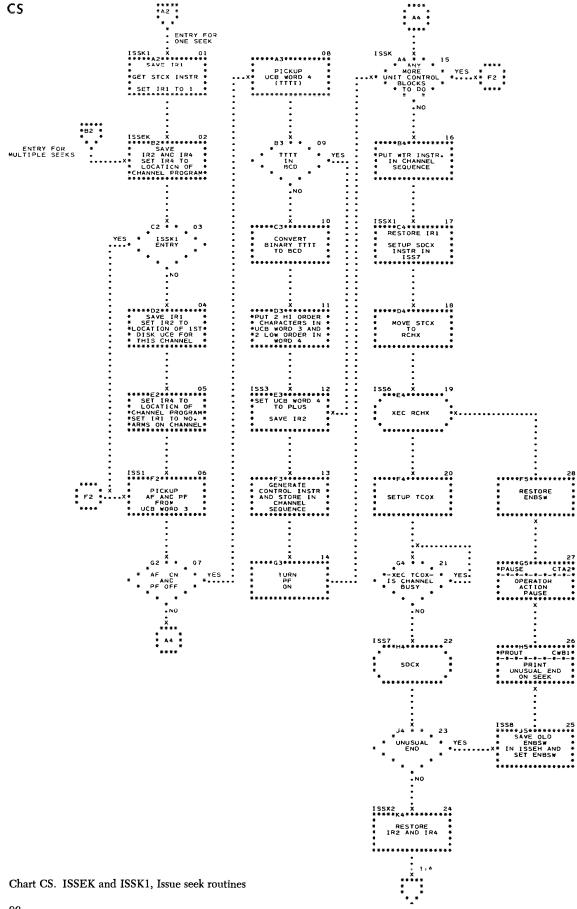
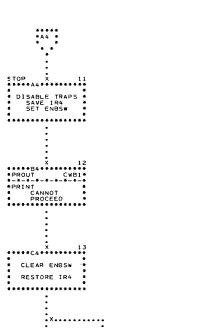


Chart CR. DKRCV, disk recovery routine, Sheet 2





CT

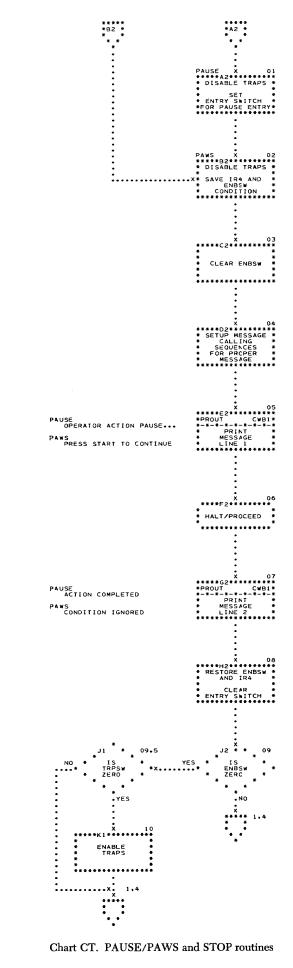


Chart CT. PAUSE/PAWS and STOP routines

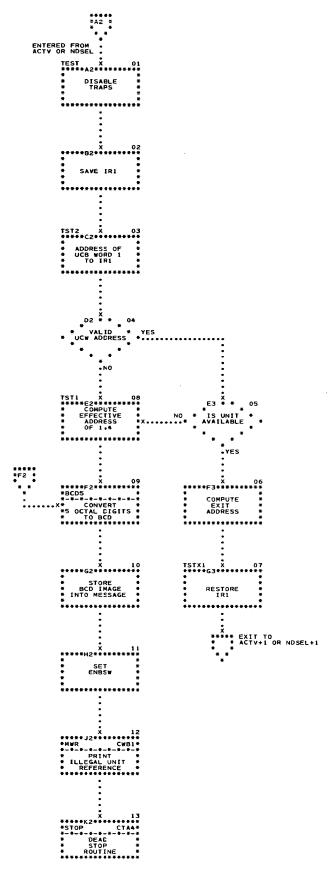


Chart CU. TEST routine

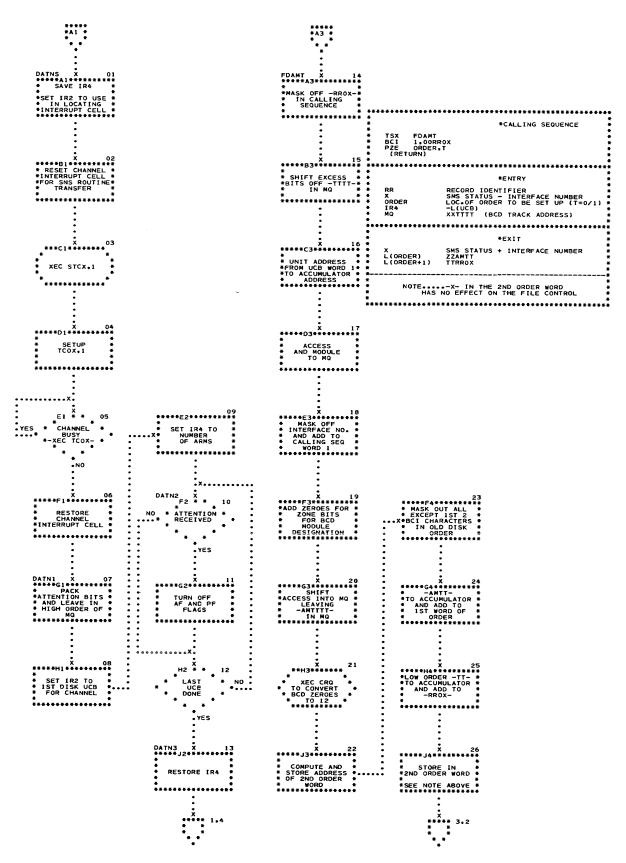


Chart CV. DATNS and FDAMT routines

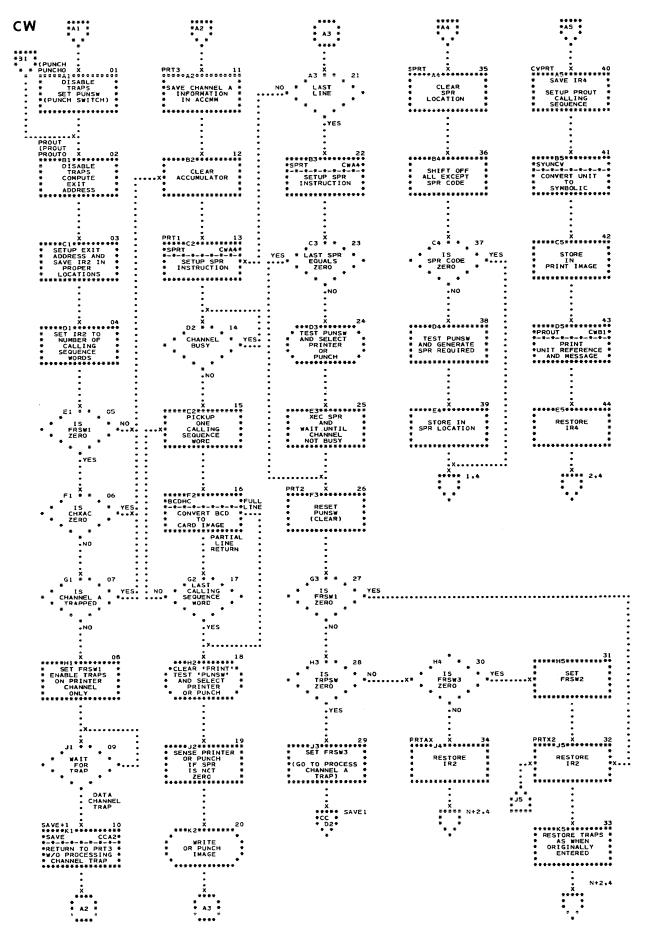


Chart CW. PUNCH and PROUT routines

Appendix A — On-Line Messages

The format of the following two lists of on-line messages is as follows: The first line or lines that are capitalized constitute the message as it appears in print. The next line indicates the block locations on the charts in the manual that show the logical flow that causes the message to be printed. The sentence or paragraph following this gives the reason for the message.

During IBSUP Operation

CONTROL CARDS NEEDED IN CARD READER OPERATOR ACTION PAUSE

BCE3, BCF3

An EOF has been sensed in the card reader while attempting to read in a control card.

NOT A BASIC MONITOR CONTROL CARD PRESS START TO CONTINUE

BEH3, BEH4

A card with an illegal operation code has been read in. The card in error is printed immediately before the error message.

ILLEGAL SYSUNI DEFINITION PROVIDE CLARIFICATION IN CARD READER OPERATOR ACTION PAUSE

BJC2, BJF3, BJG3

The system unit specified on either a srelease or sas card cannot be found in the syunam table.

BJE4/BJG4, BJF3, BJG3

The disk origin or number of cylinders on a sas card contains a character greater than 9. (In the released disk version, the same error condition occurs on a SRELEASE card.)

BKB2/BKD2, BJF3, BJG3

One or both of the system units specified on a sswitch card cannot be found in the SYUNAM table.

BHC4, BJF3, BJG3

The system unit specified on a srewind, sendfile, or sremove card cannot be found in the syunam table.

JOBS. STARTING WITH JOB XXXXXX. WILL BE PROCESSED

BUH1

Sense switch 6 has been sensed down between jobs, indicating a skip job request.

IF INCORRECT. CLARIFY IN KEYS-OR PUT S.S.6 UP TO IGNORE REQUEST OPERATOR ACTION PAUSE

BUC2, BUB2

A skip job request with a count greater than 15 (decimal) has been entered.

PLACE S.S.6 UP OPERATOR ACTION PAUSE

BUF3, BUG3

A skip job request has been interpreted and determined to be valid. A valid request would be a first request not greater than 15, or any second request.

ILLEGAL UNIT SPECIFIED
PROVIDE CLARIFICATION IN CARD READER
OPERATOR ACTION PAUSE

BFA2/BFD2, BJF3, BJG3

An illegal or invalid unit is specified on a sattach card.

BFA4/BFC4, BJF3, BJG3

An illegal or invalid unit is specified on a sdetach card.

MIXED HARDWARE SWITCH INVOLVING SYSLB1 IS ILLEGAL PROVIDE CLARIFICATION IN CARD READER OPERATOR ACTION PAUSE

BK₁₂, B₁F₃, B₁G₃

The two units specified on a SSWITCH card that involves SYSLB1 are not both of the same type, (i.e., both are not tape, or both are not disk).

SYSUT4 IS NOT ASSIGNED. NO DUMP CAN BE TAKEN

BWC4

In INITUS, the unit being initialized is sysur4 and is unassigned.

SYSOU1 IS NOT ASSIGNED. NO DUMP CAN BE TAKEN

BWC3

In INITUS, the unit being initialized is sysou1 and is unassigned.

CURRENT SYSTEM NAME MISSING RESTORE WITH SEXECUTE SYSNAM IN SYSCRD. OPERATOR ACTION PAUSE

BTB2/BTE2, BTF1, BTG1

SYSPOS equals zero on an entry to SYSRET (IBRET), or the system name in SYSPOS cannot be found in the SYSNAM table.

***** UNKNOWN SYSTEM

PROVIDE CLARIFICATION IN CARD READER

OPERATOR ACTION PAUSE

BGG2, BVC2/BVE2, BJF3, BJG3

Routine IBXCC used IFIND to locate correct system and could not find the desired system name in the SYSNAM table, or when the name is found, the second word of the table entry is cleared.

BGF4, BVC1, BJF3, BJG3

Routine IBXCC searched for system name in DSYSNM table and could not find it.

***** NO ASSIGNMENT MADE
PROVIDE CLARIFICATION IN CARD READER
OPERATOR ACTION PAUSE

BGG2, BVG2, BJF3, BJG3

Routine IEXCC used IFIND to locate correct system and no assignment was made to the system unit required for a particular system.

BBH3, BCD2, BVG1, BJF3, BJG3

During cold-start, the input tape is designated as the input unit and is unassigned or unattached.

BCD1, BCD2, BVG1, BJF3, BJG3

In IBSYS, no input unit is assigned to the required input unit as designated by the input switch (SYSCRD or SYSIN1).

SPAUSE
OPERATOR ACTION PAUSE
(MACHINE PAUSE)
ACTION COMPLETED

(BJG1), BJG2, CTE2, CTG2

A spause card has been read in during monitor operation.

\$STOP END OF JOBS CANNOT PROCEED

(BJB1), BJA2, CTB4,

A sstop card has been read in during monitor operation.

During IOEX Operation

OPERATOR ACTION PAUSE (MACHINE PAUSE) ACTION COMPLETED

CTE2, CTG2 (entered at CTA2)

A user has transferred to the CPAUSE subroutine.

PRESS START TO CONTINUE

(MACHINE PAUSE)

CONDITION IGNORED

CTE2, CTG2 (entered at CTB2)

A user has transferred to the (PAWSX subroutine.

CANNOT PROCEED

CTB4

A user has transferred to the (STOPX subroutine.

ILLEGAL TRAP OR UNIT REQ-ST AT XXXXX CANNOT PROCEED

CCH2, CUJ2, CUK2

A data channel trap was received from a non-existent channel.

CAA2/CLA1, CUD2, CUJ2, CUK2

A use of ACTIV or NDSEL has specified an illegal unit in its calling sequence.

UNIT ILLEGAL NON DATA SELECT AT TRAP TIME XX CANNOT PROCEED

CLE4, CLG5, CLH5

A non-data select operation has been attempted during trap time on a channel other than the channel that is trapped.

UNIT XX

......USERS MESSAGE.......

CWA5, CWD5

A user has used the CVPRT subroutine to convert a tape address to symbolic and print his own message along with it.

YY

XXXXXX YY ERR. TRK ZZZZ XXXXXX -- SYMBOLIC UNIT

(ONE OR MORE OF THE ABBREVIATIONS LISTED BELOW)

-- RD/WR ZZZZ -- TRACK NUMBER

PRGCK DATCK EXCND I-SEQ I-CDE FRMCK NOREC I-ADR RSPCK DCOMP P/CCK INOPR NTRDY DKCRK CUCRK

CPB4/CPK3/CRD2, CPH5

An unsuccessful recovery attempt has been made on a disk error. The abbreviation(s) for the type of error(s) is (are) printed on the line following the symbolic unit, type of error, and track number.

U. E. ON A SEEK-PRESS START TO RETRY. OPERATOR ACTION PAUSE

CSJ4, CSH5, CSG5

An Unusual End has been received on a seek issued by the ISSEK or ISSK1 routines.

UNIT XX FILE XXXXX REC. XXXXX NOISE RECORD DISCARDED

CEF4, CEF3

A user's SEL- routine has used the 2, 4 return to indicate that the noise record on a read operation is to be discarded.

UNIT XX FILE XXXXX REC. XXXXX SHORT RECORD WRITTEN

CEF4, CEH4

A user's SEL- routine has used the 2, 4 return to indicate that the short record written is to be ignored.

UNIT XX FILE XXXXX REC. XXXXX PERMANENT READ REDUNDANCY

CHA3, CHC3, CHD3

A permanent read redundancy has been encountered during redundancy recovery, and the message is not suppressed.

UNIT XX FILE XXXXX REC. XXXXX NOISE ON ERASE

CJA3, CJA2

A redundancy has been encountered while attempting to write an erase area.

UNIT XX FILE XXXXX REC. XXXXX 25 ERASES DURING WRITE

CJD4, CJE4

25 erases have been made while attempting to recover from a write redundancy.

UNIT XX EOT ON ERASE

CANNOT PROCEED

CJG3, CJG2, CJH2

An EOT has been sensed on some write redundancy recovery attempt other than the first.

I/O CK. 7607

PRESS START TO CONTINUE

CCA4, CCA5, CCB5

An 1/0 check has been detected on a 7607 channel following a data channel trap.

(ONE OR MORE OF THE FIRST THREE LINES FOLLOWED

INTF CK, 7909

SEQ CK. 7909

I/O CK • 7909

PRESS START TO CONTINUE

BY THE FOURTH LINE AS SHOWN)

CDC2, CDB3, CDC3, CDG3

The indicated error conditions were detected on a 7909 channel following a data channel trap.

Appendix B — **Assembly Parameters**

CHAMD-CHHMD Model types of units on channel: 1-

Printer; 1-printer exists

Punch; 1-punch exists

ment as CHAAT

Model IV, 0-Model II; same arrange-

Card reader; 1-card reader exists

Machine and	l System Definitions	HTA1-HTH1	Number of Hypertapes on interface 1
IBM	Machine type (709 or 7090)	HTAA1-HTHA1	Hypertape attachment indicators; sim-
IBSORG	Basic Monitor origin for nucleus (minimum is last machine trap/interrupt cell +1)	НТА2-НТН2 НТАА2-НТНА2	ilar to CHAAT Number of Hypertapes on interface 2 Hypertape attachment indicators; sim-
IOXORG	ю origin (minimum is last ucв cell +1)	DFA1-DFH1	ilar to CHAAT Number of modules on interface 1 (0 through 10)
SYSORG	System origin (minimum is last installation trap routine cell $+1$)	DFAA1-DFHA1	Disk module attachment indicators; similar to CHAAT
SYSEND	System upper core limit (move down to allow room for instal-	IFA1-IFH1	Model of 7631: 1-Model III or IV, 0-all others
	lation accounting routines, etc.)	DFA2-DFH2	Number of modules on interface 2, (0 through 10)
HIGHLO	Density to be assumed on sas card if not specified	DFAA2-DFHA2	Disk module attachment indicators; similar to CHAAT
ЕЈЕСТ	(1 indicates high, 0 indicates low) Printer board sense exit for eject (1 through 10)	IFA2-IFH2	Model of 7631: 1-Model III or IV, 0-all others
DBLSP	Printer board sense exit for double		
	space (1 through 10)	Intermediate (Calculated t	Definitions from Prior Definitions)
RDUNRT	Number of recovery tries for each read redundancy Transfer trap mode	DUCA-DUCH TDUAC	Number of disk arms on each channel Total number of disk arms on all chan-
	(1 indicates trap mode to be saved	DUEX	nels Equals 1 if disk exists on any channel
	by IOEX, 0 indicates trap mode remains in effect in IOEX)	СНА2-СНН2	Number of 7909 devices on each channel
		СНА3-СНН3	Channel type: 1 indicates 7909, 0 indicates any other
Unit Definitions CHA1-CHH1 Number of tapes, (0 through 10)		UG1-UG4	1 bit in a word for each card machine that exists (Figure 4)
СНААТ-СННАТ	Tapes attached 1 bit per unit signifying whether unit is attached to machine, (i.e. legally dialable). Bits	CHA0-CHH0 NOUCW	Number of 1/0 devices on each channel Total number of 1/0 devices on all channels
	go left to right (cr., Pu, Pr., tapes 1 to 10) and equal 1 if not attached	СНА4-СНН4	Existing channel indicators: 1-channel exists, 0-channel does not exist

CHH5

Figure 4 shows the bit configuration for the key cells required by cold-start to generate the Unit Control Blocks. These words are constructed during compilation from the unit and intermediate definitions.

Total number of channels that exist

PRNTA-PRNTH

PNCHA-PNCHH

CDRDA-CDRDH

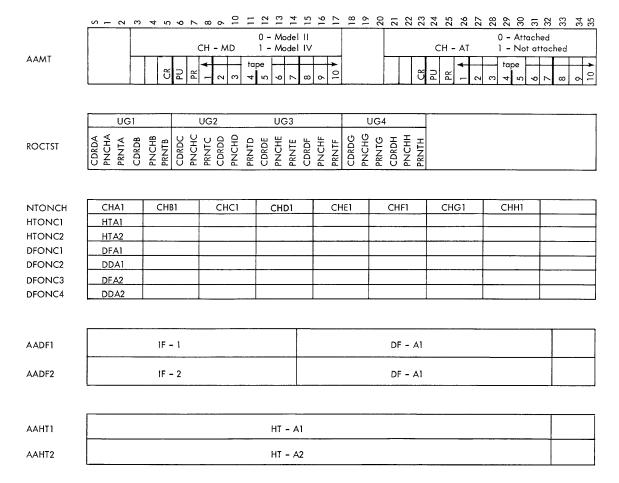


Figure 4.

Appendix C — Channel Information and Operation Tables

These tables are comprised of one entry for each channel that exists. The following tables have indirect references within the IOEX communication region and may be referenced in this manner by the user: CHXAC, URRX, RCTX, RCHX, TCOX, TRCX, ETTX, and TEFX. When using the indirect references, IRI must contain the channel index, which is the complement of the channel number minus one.

CHXAC

Channel activity cells

Cleared—no activity on a channel or non-standard use of channel L(UCB)—location of UCB for the unit that is active on the channel

CHXSP

Channel priority cells

Cleared—no priority assigned L(UCB)—priority is assigned to the unit indicated in that UCB

CHXCW

Channel control cells

PZE ADDR, 2, length of all UCB's for channel. ADDR points to word 2 of these UCB's

UCBA-UCBH

Locators for UCB's by channel

Prefix—number of card machines on

channel

Decrement-total number of 1/0 de-

vices on channel

Address—address of first uce on this

channel

UCAA-UCAH

Locators for available unit chains by

channel

Address—address of UCB for first unit in the availability chain.

RCTX

Redundancy check control cells

Zero—redundancy checking disabled Not zero—redundancy checking allowed (always zero for a 7909 channel)

channel)
URRX Redundancy con

Redundancy count cells

PZE N1,, N2

N1—number of recovery entries to SEL+

N2=0—no permanent redundancies (READ) or erase areas

N2=1—permanent redundancy (READ) or one or more erase areas (WRITE)

(N1=0 if N2=0, and N2 always 0 for disk I/O)

The following tables are instruction tables for use by the program and the user so that the recovery routines will be able to repeat the operation when required. The recovery routines need only to execute these instructions, which have been set up by the user's SEL+ routine.

ETTX End-of-tape test table

RCHX Reset and load channel table

SCHX Store channel table

spcx Store diagnostic channel table

STCX Start channel table

TCOX Test channel in operation table

TEFX Test end-of-file table

TRCX Test channel redundancy table

Appendix D — Key Switches and Storage Locations

ACOMM Store Channel Results

Subroutine PROUT places the SCHA data into this location when forcing a trap on the printer channel. XTRAP will move this data into COMM. If either FRSW2 OF FRSW3 is not zero, the SCHX in XTRAP is bypassed.

CHPSW Checkpoint Switch

Set by user when taking a checkpoint. Indicates to BG1 not to attempt to initiate another operation on the channel that just caused the trap unless it is a 7909

channel.

COLD Cold Start Executed Switch

First location of cold-start routine which is cleared to indicate that the routine has been executed. It is cleared in both the cold-start and IBRES routines. It indicates to IBXCC that SYSLB1 must be initialized when cold-start has been

executed.

COMM, Store Channel Results

COMMD XTRAP stores the channel results in this location on each channel trap

unless FRSW2 or FRSW3 is not zero. In this case, the data from ACOMM is used. This data is used by NRTST to determine the length

of the record in question.

Disk Channel Switch

XTRAP sets this location to contain the location of the UCB for the operation causing the trap if the unit is on a 7909 channel. When this location is zero, a non-7909 channel is indicated. This location is cleared on exit from XTRAP in

the out routine.

DMPSW Dump Switch

This location is set by the dump caller to indicate that two records are to be read in. It is cleared when the dump program is scat-

ter loaded into core.

Disk System Name Table

This table is comprised of two word entries for each system on disk. The format is as follows:

BCI 1, SYSNAM
PZE ,, DORG

DUELL Last Disk Error Indicators

This location is used in the disk recovery routine to save the error conditions obtained on one entry to the routine, so that they may be compared with the errors found

on the next entry.

Enable Switch

(ENBSW When

When zero, this location indicates to ioex that it may enable traps. IBSUP will enable traps before going to SYSTRA after loading in a new system. When this location is not zero, ioex may not enable traps. This location is set by the

user.

FORCE SWITCHES

A detailed explanation of the three force switches and their interaction is given in the explanation

of the PROUT subroutine.

FRSW1 Force Switch 1

This location is set to non-zero in the PROUT routine whenever it is necessary to force a channel trap on channel A. It causes the SAVE routine to transfer immediately to PRT3 in the PROUT routine without processing the trap which has been forced, or even setting TRPSW at this time. This location is cleared on exit from the trap

supervisor if it is found non-zero.

FRSW2 Force Switch 2

This location is set to non-zero on an exit from the PROUT routine when both FRSW1 and TRPSW are not zero and FRSW3 is zero. This condition indicates to PROUT and XTRAP that there is one trap waiting to be processed and one trap being processed. This location is

cleared on exit from the trap supervisor if FRSW1 is zero.

FRSW3

Force Switch 3

This switch is set in the exit routine in PROUT if FRSW1 is not zero and TRPSW is zero. This condition indicates to PROUT and XTRAP that there is a channel A trap waiting to be processed. This location is cleared on exit from the trap supervisor when FRSW1 is not zero and FRSW2 is zero. Control then returns to the exit routine in PROUT.

GOOF

Illegal Trap Switch

This is an instruction in XTRAP whose address will be set to nonzero when any trap occurs on a non-existent channel. When it is tested and found non-zero, it will cause a system halt after an online print-out indicating the error.

IBASX

Prior Assignment of Newly Assigned System Unit

> This location contains the UCB address for the prior assignment to a logical function. This is used in the IBREL and IBASC routines.

IBOPT,

IBOPX

Legal Operation Code Tables

These two tables contain the legal operation codes which may be used on basic monitor control cards, and the addresses of the routines used to process each particular control card.

IBSAV

Original Sense Switch 1 Setting

This is a location within the disk limits table where the original setting of sense switch 1 is saved. It is also set according to the requirements of a scards or stape control card.

> Zero - Down (CARDS) Non-zero - up (TAPE)

IBSINP

Input Switch

This switch indicates cards or tape mode of input. Zero indicates cards, non-zero indicates tape. A srestore card does not change this setting when restoring the nucleus.

IBWAT

Control Card Wait Loop

This location may be set to one of four possible values, as shown:

TRA

Set by ibsys while waiting for the data channel trap.

TRA IBTPIN

or

IBCDIN TRA

Set by the SEL+ routine in ibsys to give control to the proper control card interpretation rou-

tine.

IBRET TRA

Set by the SEL+ routine in IBSYS when an EOF is sensed in the card reader.

INTSW

Interlock Switch

This switch prevents an interrupt unless the position of sense switch 1 has been alternated. For example, if the operator has used sense switch 1 to cause control cards to be taken from the card reader on initial loading and has not replaced this switch in the up position, an interrupt will not occur. If the operator has placed the switch down for an interrupt and receives the interrupt, but does not return the switch to up, another interrupt will not occur until the switch is alternated.

If the switch is not zero, the interlock is on. It is set to non-zero during cold-start if sense switch 1 is used to indicate card input. It may also be set to non-zero in IBXCC when returning from an interrupt. It will be cleared on the first entry to the INTRUP routine when it is found set and sense switch 1 is up.

LATUN

Last Unit Attached

This location contains the address of the UCB for the last unit attached. The address is set by the IBATC routine, and can be cleared by the IBREL routine. It is used by both the IBASC and the IBREL routines.

LSTSW

List Switch

This switch indicates that control cards are to be printed when it is on.

104

Zero - on: Control cards printed on-line.

Non-zero—off: Control cards not printed on-line, (except \$PAUSE, \$STOP, \$LIST and illegal cards).

Map Switch MAPSW

This switch is used by IBUNT to indicate when any data has been printed under a particular heading.

Zero – No; Non-zero – YES.

Single Channel Enable Trap Location ONETRP This location is used when it is desired to enable traps on one channel only (PROUT, PUNCH,

DKRCV routines).

cannot be cleared.

PRINT Image Printed Switch

> This switch is used within the BCDHC routine. Zero indicates that the on-line image area is to be cleared before converting any more data. Non-zero indicates that only part of the desired image is converted, and it has not yet been printed. In this case the image

Pause Switch **PSTSW**

> This switch determines which pair of messages will be printed online with the use of the machine pause routine. Non-zero indicates that the entry to the routine was through PAUSE, and the operator intervention messages are to be printed. Zero indicates that the entry was through PAWS and the error messages are to be printed. This location is cleared on all

Punch Switch PUNSW

> This switch indicates that the online message is to be punched instead of printed. It is set to nonzero to indicate this if the entry is made to the PUNCH routine. It is set to zero on all exits from either the PUNCH or PROUT routines.

exits from the pause routine.

RCOLDX Alternate Cold-Start Exit

> During the initial use of coldstart, this location contains a *+1. If the cold-start routine is being used for a srestore

operation, this location will contain a TRA ibsys. This operation bypasses the setting of the input switch and the operations concerning the input unit.

RUPSW Interrupt Switch

> This switch is set to non-zero by INTRUP and cleared by IBXCC. When set, it indicates to ibsys to return to the current system when an EOF occurs in the card reader during an interrupt. When set, it also indicates to IBXCC to set the interlock switch, INTSW, to prevent another interrupt until sense switch 1 is alternated.

RWIND Temporary Sense Indicator Storage

> XTRAP saved the sense indicators in this location if a read redundancy is found to be a noise

record.

SYSORG + 100 SYSLB1 limits (disk) PZE SYSORG + 101

PZE Channel index, , Unit ad-

dress

SYSUNI, **SYSLB1** + 19

SYSORG + 102 PZE L(UCB), , TITT of spare

tracks of ibsys cylinder.

System Units and Disk Limits Tables The system units table contains a one word entry for each logical system unit. When loaded, the format of an entry in this table is PRE CHAN,, UNIT.

> The format of this table when in use is PRE L(UCB). In both formats, the prefix is used to indicate the density of the logical unit. MZE stands for high density, and PZE stands for low density.

> The disk limits table contains a one word entry corresponding to each entry in the sysuni table. It is in the format of PZE DORG, , DEND. The locations corresponding to SYSCRD, SYSPRT, and SYSPCH are used for switch storage and labelled issen, intsw, and ibsav, respectively.

System Units External Name Table **SYUNAM**

> This table contains a one word BCI entry for each logical system

unit.

Current Traps Enabled TRAP,

This location contains the word (TRAPS used to enable traps at this time.

TRPSW,

Trap Switch

(TRPSW

When this location contains LCUCBO as set in XTRAP, it indicates that a trap is being processed. When this location is cleared on an exit from XTRAP, it indicates that the trap has been completely processed. The sign of TRPSW is set to 1 on an erase operation on tape.

TRAPX,
(TRAPX

Indirect Reference to TRAP, (TRAPS

This location in the IOEX communications region provides an indirect reference to TRAP, (TRAPS containing the current traps enabled. This cell may be changed by

the user and then reset to its original value if the user desires to indicate to IOEX to use another trap cell for enabling traps. (IOCS makes use of this feature.)

TRPCH

Enable Printer Channel Trap Cell

This location contains a 1 in both the address and decrement and is used to enable traps on the printer channel by prout when a channel A trap must be forced. It is also used by DKRCV and shifted to the desired position to enable traps on the desired channel only.

${\bf Appendix} \; {\bf E} - {\bf Abbreviations}$

ACC	ACCUMULATOR	INSTR	INSTRUCTION
ADD	ADDRESS	IR	INDEX REGISTER
ADDR	ADDRESS	I/O	INPUT/OUTPUT
\mathbf{AF}	SEEK REQUEST FLAG (ACTIVITY FLAG)	LOC	LOCATION
AVL	AVAILABILITY, AVAILABLE	LRC	LONGITUDINAL REDUNDANCY CHECK
BCD	BINARY CODED DECIMAL	LT	LESS THAN
CE	CUSTOMER ENGINEER (TRACK)	L(UCB)	LOCATION OF UNIT CONTROL BLOCK
CHAN	CHANNEL	MISC	MISCELLANEOUS
CHK	CHECK	NO	NUMBER
CHN	CHAIN	OP	OPERATION
C(UCW)	CONTENTS OF UNIT CONTROL WORD	ORIG	ORIGINAL
DEND	DISK END	PF	SEEK ISSUED FLAG (PENDING FLAG)
DORG	DISK ORIGIN	SEQ	SEQUENCE
EOF	END OF FILE	SPR	SENSE PRINTER (SENSE PUNCH)
EOT	END OF TAPE	TTTT	TRACK ADDRESS
EQ	EQUAL TO	UCB	UNIT CONTROL BLOCK
GT	GREATER THAN	UCW	UNIT CONTROL WORD
HI	HIGH	UE	UNUSUAL END
IF	INTERFACE	VIA	BY WAY OF
IND	INDICATORS	WEF	WRITE END OF FILE
INFO	INFORMATION	W/O	WITHOUT
INSTALL	INSTALLATION	. XEC	EXECUTE

Appendix F — Glossary

ACTIVATE FILE: To cause an I/O operation to be started on a channel, on the unit specified in the file designation.

ACTIVE: Status of a channel or a file when an 1/0 operation is being performed on that channel or file.

ACTIVITY FLAG, AF (SEEK REQUEST FLAG): The sign position of word 3 of a disk unit control block which is used to indicate when a seek is requested by a user, or a seek was issued and an attention signal is awaited.

ADAPTER CHECK: A condition in the 7909 channel which can cause an interrupt.

ATTACHED, UNATTACHED: The physical condition of an I/O device, referring to whether or not the device is actually attached to the system. Bit position 1 of word 1 of the UCB is used to indicate this status when the sign position is set to 1. (See UCB layout in IBSYS Reference Manual, Form C28-6248.)

ATTENTION INTERRUPTS: This is a signal which indicates a change in status of an attached 1/0 device. An attention signal is generated at the completion of a seek operation by an access mechanism.

AVAILABILITY CHAIN: This is a logical list of attached units which have not been assigned to a specific system unit function. The address of the first unit in this chain for each channel is found in the table UCAA through UCAH in the nucleus. The address of subsequent UCB's is found in the address part of word 1 of each entry in the chain. (Refer to Chart BY.)

AVAILABLE, UNAVAILABLE: The logical status of an I/O device which is attached. The sign position of word 1 of the UCB is used to indicate this status. (See UCB layout, IBSYS Reference Manual, Form C28-6248.)

Calling Sequence: An instruction that gives control to a subroutine with one or more instructions or constants which are provided to supply the parameters for the subroutine operation. CE Track: A track on disk reserved for Customer Engineering use, which cannot be used by the programmer, but to which the access mechanism will move whenever an illegal address is specified.

CHANNEL INDEX: A numeric value used to index through a table of instructions which is as long as the number of channels attached to a system. The value is equal to the complement of the desired channel number minus one. This value is usually placed in IR1, and the reference to the start of one of these tables is tagged with IR1.

CHECKPOINT, CHECKPOINT RECORD: A record written at periodic intervals by a program containing the complete contents of core storage and all the machine registers and machine status conditions. This record may be later used to provide a restart without necessitating a complete rerun of the program.

CLEAR: When speaking of a switch or a location in storage, the term "clear" refers to an all zero condition.

DEAD STOP: A type of halt provided in the program from which there is no normal recovery. Depressing START causes no change because the halt consists of a HTR *

DIAGNOSTIC CHANNEL DATA: The execution of a "store diagnostic channel" instruction causes the contents of the channel check register to be placed in positions 6 through 11 of the location specified. The status of these bits may then be tested without using the TCM instruction normally used to check these conditions.

DISK LIMIT: The starting and ending addresses of a system on disk.

DORMANT: Not active, which means no 1/0 operation is in progress on a channel or file at this time.

ENTRY POINT: The first instruction in a subroutine that is executed. This is not necessarily the first actual instruction found in the routine, nor need it be the same for each use of the routine.

ERASE AREA: A blank area on magnetic tape produced when

Erase Area: A blank area on magnetic tape produced when either the word count in a desired 1/0 command is zero, or when no rch instruction follows a wrs. This blank area is then approximately 3-34 inches long.

INITIALIZED, INITIALIZATION: The preliminary setup of an area in storage, or of key locations and status indications prior to the actual beginning of a routine or subroutine.

Initiate File: To start an 1/0 operation on a channel that is already active. This is performed at the completion of another 1/0 operation without allowing the channel to become dormant. I/O CHECK: Disk—A condition in a 7909 channel which can cause an interrupt. Tape—A condition in a 7607 channel which can cause a data channel trap if this type of trapping is enabled.

Intersystem Reserve Unit: A logical 1/0 device that is given a reserve designation by one system to indicate that the unit may not be returned to the availability chain. It may be referenced later by another system when called for using the same reserve designation.

MACHINE REGISTERS: Those registers in the machine which are saved prior to the execution of a routine, and restored at the end of that routine. These include the accumulator, MQ register, index registers, and the sense indicators.

MACHINE STATUS CONDITIONS: Those status conditions which are saved prior to the execution of a routine, and restored at the end of that routine. These may include some or all of the following: Transfer trapping mode, overflow conditions, divide check status, and I/O check status.

Noise Record: A record either read or written which contains less than three words. This would be equivalent to 18 BCI characters

Non-Data Select Operation: An I/O operation that does not cause movement of data. These operations include: Set density high or low, Rewind, Unload, Backspace Record, Backspace File, and Write End-of-File.

Non-Trap Time: That time when the program is not processing a data channel trap.

PARAMETER: A specification provided as input to the compiler when assembling the program which would affect the manner in which the compilation was performed. It may also be the specifications provided as input to a subroutine in the subroutine calling sequence.

Pending Flac, PF (Seek Issued Flac): Bit position 1 of word 3 of a disk ucb which is used to indicate when a seek has been issued and an attention signal is awaited.

PERMANENT READ REDUNDANCY: A redundancy has been encountered on tape and the number of recovery attempts specified in RDUNRT has been attempted unsuccessfully.

POINT TO, SET TO POINT TO: When referring to a location in storage or an index register, the term "point to" indicates that the register or location is loaded with the complement of the desired value. This value allows the use of an index register to easily step through a block of information starting at the desired location.

POSTING, POST COMPLETION: That operation performed by the user's Select Minus routine to check the operation that just caused a trap, and to set up the indicators for IOEX to determine what recovery actions should be taken if there was an error detected.

RESET: When referring to a switch or storage location, the term "reset" indicates a cleared or zero condition.

RESTART: The process of starting an operation over again, possibly from some point other than the start of the program.

SAVE: To pick up and store information which will be required later.

SAVE RECORD: That record written on sysut4 by the dump caller, which contains the contents of the machine registers and machine status conditions, and that portion of core storage which will later be occupied by the dump program. This information is needed for the dump program in compiling its print-out.

SCATTER LOAD ROUTINE: That portion of the system loader that enables one physical record to be broken up into smaller segments which can be loaded into different areas in core storage which are not necessarily adjoining.

SELECT ROUTINE, SEL+, SEL-: The routine provided to perform an I/O operation under control of IOEX. It is comprised of two sections: SEL+ and SEL-. SEL+ starts an I/O operation and returns control to IOEX, while SEL- posts completion of an I/O operation and then returns control to IOEX.

SET: When referring to a switch or storage location without specifying an actual value, the term 'set' indicates a non-zero condition.

SEQUENCE CHECK: A condition in the 7909 channel which can cause an interrupt.

STACKED JOBS: A series of jobs placed peripherally on the same input tape, which may call for different systems under the same monitor system, and which will be processed in sequence unless directed otherwise by the operator.

TAPE CLEANER: An operation performed by the read redundancy recovery routine in an attempt to recover when a bad record is detected. It consists of two extra BSR operations followed by two RDS operations which cause the tape to move the suspected bad area back into the vacuum columns. This is done in an attempt to dislodge any dirt particles which could possibly have caused the redundancy.

TRAP SUPERVISOR, IOEX: That portion of the Basic Monitor which remains in storage and receives control from each data channel trap or interrupt.

TRAP TIME: That time when the program is processing a data channel trap.

UNIT CONTROL BLOCKS, UCB'S: A series of four-word blocks in IOEX that contain the information pertaining to a particular 1/0 device. (See UCB layout in IBSYS Reference Manual, Form C28-6248.)

UNIT CONTROL WORD: One of the four words in the Unit Control Block.

UNUSUAL End: A condition in the 7909 channel which can cause an interrupt.

Appendix G — Autochart Cross Reference Tables

This section contains three cross reference tables which may be used with the AUTOCHART diagrams within this manual. Their use will enable a reader to locate any label appearing on any chart, all references to a particular entry connector, and all blocks where a subroutine is used.

Table A — Labels

This table lists all labels that appear on all charts. To the right of each label is the chart and block location where the label appears.

where the	e label appears	•		DATN3	CV J2	GNXD3	BAG3
				DENO1	CDA3	GNXE	BBC5
LABEL	BLOCK	LABEL	BLOCK	DEND2	CDA4	GNXH1	BAA4
(ACTIV	ABA2	А3	CGC2	DEN1A	CD83	GNXH2	BAB4
{ACTVX	ABB2	Δ4	CGA3	DEN1B	CDD3	GNXUN	8845
(BCD5R	ACH2	BCD5	ACJ3	DFIND	BGF3	IBASC	BMB2
(BCD5X	AC J2	BCVDEC	ACG3	DINLB1	BWD1	IBAS1	BJC4
(CVPRT	AC D2	BG1	ABJ3 CFA4	DKRCV	CPA2	IBAS2	BMH4
(DECVA	AC G2		CFA4	DMPER	BTF1	IBAS3	BMC5
(DECVD	ACF2	BG1+1	CFA3	DMPTO	BPD5	IBAS4	BME4
(FDAMT	ABE2	862	CFH2	DRCOLD	BAE2	IBATC	BFA2
(I BCDZ	ACK2	BG3	CFB4	DUEN1	CPC3	IBAT1	8 J 84
(NDSEL	ABC2	BG4	CFD3	DUEN2	CPC5	18CCC	BJE2
INDSLX	ABD2	BG5	CFG3	DUEN3	CPF5	IBCDIN	BEAL
(PAWSX	ACB2	BG6	CFE4	DUEN4	CPG5	IBDAT	BJC2
(PROUT	ACC2	CALIBI	BPA2	DUEN6	СРН5	IBDTC	BFA4
(STDPX	AC A2	CAL IB2	BPD2	DUEN7	CRE3	IBEDT	BNAL
(SYMUN	AC E2	CALIB3	BR A2	DUEN8	CRG3	IBERR	BJD3
ACTV	CAA2	CALPOW	BSAL	DUEN9	CRA5	IBLAST	BSD1
ACTX1	CBJ2	CAL1	BPB2	DUEX4	CRC5	IBLIS	ВЈН1
ACTX2	CBG4	CAL10Y	BRE1	DUE10	CRG5	IBMPT	BLC3
ACTY1	CBJ4	CALILY	BRE2	DUMP	BPA5	IBMP1	BLF2
ACT1	CAD2	CAL12Y	BRF5	EDT5	BNA2	IBMP2	BLF3
ACT3	CAES	CAL2	BPC2	END1	CC A5	IBMP3	BLH3
AC T4	CAH3	CAL2Y	BRD2	END10	CC E4	IBMP4	BLH1
ACT5	CBB3	CAL3	BPG2	END11	CED4	IBMP5	BL J1
ACT5A	CBE4	CAL3Y	BRC3	END12	CEH4	IBMTX	BLH4
ACT6	CBA2	CAL5Y	BSA4	END13	CE J3	IBNJB	BUAL
AC T8	CBF2	CAL6Y	BSA5	END14	CEB4	IBNJ1	BUE3
A1	CGA2	CAL7Y	BSD5	END15	CEG2	IBNJ2	BUA5
A 2	CGB2	CAL8Y	BSA3	END16	CEH2	IBNJ3	BUC5

BLOCK

BRC1

BAA3

BAA2

CWA5

СРНЗ

CVA1

CVG1

CVF2

LABEL

CAL9Y

CHN+1

COLD

CVPRT

DATCK

DATNS

DATN1

DATN2

LABEL

END2

END5

EXCND

FDAMT

GNSEK

GNXCH

GNXD1

BLOCK

CCC4

CEA4

CE J4

CPK1

CVA3

BBA4

BAC4

BAE3

LABEL	BLOCK	LABEL	BLOCK	LABEL	BLOCK	LABEL	BLOCK
IBNJ4	BUB3	IGCDE	BAJ2	OUT	ABK3	RSYUR	BYAI
IBNOIN	BCD2	INITL1	BWE3	PAUSE	CGA5 CTA2		
IBOF	BCE5			PAWS	CTB2	RSY1	BYD1
IBON	BCA3	INITL2	BWF3	PROUTO	CWB1	RSY2	BYF2
IBONC	BCB5	INITL3	BWA3	PRPOS	BT J3	RSY3	BYE2
IBPAC	BJF1	INITL5	BWC3	PRTAX	CWJ4	RUBC3	BL A2
IBREL		INITL6	BWC4		CWJ5	SAVE	ABG3
	BMA2	INITL7	BWD4	PRTX2		SAVE	CC A2
IBRES	BDA2	INITUS	BWA2	PRT1	CWC2	SAVE+1	CCB2 CWK1
IBRET	BTA2	INTRUP	BPA3	PRT2	CWF3		
IBREW	BHA2	ISSEK	CSB2	PRT3	CWA2	SPRT	CWA4
IBRN1	BHC4	ISSK	CSA4	PUNCHO	CWA1	STOP	CTA4
IBRS1	BDC4	ISSK1	CSA2	RCLD	BAH2	STOPD	CTD4
IBRUN	BHA4	1\$\$ x1	CSC4	RCOLD	BAG2	SYSTRA	BP J4
IBSPL	BCE4	ISSX2	CSK4	RCOLDX	8802	SYUCU	BXA1
IBSTP	BJA1	1881	CSF2	RDUN	CKA5	SYUC2	BXC1
IBSWC	BKA2	1883	CSE3	RDUN1	CKE5	SYUC3	BXJ2
18SW1	BJA4	1556	CSE4	RED10	CKA3	SYUC 5	BXA3
IBSW2	BKC4	1887	CSH4	RED12	CHA2	SYUC6	BXA4
IBSW3	BKF2	8221	CSJ5	RED14	CHA4	SYUC 7	BXC5
IBSYS	BC A1	IUEF1	BAG4	RED15	CHB3	TEST	CUA2
IBTCC	BJH2	IUEF2	BAC5	RED16	CHC2	TPOS1	BTE4
IBTPIN	BEA2	NDEND	CC A4	RED18	CHF2	TPPOS	BT A4
IBUNL	BJK2	NDERR	CLF5	RED20	CJA2	TPPS	BTA5
IBUNT	BL A1	NDSEL	CLAI	RED22	CJA3	TSTX1	CUG3
IBVAL	BVA3	NDSX1	CL J3	RED5	CJF4	TST1	CUE2
IBV2	вунз	NDSX4	CMJ4	RED50	CKA2	TST2	CUC2
IBV3	BVF5	NDS1+1	CMA2	RED6	CJG4	UPD1	CMG5
IBV7	8VD5	NDS3	CMB2	RED7	CKB2	UPD3	CMG4
IBWAT	BC J2	NDS4	CLB3	RED9	CJF2	UPD6	CMC4
IBWEF	BHA3	NDS5	CMA3	RGTPO	BNA3	UPD7	CME4
IBXCC	BGB2	NDS6	CLFI	RGT1	BND3	WEF4+1	CNB2
IBXC1	BGB4	NDTX1	CL J4	RGT2	BNE4	WEF7	CNE3
IFIND	BVA2	NDWEF	CNA2	RGT4	BNG3	WEF8	CNF5
IFND1	BVD2	NGADR	CRA3	RGT5	BNK3	XTRAP	ABH3
IFND2	BVC1	NOREC	CR A2	RGT7	BNF5	XTRAP	CCE2
IFND5	BVG1	NRTST	CKA4	RGT8	BNG4	X2	CGD5
IFND6	BVH2	NRT1	CKF4	RNXPO	BT J4	~ =	3305

Table B — Entry Connector References

This table lists all the off-page entry connectors that are referenced by any off-page exit connector on another chart. The entry connector is listed on the left, and all references to this connector appear to the right (and on subsequent lines if necessary).

(and on	anhseament lin	es if necessary).					
(and on	subsequent im	es if ficeessary /		CBA2	CAG2	CGA5	CFC4 CFF4
				C8B3	CAH3		CFG4
				CDDJ	UMITS		CJH4
	FROM	ENTON	FROM	CBG4	CAB3		6500
ENTRY	FRUM	ENTRY			CAF3	CHA2	CEB2
	0.011/	BDA2	BTH1		CAF5		
BAE2	BDH4				CAG5	CHF2	CED3
	DA 15	BEA2	BJE4		CAH5		
BBA2	BAJ5					CJA3	CCE4
BCA1	BBD2	BGB2	BNB1	CCD2	CWJ3	CMA3	CNH2
BCAI	BEF2		BTF2			CMAS	CIVITZ
	BEG3		BU J 4	CCE2	CGF5	CNA2	CMH2
	BEH4					CNAZ	Critiz
	BFF2	BGB4	BNG2	CDA2	CCG3	CPA2	CDH2
	BFK2	BJA2	BUB3			CFAZ	COME
	BFK4			CDA4	CPC2	CPB3	CRB2
	BHD4	BJA4	BK J2		CPJ5	CFB3	CRB3
	BHH4						UNUS
	внк4	BJB4	BF A2	CEA2	CCD4	CPC3	CRC2
	BJD2		BFA4			cres	CRC3
	BJF2		BFC4	CEA4	CCG4		CRE2
	BJG2		BFD2				0.122
	BJH2			CEB4	CDF4	CPC5	CRD2
	ВЈН3	BJC4	BHC4		CHF3	0.02	
	BJJ2		BK B2			CPE3	CRD5
	BJK2		BKD2	CEG2	CHE2	3.25	
	BKH4		BMC2			CRA2	CPJ1
	BLJ4		BME4	CEH2	CHB2		
	BLK4		BMG4		CHC2	CRA3	CPHI
	BMC5		611.10		ee.		
	BMD5	BJD3	BNJ2	CEJ3	CHC4	CRA5	CCC2
	BME5		BVH1		CHD5		
	BMJ5	2222	BGD4		CHE4	CUF2	CCH2
	BTC4	BPD2			CHG4 CHH4		
	BUAL		BRA2			CWA2	CCB2
	BUB1	BPJ4	BR B5		CJA2		
	BUB5	8734	BKD3		CPF3	CWJ5	CGG5
	BUCI	BRA2	BG J5				
	BUC 5	DRAZ	BP A1	CEJ4	CCB3		
	BUD4		BTC2		CDC4		
	BUEL		0.02				
	BUF4	BUA1	BB J2	CFA3	CE13		
	BUG3	0011	BT J3				
	BVDl			CFA4	CEJ4		
	0.0113	BUA5	BEA2		CGF2		
BCD2	88H3						

ENTRY

BVC1

BVG1

FROM

BGF4

BCD2

FROM

CGD2

CFH2

ENTRY

CFB4

CGA2

Table C — Subroutine Usage

This table lists the subroutine names as they appear in each subroutine block on the individual charts. The subroutine name and the block location where it may be found appears on the first line. To the right of this and on subsequent lines is a list of all chart and block locations where this subroutine is used.

SUBROUTINE CONN BLOCK SUBROUTINE CONN BLOCK	
	,
(ACTIV CAA2 BNE2 CVPRT CWA5 CJG2	
CKJ: {DECVA BUG1 CLG:	
CNG:	5
DATNS CVAL CDG2 (NDATA CLAL BWD2 CRA	
VIII.	•
(PAUSE CTA2 BTG1 FDAMT CVA3 BRF4	÷
(PROUT CWB1 BUH1 IBVAL BVA3 BAH4	
ACTV CAA2 BCH2 BFB2	
BNJ3 BFB4	+
ACTV+1 CAB2 CLG3 IFIND BVA2 BGG2	2
CLH2 INITUS BWA2 BAG!	5
BCDHC CWF2 BCE1	l
BCD5 CUF2 BGC3	
BGE2	2
BCVDEC BTH4 BKF4 CKG3 BKH4	
CKG3 BKH4 BME:	
BCVDEC-1 BTG4 BNB3	
CKD3	
CALIB1 BPA2 BDH2 ISSEK CSB2 CBE4	
CFE4	
CALPOW BSA1 BRD1 CPF3	3 .
BRE5	
BRF1 ISSK1 CSA2 CBE3	.
CRF3	3
CAL5Y BSA4 BRC1 MWR CWB1 CCA5	i
CAL6Y BSA5 BRE1 CUJ2	<u>:</u>
CALTY BSD5 BRE2 NDSEL CLA1 BHF4	
BHK4	
CAL8Y BSA3 BRF5	,

SUBROUTINE	CONN	BLOCK	SUBROUTINE	CONN	BLOCK
		BNF3 BUE3 BUG4	RDUN	CKA5	CAG5 CFG4
NDS3	CMB2	CLG4	RED10	CKA3	CEF3 CEH4
NRTST	CKA4	CEE2 CHD2			CHD3 CJA2 CJE4
PAUSE	CTA2	BCF3 BJG2 BJG3	RED50	CKA2	CNC4
		BUB2 BUG3 CSG5	RGTPO	BNA3	BNB2 BVJ2
PAWS	СТВ2	BEH4 CCB5 CDG3	RHBCD		BEA1
PROUT	CWB1	BBH4 BCE3 BEC2 BEH3	RSYUR	BYA1	BAE5 BFF5 BFJ2 BMH2 BMH5
		BJA2 BJB1 BJF3	SAVE	CCA2	CWK1
		BJG1 BJJ1	SPRT	CWA4	CWB3 CWC2
		BLA1 BLB2 BLB3 BLD2 BLD4 BLE3 BLG3	STOP	CTA4	BBJ4 BJB2 CJH2 CLH5 CNH5 CUK2
		BLK2 BLK4	SYSIDR		BEG3
		BTF1 BTJ3 BUB3	SYUCU	BXA1	BFA2 BFA4
		BUC2 BUF3 BUH4 BWC3 BWC4	SYUNCV		BLB4 BLK1 BTF4 CWB5
		CDC3 CPH5 CSH5 CIB4 CIE2 CTG2 CWD5	TEST	CUA?	ABA3 ABC3 CAA2 CLA1

${\bf Appendix\,H-Sample\,Autochart\,Symbols}$

FUNCTIONAL	SYMBOLS	•	FLOW AND CONNE	CTOR SYMBOL	s
			(REPRESENTATIVE S		- u 1
		x			
		Po	AT END OF LINE SHOP INT AT END OF OFF-PA CONNECTOR ALSO SHOP	AGE ENTRY WS FLOW DIR	ECTION
*****81*******	*				
* *	DBUCESSING				
	PROCESSING BLOCK	•	**	**	
*************			ç.	4 🚦	
			**	**	
	1		•		
_C1 * * _			####C4##	*******	
	DECISION	ON-PAGE ENTRY CONNECTORS	••x*	*	•
* * *	DECISION BLOCK	CONNECTORS	:	*	•
* * *		• •	****		:
	•		# C4 #		•
	•		***		:
****D1******			"D4 ^{**}	* .	. CONNECTORS
* *	HALT BLOCK	ON-PAGE EXIT CONNECTORS	•••	• •	CONNECTORS BOTH EXIT TO BLOCK C4 ON THIS CHART
**********	BLOCK	CONNECTORS			. CHART
	•		****		•
			* C4 * X	••	•
			‡ c	4 *	•
E!****		*	***	***	.x LINE JUNCTION
	MODIFICATION BLOCK	LINES	x	•••••	CROSSING LINE
************	BEUCK	*	### #F4		•
		• •	**.	•*	:
		•	:	x	
		*			*F4 * *_ *
F1****		OFF-PAGE	******	*******	•
	INPUT / CUTPUT BLOCK	ENTRY CONNECTORS	••X*	*X	
***************************************		*	: :	*******	N OFF-PAGE ENTRY CONNEC MAY ALSO BE REFERRED T BY AN ON-PAGE CONNECTO ON THIS CHART
		* *	*F4 *		ON THIS CHART
		*	::		
************		* *	* X GA *		
* * * * * * * * * * * * * * * * * * * *		* OFF-PAGE	A *	* * c	
i i	SUBROUTINE BLOCK	EXIT CONNECTORS		• • • • • • • • • • • • • • • • • • • •	*****
		* *	***** *	*	*ZB * * A1*
		* *	* A2* .	В	*.*
		- * *	*** X * *** *ZC * A	**	
H1***	1	*	**^	3° *	GOES TO EXIT CHART BLOCK
* *	LOGICAL CONNECTOR	*	-		A ZB A2
* *	CONNECTOR	* *			B ZC A3
****		π ₩ ¥			C ZB A1
		*			
		* *			
		- * *			
		* *			
		* * •			
		- * *			
		*			
		*			

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