File Number S360-36 (DOS)
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Program Logic

DOS Supervisor and Related Transients

Program Number 360N-CL-453

This reference publication describes the internal logic of the IBM Disk Operating System, Supervisor and Physical and Recovery Transient Programs. It is for persons involved in program maintenance and for system programmers altering the program design. Program logic information is not needed for normal operation of these programs. This publication is a supplement to the program listing.

Effective use of this manual requires an understanding of IBM System/360 or System/370 operation and of IBM Disk Operating System control and service programs, macro instructions, and operating procedures. Reference publications for this information are listed in the Preface of this manual.

DOS Release 25

Third Edition (June 1971)

This publication was formerly titled IBM System/360 Disk Operating System, Supervisor and Physical Transients Program Logic Manual. Although titles of some DOS publications (including this one) have been simplified, the change does not affect the contents of the publication.

This edition applies to Release 25 of IBM Disk Operating System and to all subsequent releases until otherwise indicated in new editions or Technical Newsletters. Changes are continually made to the specifications herein; before using this publication in connection with the operation of IBM systems, consult the latest System/360 and System/370 SRL Newsletter, GN20-0360, for the editions that are applicable and current.

This edition, GY24-5151-2, is a major revision of, and obsoletes, GY24-5151-1.

Summary of Amendments

This edition documents addition of, and changes to, the following information: PCIL (Private Core Image Library), JAI (Job Accounting Interface), System/370 RMS (Recovery Management Support), IDRA (Independent Directory Read-in Area), OLTEP (On-Line Test Executive Program), EREP (Environmental, Recording Editing, and Printing) enhancements, IBM 3211 Printer, System/360 Model 22, and certain maintenance enhancements.

Changes or additions to the text and illustrations are indicated by a vertical line to the left of the change.

A form for reader's comments is provided at the back of this publication. If the form has been removed, comments may be addressed to IBM Laboratory, Publications Department, P.O. Box 24, Uithoorn, Netherlands. Comments become the property of IBM.

This Program Logic Manual (PLM) is a detailed guide to the IBM Disk Operating System supervisor and physical and recovery transient programs. It supplements the program listings by providing descriptive text and flowcharts.

The lists that follow give the titles of companion system control PLMs, prerequisite, and related publications.

> Note: Although titles of some DOS publications have been simplified, the change does not affect the contents of the publications.

For overall system control logic description, this PLM is to be used with six other PLMs:

- Introduction to DOS Logic, GY24-5017
- DOS IPL and Job Control, GY24-5086
- DOS Librarian, GY24-5079
- DOS Linkage Editor, GY24-5080
- DOS Logical Transients, GY24-5152
- DOS System Service Programs, GY24-5153

Prerequisite to the effective use of the seven PLMs are the following publications:

- IBM System/360 Principles of Operation, GA22-6821
- DOS System Control and Service, GC24-5036
- IBM System/360 Disk and Tape Operating Systems, Assembler Language, GC24-3414

Publications related in subject matter to the seven system control PLMs are:

- DOS Supervisor and I/O Macros, GC24-5037
- DOS System Generation, GC24-5033
- DOS Operating Guide, GC24-5022
- DOS Messages, GC24-5074
- DOS Data Management Concepts, GC24-3427

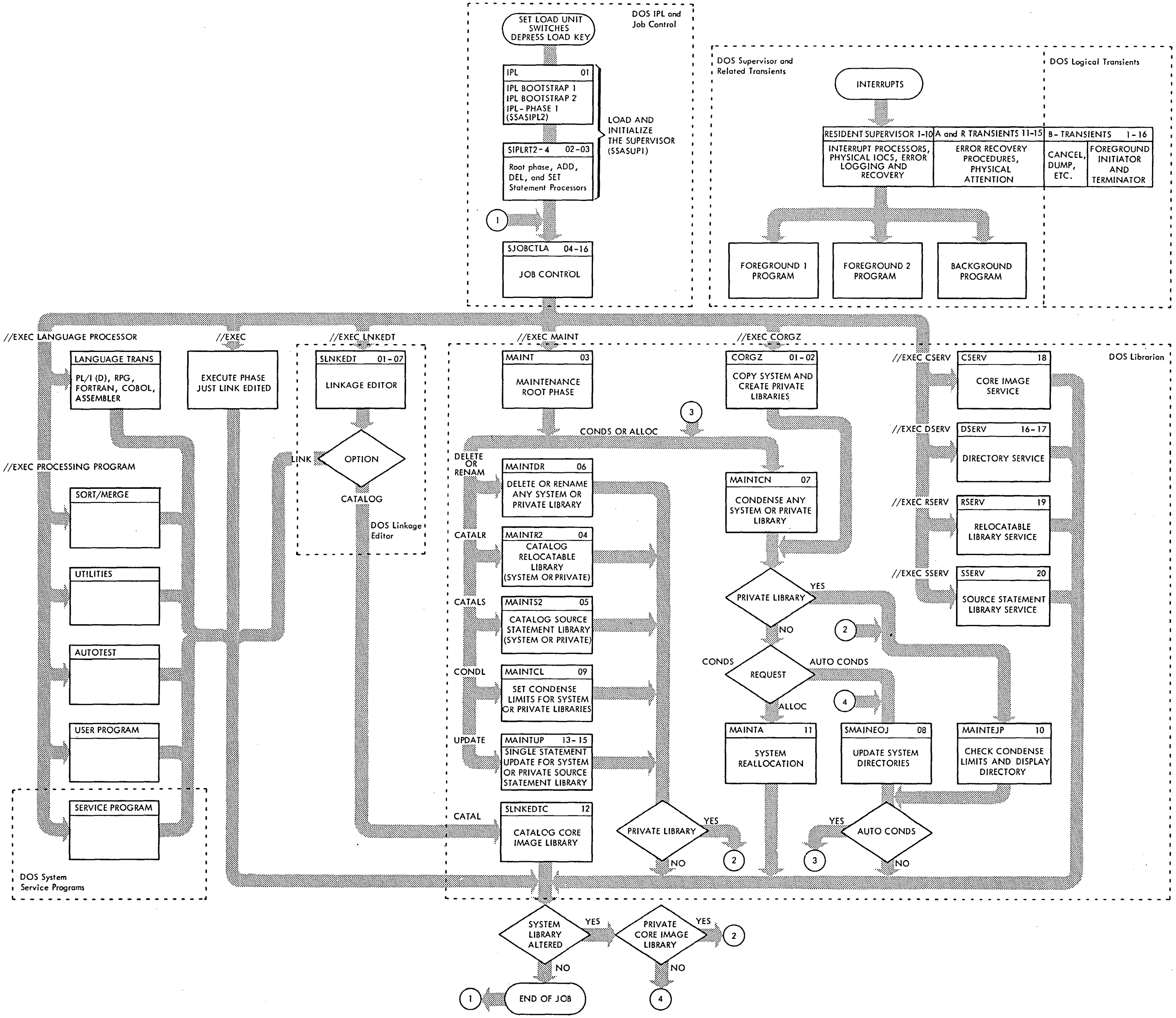
Titles and abstracts of other related publications are listed in the IBM System/360 and System/370 Bibliography, GA22-6822.

This manual consists of seven major sections. The first section is an introduction to the supervisor and transient programs. The next section describes the generation and organization of the supervisor. The next five sections describe the detailed operation of the supervisor, physical IOCS, physical transients, and error logging and recovery. The last section of the manual, the appendixes, contains the label list, error messages, microfiche cross-reference index, and other references for use in analyzing program details.

The flowchart symbols used in this manual conform with the flowcharting standards of the American National Standards Institute, Inc. Numerals, such as 00, identify the program or general level flowcharts. The detailed flowcharts are identified by letters AA through ZZ. See Appendix F for an explanation of the flowchart symbols.

FIGURES

Chart 00. Disk Operating System Program Flow



The resident version of the IBM System/360 Disk Operating System (DOS), System Control, provides disk operating system capabilities for 16K and larger System/360 configurations. At least one IBM 2311, 2314, or 2319 DASD device is required.

Systems larger than 16K can benefit from this 16K package if they do not require the expanded functions of the larger disk operating system packages offered by IBM. The system is disk resident, using the IBM 2311, 2314, or 2319 DASD device for on-line storage of all programs. Depending on the requirements of the particular application, the system can be expanded to include all processing programs used to perform the various jobs of a particular installation, or it can be tailored to a minimum system to control a single program.

The operating system includes the following components: CPU, input/output channels, input/output control units, input/output devices, microprogramming, system control programs, support programs, user programs, user data files, teleprocessing capability, and multiple programming capability. This PLM discusses the supervisor and the physical transients that are part of system control. The supervisor and physical IOCS are specifically designed for a particular configuration by means of a one time assembly (generation time). They require reassembly only if the configuration changes.

The supervisor and physical IOCS provide the required interface between the program being executed and the other components of the operating system. The program currently being executed is identified to the operating system as the current program. The last program interrupted is identified as the problem program. The problem program or the current program can be, at any given time, either a system control program, a support program, or a user program.

The supervisor operates with problem programs when job processing (problem program execution) occurs. The supervisor is divided into two parts:

1. The resident part, called the supervisor nucleus;
2. The nonresident part, called a supervisor transient.

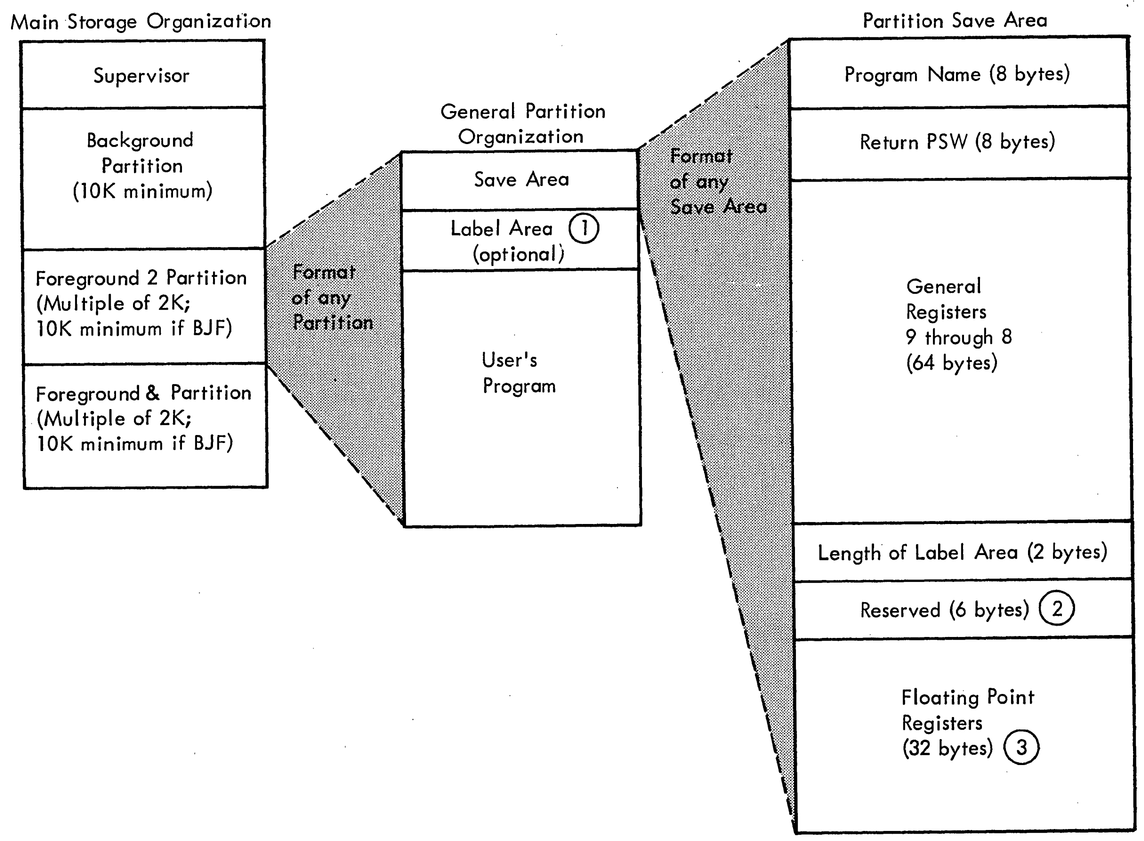
The nucleus is loaded into main storage at IPL time and remains there throughout job processing. Transients are loaded, as needed, from the core image library of SYSRES. When one transient has finished performing its service, it can be overlaid by another required transient. This technique makes maximum use of main storage allotted to the supervisor. The basic functions performed by the supervisor are:

- Storage protection (required for multiprogramming).
- Interrupt handling.
- Channel scheduling.
- Tape error statistics recording.
- Device error recovery.
- Operator communications.
- Program retrieval (fetch or load).
- End-of-job processing.
- Timer services (optional).

Each installation must generate its own custom made supervisor by means of a one time assembly. Supervisor generation macros control the generation of the supervisor control program. The user must reassemble the supervisor if its functions are to be modified (for example, when an installation configuration changes).

MULTIPROGRAMMING

For systems with main storage equal to or greater than 24K, disk operating system offers multiprogramming support. This support is referred to as fixed partitioned multiprogramming, because the number and size of the partitions is defined during system generation. After system generation, the operator may redefine the size of the partition to meet the need of a specific program. Figure 1 shows the relationships among programs in a multiprogramming environment.



Notes:

① Standard tape labels = 80 bytes; sequential DASD and DTFPH (MOUNTED = SINGLE) = 0 bytes; and DTFIS, DTFDA and DTFPH (MOUNTED = ALL) = 84 bytes + 20 bytes per extent statement.

② Job start time, for time stamp, is stored in last 4 bytes of this area (bytes 84-87) when BJF option is specified.

③ Floating point register save area is required only when floating point feature is specified for supervisor generation.

Figure 1. Multiprogram Main Storage Organization

BACKGROUND VS FOREGROUND PROGRAMS

Foreground and background are the two types of problem programs in multiprogramming. Foreground programs may operate in either the batched-job mode or in the single-program mode. Background programs and batched-job foreground programs are initiated by job control from the batched-job input streams. Single-program foreground programs are initiated by the operator from the printer-keyboard. When one completes, the operator must explicitly initiate the next program. Foreground and background programs initiate and terminate independently of each other.

The system can operate one background program and one or two foreground programs simultaneously. The supervisor controls priority for CPU processing, giving foreground programs priority over background programs. All programs operate with interrupts enabled. When an interrupt occurs, the supervisor gains control, processes the interrupt, and gives control to the highest priority program that is in a ready state.

Control is taken away from a high priority program when that program encounters a condition that prevents further processing until a specified event has occurred. Control is taken away from a lower priority program at the completion of an event for which a higher priority program is waiting. When all programs in the system are simultaneously waiting (i.e., no program can process), the system is enabled for interruptions in the wait state.

The supervisor receives and processes interruptions. When an interruption satisfies a program's wait condition, that program becomes active and competes with other programs for CPU processing time.

In addition to at least 24K positions of main storage, multiprogramming support requires the storage protection feature.

If the batched-job foreground option is selected when the system is generated, all types of programs may be run as foreground programs. (Specifying the option causes the generation of individual communications regions for each partition.)

ASYNCHRONOUS PROCESSING

Asynchronous processing, also known as multitasking, provides a multiprogramming facility within any or all of the partitions of an MPS supervisor. An asynchronous program consists of two parts:

1. The main program (maintask) that appears in the EXEC statement.
2. One or more subprograms (subtasks) that must be in main storage in the same partition as the maintask.

The maintask initiates the subtask(s) via the ATTACH macro instruction. I/O overlap is facilitated because subtasks have higher priority than the maintask for CPU time within the partition. The subtasks are assigned priority in the order they are attached, the first attached subtask having the highest priority and the last attached subtask having the lowest priority. The partitions' priorities are unchanged.

Each subtask operates independently of the maintask and has its own registers and save area. Communication and synchronization between subtasks is accomplished by use of the POST and WAIT/WAITM macro instructions. Protection of shared data areas (resources) is accomplished by the ENQ macro and the corresponding DEQ macro.

Because only one set of symbolic I/O units exists for each partition, I/O assignments for all tasks must be made prior to the EXEC statement of the maintask.

A minimum of 24K bytes is required for multiprogramming, BTAM, 1412/1419/1255/1259 MICR document processing, and for assigning system I/O files to disk. The QTAM Message Control program requires a minimum of 32K bytes of main storage. The use of QTAM with two batched-job-foreground partitions requires a minimum of 64K bytes.

This section discusses:

- Techniques used in supervisor generation.

- Generation macros and their optional operands.

- The relationship between the outer generation macros and the inner macros that generate the bulk of the supervisor code.

- The organization of the supervisor, including the nucleus code, tables, and information blocks.

To understand macro definition language structure and usage, refer to the DOS Supervisor and I/O Macros publication listed in the front of this manual. With this information, an SSERV listing of the supervisor generation macros, and the PLM material, the reader can identify those sections of code that are generated for his own supervisor program. The basic instruction used in macro definition language is the AIF (ask if) statement. The following examples show how it is used:

1. AIF (&BG20).MP1
   This instruction asks if multiprogramming support is required. If BG20 is on, the next significant line in the SSERV listing is found at the label, .MP1, and any intervening code is rejected by the language translator. If BG20 is not on, the next sequential line on the SSERV listing is significant.

2. AIF (NOT &BG20).NO23
   This instruction tests the opposite status of the BG20 switch. In this case, the line at location .NO23 is the next significant line in the SSERV listing only when BG20 is not on; that is, only when multiprogramming support is not required.

A detailed description of the AIF instruction and the other instructions used in the SSERV listing is given in the Systems Reference Library publication, IBM System/360 Disk and Tape Operating Systems, Assembler Specifications, GC24-3414.

SUPERVISOR GENERATION

The supervisor is assembled with a series of macros that describe the installation's functional requirements and its configuration. At system generation time, a source deck containing the supervisor generation macros is assembled into an object deck. The job control program places the results of the assembly on SYSLNK (I/O device for the linkage editor program) and calls the linkage editor program. The deck is link-edited and cataloged to the core image library on SYSRES. A corresponding core image library directory entry is posted for the new supervisor, and the Program Information Department (PID) supervisor directory entry is deleted.

Normally, a condense maintenance program would then be executed to remove the PID supervisor from the core image library. The procedures and sequence of events used in system generation are described in the publication, DOS System Generation, GC24-5033.

Whenever a new supervisor generation is required, take these general steps:

1. Punch the macro instructions and the selected optional operands into a card deck.

2. Execute an assembly and put the object modules on SYSLNK (using an include control statement with no operand) via the job control program.

3. Link-edit the new supervisor, cataloging it to the core image library, deleting the old supervisor directory entry, and posting the new supervisor directory entry. System control programs must be cataloged in the same run as the supervisor.

4. Re-IPL with the new supervisor.

5. Execute a maintenance program to condense the core image library, deleting the old supervisor program.

Figure 2 shows the allocation of storage for the generated supervisor.

0 ← Reset to Zeros after IPL → 13									Low Core
14 Comm Region Address	18 External Old PSW	20 SVC Old PSW	28 Program Old PSW	30 Machine Check Old PSW	38 I/O Old PSW	40 CSW	48 CAW	4C BG Job Duration	
50 System Timer	54 System Timer of Day	58 External New PSW	60 SVC New PSW	68 Program Check New PSW	70 Machine Check New PSW	78 I/O New PSW			
80 Diagnostic Scan-out Area (System/360) or Permanently Allocated Low Core (System/370)									
SUPERVISOR NUCLEUS									Nucleus Code
General Cancel Routine	Save Users Registers (SVEREG) Routine								
General Exit Routine (Task Selection)									
Background Communications Region and Extention									
MCRR or RMS Linkage Area	General Entry Routine								
JAI Common Table	SVC Interrupt Handler								
Channel Scheduler	Start I/O Routine								
I/O Interrupt	Machine Check Interrupt (S/360 only)								
Unit Check	Error Recovery Exits								
Attention Task	Error Recovery Block								
PC, OC, AB, and IT Tables	PTA, IDRA, and LTA Save Areas								
Supervisor Constants	Fetch Subroutines								
SVC Interrupt Routines									
Program Check Routines	External Interrupt Routines								
Resident Device Error Routine									I/O and Information Blocks
Option Routine	SYSLNK DIB								
MICR Interrupt Routines	SYSCLB LUBs								
2nd Part of All Bound PIB	2nd Part of BG PIB	2nd Part of F2 PIB	2nd Part of F1 PIB	2nd Part of Attn PIB	2nd Part of Quiesce I/O PIB	2nd Part of Supervisor PIB			
2nd Part of Subtask PIBs Note 2	1st Part of All Bound PIB	1st Part of BG PIB	1st Part of F2 PIB	1st Part of F1 PIB	1st Part of Attn PIB	1st Part of Quiesce I/O PIB			
1st Part of Supervisor PIB	1st Part of Subtask PIBs Note 2	Channel PUB Pointer Table	SVC Interrupt Table	Channel Queue	LUBID Table	REQID Table			
LUBDSP Table	TSKID Table	FOCL	PUB Table	FAVP	JIB	Disk Information Blocks (with SYSFIL)			
TEB/TEBV	Console Buffers	FICL	NICL	LUB Table	Track Hold Table Note 3	CBF Patch Area			
PTO Patch Area	JAI Partition Tables, User Save Area, Label Area								
(System/360)	Machine Recording and Recovery, MCRR Patch Area								I/O Error Logging and Recovery
or (System/370)	RMS Monitor, RMS Resident Routines, RTA (R-transients) $$R								
SDR Communications Region	I/O Error Logging (OBR/SDR) Routines								
Foreground 2 Communications Region	Foreground 1 Communications Region								Additional Comm Regions
F2 Comreg Extension	F1 Comreg Extension								
ASCII Translation Tables	SAB								
Patch Area	IDRA								
Logical Transient Area (B-transients) $$B									Logical and Physical Transients
Physical Transient Area (A-transients) $$A									
CE Table	CE Area	BG Program Save Area							
Problem Program Area									

Note 1: For PSW format see Figure 39. For CSW format see Figure 41. For CAW format see Figure 40.
Note 2: Total of 9 subtasks PIBs generated.
Note 3: Maximum of 225 entries generated.

Figure 2. Supervisor Storage Allocation

SUPERVISOR GENERATION MACROS

The list of supervisor macros and optional operands in Figure 3 gives the reader:

- Supervisor generation macro names.
- Required macro sequence (as listed in Figure 3).
- Macro parameters. (Where there is an assumed value, that value is underlined.)
- A brief description of what the generated macro does.
- A brief description of what the individual parameter options do.

MACRO RELATIONSHIPS

The code generated by the assembler for any selected supervisor generation is a function of the generation macros described in Figure 4 and of a group of inner macros called by the generation macros. The primary purpose of the generation macros is to set global values, based on parameter options, that can be tested by the inner macros. These macros then generate the bulk of the supervisor code. The specific instructions assembled depend on the global settings. Some of the generation macros also generate code; however, these can be treated as exceptions and are identified in this subsection.

The most important global values used in supervisor generation are the B-globals. Therefore, this subsection emphasizes the generation macros that establish B-global values. However, some A-globals that are tested in the same manner as B-globals are also described in this subsection. C-globals are not described. Two figures in this subsection show macro relationships. Figure 5 shows the code generated, if any, and the globals set, if any. Figure 6 indicates the on-off conditions of the globals.

ORGANIZATION

The physical organization of the supervisor depends on the sequence of the supervisor generation macros. The sequence is predetermined and cannot be changed by the user. The logical organization depends on the parameter options selected at generation time. Figure 2 is a main storage map of the assembled supervisor, which illustrates the supervisor physical organization in four major areas:

- Low Core
- Nucleus Code
- I/O Tables and Information Blocks
- Logical and Physical Transient Areas

The logical organization is not described in this manual because of the variety of options available. You must determine the logical organization for individual supervisor generations. By using the program level flowcharts to point to the detailed flowcharts, you may select the correct group of flowcharts for the desired generation.

LOW CORE

The first 128 bytes of main storage contain identical assignments for System/360 and System/370. The systems differ starting with byte 128. On System/360, DOS reserves a diagnostic scan-out area under conditions described in this section. On System/370, DOS allocates bytes 128-511 for specific hardware requirements. Low core assignments are made for both systems by DOS, and the user should not alter them.

The main storage locations that make up low core can be classified as PSWs, CSWs, CAWs, and main storage areas. PSWs, CAWs, and CSWs are described in the section Physical Input/Output Control System (PIOCS). The main storage areas include:

Byte (hex)	Function
0-3	System/360: Contains SEREP error codes 00 and 01, or WAIT error codes 03-60 (Figure 3).
0-3	System/370: Contains SEREP error codes A to I (X'C1' to X'C9'), or WAIT error codes 03-60 (Figure 3).
0-4	Message area when SYSLOG is disabled.

Byte 0	Byte 1	Byte 2	Byte 3	Explanation
SYSTEM/360 SEREP Codes:				
X'00'	X'E2'	Not used	Not used	Machine check. Load SEREP. Re-IPL system.
X'01'	X'E2'	Reserved	Reserved	Channel failure: interface or channel control check. Load SEREP. Re-IPL system.
SYSTEM/370 SEREP Codes:				
X'C1'	X'E2'	A, I, S*	Not used	Unrecoverable machine check.
X'C2'	X'E2'	Not used	Not used	Unrecoverable channel failure during RMS fetch.
X'C3'	X'E2'	A, I, S*	Not used	Channel failure on SYSLOG when RMS message scheduled.
X'C4'	X'E2'	A, I, S*	Not used	Reserved (should not occur)
X'C5'	X'E2'	A, I, S*	Not used	Channel failure; ERPIBs exhausted.
X'C6'	X'E2'	A, I, S*	Not used	Channel failure; two channels damaged or a damaged channel situation occurred while RMS was executing an I/O operation.
X'C7'	X'E2'	A, I, S*	Not used	Channel failure; system reset was presented by a channel.
X'C8'	X'E2'	A, I, S*	Not used	Channel failure; system codes in ECSW are invalid.
X'C9'	X'E2'	A, I, S*	Not used	Channel failure; channel address invalid.
SYSTEM/360 and SYSTEM/370 WAIT Codes:				
X'03'	X'E6'	Channel	Unit	DOS unrecoverable disk error during program fetch. The first six sense bytes are placed in hex bytes 5-A. Re-IPL system.
X'04'	X'E6'	Not used	Not used	Cancel condition has occurred while performing a Supervisor function (not a Supervisor detected problem-program error). Normally a Program Check while in Supervisor State. Re-IPL System.
X'05'	X'E6'	Channel	Unit	I/O Error Queue has overflowed as the result of an I/O error on a program fetch channel program. Re-IPL system.
X'06'	Not used	Not used	Not used	Reserved (should not occur).
X'07'	X'E6'	Channel	Unit	IPL I/O error. Channel and unit indicate whether SYSRES or communication device. Re-IPL system.
X'08' to X'60'		Channel	Unit	Error recovery messages. Refer to OP messages in DOS Messages, found in Preface.

*Note: A (X'C1') = SYSREC error recording unsuccessful.
I (X'C9') = SYSREC error recording imcomplete.
S (X'E2') = SYSREC error recording successful.

Figure 3. Low Core Error Bytes

14	When MPS=NO or YES: Contains address of background communications region.
	When MPS=BJF: Contains address of communications region of the active partition.
50	Contains the system timer used with microprogramming.
54	Contains system time of day set by job control and IPL, updated by the supervisor timer routine (optional).
80	Beginning of the System/360 diagnostic scan-out area or the System/370 permanently allocated low core.

System/360 Diagnostic Scan-Out Area

The DOS supervisor for the System/360 records machine check interrupts and channel inboard errors in the diagnostic scan-out area. The area is generated at SYSGEN and begins at byte 128 (X'80') of low core. The length of the area depends on the SYSGEN option MCRR (Machine Check Recording and Recovery).

When MCRR=NO, the diagnostic scan-out area is 12 bytes long. When MCRR=YES, the length of the area is model-dependent:

Model 30 area, 12 bytes
Model 40 area, 196 bytes
Model 50 area, 168 bytes

Note: System/370 does not generate a diagnostic scan-out area to diagnose interrupts and errors.

System/370 Permanently Allocated Low Core

Byte	Function
0-127	Identical to System/360
128-167	Reserved
168-172	Channel ID
173-175	ICEL pointer
176-181	Limited channel logout (ECSW)
182	Extended channel status
183-184	Validity
185-187	I/O address
188-231	Reserved
232-235	Machine check interruption code
236-247	Reserved
248-251	Failing-storage address
252-255	Region code
256-351	Fixed logout area
352-383	Floating-point register save area
384-447	General register save area
448-511	Control register save area

NUCLEUS CODE

The main storage map (Figure 2) illustrates the major routine and subroutine organization of the supervisor. Specific instructions are included or omitted depending on generation options. This manual describes the disk error recovery as the resident error recovery routine.

The background communications region does not change from generation to generation. Figure 8 illustrates the structure of the communications region. The starting address of the communications region is made available to a user in general register 1 through the COMRG macro. For certain options, extensions to the communications regions are generated at the end of the I/O Tables by the SEND macro. Figure 9 shows the contents of the communications region extensions.

I/O TABLES

The I/O tables (See Figure 7) that comprise this section of the supervisor establish the interface between a specific program and the hardware channels. For every device used on the system, there must be a PUB (Physical Unit Block). For every logical unit name (SYSXXX) used, there must be a LUB (Logical Unit Block). When an I/O request is made, an entry is made in CHANQ (the channel queue). The entry contains a CCB (Channel Command Block) address which, in turn, points to a CCB that contains a code (LUB table index) for the logical unit name.

The supervisor processes the request when possible on the device assigned to the logical unit. If the TEB option was selected at generation time, counts of tape errors by unit are kept in the TEBs (Tape Error Blocks). If the TEBV option was selected, counts of tape errors by volume are kept in TEBVs (Tape Error Blocks by Volume).

To understand the interaction among the various I/O tables, review the classification and sequence of the symbolic unit references (SYSXXX). The systems class (symbolic unit names reserved for system use) is made up of:

1. SYSRDR
2. SYSIPT
3. SYSPCH
4. SYSLST
5. SYSLOG
6. SYSLNK
7. SYSRES

8. SYSSLB
9. SYSRLB
10. SYSUSE
11. SYSREC
12. SYSCLB

The programmer class (symbolic unit names reserved for programmer use) is made up of SYS000 to SYS221 with MPS or SYS000 to SYS243 with no MPS. This class is subdivided into these classifications:

1. Background logical unit class (minimum of 10).
2. Foreground two logical unit class (minimum of 5).
3. Foreground one logical unit class (minimum of 5).

PUBs are built at system generation or IPL time. LUBs are built at system generation time. PUBs are assigned to LUBs at system generation or by the job control program, or by the single program initiator. CHANQ, TEBV, and TEB entries are built and processed by the supervisor program. Figure 7 shows the I/O table interrelationships

INFORMATION BLOCKS AND OTHER TABLES

To accomplish functions such as exit selection, DASD file protection, and record identification, the supervisor program requires pertinent information. At supervisor generation time certain main storage locations are set aside and, in some cases, initialized to supply the required information. The basic information blocks and their respective functions are:

PIB (Program Information Block): The first half of a PIB retains program status information for user and supervisor programs. It supplies routing information in a multiprogramming environment to allow selective program return and it contains pointers and switches used by the supervisor program (Figures 15 and 16). The second half contains the address of the area communications region and the system LUB Index, priority of the PIB address of the termination ECB, and the PIB displacement (Figure 14).

DIB (Disk Information Block): The DIB is built at generation time if the SYSFIL option was selected. It performs a record keeping function on system class units assigned to a DASD. The DIB contains the current seek address when the system is operating in a batched job environment. The block is initialized by job control with extent information and updated by physical IOCS. When the PCIL option is used, the DIB is updated each time the PCIL is assigned. It is located in the IOTAB macro expansion. (See Figure 12.)

JIB (Job Information Block): The JIB contains one of the following:

- LUB entry of the standard assignment when a temporary LUB assignment is made.
- PUB pointer for an alternate LUB assignment.
- Extent information when DASD file protection is selected as a supervisor generation option.

Extent information is supplied by the program initiator and logical IOCS open transient routines. The supervisor can then perform the file protect function for the specified file limits. File protection does not include supervisor and transient originated I/O. (See Figure 19.)

SAB (Seek Address Block): Contains a four-byte address (BCCH) for each DASD when the seek separation feature is specified. It also has a fifth byte which contains a Track Hold Table pointer or X'FF' if both SKSEP and TRKHLD were generated, or X'00' if TRKHLD was not specified. The current address is maintained in the SAB for the particular device. Each SAB is referenced by its corresponding PUB.

Other Tables: Several optional tables are built at generation time within the supervisor:

- CE Table - Generated in the SEND macro expansion. Contains 4-byte pointers, each of which points to a hook within the supervisor that accesses the CE serviceability routines. Provision is made for up to ten entries in the CE table. See Figure 28 for an illustration of this table, how it is accessed, and how the hooks are used.
- PC, OC, IT, and AB Tables - Generated in the SGTCON macro expansion. These four tables (program check, operator communications, interval timer, and abnormal termination) contain addresses supplied by the user with a STXIT macro. (See Figure 13.)
- CBF Table - Generated in the LUBGEN macro expansion. This table holds the CCW, CCB, partition ID, and data for buffered I/O requests (SVC 0) to SYSLOG where SYSLOG is an IBM 1052. (See Figure 22.)

- DTF Address - Generated in the SMICR macro expansion. These two tables (PDTABA and PDTABB) contain pointers, DTF addresses, and other information for handling external interrupts on magnetic ink character recognition devices. (See Figure 10.)

- ASCII-EBCDIC and EBCDIC-ASCII translation tables - Generated in the SEND macro expansion if the ASCII=YES optional parameter is specified. (See Figure 27.)

Additional Communications Region: The communications regions for the two foreground partitions are located at the end of the I/O tables. Their format is identical to that of the background communications region. If generated, the background communications region extension immediately follows the BG communications region within the nucleus of the supervisor. Foreground extensions follow the F2 and F1 communications regions (see Figure 2). The extensions are generated if any of the following options are specified: CE, AP, AB, TRKHLD, MCRR, TEBV, EVA, ASCII, SPARM, or ERRLOG. The extensions are also generated if the MODEL option specifies a System/370 CPU. See Figure 9 for the format of the communications region extensions.

SDR Communications Region: Generated in the SEND macro expansion when the ERRLOG option is specified at system generation. This region provides an interface among job control, the supervisor, and various A-transients when the OBR/SDR functions are in use. See Figure 26 for the SDR communications region format, and Figure 2 for the location of the region.

Transient, CE, and Save Areas: Main storage locations are reserved in the area preceding the problem program area for:

1. Logical ($$B) transients - 1200 bytes.

2. Physical ($$A) transients - 552 bytes.

3. Recovery ($$R) transients - 1000 bytes.

4. CE area (only if CE=YES or n) - 600 bytes minimum.

5. Background save area - 80 bytes (112 with floating point feature). The BG save area contains five subfields: PSW, general registers (9 through 8), label length, 6 reserved bytes, and optionally floating point registers (0,2,4,6). (See Figure 1.)

IDRA (Independent Directory Read-in Area): IDRA is a supervisor option that generates a 368 byte supplemental area to reduce contention for the physical transient area. IDRA reads core image library directories for all fetch and load operations. Thus, the PTA is left free to perform ERP.

Name	Macro Description	Parameter = Option	Option Description
SUPVR	Describes system environment	SYSTEM = DISK	System residence (SYSRES) must be on a disk device.
		MPS = NO YES BJF	Indicates multiprogramming support. If YES or BJF is specified, the system generated is capable of supporting two foreground programs. YES or BJF must be specified if TP = QTAM. If BJF is specified, the system generated will support batched mode for both foreground partitions. Multiple communications regions are generated only if MPS = BJF. MPS = YES is implied if MPS = BJF.
		TP = NO BTAM QTAM QTAMn	Specify if Basic or Queued Teleprocessing Access Method (BTAM or QTAM) is desired. When QTAM is specified, SVC support for BTAM is also included. To process QTAM in a system with asynchronous processing support, QTAMn must be specified where n is the maximum number of active QTAM message processing programs in the system. From 2 to 12 programs may be specified with a default value of 2.
		ERRLOG = NO YES RDE n (YES, RDE) (n, RDE)	Specify if the Outboard Recorder (OBR) is to record data pertinent to an error that cannot be retried or corrected after a standard number or retries. Also, specify if the Statistical Data Recorder (SDR) is to record the cumulative error status of an I/O device. n defines the number of records required on the SDR partition of the Recorder File, where n is any number equal to, or greater than, the number of PUBs. YES indicates a number of SDR records equal to the number of PUBs. ERRLOG = RDE supports the Reliability Data Extractor for System/370 only. If RDE is specified without YES or n, YES is assumed. ERRLOG is assumed YES for all System/370 MODEL options if it is not specified.
		MCRR = NO YES	Specify if MCRR is to record pertinent data after a machine check, channel control check, interface control check, or channel data check. MCRR analyzes collected data and cancels the damaged partition(s). No attempt at error retry is made. This parameter is valid only for Models 30, 40, and 50.
		MICR = NO 1412 1419 1419D	Indicates whether the supervisor is to support magnetic ink character readers or optical reader/sorters. If both 1412s and 1419s are present, indicate 1419. 1419D/1275 indicates Dual Address Adapter 1419s. If 1412/1419/1255/1259/1270/1275s are attached to the multiplexor channel, the PIOCS parameter BMPX = YES is not supported.
		AP = NO YES	Indicates asynchronous processing support. This provides the user with the facility to write dependent programs to run concurrently within a partition and still maintain the partition independency of MPS. If YES is specified, global BG20 (MPS = YES or BJF) is forced on whether or not it was specified.
		EU = NO YES RELOC	EU = YES specifies: IBM 1401/1440/1460 Emulator for Models 25, 30, or 40; IBM 1401/1440/1460 or 1410/7010 Emulator and mixed parity tape processing for System/370 CPUs. If foreground emulation is desired on any model, MPS = BJF is required. Foreground emulation on Model 40 requires EU = RELOC.
		ASCII = NO YES	Indicates whether the supervisor is to support the American National Standard Code for Information Interchange (ASCII). YES adds 512 bytes to supervisor size.
CONFG	Describes hardware features	MODEL = 30 nn nnn	nn defines the System/360 model number (Model 30, 40, or 50 must be entered if MCRR option is specified). nnn defines the System/370 model number. (A System/370 model causes generation of MCAR/CCH support. MCRR is not compatible with System/370.)
		SP = NO YES	Indicates the storage protection feature is desired. YES is assumed if MPS = YES or BJF in the SUPVR macro.
		DEC = NO YES	Decimal feature.
		FP = NO YES	Floating-point feature.
		TIMER = NO YES	Timer feature. If TIMER = YES the supervisor macro GETIME is supported.
		PORT = NO 155	Causes Model 155 MCAR/CCH functions if MODEL = 145.

Figure 4. Supervisor Macros (Part 1 of 5)

Name	Macro Description	Parameter = Option	Option Description
STDJC	Sets standard values for job control variables.	DECK = $\left\{\begin{matrix}\underline{\text{YES}}\\ \text{NO}\end{matrix}\right\}$	Output modules on SYSPCH.
		LIST = $\left\{\begin{matrix}\underline{\text{YES}}\\ \text{NO}\end{matrix}\right\}$	Source modules listings from language translators on SYSLST.
		XREF = $\left\{\begin{matrix}\underline{\text{YES}}\\ \text{NO}\end{matrix}\right\}$	Language translators output symbolic cross-reference lists on SYSLST.
		ERRS = $\left\{\begin{matrix}\underline{\text{YES}}\\ \text{NO}\end{matrix}\right\}$	Compilers summarize all errors in source programs on SYSLST.
		LOG = $\left\{\begin{matrix}\underline{\text{YES}}\\ \text{NO}\end{matrix}\right\}$	Listing of all control statements on SYSLST.
		DUMP = $\left\{\begin{matrix}\underline{\text{YES}}\\ \text{NO}\end{matrix}\right\}$	Dump of registers and main storage on SYSLST.
		LINES = $\left\{\begin{matrix}\underline{56}\\ \text{nn}\end{matrix}\right\}$	Number of lines per page on SYSLST.
		DATE = $\left\{\begin{matrix}\underline{\text{MDY}}\\ \text{DMY}\end{matrix}\right\}$	Format of date.
		CHARSET = $\left\{\begin{matrix}\underline{\text{48C}}\\ \text{60C}\end{matrix}\right\}$	Specifies the 48 or 60 character set for language translator input on SYSIPT.
		LISTX = $\left\{\begin{matrix}\underline{\text{NO}}\\ \text{YES}\end{matrix}\right\}$	Hexadecimal object module listings from compilers on SYSLST.
		SYM = $\left\{\begin{matrix}\underline{\text{NO}}\\ \text{YES}\end{matrix}\right\}$	Assembler output symbol tables on SYSPCH.
		SPARM = $\left\{\begin{matrix}\underline{\text{NO}}\\ \text{YES}\end{matrix}\right\}$	Support of assembler variable symbol &SYSPARM
FOPT	Describes functional supervisory options	OC = $\left\{\begin{matrix}\underline{\text{NO}}\\ \text{YES}\end{matrix}\right\}$	Operator initiated communications to problem programs. If OC = YES the facility is available to all programs in MPS. Must be YES if Emulator on System/370 is used.
		PC = $\left\{\begin{matrix}\underline{\text{NO}}\\ \text{YES}\end{matrix}\right\}$	Problem program routine for program check. If PC = YES, the facility is available to all programs in MPS.
		IT = $\left\{\begin{matrix}\underline{\text{NO}}\\ \text{BG}\\ \text{F1}\\ \text{F2}\end{matrix}\right\}$	Problem program ability to set timer intervals and specify a timer interrupt routine. BG, F1, or F2 indicates which program has the facility. When IT is specified for a partition, TIMER = YES is assumed in the CONFG macro. Timer support is available to only one program in MPS.
		AB = $\left\{\begin{matrix}\underline{\text{NO}}\\ \text{YES}\end{matrix}\right\}$	Provides for valid use of the STXIT (AB) macro. If AB = YES, the facility is available to all programs in MPS.
		TEB = $\left\{\begin{matrix}\underline{\text{NO}}\\ \text{n}\end{matrix}\right\}$	Tape error statistics are to be accumulated and logged, where n is the number of 2400-series tape units and tape cartridge readers (maximum of 225) attached to the system. **
		TEBV = $\left\{\begin{matrix}\underline{\text{NO}}\\ \left(\left\{\begin{matrix}\text{DASD}\\ \text{SYSLOG}\end{matrix}\right\},\text{n}\right)\end{matrix}\right\}$	Tape Error Statistics by Volume are to be accumulated and logged on SYSLOG or a DASD device, where n is the number of 2400 series tape drives attached to the system. **
		EVA = $\left\{\begin{matrix}\underline{\text{NO}}\\ \text{(rth, wth, n)}\end{matrix}\right\}$	Error Volume Analysis is supported where rth is the read error threshold, wth is the write error threshold, and n is the number of 2400 series tape drives attached to the system. **

** The n specified in TEB, TEBV, and EVA must be identical if two or more of these options are specified, and then TAPE=9 is assumed.

Figure 4. Supervisor Macros (Part 2 of 5)

Name	Macro Description	Parameter = Option	Option Description
FOPT (cont'd)		SKSEP = $\left\{\begin{matrix}\underline{\text{NO}}\\ \text{YES}\\ n\end{matrix}\right\}$	Specifies if SEEKs are to be separated from the remainder of channel programs. Seek separation allows other devices on the channel to be accessed (including other seeks) during the seek. YES indicated support for all DASD types specified by the DVCGEN macro at system generation time. n is the number of DASD to be supported and cannot be less than the number of DASD specified at system generation. The maximum number is 254.
		CE = $\left\{\begin{matrix}\underline{\text{NO}}\\ \text{YES}\\ n\end{matrix}\right\}$	Specifies the amount of core to be allocated to customer engineer serviceability routines or PDAIDs. When YES is specified, 600 bytes are allocated; when n bytes are specified, it must be for a minimum of 600 bytes. If PDAIDs or the QTAM or SVC in CEAIDs are used, specify a minimum of 800 bytes.
		CCHAIN = $\left\{\begin{matrix}\underline{\text{NO}}\\ \text{YES}\end{matrix}\right\}$	Command chaining support for retry on I/O operations. When an error occurs and CCHAIN = YES, the user is allowed to retry at the last CCW executed instead of at the first CCW in the channel program as is the case in a normal retry. This option requires that the appropriate bit be set in the CCB.
		PTO = $\left\{\begin{matrix}\underline{\text{NO}}\\ \text{YES}\end{matrix}\right\}$	Physical Transient Overlap allows tasks to be selected during the time of FETCH, LOAD, MVCOM, and ERP I/O. PTO is valid only when MPS = YES or MPS = BJF in the SUPVR macro.
		CBF = $\left\{\begin{matrix}\underline{\text{NO}}\\ n\end{matrix}\right\}$	Console Buffering provides immediate return to the caller when write I/O to SYSLOG is issued where SYSLOG is a 1052. n indicates the number of buffers to be generated. 1 to 50 buffers may be specified. 1 is assumed if the operand is invalid.
		IDRA = $\left\{\begin{matrix}\underline{\text{NO}}\\ \text{YES}\end{matrix}\right\}$	Independent Directory Read-in Area feature. YES option causes generation of the IDRA area in supervisor. IDRA reduces contention for the PTA in fetch operations when ERP is active. Use of IDRA requires MPS = YES or BJF and PTO = YES.
		TRKHLD = $\left\{\begin{matrix}\underline{\text{NO}}\\ n\end{matrix}\right\}$	If n is specified, coding to support the HOLD and FREE track macros. TRKHLD = n specifies the number of tracks to be held at any one time, and a Track Hold Table (See Figure 24) is generated for that number. If n is not in the range of 1 to 225, 10 is assumed.
		WAITM = $\left\{\begin{matrix}\underline{\text{NO}}\\ \text{YES}\end{matrix}\right\}$	Provides for valid use of the WAITM macro, waiting for one of a number of events to occur before continuing with task execution. Waits are performed on Event Control Blocks, which may be of the special form as in Figure 34. Other blocks that may be used as ECBs are CCBs, TECBs, and MICR CCBs since posting is done in bit 0 byte 2 of the block.
		** RETAIN = $\left\{\begin{matrix}\underline{\text{NO}}\\ \text{YES}\end{matrix}\right\}$	Specifies if the data link to the Remote Analysis Center is to be supported. RETAIN = YES is valid only if a S/370 CPU was specified in the MODEL option. RETAIN = YES forces OC = YES.
		DASDFP = $\left\{\begin{matrix}\underline{\text{NO}}\\ (n,n,2311)\\ (n,n,2314)\\ (n,n,2321)\end{matrix}\right\}$	Supervisory DASD file protection, where (n,n) indicates the range of channels to which DASDs may be attached. Specifying 2311 or 2314 indicates support for both. 2321 option indicates support for 2321 device as well as for 2311 and 2314. DASDFP prevents the user from writing outside the extents of his file in case of program error. Extents are protected to the nearest cylinder.
		*SYSFIL = $\left\{\begin{matrix}\underline{\text{NO}}\\ (2311\ [,n1,n2])\\ (2314\ [,n1,n2])\end{matrix}\right\}$	System input and system output (SYSRDR, SYSIPT, SYSLST, SYSPCH) files may be assigned to a 2311, 2314, or both. Specifying either indicates support for both. If MPS=BJF in the SUPVR macro, support is given for foreground logical units when running in batched mode. n1 = residual capacity (in records) for beginning of operator notification when SYSLST is assigned to a 2311 or 2314. $100 \leq n1 \leq 65536$ If n1 is omitted, 1000 is assumed.

* Valid when at least 24K bytes of main storage are available.

** YES is valid only on a S/370 CPU; YES is the default for a S/370 MODEL. NO is the default for a S/360 MODEL.

Figure 4. Supervisor Macros (Part 3 of 5)

Name	Macro Description	Parameter =Option	Option Description
FOPT (cont'd)		*SYSFIL (cont'd)	n2 =residual capacity (in records) for beginning of operator notification when SYSPCH is assigned to a 2311 or 2314. $100 \leq n2 \leq 65536$ If n2 is omitted, 1000 is assumed.
		PCIL= $\left\{\begin{array}{l}\underline{\text{NO}}\\ \text{YES}\end{array}\right\}$	Provides supervisor support for private core image library.
		JA= $\left\{\begin{array}{l}\underline{\text{NO}}\\ \text{YES}\\ \text{n1,n2,n3}\end{array}\right\}$	NO defaults to no Job Accounting Interface support. YES specifies basic JA support. (n1,n2,n3) gives additional support to count SIOs issued to I/O devices by partition. n1,n2, and n3 refer to the number of devices in BG, F2, and F1 for which SIOs are to be counted. Choose values for each n from 0 to 255 to specify the number of devices accessed by partition; if any n value is omitted, it defaults to zero.
		JALIOCS= $\left\{\begin{array}{l}\underline{\text{NO}}\\ \text{(n1,n2)}\end{array}\right\}$	NO defaults to 16 bytes in the user save area and zero bytes for the alternate label area. Set n1 from 0 to 1024 bytes for the user save area; if omitted, it defaults to 16 bytes. Set n2 from 0 to 224 bytes for the alternate label area (usually =number specified by LBLTYP); if omitted, it defaults to zero bytes.
		OLTEP= $\left\{\begin{array}{l}\underline{\text{NO}}\\ \text{YES}\end{array}\right\}$	Specify if the on-line testing function is desired. If MODEL =a System/370 CPU, then OLTEP =YES is assumed.
PIOCS	Describes the system I/O configuration	SELCH= $\left\{\begin{array}{l}\underline{\text{YES}}\\ \text{NO}\end{array}\right\}$	Selector channels attached to the system.
		BMPX= $\left\{\begin{array}{l}\underline{\text{NO}}\\ \text{YES}\end{array}\right\}$	Burst Mode devices are supported on multiplexor channel. If 1412-1419s or 1287-1288s are attached to the multiplexor channel, BMPX =YES is not supported.
		CHANSW= $\left\{\begin{array}{l}\underline{\text{NO}}\\ \text{TSWTCH}\\ \text{RWTAU}\end{array}\right\}$	Channel switching tape control unit. RWTAU =2404 or 2804, TSWTCH =2816.
		TAPE= $\left\{\begin{array}{l}\underline{\text{NO}}\\ 9\\ 7\end{array}\right\}$	Indicates required tape PIOCS support. 9 =nine track only, 7 =seven or nine track, NO =No tape units attached. NO is the assumed value.
		MRSLCH= $\left\{\begin{array}{l}\underline{\text{NO}}\\ \text{YES}\end{array}\right\}$	MICR tape device assigned to a selector channel.
ALLOC	Partitions storage for MPS (optional macro).	F1 =nK, F2 =nK	Specifies storage partitioning MPS, where n must be a multiple of 2. Must be at least 10K if MPS =BJF.
IOTAB	Describes installation requirements for I/O tables.	IODEV= $\left\{\begin{array}{c}\underline{10}\\ \text{n}\end{array}\right\}$	Number of I/O devices attached to the system.
		BGPGR= $\left\{\begin{array}{c}\underline{10}\\ \text{n}\end{array}\right\}$	Number of symbolic units of the class SYSnnn for the background program.
		F1PGR= $\left\{\begin{array}{c}\underline{5}\\ \text{n}\end{array}\right\}$	Number of symbolic units of the class SYSnnn for F1. Valid only in MPS (minimum 5). Otherwise zero is assumed when MPS =NO.
		F2PGR= $\left\{\begin{array}{c}\underline{5}\\ \text{n}\end{array}\right\}$	Number of symbolic units of the class SYSnnn for F2. Valid only in MPS (minimum 5). Otherwise zero is assumed when MPS =NO.
		CHANQ= $\left\{\begin{array}{c}\underline{6}\\ \text{n}\end{array}\right\}$	Number I/O requests in the channel queue. 6 is the minimum value generated. In a supervisor with CBF option specified, the minimum value is 6 plus the number of console buffers generated.
		JIB= $\left\{\begin{array}{c}\underline{5}\\ \text{n}\end{array}\right\}$	Number of Job Information Blocks (JIBs) for the system. Requirements are: 1. One JIB for each temporary logical unit assignment. 2. One JIB for each alternate logical unit assignment. 3. One JIB for each open 2311 or 2314 extent with the DASD file protect feature. 4. Two JIBs for each open 2321 extent with the DASD file protect feature.

*Valid when at least 24K bytes of main storage are available.

Figure 4. Supervisor Macros (Part 4 of 5)

Name	Macro Description	Parameter =Option	Option Description
DVCGEN	Specifies I/O devices. Each device type requires a separate DVCGEN macro. (See note 1 for DVCGEN rules. This is an optional macro.)	CHUN ={X'cuu'}	Specify the hexadecimal number of the channel and unit for the device.
		DVCTYP = {xxxxxx}	Specify the device type. See Figure 29.
		CHANSW = {NO YES}	Specify if the device is attached to more than one selector channel. If it is, the device can be switched.
		MODE ={X'ss'}	1. 2400T9. MODE specifies the tape mode. X'C0' is the default value. 2. 2400T7. MODE specifies the tape mode. X'90' is the default value. See Figure 30 for other values. 3. 2702. MODE designates the SADxxx command. X'00' is the default value. X'00' SAD0 X'01' SAD1 X'02' SAD2 X'03' SAD3 4. 2260 (Local). MODE is used to specify the 1053 printer when CHUN = X'cuu' refers to a 1053 attached to a 2848. The operand must be entered as MODE = X'01'. 5. 1412/1419. MODE designates the external interrupt bit associated with Magnetic Ink Character Readers. The modes X'01' through X'20' correspond to external interrupt PSW bits 31 through 26 respectively. For the dual address adapter 1419, this parameter is needed for both the 1419P and the 1419S device types. X'01' Device attached to external line 7. X'02' Device attached to external line 6. X'04' Device attached to external line 5. X'08' Device attached to external line 4. X'10' Device attached to external line 3. X'20' Device attached to external line 2. 6. 1018 Paper Tape Punch with 2826 Paper Tape Control Unit Model 1. This parameter specifies whether or not the Error Correction feature is present: X'00' feature not present X'01' feature present
ASSGN	Sets standard I/O assignments. A separate macro is required for each standard assignment desired. (Optional macro)	{SYSxxx,X'cuu',{BG F1 F2}}	SYSxxx is any symbolic logical unit (SYSIPT, SYSLOG, etc.) or programmer logical unit (SYS000, SYS001, etc.). X'cuu' is the hexadecimal number of the channel and unit to which the symbolic device is attached. {BG F1 F2} indicates the specific partition to which the ASSGN is being made.
SEND	Indicates end of supervisor generation.	[n]	Specifies the beginning address of the problem program area. An area should be reserved for supervision expansion and maintenance. The parameter is optional. If not specified, no area is reserved beyond the assembled last address of the supervisor.

Note 1: Rules for using DVCGEN

1. A separate DVCGEN macro instruction is required for each device.
2. The total number of DVCGEN macros must not exceed the total number of devices specified in the IODEV parameter of the IOTAB macro.
3. DVCGEN macros must be specified in ascending channel address sequence.
4. Switchable units (attached to more than one selector channel) must be defined once. They are defined on the lowest channel on which they are addressable.
5. The sequence of the DVCGEN cards determines the priority of the devices on their channel. Switchable units must be the last devices for each channel, and must be on consecutive channels.
6. The specifications of these macros may be altered by IPL ADD and DEL statements. See IPL PLM, GY24-5086.
7. Rules for SYSxxx:
   a. The ASSGN macro allows SYSRDR, SYSLST, SYSPCH, and SYSIPT to be assigned to a tape or DASD. However, IPL unassigns any such assignments.
   b. SYSLOG must also be assigned in BG, if assigned in foreground partition.
   c. SYSLNK cannot be specified in either foreground partition.

Figure 4. Supervisor Macros (Part 5 of 5)

Macro	Type	Code Generated	Critical Globals Set
SUPVR	generation	Defines low main storage	BG10 BG25 BG13 BG27 BG14 BG35 BG19 BG36 BG20 BG50 BG21 BG51 BG24 BG100 AG11
CONFG	generation	None	BG1 BG23 BG2 BG39 BG22 BG51 AG12
STDJC	generation	None	BG34 BG81
FOPT	generation	General cancel SVEREG routine General exit Background communication region and extension General entry SVC interrupt handler	BG0 BG60 BG2 BG61 BG4 BG62 BG5 BG71 BG6 BG72 BG7 BG73 BG8 AG2A BG14 AG7 BG15 AG10 BG16 AG13 BG18 AG21 BG26 AG22 BG30 AG23 BG32 AG28 BG33 AG31 BG40 AG32 BG52 AG39
PIOCS	generation	None, directly calls inner macros.	BG3 BG11 BG9 BG12 BG10 BG31
SGTCHS	inner	Channel scheduler Start I/O SIO accounting I/O interrupt	none
SGUNCK	inner	Unit check Error recovery exits	none
SGTCON	inner	VLDADR1 subroutine, ATNRTN routine, CCW chain, disk information blocks, error recovery block, SVC interrupt table, PC option table, and OC option table, physical transient save area, IDRA save area, logical transient save area.	none
SGDFCH	inner	Fetch subroutine	none
SGSVC	inner	Supervisor interrupts Program check interrupts External interrupts Console buffering routine	none
SGDSK	inner	Disk error recovery	none
SGTHAP	inner	Track hold, track free, set abnormal exit routine address, and asynchronous processing routines.	none
SMICR	inner	External interrupts for MICR type devices Program checks in stacker select routine Error recovery for test I/O and start I/O	none
ALLOC	generation	None	none

Figure 5. Macro Functions (Part 1 of 2)

Macro	Type	Code Generated	Critical Globals Set
IOTAB	generation	Supervisor table expansions- SYSCLB LUB,PIBs, SVC Interrupt table, channel queue table (CHANQ), PUB, JIB, TEB, and TEBV.	AG2D
LUBGEN	inner	Generates NICL, FICL, and unassigned LUB tables, console buffers, and track hold table entries.	none
DVCGEN	generation	Overlays for PUB table entries.	AG8
ASSGN	generation	Overlays for LUB table entries.	none
SEND	generation	Generates console buffer and PTO patch areas; JAI partition tables, user save area, and label area; OBR/SDR routines. Calls inner macros COMMN for F1, F2, communications regions, COMMNEX for F1, F2, communications region extensions, TRTAB for ASCII translation tables, MCRAS for RMS resident coding and RTA. Defines end of supervisor nucleus, beginning of IDRA, A and B transient areas, start of problem program area, CE area, and BG save area.	none
SMCRR	inner	Machine check recording and recovery record builder.	none
COMMN	inner	Communications regions for all partitions.	none
COMMNEX	inner	Communications region extensions for all partitions.	none
TRTAB	inner	Generates ASCII translation tables.	none
MCRAS	inner	Generates RMS Monitor and RTA.	none
MAPLOWC	inner	Generates equates to address low core for RMS.	none

Figure 5. Macro Functions (Part 2 of 2)

Global	On Setting	Purpose
BG0	CE=YES or n AP=YES AB=YES EU=YES TRKHLD=n ERRLOG=YES or CLEAR MCRR=YES MICR=1412, 1419 or 1419D JA=YES JA=(n_1,n_2,n_3) ASCII=YES MPS=YES or BJF	Determines the length of the supervisor save area.
BG1	SP=YES	Determines whether the storage protect feature is used.
BG1QT	TP=QTAM	Determines QTAM support.
BG2	TIMER=YES JA=YES JA=(n_1,n_2,n_3)	Determines whether the timer feature is used. Does not force BG0.
BG3	CHANSW=TSWTCH or RWTAU	Determines whether channel switching is supported (2816).
BG4	TEB=n	Determines if tape error statistics are to be accumulated and logged.
BG5	PTO=YES	Determines if physical transient overlap option is supported.
BG6	OC=YES	Determines if the asynchronous user interrupt key routine is supported. Does not force BG0.
BG7	IT=F1, or F2, or BG	Determines whether the internal timer option is supported. Does not force BG0.
BG8	PC=YES	Determines if the user program check routine is supported.
BG9	CHANSW=RWTAU	Determines whether channel switching is supported (2404, 2804).
BG10	SELCH=YES	Determines whether selector channels are supported.
BG11	BMPX=YES	Determines whether burst mode devices will be supported on the multiplexor channel.
BG12	TAPE=7 or 9	Determines the type of tape support required.
BG13 *	AP=YES	Determines if asynchronous processing is supported. If yes, force on BG0, BG14, BG20.
BG14	WAITM=YES AP=YES	Determines if the wait multiple function is supported. Force on if AP is specified. Does not force on BG0.

Figure 6. Global Settings (Part 1 of 5)

Global	On Setting	Purpose
BG15 *	AB=YES	Determines if user abnormal termination routine is supported. Forces on BG0.
BG16 *	TRKHLD=n	Determines if the track hold function is supported. BG20 must be on (if it is not, it defaults to NO).
BG18	CBF=n	Determines if console buffering option is supported.
BG19 *	MCRR=YES	Determines whether MCRR option is supported.
BG20	MPS=YES or BJF AP=YES	Determines whether multiprogramming support is required. Forces BG0.
BG21	TP=BTAM or QTAM	Determines whether teleprocessing support is required.
BG22	DEC=YES	Determines if the decimal feature is used. Does not force BG0.
BG23	FP=YES	Determines if the floating point feature is used. Does not force BG0.
BG24	MPS=BJF	Determines if batched jobs will be run in foreground partitions. Forces BG0.
BG25	ERRLOG=any invalid setting	Indicates ERRLOG is set with an invalid option. Causes a message and terminates supervisor assembly.
BG26	PCIL=YES	Determines if PCIL is supported.
BG27	ERRLOG=RDE	Determines if RDE Support is required.
BG30	CCHAIN=YES	Determines if command chaining support for retry on I/O operation is used. Does not force BG0.
BG31	TAPE=9	Determines if 9 track tape support is required.
BG32	DASDFP=n,n	Determines whether the DASD file protect feature is supported. Does not force BG0.
BG33	SYSFIL=2311 or 2314	Determines if logical system I/O units are a disk device. Does not force BG0.
BG34	DATE=MDY	Determines the type of date configuration to be supported.
BG35	MICR=1412, 1419, 1419D, 1270, 1275	Determines if any MICR type device is supported. Forces BG0.
BG36	MICR=1419D	Determines if 1419D (MICR type device with dual address adapter) only is supported. Forces BG0.

Figure 6. Global Settings (Part 2 of 5)

Global	On Setting	Purpose
BG38	OLTEP=YES	Indicates whether OLTEP is supported.
BG39	MODE= (a System/370 CPU)	Indicates RMS support for System/370.
BG40	RETAIN=YES	Indicates RETAIN/370 is Supported.
BG41	DECK=YES	Job control options.
BG42	LIST=YES	Job control options.
BG43	LISTX=YES	Job control options.
BG44	SYM=YES	Job control options.
BG45	XREF=YES	Job control options.
BG46	ERRS=YES	Job control options.
BG47	CHARSET=48C	Job control options.
BG48	DUMP=YES	Job control options.
BG49	LOG=YES	Job control options.
BG50	EU=YES	Determines if emulator interface is generated. Forces on BG0.
BG51	EU=RELOC	Determines if the relocatable version of CS/40 is used. Forces on BG0, BG50.
BG52	IDRA=YES	Indicates whether IDRA is supported.
BG60 *	TEBV=(device,n)	Determines if the Tape Error Statistics by Volume is supported. Does not force BG0.
BG61	TEBV=(DASD,n)	Determines if TEBV Device is DASD. Does not force BG0.
BG62 *	EVA=(rth,wth,n)	Determines if Error Volume Analysis is supported. Does not force BG0.
BG71	JA=YES or JA=(n_1,n_2,n_3)	Indicates whether JAI is supported.
BG72	JA=(n_1,n_2,n_3)	Indicates whether count of SIOs is made.
BG73	JALIOCS=(n_1,n_2)	Indicates whether JAI label processing is supported.

Figure 6. Global Settings (Part 3 of 5)

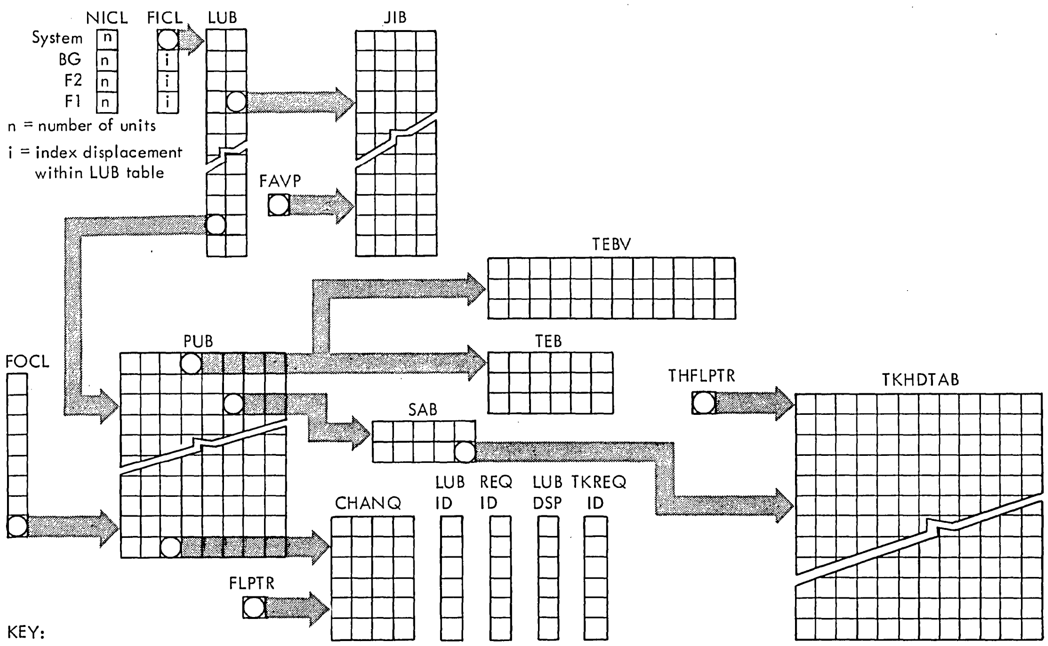
Global	On Setting	Purpose
BG81	SPARM=YES	Determines if SYSPARM is supported.
BG99	ALLOC F1=nK, F2=nK	Special sequence check for ALLOC macro within supervisor.
BG100*	ASCII=YES	Determines if ASCII translation tables are generated.
BG126	CHANSW=YES	Channel switching. Device can be attached to more than one selector channel.
BG127	---	Sequence check for DVCGEN macro.
AG1QT	TP=QTAM_n	Number of problem programs in QTAM system at one time.
AG1	IODEV=n	Number of entries for PUB Table.
AG2	Can be set by TEB, TEBV, EVA	Number of volume error blocks.
AG2A	TEB=n	Indicates number of Tape Error Blocks generated in FOPT macro.
AG3	CHUN=X'cuu'	Specifies number of channel (for example, X'cuu')
AG4	BGPGR=n	Number of BG programmer LUBs.
AG5	F2PGR=n	Number of F2 programmer LUBs.
AG6	F1PGR=n	Number of F1 programmer LUBs
AG7	SKSEP=YES or n	Determines that the seek separation option is desired. Does not force BG0.
AG8	SKSEP=YES or n	Sets count of direct access storage devices generated in DVCGEN.
AG9	CHANQ= $\left(\frac{6\ \text{or}\ 6+\text{CBF}}{n}\right)$	Length of channel queue.
AG10 *	CE=YES or n	Indicates that an area is reserved for CE routines.
AG11 *	ERRLOG=YES, RDE, or n	Sets count of Statistical Data Records.
AG12	MODEL=nn or nnn PORT=155	Indicates model of CPU. Does not force BG0.
AG13	PCIL=YES	Number of system class LUBs.
AG15	---	Checks macro sequence of supervisor macros.

Figure 6. Global Settings (Part 4 of 5)

Global	On Setting	Purpose
AG16	DASDFP= $\left(n,n, \begin{Bmatrix}2311\\2314\\2321\end{Bmatrix}\right)$	First channel with DASD devices for file protect.
AG17	DASDFP= $\left(n,n, \begin{Bmatrix}2311\\2314\\2321\end{Bmatrix}\right)$	Last channel with DASD devices for file protect.
AG18	SYSFIL= $\begin{Bmatrix}2311\\2314\end{Bmatrix}, \begin{Bmatrix}n_1,n_2\\n_1,n_2\end{Bmatrix}$	n_1 Parameter of SYSFIL.
AG19	SYSFIL= $\begin{Bmatrix}2311\\2314\end{Bmatrix}, \begin{Bmatrix}n_1,n_2\\n_1,n_2\end{Bmatrix}$	n_2 Parameter of SYSFIL.
AG20	MCRR=YES	Set to value equal to number of PUBs when MCRR is supported.
AG21	IT=BG	Determines if a timer interrupt routine is for a BG program.
AG22	IT=F1	Determines if a timer interrupt routine is for an F1 program.
AG23	IT=F2	Determines if a timer interrupt routine is for an F2 program.
AG25	F1=nK	Number of blocks for F1 (must be in increments of 2K).
AG26	F2=nK	Number of blocks for F2 (must be in increments or 2K).
AG27	TRKHLD=n	Indicates number of tracks that can be held.
AG28	CBF=n	Indicates number of console buffers generated in LUBGEN. Does not force BG0.
AG31	EVA=(rth,wth,n)	Indicates the Read Error Threshold specified in EVA.
AG32	EVA=(rth,wth,n)	Indicates the Write Error Threshold specified in EVA.
AG39	JA=(n_1,n_2,n_3) JALIOCS=(n_1,n_2)	Indicates number of devices for which SIO counts are made. Indicates whether user save area and label processing are supported.
AG41	LINES=n	SYSLST line count.
AG53	---	Number of LUBs.
AG54	MRSLCH=YES	Indicates MICR type device is on a selector channel.

*These globals determine if extension(s) to the communication region(s) are generated.

Figure 6. Global Settings (Part 5 of 5)



KEY:

NICL (Number in Class)	: The first byte contains the number of system class units. The second, third, and fourth bytes contain the number of programmer class units (BG, F2, F1) (Figure 23).
FICL (First in Class)	: The first byte points to the first system class unit in the LUB table. (Always the first LUB table entry.) The second byte points to the first programmer class unit in the LUB table BG area. The third points to the first programmer class unit in the LUB table F2 area. The fourth points to the first programmer class unit in the LUB table F1 area (Figure 23).
LUB (Logical Unit Block) Table	: The first byte points to a PUB table entry (if the logical unit is assigned) or contains X'FF'. The second byte points to a JIB table entry or contains X'FF' (Figure 23).
PUB (Physical Unit Block) Table	: The first two bytes contain the channel and unit address of the physical device; the third a CHANQ pointer; the fourth a TEB pointer; the fifth device type codes; the sixth a device characteristic code or a SAB pointer; the seventh the channel scheduler flag; and the eighth has the job control flag (See Figure 18).
FOCL (First on Channel List)	: The first byte points to the first PUB (highest priority) on channel zero. The next byte points to the first PUB (highest priority) on channel one, etc. A hexadecimal FF indicates the associated channel is not supported.
TEB (Tape Error Block by Unit)	: One TEB is built for each tape unit at supervisor generation time if tape error statistics by unit are required (Figure 20).
TEBV (Tape Error Block by Volume)	: One TEBV is built for each tape unit at supervisor generation time if tape error statistics by volume are required (Figure 21).
FAVP (First Available Pointer)	: A one-byte pointer to the next available JIB entry.
JIB (Job Information Block)	: The first two bytes contain extent or LUB information. The third contains ownership and JIB flags. The fourth contains JIB chaining information (Figure 19).
CHANQ (Channel Queue) Table	: The first byte contains the chain field (a pointer to the next in queue). The last three bytes contain the CCB address (Figure 17).
LUBID (LUB Identification)	: A one-byte pointer to the LUB making the I/O request.
REQID (Requestor Identification)	: A one-byte pointer to the program containing the CCB (Figure 17).
LUBDSP (LUB Displacement)	: A one-byte value equal to the absolute LUB number (CCB byte 7).
FLPTR (Free List Pointer)	: A one-byte pointer to the next free entry in the channel queue (Figure 17).
SAB (Seek Address Block)	: A four-byte (BCCH) address that is the current disk address of the device plus a fifth byte that contains a Track Hold Table pointer or X'FF'. If the Track Hold function is not supported, the fifth byte contains X'00'.
TKHDTAB (Track Hold Table)	: The first byte contains a pointer to the next available entry (or X'FF'); bytes 2 - 4 have CCB address of the requesting task; bytes 5 - 10 have a disk address (BBCCHH) of track being held; byte 11 has key of owning track; and byte 12 has two uses: bit 0=1 means a task is waiting for the track, and bits 4 - 7 count the number of holds on the track. (Figure 24). Note: The number of holds is one more than the value of bits 4 - 7 of the last byte.
THFLPTR (Track Hold Free List Pointer)	: A one-byte pointer to the next free entry in the Track Hold Table.
TKREQID (Track Requestor Identification)	: A one-byte pointer to the PIB of the task requesting I/O.

Figure 7. I/O Table Interrelationship

COMREG*

Displacement hexadecimal	0	8	0A	0C	17	18	20	24	28	2C
Displacement decimal	0	8	10	12	23	24	32	36	40	44
	Date	Address of PPBEG	Address of EOSSP	Problem Program Use	UPSI Byte	Job Name	Highest Storage Address of the Partition	End Address of Last Phase Fetched or Loaded	Address of Uppermost Byte of Phase with Highest Ending Address	Label Area Length
	XXXXXXXX	XX	XX	XXXXXXXXXXX	X	XXXXXXXX	XXXX	XXXX	XXXX	XX

Displacement hexadecimal	2E	30	34	35	36	37	38	39	3A	3B	3C	3E
Displacement decimal	46	48	52	53	54	55	56	57	58	59	60	62
	PIK (PID)	End of Storage Address	Machine Confg. Byte	System Confg. Byte	Standard Language Translator I/O Options	Dump, Log and ASCII Options	Job Control Byte	Linkage Control Byte	Language Translator Control Byte	Job Duration Indicator Byte	Disk Address of Label Cylinder	Address of FOCL
	XX	XXXX	X	X	X	X	X	X	X	X	XX	XX

Job Control Switches

Displacement hexadecimal	40	42	44	46	48	4A	4C	4E	4F	58	5A	5C
Displacement decimal	64	66	68	70	72	74	76	78	79	88	90	92
	Address of PUB	Address of FAVP	Address of JIB	Address of TEB	Address of FICL	Address of NICL	Address of LUB	Line Count for SYSLST	System Date	LIOCS Comm. Bytes	Address of 1st Part of PIB Table	ID Number of Last Checkpoint
	XX	XX	XX	XX	XX	XX	XX	X	XXXXXXXXX	XX	XX	XX

Displacement hexadecimal	5E	60	62	64	66	68	6A	6C	6E
Displacement decimal	94	96	98	100	102	104	106	108	110
	Length of LUB ID Queue = No. of Channel Queue Entries	Address of Disk Information Block (DIB)	Address of Error Recovery Block	Address of PC Option Table less 8 bytes	Address of IT Option Table less 8 bytes	Address of OC Option Table less 8 bytes	Key of Program with Timer Support	Address of the LUBID Queue	Logical Transient Key
	XX	XX	XX	XX	XX	XX	XX	XX	XX

Displacement hexadecimal	70	7C	7E	80	84	86	87	88
Displacement decimal	112	124	126	128	132	134	135	136
	Supervisor Constants	Address of 2nd Part of PIB Table	Address of MICR DTF Table (PDTABB)	Address of QTAM Vector Table	Address of BG Comm. Region	Option Indicator	System Configuration Byte 2	Pointer to Comm. Region Extension
	XXXXXXXXXXXX	XX	XX	XXXX	XX	X	X	XXXX

* The address of the communications region is in fixed location X'14' - X'17'.

Displacement values illustrated can be used to access the listing and/or the key that follows the figure. The key offers more detailed information about each area when necessary.

Figure 8. Supervisor Communications Region (Part 1 of 5)

Key to Communications Region Displacements:

0 MM/DD/YY or DD/MM/YY obtained from the job control date statement. Format controlled by COMREG + 53 (System Configuration Byte, date convention bit 0).

8 Address of the problem program area.

10 Address of the beginning of the problem program area. Y (EOSSP)=Y (PPBEG) if the storage protection option has not been selected. Y (EOSSP) equals the first main storage location with a storage protection key of 1, if storage protection is supported.

12 User area. If seek separation option is specified, bytes 12 and 13 are used at IPL time for the address of the seek address block.

23 User program switch indicator.

24 Job name set by the job control program from information found in the job statement.

32 Address of the uppermost byte of the problem program area as determined by the IPL program (Clear storage routine determines the address, ENDRD routine of $$A$IPL2 stores it.), or the address of the uppermost byte of the partition as determined during processing of the ALLOC statement.

36 Address of the uppermost byte of the last phase of the problem program fetched or loaded. The initial value (as shown) is overlaid by the first fetch or load to the problem program area.

40 Highest ending main-storage address of the phase among all the phases having the same first four characters as the operand on the EXEC statement. For the background partition only, job control builds a phase directory of these phases. The address value may be incorrect if the program loads any of these phases above its link-edited origin address. If the EXEC statement has no operand, job control places in this location the ending address of the program just link-edited.

44 Length of the problem program label area.

46 Program Interrupt Key - PIK (if asynchronous processing is not supported): Value is equal to the displacement from the start of the PIB table to the PIB for the task.

OR

Partition Identifier - PID (if asynchronous processing is supported): Value is hex 10, 20, or 30 to identify the partition in which a maintask or a subtask is running. (See the communications region extension, displacement 18, for the PIK in an asynchronous processing supervisor.)

First byte - always zero.
Second byte - contains the key of the program that was last enabled for interrupts, or the partition identifier in an AP supervisor.

Task	PIK (PID) Value
*All Bound	X'00'
BG	X'10'
*F2	X'20'
*F1	X'30'
Attn Rtn	X'40'
Quiesce I/O	X'50'
Supervisor	X'60'

*These tasks do not exist in a non-MPS supervisor.

48 Logical end of main storage address.

Figure 8. Supervisor Communications Region (Part 2 of 5)

Key to Communications Region Displacements:

52 Machine Configuration Byte (Values set at supervisor generation time.)

Bit 0: 1 = Storage protect feature
0 = No storage protect feature
1: 1 = Decimal feature
0 = No decimal feature
2: 1 = Floating-point feature
0 = No floating-point feature
3: 1 = Physical transient overlap option
0 = No physical transient overlap option
4: 1 = Timer feature
0 = No timer feature
5: 1 = Channel switching device
0 = No channel switching device
6: 1 = Burst mode on multiplex channel support
0 = No burst mode on multiplex channel support
7: Reserved

53 System Configuration Byte

Bit 0: 1 = DDMMYY } (Date convention bit set at generation time by STDJC)
0 = MMDDYY }
1: 1 = Multiprogramming environment
0 = Batch job environment
2: 1 = DASD file-protect supported
0 = No file-protect support for DASD
3: 1 = DASD SYSIN - SYSOUT
0 = No DASD SYSIN - SYSOUT
4: 1 = Teleprocessing
0 = No teleprocessing
5: 1 = Batch job in foreground
0 = No BJF
6: 1 = Asynchronous processing
0 = No AP
7: 1 = Track Hold
0 = No Track Hold

54 This byte contains the standard language translator I/O options (set by the STDJC macro).

Bit 0:	DECK option	1 = yes, output object modules on SYSPCH
1:	LIST option	1 = yes, output source module listings and diagnostics on SYSLST
2:	LISTX option	1 = yes, output hexadecimal object module listings on SYSLST (compilers only)
3:	SYM option	1 = yes, output symbol tables on SYSLST/SYSPCH
4:	XREF option	1 = yes, output symbolic cross reference list on SYSLST
5:	ERRS option	1 = yes, output diagnostics on SYSLST (compilers only)
6:	CHARSET option	1 = 48, input on SYSIPT is 48 or 60 character set
7:	Reserved	

55 This byte contains the standard supervisor options for abnormal EOJ and control statement display, and the indicator for the presence of the ASCII-EBCDIC and EBCDIC-ASCII translation tables.

Bit 0:	Always on	
1:	DUMP option	1 = yes, dump registers and storage on SYSLST
2:	Reserved	
3:	LOG option	1 = yes, list all control statements on SYSLST
4-6:	Reserved	
7:	ASCII option	1 = yes, ASCII supported

Figure 8. Supervisor Communications Region (Part 3 of 5)

Key to Communications Region Displacement:

56 Job control byte

Bit 0: 1 = Job Accounting Interface (JA) not supported
0 = Job Accounting Interface (JA) is supported
1: 1 = Return to caller on LIOCS disk open failure
0 = Do not return to caller on LIOCS disk open failure
2: 1 = Job control input from SYSRDR
0 = Job control input from SYSLOG
3: 1 = Job control output on SYSLOG
0 = Job control output not on SYSLOG
4: 1 = Cancel job
0 = Do not cancel job
5: 1 = Pause at end-of-job step
0 = No pause at end-of-job step
6: 1 = SYSLOG is not a 1052
0 = SYSLOG is a 1052
7: 1 = SYSLOG is assigned to the same device as SYSLST
0 = SYSLOG is not assigned to the same device as SYSLST

57 Linkage control byte

Bit 0: 1 = SYSLNK open for output
0 = SYSLNK not open for output
1: 1 = $ or FG program phase deleted, renamed, or cataloged (flag bit for $MAINEOJ)
2: 1 = Allow EXEC
0 = Suppress EXEC
3: 1 = Catalog linkage editor output
0 = Do not catalog linkage editor output
4: 1 = Supervisor has been updated
0 = Supervisor has not been updated
5: 1 = Executing in AUTOTEST mode
0 = Not executing in AUTOTEST mode
6: 1 = Reallocate or condense in progress
7: 1 = Fetch $MAINEOJ at end of job to update system directory
0 = Do not fetch $MAINEOJ at end of job for update

58 Language processor control byte. This is a set of switches used to specify nonstandard language translator options. The switches within the byte are controlled by job control OPTION statements and when set to 1, override standard options. The format of this byte is identical to the stnadard option byte (displacement 54) with one exception: Bit 7 in this byte is used to indicate to LIOCS that the rewind and unload option has been specified.

59 Job duration indicator byte

Bit 0: 1 = Within a job condition
0 = Outside a job condition
1: 1 = Dump on an abnormal end-of-job condition
0 = No dump on abnormal EOJ
2: 1 = Pause at EOJ step }
0 = No pause at EOJ } Set by Attention Routine for Job Control
3: 1 = Job control output on SYSLST
0 = Output not on SYSLST
4: 1 = Job is being run out of sequence with a temporary assignment for SYSRDR
0 = Conditions for 1 setting not met
5: 1 = PCIL is being condensed
0 = PCIL is not being condensed
6: Reserved
7: 1 = Batch command just issued
0 = Condition for 1 setting did not occur

Figure 8. Supervisor Communications Region (Part 4 of 5)

Key to Communications Region Displacements:

60	Binary disk address of the volume label area (label cylinder).
62 → 76	As illustrated (Figures for information blocks, I/O tables, and pointers begin at Figure 7 which refers to more detailed Figures).
78	Set to the value nn specified in the LINES = nn parameter of the STDJC macro.
79	The format of the system date contained within this field is determined by the IPL program from information supplied in the date convention byte (displacement 53). Bytes 85 - 87 contain the day count.
88	Bytes reserved for use by LIOCS. Transient dump programs insert a key to indicate to the LIOCS end-of-volume routine, $$BCMT07, that it was called by a B-transient.
90	Address of the first part of the program information block (PIB) table. (See Figures 15, and 16.)
92	ID number of the last checkpoint. Temporary indicator of file protected DASD. Used at IPL time, when DASDFP is specified.
94	Length of the LUBID queue (in bytes). This equals the number of channel queue entries. It can also be used to access the REQID, LUBDSP, and TKREQID queues: (See Figure 17.)
96	Address of disk I/O position data. This is the starting address of the disk information block (DIB) table (See Figure 12).
98	Address of the beginning of the error recovery block. The error recovery block contains addresses of error recovery exits, error recovery queue information that can be used by physical transients routines, and defines storage for the error queue entries (See Figure 43).
100 → 104	As illustrated (See Figure 13).
106	Key of the program (BG, F2, or F1) that has timer support.
108	As illustrated (See Figure 17).
110	Logical Transient Key (LTK) contains the same value as the PIK (PID) (Displacement 46) when the logical transient is requested. When the transient area is not in use, LTK is equal to zero. The SVC 2 routine sets the LTK. The SVC 11 routine resets the LTK.
112	Supervisor constants: DOLLARBO (4 bytes) = C'$$BO' SSKADR (5 bytes) = XL5'0' LTAREA (3 bytes) = Adcon of LTSVPT, logical transient save pointer
124	Address of second part of program information block (PIB) table (See Figure 14).
126	Address of PDTABB, table of DTF addresses for MICR support (See Figure 10).
128	Address of QTAM vector table (IJLQTTAD).
132	Address of background communications region.
134	Option Indicator Byte Bit 0: 1 = MCRR indicated for OBR writer 0 = No MCRR indicated for OBR writer 1: 1 = EU interface active 0 = EU interface not active 2: 1 = Teleprocessing request 0 = No teleprocessing request 3: 1 = Supervisor support for only 9-track tape 0 = Supervisor does not support 9-track tape exclusively 4: Reserved 5: 1 = RETAIN/370 support generated 0 = RETAIN/370 support not generated 6-7: Reserved
135	System Configuration Byte 2 Bit 0: 1 = PCIL supported 0 = PCIL not supported 1 -7: Reserved
136	Pointer to communications region extension (See Figure 9.)

Figure 8. Supervisor Communications Region (Part 5 of 5)

BGXTNSN (See Note)

0 (Hexadecimal Displacement)	4	8	0C	10	12	14	18	1C	20
0 (Decimal Displacement)	4	8	12	16	18	20	24	28	32
CE Table Address	Track Hold Table Address (THTABAD)	Difference Between 1st and 2nd Part of PIB Table (PIBDIFF)	AB Termination Table Address -8 (ABPTR)	ID of Task Owning LTA (LID)	ID of Task Running (PIK)	Task Requester ID Table Address (TKIDPTR)	Address Used by QTAM (MVCFLD)	SDR Table Address (SDRTABLE)	TEBV Table Address (TEBVTAB)
XXXX	XXXX	XXXX	XXXX	XX	XX	XXXX	XXXX	XXXX	XXXX

24 (Hexadecimal Displacement)	28	2C	30	34	38	3C
36 (Decimal Displacement)	40	44	48	52	56	60
OLTEP Linkage Address	RMS Linkage Address (RASLINK)	ASCII-EBCDIC Translation Table Address	(Reserved)	JAI Common Table Address (ACCTCOMN)	JAI Partition Table Address (ACCTxx)	&SYSPARM Field Address
XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX

Key to displacements:

0 CE Table Address.

4 Track Hold Table Address (THTABAD).

8 Difference between addresses of first part of PIB table and second part of PIB table (PIBDIFF).

12 Abnormal Termination Table Address (minus 8) (ABPTR).

16 Identification (LID) of the task owning the Logical Transient Area. Contains same value as PIK (displacement 18) when LTA is in use. Contains zero when LTA is not in use.

18 Program Interrupt Key (PIK) if asynchronous processing is supported. Value is equal to the displacement of the start of the PIB table to the PIB of the main task or subtask being selected (running).
First byte - zero
Second byte - contains the displacement into the PIB table for a maintask or a subtask.
Maintask - PIK value is hex 10, 20, or 30.
Subtask - PIK value is hex 70, 80, 90, . . . F0.

20 Task Requester ID Table Address (TKIDPTR).

24 MVCFLD address used by QTAM.

28 Statistical Data Recorder Table Address (SDRTABLE).

32 Tape Error Blocks by Volume Table Address (TEBVTAB).

36 Pointer to OLTEP Linkage Addresses

40 RMS Linkage Area Address (RASLINK)

44 ASCII-EBCDIC Translation Table Address.

48 (Reserved)

52 JAI Common Table Address (ACCTCOMN)

56 JAI Partition Table Address (ACCTxx; where xx = BG, F2, or F1).

60 Address of &SYSPARM Field.

Note: If communications regions are generated for the foreground partitions, the labels in those extensions will be F2XTNSN and F1XTNSN. The extensions, wherever used, are generated by the COMMNEX macro. Following the background extension (and immediately preceding the MCRR Linkage Table) is a six-byte area. The first four bytes are the address of the background save area (BGSAV), and the last two bytes are the value 4,096, used to restore base registers.

Figure 9. Communications Region Extensions

The table of DTF addresses (PDTABB) contains six 8-byte entries; one for each external line of the direct control feature on the system.

PDTABB

Byte	0	1	2	3	4	5	6	7
						DTF address for MICR:		
0	NI	PDSTAT +1,		X'FE'	Ownership Flags	Device on line 7		
8	NI	PDSTAT +1,		X'FD'		Device on line 6		
16	NI	PDSTAT +1,		X'FB'		Device on line 5		
24	NI	PDSTAT +1,		X'F7'		Device on line 4		
32	NI	PDSTAT +1,		X'EF'		Device on line 3		
40	NI	PDSTAT +1,		X'DF'		Device on line 2		

Background = 10
Foreground 2 = 20
Foreground 1 = 30

- Bytes 0-3 --Contain an 'AND' instruction that is executed in main line coding to turn off the external line status after its detection.

  PDSTAT+1 will contain one or more of the following interrupt codes:

PSW Interrupt Code Bit	Interrupt Code (PSW Bits 26-31)*	External Interrupt Cause
31	nnnnnnn1	External signal 7
30	nnnnnn1n	External signal 6
29	nnnnn1nn	External signal 5
28	nnnn1nnn	External signal 4
27	nnn1nnnn	External signal 3
26	nn1nnnnn	External signal 2

- Byte 4--Contains the flag of the partition containing the DTF.
- Bytes 5-7--Contain the address of the DTF table.

Table of pointers (PDTABA) to DTF addresses associated with the external interrupt line. The table is set up to handle the status in descending order from Bit 31 to Bit 26 of the external old PSW.

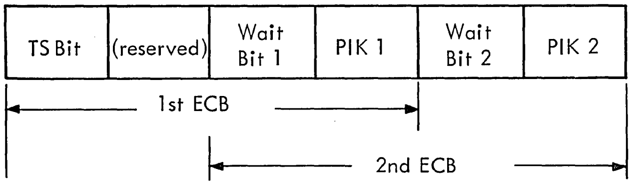
PDTABA

Byte	0	1	2	3	4	5	6	7
0	00	08	00	10	00	08	00	18
8	00	08	00	10	00	08	00	20
16	00	08	00	10	00	08	00	18
24	00	08	00	10	00	08	00	28
32	00	08	00	10	00	08	00	18
40	00	08	00	10	00	08	00	20
48	00	08	00	10	00	08	00	18
56	00	08	00	10	00	08	00	

*n=other external-interrupt conditions.

Bytes 126 and 127 (X'7E'-'7F') of the communications region contain the address of these tables. Label PDTABB identifies the first byte of the first table. These tables are also used for optical reader/sorters.

Figure 10. Tables for MICR DTF Addresses and Pointers

Displacement	Label	Description
0-15	(ACCTCOMN) ACCTSVRG	Temporary register save area.
16-17	ACCTSVRX	Save area for remainder of overhead counter times distributed by partition on exit.
18-19	ACCTSVRE	Save area for remainder of all-bound counter times distributed by partition on entry.
20-23	ACCTPCNT	Count of partitions using JAI.
24	ACCTSAID	Owner of physical transient area*.
25	ACCTFAID	Interrupted program*.
26	ACCTRAID	Active program*.
27	ACCTSWCH	Accounting switches: if bit = 1, true; if bit = 0, not true. bit 0 - cancel accounting bit 1 - no active partitions bit 2 - catalog in process bit 3 - alternate label area bit 4 - IPL indicator bit 5 - $JOBACCT in F1 bit 6 - $JOBACCT in F2 bit 7 - $JOBACCT in BG
28-31	ACCTIME	Start time of current accounting interval, in complement format.
32-33	ACCTRESC	Reserved.
34-35	ACCTUSEP	Address of user save area (ACCTUSER).
36-39	ACCTBLES	Address of BG Job Accounting Table.
40-43	-----	Address of F2 Job Accounting Table if BJF; otherwise zero.
44-47	-----	Address of F1 Job Accounting Table if BJF; otherwise zero.
48-53	ACCTSEAS	Seize blocks; serve as overlapped Event Control Blocks.  TS Bit: X'00' = no $JOBACCT running X'FF' = $JOBACCT active
54-55	ACCTUSEL	Length of user save area, set with 4th operand of global AG39.

*Note: X'00' = all bound, X'10' = BG, X'20' = F2, X'30' = F1, X'40' = overhead and FG if SPI.

Figure 11. Job Accounting Interface Common Table (ACCTCOMN)

	Current Address										End Address						R	U.L.	L.L.		R.C.		Reserved	
SYSLNK	B	B	C	C	H	H	R	P	This area not used for SYSLNK DIB															
SYSIN	B	B	C	C	H	H	R	K	D	D	B	B	C	C	H	H	X	H	H	*	XX	XX		
SYSPCH																				*				
SYSLST																				*				
Number of Bytes	7							3			6						1	1	1	1	2		2	

KEY: Current Address: The next address to be used (for both input and output).
End Address : The last address within the limits of the extent.
R : Maximum number of records per track.
U.L. : Upper head limit
L.L. : Lower head limit
R.C. : Record Count - residual capacity for beginning of operator notification. This is set at system generation time with the SYSFIL parameter, or after IPL with the SET statement (RCLST and/or RCPCH operands). A warning message is issued by job control after end-of-job step when the minimum number of remaining records has been reached or exceeded during the previous job.
P : Starting cylinder of Private Core Image Library, if PCIL is assigned.
KDD : Key and data length for the symbolic device.

KDD for SYSIN = X'000050'
KDD for SYSPCH = X'000051'
KDD for SYSLST = X'000079'

Bytes 96 and 97 (X'60' - '61') of the communications region contain the address of the SYSLNK entry.
Label DSKPOS identifies the first byte of the table.

Figure 12. Disk Information Block (DIB) Table

PC Option Table and OC Option Table:

	A	B
BG	a	b
F2	a	b
F1	a	b
	word	word

A

No STXIT given: a = 0
STXIT issued: a = address of the user program check (operator communications) routine
STXIT issued when the user routine is already in use: a = complement of user program check (Operator communications) routine address

B

No STXIT given: b = 0
STXIT issued: address of the user save area

IT Option Table:

C	D
c	d
word	word

C

No TECB or STXIT issued: c = 0
TECB issued: c = address of the timer event control block
STXIT issued: c = address of the user interval timer routine
STXIT issued when user routine is already in use: c = complement of the user interval time routine address

D

No TECB or STXIT issued: d = 0
TECB issued: d = complement of the TECB address
STXIT issued: d = address of the user save area

AB Option Table:

	E	F
BG	e	f
F2	e	f
F1	e	f
	word	word

E

No STXIT given: e = 0
STXIT issued and rtnaddr parameter passed: e = address of entry point of user's abnormal termination routine. If AP (asynchronous processing) is supported, the maintask and subtasks may have the same or different AB routines. When a subtask is ATTACHed after a STXIT AB macro has been issued by the maintask, the subtask will receive the AB routine address specified by the maintask only if the ATTACH macro for that subtask has the ABSAVE parameter specified. The subtask can override this by issuing its own STXIT AB macro.

F

No STXIT given or no save area parameter passed: f = 0
STXIT issued and save area parameter passed: f = address of a 72-byte save area used by the supervisor to store the old PSW and general registers 0-15.

Each table address (less 8 bytes) is found in the communications region at the byte locations specified below. The labels shown identify the first byte of the corresponding table.

Table	Bytes in COMREG	Label
PC	100-101 (X'64' - '65')	PCTAB
IT	102-103 (X'66' - '67')	ITTAB
OC	104-105 (X'68' - '69')	OCTAB
AB	12-13 (X'0C - '0D') of extension	ABTAB

Figure 13. Option Tables

Byte Number	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
All Bound PIB	Reserved						H'16' Priority of All Bound PIB (Lowest)		Reserved				H'0' All Bound PIB Displacement		Reserved	
Background PIB	Address of BG Comm. Region		System LUB Index		Reserved		Priority of BG PIB (Note 4)		Address of Termination ECB, if any, or F'0'				X'0010' BG PIB Displacement		Reserved	
FG2 PIB (Note 1)	Address of Area Comm. Region (Note 2)		System LUB Index		Reserved		Priority of F2 PIB (Note 4)		Address of Termination ECB, if any, or F'0'				X'0020' F2 PIB Displacement		Reserved	
FG1 PIB (Note 1)	Address of Area Comm. Region (Note 2)		System LUB Index		Reserved		Priority of F1 PIB (Note 4)		Address of Termination ECB, if any, or F'0'				X'0030' F1 PIB Displacement		Reserved	
Attention PIB	Address of BG Comm. Region		0	0	Reserved		H'3' Priority of Attention PIB		F'0'				X'0040' Attention PIB Displacement		Reserved	
Quiesce I/O PIB	Reserved						H'2' Priority of Quiesce I/O PIB		F'0'				X'0050' Quiesce PIB Displacement		Reserved	
Supervisor PIB	Reserved						H'1' Priority of Supervisor PIB (Highest)		F'0'				X'0060' Supervisor PIB Displacement		Reserved	
Subtask PIB (Note 3)	Address of Area Comm. Region		System LUB Index		Reserved		Priority of Subtask (Note 4)		ECB Address for Subtask, or F'0'				PIB Displacement of Maintask		Reserved	

= 16 Byte Length

Note 1. Generated only if MPS is specified.

Note 2. Always background communications region except when MPS = BJF.

Note 3. Total of nine subtasks generated, and only when AP is specified.

Note 4. Will be filled in with halfword indicating the relative priority of task in the system (range H'4' to H'15', the lower the number the higher the priority).

Bytes 124 and 125 (X'7C'-'7D') of the communications region contain the address of the second part of the PIB table. Label PIB2AD identifies the first byte of the table. The second part of PIB table comes before the first part in storage allocation. Refer to Figure 2.

Figure 14. Second Part of Program Information Block (PIB) Table

PIB TABLE

Byte Number	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
All Bound PIB	Flag Byte See A *	Reserved	SP Prefix		Branch Instruction to the All Bound Routine				Reserved							
Problem Program PIB (Note 1)	Flag Byte See B *	Cancel Code (Fig. 36)	SYSLOG ID (BG, F2, or F1)		NOP Instruction (CR)	Address of the Partition Save Area			Number of Core Blocks (Note 2)	Address of the Origin of the Partition			PIB Assign Flag See D *	User LUB Index	Number of Program LUBs	Flag Byte See C *
Attention PIB	Flag Byte See E *	Cancel Code (Fig.36)	SYSLOG ID (AR)		Branch Code (BC)	Active=Address of Save Area Inactive=Remainder of BC Instruction			Switch Byte See F *	Logical Transient Bucket (contains save area address)			X'07' See D *	Reserved	Address of the Logical Transient	
Quiesce PIB	Flag Byte See A *	Cancel Code (Fig.36)	C'/&'		Branch Instruction to Quiesce I/O Routine				Scratch Byte X'00'	X'00'	Channel PUB Table Index Values X'04'	X'08'	X'OC'	X'10'	X'14'	X'18'
Supervisor PIB	Flag Byte See A *	Cancel Code (Fig.36)	SP Prefix		Branch Instruction to General Exit Routine				Address of SYSRES PUB		Length of Error Queue Entry		Constants to Clear Bytes 2-5 of CCB X'1F'	X'05'	X'00'	X'00'
Subtask PIB for AP (Note 3)	Flag Byte See B *	Cancel Code (Fig.36)	SYSLOG ID (BG, F2, or F1)		NOP Instruction	Address of the Save Area			Number of Core Blocks (Note 2)	Address of the Origin of the Main Task			PIB Assign Flag See D *	User LUB Index	Number of LUBs	Flag Byte See C *

= 16 Byte Length

Note 1: Three problem program PIBs are built in this sequence when the MPS or BJF feature is selected as a generation option:

- Background PIB
- Foreground 2 PIB
- Foreground 1 PIB

When a batch-only environment is established at generation time, the All Bound and Foreground PIBs are excluded from the table, and only one (BG) problem program PIB is built. However, the X'20' bytes that F2 and F1 PIBs normally occupy (between PIBBG and PIBAR) are filled with 32 bytes of DIBs data.

Note 2: Number is in multiples of 2K for F2 and F1. BG is always 10K (X' 0A').

Note 3: Total of nine subtask PIBs are generated, and only when AP is specified at generation time.

* See Figure 16 for flag byte expansions A, B, C, D, E and F.

Bytes 90 and 91 (X'5A' - '5B') of the communications region contain the address of the first part of the PIB Table. Label PIBTAB identifies the first byte of the table.

Figure 15. First Part of Program Information Block (PIB) Table (See Figure 14 for Second Part)

A Supervisor, Quiesce, and ALL Bound PIB Flags:

Bit 0: 1 = Always one
1-4 : 0 = Always zero
5 : 1 = Always one
6 : 1 = Active
0 = Inactive
7 : 1 = Active
0 = Inactive

Note: If PTO=YES is specified, Bit 6 is a one in the Quiesce I/O PIB when attached by the supervisor. Otherwise it is always zero.

B Problem Program PIB Flag (First Byte in PIB):

Bit 0: 1 = Registers stored
0 = Registers not stored
1-3 : 0 = Always zero
4 : 1 = QTAM Wait active
0 = QTAM Wait inactive
5 : 0 = Normal execution
1 = Program has seized the system
6 : 1 = Unbound
0 = SVC 2-bound (B-transient in progress)
7 : 1 = Unbound
0 = SVC 7-bound (waiting for an I/O interrupt)
X'80' indicates the program is not present in the system
X'87' indicates the program is PTO bound
X'89' indicates the program is IDRA bound

C Problem Program PIB Flag (Last Byte in PIB):

Bit 0: 1 = Batched Job in Foreground
0 = No BJF
1: Cancel in LTA and Device not Assigned
2: 1 = /& on SYSIN if DASD
0 = No /& on SYSIN
3-4: Reserved
5: 1 = Task is cancelled
0 = Task not cancelling
6: 1 = Subtask (s) attached
0 = No subtasks attached
7: 1 = In AB Routine
0 = Not in AB Routine

D PIB Assign Flag

X'80' = SYSRES DASD file protect inhibited (allow write operation on SYSRES)
X'40' = Channel appendage exit allowed (BTAM)
X'20' = Cancel in progress (used in terminator function)
X'10' = Cancel control (set on a foreground cancel)
X'08' = Hold-Release flag for foreground assignments
X'07' = Supervisor or Attention routine PIB assign flag setting
X'04' = Background program PIB assign flag setting
X'02' = Foreground 1 program PIB assign flag setting
X'01' = Foreground 2 program PIB assign flag setting

E Attention PIB Flag

Bit 0: 1 = Registers stored
0 = Registers not stored
1-5 : 0 = Always zero
6 : 1 = Attention routine active
0 = Attention routine SVC 2-bound
7 : 1 = Active
0 = SVC 7-bound

X'80' indicates the attention routine is not present in the system.
X'89' indicates the program is IDRA bound

F Attention PIB Switch Byte

Bit 0-2: Reserved
3: 1 = PTAFTCH (Fetch $SANERRY, Z, or 0) Switch ON
0 = PTAFTCH (Fetch $SANERRY, Z, or 0) Switch OFF
4: 1 = Detach Logical Attention Routine ($$BATTNA) Switch ON
0 = Detach Logical Attention Routine ($$BATTNA) Switch OFF
5: 1 = Physical Attention Recall Switch ON
0 = Physical Attention Recall Switch OFF
6: 1 = Attention Request Switch ON
0 = Attention Request Switch OFF
7: 1 = External Interrupt Request Switch ON
0 = External Interrupt Request Switch OFF

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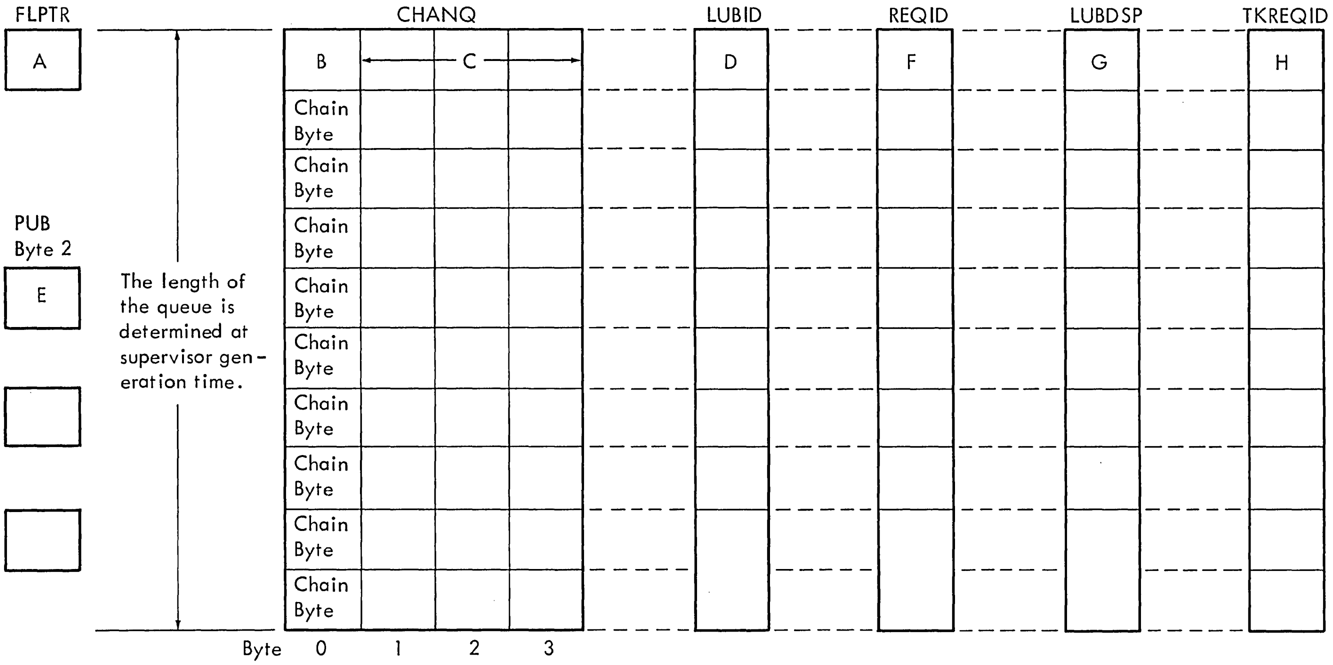
Figure 16. PIB Flag Expansions



The length of the queue is determined at supervisor generation time.

KEY

A — The free list pointer contains a displacement index to a free list entry within the channel queue. The free list is a group of entries that function in essentially the same manner as a device queue. When the free list pointer contains a hexadecimal FF, it indicates that no more free list entries are available.

B — The first byte of the channel queue entry (chain byte) contains a pointer (displacement index) to the next channel queue entry for that device. A hexadecimal FF indicates the last channel queue entry for that device. New requests on a given device are queued at the end of a given device queue.

C — CCB address for the specified device.

D — A pointer (displacement index) to the entire LUB table identifying the logical unit making the I/O request. This is doubled to get the actual displacement into the full LUB table.

E — Contains a pointer (displacement index) to the first channel queue entry for a specific device (Figure 18).

F — Contains a code identifying the program making the I/O request. The one-byte entry is called a RID (Requestor Identification). The RID indicates what program the CCB belongs to. The RID is in the form X'nk'.

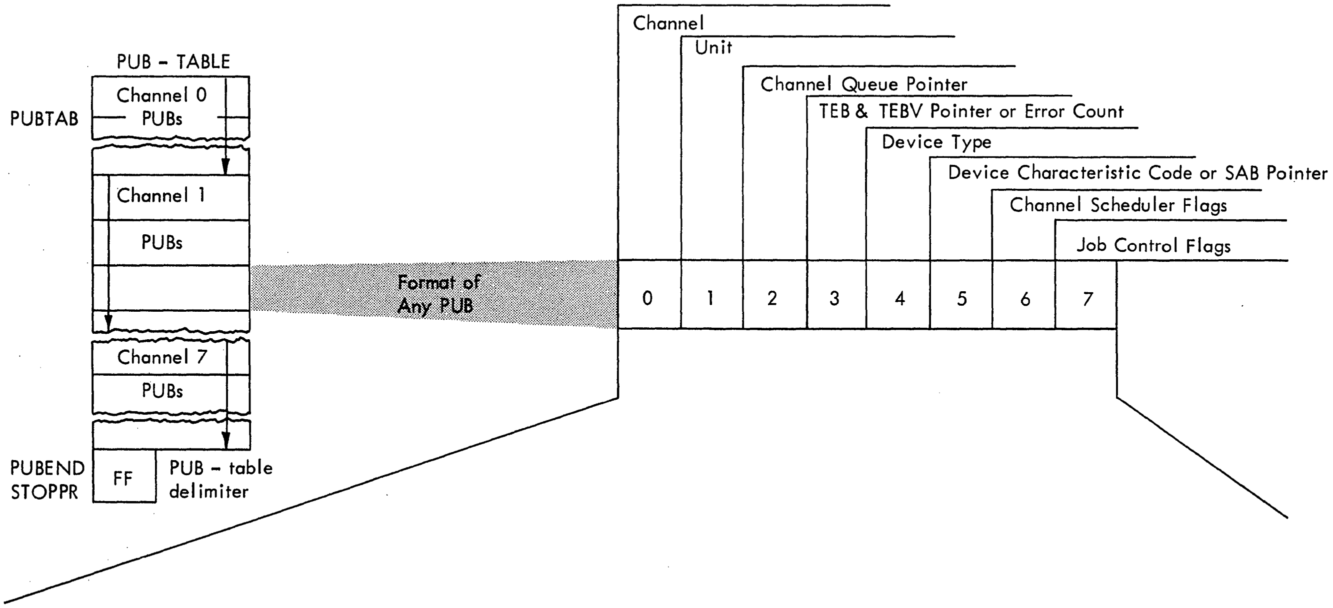
n = user-storage protection key (supervisor = 0, BG = 1, F2 = 2, F1 = 3).
k = 0 for all user requests and all supervisor CCBs, where n = 0.
k = 1 for supervisor CCBs to SYSLOG that bypass ID prefix.
k = 2 for a fetch CCB.
nk = FF for any unused channel queue entries.

G — Contains X'FF' if the LUB is nonsystem class, or contains the displacement index within the partition LUB if it is a system class LUB.

H — Contains X'FF', or the displacement into the PIB table for the PIB of the task requesting I/O.

Bytes 108-109 (X'6C'-'6D') of the communications region contain the address of the LUBID Table. Label LUBIDTAB identifies the first byte of the table. The addresses of the other tables are not at fixed locations. They can be found in the program listing cross-reference by using the labels CHANQ, REQIDTAB, LUBDSPTB, and TSKIDTAB.

Figure 17. CHANQ, LUBID, REQID, LUBDSP, and TKREQID Tables



BYTE 0 - Channel number. (Hex 0-7, FF=NULL)

BYTE 1 - I/O device unit number. (HEX 1F= 1052, HEX 80=magnetic tape unit 0 . . .)

BYTE 2 - HEX 0, 1, 2, . . . points to the first channel queue entry for this device.

BYTE 3 - If device is a magnetic tape unit* and TEBs and/or TEBVs are specified, this byte is a TEB/TEBV pointer (HEX 1, 2, 3 . . .)

If device is a magnetic tape unit* but neither TEBs nor TEBVs are specified, this byte is an error counter.

If device is not a magnetic tape unit*, this byte is an error counter.

BYTE 4 - See Figure 29 for device type codes.

BYTE 5 - SS of the MODE=parameter in the DVCGEN macro for tape unit. (See Figure 30.)

For DASD with seek separation, this byte is used as the SAB pointer. With track hold but not seek separation supported, this byte contains a pointer to the Track Hold Table entry or X'FF' (with both SKSEP and TRKHLD specified, the track hold pointer is found in the SAB entry).

For MICR type devices, this byte indicates the external interrupt line is in use.

BYTE 6 -
Bit 0: 1 = Device busy
1: 1 = Switchable device
2: 1 = EOJ for SYSRDR or SYSIPT
3: 1 = I/O error queued for recovery
4: 1 = Operator intervention required
5: 1 = Device end posting required
6: 1 = Burst device on MPX
7: 1 = 7-track tape unit

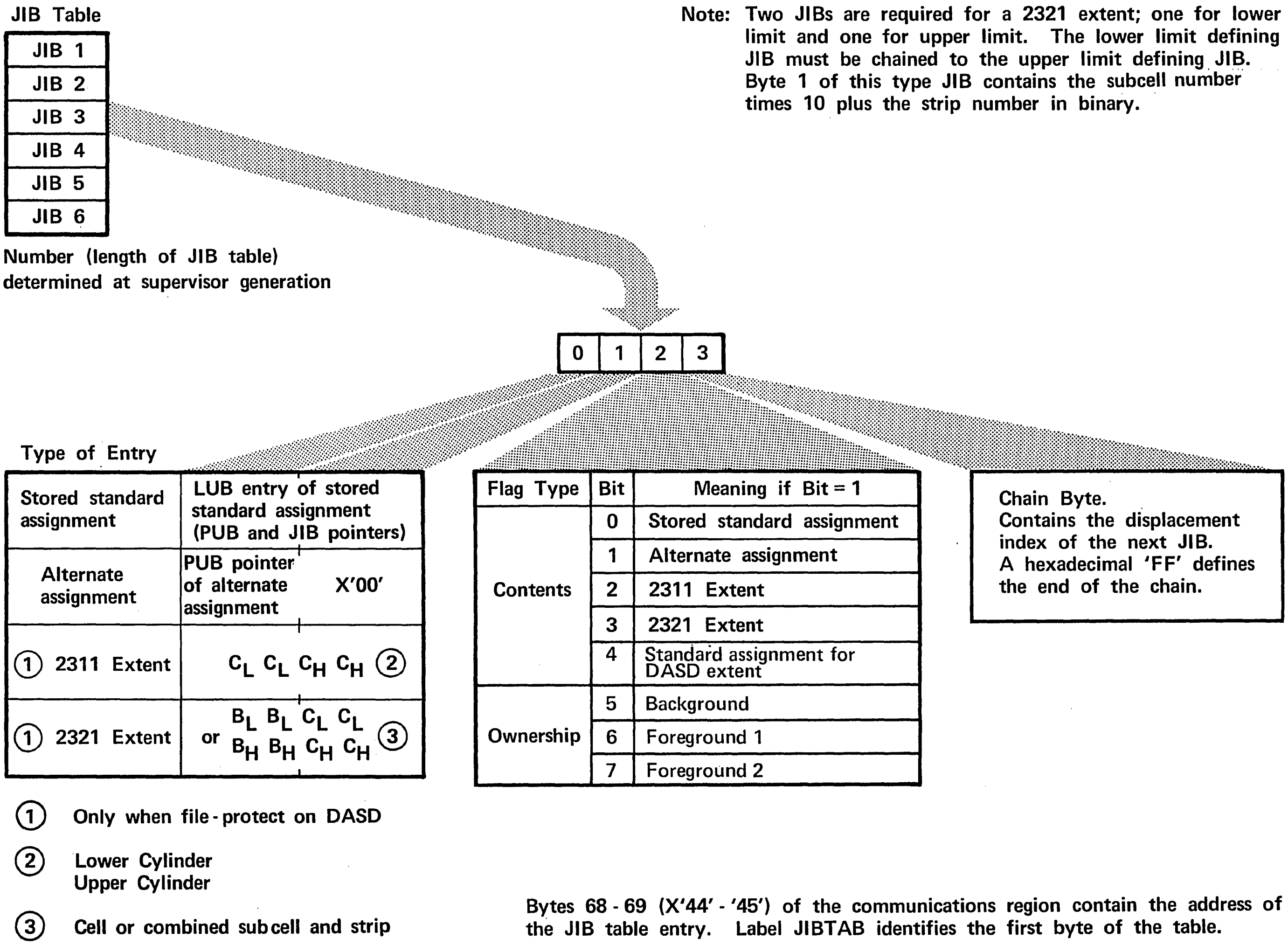
BYTE 7 -
Bit 0-4: standard MODE assignment for 7-track tape (all ones if not tape, all zeros if device is down).
5: device is assigned to a background job
6: device is assigned to a foreground 1 job
7: device is assigned to a foreground 2 job

NOTE: A null is generated for each device to be supported by the supervisor.
Standard physical unit assignments are made to the PUB table at supervisor generation time. PUBs are ordered by channel and priority within a channel.

Bytes 64 and 65 (X'40' - '41') of the communications region contain the address of the PUB table entry.
Label PUNTAB identifies the first byte of the table.

*2400 series or 3420 Magnetic Tape units or 2495 Tape Cartridge Reader (TEBs); 2400 series or 3420 Magnetic Tape units only (TEBVs).

Figure 18. Physical Unit Block (PUB) Table



Number (length of JIB table) determined at supervisor generation

Note: Two JIBs are required for a 2321 extent; one for lower limit and one for upper limit. The lower limit defining JIB must be chained to the upper limit defining JIB. Byte 1 of this type JIB contains the subcell number times 10 plus the strip number in binary.

Stored standard assignment	LUB entry of stored standard assignment (PUB and JIB pointers)
Alternate assignment	PUB pointer of alternate assignment X'00'
① 2311 Extent	C_L C_L C_H C_H ②
① 2321 Extent	B_L B_L C_L C_L or B_H B_H C_H C_H ③

Flag Type	Bit	Meaning if Bit = 1
Contents	0	Stored standard assignment
	1	Alternate assignment
	2	2311 Extent
	3	2321 Extent
	4	Standard assignment for DASD extent
Ownership	5	Background
	6	Foreground 1
	7	Foreground 2

Chain Byte.
Contains the displacement index of the next JIB.
A hexadecimal 'FF' defines the end of the chain.

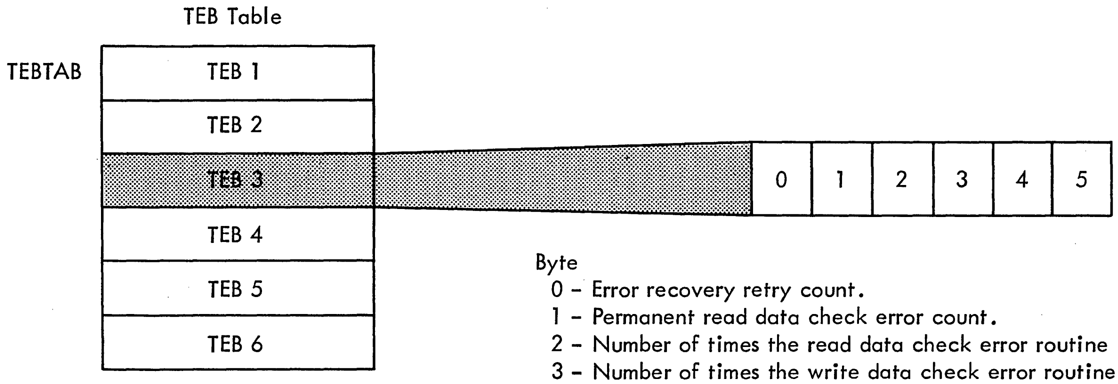
① Only when file-protect on DASD

② Lower Cylinder
Upper Cylinder

③ Cell or combined subcell and strip

Bytes 68 - 69 (X'44' - '45') of the communications region contain the address of the JIB table entry. Label JIBTAB identifies the first byte of the table.

Figure 19. Job Information Block (JIB) Table



Byte
0 - Error recovery retry count.
1 - Permanent read data check error count.
2 - Number of times the read data check error routine is entered.
3 - Number of times the write data check error routine is entered.
4 - Write skip (erase gap) count.
5 - Noise record count.

One TEB is generated for each 2400 series or 3420 magnetic tape or 2495 Tape Cartridge Reader unit if the FOPT macro contains the TEB = n parameter. Job control resets each TEB at normal or abnormal End-of-Job. An unused TEB contains HEX'FF0000000000'. A TEB is referenced from byte 3 of a magnetic tape unit PUB.

Bytes 70 and 71 (X'46'-'47') of the communications region contain the address of the TEB table entry. Label TEBTAB identifies the first byte of the table.

Figure 20. Tape Error Block (TEB) Table

Decimal Displacement	Label	Byte Length	Description
(TEBV Status Block portion of TEBV Table, see Note 1)			
0	TEBLEN	1	Length of TEBV Error Block (for each Error Block generated)
1	TSBLEN	1	Length of TEBV Status Block (4, 6, or 22 bytes, see Note 1)
2	EVARTH	1	EVA Read Error Threshold
3	EVAWTH	1	EVA Write Error Threshold
...	......	...	... ...
4	TEBSTAT	1	DASD ESTV File Status
5	TEBUDC	1	ESTVFLE Label Update Counter
...	......	...	... ...
6	TEBDEV	1	Data Set Device Code
7	UPXTNT	4	Disk Address of Upper Extent of Data Set (cchh)
11	TEBRPT	1	Number of Records per Track
12	NXTESR	5	Disk Address of Next Available Space for Data Record (cchhr)
17	ESTVLABL	5	Pointer to ESTVFLE Label in VTOC (cchhr)
...	......	...	... ...
(TEBV Error Block portion of TEBV Table, see Note 2)			
22	TEBV	1	Status Indicator (giving status of posting and writing error conditions)
23		1	Usage Indicator (X'00'=TEBV Error Block in use, X'FF'=Error Block generated but not serving any tape unit)
24		1	Retry Counter
25		1	Permanent Read Errors
26		1	Temporary Read Errors
27		1	Temporary Write Errors
28		1	Erase Gaps
29		1	Noise Blocks
30		1	Permanent Write Errors
31		1	Cleaner Actions
32		2	Number of Start I/Os
34		6	Volume Serial Number (volume ID)
...	......	...	... ...
40 (repeat bytes 22-39 for each TEBV Error Block)			

Figure 21. TEBV Table Showing Status Block and Error Blocks (Part 1 of 2)

Note 1: The TEBV (Tape Error Block by Volume) Table is composed of one Status Block and (n) Error Blocks, and is addressed symbolically by label TEBVTAB.

Supervisor generation options in the FOPT macro determine the size of the TEBV Status Block at generation time:

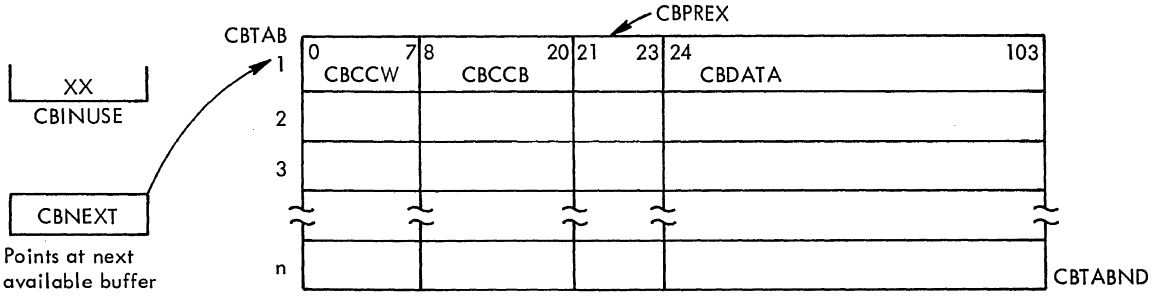
- When EVA is chosen without ESTV, the TEBV Status Block is four bytes long (bytes 0-3), followed by TEBV Error Blocks, so that bytes 4-21 are omitted.

- When ESTV output is to SYSLOG, the TEBV Status Block is six bytes long (bytes 0-5), followed by TEBV Error Blocks, so that bytes 6-21 are omitted.

- When ESTV output is to DASD, the TEBV Status Block is 22 bytes long (bytes 0-21, such as shown in this Figure), followed by TEBV Error Blocks.

Note 2: The number of TEBV Error Blocks generated corresponds to the (n) parameter of the FOPT macro for TEB, TEBV, or EVA options. A TEBV Error Block always contains 18 bytes, as shown in bytes 22-39 of this Figure. Therefore, the TEBV Table is composed of one TEBV Status Block (with its byte length dependent on supervisor generation options, as described in Note 1), followed by (n) number of 18-byte TEBV Error Blocks.

Figure 21. TEBV Table Showing Status Block and Error Blocks (Part 2 of 2)



The Buffer Table is a 104 multiplied-by-n byte area of main storage, where n is 1 - 50. Each buffer entry in the table is 104 bytes. CBNEXT is a half-word constant that points at the next available buffer entry. CBNEXT is initialized with the address of CBTAB and is incremented by 104 every time a buffer is used, so that it points at the next entry. When its value becomes greater than CBTABND, CBNEXT is reinitialized with the value CBTAB.

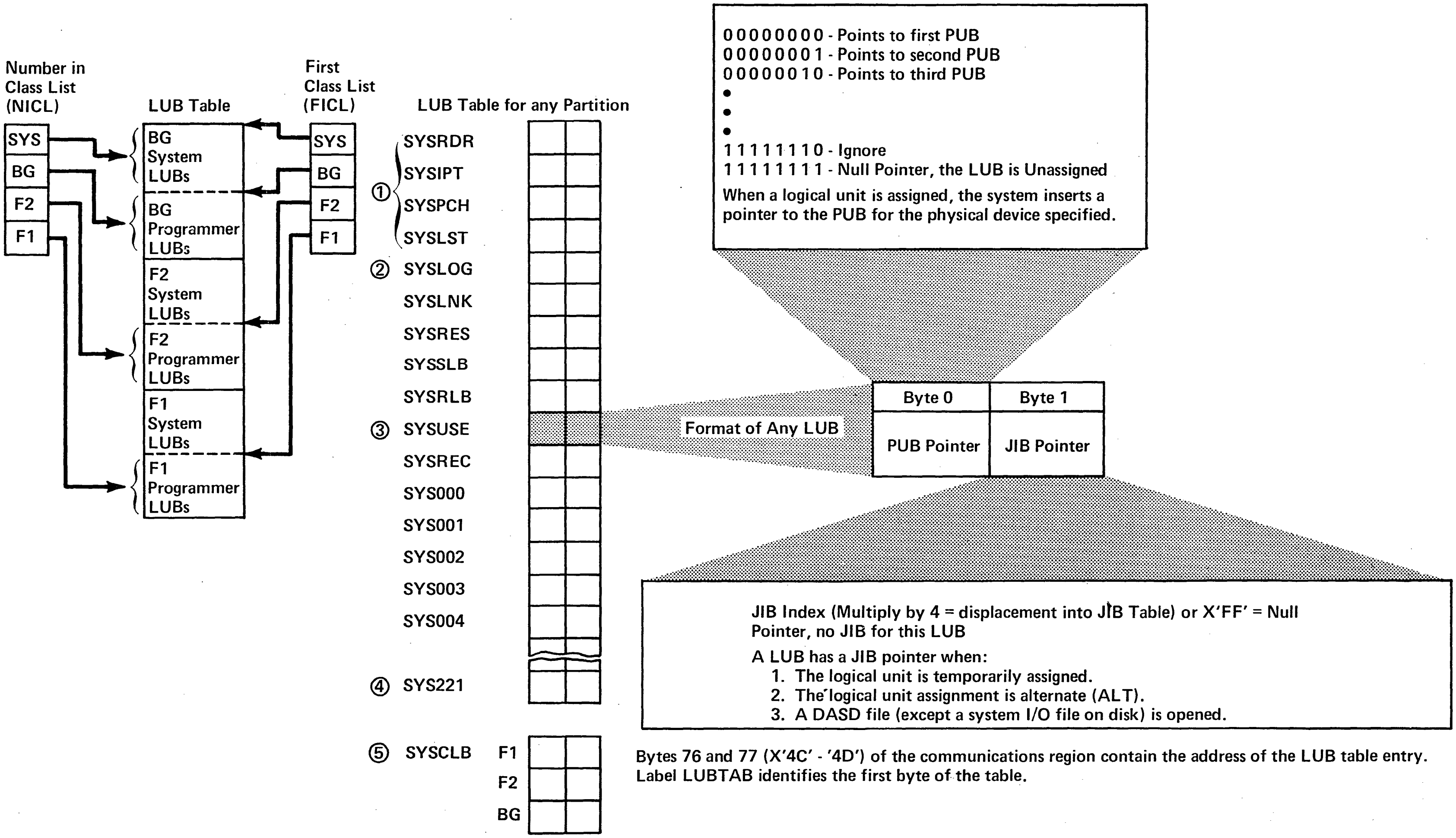
CBINUSE is a one-byte counter that contains the number of entries currently in use. It is incremented whenever a buffer is used and is decremented at dequeue time when the buffer becomes free.

Each buffer entry contains the following fields:

Displacement:	0	CCW moved from requestor core. The data address portion of the CCW is modified to point at the data portion of the buffer.
	8	CCB moved from requestor core. The CCW address in the CCB is modified to point at the CCW in the buffer.
	21	Prefix. SYSLOG ID moved from problem program PIB. The prefix is printed with the data to identify BG, F1, or F2 partitions.
	24	Data moved from requestor core.

Figure 22. Console Buffering Table (CBTAB) and Work Areas

Figure 23. Logical Unit Block (LUB) Table



00000000 - Points to first PUB
00000001 - Points to second PUB
00000010 - Points to third PUB
•
•
•
11111110 - Ignore
11111111 - Null Pointer, the LUB is Unassigned

When a logical unit is assigned, the system inserts a pointer to the PUB for the physical device specified.

JIB Index (Multiply by 4 = displacement into JIB Table) or X'FF' = Null Pointer, no JIB for this LUB

A LUB has a JIB pointer when:

1. The logical unit is temporarily assigned.
2. The logical unit assignment is alternate (ALT).
3. A DASD file (except a system I/O file on disk) is opened.

Bytes 76 and 77 (X'4C' - '4D') of the communications region contain the address of the LUB table entry. Label LUBTAB identifies the first byte of the table.

① When in Single Program Initiation mode (Foreground 1 or 2): Must be unit record device and can be referenced by the program.

② When in Single Program Initiation mode (Foreground 1 or 2): Can be referenced by the program.

③ SYSUSE may be called SYSCTL in error recovery messages.

④ The maximum number of programmer logical units in the system is 222 if MPS = BJF, or 244 if MPS = YES or NO.

⑤ The SYSCLB (Private Core Image Library) LUB entry functions the same as other LUB entries, but is not part of the LUB Table. To locate the SYSCLB LUB in supervisor, perform the following steps:

1. Divide the PIK by 8.
2. Subtract the result in step 1 from the address of the PIB extension block.
3. If option AP = YES, the result of step 2 is the location of SYSCLB LUB. If option AP = NO, add 16 (for the all-bound PIBX) to the result of step 2.

	X'FF' or Pointer	CCB Address	Address of Held Track (BBCCHH)	Key of Task	Flag and Counter
	X	XXX	XXXXXX	X	X
Byte	0	1	4	10	11

Byte	Explanation
0	X'FF' or pointer to next available entry in the table. This is also placed in the PUB table, byte 5.
1-3	Address of CCB associated with the task requesting the hold.
4-9	Disk address of the track being held (in the form BBCCHH).
10	Key of the task owning the track.
11	Bit 0 on indicates a task is waiting for this track. 1-3 Unused 4-7 counter of number of holds on the track.

Figure 24. Track Hold (TKHDTAB) Table

Displacement	Label	Description
0-3	ACCTWK1* (ACCTABLE)*	Work area used in SIO update.
4-7	ACCTWK2	Work area used with ACCTWK1 in start/stop time routine
8-11	ACCTSVPT	Job card pointer; address of job card field following jobname.
12	ACCTPART	ID of partition in charge (partition switch name).
13	ACCTRES2	Reserved.
14-15	ACCTLEN	Length of SIO area=6n+1, where n=number of devices for this partition in SYSGEN option JA=(n1, n2, n3).
16-21	ACCTLOAD	Label area instruction; moves JAI label area address to OPEN/CLOSE transients.
22-23	ACCTRES3	Reserved.
24-27	ACCTLADD	Address of alternate label area.
28-31	ACCTCPUT	Counter for CPU time elapsed in a jobstep, counted in 300ths of a second.
32-35	ACCTOVHT	Counter for overhead time; time not charged to any partition.
36-39	ACCTBNDT	Counter for all-bound time; system wait state time divided between running partitions.
40-47	ACCTSVJN	Save area for job name during simulated EOJ.
		JOB ACCOUNTING TABLE (user's portion of Partition Table)
48-55	ACCTJBNM	Job name; taken from job card.
56-71	ACCTUSRS	User information; 16 bytes from Job card.
72-73	ACCTPTID	Partition ID; 'BG', 'F2', or 'F1' in EBCDIC format.
74	ACCTCNCL	Cancel code; see Cancel Codes and Messages (Figure 32).
75	ACCTYPER	Type of record: 'S'=job step, 'L'=last step of job.
76-83	ACCTDATE	Date in format specified at SYSGEN (MM/DD/YY or DD/MM/YY).
84-87	ACCTSTRT	Start time of job, in packed decimal (OHHMMSSF; F=sign).
88-91	ACCTSTOP	Stop time of job, in same format as ACCTSTRT
92-95	ACCTRES	Reserved.
96-103	ACCTEXEC	Phase name; taken from execute card.
104-107	ACCTHICR	High core address of active program phase, from COMREG.
108-111	ACCTIMES	CPU time elapsed in a job step; counted in 300ths of a second.
112-115	------	Overhead time; elapsed time not charged to any partition, in 300ths of a second.
116-119	------	All-bound time; system wait state time divided between running partitions, in 300ths of a second.
120	ACCTSIOS	SIO tables: 6 bytes for each device specified by SYSGEN options, as follows: 2 bytes for device address (Ocuu), 4 bytes for count of SIOs in current jobstep.
———	------	Overflow byte: normally X'20', but is X'30' if more devices are used within a partition than specified by SYSGEN options.

*Note: DSECT ACCTABLE symbolically addresses the JAI Partition Tables with labels as shown. Each partition in which JAI is supported has its own JAI Partition Table, labeled ACCTBG, ACCTF2, ACCTF1, for active partitions BG, F2, and F1 respectively.

Figure 25. Job Accounting Interface Partition Table (ACCTxx)

0 SDR Flags (SDR-TABLE)	1 Partition ID	2 3 Number of SDR Records	4 10 First SDR ID BBCCHHR	11 17 First OBR ID BBCCHHR	18 24 Current OBR ID BBCCHHR	25 31 Last OBR ID BBCCHHR

32 35 Address of SDR Accumulator	36 39 Address of SDR Unit Switches	40 43 Reserved	44 71 List Save Area

72 75 Mask Bytes	76 95 SDR1 Work Area	96 103 Test Under Mask Table	104 107 Temporary Work Area	108 111 Test Under Mask Instruction	112 115 F'65536'	116 117 SDR Queue Save Area

118 135 SDR2 Work Area	136 155 Area Modified by A-Transients	156 159 SDR Error Message Save Area	160 163 Branch Instruction	164 167 OBR/SDR Flag Byte Address

168 250 Data Area for OBR/SDR Records

Key to SDR Communications Region Displacements:

0 SDR Flags:

Bit 0: Key of OBR
1: RDE option
2: Initial IPL time
3: RF option = NO, recording is suppressed

Bit 4: RF option = CREATE
5: RF option = YES
6: Error while recording
7: Recorder file ready

Set and tested by Job Control.

1 Set by EREP transient $$BSDRUP to identify the partition making the call for EREP recording.

Settings: X'10' if EREP is running in BG.
X'20' if EREP is running in F2.
X'30' if EREP is running in F1.
X'01' with one of the above if recorder file is ready.
X'00' with one of the above if recorder file is not ready.

2 Initial number of SDR records specified. If SDR record count is not specified, the file is formatted for OBR records only ($JOBCTLM, see IPL and Job Control PLM, Y24-5086).

4 Disk address of first SDR record.

11 Disk address of first OBR record.

18 Disk address of current OBR record.

25 Disk address of last OBR record.

Figure 26. SDR Communications Region (SDRTABLE) (Part 1 of 2)

Key to SDR Communications Region Displacements:

32	Address of SDR accumulator area which contains half-byte counters and accumulated error conditions.
36	Address of SDR unit switches. SDR switch byte (1 for each PUB): X'80' - Update operations complete X'40' - Counters on external file overflowed X'20' - I/O error during write X'08' - SDR update half-byte counters routine required X'04' - Update SDR record routine required Other - Reserved When entry contains X'01000000', indicates MCRR, no SDR supported.
40	Reserved.
44	SDR1 register save area.
72	Mask formats for interpretive error accumulator, SDR1: X'FF' - End of update X'FE' - Bypass counter X'FD' - Set up 'OR' condition to previous counter X'FC' - Ignore list item Other - Test bit in error queue
76	Used by the interpretive error accumulator routine to process list passed by OBR/SDR A-transient.
96	Used by the interpretive error accumulator routine.
104	Used by the interpretive error accumulator routine for address alignment.
108	Executed by the interpretive error accumulator routine.
112	Loop counter for the SDR counter update.
116	Save area for pointers to entries in the SDR error queue.
118	Work area where half byte error counters are unpacked and updated.
136	List of devices passed to the SDR processor from $$ANERAD.
156	Used by SDR/OBR recorder phases to pass error message displacements and disk error addresses in event of an error.
160	Entry point from OBR/SDR A-transients. Branches to label SDRMM.
164	Pointer into the OBR/SDR unit switches. Status posted by recorder phases. (See byte 36).
168	OBR and SDR records formatted by the recorder phases.

Figure 26. SDR Communications Region (SDRTABLE) (Part 2 of 2)

ASCII to EBCDIC Correspondence (0/0 to 3/15)

ASCII					EBCDIC				
Character	Col	Row	Bit Pattern		Col (in Hex)	Row (in Hex)	Bit Pattern		Comments
NUL	0	0	0000	0000	0	0	0000	0000	
SOH	0	1	0000	0001	0	1	0000	0001	
STX	0	2	0000	0010	0	2	0000	0010	
ETX	0	3	0000	0011	0	3	0000	0011	
EOT	0	4	0000	0100	3	7	0011	0111	
ENQ	0	5	0000	0101	2	D	0010	1101	
ACK	0	6	0000	0110	2	E	0010	1110	
BEL	0	7	0000	0111	2	F	0010	1111	
BS	0	8	0000	1000	1	6	0001	0110	
HT	0	9	0000	1001	0	5	0000	0101	
LF	0	10	0000	1010	2	5	0010	0101	
VT	0	11	0000	1011	0	B	0000	1011	
FF	0	12	0000	1100	0	C	0000	1100	
CR	0	13	0000	1101	0	D	0000	1101	
SO	0	14	0000	1110	0	E	0000	1110	
SI	0	15	0000	1111	0	F	0000	1111	
DLE	1	0	0001	0000	1	0	0001	0000	
DC1	1	1	0001	0001	1	1	0001	0001	
DC2	1	2	0001	0010	1	2	0001	0010	
DC3	1	3	0001	0011	1	3	0001	0011	
DC4	1	4	0001	0100	3	C	0011	1100	
NAK	1	5	0001	0101	3	D	0011	1101	
SYN	1	6	0001	0110	3	2	0011	0010	
ETB	1	7	0001	0111	2	6	0010	0110	
CAN	1	8	0001	1000	1	8	0001	1000	
EM	1	9	0001	1001	1	9	0001	1001	
SUB	1	10	0001	1010	3	F	0011	1111	
ESC	1	11	0001	1011	2	7	0010	0111	
FS	1	12	0001	1100	1	C	0001	1100	
GS	1	13	0001	1101	1	D	0001	1101	
RS	1	14	0001	1110	1	E	0001	1110	
US	1	15	0001	1111	1	F	0001	1111	
SP	2	0	0010	0000	4	0	0100	0000	
|	2	1	0010	0001	4	F	0100	1111	Logical OR
"	2	2	0010	0010	7	F	0111	1111	
#	2	3	0010	0011	7	B	0111	1011	
$	2	4	0010	0100	5	B	0101	1011	
%	2	5	0010	0101	6	C	0110	1100	
&	2	6	0010	0110	5	0	0101	0000	
'	2	7	0010	0111	7	D	0111	1101	
(	2	8	0010	1000	4	D	0100	1101	
)	2	9	0010	1001	5	D	0101	1101	
*	2	10	0010	1010	5	C	0101	1100	
+	2	11	0010	1011	4	E	0100	1110	
,	2	12	0010	1100	6	B	0110	1011	
–	2	13	0010	1101	6	0	0110	0000	Hyphen, Minus
.	2	14	0010	1110	4	B	0100	1011	
/	2	15	0010	1111	6	1	0110	0001	
0	3	0	0011	0000	F	0	1111	0000	
1	3	1	0011	0001	F	1	1111	0001	
2	3	2	0011	0010	F	2	1111	0010	
3	3	3	0011	0011	F	3	1111	0011	
4	3	4	0011	0100	F	4	1111	0100	
5	3	5	0011	0101	F	5	1111	0101	
6	3	6	0011	0110	F	6	1111	0110	
7	3	7	0011	0111	F	7	1111	0111	
8	3	8	0011	1000	F	8	1111	1000	
9	3	9	0011	1001	F	9	1111	1001	
:	3	10	0011	1010	7	A	0111	1010	
;	3	11	0011	1011	5	E	0101	1110	
<	3	12	0011	1100	4	C	0100	1100	
=	3	13	0011	1101	7	E	0111	1110	
>	3	14	0011	1110	6	E	0110	1110	
?	3	15	0011	1111	6	F	0110	1111	

Figure 27. ASCII Translation Tables (Part 1 of 4)

ASCII to EBCDIC Correspondence (4/0 to 7/15)

ASCII					EBCDIC				
Character	Col	Row	Bit Pattern		Col (in Hex)	Row	Bit Pattern		Comments
@	4	0	0100	0000	7	C	0111	1100	
A	4	1	0100	0001	C	1	1100	0001	
B	4	2	0100	0010	C	2	1100	0010	
C	4	3	0100	0011	C	3	1100	0011	
D	4	4	0100	0100	C	4	1100	0100	
E	4	5	0100	0101	C	5	1100	0101	
F	4	6	0100	0110	C	6	1100	0110	
G	4	7	0100	0111	C	7	1100	0111	
H	4	8	0100	1000	C	8	1100	1000	
I	4	9	0100	1001	C	9	1100	1001	
J	4	10	0100	1010	D	1	1101	0001	
K	4	11	0100	1011	D	2	1101	0010	
L	4	12	0100	1100	D	3	1101	0011	
M	4	13	0100	1101	D	4	1101	0100	
N	4	14	0100	1110	D	5	1101	0101	
O	4	15	0100	1111	D	6	1101	0110	
P	5	0	0101	0000	D	7	1101	0111	
Q	5	1	0101	0001	D	8	1101	1000	
R	5	2	0101	0010	D	9	1101	1001	
S	5	3	0101	0011	E	2	1110	0010	
T	5	4	0101	0100	E	3	1110	0011	
U	5	5	0101	0101	E	4	1110	0100	
V	5	6	0101	0110	E	5	1110	0101	
W	5	7	0101	0111	E	6	1110	0110	
X	5	8	0101	1000	E	7	1110	0111	
Y	5	9	0101	1001	E	8	1110	1000	
Z	5	10	0101	1010	E	9	1110	1001	
[	5	11	0101	1011	4	A	0100	1010	
\	5	12	0101	1100	E	0	1110	0000	Reverse Slant
]	5	13	0101	1101	5	A	0101	1010	
¬	5	14	0101	1110	5	F	0101	1111	Logical NOT
_	5	15	0101	1111	6	D	0110	1101	Underscore
`	6	0	0110	0000	7	9	0111	1001	Grave Accent
a	6	1	0110	0001	8	1	1000	0001	
b	6	2	0110	0010	8	2	1000	0010	
c	6	3	0110	0011	8	3	1000	0011	
d	6	4	0110	0100	8	4	1000	0100	
e	6	5	0110	0101	8	5	1000	0101	
f	6	6	0110	0110	8	6	1000	0110	
g	6	7	0110	0111	8	7	1000	0111	
h	6	8	0110	1000	8	8	1000	1000	
i	6	9	0110	1001	8	9	1000	1001	
j	6	10	0110	1010	9	1	1001	0001	
k	6	11	0110	1011	9	2	1001	0010	
l	6	12	0110	1100	9	3	1001	0011	
m	6	13	0110	1101	9	4	1001	0100	
n	6	14	0110	1110	9	5	1001	0101	
o	6	15	0110	1111	9	6	1001	0110	
p	7	0	0111	0000	9	7	1001	0111	
q	7	1	0111	0001	9	8	1001	1000	
r	7	2	0111	0010	9	9	1001	1001	
s	7	3	0111	0011	A	2	1010	0010	
t	7	4	0111	0100	A	3	1010	0011	
u	7	5	0111	0101	A	4	1010	0100	
v	7	6	0111	0110	A	5	1010	0101	
w	7	7	0111	0111	A	6	1010	0110	
x	7	8	0111	1000	A	7	1010	0111	
y	7	9	0111	1001	A	8	1010	1000	
z	7	10	0111	1010	A	9	1010	1001	
{	7	11	0111	1011	C	0	1100	0000	
|	7	12	0111	1100	6	A	0110	1010	Vertical Line
}	7	13	0111	1101	D	0	1101	0000	
~	7	14	0111	1110	A	1	1010	0001	Tilde
DEL	7	15	0111	1111	0	7	0000	0111	

Figure 27. ASCII Translation Tables (Part 2 of 4)

EBCDIC to ASCII Correspondence (X'00' to X'82')

EBCDIC					ASCII				
Character	Col	Row	Bit Pattern		Col	Row	Bit Pattern		Comments
	(in Hex)								
NUL	0	0	0000	0000	0	0	0000	0000	
SOH	0	1	0000	0001	0	1	0000	0001	
STX	0	2	0000	0010	0	2	0000	0010	
ETX	0	3	0000	0011	0	3	0000	0011	
HT	0	5	0000	0101	0	9	0000	1001	
DEL	0	7	0000	0111	7	15	0111	1111	
VT	0	B	0000	1011	0	11	0000	1011	
FF	0	C	0000	1100	0	12	0000	1100	
CR	0	D	0000	1101	0	13	0000	1101	
SO	0	E	0000	1110	0	14	0000	1110	
SI	0	F	0000	1111	0	15	0000	1111	
DLE	1	0	0001	0000	1	0	0001	0000	
DC1	1	1	0001	0001	1	1	0001	0001	
DC2	1	2	0001	0010	1	2	0001	0010	
DC3	1	3	0001	0011	1	3	0001	0011	
BS	1	6	0001	0110	0	8	0000	1000	
CAN	1	8	0001	1000	1	8	0001	1000	
EM	1	9	0001	1001	1	9	0001	1001	
FS	1	C	0001	1100	1	12	0001	1100	
GS	1	D	0001	1101	1	13	0001	1101	
RS	1	E	0001	1110	1	14	0001	1110	
US	1	F	0001	1111	1	15	0001	1111	
LF	2	5	0010	0101	0	10	0000	1010	
ETB	2	6	0010	0110	1	7	0001	0111	
ESC	2	7	0010	0111	1	11	0001	1011	
ENQ	2	D	0010	1101	0	5	0000	0101	
ACK	2	E	0010	1110	0	6	0000	0110	
BEL	2	F	0010	1111	0	7	0000	0111	
SYN	3	2	0011	0010	1	6	0001	0110	
EOT	3	7	0011	0111	0	4	0000	0100	
DC4	3	C	0011	1100	1	4	0001	0100	
NAK	3	D	0011	1101	1	5	0001	0101	
SUB	3	F	0011	1111	1	10	0001	1010	
SP	4	0	0100	0000	2	0	0010	0000	
[	4	A	0100	1010	5	11	0101	1011	
.	4	B	0100	1011	2	14	0010	1110	
<	4	C	0100	1100	3	12	0011	1100	
(	4	D	0100	1101	2	8	0010	1000	
+	4	E	0100	1110	2	11	0010	1011	
|	4	F	0100	1111	2	1	0010	0001	Logical OR
&	5	0	0101	0000	2	6	0010	0110	
]	5	A	0101	1010	5	13	0101	1101	
$	5	B	0101	1011	2	4	0010	0100	
*	5	C	0101	1100	2	10	0010	1010	
)	5	D	0101	1101	2	9	0010	1001	
;	5	E	0101	1110	3	11	0011	1011	
¬	5	F	0101	1111	5	14	0101	1110	Logical NOT
-	6	0	0110	0000	2	13	0010	1101	Hyphen, Minus
/	6	1	0110	0001	2	15	0010	1111	
¦	6	A	0110	1010	7	12	0111	1100	Vertical Line
,	6	B	0110	1011	2	12	0010	1100	
%	6	C	0110	1100	2	5	0010	0101	
_	6	D	0110	1101	5	15	0101	1111	Underscore
>	6	E	0110	1110	3	14	0011	1110	
?	6	F	0110	1111	3	15	0011	1111	
`	7	9	0111	1001	6	0	0110	0000	Grave Accent
:	7	A	0111	1010	3	10	0011	1010	
#	7	B	0111	1011	2	3	0010	0011	
@	7	C	0111	1100	4	0	0100	0000	
'	7	D	0111	1101	2	7	0010	0111	
=	7	E	0111	1110	3	13	0011	1101	
"	7	F	0111	1111	2	2	0010	0010	
a	8	1	1000	0001	6	1	0110	0001	
b	8	2	1000	0010	6	2	0110	0010	

Figure 27. ASCII Translation Tables (Part 3 of 4)

EBCDIC to ASCII Correspondence (X'83' to X'F9')

EBCDIC					ASCII				
Character	Col (in Hex)	Row (in Hex)	Bit Pattern		Col	Row	Bit Pattern		Comments
c	8	3	1000	0011	6	3	0110	0011	
d	8	4	1000	0100	6	4	0110	0100	
e	8	5	1000	0101	6	5	0110	0101	
f	8	6	1000	0110	6	6	0110	0110	
g	8	7	1000	0111	6	7	0110	0111	
h	8	8	1000	1000	6	8	0110	1000	
i	8	9	1000	1001	6	9	0110	1001	
j	9	1	1001	0001	6	10	0110	1010	
k	9	2	1001	0010	6	11	0110	1011	
l	9	3	1001	0011	6	12	0110	1100	
m	9	4	1001	0100	6	13	0110	1101	
n	9	5	1001	0101	6	14	0110	1110	
o	9	6	1001	0110	6	15	0110	1111	
p	9	7	1001	0111	7	0	0111	0000	
q	9	8	1001	1000	7	1	0111	0001	
r	9	9	1001	1001	7	2	0111	0010	
~	A	1	1010	0001	7	14	0111	1110	Tilde
s	A	2	1010	0010	7	3	0111	0011	
t	A	3	1010	0011	7	4	0111	0100	
u	A	4	1010	0100	7	5	0111	0101	
v	A	5	1010	0101	7	6	0111	0110	
w	A	6	1010	0110	7	7	0111	0111	
x	A	7	1010	0111	7	8	0111	1000	
y	A	8	1010	1000	7	9	0111	1001	
z	A	9	1010	1001	7	10	0111	1010	
{	C	0	1100	0000	7	11	0111	1011	
A	C	1	1100	0001	4	1	0100	0001	
B	C	2	1100	0010	4	2	0100	0010	
C	C	3	1100	0011	4	3	0100	0011	
D	C	4	1100	0100	4	4	0100	0100	
E	C	5	1100	0101	4	5	0100	0101	
F	C	6	1100	0110	4	6	0100	0110	
G	C	7	1100	0111	4	7	0100	0111	
H	C	8	1100	1000	4	8	0100	1000	
I	C	9	1100	1001	4	9	0100	1001	
}	D	0	1101	0000	7	13	0111	1101	
J	D	1	1101	0001	4	10	0100	1010	
K	D	2	1101	0010	4	11	0100	1011	
L	D	3	1101	0011	4	12	0100	1100	
M	D	4	1101	0100	4	13	0100	1101	
N	D	5	1101	0101	4	14	0100	1110	
O	D	6	1101	0110	4	15	0100	1111	
P	D	7	1101	0111	5	0	0101	0000	
Q	D	8	1101	1000	5	1	0101	0001	
R	D	9	1101	1001	5	2	0101	0010	
\	E	0	1110	0000	5	12	0101	1100	Reverse Slant
S	E	2	1110	0010	5	3	0101	0011	
T	E	3	1110	0011	5	4	0101	0100	
U	E	4	1110	0100	5	5	0101	0101	
V	E	5	1110	0101	5	6	0101	0110	
W	E	6	1110	0110	5	7	0101	0111	
X	E	7	1110	0111	5	8	0101	1000	
Y	E	8	1110	1000	5	9	0101	1001	
Z	E	9	1110	1001	5	10	0101	1010	
0	F	0	1111	0000	3	0	0011	0000	
1	F	1	1111	0001	3	1	0011	0001	
2	F	2	1111	0010	3	2	0011	0010	
3	F	3	1111	0011	3	3	0011	0011	
4	F	4	1111	0100	3	4	0011	0100	
5	F	5	1111	0101	3	5	0011	0101	
6	F	6	1111	0110	3	6	0011	0110	
7	F	7	1111	0111	3	7	0011	0111	
8	F	8	1111	1000	3	8	0011	1000	
9	F	9	1111	1001	3	9	0011	1001	

Figure 27. ASCII Translation Tables (Part 4 of 4)

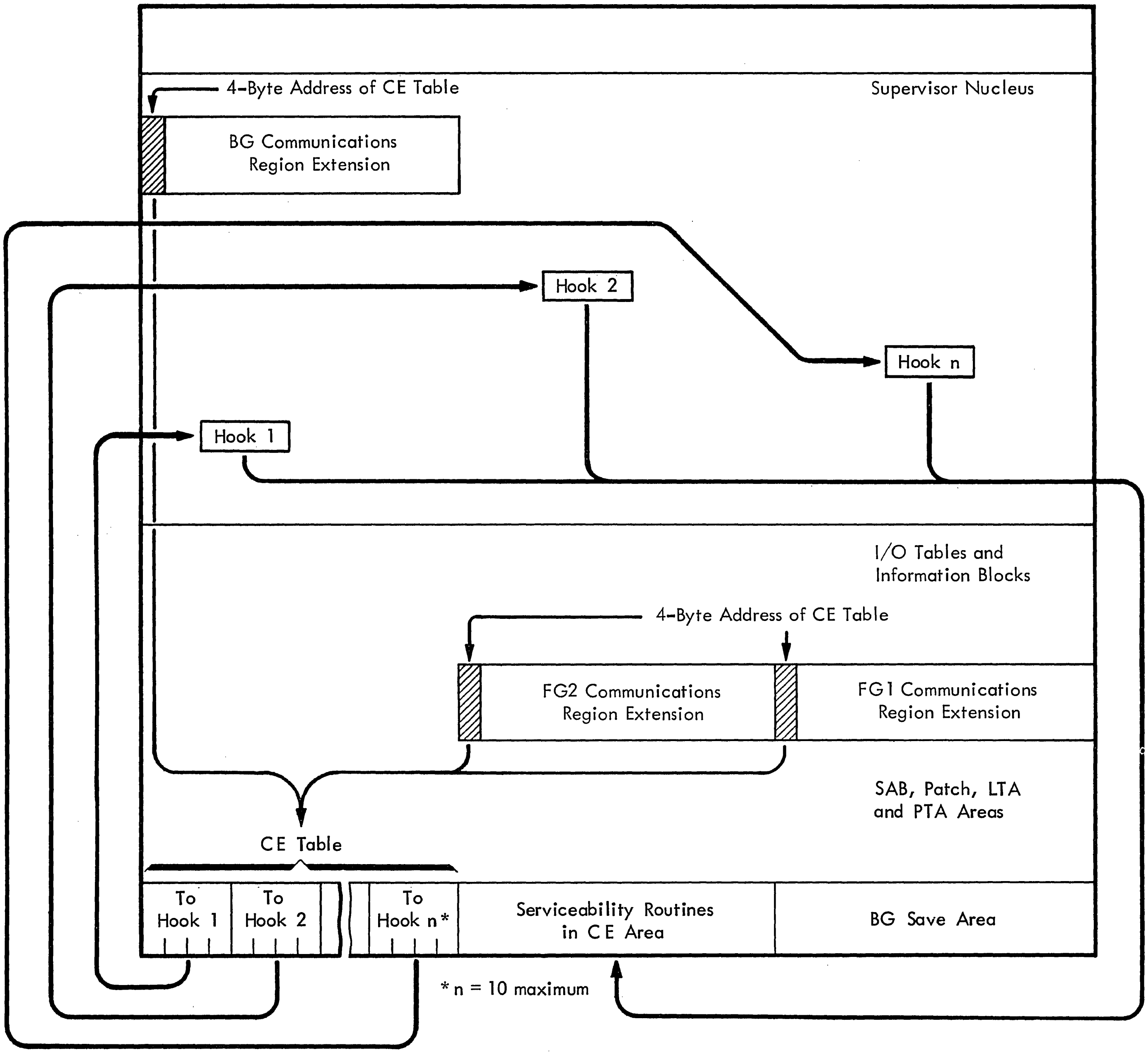


Figure 28. Accessing CE Serviceability and PDAID Routines

Card Code	Actual Device	Dev. Type X'nn'	Device Type
2400T9	9-track 2400 Series Magnetic Tape Units	50	Magnetic Tape Units
	9-track 3420 Magnetic Tape Units		
2400T7	7-track 2400 Series Magnetic Tape Units		
	7-track 3420 Magnetic Tape Units		
2495TC	2495 Tape Cartridge Reader	51	Tape Cartridge Reader
1442N1	1442N1 Card Read Punch	30	Card Readers - Punches
2520B1	2520B1 Card Read Punch	31	
2501	2501 Card Reader	10	Card Readers
2540R	2540 Card Reader	11	
2540P	2540 Card Punch	21	Card Punches
2520B2	2520B2 Card Punch	20	
1442N2	1442N2 Card Punch	22	
2520B3	2520B3 Card Punch	20	
1403	1403 Printer	40	Printers
1403U	1403 Printer with UCS Feature	42	
3211	3211 Printer	43	
1404	1404 Printer	40	
1443	1443 Printer	41	
1445	1445 Printer	41	
1050A	1052, 3210, or 3215 Printer-Keyboard	00	
UNSP	Unsupported Device	FF	Unsupported. No burst mode on multiplexor channel
UNSPB	Unsupported Device	FF	Unsupported with burst mode on multiplexor channel
2311	2311 Disk Storage Drive	60	DASD
2314	2314 Direct Access Storage Facility	62	
	2319 Disk Storage Facility		
2321	2321 Data Cell Drive	61	
1412 **	1412 Magnetic Character Reader	75	MICR - Magnetic Ink Character Recognition Devices and Optical Reader/Sorters
1419 **	1419 Magnetic Character Reader	72	
	1255 Magnetic Character Reader		
	1259 Magnetic Character Reader		
1419P **	1419 Dual Address Adapter Primary Control Unit	73	
1419S **	1419 Dual Address Adapter Secondary Control Unit	74	
2701 *	2701 Data Adapter Unit	D0	Teleprocessing lines A = SAD0 command when enabling the line B = SAD1 command when enabling the line C = SAD2 command when enabling the line D = SAD3 command when enabling the line
2702 A B C D		D1	
2703	2703 Transmission Control	D2	
2955	2955 Data Adapter Unit	D7	Data link for RETAIN/370
2671	2671 Paper Tape Reader	70	Paper Tape Reader
1285	1285 Optical Reader	76	Optical Readers
1287	1287 Optical Reader	77	
1288	1288 Optical Page Reader		
1017	1017 Paper Tape Reader with 2826 Control Unit Model 1	78	Paper Tape Reader
1018	1018 Paper Tape Punch with 2826 Control Unit Model 1	79	Paper Tape Punch
2260	2260 or 2265 Display Station	C0	Display Station
7770	7770 Audio Response Unit	D3	Audio Response Units
7772	7772 Audio Response Unit	D4	
1017TP	1017 Paper Tape Reader with 2826 Control Unit Model 2	D5	Paper Tape Reader
1018TP	1018 Paper Tape Punch with 2826 Control Unit Model 2	D6	Paper Tape Punch

Note: The codes used in the DVCGEN macros are the same codes used in IPL statements.

* For other teleprocessing devices, see IBM System/360, DOS BTAM and QTAM PLMs, GY30-5001 and GY30-5002.

** This device type code is also used for the 1270/1275 optical reader/sorters.

Figure 29. Device Type Codes

Density (Bytes per inch)	Parity	Convert Feature	Translate	SS Code*
200	odd	on	off	10
200	odd	off	off	30
200	odd	off	on	38
200	even	off	off	20
200	even	off	on	28
556	odd	on	off	50
556	odd	off	off	70
556	odd	off	on	78
556	even	off	off	60
556	even	off	on	68
800	odd	on	off	90
800	odd	off	off	B0
800	odd	off	on	B8
800	even	off	off	A0
800	even	off	on	A8
800	dual density nine-track			C8
1600	dual density nine-track			C0

* Refer to PUB Table (Figure 18), byte 5.

Figure 30. Density Data

RESIDENT SUPERVISOR (CHARTS 01-10)

The supervisor is the storage resident portion of the Disk Operating System. It is loaded into storage at IPL time and remains there throughout system operations. Refer to the preceding section of this manual for information about generation of the resident supervisor. Refer to Figure 2 for information about the storage organization of the resident supervisor.

Infrequently-used supervisory functions are not included in the resident supervisor. They are in the form of transient programs (A and B) and are fetched or loaded from the core image library when needed.

BATCH JOB SUPPORT

Batch jobs may be run in any of the three partitions (BG, F2, F1). Batch job support is always provided in the background partition. To run in the foreground partitions, the MPS=BJF option must be specified.

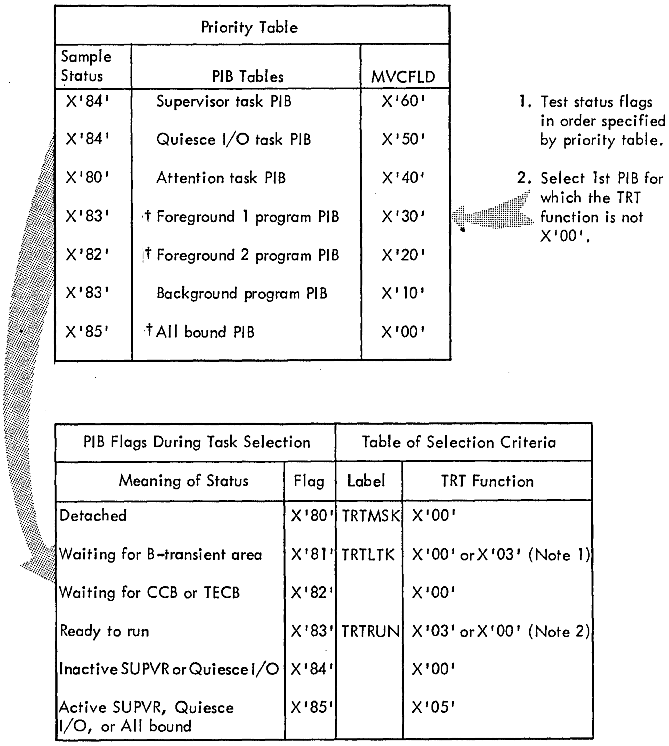
MULTIPROGRAMMING SUPPORT (MPS)

General Entry and General Exit routines provide the mechanism for multiprogramming support. Refer to these areas on Chart 01 for additional descriptions for multiprogramming concepts. Figure 31 illustrates the task selection procedure associated with multiprogramming.

SUPERVISOR INTERRUPT PROCESSORS

This portion of the resident supervisor processes the following system interrupts:

- I/O interrupt.
- Program check interrupt.
- External interrupt.
- Machine check interrupt.
- Supervisor call interrupt.



Priority Table		
Sample Status	PIB Tables	MVCFLD
X'84'	Supervisor task PIB	X'60'
X'84'	Quiesce I/O task PIB	X'50'
X'80'	Attention task PIB	X'40'
X'83'	†Foreground 1 program PIB	X'30'
X'82'	†Foreground 2 program PIB	X'20'
X'83'	Background program PIB	X'10'
X'85'	†All bound PIB	X'00'

1. Test status flags in order specified by priority table.
2. Select 1st PIB for which the TRT function is not X'00'.

PIB Flags During Task Selection		Table of Selection Criteria	
Meaning of Status	Flag	Label	TRT Function
Detached	X'80'	TRTMSK	X'00'
Waiting for B-transient area	X'81'	TRTLTK	X'00' or X'03' (Note 1)
Waiting for CCB or TECB	X'82'		X'00'
Ready to run	X'83'	TRTRUN	X'03' or X'00' (Note 2)
Inactive SUPVR or Quiesce I/O	X'84'		X'00'
Active SUPVR, Quiesce I/O, or All bound	X'85'		X'05'

Note 1: X'00' when the B-transient area is in use as indicated by the Logical Transient Key (LTK).

Note 2: X'00' when a task has seized the system. That task's status flag will equal X'84' or X'85'.

† These PIBs are generated for MPS option only.

Figure 31. Task Selection Procedure

I/O INTERRUPT

Microprogramming detects an I/O interrupt and loads the I/O new PSW. Refer to the I/O Interrupt Processor on Chart 04.

PROGRAM CHECK INTERRUPT

Microprogramming detects a program check interrupt and loads the program check new PSW. Refer to Program Check Interrupt Processor on Chart 02.

EXTERNAL INTERRUPT

Microprogramming detects an external interrupt and loads the external new PSW. External interrupts can be caused by:

- Timer
- External interrupt key
- Signal

Refer to External Interrupt Processor on Chart 05.

MACHINE CHECK INTERRUPT

Microprogramming detects a machine check interrupt and loads the machine check new PSW. In a system without MCRR option, the SEREP action code (S) is stored in storage location 0001, and the system enters the wait state. If MCRR is present, system recovery is attempted. Refer to Chart 07.

SUPERVISOR CALL INTERRUPT (SVC)

SVC is detected by microprogramming, which loads the SVC new PSW. The SVC interrupt processor (Chart 03) analyzes the SVC code placed in the SVC old PSW by the calling program. Control is transferred to the appropriate processing routine. Some SVCs are optional and cause a cancel if the supervisor was generated without the option. (See Figure 33 for a list of supervisor calls.)

SVC 0: Execute the channel program (EXCP). The address of the user's command control block (CCB) must be supplied in general register 1 before this SVC is issued. Return may be either to the interrupted program or to the highest priority program ready to run.

Note: When an SVC 0 is issued by supervisor or A-Transient programs, the address of the CCB must be supplied in general register 15 before the SVC is issued.

SVC 1: Fetches a phase. A fetch loads a phase from the system core image library or a private core image library (see Note) and branches to the entry address in that phase. The load and entry addresses are obtained from the respective core image directory entry for the phase being fetched. The storage address of the phase name must be supplied in general register 1 before this SVC is issued. The user may override the linkage editor entry address by supplying an entry address in general register 0. Return may be either to the interrupted program or to the highest priority program ready to run.

Note: If a PCIL (Private Core Image Library) is assigned, it is searched first for the proper phase. If the phase is not found, the system core image library is then searched. When the first character of the phase name is $, the system core image library is searched first and the private core image library last.

SVC 2: Fetches a B-transient. Loads a B-transient program (phase name prefix equals $$B) from the system core image library, or a private core image library (see SVC 1 Note), to the B-transient area (refer to Figure 2), and enters the B-transient at its load address plus 8 bytes. The storage address of the B-transient phase name must be supplied in general register 1.

An address in general register 0 is ignored. The B-transient is loaded at the beginning address of the B-transient area. General register 15 is loaded with this address and may be used by B-transients as a base register. Return may be either to the interrupted program or to the highest priority program ready to run.

Only one program can use the B-transient area at a time. If the B-transient program is SVC 7 bound, another program is selected. This program becomes SVC 2 bound (waiting for the B-transient area) if it issues an SVC 2. Another program is then selected.

Note: Supervisor may branch directly to the SVC 2 routine when fetching a B-transient. If the transient is not in the library when referenced by the supervisor, the system enters the wait state.

SVC 3: Fetches or returns from an A-transient. Load an A-transient program (phase name prefix equals $$A) from the system core image library, or a private core image library (see SVC 1 Note), to the A-transient area (refer to Figure 2), and enters the A-transient at its load address plus 8 bytes. The storage address of the A-transient phase name is loaded in general register 1 before the fetch is made.

An address in general register 0 is ignored. The A-transient is loaded at the beginning address of the A-transient area. General register 11 is loaded with this address and is used by A-transients as a base register. Return is to the interrupted program.

Note: Supervisor may branch directly to the SVC 3 routine when fetching an A-transient. Only programs operating in the supervisor mode can issue an SVC 3. If the transient is not in the library, the system enters the wait state.

Caution: SVC 3 is also used as a return from an A-transient program. The last byte of the A-transient name field determines the usage.

- X'00' - Returning from error recovery A-transients.
- X'01' - Returning from physical attention transients ($$ANERRZ, Y, 0) or post cancel by any A-transient.
- Alphameric - Fetch A-transient.

When returning from an A-transient, the branch address is in general register 15. The A-transient must load one of the exit addresses from the error recovery block (ERBLOC). Refer to Figure 43.

SVC 4: Loads a phase from the system core image library, or a private core image library (see SVC 1 Note), and returns to the user. (See the following Note.) The storage address of the phase name must be supplied in general register 1 before this SVC is issued. The user may override the link-edited load address by supplying a load address in general register 0. Upon return to the user, general register 1 contains the phase entry address adjusted for any changes in the phase's load address.

Note: Return may be either to the interrupted program or to the highest priority program ready to run.

SVC 5: Modifies the supervisor communications region. Supplies the supervisory support for the MVCOM macro. The sequence of events is:

1. MVCOM macro issues an SVC 5.
2. SVC 5 fetches $$ANERR1 by branching to the SVC 3 routine.
3. $$ANERR1 alters the supervisor communications region as specified by the MVCOM macro.

Return may be either to the interrupted program or to the highest priority program ready to run.

SVC 6: Cancels a program (task) or partition. If either a subtask or maintask (or only program in the partition) issues a CANCEL, cancel code X'23' is posted to the PIB for the task issuing the cancel. If a maintask issues a CANCEL while subtasks are attached, cancel code X'17' is posted in the maintask PIB. If a CANCEL ALL is issued, cancel code X'1C' is posted. Cancel code X'23' does not cause a system dump even if the dump option has been specified.

A simple cancel issued by a subtask performs the same function as DETACH (see SVC 39), but also posts the ECB's byte 2, bits 0 and 1, and issues a subtask cancellation message. When CANCEL is issued by a maintask, the partition is canceled.

A CANCEL ALL macro issued by a subtask cancels the entire partition. In this case, the AB exits for all tasks that have them are taken, except for the subtask issuing the CANCEL ALL. (Refer to Figures 14-16 for the format of the PIB table, to Chart 03 for General Cancel Routine, and to Figure 36 for cancel codes.) The next time the canceled program is selected on general exit, the supervisor branches to the SVC 2 routine to fetch the cancel B-transient program $$BEOJ3 if teleprocessing is supported, or $$BEOJ4 if teleprocessing is not supported.

SVC 7: Waits for I/O to complete or a timer interrupt to occur. SVC 7 supplies the supervisory support for the WAIT macro.

With MPS option, returns directly to the interrupted program if the traffic bit has been posted in the CCB or TECB. See SVC 24 in this list for an explanation of the TECB. If traffic bit is not posted:

1. Change the status of the interrupted program PIB to SVC 7 bound (not ready to run).
2. Select the highest priority program that is ready to run.

When I/O is completed or a timer interrupt occurs:

1. The traffic bit is posted in the CCB or TECB.
2. The PIB is restored to the ready-to-run status.
3. When this program is again selected at general exit, the old PSW is loaded with the address of the second instruction of the WAIT macro expansion.

Without MPS option, returns directly to the interrupted program if the traffic bit has been posted in the CCB or TECB. (See SVC 24 in this list for an explanation of the TECB.) If the traffic bit is not posted, the system enters the wait state with interrupts enabled.

SVC 8: Supplies the supervisory support to temporarily return from a B-transient program to the problem program. The B-transient area is not released. The task selection exit loads the problem program registers. An SVC 9 is used to return to the B-transient program.

SVC 9: Supplies the supervisory support for returning to the B-transient after an SVC 8 is issued. The task selection exit loads the B-transient registers.

SVC 10: Sets a timer interval. This SVC is optional, and the issuing program is canceled if supervisor is generated without the IT option. Only the timer supported program can issue an SVC 10. Others are canceled.

The time interval is specified in general register 1 by the user (SETIME macro). The system time of day (SYSTOD, X'54') is updated to the time that the next interrupt should occur (may change if another SVC 10 is issued). The system timer (SYSTIMER, X'50') is set to the specified time interval. The time interval in SYSTIMER immediately begins to lapse. Refer to IBM System/360 Principles of Operation, GA22-6821, for information concerning the operation of SYSTIMER.

Note: Current system time of day can be obtained by shifting out the low order byte from the remaining time interval (SYSTIMER) and subtracting it from system time of day (SYSTOD). Time in SYSTOD is represented in the form, seconds x 300. Time in SYSTIMER is in the form, seconds x 300 x 256.

An SVC 10 returns directly to the timer supported program. No task selection is performed.

SVC 11: Returns from a B-transient releasing the B-transient area. SVC 11 is invalid if issued by other than a B-transient. The logical transient area is released for use by other programs or tasks. Return is to the highest priority program ready to run.

SVC 12: Supplies the supervisory support to reset flags to 0 in the linkage control byte (displacement 57 in the supervisor communications region). The user loads the address of a mask (1 byte, hexadecimal) into general register 1. This mask is ANDed with the linkage control byte. An SVC 12 returns directly to the interrupted program. No task selection is performed.

SVC 13: Supplies the supervisory support to set flags to 1 in the linkage control byte (displacement 57 in the supervisor communications region). The user loads the address of a mask (1 byte, hexadecimal) into general register 1. This mask is ORed with the linkage control byte. An SVC 13 returns directly to the interrupted program. No task selection is performed.

SVC 14: This is the normal end of job (EOJ). Cancel code X'10' is posted to the PIB for the program issuing the SVC 14. Refer to Figures 14-16 for the format of the PIB tables and to Chart 03 for the General Cancel routine. The next time the canceled program is selected on general exit, a branch is made to the SVC 2 routine to fetch the cancel B-transient program $$BEOJ3 if teleprocessing is supported, or $$BEOJ4 if teleprocessing is not supported. Job control is loaded by $$BEOJ to perform the end-of-job-step.

SVC 15: This is the same as SVC 0 (EXCP), with this exception: when the CHANQ table is full, the SVC is ignored. Return is directly to the interrupted program in this case. If the CHANQ table is not full, general register 0 is zeroed and EXCP is issued (see SVC 0 in this list).

Note: The CHANQ table is full when the free list pointer (FLPTR) equals X'FF'. Refer to Figure 17 for the format of the CHANQ table and to Figure 32 for CHANQ operation.

SVCs 16 through 21 and SVC 37: These supervisor calls provide supervisory support for the STXIT and EXIT macros. They are optional, and the issuing program is canceled if supervisor was not generated with the applicable option.

- SVC 16 stores the address of the user's program check (PC) routine and save area address in the PC option table.
- SVC 17 provides a return from the user's PC routine to the program interrupted due to a program check.
- SVC 18 stores the address of the user's interval timer (IT) routine and save area address in the IT option table. Only the timer supported program can issue SVC 18. If multitasking, only the maintask can process the interruption.
- SVC 19 provides a return from the user's IT routine to the timer supported program. Only the timer supported program can issue SVC 19.
- SVC 20 stores the address of the user's operator communications (OC) routine

and save area address in the OC option table. If multitasking, only the maintask can process the interruption.

- SVC 21 provides a return from the user's OC routine to the program interrupted by the external interrupt key.

The address of the user routine is specified in general register 0, and the address of the user's save area is specified in general register 1 in all cases. Refer to Figure 13 for the format of the option tables.

SVCs 16, 18, and 20 return directly to the interrupted program. SVCs 17, 19, and 21 return either to the interrupted program or to the highest priority program ready to run.

SVC 22: Seizes the system and provides a release from such a seizure. The SVC 22 is ignored if supervisor was generated without the MPS option. The program issuing an SVC 22 is canceled if the PSW protection key field does not equal 0. (Only job control and B-transient programs can issue an SVC 22.)

The first SVC 22 issued seizes the system and the next one issued releases the system. The last byte of register 0 replaces the system mask. If register 0 is negative, the protection key is replaced by the protection key of the PIK.

The task selection mechanism is altered by the first SVC 22 so that only supervisor or quiesce I/O tasks and the program that issued the SVC 22 can be selected. The next SVC 22 issued restores the task selection mechanism. The contents of the last byte of general register 0 are again used as the system mask.

Return from each SVC 22 is directly to the interrupted program.

Note:

- There is no way to cancel a program that has seized the system.
- The program must have no pending I/O operations.
- The program cannot issue supervisor calls while the system is seized.

SVC 23: Loads phase header. Retrieves the load address for a specified phase from the system core image directory or a private core image directory. The program issuing an SVC 23 is canceled if supervisor was generated without the MPS option or if the PSW protection key does not equal 0. (Only job control and B-transient programs can issue an SVC 23.)

The user must specify the address of the core image phase name in general register 1 and the address where the load address is to be stored in general register 0. The main fetch subroutine scans the core image directory and retrieves the load address. If the phase is found in the directory, the load address (3 bytes) is stored at the address specified by general register 0. If the phase is not found, the supervisor returns control to the interrupted program.

SVC 24: Stores the address of the user's timer event control block (TECB) and sets a timer interval. This SVC is optional, and the issuing program is canceled if supervisor is generated without IT option. Only the timer supported program can issue an SVC 24. Others are canceled.

The address of the user's TECB is specified in general register 0, and the time interval is specified in general register 1.

The traffic bit is reset in the TECB, and the TECB address is stored in the IT option table. Refer to Figure 13 for the format of the IT option table.

Note: The TECB has the same format as a command control block (CCB), but only the traffic bit is used. The traffic bit is set when a timer interrupt occurs. Refer to Figure 37 for the format of the CCB.

The time interval is set, and the system time of day is updated as for an SVC 10. (See SVC 10.) An SVC 24 returns directly to the timer supported program. No task selection is performed.

The user causes the program to wait for the timer interrupt to occur by issuing an SVC 7. (See SVC 7 in this list.)

SVC25: Halts I/O on a teleprocessing device, or halts I/O on any device if issued by OLTEP. If the supervisor is generated without teleprocessing and without OLTEP, any issuing program is canceled.

The address of any command control block (CCB) containing the symbolic address of the device to be halted must be supplied in register 1 before issuing the SVC 25. If the SVC 25 is used by a program other then OLTEP, an HIO instruction is issued to the device if:

1. It is a teleprocessing device, and
2. An I/O interrupt is pending for the device.

If OLTEP is the issuing program, an HIO instruction is issued to the device if there is I/O pending for the device. That is the only restriction on OLTEP's use of SVC 25.

The supervisor returns to the highest priority program ready to run. The device busy flag is reset at this time. Unless SVC 25 is issued by OLTEP or a teleprocessing device, this SVC is ignored and results in cancelation. If OLTEP was a supervisor option and teleprocessing was not, issuing as SVC 25 by a program other than OLTEP results in cancelation.

SVC 26: Validate address limits. The program issuing an SVC 26 is canceled if the PSW protection key does not equal 0. (Only job control and B-transient programs can issue an SVC 26.)

The upper address must be specified in general register 2, and the lower address must be specified in general register 1. The upper address must be within main storage, and the lower address must be higher than the end of supervisor address, or the program is canceled (ERR25). Return is to the interrupted program. No task selection is performed.

With MPS option, the PIK of the program issuing the SVC 26 must equal the storage protection key for both addresses or the program is canceled (ERR25).

With batch operation, SVC 26 is ignored unless storage protection has been specified.

SVC 27: Same as SVC 25, except that SVC 27 cannot be used by OLTEP. It can be used only to halt I/O on a teleprocessing device. The CCB is not dequeued if the CSW has been stored after an HIO command.

SVC 28: Provides return from user's stacker select routine to the MICR external interrupt routine in the supervisor. This SVC is optional and causes a cancel if issued at any point other than in a stacker select routine with MICR devices.

SVC 29: Provides supervisory support for the WAITM macro (except for MICR type devices). If WAITM=YES has been specified in the FOPT macro, WAITM coding is generated to load general register 1 with the address of the ECB list name and to issue the SVC 29. However, when MICR type devices are used, SVC 47 is issued to identify the wait on the MICR CCB.

All interrupts are disabled and the CCBs are all checked for the traffic bit. When a CCB is found with the traffic bit posted, SVC 29 returns to the interrupted program.

If all CCBs are checked and no traffic bits are posted, one of two courses is taken:

- With MPS option - Cause user to become I/O-bound, disable for I/O interrupts only, and return to task selection.
- Without MPS option - Set wait bit in SVC old PSW, disable for I/O interrupts only, and return to interrupted program.

SVCs 30, 31, and 32: Reserved for QTAM. Refer to the QTAM PLM listed in the Preface.

SVCs 33 and 34: Reserved for internal macros COMRG and GETIME, respectively. Their use by other programs results in a branch to EXT01 (see Chart BG).

SVC 35: Protects a track from use by more than one task at a time. A X'FF' is moved to byte 2 of the SVC old PSW to indicate track hold. A requesting task not owning a held track is made inactive and must wait until the track is free. If more than sixteen holds on a track are attempted, the requesting task is canceled.

Exits are to EXCP3 to execute the I/O, or to RESVC if the track is already held. At RESVC, the problem program old PSW is set to execute the SVC 35 again, and a branch to EXT03 is taken for task selection. See Figure 24 for the Track Hold Table.

SVC 36: Frees a track that is held by the task issuing the FREE. An attempt to free a track not owned by the requestor results in cancellation of that task.

Exits on a successful FREE are to EXT03 for task selection, or to the DETACH routine if the FREE was issued by that routine.

SVC 37: Establishes linkage from the supervisor to a problem program abnormal termination (AB) routine. It stores the routine's entry point and save area address in the AB table. (The save area is a 72-byte area in which the old PSW and general registers 0-15 are stored.) Return is to the STXITing program.

SVC 38: Initializes a subtask. The main task's PIB and save area are copied to the subtask's PIB and save area. The subtask's PIB flag is set to X'83' to indicate 'ready-to-run.' Bit 0 of the maintask's R1 is set to 0 to indicate a successful attach, and absolute priority is established for the subtask. A subtask attempting to issue an ATTACH is canceled. Exit is to EXT03 for task selection.

SVC 39: Performs normal termination of a subtask. DETACH may be issued by either the subtask being terminated or by the main task.

The subtask's PIB is set inactive (byte 0 = X'80'), and its ECB (see Figure 34) is posted for termination. This routine calls the free routine to free any tracks held by this subtask, and a waiting task is removed from the wait state. Exit is to EXT03 for task selection.

SVC 40: Used for intertask communication. POST may be issued by either a maintask or a subtask. It is issued so that a task is aware of the termination of an event. Normal completion of the specified event is posted in the ECB (byte 2, bit 0 = 1). If the SAVE= parameter is present, only the task waiting for this ECB is taken out of the wait state; otherwise, all waiting tasks are removed from the wait state. Exit from this routine is to EXT03 for task selection.

SVC 41: Informs the system that a resource (shared data area) is now available for use by another task. A task may issue the DEQ macro only to a resource that it currently owns. If it attempts to issue the DEQ macro to some other resource, the task is canceled.

If any other tasks are waiting for the resource, the highest priority task ready to run is removed from the wait state and gains control. If no other task is waiting for the resource, control returns to the task that issued the DEQ.

If a task terminates without DEQuing all of its ENQued resources, either in its normal coding or in its abnormal termination exit routine, any task subsequently attempting to ENQ the resource is canceled. See Figure 35 for the Resource Control Block (RCB).

Normal exits are to EXT01 or EXT03.

SVC 42: ENQ prevents tasks from simultaneous manipulation of a shared data area (resource). This is accomplished, using the TS instruction, by setting to ones all bits of byte 0 of the specified resource control block (RCB). Then the event control block (ECB) address is placed in bytes 4-7 of the RCB.

A task attempting to ENQ a resource that is already enqueued by another task is placed in a queue and put in a waiting condition. The old PSW is set to reexecute the SVC 42 and task selection is performed.

A task is canceled if it attempts to nest ENQ(s) of a resource or if it attempts to ENQ a resource that is still owned by a terminated task.

When a task is finished with a resource, it should inform the system by issuing the DEQ macro. If it does not, tasks subsequently requesting that resource are canceled. See Figure 35 for the Resource Control Block.

SVC 43: Supplies supervisory support for the creation and updating of SDR records for devices not explicitly supported by the system. The address of the compressed SDR record area must be supplied in general register 1 before the SVC is issued. The SDR record area must be 22 bytes long: 2 bytes reserved for the SDR processor, 1 byte initialized to zeroes, and a 19 byte SDR record with the 16 error counters compacted to 8 bytes. The SVC 43 causes a branch to the SDRSDR routine in the supervisor to complete processing of the record. Immediately following the SVC, the WAIT macro must be issued on the address in register 1.

Example:

```
LA 1,SDRAREA
SVC 43
WAIT (1) or SDRAREA
```

This SVC is available only with the I/O Error Logging option (ERRLOG). See Chart 08 for the SDRSDR update routine.

SVC 44: Supplies supervisory support for external creation of OBR records for devices not explicitly supported by the system. The address of the OBR record area must be supplied in general register 1 before the SVC is issued. The OBR record area must be 83 bytes long: 2 bytes reserved for the OBR processor, 1 byte initialized to zeroes, and an 80 byte OBR record. The SVC 44 causes a branch to the SDROBR routine in the supervisor to write the OBR record. Immediately following the SVC, the WAIT macro must be issued on the address in register 1.

Example:

```
LA 1,OBRAREA
SVC 44
WAIT (1) or OBRAREA
```

This SVC is available only with the I/O Error Logging option (ERRLOG). See Chart 08 for the SDROBR update routine.

SVC 45: Provides emulator interface for CPU Models 30 and 40, or System/370 models. On System/370, this SVC serves two purposes:

1. When register 1 contains zero, SVC 45 sets communication region byte 134 to X'40', indicating that the emulator is active.
2. When register 1 contains a PUB address, SVC 45 switches the parity bit in the PUB.

SVC 46: Provides OLTEP with the facility to operate in the supervisory state. In the initial issuing of the SVC, register 1 contains an entry point in OLTEP. The next time the SVC is issued, register 1 is zeroed out, forcing task selection.

SVC 47: Provides identification to the supervisor for MICR type device waits. The SVC results in exiting to task selection (EXT03) rather than reissuing the SVC (RESVC) as is done when SVC 29 is issued.

SVC 48: Reserved for future use.

SVC 49: Reserved for future use.

SVC 50: Reserved for LIOCS error recovery.

SVC 51: Provides OLTEP with the ability to find the length of a core image library without loading the phase. Registers 0 and 1 must be initialized before issuing SVC 51. Register 0 must be pointed at a twelve-byte save area for the phase header, and register 1 must be pointed at the eight-byte phase name. The first 12 bytes of the phase header are moved to the save area. The save area is not altered if the phase is not in the core image library. If any program except OLTEP issues an SVC 51, that program is canceled.

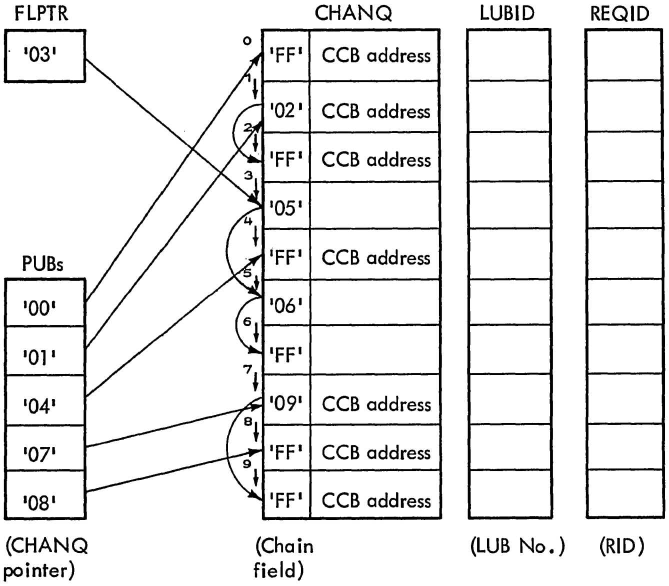


Figure 32. Example of the CHANQ Table Operation

Macro Supported	SVC		Function
	Dec.	Hex.	
EXCP	0	0	Execute channel programs.
FETCH	1	1	Fetch any phase.
	2	2	Fetch a logical transient (B-transient).
	3	3	Fetch or return from a physical transient (A-transient).
LOAD	4	4	Load any phase.
MVCOM	5	5	Modify supervisor communications region.
CANCEL	6	6	Cancel a problem program or task.
WAIT	7	7	Wait for a CCB or TECB.
	8	8	Transfer control to the problem program from a logical transient (B-transient).
LBRET	9	9	Return to a logical transient (B-transient) from the problem program after an SVC 8.
SETIME	10*	A	Set timer interval.
	11	B	Return from a logical transient (B-transient).
	12	C	Logical AND (Reset) to second job control byte (displacement 57 in communications region).
	13	D	Logical OR (Set) to second job control byte (displacement 57 in communications region).
EOJ	14	E	Cancel job and go to job control for end of job step.
	15	F	Same as SVC 0 except ignored if CHANQ table is full. (Primarily used by ERP).
STXIT (PC)	16*	10	Provide supervisor with linkage to user's PC routine for program check interrupts.
EXIT (PC)	17*	11	Return from user's PC routine.
STXIT (IT)	18*	12	Provide supervisor with linkage to user's IT routine for interval timer interrupts.
EXIT (IT)	19*	13	Return from user's IT routine.
STXIT (OC)	20*	14	Provide supervisor with linkage to user's OC routine for external or attention interrupts (operator communications).
EXIT (OC)	21*	15	Return from user's OC routine.
	22*	16	The first SVC 22 seizes the system for the issuing program by disabling multiprogram operation. The second SVC 22 releases the system (enables multiprogram operation).
	23*	17	Load phase header. Phase load address is stored at user's address.
SETIME	24*	18	Provide supervisor with linkage to user's TECB and set timer interval.
	25*	19	Issue HALT I/O on a teleprocessing device, or HALT I/O on any device if issued by OLTEP.
	26*	1A	Validate address limits.
	27*	1B	Special HIO on teleprocessing devices.

* = optional

Figure 33. DOS Supervisor Calls (Part 1 of 2)

Macro Supported	SVC		Function
	Dec.	Hex.	
EXIT (MR)	28*	1C	Return from user's stacker select routine (MICR type devices only).
	29*	1D	Provide return from multiple wait macros WAITF and WAITM (except MICR type devices).
QWAIT	30*	1E	Wait for a QTAM element.
QPOST	31*	1F	Post a QTAM element.
	32 33 34	20 21 22	(Reserved). Reserved for internal macro COMRG. Reserved for internal macro GETIME.
HOLD	35*	23	Hold a track for use by the requesting task only.
FREE	36*	24	Free a track held by the task issuing the FREE.
STXIT (AB)	37*	25	Provide supervisor with linkage to user's AB routine for abnormal termination of a task.
ATTACH	38*	26	Initialize a subtask and establish its priority.
DETACH	39*	27	Perform normal termination of a subtask. It includes calling the FREE routine to free any tracks held by the subtask.
POST	40*	28	Inform the system of the termination of an event and ready any waiting tasks.
DEQ	41*	29	Inform the system that a previously enqueued resource is now available.
ENQ	42*	2A	Prevent tasks from simultaneous manipulation of a shared data area (resource).
	43* 44* 45* 46* 47* 48 49 50 51*	2B 2C 2D 2E 2F 30 31 32 33	Provide supervisor support for external creation and updating of SDR records. Provide supervisor support for external creation of OBR records. Provide emulator interface. Provide OLTEP with the facility to operate in supervisory state. Provide return from wait multiple WAITF for MICR type device. (Reserved) (Reserved) Reserved for LIOCS error recovery. Return phase length at OLTEP request.

* = optional

Figure 33. DOS Supervisor Calls (Part 2 of 2)

	Reserved	Reserved	*	Reserved
Byte	0	1	2	3

*Byte 2

Bit 0: Turned on (X'80') at normal termination of subtask.

Bits 0 and 1: Turned on (X'c0') if the subtask is abnormally terminated.

Bits 2-7: Reserved.

Note: Other blocks that may be used as ECBs are CCBs, TECBs, and MICR CCBs since posting is done in bit 0 of byte 2 of the block.

Figure 34. Event Control Block (ECB)

	*	Unused	**	ECB Address of Current Resource Owner
	X	X X X	X	X X X
Byte	0	1 2 3	4	5 6 7

*Byte 0: Availability byte - All ones when resource is in use.
- All zeros when not in use.

**Byte 4: Flag byte: Bit 0 = 1, another task waiting for the resource.
= 0, no other task waiting for the resource.

Note: The address of the RCB is passed in register 1.

Figure 35. Resource Control Block (RCB)

Cancel Code (hex)	Message Code	Descriptive Part of Message (or Condition)	Label
10	----	Normal EOJ	ERR10
17	0S02I	(Same as 23 but causes dump because subtasks were attached when maintask issued CANCEL macro)	-----
18	----	(Eliminates cancel message when maintask issues DUMP macro with subtasks attached)	
19	0P74I	I/O Operator Option	-----
1A	0P73I	I/O Error	-----
1B	0P82I	Channel Failure	ERRGO
1C	0S14I	CANCEL ALL Macro	ERR1C
1D	0S12I	Maintask Termination	ERR1D
1E	0S13I	Unknown ENQ Requestor	ERR1E
1F	0P81I	CPU Failure	ERRGO
20	0S03I or 0S11I	Program Check	ERR20
21	0S04I or 0S09I	Illegal SVC	ERR21
22	0S05I or 0S06I	Phase Not Found	ERR22
23	0S02I	Program Request	ERR23
24	0S01I	Operator Intervention	ERR24
25	0P77I	Invalid address or insufficient core allocation to a partition.	ERR25
26**	0P71I	SYSXXX Not Assigned (unassigned LUB code)	ERR26
27	0P70I	Undefined Logical Unit (invalid LUB code in CCB)	ERR27
28	----	(QTAM cancel in progress)	EXT02
30	0P72I	Reading Past /& Statement (on SYSRDR or SYSIPT)	ERR30
31	0P75I	I/O Error Queue Overflow (error queue overflow or no CHANQ entry available for ERP)	ERR31

Figure 36. Cancel Codes and Messages (Part 1 of 2)

Cancel Code (hex)	Message Code	Descriptive Part of Message (or Condition)	Label
32	0P76I	Invalid DASD Address (disk) Irrecoverable I/O Error (tape)	ERR32
33	0P79I	No Long Seek (disk)	ERR33
34	0P84I	I/O Error during fetch (unrecoverable I/O error during fetch of non$ phase)	ERRGO
35	0P851	Job control open failure	-----
40	----	(load $$BEOJ)	EXT02
80	----	(cancel occurred in LTA)	EXT02
FF	0P78I	Unrecognized Cancel Code	-----
FF*	0P83x	Supervisor Catalog Failure	-----

All cancel-codes except in connection with DUMP-macro (code=X'00' is not a true cancel-condition) initially have a value X'40' higher than indicated above, but the X'40' bit is stripped by the SUPVR before fetching the Terminator. In addition to recognizing the cancel-codes above, the Terminator also recognizes the same codes with the X'80' bit on. The X'80' bit is tested for by $$BEOJ and subsequently reset.

*This cancel code is not significant in case of a supervisor catalog failure, because the system is placed in a wait state without any further processing by the Terminator. Thus, there is no conflict between this cancel code and the preceding X'FF' cancel code.

**If the CCB is unavailable, the logical unit is SYSxxx.

Figure 36. Cancel Codes and Messages (Part 2 of 2)

Physical IOCS is that portion of the resident supervisor that:

- Builds a schedule of I/O operations for all devices on the system (CHANQ table). Refer to Channel Scheduler on Chart 04 and to Figure 32 for CHANQ operation.
- Starts the actual I/O operations on a device (SIO). Refer to Actual I/O on Chart 04.
- Schedules the starting of all I/O operations and monitors all events associated with I/O. Refer to I/O Interrupt Processor on Chart 04.
- Performs error recovery procedures (ERP). Refer to Unit Check, Quiesce I/O, ERP Exits, and Resident Disk Error Recovery on Chart 06 and 07. Figures 37 through 41 illustrate: Command Control Block (CCB), Channel Command Word (CCW), Program Status Word (PSW), Channel Address Word (CAW), and Channel Status Word (CSW). See Figures 42 and 43 for CSW testing and error recovery block layout, respectively.

COMMAND CONTROL BLOCK

The CCB establishes communication between the problem program and physical IOCS. The CCB is two double words in length with eight major fields, as shown in Figure 37. All data in the CCB is in the hexadecimal format. The eight fields of the CCB are listed and described as follows:

1. Count Field (bytes 0, 1): Contains the residual count, which is stored in these two bytes by PIOCS when the CCB is removed from the queue.

2. Transmission Information (bytes 2, 3): Used for communication between PIOCS and the problem program.

   Note: Bytes 2 through 5 are ANDed off, by PIOCS, when the CCB is placed in the queue. However, the communication bits that were set on by the problem program are left on.

3. CSW Status Bits (bytes 4, 5): Contains the CSW status information, which is stored in these two bytes by PIOCS before control is returned to the problem program.

   Note: The particular bits that are turned on in bytes 2 through 5 indicate the conditions that were detected by the problem program and PIOCS.

4. Symbolic Unit Address (bytes 6, 7): Contains the 2-byte hexadecimal representation of SYSnnn. This value represents the location of the logical unit in the LUB table (see Figure 23) and is placed in the CCB by the problem program.

5. Byte 8: Is not used in EBCDIC files, and must then contain hexadecimal 0.

   Contains the buffer offset (block prefix length) in ASCII files

Input (F, V, U)	x'00' - x'63'
Output (F, U)	x'00'
Output (V)	x'00' or x'04'

6. CCW Address (bytes 9-11): Contains the address of the CCW that is associated with this CCB. This address is placed in the CCB by the problem program.

7. Byte 12: X'80'-CCB being used by ERP. X'40'-channel appendage routine for a teleprocessing device. X'20'-sense information desired. X'10'-message writer use. X'08'-EU tape error indicator. X'01'-seek separation or console buffering option specified.

8. CCW Address in CSW (bytes 13-15): Contains the CCW address from the CSW. This address is stored by PIOCS before control is returned to the problem program. A CCB that has been queued, by PIOCS, to service a problem program I/O request cannot be used for a second problem program I/O request until the first request has been completed.

Note: Bytes 13-15 contain the address of the channel appendage routine when bit X'40' is set in byte 12.

9. _Optional-Sense CCW (bytes 16-23)_: Bytes 16-23 are appended to the CCB by the CCB macro expansion when the user desires sense information to be returned on unrecoverable I/O errors. The macro expansion also turns on bit 2 (X'20') in byte 12 of the CCB. User handles all error or exceptional conditions except program check, protection check, channel control check, and interface control check.

Bytes	0–1	2–3	4–5	6–7	8	9–11	12	13–15	16–23
	Count	Transmission Information	CSW Status Bits	Symbolic Unit Address	Reserved for Logical IOCS	CCW Address	Reserved for Physical IOCS	CCW Address in CSW	Optional Sense CCW
Used for	Residual Count	Transmitting Information Between Physical IOCS and Problem Program	(Note 1)	Hexadecimal Representation of SYSnnn SYSRDR = 0000 SYSIPT = 0001 SYSPCH = 0002 SYSLST = 0003 SYSLOG = 0004 SYSLNK = 0005 SYSRES = 0006 SYSSLB = 0007 SYSRLB = 0008 SYSUSE = 0009 SYSREC = 000A SYSCLB = 000B SYS000 = 0100 SYS001 = 0101 SYS221 = 01DD	Buffer Offset: ASCII Input Tapes X'00'-X'63' ASCII Output Tapes Fixed: X'00' Variable: X'00' or X'04' Undefined: X'00'	Address of CCW Associated with this CCB	X'80'-CCB being used by ERP X'40'-Channel Appendage Routine Present for Teleprocessing Device X'20'-Sense Information Desired X'10'-Message Writer X'08'-EU Tape Error X'02'-Tape ERP Read Opposite Recovery X'01'-Seek Separation or Console Buffering	Address of CCW in the CSW Stored at Channel End, or Address of the Channel Appendage Routine for Teleprocessing Devices	8 Bytes Appended to the CCB when Sense Information is Desired

(Note 1)

Byte 4	Byte 5
BIT DESIGNATION	BIT DESIGNATION
32 Attention	40 Program-controlled interruption
33 Status modifier	41 Incorrect length
34 Control unit end	42 Program check
35 Busy	43 Protection check
36 Channel end	44 Channel data check
37 Device end	45 Channel control check
38 Unit check	46 Interface control check
39 Unit exception	47 Chaining check

Byte 2

	Traffic Bit (Wait) (Note 5)	End-of-File (/* or /&) UCSB Parity Check (Line Complete) (Note 2)	Unrecoverable I/O Error	Accept Unrecoverable I/O	Return DASD Data Checks 2671 errors, or 1017/1018 errors to the user	Post at Device End (Note 5)	Return Tape Read Data Check, 1018 Data Check, 2540 or 2520 Equipment Check, DASD Data Checks on Read or Verify Command, or 3211 Passback Requested (Notes 3 & 6)	User Error Routine
Bits	0	1	2	3	4	5	6	7
Set On By	PIOCS	PIOCS	PIOCS	Pr. Pr.	Pr. Pr.	Pr. Pr.	Pr. Pr.	Pr. Pr.

Byte 3

	DASD - Data Check in Count Area MICR - SCU Not Operational 1285/1287/1288 Data Check Print Check/ Equipment Check	DASD - Track Overrun MICR - Intervention Required 1285/1287 - Keyboard Correction in Journal Tape Mode 1017 - Broken Tape Print Quality/ Equipment Check	DASD - End of Cylinder MICR - (Note 4) 1287/1288 - Hopper Empty in Document Mode Line Position Error (Note 7)	2540, 2520 - Equipment Check Tape - Read Data Check DASD - Any Data Check 1285/1287 Equipment Check 1017/1018 Data Check Print Check Data Check	Non-Recovery Questionable Condition: Card - Unusual Command Sequence DASD - No Record Found 1285/1287/1288 - Document Jam or Torn Tape UCSB Parity Check (Command Retry)	No-Record-Found Condition (Retry on 2311, 2314, or 2319)	Carriage Channel 9 Overflow or Verify Error for DASD 1287 Document Mode - Late Stacker Select 1288 - End of Page	Command Chaining Retry from the next CCW to be executed
Bits	0	1	2	3	4	5	6	7
Set On By	PIOCS	PIOCS	PIOCS	PIOCS	PIOCS	Pr. Pr.	PIOCS	Pr. Pr.

PIOCS = Physical IOCS
Pr. Pr. = Problem Program

Note 1. Bytes 4 and 5 contain the status bytes of the Channel Status Word (Bits 32-47). If byte 2, bit 5 is on and device end results as a separate interrupt, device end will be ORed into CCB byte 4.
Note 2. Indicates /* or /& statement encountered on SYSRDR or SYSIPT. Byte 4, bit 7 (unit exception) is also on.
Note 3. DASD data checks on count not returned.
Note 4. For 1255/1259/1270/1275/1412/1419, disengage. For 1275/1419D, I/O Error in external interrupt routine (channel data check or busout check).
Note 5. The traffic bit (Byte 2, bit 0) is normally set on at channel end to signify that the I/O was completed. If byte 2, bit 5 has been set on, the traffic bit and bits 2 and 6 in byte 3 will be set on at device end. Also see Note 1.
Note 6. 1018 ERP does not support the Error Correction Function.
Note 7. This error occurs as an equipment check, data check, or FCB parity check.

Figure 37. Command Control Block (CCB)

<table>
<tr><td>Byte</td><td colspan="8">0</td><td colspan="8">1</td><td colspan="8">2</td><td colspan="8">3</td><td colspan="8">4</td><td colspan="8">5</td></tr>
<tr><td>Bit</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td><td>27</td><td>28</td><td>29</td><td>30</td><td>31</td><td>32</td><td>33</td><td>34</td><td>35</td><td>36</td><td>37</td><td>38</td><td>39</td><td>40</td><td>41</td><td>42</td><td>43</td><td>44</td><td>45</td><td>46</td><td>47</td></tr>
<tr><td>Name</td><td colspan="8">Command Code</td><td colspan="24">← Data Address →</td><td colspan="5">Flags</td><td colspan="3">0 0 0</td><td colspan="8">(Ignored)</td></tr>
<tr><td>Field</td><td colspan="8">A</td><td colspan="24">B</td><td colspan="5">C</td><td colspan="3">D</td><td colspan="8">E</td></tr>
</table>

<table>
<tr><td colspan="8">6</td><td colspan="8">7</td></tr>
<tr><td>48</td><td>49</td><td>50</td><td>51</td><td>52</td><td>53</td><td>54</td><td>55</td><td>56</td><td>57</td><td>58</td><td>59</td><td>60</td><td>61</td><td>62</td><td>63</td></tr>
<tr><td colspan="16">← Count →</td></tr>
<tr><td colspan="16">F</td></tr>
</table>

FIELD	NAME	DESCRIPTION
A	Command Code	Bits 0-7: Specify the operation to be performed. (See Part 2 of this Figure)
B	Data Address	Bits 8-31: Specify the location of a byte in main storage. It is the first location referred to in the area designated by the CCW.
C	Flags	Bits 32-36: Specify the flag bits used in conjunction with the CCW, Bit 32- Chain-Data (CD) causes the address portion of the next CCW to be used with the current CCW. †Note Bit 33- Chain-Command (CC) causes the command code and data address of the next CCW to be used. The chain data flag (bit 32) takes precedence over this flag. Bit 34- Suppress Length Indication (SLI) causes a possible incorrect length indication to be suppressed. The chain data flag (bit 32) takes precedence over this flag. Bit 35- Skip (SKIP) suppresses the transfer of information to main storage. Bit 36- Program Control Interruption (PCI) causes the channel to generate an interrupt when the CCW is fetched.
D	Reserved	Bits 37-39: (Must contain zeros)*
E	Ignored	Bits 40-47: Not checked
F	Count	Bits 48-63: Specify the number of bytes in the operation

* The transfer in channel command (TIC) is the one exception to this statement.
†Note: Chain data cannot be done on 360/30 if a highspeed device is being used.
Excmple - 2311,2400 Model 3.

Figure 38. Channel Command Word (CCW) (Part 1 of 2)

CHANNEL COMMAND CODES

Command Code assignments are listed in the following table. The symbol X indicates that the bit position is ignored; M identifies a modifier bit.

CODE	COMMAND
MMMM 0 1 0 0	Sense
XXXX 1 0 0 0	Transfer in channel
MMMM 1 1 0 0	Read backward
MMMM MM0 1	Write
MMMM MM1 0	Read
MMMM MM1 1	Control

DASD, CHANNEL COMMAND CODES (see A26-5988)

Command for CCW		Count	Multiple Track (M-T) Off 8-Bit Code 0123 4567			M-T On †	
				Hex	Dec	Hex	Dec
Control	No Op	X	0000 0011	03	03		
	Seek	6	0000 0111	07	07		
	Seek Cylinder	6	0000 1011	0B	11		
	Seek Head	6	0001 1011	1B	27		
	Set File Mask	1	0001 1111	1F	31		
	Space Count	X	0000 1111	0F	15		
	Transfer in Channel	X	XXXX 1000	X8			
	Recalibrate (2311 only)		0001 0011	13	19		
	Restore (2321 only)	X	0001 0111	17	23		
Sense	Sense I/O	4	0000 0100	04	04		
Switching	Release Device	X	1001 0100	94	148		
	Reserve Device	X	1011 0100	B4	180		
Search †	Home Address EQ	4 (usually)	0011 1001	39	57	B9	185
	Identifier EQ	5 (usually)	0011 0001	31	49	B1	177
	Identifier HI	5 (usually)	0101 0001	51	81	D1	209
	Identifier EQ or HI	5 (usually)	0111 0001	71	113	F1	241
	Key EQ	1 to 255	0010 1001	29	41	A9	169
	Key HI	1 to 255	0100 1001	49	73	C9	201
	Key EQ or HI	1 to 255	0110 1001	69	105	E9	233
	Key & Data EQ*	Note 1	0010 1101	2D	45	AD	173
	Key & Data HI*		0100 1101	4D	77	CD	205
	Key & Data EQ or HI*		0110 1101	6D	109	ED	237
	Continue Scan EQ*		0010 0101	25	37		
	Continue Scan HI*		0100 0101	45	69		
	Continue Scan EQ or HI*		0110 0101	65	101		
	Continue Scan No Compare*		0101 0101	55	85		
	Continue Scan Set Compare*		0111 0101	75	117		
Read †	Home Address	5	0001 1010	1A	26	9A	154
	Count	8	0001 0010	12	18	92	146
	Record R0	Number of bytes trans-ferred	0001 0110	16	22	96	150
	Data		0000 0110	06	06	86	134
	Key & Data		0000 1110	0E	14	8E	142
	Count, Key & Data		0001 1110	1E	30	9E	158
	Initial Program Load (IPL)		0000 0010	02	02		
Write	Home Address	5 (usually)	0001 1001	19	25		
	Record R0	8+KL+DL of R0	0001 0101	15	21		
	Count, Key & Data	8+KL+DL	0001 1101	1D	29		
	Special Count, Key & Data*	8+KL+DL	0000 0001	01	01		
	Data	DL	0000 0101	05	05		
	Key & Data	KL & DL	0000 1101	0D	13		

* Special Feature Note 1. Includes mask bytes in search argument.
† M-T On = M-T Off except, during Search and Read bit 0 = 1 in M-T On.
X = not significant; KL = Key Length DL = Data Length; EQ = Equal; HI = High

CHANNEL COMMAND CODES

Device	Command for CCW	8-Bit Code 0	1	2	3	4	5	6	7	Hex	Dec
1052	Read Inquiry BCD	0	0	0	0	1	0	1	0	0A	10
	Read Reader 2 BCD	0	0	0	0	0	0	1	0	02	02
	Write BDC, Auto Carriage Return	0	0	0	0	1	0	0	1	09	09
	Write BDC, No Auto Carriage Return	0	0	0	0	0	0	0	1	01	01
	No Op	0	0	0	0	0	0	1	1	03	03
	Sense	0	0	0	0	0	1	0	0	04	04
	Alarm	0	0	0	0	1	0	1	1	0B	11
2540	Read, Feed, Select Stacker SS Type AA	S	S	D	0	0	0	1	0		
	Read Type AB	1	1	D	0	0	0	1	0		
	Read, Feed (1400 compatability mode only)	1	1	D	1	0	0	1	0		
	Feed, Select Stacker SS Type BA	S	S	1	0	0	0	1	1		
	PFR Punch, Feed, Select Stacker SS Type BA	S	S	D	0	1	0	0	1		
	Punch, Feed, Select Stacker SS Type BB	S	S	D	0	0	0	0	1		

SS	Stacker
00	R1
01	R2
10	RP3

D	Data Mode
0	EBCDIC
1	Column Binary

Device	Command for CCW	0	1	2	3	4	5	6	7	Hex	Dec
1442 N1	Read	M	M	M	0	0	0	1	0		
	Write	M	M	M	0	0	0	0	1		
	Control	M	M	0	0	0	0	1	1		
	No Op	0	0	0	0	0	0	1	1		
	Sense	0	0	M	M	0	1	0	0		

	M	M	M	M	
Read	0	0	X		Eject and SS1
Read	1	0	X		Eject and SS1
Read	0	1	X		Eject and SS2
Read	1	1	X		Eject and SS2
Write	0	0	X		SS1
Write	1	0	X		Eject and SS1
Write	0	1	X		SS2
Write	1	1	X		Eject and SS2
Control	1	0			Eject and SS1
Control	0	1			SS2
Control	1	1			Eject and SS2
Sense			1	1	Punch diagnostic
Sense			0	1	Read diagnostic

X = 0 means EBCDIC mode
X = 1 means Column Binary Mode

Device	Command for CCW	0	1	2	3	4	5	6	7	Hex	Dec
1403 or 1443	Write, No Space	0	0	0	0	0	0	0	1	01	01
	Write, Space 1 After Print	0	0	0	0	1	0	0	1	09	09
	Write, Space 2 After Print	0	0	0	1	0	0	0	1	11	17
	Write, Space 3 After Print	0	0	0	1	1	0	0	1	19	25
	Write, Skip To Channel N After Print	1	C	H	A	N	0	0	1		
	Diagnostic Read (1403)	0	0	0	0	0	0	1	0	02	02
	Diagnostic Read (1443)	0	0	0	0	0	1	1	0	06	06
	Test I/O	0	0	0	0	0	0	0	0	00	00
	Sense	0	0	0	0	0	1	0	0	04	04
Carriage Control	Space 1 Line Immediately	0	0	0	0	1	0	1	1	0B	11
	Space 2 Line Immediately	0	0	0	1	0	0	1	1	13	19
	Space 3 Line Immediately	0	0	0	1	1	0	1	1	1B	27
	Skip To Channel N Immediately	1	C	H	A	N	0	1	1		
	No Op	0	0	0	0	0	0	1	1	03	03

C	H	A	N	Channel
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6

C	H	A	N	Channel
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	10
1	0	1	1	11
1	1	0	0	12

Device	Command for CCW	0	1	2	3	4	5	6	7	Hex	Dec
UCS	Allow buffer loading	1	1	1	0	1	0	1	1	EB	235
	Load buffer (no folding)	1	1	1	1	1	0	1	1	FB	251
	Load buffer (folding)	1	1	1	1	0	0	1	1	F3	243
	Block data check latch	0	1	1	1	0	0	1	1	73	121
	Reset block data check latch	0	1	1	1	1	0	1	1	7B	129
2400 Tape*	Read Backward (Overrides Data Converter On)	0	0	0	0	1	1	0	0	0C	12
	Sense	0	0	0	0	0	1	0	0	04	04
	Write	0	0	0	0	0	0	0	1	01	01
	Read	0	0	0	0	0	0	1	0	02	02
	Control	0	0	C	C	C	1	1	1		
		D	D	M	M	M	0	1	1		
		1	1	N	N	N	0	1	1		

N	N	N	
0	0	0	1600 bpi P.E. **
0	0	1	800 bpi NRZI

C	C	C	Control Codes	Hex	Dec
0	0	0	REW	7	7
0	0	1	RUN	0F	15
0	1	0	ERG	17	23
0	1	1	WTM	1F	31
1	0	0	BSR	27	39
1	0	1	BSF	2F	47
1	1	0	FSR	37	55
1	1	1	FSF	3F	63

D	D	7 Track Density	
0	0	200	7 Track
0	1	556	
1	0	800**	
1	1	***	

M	M	M	(Mode Modifiers)	Set Density	Set Odd Parity	Set Even Parity	Data Converter On	Data Converter Off	Translator On	Translator Off	Request TIE (Track in Error)
0	0	0	No Op								
0	0	1	Not Used								
0	1	0	Reset Condition	X	X		X			X	
0	1	1	Nine-track only								X
1	0	0		X		X		X		X	
1	0	1		X		X		X	X		
1	1	0	Reset Condition	X	X			X		X	
1	1	1		X	X			X	X		

*9 track op. forces 800 BPI and odd parity; also, it overrides 7 track but does not reset 7 track. Load/Sys Reset forces 7 track to 800 BPI, odd parity, data converter on, translator off.

** Reset condition

*** Set 9 Track mode, Models 4-6

Figure 38. Channel Command Word (CCW) (Part 2 of 2)

Figure 39. Program Status Word (PSW)

<table>
<tr><td>Byte</td><td colspan="8">0</td><td colspan="8">1</td><td colspan="8">2</td><td colspan="8">3</td><td colspan="8">4</td><td colspan="8">5</td><td colspan="8">6</td><td colspan="8">7</td></tr>
<tr><td>Bit</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td><td>27</td><td>28</td><td>29</td><td>30</td><td>31</td><td>32</td><td>33</td><td>34</td><td>35</td><td>36</td><td>37</td><td>38</td><td>39</td><td>40</td><td>41</td><td>42</td><td>43</td><td>44</td><td>45</td><td>46</td><td>47</td><td>48</td><td>49</td><td>50</td><td>51</td><td>52</td><td>53</td><td>54</td><td>55</td><td>56</td><td>57</td><td>58</td><td>59</td><td>60</td><td>61</td><td>62</td><td>63</td></tr>
<tr><td>Name</td><td colspan="8">System Mask</td><td colspan="4">Key</td><td colspan="4">CPU Mask</td><td colspan="16">Interruption Code</td><td colspan="2">ILC</td><td colspan="2">CC</td><td colspan="4">Prog. Mask</td><td colspan="24">Instruction Address</td></tr>
<tr><td>Field</td><td colspan="8">A</td><td colspan="4">B</td><td colspan="4">C</td><td colspan="16">D</td><td colspan="2">E</td><td colspan="2">F</td><td colspan="4">G</td><td colspan="24">H</td></tr>
</table>

FIELD	NAME	DESCRIPTION
A	System Mask*	Bits 0-7: Are associated with the I/O channels and external signals as follows: Bit Interruption source 0 Multiplexor channel 1 Selector channel 1 2 Selector channel 2 3 Selector channel 3 4 Selector channel 4 5 Selector channel 5 6 Selector channel 6 7 Timer Interrupt key External signal *A one-bit equals ON and permits an interrupt.
B	Protection Key	Bits 8-11: Form the CPU protection key. The key is matched with a storage key whenever a result is stored. If the protection feature is not implemented, bits 8-11 must be zero when loaded and are zero when stored.
C	CPU Mask (AMWP)	Bits 12-15: Form the CPU mask as follows: Bit Meaning (A) 12 If 1 - generate extended ASCII code If 0 - generate EBCDIC (M) 13 If 1 - permits machine check interrupt If 0 - prohibits machine check interrupt (W) 14 If 1 - the CPU is in the wait state If 0 - the CPU is in the running state (P) 15 If 1 - the CPU is in the problem mode If 0 - the CPU is in the supervisor mode
D	Interruption Code	Bits 16-31: Identify the cause of the interruption. (See NOTE for specific interruption codes.)

FIELD	NAME	DESCRIPTION
E	Instruction Length Code	Bits 32 and 33: Indicate the length, in halfwords, of the instruction last executed, as follows: 00 (0) Not available (unpredictable) 01 (1) 1 halfword 10 (2) 2 halfwords 11 (3) 3 halfwords
F	Condition Code	Bits 34 and 35: Indicate the last condition code setting. All instructions do not set a condition code. 00 Condition code 0 01 Condition code 1 10 Condition code 2 11 Condition code 3
G	Program Mask**	Bits 36-39: Form the program mask for the following program exceptions. Bit Exception 36 Fixed-point overflow 37 Decimal overflow 38 Exponent underflow 39 Significance **A one-bit equals ON and permits a program check interrupt for a specific exception.
H	Instruction Address	Bits 40-63: Indicate the address of the leftmost byte of the next instruction to be executed.

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SOURCE IDENTIFICATION	INTERRUPTION CODE PSW BITS 16-31	MASK BITS	ILC SET	EXE-CUTION
Input/Output (old PSW 56, new PSW 120, priority 4)				
Multiplexor channel	00000000 aaaaaaaa	0	x	complete
Selector channel 1	00000001 aaaaaaaa	1	x	complete
Selector channel 2	00000010 aaaaaaaa	2	x	complete
Selector channel 3	00000011 aaaaaaaa	3	x	complete
Selector channel 4	00000100 aaaaaaaa	4	x	complete
Selector channel 5	00000101 aaaaaaaa	5	x	complete
Selector channel 6	00000110 aaaaaaaa	6	x	complete
Program (old PSW 40, new PSW 104, priority 2)				
Operation	00000000 00000001		1,2,3	suppress
Privileged operation	00000000 00000010		1,2	suppress
Execute	00000000 00000011		2	suppress
Protection	00000000 00000100		0,2,3	suppress/ terminate
Addressing	00000000 00000101		0,1,2,3	suppress/ terminate
Specification	00000000 00000110		1,2,3	suppress
Data	00000000 00000111		2,3	terminate
Fixed-point overflow	00000000 00001000	36	1,2	complete
Fixed-point divide	00000000 00001001		1,2	suppress/ complete
Decimal overflow	00000000 00001010	37	3	complete
Decimal divide	00000000 00001011		3	suppress
Exponent overflow	00000000 00001100		1,2	terminate
Exponent underflow	00000000 00001101	38	1,2	complete
Significance	00000000 00001110	39	1,2	complete
Floating-point divide	00000000 00001111		1,2	suppress
Supervisor Call (old PSW 32, new PSW 96, priority 2)				
Instruction bits	00000000 rrrrrrrr		1	complete
External (old PSW 24, new PSW 88, priority 3)				
External signal 1	00000000 xxxxxxx1	7	x	complete
External signal 2	00000000 xxxxxx1x	7	x	complete
External signal 3	00000000 xxxxx1xx	7	x	complete
External signal 4	00000000 xxxx1xxx	7	x	complete
External signal 5	00000000 xxx1xxxx	7	x	complete
External signal 6	00000000 xx1xxxxx	7	x	complete
Interrupt key	00000000 x1xxxxxx	7	x	complete
Timer	00000000 1xxxxxxx	7	x	complete
Machine Check (old PSW 48, new PSW 112, priority 1)				
Machine malfunction	00000000 00000000	13	x	terminate

a	Device address bits
r	Bits of R_1 and R_2 field of SUPERVISOR CALL
x	Unpredictable

Mask bits 0 - 7 refer to the system mask.

Mask bits 36 - 39 refer to the program mask.

<table>
<tr><td>Byte</td><td colspan="8">0</td><td colspan="8">1</td><td colspan="8">2</td><td colspan="8">3</td></tr>
<tr><td>Bit</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td><td>27</td><td>28</td><td>29</td><td>30</td><td>31</td></tr>
<tr><td>Name</td><td colspan="4">Key</td><td colspan="4">0 0 0 0</td><td colspan="24">←——— Command Address ———→</td></tr>
<tr><td>Field</td><td colspan="4">A</td><td colspan="4">B</td><td colspan="24">C</td></tr>
</table>

FIELD	NAME	DESCRIPTION
A	Protection Key	Bits 0 - 3 form the storage protection key for all commands associated with START I/O. This key is matched with a storage key whenever data is placed in storage. (Must contain zeros whenever storage protection is not implemented.)
B	Reserved	Bits 4 - 7 (Must contain zeros.)
C	Command Address	Bits 8- 31 Designates the location of the first CCW in main storage associated with the START I/O. (The three low order bits, 29 - 31, must be zeros, specifying a CCW address on integral boundaries of a double word.)

Figure 40. Channel Address Word (CAW)

Figure 41. Channel Status Word (CSW)

Byte	0		1	2	3	4	5	6	7
Bit	0 1 2 3	4 5 6 7	8 9 10 11 12 13 14 15	16 17 18 19 20 21 22 23	24 25 26 27 28 29 30 31	32 33 34 35 36 37 38 39	40 41 42 43 44 45 46 47	48 49 50 51 52 53 54 55	56 57 58 59 60 61 62 63
Name	Key	0 0 0 0	← Command Address →			← Status →		← Count →	
Field	A	B	C			D		E	

FIELD	NAME	DESCRIPTION
A	Protection Key	Bits 0-3 form the storage protection key used in the chain of operations at the subchannel.
B	Reserved	Bits 4-7 (Must be zeros.)
C	Command Address	Bits 8-31 form an address that is eight higher than the address of the last CCW used. *
D	Status	Bits 32-47 identify the conditions in the device and channel that caused the CSW to be stored. Bits 32-39 are obtained over the I/O Interface and indicate conditions detected by the device or the control unit. Bits 40-47 are provided by the channel and indicate conditions associated with the subchannel. Each status bit represents one type of condition as follows:
E	Count	Bits 48-63 form the residual count for the last CCW used.

DEVICE OR CONTROL UNIT	
Bit Position	Designated Condition
32	Attention
33	Status Modifier
34	Control Unit End
35	Busy
36	Channel End
37	Device End
38	Unit Check
39	Unit Exception

CHANNEL/SUBCHANNEL	
Bit Position	Designated Condition
40	Program-Controlled Interrupt
41	Incorrect Length
42	Program Check
43	Protection Check
44	Channel Data Check
45	Channel Control Check
46	Interface Control Check
47	Chaining Check

* This address is not 8 higher on a command reject.

Status Bit	Status Condition	Action
45 46	Channel control check Interface control check	Enter wait state with all interrupts masked off. Note: System/370 CCH interrogates these bits for attempted recovery through the RMS function.
38 42 43 44 47	Unit check Program check Protection check Channel data check Channel chaining check	Exit to unit check on Chart 06 for error recovery.
32	Attention	For attention from a 1052, include attention task in task selection and take general exit (EXT03). Attention interrupts are ignored if: 1. System reallocation or condense is in operation. 2. Attention is not from a 1052.
35	Device busy	Skip channel end test.
36	Channel end	See Charts CP and CQ for actions taken. Attempts to reschedule the channel (No attempt is made for the multiplex channel unless this is a burst-multiplex device).
37 34	Device end Control unit end	See Chart CL for actions taken. Attempts to reschedule the channel (If the multiplex channel is being rescheduled. If the device on the multiplex channel is a burst-multiplex device, both channel and device are rescheduled.)
33 and 35	Control unit busy	Reset device to available. The status is not tested unless neither channel end, device end, nor control unit end has occurred.

Figure 42. CSW Testing in I/O Interrupt Processor

Displacement from ERBLOC in Decimal	Length in Bytes	Label	Description
-2	2	ERRQ	Address of first error queue entry in table (ERQUE).
0	2	ERBLOC	Address of retry ERP exit (EXRTY).
2	2		Address of ignore ERP exit (EXIGN).
4	2		Address of DISWHY (retry) ERP exit (EXWHY).
6	2	YCHANQ	Address of the channel queue table (CHANQ).
8	2		Address of cancel ERP exit (EXCAN).
10	2	FULQUE	Address of last entry in error queue table.
12	2	ERQPTR	Address of last entry queued to table (initially ERQUE - 22).
14	2	RIK	Requestor I/O key (RIK).
16	2		Address of cancel attention exit (ATNCNL).
18	2		Address of attention dequeue exit (PUBDEQ).
20	2	ATNEXT	Address of attention exit (EXT02).
22	8	SVC3NM	A - transient phase name field ($$ANERxx, where xx = any alphameric characters.
30	n x 22	ERQUE	n x 22 bytes error queue entries, where n = 3 when SP = NO, and n = 5 when SP = YES.

Error Queue Entry (22 bytes)

	CSW	Pub Address of Device in Error	Flag Byte (see below)	Message Number ①	Sense Data ②	Disk Seek Address
Bytes	0-7	8-9	10	11	12-17	18-21
	XXXXXXXX	XX	X	X	XXXXXX	XXXX

Flag Byte

Bit	Designation
0	Unused
1	Intervention required
2	Passback ← ③
3	Allow ignore
4	DASD in error
5	Allow retry
6	No CCB available
7	Unused

Notes:

① See Figure 46 for Physical Transient error messages.

② See the following section, Physical Transient Programs, I/O Error Recovery Procedures and Sense Data.

③ Put on by device ERP when user wants control returned on error.

Bytes 98 and 99 (X'62' - X'63') of the communications region contain the address of the error block. Label ERBLOC identifies the first byte of the table. The address of the first error queue entry is at ERBLOC - 2.

Figure 43. Error Recovery Block (ERBLOC) and Error Queue Entry

Physical transient programs are commonly referred to as A-transients. These infrequently-used sections of the supervisor reside in the core image library and are fetched by the resident supervisor (SVC 3) only when needed. Each program phase name begins with the prefix characters $$A. These phases are loaded singly into the A-transient area. See Figure 2 for supervisor storage organization. The A-transient functions within DOS:

1. Provide device-dependent Error Recovery Procedures (ERP).
2. Issue messages associated with ERP operations, Message Writer.
3. Process 1052 attention requests, Physical Attention Routines.
4. Build and write OBR/SDR records.

The Physical Transient Overlap option allows user processing to continue during FETCH (SVCs 1, 2, and 3), LOAD (SVC 4), MVCOM (SVC 5), and ERP I/O operations. Otherwise, no task is selected while FETCH, LOAD, MVCOM, and ERP are processing.

Figure 44 illustrates each A-transient in terms of phase name, function, and program level chart identification.

ERP

To understand the error recovery procedures detailed in the flowcharts, you should be familiar with the sense information that corresponds to the individual I/O devices supported by this system.

Figure 45 illustrates the unit record equipment supported by ERP and also indicates the sense bits associated with each device. This figure is followed by ERP descriptions with their corresponding messages.

> Note: Registers 1-8 cannot be used by error recovery phases. The contents of these registers may be destroyed should an interrupt cause a return to the supervisor.

Note: Although the disk error recovery procedure is not an A-transient, the sense data and action-taken information is included here to consolidate the sense data in this section of the manual. The disk ERP is part of the supervisor nucleus. See Chart 06.

MESSAGE WRITER

The message writer is a group of eight A-transients that build error messages, issue the message, analyze operator responses, and select the proper exit. See Figure 46 for a listing of the error messages.

PHYSICAL ATTENTION ROUTINES

The physical attention routines are three A-transients fetched by the supervisor when an attention interrupt has been determined. The attention key signals operator communication with the system. If the operator chooses to initiate a foreground program or to use the nonresident attention routine facilities (other B-transients) the physical attention transients get the $$BATTNA root phase. If the operator is satisfying an operator intervention condition or canceling the job, the physical attention transients process the attention interrupt. When the physical attention routines are processing the interrupt, they perform parameter passing by using a common area called the interphase communications area. Figure 47 illustrates this area and its relationship to the entire A-transient area.

OBR/SDR A-TRANSIENTS

OBR/SDR Record Builder

The record builder routines are three A-transients that build and write on disk formatted OBR records, and update SDR disk counters. See Chart 12.

List Passer

This A-transient passes a device to the SDR routine in the supervisor whenever an I/O error occurs. The list is a string of constants that map into some or all of the sixteen counters that are maintained by OBR/SDR support. See Figure 48 for examples of SDR device lists.

OBR/SDR Message Writer

The OBR/SDR message writers are two A-transients that build and issue error messages in the event of an error while recording on the recorder file. These transients exit to the supervisor. See Figure 49 for a listing of the error messages.

Phase Name	Function	Program Level Chart ID
$$ANERRA $$ANERRB $$ANERRC	Error Recovery Monitor	11 11 11
$$ANERAK $$ANERAL $$ANERAM $$ANERAN $$ANERAP $$ANERAQ $$ANERAR $$ANERAS $$ANERRD $$ANERRE $$ANERRL $$ANERRF	Tape (2400) Error Recovery	13 13 13 13 13 13 13 13 13 13 13 13
$$ANERRG $$ANERRH $$ANERRI $$ANERRJ $$ANERRK	Data Cell (2321) Error Recovery	11 11 11 11 11
$$ANERAE $$ANERAB $$ANERRN $$ANERRO $$ANERRP $$ANERRQ $$ANERRR $$ANERRS	Message Writer <u>Note</u>: $$ANERRM is also an initial message writer phase.	14 14 14 14 14 14 14 14
$$ANERAI $$ANERAJ	1017/1018 Paper Tape Error Recovery	12 12

Figure 44. A-Transient Programs (Part 1 of 2)

Phase Name	Function	Program Level Chart ID
$$ANERRT	MICR type devices (Single Address Adapter) Error Recovery	12
$$ANERRU $$ANERRV	Unit Record Error Recovery	11 11
$$ANERRW	1419/1275 (Dual Address Adapter) Error Recovery	12
$$ANERRX	Paper Tape Error Recovery	12
$$ANERR9	Optical Reader Error Recovery	11
$$ANERR6 $$ANERR7 $$ANERR8	Tape Cartridge Reader (2495) Error Recovery	11 11 11
$$ANERRZ $$ANERRY $$ANERR0	Physical Attention	15 15 15
$$ANERR1	Modify Communications Region	None (See Chart TG)
*$$ANERRM $$ANERAA $$ANERAC	OBR/SDR Record Builder	13 13 13
$$ANERAD	List Passer	11
$$ANERAF $$ANERAG	OBR/SDR Message Writer	13 13
$$ANERSA $$ANERSB	3211 Printer ERP	12 12
$$ANERSC	3211 Printer OBR Record Builder	12

*$$ANERRM is also the initial message writer phase

Figure 44. A-Transient Programs (Part 2 of 2)

ERQUE Device	DASD	Tapes	Reader Punch	Printers		Printer Keyboard	Paper Tape Readers	Paper Tape Punch	Optical Reader	MICR	TCR
	2311, 2314, 2319, 2321	2400T7 2400T9 3420	1442, 2501, 2520, 2540	1403, 1404, 1443	3211	1052, 3210, 3215	2671 1017	1018	1285, 1287, 1288	1412, 1419, 1255, 1259, 1270, 1275	2495
Sense Bytes Byte 0 Bit 0	Command Reject									①	Command Reject
1	Intervention Required										
2	Busout Check										
3	Equipment Check										
4	Data Check					N/A	Data Check	⑧	Data Check		
5	Overrun			②	Buffer Parity Check	N/A			Overrun		N/A
6	Track Condition Check	N/A	③	N/A	Load Check	N/A			Non-Recovery	Auto Select	Partition Check
7	Seek Check	Data Converter Check	N/A	Channel 9 Overflow		N/A	⑦	N/A	Keyboard Correction	⑥	N/A
Byte 1 Bit 0	Data Check in Count	N/A			Command Retry	N/A			④	N/A	
1	Track Overrun	N/A			Print Check	N/A					
2	End-of-Cylinder	N/A			Print Quality	N/A					
3	N/A				Line Position	N/A					
4	No Record Found	At Load Point	N/A		Forms Check	N/A			Invalid Font ⑤	N/A	
5	File Protected	N/A			Command Suppress	N/A					
6	Missing Address Marker	File Protect Ring Present	N/A		Mechanical Motion	N/A					
7	N/A	Tape Not Compatible	N/A								

Notes: N/A = Not Applicable

① Command Reject or Disengage Failure (1412/1419); Command Reject or Control Command (1270/1275).

② UCB Parity Check (1403 only).

③ Unusual Command Sequence (2540 read only).

④ Applies for 1287 to indicate tape (set to 1) or document (set to 0) mode.

⑤ Applies for 1287 in the document mode only.

⑥ SIO-Batch numbering switch off; TIO-Document Spacing Error (1287).

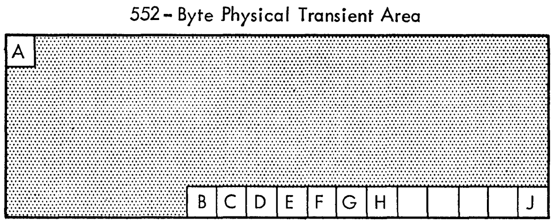
⑦ Applies for 1017 only; Broken Tape.

⑧ Only if Error Correction Feature present.

Figure 45. Sense Information for Devices Supported by Device Error Recovery

MESSAGE CODE (IN HEX)	10-CHARACTER MESSAGE	ERROR
08	C'INTERV REQ'	OPERATOR INTERVENTION REQUIRED
09	C'BUSOUT CHK'	BUS OUT CHECK
10	C'EQUIP CHK '	EQUIPMENT CHECK
11	C'DATA CHECK'	DATA CHECK
12	C'VERIFY CHK'	VERIFY CHECK
13	C'ADDR MRKER'	MISSING ADDRESS MARKER
14	C'OVERRUN '	OVERRUN
15	C'SEEK CHECK'	SEEK CHECK
16	C'DTA CHK CT'	DATA CHECK IN COUNT FIELD
17	C'FILE PROT '	VIOLATED FILE PROTECTION
18	C'COMM REJCT'	COMMAND REJECT
19	C'UNDETR ERR'	UNDETERMINED ERROR
20	C'ERR ON REC'	ERROR DURING RECOVERY ATTEMPT
21	C'NRF-MADDMK'	NO RECORD FOUND & MISSING ADDRESS MARKER
22	C'BALST CELL'	BALLAST CELL ACCESSED ON 2321
23	C'BLNK STRIP'	ACCESSED A PREVIOUSLY UNUSED STRIP
24	C'PROG CHECK'	I/O PROGRAM CHECK
25	C'PROT CHECK'	STORAGE PROTECTION CHECK
26	C'INVAL SEEK'	SEEK ADDRESS NOT VALID
27	C'UNKNWN DEV'	DEVICE IN ERROR NOT RECOGNIZED
28	C'CHAN DTCHK'	CHANNEL DATA CHECK
29	C'BK INTO LP'	BACKSPACE INTO LOADPOINT
30	C'CONVRT CHK'	TAPE CONVERT CHECK
31	C'DVC NOT OP'	DEVICE NOT OPERATIONAL
32	C'NON COMPAT'	NONCOMPATIBLE TAPE ON DRIVE
33	C'BUF PARITY'	PARITY ERROR IN PRINTER BUFFER
34	C'BCH NM OFF'	BATCH NUMBERING SWITCH OFF ON MICR
35	C'NON RECOV '	NON-RECOVERY ON 1285
36	C'NO REC FND'	NO RECORD FOUND
37	C'DISEN FAIL'	DISENGAGE FAILURE ON MICR
38	C'INVLD FONT'	INVALID FONT ON 1287 IN DOCUMENT MODE
39	C'POSN CHECK'	POSITION CHECK ON 2495 TCR
40	C'BROKN TAPE'	BROKEN TAPE ON 1017
41	C'LOAD CHECK'	BUFFER LOAD CHECK ON 3211

Figure 46. Physical Transients Error Messages



The labels which are associated with these bytes are as designated below. Byte A is the first byte of the Physical Transient Area, Byte J is the last. Bytes B through H constitute the interphase communications area. When phases Z, Y and 0 are fetched or refetched, these bytes (B through H) are not overlaid and remain with information for the other phases.

Byte	Label	Phase
A	IJBPAR1	Z
	IJBPAR2	Y
	IJBPAR3	0
B	PARLTK	Z
	PARCOMM-1	
C	IJBPAR1+504	
	PARCOMM	Z
	IJBPAR2+504	
	PARCOMM2	Y
	PARCOMMC	Z
	PARCOMMD	Y
F	PARCOMMI	Z
	PARCOMMJ	Y
	PARCOMMC+3	
	PARCOMMD+3	
D, E, G, H	Addressed by incrementing or decrementing one of these labels.	

Note: Bytes C, D and E are used to indicate the program(s) F1, F2 or BG, to be canceled.

Bytes F, G and H indicate the programs which use devices which require operator intervention.

Byte B indicates if a canceled program has fetched a logical transient.

Figure 47. Interphase Communication Area (For A-Transients $$ANERRZ, Y, and 0)

```
*****                               *****
**     LIST FOR UNSUPPORTED DEVICE     **
*****                               *****

UNSUP  EQU   *
       SDRMSK SENSE,0,2          BUS-OUT CHECK
       SDRMSK SENSE,0,3          EQUIPMENT CHECK
       SDRMSK SENSE,0,5          OVERRUN
       SDRMSK END                END OF LIST
LUNSUP EQU   *-UNSUP             LENGTH OF LIST

*****                                                         *****
**     LIST FOR CHARACTER READER DEVICES 1285/1287/1412/1419     **
*****                                                         *****

CHAR   EQU   *
       SDRMSK SENSE,0,0          COMMAND REJECT
       SDRMSK SENSE,0,2          BUS-OUT CHECK
       SDRMSK SENSE,0,5          OVERRUN
       SDRMSK END                END OF LIST
LCHAR  EQU   *-CHAR              LENGTH OF LIST

*****                                *****
**     LIST FOR UNIT RECORD DEVICES     **
*****                                *****

UNIT   EQU   *
       SDRMSK SENSE,0,1          INTERVENTION REQUIRED
       SDRMSK SENSE,0,2          BUS-OUT CHECK
       SDRMSK SENSE,0,3          EQUIPMENT CHECK
       SDRMSK END                END OF LIST
LUNIT  EQU   *-UNIT              LENGTH OF LIST

*****                         *****
**     LIST FOR 1052 CONSOLE     **
*****                         *****

CONSL  EQU   *
       SDRMSK SENSE,0,1          INTERVENTION REQUIRED
       SDRMSK SENSE,0,2          BUS-OUT CHECK
       SDRMSK SENSE,0,3          EQUIPMENT CHECK
       SDRMSK SENSE,0,5          OVERRUN
       SDRMSK END                END OF LIST
LCONSL EQU   *-CONSL             LENGTH OF LIST

*****                             *****
**     LIST FOR 2540 READER,PUNCH    **
*****                             *****

RDPCH  EQU   *
       SDRMSK SENSE,0,1          INTERVENTION REQUIRED
       SDRMSK SENSE,0,2          BUS-OUT CHECK
       SDRMSK SENSE,0,3          EQUIPMENT CHECK
       SDRMSK BYPASS             SKIP THIS COUNTER
       SDRMSK SENSE,0,6          UNUSUAL COMMAND SEQUENCE
       SDRMSK END                END OF LIST
LRDPCH EQU   *-RDPCH             LENGTH OF LIST
```

```
*****                             *****
**     LIST FOR 2400 TAPE SERIES     **
*****                             *****

TAPE   EQU   *
       SDRMSK SENSE,0,1        INTERVENTION REQUIRED
       SDRMSK SENSE,0,2        BUS-OUT CHECK
       SDRMSK SENSE,0,3        EQUIPMENT CHECK
       SDRMSK SENSE,0,5        OVERRUN MASK
       SDRMSK SENSE,0,6        WORD COUNT ZERO
       SDRMSK SENSE,0,7        DATA CONVERTER CHECK
       SDRMSK SENSE,3,0        R/W VERTICAL REDUNDANCY CHECK
       SDRMSK SENSE,3,1        LONGITUDINAL REDUNDANCY CHECK
       SDRMSK SENSE,3,2        SKEW MASK
       SDRMSK SENSE,3,3        CYCLIC REDUNDANCY CHECK
       SDRMSK SENSE,3,4        SKEW REGISTER VRC MASK
       SDRMSK SENSE,1,0        NOISE MASK
       SDRMSK END              END OF LIST
LTAPE  EQU   *-TAPE            LENGTH OF LIST

*****                                *****
**     LIST FOR DASD 2311/2314/2321     **
*****                                *****

DASD   EQU   *
       SDRMSK SENSE,0,1        INTERVENTION REQUIRED
       SDRMSK SENSE,0,2        BUS-OUT CHECK
       SDRMSK SENSE,0,3        EQUIPMENT CHECK
       SDRMSK SENSE,0,5        OVERRUN
       SDRMSK SENSE,0,6        TRACK CONDITION
       SDRMSK SENSE,0,7        SEEK CHECK
       SDRMSK SENSE,2,0        UNSAFE
       SDRMSK BYPASS           BYPASS THIS COUNTER
       SDRMSK SENSE,2,2        SERIALIZER/DESERILIZER
       SDRMSK SENSE,2,3        CONTROL UNIT TAG LINE
       SDRMSK SENSE,2,4        ALU CHECK
       SDRMSK BYPASS           BYPASS THIS COUNTER
       SDRMSK SENSE,1,6        MISSING ADDRESS MARKER
       SDRMSK END              END OF LIST
LDASD  EQU   *-DASD            LENGTH OF LIST

***                               ***
*      2495 TAPE CARTRIDGE READER   *
***                               ***

CARTAP EQU   *
       SDRMSK SENSE,0,1        INTERVENTION REQUIRED
       SDRMSK SENSE,0,2        BUS-OUT CHECK
       SDRMSK SENSE,0,6        POSITION CHECK
       SDRMSK END
LCARTAP EQU  *-RDPCH           LENGTH OF LIST
```

Figure 48. SDR Device List Example

PHASE	MESSAGE CODE	RECORDER FILE ERROR MESSAGE
$$ANERAF	0T01I	0CUU....SDR RECORD OVERFLOWED
	0T02I	SDR AREA FULL 0CUU...
	0T03I	ERROR ON RECORDER FILE AT CCHHR
$$ANERAG	0T00I	LAST TRACK ON RECORDER FILE
	0T04I	CHANNEL QUE FULL NO RECORD

Figure 49. Physical Transients Error Messages for OBR/SDR

ERROR LOGGING AND RECOVERY

Error logging and recovery procedures are done by the I/O Error Logging (ERRLOG), Machine Check Recording and Recovery (MCRR), and Machine Check Analysis and Recovery (MCAR) functions. These routines collect information about the reliability of the hardware. The environment records produced facilitate diagnosis and repair of a system and thus reduce interruptions due to hardware failure.

The system recovery portion of the MCRR function on System/360 reduces the number of conditions which cause the system to enter an uninterruptible wait state. System recovery is accomplished by canceling all affected tasks.

MCAR functions only when the MODEL option equals a System/370 CPU. If ERRLOG is not specified, MCAR forces the ERRLOG=YES option at system generation. MCAR gathers reliability information on SYSREC and contains error recovery procedures to minimize system hard waits.

If ERRLOG=RDE (Reliability Data Extractor) is specified, users of System/370 systems can gather additional data about hardware reliability. RDE writes IPL and EOD (End Of Day) records on SYSREC. These records indicate the reason for IPL and identify the RDE data on SYSREC.

For more information about MCAR, see the section Recovery Management Support for System/370.

I/O ERROR LOGGING (ERRLOG)

The Error Log function records two types of I/O errors. The Outboard Recorder (OBR) records pertinent data when a hard I/O error occurs. A hard I/O error is one which cannot be retried or cannot be corrected after a standard number of retries. The Statistical Data Recorder (SDR) records the cumulative error status of an I/O device. The data recorded by OBR and SDR may be processed and displayed by the Environment Record Editing and Printing (EREP) program. For the internal logic of the EREP program, refer to the System Service Program PLM, listed in the Preface.

Outboard Recorder (OBR)

OBR creates records when I/O errors occur which cannot be corrected by standard programmed error recovery procedures. The OBR records are built and written on the Recorder File (SYSREC) by two A-transients, $$ANERRM and $$ANERAA. Figure 49 shows the information contained in the OBR record. See Chart 12 for the OBR record builder and record writer A-transients.

Statistical Data Recorder (SDR)

SDR records the cumulative error status of each I/O device on the system. Sixteen half-byte counters are retained in core storage for each device. Each half-byte counter corresponds to one of the sixteen 2-byte error counters of the SDR record. These in-core counters are updated when an I/O error occurs. Figure 51 shows the SDR record format.

Whenever an OBR record is written onto the Recorder File, the SDR record for the device in error is also updated. When the SDR update routines are processing, they pass parameters in a common area, the SDR Communications Region. Figure 26 illustrates this region. SDR routines in the SEND macro expansion update internal counters and record information, and schedule Recorder File updates.

The counter update routine uses a device list passed by the A-transient $$ANERAD just before the ERP A-transient processing begins. Figure 48 display the SDRMSK device lists that are passed to the SDR processor whenever an error occurs on a given device. (SDRMSK is an internal macro that generates the device list entries used by the SDR processor. It is not documented in this manual.)

The first two in-core counters, which record, read, and write data check occurrences, are handled by the SDR processor itself and have no corresponding entry in the SDRMSK list. The SDR processor tests the CSW bit that corresponds to data check and examines the OP code of the CCW in question to determine if it is a read or write command.

The first entry in the SDRMSK list corresponds to the third in-core counter, second to the fourth, third to the fifth, and so on. SDRMSK Sense 0,1 means that this 1-byte generated entry corresponds to sense byte 0, bit=1 of the device associated with that list.

The updated SDR record is written on the Recorder File (SYSREC) by the A-transient $$ANERAC when thirteen errors have occured on a device. Chart 08 gives a description of the SDR update routines. See Charts 09 and 10 for $$ANERAD and $$ANERAC.

Writing OBR/SDR Records

It is possible to write or update SDR records and write OBR records for devices not explicitly supported by the system by using the SVCs 43 and 44.

The address of the compressed SDR record area must be supplied in general register 1 before the SVC 43 is issued. SVC 43 causes a branch to the SDRSDR routine in the supervisor to complete processing of the record. Immediately following the SVC, the WAIT macro must be issued on the address in register 1.

Example:

```
        LA 1,SDRAREA
        SVC 43
        WAIT (1) or SDRAREA
```

The SDR record area must be 22 bytes long and have three fields. The first field is reserved for the SDR processor. The second field must be initialized as zeros. During write, the SDR processor posts status, operation complete, or I/O error. The WAIT macro tests for operation complete. The third field is the updated SDR record. The counters field of the record must be in compacted format, meaning 16 half-byte error counters for a total of 8 bytes in length. Figure 51 shows the SDR record format with the 16 error counters in expanded form. The SDR processor expands the field to 16 two-byte areas on the disk.

FIELD	SIZE	CONTENTS
1	2 Bytes	Reserved for SDR processor
2	1 Byte	X'00' Initially X'80' Posted for operation complete X'20' Posted for I/O error during write X'10' Posted if SVC 43 is issued with Recorder file off.*
3	19 Bytes	SDR record with compacted error counters field - 16 half-byte counters.

AREA SIZE - 22 Byte Total

*This bit must be interrogated by the issuer of the SVC 43. If this bit is on, the SDR record was not written.

The address of the OBR record area must be supplied in general register 1 before the SVC 44 is issued. SVC 44 causes a branch to the SDROBR routine in the supervisor to write the OBR record. Immediately following the SVC, the WAIT macro must be issued on the address in register 1.

Example:

```
        LA 1,OBRAREA
        SVC 44
        WAIT (1) or OBRAREA
```

The OBR record area must be 83 bytes long and have 3 fields. The first field is reserved for the OBR processor. The second field must be initialzed as zeroes. During write, the OBR processor posts status, operation complete, or I/O error. The WAIT macro tests for operation complete. The third field is the OBR record. Figure 50 shows the OBR record format.

FIELD	SIZE	CONTENTS
1	2 Bytes	Reserved for OBR processor
2	1 Byte	X'00' Initially X'80' Posted for operation complete X'20' Posted for I/O error during write. X'10' Posted if SVC 44 is issued with Recorder file off.*
3	80 Bytes	OBR record.

AREA SIZE - 83 Byte Total

*This bit must be interrogated by the issuer of the SVC 44. If this bit is on, the OBR record was not written.

GENERAL FORMAT

FIELD	SIZE	CONTENT/DESCRIPTION
Record Type	1 Byte	X'01' identifies OBR record.
Date	4 Bytes	In packed decimal form: 00YYDDDF = (Year, julian Date, Zone)
Time	4 Bytes	System time of day.
Program ID	8 Bytes	Name of JOB (in a Batched partition), or program name.
First CCW	8 Bytes	First CCW of failing chain.
Failing CCW	8 Bytes	CCW on which error occurred.
Channel & Unit	2 Bytes	
CSW	8 Bytes	
Sense	6 Bytes	Device sense bytes.
	6 Bytes	Reserved for new sense.
Seek Address	6 Bytes	BBCCHH
Device Type	4 Bytes	Device type as stored in PUB table, mode setting, and characteristics.
Poll Characters	4 Bytes	
Logical Unit	2 Bytes	
Volume ID	6 Bytes	
Reserved	2 Bytes	
Guard Byte	1 Byte	X'FF'

RECORD CAPACITY - 80 Bytes Total

Note:

Device Type	Records/Track
2311	25
2314	40

IBM 3211 FORMAT

FIELD	SIZE	CONTENT/DESCRIPTION
Record type	1 Byte	X'01' identifies OBR record.
Date	4 Bytes	Format is 00YYDDDZ (Year, julian Date, Zone in packed decimal).
Time	4 Bytes	System time of day.
Job ID	8 Bytes	Program name, or job in batched partition.
First CCW	8 Bytes	First CCW in failing chain.
Failing CCW	8 Bytes	CCW on which error occurred.
Channel & Unit	2 Bytes	Failing device address.
CSW	8 Bytes	
Sense	6 Bytes	Six sense bytes produced by 3211.
	6 Bytes	Reserved.
Device type	4 Bytes	First two bytes taken from bytes 4, 5 of 3211 PUB entry.
Logical unit	2 Bytes	
Parity error locations	8 Bytes	Up to 8 parity error locations in the print line buffer (one byte per location, X'01' to X'96').
Contents of parity error locations	8 Bytes	Contents of positions referenced in parity error locations.
Flag	1 Byte	Flag contains: X'40' - 8 or fewer parity error locations. X'41' - 8 or fewer parity error locations, but locations are unobtainable. X'42' - Number and contents of parity error locations are unobtainable. X'5C' - More than 8 parity error locations. X'5D' - More than 8 parity error locations, but contents are unobtainable.
Device ID	1 Byte	X'FF' = 3211 OBR record indicator.
Guard byte	1 Byte	X'FF' designates end of record.

Figure 50. OBR Record Formats

KEY	FIELD	SIZE	DESCRIPTION
	Channel & Unit	2 Bytes	Last Record X'FFFE' Available Record X'FFFF'
	Poll Characters	4 Bytes	
DATA	FIELD	SIZE	DESCRIPTION
	Type	1 Byte	Device Type from PUB Table
	Characteristics	1 Byte	X'40' if Switchable Device X'02' if Burst on MPX Channel X'01' if 7 Track Tape
	Counters *	16x2 Bytes	Error Counters
	Reserved	2 Bytes	
	Guard	1 Byte	X'FF'

RECORD CAPACITY - 43 Bytes Total

Note:

Device Type	Records/Track
2311	29
2314	38

*The SDR processor expands each of the sixteen half-byte in core counters into two byte counters on the disk. There can be thirteen errors on a device before updating the disk; the capacity of the 2 byte expansion is 32767 errors before overflow is reached.

Figure 51. SDR Record Format

MACHINE CHECK RECORDING AND RECOVERY (MCRR)

The SYSGEN option MCRR is valid for only System/360. The Disk Operating System provides System/370 a similar, but automatic, function. See the Recovery Management Support for System/370 section.

The MCRR function records system error information after a machine check, channel control check, interface control check, or channel data check occurs. MCRR then cancels the damaged task or tasks. No attempt is made to recover on any error involving the MCRR function. The recorded data can be processed and displayed by the Environment Record Editing and Printing (EREP) program. For information regarding the internal logic of the EREP program, refer to the System Service Program PLM, listed in the Preface of this manual.

The MCRR function builds two types of records on the Recorder File (SYSREC). Whenever a log-out occurs as a result of a channel failure, the routine builds model dependent Channel Inboard Error records and cancels the damaged task(s). The A-Transient $$ANERAA writes the CIE record. When a machine check occurs, the routine builds model dependent CPU Machine Check records, and cancels the damaged task(s). The A-Transient $$ANERAA writes the CPU record. Figure 53 shows the format of the two record types. See Chart 10 for a description of the MCRR routine.

If another MCRR condition occurs while the MCRR routine is in progress, the system enters a hard wait after posting the SEREP cancel code in low core.

MCRRPSW1 (See Note)

0 (Hexadecimal Displacement)	8	10	14
0 (Decimal Displacement)	8	16	20
MCRR PSW Reentrant Address of MCRR Routine	MCRR PSW Address of MCRR Routine	Address of Channel Failure Routine	Address of Machine Check Routine
XXXXXXXX	XXXXXXXX	XXXX	XXXX

Key to displacement:

0 Machine Check Recording and Recovery PSW. Loaded to enable machine check interrupts. Second word (displacement 4-7) contains reentrant address (MCRETURN) to MCRR routine.

8 Machine Check Recording and Recovery PSW. Loaded to enable machine check interrupts. Second word (displacement 12-15) contains initial address (MCRRRTN) of the MCRR routine.

16 Address of channel failure routine (MACHEK1).

20 Address of machine check routine (MACHEK).

Note: MCRRPSW1 is the label of the first byte of the MCRR Linkage Table.

Figure 52. Machine Check Recording and Recovery (MCRR) Linkage Table

Record 1:

ENTRY	SIZE	CONTENT/DESCRIPTION
Record ID	1 Byte	X'02' CIE Record ID
Record Number	2 Bytes	X'nnNN' n of N records
Model Number	1 Byte	X'30', X'40', or X'50'
Date	4 Bytes	In packed decimal form 00YYDDDF = (Year, julian Date, Zone)
Time	4 Bytes	System time of day
Program ID	8 Bytes	C'XXXXXXXX' Job name
10 Active Devices	20 Bytes	X'cuu' First 10 active devices on Channel
First CCW	8 Bytes	First CCW of failing chain
Failing CCW	8 Bytes	CCW on which error occurred
CSW	8 Bytes	
Failing Device	2 Bytes	X'cuu'
Log-Out	12 Bytes	Mod 30 core bytes X'80'-X'8B' Mod 40 core bytes X'80'-X'8B' Mod 50 core bytes X'80'-X'8B' or X'88'-X'93'
Indicator	1 Byte	X'01' OBR full log bit - Mod 50 only Unused Models 30 & 40
End of Record	1 Byte	X'FF'

RECORD CAPACITY - 80 Bytes Total

Record 2: Models 40 & 50 only

ENTRY	SIZE	CONTENT/DESCRIPTION
Record ID	1 Byte	X'02' CIE Record ID
Record Number	2 Bytes	X'nnNN' n of N records
Model Number	1 Byte	X'40' or X'50'
Log-Out	75 Bytes	Mod 40 core bytes X'8C'-X'D6'
	or	Mod 50 core bytes X'8c'-X'D6' or
	55 Bytes	Mod 50 core bytes X'95'-X'CB'
	20 Bytes	Mod 50 only - Unused with short record.
End of Record	1 Byte	X'FF'

RECORD CAPACITY - 80 Bytes Total

Figure 53. Machine Check Recording and Recovery (MCRR) Record Formats (Part 1 of 4)

Record 3: Models 40 & 50 only

ENTRY	SIZE	CONTENT/DESCRIPTION
Record ID	1 Byte	X'02' CIE Record ID
Record Number	2 Bytes	X'nnNN' n of N records
Model Number	1 Byte	X'40' or X'50'
Log-Out	75 Bytes	Mod 40 core bytes X'D7'-X'121'
		Mod 50 core bytes X'D7'-X'121'
	75 Bytes	Unused for Partition Log-Out
End of Record	1 Byte	X'FF'

RECORD CAPACITY - 80 Bytes Total

Record 4: Models 40 & 50 only

ENTRY	SIZE	CONTENT/DESCRIPTION
Record ID	1 Byte	X'02' CIE Record ID
Record Number	2 Bytes	X'nnNN' n of N records
Model Number	1 Byte	X'40' or X'50'
Log-Out	34 Bytes	Mod 40 core bytes X'122' - X'143'
	2 Bytes	Mod 50 core bytes X'122'-X'123'
Unused	41 Bytes	Mod 40
	73 Bytes	Mod 50
End of Record	1 Byte	X'FF'

RECORD CAPACITY - 80 Bytes Total

Figure 53. Machine Check Recording and Recovery (MCRR) Record Formats (Part 2 of 4)

Record 1:

ENTRY	SIZE	CONTENT/DESCRIPTION
Record ID	1 Byte	X'04' CPU Record ID
Record Number	2 Bytes	X'nnNN' n of N records
Model Number	1 Byte	X'30', X'40', X'50'
Date	4 Bytes	In packed decimal form 00YYDDDF = (Year, julian Date, Zone)
Time	4 Bytes	System time of day
Program ID	8 Bytes	C'XXXXXXXX' Job name
10 Active Devices	20 Bytes	X'cuu' First 10 active I/O units on channel
PSW	8 Bytes	Machine check old PSW
G.P. Registers	28 Bytes	Registers 0-6
Unused	3 Bytes	
End of Record	1 Byte	X'FF'

RECORD CAPACITY - 80 Byte Total

Record 2:

ENTRY	SIZE	CONTENT/DESCRIPTION
Record ID	1 Byte	X'04' CPU Record ID
Record Number	2 Bytes	X'nnNN' n of N records
Model Number	1 Byte	X'30', X'40', X'50'
G.P. Registers	36 Bytes	Registers 7-15
F.P. Registers	32 Bytes	0, 2, 4, 6
Unused	7 Bytes	
End of Record	1 Byte	X'FF'

RECORD CAPACITY - 80 Byte Total

Record 3:

ENTRY	SIZE	CONTENT/DESCRIPTION
Record ID	1 Byte	X'04' CPU Record ID
Record Number	2 Bytes	X'nnNN' n of N Records
Model Number	1 Byte	X'30', X'40', X'50'
Log-Out	12 Bytes	Mod 30 core bytes X'80'-X'8B'
	75 Bytes	Mod 40 core bytes X'80'-X'CA'
		Mod 50 core bytes X'80'-X'CA'
Unused	63 Bytes	(Model 30 only)
End of Record	1 Byte	X'FF'

RECORD CAPACITY - 80 Byte Total

Figure 53. Machine Check Recording and Recovery (MCRR) Record Formats (Part 3 of 4)

Record 4: Models 40 & 50 only

ENTRY	SIZE	CONTENT/DESCRIPTION
Record ID	1 Byte	X'04' CPU Record ID
Record Number	2 Bytes	X'nnNN' n of N records
Model Number	1 Byte	X'40' or X'50'
Log-Out	75 Bytes	Mod 40 core bytes X'CB'-X'115'
		Mod 50 core bytes X'CB'-X'115'
End of Record	1 Byte	X'FF'

RECORD CAPACITY - 80 Byte Total

Record 5: Models 40 & 50 only

ENTRY	SIZE	CONTENT/DESCRIPTION
Record ID	1 Byte	X'04' CPU Record ID
Record Number	2 Bytes	X'nnNN' n of N records
Model Number	1 Byte	X'40' or X'50'
Log-Out	46 Bytes	Mod 40 core bytes X'116'-X'143'
	14 Bytes	Mod 50 core bytes X'116'-X'123'
Parities	12 Bytes	Registers parities (Mod 50 only)
Unused	29 Bytes	Mod 40
	49 Bytes	Mod 50
End of Record	1 Byte	X'FF'

RECORD CAPACITY - 80 Byte Total

Figure 53. Machine Check Recording and Recovery (MCRR) Record Formats (Part 4 of 4)

I/O ERROR RECOVERY PROCEDURES AND SENSE DATA

2400 TAPE ERROR RECOVERY

Byte 0, Bit 3--Equipment Check

Action: Take equipment error exit (cancel).

Message: 0P10 EQUIP CHK.

Byte 0. Bit 2--Bus Out Check

Action: If at initial selection and command chaining, take equipment error exit (cancel); otherwise, retry.

Device End in Unit Status: If this condition occurs during a write, the tape is repositioned and the command is reissued. If this condition occurs during another type of command, the command is reissued. This procedure is followed until five retries have been attempted; if recovery is not sucessful, take equipment error exit (cancel).

Message: 0P09 BUSOUT CHK.

Byte 0, Bit 1--Intervention Required

Action: No Device End in Unit Status; TU Status B (sense byte 1, bit2) is tested. If TU Status B is off, the device is nonexistent. No retries are attempted. If TU Status B is on, an operator intervention required message is provided and, when the unit is made ready, the command is reissued.

Message: 0P08 INTERV REQ.

Action: Device End in Unit Status: If the command was a Rewind- Unload, processing continues; otherwise, take the equipment error exit (cancel).

Message: 0P19 UNDETR ERR.

Byte 0, Bit 0--Command Reject

Action: If at load point and file protect, rewind and unload.

Message: 0P17 FILE PROT.

Action: Take equipment error exit (cancel).

Message: 0P18 COMM REJCT.

Byte 0, Bit 5--Overrun

Action: The tape is repositioned and the command is reissued. This procedure is followed until five retries have been attempted. If recovery is not sucessful, take equipment error exit (cancel).

Note that a data check during overrun suppresses the overrun condition.

Byte 1, Bit 4--Load Point

Action: If not caused by read backward operation, take equipment error exit (cancel).

Message: 0P29 BK INTO LP (Backspace into Load Point Command).

Byte 0, Bit 4--Data Check

Action: If the operation is read or read backward, and if the noise bit (Byte 1, Bit 0) is on, or if more than 11 bytes were read, the tape is repositioned and the read or read backwards is retried. If the noise bit is off and the block size is less than 12 bytes, another block is read and operation continues. This procedure is followed until forty retries have been attempted. Every fifth retry is preceded by a tape cleaner action. A TIE (Track-in-Error) command is issued before every reread to send sense byte 2, which contains track-in-error information, to the tape control unit.

If the above procedure does not recover the error, the error routine tries to recover by reading in the opposite direction. If, however, any of the following conditions exists, the routine does not attempt opposite-direction recovery:

- Data chaining is being performed.
- Data conversion mode and 7-track tape are being used.
- The original CCW count is less than the physical block size on the tape.
- "Suppress data transfer" is specified in the original CCW.

In attempting opposite-direction recovery, the error routine first prepares to read without repositioning the tape. It issues a Track-in-Error command to send to the tape control unit the sense byte 2 obtained during the last original-direction retry. The routine then issues a Read or Read Backwards command as its first retry. On subsequent retries, it repositions the tape, issues a Track-in-Error command, then a Read or Read Backwards command. Before every fifth retry, the routine causes a tape-cleaner action. The routine continues to retry until it either succeeds (i.e., no unit check occurs) or has made 40 unsucessful retries.

The read-opposite CCW has the "suppress data transfer" bit set until the first successful retry. The routine then alters the read-opposite CCW so that it can transfer data. The alteration consists of clearing the "suppress data transfer" bit and placing the "exact" count and the data address in the CCW. The "exact" count equals the block size to be read. If successful, the routine issues a Forward Space Record or

Backward Space Record command to reposition the tape past the block being read.

If all 40 read-opposite recovery attempts are unsuccessful, the routine makes one final retry, this time attempting to read in the original direction. Unlike previous attempts, it does not issue a Track-in-Error command before the Read or Read Backward command. Note that the routine avoids the final read attempt if either a permanent bus-out check occurs when the repositioning command is issued or an equipment check occurs. If the user will not accept the data check, take the cancel, ignore exit after the specified number of retries. If the user will accept the data check, return control to the user.

If the operation is a write or write tapemark, the tape is repositioned, an Erase Gap command is issued, and the Write or Write Tapemark command is reissued. This procedure is followed until fifteen retries have been attempted; then take equipment error exit (cancel).

If the operation is an erase gap, the command is reissued. This procedure is followed until three retries have been attempted; then take equipment error exit (cancel).

Message: 0P11 DATA CHECK.

- CSW Bit 44--Channel Data Check

  Action: If this condition occurs during a read or write operation, the tape is repositioned and the command is reissued. If this condition occurs during a control command, the command is reissued. This procedure is followed until five retries have been attempted; then take equipment error exit (cancel).

  Message: 0P28 CHAN DTCHK.

- Byte 0, Bit 7--Data Converter Check

  Action: Take equipment error exit (cancel).

  Message: 0P30 CONVRT CHK.

- Byte 1, Bit 7--Not Capable

  Action: Rewind and unload tape. Take equipment error exit.

  Message: 0P32 NON COMPAT.

- No Previous Sense Bits On

  Action: No retries are attempted. Take equipment error exit.

  Message: 0P19 UNDETR ERR.

- CSW Bit 47--Chaining Check

  Action: The tape is repositioned and the command is reissued. This procedure is followed until five retries have been attempted; then take equipment error exit (cancel).

  Message: 0P14 OVERRUN.

1052 ERROR RECOVERY

- CSW Bit 44--Channel Data Check

  Action: One retry, take equipment error exit (cancel, retry, ignore).

  Message: 0P28 CHAN DTCHK.

- Byte 0, Bit 3--Equipment Check

  Action: One retry, take equipment error exit (cancel, retry, ignore).

  Message: 0P10 EQUIP CHK.

- Byte 0, Bit 1--Intervention Required

  Action: Execute audible alarm command and take operator intervention exit.

  Message: 0P08 INTERV REQ.

- Byte 0, Bit 2--Bus Out Check

  Action: One retry, take equipment error exit (cancel, retry, ignore).

  Message: 0P09 BUSOUT CHK.

- Byte 0, Bit 0--Command Reject

  Action: Take program check exit.

  Message: 0P18 COMM REJCT.

1403-1443 ERROR RECOVERY

- CSW Bit 44--Channel Data Check

  Action: If initial selection, one retry--take equipment error exit (initial selection: cancel, retry. Channel end: cancel, retry, ignore).

  Message: 0P28 CHAN DTCHK.

- Byte 0, Bit 3--Equipment Check

  Action: Take equipment error exit (cancel, ignore).

  Message: 0P10 EQUIP CHK.

- Byte 0, Bit 5--Code General Storage Parity Error (1403 only)

  Action: Take equipment error exit (cancel). UCS buffer must be reloaded.

  Message: 0P33 UCB PARITY.

- Byte 0, Bit 1--Intervention Required

  Action: Take operator intervention exit.

  Message: 0P08 INTERV REQ.

- Byte 0, Bit 2--Bus Out Check

  Action: If initial selection, one retry; otherwise, take equipment error exit (initial selection: cancel, retry. Channel end: cancel, retry, ignore).

  Message: 0P09 BUSOUT CHK.

- Byte 0, Bit 7--Channel 9

  Action: Post CCB, take continue exit.

  Note: This test is main storage resident.

- Byte 0, Bit 0--Command Reject

  Action: If command code is UCS enable or inhibit data check, take continue exit; otherwise, take program check exit. This procedure allows UCS-oriented programs to operate on non-UCS hardware.

  Message: 0P18 COMM REJCT.

- Byte 0, Bit 4--Data Check (1403 Only)

  Action: Take equipment error exit (cancel, ignore).

  Message: 0P11 DATA CHECK.

1442 ERROR RECOVERY

- CSW Bit 44--Channel Data Check

  Action: If initial selection, one retry; then take equipment error exit (cancel, retry). If data transfer, take operator intervention exit.

  Message: 0P28 CHAN DTCHK.

- Byte 0, Bit 3--Equipment Check

  Action: Take operator intervention exit.

  Message: 0P10 EQUIP CHK.

- Byte 0, Bit 1--Intervention Required

  Action: Take operator intervention exit.

  Message: 0P08 INTERV REQ.

- Byte 0, Bit 2--Bus Out Check

  Action: If initial selection, do one retry; then take equipment error exit (cancel, retry). If data transfer, take operator intervention exit.

  Message: 0P09 BUSOUT CHK.

- Byte 0, Bit 4--Data Check

  Action: Take operator intervention exit.

  Message: 0P11 DATA CHECK.

- Byte 0, Bit 5--Overrun

  Action: Take operator intervention exit.

  Message: 0P14 OVERRUN.

- Byte 0, Bit 0--Command Reject

  Action: Take program check exit.

  Message: 0P18 COMM REJCT.

- CSW Bit 47--Chaining Check

  Action: Take operator intervention exit.

  Message: 0P14 OVERRUN.

2501, 2520, 2540 ERROR RECOVERY

- CSW Bit 44--Channel Data Check

  Action: If initial selection, one retry; then take equipment error exit (cancel, retry). If read data transfer, take operator intervention exit. If punch data transfer, one retry; then take equipment error exit (cancel, retry).

  Message: 0P28 CHAN DTCHK.

- Byte 0, Bit 3--Equipment Check

  Action: Reader--Take operator intervention exit. Punch--CCB option. Take equipment error exit (cancel, ignore). For 2520, Byte 0, Bit 7 indicates punch check.

  Message: 0P10 EQUIP CHK.

- Byte 0, Bit 1--Intervention Required

  Action: Take operator intervention exit.

  Message: 0P08 INTERV REQ.

- Byte 0, Bit 2--Bus Out Check

  Action: One retry; then take equipment error exit (cancel, retry). If the device is a 2520, do not retry if this is not initial selection (cancel, retry).

  Message: 0P09 BUSOUT CHK.

- Byte 0, Bit 4--Data Check (Cannot occur on a 2520 punch)

  Action: Take operator intervention exit.

  Message: 0P11 DATA CHECK.

- Byte 0, Bit 5--Overrun (Cannot occur on 2540 or 2520 punch)

  Action: Take operator intervention exit.

  Message: 0P14 OVERRUN.

- Byte 0, Bit 0--Command Reject

  Action: Take program check exit.

  Message: 0P18 COMM REJCT.

- Byte 0, Bit 6--Unusual Command Sequence (2540 read only)

  Action: Post CCB--take continue exit.

- CSW Bit 47--Chaining Check (2501, 2520 read only)

  Action: Take operator intervention exit.

  Message: 0P14 OVERRUN.

2671 ERROR RECOVERY

- CSW Bit 44--Channel Data Check

  Action: If initial selection, one retry. Take equipment error exit (cancel).

  Message: 0P28 CHAN DTCHK.

- Byte 0, Bit 3--Equipment Check

  Action: Test CCB for ignore option (byte 2, bit 4) and if on, turn on byte 3, bit 1 of the CCB and take equipment error exit (cancel, ignore, retry). Otherwise, take operator intervention exit.

  Message: 0P10 EQUIP CHK.

  Note: When an equipment check occurs, reposition the paper tape to the beginning of the record in error to perform the retry operation. The device must not be readied until this repositioning has been performed. If the ignore option is available, exercise this option by repositioning the tape to the beginning of the next record on the tape and then responding ignore on the 1052 keyboard. The ignore option is available to the operator whenever the user specifies any of the DTFPT ERROPT entry options.

- Byte 0, Bit 1--Intervention Required

  Action: Take operator intervention exit.

  Message: 0P08 INTERV REQ.

- Byte 0, Bit 2--Bus Out Check

  Action: One retry; if error persists, take equipment error exit (cancel, retry).

  Message: 0P09 BUSOUT CHK.

- Byte 0, Bit 4--Data Check

  Action: Test CCB for ignore option (byte 2, bit 4) and if on, turn on byte 3, bit 3 of the CCB and take equipment error exit (cancel, ignore, retry). Otherwise, take operator intervention exit.

  Message: 0P11 DATA CHECK.

Notes: When a data check occurs, the user's CCW is modified by the error routine to allow rereading of the last character. The data address is the last character read (character in error), and the byte count is decreased by the number of valid characters read. If the CCB ignore option is chosen and the operator responds ignore, the I/O operation is dequeued and posted with the unrecoverable error bit on (CCB byte 2, bit 2) and 2671 data-check bit on (CCB byte 3, bit 3).

To read the rest of the record, the problem program (logical IOCS) should add one to the CCW data address and subtract one from the byte count to adjust for not rereading the bad character. It should then reissue the EXCP. The operator must backspace the tape two characters for retry (option retry or on the A-type message when ignore is not allowed). If the operator chooses the ignore option (the character in error is not to be reread), he must backspace the tape one character if the load key was pressed to free the tape or if the character preceding the character under the read head is an EOR (End-of-Record). Otherwise, no manual intervention is required for the ignore option. The ignore option is available to the operator whenever the user specifies any of the DTFPT ERROPT entry options.

- Byte 0, Bit 0--Command Reject

  Action: Take program check exit.

  Message: 0P18 COMM REJCT.

  Note: A record may not be partly on one tape and partly on another.

2311-2314 DASD ERROR RECOVERY

- CSW Bit 44--Channel Data Check

  Action: One retry; then take equipment error exit (cancel, retry).

  Message: 0P28 CHAN DTCHK.

- Byte 0, Bit 3 - Equipment Check

  Action: Take equipment error exit (cancel, retry).

  Message: 0P10 EQUIP CHK.

- Byte 1, Bit 4 - No Record Found

  Action: Test for byte 1, bit 6 (Missing Address Marker). If present, execute restore command and take retry exit. After ten retries, take equipment error exit (cancel, retry). If not present, read Home Address and compare to user's Seek Address. If equal, post No Record Found to the CCB and take continue exit. If not equal, treat as a Seek Check.

  Messages: 0P21 NRF - MADDMK (No Record Found/Missing Address Marker).
  0P15 SEEK CHECK (Home Address unequal to Seek Address).

  Note: Home Address is read, and the track address is provided for the error message. For other errors, the track address is obtained from the user seek address if error occurs during channel program execution.

- Byte 0, Bit 7--Seek Check

  Action: If byte 0, bit 0 (command reject) is on, take program check exit. Otherwise, execute restore command and take retry exit. After ten retries, take equipment error exit (cancel, retry).

  Messages: 0P26 INVAL SEEK (Seek Check/Command Reject)
  0P15 SEEK CHECK.

- Byte 0, Bit 1--Intervention Required

  Action: Take operator intervention exit.

  Message: 0P08 INTERV REQ.

- Byte 0, Bit 2--Bus Out Check

  Action: If retry count is greater than nine, take equipment error exit (cancel, retry); otherwise, take retry exit.

  Message: 0P09 BUSOUT CHK.

- Byte 0, Bit 4 - Data Check

  Action: CCB options (all data checks, data check on read or verify). If retry count is greater than 256, take equipment error exit (cancel, retry); otherwise, take retry exit. After each 16 retries, a recalibrate is performed until the maximum of 256 retries is reached. After 256 retries, post data check on count to CCB, if present; otherwise, post data check. If command code is verify (implied), post verify error in CCB.

  The verify command is implied under the following conditions:

  - The CCW has a command code X'01' (Write - Special Count, Key and Data), and the skip and SILI flags are set on.
  - The CCW has a command code X'1E' (Read - Count, Key and Data), the skip and SILI flags are set on, and this CCW follows a CCW with a write command code X'1D'.

  Messages: 0P12 VERIFY CHK (Data Check on Verify Command).
  0P11 DATA CHECK (Data Check/not Data Check on Count or Verify).
  0P16 DTA CHK CT (Data Check on Count).

  Note: Home Address is read, and the track address is provided for the error message. For other errors, the track address is obtained from the user seek address if error occurs during channel program execution.

- Byte 0, Bit 5--Overrun

  Action: If retry count is greater than nine, take equipment error exit (cancel, retry); otherwise, take retry exit.

  Message: 0P14 OVERRUN.

- Byte 1, Bit 6--Missing Address Markers

  Action: If retry count is greater than nine, take equipment error exit (cancel, retry); otherwise, take retry exit.

  Message: 0P13 ADDR MRKER.

  Note: Home Address is read, and the track address is provided for the error message. For other errors, the track address is obtained from the user seek address if error occurs during channel program execution.

- Byte 0, Bit 0 - Command Reject

  Action: Check for Byte 1, Bit 5 (File Protect); in either case, take program check exit.

  Messages: 0P18 COMM REJCT.
  0P17 FILE PROT.

- Byte 0, Bit 6--Track Condition Check

  Action:
  1. Read Home Address and R0 in the error recovery routine and move CCHH from R0 to Seek command executed below.

  2. If alternate track: update seek address to the next track address. If the track address equals ten, treat it as End of Cylinder; otherwise, proceed to step 3.

  3. Set up the channel program: Seek, Read Home Address (with skip bit on), TIC to CSW address minus eight. Execute this channel program in error recovery. At channel end, exit to channel scheduler CSW processing routine. If DASD file protection is present, set the appropriate file mask following Seek.

- Byte 1, Bit 1--Track Overrun

  Action: Post track overrun to the CCB and take continue exit.

- Byte 1, Bit 2--End of Cylinder

  Action: Post End of Cylinder to the CCB and take continue exit.

- Byte 1, Bit 5--File Protect

  Action: Take program check exit.

  Message: 0P17 FILE PROT.

- CSW Bit 47--Chaining Check

  Action: If retry count is greater than nine, take equipment error exit (cancel, retry); otherwise, take retry exit.

  Message: 0P14 OVERRUN.

Note: If the error routine gets an error while trying to execute a Restore command or Read Home Address or R0, equipment error exit is taken with retry and cancel options with the message: 0P20 ERR ON REC (Error During Recovery).

2321 DASD ERROR RECOVERY

- CSW Bit 44--Channel Data Check

  Action: One retry; then take equipment error exit (cancel, retry).

  Message: 0P28 CHAN DTCHK.

- Byte 0, Bit 3--Equipment Check

  Action: Take equipment error exit (cancel, retry).

  Message: 0P10 EQUIP CHK.

Byte 1, Bit 4--No Record Found

Action:
1. If Byte 1, Bit 6 (missing Address Markers) is present, go to step 2. Otherwise, go to step 6.

2. If retry count is less than 3, issue a Restore command and go to step 5.

3. If retry count is equal to 3, issue a Read Home Address to the first and last tracks of the cylinder. If neither is successful (unit checks), take equipment error exit (cancel, retry). Otherwise, go to step 4.

4. If retry count is equal to 15, take equipment error exit (cancel, retry). Otherwise, go to step 5.

5. Increment retry count and take retry exit.

6. Issue a Read R0 and compare CCH to user's Seek Address. If equal, post No Record Found to the CCB and take continue exit. Otherwise, go to routine for Seek Check (alone).

Messages: 0P15 SEEK CHECK (No Record Found/R0 unequal to Seek Address).
0P23, BLNK STRIP (Step 3, cannot read Home Address).
0P21 NRF - MADDMK (Step 4, 15 retries).

- Byte 0, Bit 7--Seek Check

  Action: If Byte 0, Bit 0 (command reject) is present, take program check exit. If Byte 1, Bit 6 (missing Address Markers) is present, take operator intervention exit. Otherwise, issue a Seek to BB1111, a Seek to BB2222, and take retry exit. After ten retries, take equipment error exit (cancel, retry).

  Messages: 0P26 INVAL SEEK (Seek Check/Command Reject).
  0P22 BALST CELL (Seek Check/Missing Address Markers).
  0P15 SEEK CHECK (Seek Check alone).

- Byte 0, Bit 1--Intervention Required

  Action: Take operator intervention exit.

  Message: 0P08 INTERV REQ.

- Byte 0, Bit 2--Bus Out Check

  Action: Take retry exit. After 15 retries, take equipment error exit (cancel, retry).

  Message: 0P09 BUSOUT CHK.

- Byte 0, Bit 4--Data Check

  Action:
  1. If retry count is less than eight, go to step 5.
  2. If retry count is equal to 226, take equipment error exit (cancel, retry).
  3. If retry count is an even number, issue a Seek to X-X-X-4-19 (last track of strip) and a Seek to X-X-X-0-0 (first track of strip). Perform this operation eight times. Then proceed to step 4.
  4. If retry count is any multiple of 32 (32, 64, 96, ...), issue a Seek to next lower strip. (If this is the lowest strip - 00000 - seek the next higher strip.) Proceed to step 5.
  5. Increment retry count and take retry exit.

  Messages: 0P11 DATA CHECK (Data Check/not Data Check on Count or Verify).
  0P12 VERIFY CHK (Data Check on Verify Command).
  0P16 DTA CHK CT (Data Check on Count).

  Note: Home Address is read, and the track address is provided for the error message. For other conditions, the track address is obtained from the user's initial Seek Address if the error occurs during channel program execution.

- Byte 0, Bit 5--Overrun

  Action: Take retry exit. After 15 retries, take equipment error exit (cancel, retry).

  Message: 0P14 OVERRUN.

- Byte 1, Bit 6--Missing Address Markers

  Action: Perform action indicated under Data Check just described.

  Message: 0P13 ADDR MRKER.

  Note: Home Address is read, and the track address is provided for the error message. For other conditions, the track address is obtained from the user's initial Seek Address if the error occurs during channel program execution.

- Byte 0, Bit 0--Command Reject

  Action: Check for byte 1, bit 5 (file protect); in either case, take program check exit.

  Messages: 0P17 FILE PROT (Command Reject/File Protect).
  0P18 COMM REJCT (Command Reject alone).

- Byte 0, Bit 6--Track Condition Check

  Action:
  1. Read Home Address and R0 and move CCHH from R0 to Seek command executed below.
  2. If alternate track: Update Seek Address to the next track address. If track address equals 20, treat it as End of Cylinder; otherwise, proceed to step 3.
  3. Set up the channel program: Seek, Read Home Address (with skip bit on), TIC to CSW command address minus eight (last CCW executed). Execute this channel program in error recovery. At channel end, exit to channel scheduler CSW processing routine. If DASD file protection is present, set file mask (inhibit long Seeks) following the seek.

- Byte 1, Bit 1--Track Overrun

  Action: Post track overrun to the CCB and take continue exit.

- Byte 1, Bit 2--End of Cylinder

  Action: Post End of Cylinder to the CCB and take continue exit.

- Byte 1, Bit 5--File Protect

  Action: Take program check exit.

  Message: 0P17 FILE PROT.

- CSW Bit 47--Chaining Check

  Action: Take retry exit. After 15 retries, take equipment error exit (cancel, retry).

  Message: 0P14 OVERRUN.

Note: If the 2321 Error Routine gets an error while trying to execute a Restore command, a Seek command (data-check procedure), or a Read Home Address or a Read R0, equipment error exit is taken with retry and cancel options with the message: 0P20 ERR ON REC (Error During Recovery).

1285-1287-1288 ERROR RECOVERY

- CSW Bit 44--Channel Data Check

  Action: One retry; then take equipment error exit (retry, cancel).

  Message: 0P28 CHAN DTCHK.

- Byte 0, Bit 3--Equipment Check

  Action: Post byte 3 of CCB and then take continue exit.

  Note: Data Check and Equipment Check, which indicate unreadable character and unreadable line, respectively, are retried by Logical IOCS in an attempt to correct the error.

- Byte 0, Bit 1--Intervention Required

  Action: Test for byte 0, bit 6 (Nonrecovery)--if present, post byte 3, bit 4 of the CCB. This indicates that the error is passed back to the problem program. Exit via equipment error.

  Message: 0P35 NON RECOV. If byte 0, bit 6 is not present, take operator intervention exit.
  0P08 INTERV REQ.

- Byte 0, Bit 6--Nonrecovery

  Action: Post byte 3, bit 4, of CCB and take continue exit.

- Byte 0, Bit 2--Busout Check

  Action: One retry; then take equipment error exit (manual retry, cancel through ATTN routine).

  Message: 0P09 BUSOUT CHK.

- Byte 0, Bit 4--Data Check

  Action: Post byte 3, bit 0, of CCB and take continue exit.

  Note: Data Check and Equipment Check, which indicate unreadable character and unreadable line, respectively, are retried by Logical IOCS in an attempt to correct the error.

- Byte 0, Bit 5--Overrun

  Action: Four retries; then take equipment error exit (retry, cancel).

  Message: 0P14 OVERRUN.

- Byte 0, Bit 0--Command Reject

  Action: Take program check exit.

  Message: 0P18 COMM REJCT.

- CSW Bit 47--Chaining Check

  Action: Four retries; then take equipment error exit (retry, cancel).

  Message: 0P14 OVERRUN.

- Byte 0, Bit 7--Keyboard Correction

  Action: Post byte 3, bit 1, of CCB and take continue exit.

- Byte 1, Bit 4--Invalid Font

  Action: Take program check exit.

  Message: 0P37 INVLD FONT.

  Note: Byte 1, bit 4 applies only to the 1287 in document mode.

1412-1419 ERROR RECOVERY

- CSW Bit 44--Channel Data Check

  Action: Post unrecoverable I/O error to CCB byte 2, bit 2. Turn on passback bit in error queue entry byte 10, bit 2 for return to user for error recovery.

  Message: 0P28 CHAN DTCHK.

- Byte 0, Bit 0--Command Reject

  Action: Check command code of CCW causing interrupt with X'E1' for 'Disengage Failed'. If 'Disengage Failed', post intervention required to CCB byte 3, bit 1; if not, post unrecoverable I/O error to CCB byte 2, bit 2. In either case, turn on passback in error queue entry of ERBLOC byte 10, bit 2, for return to user for error recovery.

  Message: 0P18 COMM REJCT or 0P37 DISEN FAIL.

- Byte 0, Bit 1--Intervention Required

  Action: Post "Intervention Required" to the CCB (byte 3, bit 1), and take IGNORE exit. No message is printed.

  Message: 0P08 INTERV REQ.

  Note: The problem program should process all documents in the input buffer, note the Intervention Required and perform any print out necessary for operator recovery, and issue an Engage-Read to the device to continue processing documents. If the Intervention Required is due to a batch numbering update failure, the operator must update the batch number as part of manual recovery.

- Byte 0, Bit 2--Bus Out Check

  Action: Post unrecoverable I/O error to CCB byte 2, bit 2, and turn on passback bit in error queue entry of ERBLOC Byte 10, bit 2, for return to user for error recovery.

  Message: 0P09 BUSOUT CHK.

- Byte 0, Bit 3--Should not occur

  Action: Post Unrecoverable I/O error to the CCB and provide informational message to the operator.

  Message: 0P19 UNDETR ERR

Note: CSW Bit 47 and Sense bits 4, 5, 6, and 7 will not cause an I/O Interrupt. If CSW bit 44 or sense bit 1, 2, or 3 is not present for an I/O interrupt, the action and message for sense bit 3 will be generated. LIOCS issues two informational messages through the MICR Message Writer:

1. 4MR1I - EXTERNAL INTERRUPT I/O ERROR

2. 4MR2I - SCU NOT OPERATIONAL

- Byte 0, Bit 7--Batch Numbering Switch Off

  Action: Post document buffer byte 0, bits 0 and 1 and insert reject code X'CF' in byte 5. Turn off retry and turn on ignore bits in ERRFLG of error queue entry of ERBLOC.

  Message: OP34 BCH NM OFF.

2495 ERROR RECOVERY

- CSW Bit 42--Program Check

  Action: Take equipment error exit (cancel).

  Message: 0P24 PROG CHECK

- CSW Bit 43--Protection Check

  Action: Take equipment error exit (cancel).

  Message: 0P25 PROT CHECK

- CSW Bit 44--Channel Data Check

  Action:
  1. Read Commands--backspace record, one retry, then take equipment error exit (cancel).
  2. All other commands--take equipment error exit (cancel).

  Message: 0P28 CHAN DTCHK

- Byte 0, Bit 5--Should not occur

  or
- Byte 0, Bit 7--Should not occur

  Action: Take equipment error exit (cancel).

  Message: 0P19 UNDETR ERR

- Byte 0, Bit 3--Equipment Check

  Action: Take equipment error exit (cancel).

  Message: 0P10 EQUIP CHK

- Byte 0, Bit 2--Bus Out Check

  Action: One retry, then take equipment error exit (cancel).

  Message: 0P09 BUSOUT CHECK

- Byte 0, Bit 1--Intervention Required

  Action: Take operator intervention exit.

  Message: 0P08 INTERV REQ.

- Byte 0, Bit 6--Position Check

  Action:
  1. Read Commands--backspace one byte. Reread the remaining portion of the record. Repeat this sequence nine times for a total of ten rereads. On the eleventh try, take equipment error exit (cancel).
  2. All other commands--take equipment error exit (cancel).

  Message: 0P39 POSN CHECK

- Byte 0, Bit 4--Data Check

  Action: Backspace one byte. Reread the remaining portion of the record. Repeat this sequence nine times for a total of ten rereads. On the eleventh try, post data check error and set passback flag in ERBLOC if user requests return of data check errors, take equipment error exit (ignore, cancel).

  Message: 0P11 DATA CHECK

- Byte 0, Bit 0--Command Reject

  Action: Take program check exit.

  Message: 0P18 COMM REJCT

1017/1018 ERROR RECOVERY

- CSW Bit 44--Channel Data Check

  Action: For Read/Write Commands: If data transfer, no retry is performed. If initial selection, retry twice without repositioning. After specified number of retries has been reached, take equipment error exit (cancel).

  Message: OP28 CHAN DTCHK

- CSW Bit 47--Chaining Check (Read/Write Commands).
- Byte 0, Bit 2--Bus-Out Check (Read Command during data transfer).
- Byte 0, Bit 3--Equipment Check (Read Command)
- Byte 0, Bit 4--Data-Check (Write Command if Error Correction feature not present)

- Byte 0, Bit 5--Overrun (Read/Write Commands)

- Byte 0, Bit 6--Lost Data (Read/Write Commands)

- Byte 0, Bit 7--Broken Tape (Write Command) This sense and status information is not used or may not occur for the indicated condition.

  Action: Take equipment error exit (cancel),

  Message: 0P19 UNDETR ERR

- Byte 0, Bit 0--Command Reject

  Action: Take Program check exit.

  Message: 0P18 COMM REJECT

- Byte 0, Bit 1--Intervention Required

  Action: If initial selection (Read/Write Commands), take operator intervention exit. If data transfer (Write Command), update interrupted CCW and retry.

  Message: 0P08 INTERV REQ

- Byte 0, Bit 2--Bus-Out Check

  Action: If initial selection (Read/Write Commands), retry the operation twice. If data transfer (Write Command), update interrupted CCW and retry. If error persists, take equipment error exit (cancel).

  Message: 0P09 BUSOUT CHK

- Byte 0, Bit 3--Equipment Check (Write Command)

  Action: Take equipment error exit (cancel).

  Message: 0P10 EQUIP CHK

- Byte 0, Bit 4--Data Check

  Action: If Read Command, update interrupted CCW, backspace one character and retry. If the error persists after four retries, test the CCB for the ignore option (byte 2, bit 4); if the bit is on, turn on byte 3, bit 3 of the CCB (1017/1018 data check) and take the equipment error exit (ignore, cancel). If the bit is not on, take the equipment error exit (cancel). If Write Command, (Error Correction Feature Not Supported) byte 3, bit 3 in the CCB is set on, then if the user wants to process the data check himself (byte 2, bit 6 on in the CCB), control is returned to the user program. If the user does not want to process the data check, he must take the equipment error exit (ignore, cancel) if bit 4 of byte 2 in CCB is off.

  Message: 0P11 DATA CHECK

  Note: When a data check occurs, the user's CCW is modified by the error routine to allow rereading or rewriting of the last character. The data address is the last character read or written (i.e., the character in error), and the byte count is decreased by the number of valid characters read or written. If the CCB ignore option is chosen and the operator responds ignore, the I/O operation is dequeued and posted with the unrecoverable error bit on (CCB byte 2, bit 2) and 1017/1018 data check bit on (CCB byte 3, bit 3). To read or write the rest of the record, the problem program (logical IOCS) adds 1 to the CCW data address and subtracts 1 from the byte count to adjust for not rereading or rewriting the bad character, and then reissues the EXCP. The ignore option is available to the operator whenever the user specifies any of the DTFPT ERROPT entry options.

- Byte 0, Bit 7--Broken Tape (Read Command)

  Action: When this condition occurs, the last record has not been completely read. Turn on byte 3, bit 1 of the CCB (1017 broken tape) and take the equipment error exit (retry, ignore, cancel).

  Message: 0P40 BROKEN TAPE

  Note 1: When broken tape condition occurs, the operator must reposition the paper tape at the beginning of the record before responding. The 1017 must not be readied until this repositioning has been performed. If the ignore option is chosen, the I/O operation is dequeued and posted with the unrecoverable error bit on (CCB byte 2, bit 2) and the 1017 broken tape bit on (CCB byte 3, bit 1).

  Note 2: A record may not be partly on one tape and partly on another.

The RMS (Recovery Mangement Support) is an automatic DOS feature for IBM System/370. RMS gathers information about hardware reliability and attempts certain error recovery operations. It is part of the entire RAS (reliability, availability, and serviceability) support for System/370.

RMS is supervisor generated and is composed of two functions:

- MCAR (Machine Check Analysis and Recovery) and
- CCH (Channel Check Handler).

However, RMS is not a supervisor option. It is generated automatically for System/370 at SYSGEN. The CONFG macro sets global BG39 when MODEL option shows a System/370 CPU. Figure 54 gives the overview of the RMS function in DOS.

MCAR FUNCTION

MCAR responds to machine check interrupts and attempts recovery. It logs error data on ERDS (Environmental Recording Data Set) on the Recorder File. It provides operator messages via SYSLOG.

When a machine check occurs, MCAR first logs the error, then retries the failure by CPU retry and ECC (Error Correction Code). If successful, a soft MCI (machine check interrupt) message occurs, signifying recovery from a machine check.

If hardware retry is unsuccessful, MCAR determines machine check severity through recovery transient analysis and records pertinent data on SYSREC. RMS controls the recording of data through the EFL (Error Frequency Limit) feature of operating in Quiet or Recording mode. See the MODE Command section.

Hard MCI occurs when:

- CPU retry is unsuccessful, or
- Interrupted instruction cannot be retried, or
- Storage failure is permanent.

In event of a hard MCI, execution of the affected task stops. MCAR assesses damage and continues system operation when possible. It selectively terminates the affected partition. RMS records a full Damage Report on the Recorder File.

The system enters the hard wait state when a hard MCI:

- Interrupts supervisor coding
- Occurs while accessing critical information or phases from SYSRES, or
- Damages privileged coding through permanent storage error

MCAR attempts to notify the operator about:

1. Machine check type
2. Wait state, re-IPL
3. Problem program termination
4. MODE operation change
5. Buffer deletion

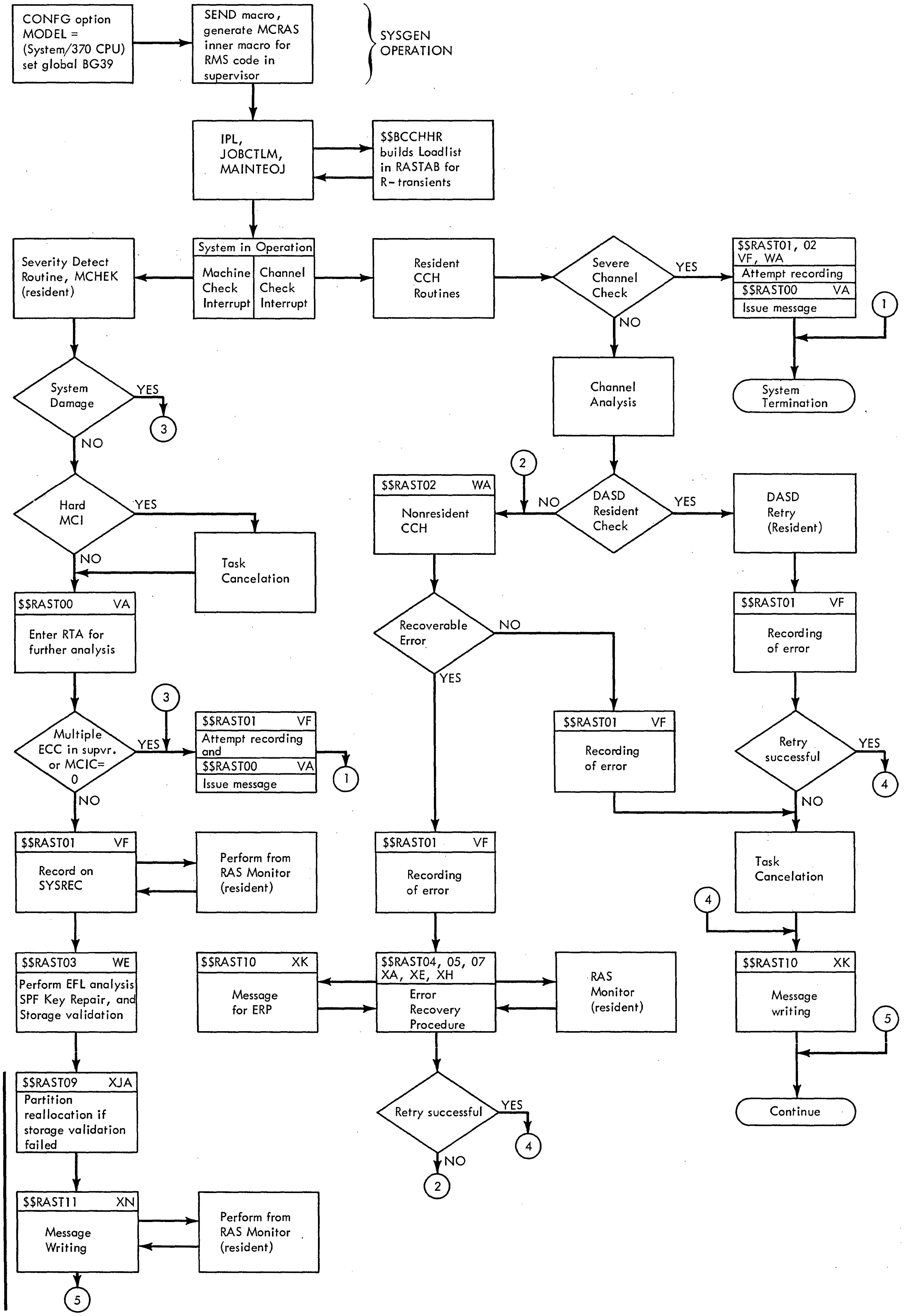


Figure 54. RMS Generation and Operation

CCH FUNCTION

The Channel Check Handler responds to channel error conditions. It first logs the error. Then, it evaluates the damage and attempts to decrease the impact on the entire system.

CCH assesses channel control checks and interface control checks to determine if the system can continue. Figure 55 shows the results of the Channel Check Severity Routine. Resident CCH performs severity analysis, records errors on SYSREC (see Figure 56 for the format of System/370 machine check records and Figure 57 for the format of System/370 channel check records), and builds an ERPIB (Error Recovery Procedure Interface Byte) entry.

Resident CCH coding performs no recovery action, but fetches the proper recovery transient to attempt restoration of system operation. Recovery transients operate under control of the RAS Monitor.

Figure 58 shows the devices supported with ERP by CCH routines and the action taken for each condition.

System termination results when:

- Hard channel error occurs on accessing critical information or phases from SYSRES
- System reset has occurred
- Channel address or reset codes are invalid
- Two channels are damaged simultaneously, or
- Four system ERPIBs are exhausted

RAS MONITOR AND R-TRANSIENTS

The RAS Monitor is a resident control program with which RMS (MCAR/CCH functions) controls the RTA. At DOS system generation for System/370, the RAS Monitor forms a portion of the resident supervisor. The RAS Monitor and RMS coding are generated when the SYSGEN option MODEL=a System/370 CPU. That MODEL option turns on macro global BG39, generating RMS support.

The RAS Monitor:

1. Fetches R-transients into the RTA
2. Schedules I/O requests from the RTA
3. Accepts RTA I/O request complete postings from CCH, and
4. Provides exit interface from R-transients.

The R-transients (or recovery transients) are nonresident RMS ERPs (error recovery procedures). The transients are listed in order of descending priority in Figure 59 and in the load list portion (bytes 0-47) of the RMS table. Refer to Figure 60, RASTAB. The R-transient with the highest priority is activated wherever multiple transients are selected for the RTA.

R-transients perform channel check ERP and differ from A-transients, which still perform channel data check recovery. R-transients operate on channel control checks and channel interface checks. They attempt to retry the operation, or terminate the affected partition, while trying to permit continued system activity. See Figure 61 for the recovery transient error messages.

MODE COMMAND

The MODE command gives the operator control of soft machine check interrupts. It permits the operator three options:

1. Determine whether the system is in quiet or recording mode
2. Alter mode of operation
3. Change error threshold values

By the mode command, the operator can change machine check logging and can receive status reports about the system.

Channel Check Severity Detect Routine (Part 1):

Channel Address Valid	Reset Codes Valid	System Reset Code On	Start I/O Time	Unit Address Valid	RTA I/O Active	SYSRES Channel	Action Taken
No							1,2
Yes	No						1,2
Yes	Yes	Yes					1,2
Yes	Yes	No	Yes				5
Yes	Yes	No	No	No	No	No	1,3
Yes	Yes	No	No	No	Yes		1,2
Yes	Yes	No	No	No	No	Yes	1,3,4,5
Yes	Yes	No	No	Yes			5

ACTION CODES

1. Schedule recording.
2. Schedule system termination with proper message.
3. Set the damaged channel byte for non-resident channel check handler.
4. Assume the error is on SYSRES device.
5. Error can be isolated to a device, use Part 2.

Note: Every Channel Check that occurs in the system is passed through the Channel Check Severity Detect Routine. You can determine the disposition of the check by using part 1. When a Channel Check has been isolated to a device, use part 2 to determine the action taken.

Channel Check Device Isolation Results (Part 2):

Active ERPIB Exist	Channel Check Entry	DASD	Channel Retry Request	Action Taken
No	No			6
No	Yes			7
Yes	No	No	No	8
Yes	No	No	Yes	6,9,10
Yes	No	Yes		6
Yes	Yes	No	No	8
Yes	Yes	No	Yes	8,9,10
Yes	Yes	Yes		11

ACTION CODES

6. Exit to supervisor I/O routine after other functions performed.
7. Find a free ERPIB in queue and fill with information for ERPs.
8. Exit to task selection after other functions performed.
9. Post ERPIB complete.
10. Dequeue the RAS CCB and requeue the users CCB.
11. Exit to DASD channel check handler.

Figure 55. Channel Check Severity Routine Results

Record 1	0	1-2	3	4	5-7	8-9	10-11	12-15	16-19	20-27	28-35	36-43	44-77	78	79
	Machine Check ID (X'10')	Record Sequence Counter	CPU Model Number	Reserved	CPU Serial	CPU ID	MCEL Length	Date	Time of day in 300ths of a second Timer units	Reserved	Job ID	Machine Check Old PSW	Reserved	Damage Assessment	End of Record Indicator (X'FF')

Record 2	0-3	4	5	6-7	8-11	12-19	20-23	24-25	26-27	28-78	79
	(Same as Record 1)	Sub Class Codes	Tense Codes	Error and Validity Codes	Extended Logout Length	Reserved	Failing Storage Address	Region Code ECC Information	Region Code Control Word Address	Reserved	(Same as Record 1)

Record 3	0-3	4-48	49-78	79
	(Same as Record 1)	Reserved	Floating Point Register Area	(Same as Record 1)

Record 4	0-3	4-5	6-69	70-78	79
	(Same as Record 1)	Floating Point Regs Save Area (Continued)	General Registers Save Area	Control Registers Save Area	(Same as Record 1)

Record 5	0-3	4-58	59-78	79
	(Same as Record 1)	Control Registers Save Area	MCEL (Machine Check Extended Logout)	(Same as Record 1)

Record 6-17	0-3	4-78	79
	(Same as Record 1)	MCEL (Machine Check Extended Logout)	(Same as Record 1)

Record 18	0-3	4-75	76-78	79
	(Same as Record 1)	MCEL (Machine Check Extended Logout)	Reserved (X'000000')	(Same as Record 1)

* Note: The Model 155 uses Records 1-18, as shown. The Model 145 uses only Records 1-8. In Record 8 for the Model 145, Bytes 0-3 are the same as Record 1, Bytes 4-25 contain the remainder of the MCEL (Machine Check Extended Logout) area, and the remainder of the record is not used.

Figure 56. RMS Machine Check Record on SYSREC

Displacement	0	1	2	3	4-11	12-15	16-19	20-27	28-43	44-51
Label	CCKEY	CCN1	CCN2	CCMOD	CCCPUID	CCDATE	CCTIME	CCNAME	CCAIOU	CCFCCW
Record 1 *	Record ID	Record Number	Total Records	CPU Model Code	CPU ID Information	Date	Time of Day	Job Name	Active I/O Units	Failing CCW

Displacement	52-59	60-63	64-65	66	67-69	70-73	74-77	78	79
Label	CCCSW	CCECSW	CCDEVTYP	CCCHID	CCCUA	CCMPI		CCSYSCON	CCGUARD
Record 1 (continued)	CSW	Extended CCW	Device Type	Channel ID	Control Unit	Multi-processing Information	Reserved	System Condition Byte	Guard Byte X'FF'

Displacement	0-3	4-78	79
Record 2	Same as Record 1	Channel Logout Area	Same as Record 1

Displacement	0-3	4-24	25-78	79
Record 3	Same as Record 1	Channel Logout Area	Unused	Same as Record 1

* Note: Only Record 1 is written for the Model 155.
Record 1 is also addressed symbolically as CCREC with the logout data area, Bytes 4-78, addressed as CCLOGD.

Figure 57. RMS Channel Check Record on SYSREC

1403 AND 1443 Printers

Operation	Termination Code*	Sequence Code							
		000	001	010	011	100	101	110	111
Write (Only)		2	5	5	3	5	3	2	3
Write/Control		2	5	3	3	5	3	2	3
No Op		2	5	5	5	5	5	2	5
Control		2	5	3	3	5	3	2	3
*Recovery procedures for the 1403 and 1443 are termination code independent.									

2520 Card Read Punch

Operation	Termination Code*	Sequence Code							
		000	001	010	011	100	101	110	111
Sense	00	2	5	5	5	5	5	2	5
	01	2	2	5	5	2	5	2	5
	10	2	5	5	5	5	5	2	5
	11	2	5	5	5	5	5	2	5
Read/Control	00	2	5	4	4	5	4	2	4
	01	2	2	4	4	2	4	2	4
	10	2	5	4	4	5	4	2	4
	11	2	5	4	4	5	4	2	4
Write/Control	00	2	5	4	4	5	4	2	4
	01	2	2	4	4	2	4	2	4
	10	2	5	5	5	5	5	2	5
	11	2	5	5	5	5	5	2	5
Write, No Control	00	2	5	3	3	5	3	2	3
	01	2	2	3	3	2	3	2	3
	10	2	5	5	5	5	5	2	5
	11	2	5	5	5	5	5	2	5
Immediate	00	2	5	2	2	5	2	2	5
	01	2	2	2	2	2	2	2	2
	10	2	5	2	2	5	2	2	5
	11	2	5	2	2	5	2	2	5

1442 Card Read Punch

Operation	Termination Code*	Sequence Code							
		000	001	010	011	100	101	110	111
Sense	00	2	5	5	5	5	5	2	5
	01	2	2	5	5	2	5	2	5
	10	2	5	3	3	5	3	2	3
	11	2	5	3	3	5	3	2	3
Read/Control	00	2	5	3	3	5	3	2	3
	01	2	2	3	3	2	3	2	3
	10	2	5	3	3	5	3	2	3
	11	2	5	3	3	5	3	2	3
Write/Control	00	2	5	3	3	5	3	2	3
	01	2	2	3	3	2	3	2	3
	10	2	5	3	3	5	3	2	3
	11	2	5	3	3	5	3	2	3

Note: This Figure shows individual errors for each device supported by CCH and the action taken for each condition. The Action Codes are explained at the end.

Figure 58. Error Recovery Procedures for CCH-Supported Devices (Part 1 of 2)

2501 Card Reader

Operation	Termination Code*	Sequence Code							
		000	001	010	011	100	101	110	111
Read	00	2	5	4	4	5	4	2	4
	01	2	2	4	2	2	4	2	4
	10	2	5	4	4	5	4	2	4
	11	2	5	4	4	5	4	2	4
Sense	00	2	5	5	5	5	5	2	5
	01	2	2	5	5	2	5	2	5
	10	2	5	5	5	5	5	2	5
	11	2	5	5	5	5	5	2	5

2540 Card Read Punch

Operation	Termination Code*	Sequence Code							
		000	001	010	011	100	101	110	111
Read-Feed-SS		2	5	3	4	5	3	2	3
Read		2	4	4	4	4	4	2	4
Feed-SS		2	4	3	2	4	2	2	3
Punch-Feed-SS		2	5	3	4	5	3	2	3

*Recovery procedures for the 2540 are termination code independent.

3210 and 3215 Console Printer-Keyboard

Operation	Termination Code*	Sequence Code							
		000	001	010	011	100	101	110	111
Read		2	5	5	3	5	3	2	3
Write, CR		2	5	5	3	5	3	2	3
Write, No CR		2	5	5	3	5	3	2	3
No Op		2	5	5	5	5	5	2	5
Alarm		2	5	5	5	5	5	2	5

*Recovery procedures for the 3210 and 3215 are termination code independent.

DASD Devices 2311, 2314, 2319, 2321

These devices are retryable for all conditions of Retry Code and Termination Code by restarting the CCW list from the beginning (from the initial SEEK, SET FILE MASK, etc.). Ten attempts are made at retry of DASD Channel Errors.

Note: Recovery ($$R) transients are not invoked to act on all termination codes shown. Termination code 11 (system reset code) is handled by resident RMS routines. This termination code is shown primarily for reference purposes.

ACTION CODES

Action 1. The channel is damaged and the channel user will be canceled unless he accepts unrecoverable I/O errors. If specified, control returns to the damaged channel user for further analysis. If the channel user is to be canceled due to a non-retryable or unrecoverable channel failure, the CCH ERP restores the Channel Queue Pointer and Channel Scheduler Flags in the PUB if required. It flags the ERPIB with a cancel code (X'FD'), saves CSW and CCW information for the user, and then returns to the CCH. The CCH then cancels the failing channel user.

Action 2. Action 1 is taken followed by the CCH ERP.

Action 3. This is a non-retryable condition. An operator message is issued by the CCH ERP, and Action 1 follows.

Action 4. With this condition, retry is possible with manual repositioning by the operator. The CCH ERP issues an operator message and waits for a response to retry the operation (reoccurrence of this error during the retry causes Action 1).

Action 5. This condition indicates the failing CCW can be retried. The CCH ERP identifies the failing CCW chain. If the failure reoccurs during the retry operation, an operator message is issued and Action 1 follows.

Figure 58. Error Recovery Procedures for CCH-Supported Devices (Part 2 of 2)

R-Transients	Charts	Function
$$RAST00	VA	MCAR analysis / CCH data gatherer
$$RAST01	VF	MCAR / CCH recording
$$RAST02	WA	CCH ERP scheduling
$$RAST03	WE	MCAR repair (error frequency unit)
$$RAST04	XA	Unit record CCH ERP
$$RAST05	XE	Unit record CCH ERP
$$RAST06		Reserved
$$RAST07	XH	Tape CCH ERP
$$RAST08		Reserved
$$RAST09	XJA	Partition reallocation
$$RAST10	XK	Message writer for ERPs.
$$RAST11	XN	Message writer

Figure 59. Load List of R-transients

0 LD00SLOT ($$RAST00) ① ②	4 LD01SLOT ($$RAST01) ③	8 LD02SLOT ($$RAST02) ⑤	12 LD03SLOT ($$RAST03) ⑤	16 LD04SLOT ($$RAST04) ⑤	20 LD05SLOT ($$RAST05) ⑤	24 LD06SLOT ($$RAST06) ⑤	28 LD07SLOT ($$RAST07) ⑤	32 LD08SLOT ($$RAST08) ⑤
36 LD09SLOT ($$RAST09) ⑤	40 LD10SLOT ($$RAST10) ④	44 LD11SLOT ($$RAST11) ⑤	48 RASCCB Residual Count	50 RASTIB Transmission information	52 - - - - CCW Status bytes	54 - - - - SYSRES LUB	56 RASCCBF RAS CCB indicator	57 - - - - RAS Fetch CCWs address
60 - - - - CCW stored address	64 RASCCWS RAS seek CCW	72 RASRCG RAS search CCW	80 RASTIC TIC CCW	88 RASREAD CCW to read module into RTA	96 RASEEK Seek Address	103 RTAOWN Index into load list for RTA owner	104 MCPIK PIK of task interrupted by machine check	106 RTAID RTA I/O requestor ID
107 ERPID WTOR request return load index	108 RASRETR RTA return address after I/O operation	112 RASIOA RAS I/O request address	116 RASFCHA RAS FETCH request address	120 ERPIBA ERPIB queue address	124 RASDEQA CCB DEQ routine address	128 XCANRASA RAS cancel routine address	132 CCENTADR Channel Check entry address	136 RASRES SYSRES I/O address

138 RASREC SYSREC I/O address	140 RASLOG SYSLOG device address	142 RASEMIOA Emergency SIO address	144 RASCQDSP CCB look-up routine address	148 SUPRETR Save area for registers 9 and 10	156 SUPBB Base address (X'1000') for supervisor	160 SUPBC Base address (X'2000') for supervisor	164 SUPBD Base address (X'3000') for supervisor
168 (HIR - Hardware Instruction Retry accumulators)				180 (ECCMAIN - Main storage error accumulators)			
168 HIRACNT HIR accumulated count	170 HIRICNT Count threshold value	172 HIRITIME Time of day for first error of group	176 HIRLTIME Time threshold in clock units	180 ECMACNT Accumulated ECC count for main storage	182 ECMLCNT Count threshold value	184 ECMITME Time of day for first error of count	188 ECMLTME Time threshold in clock units
192 RESTARTA Disk restart address	194 RESTARTP PUB address of unit to be restarted	196 MCMODE Mode status for machine checks	197 BUFDEL Count of buffers deleted	198 RASMSG1 Message byte 1 ⑥	199 RASMSG2 Message byte 2 ⑦	200 EOR Records/track for SYSREC	201 EOT Tracks/cylinder for SYSREC

Figure 60. RAS Monitor Table (RASTAB) (Part 1 of 2)

Notes:

① Areas labeled LDxxSLOT (bytes 0 - 47) are called the Load List and each of the 12 entries are formatted as follows:

BYTE	0	1	2	3
	Flag Byte	Cylinder - Head - Record (disk address of R-transient in the core image directory)		

② LD00SLOT flag byte:

Bit	Flag	Description
0	X'80'	$$RAST00 module activated.
1	X'40'	Machine check analysis to be performed.
2	X'20	Channel check analysis to be performed.
3	X'10'	Active I/O units are valid.
4	X'08'	System termination situation.
5	X'04	Reserved.
6	X'02'	Reserved.
7	X'01'	Attempt made to record in system termination situation.

③ LD01SLOT flag byte:

Bit	Flag	Description
0	X'80'	$$RAST01 module activated.
1	X'40'	Build and record channel check records.
2-7	- -	Reserved.

④ LD10SLOT flag byte:

Bit	Flag	Description
0	X'80'	$$RAST10 module activated.
1	X'40'	Refetch calling module after issuing message.
2-7	- -	Reserved.

⑤ LDxxSLOT flag byte:

Bit	Flag	Description
0	X'80'	$$RASTxx module activated; that is, should be fetched.
1-7	- -	Reserved.

⑥ RASMSG1:

Bit	Flag	Description
0-3	- -	Reserved.
4	X'08'	Timer damage.
5	X'04'	ECC in Quiet mode.
6	X'02'	Reserved.
7	X'01'	MCAR repair failed.

⑦ RASMSG2:

Bit	Flag	Description
0	X'80'	Check damage.
1	X'40'	Last track on SYSREC.
2	X'20'	C40 buffer pages deleted.
3	X'10'	Soft machine checks disabled.
4	X'08'	ECC MCI disabled.
5	X'04'	SYSREC full-run EREP.
6	X'02'	Error on SYSREC at BBCCHHR.
7	X'01'	Soft machine check.

Figure 60. RAS Monitor Table (RASTAB) (Part 2 of 2)

Message Code	Initiating Phase	Error Message
0I25I	$$IPLRT2,4 (Note 3)	No RAS support for this model CPU.
0P13A	$$RAST10	Invalid response.
0P81I	$$BEOJ2A (Note 2)	Job XXXXXXXX canceled due to CPU failure.
0P82I	$$BEOJ2A (Note 2)	Job XXXXXXXX canceled due to channel failure.
0T00I	$$RAST01,11	Last track on Recorder File.
0T03I	$$RAST01,11	Error on Recorder File at CCHHR.
0T05I	$$RAST01,11	Recorder File full--run EREP.
0T06I	$$RAST03,11	ECC main storage MCI disabled.
0T07I	$$RAST03,11	All soft machine checks disabled.
0T08I	$$RAST03,11	C40 buffer pages deleted = XXX.
0T09I	$$RAST03,11	Soft machine check.
0T10I	$$RAST04,5,7,10	Channel error recovery on cuu.
0T11I	$$RAST00,01	Hard wait, Code = X. (Note 1) Run EREP. Recording successful. Run EREP. Recording incomplete. Run SEREP. Recording unsuccessful.
0T12I	$$RAST04,5,7,10	Unrecoverable channel errors on cuu.
0T13A	$$RAST04,5,7,10	Channel error on cuu.
0T14I	$$RAST03,11	Check damage. All modes quiet.
0T15I	$$RAST09	MCAR repair failed.
0T16I	$$RAST03,11	EFL overflow.
0T17I	$$RAST03,11	Control storage ECC in quiet mode.
0T18I	$$RAST01	Timer damage.

Figure 61. RMS Error Messages (Part 1 of 2)

Message Code	Initiating Phase	Error Message
0T19I	$$RAST09	(Lower, Upper) boundary of XX is DDDDDD, length is LLLK.
0T20I	$$RAST09	XX not usable.
1I93I	$JOBCTLM (Note 3)	Recorder File is XXX% full. Run EREP.

Note 1: Hard wait has resulted due to system failure explained in the code X, where

X =			
A	Unrecoverable machine check	E	ERPIB exhausted
B	RAS fetch error	F	Two channels damaged or RTA I/O active
C	SYSLOG channel check while printing RMS message	G	Reserved
		H	Reserved
D	No ECSW stored	I	Invalid channel address on channel error

Note 2: For this phase, refer to the Logical Transients PLM, listed in Preface.

Note 3: For this phase, refer to the IPL and Job Control PLM, listed in Preface.

Figure 61. RMS Error Messages (Part 2 of 2)

RASLINK

0 (Decimal Displacement) CPUID	8 RASDMC	9 RASFLAGS	10 MCFLAGS	11 RASMODEL	12 RASTABA	16 RASBASE
CPU ID field	Damaged Channel byte	RAS flag byte	Machine Check flags	CPU Model	RAS Table (RASTAB) address	Base address for RAS Monitor
XXXXXXXX	X	X	X	X	XXXX	XXXX

Key to RAS Linkage Area displacements:

0 CPU ID field.

8 Address of damaged channel, or X'FF' if no channel damaged.

9 RAS Flag byte:

bit	flag	description
0	X'80'	RAS active
1	X'40'	RAS SIO flag
2	X'20'	RTA in control
3	X'10'	RAS I/O delayed
4	X'08'	Channel check on error SIO
5	X'04'	Reserved
6	X'02'	Channel check on SIO
7	X'01'	I/O active for SIO

10 Machine Check Flags:

bit	flag	description
0-4	——	Reserved
5	X'04'	Hard machine check
6	X'02'	All machine records built
7	X'01'	All channel check records built

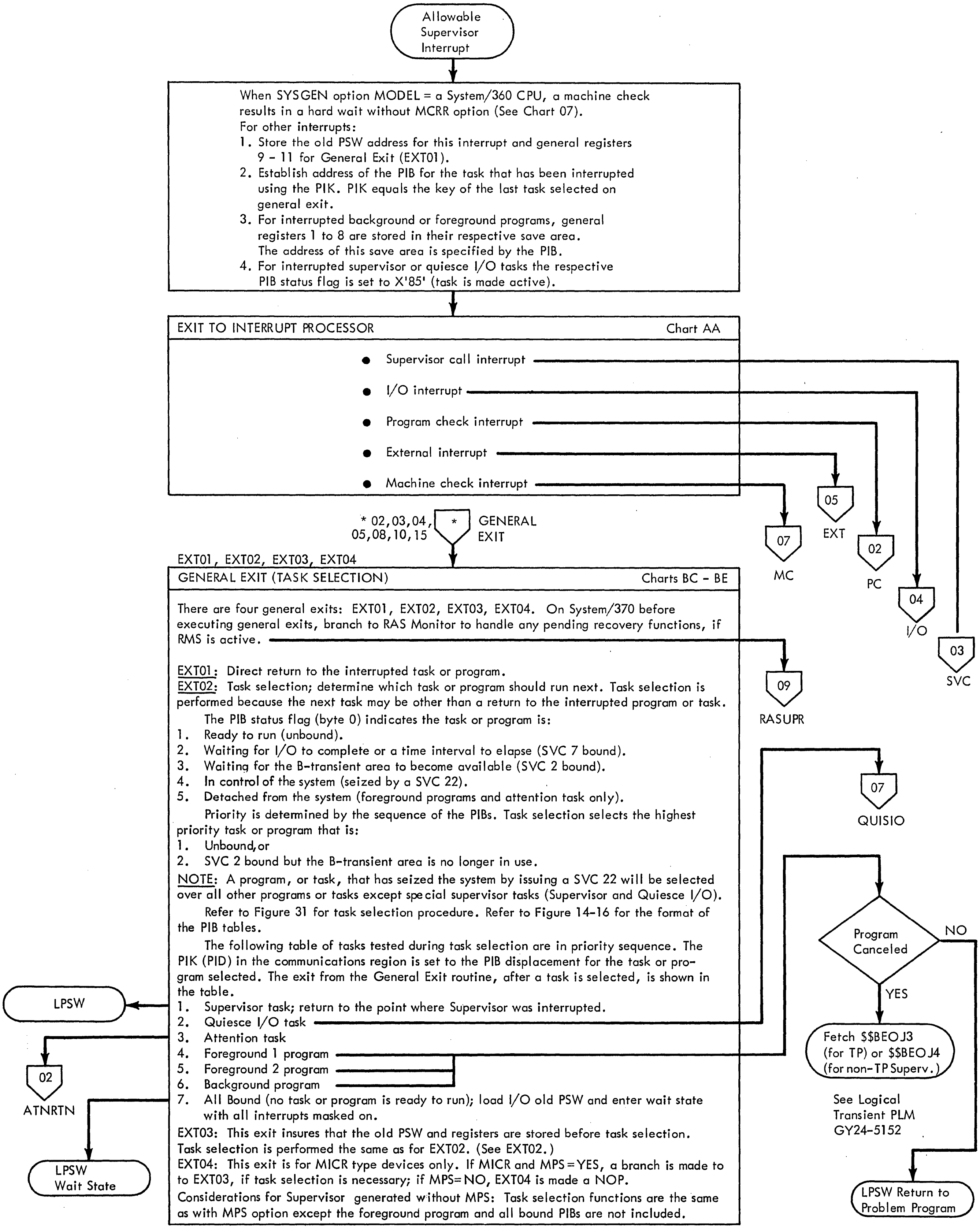
11 Largest CPU Model.

12 Address of RAS Table (RASTAB).

16 Address used for base register in RAS Monitor Program.

Figure 62. RMS Linkage Area (RASLINK)

Chart 01. Supervisor General Entry, General Exit, and Processor Exit



When SYSGEN option MODEL = a System/360 CPU, a machine check results in a hard wait without MCRR option (See Chart 07).

For other interrupts:

1. Store the old PSW address for this interrupt and general registers 9 - 11 for General Exit (EXT01).
2. Establish address of the PIB for the task that has been interrupted using the PIK. PIK equals the key of the last task selected on general exit.
3. For interrupted background or foreground programs, general registers 1 to 8 are stored in their respective save area. The address of this save area is specified by the PIB.
4. For interrupted supervisor or quiesce I/O tasks the respective PIB status flag is set to X'85' (task is made active).

There are four general exits: EXT01, EXT02, EXT03, EXT04. On System/370 before executing general exits, branch to RAS Monitor to handle any pending recovery functions, if RMS is active.

EXT01: Direct return to the interrupted task or program.

EXT02: Task selection; determine which task or program should run next. Task selection is performed because the next task may be other than a return to the interrupted program or task.

The PIB status flag (byte 0) indicates the task or program is:

1. Ready to run (unbound).
2. Waiting for I/O to complete or a time interval to elapse (SVC 7 bound).
3. Waiting for the B-transient area to become available (SVC 2 bound).
4. In control of the system (seized by a SVC 22).
5. Detached from the system (foreground programs and attention task only).

Priority is determined by the sequence of the PIBs. Task selection selects the highest priority task or program that is:

1. Unbound, or
2. SVC 2 bound but the B-transient area is no longer in use.

NOTE: A program, or task, that has seized the system by issuing a SVC 22 will be selected over all other programs or tasks except special supervisor tasks (Supervisor and Quiesce I/O).

Refer to Figure 31 for task selection procedure. Refer to Figure 14-16 for the format of the PIB tables.

The following table of tasks tested during task selection are in priority sequence. The PIK (PID) in the communications region is set to the PIB displacement for the task or program selected. The exit from the General Exit routine, after a task is selected, is shown in the table.

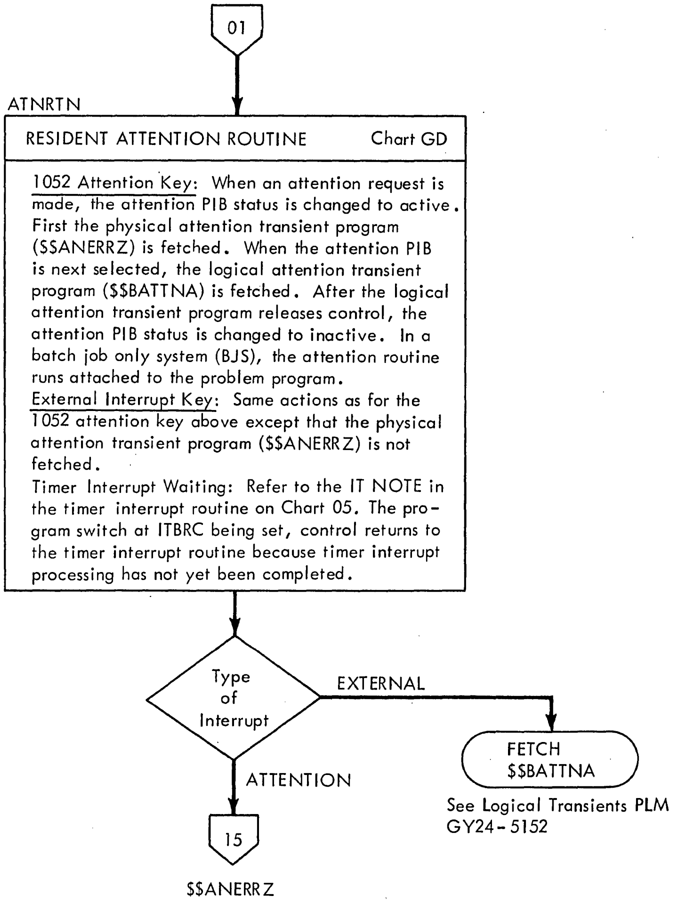
1. Supervisor task; return to the point where Supervisor was interrupted.
2. Quiesce I/O task
3. Attention task
4. Foreground 1 program
5. Foreground 2 program
6. Background program
7. All Bound (no task or program is ready to run); load I/O old PSW and enter wait state with all interrupts masked on.

EXT03: This exit insures that the old PSW and registers are stored before task selection. Task selection is performed the same as for EXT02. (See EXT02.)

EXT04: This exit is for MICR type devices only. If MICR and MPS=YES, a branch is made to to EXT03, if task selection is necessary; if MPS=NO, EXT04 is made a NOP.

Considerations for Supervisor generated without MPS: Task selection functions are the same as with MPS option except the foreground program and all bound PIBs are not included.

Chart 02. Resident Attention Routine and Program Check Interrupt Routine

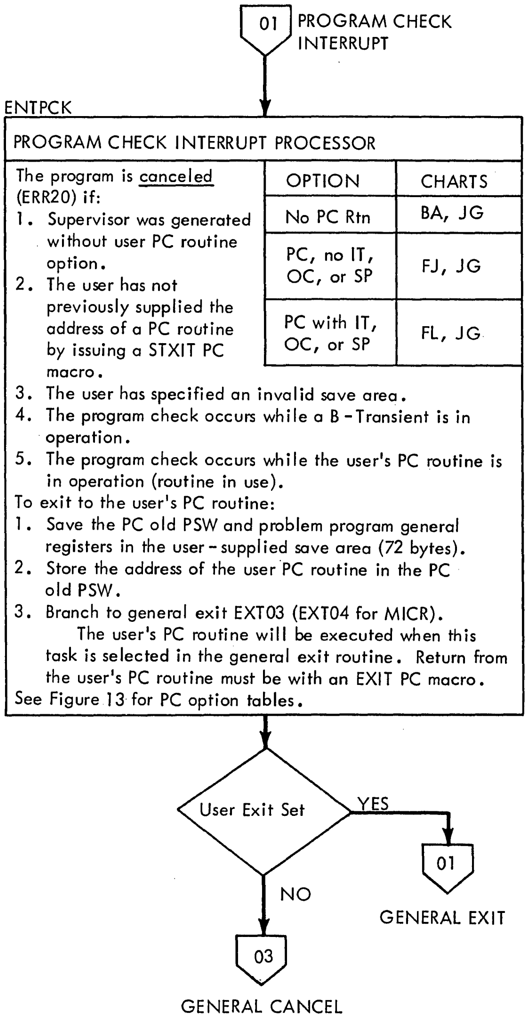


1052 Attention Key: When an attention request is made, the attention PIB status is changed to active. First the physical attention transient program ($$ANERRZ) is fetched. When the attention PIB is next selected, the logical attention transient program ($$BATTNA) is fetched. After the logical attention transient program releases control, the attention PIB status is changed to inactive. In a batch job only system (BJS), the attention routine runs attached to the problem program.

External Interrupt Key: Same actions as for the 1052 attention key above except that the physical attention transient program ($$ANERRZ) is not fetched.

Timer Interrupt Waiting: Refer to the IT NOTE in the timer interrupt routine on Chart 05. The program switch at ITBRC being set, control returns to the timer interrupt routine because timer interrupt processing has not yet been completed.

See Logical Transients PLM GY24-5152



The program is canceled (ERR20) if:

1. Supervisor was generated without user PC routine option.
2. The user has not previously supplied the address of a PC routine by issuing a STXIT PC macro.
3. The user has specified an invalid save area.
4. The program check occurs while a B-Transient is in operation.
5. The program check occurs while the user's PC routine is in operation (routine in use).

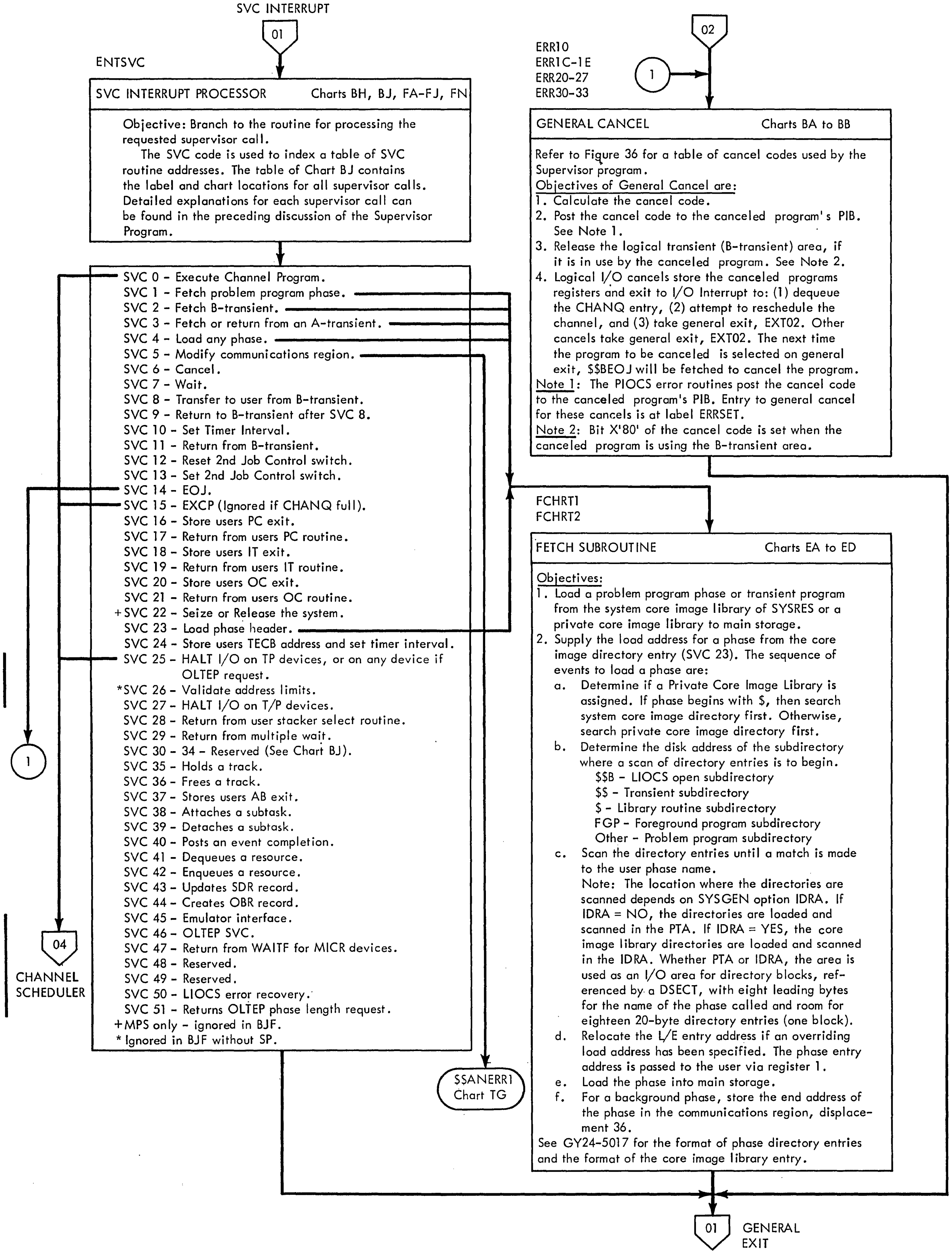
OPTION	CHARTS
No PC Rtn	BA, JG
PC, no IT, OC, or SP	FJ, JG
PC with IT, OC, or SP	FL, JG

To exit to the user's PC routine:

1. Save the PC old PSW and problem program general registers in the user-supplied save area (72 bytes).
2. Store the address of the user PC routine in the PC old PSW.
3. Branch to general exit EXT03 (EXT04 for MICR). The user's PC routine will be executed when this task is selected in the general exit routine. Return from the user's PC routine must be with an EXIT PC macro.

See Figure 13 for PC option tables.

Chart 03. SVC Interrupt Processor, General Cancel, and Fetch



SVC INTERRUPT PROCESSOR Charts BH, BJ, FA-FJ, FN

Objective: Branch to the routine for processing the requested supervisor call.

The SVC code is used to index a table of SVC routine addresses. The table of Chart BJ contains the label and chart locations for all supervisor calls. Detailed explanations for each supervisor call can be found in the preceding discussion of the Supervisor Program.

SVC 0 - Execute Channel Program.
SVC 1 - Fetch problem program phase.
SVC 2 - Fetch B-transient.
SVC 3 - Fetch or return from an A-transient.
SVC 4 - Load any phase.
SVC 5 - Modify communications region.
SVC 6 - Cancel.
SVC 7 - Wait.
SVC 8 - Transfer to user from B-transient.
SVC 9 - Return to B-transient after SVC 8.
SVC 10 - Set Timer Interval.
SVC 11 - Return from B-transient.
SVC 12 - Reset 2nd Job Control switch.
SVC 13 - Set 2nd Job Control switch.
SVC 14 - EOJ.
SVC 15 - EXCP (Ignored if CHANQ full).
SVC 16 - Store users PC exit.
SVC 17 - Return from users PC routine.
SVC 18 - Store users IT exit.
SVC 19 - Return from users IT routine.
SVC 20 - Store users OC exit.
SVC 21 - Return from users OC routine.
+SVC 22 - Seize or Release the system.
SVC 23 - Load phase header.
SVC 24 - Store users TECB address and set timer interval.
SVC 25 - HALT I/O on TP devices, or on any device if OLTEP request.
*SVC 26 - Validate address limits.
SVC 27 - HALT I/O on T/P devices.
SVC 28 - Return from user stacker select routine.
SVC 29 - Return from multiple wait.
SVC 30 - 34 - Reserved (See Chart BJ).
SVC 35 - Holds a track.
SVC 36 - Frees a track.
SVC 37 - Stores users AB exit.
SVC 38 - Attaches a subtask.
SVC 39 - Detaches a subtask.
SVC 40 - Posts an event completion.
SVC 41 - Dequeues a resource.
SVC 42 - Enqueues a resource.
SVC 43 - Updates SDR record.
SVC 44 - Creates OBR record.
SVC 45 - Emulator interface.
SVC 46 - OLTEP SVC.
SVC 47 - Return from WAITF for MICR devices.
SVC 48 - Reserved.
SVC 49 - Reserved.
SVC 50 - LIOCS error recovery.
SVC 51 - Returns OLTEP phase length request.
+MPS only - ignored in BJF.
* Ignored in BJF without SP.

GENERAL CANCEL Charts BA to BB

Refer to Figure 36 for a table of cancel codes used by the Supervisor program.

Objectives of General Cancel are:

1. Calculate the cancel code.
2. Post the cancel code to the canceled program's PIB. See Note 1.
3. Release the logical transient (B-transient) area, if it is in use by the canceled program. See Note 2.
4. Logical I/O cancels store the canceled programs registers and exit to I/O Interrupt to: (1) dequeue the CHANQ entry, (2) attempt to reschedule the channel, and (3) take general exit, EXT02. Other cancels take general exit, EXT02. The next time the program to be canceled is selected on general exit, $$BEOJ will be fetched to cancel the program.

Note 1: The PIOCS error routines post the cancel code to the canceled program's PIB. Entry to general cancel for these cancels is at label ERRSET.

Note 2: Bit X'80' of the cancel code is set when the canceled program is using the B-transient area.

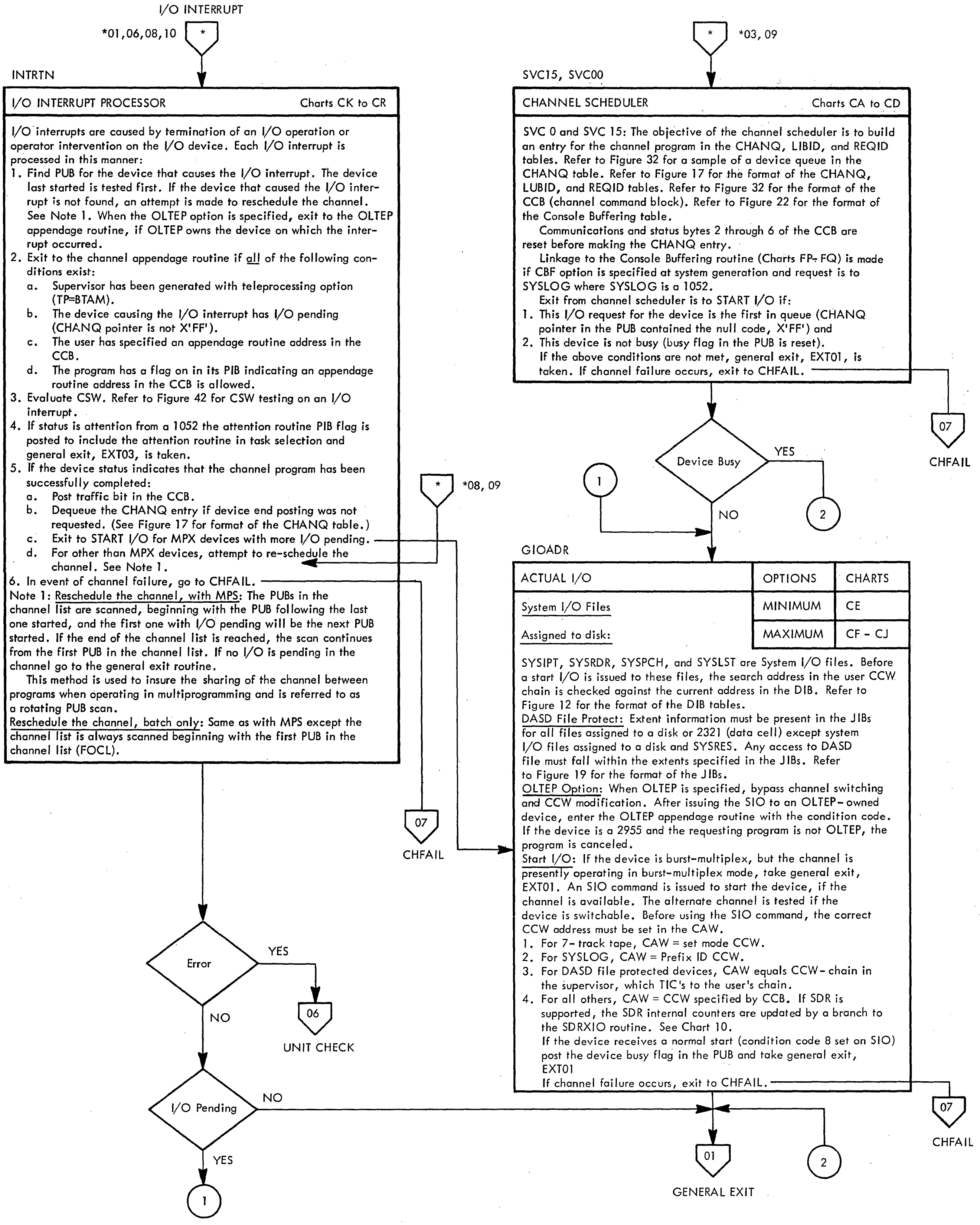
FETCH SUBROUTINE Charts EA to ED

Objectives:

1. Load a problem program phase or transient program from the system core image library of SYSRES or a private core image library to main storage.
2. Supply the load address for a phase from the core image directory entry (SVC 23). The sequence of events to load a phase are:
   a. Determine if a Private Core Image Library is assigned. If phase begins with $, then search system core image directory first. Otherwise, search private core image directory first.
   b. Determine the disk address of the subdirectory where a scan of directory entries is to begin.
      $$B - LIOCS open subdirectory
      $$ - Transient subdirectory
      $ - Library routine subdirectory
      FGP - Foreground program subdirectory
      Other - Problem program subdirectory
   c. Scan the directory entries until a match is made to the user phase name.
      Note: The location where the directories are scanned depends on SYSGEN option IDRA. If IDRA = NO, the directories are loaded and scanned in the PTA. If IDRA = YES, the core image library directories are loaded and scanned in the IDRA. Whether PTA or IDRA, the area is used as an I/O area for directory blocks, referenced by a DSECT, with eight leading bytes for the name of the phase called and room for eighteen 20-byte directory entries (one block).
   d. Relocate the L/E entry address if an overriding load address has been specified. The phase entry address is passed to the user via register 1.
   e. Load the phase into main storage.
   f. For a background phase, store the end address of the phase in the communications region, displacement 36.

See GY24-5017 for the format of phase directory entries and the format of the core image library entry.

Chart 04. I/O Interrupt Processor and Channel Scheduler



I/O INTERRUPT PROCESSOR Charts CK to CR

I/O interrupts are caused by termination of an I/O operation or operator intervention on the I/O device. Each I/O interrupt is processed in this manner:

1. Find PUB for the device that causes the I/O interrupt. The device last started is tested first. If the device that caused the I/O interrupt is not found, an attempt is made to reschedule the channel. See Note 1. When the OLTEP option is specified, exit to the OLTEP appendage routine, if OLTEP owns the device on which the interrupt occurred.
2. Exit to the channel appendage routine if <u>all</u> of the following conditions exist:
   - a. Supervisor has been generated with teleprocessing option (TP=BTAM).
   - b. The device causing the I/O interrupt has I/O pending (CHANQ pointer is not X'FF').
   - c. The user has specified an appendage routine address in the CCB.
   - d. The program has a flag on in its PIB indicating an appendage routine address in the CCB is allowed.
3. Evaluate CSW. Refer to Figure 42 for CSW testing on an I/O interrupt.
4. If status is attention from a 1052 the attention routine PIB flag is posted to include the attention routine in task selection and general exit, EXT03, is taken.
5. If the device status indicates that the channel program has been successfully completed:
   - a. Post traffic bit in the CCB.
   - b. Dequeue the CHANQ entry if device end posting was not requested. (See Figure 17 for format of the CHANQ table.)
   - c. Exit to START I/O for MPX devices with more I/O pending.
   - d. For other than MPX devices, attempt to re-schedule the channel. See Note 1.
6. In event of channel failure, go to CHFAIL.

Note 1: <u>Reschedule the channel, with MPS</u>: The PUBs in the channel list are scanned, beginning with the PUB following the last one started, and the first one with I/O pending will be the next PUB started. If the end of the channel list is reached, the scan continues from the first PUB in the channel list. If no I/O is pending in the channel go to the general exit routine.

This method is used to insure the sharing of the channel between programs when operating in multiprogramming and is referred to as a rotating PUB scan.

<u>Reschedule the channel, batch only</u>: Same as with MPS except the channel list is always scanned beginning with the first PUB in the channel list (FOCL).

CHANNEL SCHEDULER Charts CA to CD

SVC 0 and SVC 15: The objective of the channel scheduler is to build an entry for the channel program in the CHANQ, LIBID, and REQID tables. Refer to Figure 32 for a sample of a device queue in the CHANQ table. Refer to Figure 17 for the format of the CHANQ, LUBID, and REQID tables. Refer to Figure 32 for the format of the CCB (channel command block). Refer to Figure 22 for the format of the Console Buffering table.

Communications and status bytes 2 through 6 of the CCB are reset before making the CHANQ entry.

Linkage to the Console Buffering routine (Charts FP-FQ) is made if CBF option is specified at system generation and request is to SYSLOG where SYSLOG is a 1052.

Exit from channel scheduler is to START I/O if:

1. This I/O request for the device is the first in queue (CHANQ pointer in the PUB contained the null code, X'FF') and
2. This device is not busy (busy flag in the PUB is reset).

If the above conditions are not met, general exit, EXT01, is taken. If channel failure occurs, exit to CHFAIL.

ACTUAL I/O	OPTIONS	CHARTS
<u>System I/O Files</u>	MINIMUM	CE
<u>Assigned to disk:</u>	MAXIMUM	CF - CJ

SYSIPT, SYSRDR, SYSPCH, and SYSLST are System I/O files. Before a start I/O is issued to these files, the search address in the user CCW chain is checked against the current address in the DIB. Refer to Figure 12 for the format of the DIB tables.

<u>DASD File Protect:</u> Extent information must be present in the JIBs for all files assigned to a disk or 2321 (data cell) except system I/O files assigned to a disk and SYSRES. Any access to DASD file must fall within the extents specified in the JIBs. Refer to Figure 19 for the format of the JIBs.

<u>OLTEP Option:</u> When OLTEP is specified, bypass channel switching and CCW modification. After issuing the SIO to an OLTEP-owned device, enter the OLTEP appendage routine with the condition code. If the device is a 2955 and the requesting program is not OLTEP, the program is canceled.

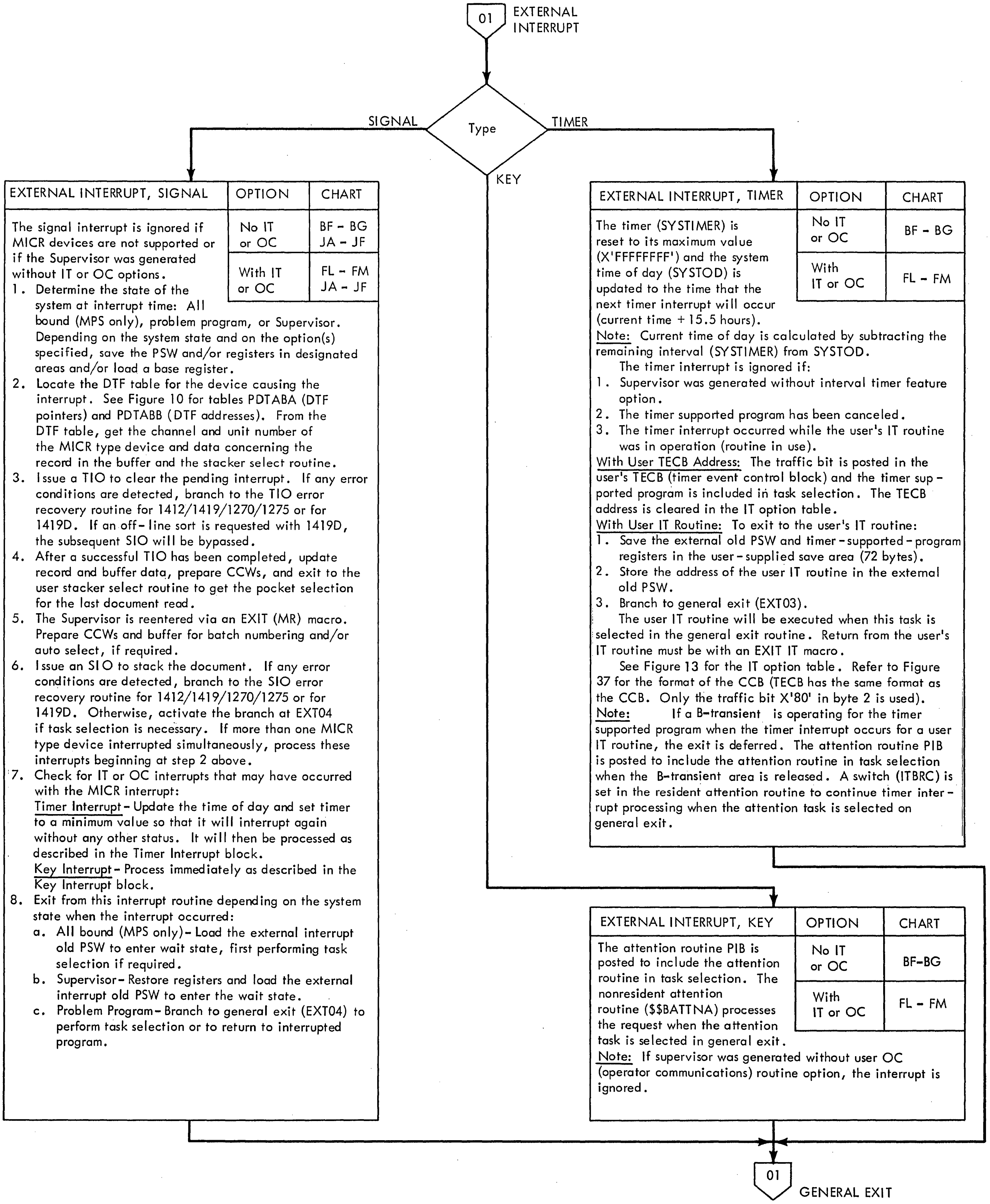
<u>Start I/O:</u> If the device is burst-multiplex, but the channel is presently operating in burst-multiplex mode, take general exit, EXT01. An SIO command is issued to start the device, if the channel is available. The alternate channel is tested if the device is switchable. Before using the SIO command, the correct CCW address must be set in the CAW.

1. For 7-track tape, CAW = set mode CCW.
2. For SYSLOG, CAW = Prefix ID CCW.
3. For DASD file protected devices, CAW equals CCW-chain in the supervisor, which TIC's to the user's chain.
4. For all others, CAW = CCW specified by CCB. If SDR is supported, the SDR internal counters are updated by a branch to the SDRXIO routine. See Chart 10.

If the device receives a normal start (condition code 8 set on SIO) post the device busy flag in the PUB and take general exit, EXT01

If channel failure occurs, exit to CHFAIL.

Chart 05. External Interrupt Routines



EXTERNAL INTERRUPT, SIGNAL

OPTION	CHART
No IT or OC	BF - BG JA - JF
With IT or OC	FL - FM JA - JF

The signal interrupt is ignored if MICR devices are not supported or if the Supervisor was generated without IT or OC options.

1. Determine the state of the system at interrupt time: All bound (MPS only), problem program, or Supervisor. Depending on the system state and on the option(s) specified, save the PSW and/or registers in designated areas and/or load a base register.
2. Locate the DTF table for the device causing the interrupt. See Figure 10 for tables PDTABA (DTF pointers) and PDTABB (DTF addresses). From the DTF table, get the channel and unit number of the MICR type device and data concerning the record in the buffer and the stacker select routine.
3. Issue a TIO to clear the pending interrupt. If any error conditions are detected, branch to the TIO error recovery routine for 1412/1419/1270/1275 or for 1419D. If an off-line sort is requested with 1419D, the subsequent SIO will be bypassed.
4. After a successful TIO has been completed, update record and buffer data, prepare CCWs, and exit to the user stacker select routine to get the pocket selection for the last document read.
5. The Supervisor is reentered via an EXIT (MR) macro. Prepare CCWs and buffer for batch numbering and/or auto select, if required.
6. Issue an SIO to stack the document. If any error conditions are detected, branch to the SIO error recovery routine for 1412/1419/1270/1275 or for 1419D. Otherwise, activate the branch at EXT04 if task selection is necessary. If more than one MICR type device interrupted simultaneously, process these interrupts beginning at step 2 above.
7. Check for IT or OC interrupts that may have occurred with the MICR interrupt:
   Timer Interrupt - Update the time of day and set timer to a minimum value so that it will interrupt again without any other status. It will then be processed as described in the Timer Interrupt block.
   Key Interrupt - Process immediately as described in the Key Interrupt block.
8. Exit from this interrupt routine depending on the system state when the interrupt occurred:
   a. All bound (MPS only) - Load the external interrupt old PSW to enter wait state, first performing task selection if required.
   b. Supervisor - Restore registers and load the external interrupt old PSW to enter the wait state.
   c. Problem Program - Branch to general exit (EXT04) to perform task selection or to return to interrupted program.

EXTERNAL INTERRUPT, TIMER

OPTION	CHART
No IT or OC	BF - BG
With IT or OC	FL - FM

The timer (SYSTIMER) is reset to its maximum value (X'FFFFFFFF') and the system time of day (SYSTOD) is updated to the time that the next timer interrupt will occur (current time + 15.5 hours).

Note: Current time of day is calculated by subtracting the remaining interval (SYSTIMER) from SYSTOD.

The timer interrupt is ignored if:

1. Supervisor was generated without interval timer feature option.
2. The timer supported program has been canceled.
3. The timer interrupt occurred while the user's IT routine was in operation (routine in use).

With User TECB Address: The traffic bit is posted in the user's TECB (timer event control block) and the timer supported program is included in task selection. The TECB address is cleared in the IT option table.

With User IT Routine: To exit to the user's IT routine:

1. Save the external old PSW and timer-supported-program registers in the user-supplied save area (72 bytes).
2. Store the address of the user IT routine in the external old PSW.
3. Branch to general exit (EXT03).

The user IT routine will be executed when this task is selected in the general exit routine. Return from the user's IT routine must be with an EXIT IT macro.

See Figure 13 for the IT option table. Refer to Figure 37 for the format of the CCB (TECB has the same format as the CCB. Only the traffic bit X'80' in byte 2 is used).

Note: If a B-transient is operating for the timer supported program when the timer interrupt occurs for a user IT routine, the exit is deferred. The attention routine PIB is posted to include the attention routine in task selection when the B-transient area is released. A switch (ITBRC) is set in the resident attention routine to continue timer interrupt processing when the attention task is selected on general exit.

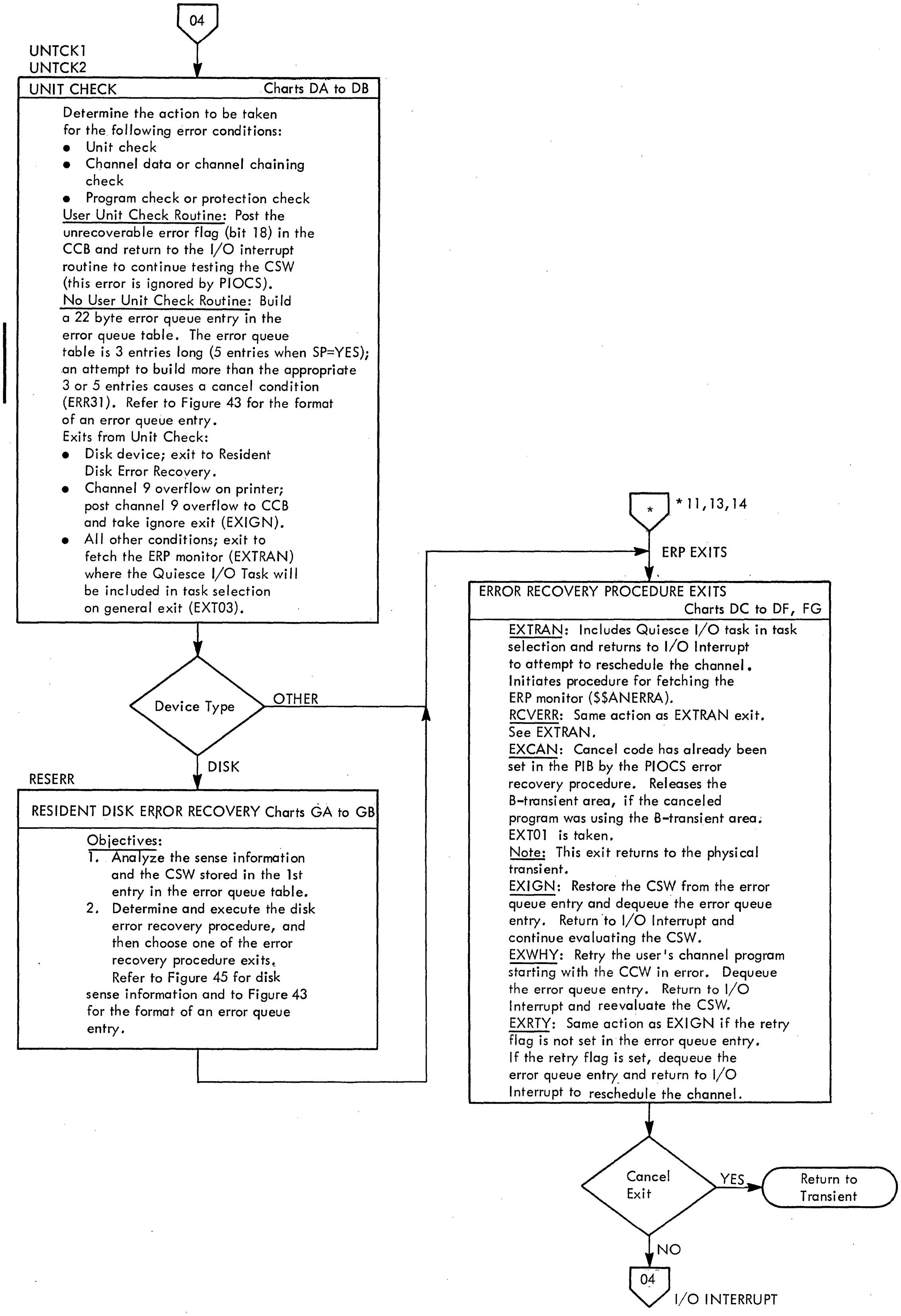
EXTERNAL INTERRUPT, KEY

OPTION	CHART
No IT or OC	BF-BG
With IT or OC	FL - FM

The attention routine PIB is posted to include the attention routine in task selection. The nonresident attention routine ($$BATTNA) processes the request when the attention task is selected in general exit.

Note: If supervisor was generated without user OC (operator communications) routine option, the interrupt is ignored.

Chart 06. Unit Check and Resident ERP Routines



UNIT CHECK Charts DA to DB

Determine the action to be taken for the following error conditions:

- Unit check
- Channel data or channel chaining check
- Program check or protection check

User Unit Check Routine: Post the unrecoverable error flag (bit 18) in the CCB and return to the I/O interrupt routine to continue testing the CSW (this error is ignored by PIOCS).

No User Unit Check Routine: Build a 22 byte error queue entry in the error queue table. The error queue table is 3 entries long (5 entries when SP=YES); an attempt to build more than the appropriate 3 or 5 entries causes a cancel condition (ERR31). Refer to Figure 43 for the format of an error queue entry.

Exits from Unit Check:

- Disk device; exit to Resident Disk Error Recovery.
- Channel 9 overflow on printer; post channel 9 overflow to CCB and take ignore exit (EXIGN).
- All other conditions; exit to fetch the ERP monitor (EXTRAN) where the Quiesce I/O Task will be included in task selection on general exit (EXT03).

RESIDENT DISK ERROR RECOVERY Charts GA to GB

Objectives:

1. Analyze the sense information and the CSW stored in the 1st entry in the error queue table.
2. Determine and execute the disk error recovery procedure, and then choose one of the error recovery procedure exits. Refer to Figure 45 for disk sense information and to Figure 43 for the format of an error queue entry.

ERROR RECOVERY PROCEDURE EXITS Charts DC to DF, FG

EXTRAN: Includes Quiesce I/O task in task selection and returns to I/O Interrupt to attempt to reschedule the channel. Initiates procedure for fetching the ERP monitor ($$ANERRA).

RCVERR: Same action as EXTRAN exit. See EXTRAN.

EXCAN: Cancel code has already been set in the PIB by the PIOCS error recovery procedure. Releases the B-transient area, if the canceled program was using the B-transient area. EXT01 is taken.

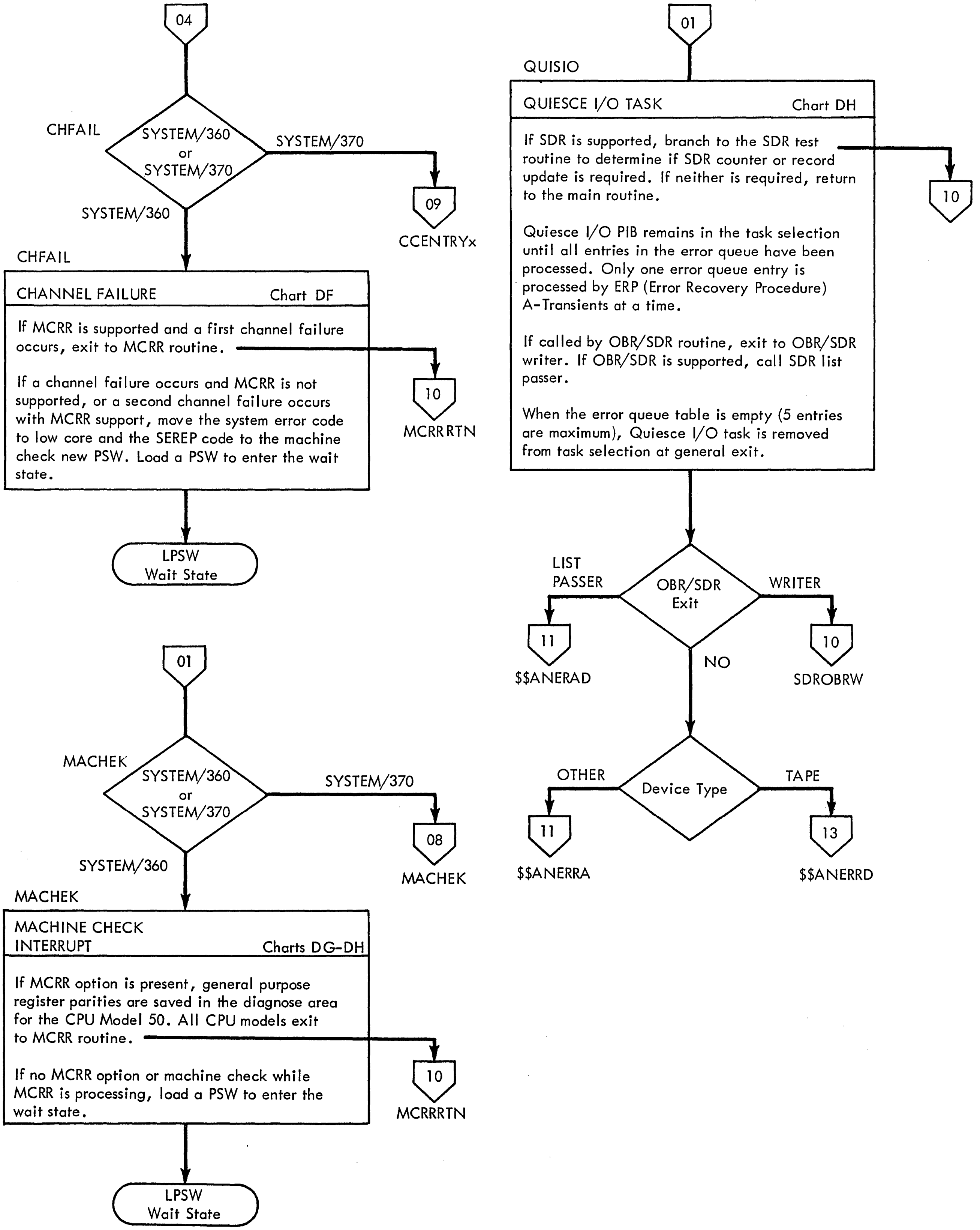
Note: This exit returns to the physical transient.

EXIGN: Restore the CSW from the error queue entry and dequeue the error queue entry. Return to I/O Interrupt and continue evaluating the CSW.

EXWHY: Retry the user's channel program starting with the CCW in error. Dequeue the error queue entry. Return to I/O Interrupt and reevaluate the CSW.

EXRTY: Same action as EXIGN if the retry flag is not set in the error queue entry. If the retry flag is set, dequeue the error queue entry and return to I/O Interrupt to reschedule the channel.

Chart 07. Quiesce I/O, Channel Failure, and Machine Check Interrupt Routines



If MCRR is supported and a first channel failure occurs, exit to MCRR routine.

If a channel failure occurs and MCRR is not supported, or a second channel failure occurs with MCRR support, move the system error code to low core and the SEREP code to the machine check new PSW. Load a PSW to enter the wait state.

If MCRR option is present, general purpose register parities are saved in the diagnose area for the CPU Model 50. All CPU models exit to MCRR routine.

If no MCRR option or machine check while MCRR is processing, load a PSW to enter the wait state.

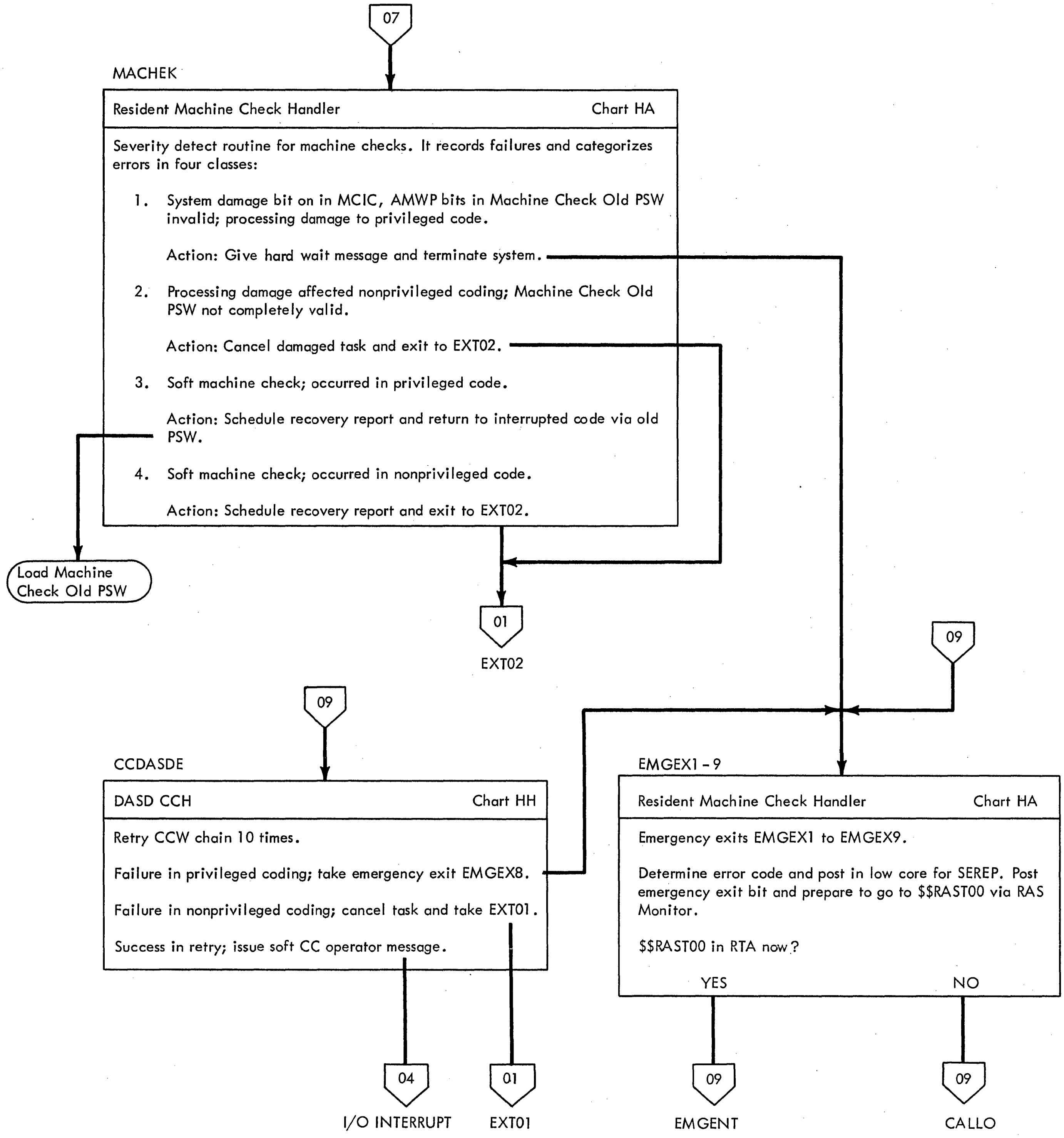
If SDR is supported, branch to the SDR test routine to determine if SDR counter or record update is required. If neither is required, return to the main routine.

Quiesce I/O PIB remains in the task selection until all entries in the error queue have been processed. Only one error queue entry is processed by ERP (Error Recovery Procedure) A-Transients at a time.

If called by OBR/SDR routine, exit to OBR/SDR writer. If OBR/SDR is supported, call SDR list passer.

When the error queue table is empty (5 entries are maximum), Quiesce I/O task is removed from task selection at general exit.

Chart 08. RMS Resident Machine Check Handler



Severity detect routine for machine checks. It records failures and categorizes errors in four classes:

1. System damage bit on in MCIC, AMWP bits in Machine Check Old PSW invalid; processing damage to privileged code.

   Action: Give hard wait message and terminate system.

2. Processing damage affected nonprivileged coding; Machine Check Old PSW not completely valid.

   Action: Cancel damaged task and exit to EXT02.

3. Soft machine check; occurred in privileged code.

   Action: Schedule recovery report and return to interrupted code via old PSW.

4. Soft machine check; occurred in nonprivileged code.

   Action: Schedule recovery report and exit to EXT02.

Retry CCW chain 10 times.

Failure in privileged coding; take emergency exit EMGEX8.

Failure in nonprivileged coding; cancel task and take EXT01.

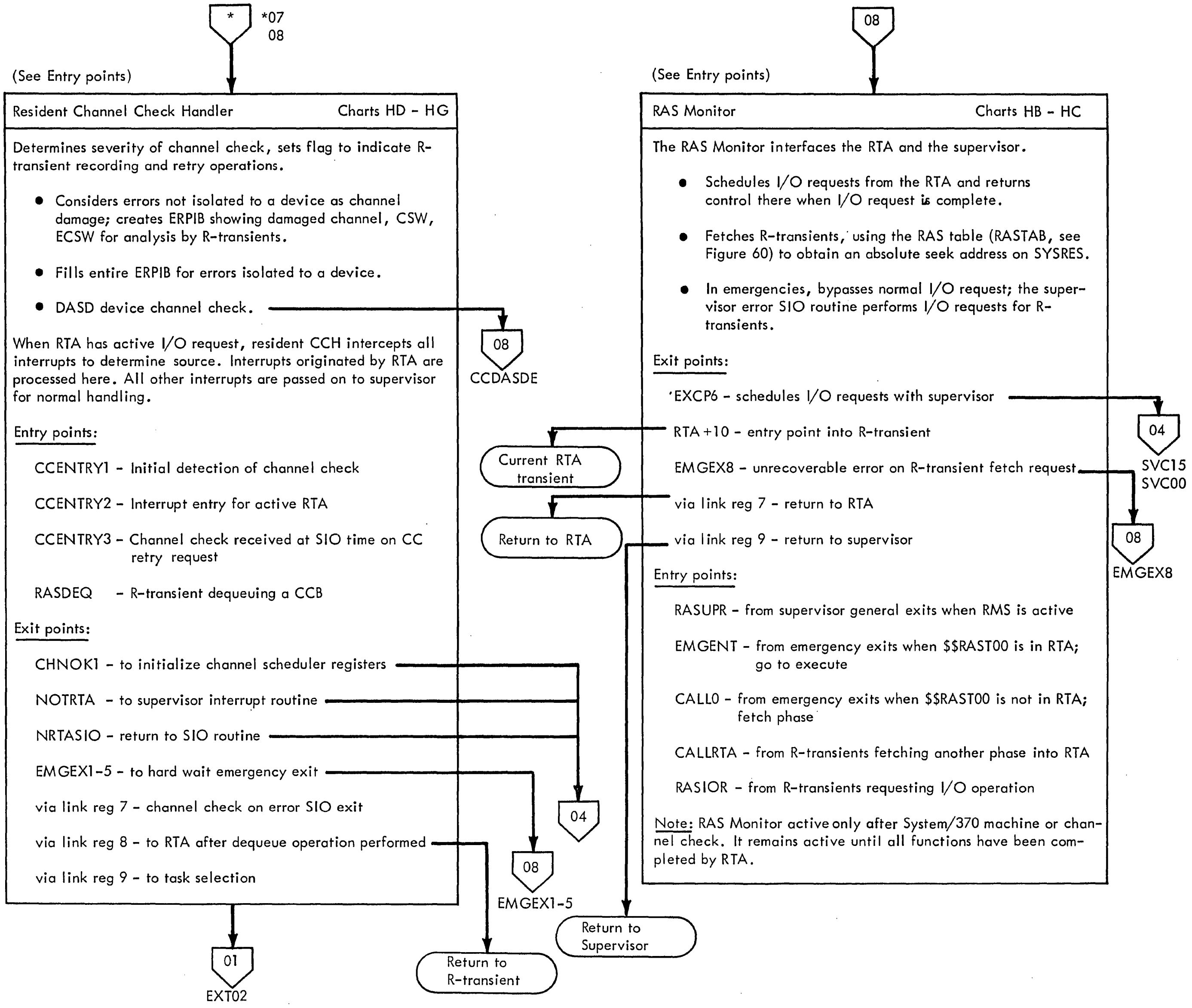
Success in retry; issue soft CC operator message.

Emergency exits EMGEX1 to EMGEX9.

Determine error code and post in low core for SEREP. Post emergency exit bit and prepare to go to $$RAST00 via RAS Monitor.

$$RAST00 in RTA now?

Chart 09. RMS Resident Channel Check Handler and RAS Monitor



(See Entry points)

Resident Channel Check Handler — Charts HD - HG

Determines severity of channel check, sets flag to indicate R-transient recording and retry operations.

- Considers errors not isolated to a device as channel damage; creates ERPIB showing damaged channel, CSW, ECSW for analysis by R-transients.
- Fills entire ERPIB for errors isolated to a device.
- DASD device channel check.

When RTA has active I/O request, resident CCH intercepts all interrupts to determine source. Interrupts originated by RTA are processed here. All other interrupts are passed on to supervisor for normal handling.

Entry points:

CCENTRY1 - Initial detection of channel check

CCENTRY2 - Interrupt entry for active RTA

CCENTRY3 - Channel check received at SIO time on CC retry request

RASDEQ - R-transient dequeuing a CCB

Exit points:

CHNOK1 - to initialize channel scheduler registers

NOTRTA - to supervisor interrupt routine

NRTASIO - return to SIO routine

EMGEX1-5 - to hard wait emergency exit

via link reg 7 - channel check on error SIO exit

via link reg 8 - to RTA after dequeue operation performed

via link reg 9 - to task selection

(See Entry points)

RAS Monitor — Charts HB - HC

The RAS Monitor interfaces the RTA and the supervisor.

- Schedules I/O requests from the RTA and returns control there when I/O request is complete.
- Fetches R-transients, using the RAS table (RASTAB, see Figure 60) to obtain an absolute seek address on SYSRES.
- In emergencies, bypasses normal I/O request; the supervisor error SIO routine performs I/O requests for R-transients.

Exit points:

'EXCP6 - schedules I/O requests with supervisor

RTA+10 - entry point into R-transient

EMGEX8 - unrecoverable error on R-transient fetch request

via link reg 7 - return to RTA

via link reg 9 - return to supervisor

Entry points:

RASUPR - from supervisor general exits when RMS is active

EMGENT - from emergency exits when $$RAST00 is in RTA; go to execute

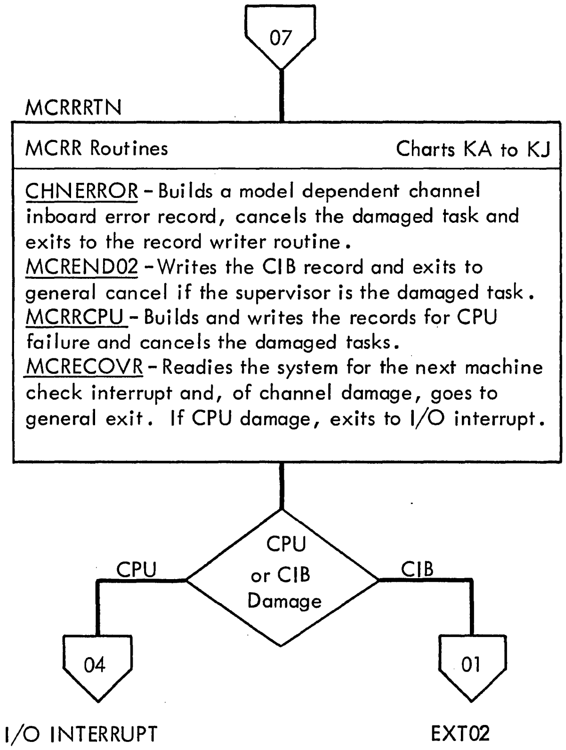
CALL0 - from emergency exits when $$RAST00 is not in RTA; fetch phase

CALLRTA - from R-transients fetching another phase into RTA

RASIOR - from R-transients requesting I/O operation

Note: RAS Monitor active only after System/370 machine or channel check. It remains active until all functions have been completed by RTA.

Chart 10. MCRR and OBR/SDR Routines

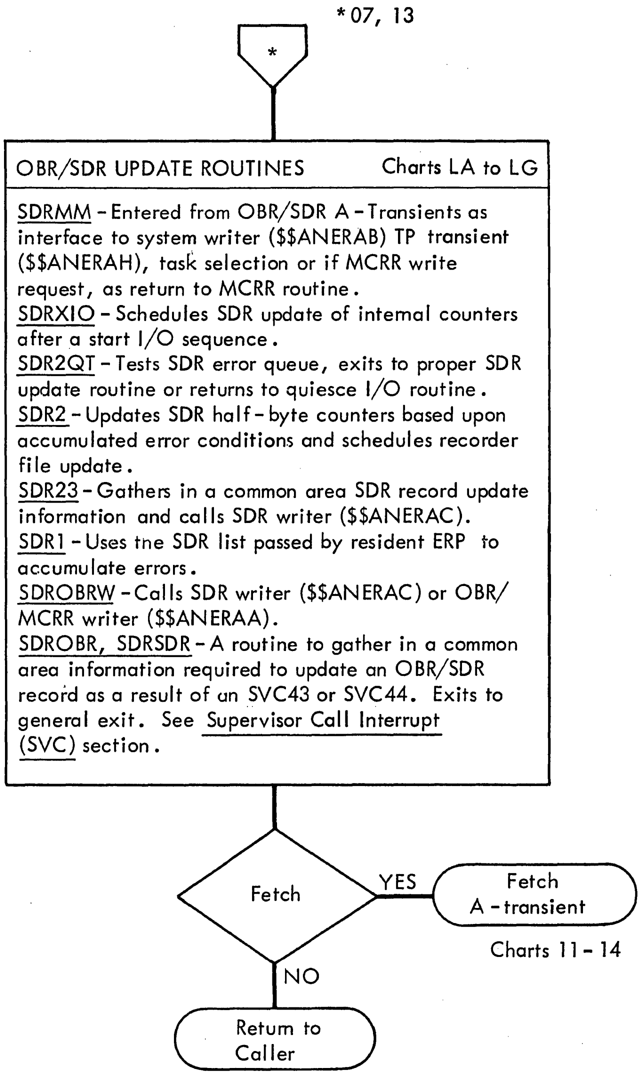


CHNERROR - Builds a model dependent channel inboard error record, cancels the damaged task and exits to the record writer routine.

MCREND02 - Writes the CIB record and exits to general cancel if the supervisor is the damaged task.

MCRRCPU - Builds and writes the records for CPU failure and cancels the damaged tasks.

MCRECOVR - Readies the system for the next machine check interrupt and, of channel damage, goes to general exit. If CPU damage, exits to I/O interrupt.



SDRMM - Entered from OBR/SDR A - Transients as interface to system writer ($$ANERAB) TP transient ($$ANERAH), task selection or if MCRR write request, as return to MCRR routine.

SDRXIO - Schedules SDR update of internal counters after a start I/O sequence.

SDR2QT - Tests SDR error queue, exits to proper SDR update routine or returns to quiesce I/O routine.

SDR2 - Updates SDR half-byte counters based upon accumulated error conditions and schedules recorder file update.

SDR23 - Gathers in a common area SDR record update information and calls SDR writer ($$ANERAC).

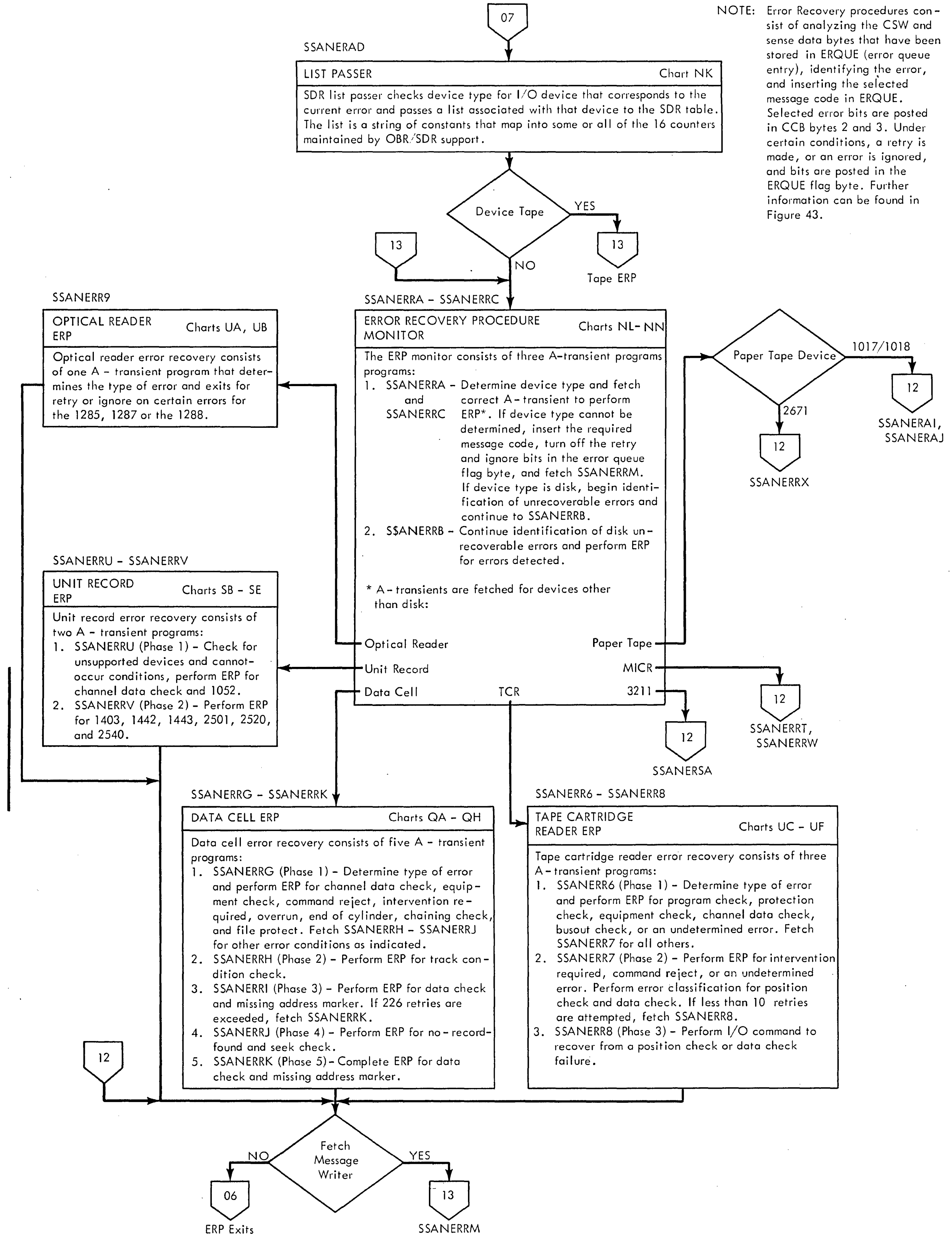
SDR1 - Uses tne SDR list passed by resident ERP to accumulate errors.

SDROBRW - Calls SDR writer ($$ANERAC) or OBR/MCRR writer ($$ANERAA).

SDROBR, SDRSDR - A routine to gather in a common area information required to update an OBR/SDR record as a result of an SVC43 or SVC44. Exits to general exit. See Supervisor Call Interrupt (SVC) section.

Chart 11. Physical Transients (Part 1 of 4)

NOTE: Error Recovery procedures consist of analyzing the CSW and sense data bytes that have been stored in ERQUE (error queue entry), identifying the error, and inserting the selected message code in ERQUE. Selected error bits are posted in CCB bytes 2 and 3. Under certain conditions, a retry is made, or an error is ignored, and bits are posted in the ERQUE flag byte. Further information can be found in Figure 43.



SSANERAD

LIST PASSER — Chart NK

SDR list passer checks device type for I/O device that corresponds to the current error and passes a list associated with that device to the SDR table. The list is a string of constants that map into some or all of the 16 counters maintained by OBR/SDR support.

SSANERRA - SSANERRC

ERROR RECOVERY PROCEDURE MONITOR — Charts NL- NN

The ERP monitor consists of three A-transient programs programs:

1. SSANERRA - and SSANERRC - Determine device type and fetch correct A-transient to perform ERP*. If device type cannot be determined, insert the required message code, turn off the retry and ignore bits in the error queue flag byte, and fetch SSANERRM. If device type is disk, begin identification of unrecoverable errors and continue to SSANERRB.
2. S$ANERRB - Continue identification of disk unrecoverable errors and perform ERP for errors detected.

* A-transients are fetched for devices other than disk:

SSANERR9

OPTICAL READER ERP — Charts UA, UB

Optical reader error recovery consists of one A - transient program that determines the type of error and exits for retry or ignore on certain errors for the 1285, 1287 or the 1288.

SSANERRU - SSANERRV

UNIT RECORD ERP — Charts SB - SE

Unit record error recovery consists of two A - transient programs:

1. SSANERRU (Phase 1) - Check for unsupported devices and cannot-occur conditions, perform ERP for channel data check and 1052.
2. SSANERRV (Phase 2) - Perform ERP for 1403, 1442, 1443, 2501, 2520, and 2540.

SSANERRG - SSANERRK

DATA CELL ERP — Charts QA - QH

Data cell error recovery consists of five A - transient programs:

1. SSANERRG (Phase 1) - Determine type of error and perform ERP for channel data check, equipment check, command reject, intervention required, overrun, end of cylinder, chaining check, and file protect. Fetch SSANERRH - SSANERRJ for other error conditions as indicated.
2. SSANERRH (Phase 2) - Perform ERP for track condition check.
3. SSANERRI (Phase 3) - Perform ERP for data check and missing address marker. If 226 retries are exceeded, fetch SSANERRK.
4. SSANERRJ (Phase 4) - Perform ERP for no-record-found and seek check.
5. SSANERRK (Phase 5)- Complete ERP for data check and missing address marker.

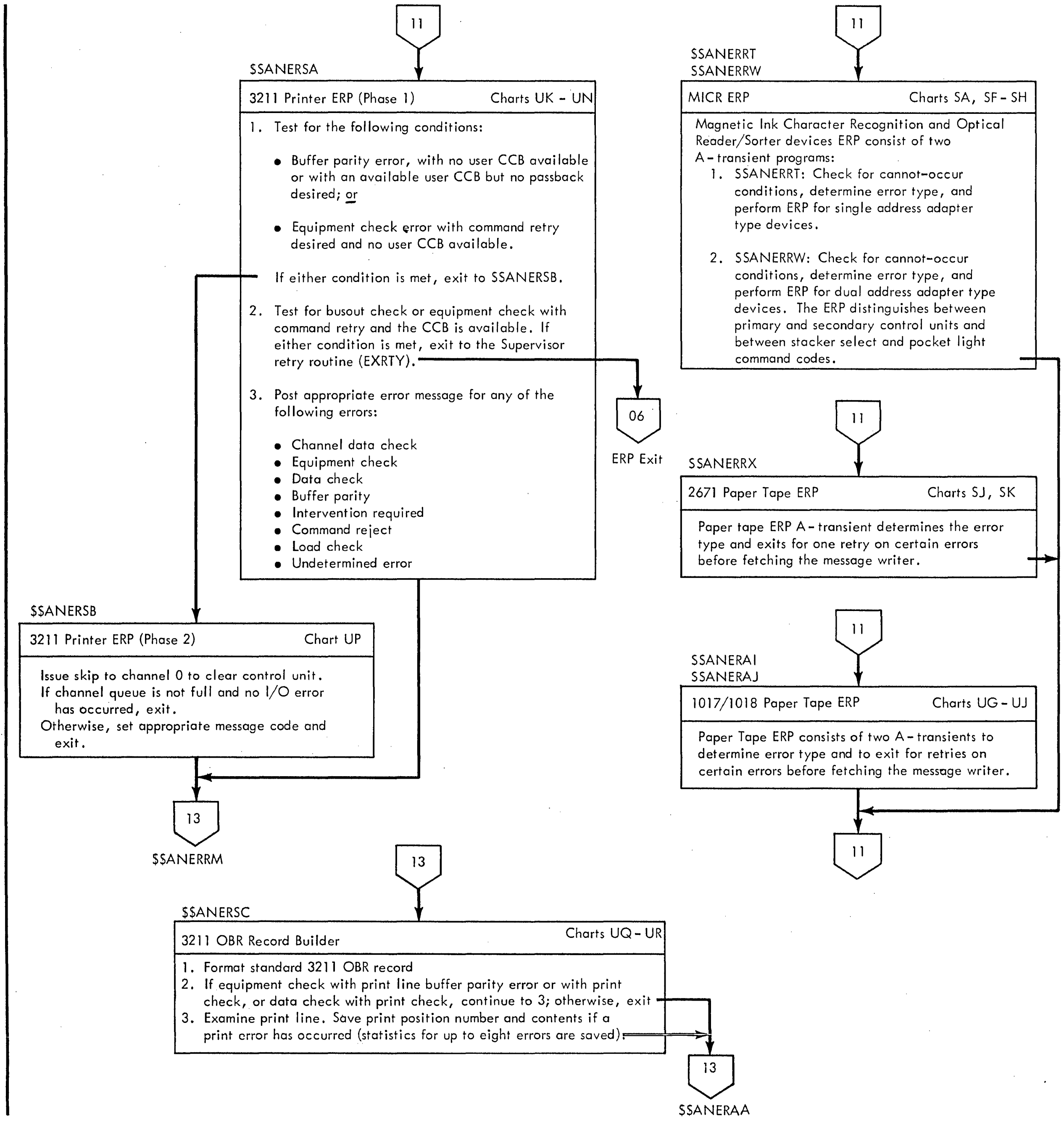
SSANERR6 - SSANERR8

TAPE CARTRIDGE READER ERP — Charts UC - UF

Tape cartridge reader error recovery consists of three A-transient programs:

1. SSANERR6 (Phase 1) - Determine type of error and perform ERP for program check, protection check, equipment check, channel data check, busout check, or an undetermined error. Fetch SSANERR7 for all others.
2. SSANERR7 (Phase 2) - Perform ERP for intervention required, command reject, or an undetermined error. Perform error classification for position check and data check. If less than 10 retries are attempted, fetch SSANERR8.
3. SSANERR8 (Phase 3) - Perform I/O command to recover from a position check or data check failure.

Chart 12. Physical Transients (Part 2 of 4)



$$ANERSA

3211 Printer ERP (Phase 1) Charts UK - UN

1. Test for the following conditions:
    - Buffer parity error, with no user CCB available or with an available user CCB but no passback desired; or
    - Equipment check error with command retry desired and no user CCB available.

    If either condition is met, exit to $$ANERSB.
2. Test for busout check or equipment check with command retry and the CCB is available. If either condition is met, exit to the Supervisor retry routine (EXRTY).
3. Post appropriate error message for any of the following errors:
    - Channel data check
    - Equipment check
    - Data check
    - Buffer parity
    - Intervention required
    - Command reject
    - Load check
    - Undetermined error

$$ANERSB

3211 Printer ERP (Phase 2) Chart UP

Issue skip to channel 0 to clear control unit.
If channel queue is not full and no I/O error has occurred, exit.
Otherwise, set appropriate message code and exit.

$$ANERSC

3211 OBR Record Builder Charts UQ - UR

1. Format standard 3211 OBR record
2. If equipment check with print line buffer parity error or with print check, or data check with print check, continue to 3; otherwise, exit
3. Examine print line. Save print position number and contents if a print error has occurred (statistics for up to eight errors are saved).

$$ANERRT
$$ANERRW

MICR ERP Charts SA, SF - SH

Magnetic Ink Character Recognition and Optical Reader/Sorter devices ERP consist of two A-transient programs:
1. $$ANERRT: Check for cannot-occur conditions, determine error type, and perform ERP for single address adapter type devices.
2. $$ANERRW: Check for cannot-occur conditions, determine error type, and perform ERP for dual address adapter type devices. The ERP distinguishes between primary and secondary control units and between stacker select and pocket light command codes.

$$ANERRX

2671 Paper Tape ERP Charts SJ, SK

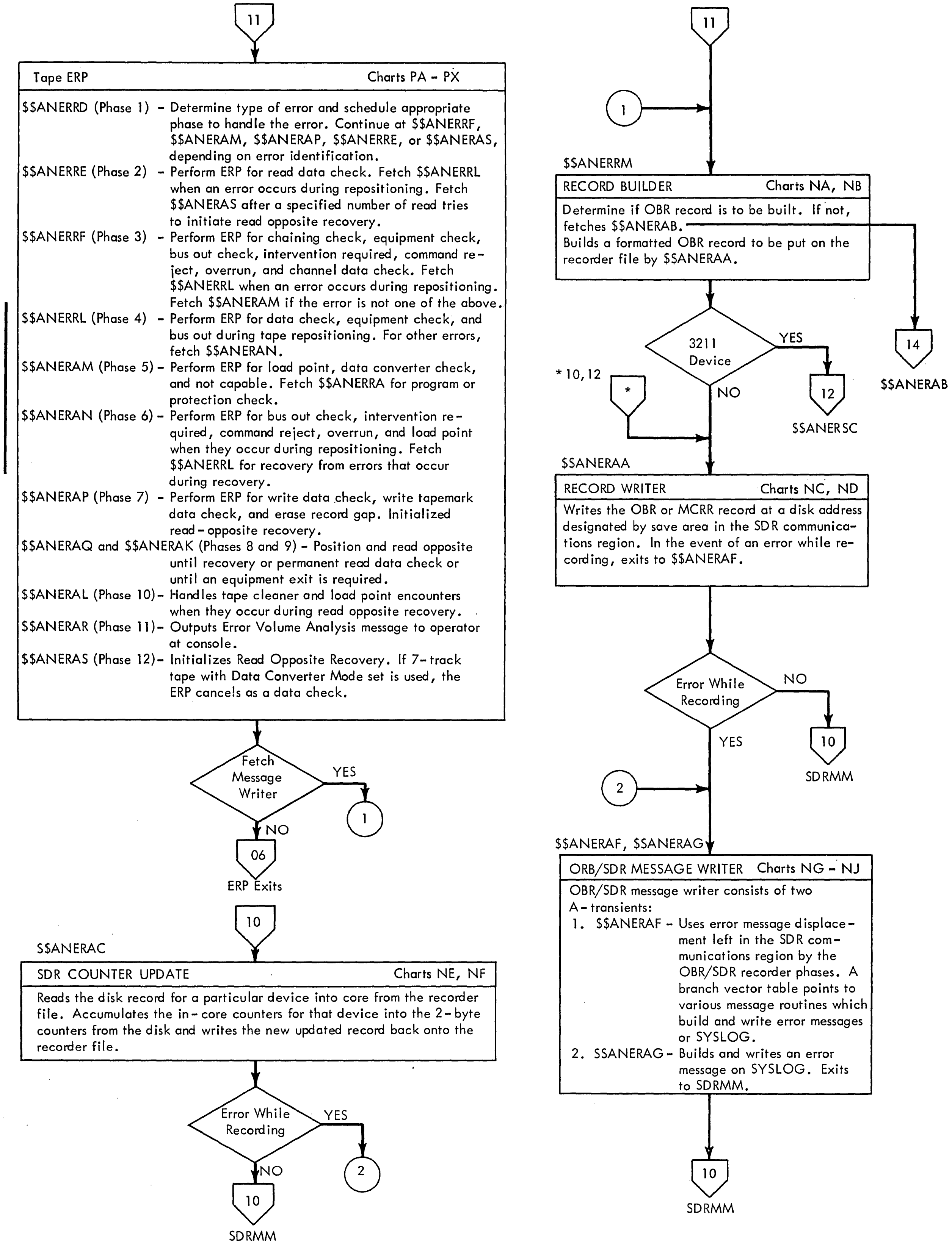
Paper tape ERP A-transient determines the error type and exits for one retry on certain errors before fetching the message writer.

$$ANERAI
$$ANERAJ

1017/1018 Paper Tape ERP Charts UG - UJ

Paper Tape ERP consists of two A-transients to determine error type and to exit for retries on certain errors before fetching the message writer.

Chart 13. Physical Transients (Part 3 of 4)



Tape ERP — Charts PA - PX

$$ANERRD (Phase 1) - Determine type of error and schedule appropriate phase to handle the error. Continue at $$ANERRF, $$ANERAM, $$ANERAP, $$ANERRE, or $$ANERAS, depending on error identification.

$$ANERRE (Phase 2) - Perform ERP for read data check. Fetch $$ANERRL when an error occurs during repositioning. Fetch $$ANERAS after a specified number of read tries to initiate read opposite recovery.

$$ANERRF (Phase 3) - Perform ERP for chaining check, equipment check, bus out check, intervention required, command reject, overrun, and channel data check. Fetch $$ANERRL when an error occurs during repositioning. Fetch $$ANERAM if the error is not one of the above.

$$ANERRL (Phase 4) - Perform ERP for data check, equipment check, and bus out during tape repositioning. For other errors, fetch $$ANERAN.

$$ANERAM (Phase 5) - Perform ERP for load point, data converter check, and not capable. Fetch $$ANERRA for program or protection check.

$$ANERAN (Phase 6) - Perform ERP for bus out check, intervention required, command reject, overrun, and load point when they occur during repositioning. Fetch $$ANERRL for recovery from errors that occur during recovery.

$$ANERAP (Phase 7) - Perform ERP for write data check, write tapemark data check, and erase record gap. Initialized read-opposite recovery.

$$ANERAQ and $$ANERAK (Phases 8 and 9) - Position and read opposite until recovery or permanent read data check or until an equipment exit is required.

$$ANERAL (Phase 10) - Handles tape cleaner and load point encounters when they occur during read opposite recovery.

$$ANERAR (Phase 11) - Outputs Error Volume Analysis message to operator at console.

$$ANERAS (Phase 12) - Initializes Read Opposite Recovery. If 7-track tape with Data Converter Mode set is used, the ERP cancels as a data check.

SDR COUNTER UPDATE — Charts NE, NF

Reads the disk record for a particular device into core from the recorder file. Accumulates the in-core counters for that device into the 2-byte counters from the disk and writes the new updated record back onto the recorder file.

RECORD BUILDER — Charts NA, NB

Determine if OBR record is to be built. If not, fetches $$ANERAB. Builds a formatted OBR record to be put on the recorder file by $$ANERAA.

RECORD WRITER — Charts NC, ND

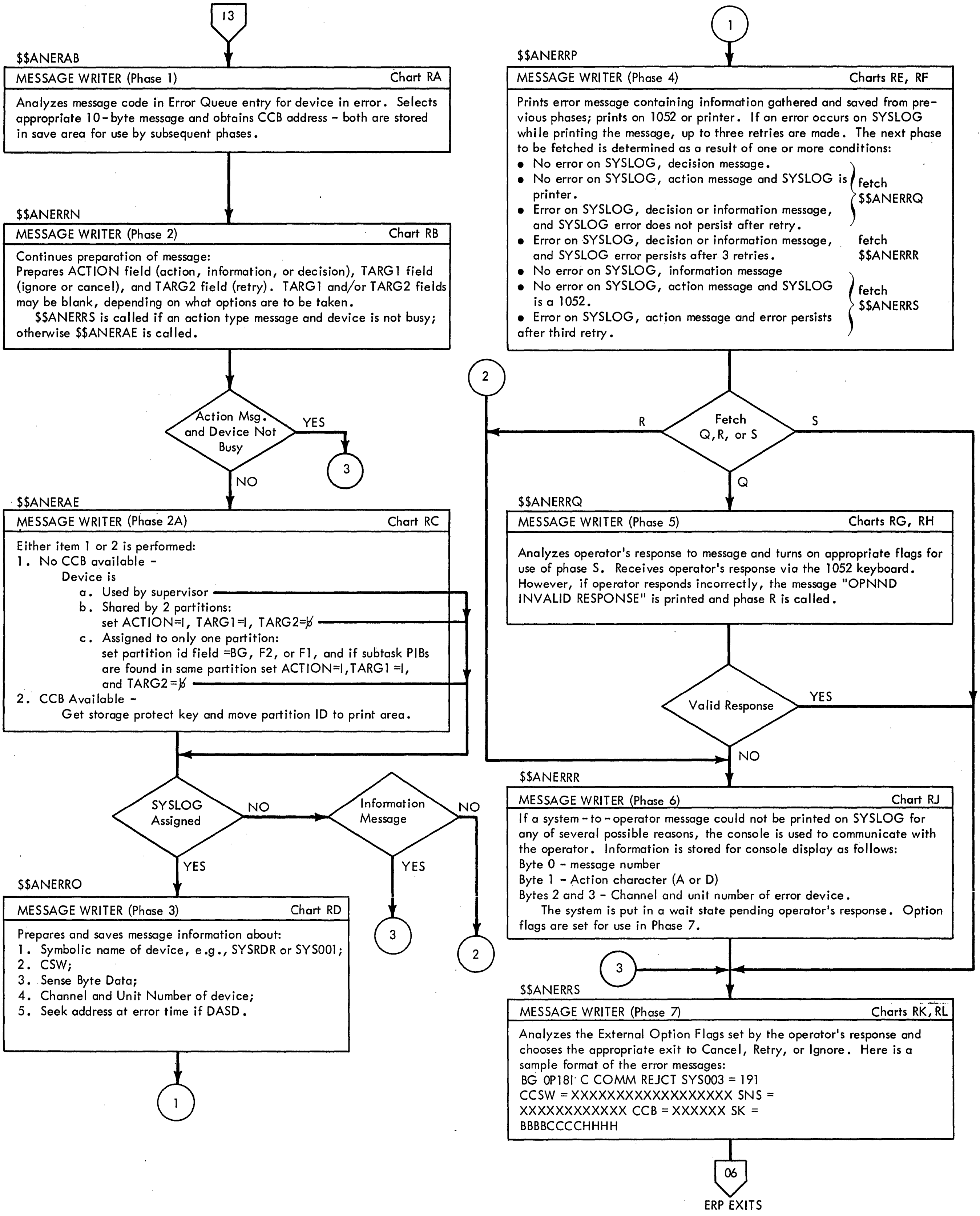
Writes the OBR or MCRR record at a disk address designated by save area in the SDR communications region. In the event of an error while recording, exits to $$ANERAF.

ORB/SDR MESSAGE WRITER — Charts NG - NJ

OBR/SDR message writer consists of two A-transients:

1. $$ANERAF - Uses error message displacement left in the SDR communications region by the OBR/SDR recorder phases. A branch vector table points to various message routines which build and write error messages or SYSLOG.
2. $$ANERAG - Builds and writes an error message on SYSLOG. Exits to SDRMM.

Chart 14. Physical Transients (Part 4 of 4)



$$ANERAB

MESSAGE WRITER (Phase 1) Chart RA

Analyzes message code in Error Queue entry for device in error. Selects appropriate 10-byte message and obtains CCB address - both are stored in save area for use by subsequent phases.

$$ANERRN

MESSAGE WRITER (Phase 2) Chart RB

Continues preparation of message:
Prepares ACTION field (action, information, or decision), TARG1 field (ignore or cancel), and TARG2 field (retry). TARG1 and/or TARG2 fields may be blank, depending on what options are to be taken.

$$ANERRS is called if an action type message and device is not busy; otherwise $$ANERAE is called.

$$ANERAE

MESSAGE WRITER (Phase 2A) Chart RC

Either item 1 or 2 is performed:

1. No CCB available -
   Device is
   a. Used by supervisor
   b. Shared by 2 partitions:
      set ACTION=I, TARG1=I, TARG2=b̸
   c. Assigned to only one partition:
      set partition id field =BG, F2, or F1, and if subtask PIBs are found in same partition set ACTION=I,TARG1 =I, and TARG2=b̸
2. CCB Available -
   Get storage protect key and move partition ID to print area.

$$ANERRO

MESSAGE WRITER (Phase 3) Chart RD

Prepares and saves message information about:

1. Symbolic name of device, e.g., SYSRDR or SYS001;
2. CSW;
3. Sense Byte Data;
4. Channel and Unit Number of device;
5. Seek address at error time if DASD.

$$ANERRP

MESSAGE WRITER (Phase 4) Charts RE, RF

Prints error message containing information gathered and saved from previous phases; prints on 1052 or printer. If an error occurs on SYSLOG while printing the message, up to three retries are made. The next phase to be fetched is determined as a result of one or more conditions:

- No error on SYSLOG, decision message.
- No error on SYSLOG, action message and SYSLOG is printer.
- Error on SYSLOG, decision or information message, and SYSLOG error does not persist after retry.

} fetch $$ANERRQ

- Error on SYSLOG, decision or information message, and SYSLOG error persists after 3 retries.

fetch $$ANERRR

- No error on SYSLOG, information message
- No error on SYSLOG, action message and SYSLOG is a 1052.
- Error on SYSLOG, action message and error persists after third retry.

} fetch $$ANERRS

$$ANERRQ

MESSAGE WRITER (Phase 5) Charts RG, RH

Analyzes operator's response to message and turns on appropriate flags for use of phase S. Receives operator's response via the 1052 keyboard. However, if operator responds incorrectly, the message "OPNND INVALID RESPONSE" is printed and phase R is called.

$$ANERRR

MESSAGE WRITER (Phase 6) Chart RJ

If a system-to-operator message could not be printed on SYSLOG for any of several possible reasons, the console is used to communicate with the operator. Information is stored for console display as follows:
Byte 0 - message number
Byte 1 - Action character (A or D)
Bytes 2 and 3 - Channel and unit number of error device.

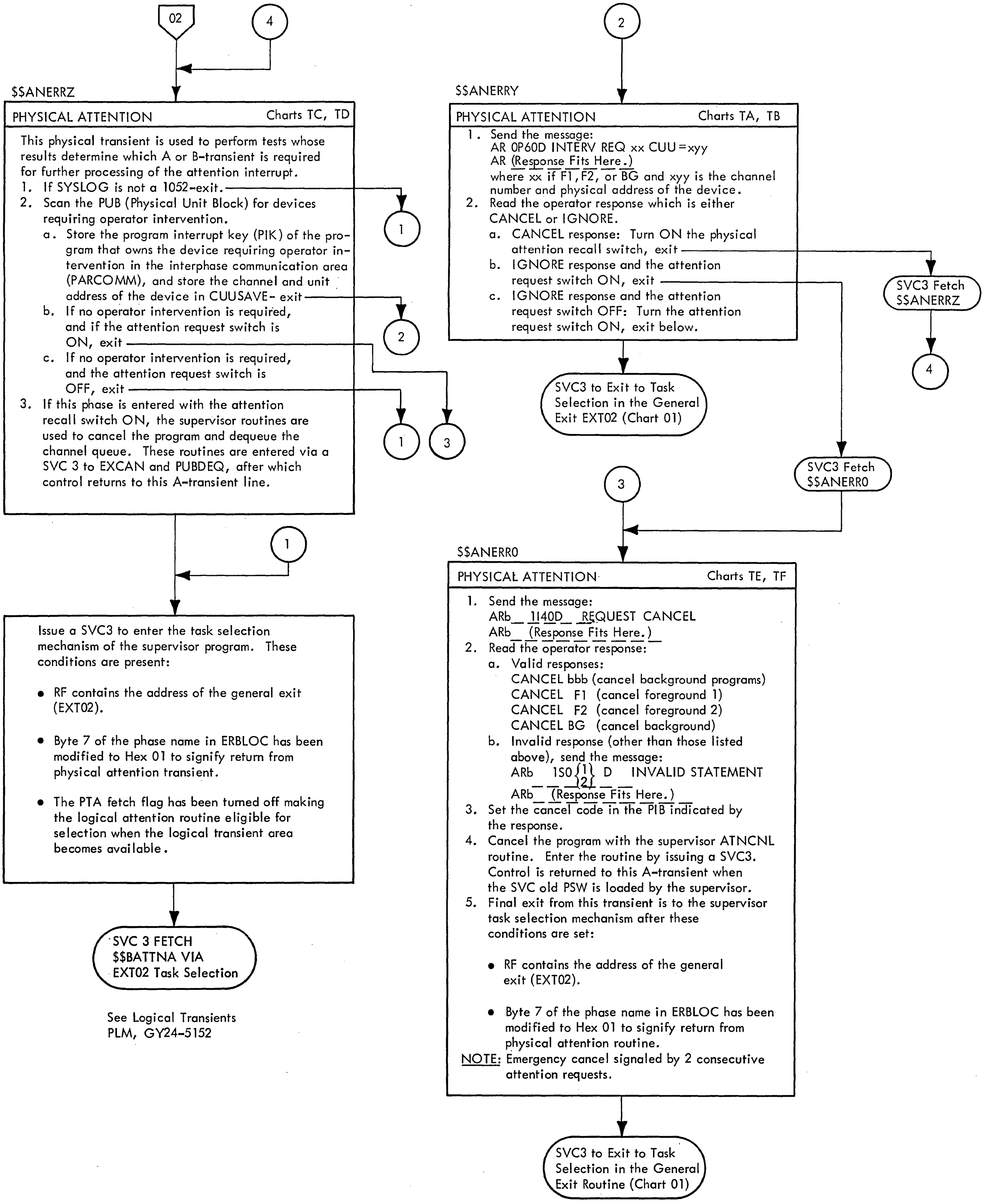
The system is put in a wait state pending operator's response. Option flags are set for use in Phase 7.

$$ANERRS

MESSAGE WRITER (Phase 7) Charts RK, RL

Analyzes the External Option Flags set by the operator's response and chooses the appropriate exit to Cancel, Retry, or Ignore. Here is a sample format of the error messages:
BG 0P181 C COMM REJCT SYS003 = 191
CCSW = XXXXXXXXXXXXXXXXXX SNS =
XXXXXXXXXXXX CCB = XXXXXX SK =
BBBBCCCCHHHH

Chart 15. Physical Attention Transients



This physical transient is used to perform tests whose results determine which A or B-transient is required for further processing of the attention interrupt.

1. If SYSLOG is not a 1052-exit.
2. Scan the PUB (Physical Unit Block) for devices requiring operator intervention.
   a. Store the program interrupt key (PIK) of the program that owns the device requiring operator intervention in the interphase communication area (PARCOMM), and store the channel and unit address of the device in CUUSAVE- exit
   b. If no operator intervention is required, and if the attention request switch is ON, exit
   c. If no operator intervention is required, and the attention request switch is OFF, exit
3. If this phase is entered with the attention recall switch ON, the supervisor routines are used to cancel the program and dequeue the channel queue. These routines are entered via a SVC 3 to EXCAN and PUBDEQ, after which control returns to this A-transient line.

Issue a SVC3 to enter the task selection mechanism of the supervisor program. These conditions are present:

- RF contains the address of the general exit (EXT02).
- Byte 7 of the phase name in ERBLOC has been modified to Hex 01 to signify return from physical attention transient.
- The PTA fetch flag has been turned off making the logical attention routine eligible for selection when the logical transient area becomes available.

See Logical Transients PLM, GY24-5152

1. Send the message:
   AR 0P60D INTERV REQ xx CUU=xyy
   AR (Response Fits Here.)
   where xx if F1, F2, or BG and xyy is the channel number and physical address of the device.
2. Read the operator response which is either CANCEL or IGNORE.
   a. CANCEL response: Turn ON the physical attention recall switch, exit
   b. IGNORE response and the attention request switch ON, exit
   c. IGNORE response and the attention request switch OFF: Turn the attention request switch ON, exit below.

1. Send the message:
   ARb__1I40D__REQUEST CANCEL
   ARb__(Response Fits Here.)__
2. Read the operator response:
   a. Valid responses:
      CANCEL bbb (cancel background programs)
      CANCEL F1 (cancel foreground 1)
      CANCEL F2 (cancel foreground 2)
      CANCEL BG (cancel background)
   b. Invalid response (other than those listed above), send the message:
      ARb 1S0$\begin{Bmatrix}1\\2\end{Bmatrix}$ D INVALID STATEMENT
      ARb__(Response Fits Here.)__
3. Set the cancel code in the PIB indicated by the response.
4. Cancel the program with the supervisor ATNCNL routine. Enter the routine by issuing a SVC3. Control is returned to this A-transient when the SVC old PSW is loaded by the supervisor.
5. Final exit from this transient is to the supervisor task selection mechanism after these conditions are set:
   - RF contains the address of the general exit (EXT02).
   - Byte 7 of the phase name in ERBLOC has been modified to Hex 01 to signify return from physical attention routine.

NOTE: Emergency cancel signaled by 2 consecutive attention requests.

Chart AA. $$A$SUP1 - SUPVR Macro, General Entry
Refer to Chart 01.

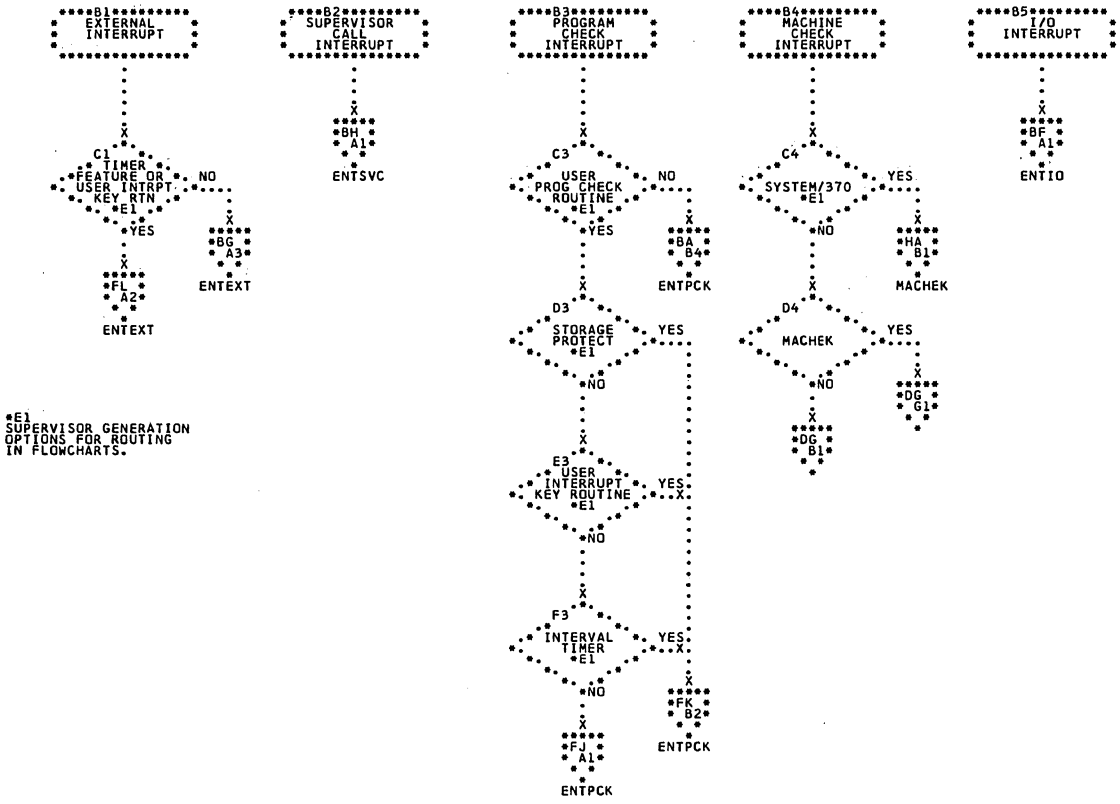
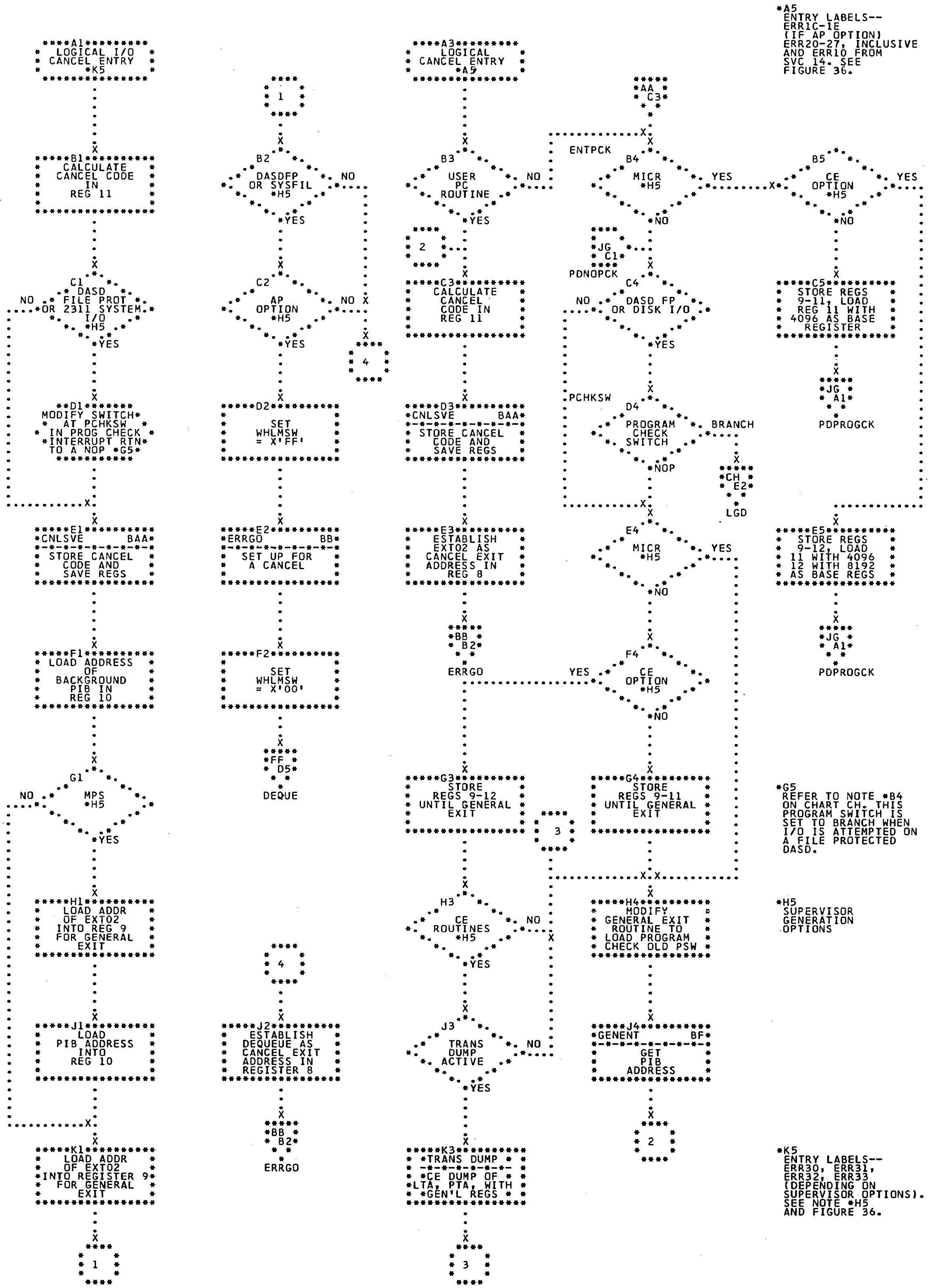


Chart BA. $$A$SUP1 - FOPT Macro, General Cancels and Program Check without PC Routine
Refer to Charts 02 and 03.



*A5
ENTRY LABELS--
ERR1C-1E
(IF AP OPTION)
ERR20-27, INCLUSIVE
AND ERR10 FROM
SVC 14. SEE
FIGURE 36.

*G5
REFER TO NOTE *B4
ON CHART CH. THIS
PROGRAM SWITCH IS
SET TO BRANCH WHEN
I/O IS ATTEMPTED ON
A FILE PROTECTED
DASD.

*H5
SUPERVISOR
GENERATION
OPTIONS

*K5
ENTRY LABELS--
ERR30, ERR31,
ERR32, ERR33
(DEPENDING ON
SUPERVISOR OPTIONS).
SEE NOTE *H5
AND FIGURE 36.

Chart BAA. $$A$SUP1 - FOPT Macro, CNLSVE and SVEREG Subroutines
Refer to Charts 02 and 03.

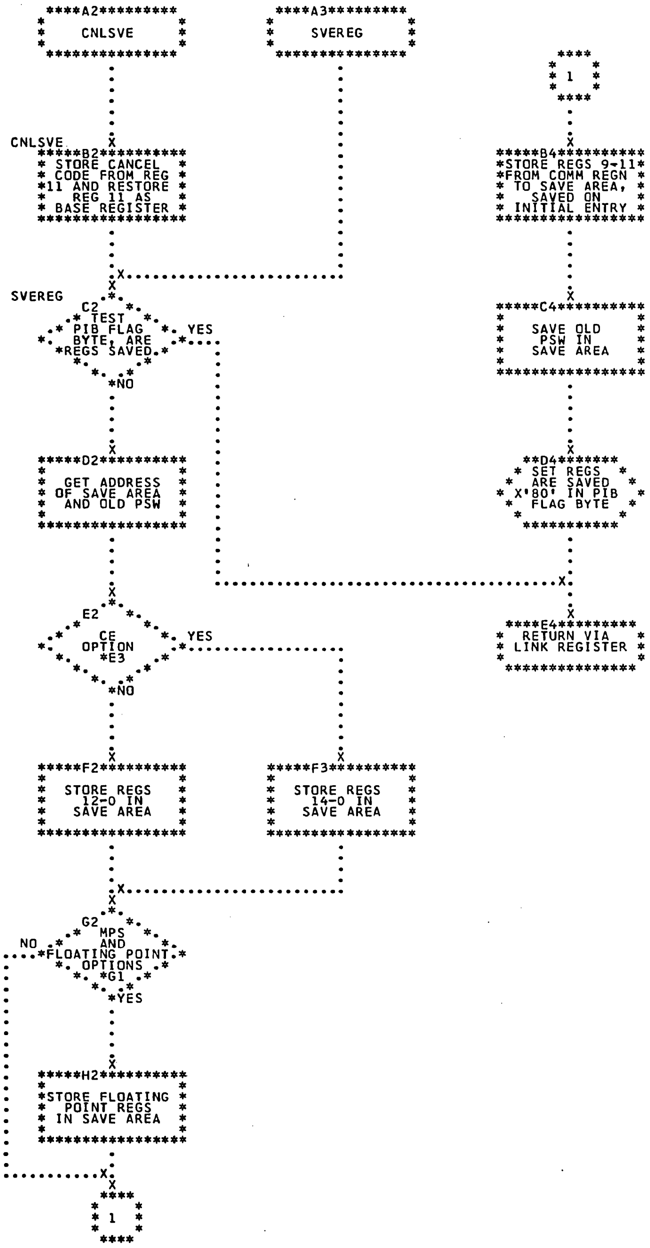
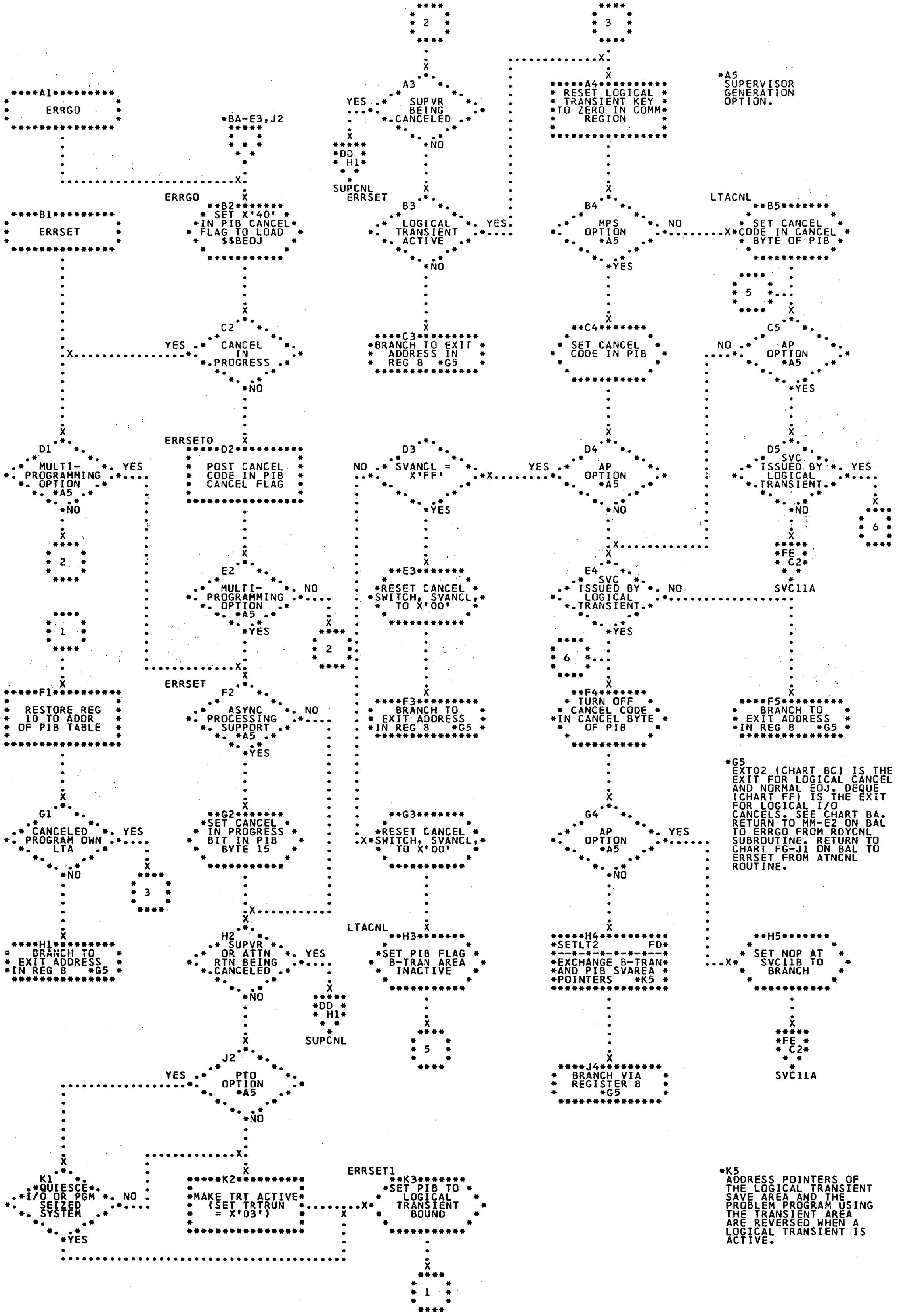


Chart BB. $$A$SUP1 - FOPT Macro, General Cancel Subroutine Refer to Chart 03.

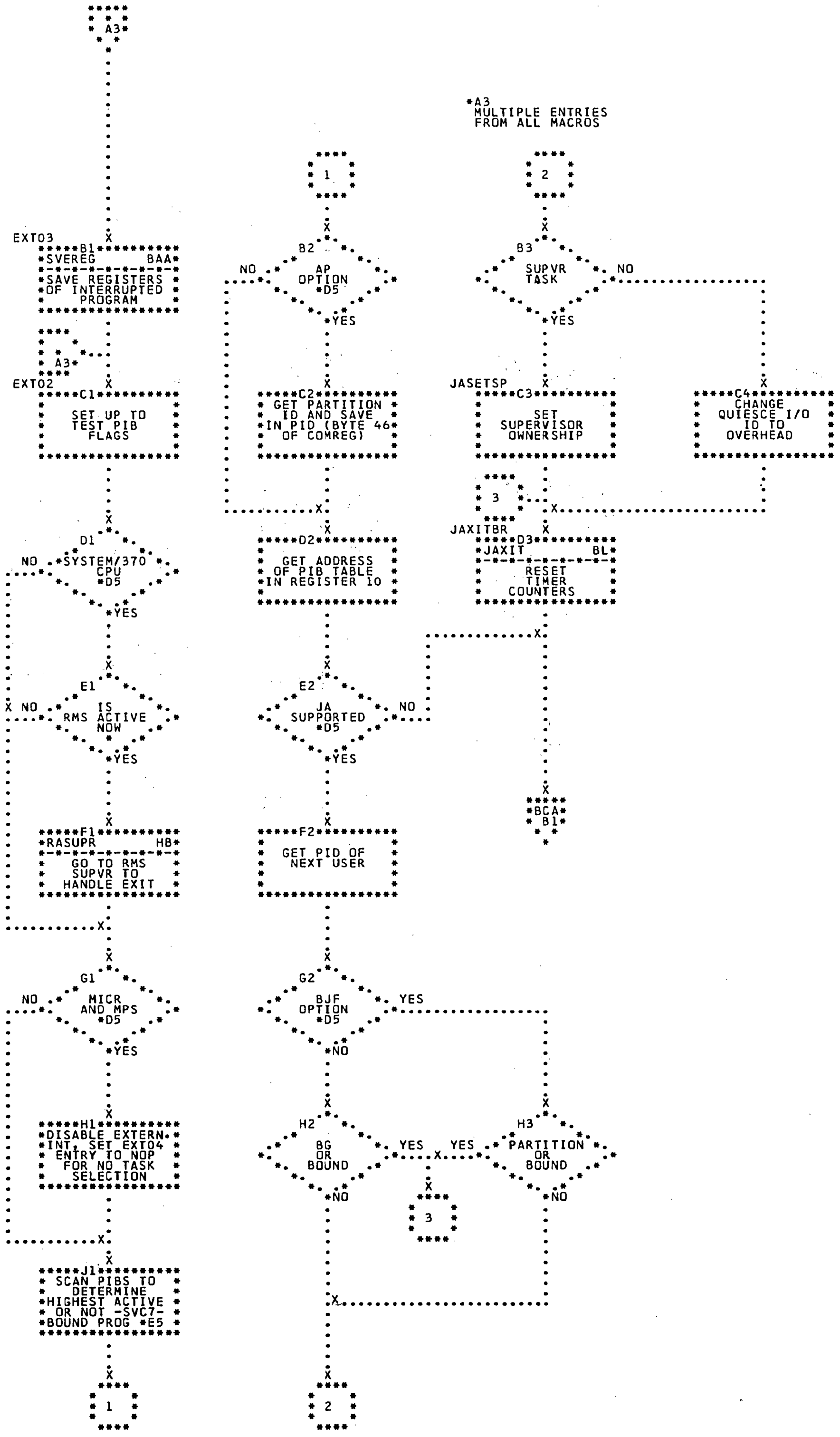


*A5 SUPERVISOR GENERATION OPTION.

*G5 EXTO2 (CHART BC) IS THE EXIT FOR LOGICAL CANCEL AND NORMAL EOJ. DEQUE (CHART FF) IS THE EXIT FOR LOGICAL I/O CANCELS. SEE CHART BA. RETURN TO MM-E2 ON BAL TO ERRGO FROM RDYCNL SUBROUTINE. RETURN TO CHART FG-J1 ON BAL TO ERRSET FROM ATNCNL ROUTINE.

*K5 ADDRESS POINTERS OF THE LOGICAL TRANSIENT SAVE AREA AND THE PROBLEM PROGRAM USING THE TRANSIENT AREA ARE REVERSED WHEN A LOGICAL TRANSIENT IS ACTIVE.

Chart BC. $$A$SUP1 - FOPT Macro, General Exits (Part 1 of 4)
Refer to Chart 01.



*D5
SUPERVISOR
GENERATION
OPTION.

*E5
IF THE SYSTEM
HAS BEEN SEIZED
BY AN SVC 22 ISSUED
IN A FG1, FG2, OR
BG PROGRAM, THE TRT
OPERATION WILL NOT
STOP AT THE OTHER 2
PROBLEM PROGRAM PIBS
OR THE ATTENTION PIB.

Chart BCA. $$A$SUP1 - FOPT Macro, General Exits (Part 2 of 4)
Refer to Chart 01.

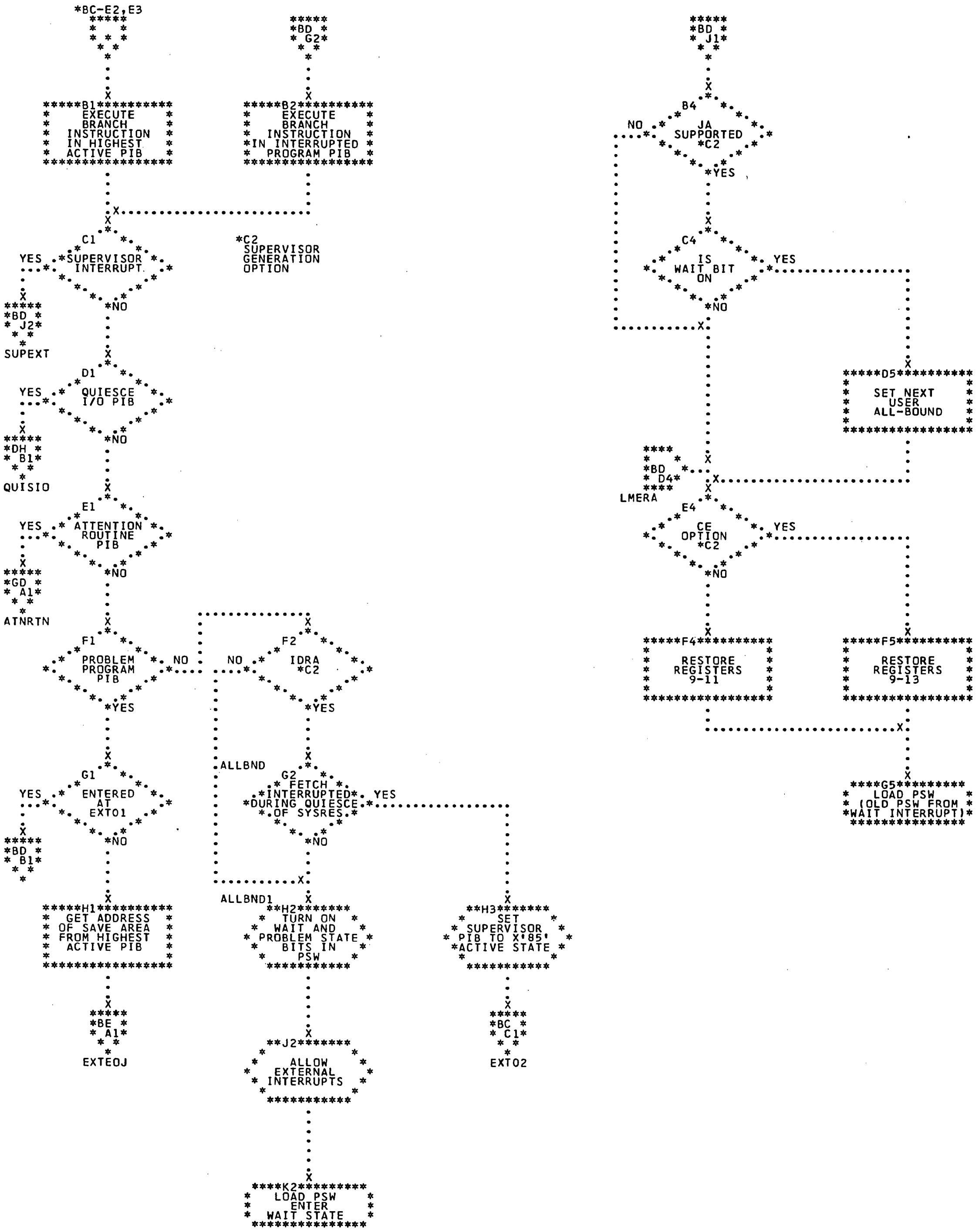


Chart BD. $$A$SUP1 - FOPT Macro, General Exits (Part 3 of 4)
Refer to Chart 01.

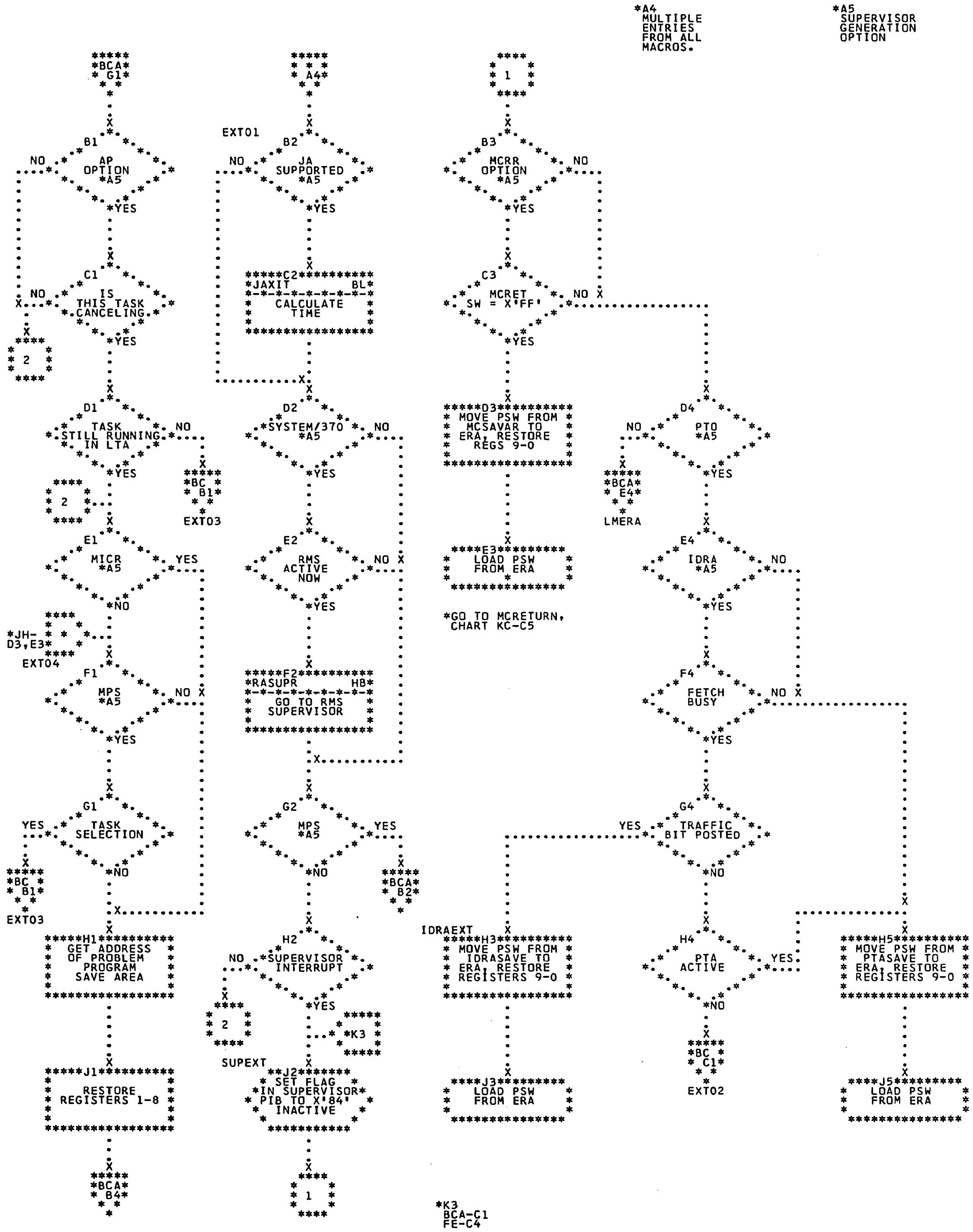


Chart BE. $$A$SUP1 - FOPT Macro, General Exits (Part 4 of 4)
Refer to Chart 01.

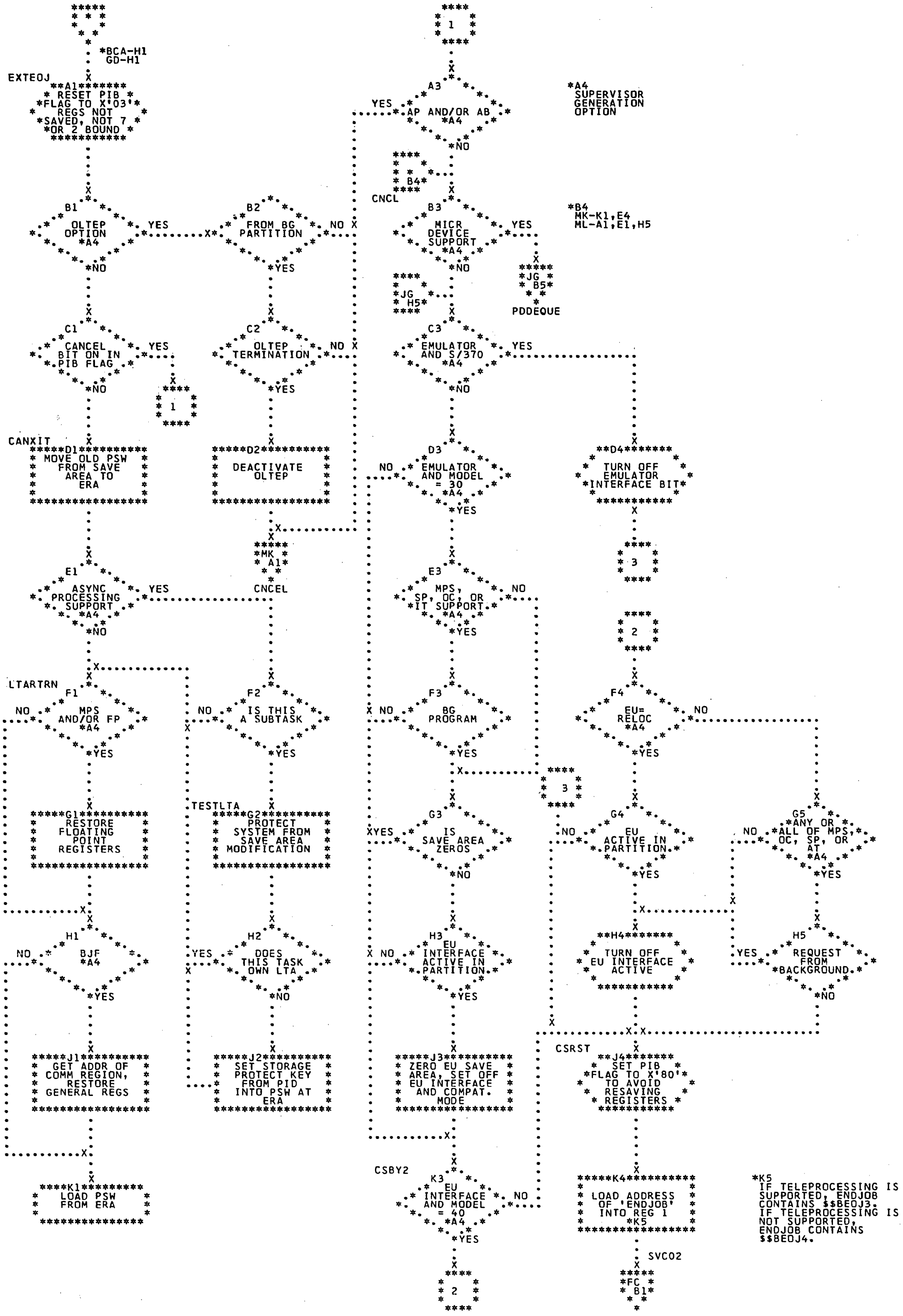


Chart BF. $$A$SUP1 - FOPT Macro, General Entry (Part 1 of 2)
Refer to Chart 05.

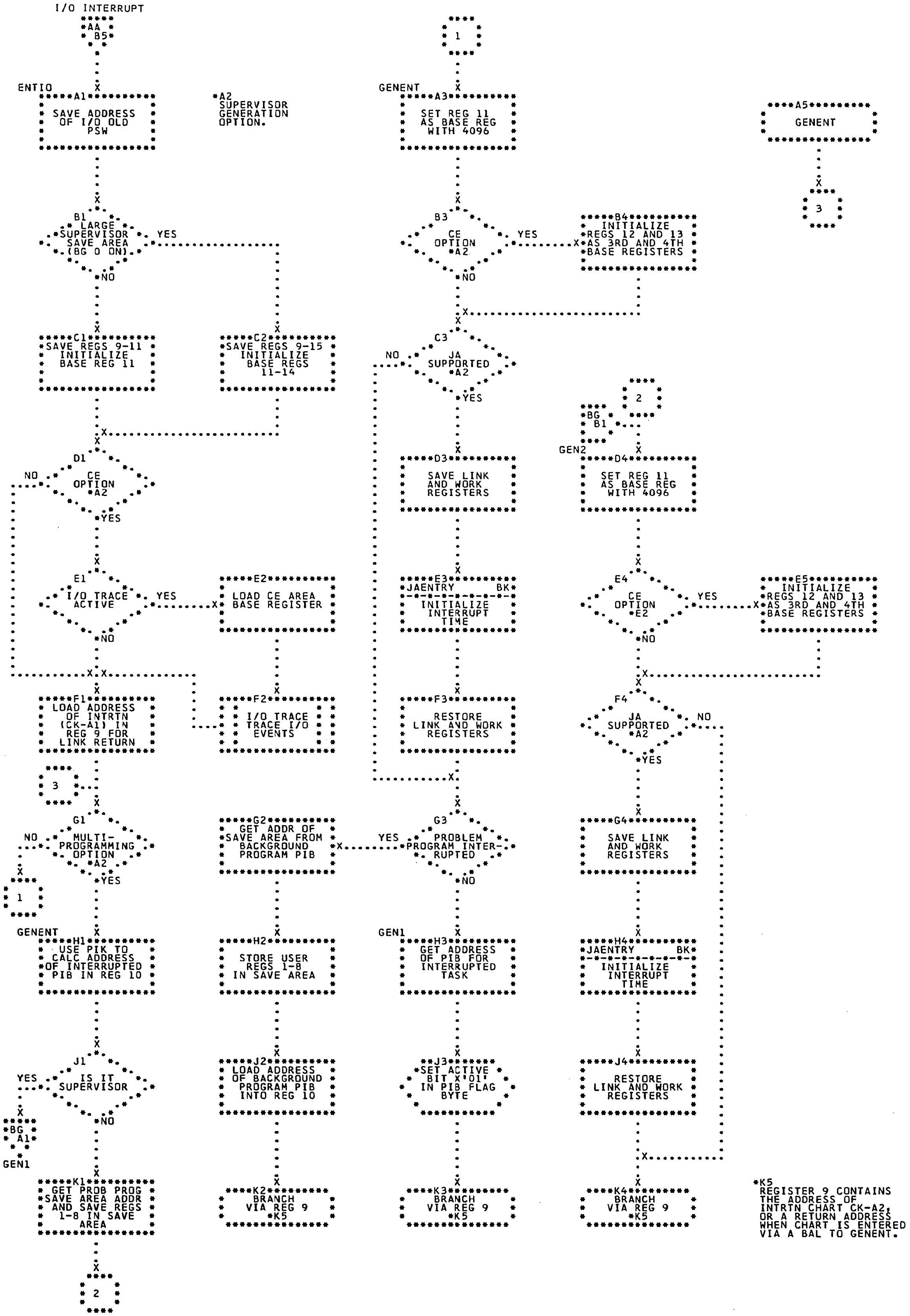


Chart BG. $$A$SUP1 - FOPT Macro, General Entry (Part 2 of 2) Refer to Chart 05.

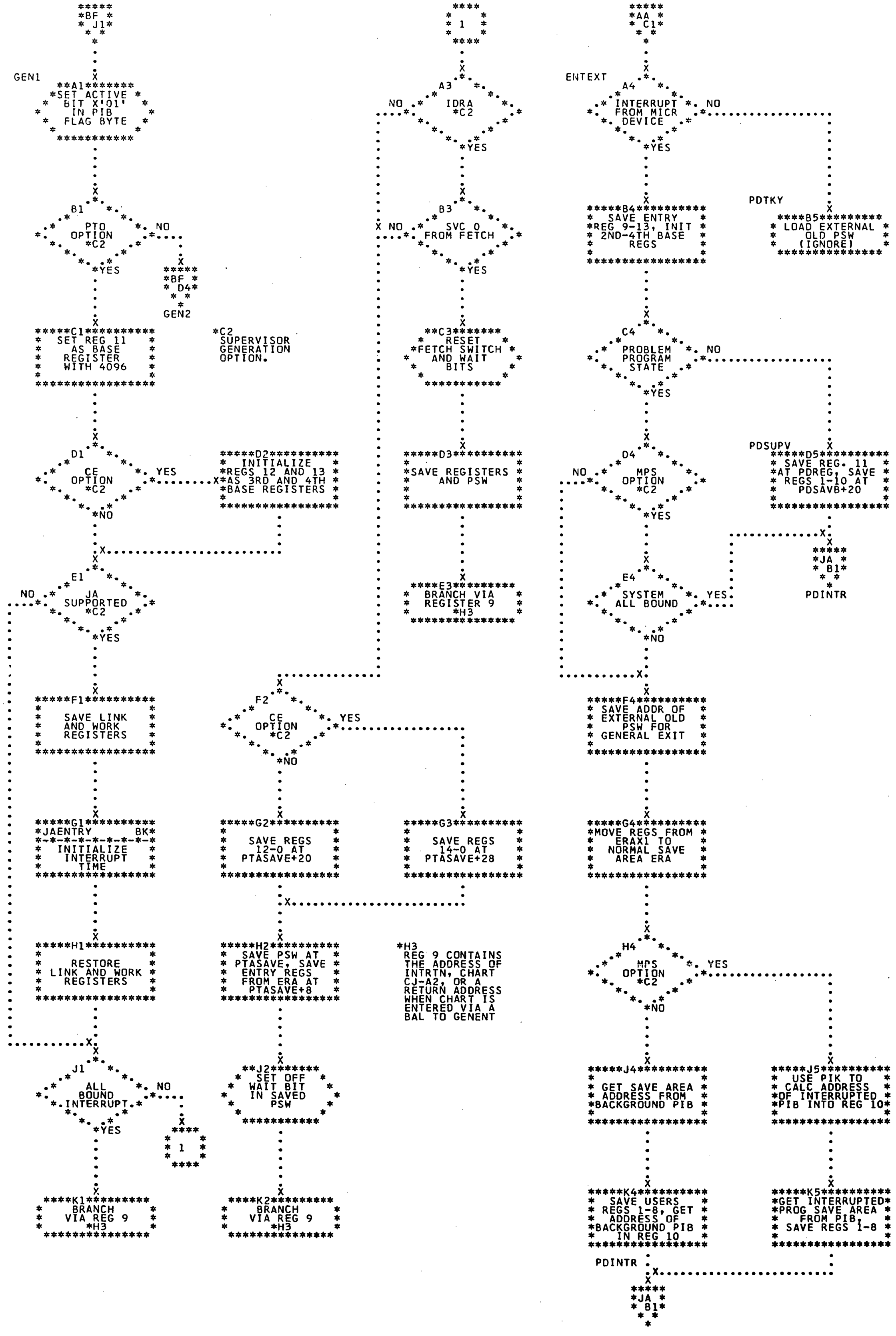
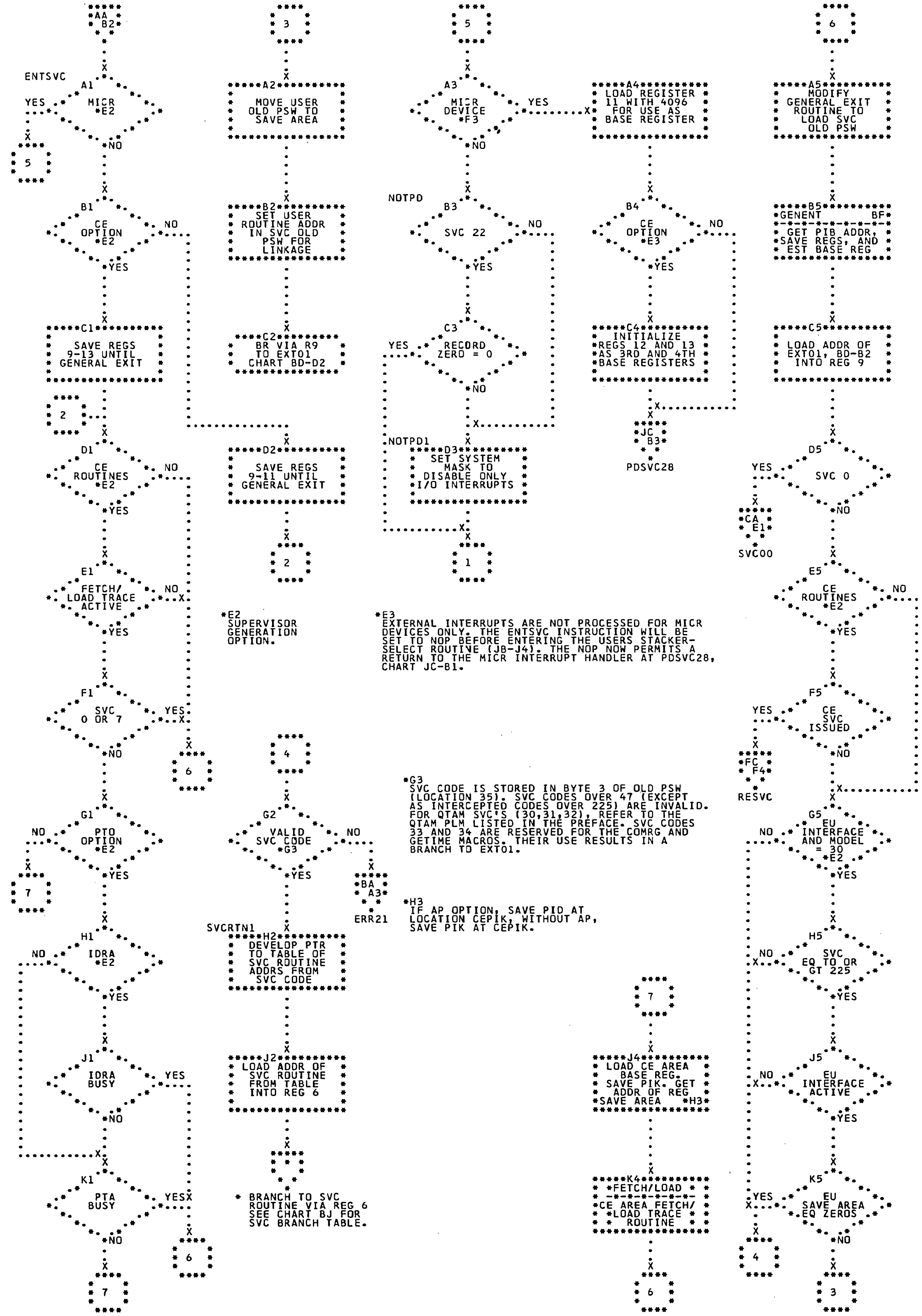


Chart BH. $$A$SUP1 - FOPT Macro, SVC Interrupt Handler Refer to Chart 03.



*E2
SUPERVISOR
GENERATION
OPTION.

*E3
EXTERNAL INTERRUPTS ARE NOT PROCESSED FOR MICR DEVICES ONLY. THE ENTSVC INSTRUCTION WILL BE SET TO NOP BEFORE ENTERING THE USERS STACKER-SELECT ROUTINE (JB-J4). THE NOP NOW PERMITS A RETURN TO THE MICR INTERRUPT HANDLER AT PDSVC28, CHART JC-B1.

*G3
SVC CODE IS STORED IN BYTE 3 OF OLD PSW (LOCATION 35). SVC CODES OVER 47 (EXCEPT AS INTERCEPTED CODES OVER 225) ARE INVALID. FOR QTAM SVC'S (30,31,32), REFER TO THE QTAM PLM LISTED IN THE PREFACE. SVC CODES 33 AND 34 ARE RESERVED FOR THE COMRG AND GETIME MACROS. THEIR USE RESULTS IN A BRANCH TO EXT01.

*H3
IF AP OPTION, SAVE PID AT LOCATION CEPIK, WITHOUT AP, SAVE PIK AT CEPIK.

Chart BJ. $$A$SUP1 - FOPT Macro, Supervisor Call Branch Table

SVC	OPTIONS	LABEL	CHART
0	ALL	SVC00	CA-F1
1	ALL	SVC01	FA-B1
2	ALL	SVC02	FC-B1
3	ALL	SVC03	FF-A1
4	ALL	SVC04	FF-B4
5	ALL	SVC05	FB-B2
6	ALL	SVC06	MM-B4
7	ALL	SVC07	FE-A3
8	ALL	SVC08	FG-A1
9	ALL	SVC09	FG-A2
10	TIMER NO TIMER	SVC10 ERR21	FG-B5 BA-A3
11	ALL	SVC11	FE-B1
12	ALL	SVC12	FA-B2
13	ALL	SVC13	FA-B4
14	ALL	ERR10	BA-A1
15	MPS NO MPS	SVC15	CA-B1 CB-B1
16	PC, NO IT OR OC PC AND IT OR OC NO PC	SXTRT1 SXTRT1 ERR21	FJ-B5 FN-B4 BA-A3
17	PC, NO IT OR OC PC AND IT OR OC NO PC	EXTRT1 EXTRT1 ERR21	FJ-B4 FN-B2 BA-A3
18	TIMER NO TIMER	SVC18 ERR21	FN-B5 BA-A3
19	TIMER NO TIMER	SVC19 ERR21	FN-B3 BA-A3
20	OC RTN NO OC TRN	SXTRT1 ERR21	FN-B4 BA-A3
21	OC RTN NO OC RTN	EXTRT1 ERR21	FN-B2 BA-A3
22	MPS NO MPS	SVC22 EXT01	FH-B1 BD-B2
23	MPS NO MPS	SVC23 ERR21	FH-B3 BA-A3
24	TIMER NO TIMER	SVC24 ERR21	FH-B5 BA-A3
25	BTAM OR OLTEP NO BTAM AND NO OLTEP	SVC25 ERR21	CA-F1 BA-A3

SVC	OPTIONS	LABEL	CHART
26	STOR PROT NO STOR PROT	SVC26 EXT01	FH-B4 BD-B2
27	BTAM NO BTAM	SVC27 EXT01	CA-F1 BD-B2
28	MICR NO MICR	PDSVC28 ERR21	JC-B3 BA-A3
29	MICR NO MICR	SVC29 ERR21	FB-B3 BA-A3
30 TO 32	RESERVED FOR QTAM; REFER TO QTAM PLM LISTED IN PREFACE		———
33,34	RESERVED FOR COMRG AND GETIME MACROS		———
35	TRKHLD NO TRKHLD	SVC35 ERR21	MA-A1 BA-A3
36	TRKHLD NO TRKHLD	SVC36 ERR21	MB-A1 BA-A3
37	AB NO AB	SVC37 ERR21	MC-A4 BA-A3
38	AP NO AP	SVC38 ERR21	MD-A1 BA-A3
39	AP NO AP	SVC39 ERR21	ME-A1 BA-A3
40	AP NO AP	SVC40 ERR21	MG-A1 BA-A3
41	AP NO AP	SVC41 ERR21	MH-A1 BA-A3
42	AP NO AP	SVC42 ERR21	MG-A4 BA-A3
43	ERROR OR MCRR NO ERRLOG AND NO MCRR	SDRSDR ERR21	LF-C5 BA-A3
44	ERRLOG OR MCRR NO ERRLOG AND MCRR	SDROBR ERR21	LF-C4 BA-A3
45	EMULATOR INTERFACE NO EMULATOR INTERFACE	SVC45 ERR21	FR-B1 BA-A3
46	OLTEP INTERFACE NO OLTEP INTERFACE	SVC46 ERR21	FR-F4 BA-A3
47	WAITF FOR MICR DEVICES	SVC29	FB-B3
50	USED BY LIOCS FOR ERROR RECOVERY	———	———
51	OLTEP NO OLTEP	SVC51 ERR21	FS-B2 BA-A3

Chart BK. $$A$SUP1 - FOPT Macro, Job Accounting Timer Update Routine

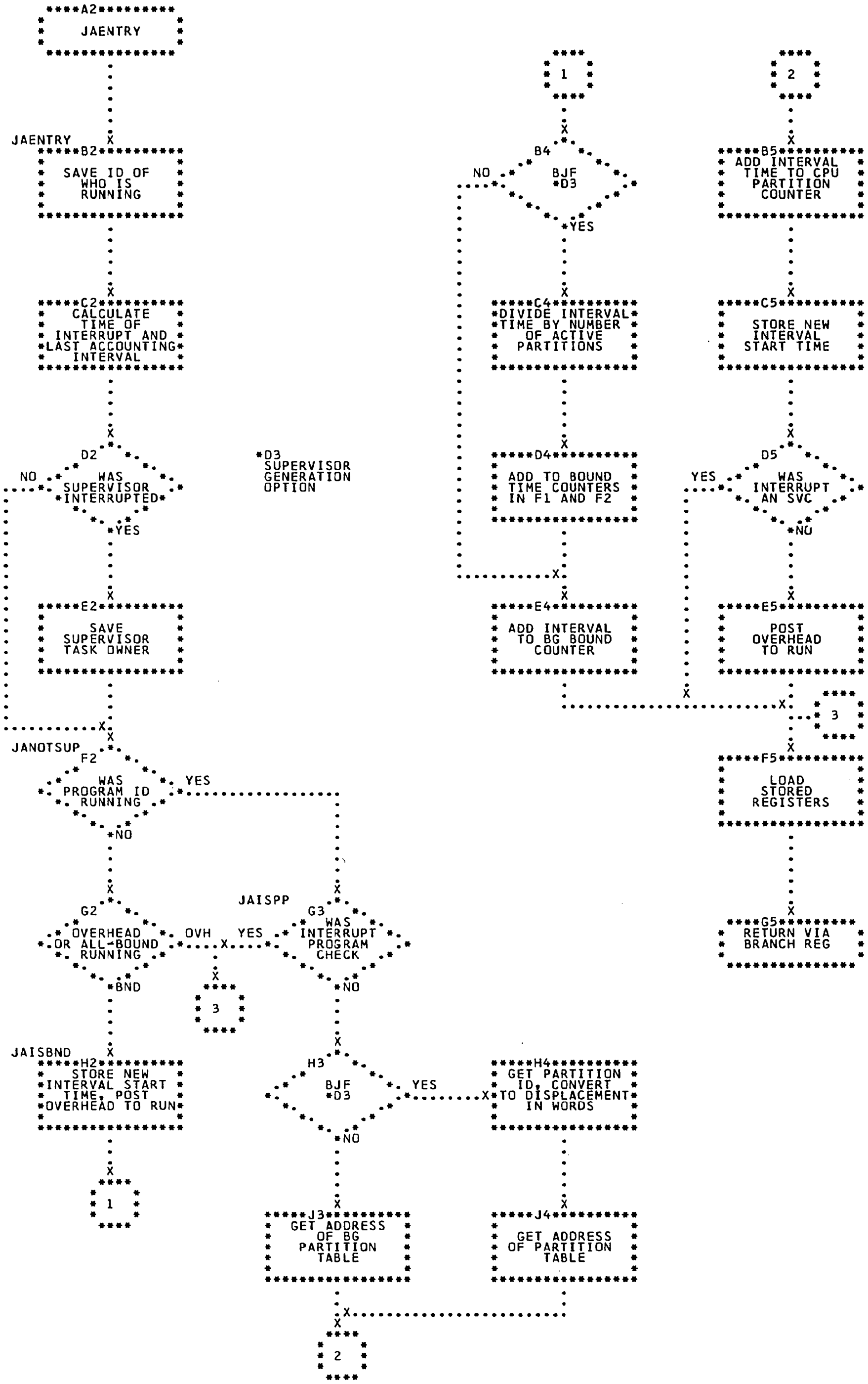


Chart BL. $$A$SUP1 - FOPT Macro, Job Accounting Calculation Routine

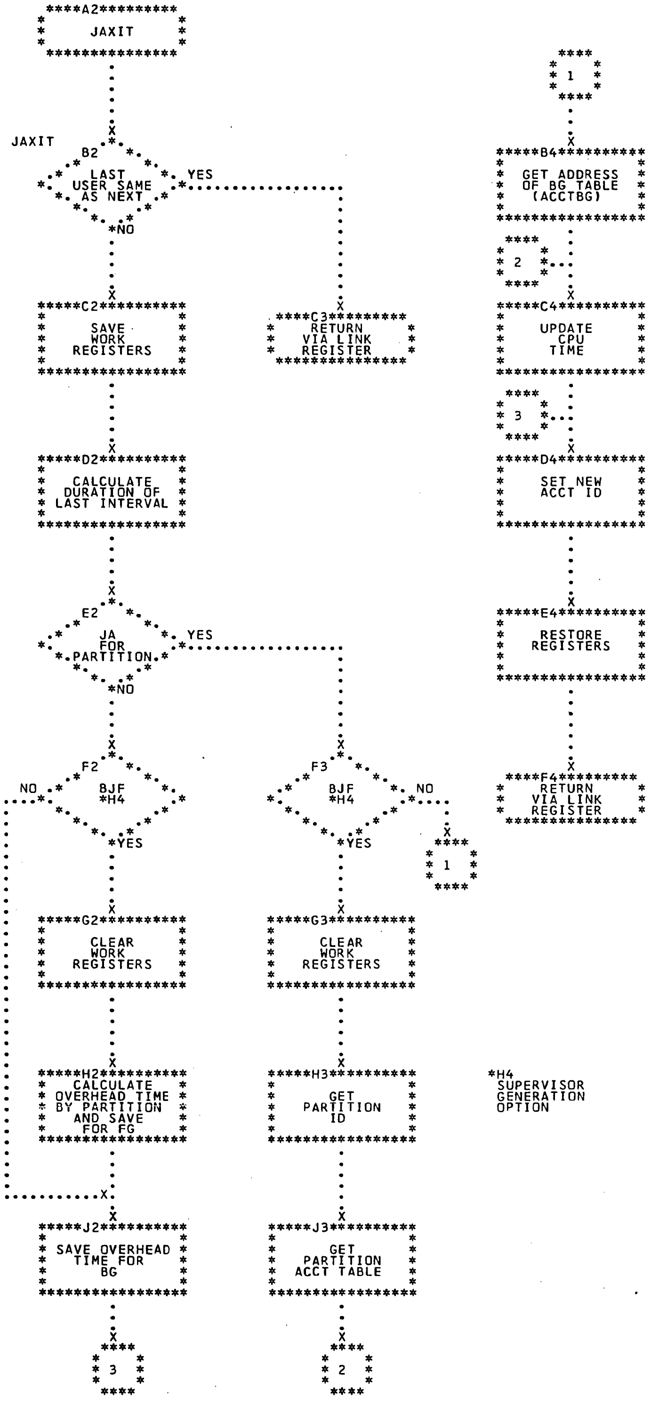


Chart CA. $$A$SUP1 - SGTCHS Macro, Channel Scheduler with MPS (Part 1 of 2) Refer to Chart 04.

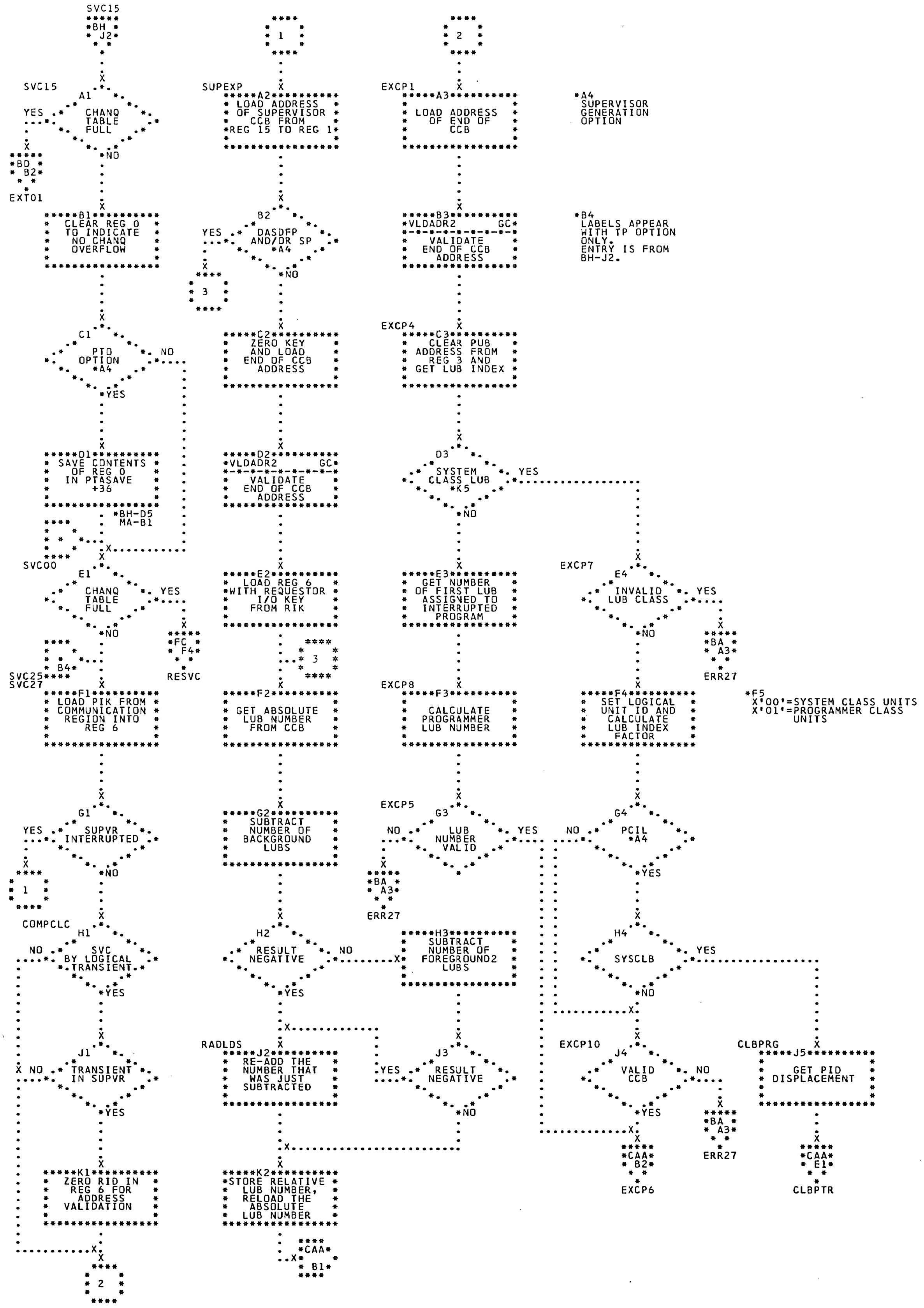
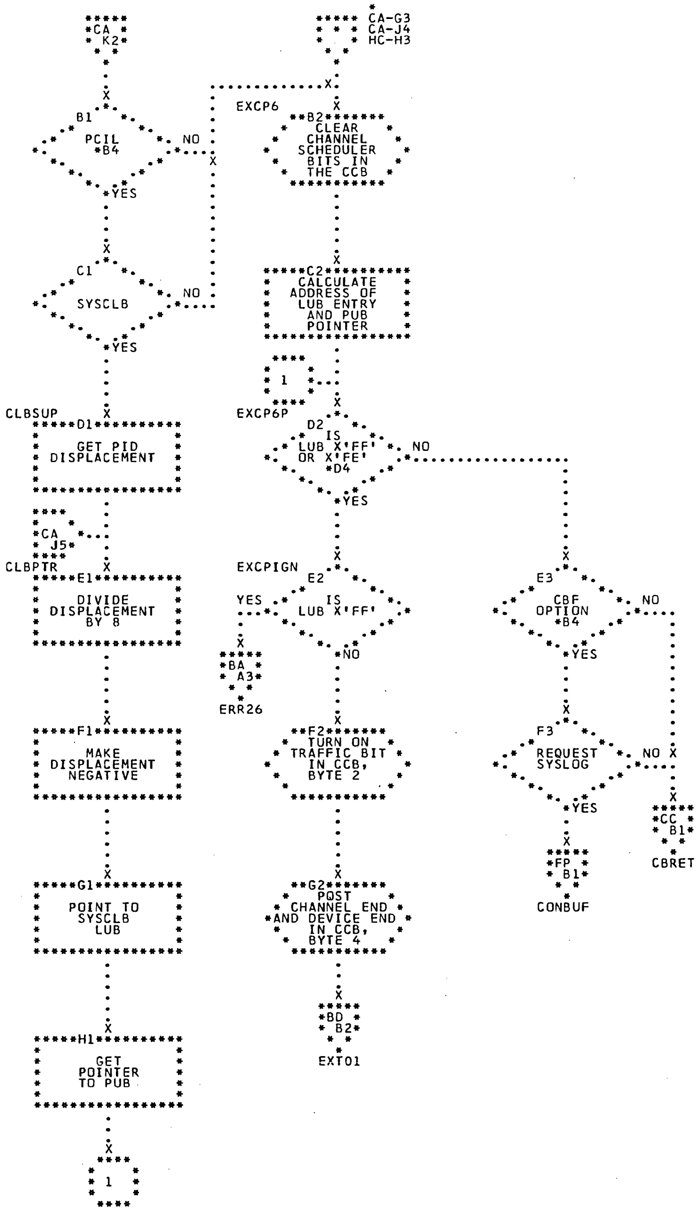


Chart CAA. $$A$SUP1 - SGTCHS Macro, Channel Scheduler with MPS (Part 2 of 2)
Refer to Chart 04.



*B4
SUPERVISOR
GENERATION
OPTION

*D4
X'FF' = UNASSIGNED
X'FE' = IGNORE

Chart CB. $$A$SUP1 - SGTCHS Macro, Channel Scheduler without MPS
Refer to Chart 04.

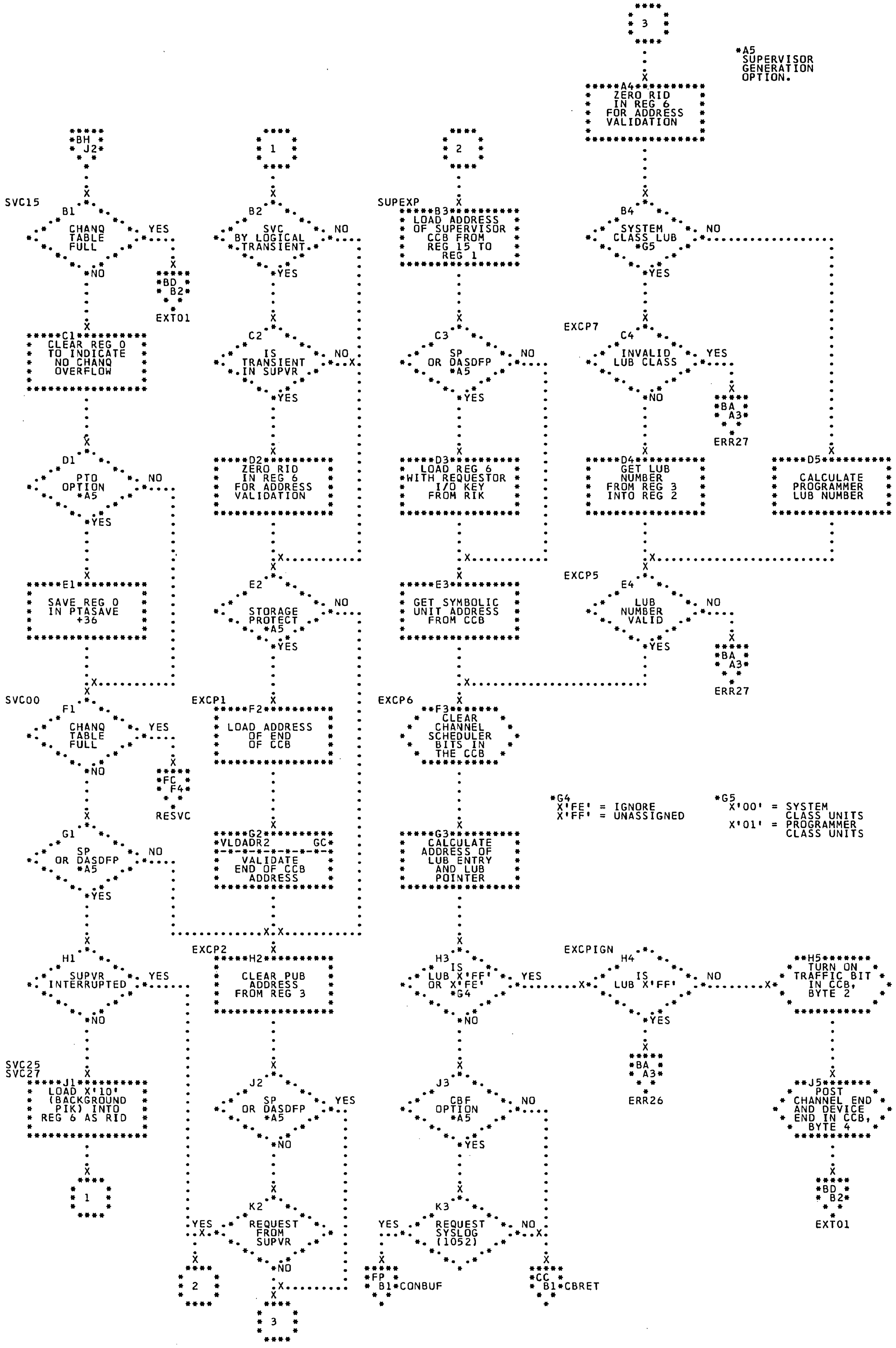


Chart CC. $$A$SUP1 - SGTCHS Macro, Channel Scheduler (Part 1 of 3)
Refer to Chart 04.

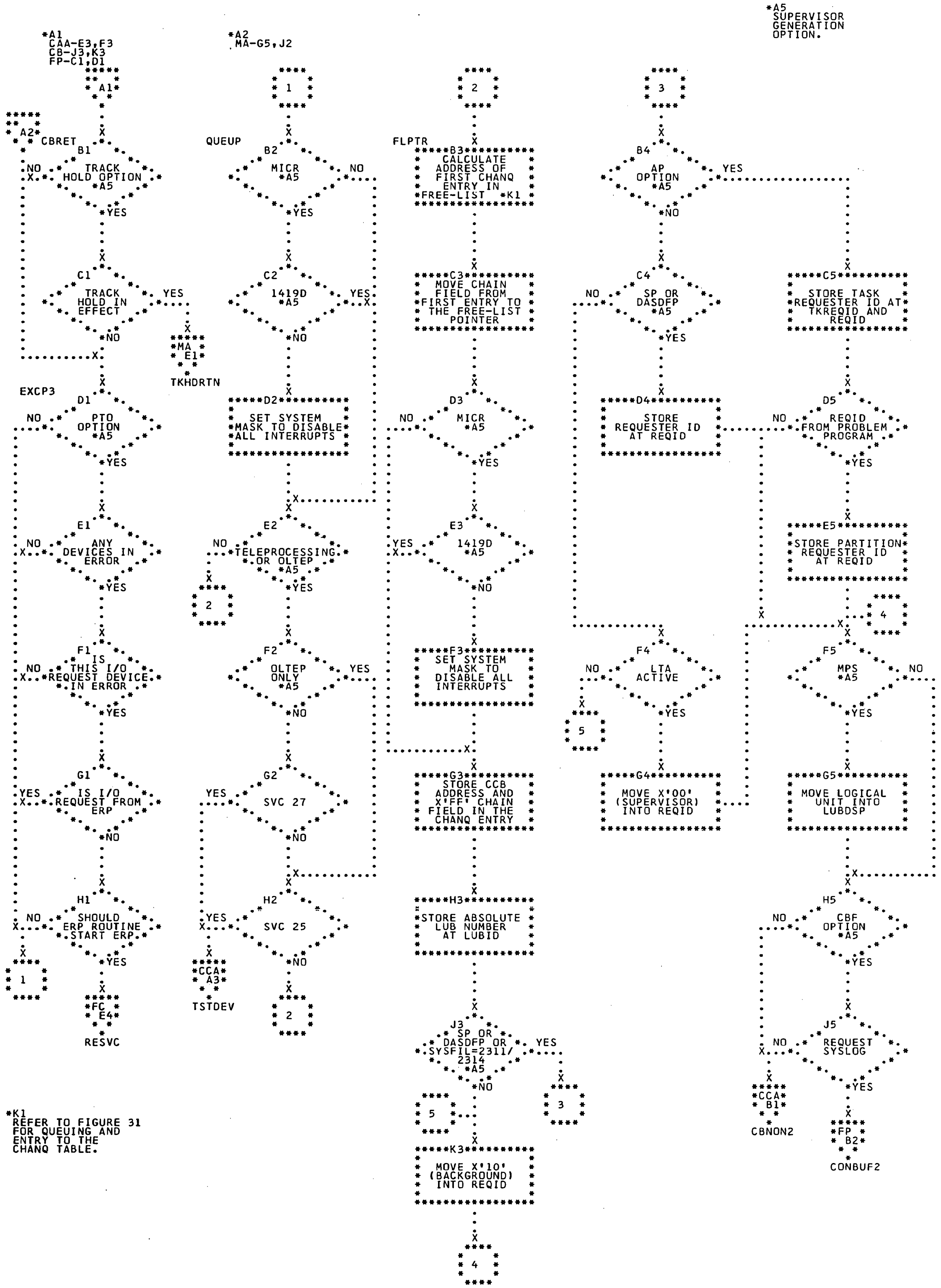


Chart CCA. $$A$SUP1 - SGTCHS Macro, Channel Scheduler (Part 2 of 3)
Refer to Chart 04.

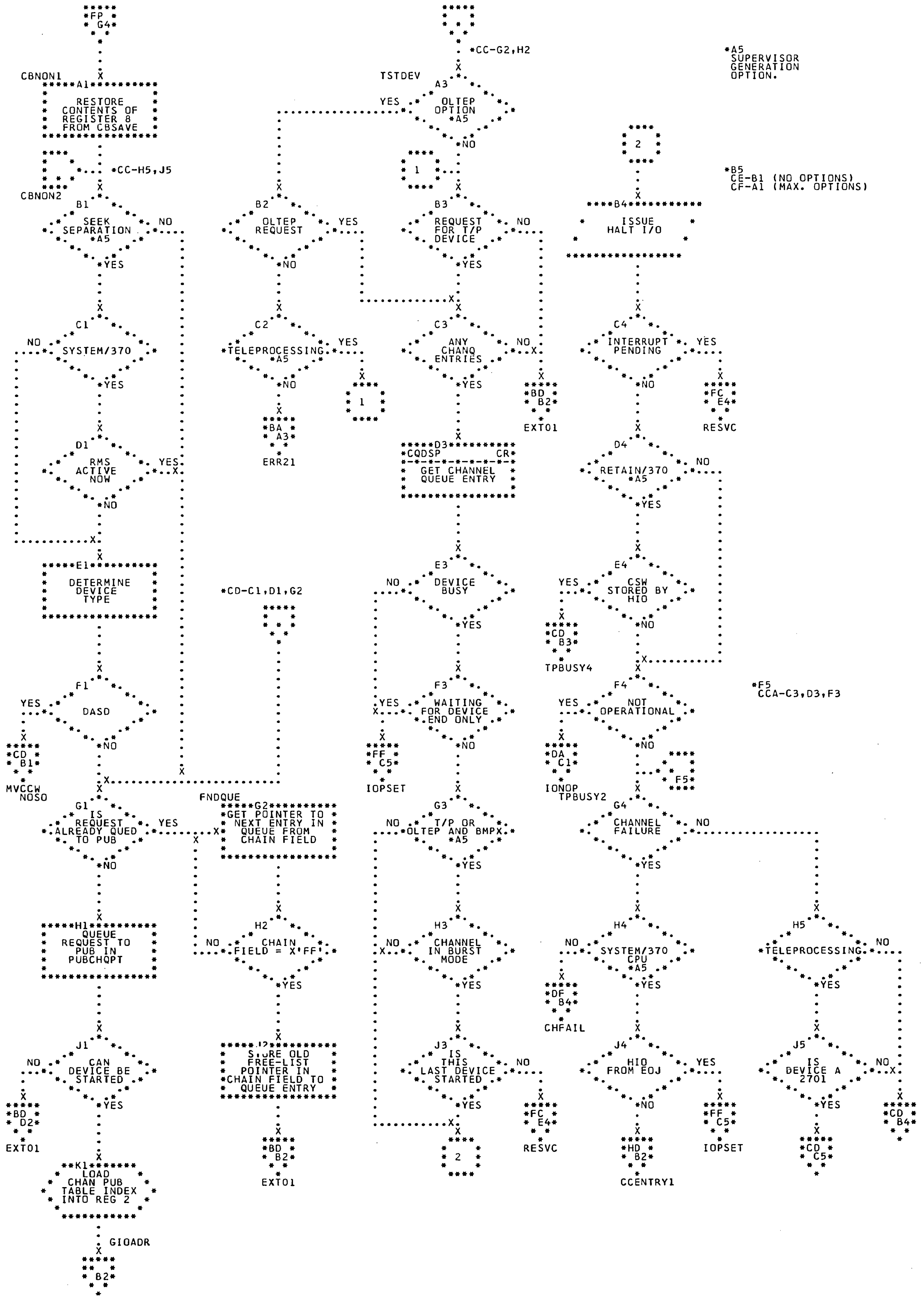
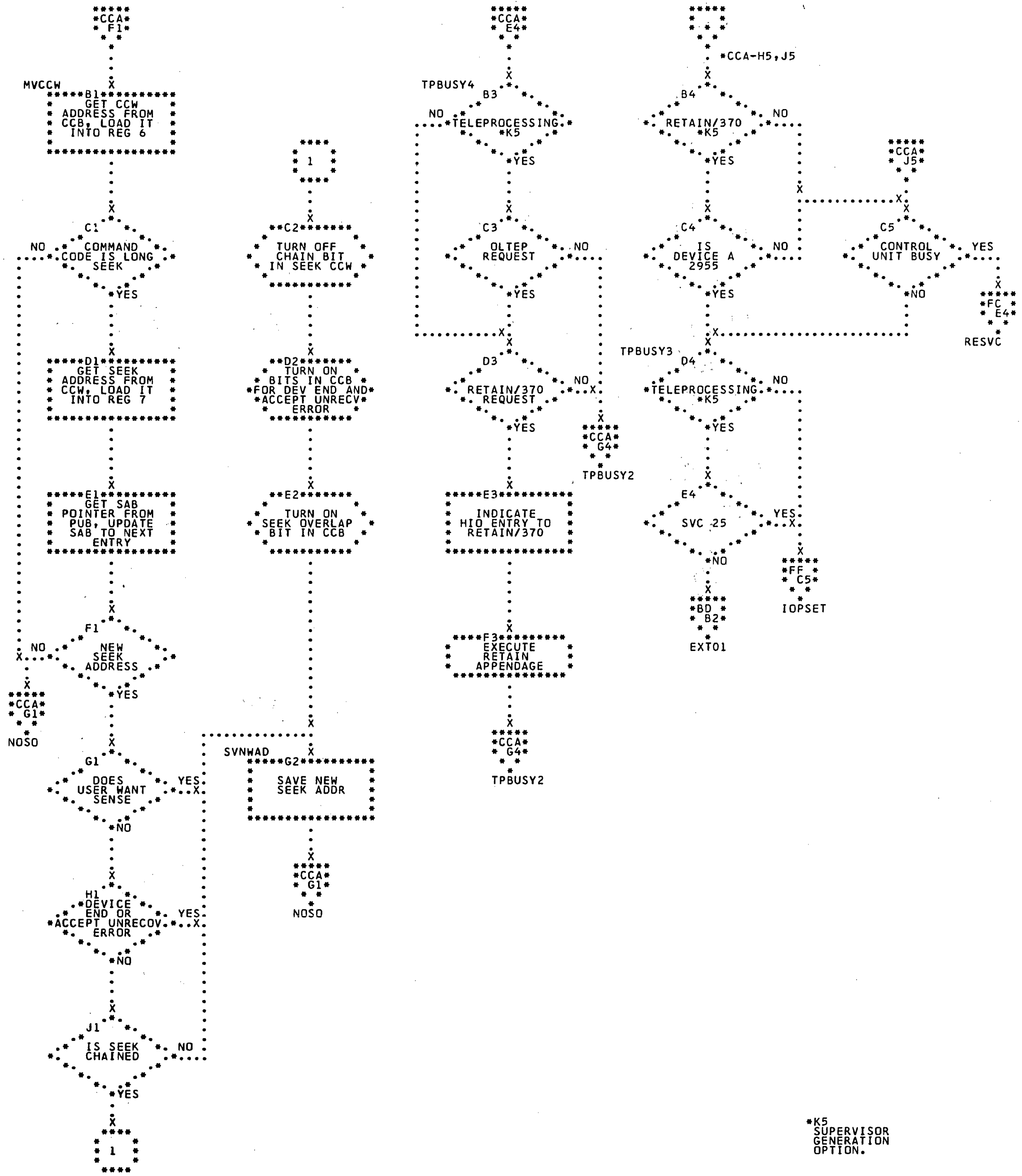


Chart CD. $$A$SUP1 - SGTCHS Macro, Channel Scheduler (Part 3 of 3)
Refer to Chart 04.



*K5 SUPERVISOR GENERATION OPTION.

Chart CE. $$A$SUP1 - SGTCHS Macro, Start I/O -- No Options, UNCOMMON Routine Refer to Chart 04.

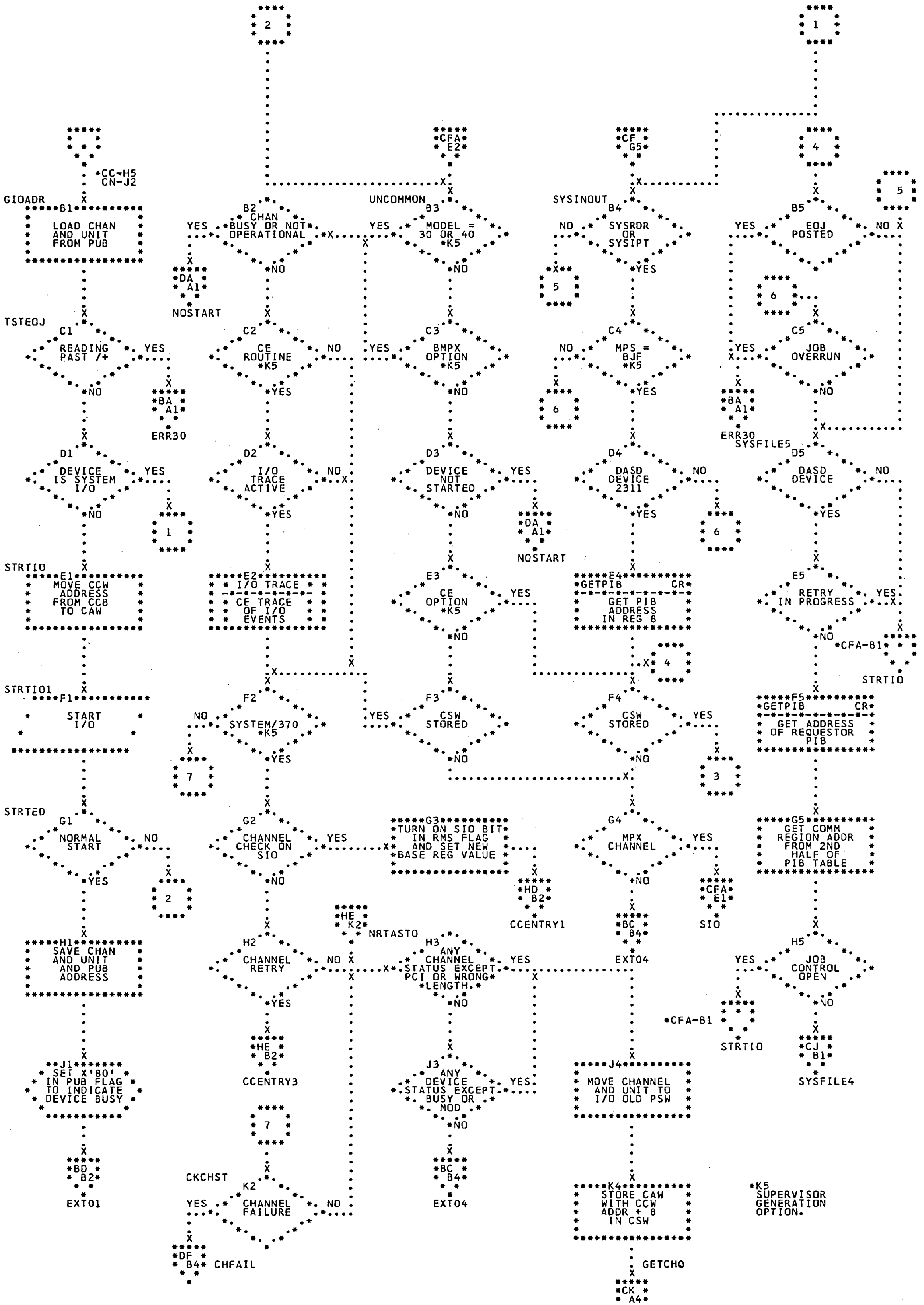


Chart CF. $$A$SUP1 - SGTCHS Macro, Start I/O -- Maximum Options (Part 1 of 5)
Refer to Chart 04.

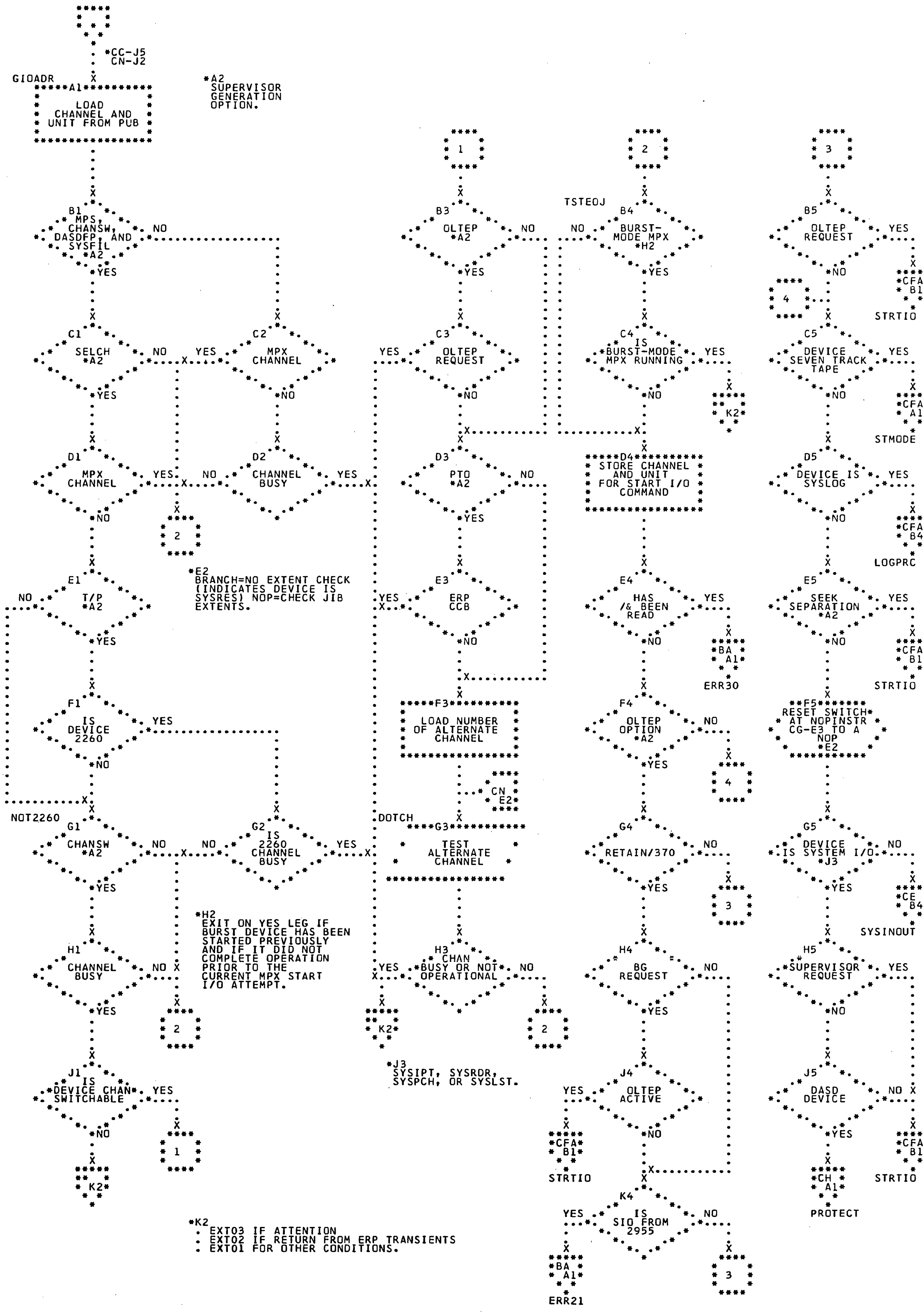


Chart CFA. $$A$SUP1 - SGTCHS Macro, Start I/O -- Maximum Options (Part 2 of 5) Refer to Chart 04.

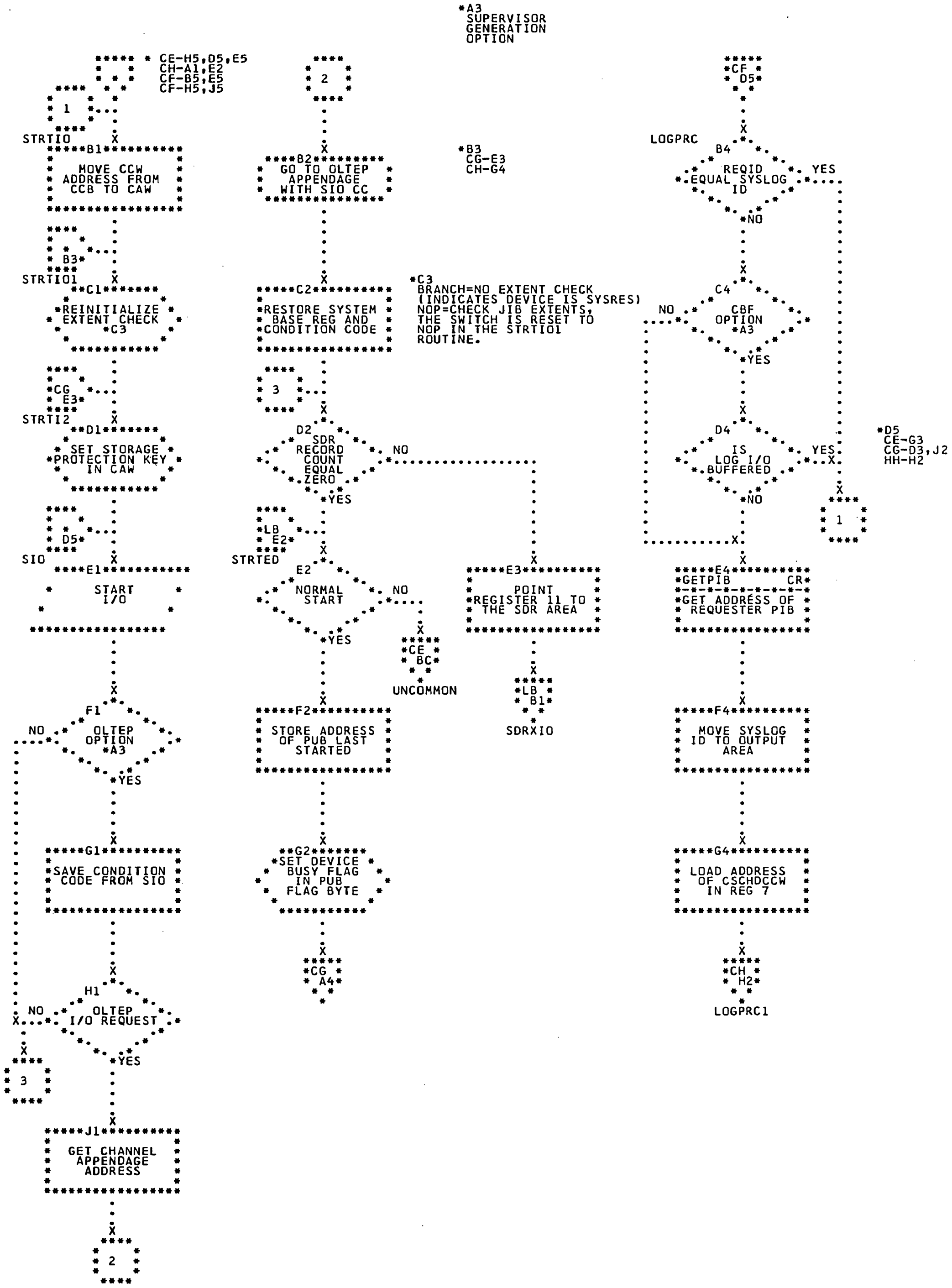


Chart CG. $$A$SUP1 - SGTCHS Macro, Start I/O -- Maximum Options (Part 3 of 5) Refer to Chart 04.

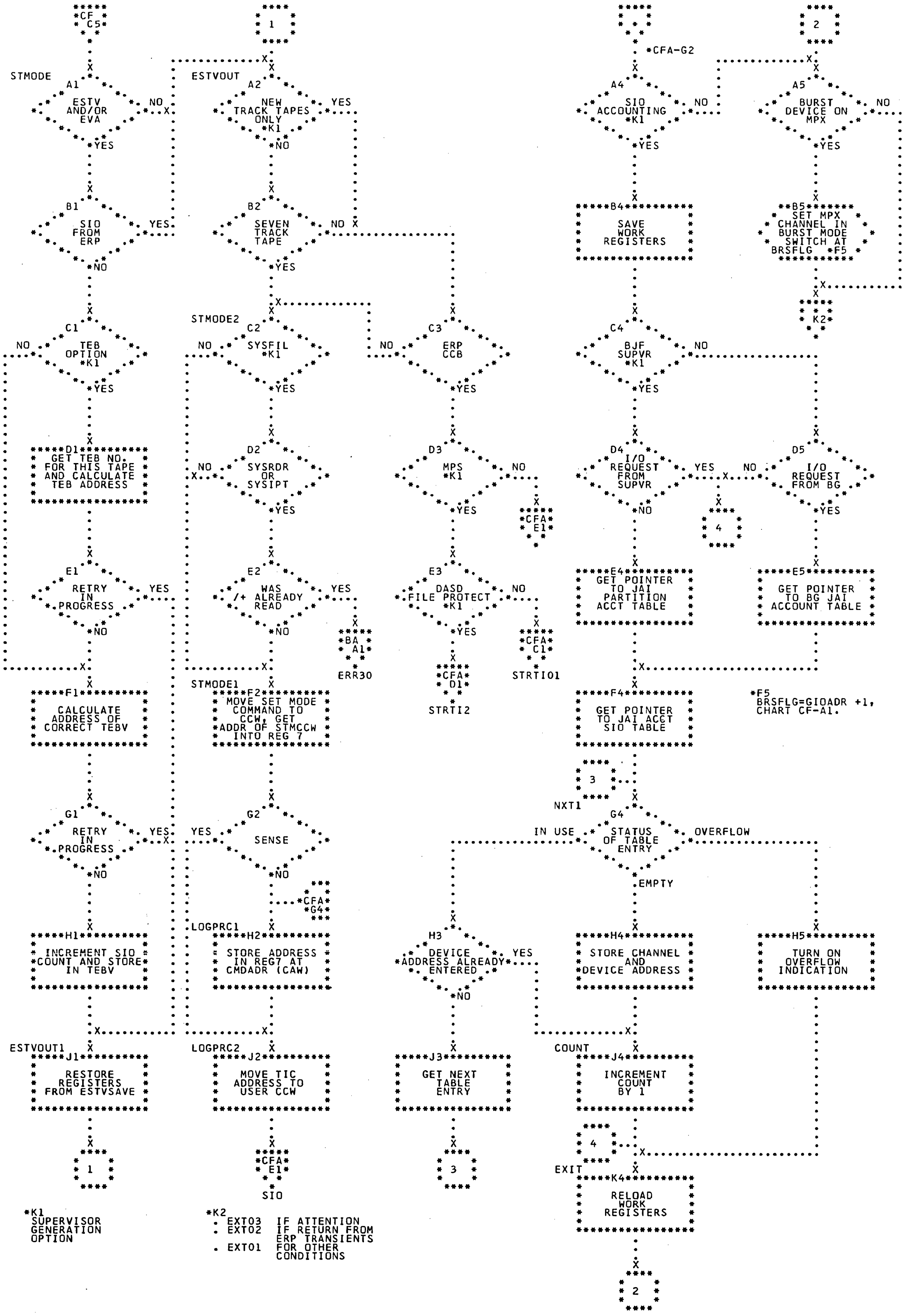


Chart CH. $$A$SUP1 - SGTCHS Macro, Start I/O -- Maximum Options (Part 4 of 5) Refer to Chart 04.

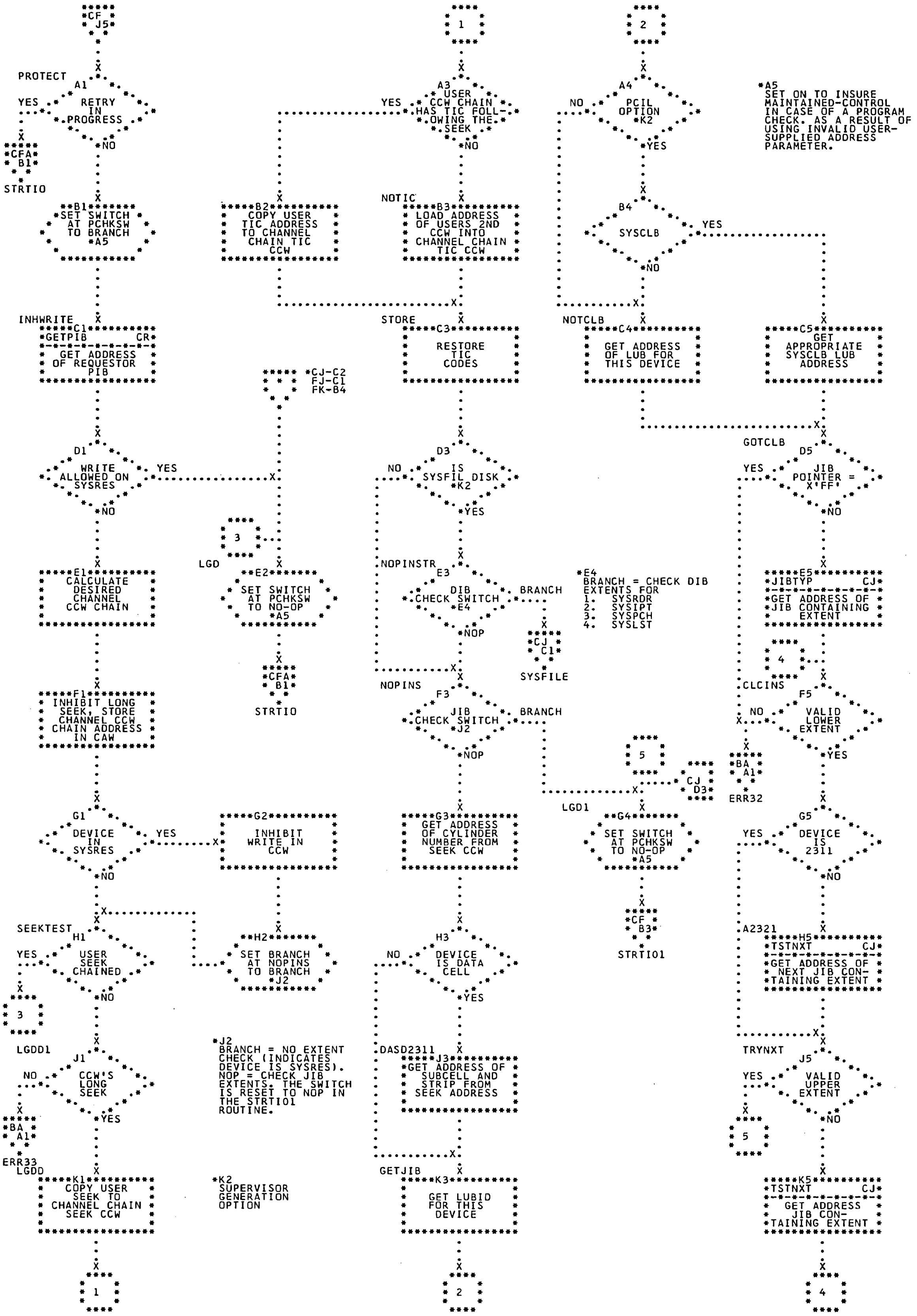
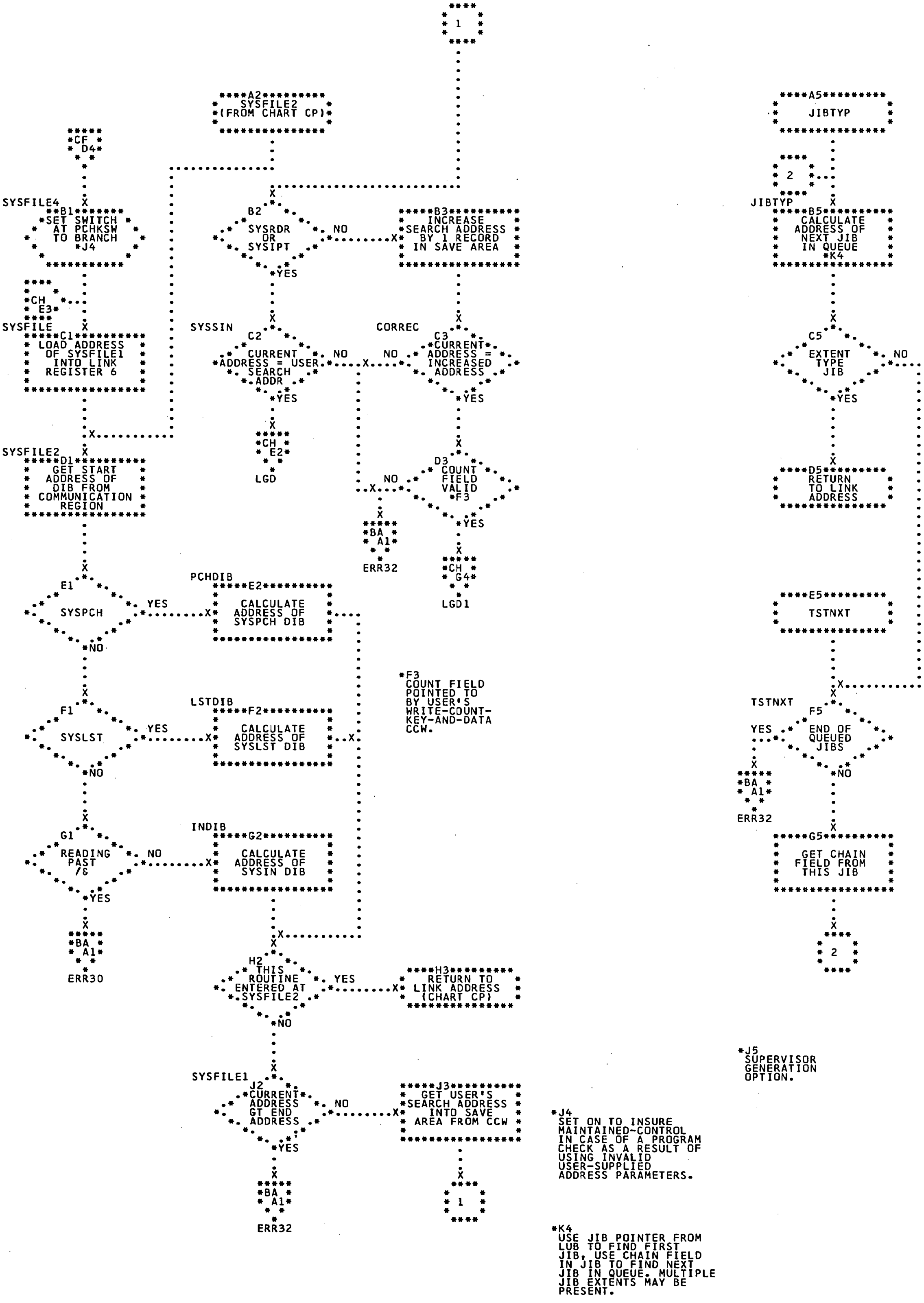


Chart CJ. $$A$SUP1 - SGTCHS Macro, Start I/O -- Maximum Options (Part 5 of 5)
Refer to Chart 04.



*F3
COUNT FIELD POINTED TO BY USER'S WRITE-COUNT-KEY-AND-DATA CCW.

*J5
SUPERVISOR GENERATION OPTION.

*J4
SET ON TO INSURE MAINTAINED-CONTROL IN CASE OF A PROGRAM CHECK AS A RESULT OF USING INVALID USER-SUPPLIED ADDRESS PARAMETERS.

*K4
USE JIB POINTER FROM LUB TO FIND FIRST JIB, USE CHAIN FIELD IN JIB TO FIND NEXT JIB IN QUEUE. MULTIPLE JIB EXTENTS MAY BE PRESENT.

Chart CK. $$A$SUP1 - SGTCHS Macro, I/O Interrupt (Part 1 of 7) Refer to Chart 04.

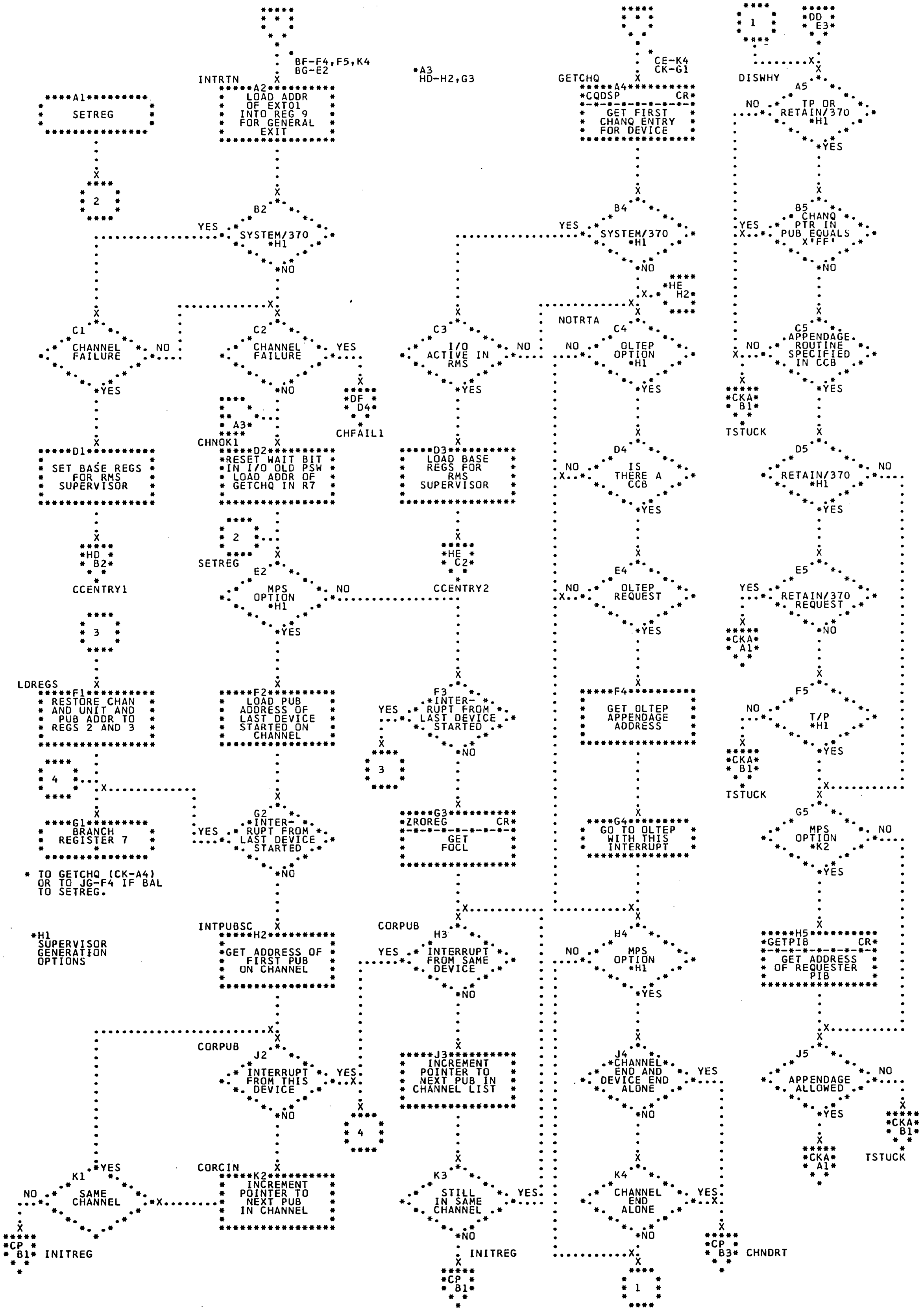


Chart CKA. $$A$SUP1 - SGTCHS Macro, I/O Interrupt (Part 2 of 7)
Refer to Chart 04.

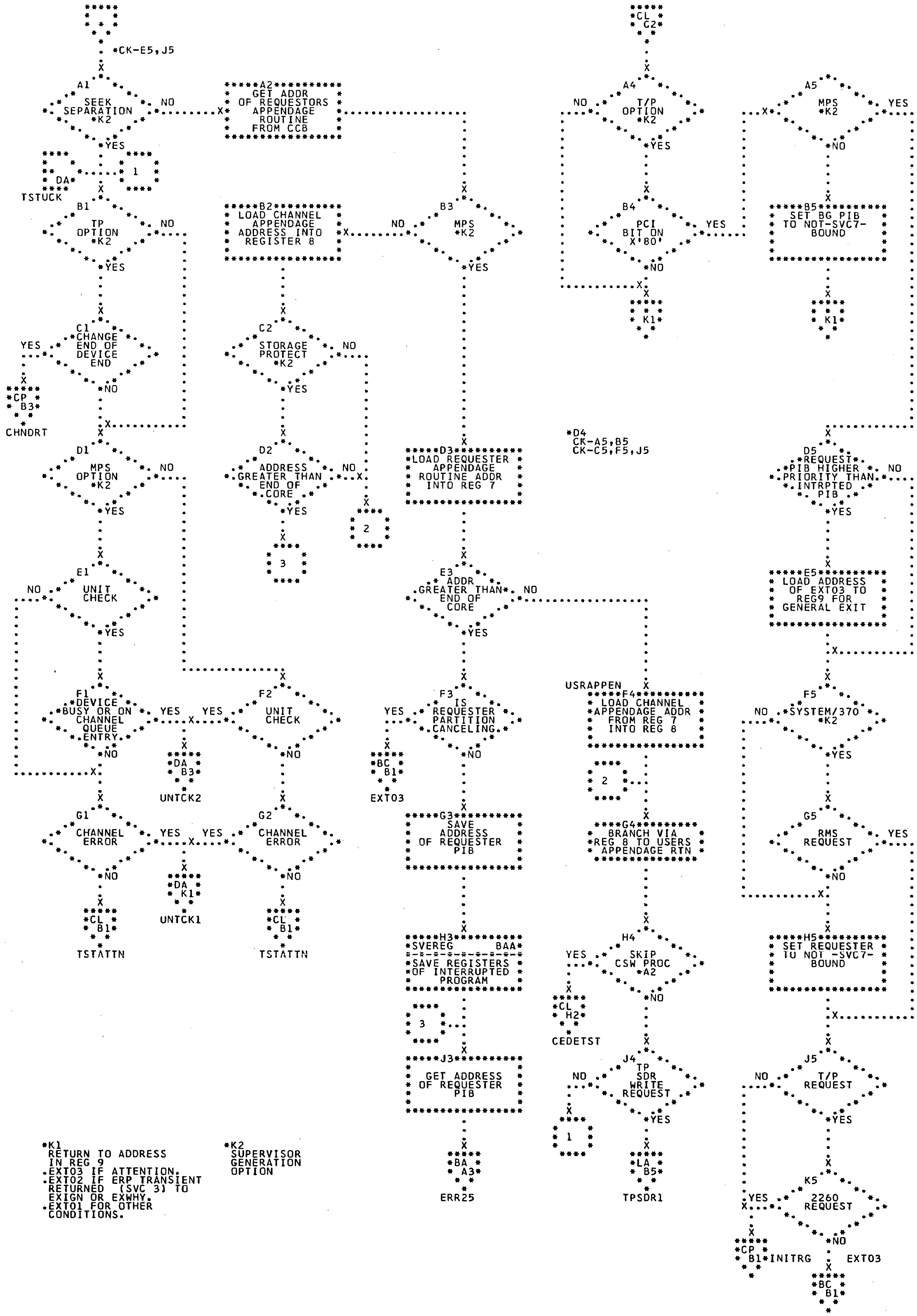
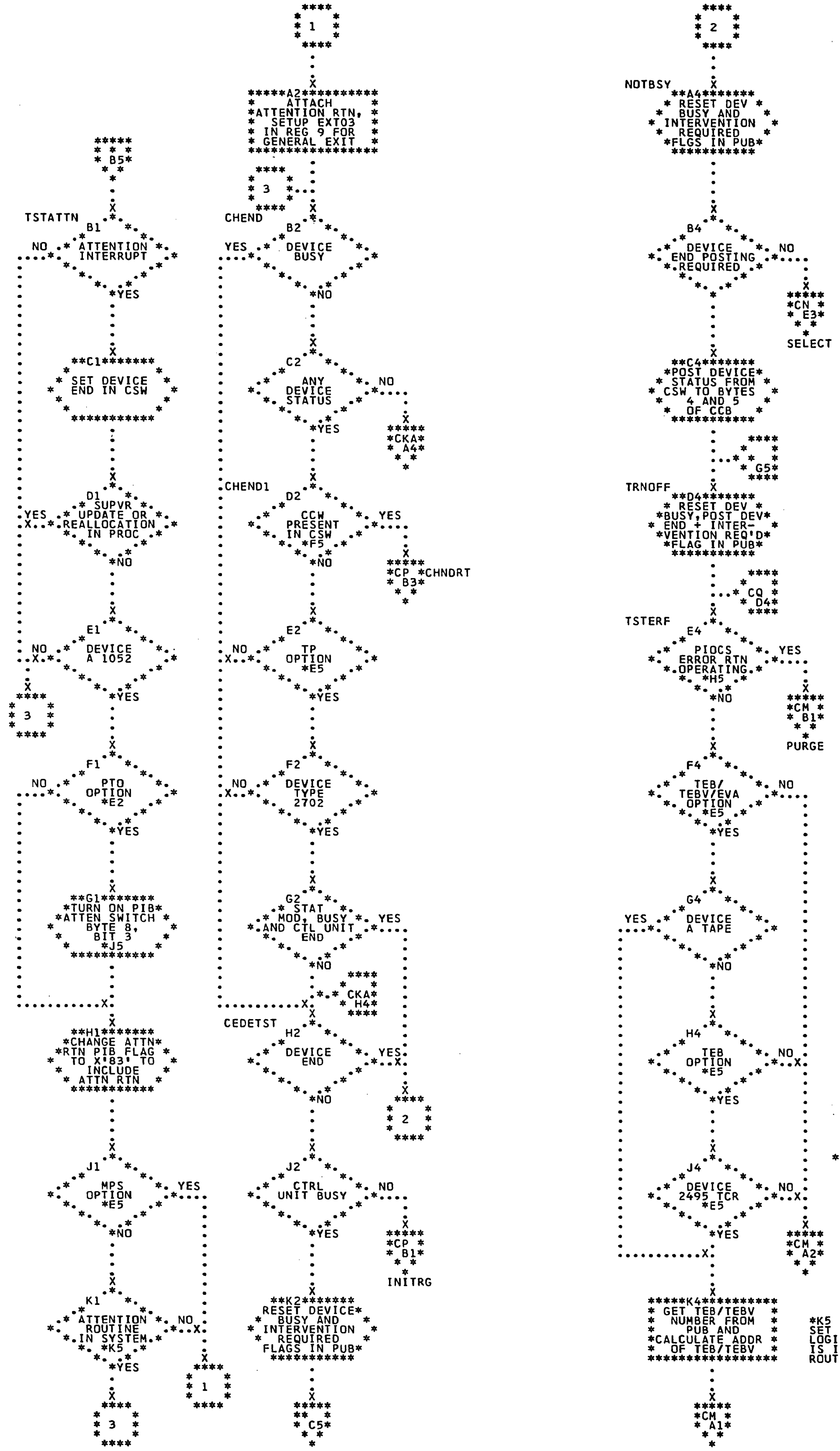


Chart CL. $$A$SUP1 - SGTCHS Macro, I/O Interrupt (Part 3 of 7) Refer to Chart 04.



*B5
CKA-G1,G2
DA-K1
DB-A2
DD-C4

*C5
RETURN TO ADDR
IN REG 9
- EXT03 IF ATTENTION.
- EXT02 IF ERP TRANSIENT RETURNED (SVC 3) TO EXIGN OR EXWHY.
- EXT01 FOR OTHER CONDITIONS.

*E5
SUPERVISOR GENERATION OPTION.

*F5
IF ADDRESS NOT PRESENT = DEVICE END ONLY. IF PRESENT = CHANNEL END.

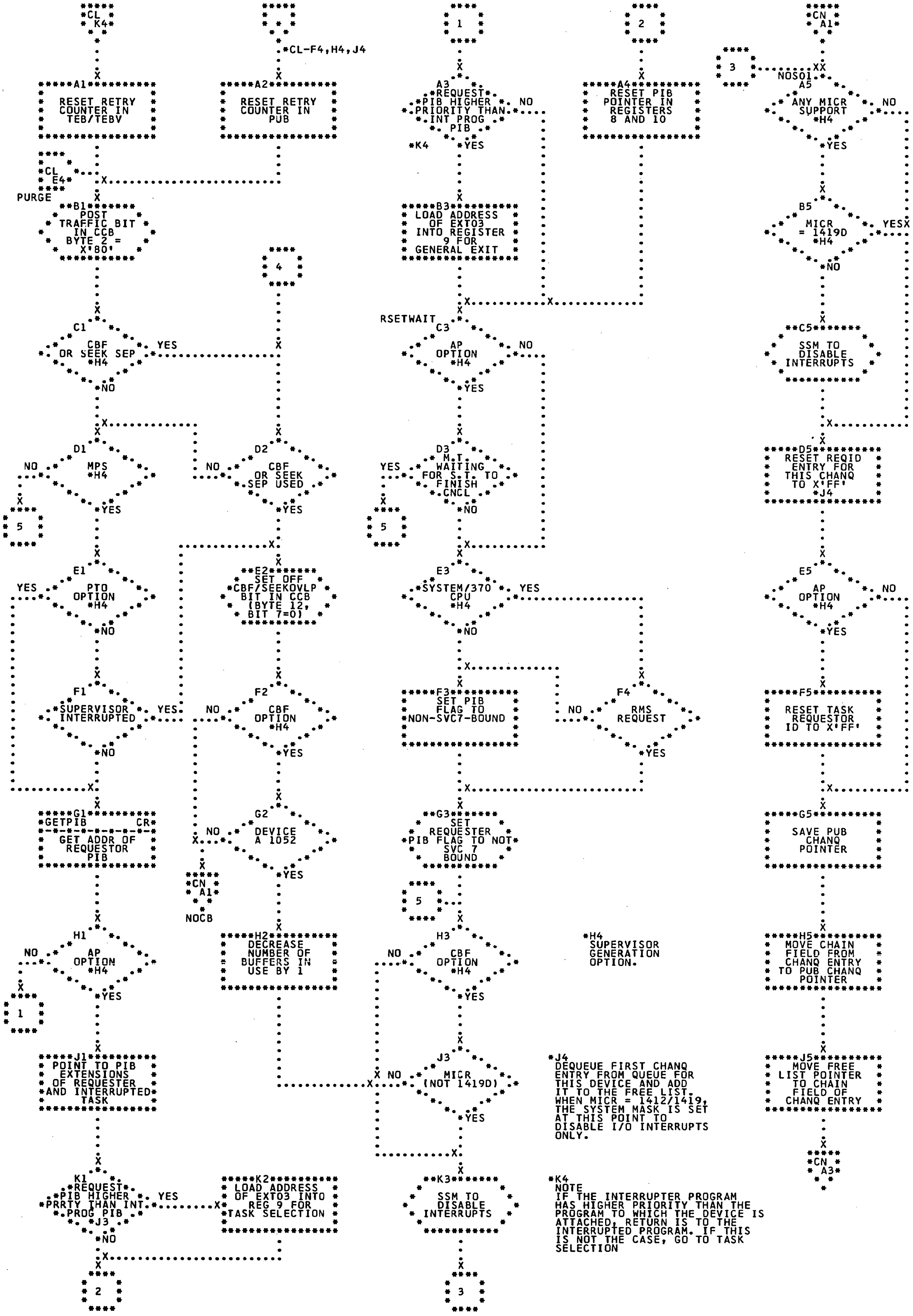
*G5
CQ-B4
FF-E5,H5
JG-F4
HH-F4

*H5
X'80' IN BYTE 12 OF CCB.

*J5
PTAFTCH FOR $$ANERRY, Z, 0.

*K5
SET TO BRANCH IF LOGICAL TRANSIENT IS IN ATTENTION ROUTINE

Chart CM. $$A$SUP1 - SGTCHS Macro, I/O Interrupt (Part 4 of 7)
Refer to Chart 04.

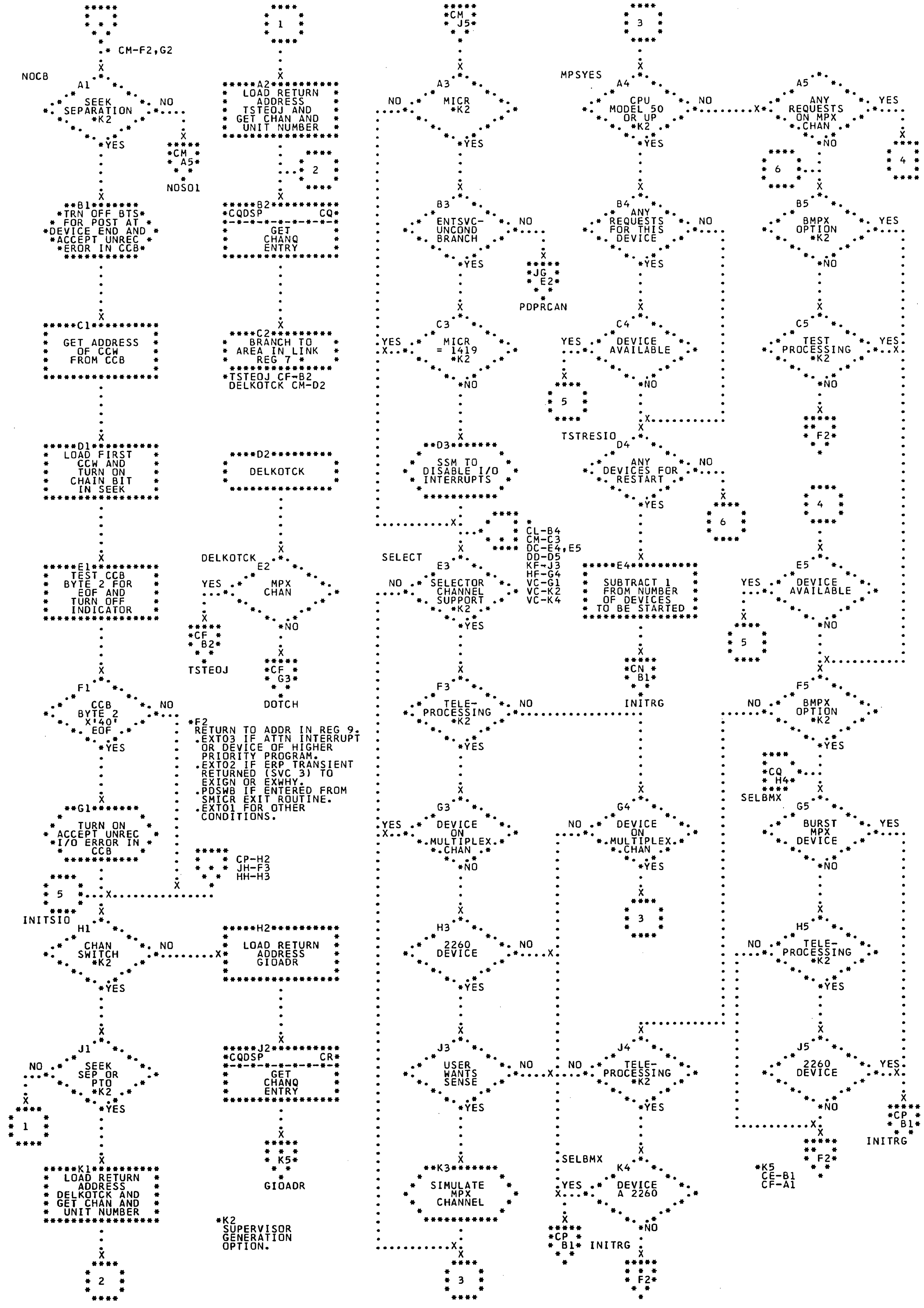


*H4
SUPERVISOR GENERATION OPTION.

*J4
DEQUEUE FIRST CHANQ ENTRY FROM QUEUE FOR THIS DEVICE AND ADD IT TO THE FREE LIST. WHEN MICR = 1412/1419, THE SYSTEM MASK IS SET AT THIS POINT TO DISABLE I/O INTERRUPTS ONLY.

*K4
NOTE
IF THE INTERRUPTER PROGRAM HAS HIGHER PRIORITY THAN THE PROGRAM TO WHICH THE DEVICE IS ATTACHED, RETURN IS TO THE INTERRUPTED PROGRAM. IF THIS IS NOT THE CASE, GO TO TASK SELECTION

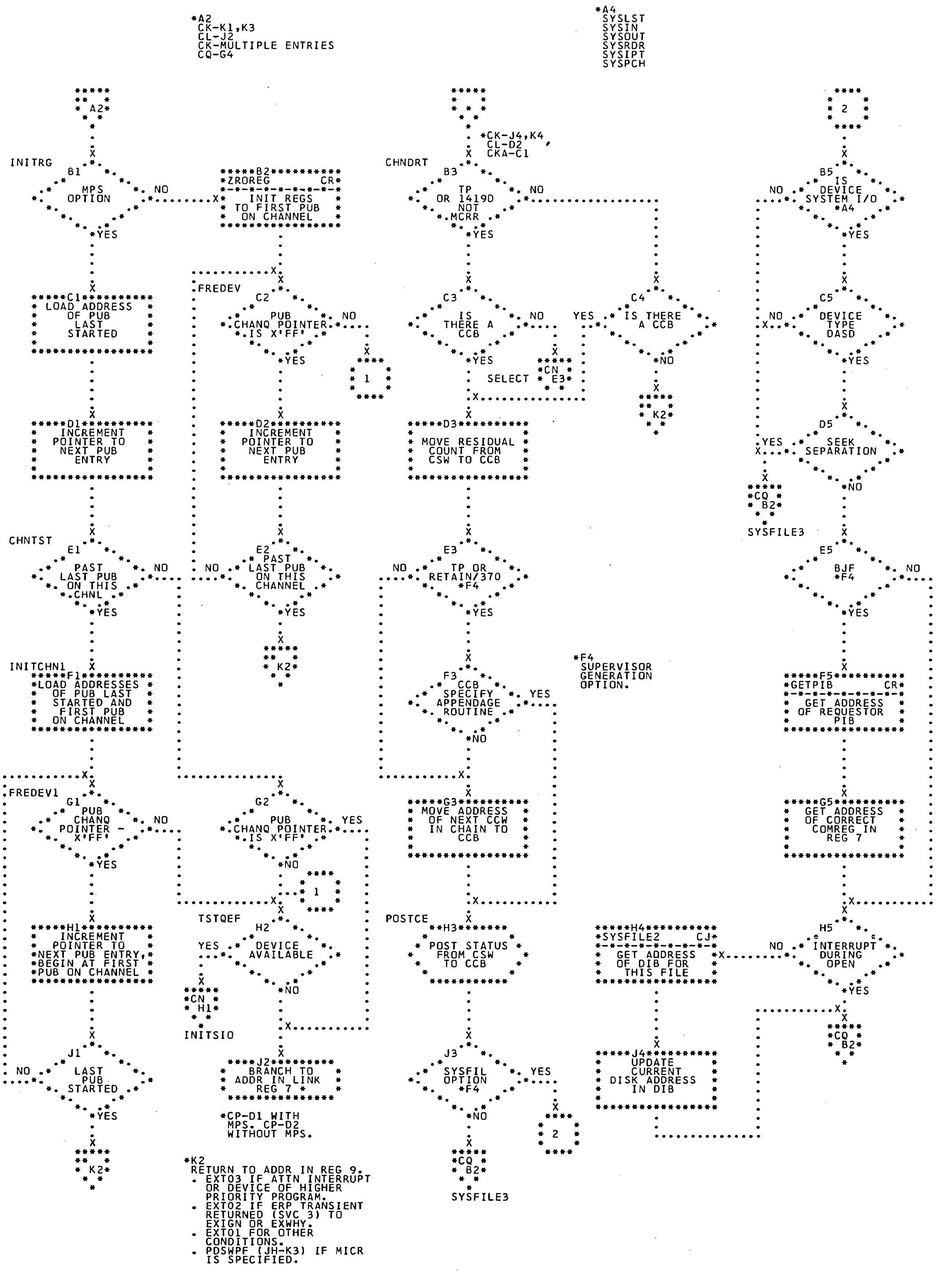
Chart CN. $$A$SUP1 - SGTCHS Macro, I/O Interrupt (Part 5 of 7)
Refer to Chart 04.



*F2
RETURN TO ADDR IN REG 9.
.EXTO3 IF ATTN INTERRUPT OR DEVICE OF HIGHER PRIORITY PROGRAM.
.EXTO2 IF ERP TRANSIENT RETURNED (SVC 3) TO EXIGN OR EXWHY.
.PDSWB IF ENTERED FROM SMICR EXIT ROUTINE.
.EXTO1 FOR OTHER CONDITIONS.

*K2
SUPERVISOR GENERATION OPTION.

Chart CP. $$A$SUP1 - SGTCHS Macro, I/O Interrupt (Part 6 of 7)
Refer to Chart 04.



*A2
CK-K1,K3
CL-J2
CK-MULTIPLE ENTRIES
CQ-G4

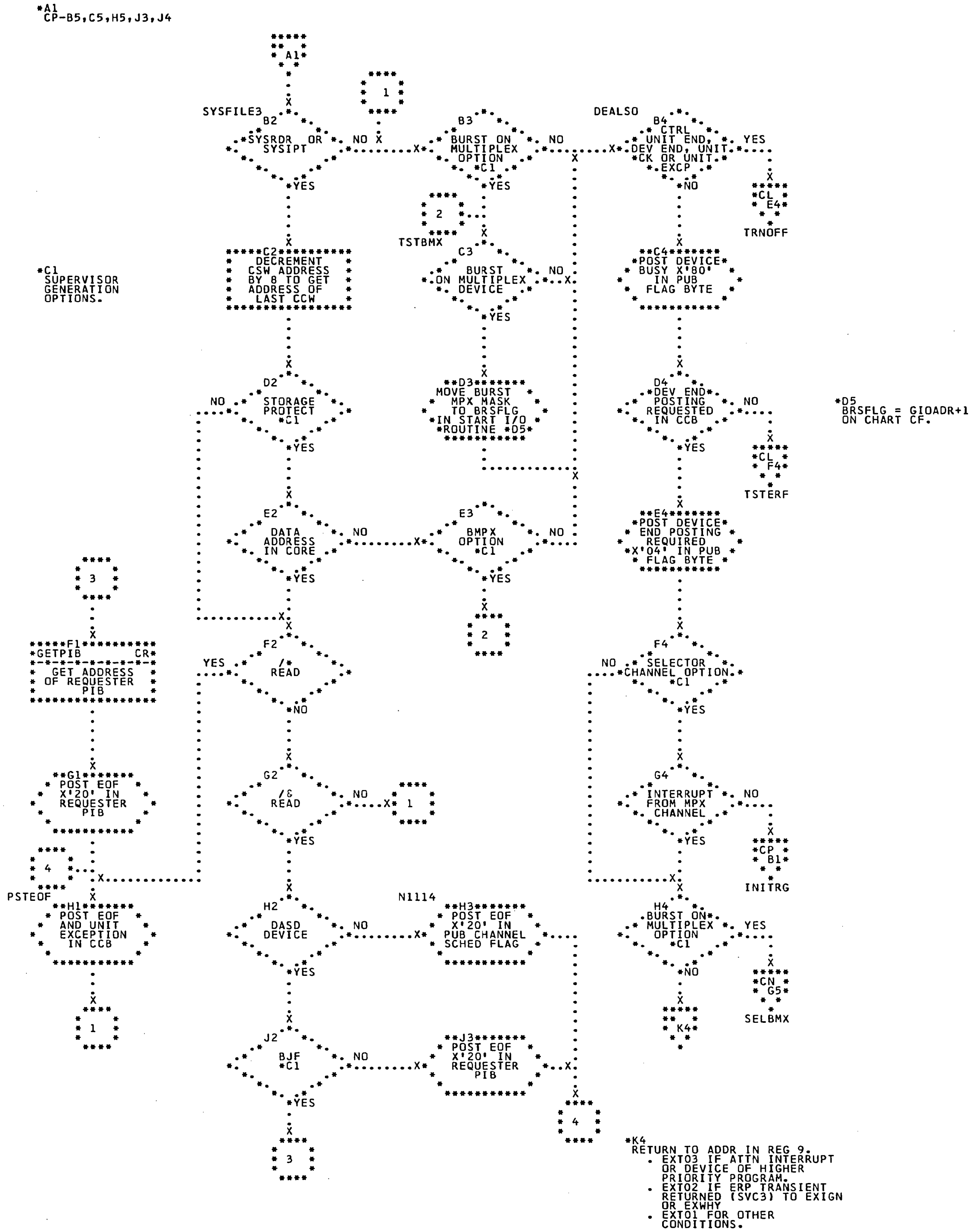
*A4
SYSLST
SYSIN
SYSOUT
SYSRDR
SYSIPT
SYSPCH

*F4
SUPERVISOR
GENERATION
OPTION.

*CP-D1 WITH
MPS. CP-D2
WITHOUT MPS.

*K2
RETURN TO ADDR IN REG 9.
- EXT03 IF ATTN INTERRUPT OR DEVICE OF HIGHER PRIORITY PROGRAM.
- EXT02 IF ERP TRANSIENT RETURNED (SVC 3) TO EXIGN OR EXWHY.
- EXT01 FOR OTHER CONDITIONS.
- PDSWPF (JH-K3) IF MICR IS SPECIFIED.

Chart CQ. $$A$SUP1 - SGTCHS Macro, I/O Interrupt (Part 7 of 7) Refer to Chart 04.



*A1
CP-B5,C5,H5,J3,J4

*C1
SUPERVISOR
GENERATION
OPTIONS.

*D5
BRSFLG = GIOADR+1
ON CHART CF.

*K4
RETURN TO ADDR IN REG 9.
. EXT03 IF ATTN INTERRUPT OR DEVICE OF HIGHER PRIORITY PROGRAM.
. EXT02 IF ERP TRANSIENT RETURNED (SVC3) TO EXIGN OR EXWHY
. EXT01 FOR OTHER CONDITIONS.

Chart CR. $$A$SUP1 - SGTCHS Macro, I/O Interrupt Subroutines
Refer to Chart 04.

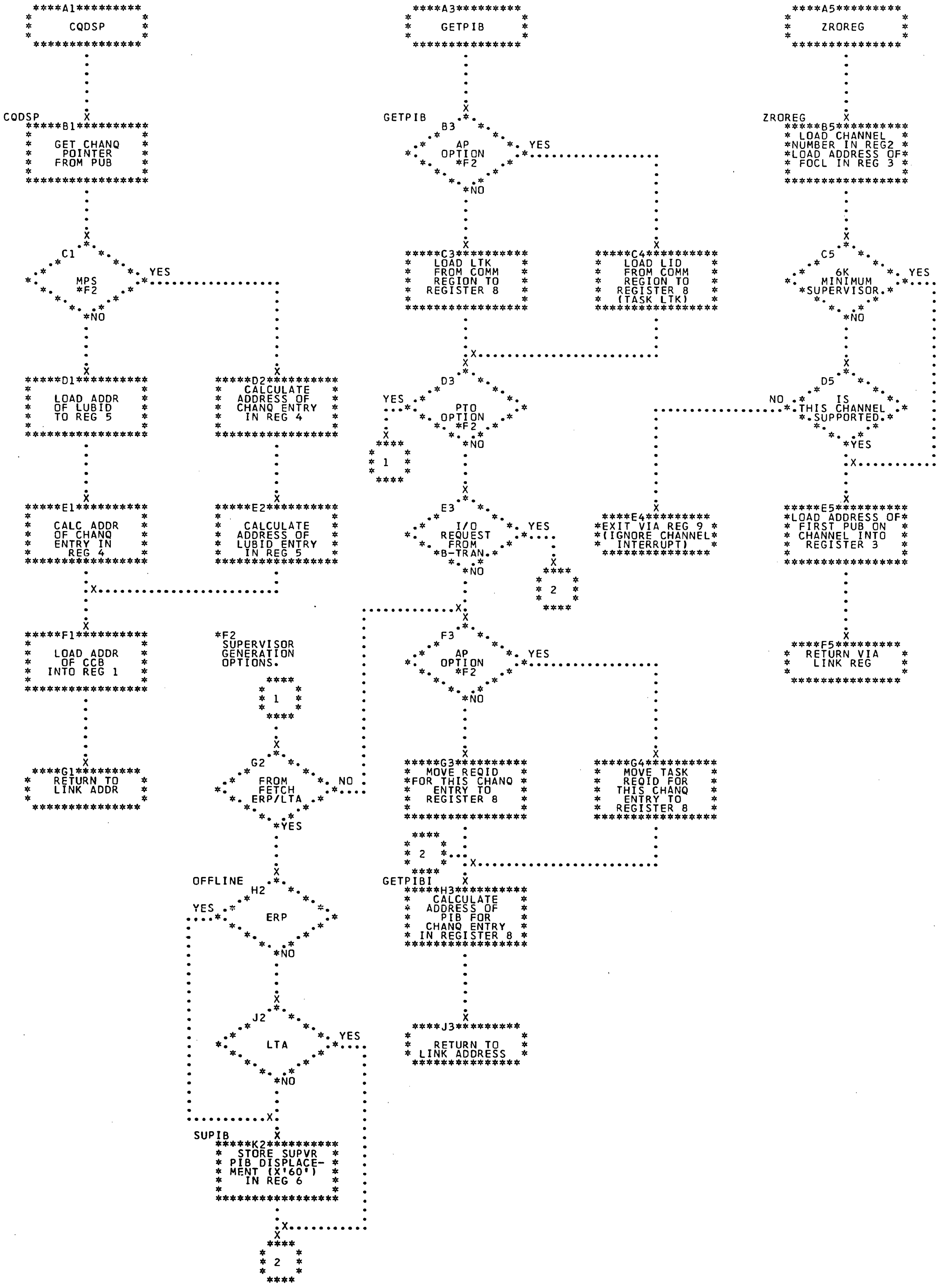
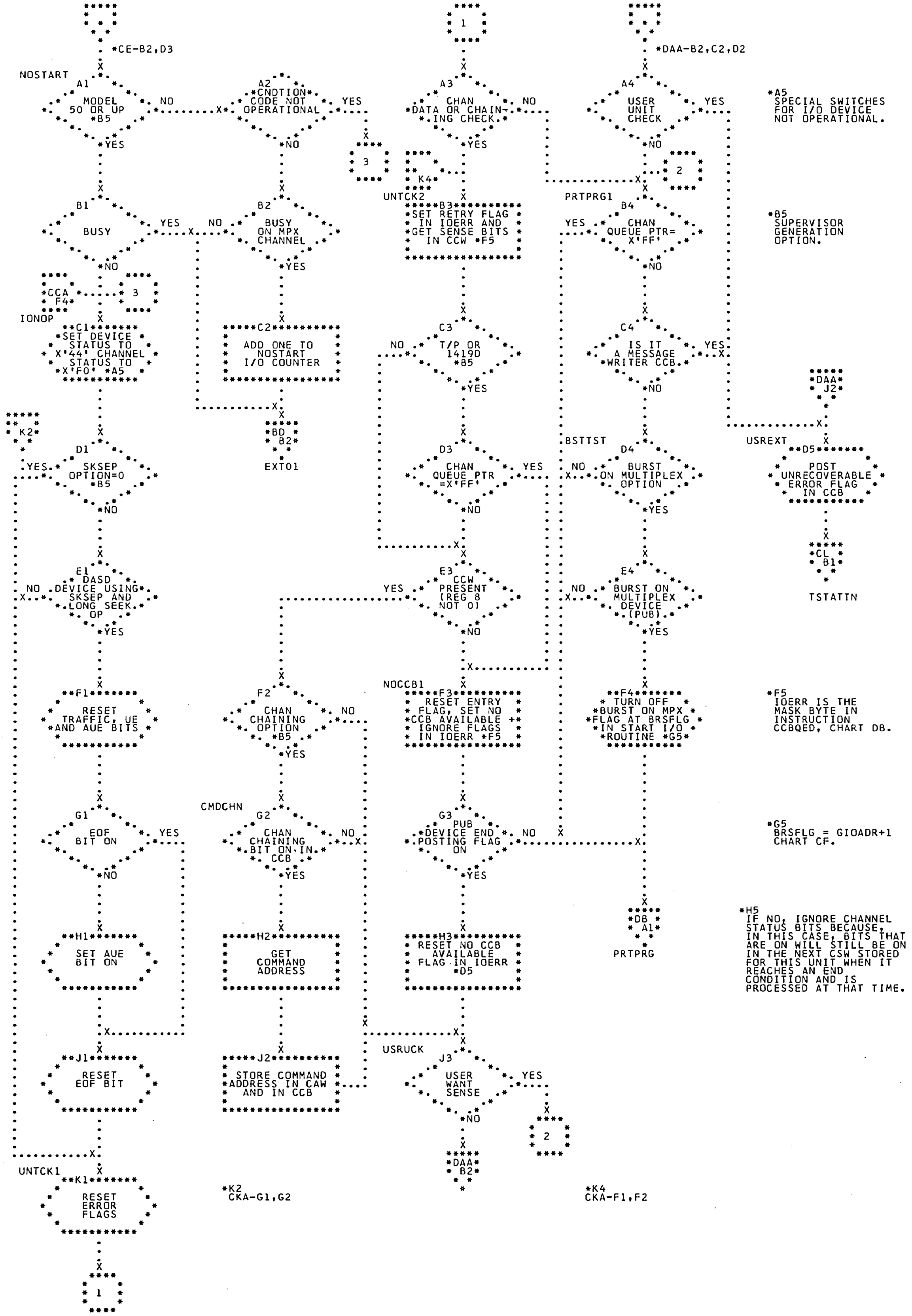


Chart DA. $$A$SUP1 - SGUNCK Macro, Unit Check Entries (Part 1 of 2)
Refer to Chart 06.



*A5
SPECIAL SWITCHES FOR I/O DEVICE NOT OPERATIONAL.

*B5
SUPERVISOR GENERATION OPTION.

*F5
IOERR IS THE MASK BYTE IN INSTRUCTION CCBQED, CHART DB.

*G5
BRSFLG = GIOADR+1 CHART CF.

*H5
IF NO, IGNORE CHANNEL STATUS BITS BECAUSE, IN THIS CASE, BITS THAT ARE ON WILL STILL BE ON IN THE NEXT CSW STORED FOR THIS UNIT WHEN IT REACHES AN END CONDITION AND IS PROCESSED AT THAT TIME.

*K2
CKA-G1,G2

*K4
CKA-F1,F2

Chart DAA. $$A$SUP1 - SGUNCK Macro, Unit Check Entries (Part 2 of 2)
Refer to Chart 06.

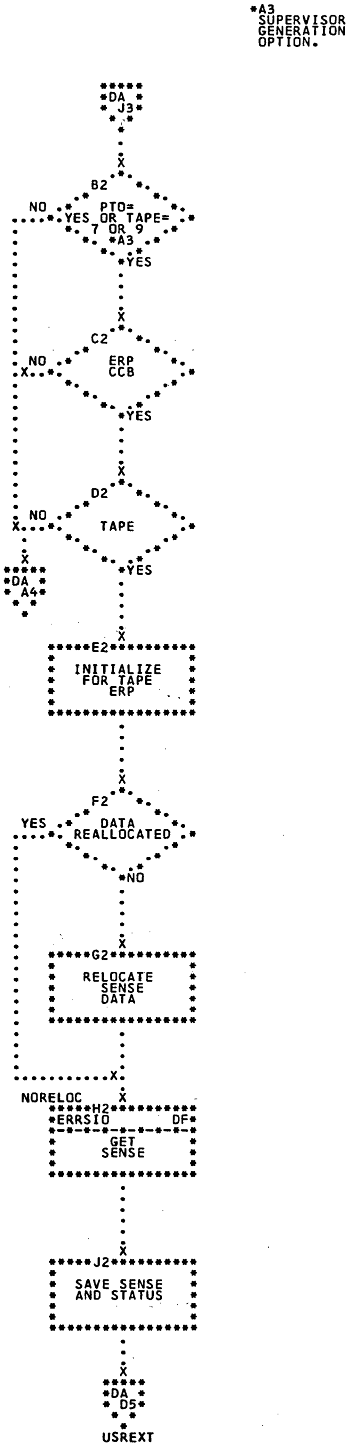


Chart DB. $$A$SUP1 - SGUNCK Macro, Build Error Queue Entry Refer to Chart 06.

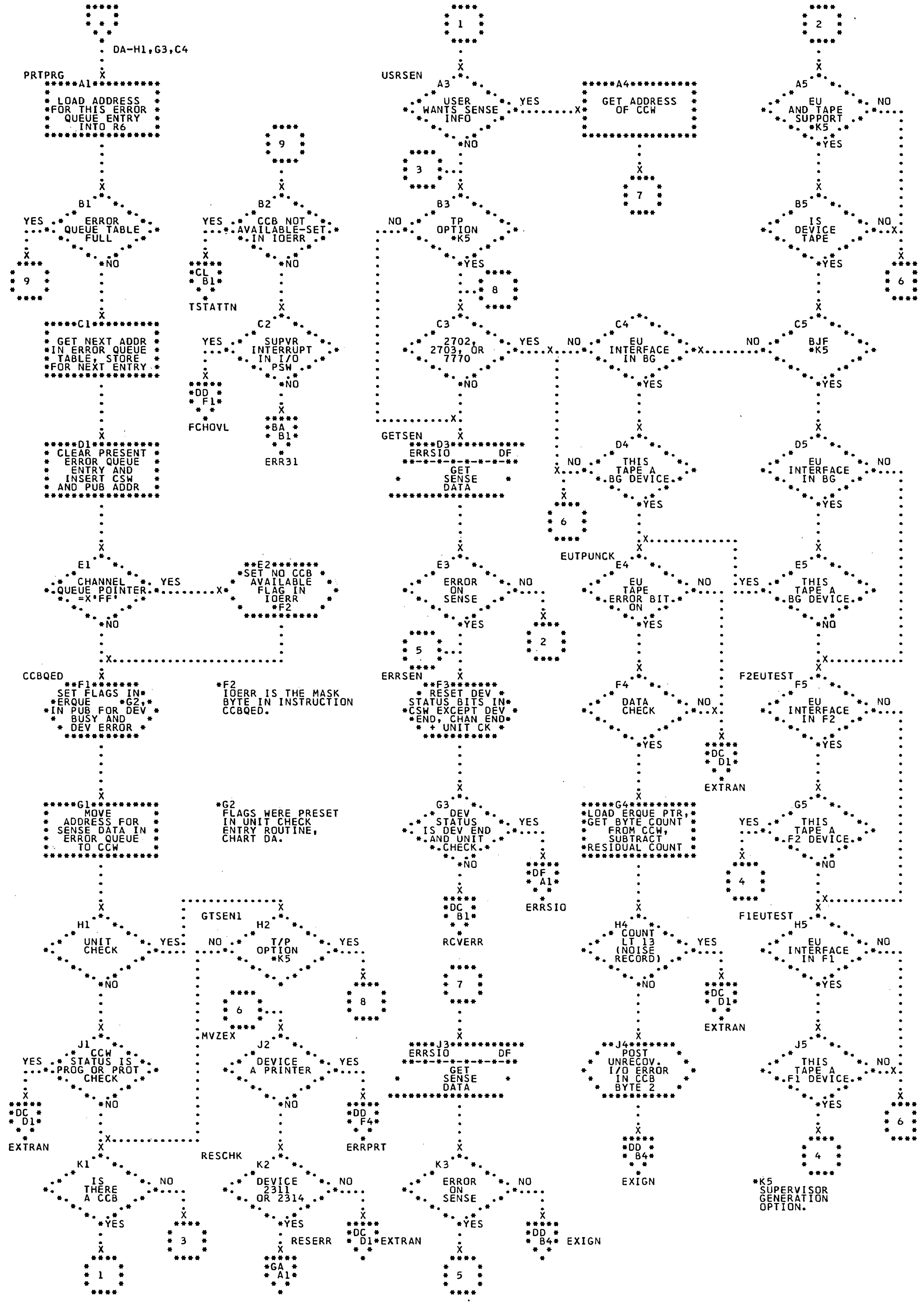


Chart DC. $$A$SUP1 - SGUNCK Macro, Error Recovery Exits (Part 1 of 2)
Refer to Chart 06.

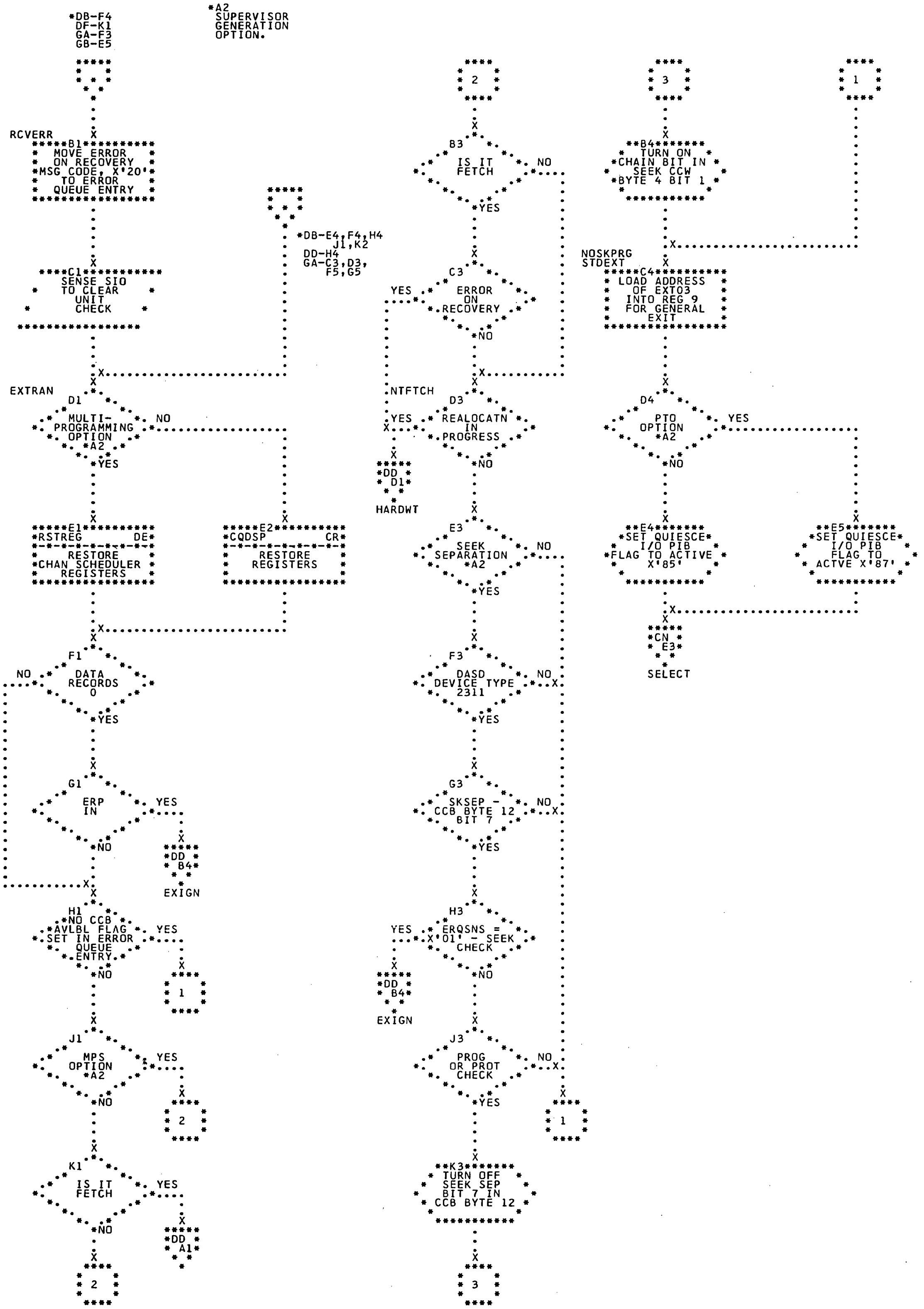
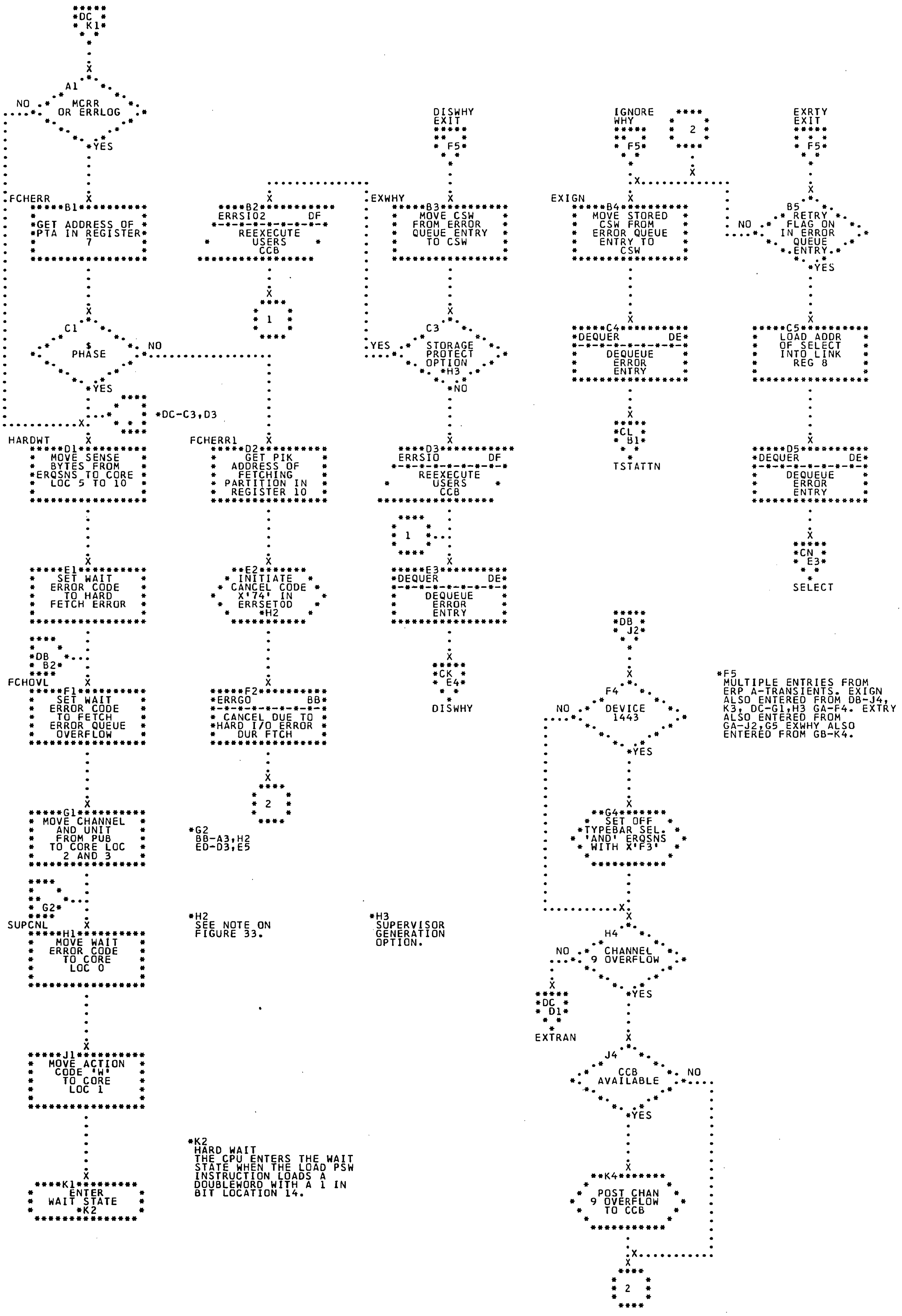


Chart DD. $$A$SUP1 - SGUNCK Macro, Error Recovery Exits (Part 2 of 2) Refer to Chart 06.



*F5
MULTIPLE ENTRIES FROM ERP A-TRANSIENTS. EXIGN ALSO ENTERED FROM DB-J4, K3, DC-G1,H3 GA-F4. EXTRY ALSO ENTERED FROM GA-J2,G5 EXWHY ALSO ENTERED FROM GB-K4.

*G2
BB-A3,H2
ED-D3,E5

*H2
SEE NOTE ON FIGURE 33.

*H3
SUPERVISOR GENERATION OPTION.

*K2
HARD WAIT
THE CPU ENTERS THE WAIT STATE WHEN THE LOAD PSW INSTRUCTION LOADS A DOUBLEWORD WITH A 1 IN BIT LOCATION 14.

Chart DE. $$A$SUP1 - SGUNCK Macro, DEQUER and RSTREG Subroutines
Refer to Chart 06.

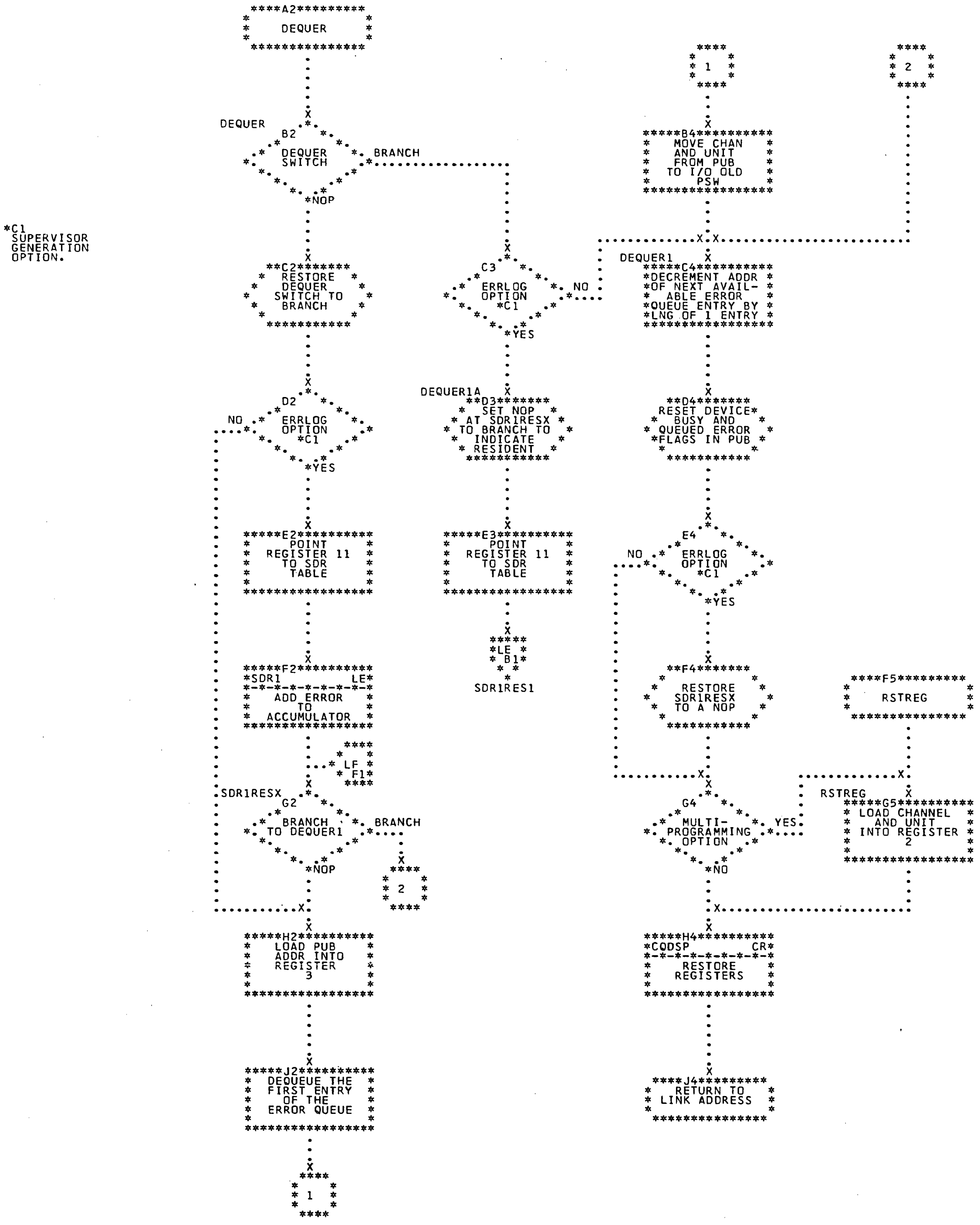


Chart DF. $$A$SUP1 - SGUNCK Macro, Error Start I/O and Channel Failure Subroutines Refer to Charts 06 and 07.

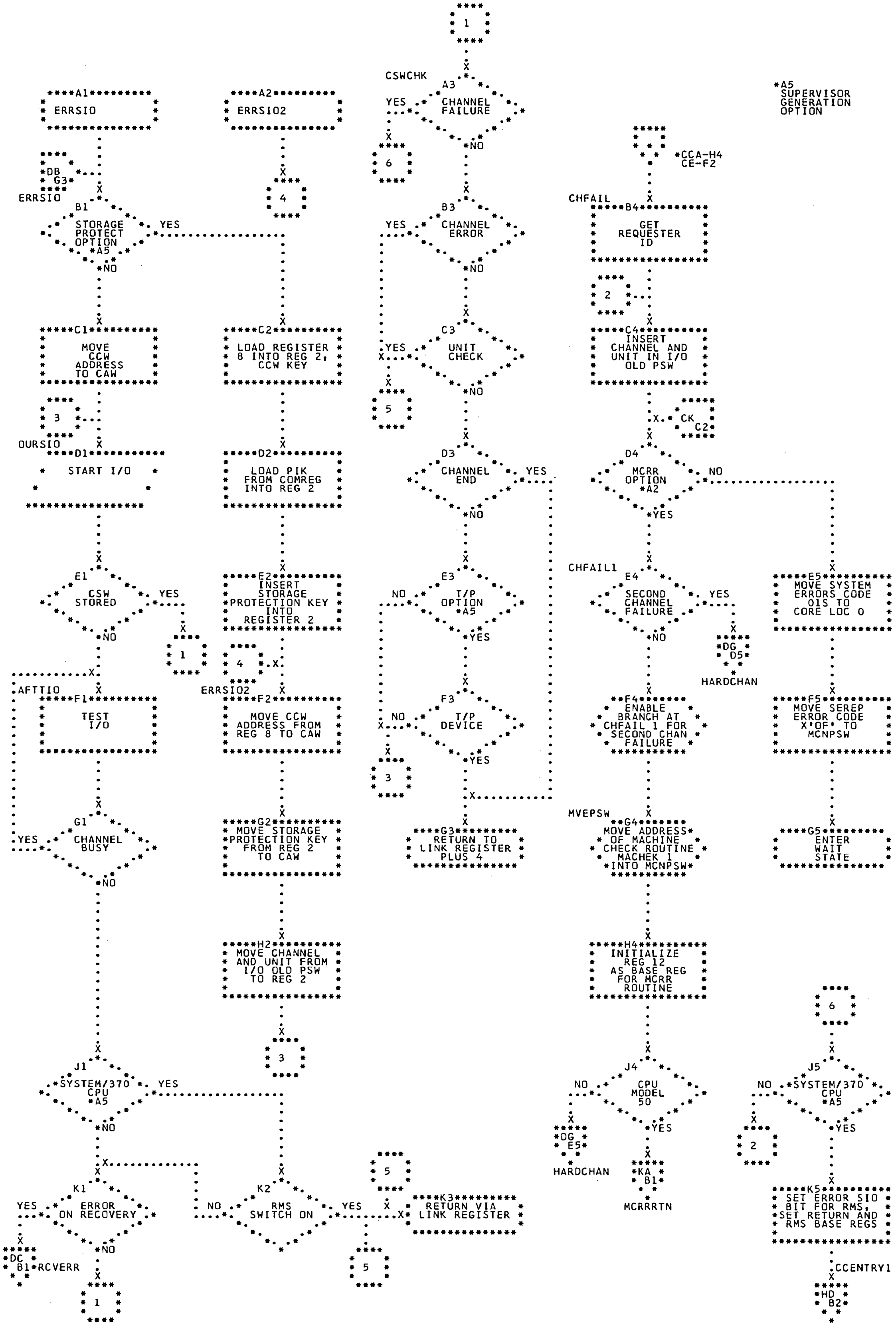


Chart DG. $$A$SUP1 - SGUNCK Macro, Machine Check Interrupt
Refer to Chart 07.

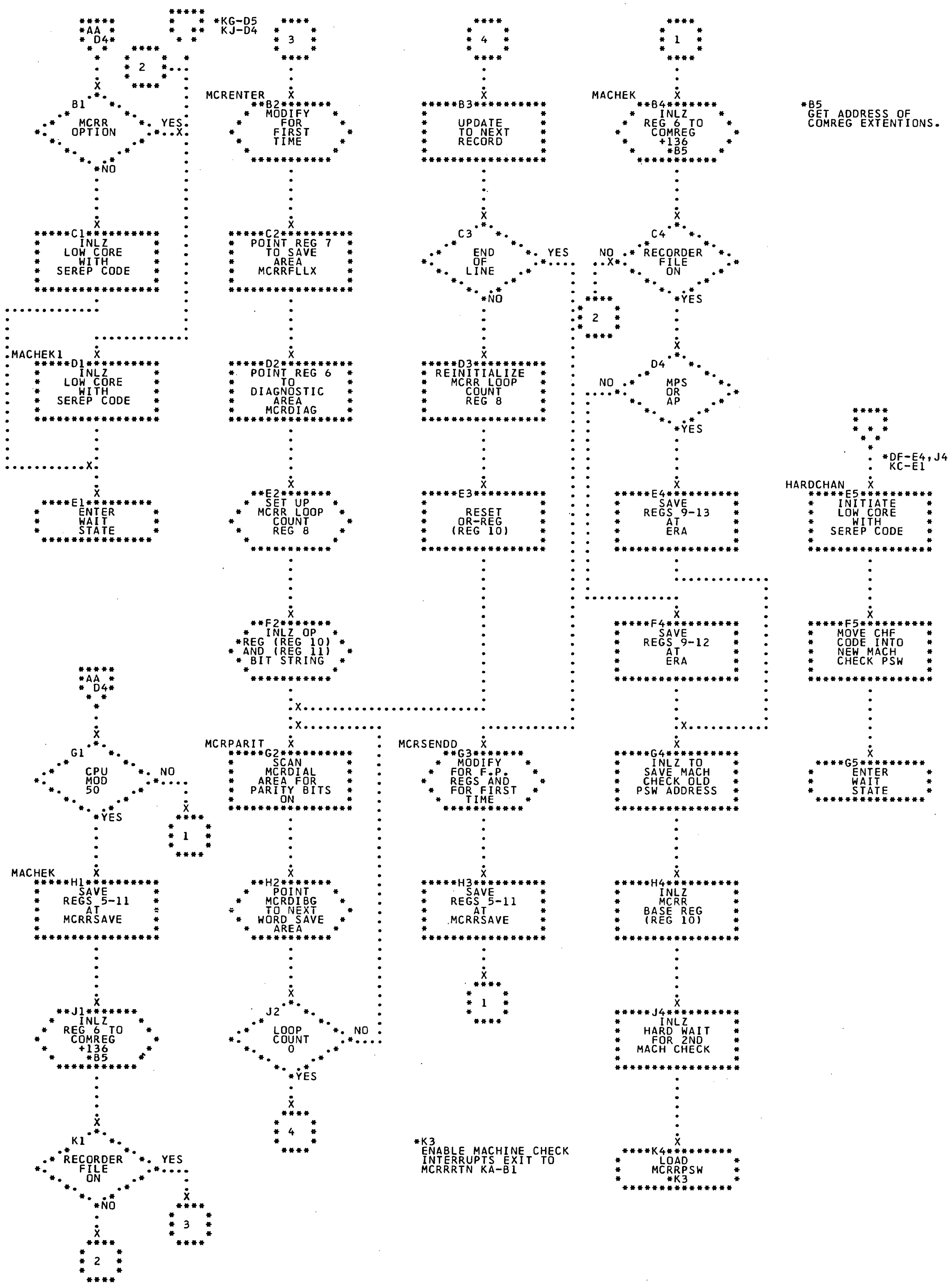


Chart DH. $$A$SUP1 - SGUNCK Macro, Quiesce I/O Task
Refer to Chart 07

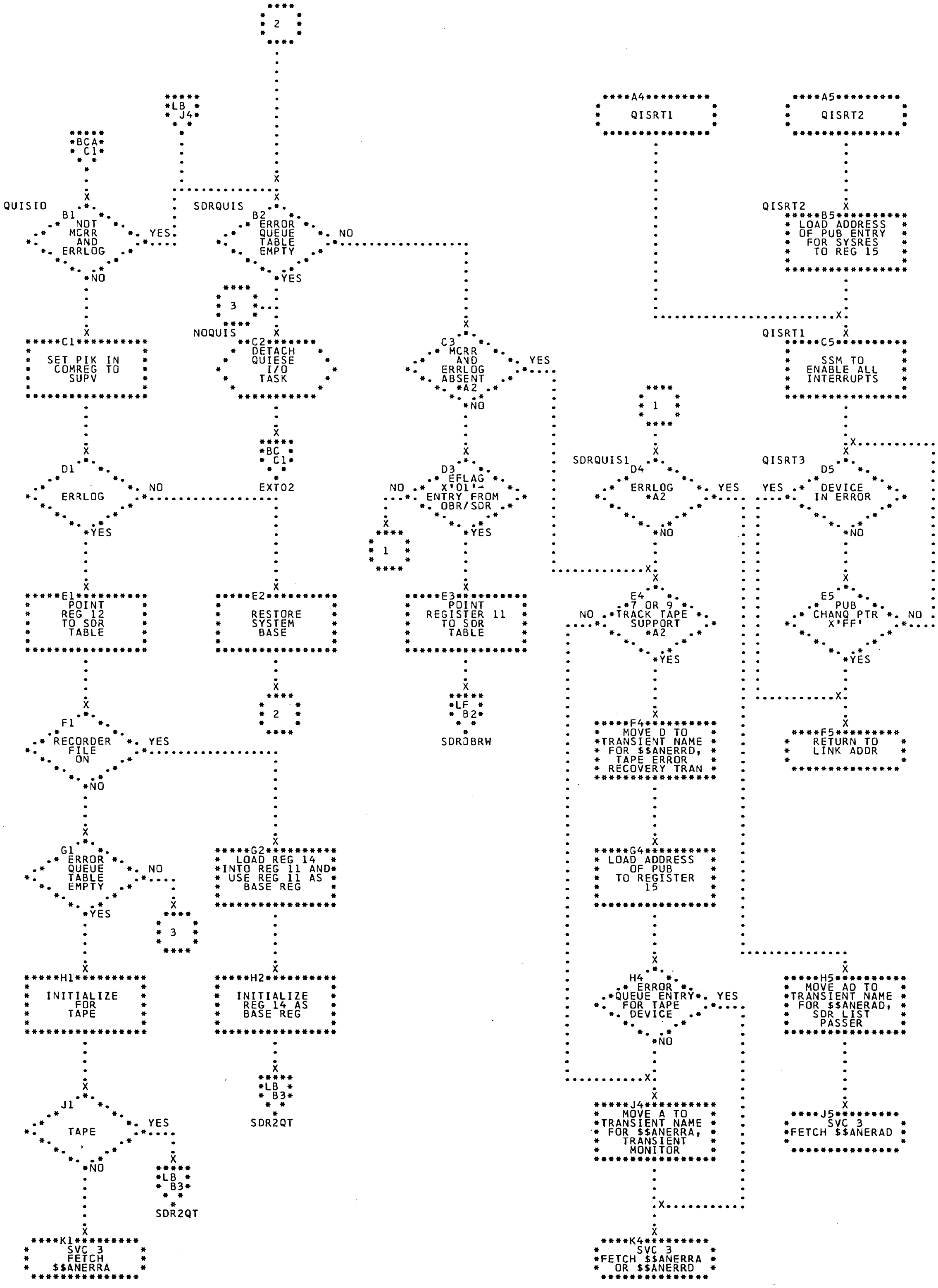


Chart EA. $$A$SUP1 - SGDFCH Macro, Fetch (Part 1 of 9)
Refer to Chart 03.

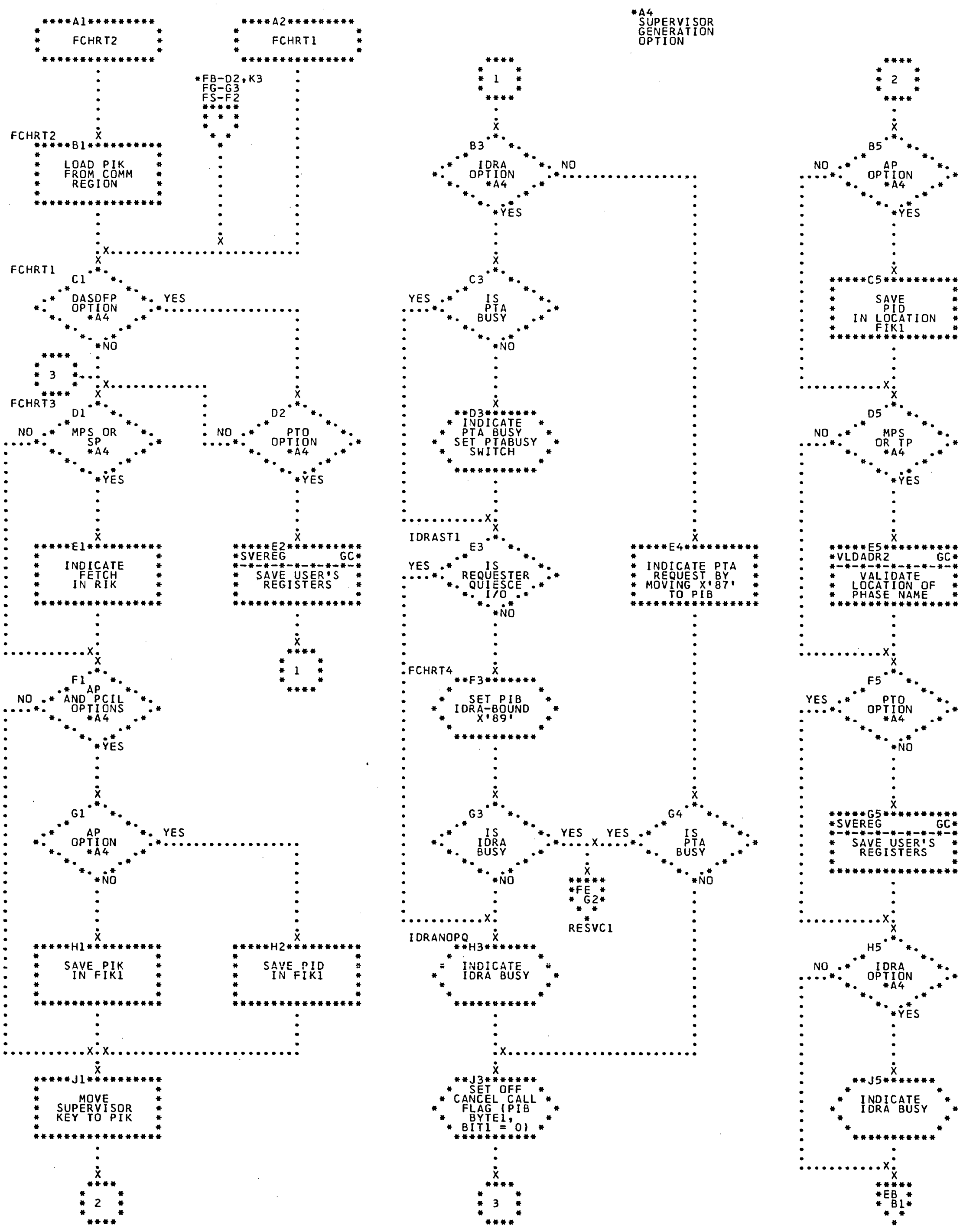


Chart EB. $$A$SUP1 - SGDFCH Macro, Fetch (Part 2 of 9)
Refer to Chart 03.

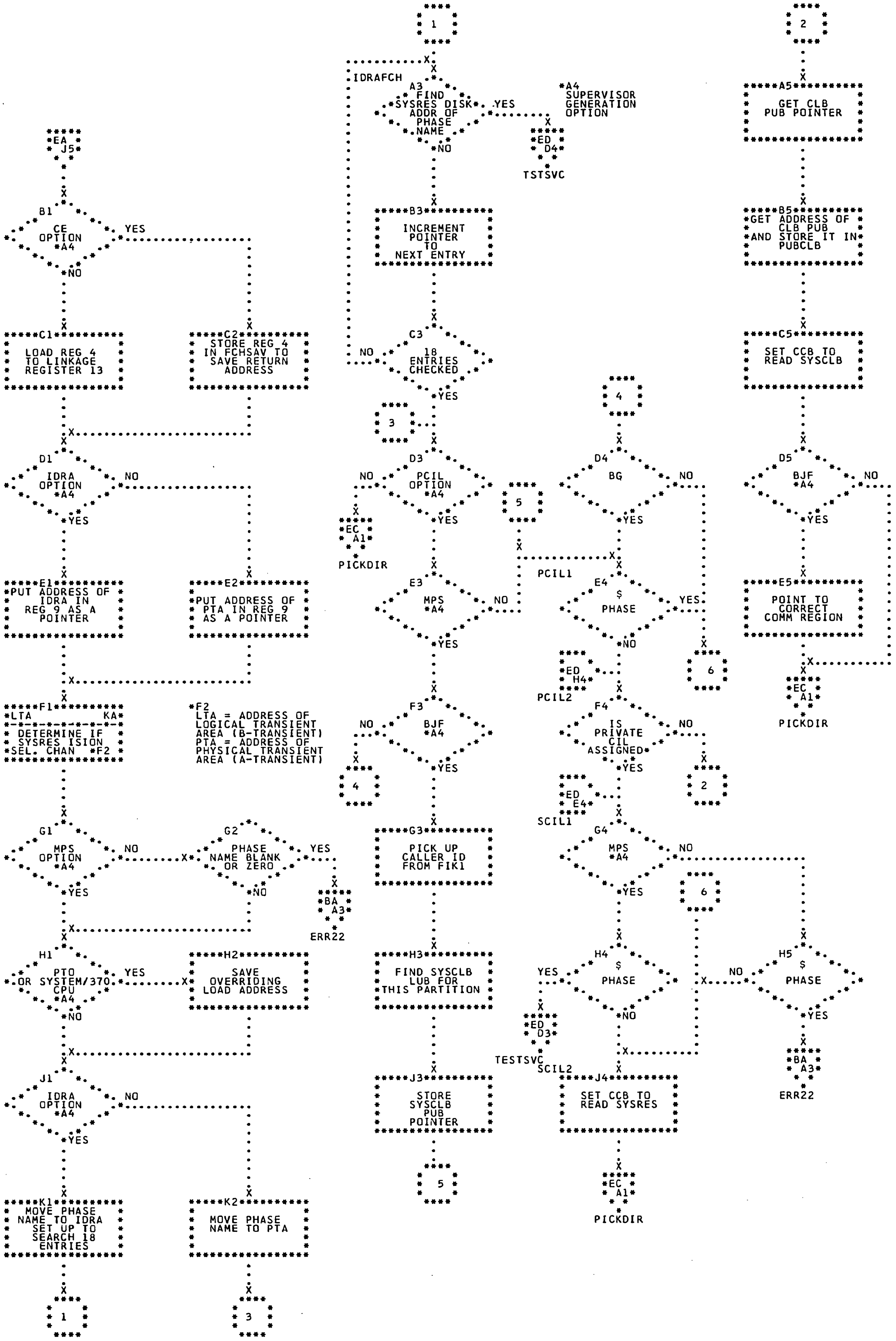


Chart EC. $$A$SUP1 - SGDFCH Macro, Fetch (Part 3 of 9)
Refer to Chart 03.

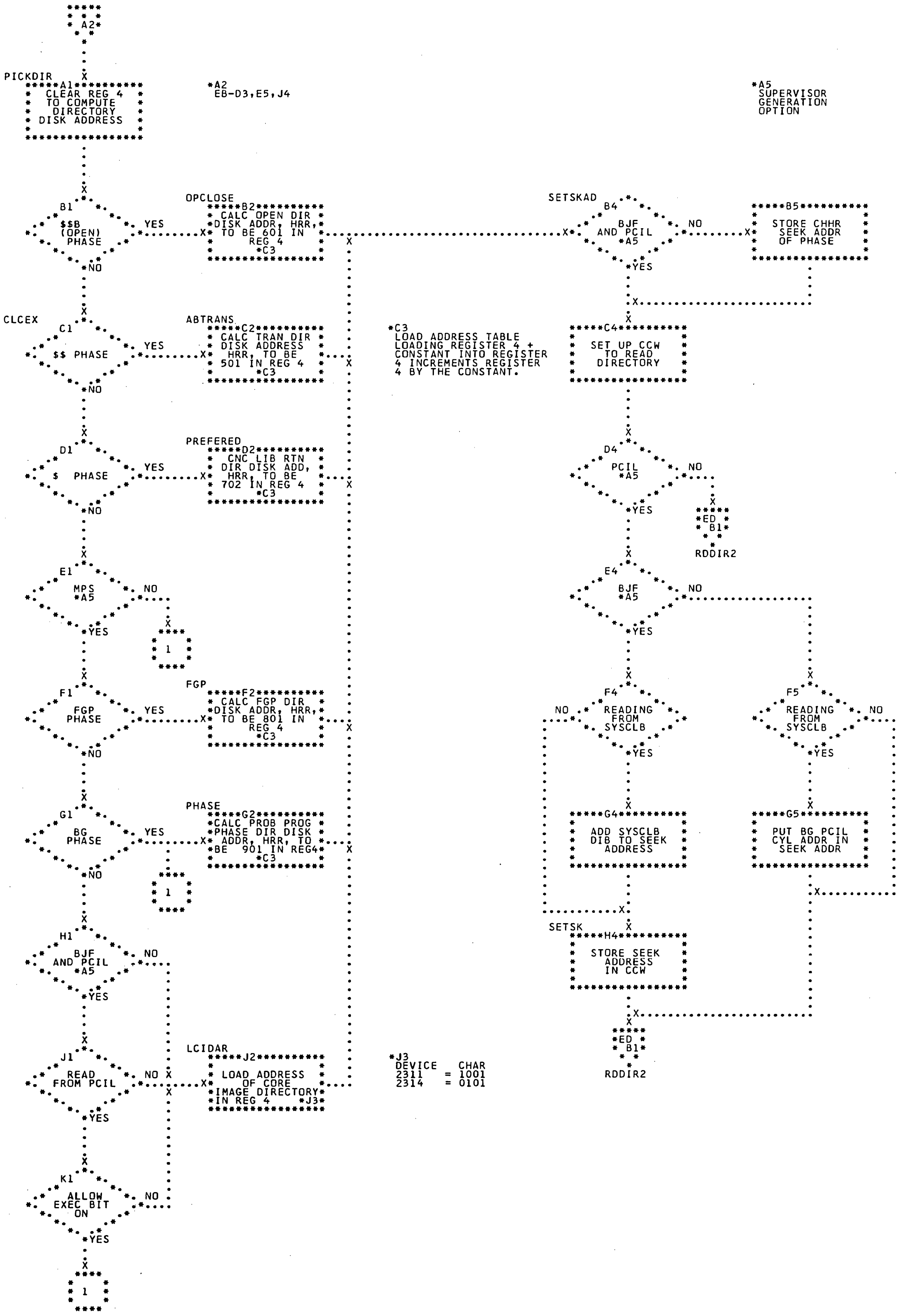


Chart ED. $$A$SUP1 - SGDFCH Macro, Fetch (Part 4 of 9) Refer to Chart 03.

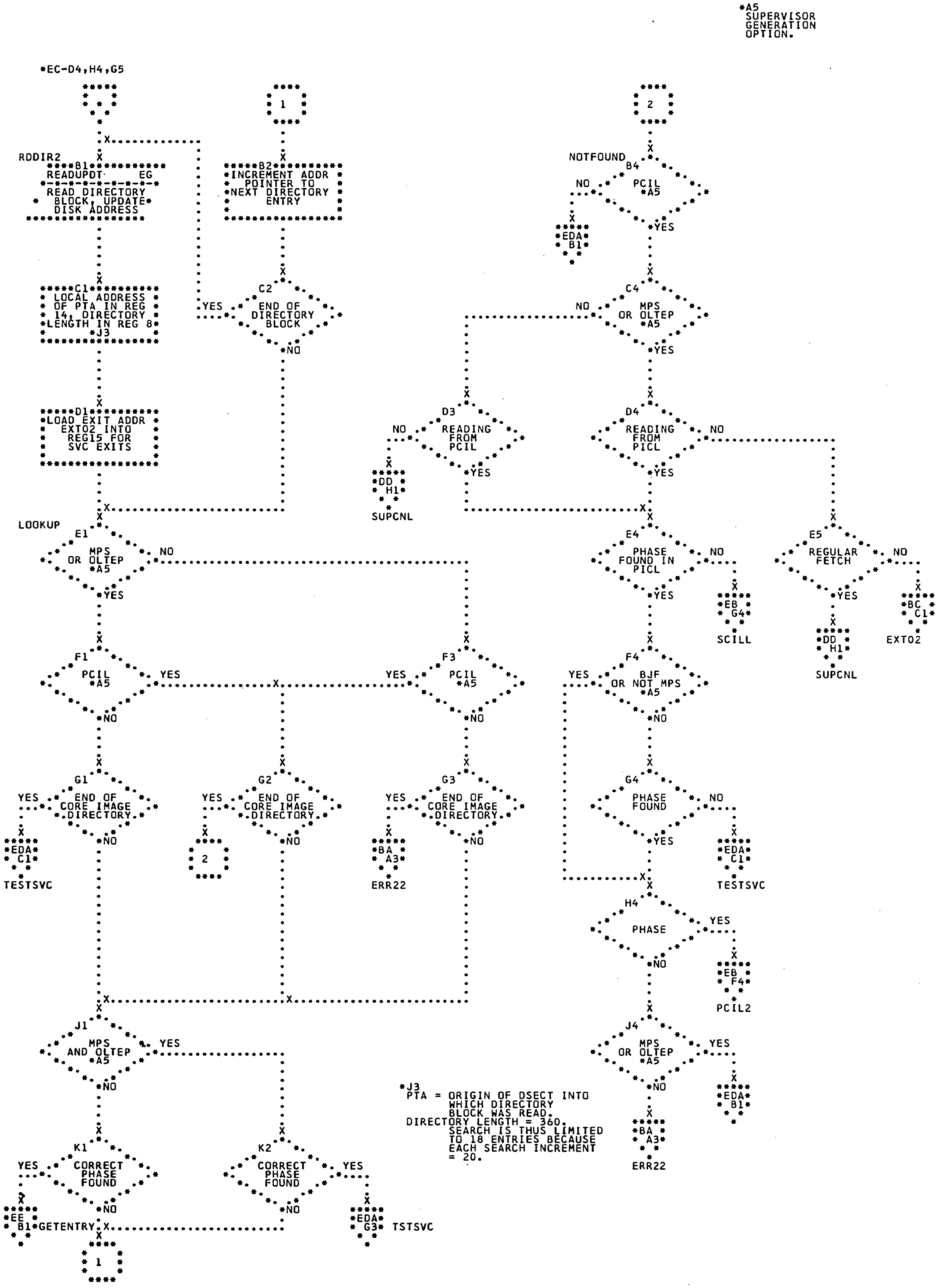


Chart EDA. $$A$SUP1 - SGDFCH Macro, Fetch (Part 5 of 9)
Refer to Chart 03.

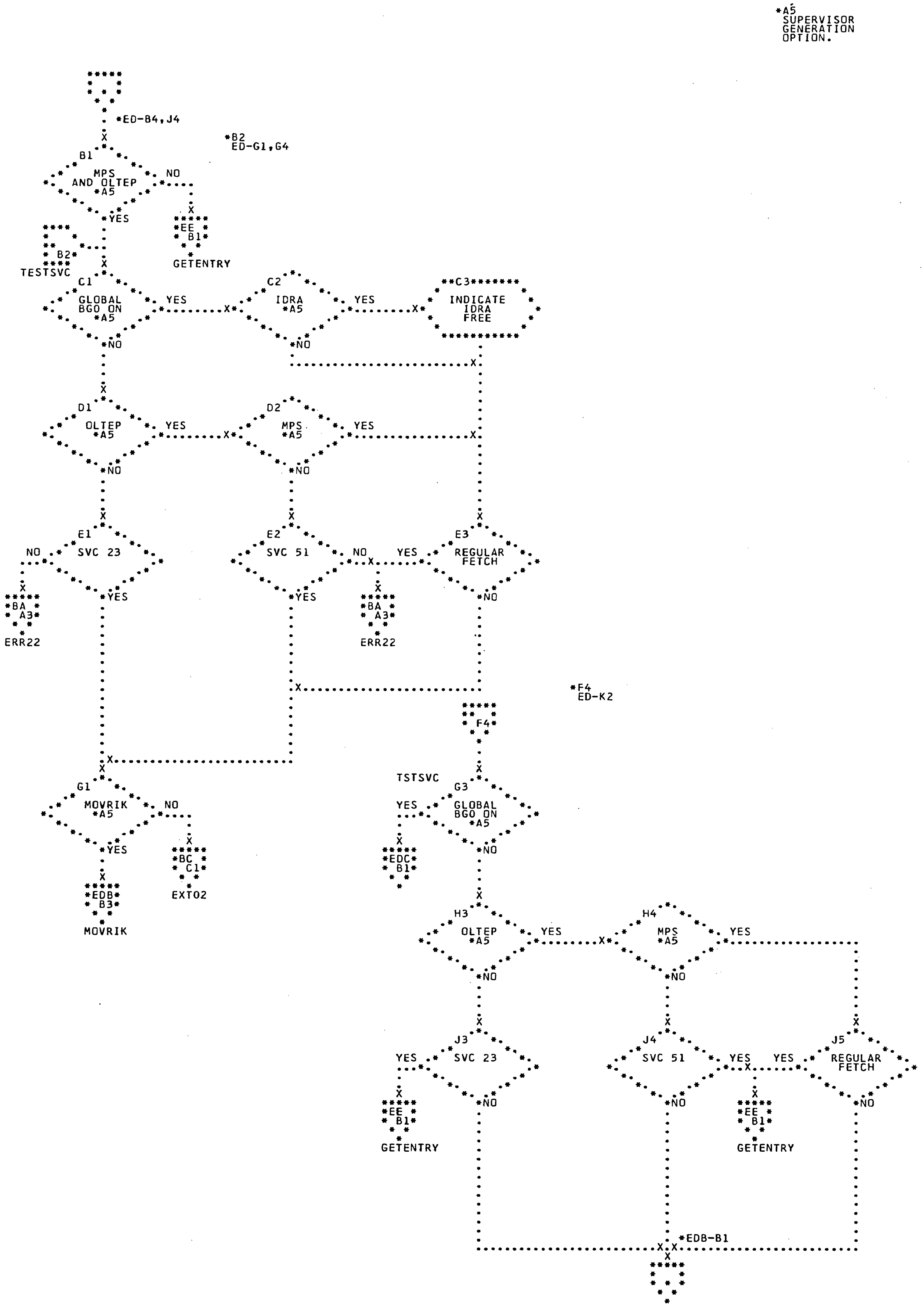


Chart EDB. $$A$SUP1 - SGDFCH Macro, Fetch (Part 6 of 9)
Refer to Chart 03.

*A5
SUPERVISOR
GENERATION
OPTION.

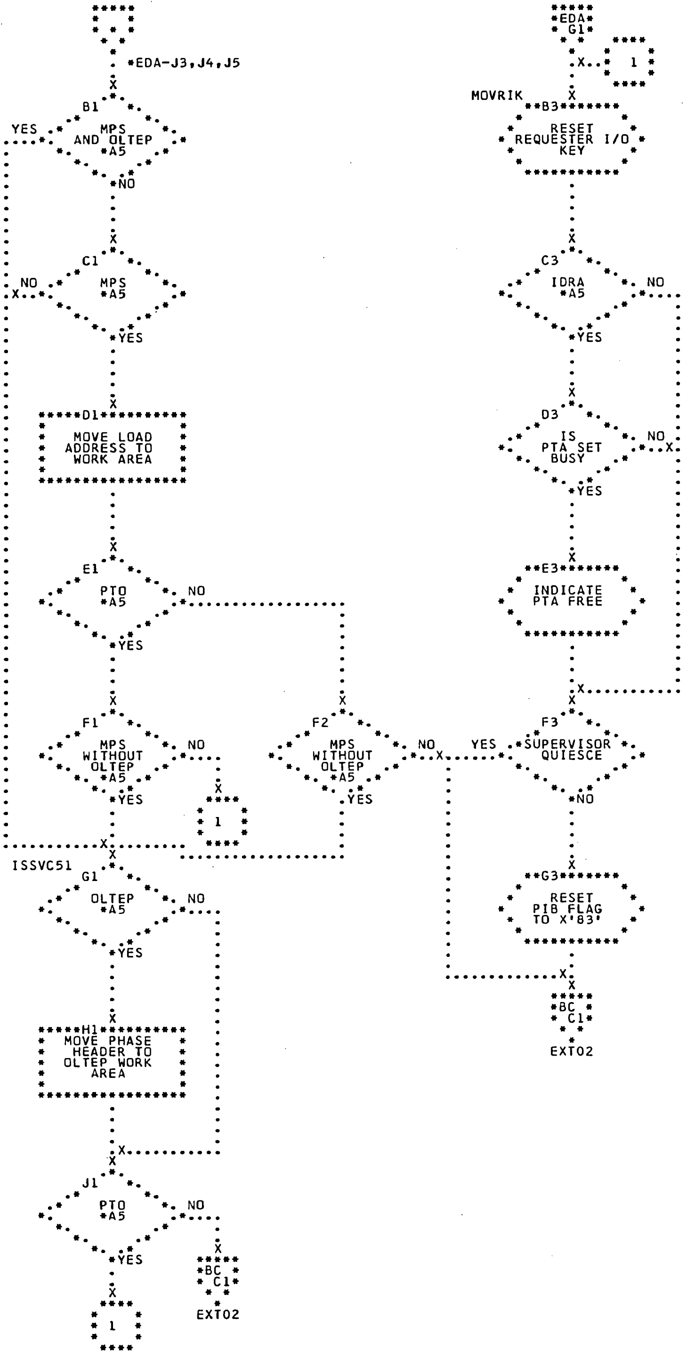


Chart EDC. $$A$SUP1 - SGDFCH Macro, Fetch (Part 7 of 9)
Refer to Chart 03.

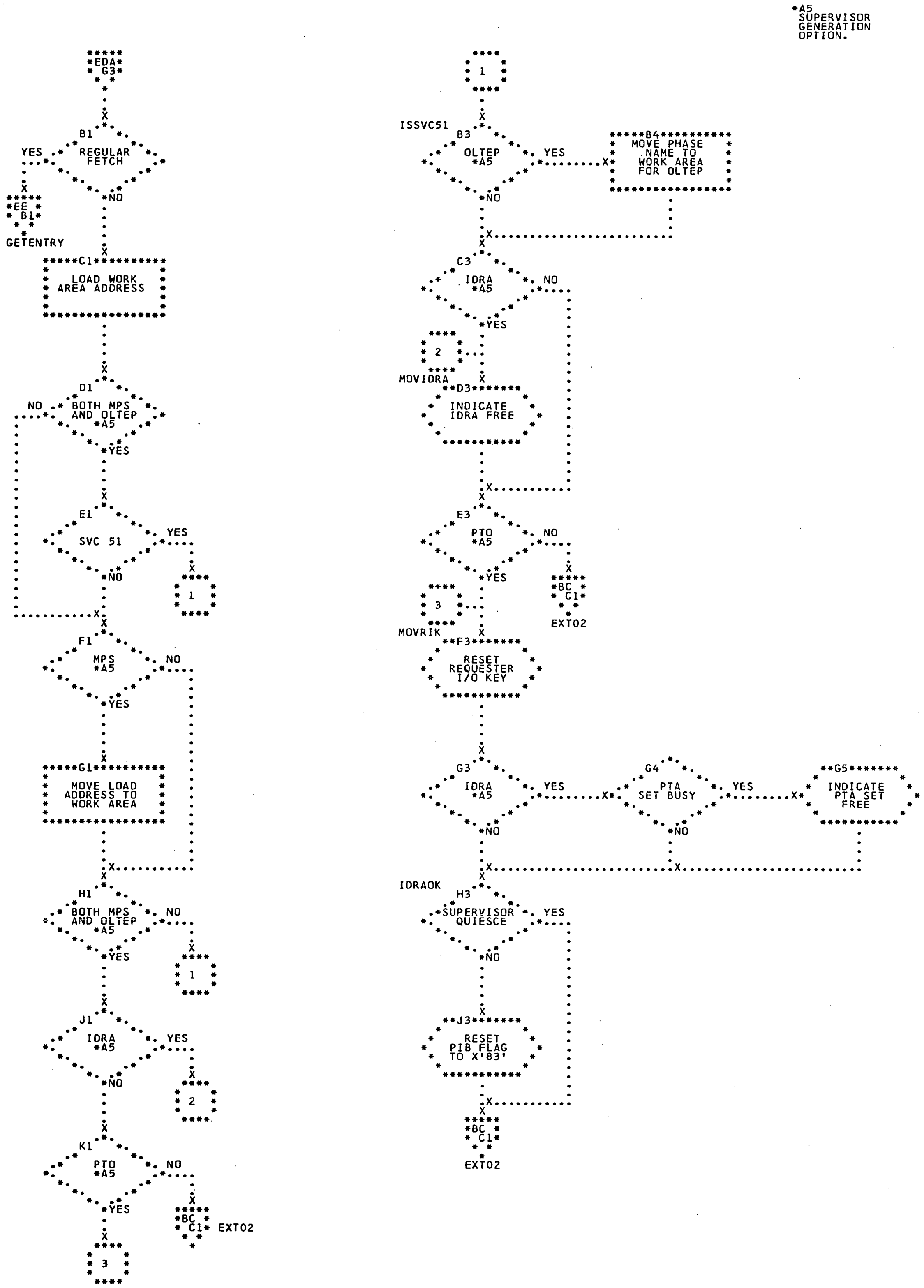
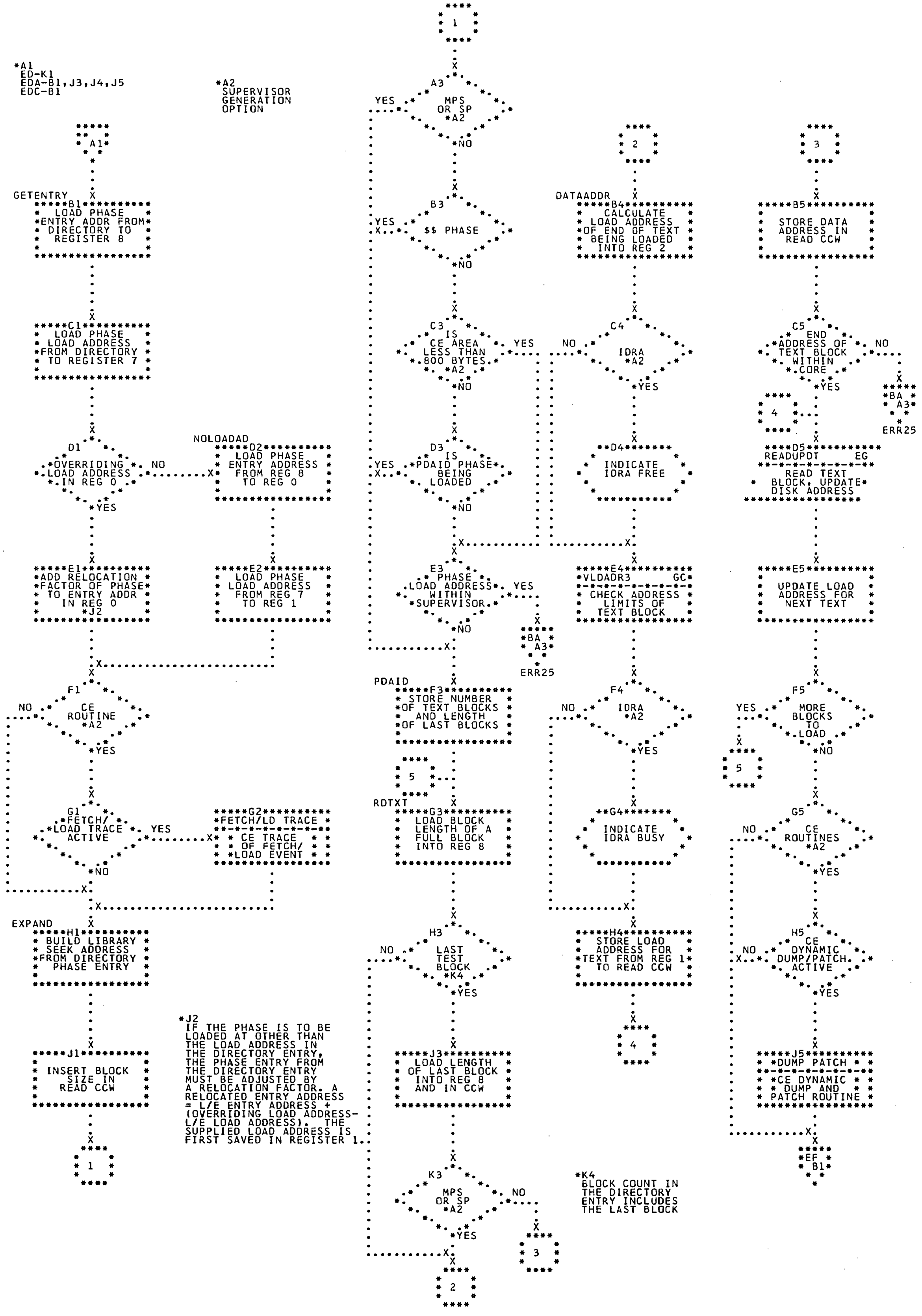


Chart EE. $$A$SUP1 - SGDFCH Macro, Fetch (Part 8 of 9)
Refer to Chart 03.



*A1
ED-K1
EDA-B1,J3,J4,J5
EDC-B1

*A2
SUPERVISOR
GENERATION
OPTION

*J2
IF THE PHASE IS TO BE LOADED AT OTHER THAN THE LOAD ADDRESS IN THE DIRECTORY ENTRY, THE PHASE ENTRY FROM THE DIRECTORY ENTRY MUST BE ADJUSTED BY A RELOCATION FACTOR. A RELOCATED ENTRY ADDRESS = L/E ENTRY ADDRESS + (OVERRIDING LOAD ADDRESS- L/E LOAD ADDRESS). THE SUPPLIED LOAD ADDRESS IS FIRST SAVED IN REGISTER 1.

*K4
BLOCK COUNT IN THE DIRECTORY ENTRY INCLUDES THE LAST BLOCK

Chart EF. $$A$SUP1 - SGDFCH Macro, Fetch (Part 9 of 9) Refer to Chart 03.

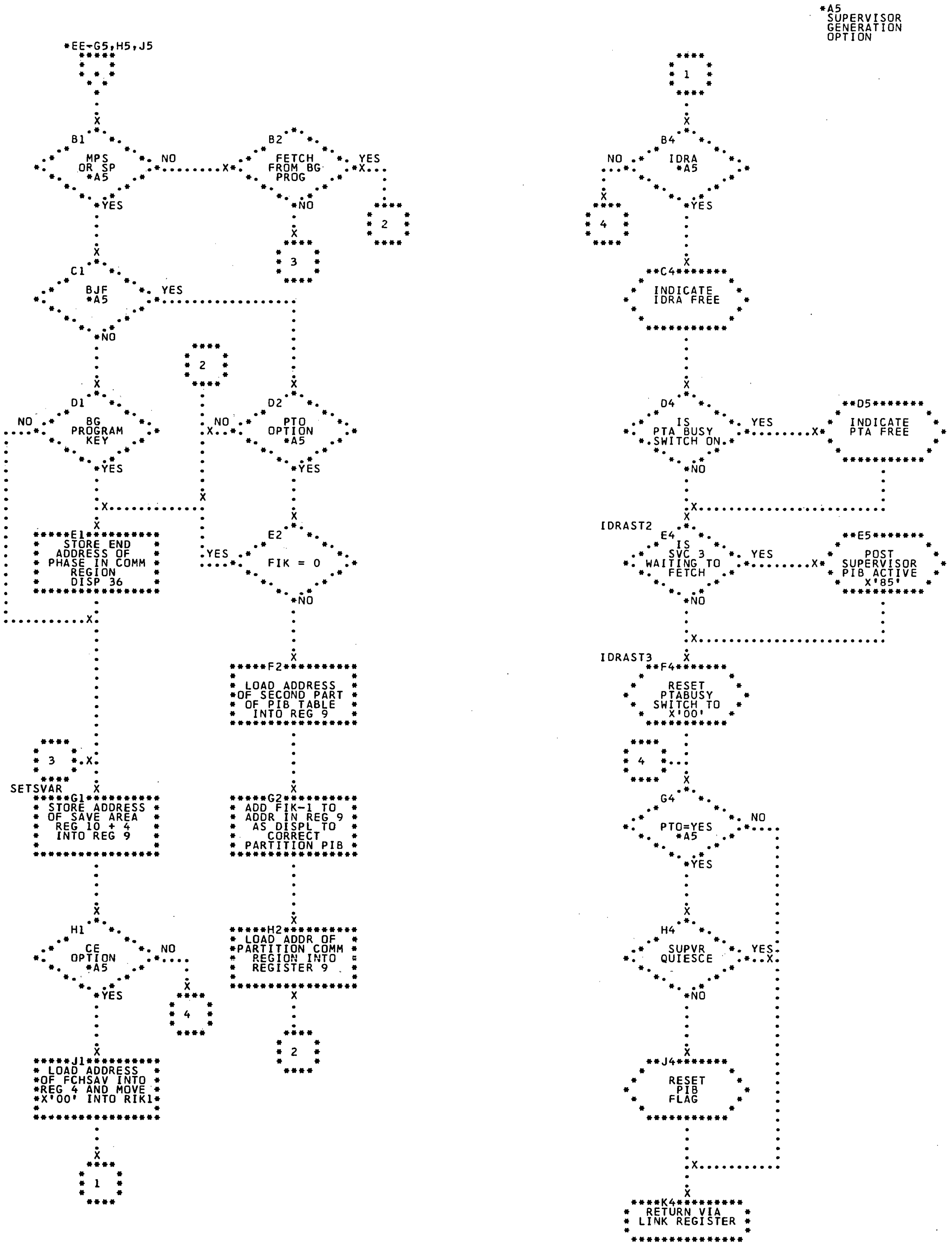


Chart EG. $$A$SUP1 - SGDFCH Macro, Fetch Subroutine (Part 1 of 2)
Refer to Chart 03.

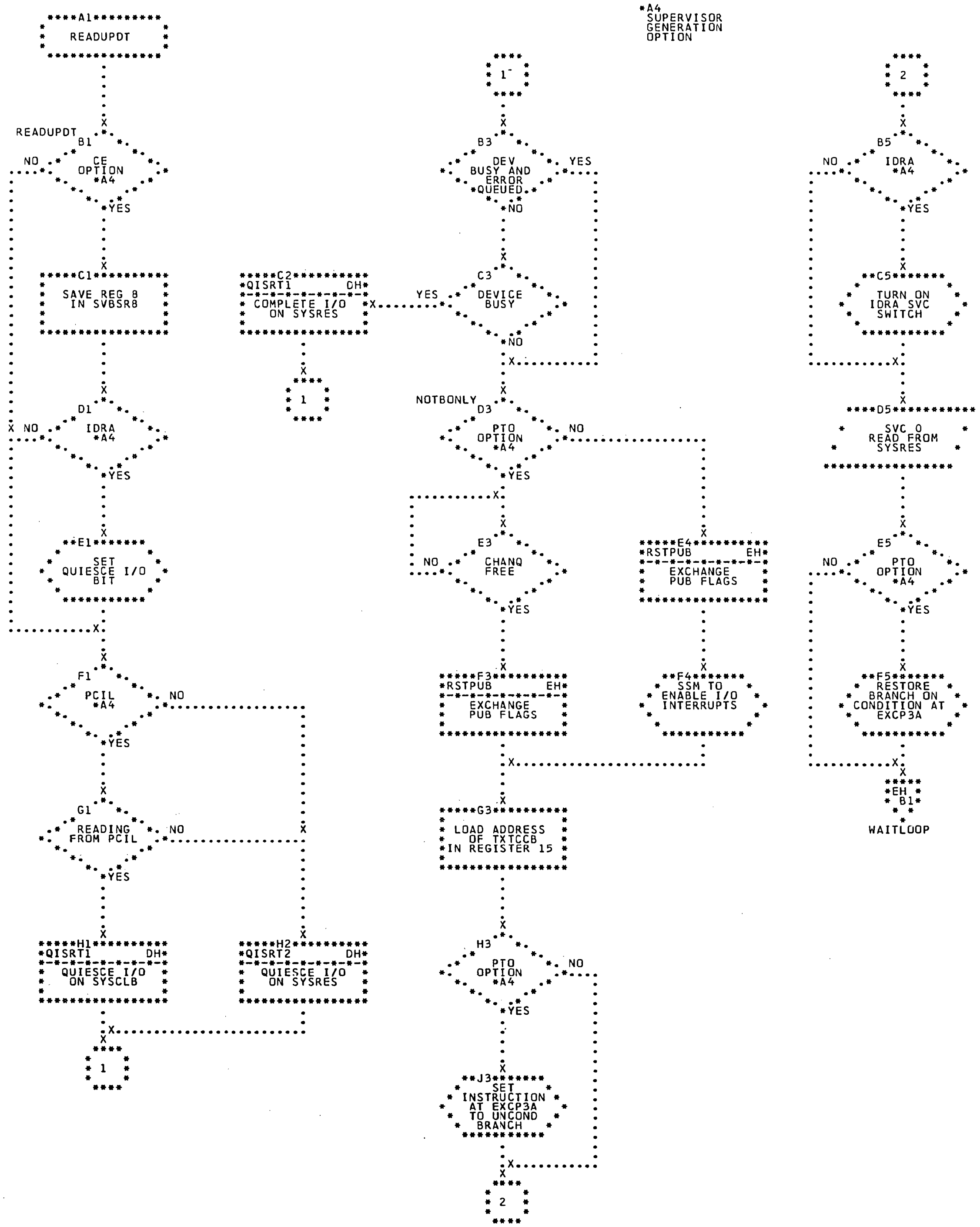


Chart EH. $$A$SUP1 - SGDFCH Macro, Fetch Subroutine (Part 2 of 2)
Refer to Chart 03.

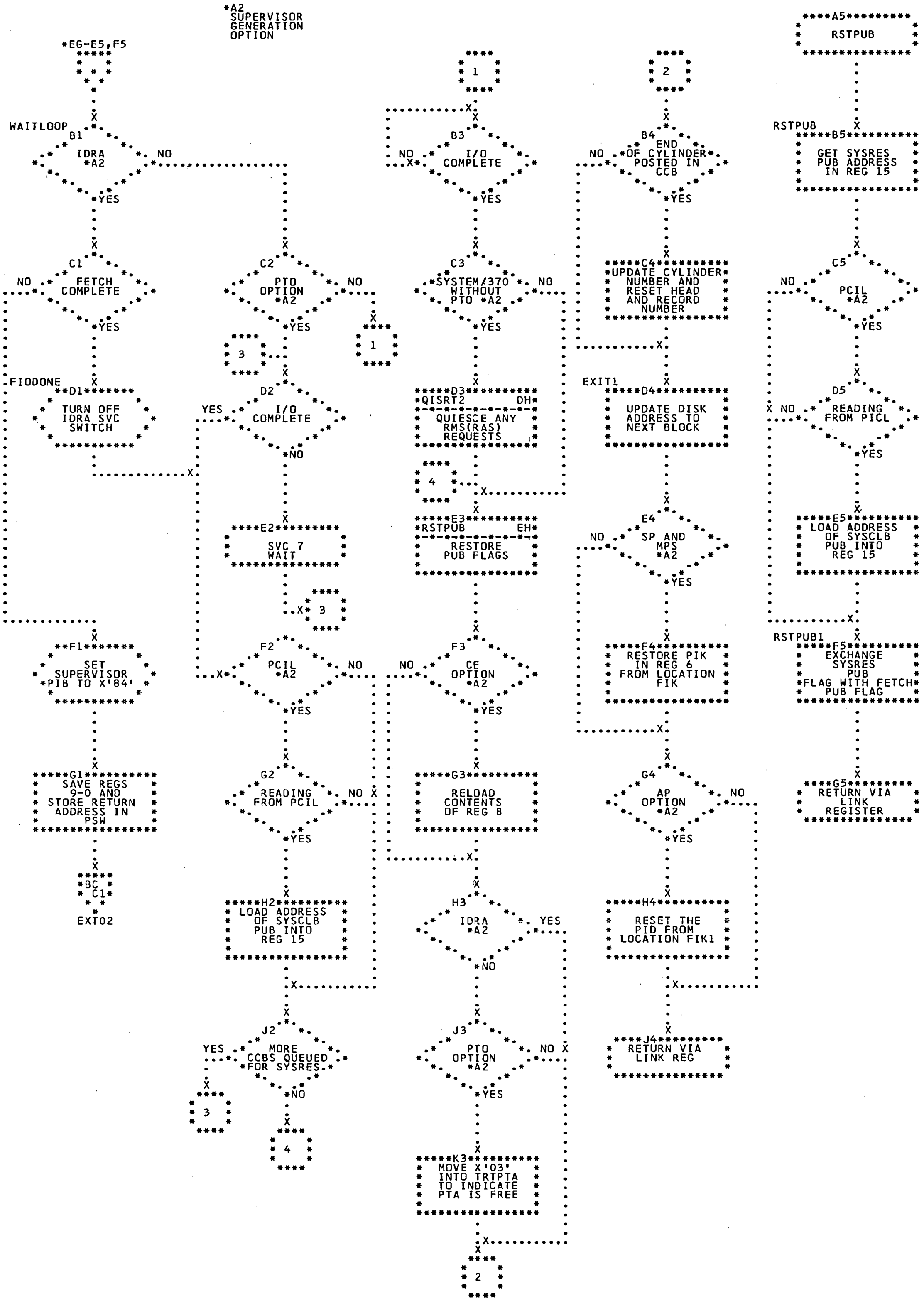


Chart FA. $$A$SUP1 - SGSVC Macro, SVCs 1, 12, and 13
Refer to Chart 03.

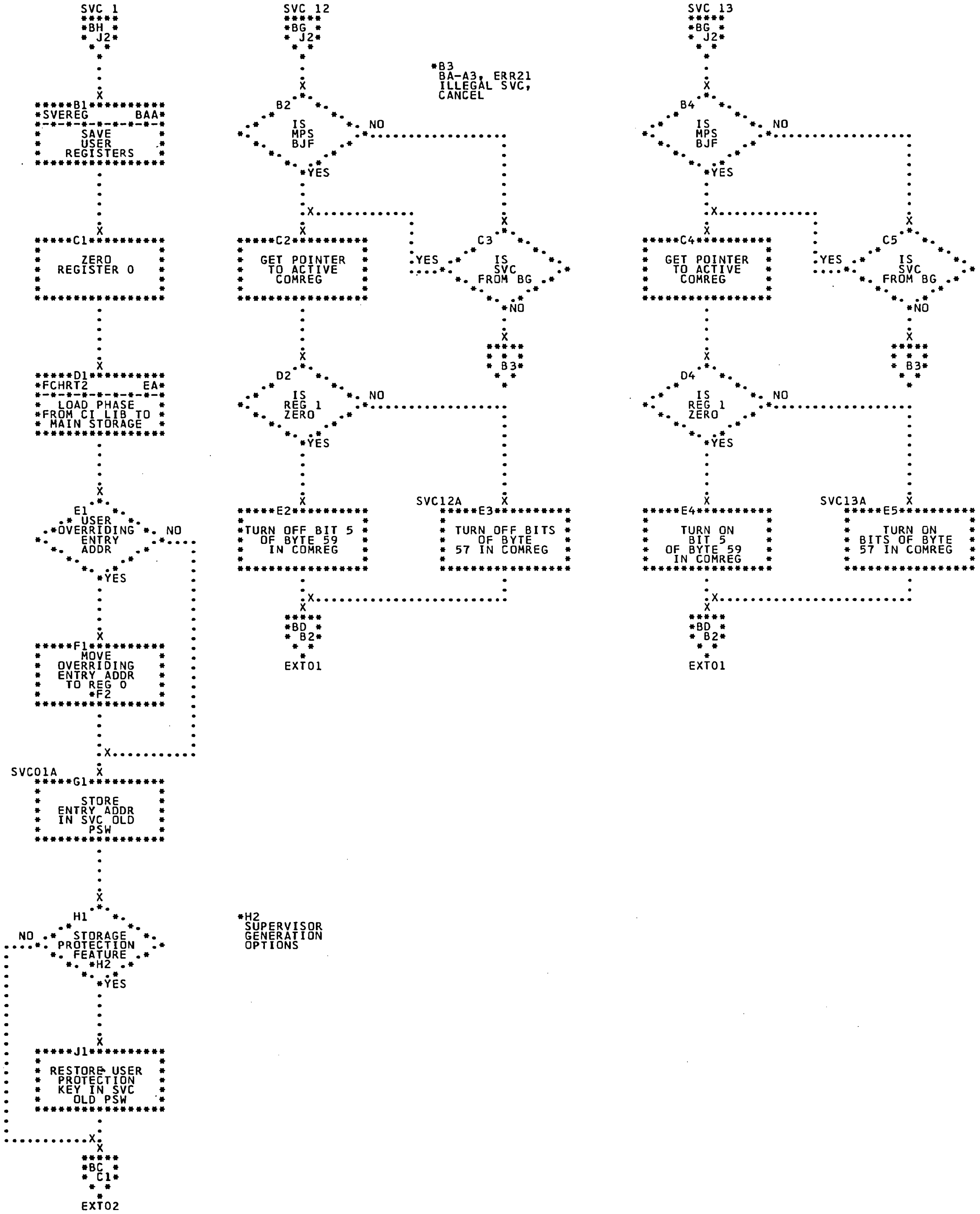
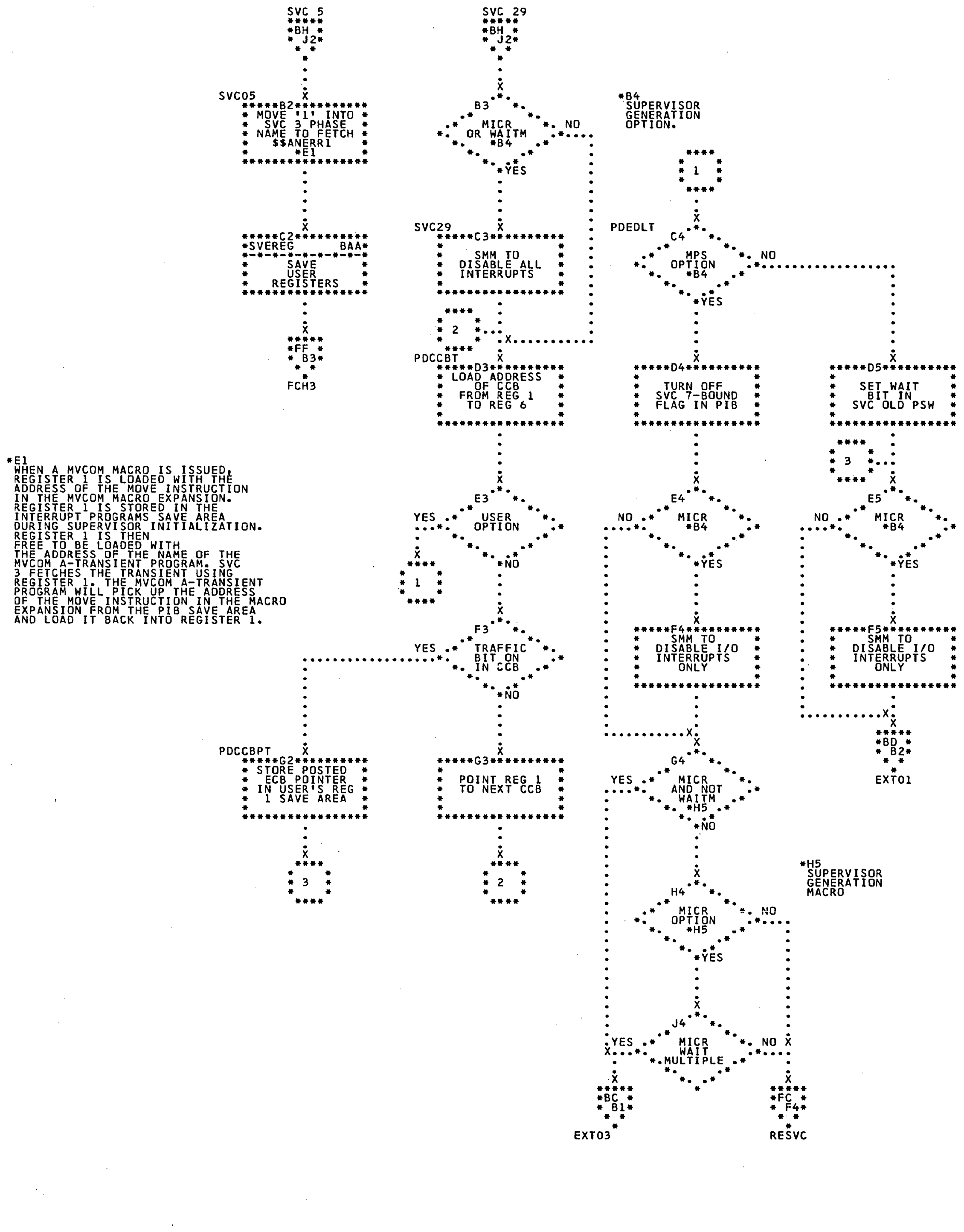


Chart FB. $$A$SUP1 - SGSVC Macro, SVCs 5 and 29
Refer to Chart 03.

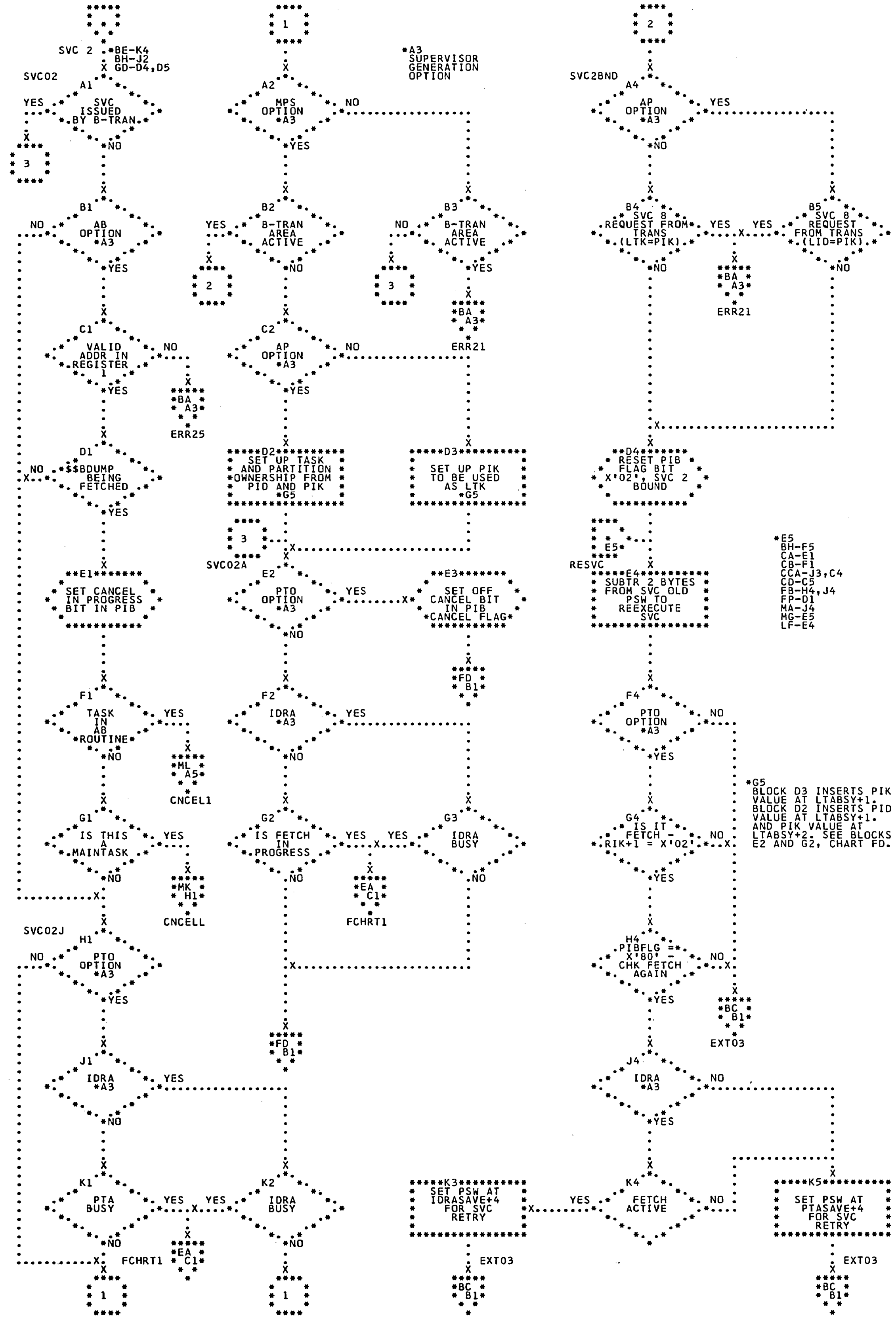


*B4
SUPERVISOR
GENERATION
OPTION.

*E1
WHEN A MVCOM MACRO IS ISSUED, REGISTER 1 IS LOADED WITH THE ADDRESS OF THE MOVE INSTRUCTION IN THE MVCOM MACRO EXPANSION. REGISTER 1 IS STORED IN THE INTERRUPT PROGRAMS SAVE AREA DURING SUPERVISOR INITIALIZATION. REGISTER 1 IS THEN FREE TO BE LOADED WITH THE ADDRESS OF THE NAME OF THE MVCOM A-TRANSIENT PROGRAM. SVC 3 FETCHES THE TRANSIENT USING REGISTER 1. THE MVCOM A-TRANSIENT PROGRAM WILL PICK UP THE ADDRESS OF THE MOVE INSTRUCTION IN THE MACRO EXPANSION FROM THE PIB SAVE AREA AND LOAD IT BACK INTO REGISTER 1.

*H5
SUPERVISOR
GENERATION
MACRO

Chart FC. $$A$SUP1 - SGSVC Macro, SVC 2 (Part 1 of 2)
Refer to Chart 03.

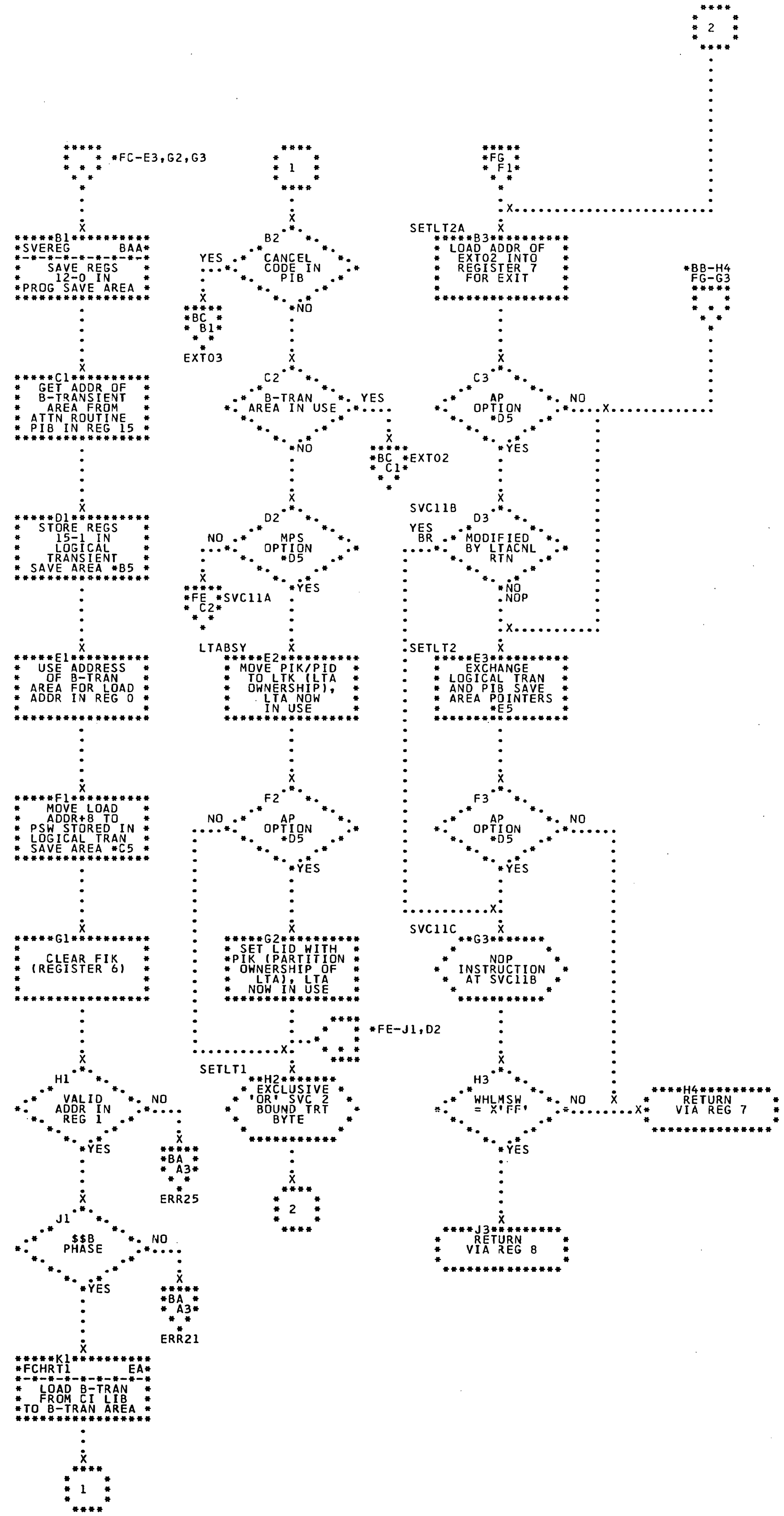


*A3
SUPERVISOR
GENERATION
OPTION

*E5
BH-F5
CA-E1
CB-F1
CCA-J3,C4
CD-C5
FB-H4,J4
FP-D1
MA-J4
MG-E5
LF-E4

*G5
BLOCK D3 INSERTS PIK VALUE AT LTABSY+1. BLOCK D2 INSERTS PID VALUE AT LTABSY+1. AND PIK VALUE AT LTABSY+2. SEE BLOCKS E2 AND G2, CHART FD.

Chart FD. $$A$SUP1 - SGSVC Macro, SVC 2 (Part 2 of 2), SETLT1 and SETLT2 Routines. Refer to Chart 03.



*B5
REGISTER 15 IS USED AS A BASE REGISTER FOR B-TRANSIENTS.

*C5
ADDRESS OF B-TRANSIENT AREA + 8 BYTES = ENTRY ADDRESS FOR A B-TRANSIENT. THE TRANSIENT NAME IS LOCATED IN THE FIRST 8 BYTES.

*D5
SUPERVISOR GENERATION OPTION.

*E5
ADDRESS POINTERS OF THE LOGICAL TRANSIENT SAVE AREA AND THE PROBLEM PROGRAM USING THE TRANSIENT AREA ARE REVERSED WHEN A LOGICAL TRANSIENT IS ACTIVE.

Chart FE. $$A$SUP1 - SGSVC Macro, SVCs 7 and 11 Refer to Chart 03.

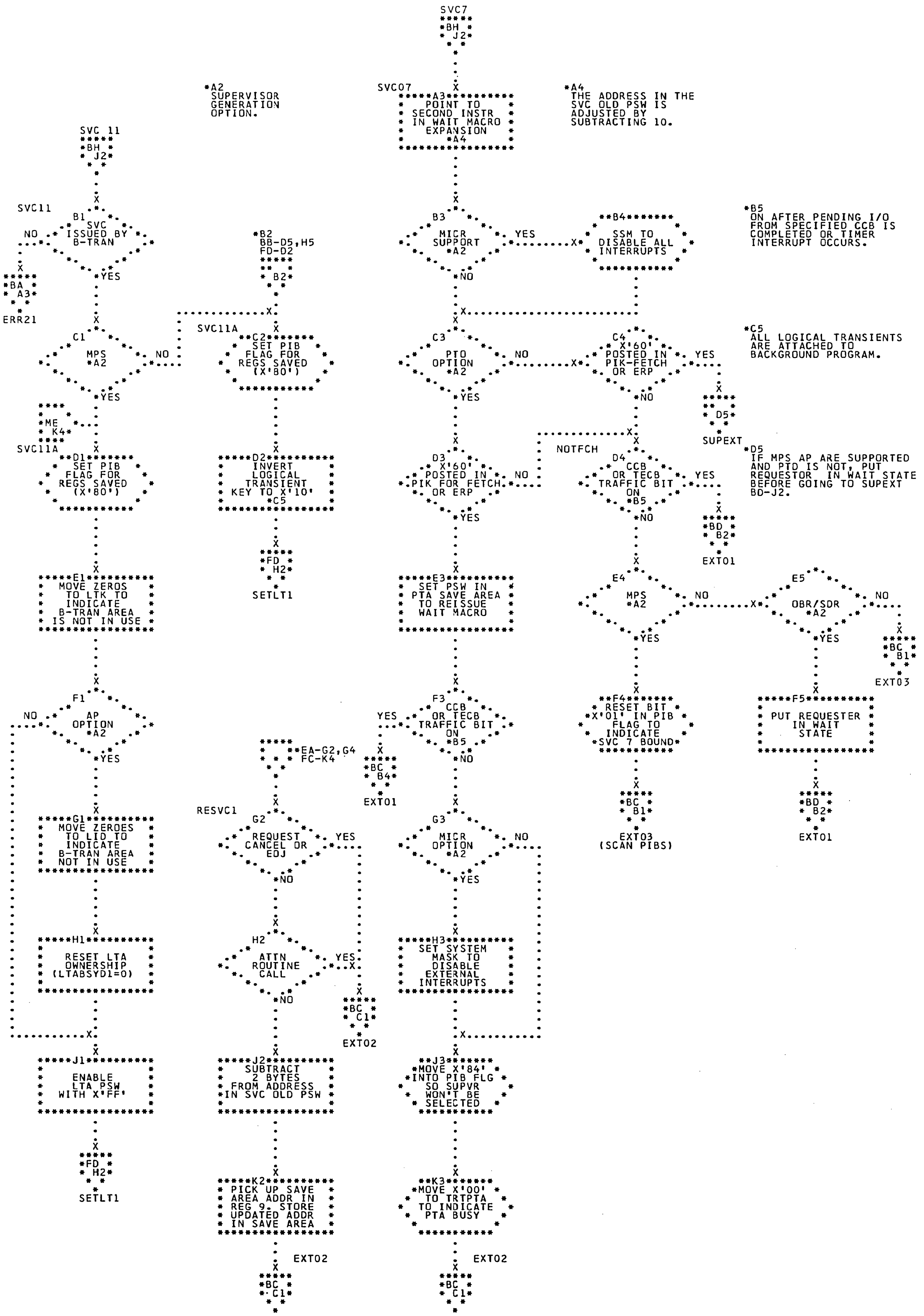


Chart FF. $$A$SUP1 - SGSVC Macro, SVCs 3 and 4
Refer to Chart 03.

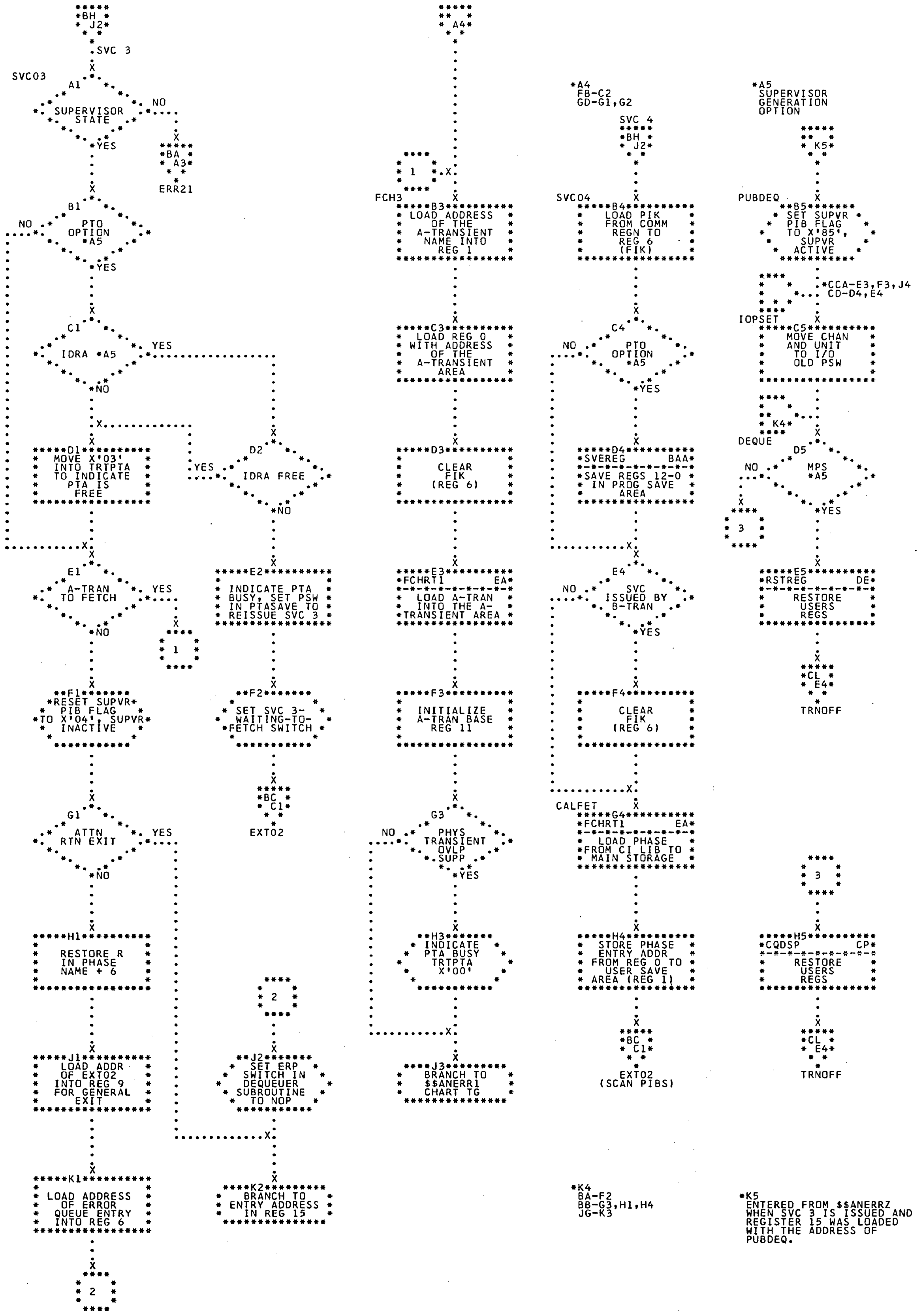


Chart FG. $$A$SUP1 - SGSVC Macro, SVCs 8, 9, and 10
Refer to Chart 03.

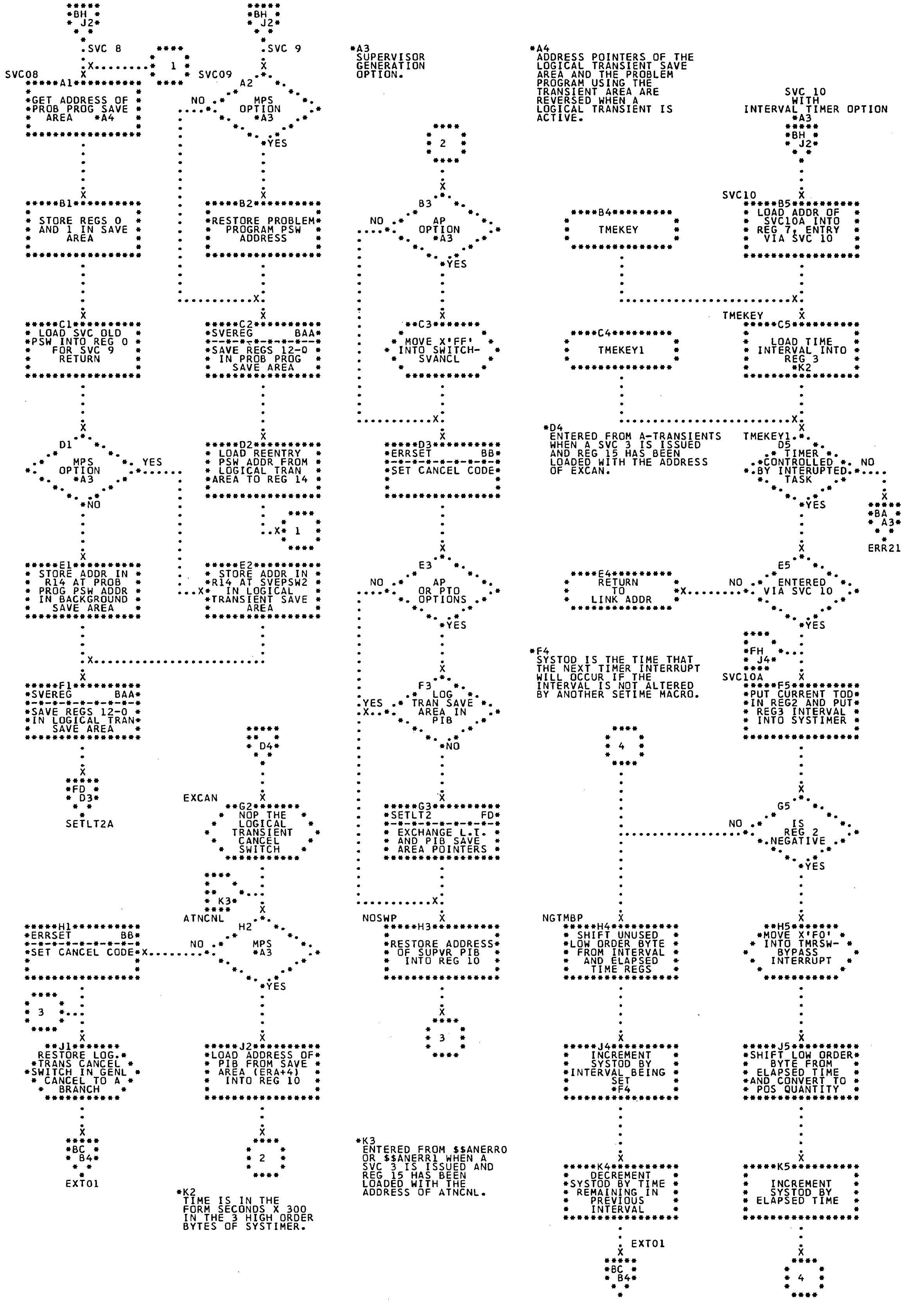


Chart FH. $$A$SUP1 - SGSVC Macro, SVCs 22, 23, 24, and 26
Refer to Chart 03.

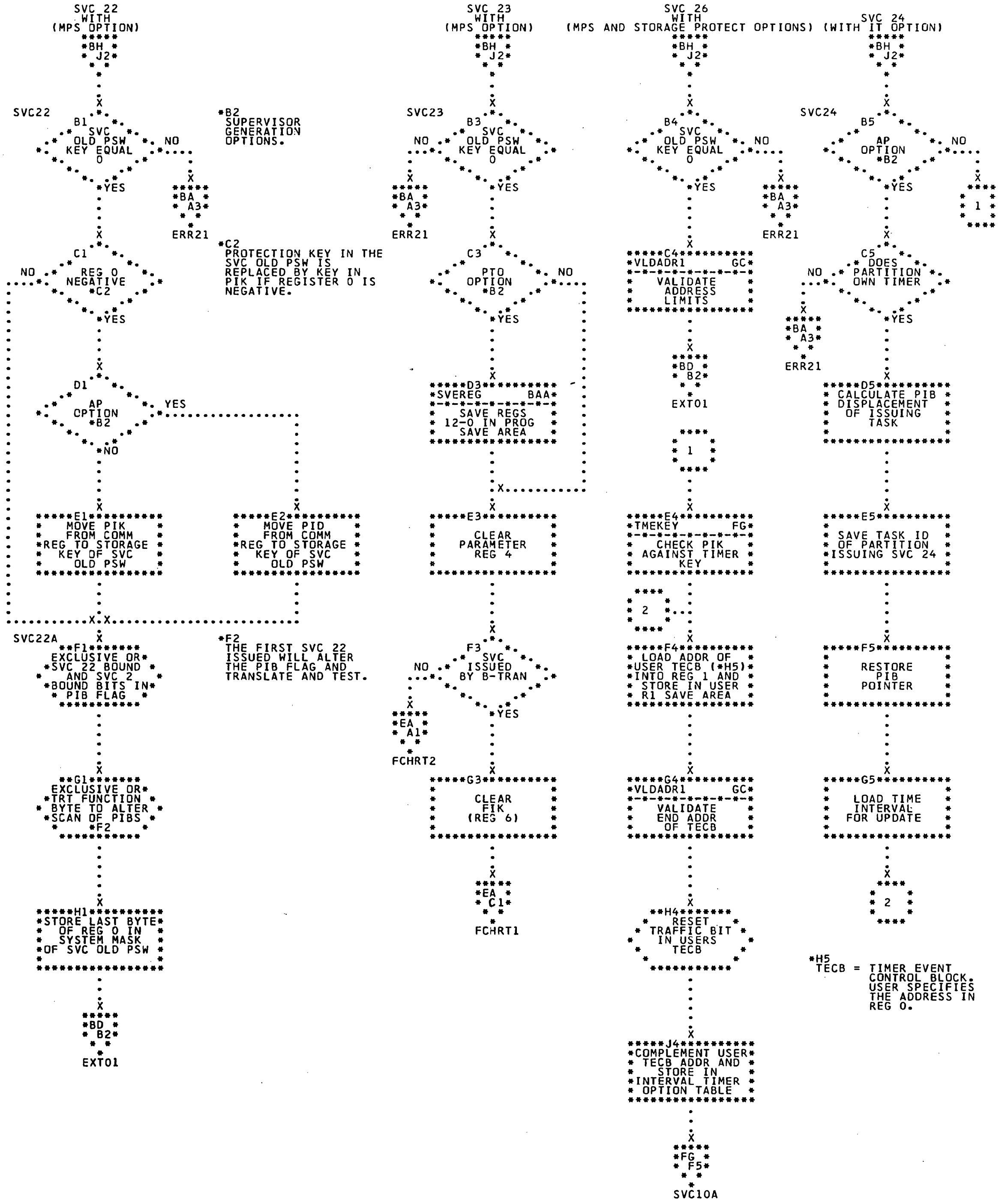
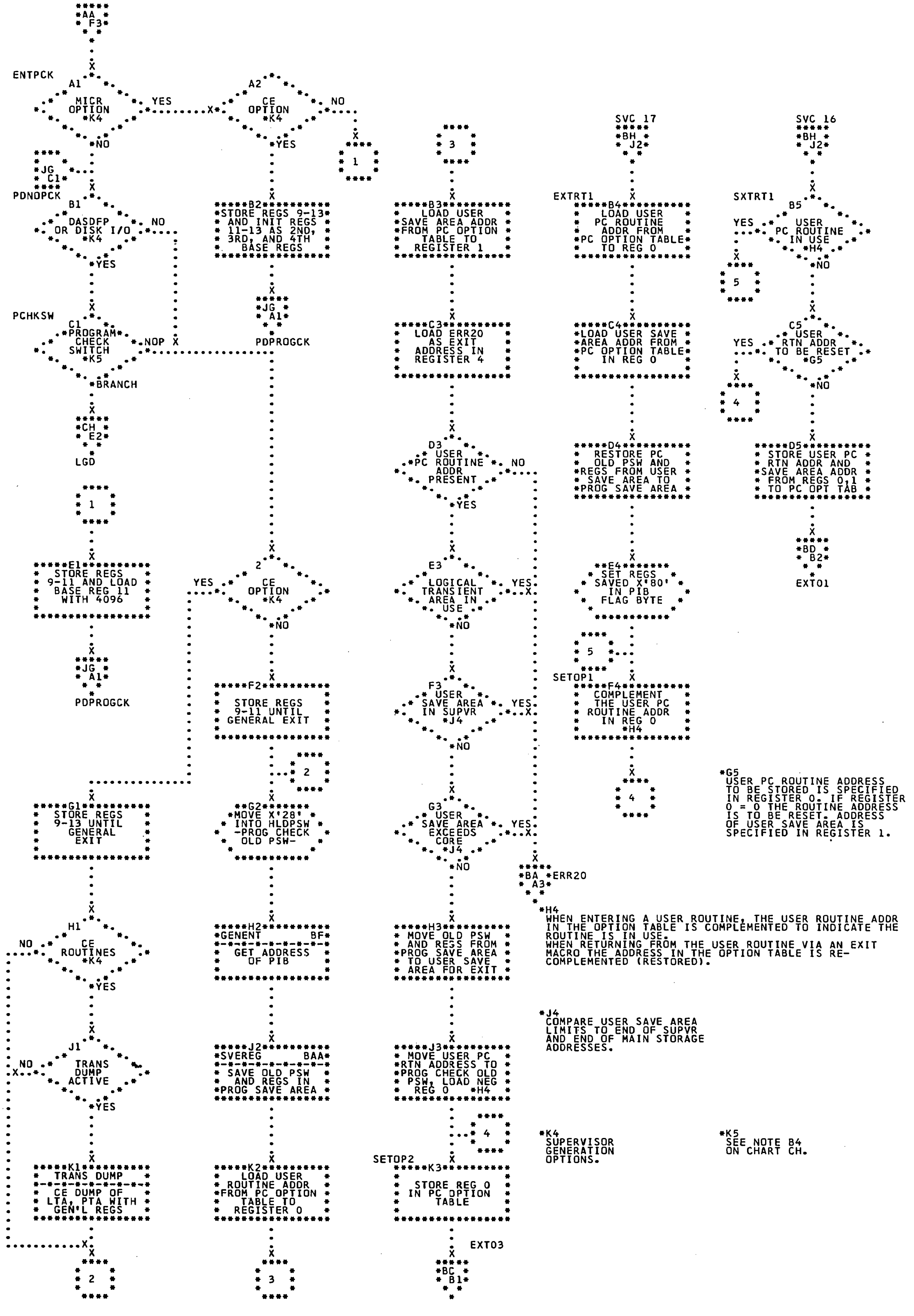


Chart FJ. $$A$SUP1 - SGSVC Macro, Program Check Interrupt and SVCs 16 and 17
Refer to Charts 02 and 03.



*G5
USER PC ROUTINE ADDRESS TO BE STORED IS SPECIFIED IN REGISTER 0. IF REGISTER 0 = 0 THE ROUTINE ADDRESS IS TO BE RESET. ADDRESS OF USER SAVE AREA IS SPECIFIED IN REGISTER 1.

*H4
WHEN ENTERING A USER ROUTINE, THE USER ROUTINE ADDR IN THE OPTION TABLE IS COMPLEMENTED TO INDICATE THE ROUTINE IS IN USE.
WHEN RETURNING FROM THE USER ROUTINE VIA AN EXIT MACRO THE ADDRESS IN THE OPTION TABLE IS RE-COMPLEMENTED (RESTORED).

*J4
COMPARE USER SAVE AREA LIMITS TO END OF SUPVR AND END OF MAIN STORAGE ADDRESSES.

*K4
SUPERVISOR GENERATION OPTIONS.

*K5
SEE NOTE B4 ON CHART CH.

Chart FK. $$A$SUP1 - SGSVC Macro, Program Check Interrupt Refer to Chart 02.

OPTIONS -- USER PC ROUTINE WITH (STORAGE PROTECT, INTERVAL TIMER, OR USER OC ROUTINE).

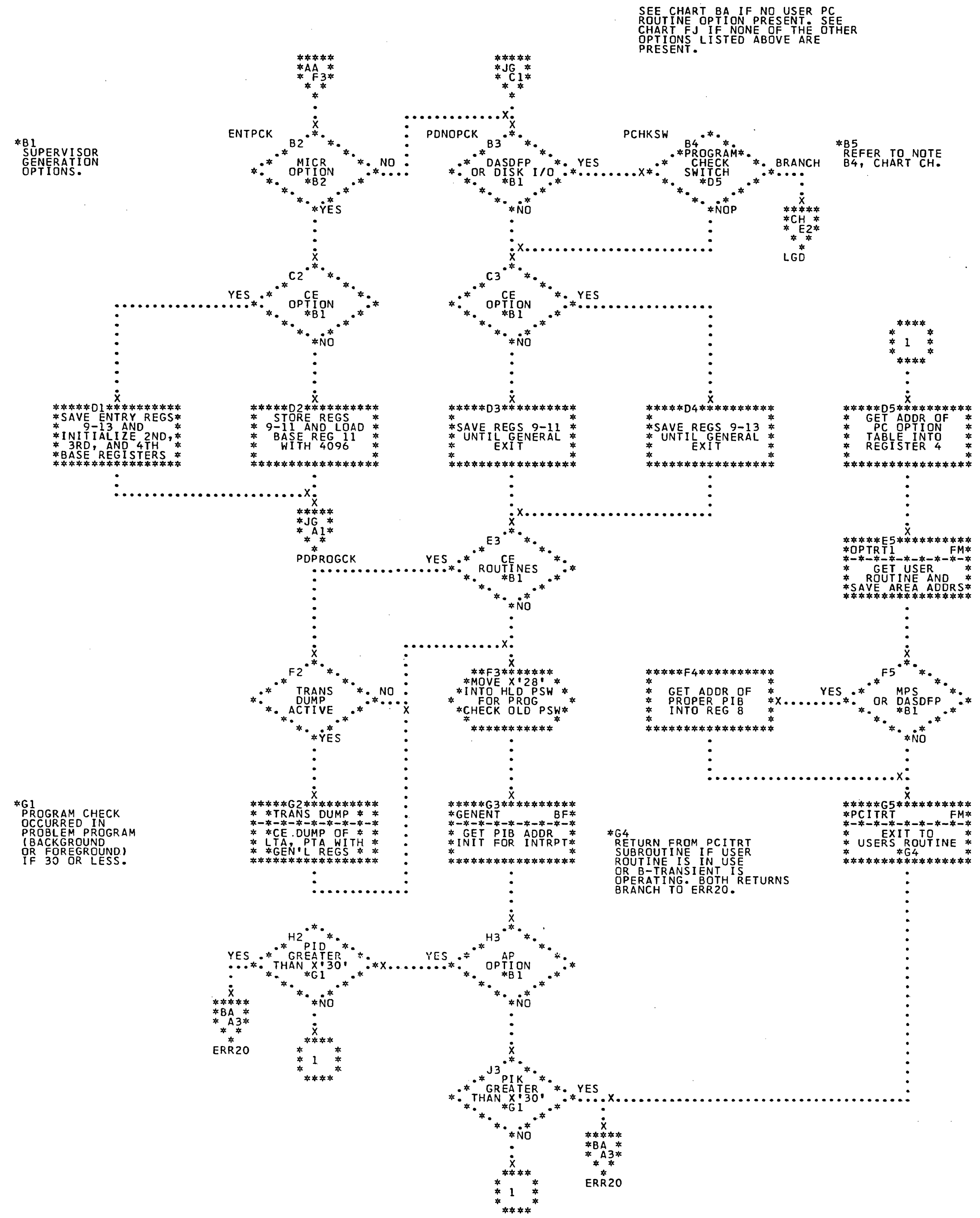


Chart FL. $$A$SUP1 - SGSVC Macro, External Interrupt (Part 1 of 2)
Refer to Chart 05.

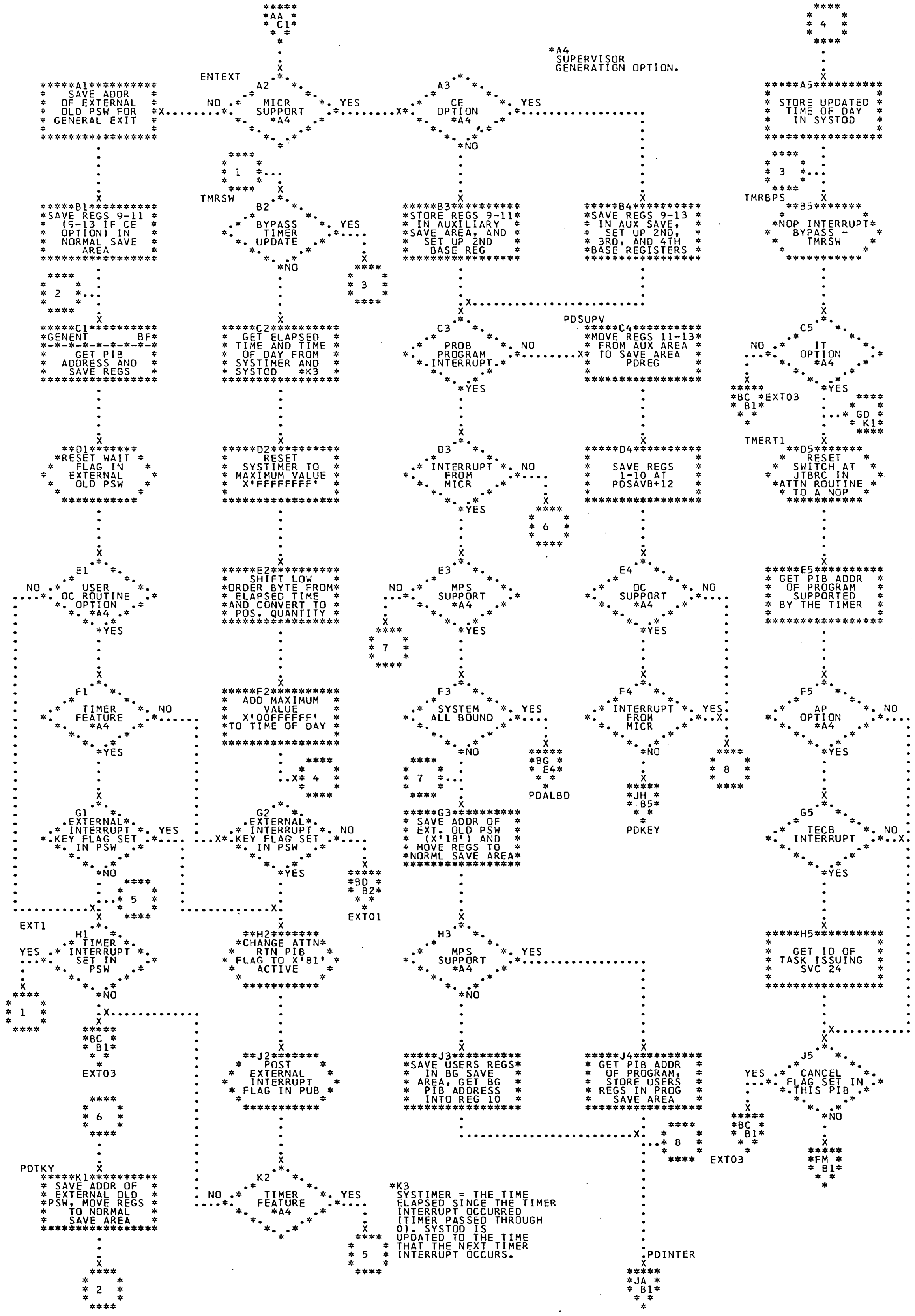


Chart FM. $$A$SUP1 - SGSVC Macro, External Interrupt (Part 2 of 2) and External Interrupt Subroutines

Refer to Chart 05.

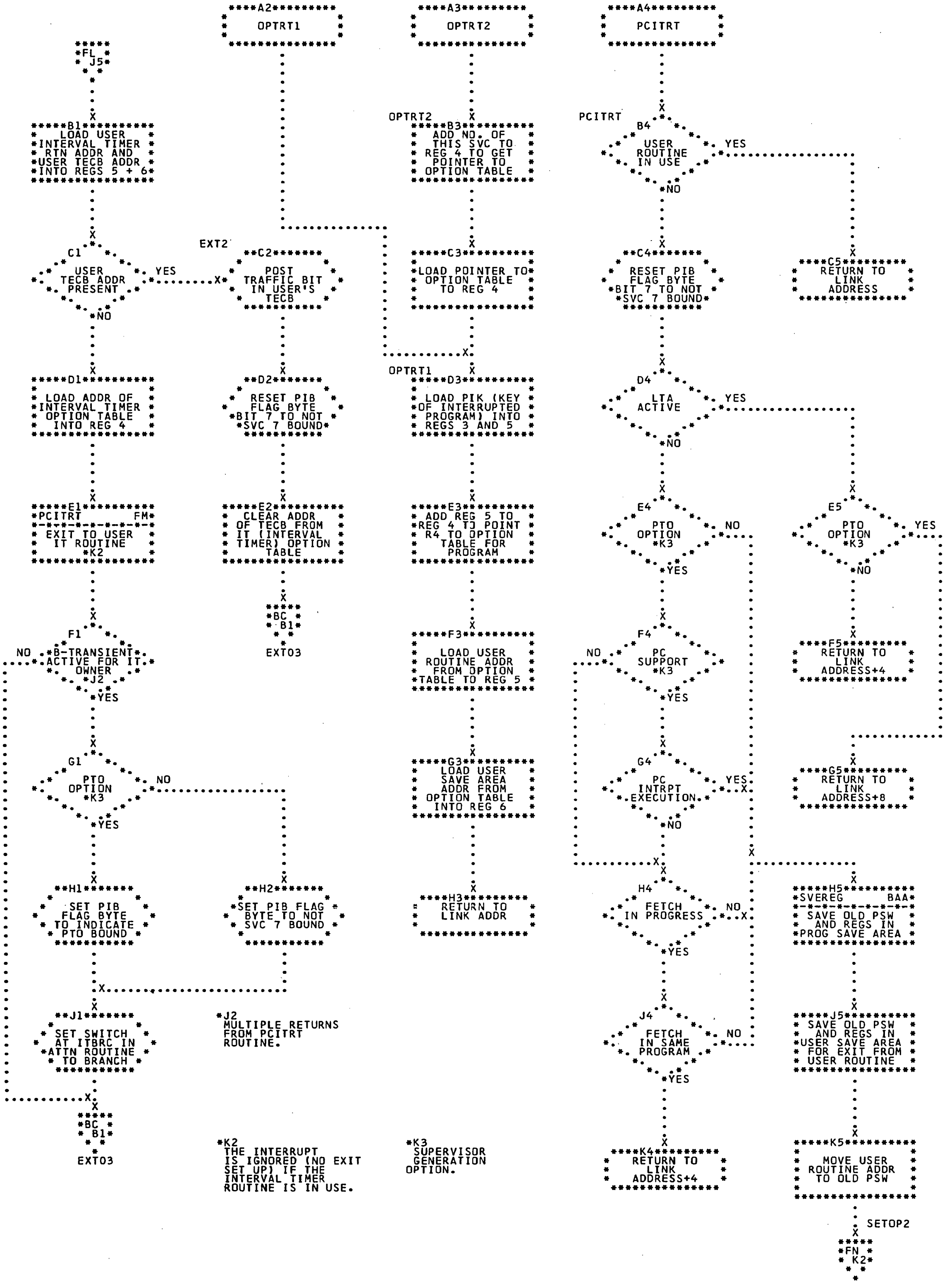
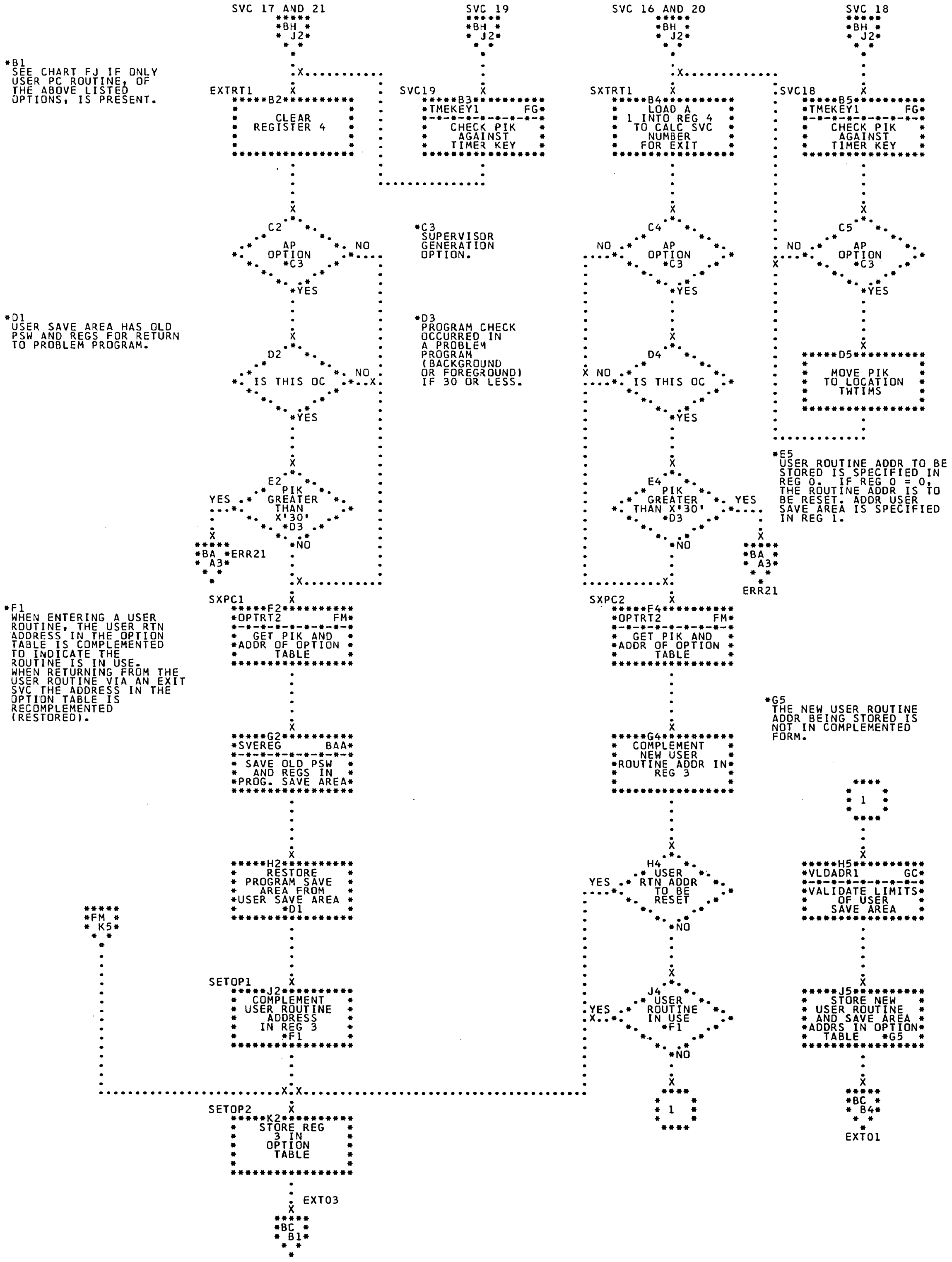


Chart FN. $$A$SUP1 - SGSVC Macro, Program Check Interrupt (SVCs 16 through 21 with Options)

Refer to Chart 03.

OPTIONS -- USER PC ROUTINE WITH (STORAGE PROTECT, INTERVAL TIMER, OR USER OC ROUTINE). *B1



*B1
SEE CHART FJ IF ONLY USER PC ROUTINE, OF THE ABOVE LISTED OPTIONS, IS PRESENT.

*C3
SUPERVISOR GENERATION OPTION.

*D1
USER SAVE AREA HAS OLD PSW AND REGS FOR RETURN TO PROBLEM PROGRAM.

*D3
PROGRAM CHECK OCCURRED IN A PROBLEM PROGRAM (BACKGROUND OR FOREGROUND) IF 30 OR LESS.

*E5
USER ROUTINE ADDR TO BE STORED IS SPECIFIED IN REG 0. IF REG 0 = 0, THE ROUTINE ADDR IS TO BE RESET. ADDR USER SAVE AREA IS SPECIFIED IN REG 1.

*F1
WHEN ENTERING A USER ROUTINE, THE USER RTN ADDRESS IN THE OPTION TABLE IS COMPLEMENTED TO INDICATE THE ROUTINE IS IN USE. WHEN RETURNING FROM THE USER ROUTINE VIA AN EXIT SVC THE ADDRESS IN THE OPTION TABLE IS RECOMPLEMENTED (RESTORED).

*G5
THE NEW USER ROUTINE ADDR BEING STORED IS NOT IN COMPLEMENTED FORM.

Chart FP. $$A$SUP1 - SGSVC Macro, Console Buffering Routine (Part 1 of 2)
Refer to Chart 04.

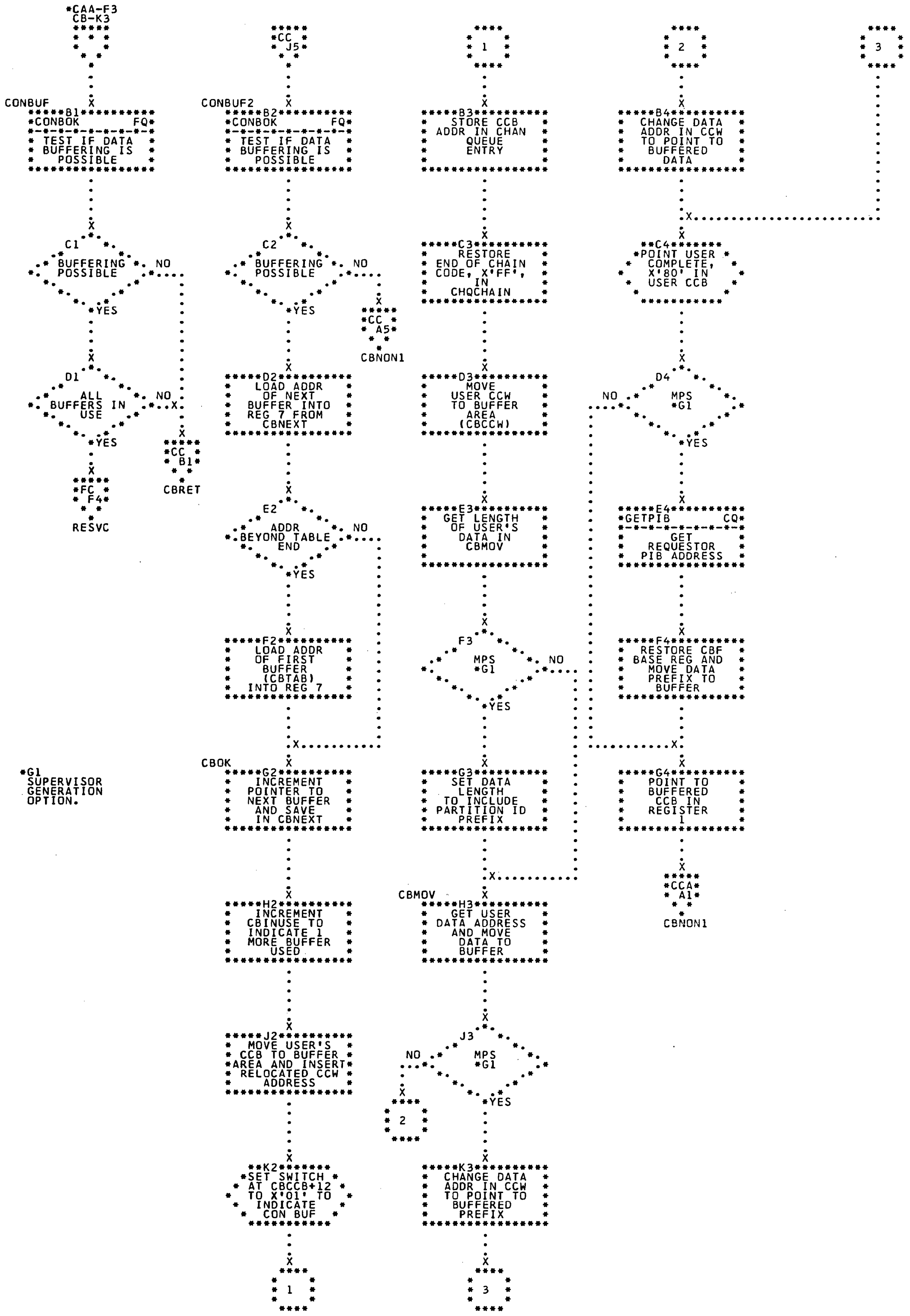
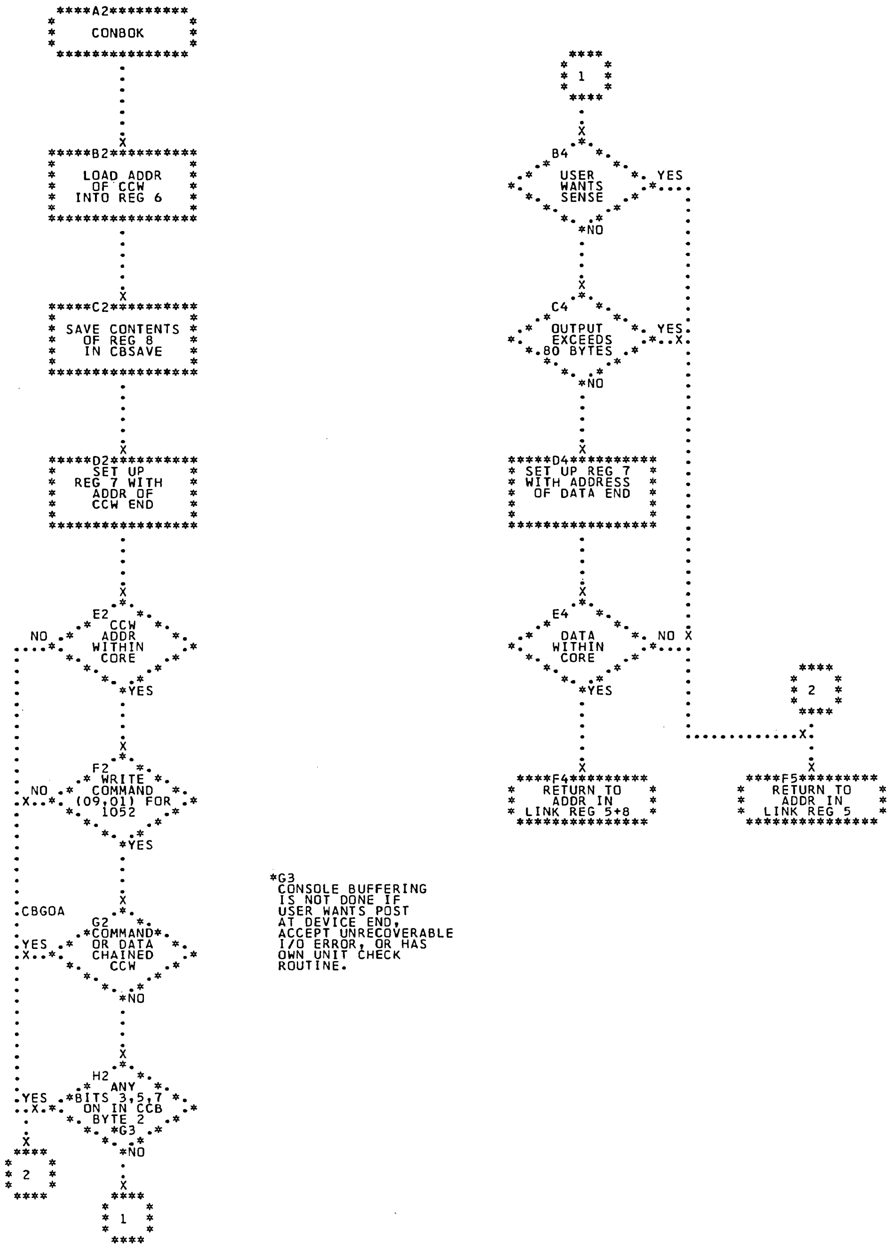


Chart FQ. $$A$SUP1 - SGSVC Macro, Console Buffering Routine (Part 2 of 2) Refer to Chart 04.



*G3
CONSOLE BUFFERING
IS NOT DONE IF
USER WANTS POST
AT DEVICE END,
ACCEPT UNRECOVERABLE
I/O ERROR, OR HAS
OWN UNIT CHECK
ROUTINE.

Chart FR. $$A$SUP1 - SGSVC Macro, SVCs 43 and 45
Refer to Chart 03.

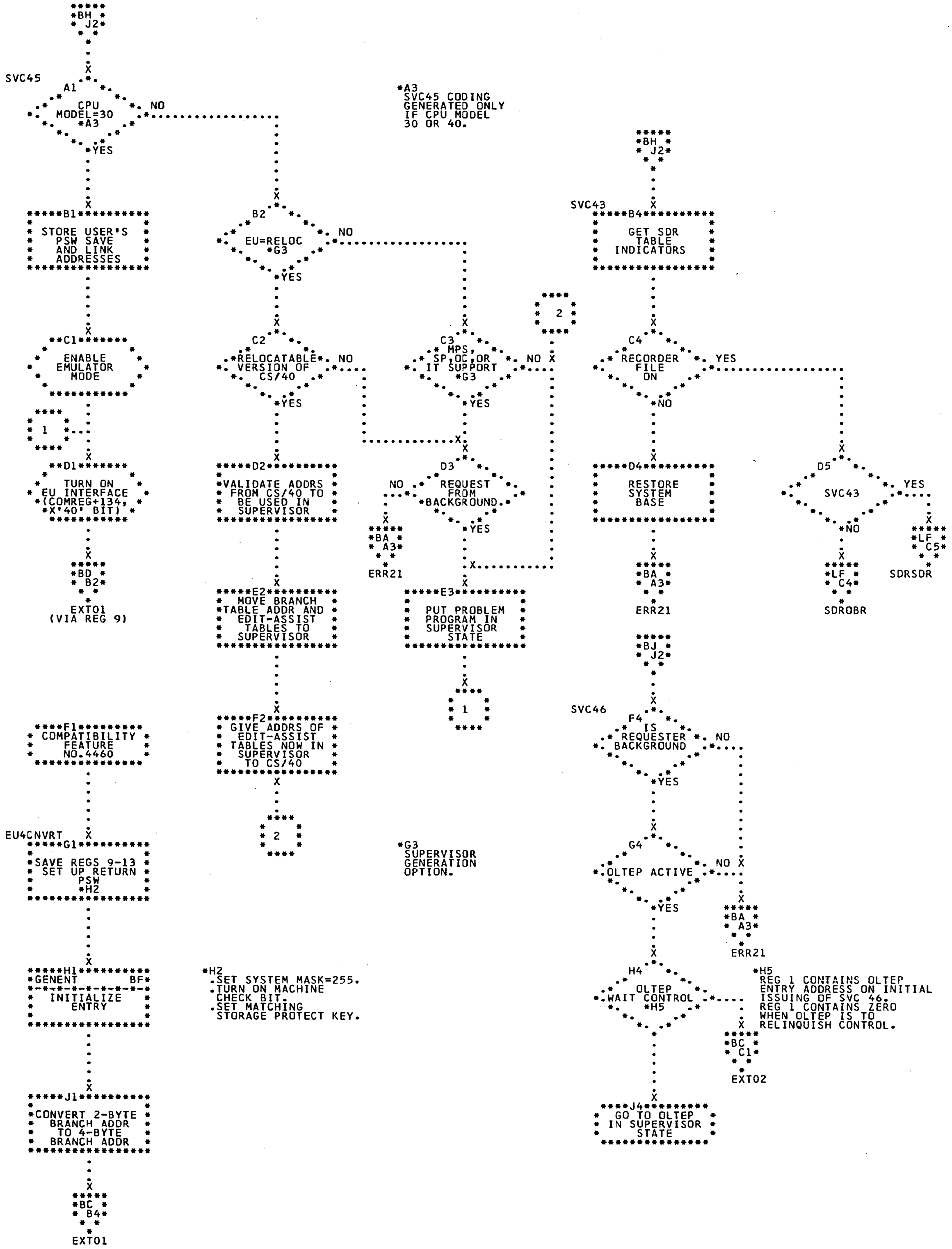


Chart FS. $$A$SUP1 - SGSVC Macro, SVC 51
Refer to Chart 03.

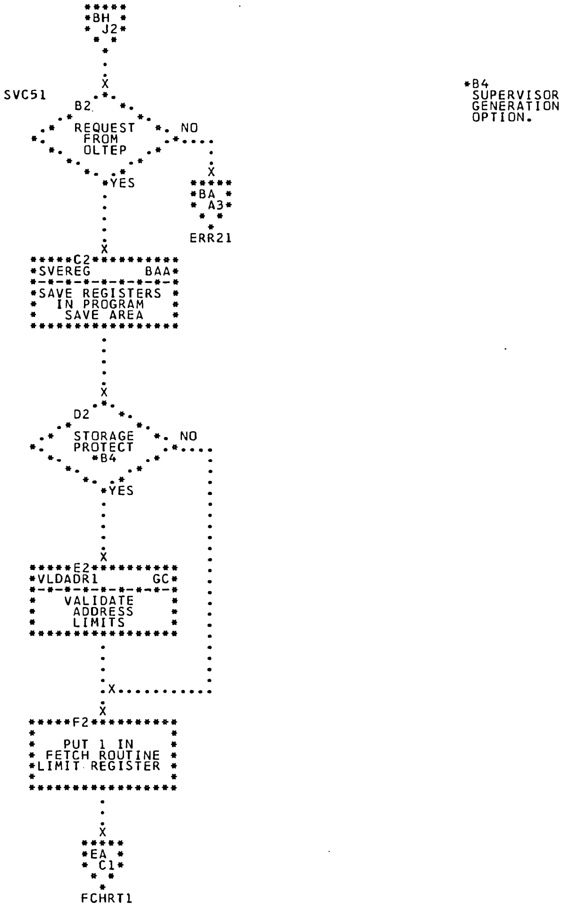


Chart GA. $$A$SUP1 - SGDSK Macro, Disk Error Recovery (Part 1 of 2) Refer to Chart 06.

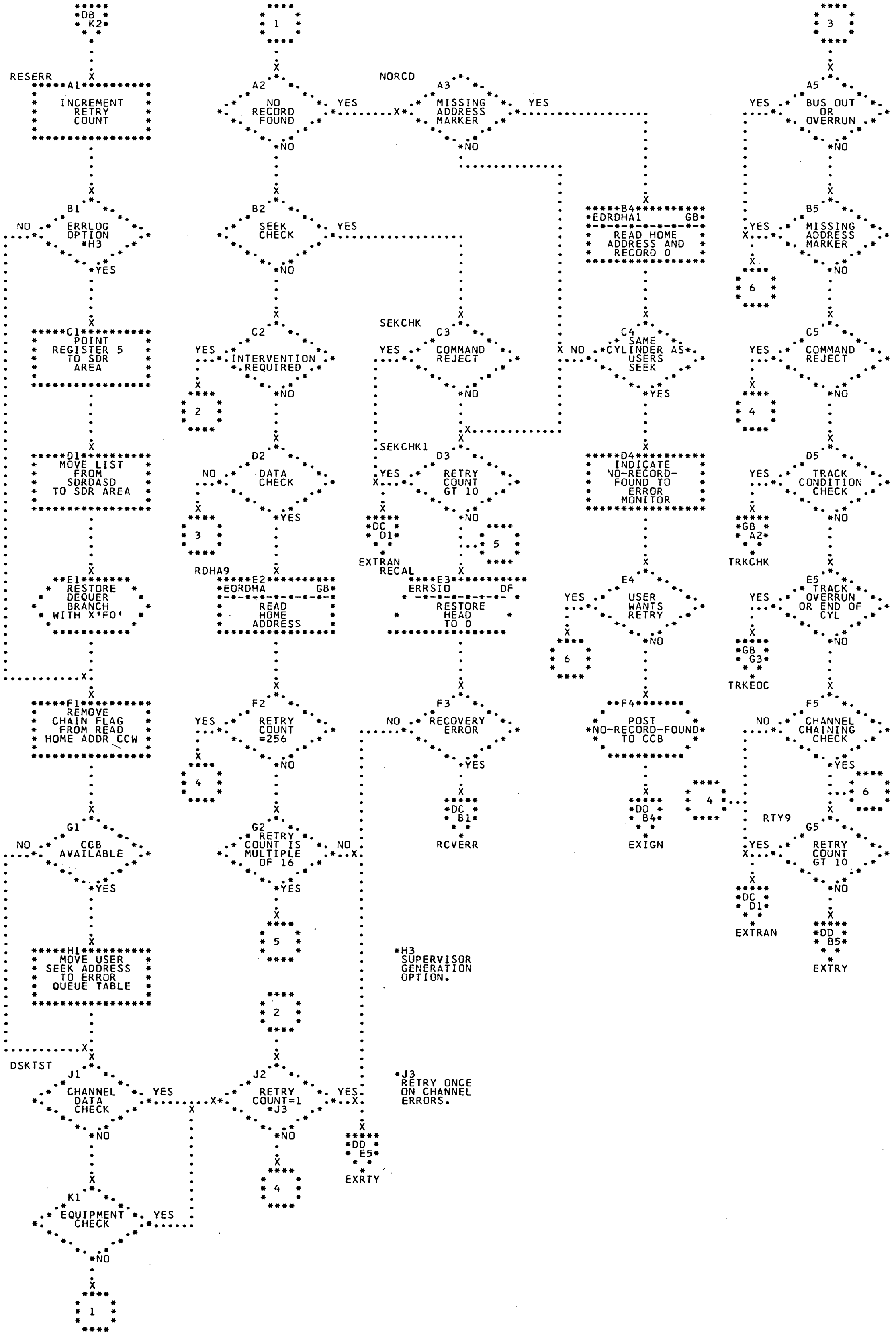


Chart GB. $$A$SUP1 - SGDSK Macro, Disk Error Recovery (Part 2 of 2) Refer to Chart 06.

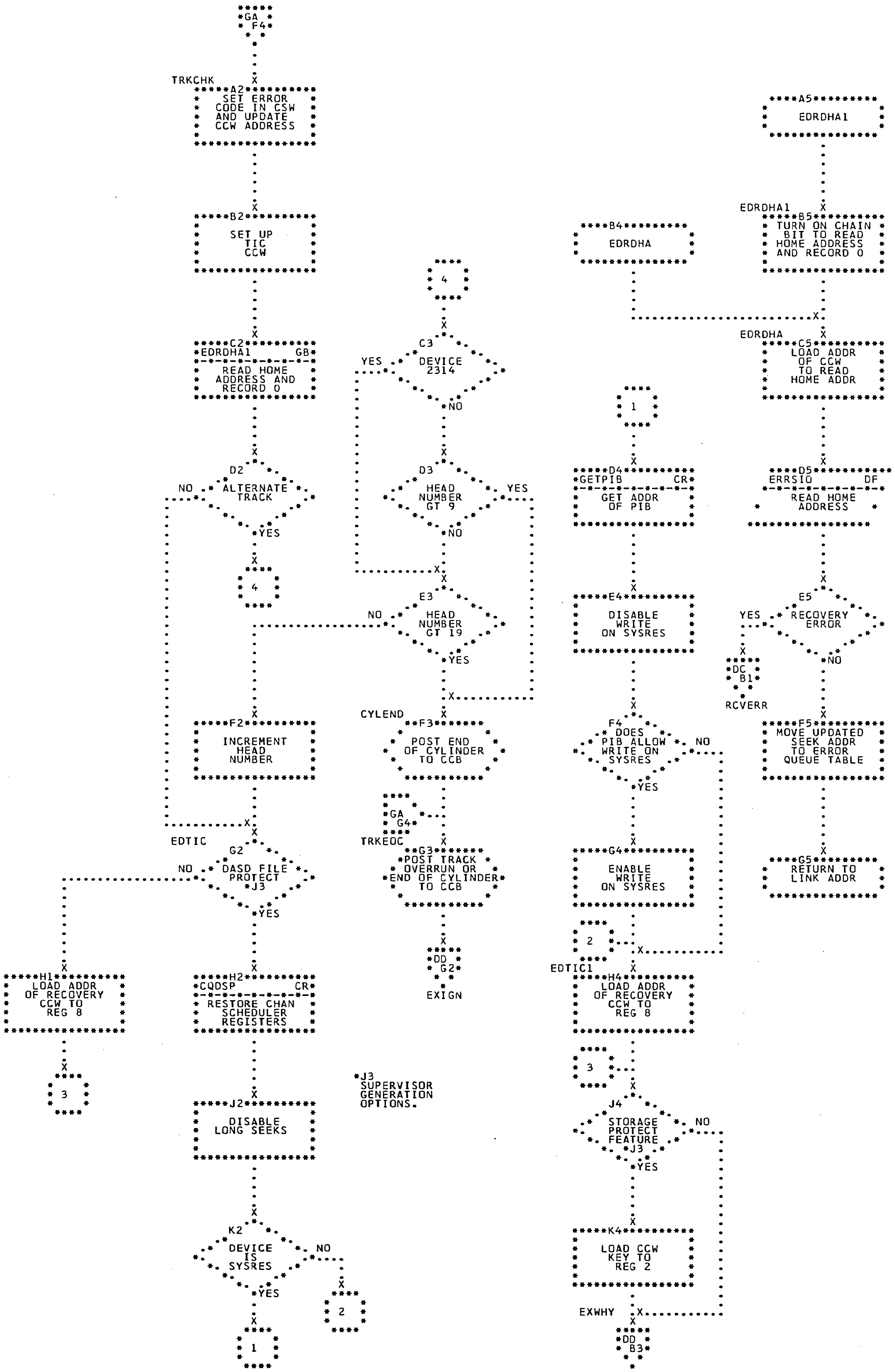


Chart GC. $$A$SUP1 - SGTCON Macro, VLDADR Subroutine
Refer to Chart 02.

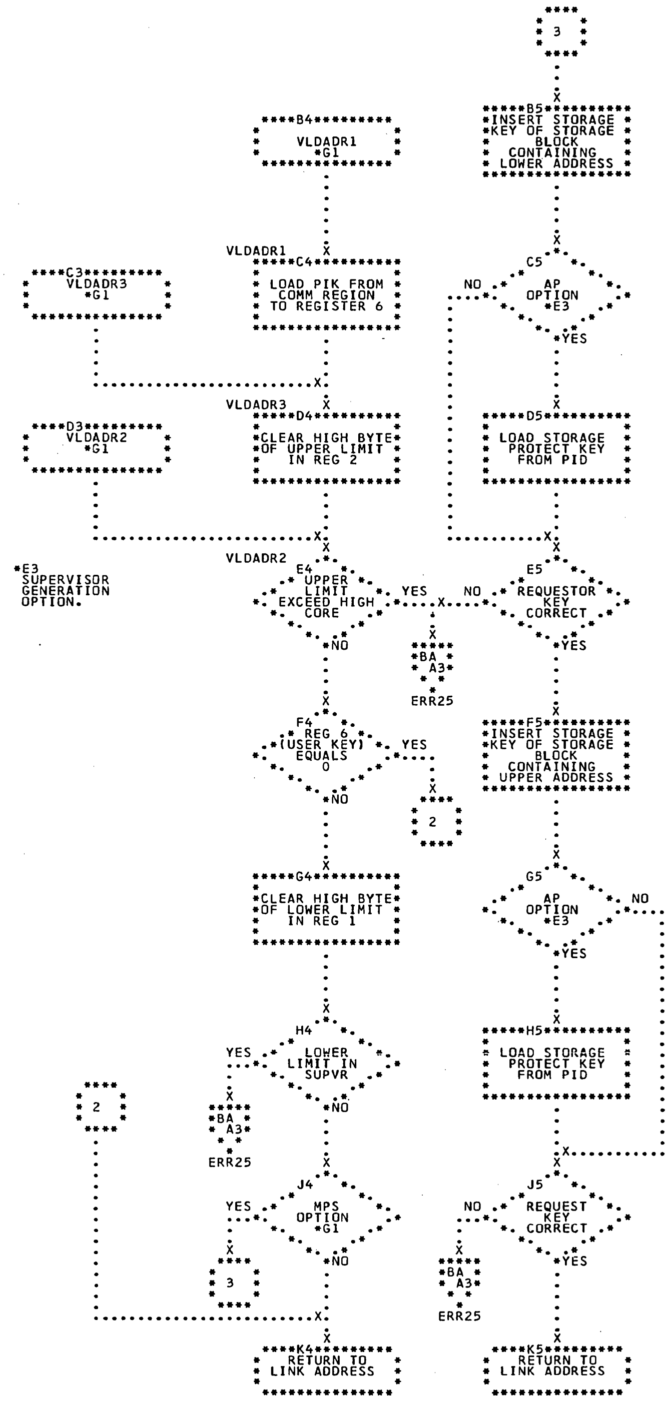


Chart GD. $$A$SUP1 - SGTCON Macro, Resident Attention Subroutine
Refer to Chart 02.

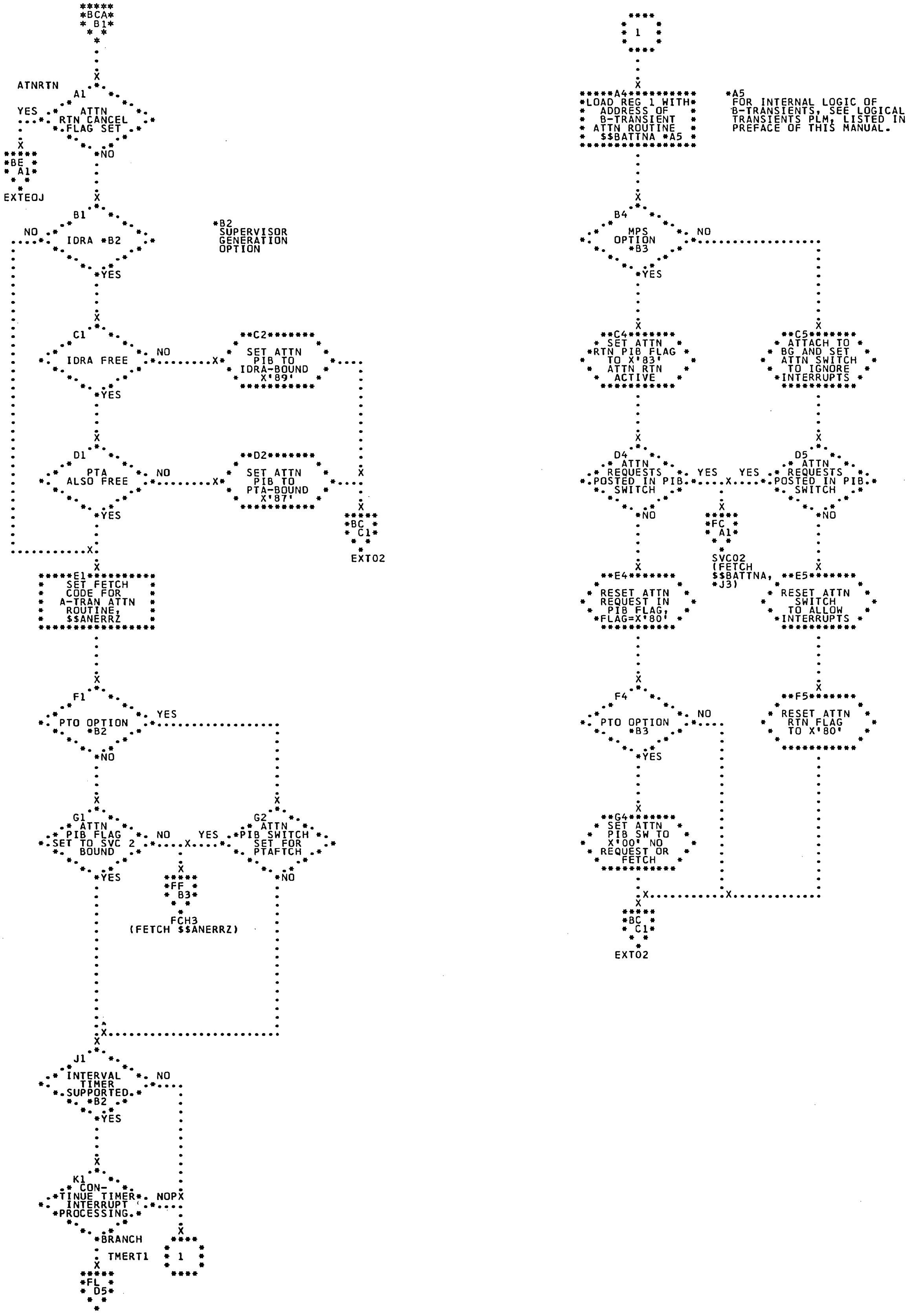


Chart HA. $$A$SUP1 - MCRAS Macro, Resident Machine Check Handler
Refer to Chart 08.

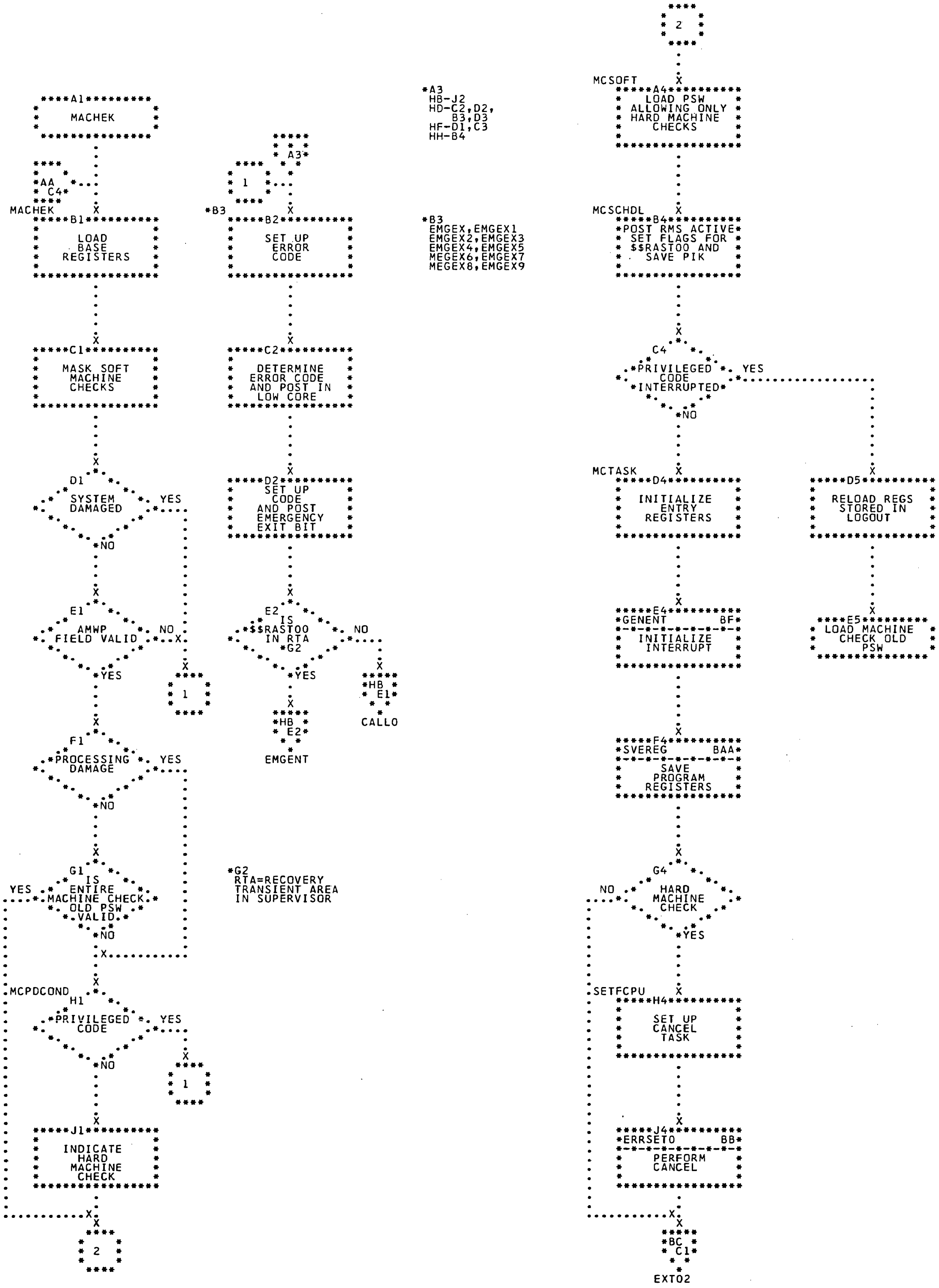


Chart HB. $$A$SUP1 - MCRAS Macro, RAS Monitor (Part 1 of 2)
Refer to Chart 09.

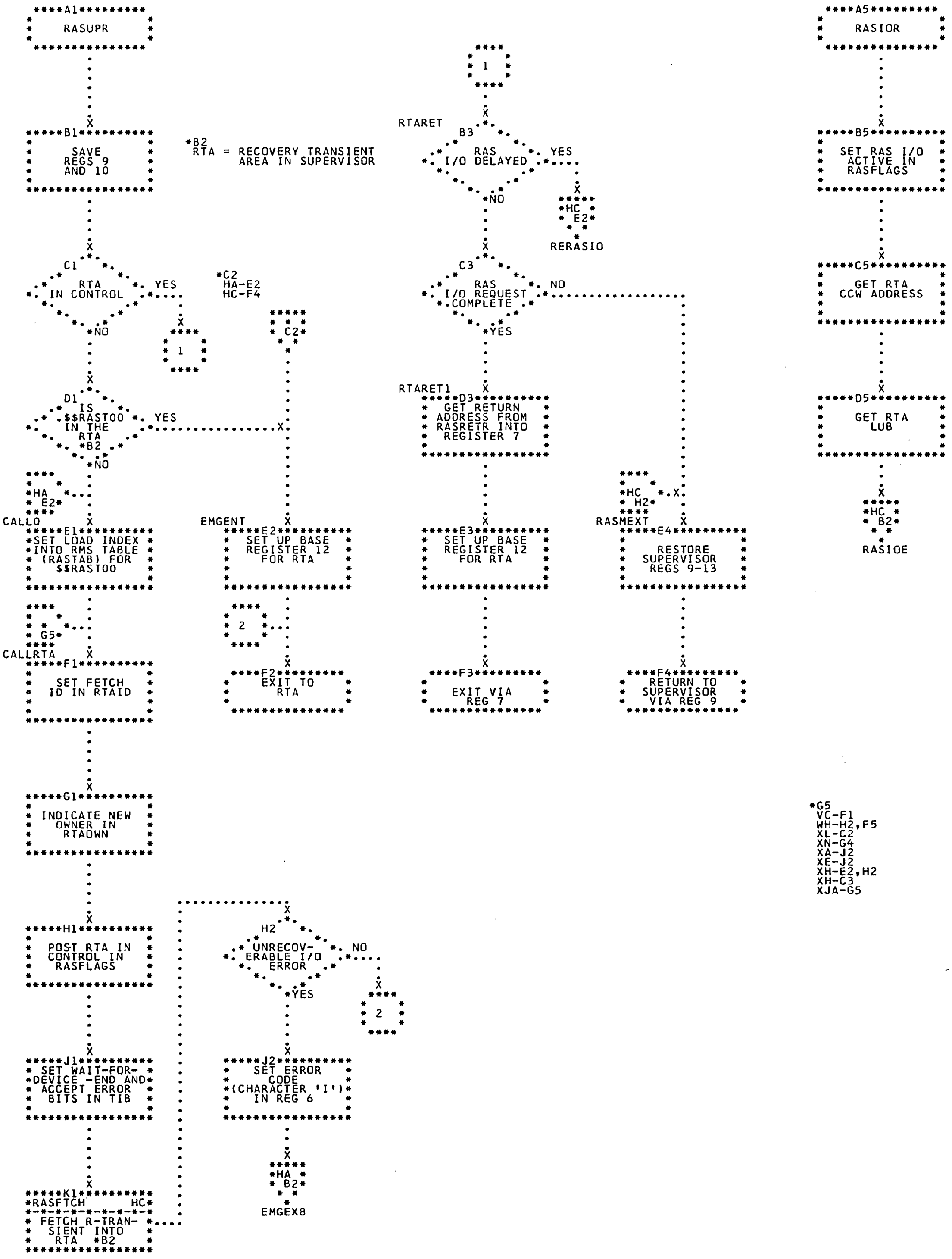


Chart HC. $$A$SUP1 - MCRAS Macro, RAS Monitor (Part 2 of 2)
Refer to Chart 09.

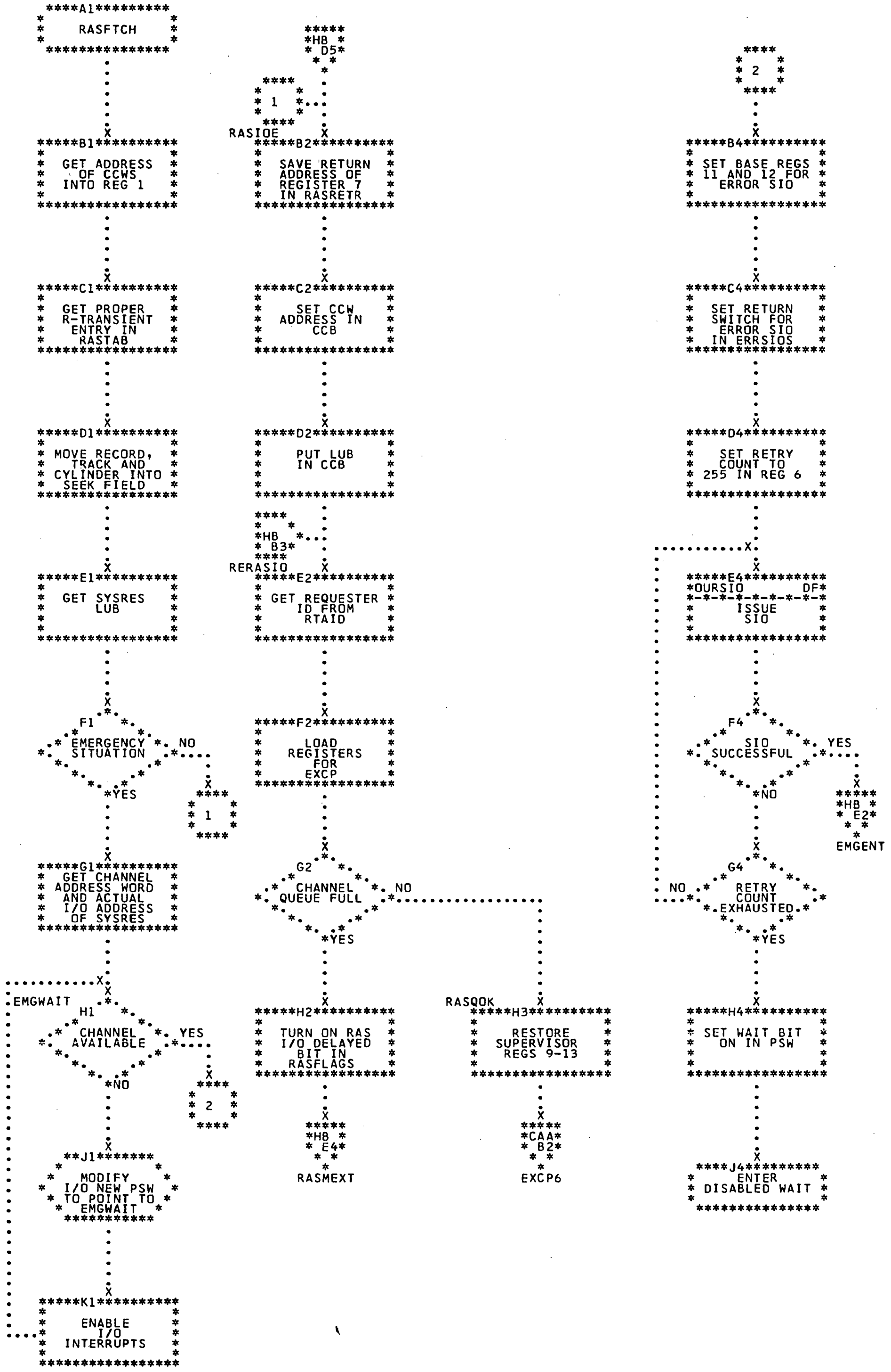


Chart HD. $$A$SUP1 - MCRAS Macro, Resident Channel Check Handler (Part 1 of 4)
Refer to Chart 09.

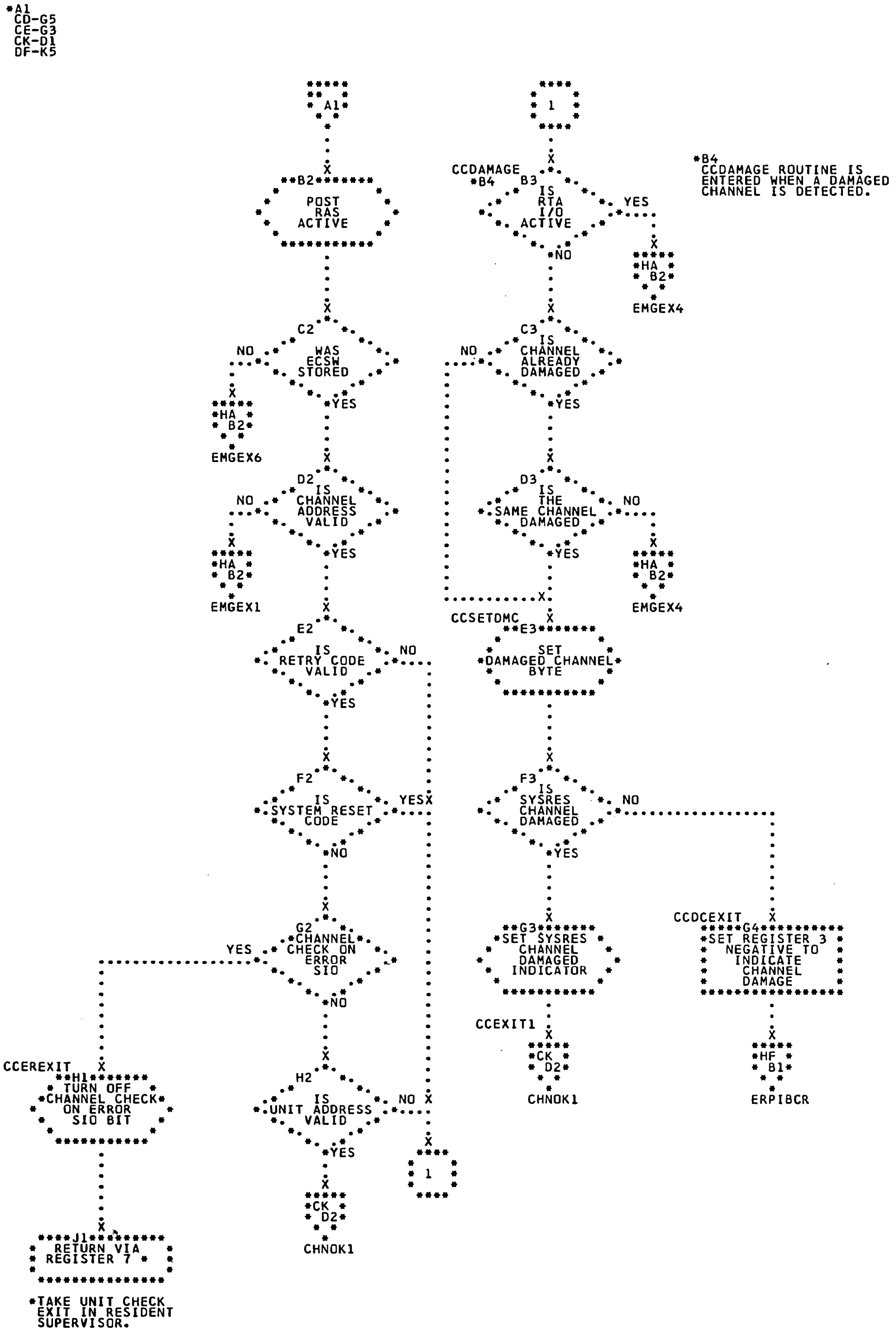


Chart HE. $$A$SUP1 - MCRAS Macro, Resident Channel Check Handler (Part 2 of 4)
Refer to Chart 09.

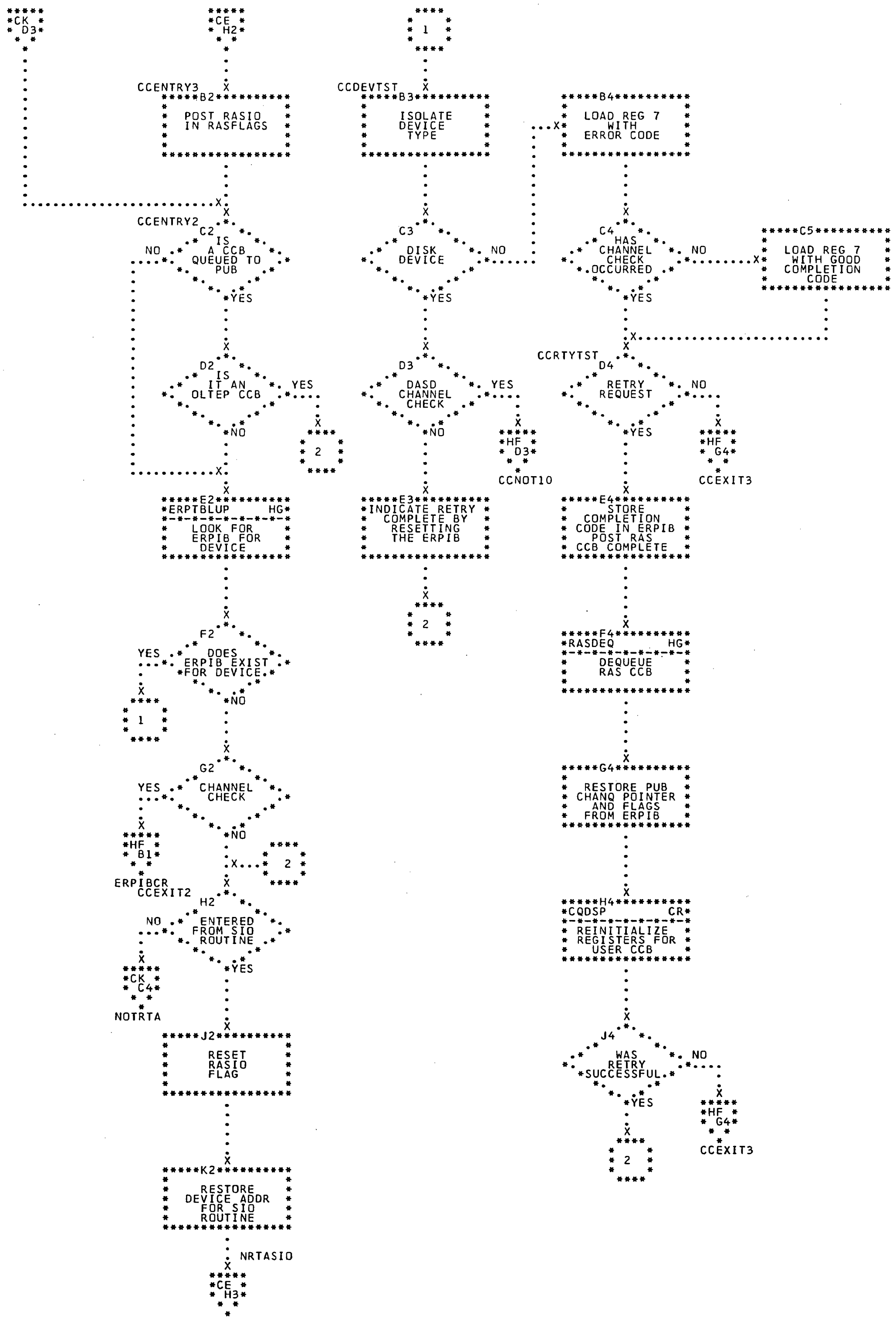


Chart HF. $$A$SUP1 - MCRAS Macro, Resident Channel Check Handler (Part 3 of 4)
Refer to Chart 09.

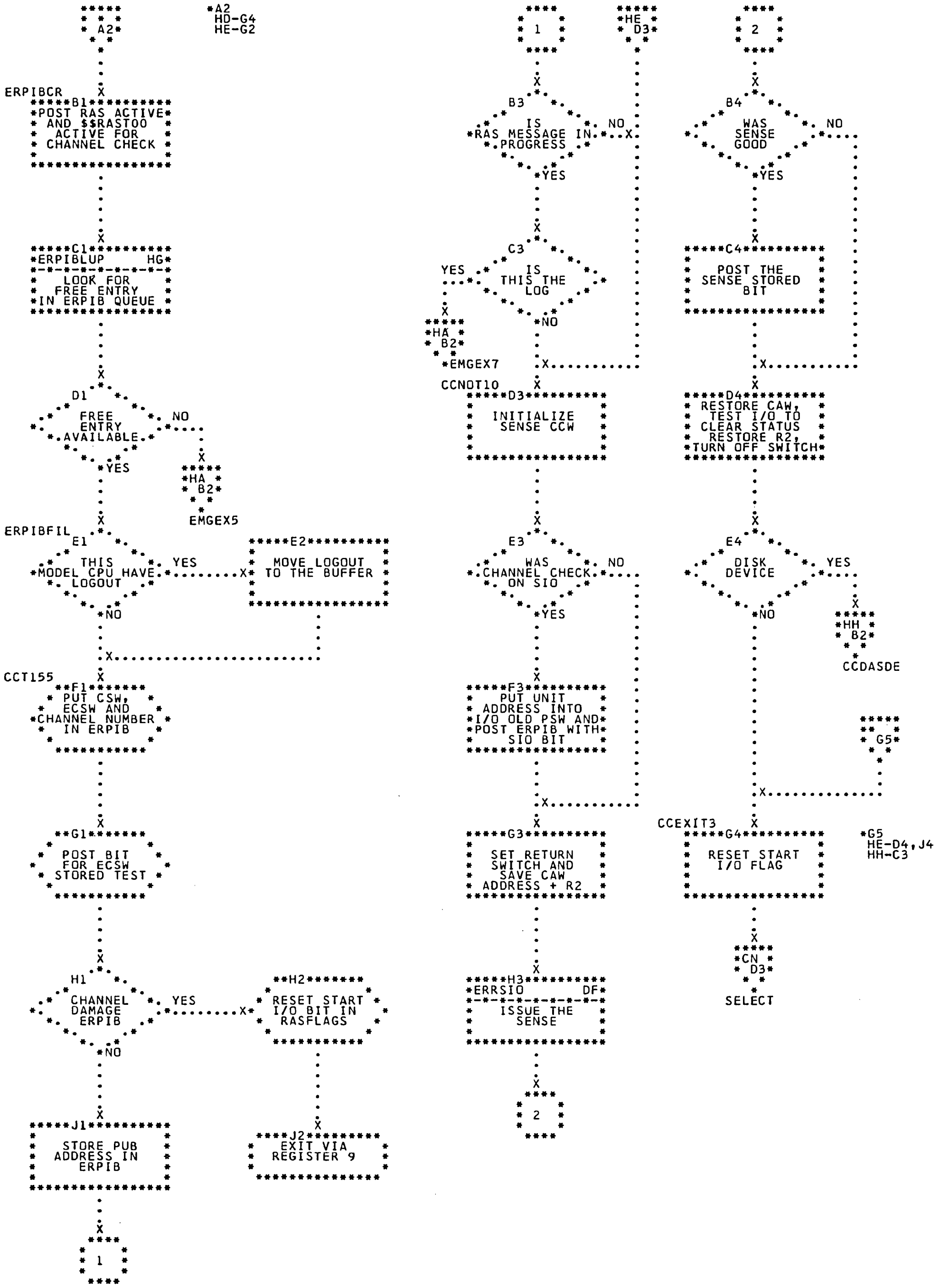


Chart HG. $$A$SUP1 - MCRAS Macro, Resident Channel Check Handler (Part 4 of 4)
Refer to Chart 09.

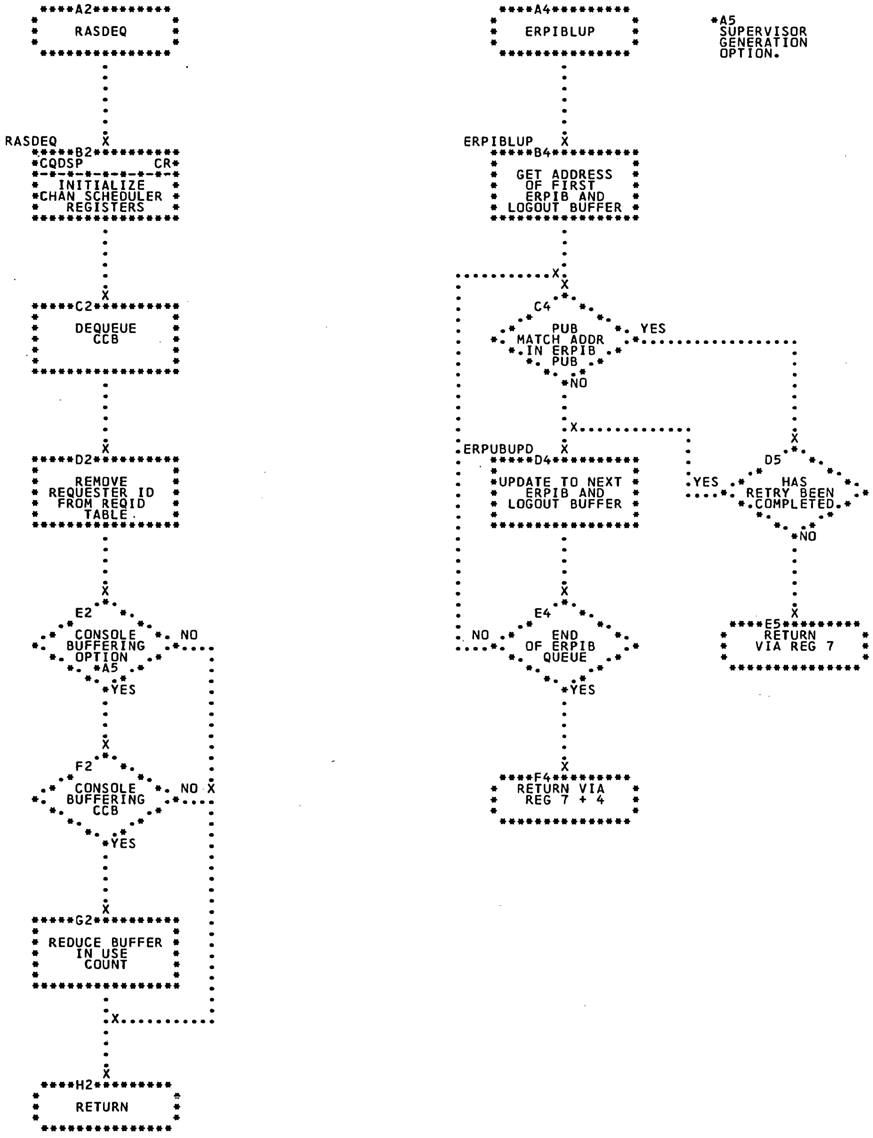


Chart HH. $$A$SUP1 - MCRAS Macro, DASD Channel Check Handler
Refer to Chart 08.

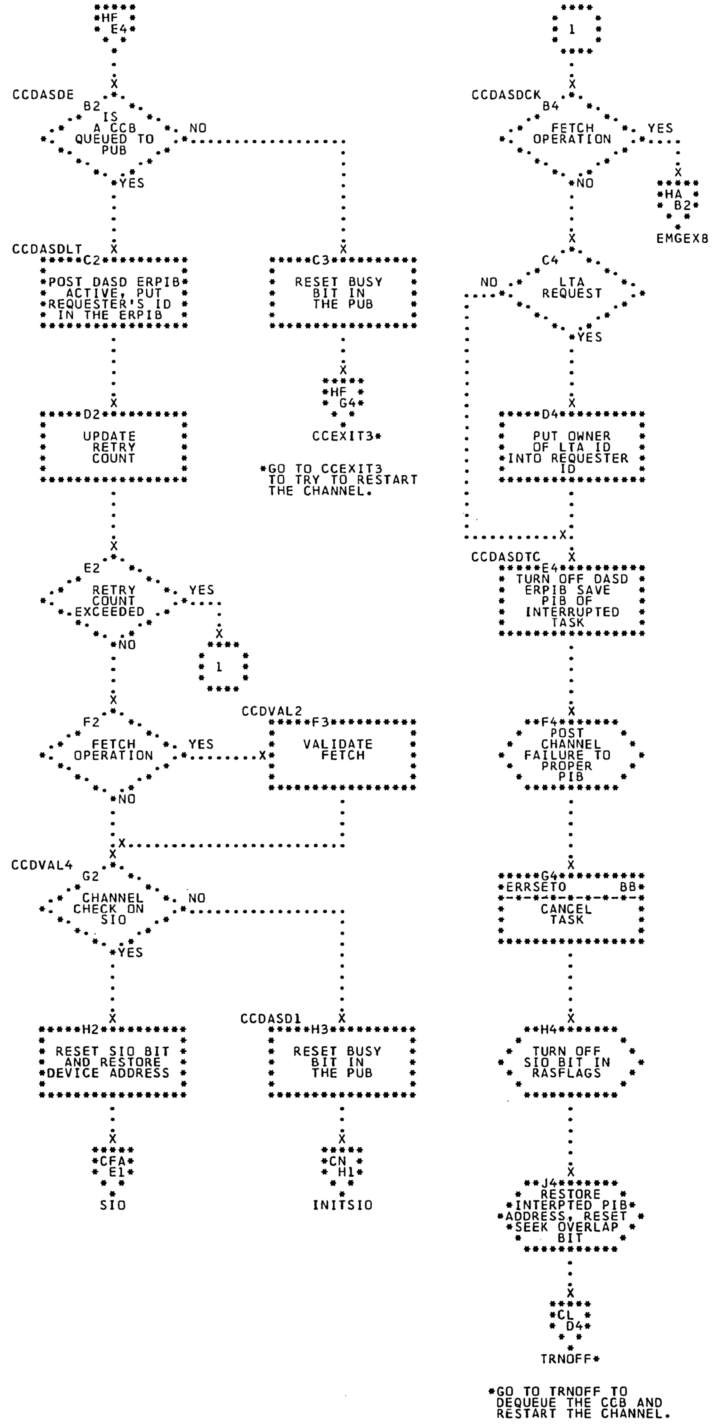


Chart JA. $$A$SUP1 - SMICR Macro, External Interrupt (Part 1 of 3) Refer to Chart 05.

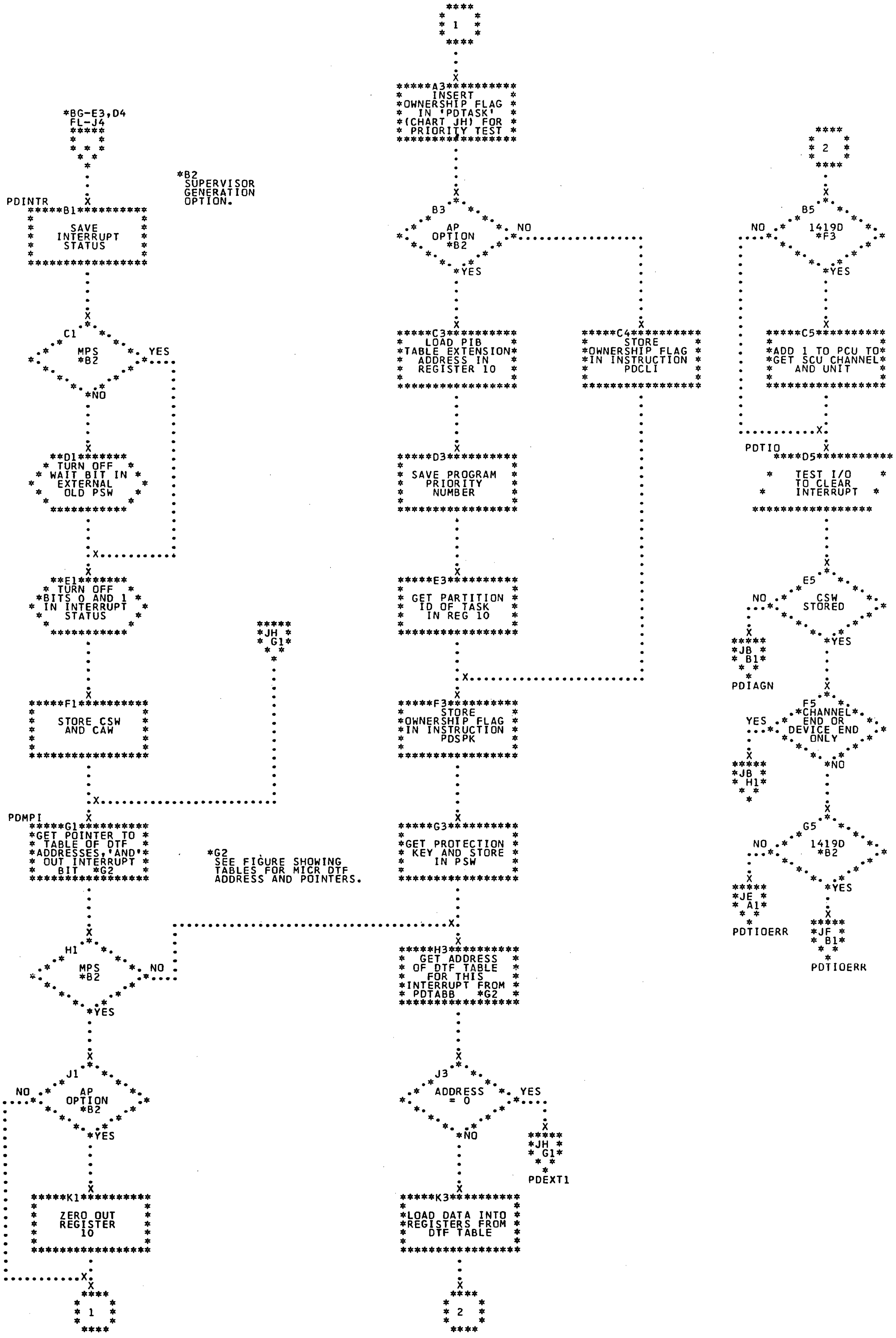


Chart JB. $$A$SUP1 - SMICR Macro, External Interrupt (Part 2 of 3)
Refer to Chart 05.

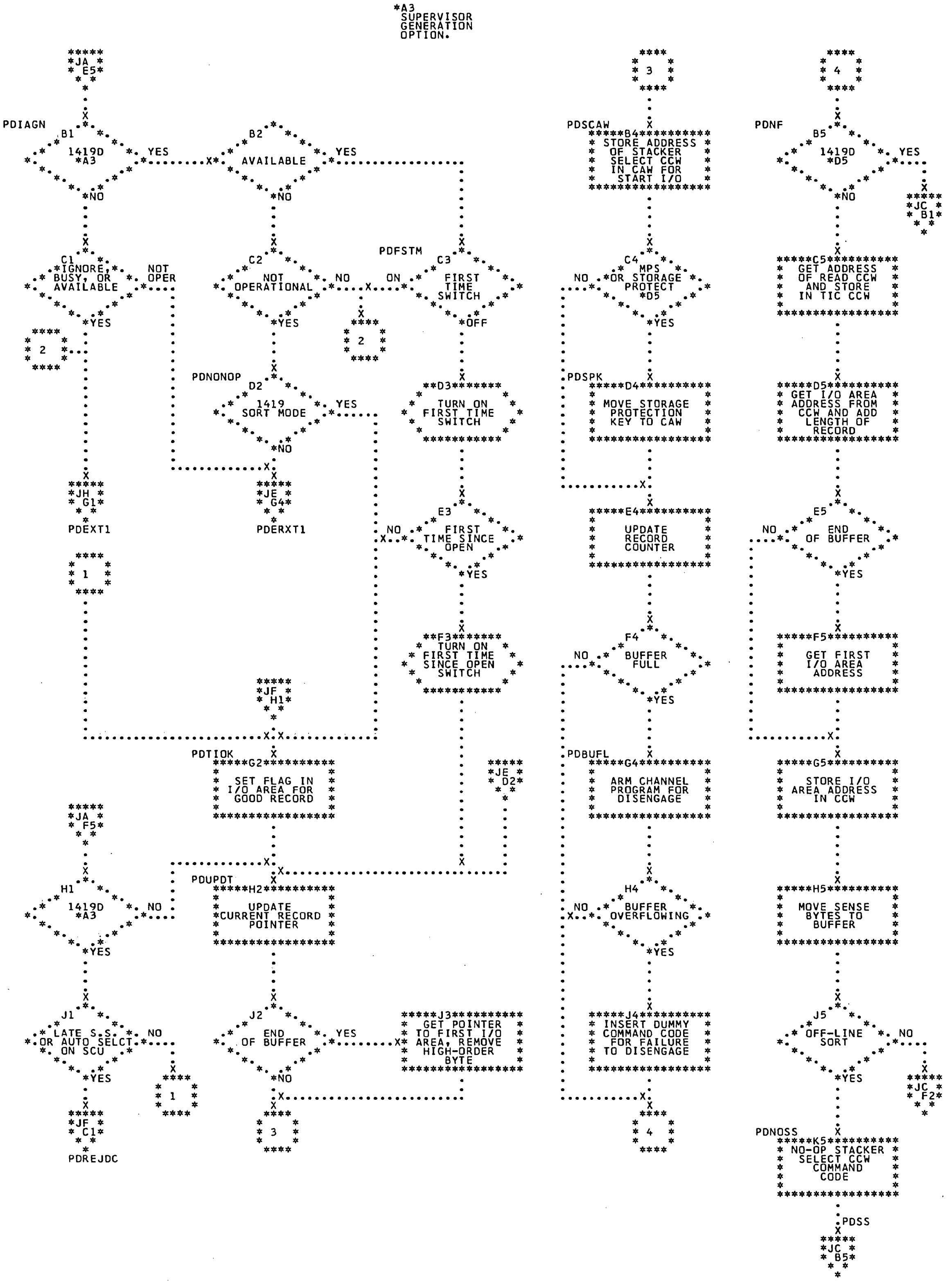


Chart JC. $$A$SUP1 - SMICR Macro, External Interrupt (Part 3 of 3) Refer to Chart 05.

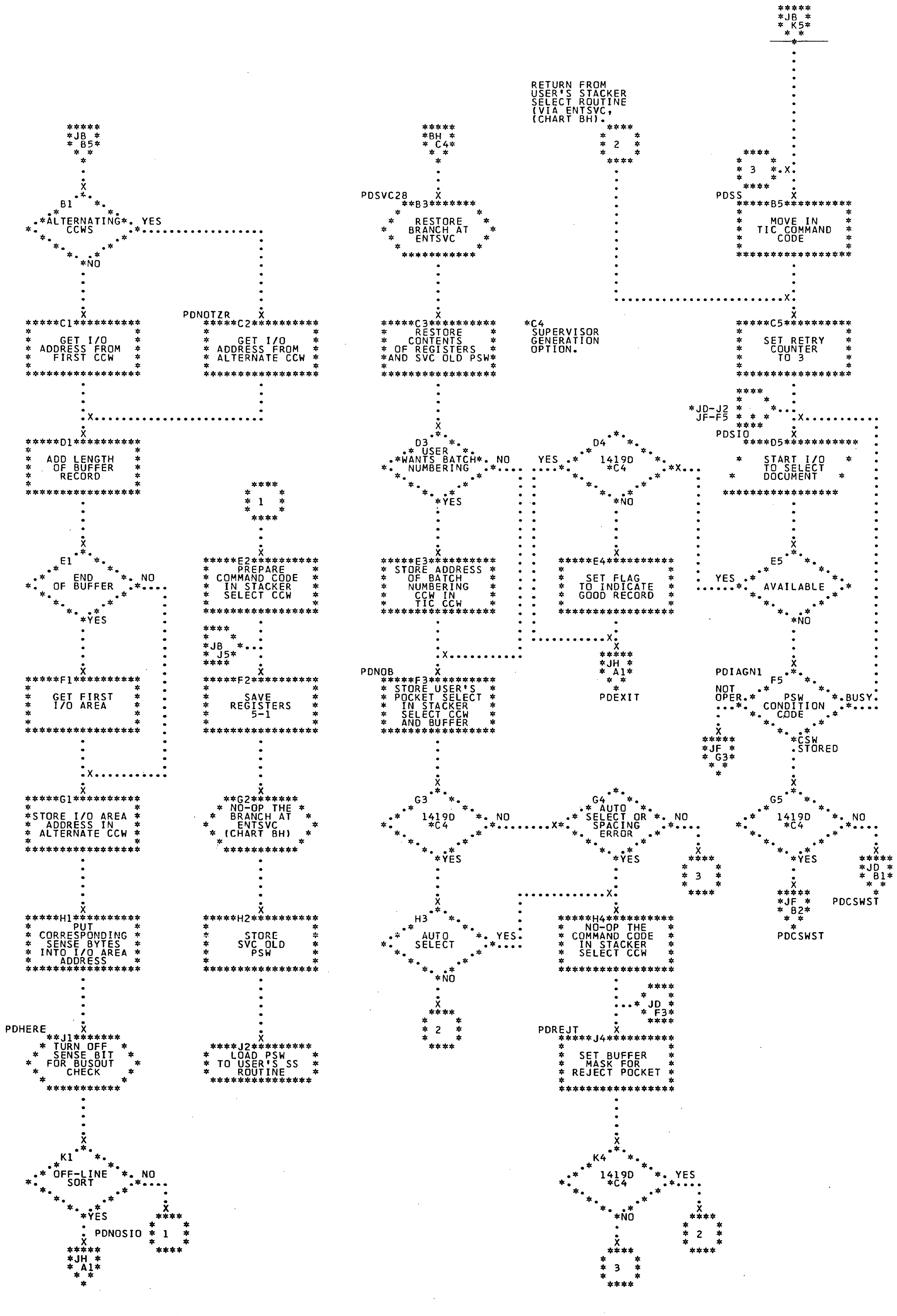


Chart JD. $$A$SUP1 - SMICR Macro, ERP for 1412/1419 Start I/O
Refer to Chart 05.

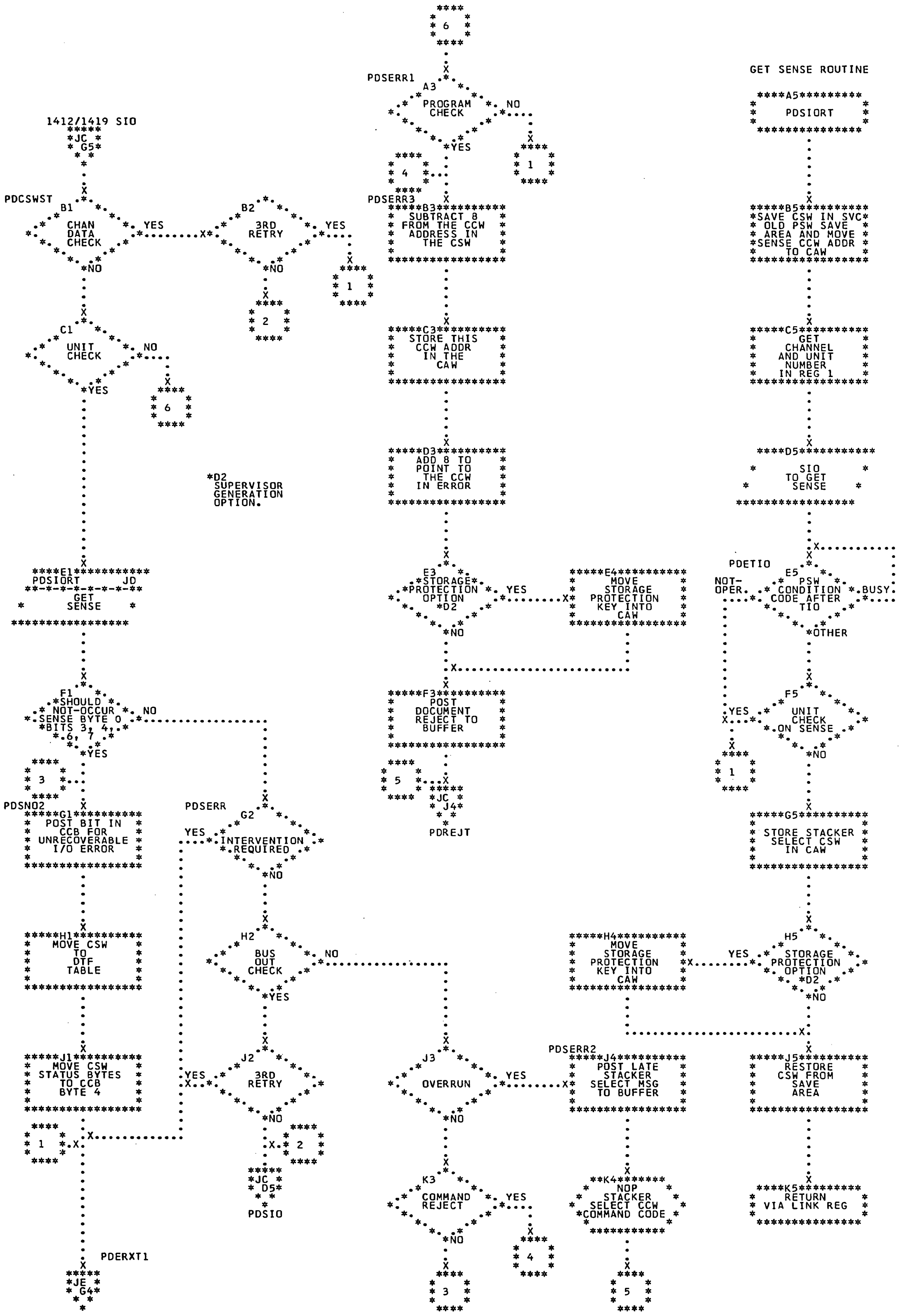


Chart JE. $$A$SUP1 - SMICR Macro, ERP for 1412/1419 Test I/O
Refer to Chart 05.

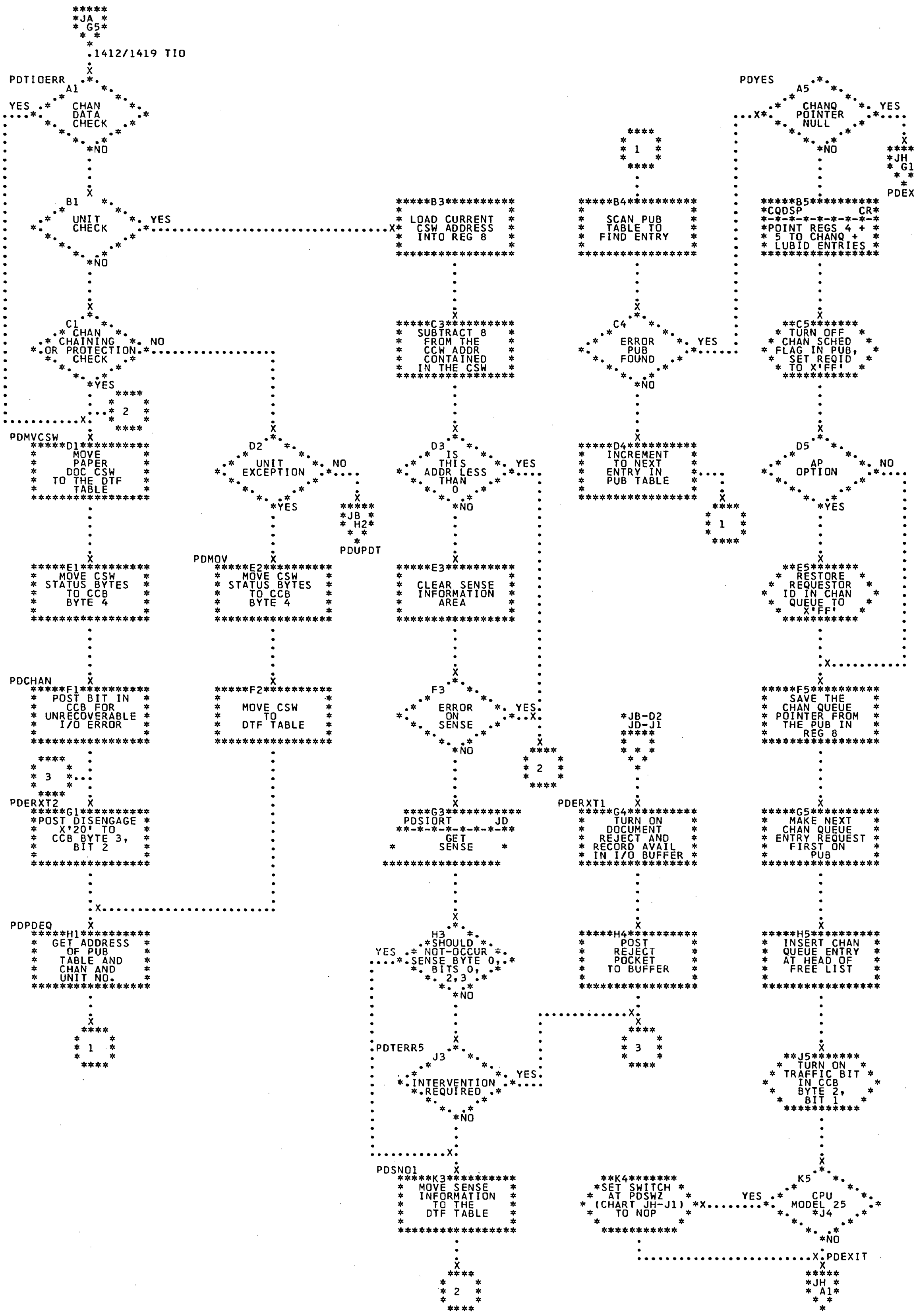


Chart JF. $$A$SUP1 - SMICR Macro, ERP for 1419D SIO and TIO
Refer to Chart 05.

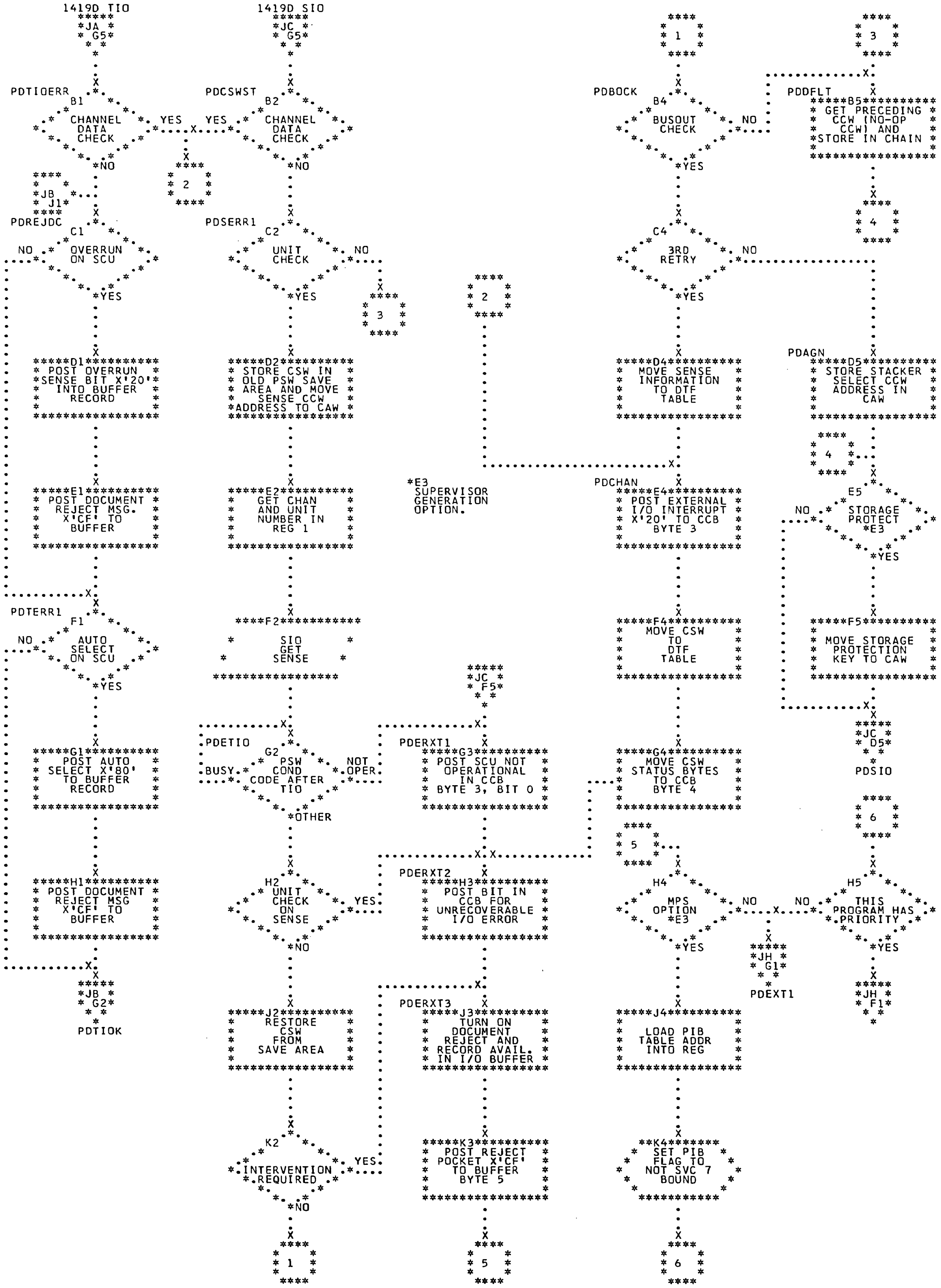


Chart JG. $$A$SUP1 - SMICR Macro, Program Check Interrupt
Refer to Chart 02.

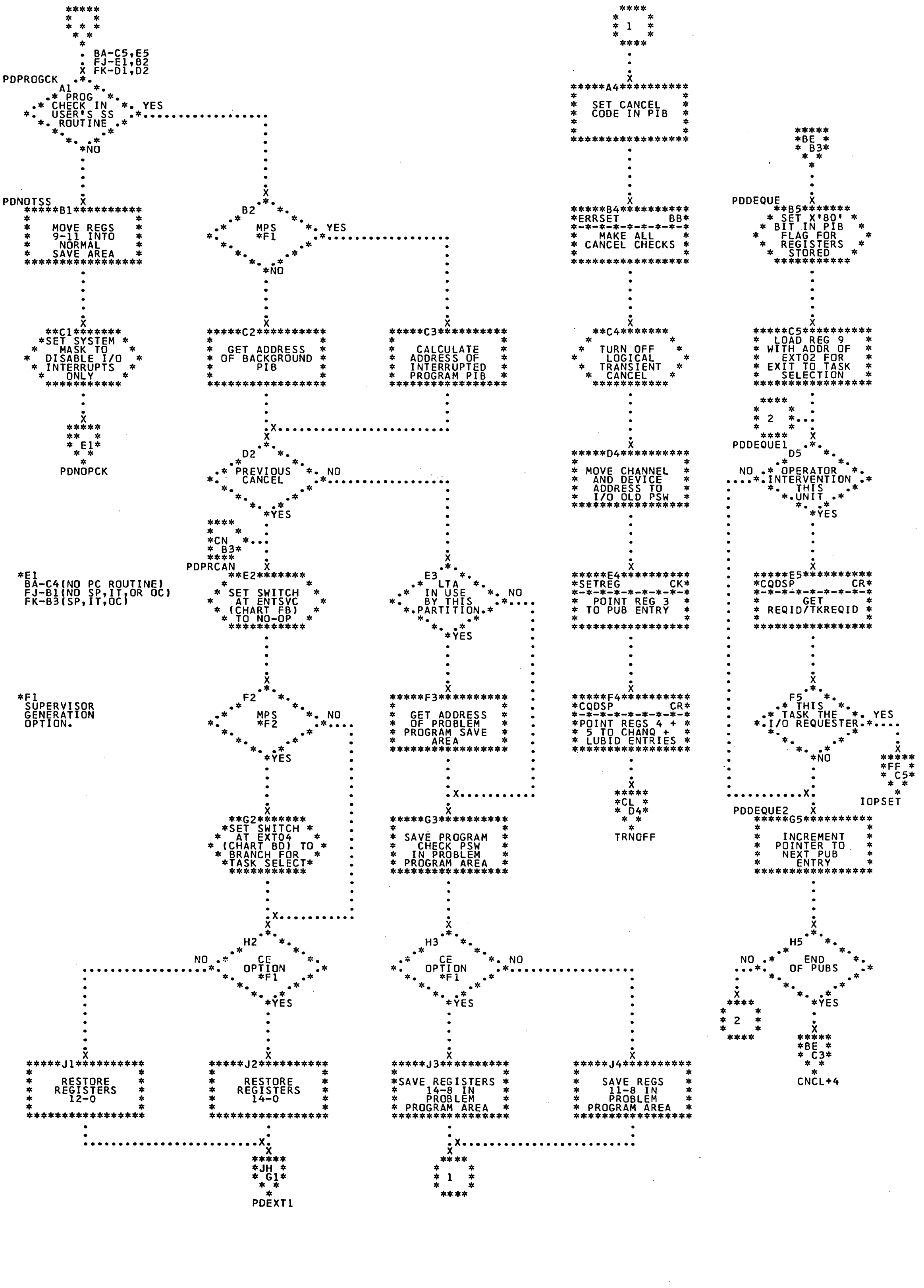


Chart JH. $$A$SUP1 - SMICR Macro, Exit Routine
Refer to Chart 02.

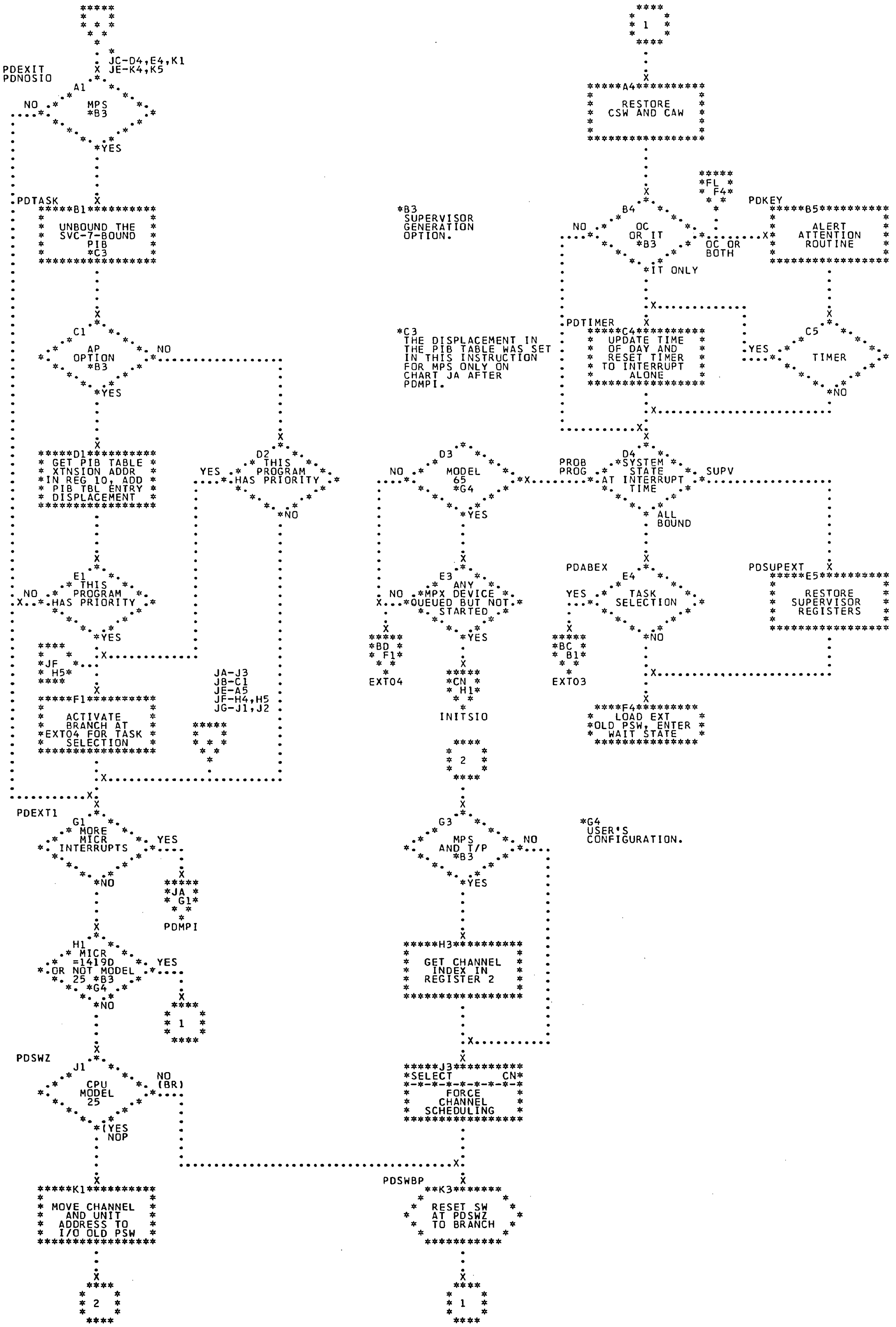


Chart KA. $$A$SUP1 - SMCRR Macro, Channel Inboard Error Record Builder (Part 1 of 4) Refer to Chart 10.

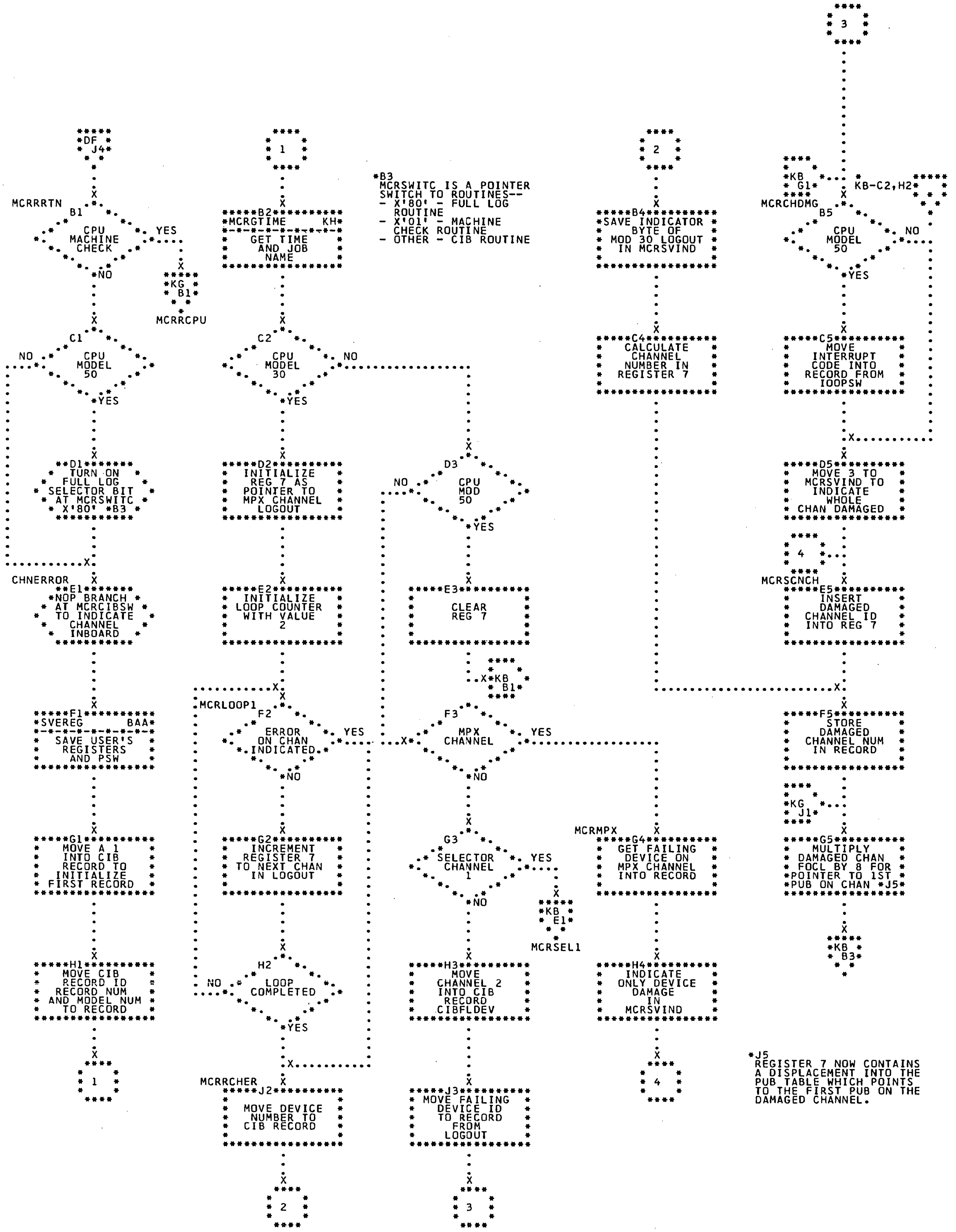


Chart KB. $$A$SUP1 - SMCRR Macro, Channel Inboard Error Record Builder (Part 2 of 4) Refer to Chart 10.

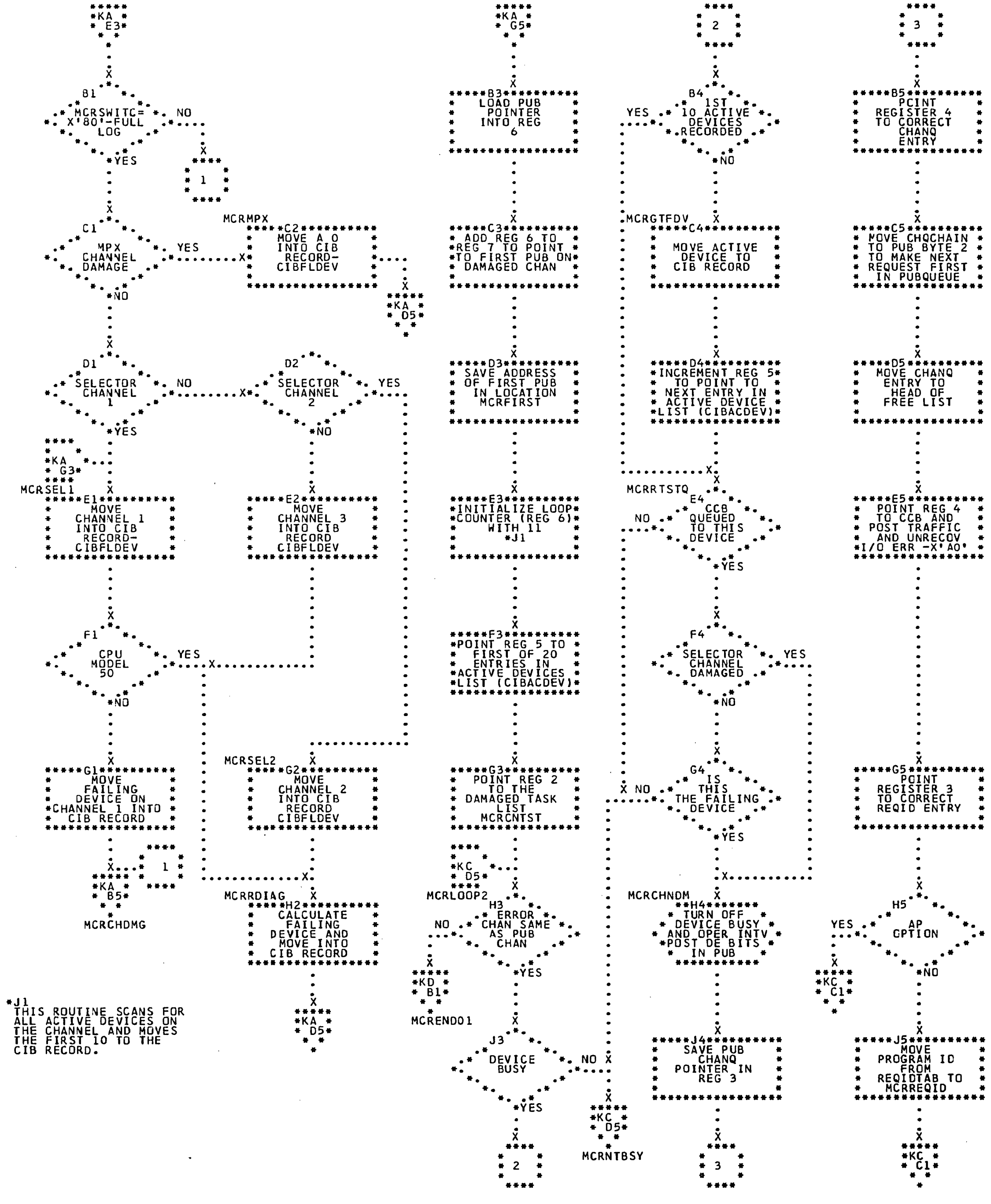
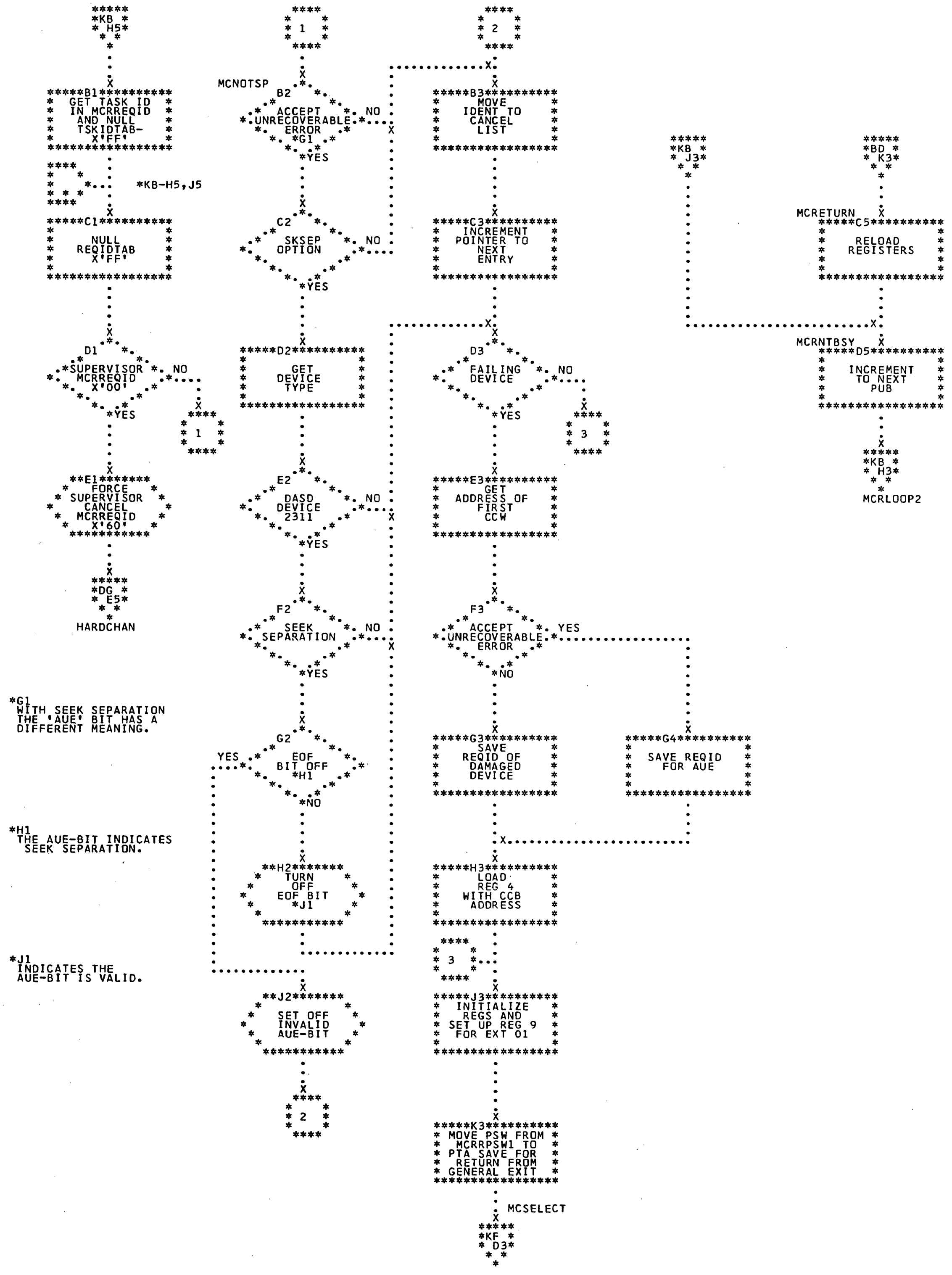


Chart KC. $$A$SUP1 - SMCRR Macro, Channel Inboard Error Record Builder (Part 3 of 4)
Refer to Chart 10.

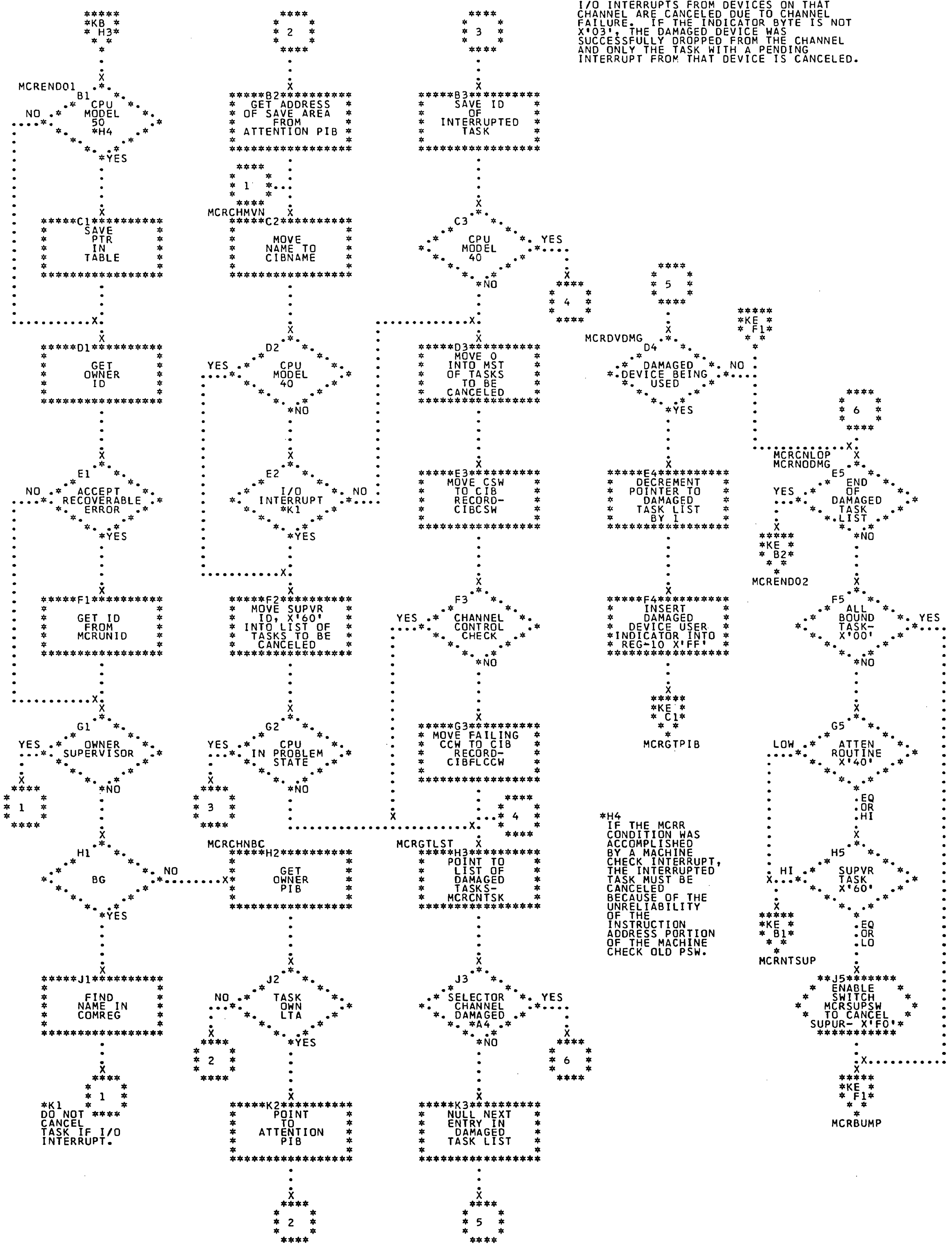


*G1
WITH SEEK SEPARATION
THE 'AUE' BIT HAS A
DIFFERENT MEANING.

*H1
THE AUE-BIT INDICATES
SEEK SEPARATION.

*J1
INDICATES THE
AUE-BIT IS VALID.

Chart KD. $$A$SUP1 - SMCRR Macro, Channel Inboard Error Record Builder (Part 4 of 4)
Refer to Chart 10.

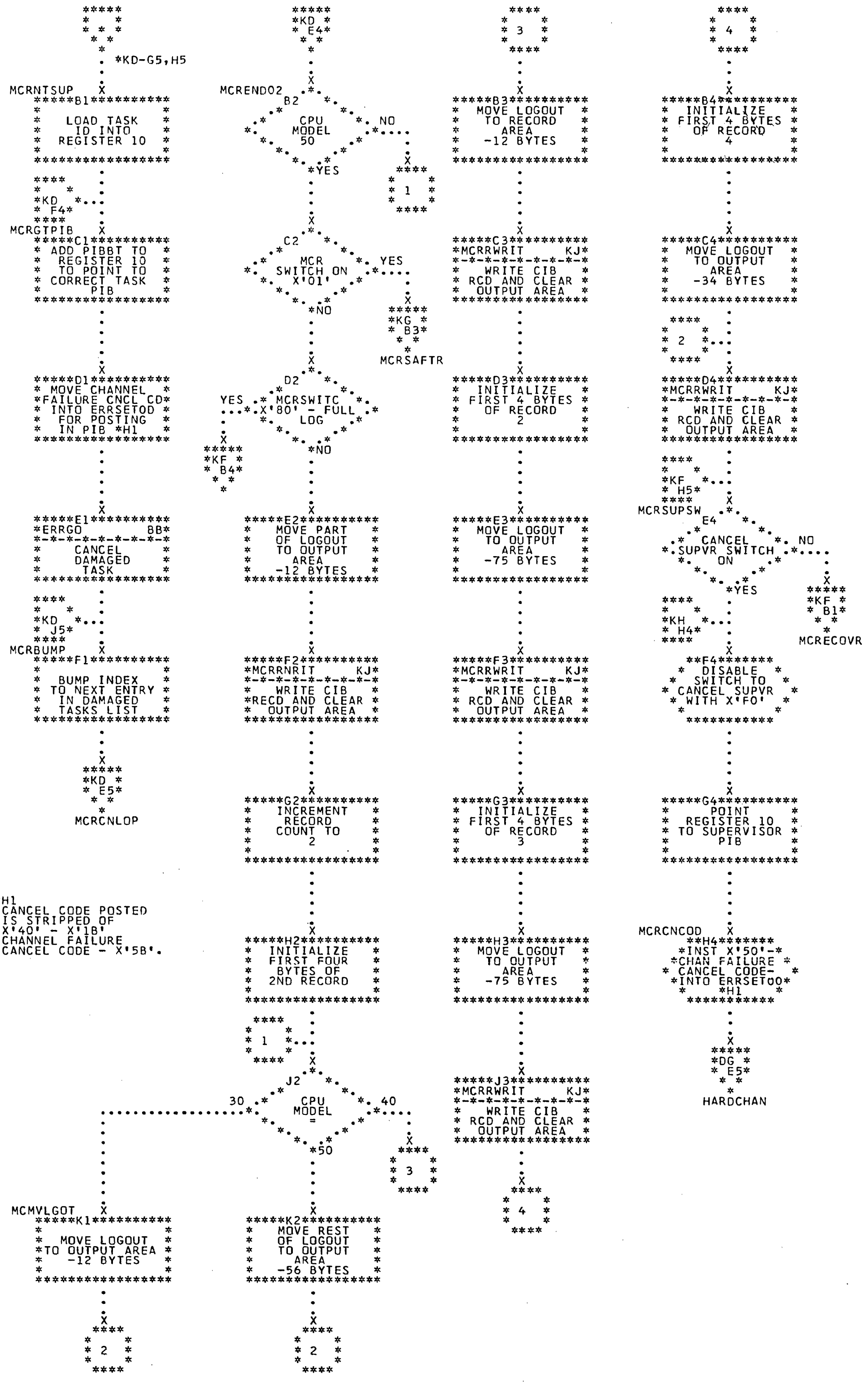


*A4
IF THE CPU MODEL=30 OR 40--
AN X'30' IN THE INDICATOR BYTE OF THE DAMAGED CHANNEL IN THE LOGOUT MEANS THAT A SELECTIVE RESET FAILED TO DISCONNECT THE DAMAGED DEVICE FROM THE CHANNEL. THE CHANNEL IS CONSIDERED INOPERABLE AND ALL TASKS WITH PENDING I/O INTERRUPTS FROM DEVICES ON THAT CHANNEL ARE CANCELED DUE TO CHANNEL FAILURE. IF THE INDICATOR BYTE IS NOT X'03', THE DAMAGED DEVICE WAS SUCCESSFULLY DROPPED FROM THE CHANNEL AND ONLY THE TASK WITH A PENDING INTERRUPT FROM THAT DEVICE IS CANCELED.

*H4
IF THE MCRR CONDITION WAS ACCOMPLISHED BY A MACHINE CHECK INTERRUPT, THE INTERRUPTED TASK MUST BE CANCELED BECAUSE OF THE UNRELIABILITY OF THE INSTRUCTION ADDRESS PORTION OF THE MACHINE CHECK OLD PSW.

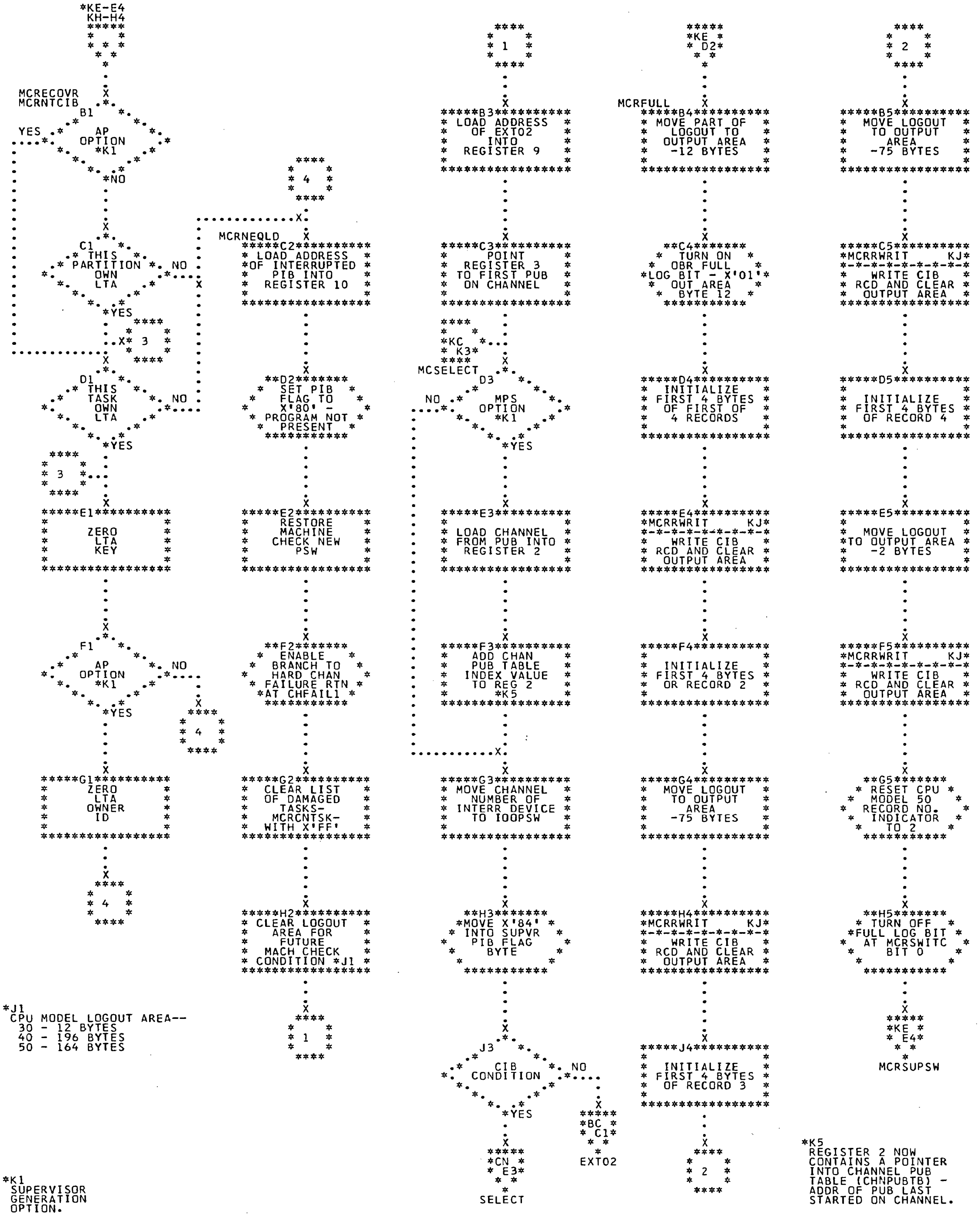
*K1
DO NOT CANCEL TASK IF I/O INTERRUPT.

Chart KE. $$A$SUP1 - SMCRR Macro, Write CIB Record
Refer to Chart 10.



*H1
CANCEL CODE POSTED
IS STRIPPED OF
X'40' - X'1B'
CHANNEL FAILURE
CANCEL CODE - X'5B'.

Chart KF. $$A$SUP1 - SMCRR Macro, MCRR Exit Routine
Refer to Chart 10.

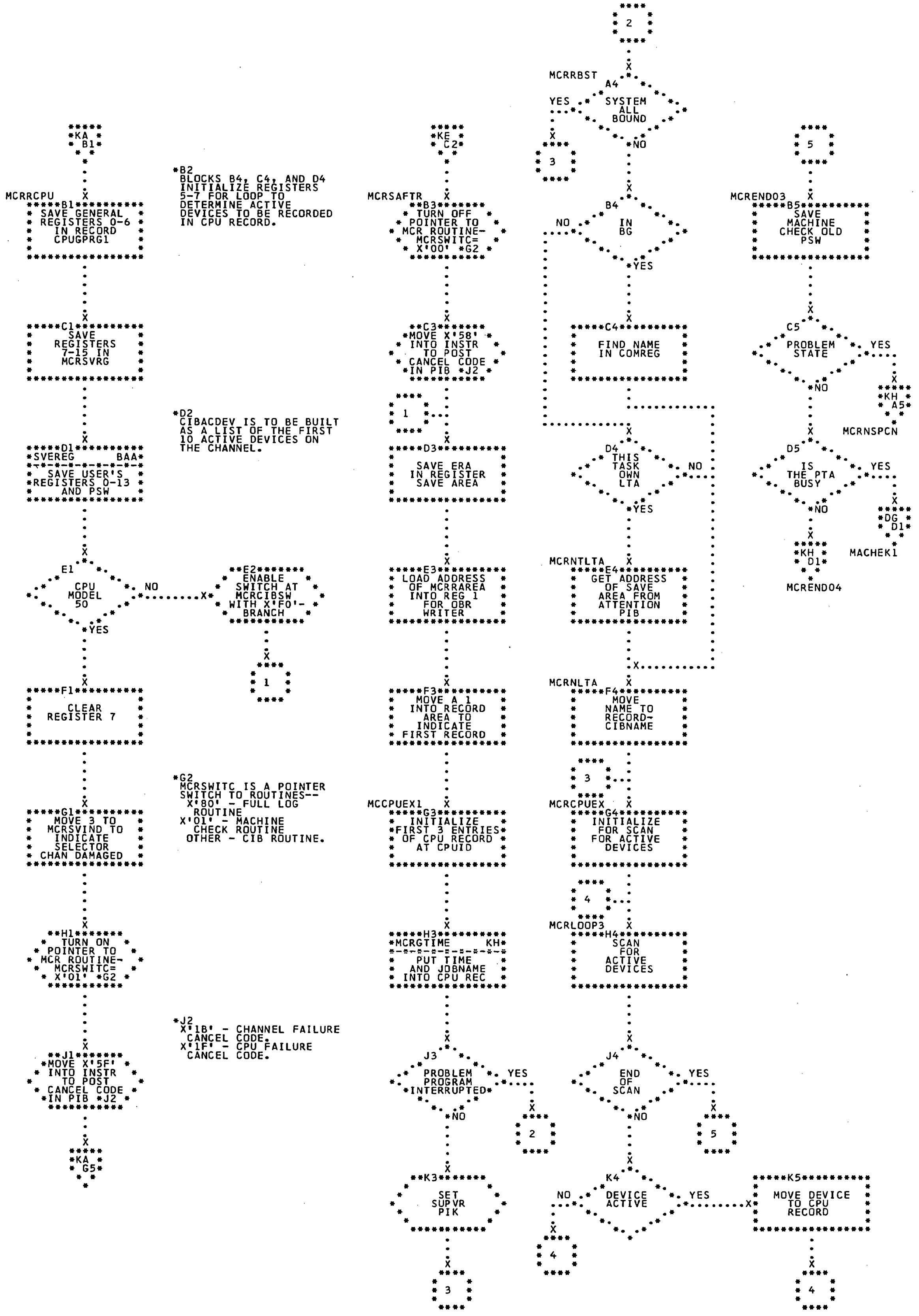


*J1
CPU MODEL LOGOUT AREA--
30 - 12 BYTES
40 - 196 BYTES
50 - 164 BYTES

*K1
SUPERVISOR GENERATION OPTION.

*K5
REGISTER 2 NOW CONTAINS A POINTER INTO CHANNEL PUB TABLE (CHNPUBTB) - ADDR OF PUB LAST STARTED ON CHANNEL.

Chart KG. $$A$SUP1 - SMCRR Macro, Machine Check Error Record Builder
Refer to Chart 10.



*B2
BLOCKS B4, C4, AND D4 INITIALIZE REGISTERS 5-7 FOR LOOP TO DETERMINE ACTIVE DEVICES TO BE RECORDED IN CPU RECORD.

*D2
CIBACDEV IS TO BE BUILT AS A LIST OF THE FIRST 10 ACTIVE DEVICES ON THE CHANNEL.

*G2
MCRSWITC IS A POINTER SWITCH TO ROUTINES--
X'80' - FULL LOG ROUTINE
X'01' - MACHINE CHECK ROUTINE
OTHER - CIB ROUTINE.

*J2
X'1B' - CHANNEL FAILURE CANCEL CODE.
X'1F' - CPU FAILURE CANCEL CODE.

Chart KH. $$A$SUP1 - SMCRR Macro, Write Machine Check Record
Refer to Chart 10.

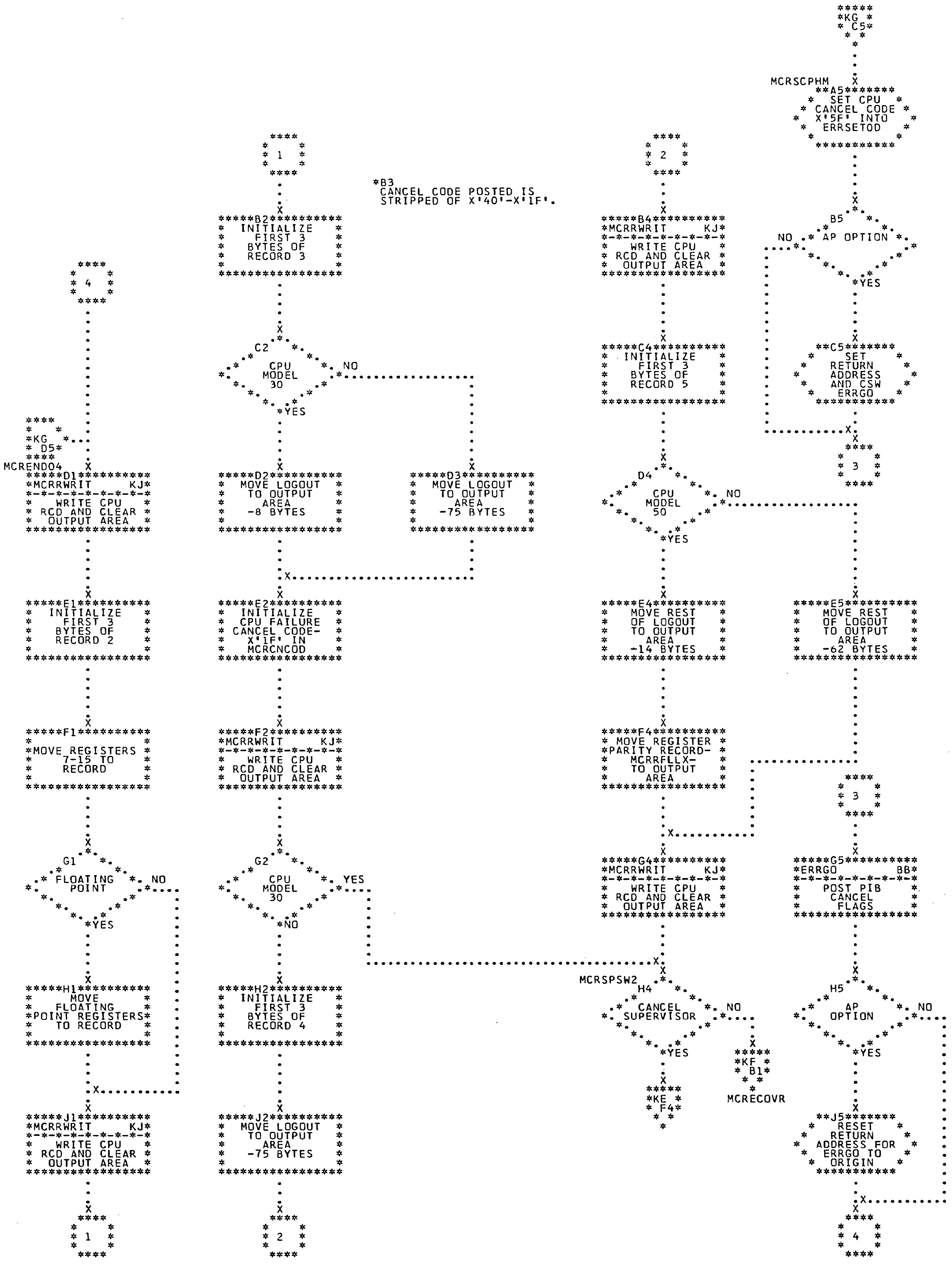


Chart KJ. $$A$SUP1 - SMCRR Macro, MCRGTIME and MCRRWRIT Subroutines Refer to Chart 10.

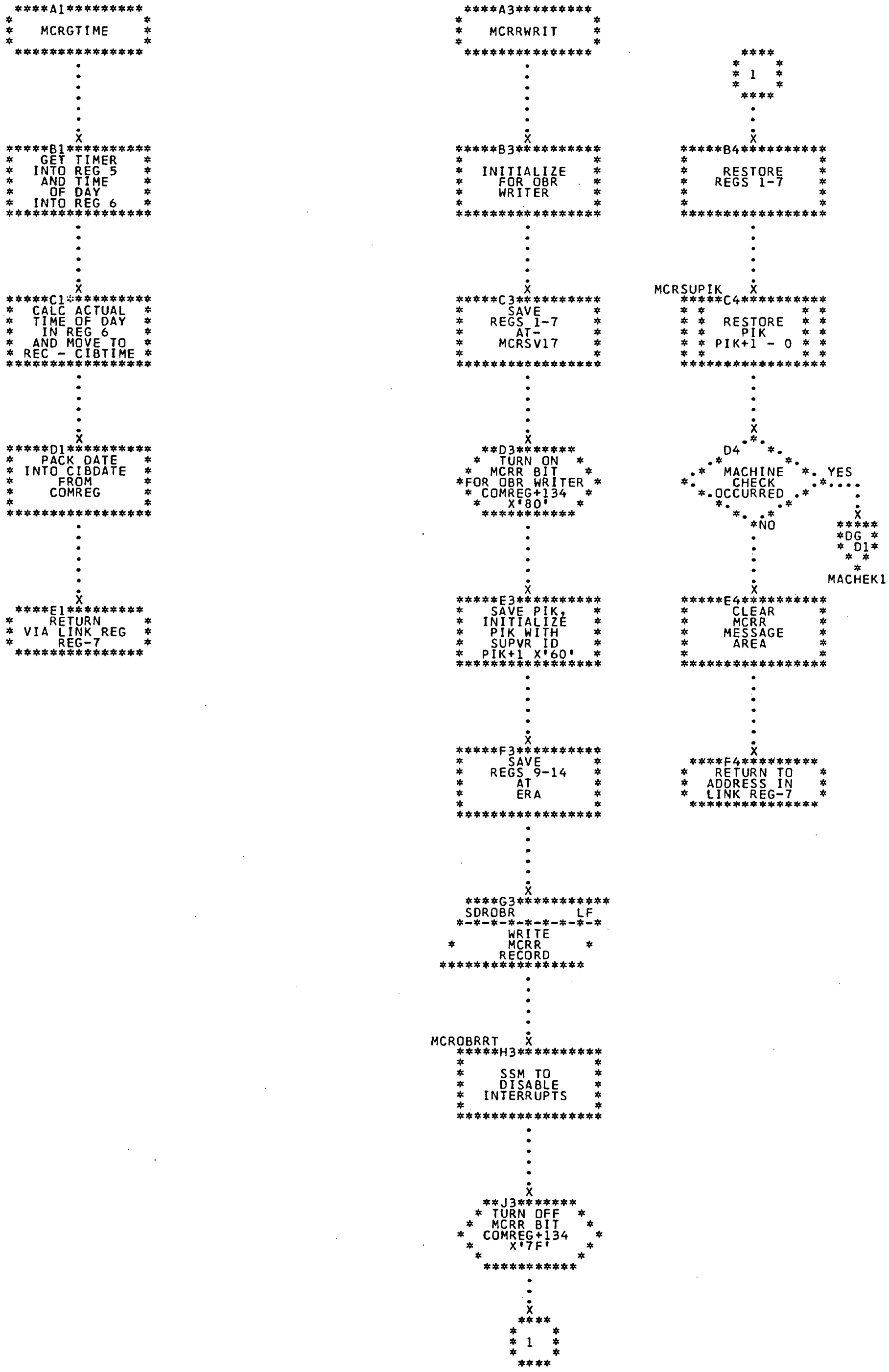


Chart LA. $$A$SUP1 - SEND Macro, Exit to System Message Writer or Task Selection and TP Routines

Refer to Chart 10.

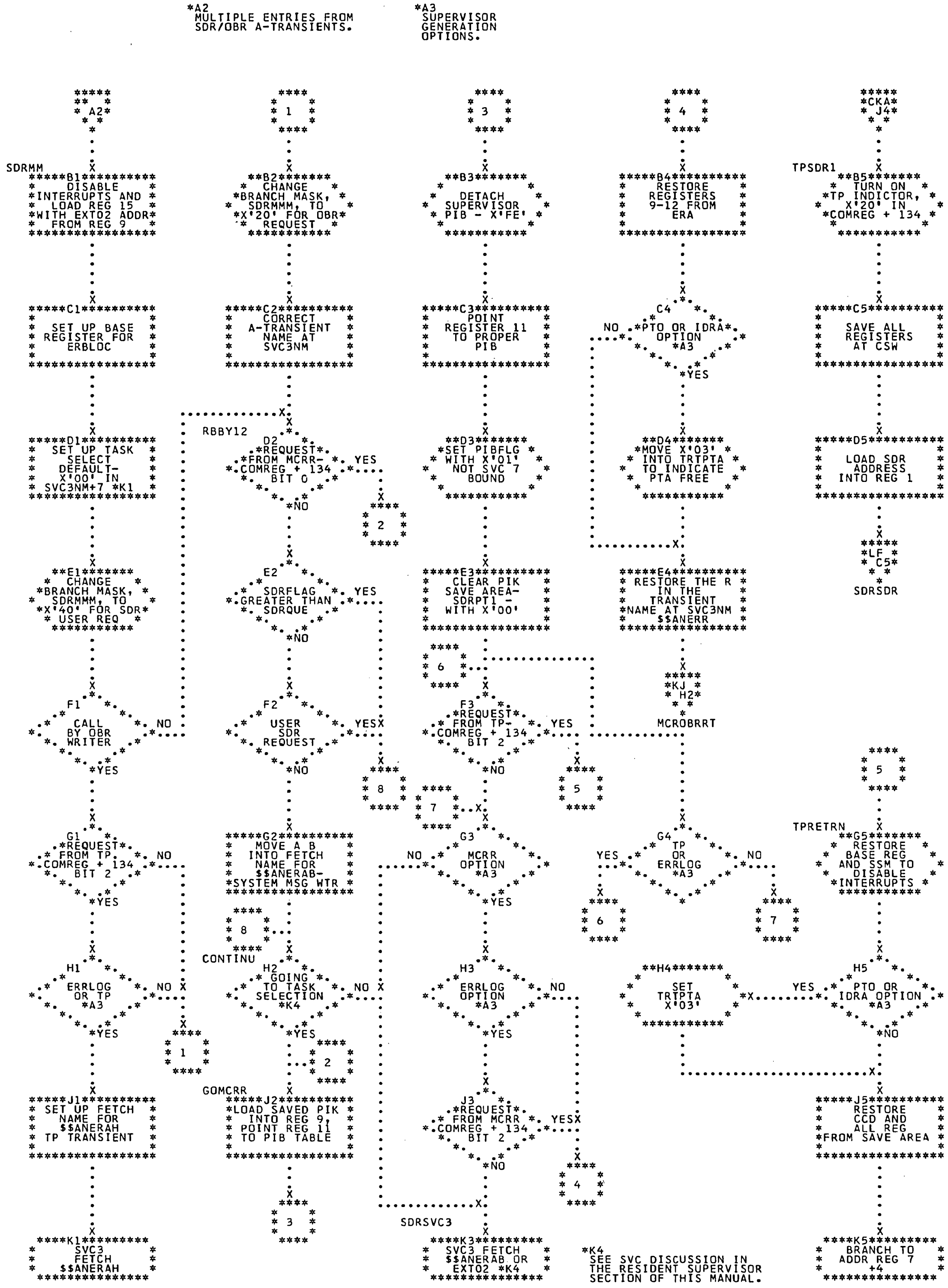


Chart LB. $$A$SUP1 - SEND Macro, Routines to Test SDR Error Queue and to Schedule SDR Update of Internal Counters

Refer to Chart 10.

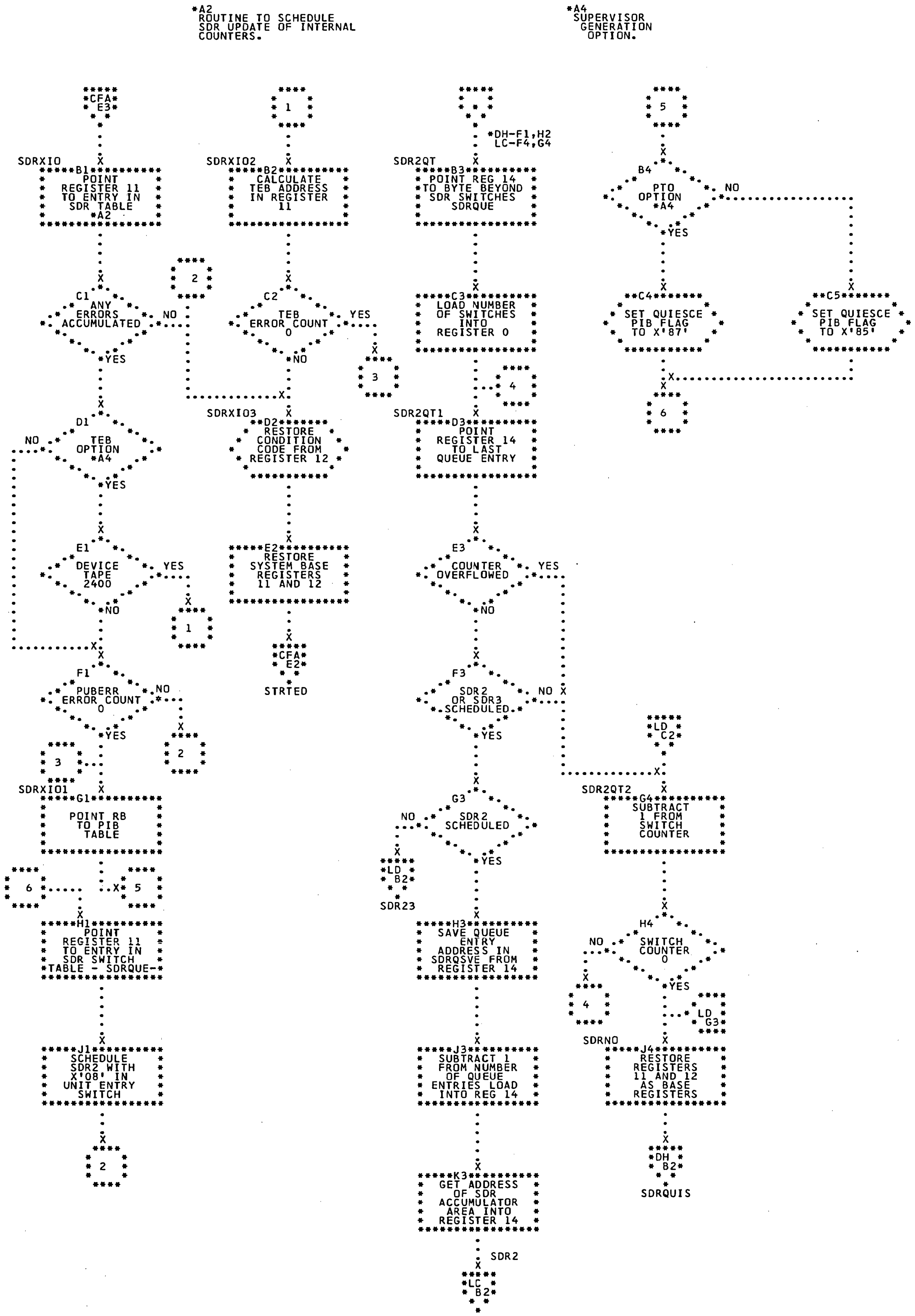
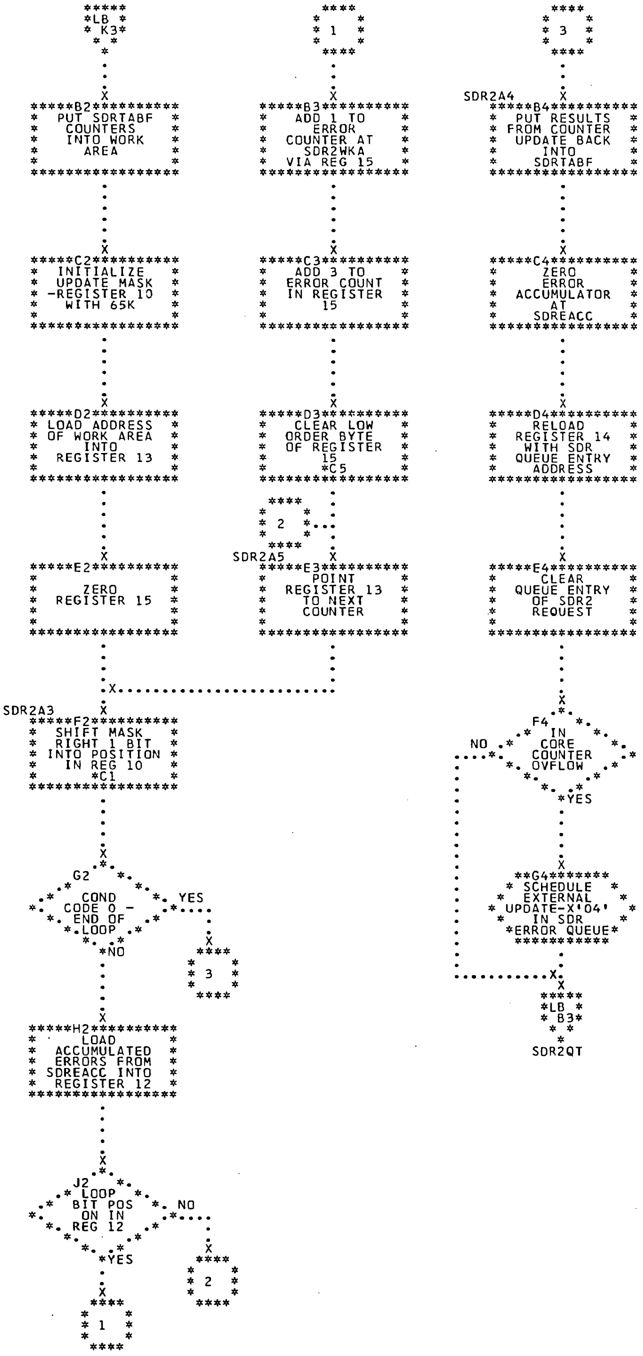


Chart LC. $$A$SUP1 - SEND Macro, Update SDR Half-Byte Counters and Schedule Recorder File Update

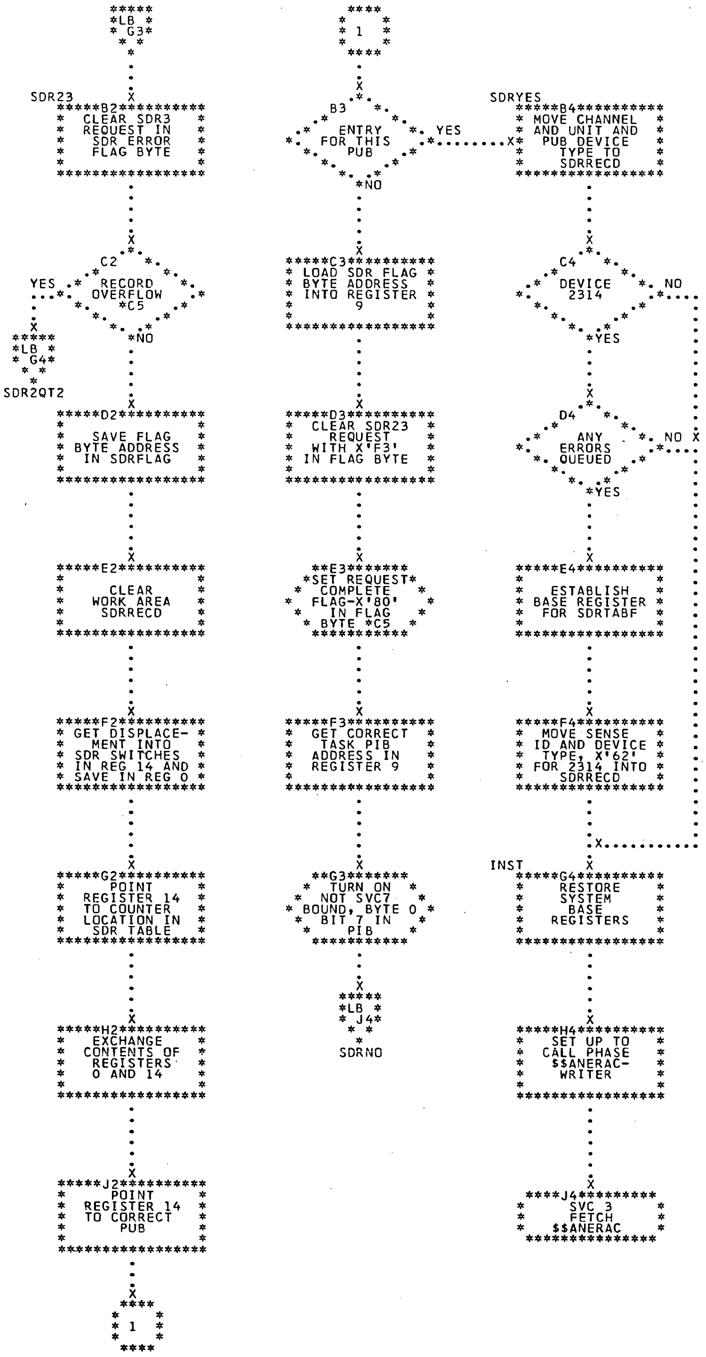
Refer to Chart 10.



*C1
LOADING REGISTER 10 WITH 65K IS THE SAME AS LOADING A LOOP COUNTER WITH 17. EACH TIME THE COUNTER UPDATE ROUTINE IS ENTERED, THE SRA INSTRUCTION (BLOCK F2) SUBTRACTS 1 FROM THE COUNTER UNTIL THE FINAL RESULT OF ZERO COMPLETE THE LOOK (BLOCK G2).

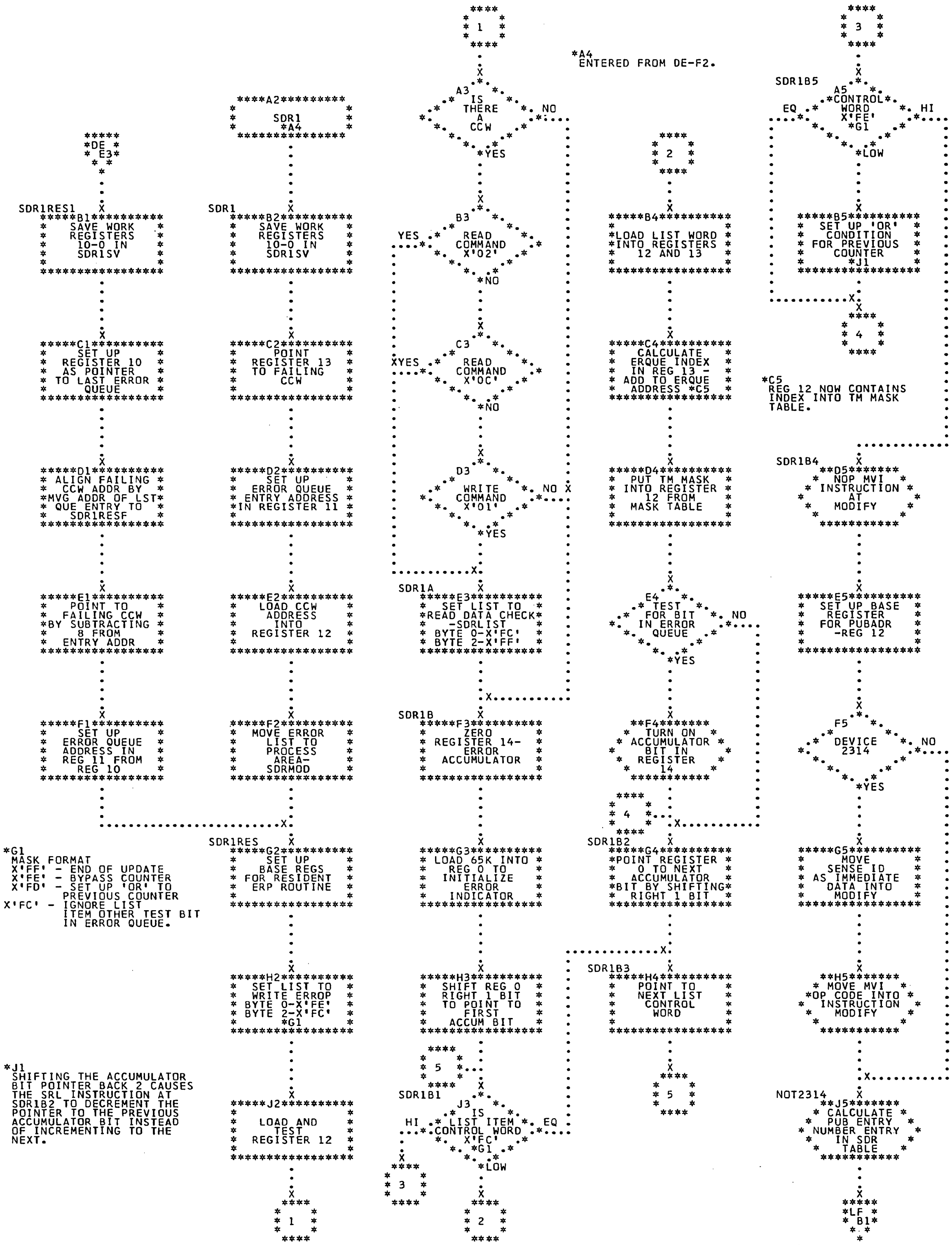
*C5
WHEN SDR 2 ROUTINE HAS BEEN ENTERED 13 TIMES AN OVERFLOW OCCURS (BLOCK C3) WHICH CAUSES RECORDER FILE UPDATE TO BE SCHEDULED.

Chart LD. $$A$SUP1 - SEND Macro, Gather Update Information and Fetch Writer
Refer to Chart 10.



*C5
SDR FLAG BYTE--
X'80' - UPDATE REQUEST COMPLETE
X'40' - EXTERNAL FILE COUNTERS HAVE OVERFLOWED
X'20' - I/O ERROR HAS OCCURRED
X'08' - SDR UPDATE HALF-BYTE COUNTERS ROUTINE IS REQUIRED
X'04' - UPDATE SDR RECORD IS REQUIRED.

Chart LE. $$A$SUP1 - SEND Macro, Interpretive Error Accumulator Refer to Chart 10.



*A4
ENTERED FROM DE-F2.

*C5
REG 12 NOW CONTAINS INDEX INTO TM MASK TABLE.

*G1
MASK FORMAT
X'FF' - END OF UPDATE
X'FE' - BYPASS COUNTER
X'FD' - SET UP 'OR' TO PREVIOUS COUNTER
X'FC' - IGNORE LIST ITEM OTHER TEST BIT IN ERROR QUEUE.

*J1
SHIFTING THE ACCUMULATOR BIT POINTER BACK 2 CAUSES THE SRL INSTRUCTION AT SDR1B2 TO DECREMENT THE POINTER TO THE PREVIOUS ACCUMULATOR BIT INSTEAD OF INCREMENTING TO THE NEXT.

Chart LF. $$A$SUP1 - SEND Macro, Call OBR/SDR Writers and Routines for OBR/SDR Requests (Part 1 of 2)

Refer to Chart 10.

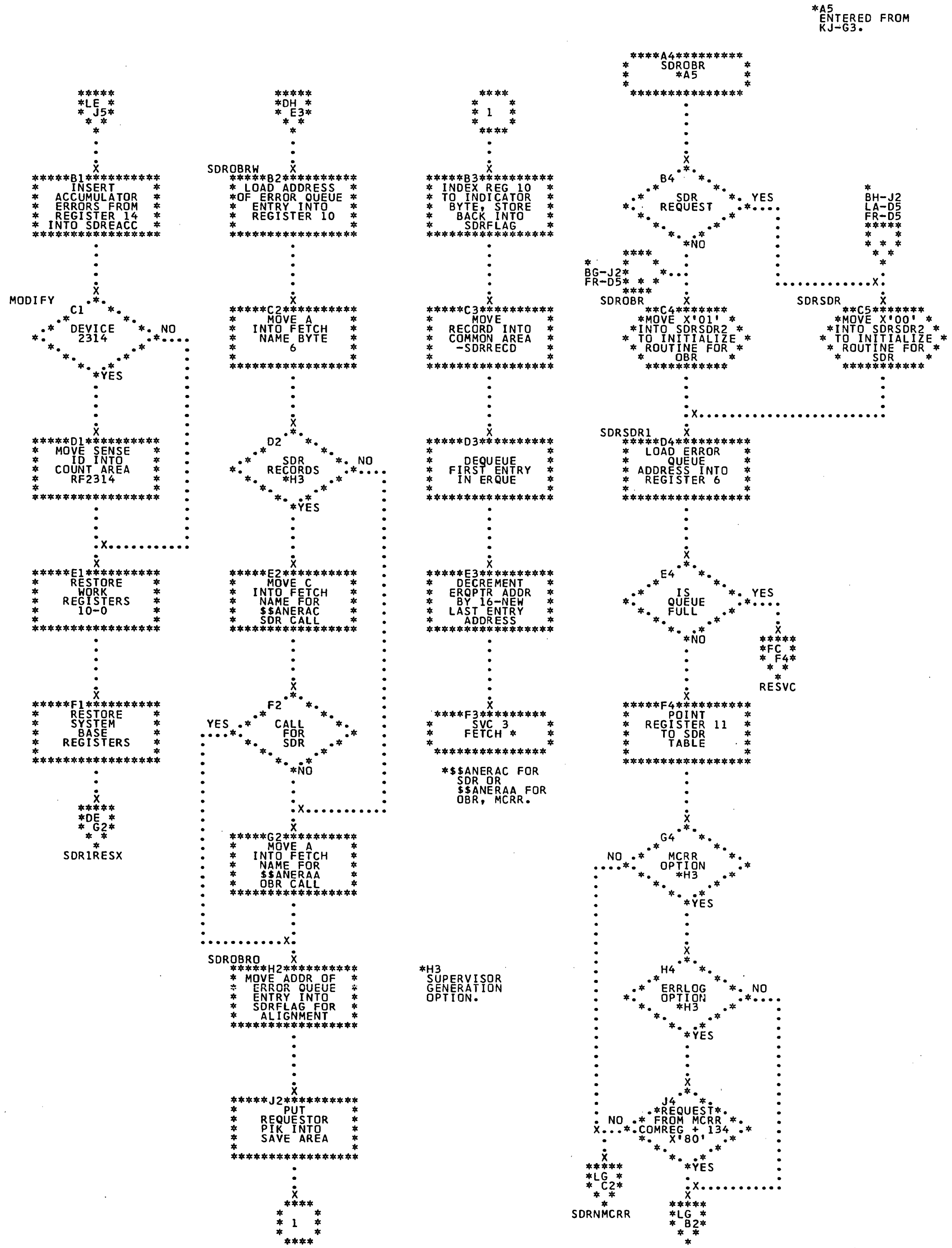


Chart LG. $$A$SUP1 - SEND Macro, Routines for OBR/SDR Requests (Part 2 of 2) Refer to Chart 10.

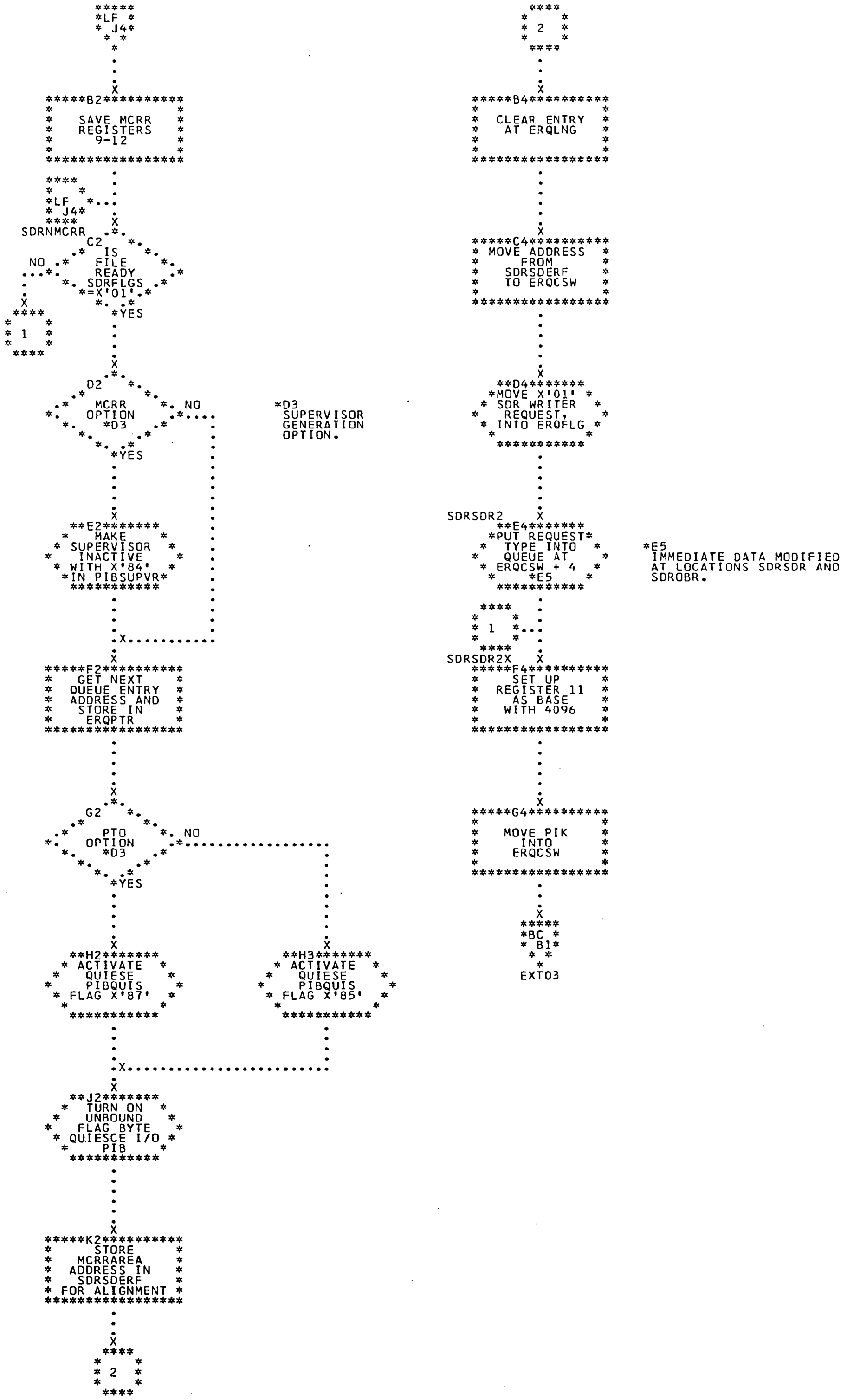
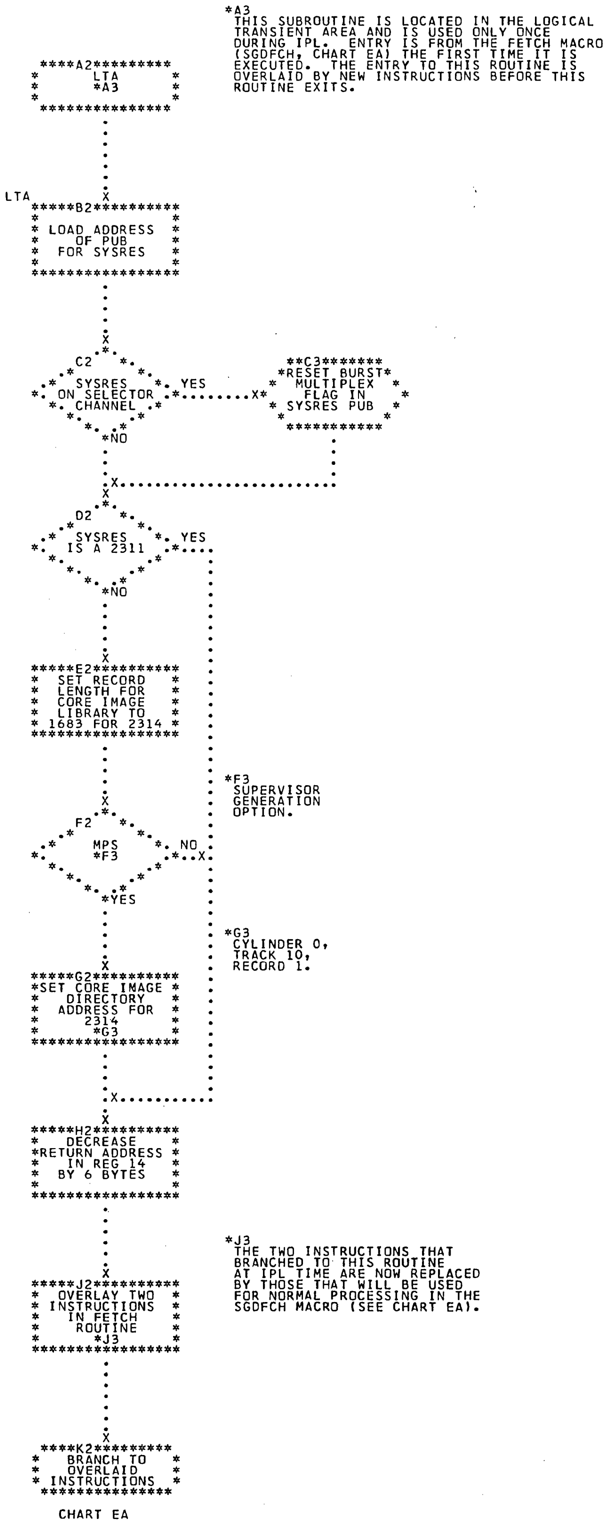


Chart LH. $$A$SUP1 - SEND Macro, LTA Subroutine



*A3
THIS SUBROUTINE IS LOCATED IN THE LOGICAL TRANSIENT AREA AND IS USED ONLY ONCE DURING IPL. ENTRY IS FROM THE FETCH MACRO (SGDFCH, CHART EA) THE FIRST TIME IT IS EXECUTED. THE ENTRY TO THIS ROUTINE IS OVERLAID BY NEW INSTRUCTIONS BEFORE THIS ROUTINE EXITS.

*F3
SUPERVISOR GENERATION OPTION.

*G3
CYLINDER 0, TRACK 10, RECORD 1.

*J3
THE TWO INSTRUCTIONS THAT BRANCHED TO THIS ROUTINE AT IPL TIME ARE NOW REPLACED BY THOSE THAT WILL BE USED FOR NORMAL PROCESSING IN THE SGDFCH MACRO (SEE CHART EA).

Chart MA. $$A$SUP1 - SGTHAP Macro, Track HOLD
Refer to Chart 03.

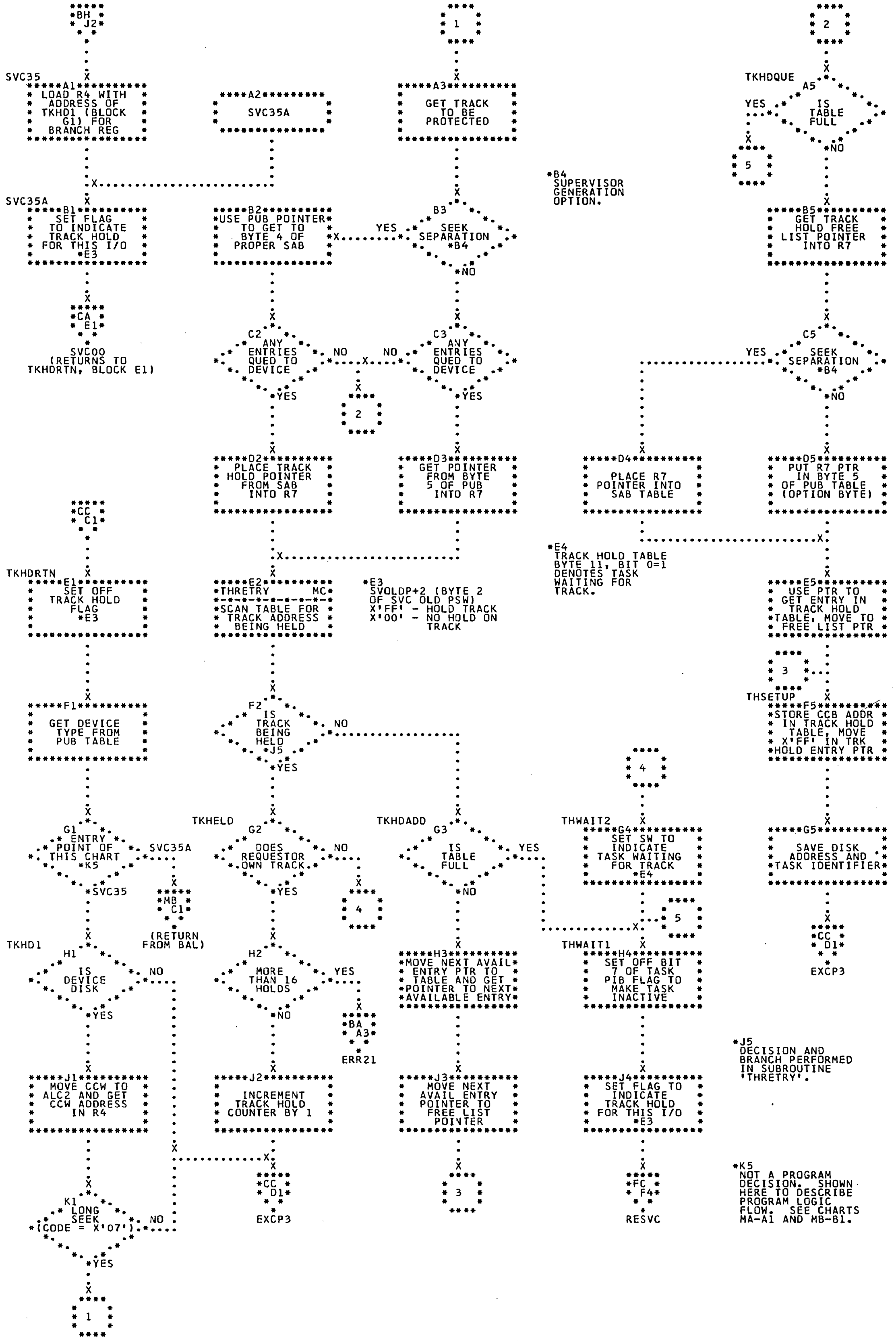


Chart MB. $$A$SUP1 - SGTHAP Macro, FREE Track (Part 1 of 2) Refer to Chart 03.

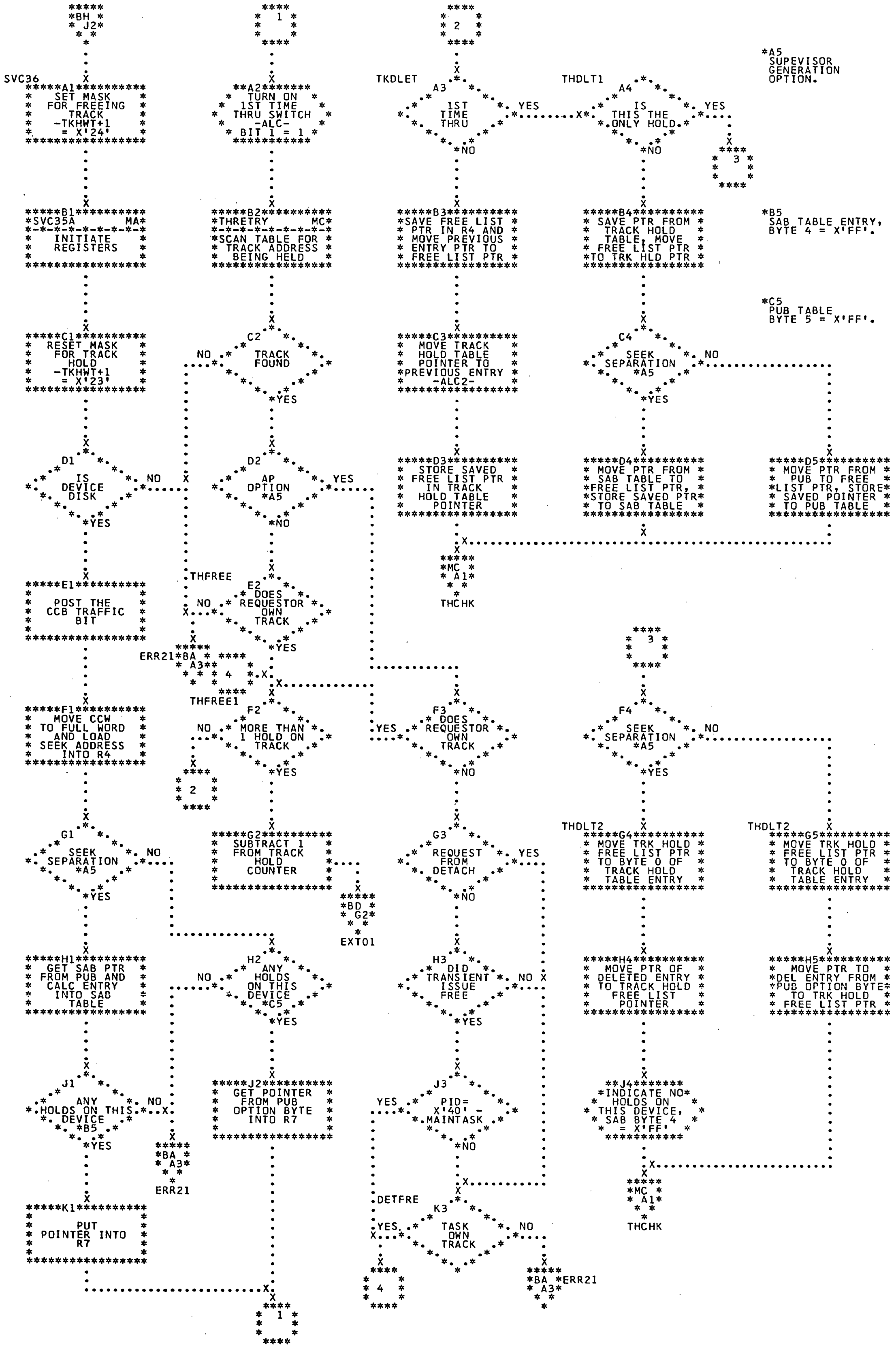


Chart MC. $$A$SUP1 - SGTHAP Macro, FREE Track (Part 2 of 2), THRETRY Subroutine, and AB STXIT

Refer to Chart 03.

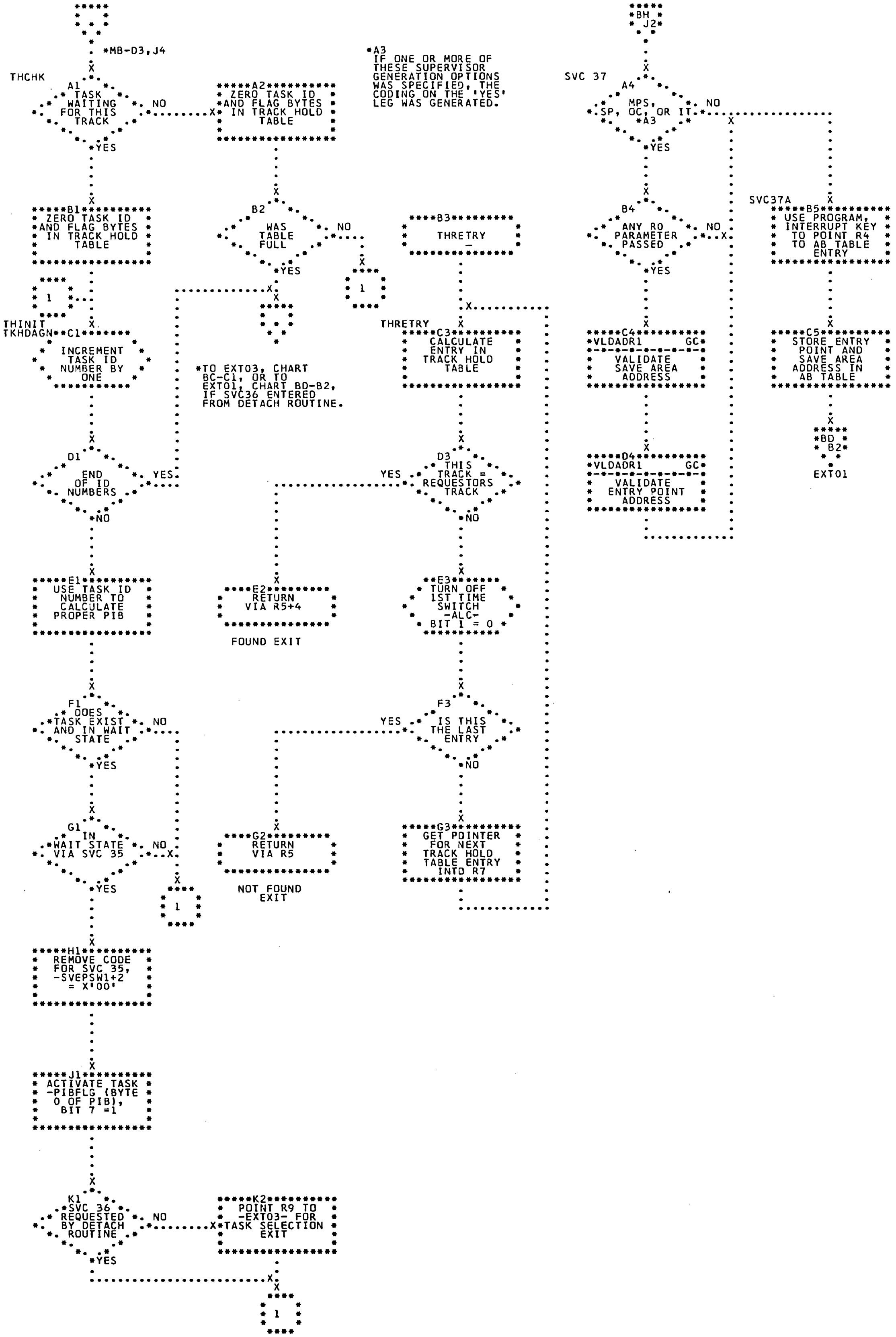


Chart MD. $$A$SUP1 - SGTHAP Macro, ATTACH a Task
Refer to Chart 03.

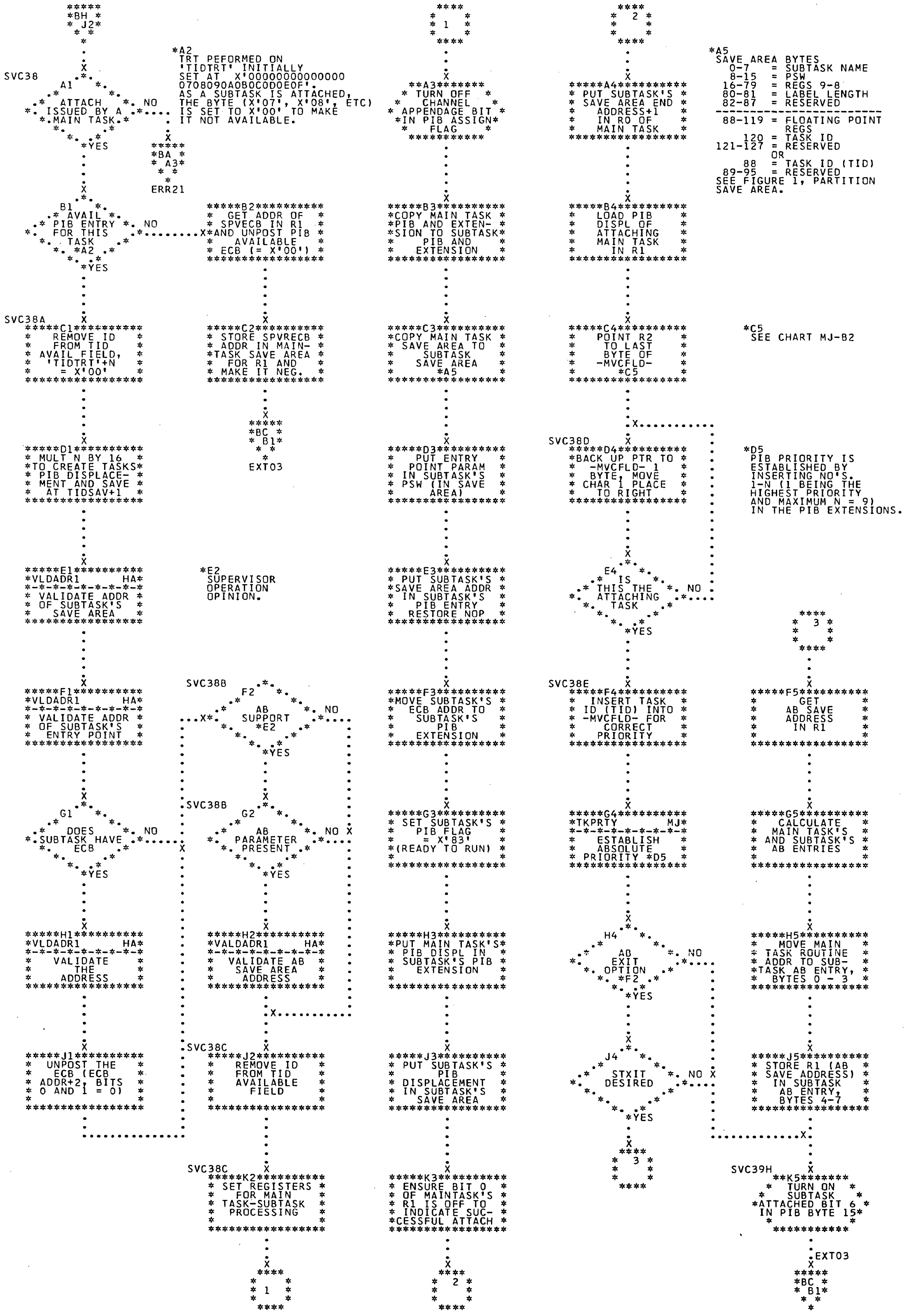


Chart ME. $$A$SUP1 - SGTHAP Macro, DETACH a Task (Part 1 of 2)
Refer to Chart 03.

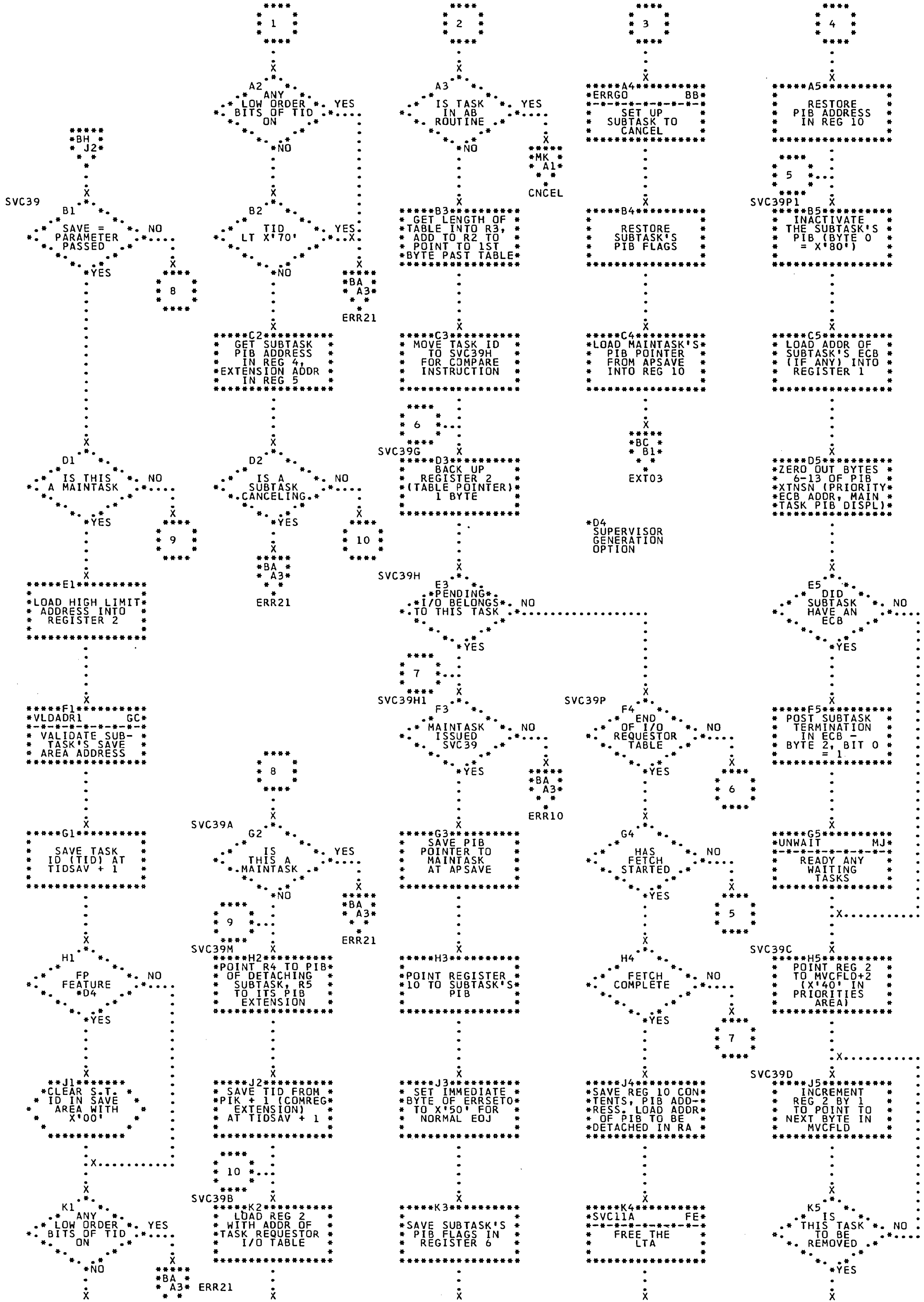


Chart MF. $$A$SUP1 - SGTHAP Macro, DETACH a Task (Part 2 of 2)

Refer to Chart 03.

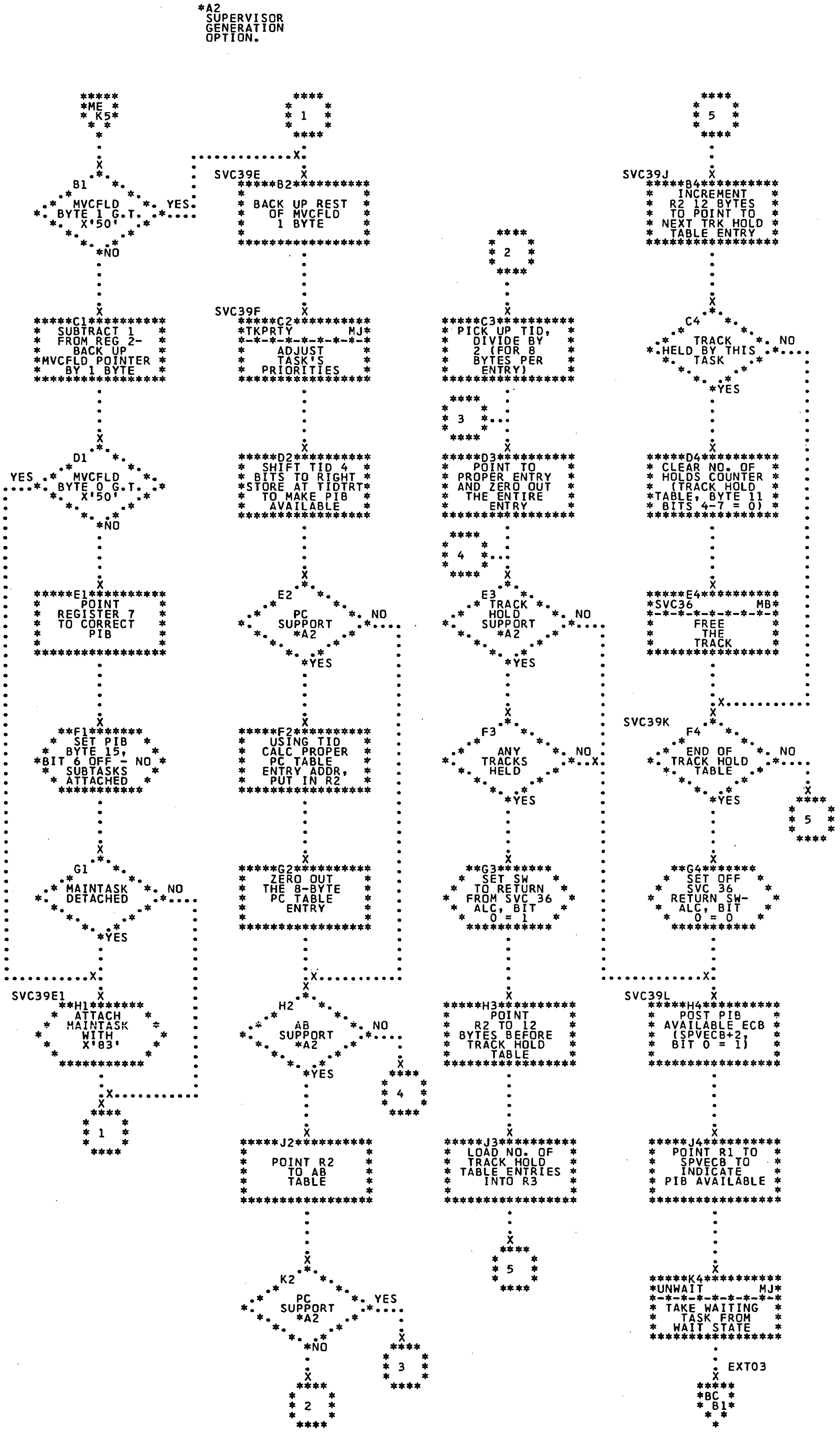


Chart MG. $$A$SUP1 - SGTHAP Macro, POST a Completed Event and ENQ a Resource
Refer to Chart 03.

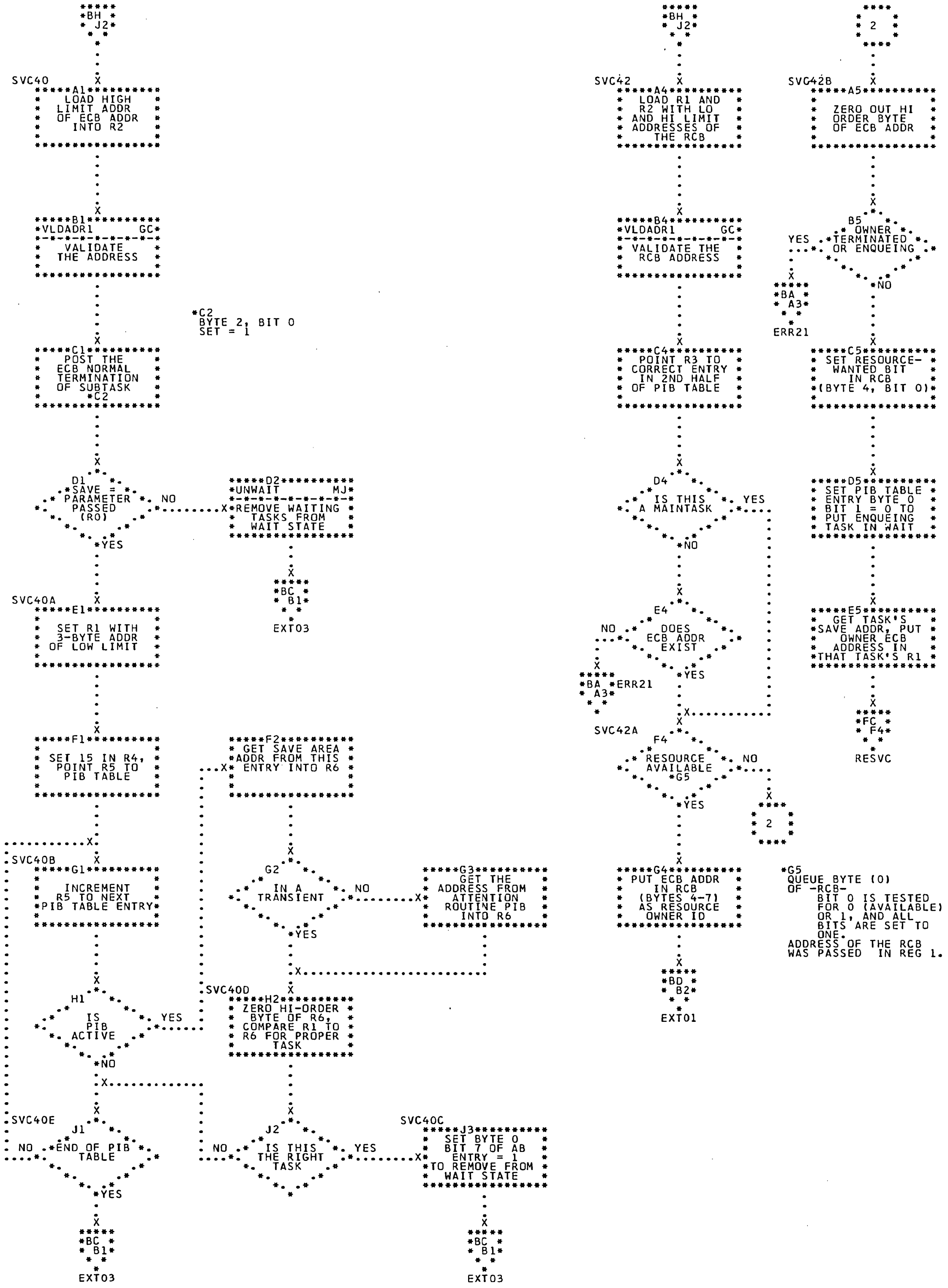


Chart MH. $$A$SUP1 - SGTHAP Macro, DEQ a Resource
Refer to Chart 03.

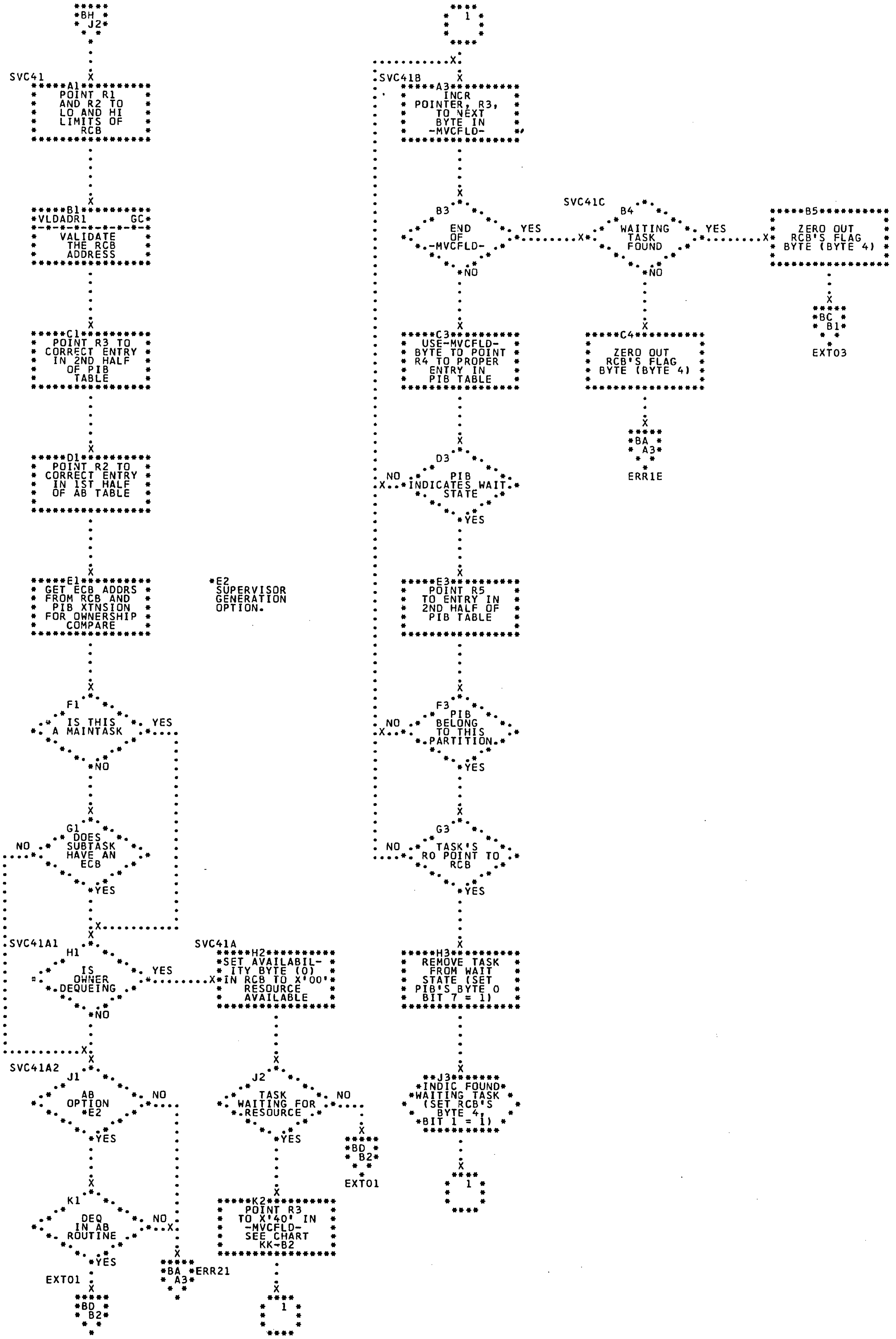


Chart MJ. $$A$SUP1 - SGTHAP Macro, Task Priority and UNWAIT Subroutines
Refer to Chart 03.

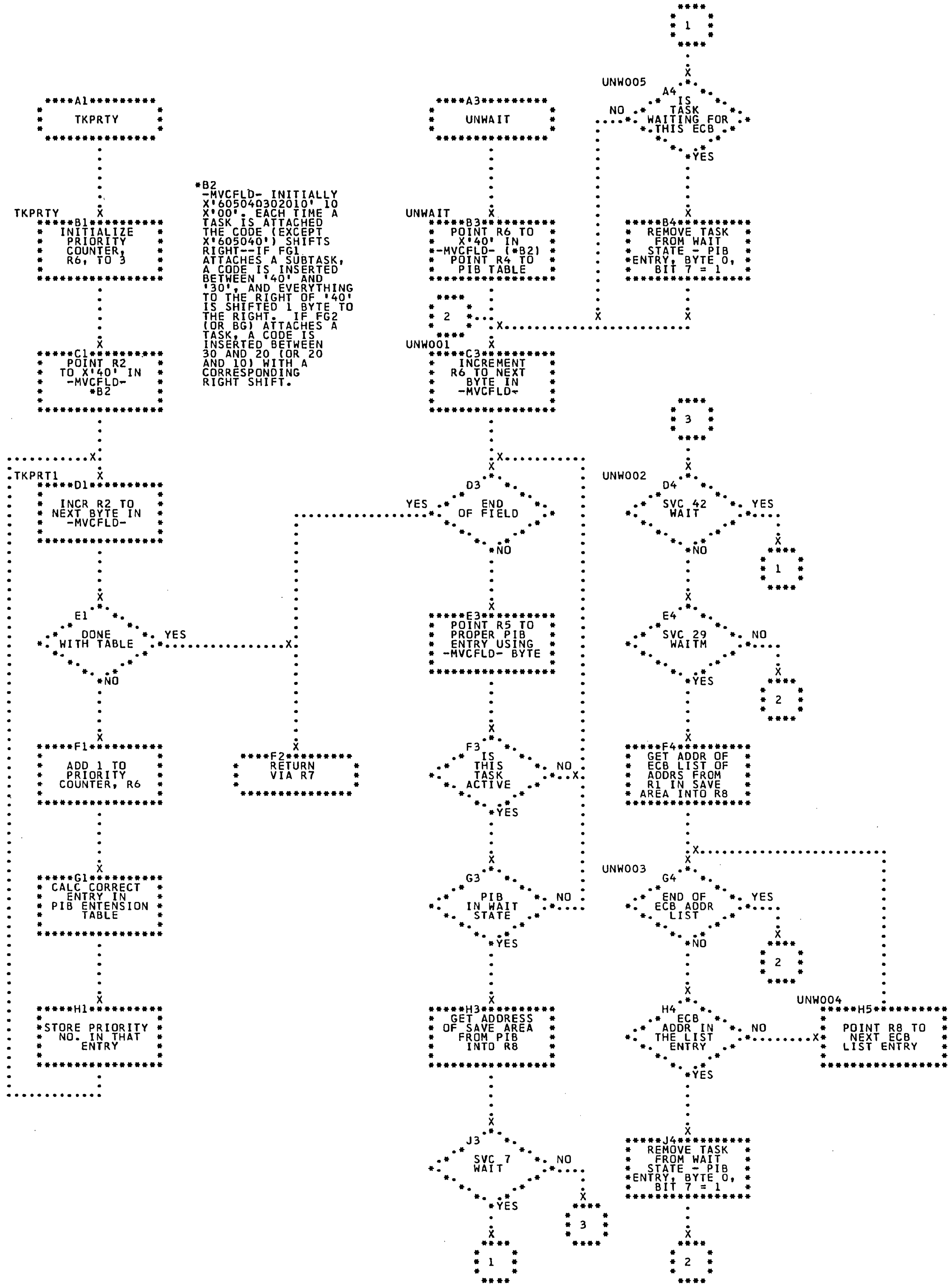


Chart MK. $$A$SUP1 - SGTHAP Macro, Task Termination Handling (Part 1 of 2) Refer to Chart 01.

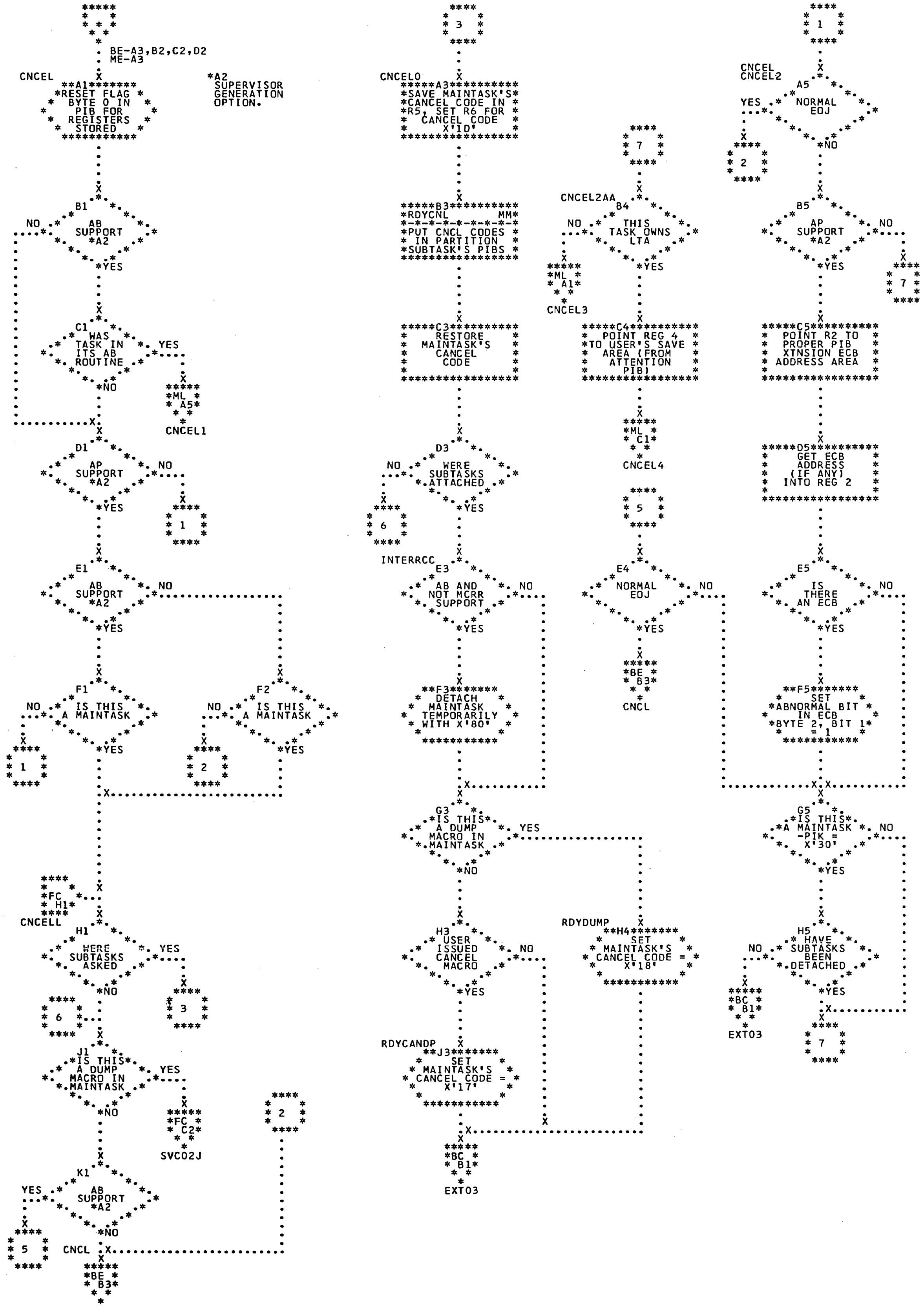


Chart ML. $$A$SUP1 - SGTHAP Macro, Task Termination Handling (Part 2 of 2)
Refer to Chart 01.

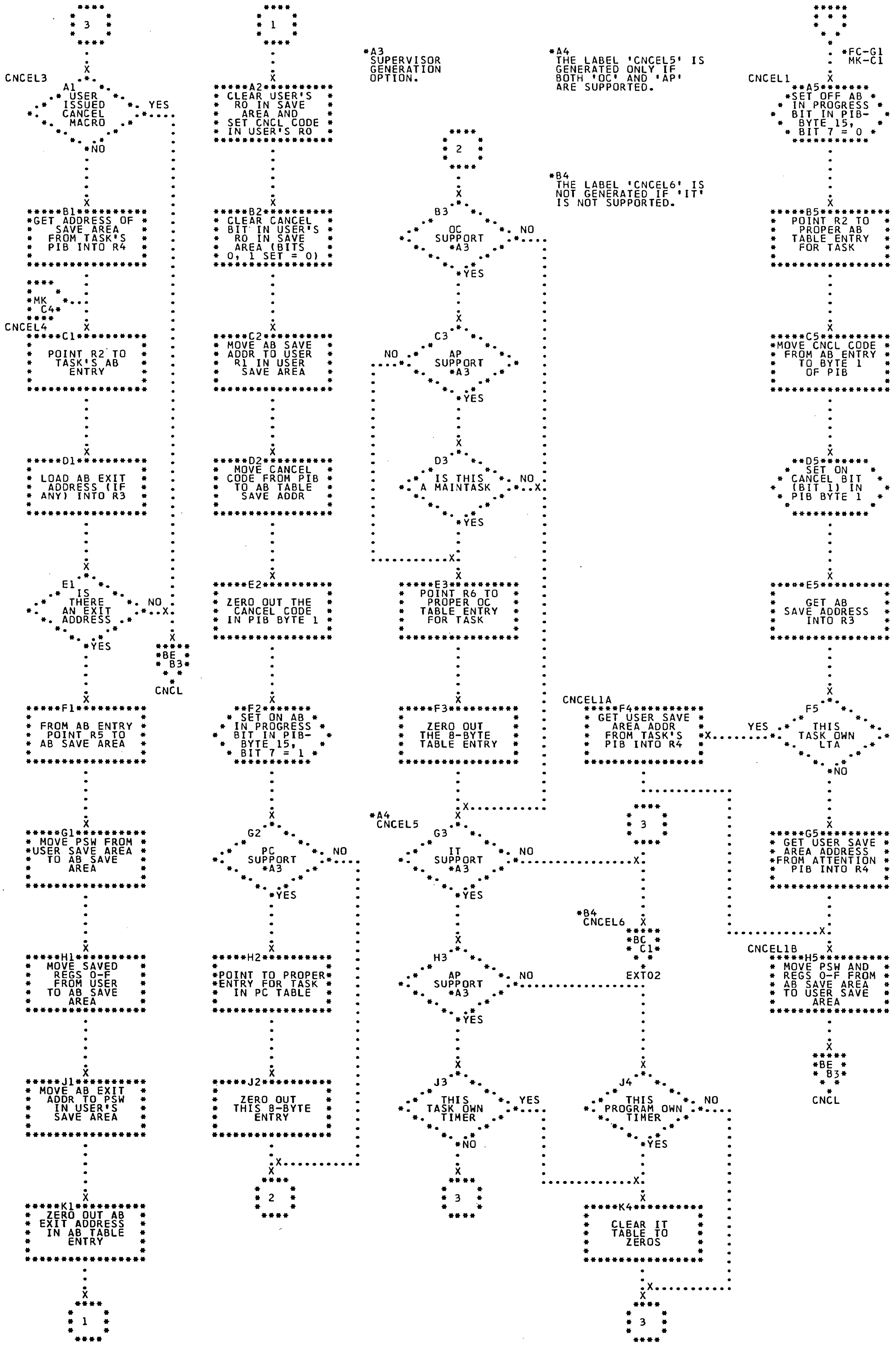


Chart MM. $$A$SUP1 - SGTHAP Macro, RDYCNL Subroutine and CANCEL ALL Processing Refer to Chart 01.

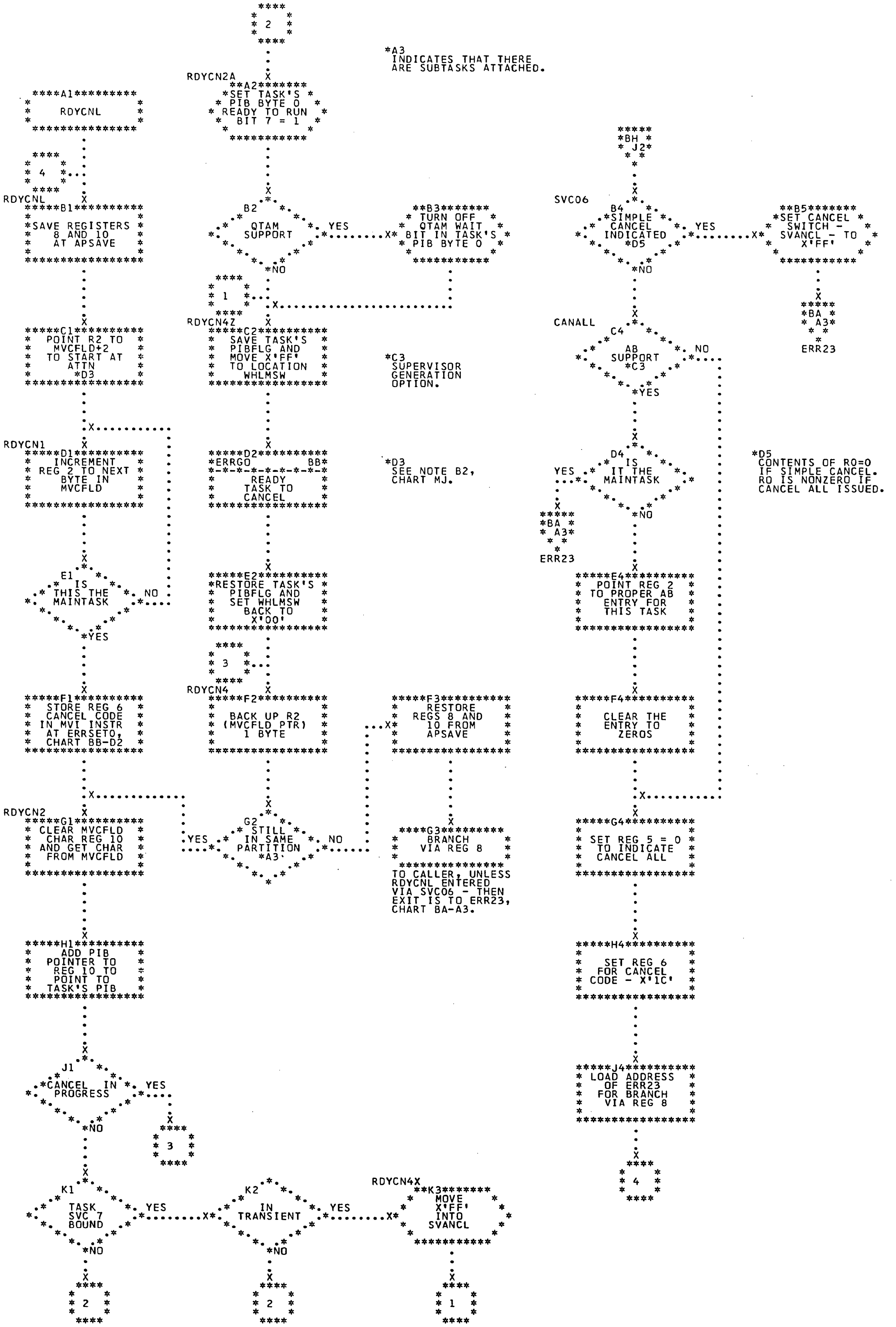


Chart NA. $$ANERRM - OBR Record Builder (Part 1 of 2)
Refer to Chart 13.

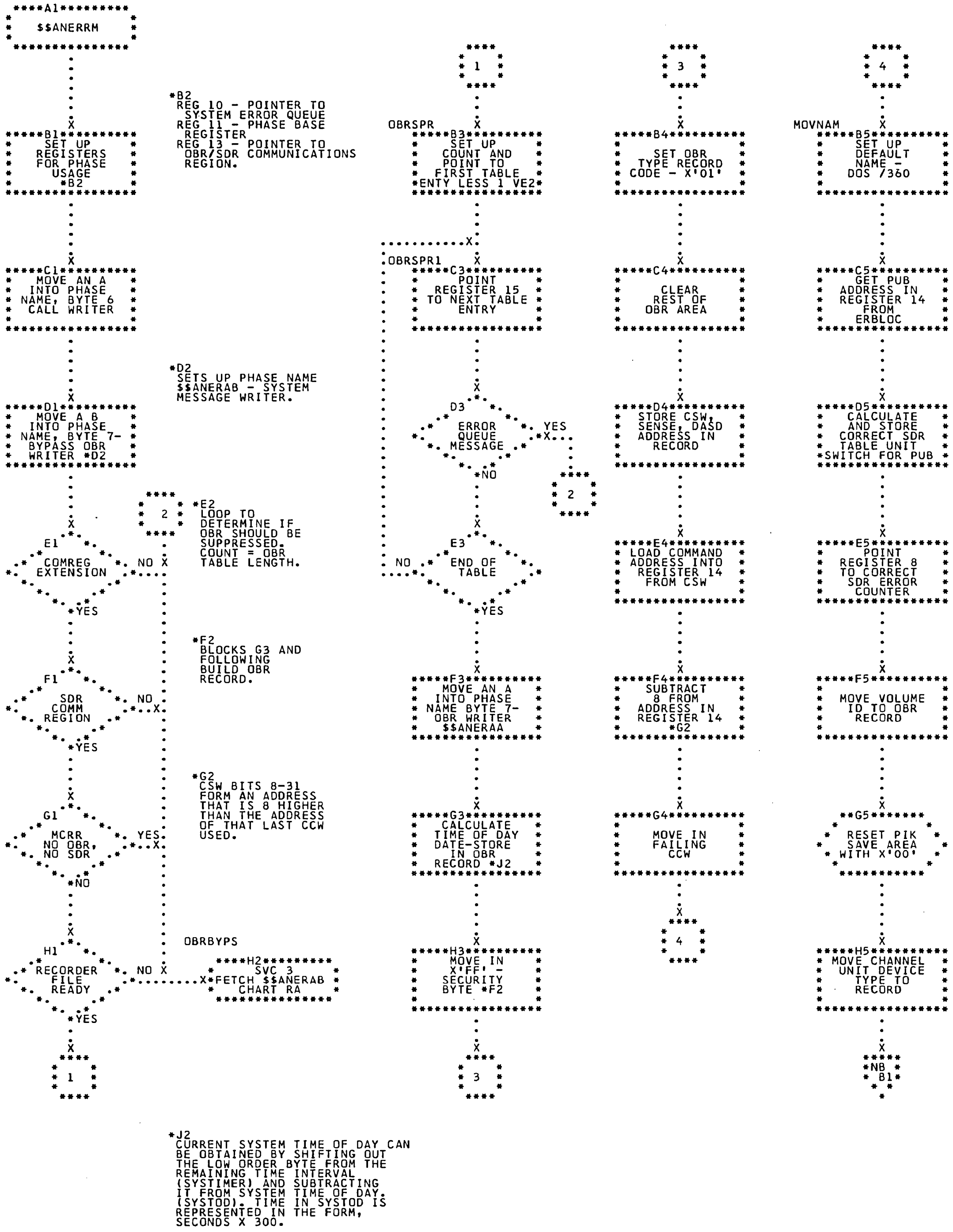


Chart NB. $$ANERRM - OBR Record Builder (Part 2 of 2)
Refer to Chart 13.

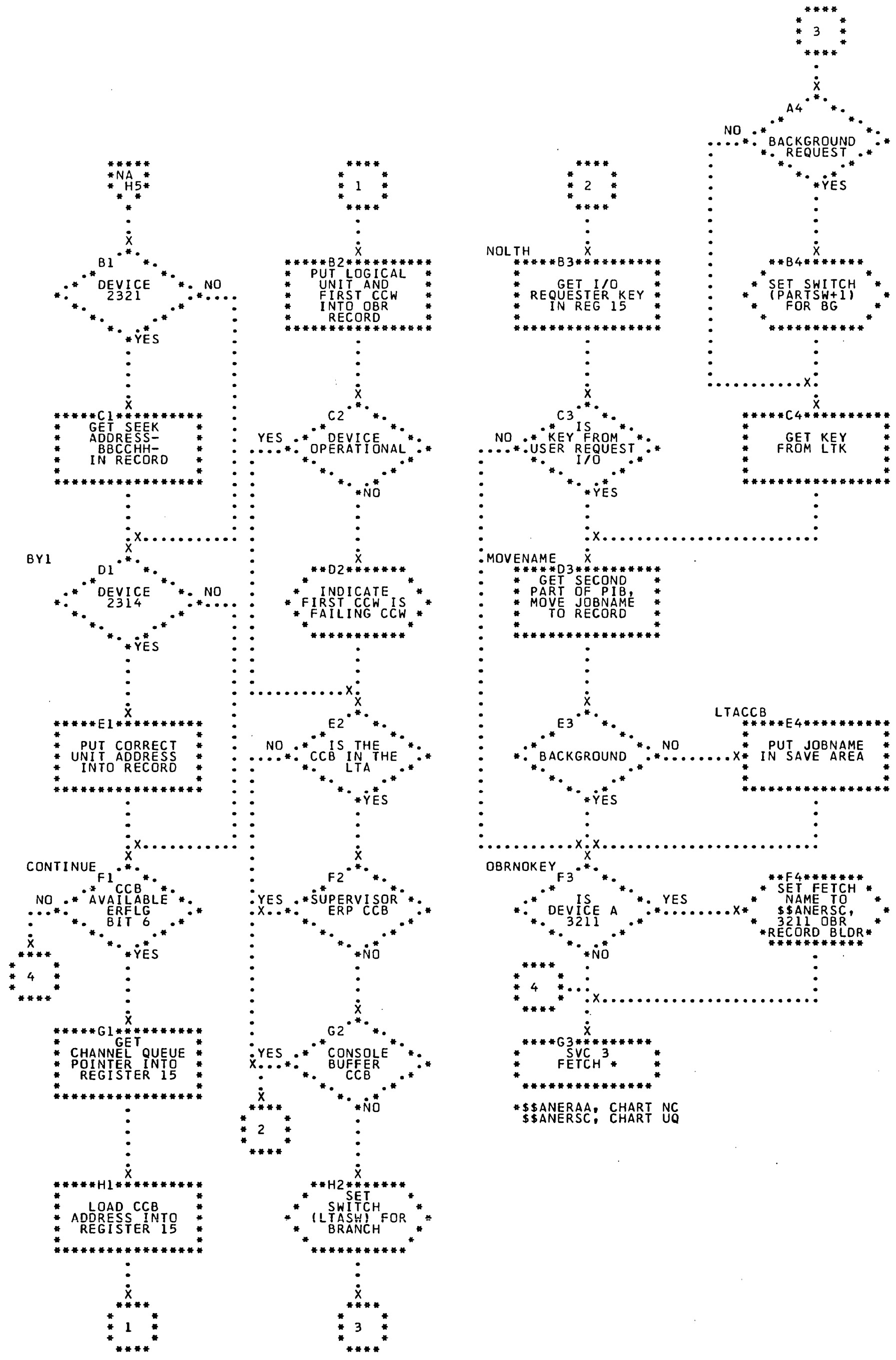
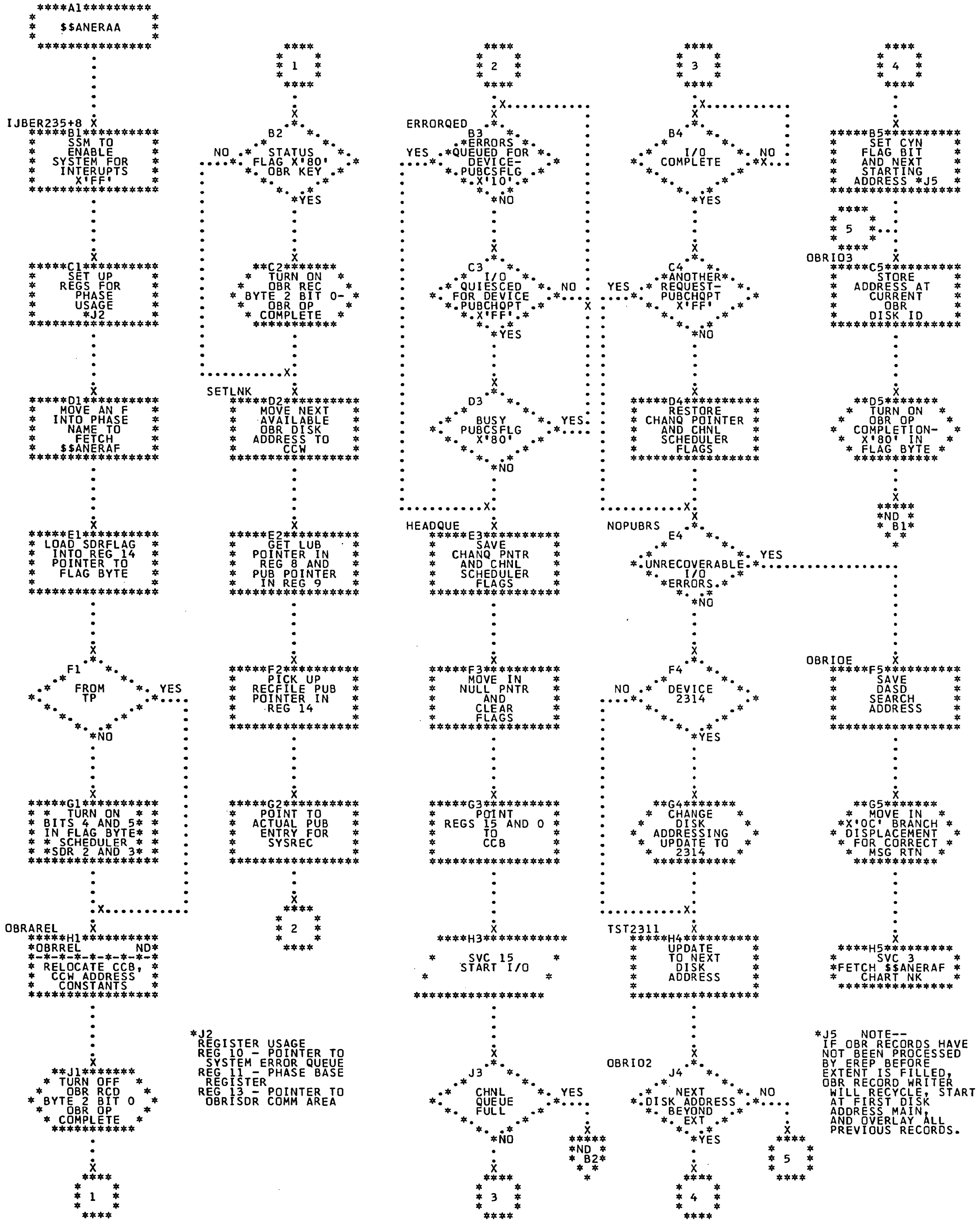


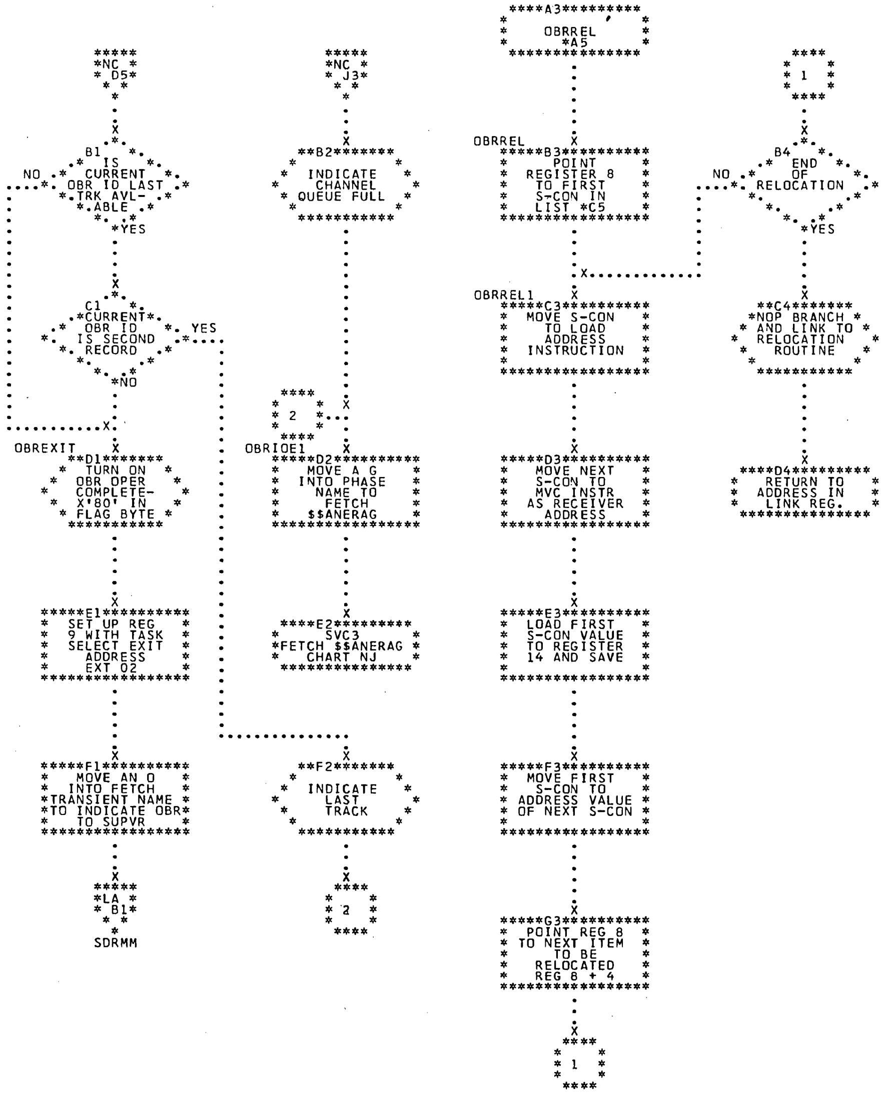
Chart NC. $$ANERAA - OBR/MCRR Record Writer (Part 1 of 2)
Refer to Chart 13.



*J2
REGISTER USAGE
REG 10 - POINTER TO SYSTEM ERROR QUEUE
REG 11 - PHASE BASE REGISTER
REG 13 - POINTER TO OBRISDR COMM AREA

*J5 NOTE--
IF OBR RECORDS HAVE NOT BEEN PROCESSED BY EREP BEFORE EXTENT IS FILLED, OBR RECORD WRITER WILL RECYCLE, START AT FIRST DISK ADDRESS MAIN, AND OVERLAY ALL PREVIOUS RECORDS.

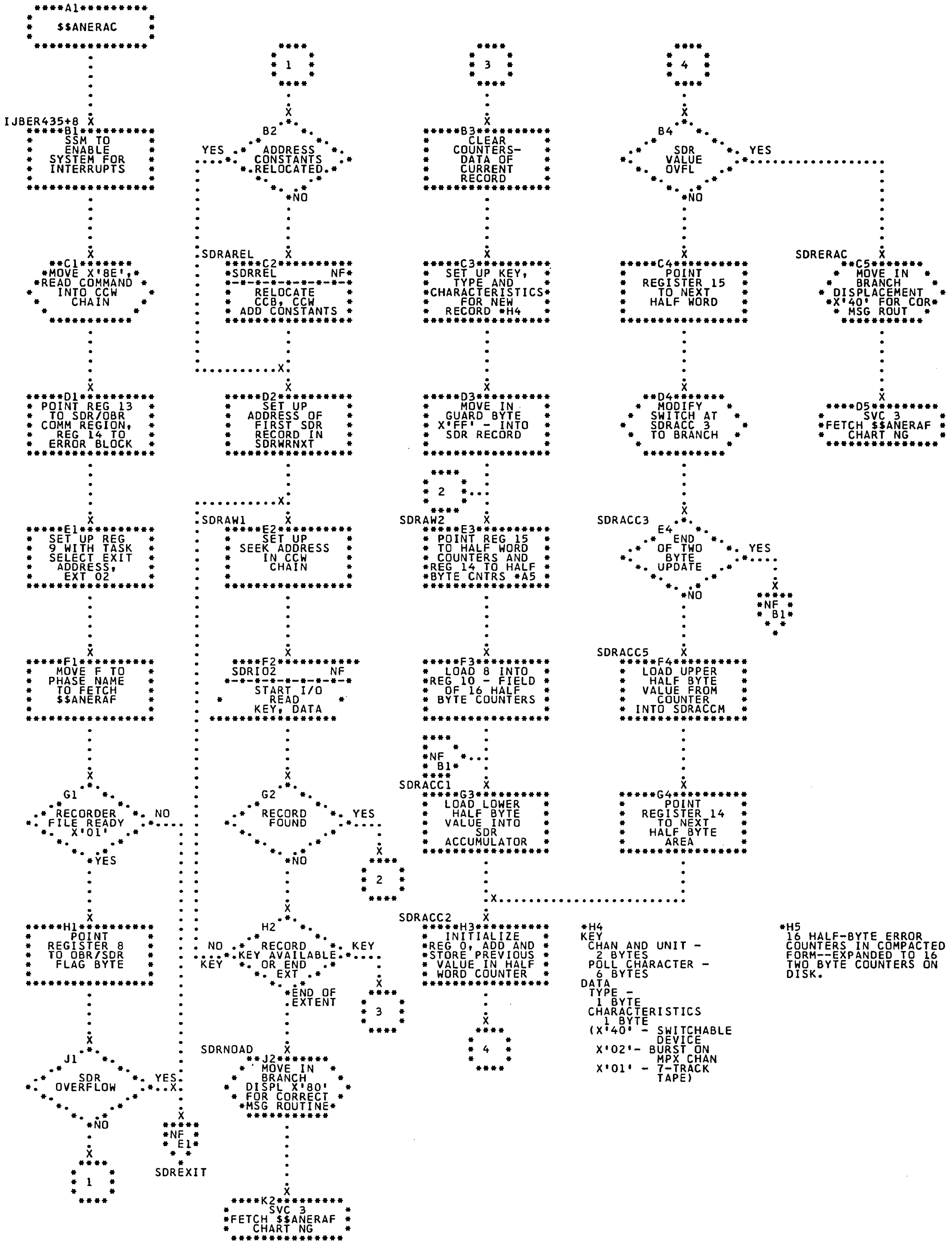
Chart ND. $$ANERAA - OBR/MCRR Record Writer (Part 2 of 2) Refer to Chart 13.



*A5
RELOCATION ROUTINE
CHANGES CCB, CCW
ADDRESSING TO BASE
DISPLACEMENT FORM
BY MOVING IN S-CON
EQUIVALENTS.

*C5
S-CON--
ADDRESSING CONSTANT IN
BASE DISPLACEMENT FORM.

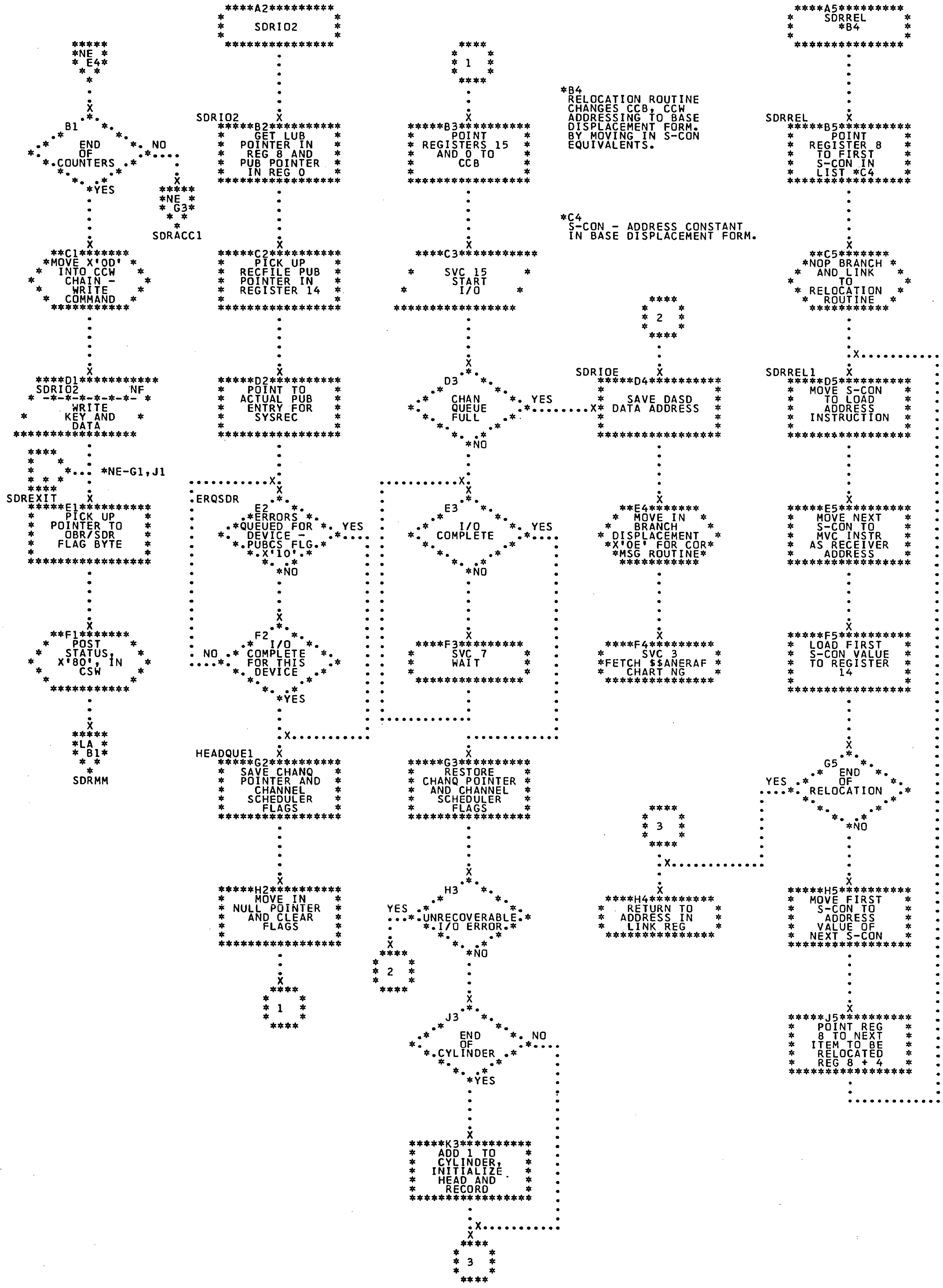
Chart NE. $$ANERAC - SDR External Update of Recorder File Records (Part 1 of 2) Refer to Chart 13.



*H4
KEY
CHAN AND UNIT - 2 BYTES
POLL CHARACTER - 6 BYTES
DATA
TYPE - 1 BYTE
CHARACTERISTICS 1 BYTE
(X'40' - SWITCHABLE DEVICE
X'02'- BURST ON MPX CHAN
X'01' - 7-TRACK TAPE)

*H5
16 HALF-BYTE ERROR COUNTERS IN COMPACTED FORM--EXPANDED TO 16 TWO BYTE COUNTERS ON DISK.

Chart NF. $$ANERAC - SDR External Update of Recorder File Records (Part 2 of 2)
Refer to Chart 13.


*B4
RELOCATION ROUTINE CHANGES CCB, CCW ADDRESSING TO BASE DISPLACEMENT FORM. BY MOVING IN S-CON EQUIVALENTS.

*C4
S-CON - ADDRESS CONSTANT IN BASE DISPLACEMENT FORM.

Chart NG. $$ANERAF - Recorder File Error Message Writer for OBR/SDR (Part 1 of 2) Refer to Chart 13.

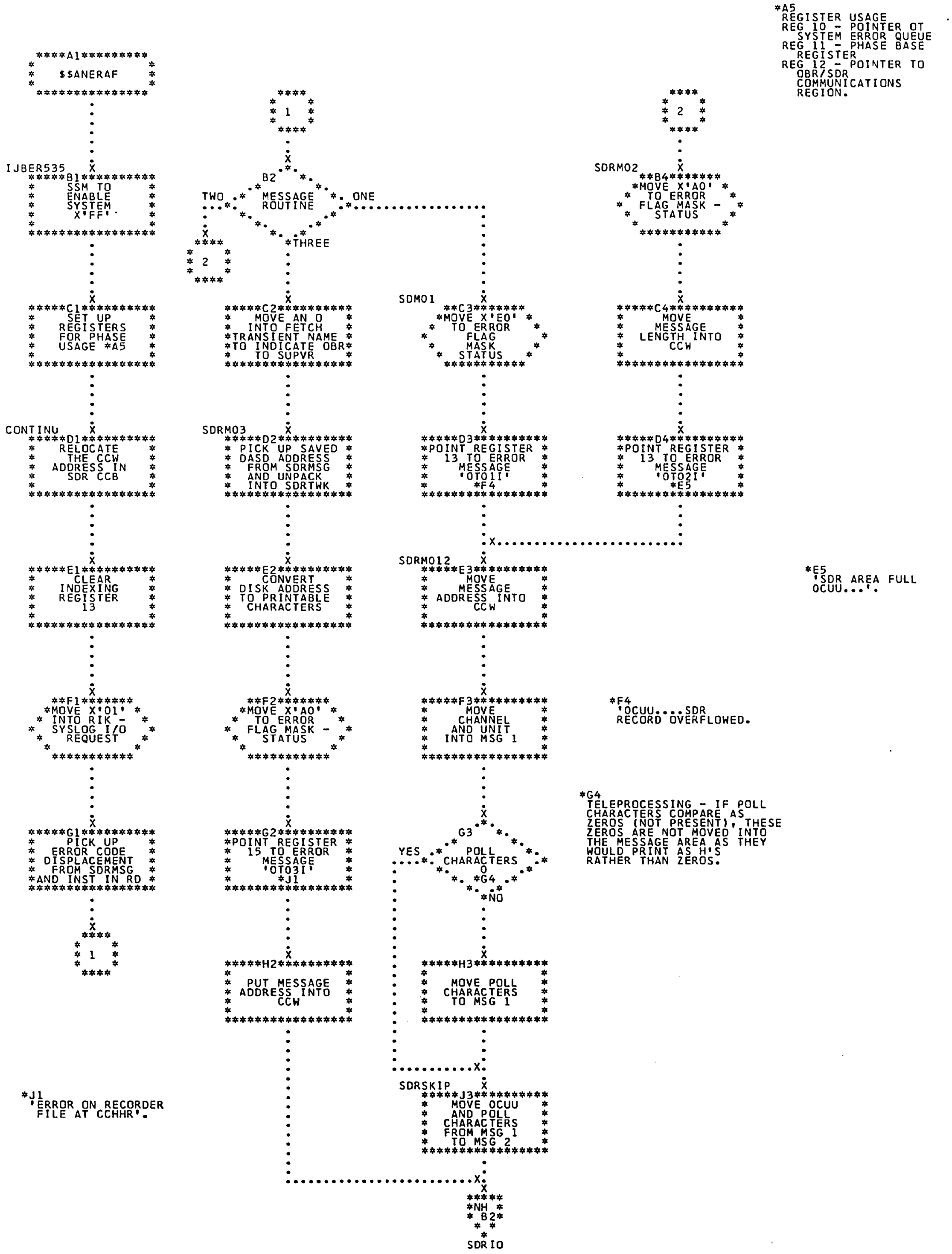


Chart NH. $$ANERAF - Recorder File Error Message Writer for OBR/SDR (Part 2 of 2)
Refer to Chart 13.

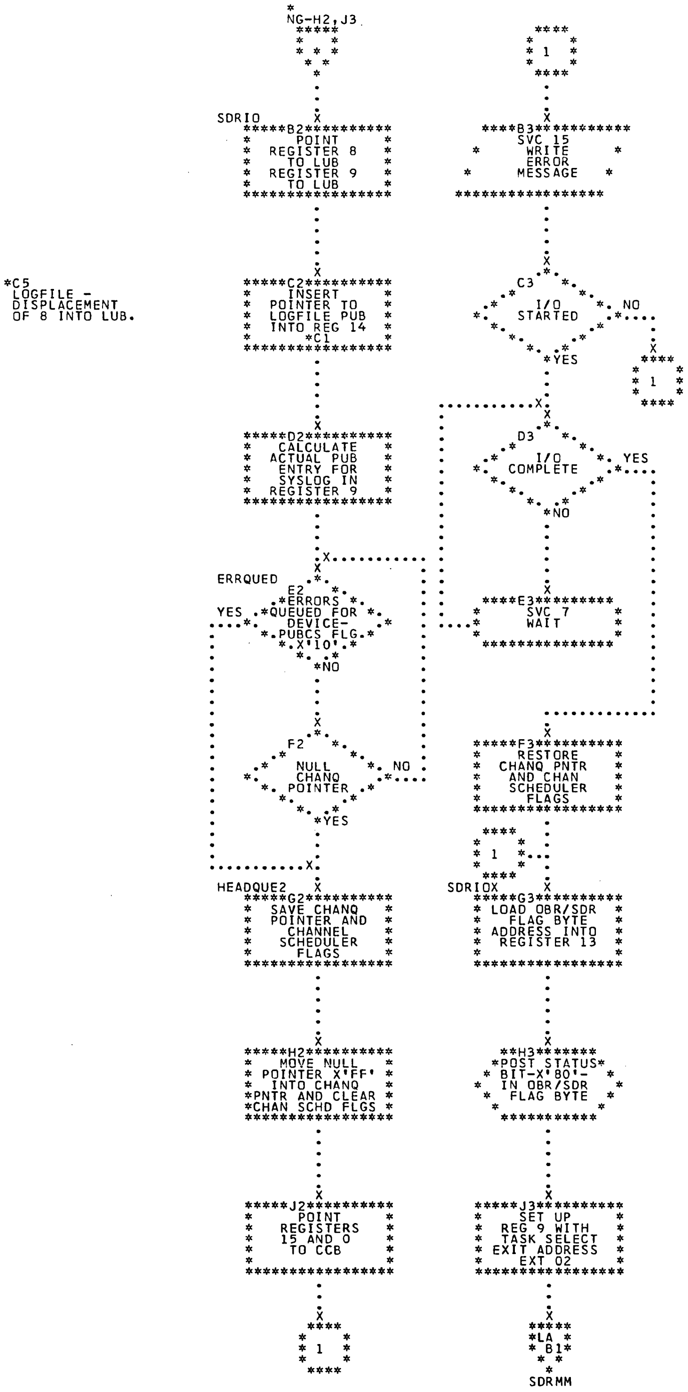


Chart NJ. $$ANERAG - Recorder File Last Track Error Message Writer for OBR/SDR Refer to Chart 13.

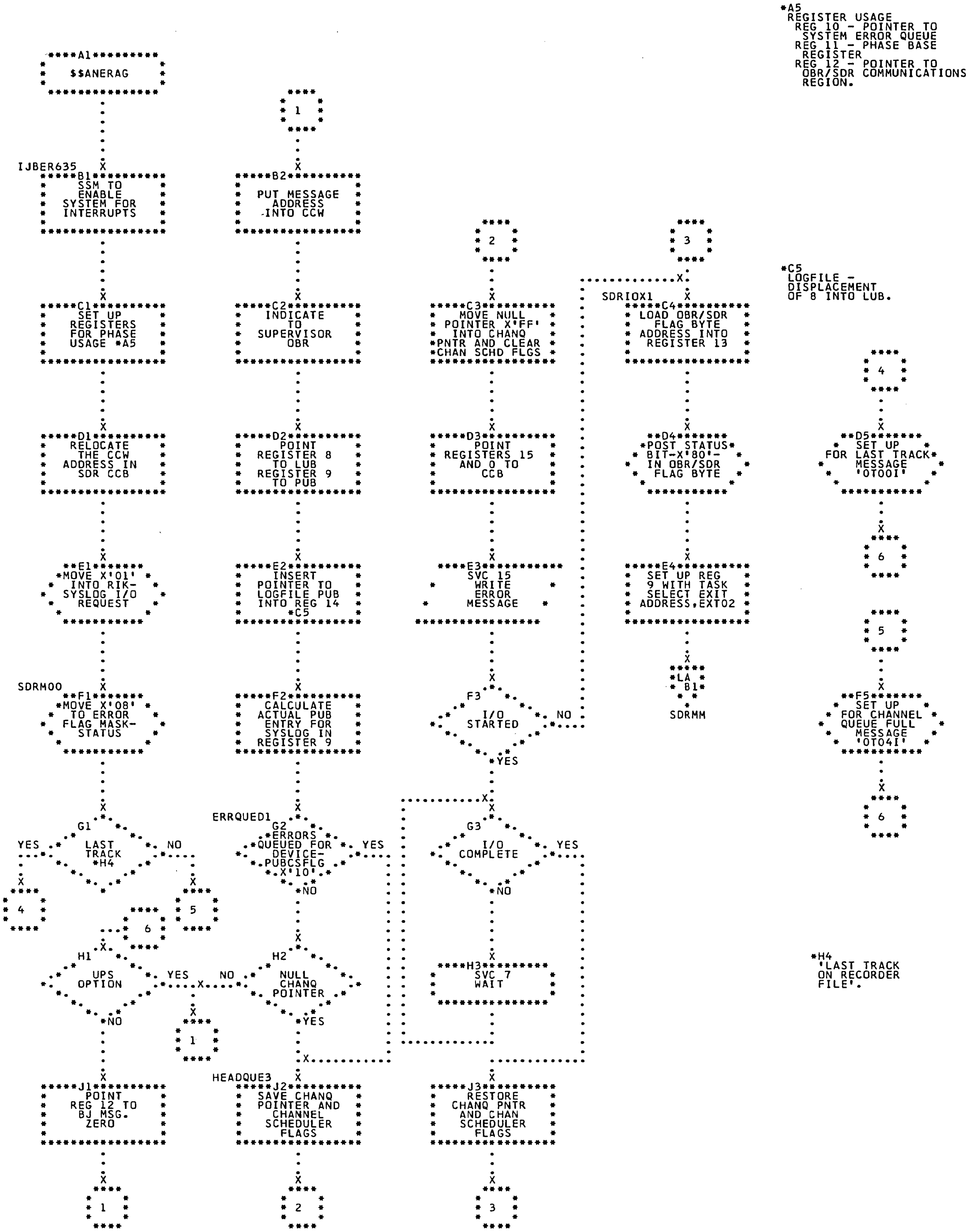
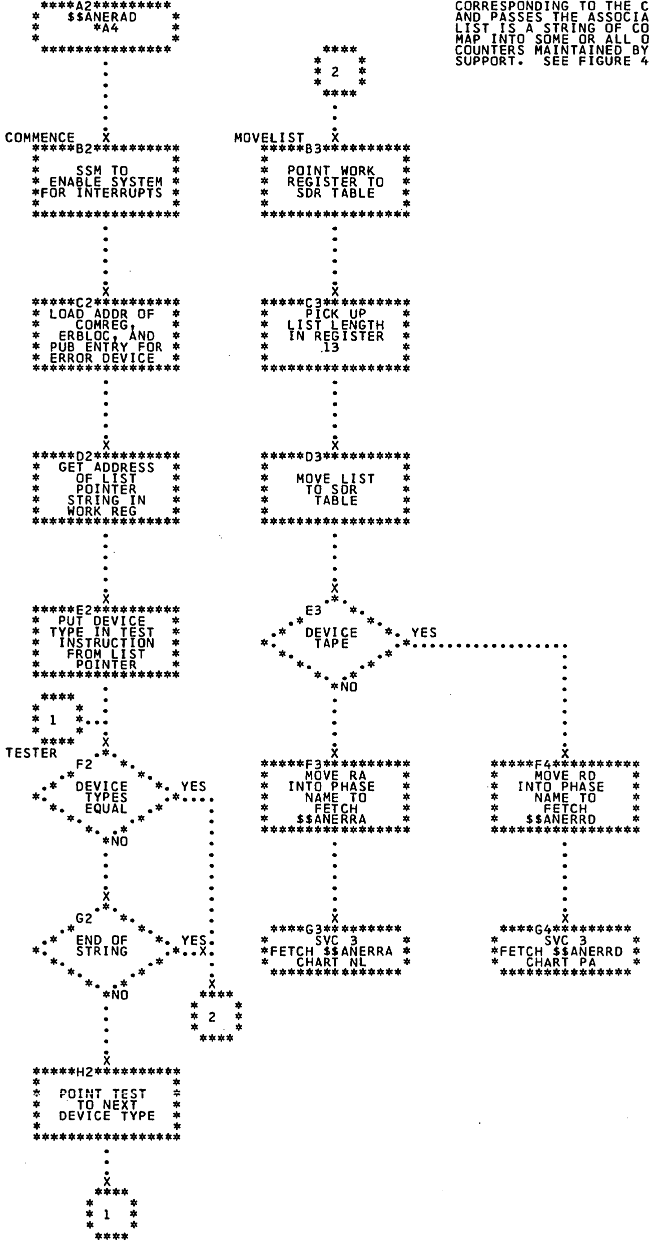


Chart NK. $$ANERAD - List Passer for SDR Processor
Refer to Chart 11.



*A4
BEFORE THE ROUTINES ARE FETCHED TO PROCESS A PARTICULAR ERROR CONDITION, THIS ROUTINE IS FETCHED. IT GETS THE DEVICE TYPE FOR THE I/O DEVICE CORRESPONDING TO THE CURRENT ERROR AND PASSES THE ASSOCIATED LIST. THE LIST IS A STRING OF CONSTANTS THAT MAP INTO SOME OR ALL OF THE 16 COUNTERS MAINTAINED BY OBR/SDR SUPPORT. SEE FIGURE 48.

Chart NL. $$ANERRA - ERP Monitor (Part 1 of 2)
Refer to Chart 11.

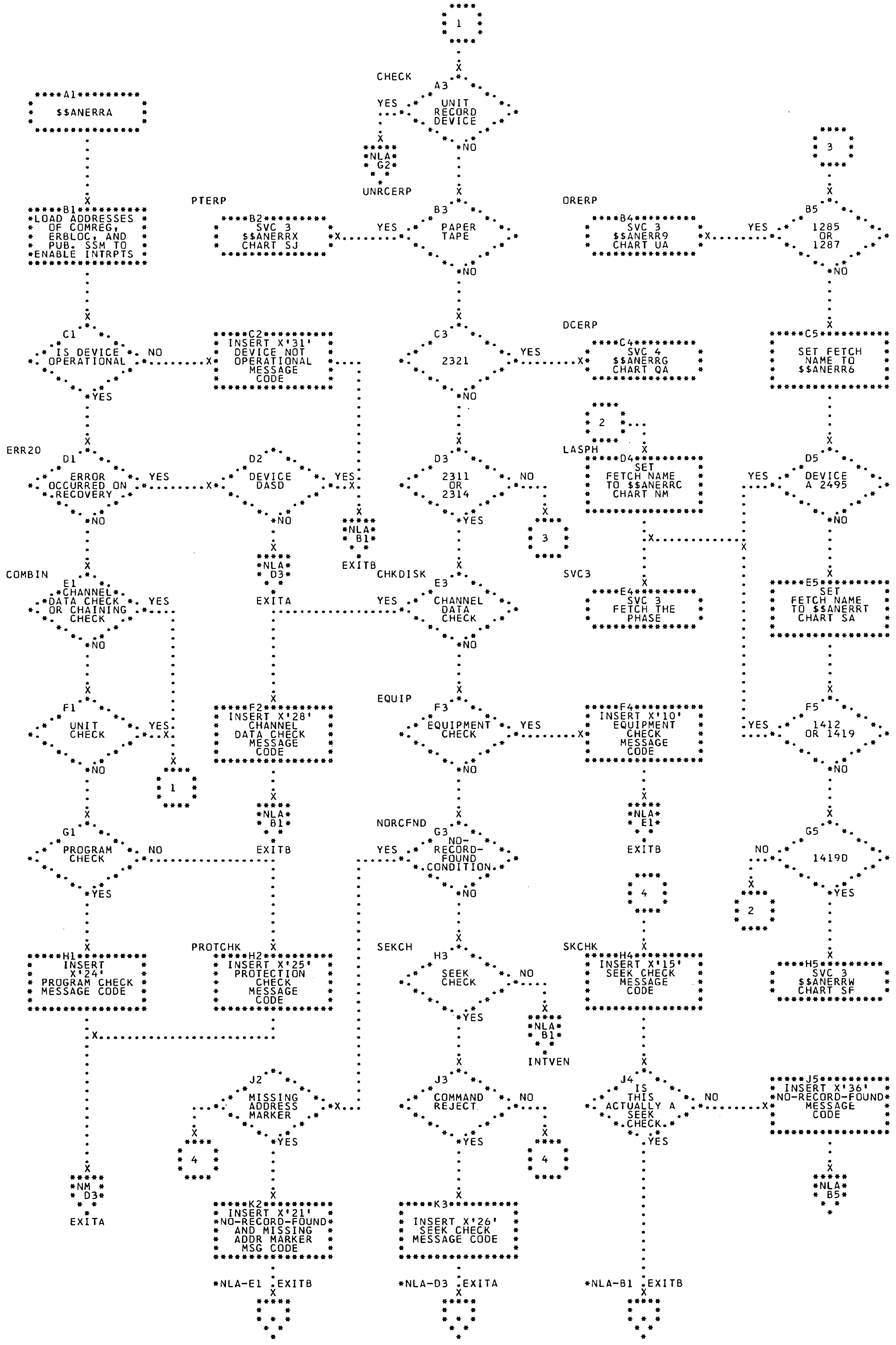


Chart NLA. $$ANERRA - ERP Monitor (Part 2 of 2)
Refer to Chart 11.

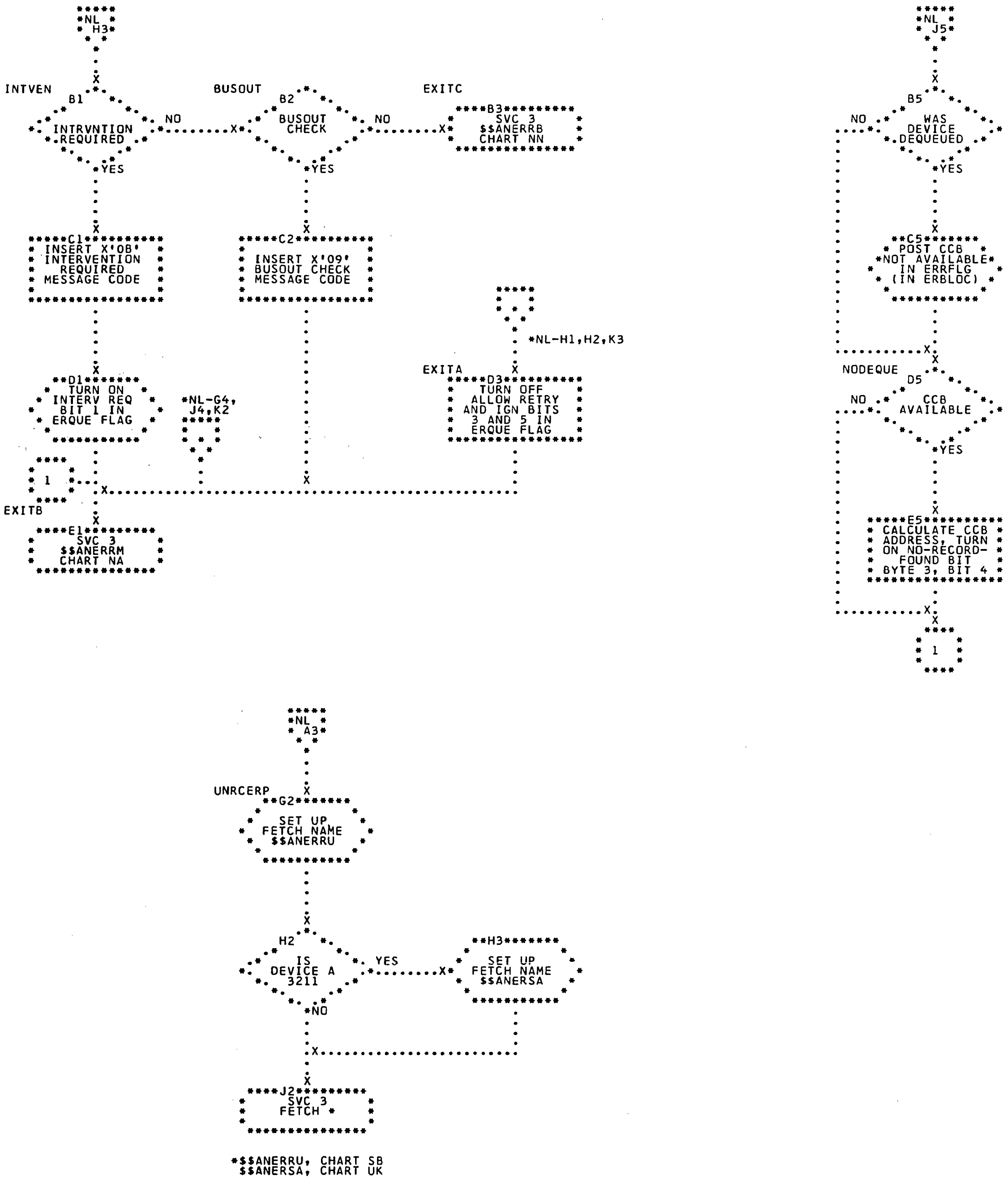


Chart NM. $$ANERRC - ERP Monitor
Refer to Chart 11.

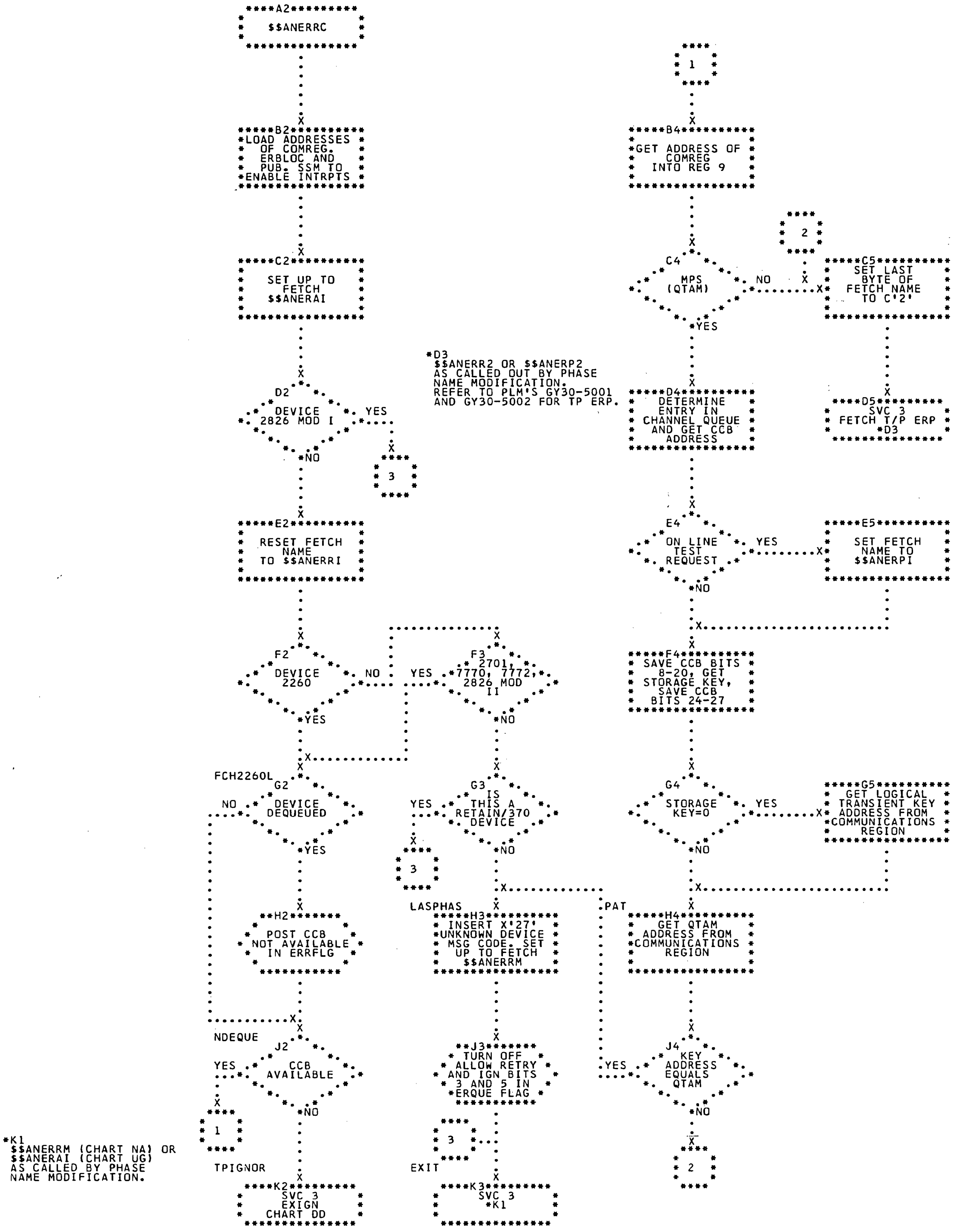


Chart NN. $$ANERRB - Disk ERP
Refer to Chart 11.

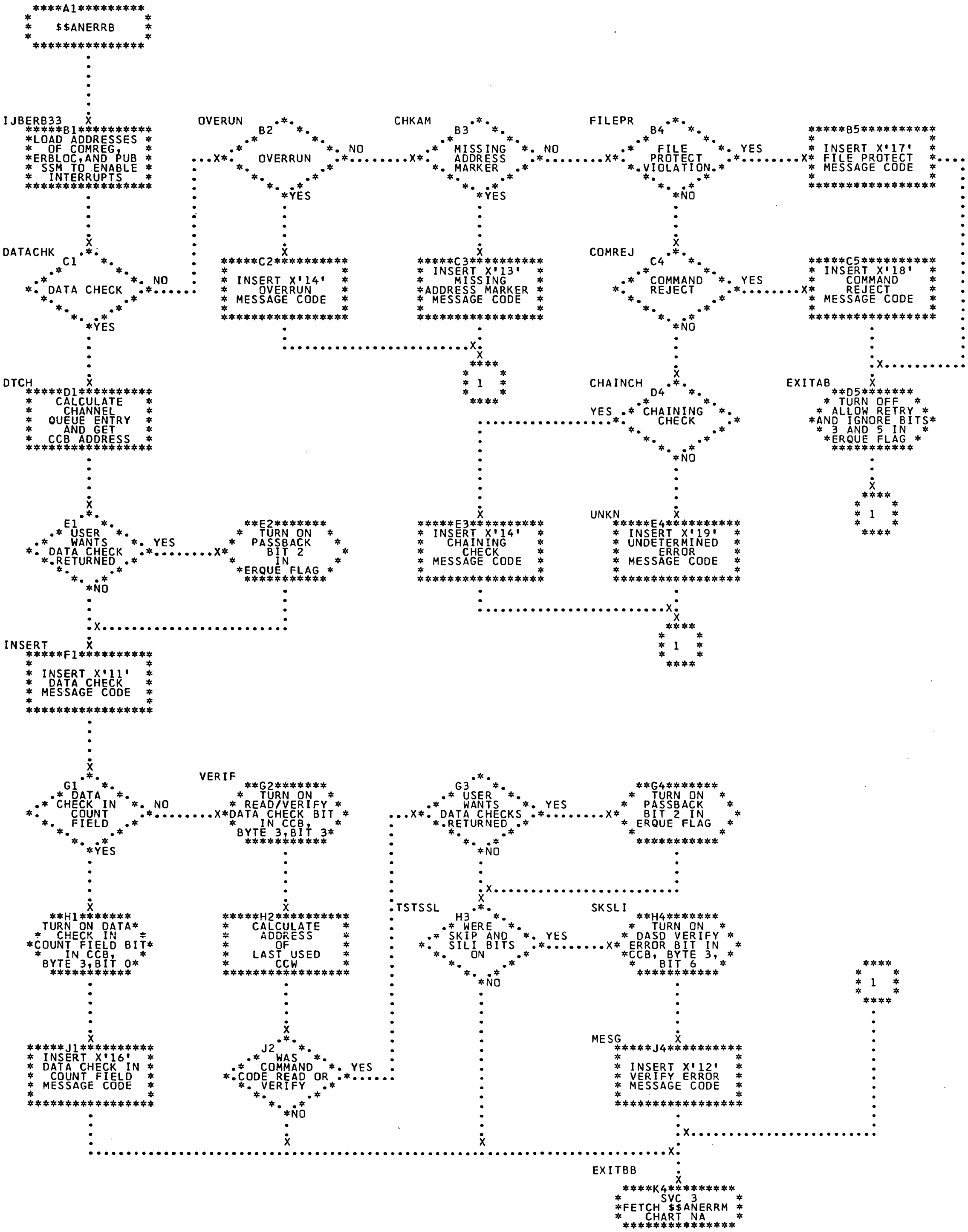


Chart PA. $$ANERRD - Phase 1 of Tape ERP (Part 1 of 2) Refer to Chart 13.

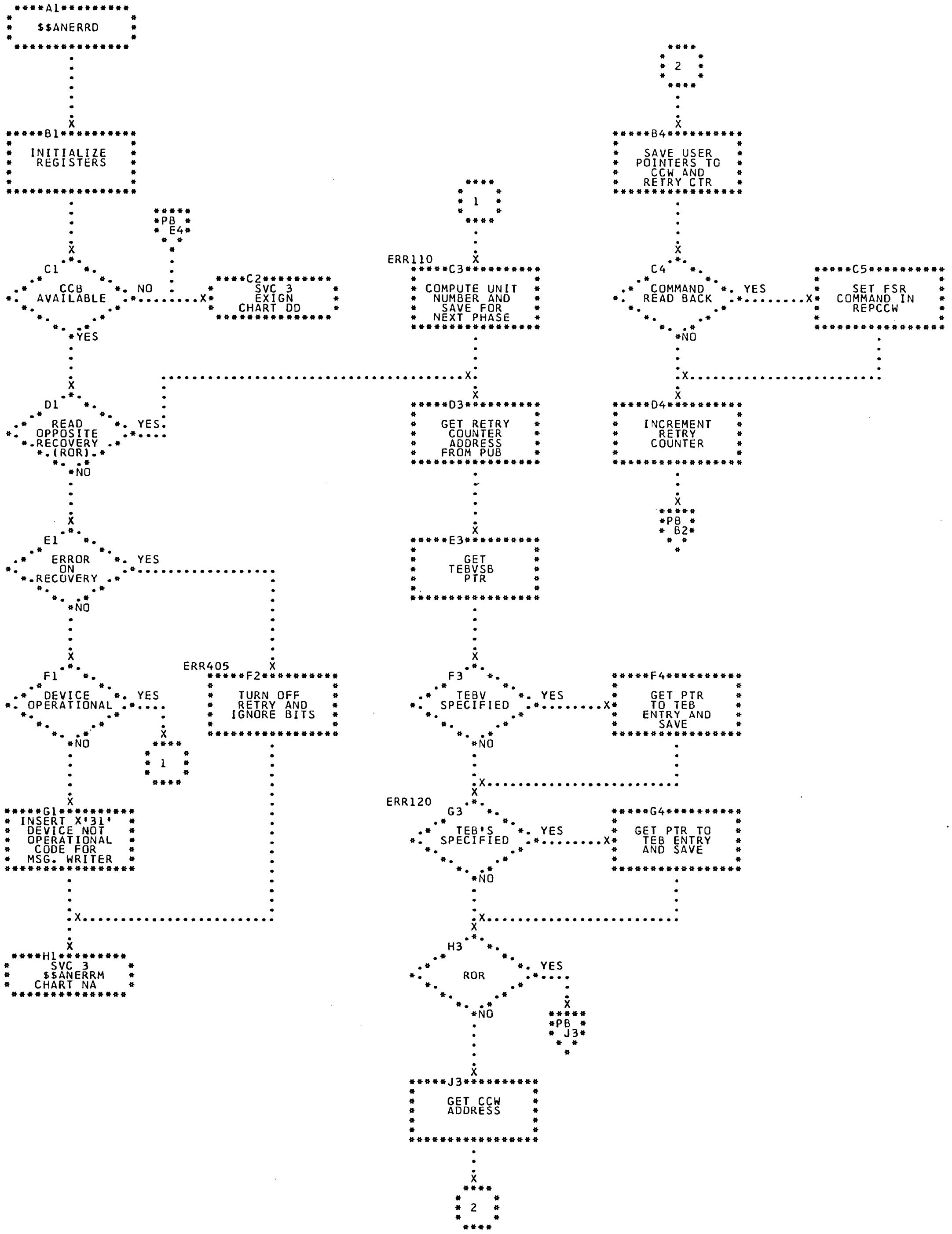


Chart PB. $$ANERRD - Phase 1 of Tape ERP (Part 2 of 2)
Refer to Chart 13.

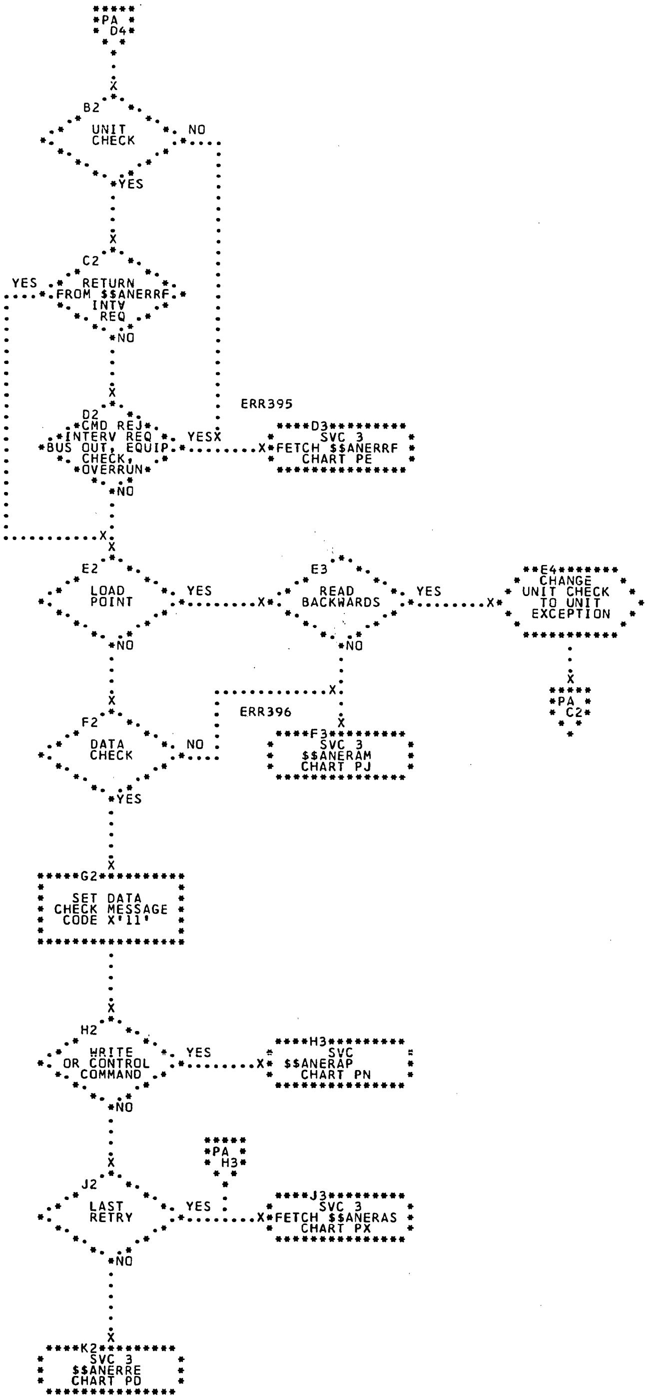


Chart PC. $$ANERRE - Phase 2 of Tape ERP (Part 1 of 2) Refer to Chart 13.

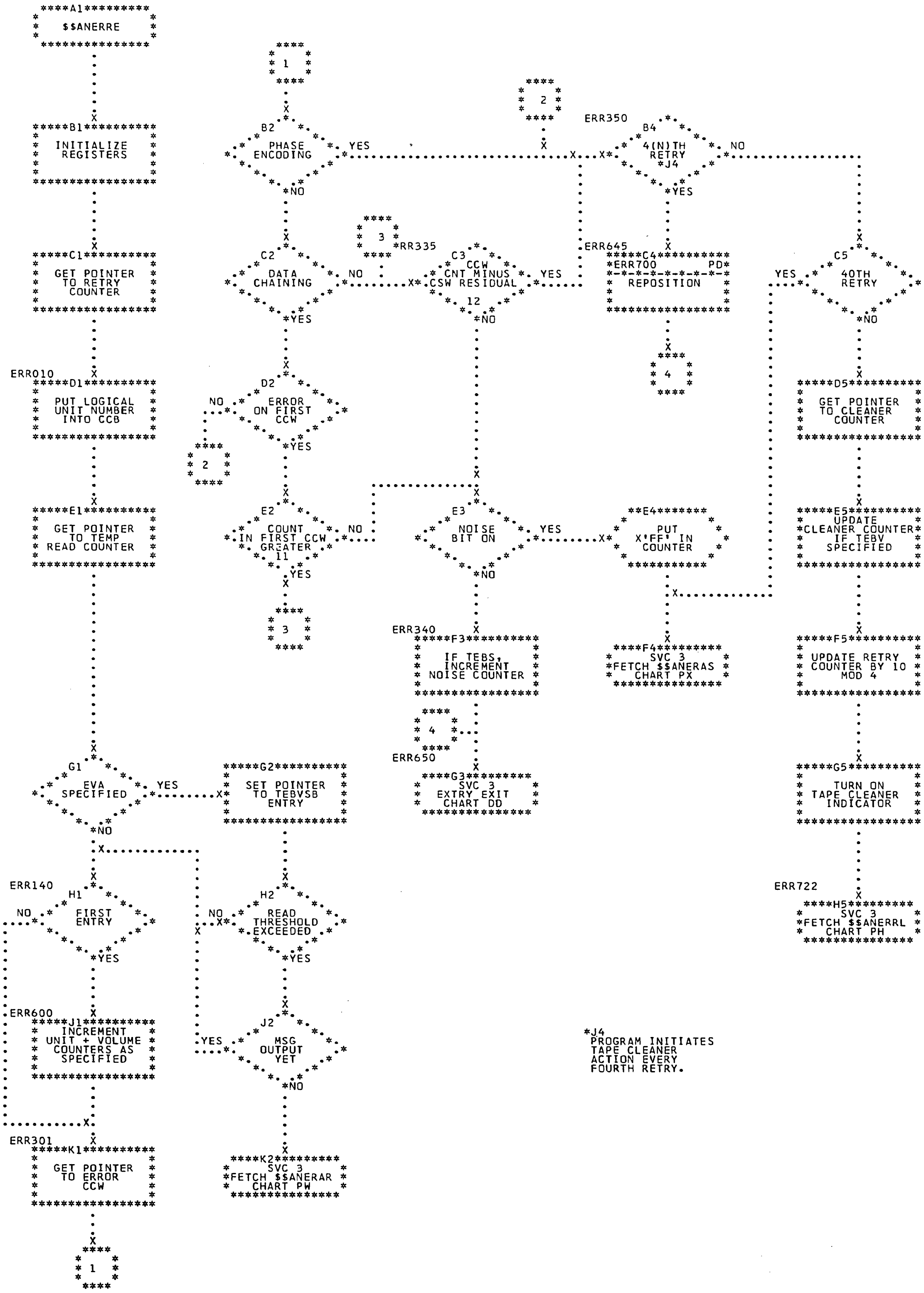


Chart PD. $$ANERRE - Phase 2 of Tape ERP (Part 2 of 2)

Refer to Chart 13.

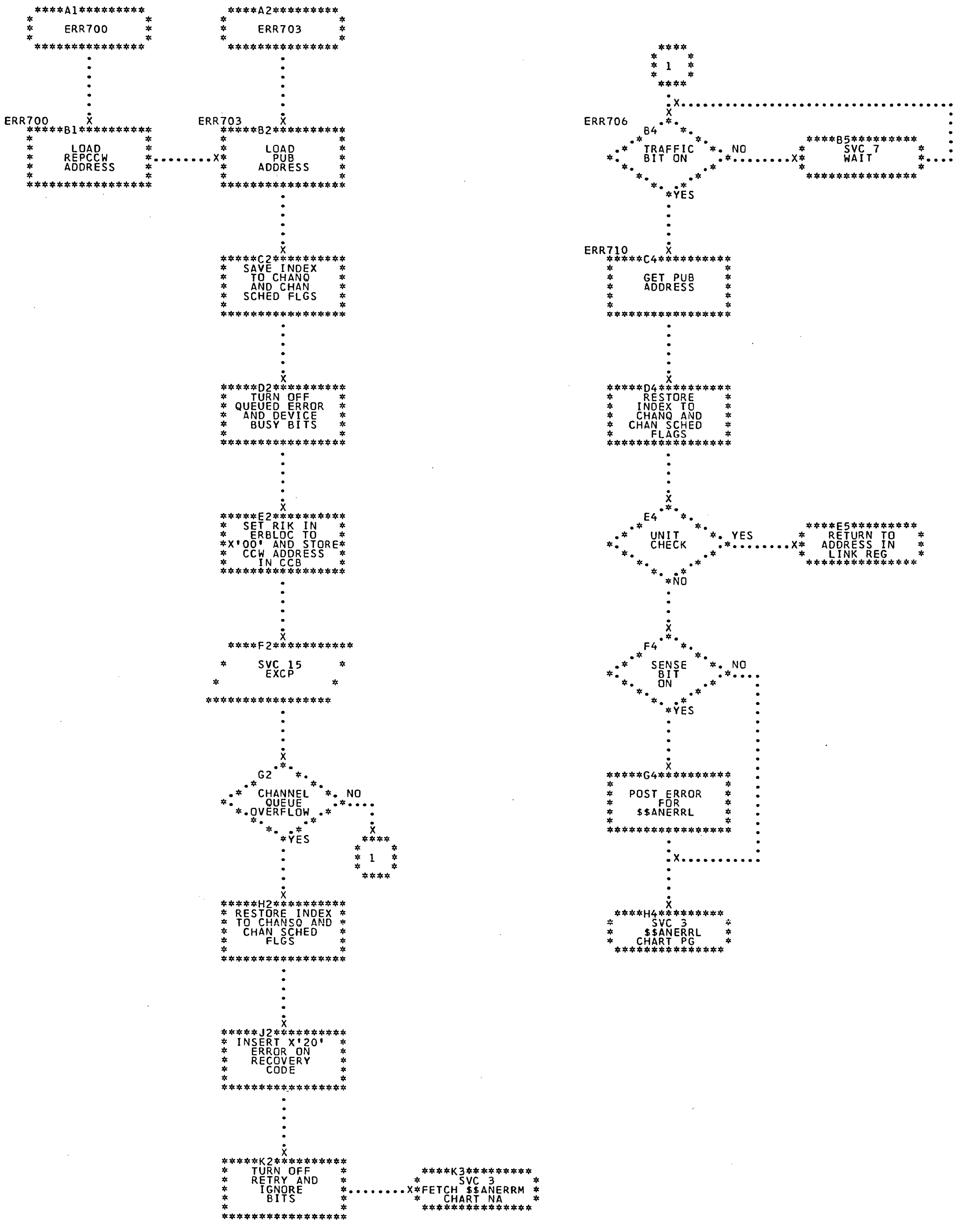


Chart PE. $$ANERRF - Phase 3 of Tape ERP (Part 1 of 2) Refer to Chart 13.

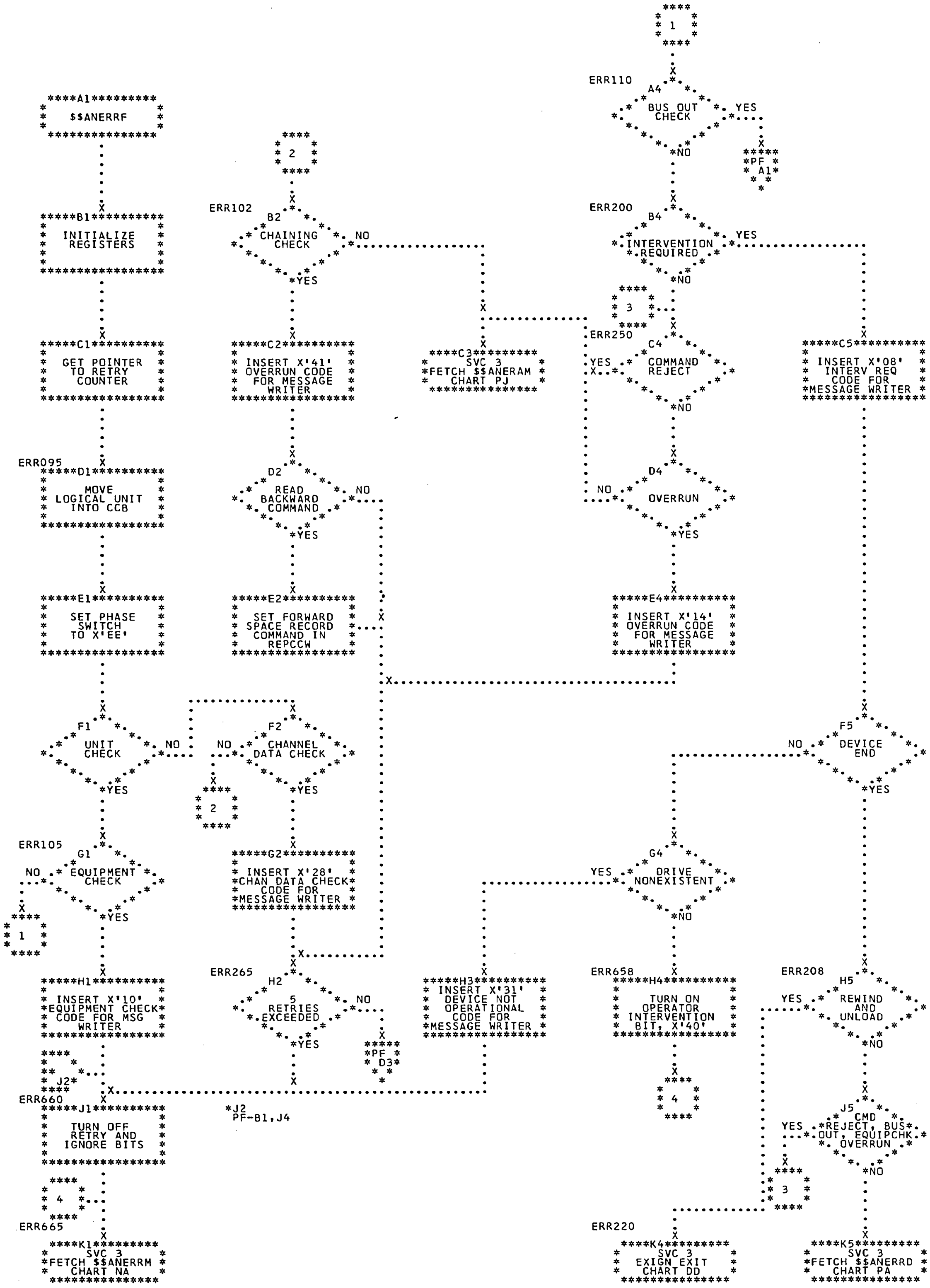


Chart PF. $$ANERRF - Phase 3 of Tape ERP (Part 2 of 2)
Refer to Chart 13.

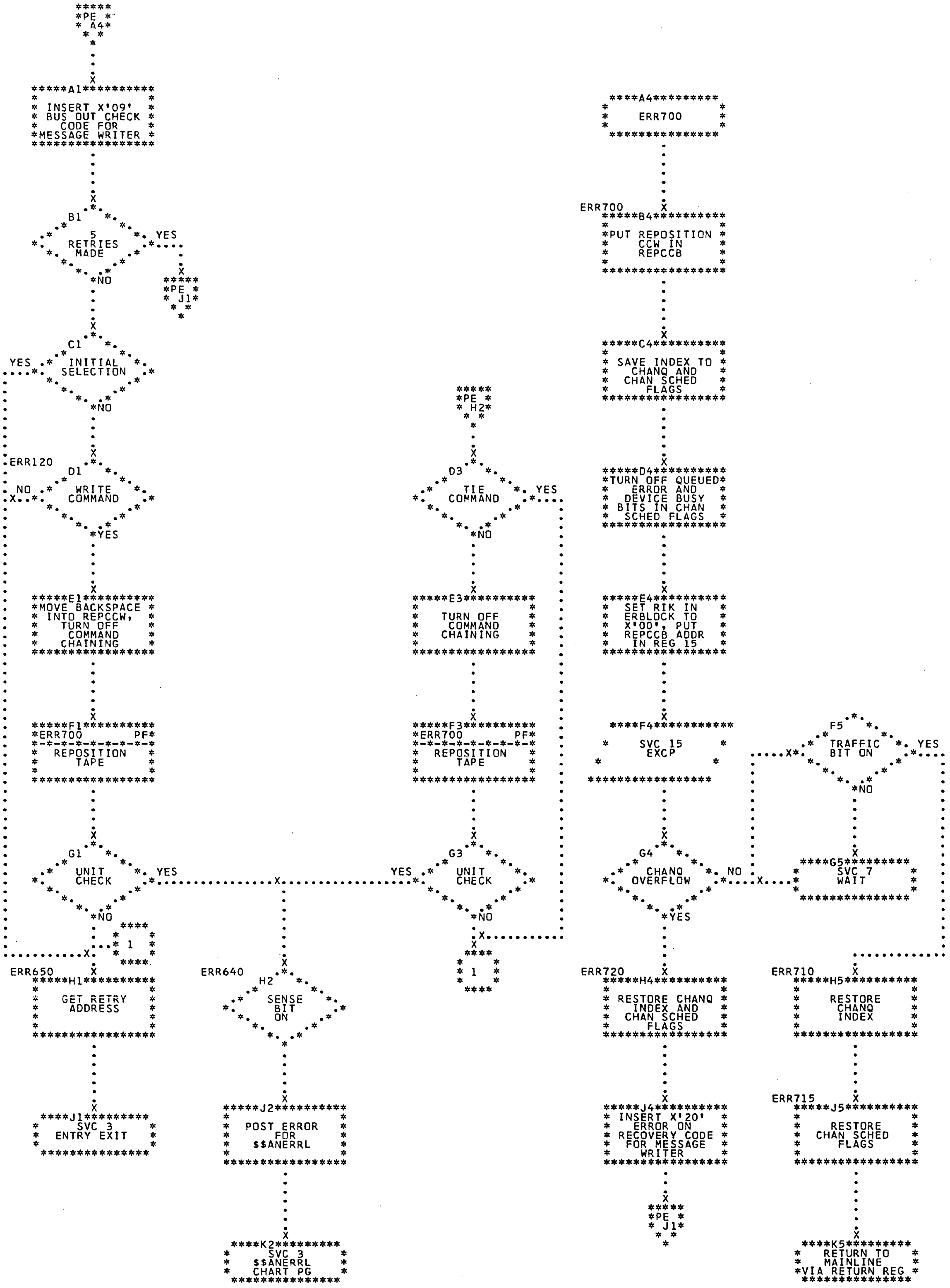


Chart PG. $$ANERRL - Phase 4 of Tape ERP (Part 1 of 2)
Refer to Chart 13.

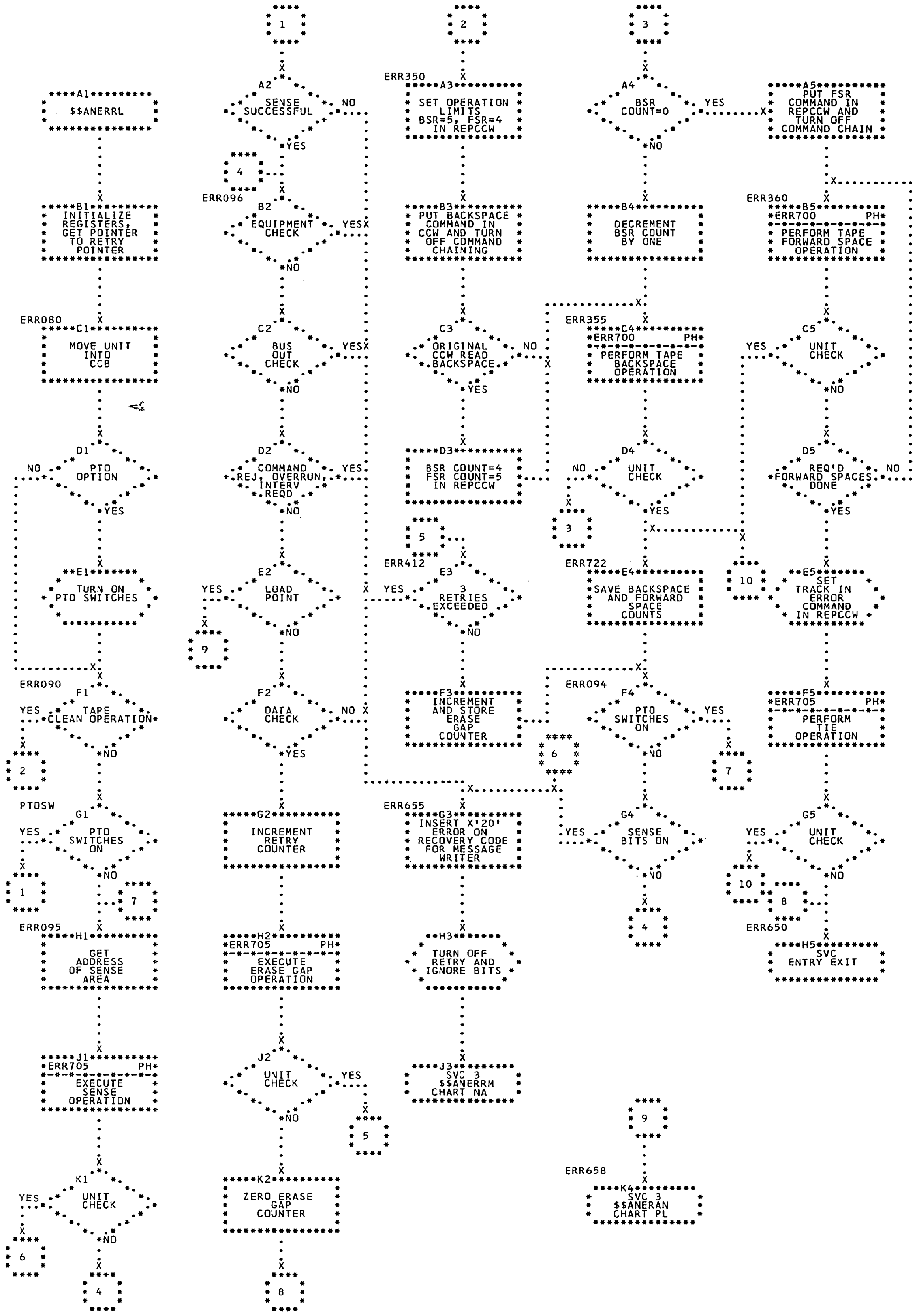


Chart PH. $$ANERRL - Phase 4 of Tape ERP (Part 2 of 2) Refer to Chart 13.

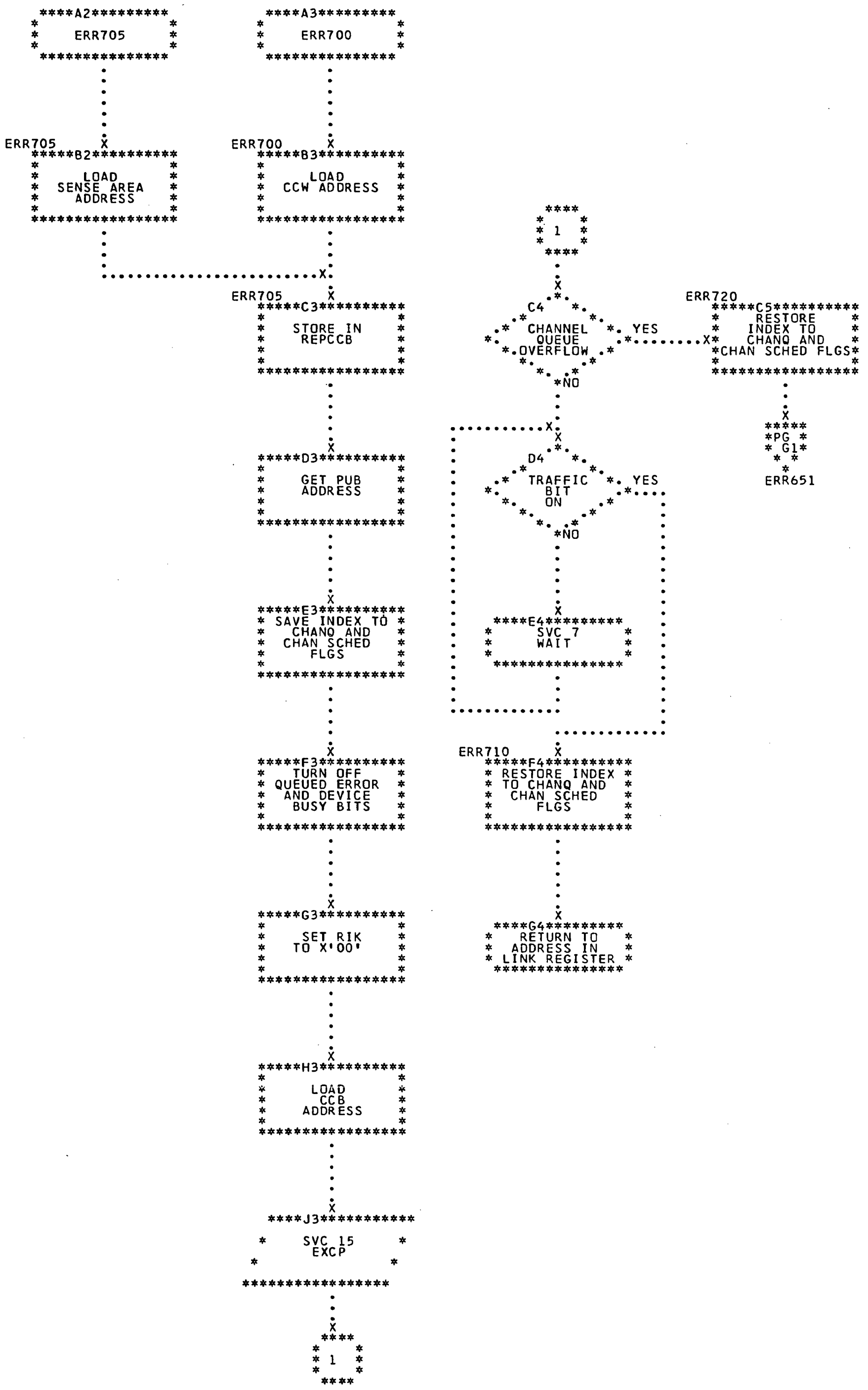


Chart PJ. $$ANERAM - Phase 5 of Tape ERP (Part 1 of 2) Refer to Chart 13.

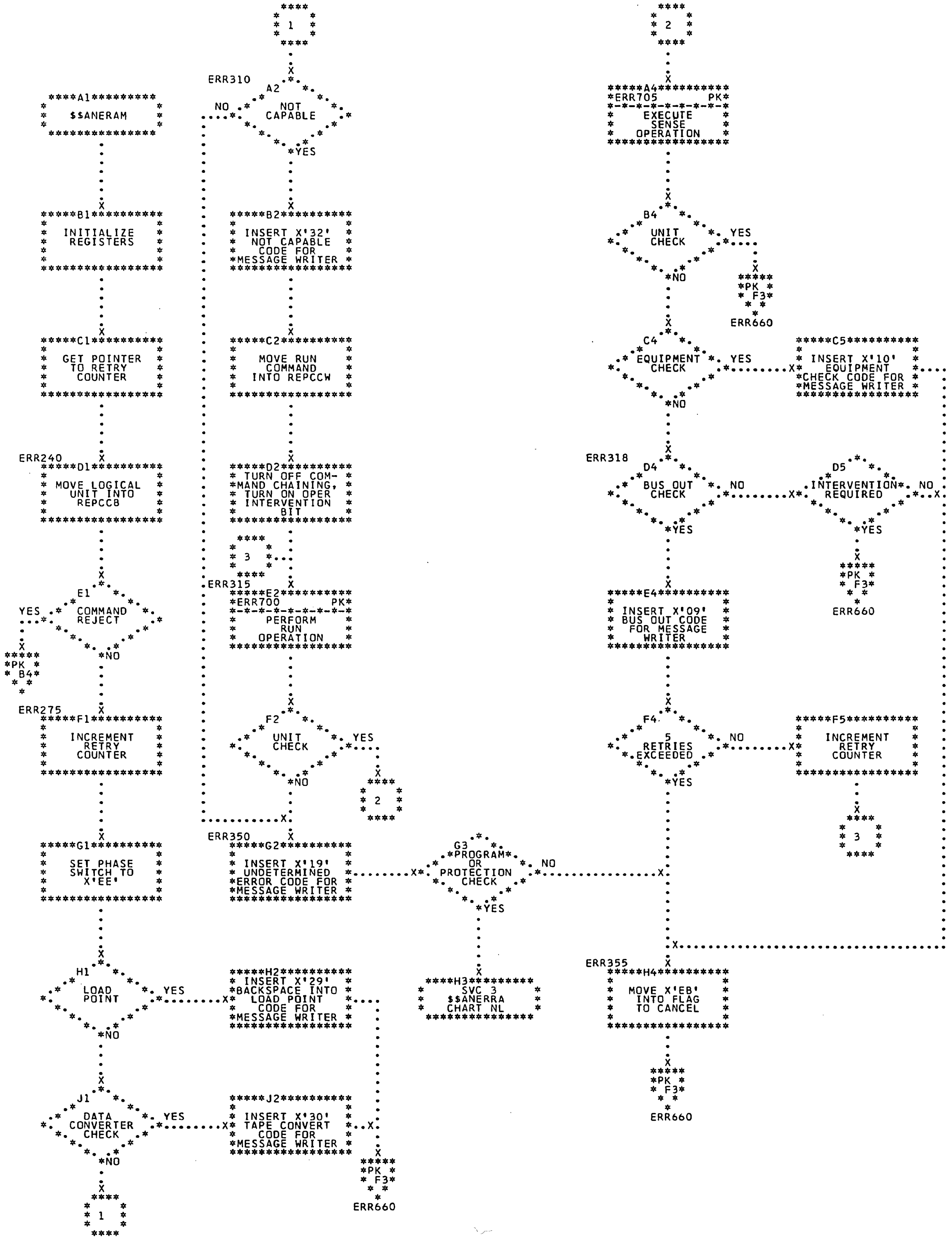


Chart PK. $$ANERAM - Phase 5 of Tape ERP (Part 2 of 2) Refer to Chart 13.

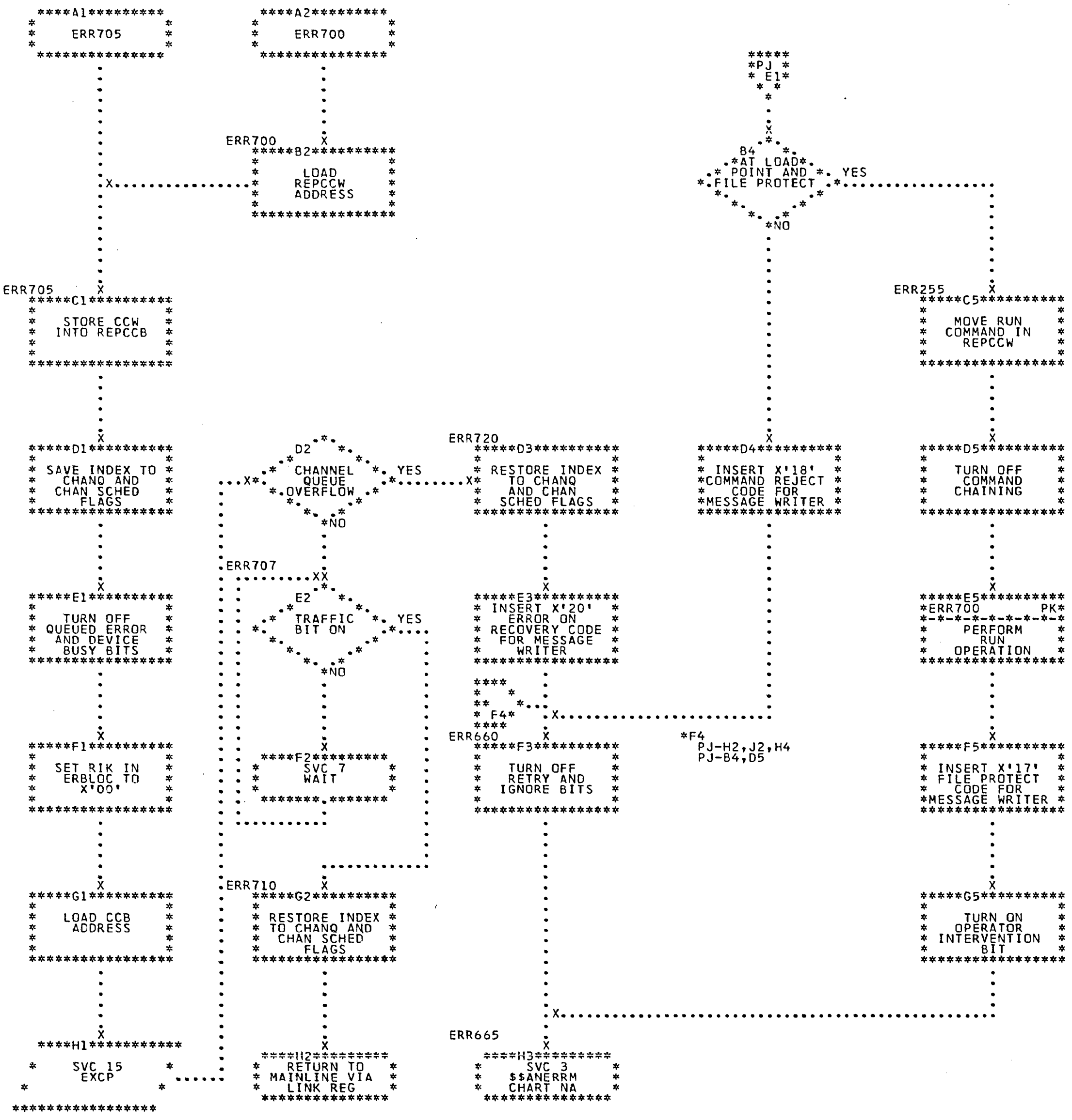


Chart PL. $$ANERAN - Phase 6 of Tape ERP (Part 1 of 2)
Refer to Chart 13.

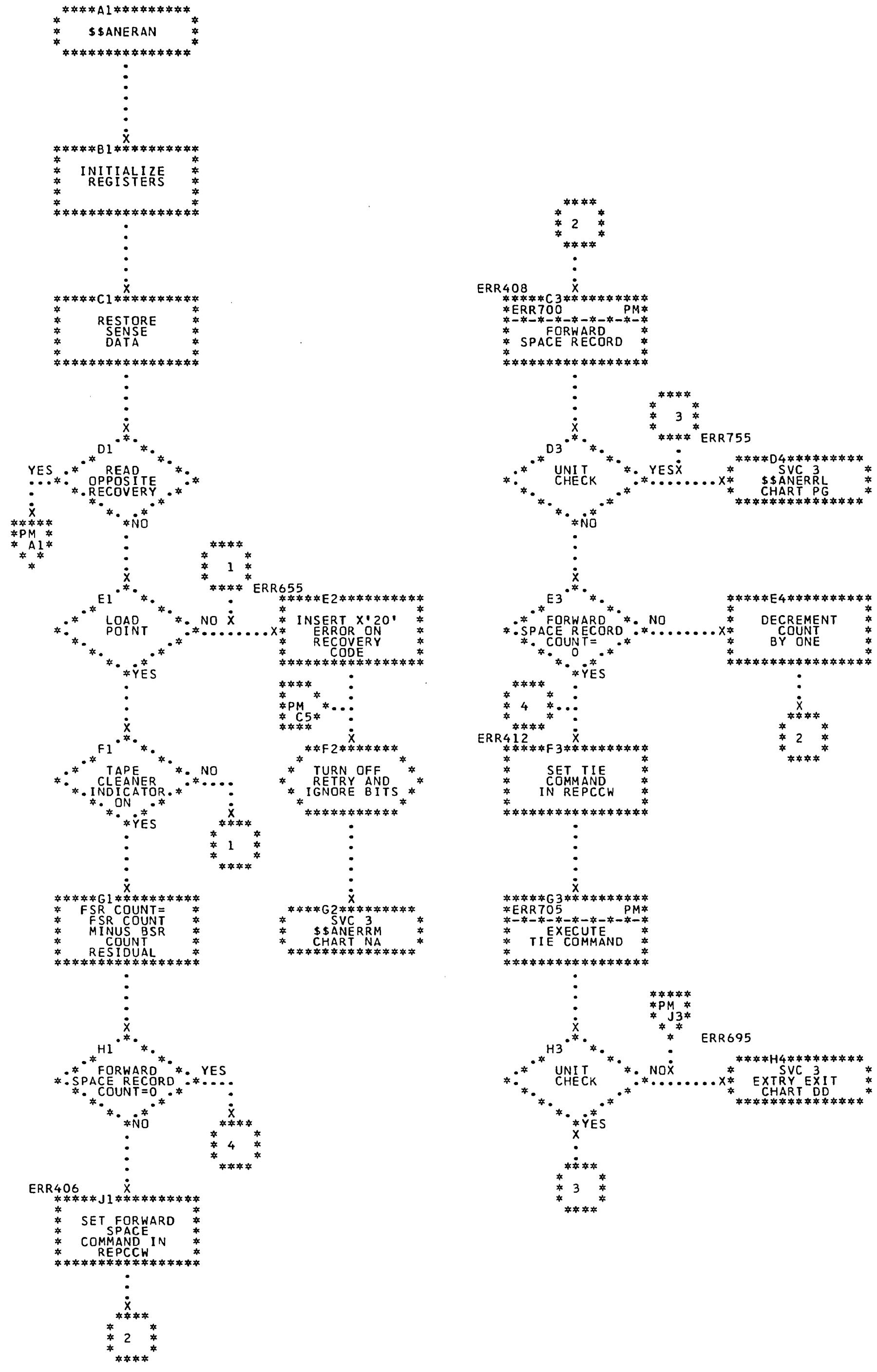


Chart PM. $$ANERAN - Phase 6 of Tape ERP (Part 2 of 2)
Refer to Chart 13.

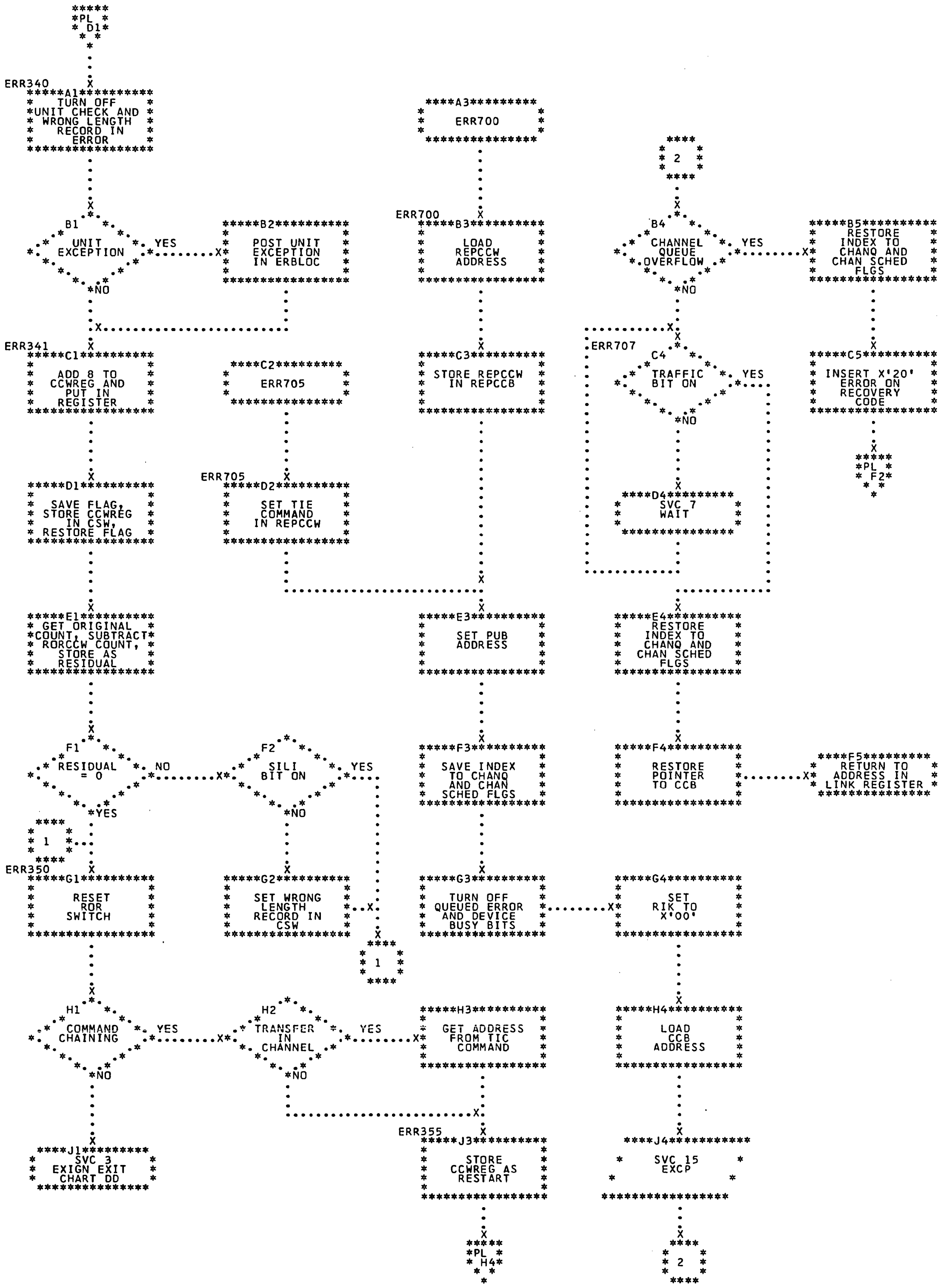


Chart PN. $$ANERAP - Phase 7 of Tape ERP (Part 1 of 2) Refer to Chart 13.

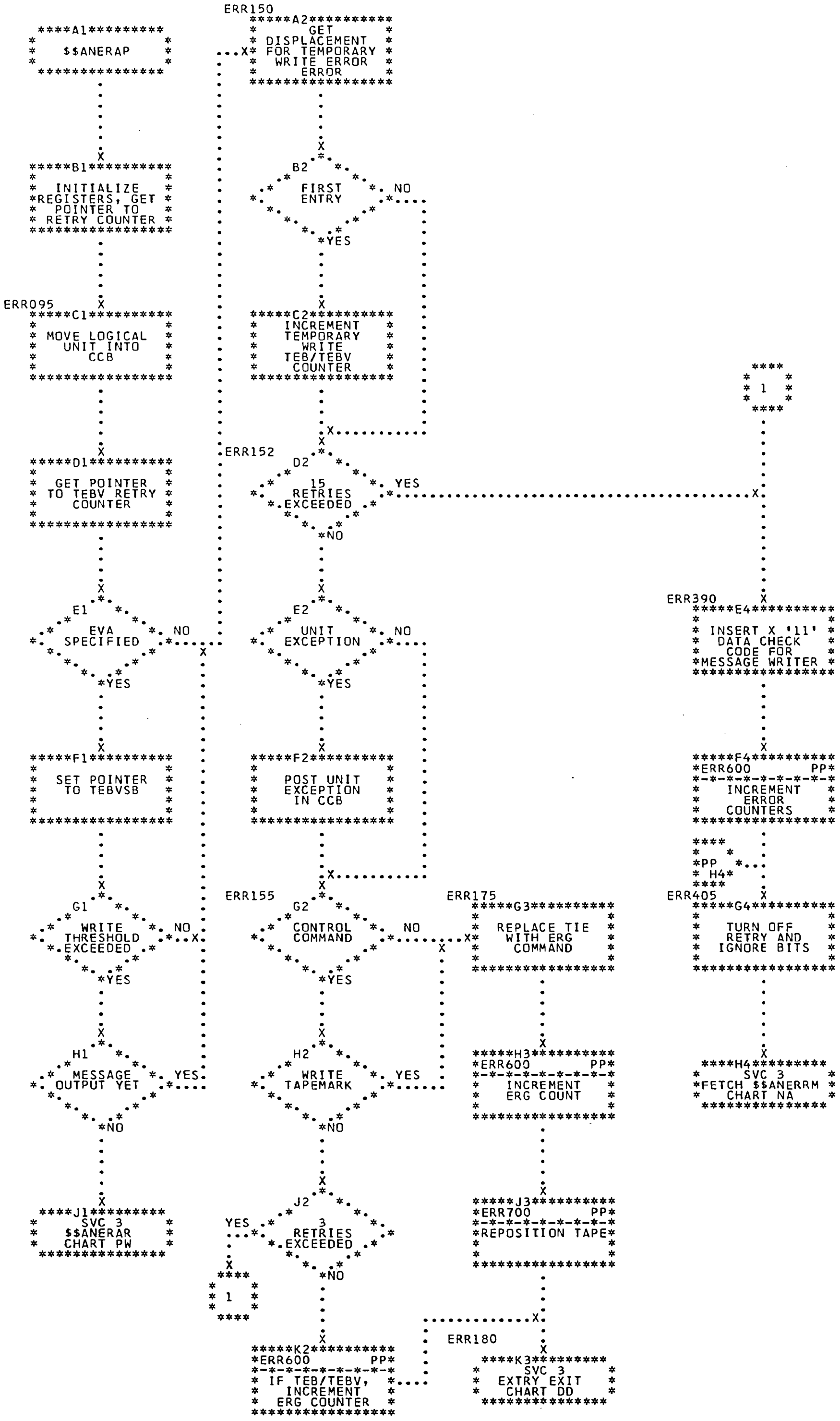


Chart PP. $$ANERAP - Phase 7 of Tape ERP (Part 2 of 2)
Refer to Chart 13.

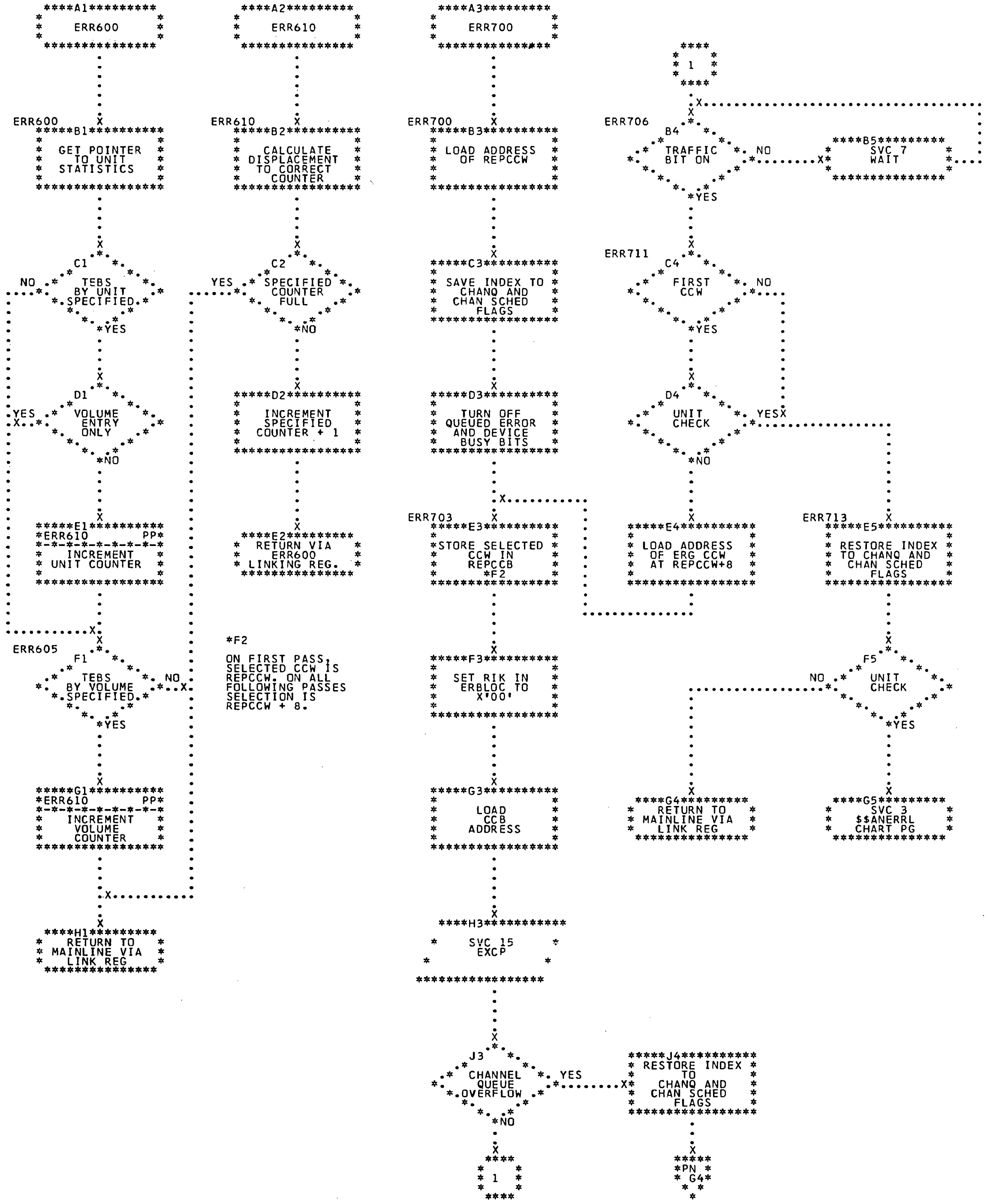


Chart PQ. $$ANERAQ - Phase 8 of Tape ERP (Part 1 of 2)
Refer to Chart 13.

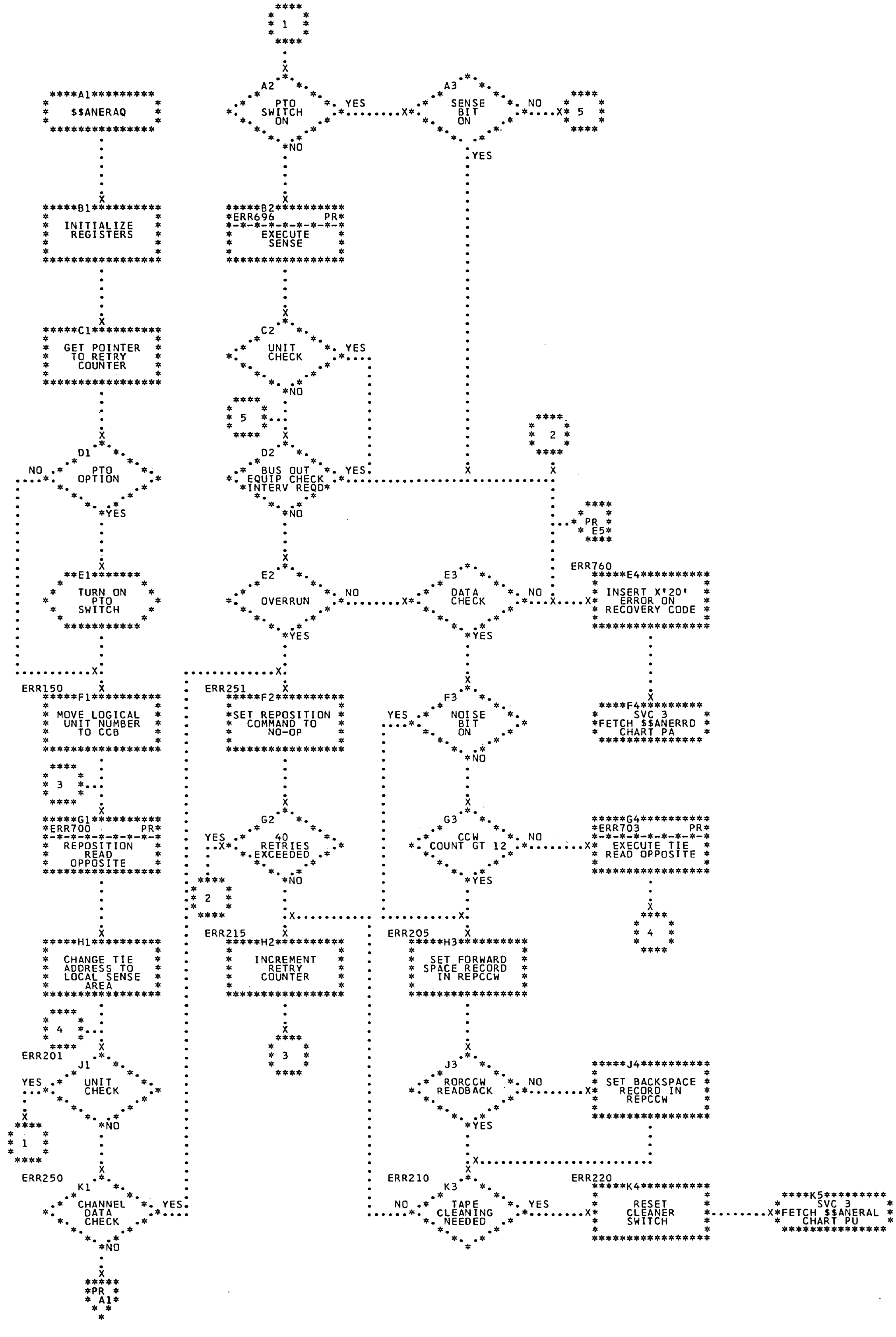


Chart PR. $$ANERAQ - Phase 8 of Tape ERP (Part 2 of 2)
Refer to Chart 13.

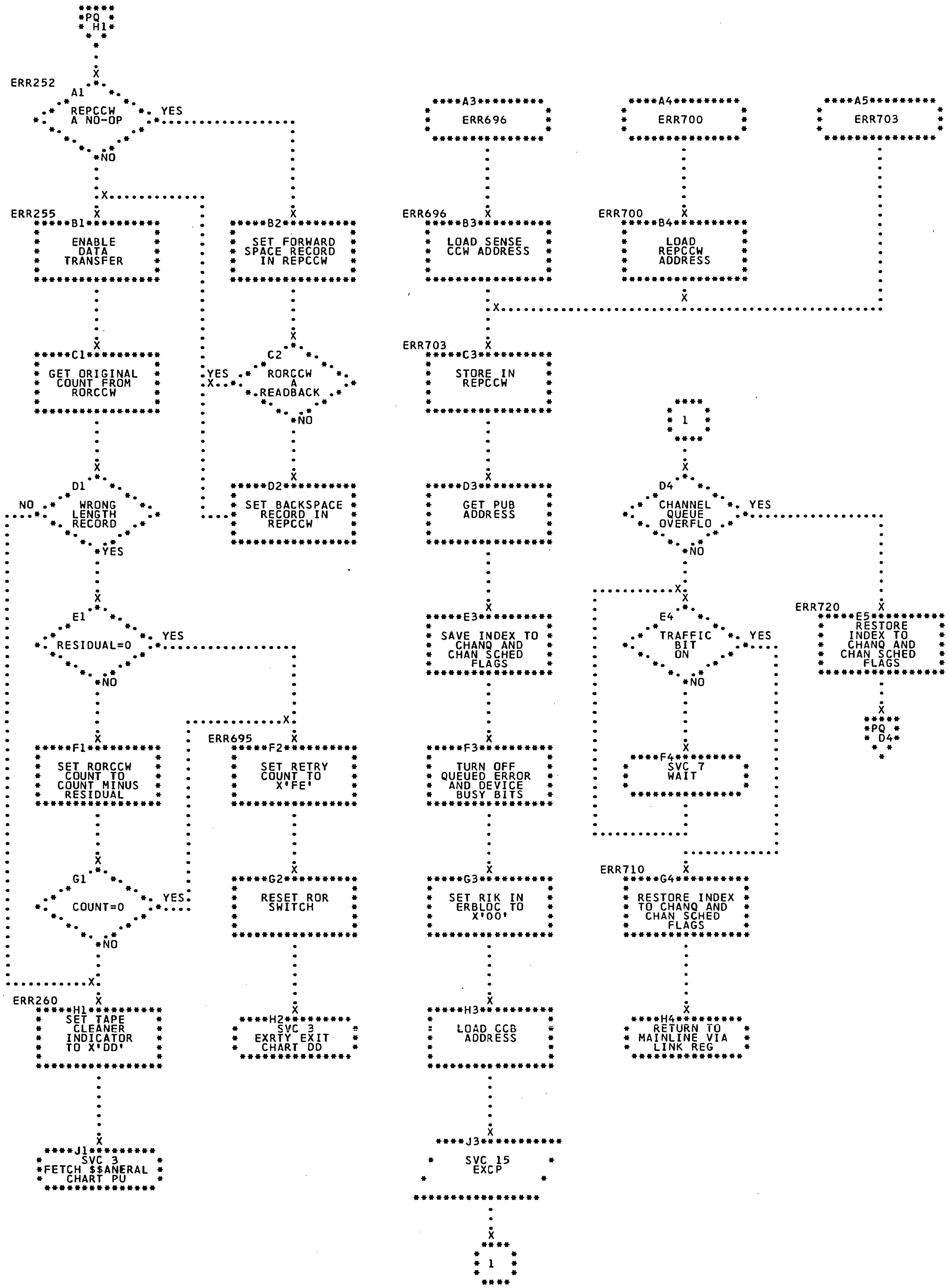


Chart PS. $$ANERAK - Phase 9 of Tape ERP (Part 1 of 2)
Refer to Chart 13.

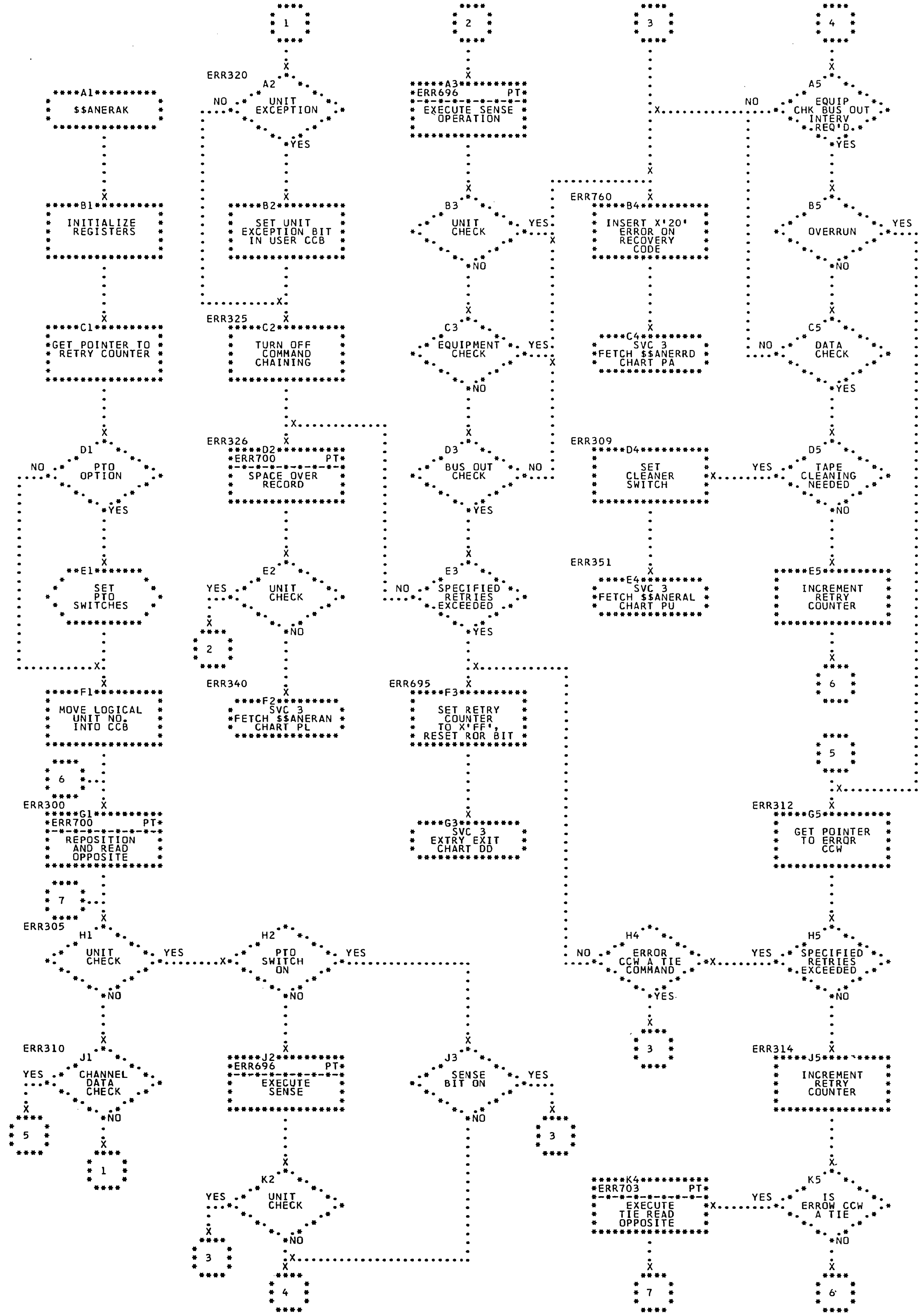


Chart PT. $$ANERAK - Phase 9 of Tape ERP (Part 2 of 2)
Refer to Chart 13.

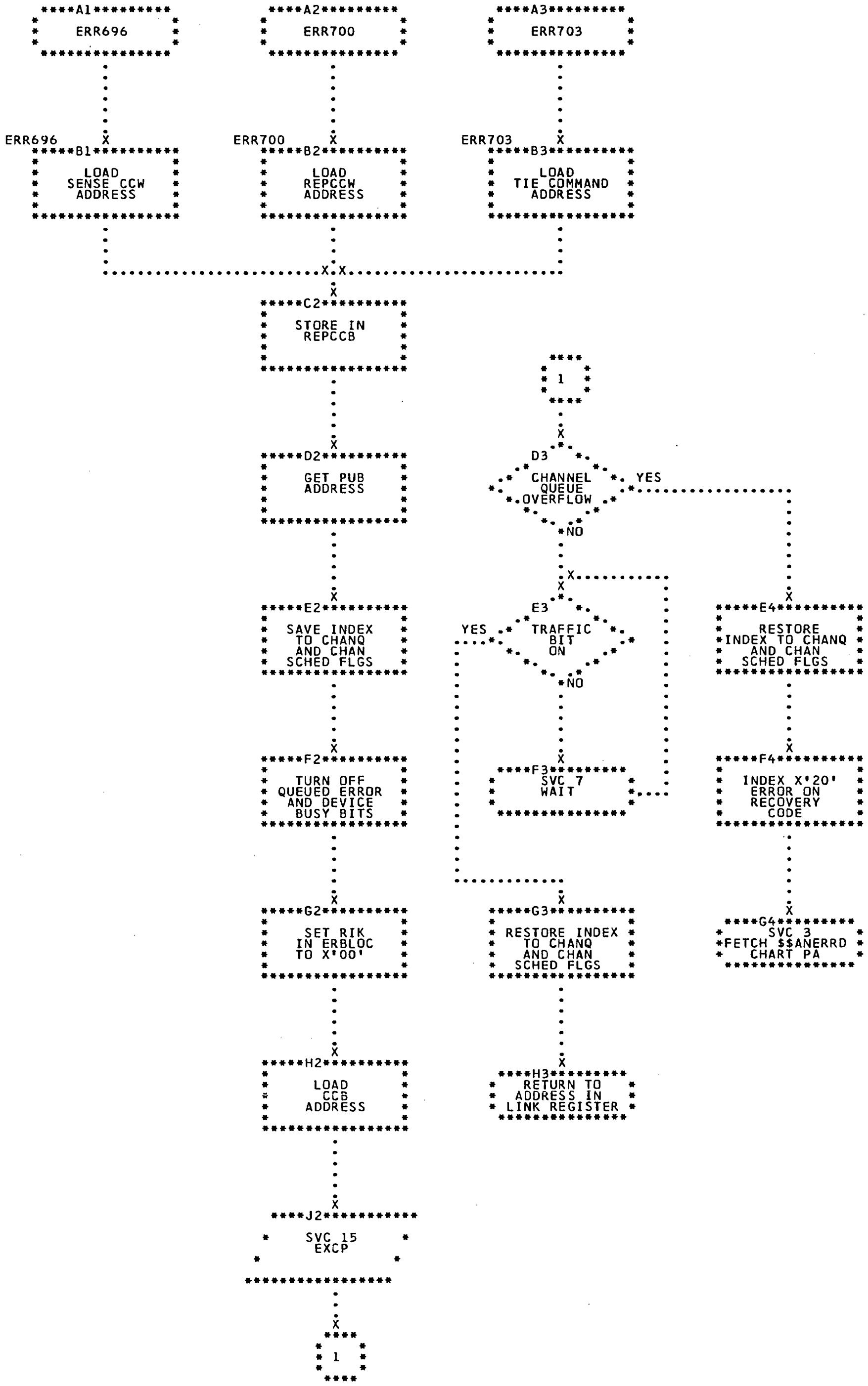


Chart PU. $$ANERAL - Phase 10 of Tape ERP (Part 1 of 2)
Refer to Chart 13.

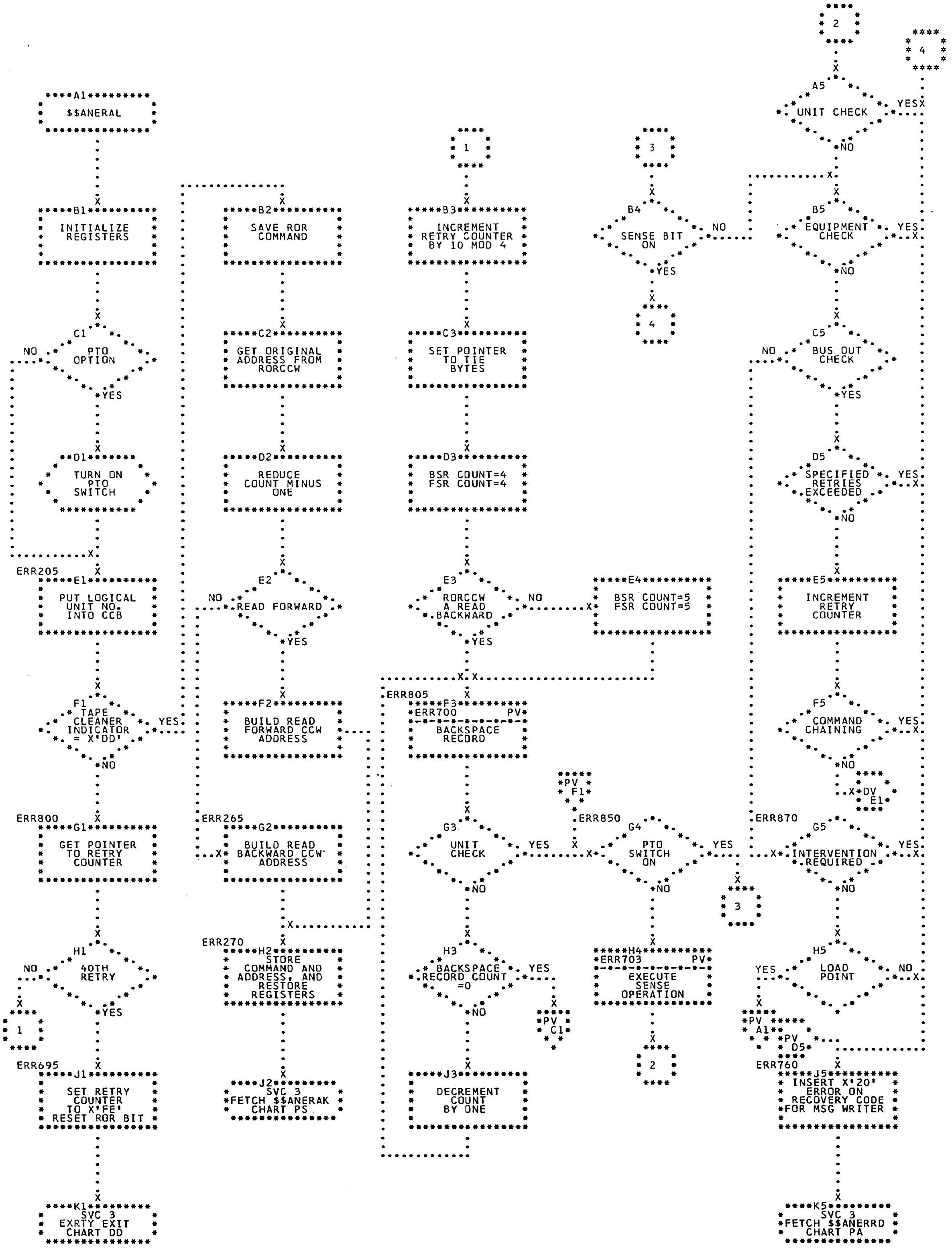


Chart PV. $$ANERAL - Phase 10 of Tape ERP (Part 2 of 2)
Refer to Chart 13.

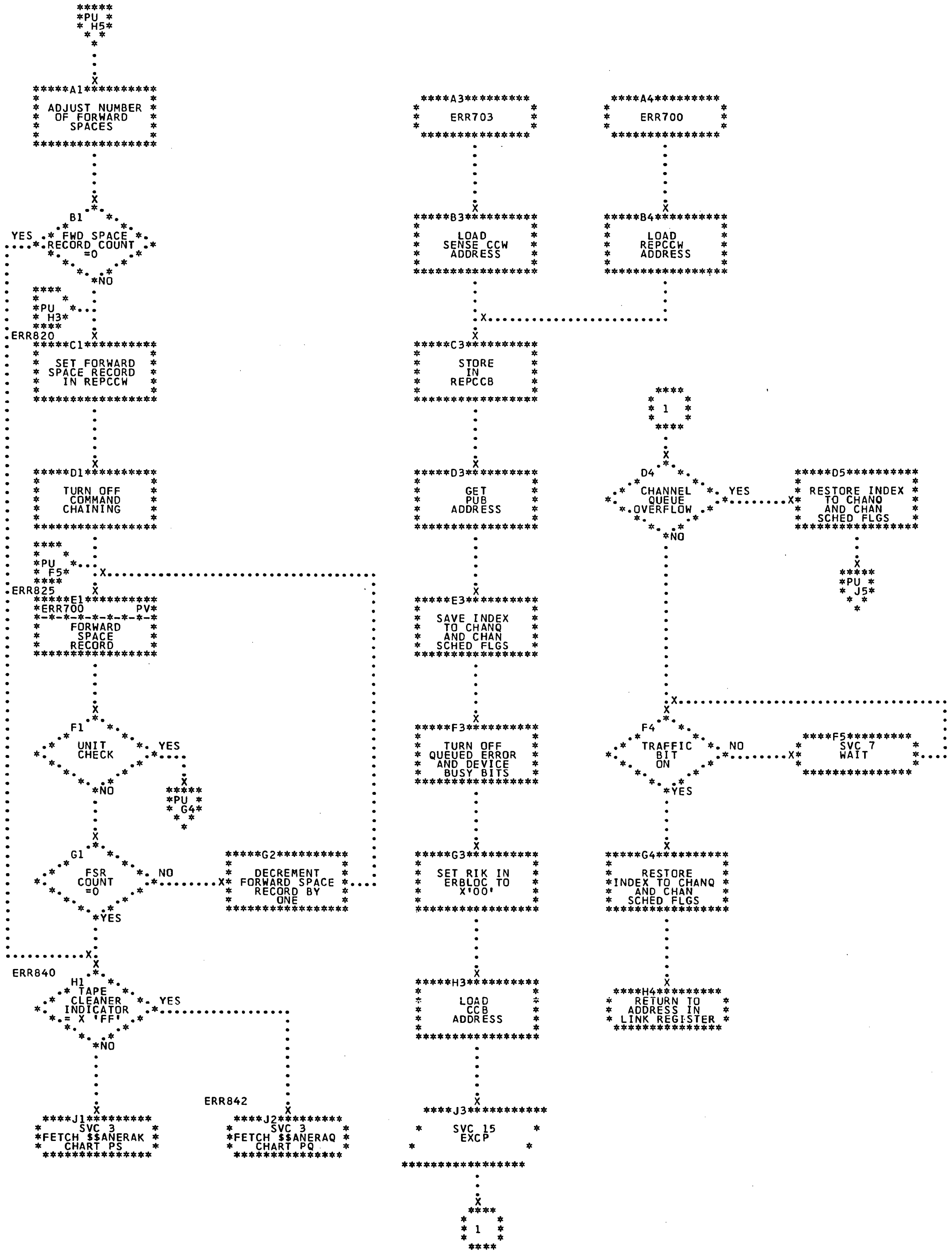


Chart PW. $$ANERAR - Phase 11 of Tape ERP
Refer to Chart 13.

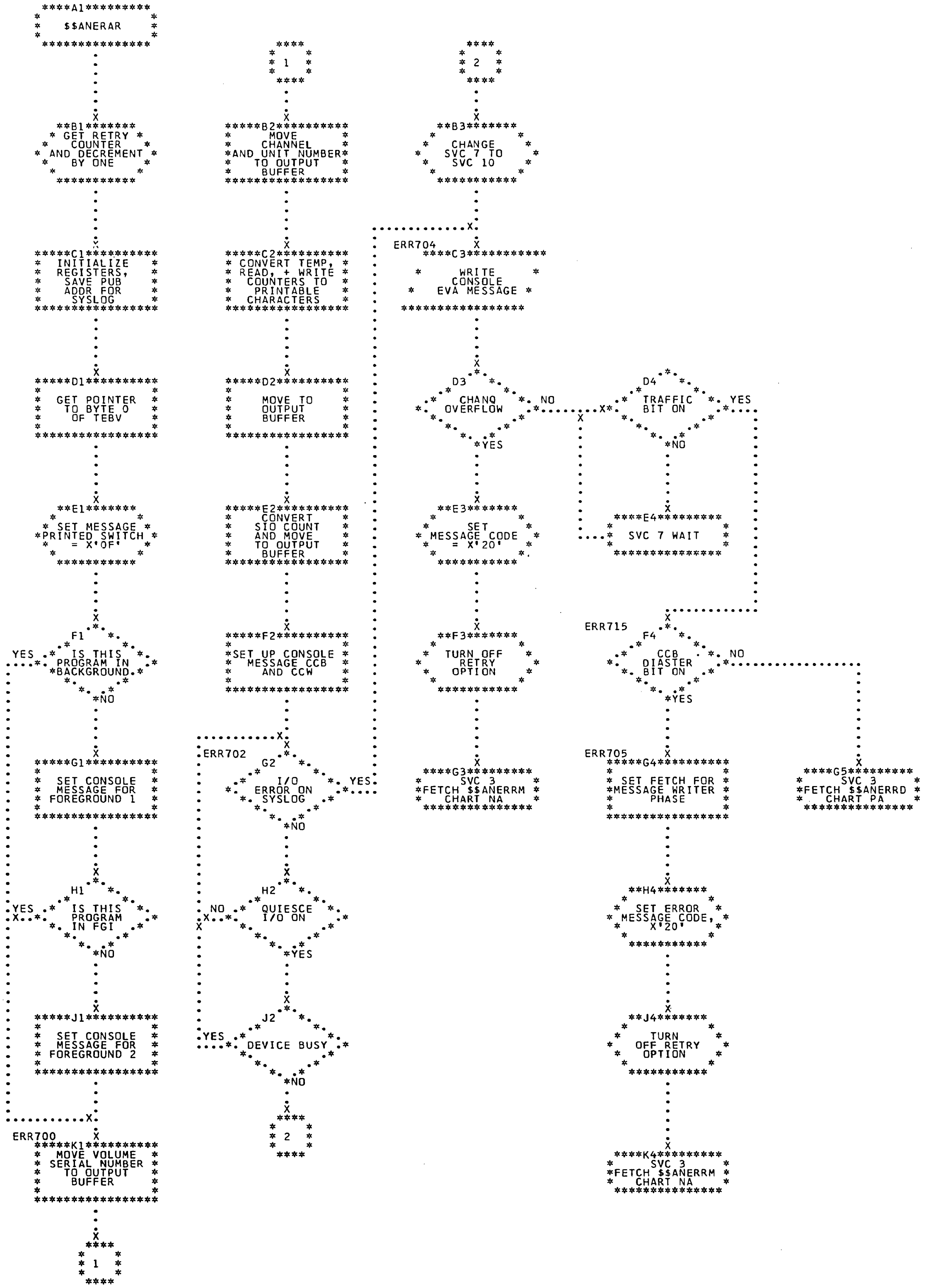


Chart PX. $$ANERAS - Phase 12 of Tape ERP Refer to Chart 13.

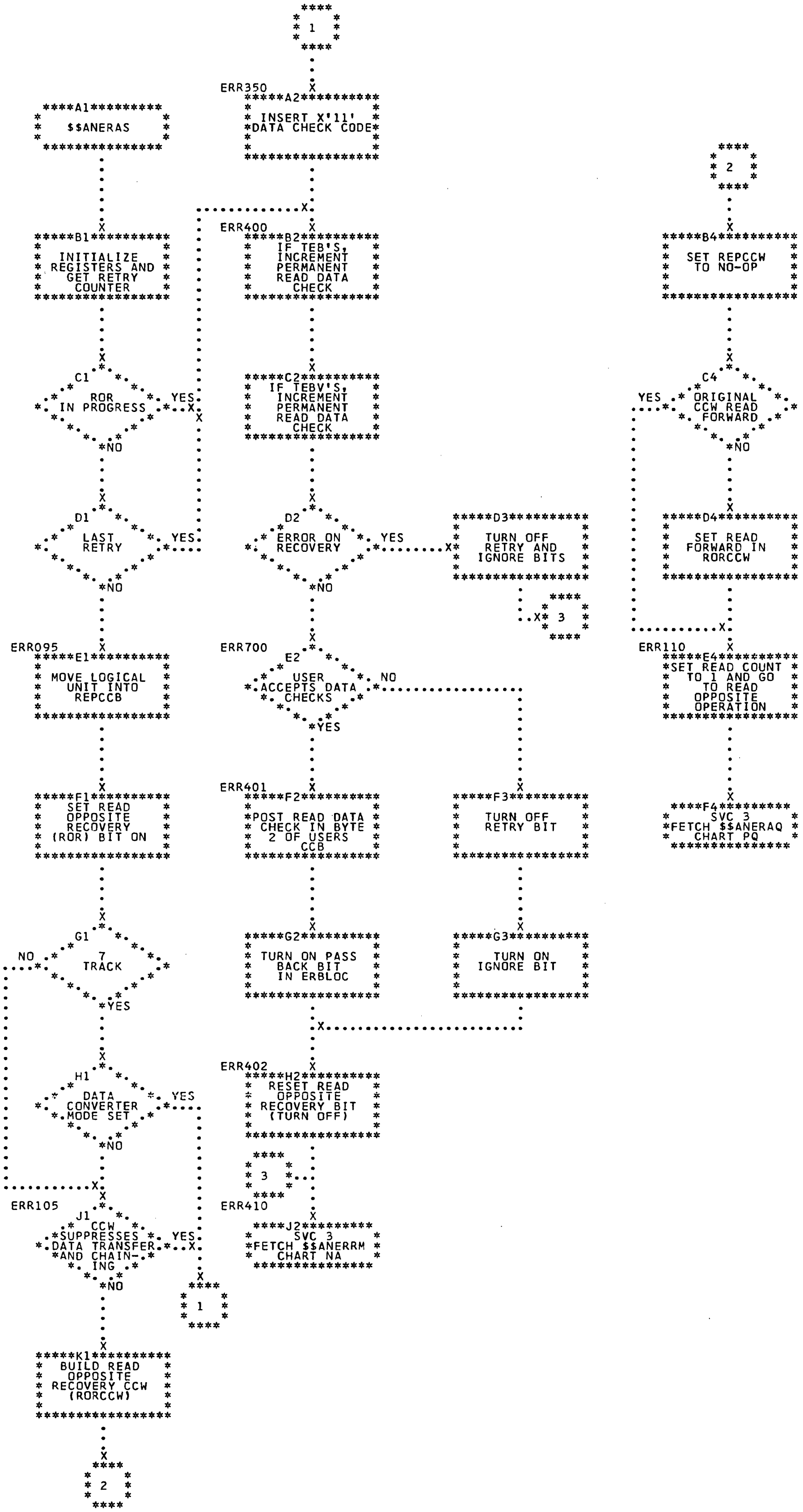


Chart QA. $$ANERRG - Phase 1 of Data Cell ERP (Part 1 of 3)
Refer to Chart 11.

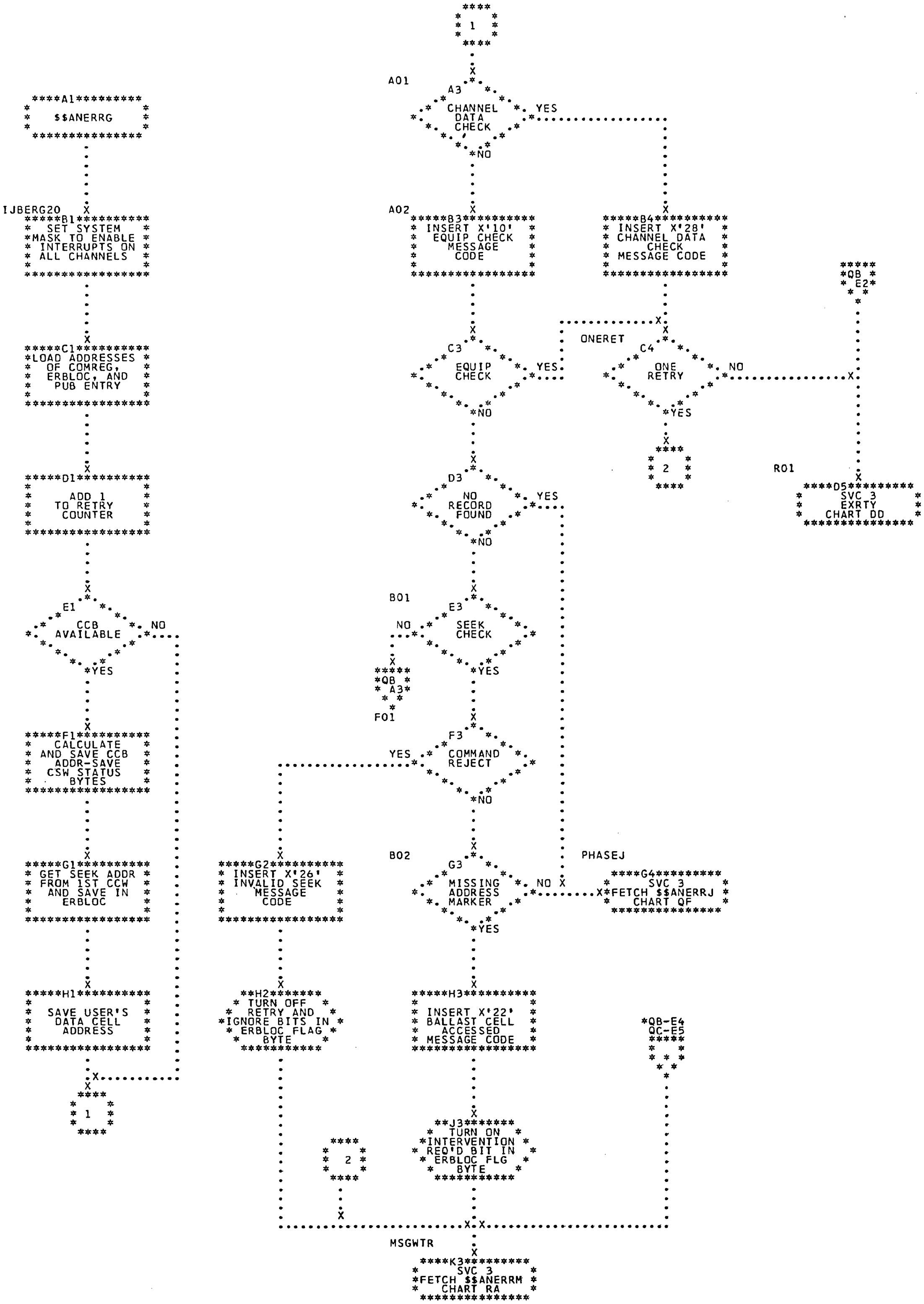


Chart QB. $$ANERRG - Phase 1 of Data Cell ERP (Part 2 of 3)
Refer to Chart 11.

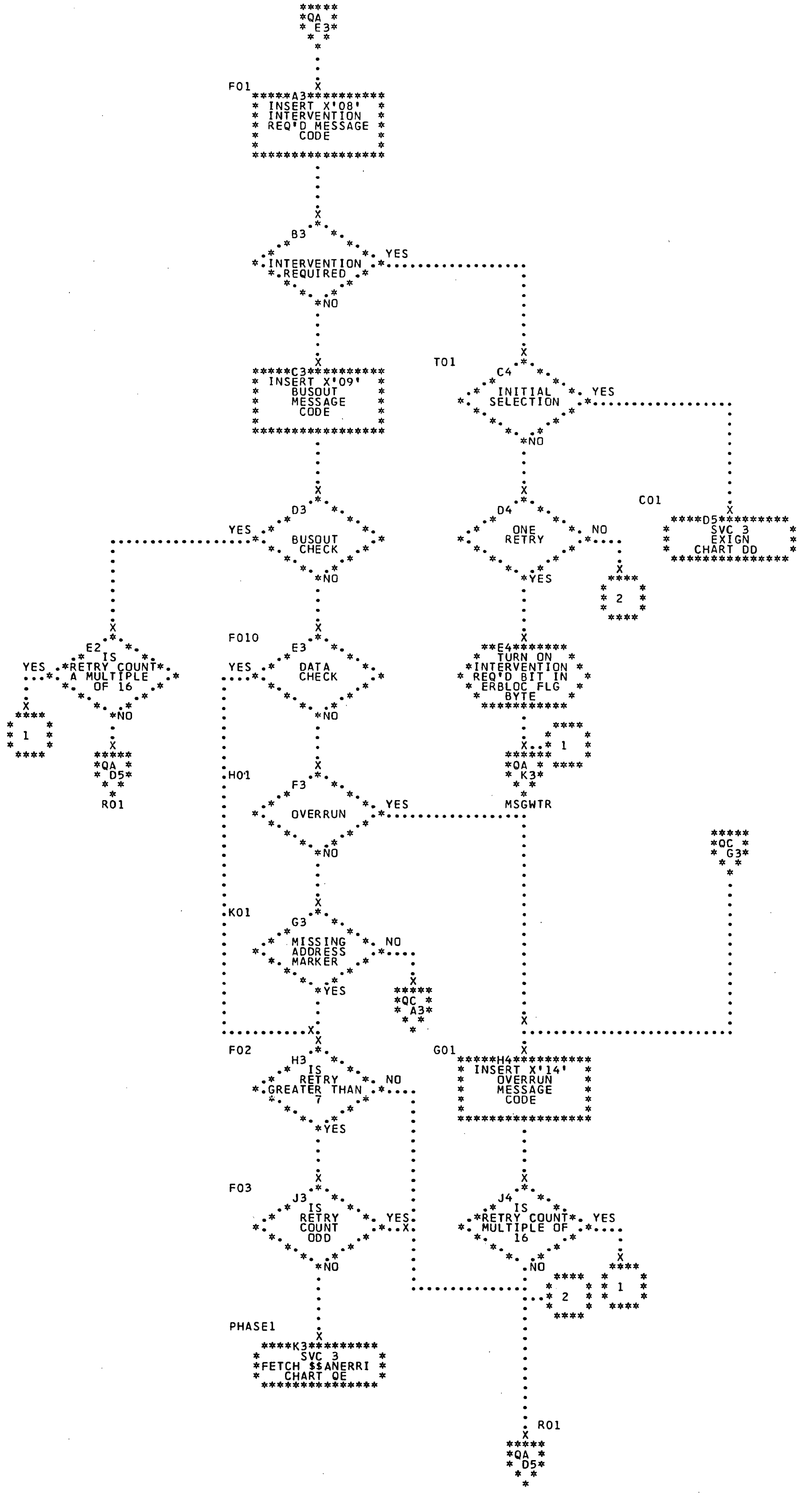


Chart QC. $$ANERRG - Phase 1 of Data Cell ERP (Part 3 of 3)
Refer to Chart 11.

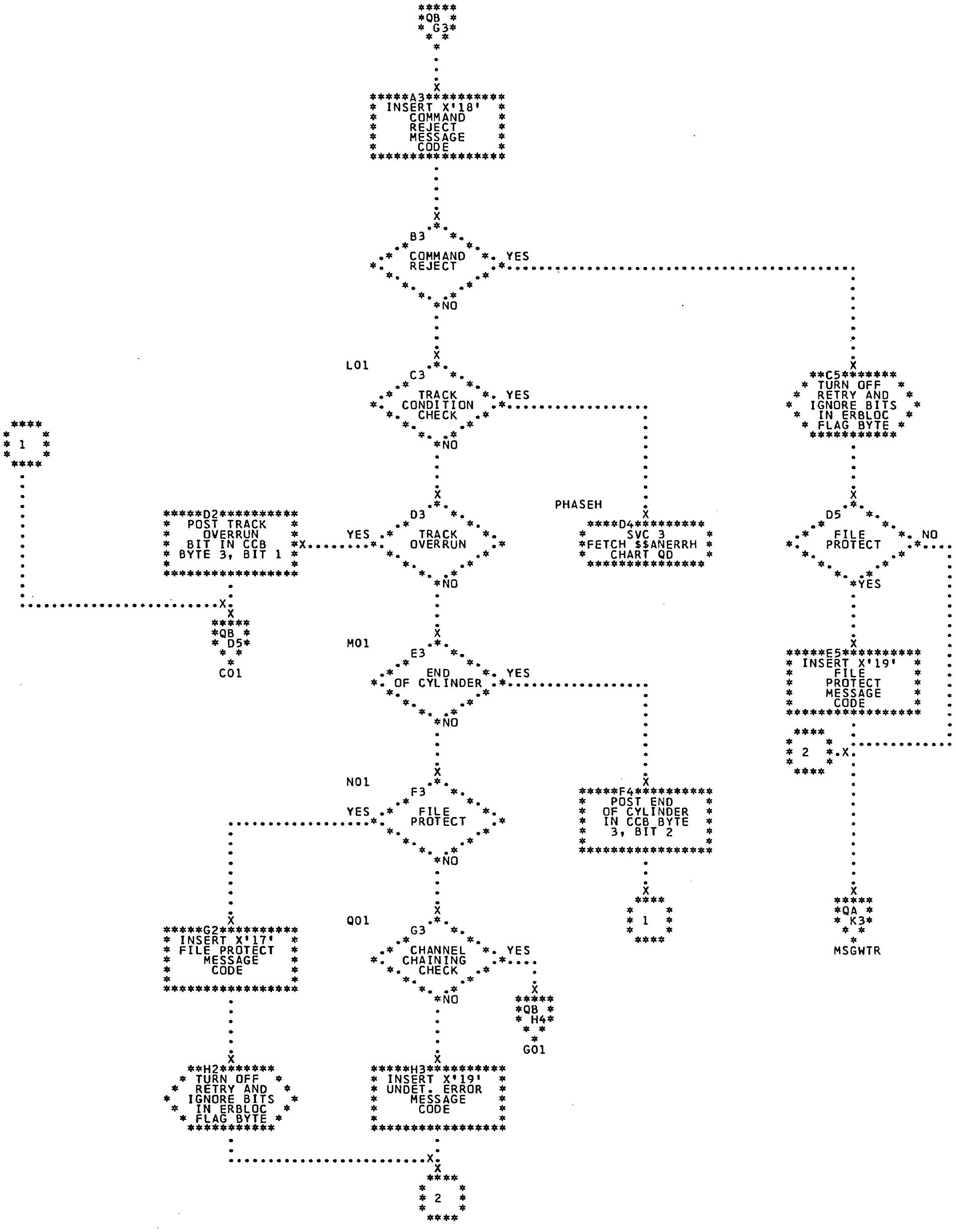


Chart QD. $$ANERRH - Phase 2 of Data Cell ERP Refer to Chart 11.

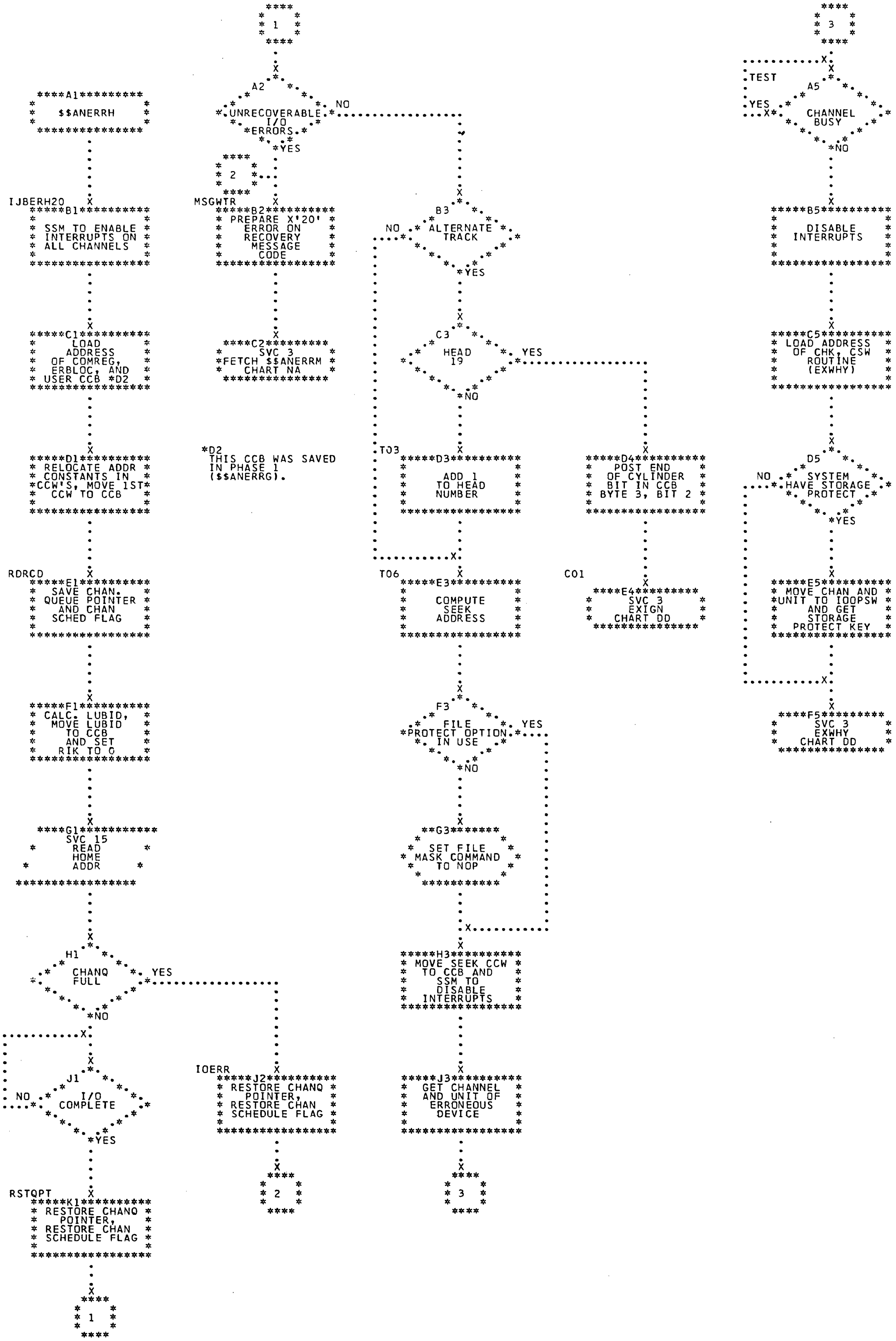


Chart QE. $$ANERRI - Phase 3 of Data Cell ERP
Refer to Chart 11.

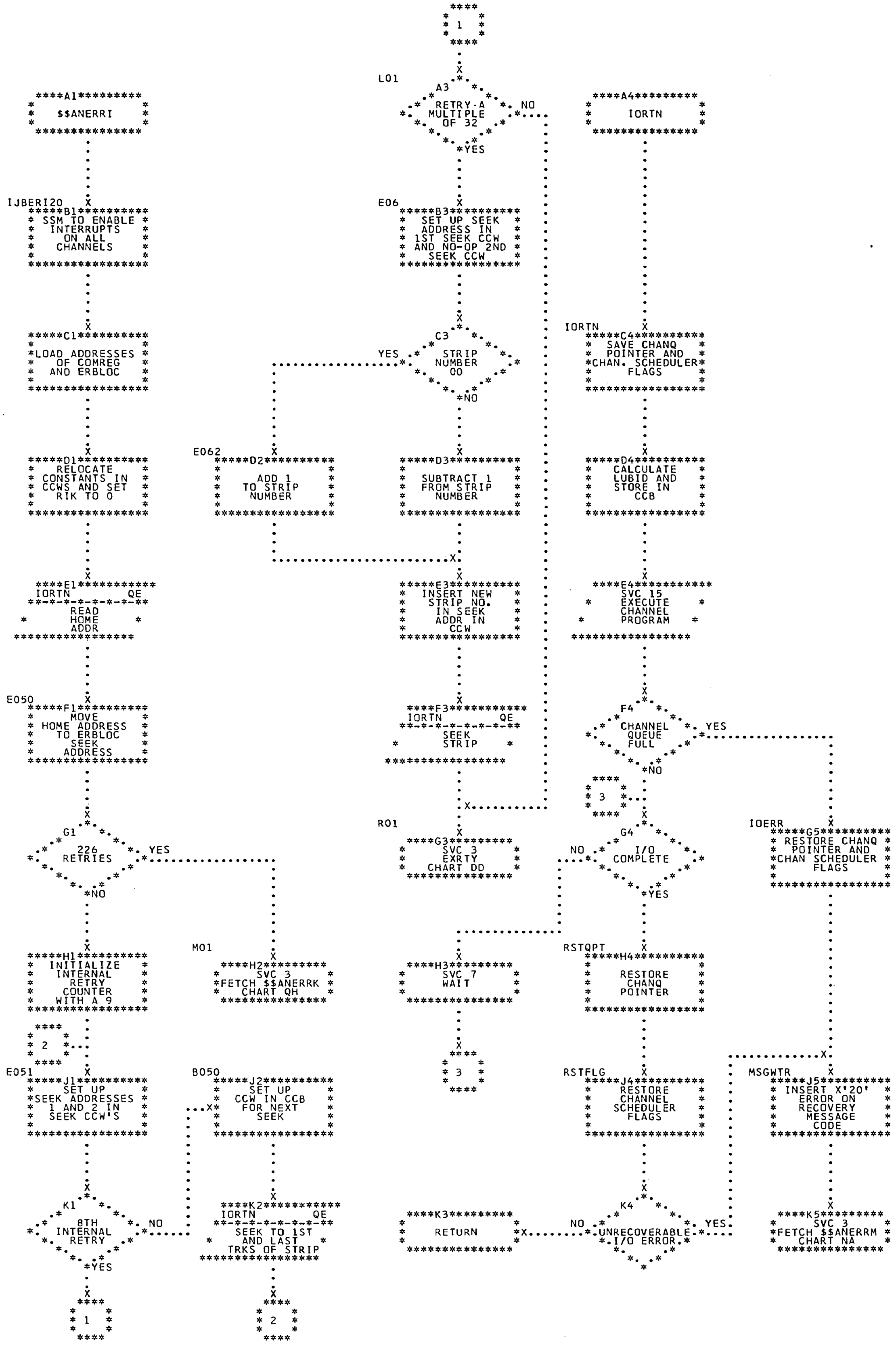
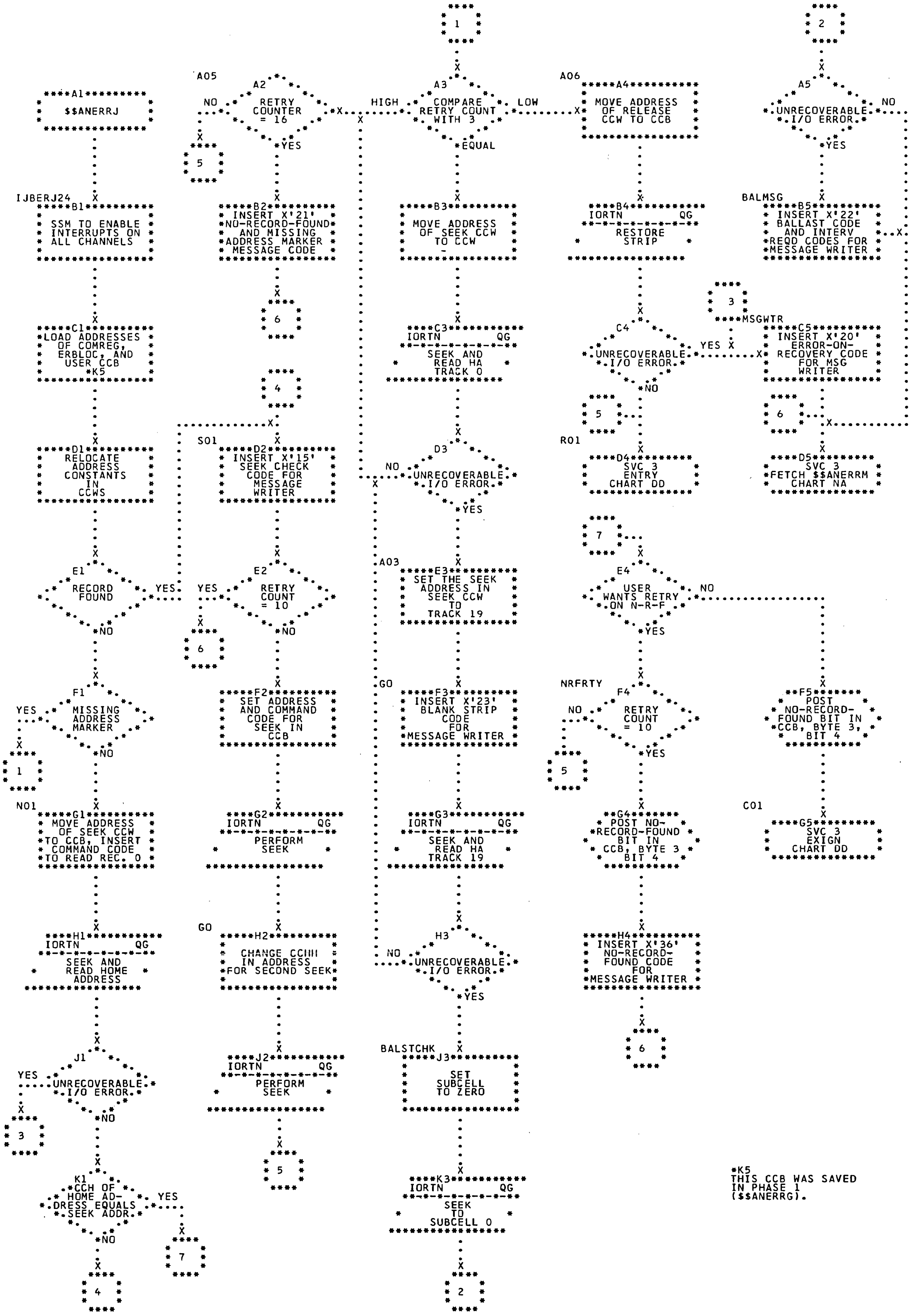


Chart QF. $$ANERRJ - Phase 4 of Data Cell ERP (Part 1 of 2)

Refer to Chart 11.



*K5
THIS CCB WAS SAVED
IN PHASE 1
($$ANERRG).

Chart QG. $$ANERRJ - Phase 4 of Data Cell ERP (Part 2 of 2)
Refer to Chart 11.

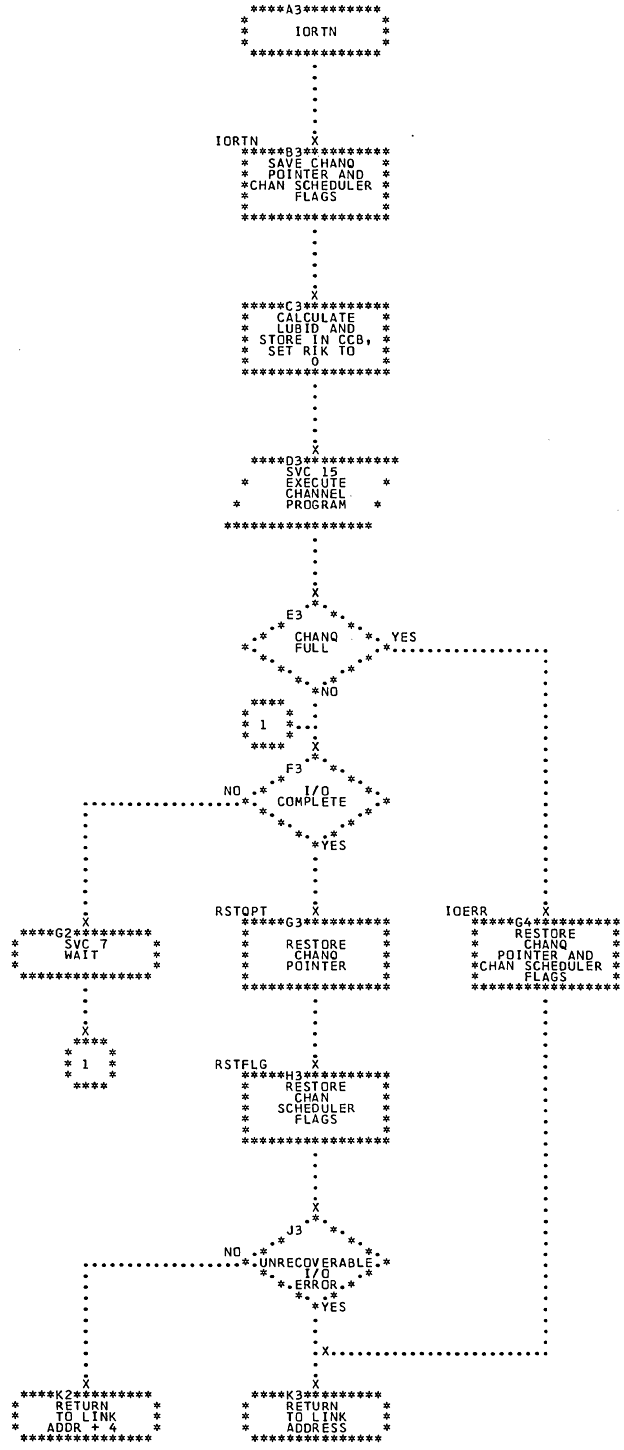


Chart QH. $$ANERRK - Phase 5 of Data Cell ERP
Refer to Chart 11.

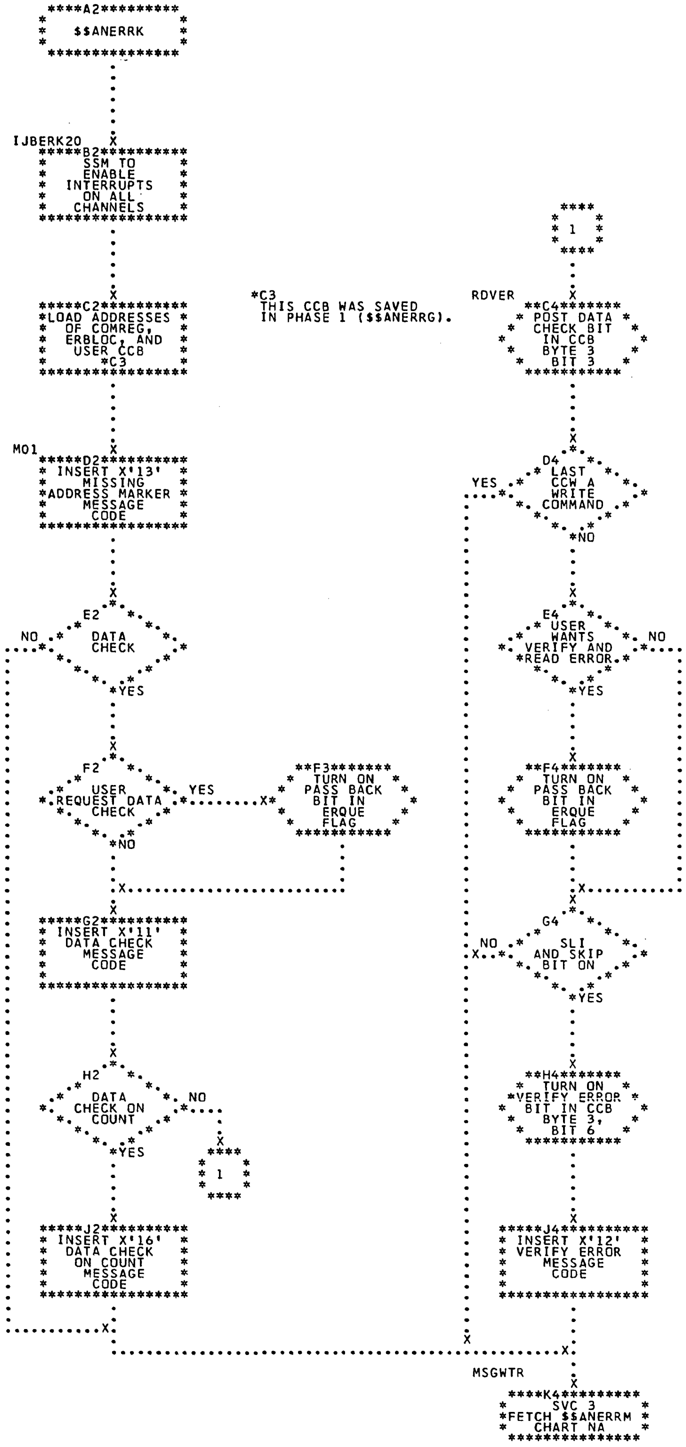
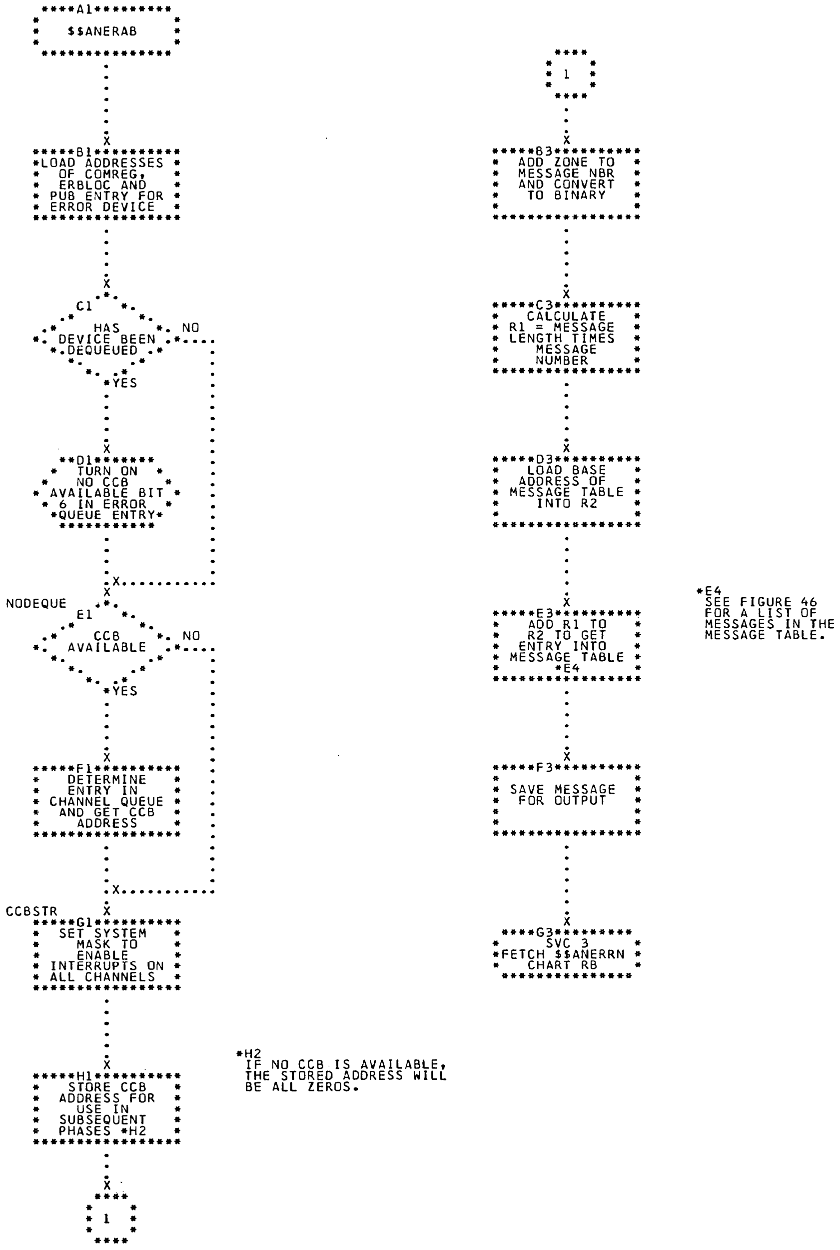


Chart RA. $$ANERAB - Phase 1 of ERP Message Writer
Refer to Chart 14.



*E4
SEE FIGURE 46
FOR A LIST OF
MESSAGES IN THE
MESSAGE TABLE.

*H2
IF NO CCB IS AVAILABLE,
THE STORED ADDRESS WILL
BE ALL ZEROS.

Chart RB. $$ANERRN - Phase 2 of ERP Message Writer
Refer to Chart 14.

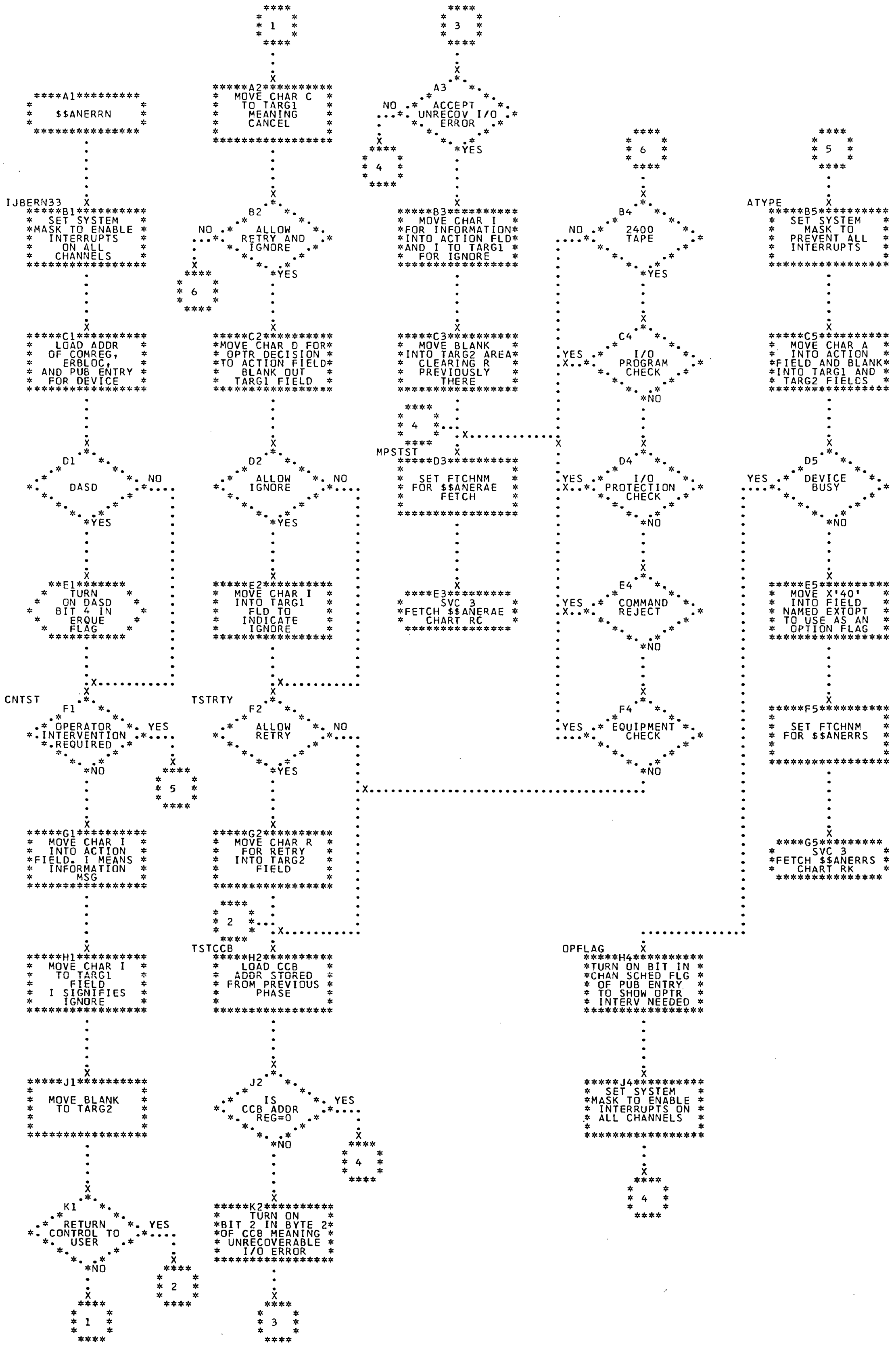


Chart RC. $$ANERAE - Phase 2A of ERP Message Writer
Refer to Chart 14.

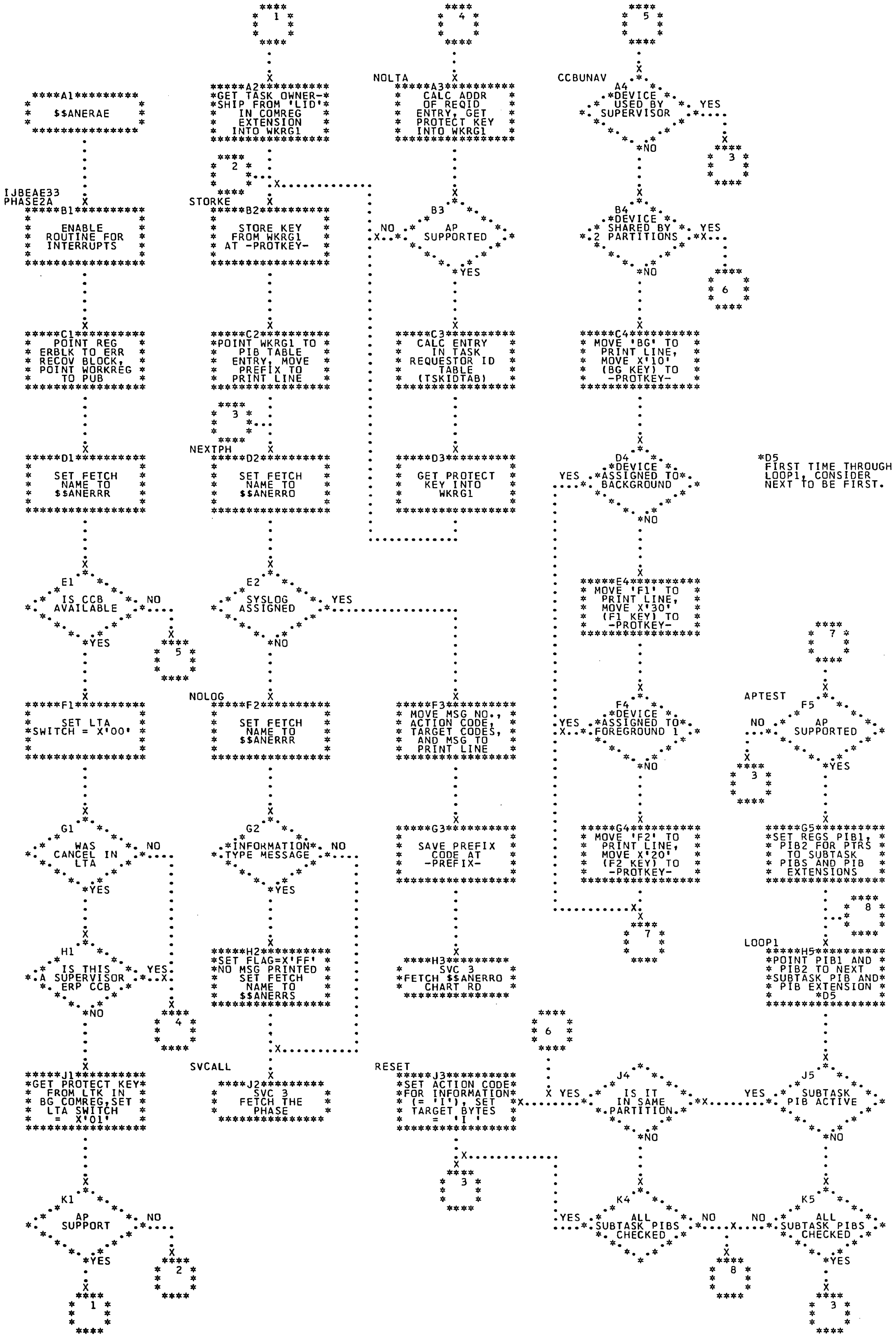


Chart RD. $$ANERRO - Phase 3 of ERP Message Writer
Refer to Chart 14.

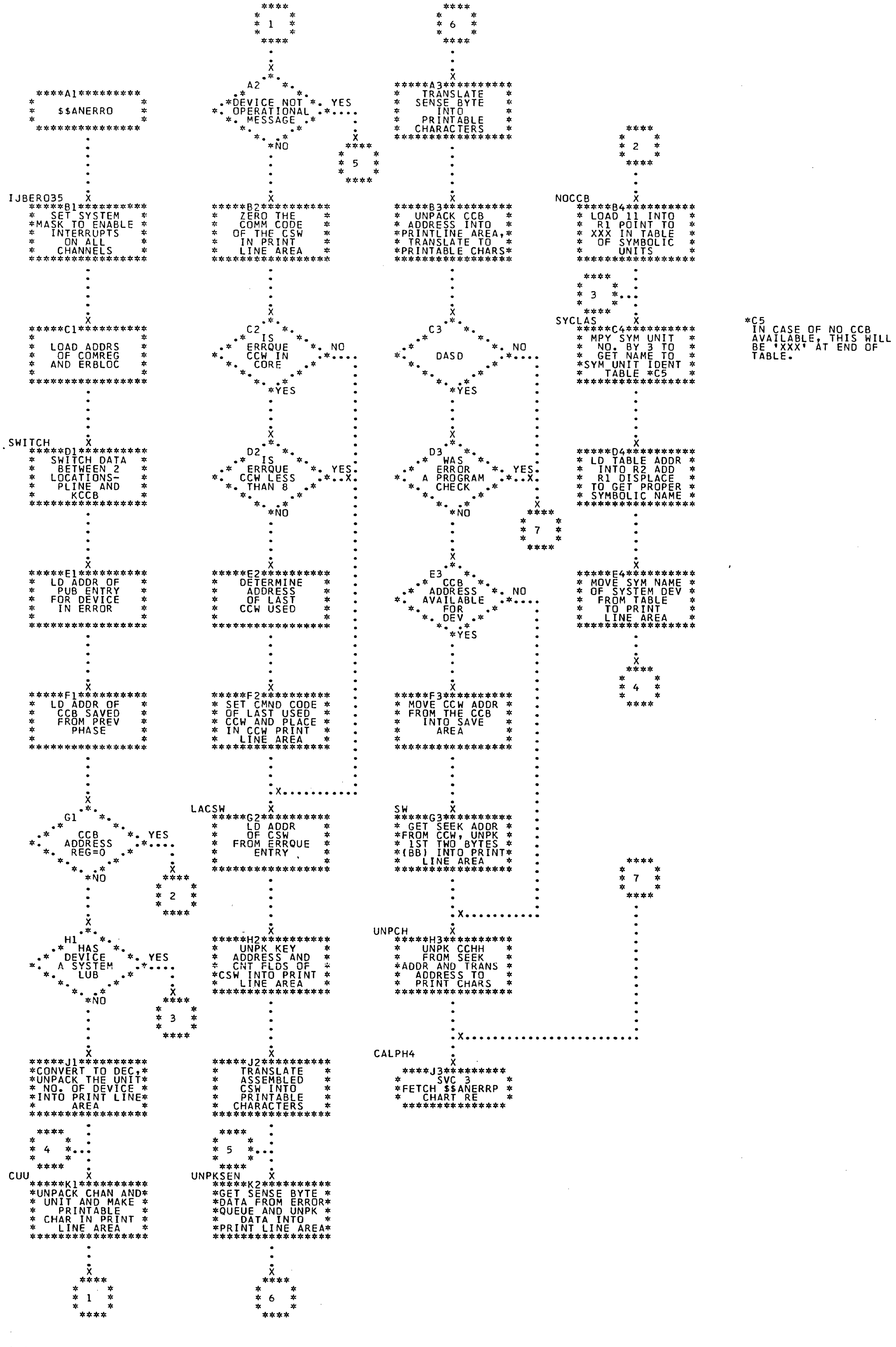


Chart RE. $$ANERRP - Phase 4 of ERP Message Writer (Part 1 of 2)
Refer to Chart 14.

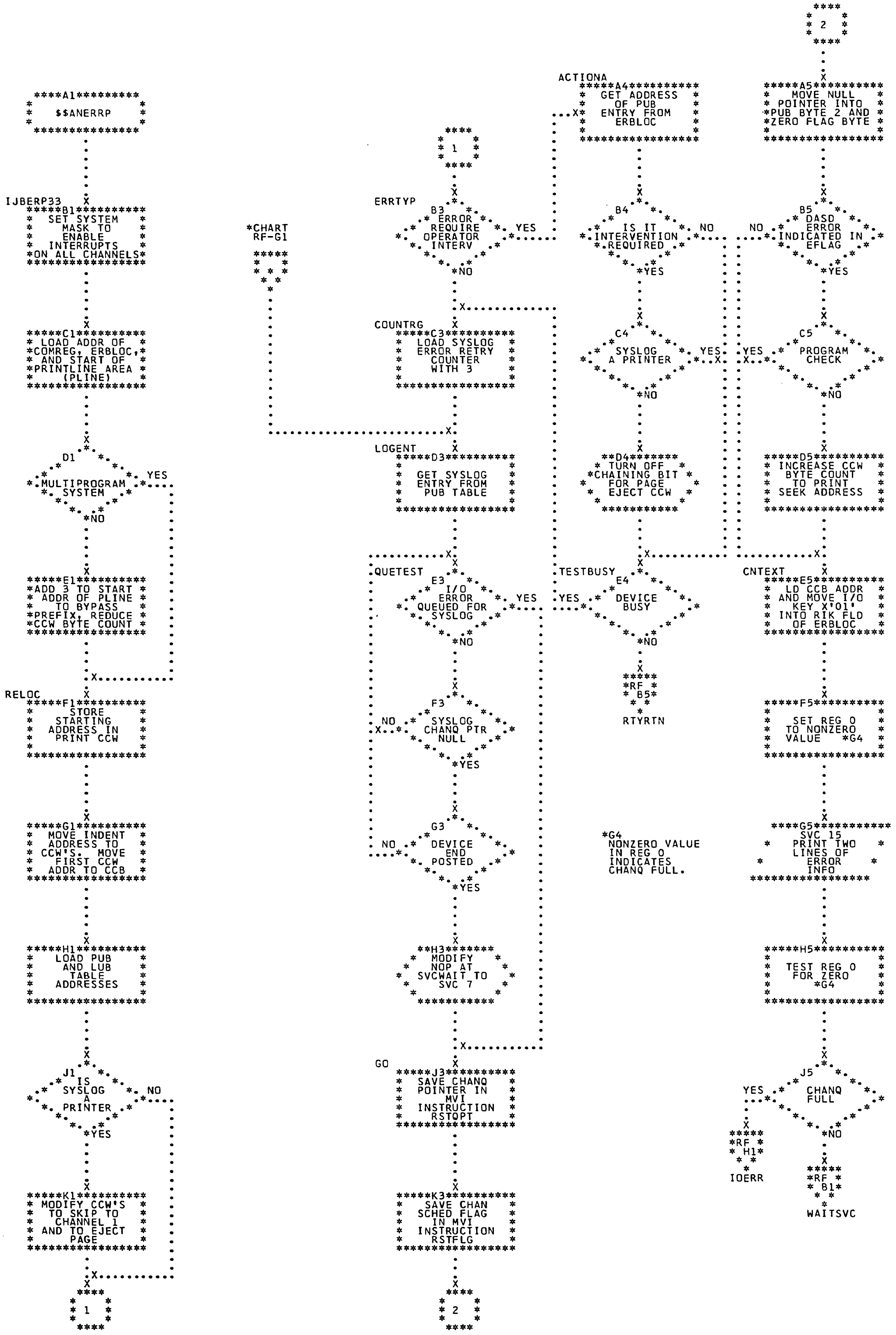
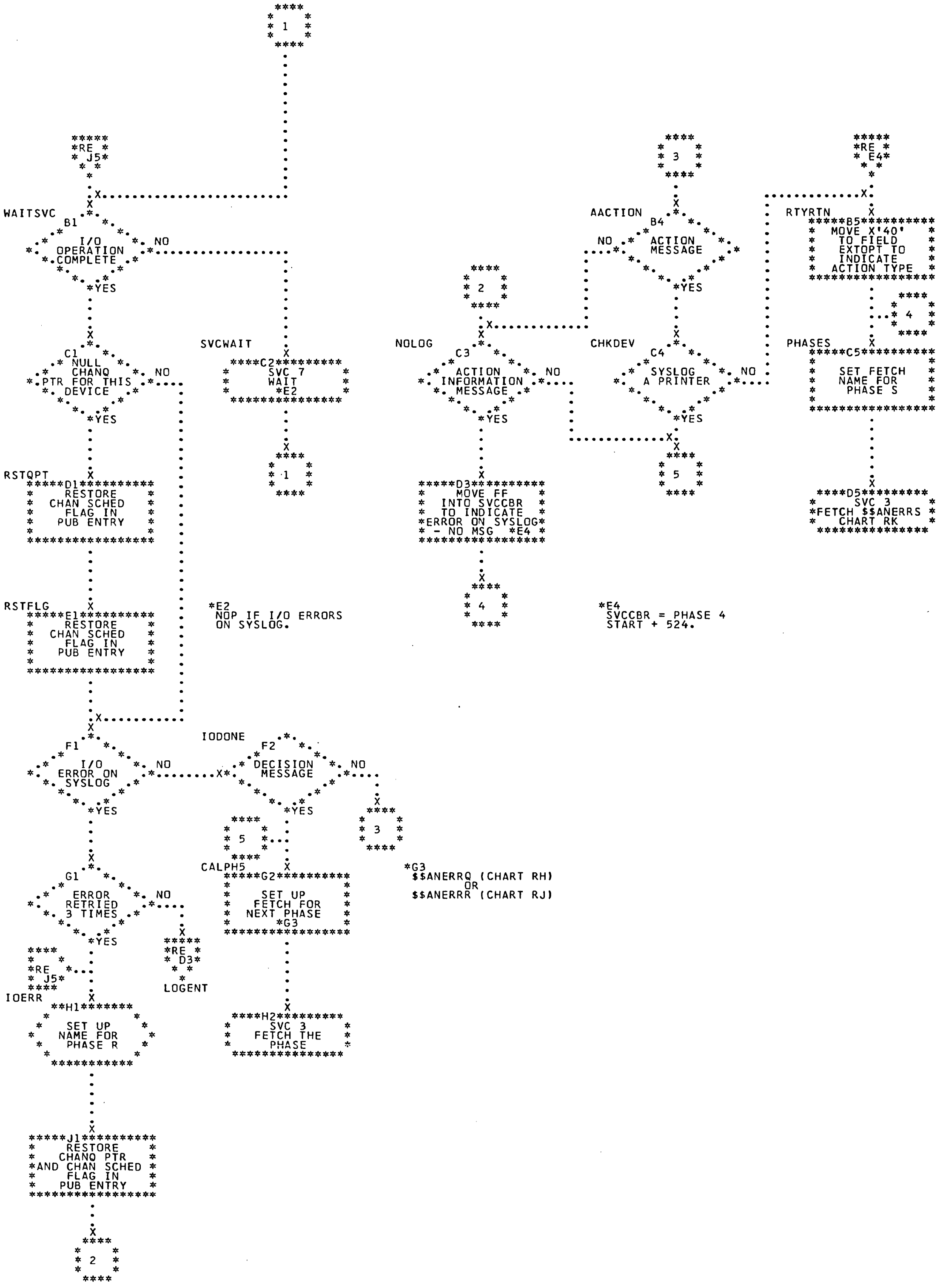


Chart RF. $$ANERRP - Phase 4 of ERP Message Writer (Part 2 of 2)
Refer to Chart 14.



*E2
NOP IF I/O ERRORS
ON SYSLOG.

*E4
SVCCBR = PHASE 4
START + 524.

*G3
$$ANERRQ (CHART RH)
OR
$$ANERRR (CHART RJ)

Chart RG. $$ANERRQ - Phase 5 of ERP Message Writer (Part 1 of 2) Refer to Chart 14.

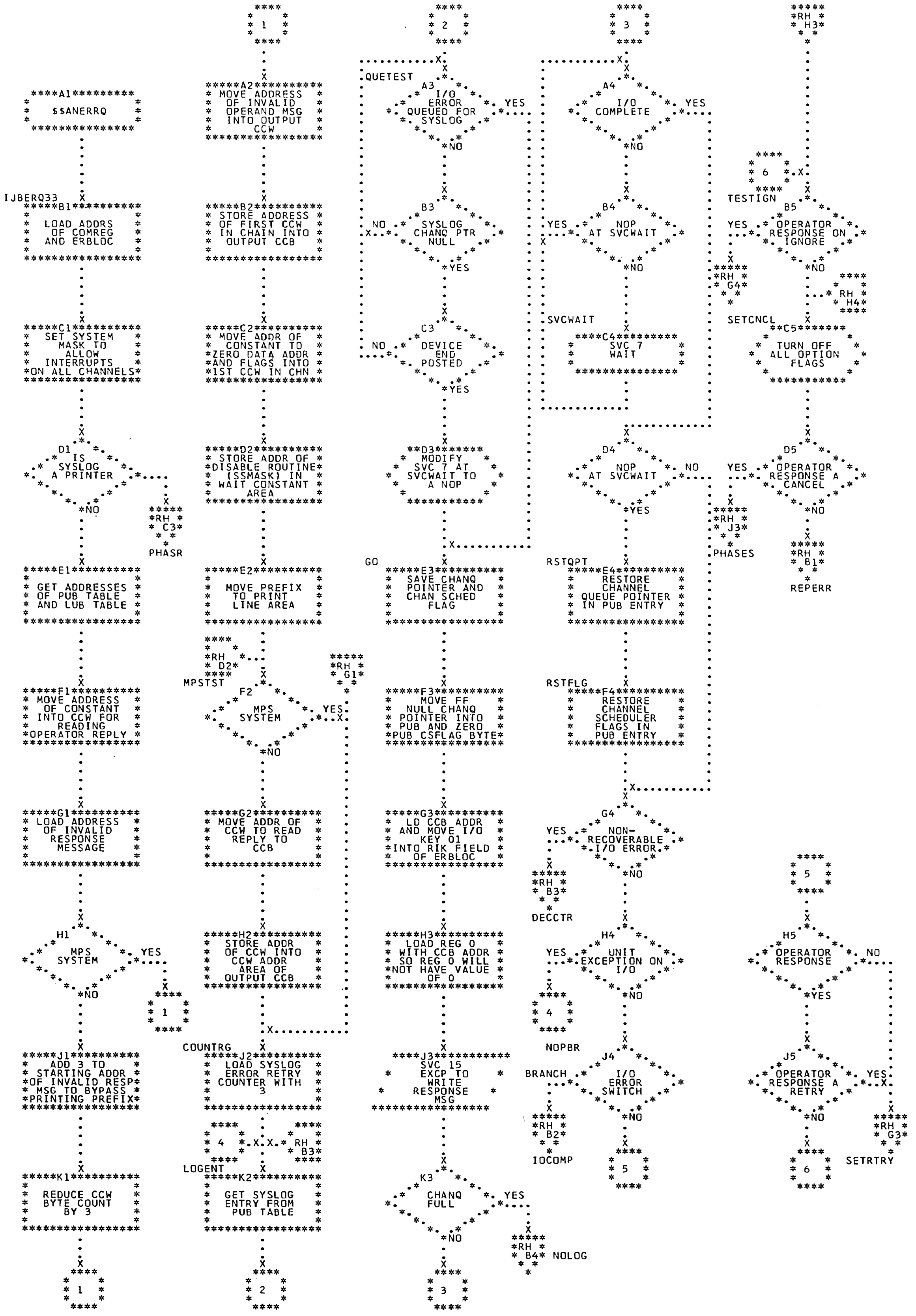


Chart RH. $$ANERRQ - Phase 5 of ERP Message Writer (Part 2 of 2) Refer to Chart 14.

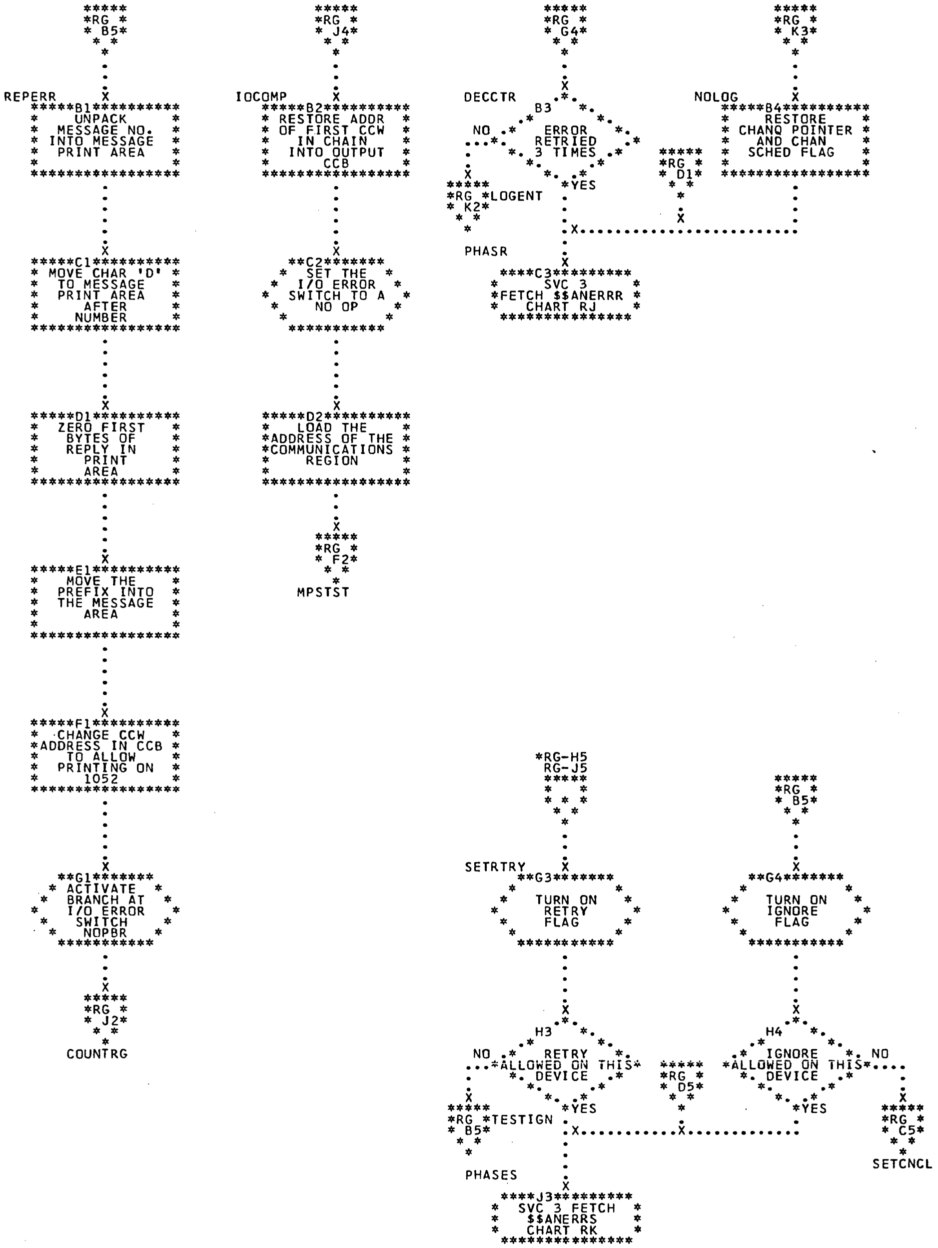


Chart RJ. $$ANERRR - Phase 6 of ERP Message Writer
Refer to Chart 14.

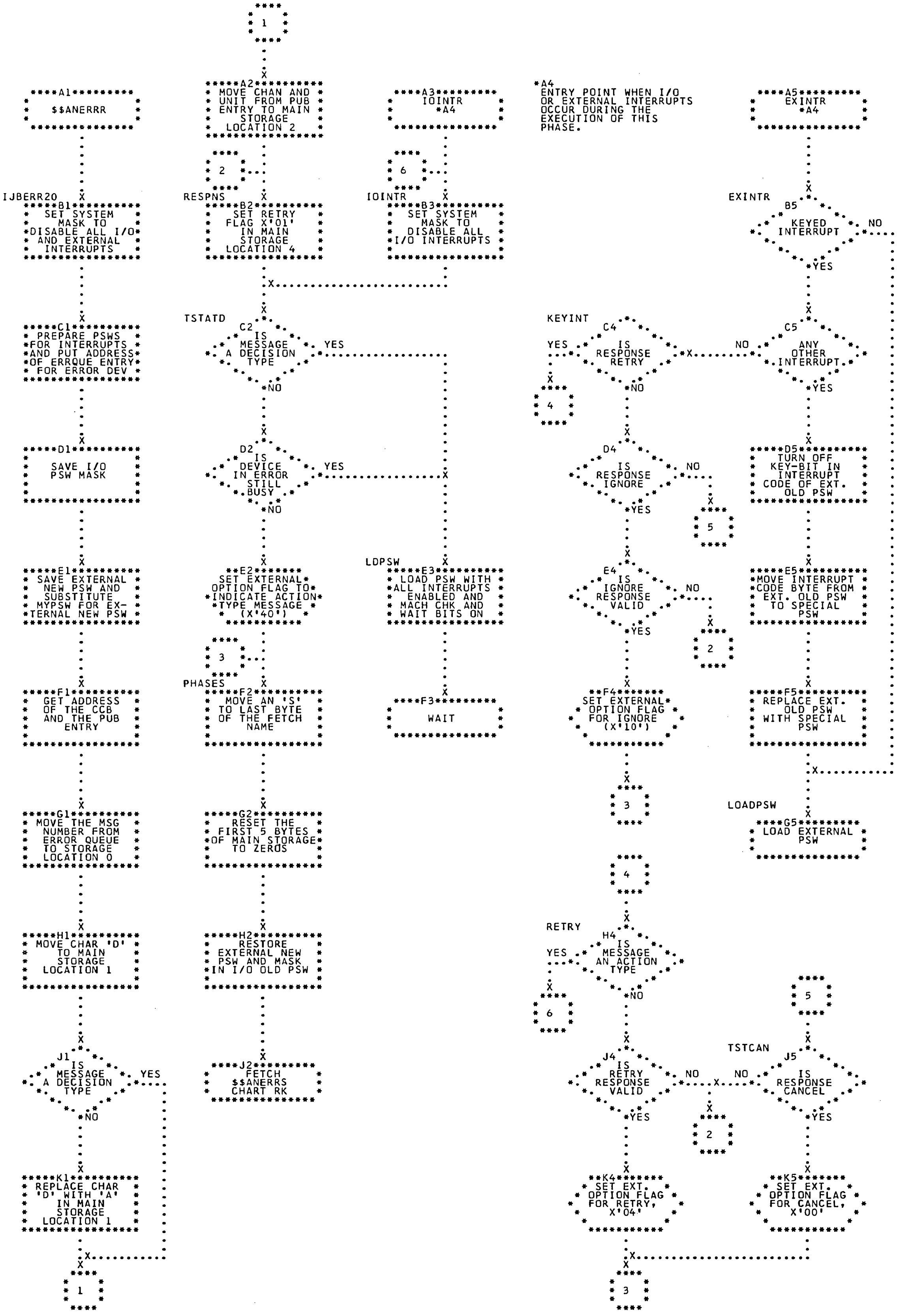
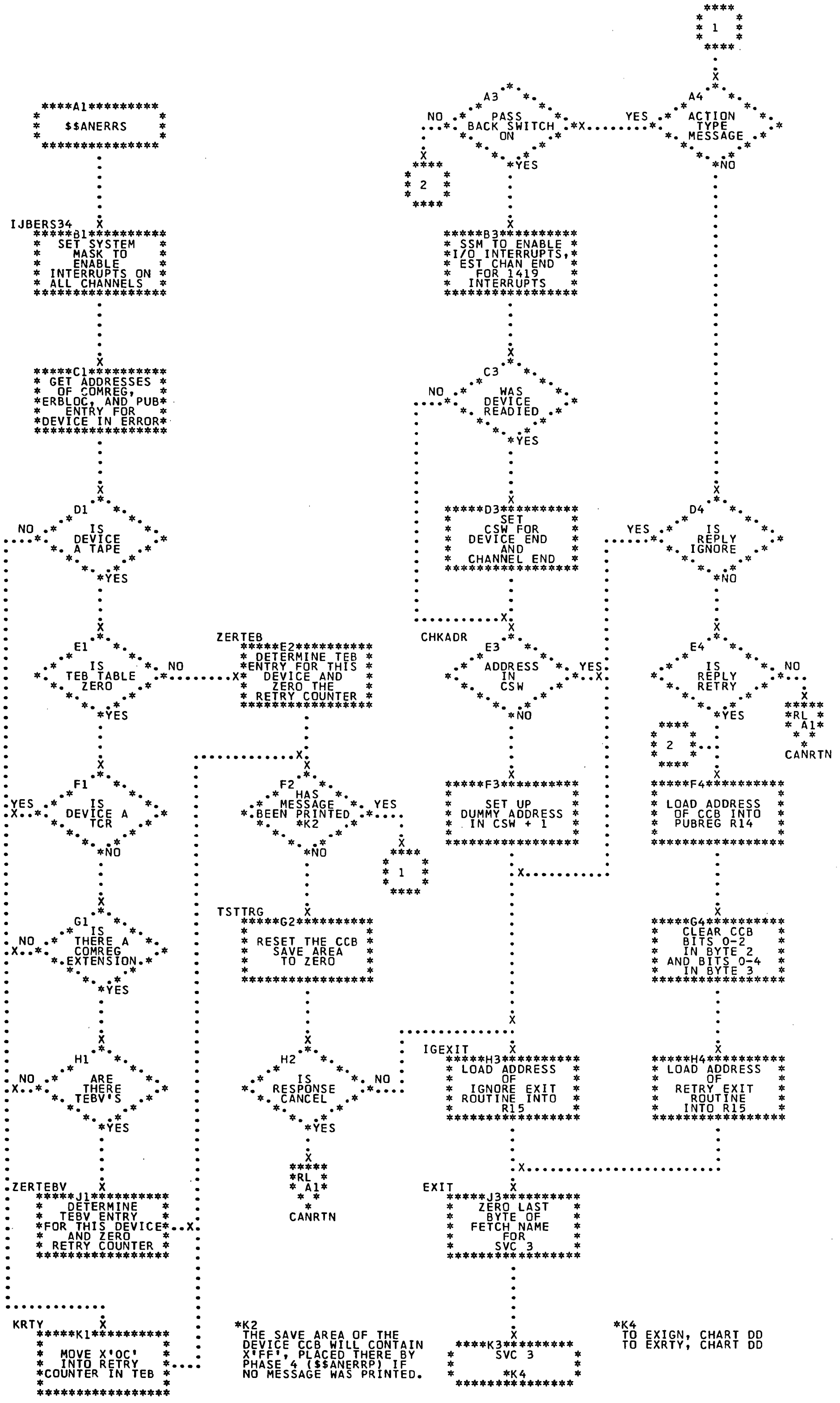


Chart RK. $$ANERRS - Phase 7 of ERP Message Writer (Part 1 of 2)
Refer to Chart 14.



*K2
THE SAVE AREA OF THE DEVICE CCB WILL CONTAIN X'FF', PLACED THERE BY PHASE 4 ($$ANERRP) IF NO MESSAGE WAS PRINTED.

*K4
TO EXIGN, CHART DD
TO EXRTY, CHART DD

Chart RL. $$ANERRS - Phase 7 of ERP Message Writer (Part 2 of 2) Refer to Chart 14.

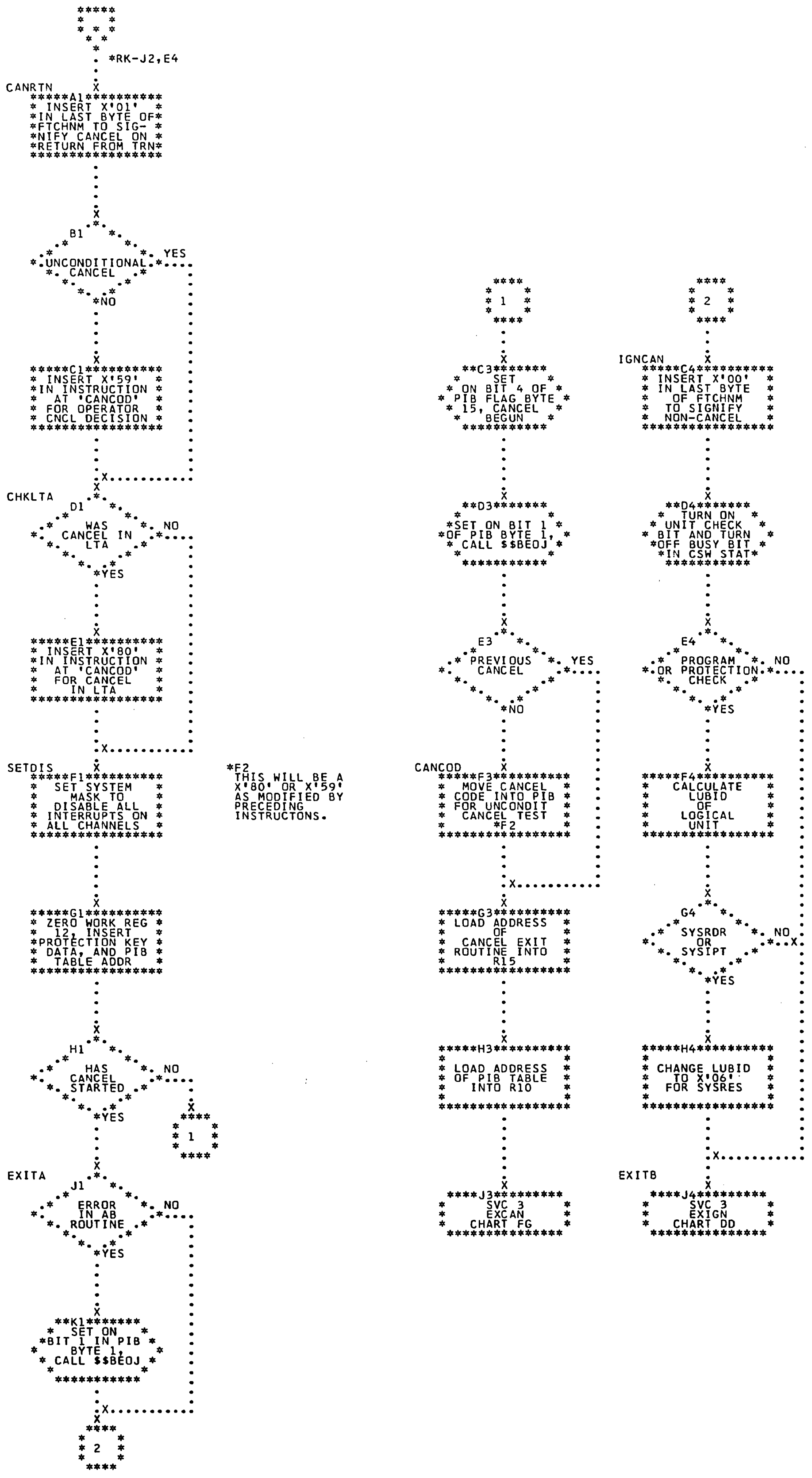


Chart SA. $$ANERRT - MICR (1412/1419) ERP
Refer to Chart 12.

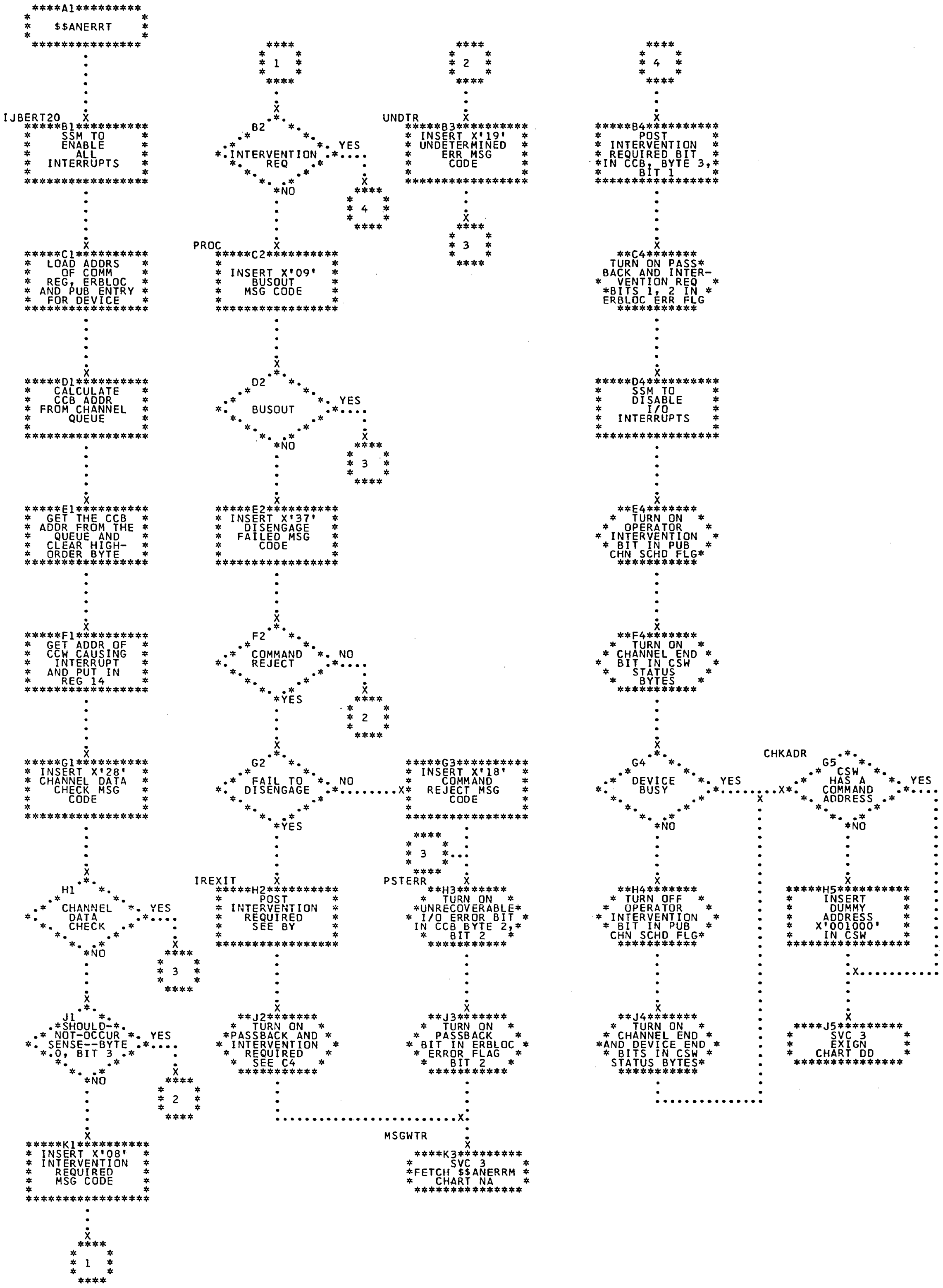


Chart SB. $$ANERRU - Phase 1 of Unit Record ERP (Part 1 of 2) Refer to Chart 11.

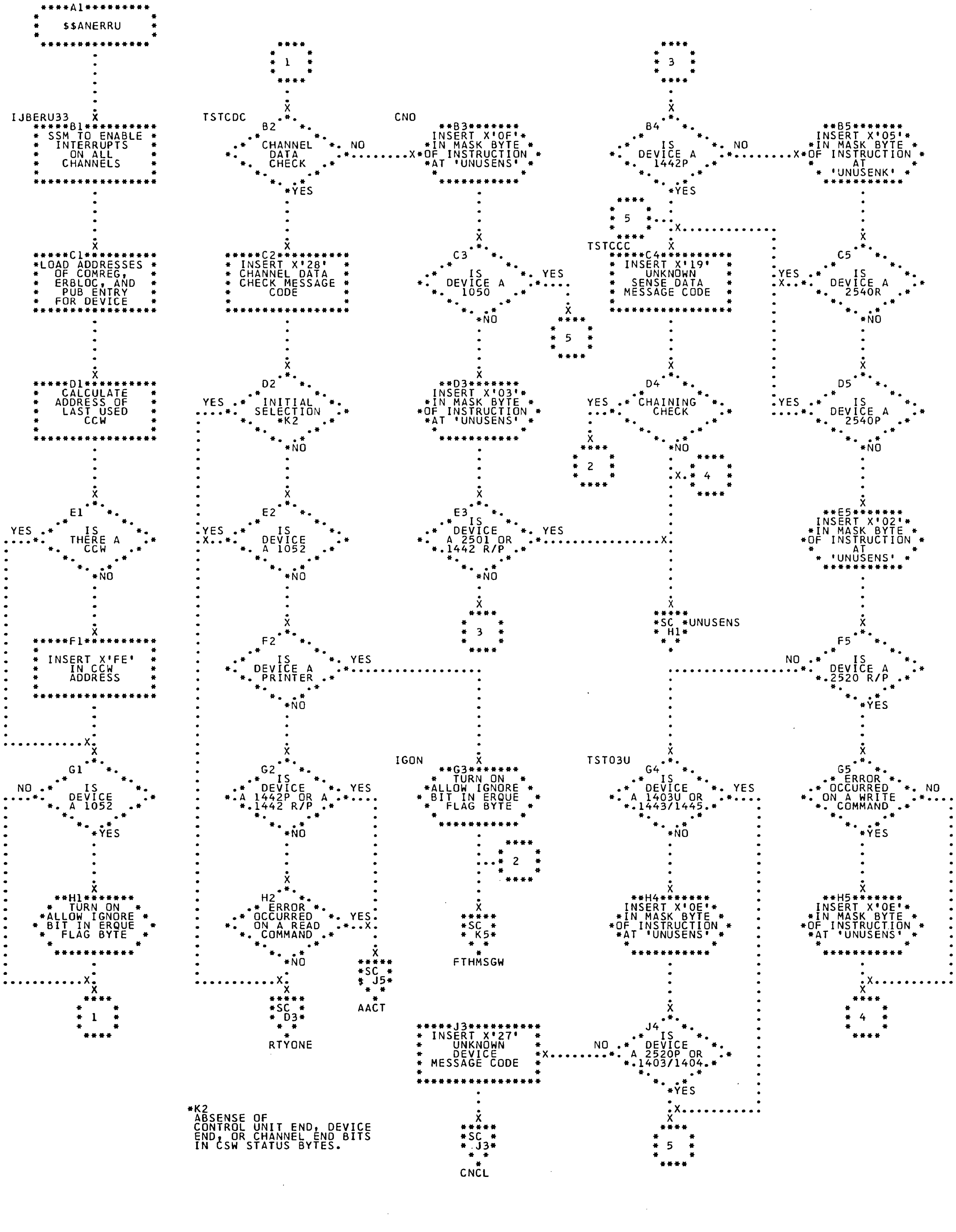
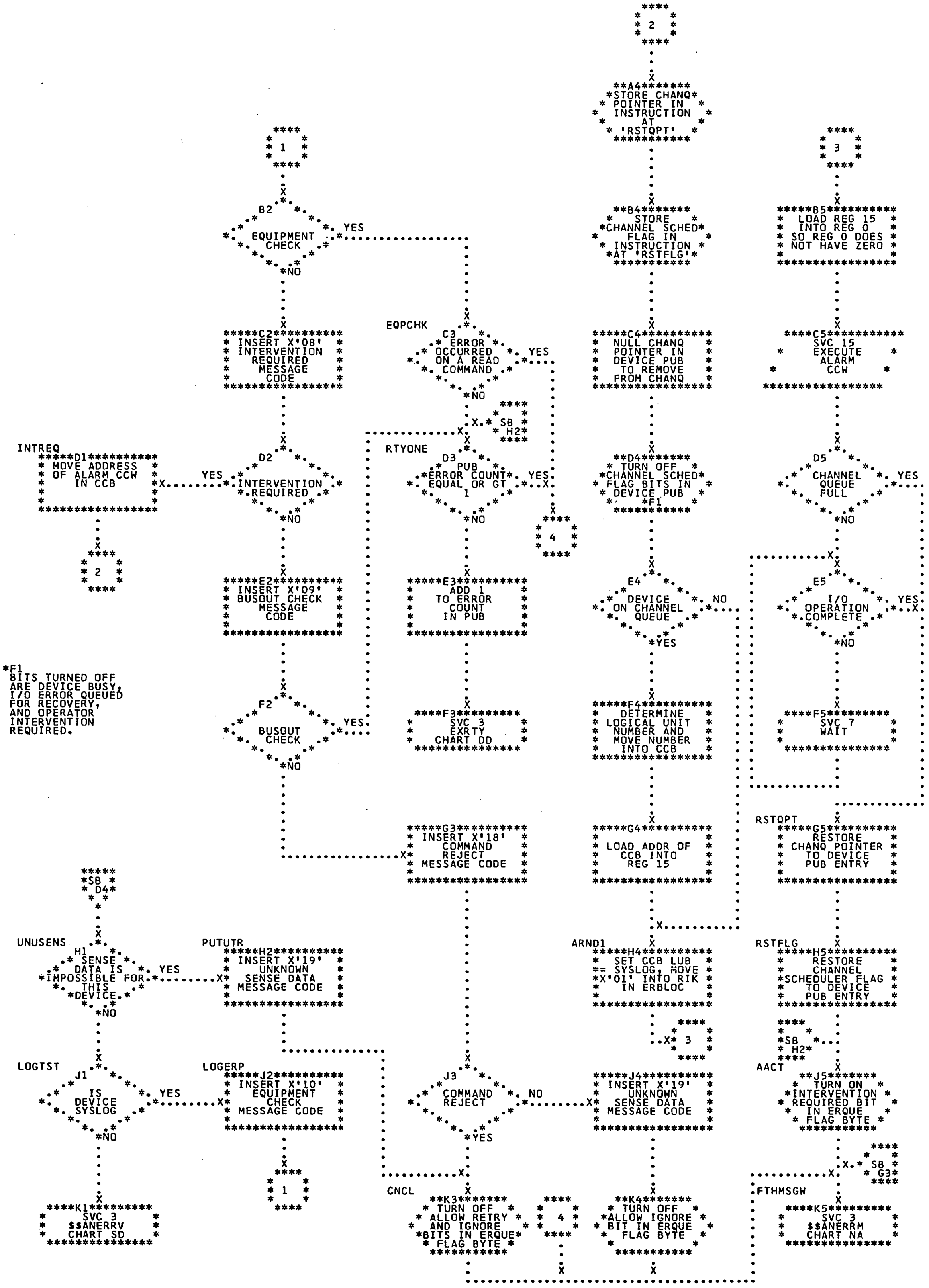


Chart SC. $$ANERRU - Phase 1 of Unit Record ERP (Part 2 of 2) Refer to Chart 11.



*F1
BITS TURNED OFF ARE DEVICE BUSY, I/O ERROR QUEUED FOR RECOVERY, AND OPERATOR INTERVENTION REQUIRED.

Chart SD. $$ANERRV - Phase 2 of Unit Record ERP (Part 1 of 2) Refer to Chart 11.

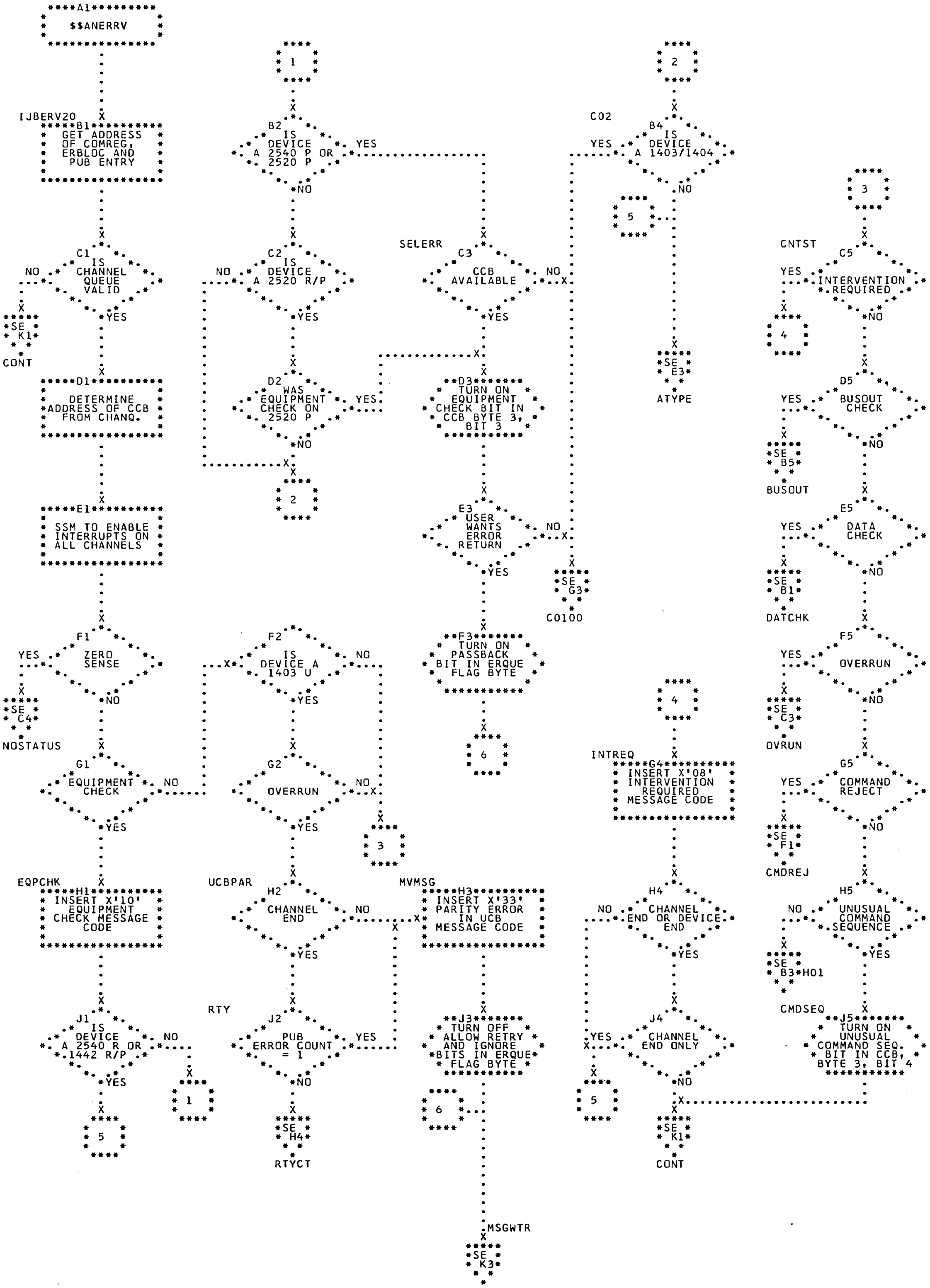


Chart SE. $$ANERRV - Phase 2 of Unit Record ERP (Part 2 of 2) Refer to Chart 11.

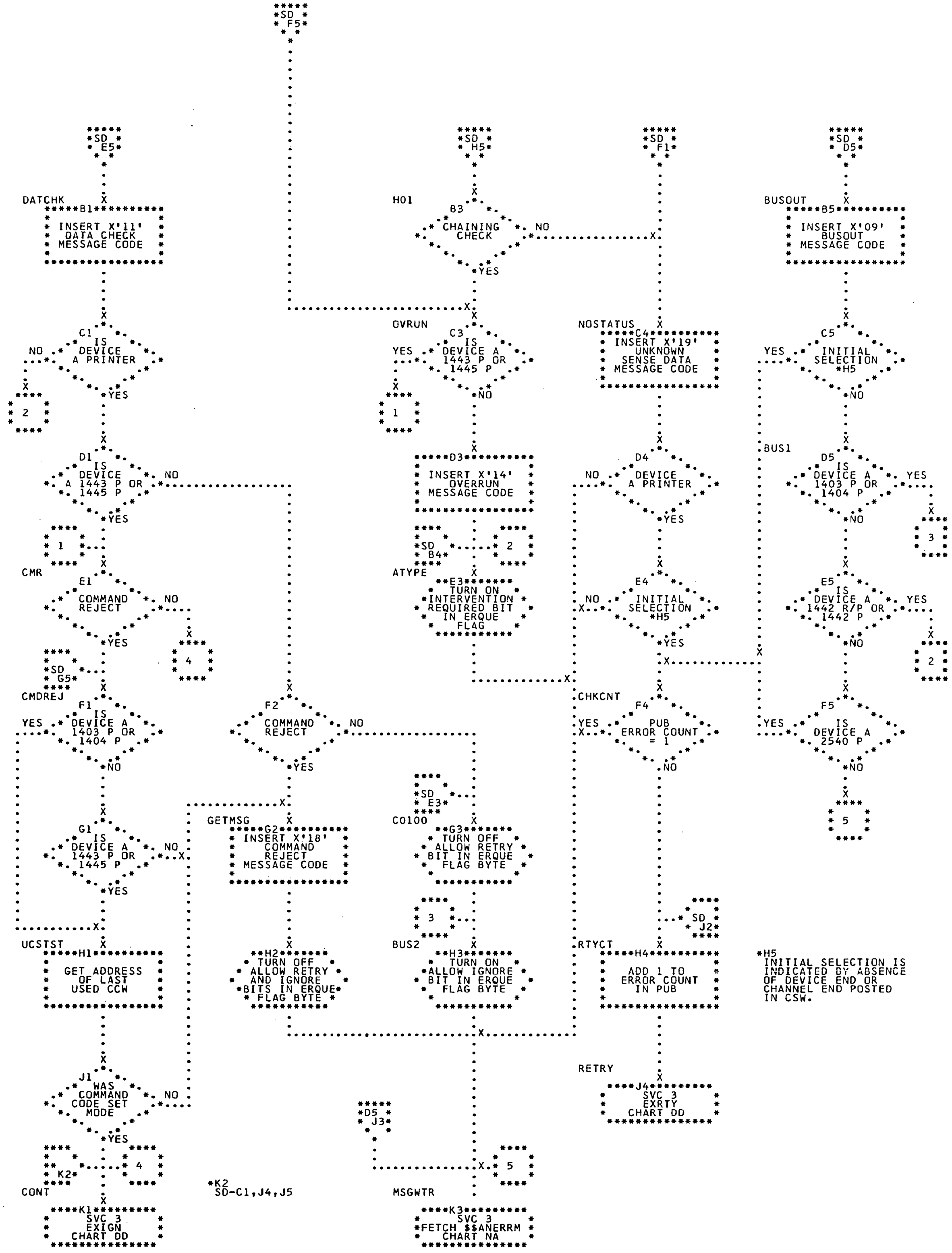


Chart SF. $$ANERRW - MICR (1419D) ERP (Part 1 of 3)
Refer to Chart 12.

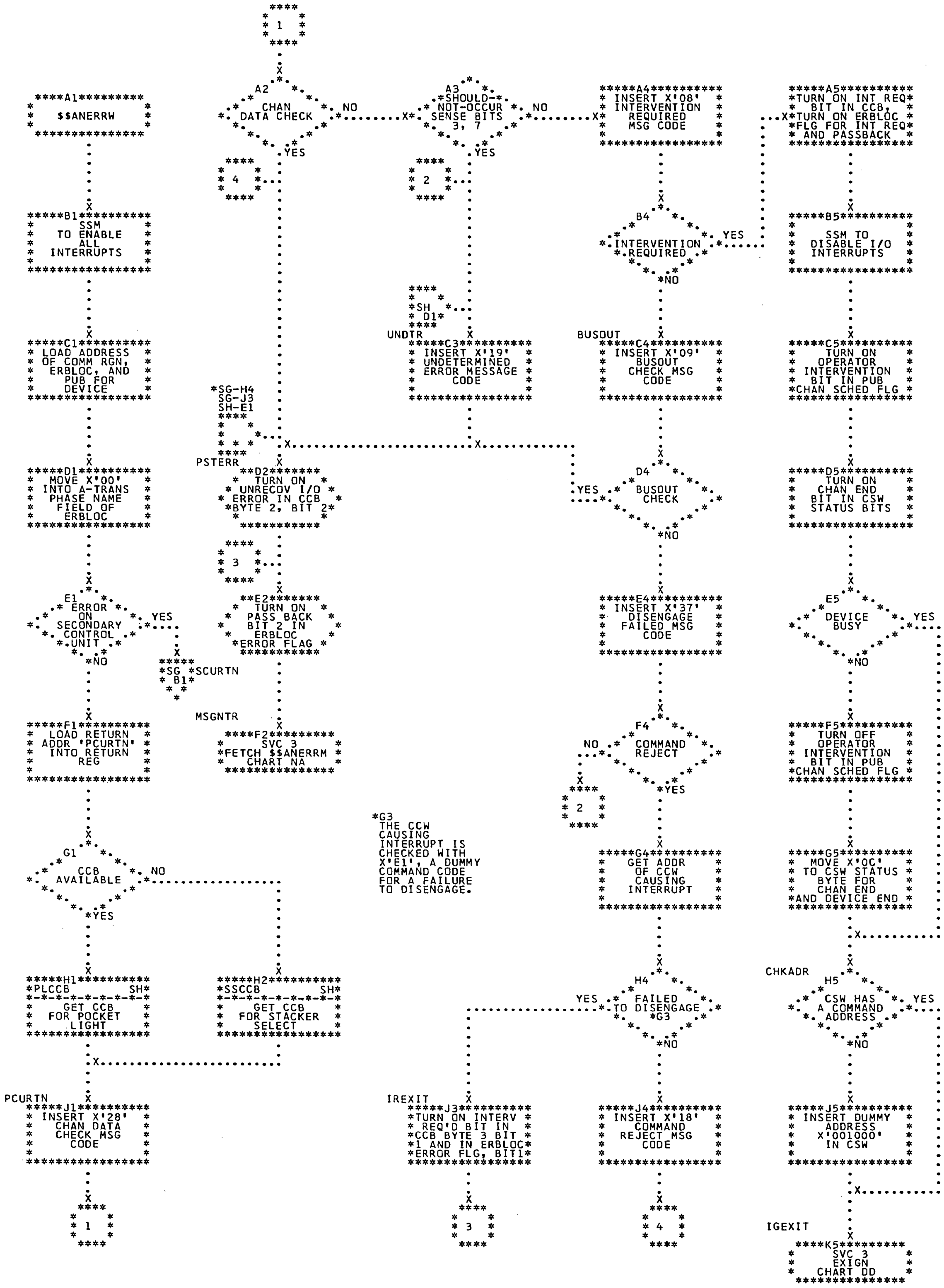


Chart SG. $$ANERRW - MICR (1419D) ERP (Part 2 of 3)
Refer to Chart 12.

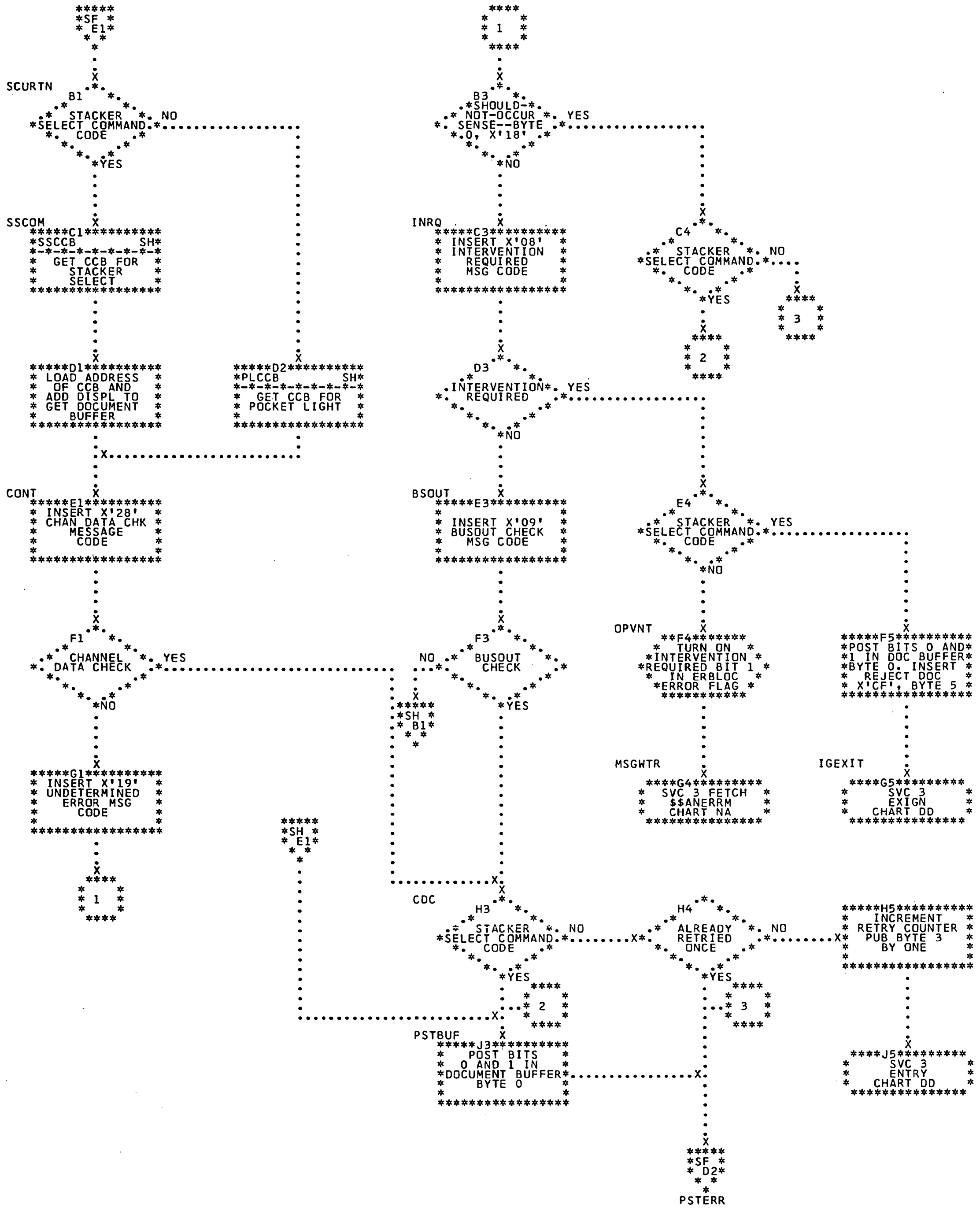


Chart SH. $$ANERRW - MICR (1419D) ERP (Part 3 of 3)

Refer to Chart 12.

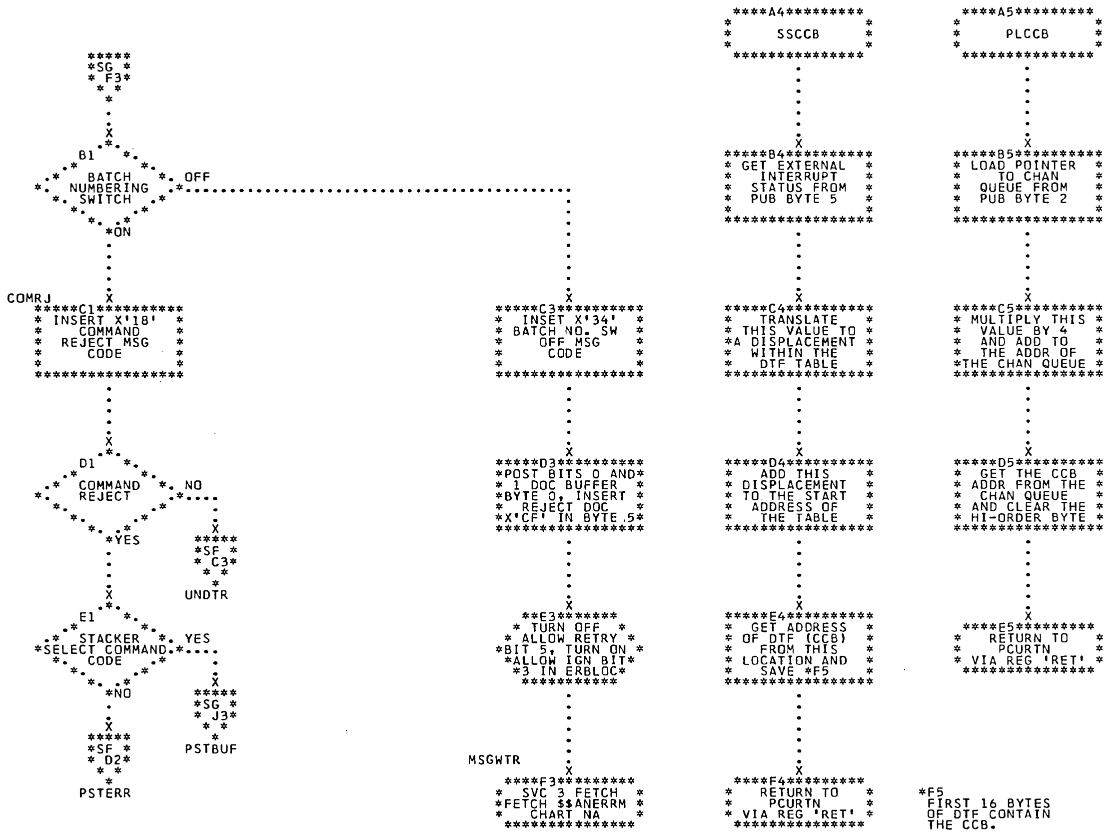


Chart SJ. $$ANERRX - 2671 Paper Tape ERP (Part 1 of 2) Refer to Chart 12.

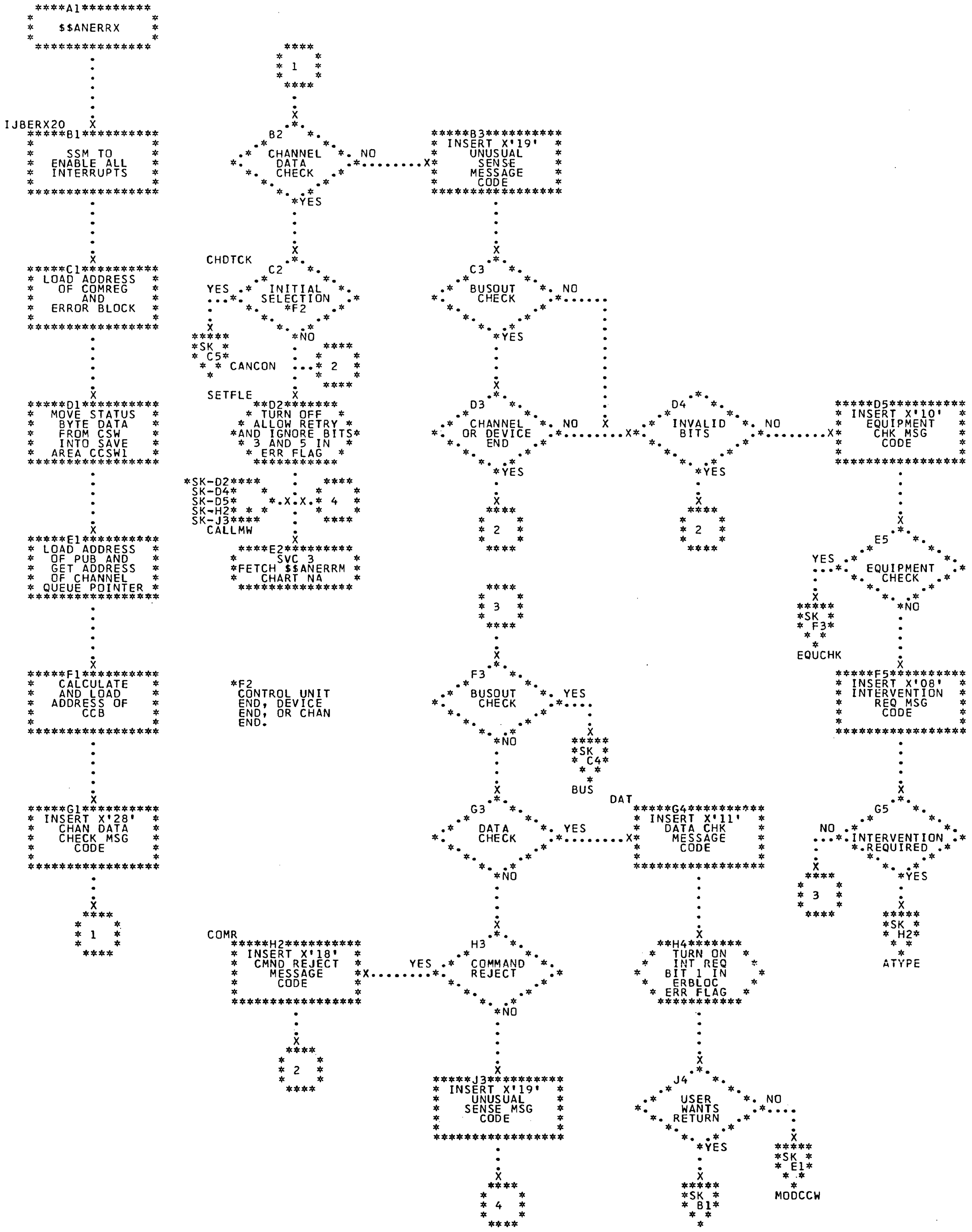


Chart SK. $$ANERRX - 2671 Paper Tape ERP (Part 2 of 2)
Refer to Chart 12.

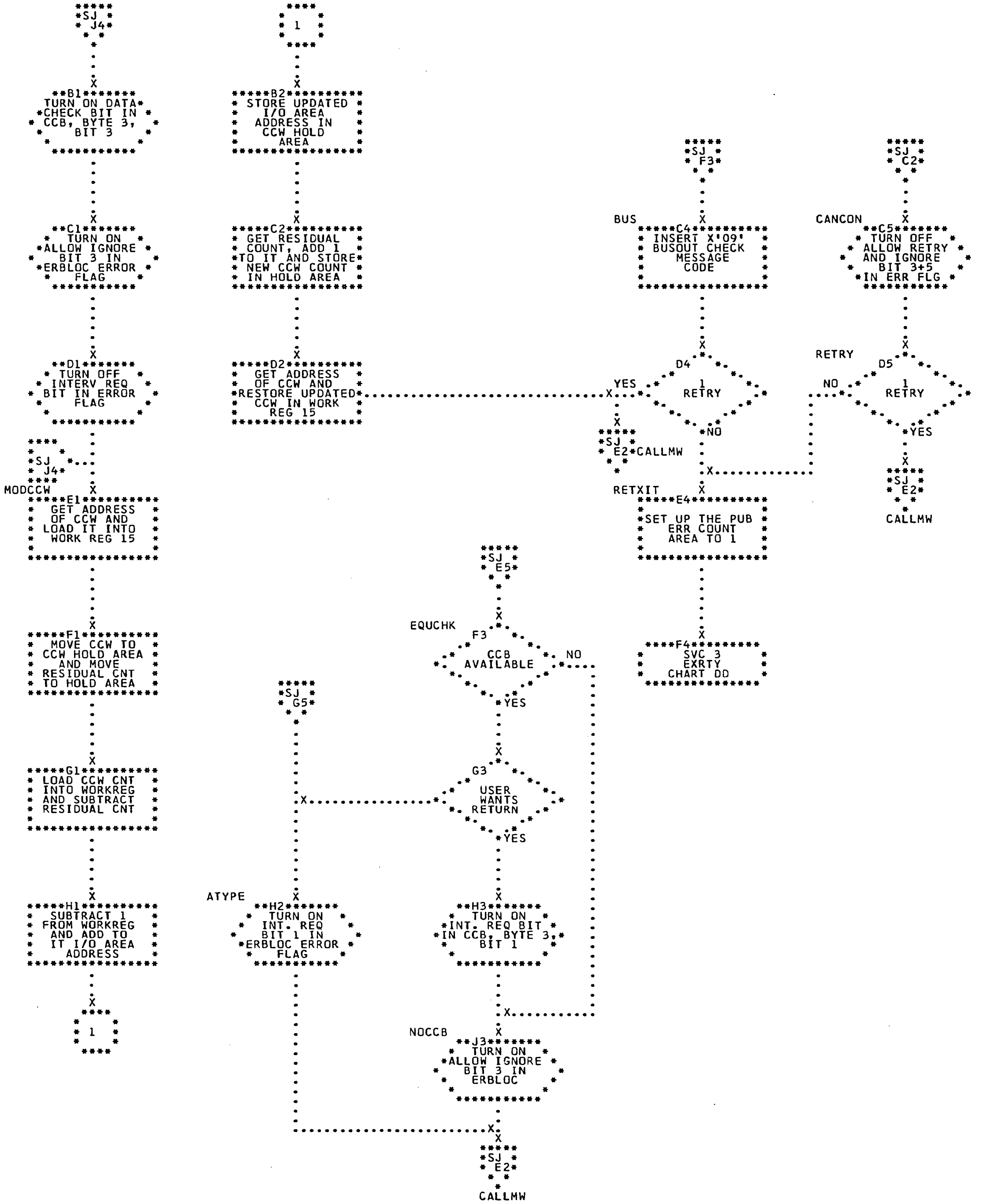
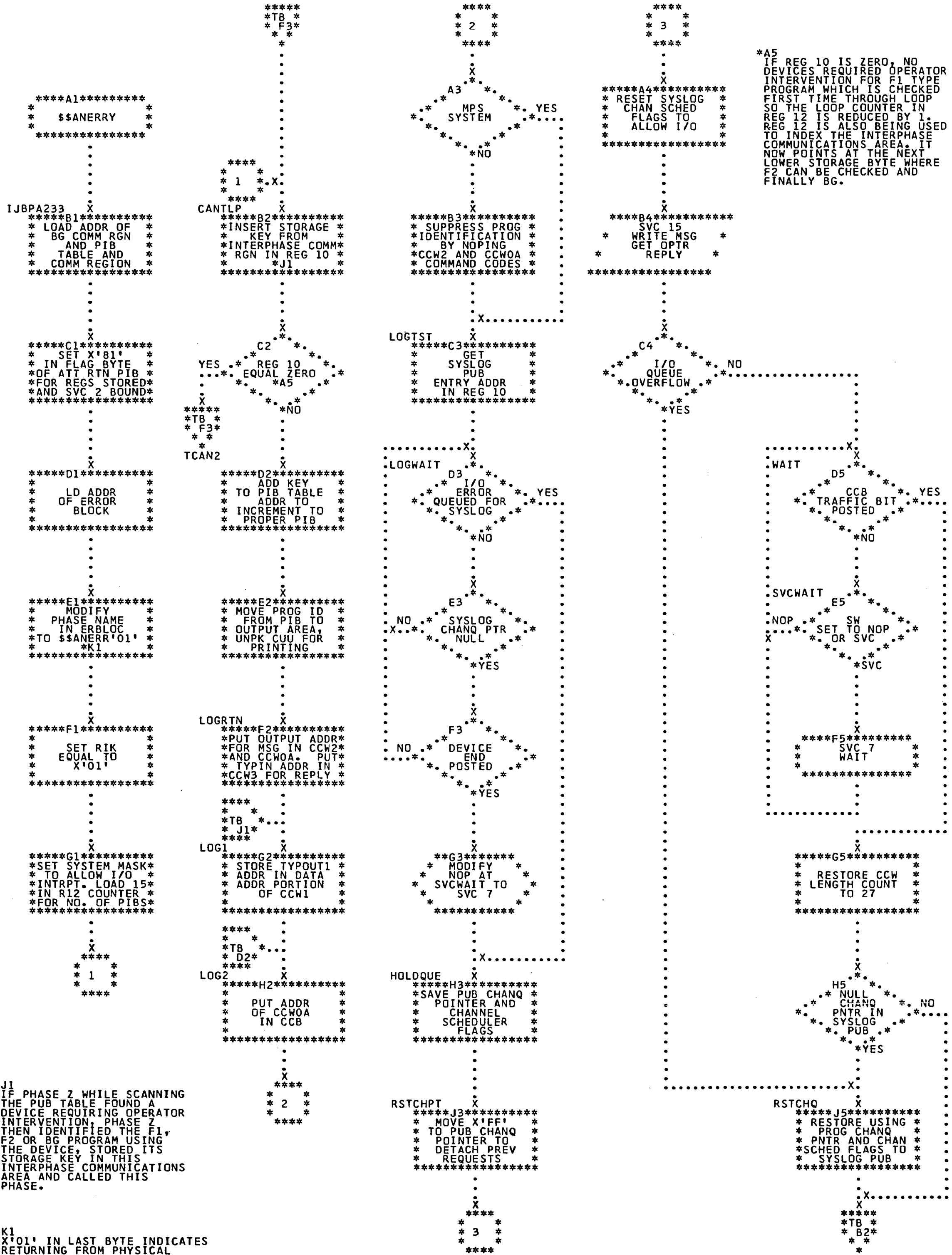


Chart TA. $$ANERRY - Physical Attention Routine: Send Message
Refer to Chart 15.

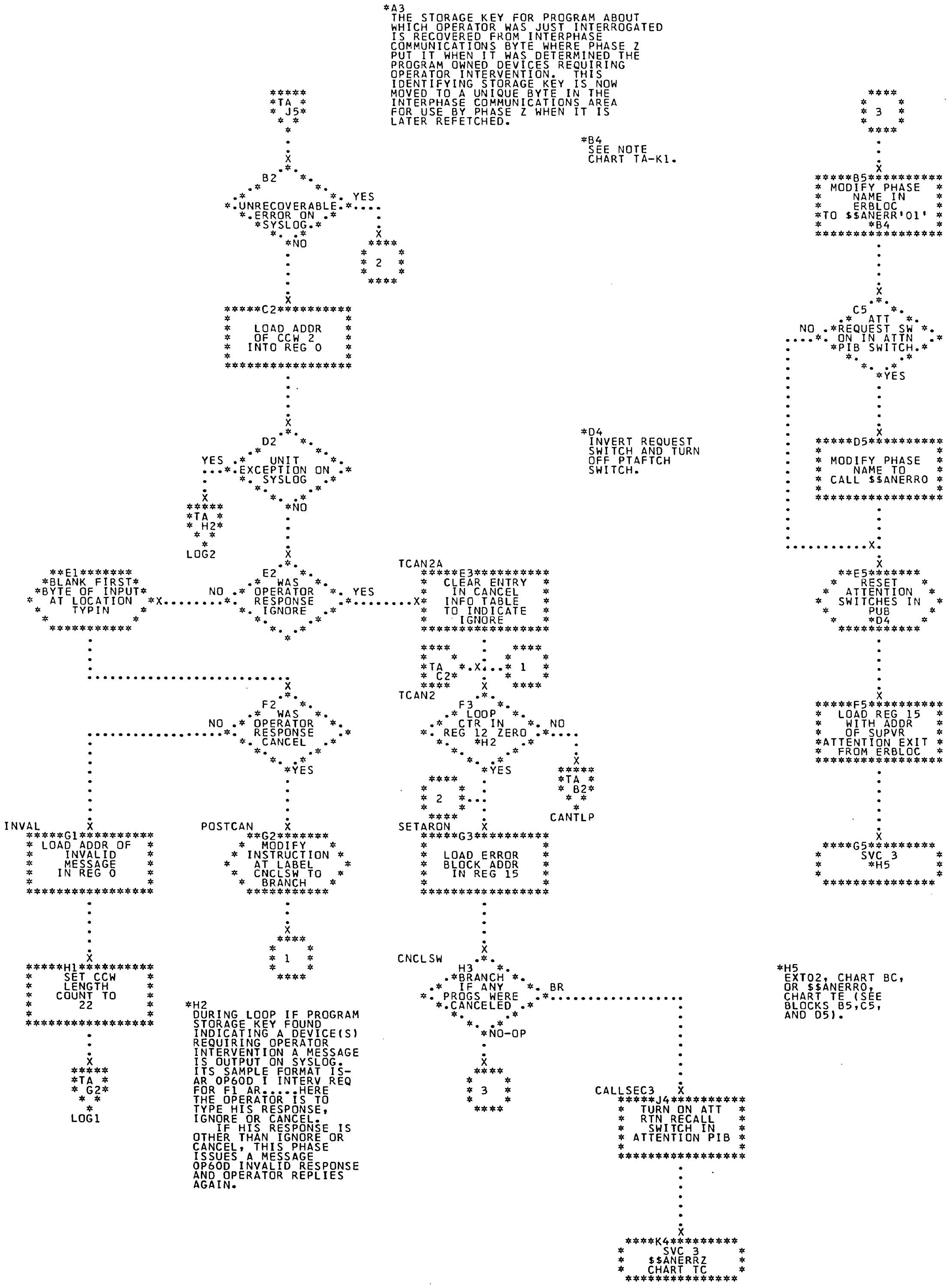


*A5
IF REG 10 IS ZERO, NO DEVICES REQUIRED OPERATOR INTERVENTION FOR F1 TYPE PROGRAM WHICH IS CHECKED FIRST TIME THROUGH LOOP SO THE LOOP COUNTER IN REG 12 IS REDUCED BY 1. REG 12 IS ALSO BEING USED TO INDEX THE INTERPHASE COMMUNICATIONS AREA. IT NOW POINTS AT THE NEXT LOWER STORAGE BYTE WHERE F2 CAN BE CHECKED AND FINALLY BG.

*J1
IF PHASE Z WHILE SCANNING THE PUB TABLE FOUND A DEVICE REQUIRING OPERATOR INTERVENTION, PHASE Z THEN IDENTIFIED THE F1, F2 OR BG PROGRAM USING THE DEVICE, STORED ITS STORAGE KEY IN THIS INTERPHASE COMMUNICATIONS AREA AND CALLED THIS PHASE.

*K1
X'01' IN LAST BYTE INDICATES RETURNING FROM PHYSICAL ATTENTION TRANSIENTS ($$ANERRY, Z, 0).

Chart TB. $$ANERRY - Physical Attention Routine: Read Operator Reply
Refer to Chart 15.



*A3
THE STORAGE KEY FOR PROGRAM ABOUT WHICH OPERATOR WAS JUST INTERROGATED IS RECOVERED FROM INTERPHASE COMMUNICATIONS BYTE WHERE PHASE Z PUT IT WHEN IT WAS DETERMINED THE PROGRAM OWNED DEVICES REQUIRING OPERATOR INTERVENTION. THIS IDENTIFYING STORAGE KEY IS NOW MOVED TO A UNIQUE BYTE IN THE INTERPHASE COMMUNICATIONS AREA FOR USE BY PHASE Z WHEN IT IS LATER REFETCHED.

*B4
SEE NOTE CHART TA-K1.

*D4
INVERT REQUEST SWITCH AND TURN OFF PTAFTCH SWITCH.

*H2
DURING LOOP IF PROGRAM STORAGE KEY FOUND INDICATING A DEVICE(S) REQUIRING OPERATOR INTERVENTION A MESSAGE IS OUTPUT ON SYSLOG. ITS SAMPLE FORMAT IS- AR OP60D I INTERV REQ FOR F1 AR.....HERE THE OPERATOR IS TO TYPE HIS RESPONSE, IGNORE OR CANCEL.
IF HIS RESPONSE IS OTHER THAN IGNORE OR CANCEL, THIS PHASE ISSUES A MESSAGE OP60D INVALID RESPONSE AND OPERATOR REPLIES AGAIN.

*H5
EXT02, CHART BC, OR $$ANERRO, CHART TE (SEE BLOCKS B5,C5, AND D5).

Chart TC. $$ANERRZ - Physical Attention Routine: Initial PUB Scan Refer to Chart 15.

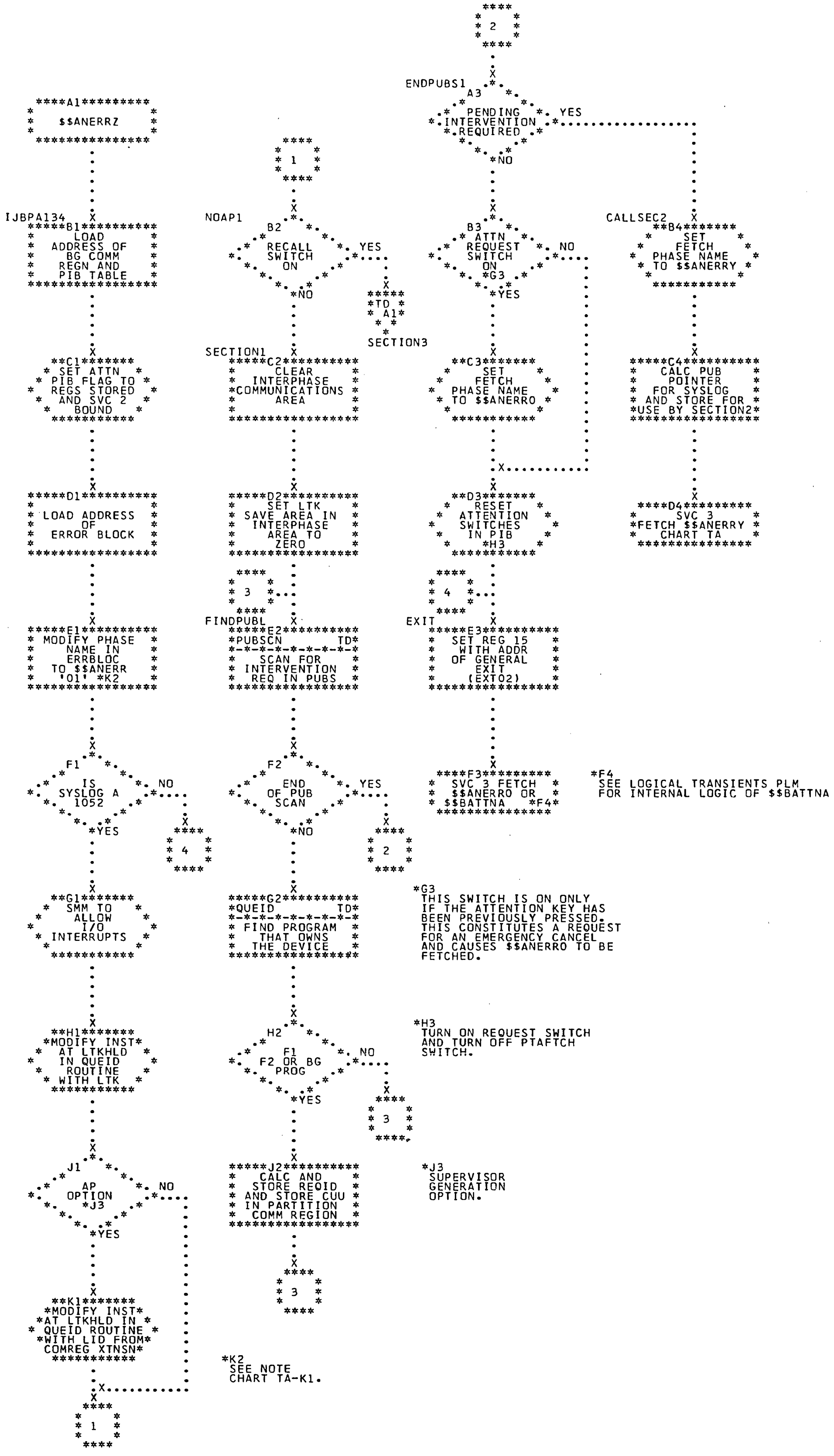


Chart TD. $$ANERRZ - Physical Attention Routine: Cancel
Refer to Chart 15.

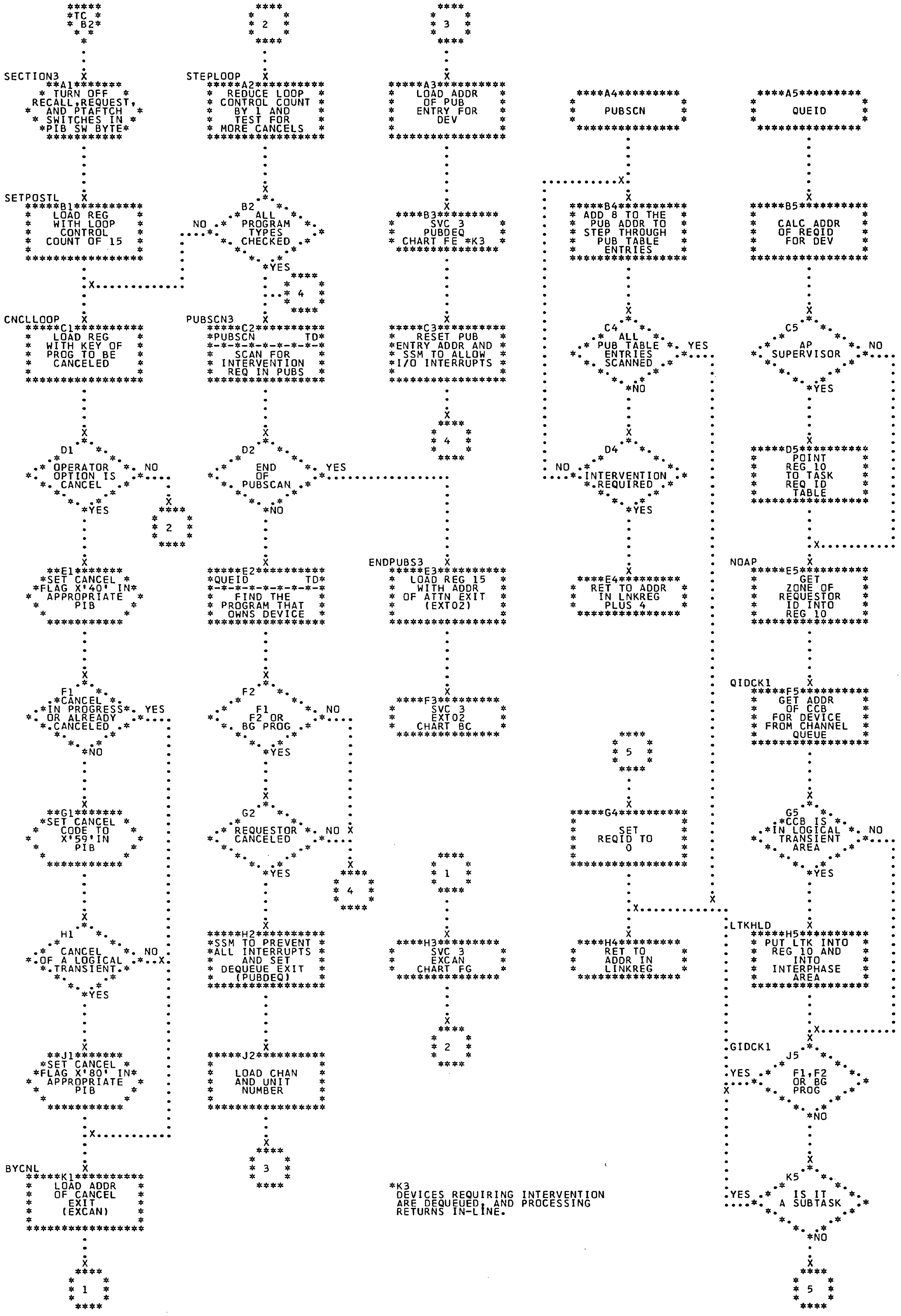


Chart TE. $$ANERRO - Physical Attention Routine: Request Cancel (Part 1 of 2) Refer to Chart 15.

*A1
SEVERAL MESSAGES ARE AVAILABLE. THE DESIRED MESSAGE AT ANY I/O OUTPUT TIME IS SELECTED BY CHANGING THE DATA ADDRESS IN CCW2. CCW 4 RETURNS OPERATOR'S REPLY TO THE SYSTEM.

*C1
IF SYSLOG IS ON CHANNEL QUEUE, THIS IS A WAIT LOOP FOR USING PROGRAM TO COMPLETE ITS I/O OPERATION SO THIS PHASE CAN USE IT. PUB FLAGS ARE SAVED AFTER USING PROGRAM FINISHES WITH DEVICE.

*D1
IN ERBLOC=$$ANERR'01'. X'01' INDICATES RETURNING FROM PHYSICAL ATTENTION TRANSIENTS ($$ANERRY,Z,O).

*E1
FIRST MESSAGE FROM THIS PHASE IS AR 1I40D REQUEST CANCEL. AR.... OPERATOR REPLY MUST BE GIVEN AS DISCUSSED IN CHART TF, NOTE A5.

*J1
TEST IS MADE FOR OTHER THAN BLANKS IN INPUT AREA.

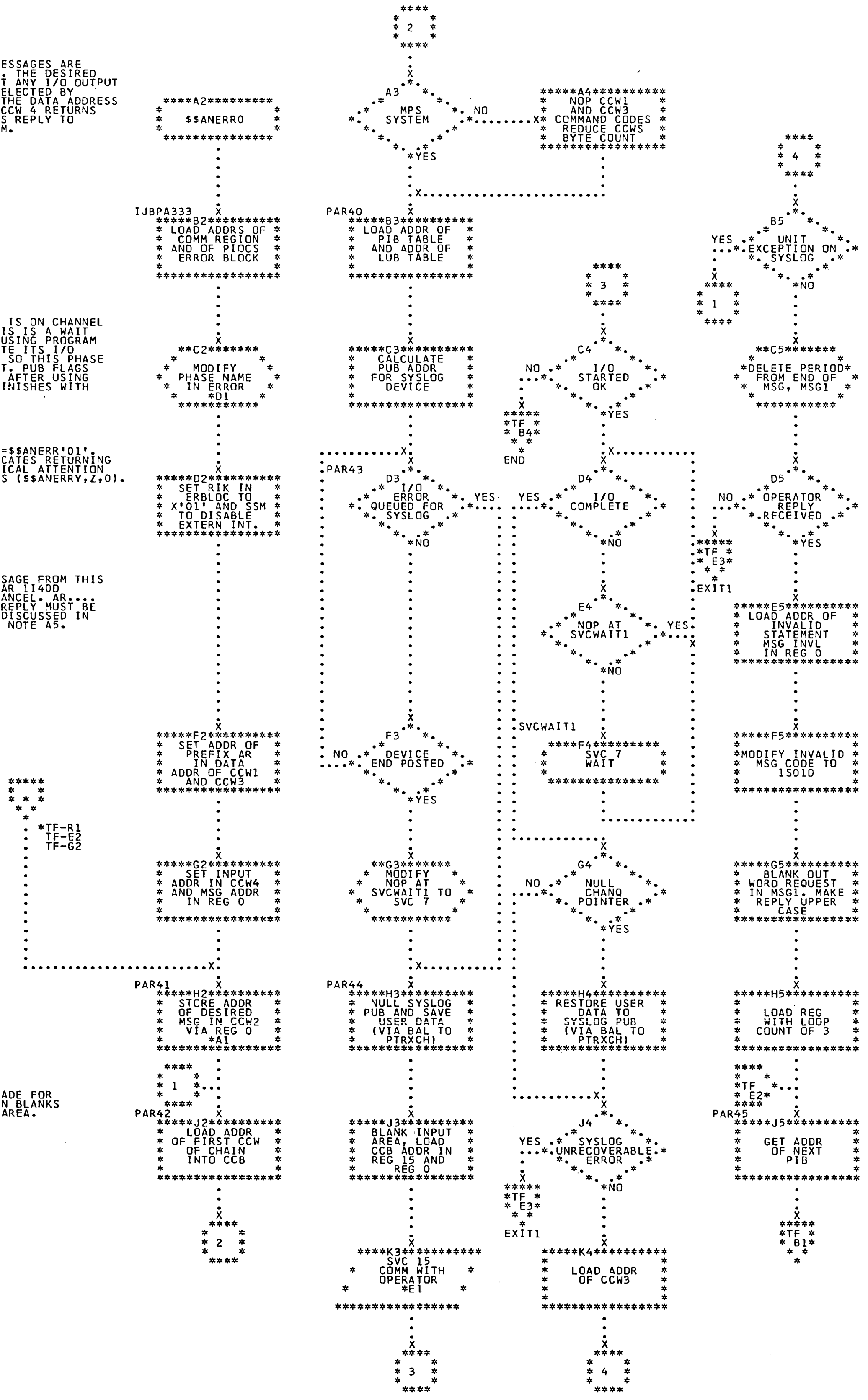
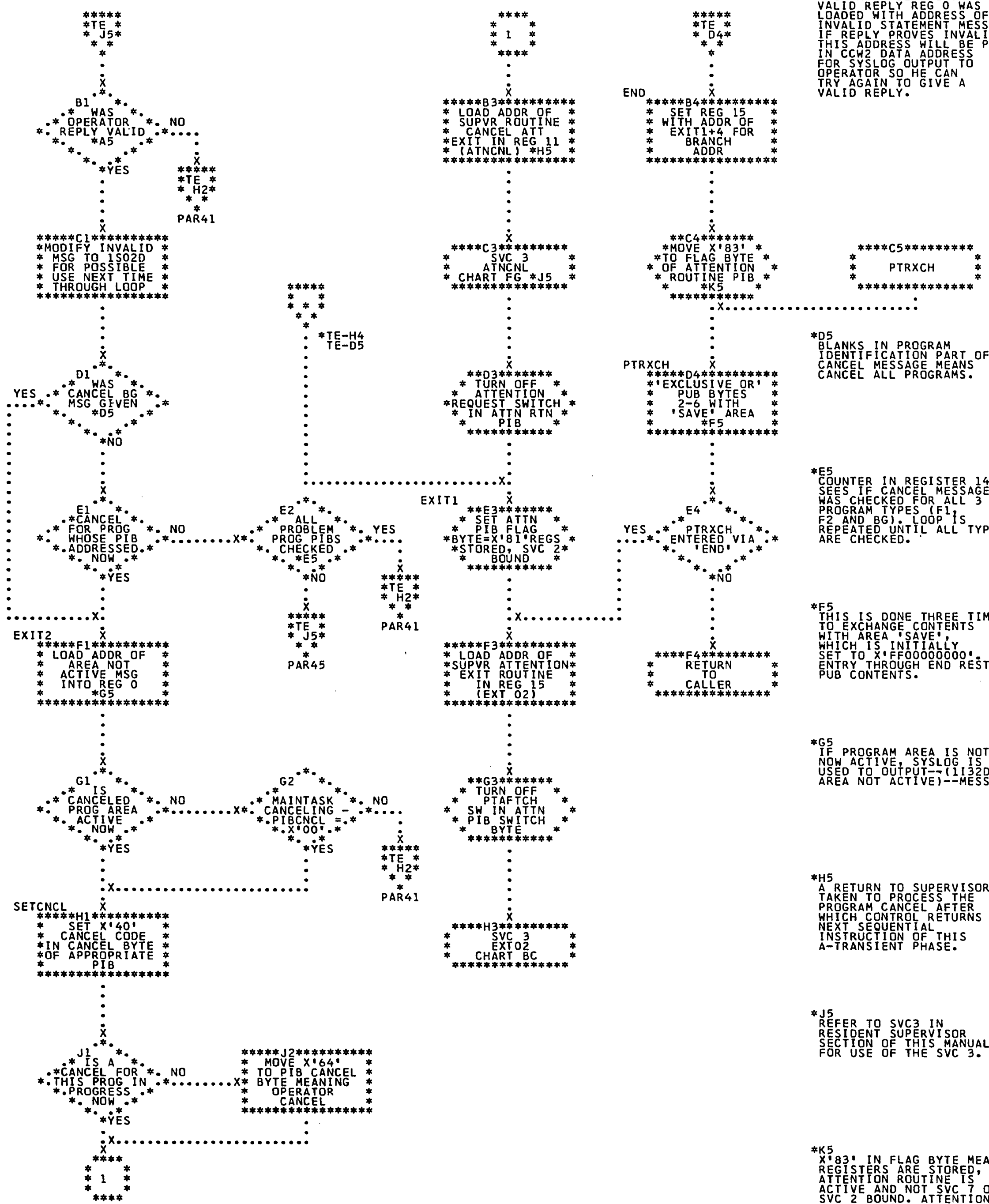


Chart TF. $$ANERR0 - Physical Attention Routine: Request Cancel (Part 2 of 2)
Refer to Chart 15.



*A5
OPERATOR RESPONSES CAN BE-
1. CANCEL F1
2. CANCEL F2
3. CANCEL BG
4. CANCEL
REPLY 4 MEANS CANCEL BG PROGRAMS. BEFORE TEST FOR VALID REPLY REG 0 WAS LOADED WITH ADDRESS OF INVALID STATEMENT MESSAGE. IF REPLY PROVES INVALID, THIS ADDRESS WILL BE PUT IN CCW2 DATA ADDRESS FOR SYSLOG OUTPUT TO OPERATOR SO HE CAN TRY AGAIN TO GIVE A VALID REPLY.

*D5
BLANKS IN PROGRAM IDENTIFICATION PART OF CANCEL MESSAGE MEANS CANCEL ALL PROGRAMS.

*E5
COUNTER IN REGISTER 14 SEES IF CANCEL MESSAGE WAS CHECKED FOR ALL 3 PROGRAM TYPES (F1, F2 AND BG). LOOP IS REPEATED UNTIL ALL TYPES ARE CHECKED.

*F5
THIS IS DONE THREE TIMES TO EXCHANGE CONTENTS WITH AREA 'SAVE', WHICH IS INITIALLY SET TO X'FF00000000'. ENTRY THROUGH END RESTORES PUB CONTENTS.

*G5
IF PROGRAM AREA IS NOT NOW ACTIVE, SYSLOG IS USED TO OUTPUT--(1I32D AREA NOT ACTIVE)--MESSAGE.

*H5
A RETURN TO SUPERVISOR IS TAKEN TO PROCESS THE PROGRAM CANCEL AFTER WHICH CONTROL RETURNS TO NEXT SEQUENTIAL INSTRUCTION OF THIS A-TRANSIENT PHASE.

*J5
REFER TO SVC3 IN RESIDENT SUPERVISOR SECTION OF THIS MANUAL FOR USE OF THE SVC 3.

*K5
X'83' IN FLAG BYTE MEANS REGISTERS ARE STORED, ATTENTION ROUTINE IS ACTIVE AND NOT SVC 7 OR SVC 2 BOUND. ATTENTION ROUTINE WILL BE CALLED AGAIN.

Chart TG. $$ANERR1 - Move Data to Communications Region

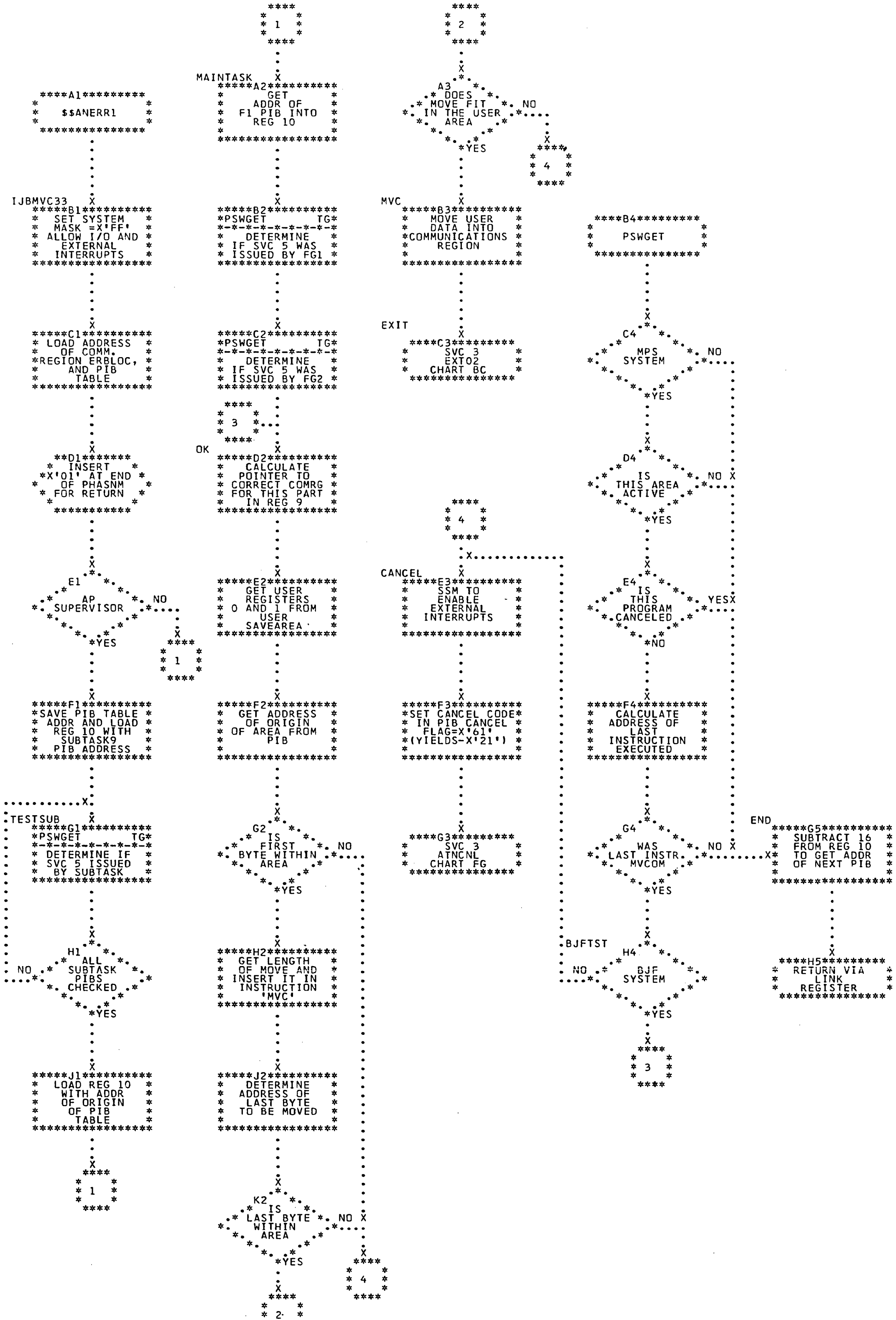


Chart UA. $$ANERR9 - Optical Reader ERP (Part 1 of 2)
Refer to Chart 11.

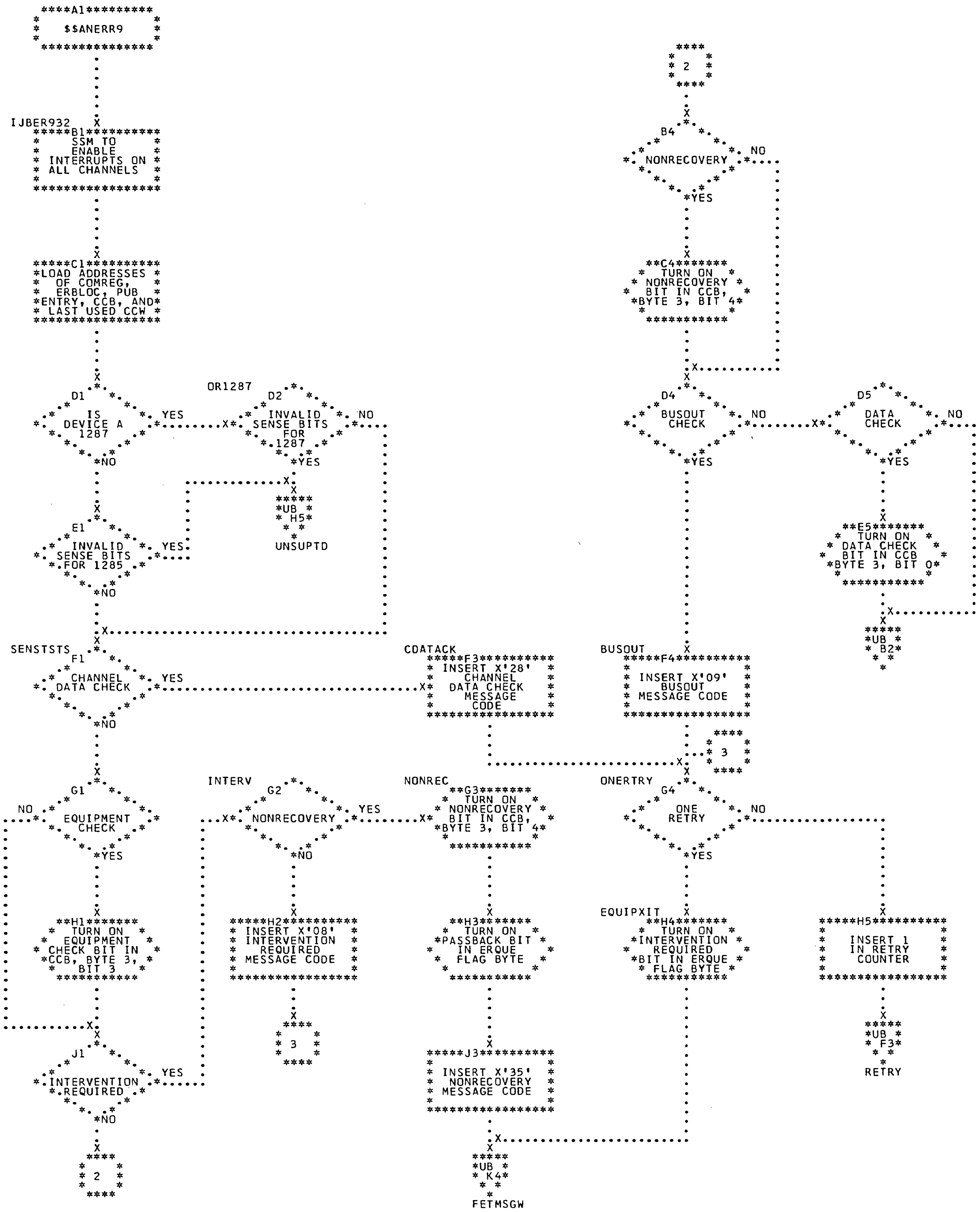


Chart UB. $$ANERR9 - Optical Reader ERP (Part 2 of 2)
Refer to Chart 11

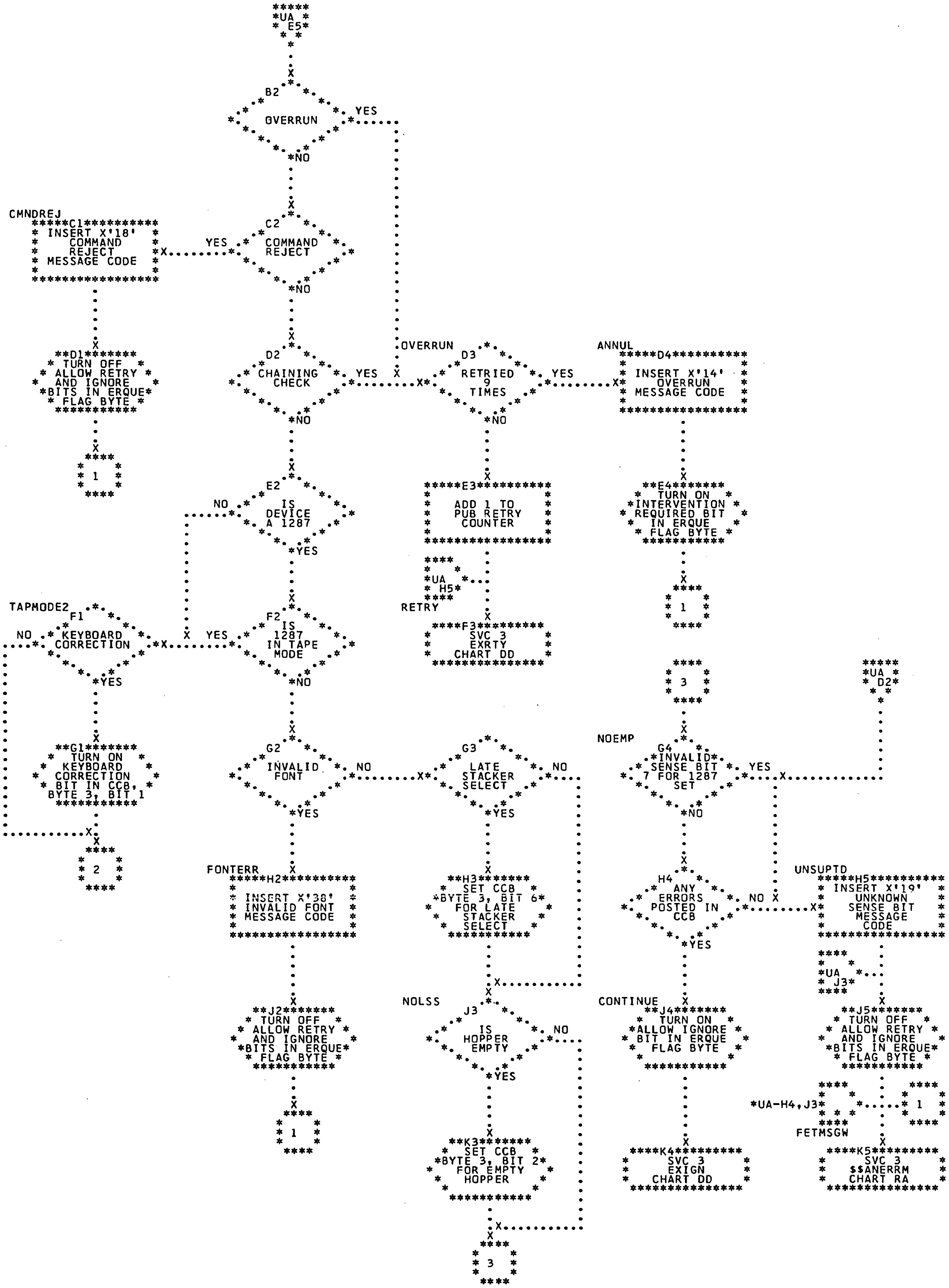


Chart UC. $$ANERR6 - Phase 1 of 2495 ERP (Part 1 of 2)
Refer to Chart 11.

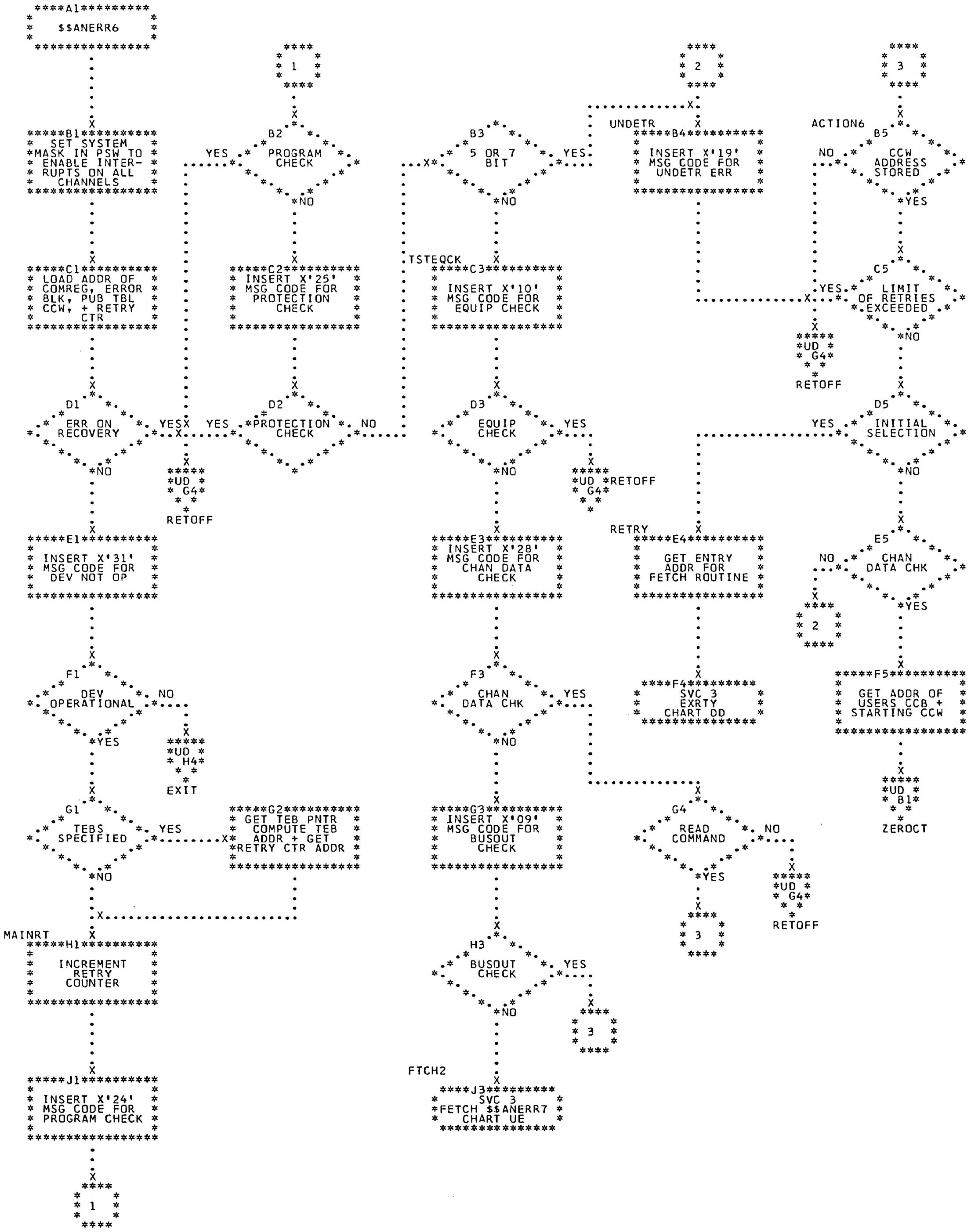


Chart UD. $$ANERR6 - Phase 1 of 2495 ERP (Part 2 of 2)
Refer to Chart 11.

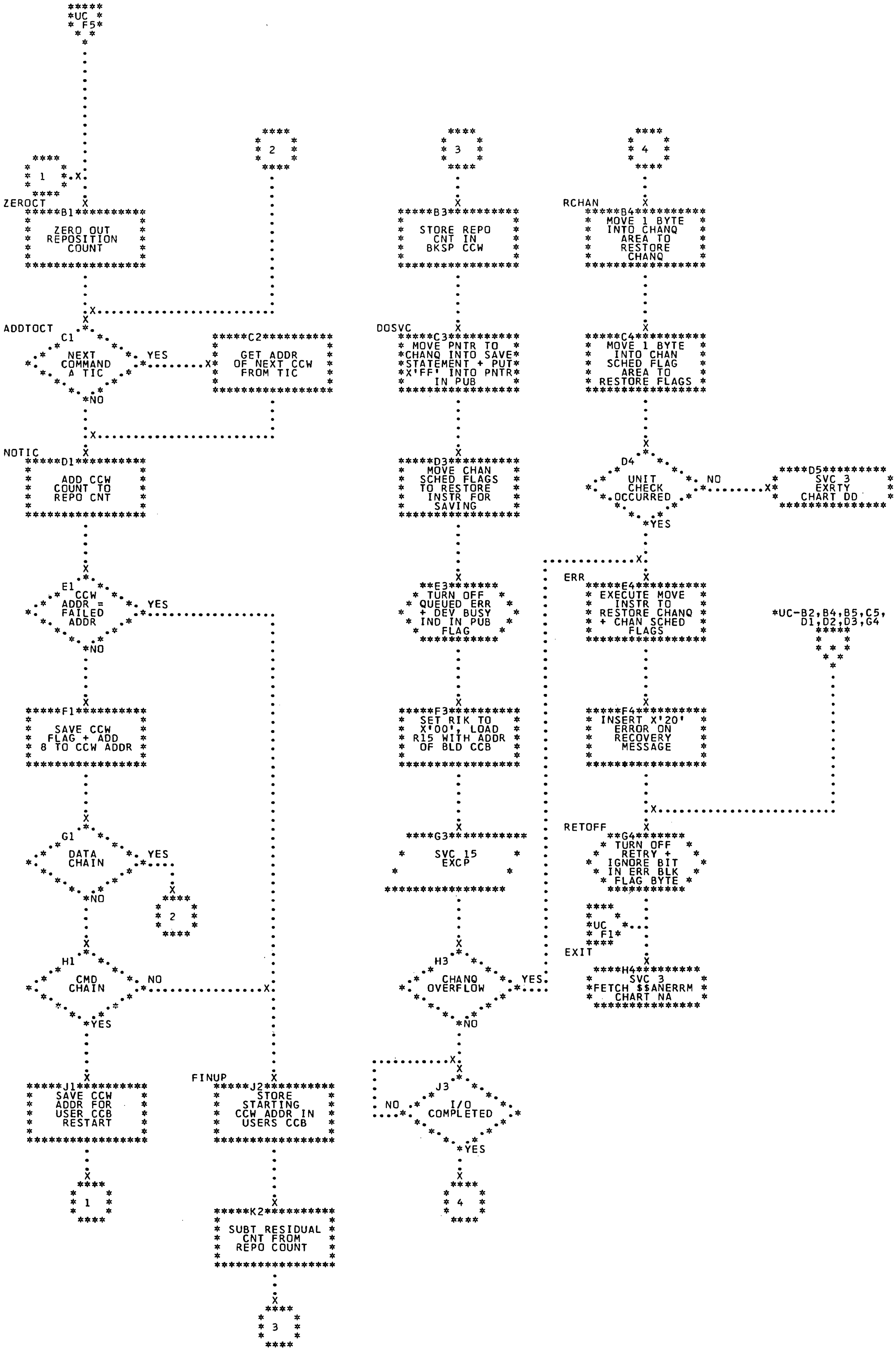


Chart UE. $$ANERR7 - Phase 2 of 2495 ERP
Refer to Chart 11.

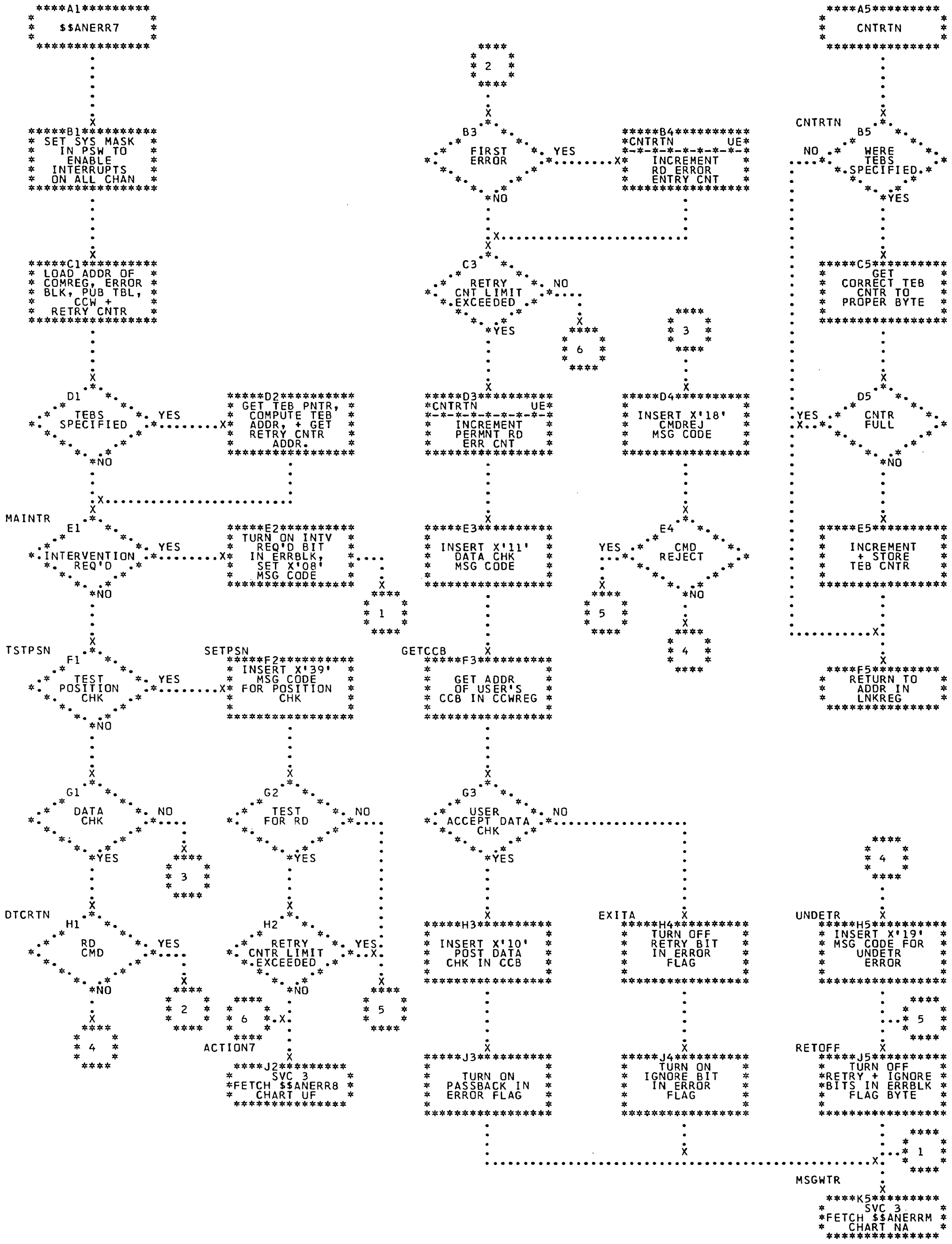


Chart UF. $$ANERR8 - Phase 3 of 2495 ERP
Refer to Chart 11.

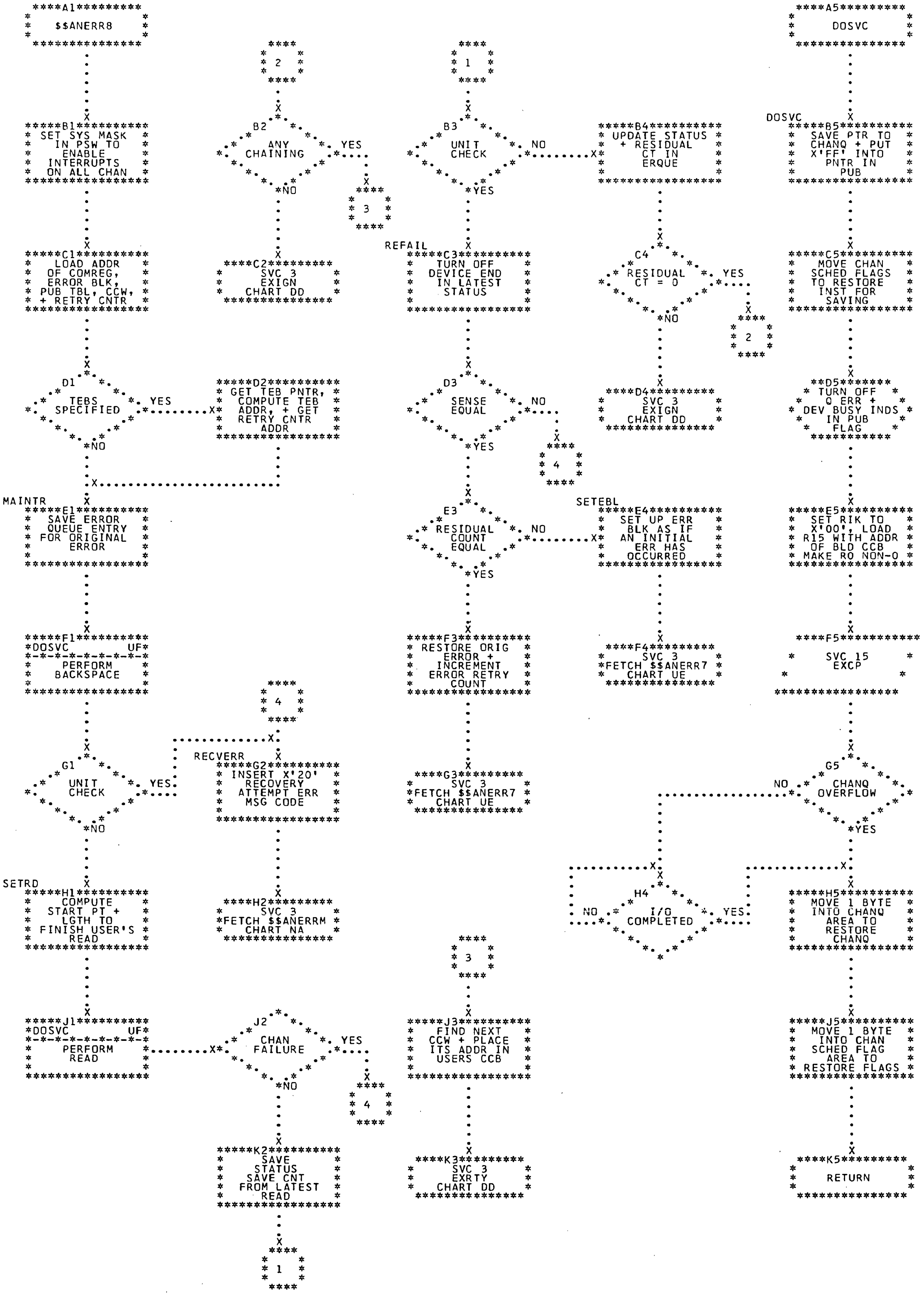


Chart UG. $$ANERAI - Phase 1 of 1017/1018 Paper Tape ERP
Refer to Chart 12.

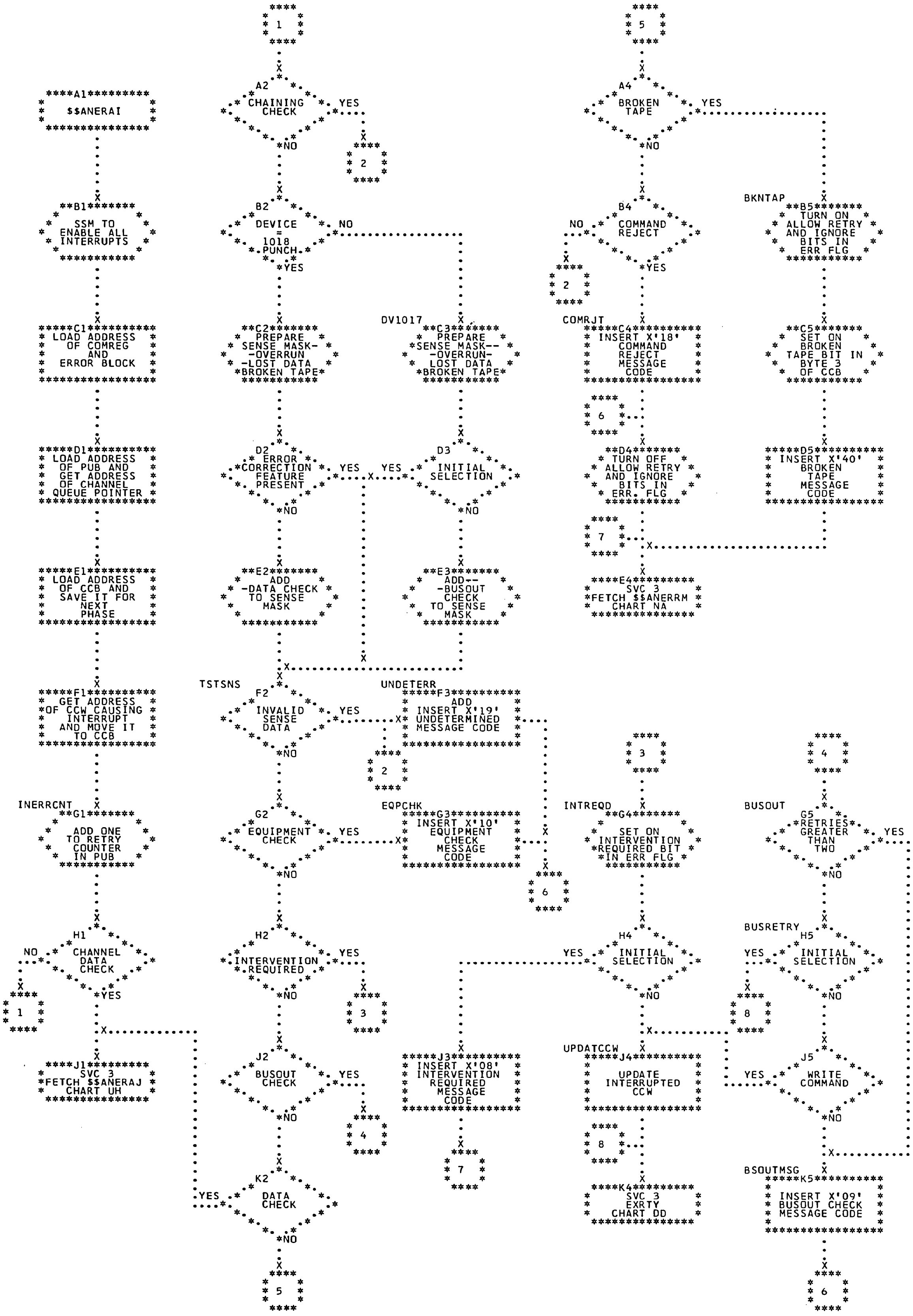


Chart UH. $$ANERAJ - Phase 2 of 1017/1018 Paper Tape ERP (Part 1 of 2)
Refer to Chart 12.

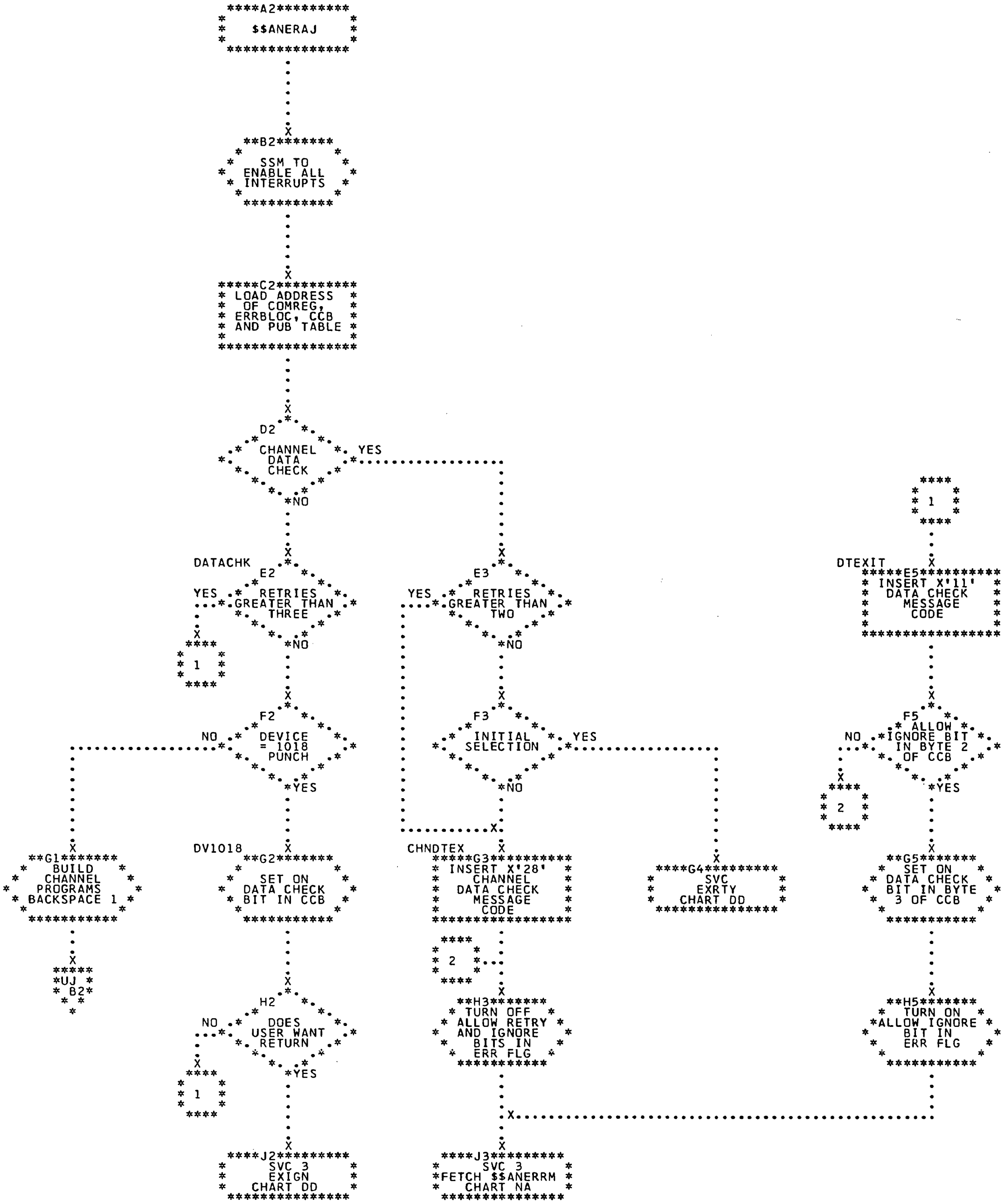


Chart UJ. $$ANERAJ - Phase 2 of 1017/1018 Paper Tape ERP (Part 2 of 2)
Refer to Chart 12.

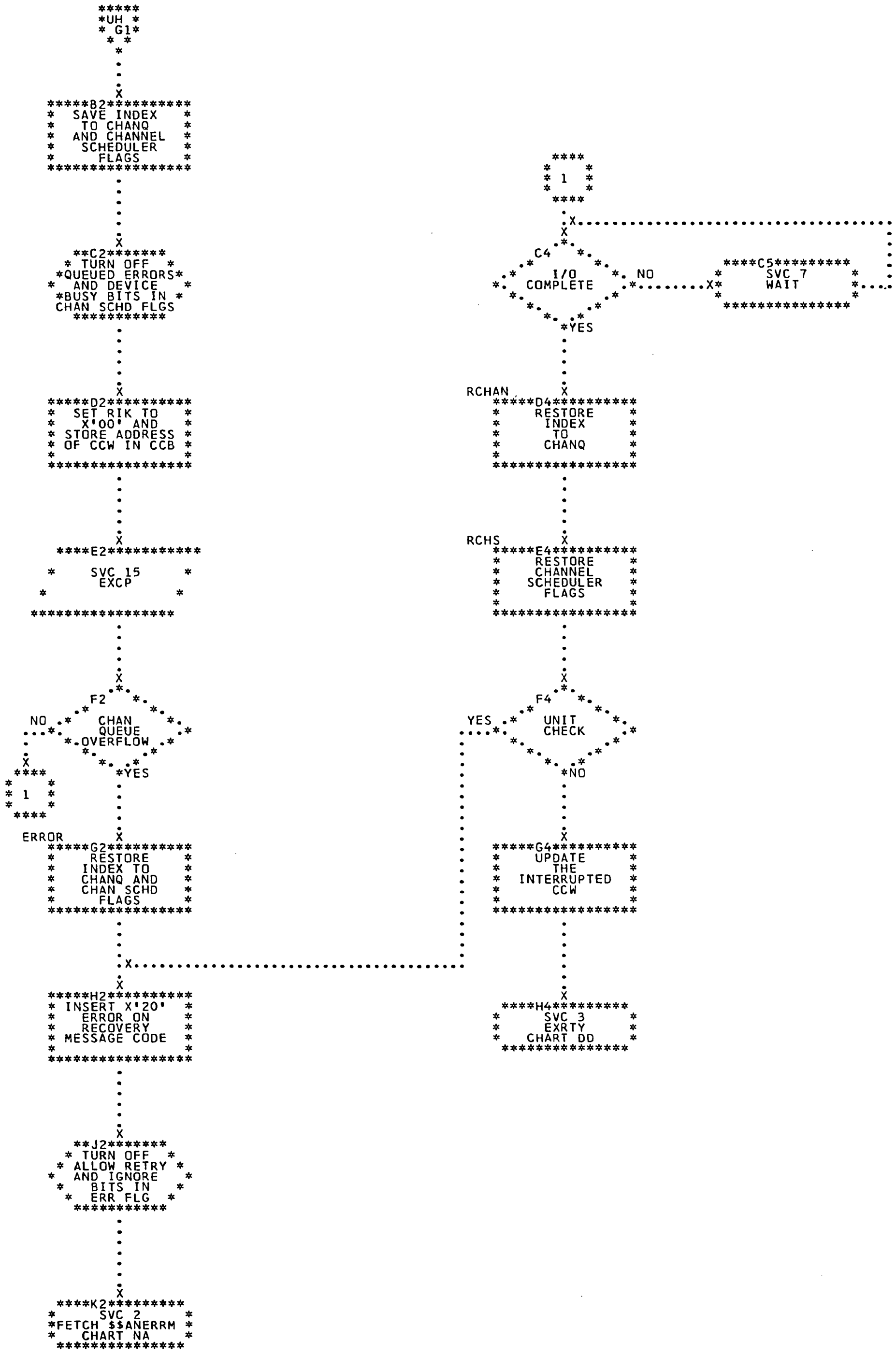


Chart UK. $$ANERSA - 3211 Printer ERP (Phase 1) (Part 1 of 4)
Refer to Chart 12.

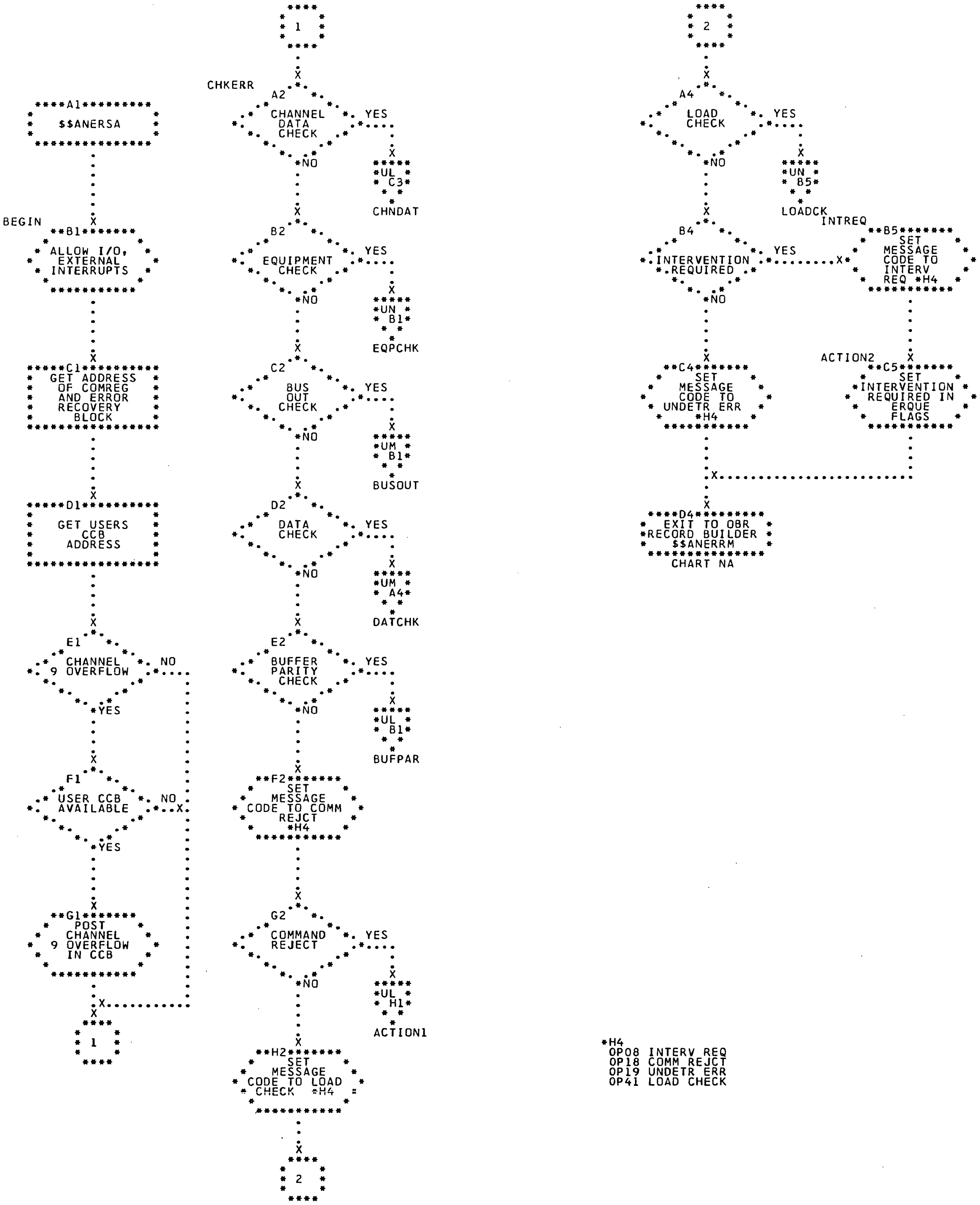
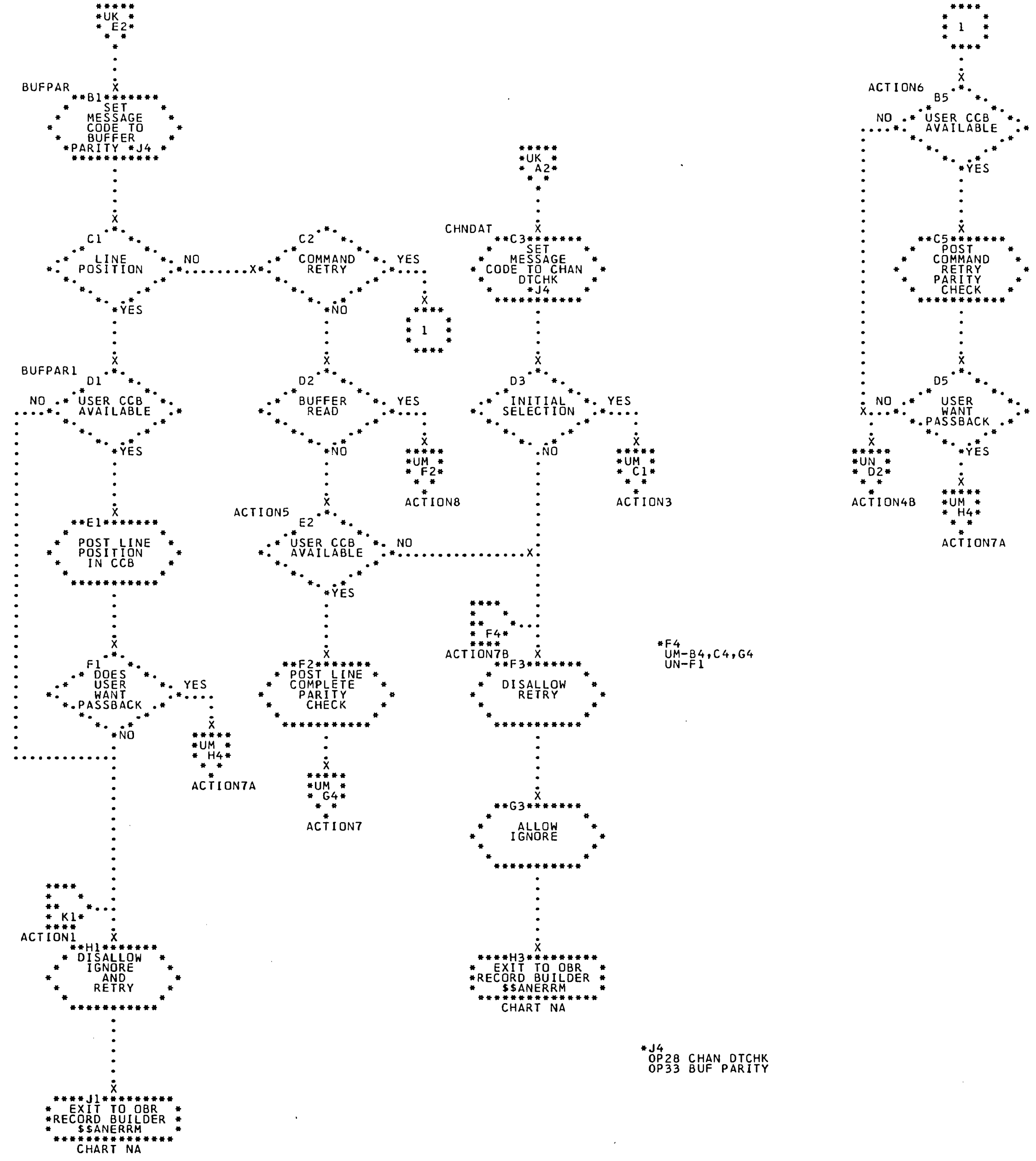


Chart UL. $$ANERSA - 3211 Printer ERP (Phase 1) (Part 2 of 4) Refer to Chart 12.



*F4
UM-B4,C4,G4
UN-F1

*J4
OP28 CHAN DTCHK
OP33 BUF PARITY

*K1
UK-G2
UM-C1
UN-D1,B5,C5

Chart UM. $$ANERSA - 3211 Printer ERP (Phase 1) (Part 3 of 4)
Refer to Chart 12.

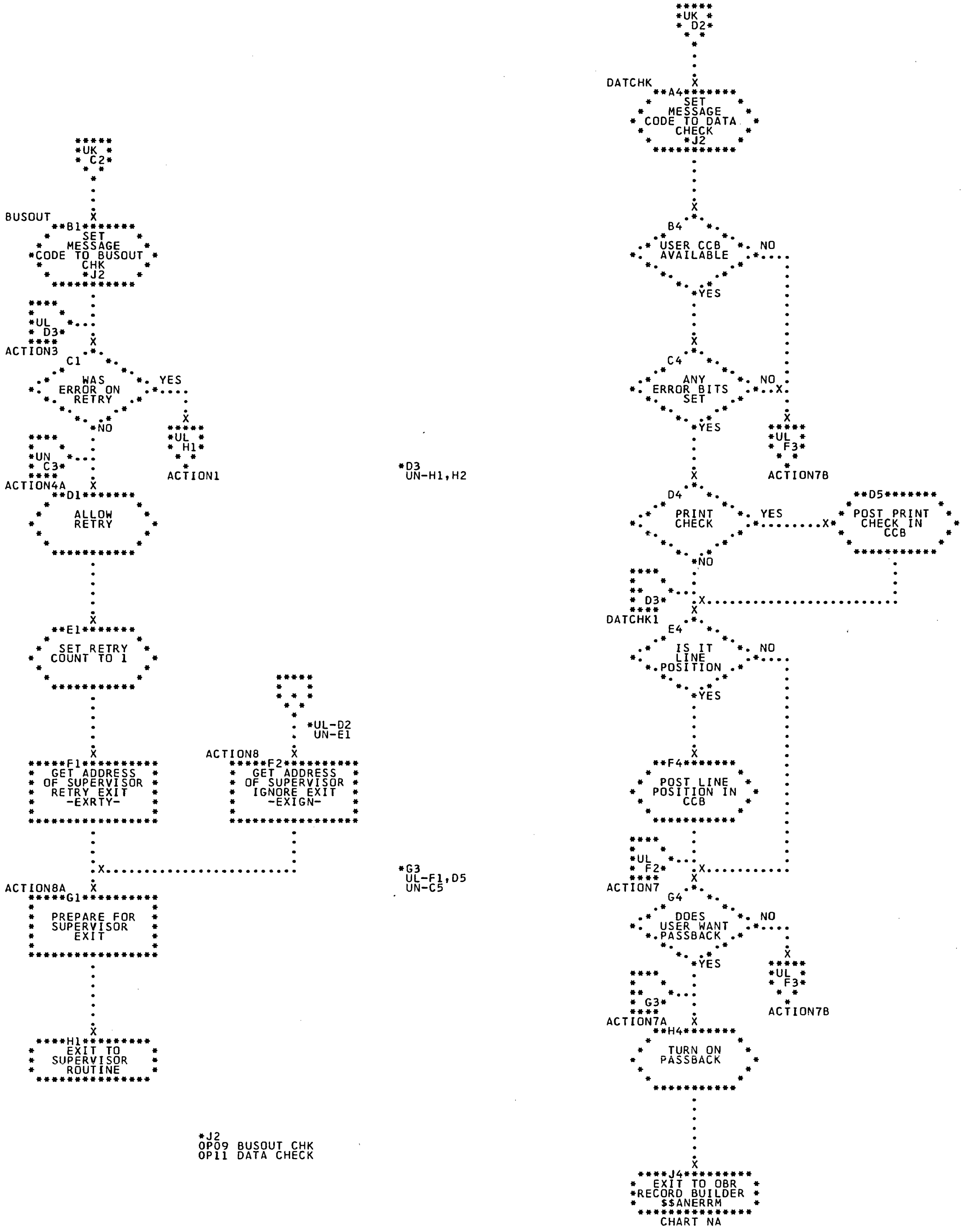


Chart UN. $$ANERSA - 3211 Printer ERP (Phase 1) (Part 4 of 4)
Refer to Chart 12.

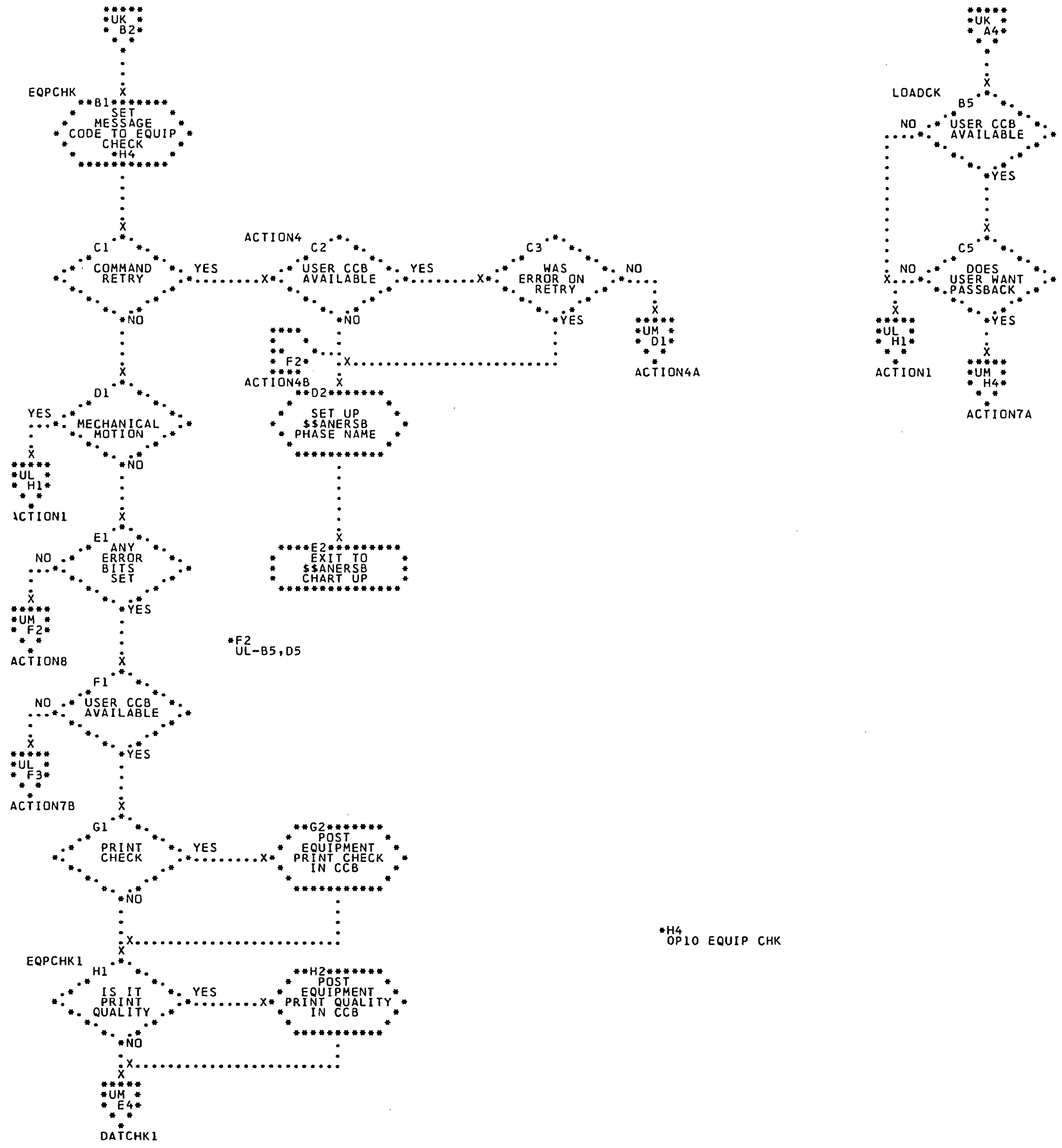


Chart UP. $$ANERSB - 3211 Printer ERP (Phase 2)
Refer to Chart 12.

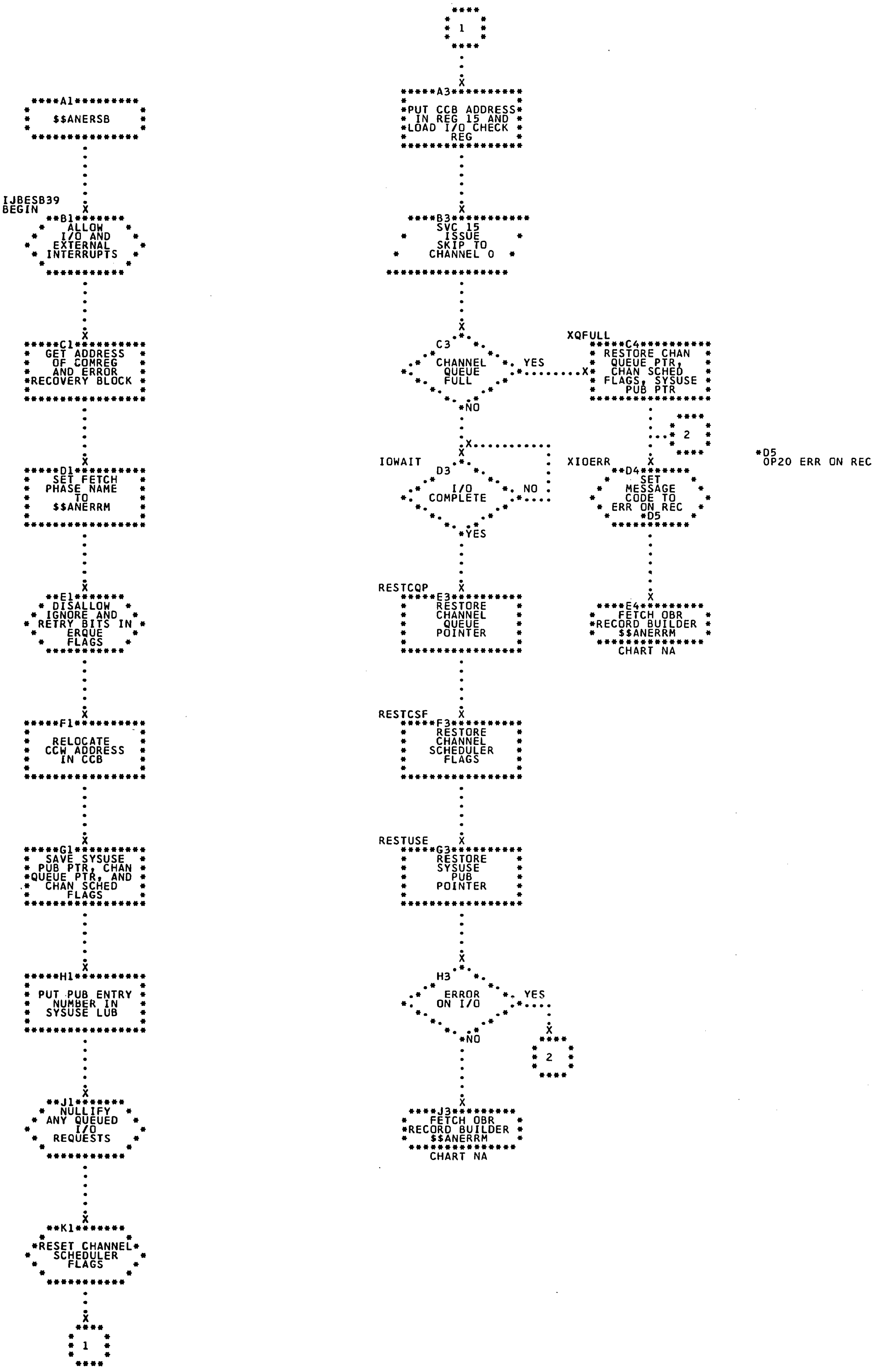


Chart UQ. $$ANERSC - 3211 OBR Record Builder (Part 1 of 2) Refer to Chart 12.

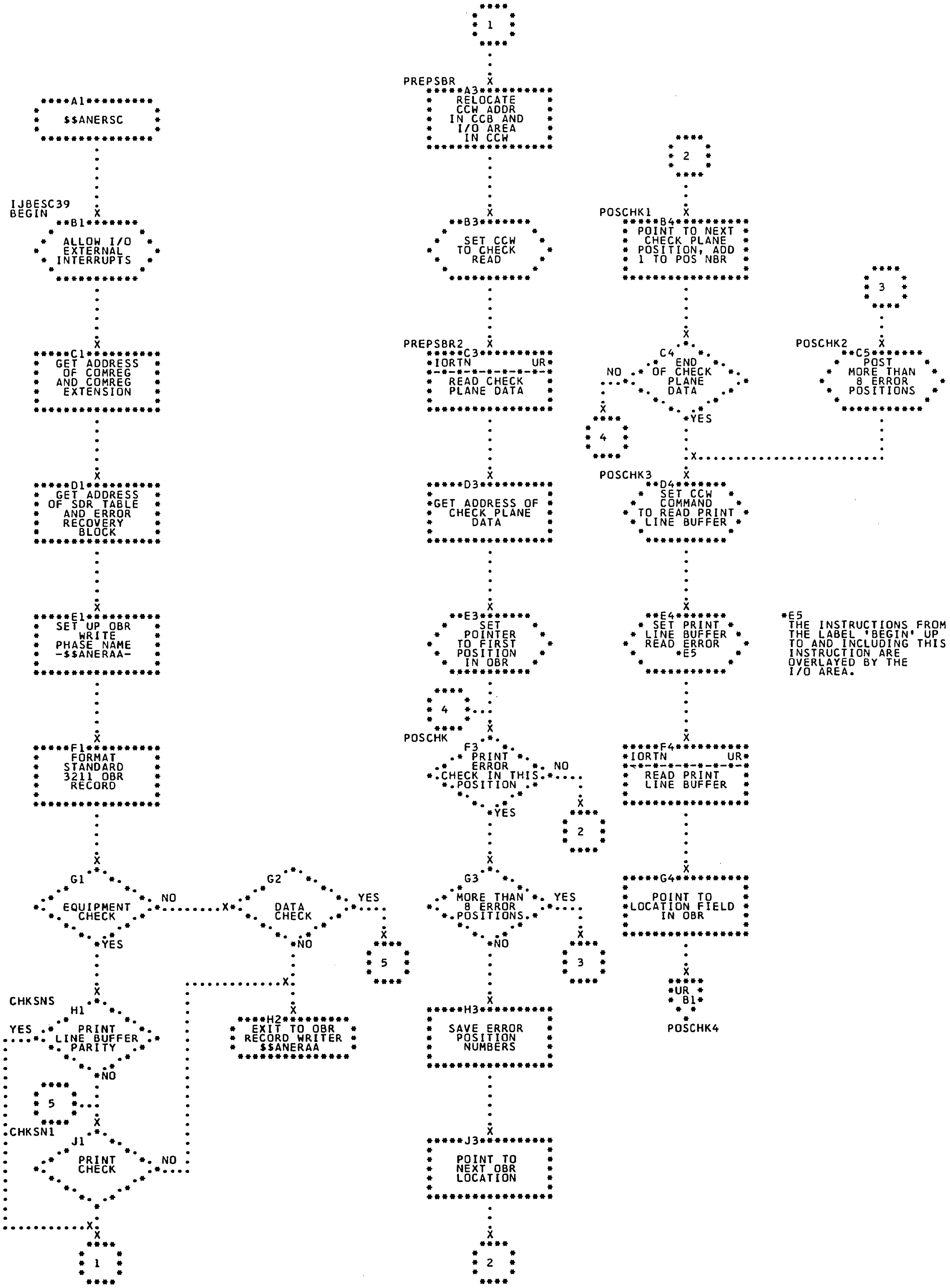


Chart UR. $$ANERSC - 3211 OBR Record Builder (Part 2 of 2)
Refer to Chart 12.

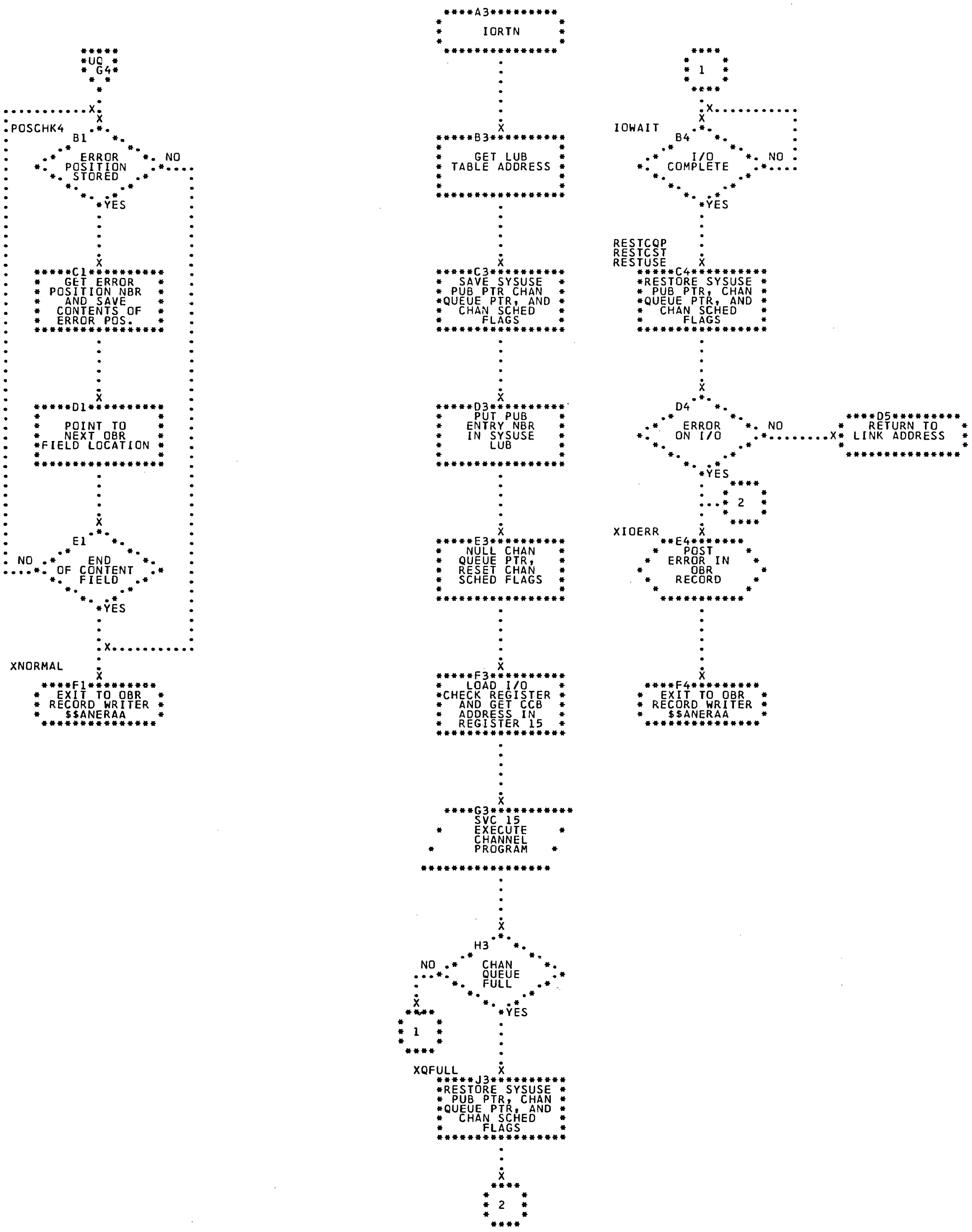


Chart VA. $$RAST00 - Initial MCAR/CCH Analysis (Part 1 of 4)
Refer to Figure 54.

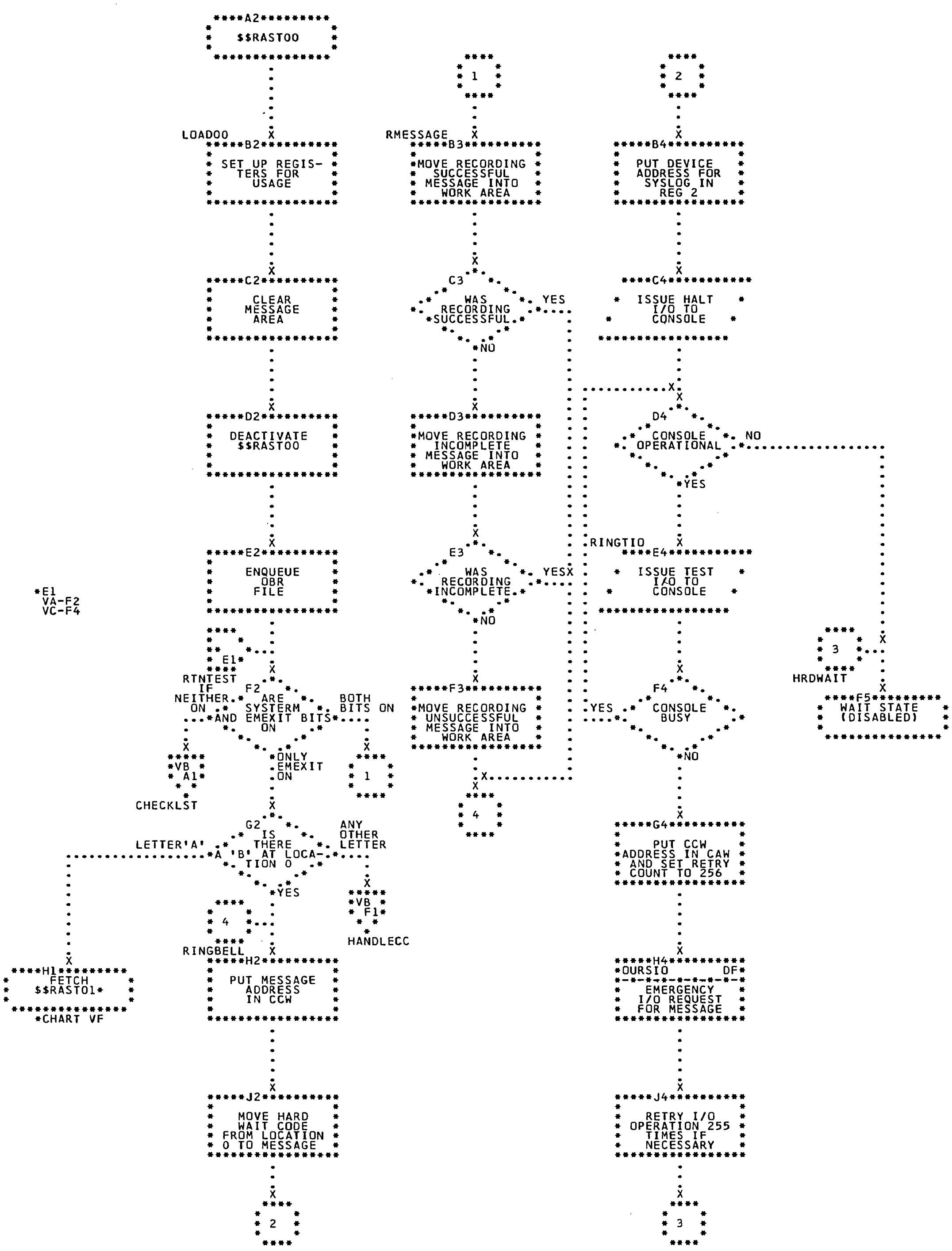


Chart VB. $$RAST00 - Initial MCAR/CCH Analysis (Part 2 of 4)
Refer to Figure 54.

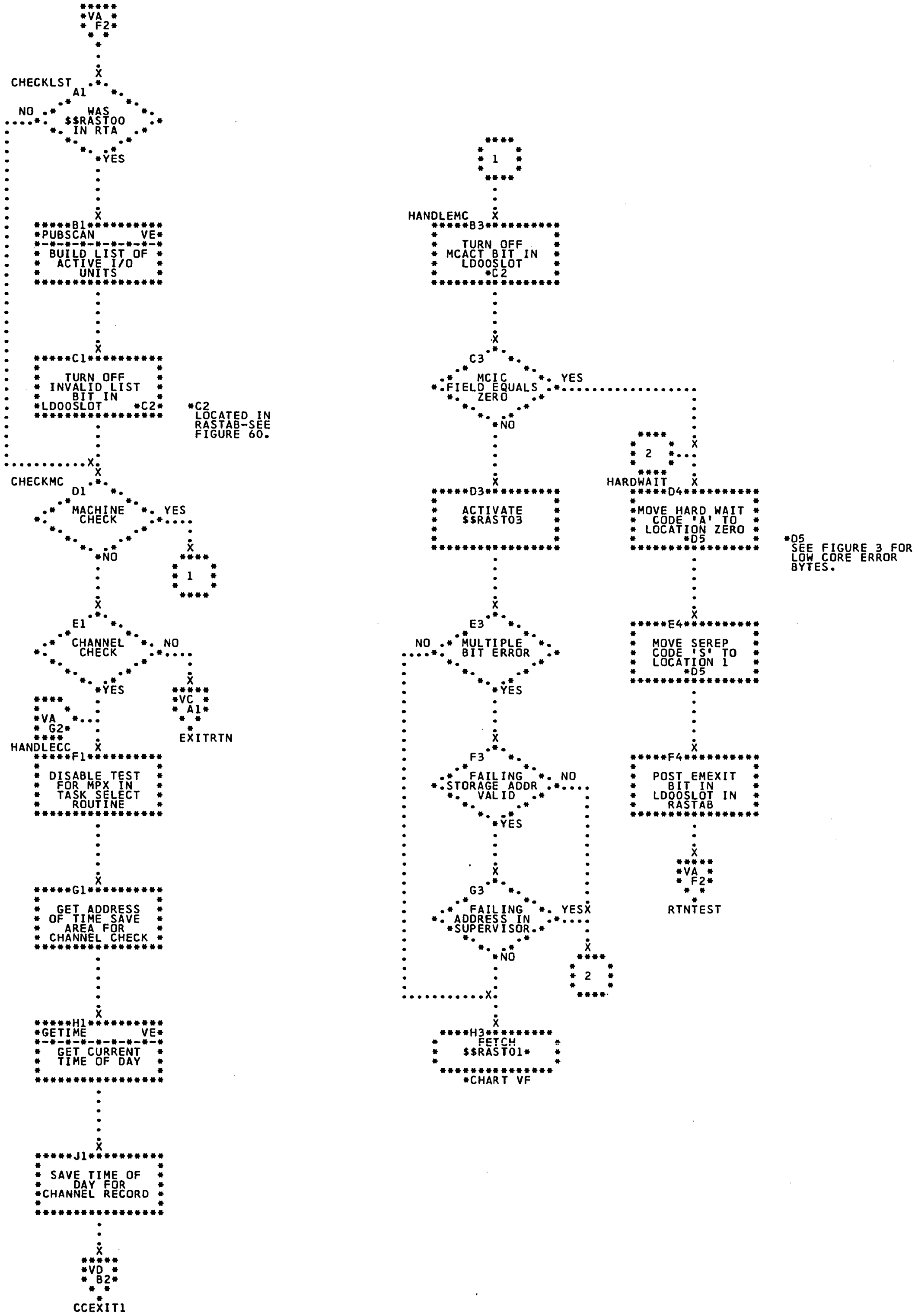


Chart VC. $$RAST00 - Initial MCAR/CCH Analysis (Part 3 of 4)
Refer to Figure 54.

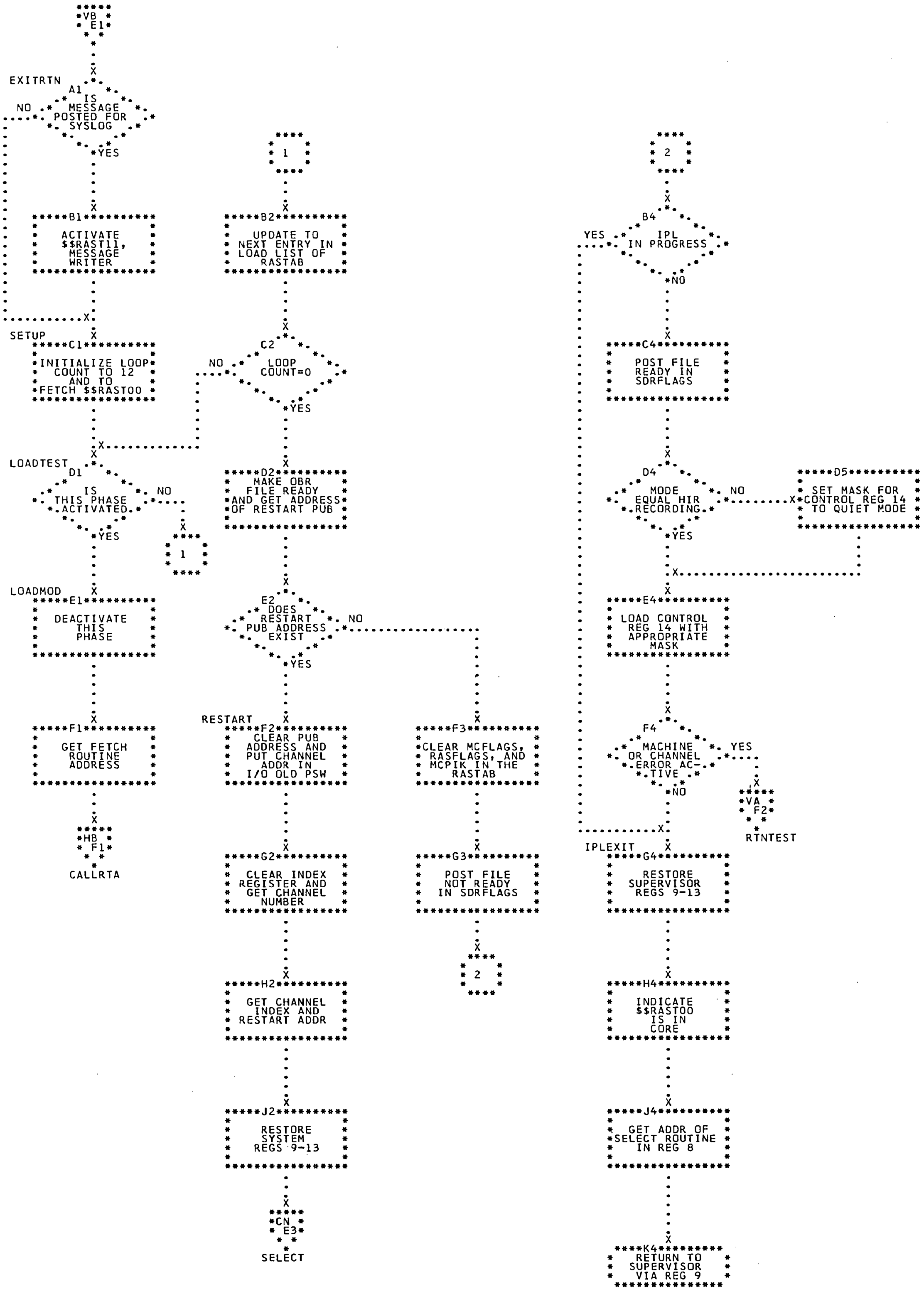


Chart VD. $$RAST00 - Initial MCAR/CCH Analysis (Part 4 of 4) Refer to Figure 54.

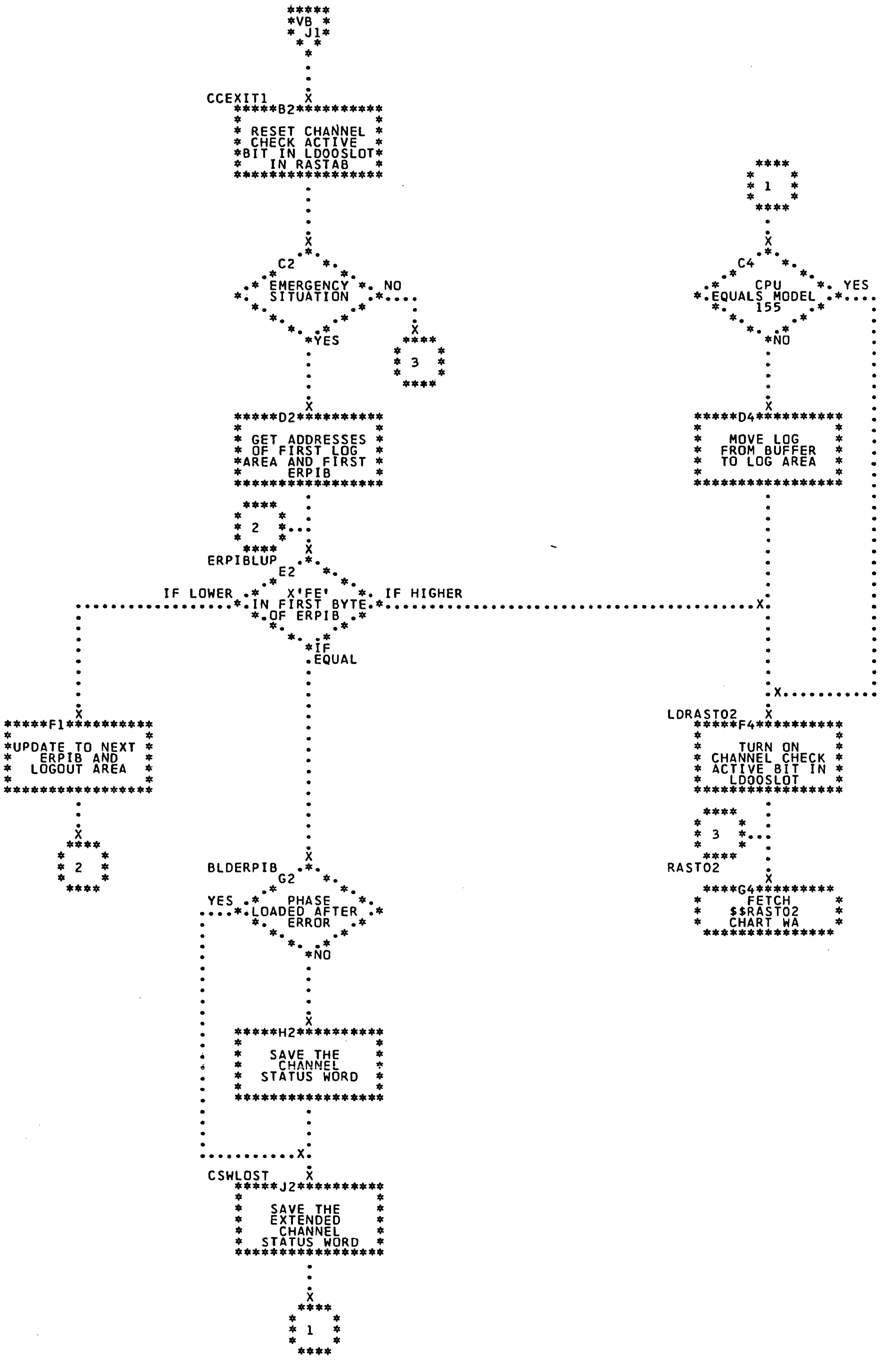


Chart VE. $$RAST00 - Subroutines
Refer to Figure 54.

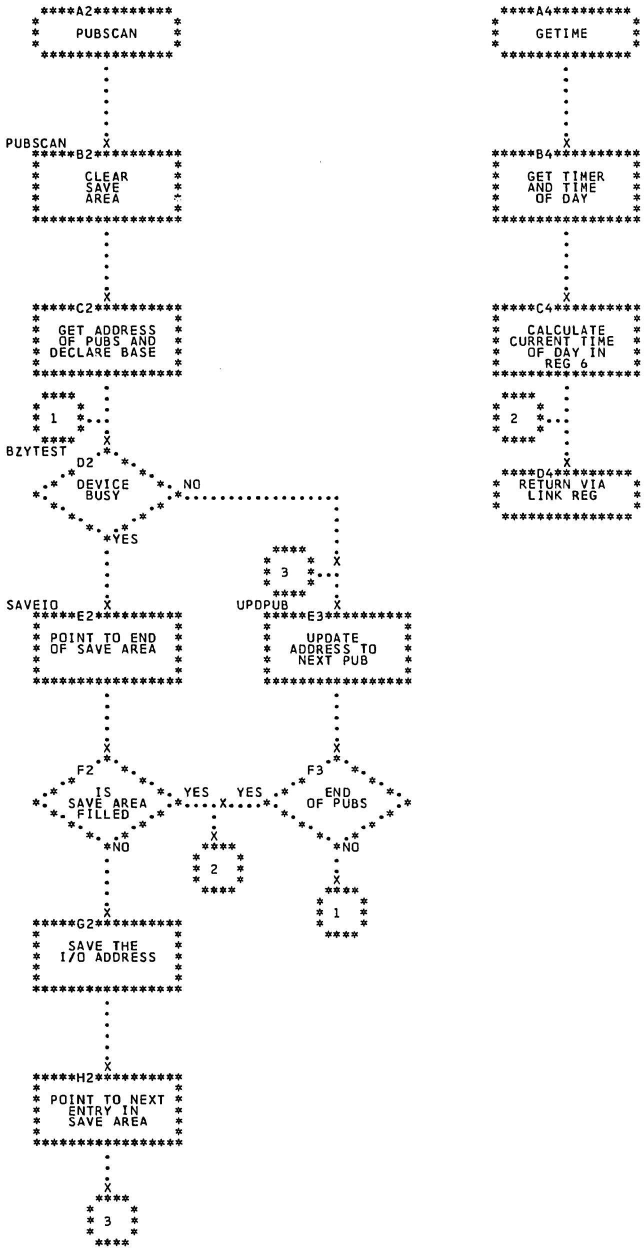


Chart VF. $$RAST01 - MCAR/CCH Record Builder (Part 1 of 5)
Refer to Figure 54.

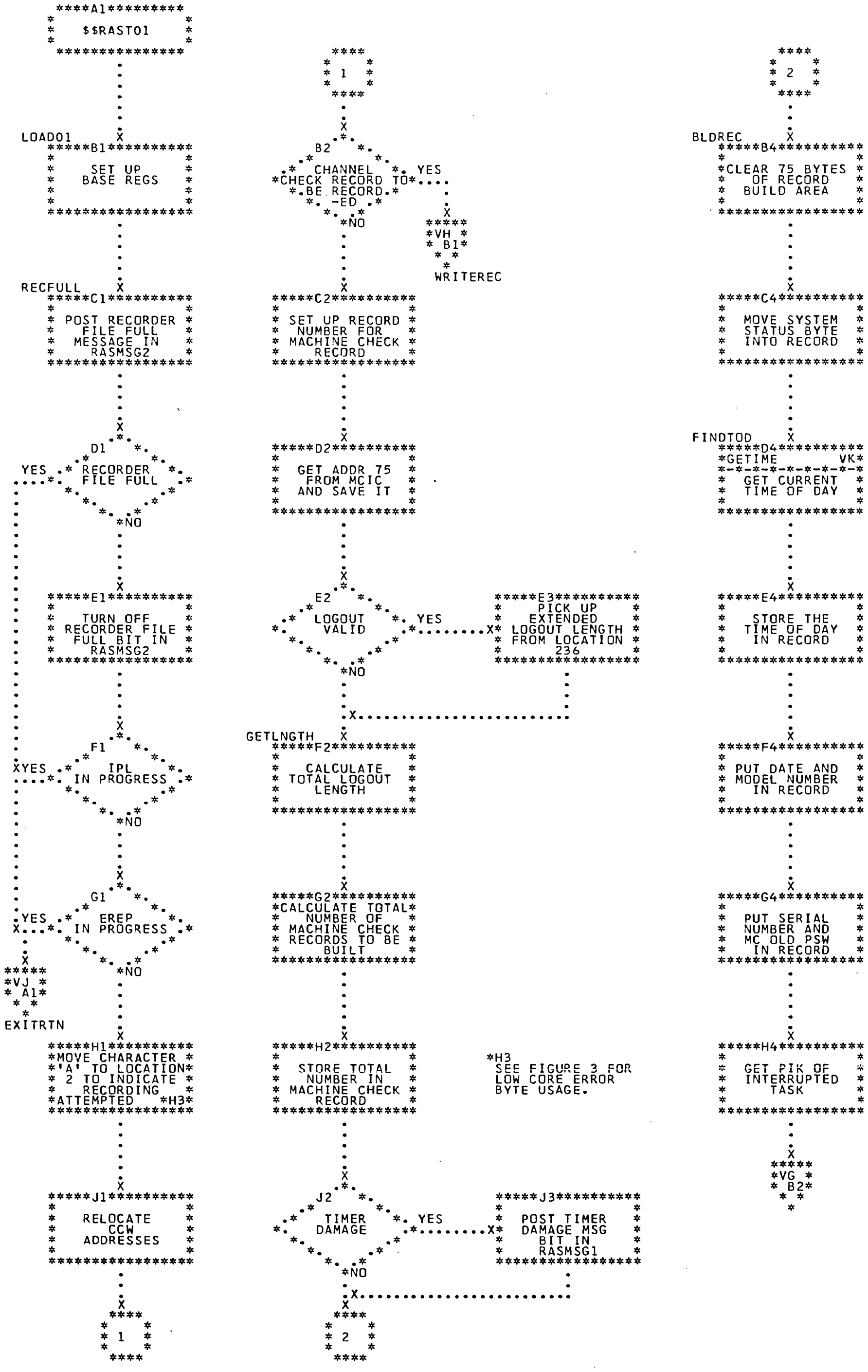


Chart VG. $$RAST01 - MCAR/CCH Record Builder (Part 2 of 5)
Refer to Figure 54.

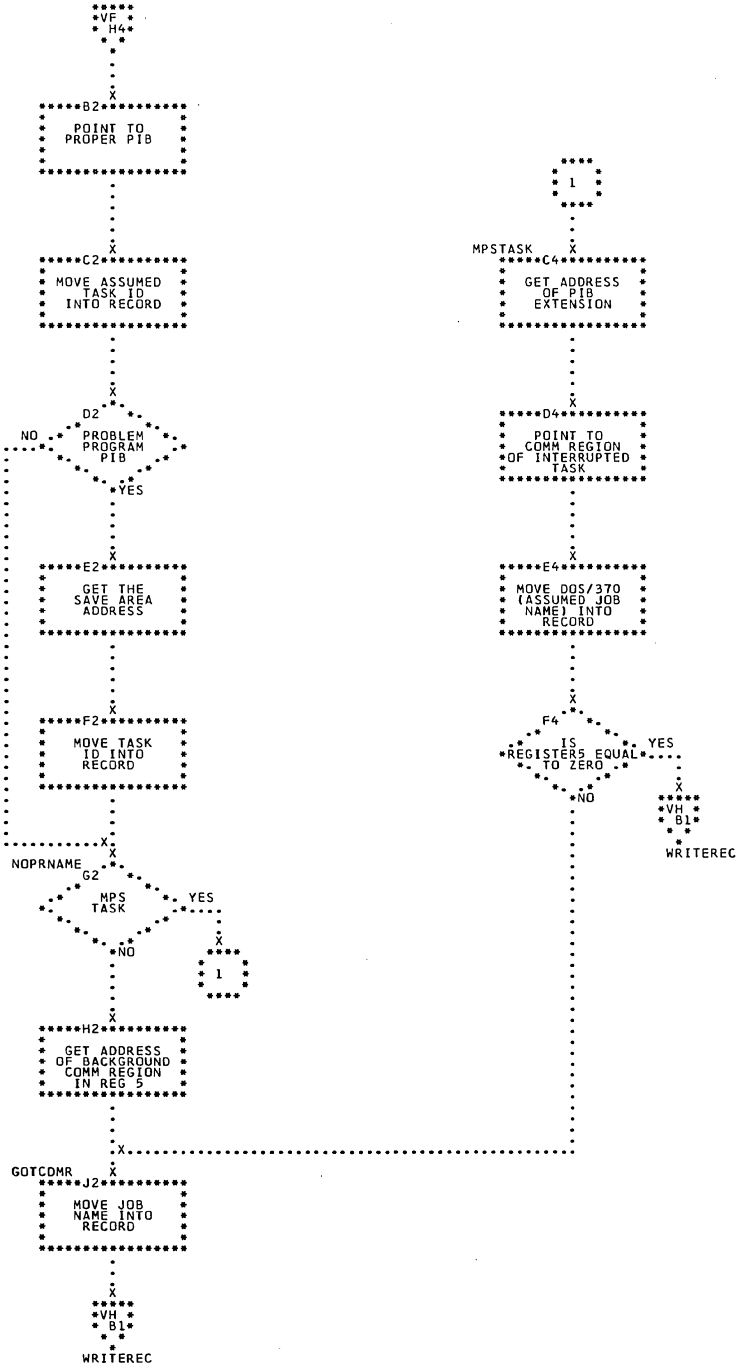


Chart VH. $$RAST01 - MCAR/CCH Record Builder (Part 3 of 5) Refer to Figure 54.

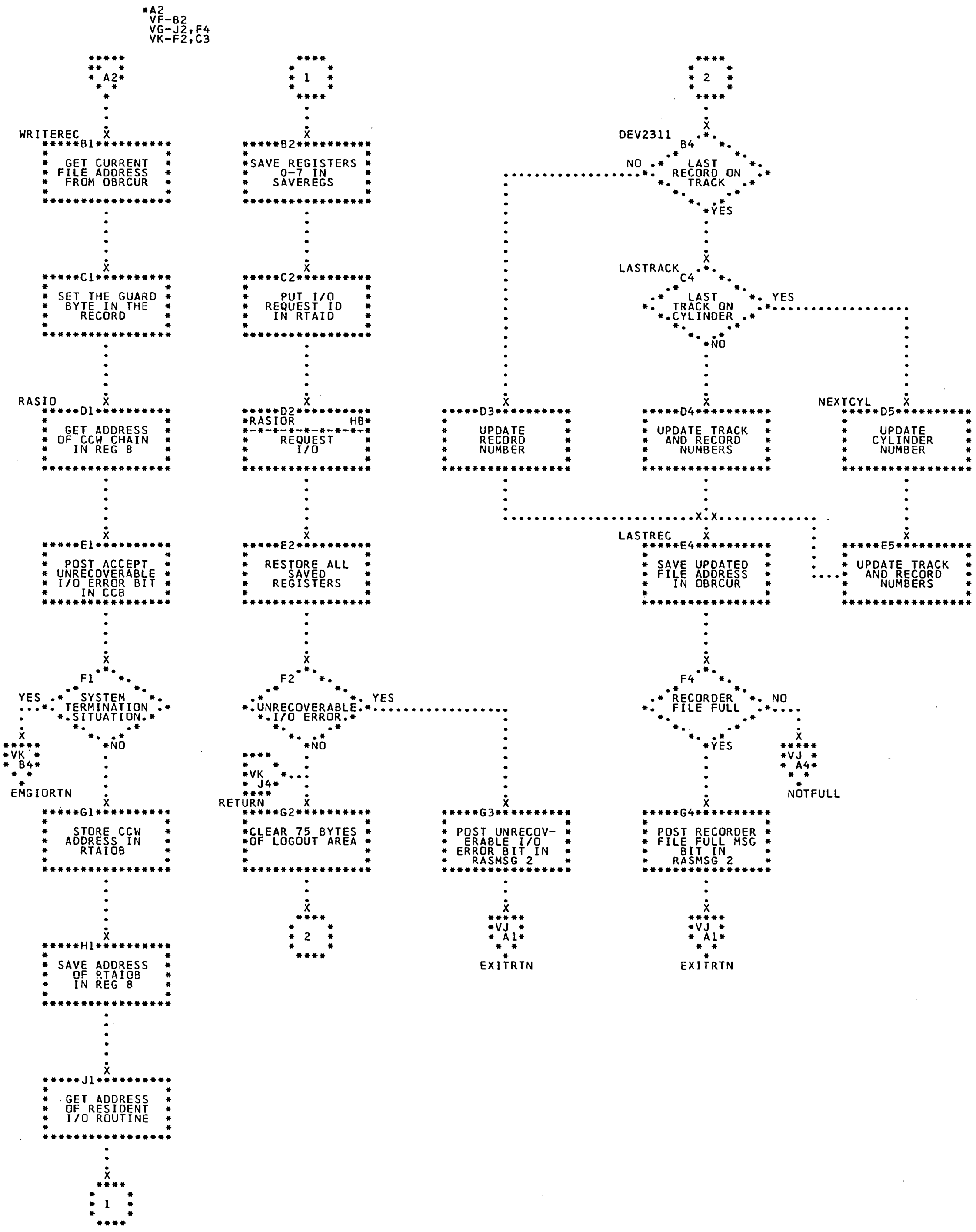


Chart VJ. $$RAST01 - MCAR/CCH Record Builder (Part 4 of 5)
Refer to Figure 54.

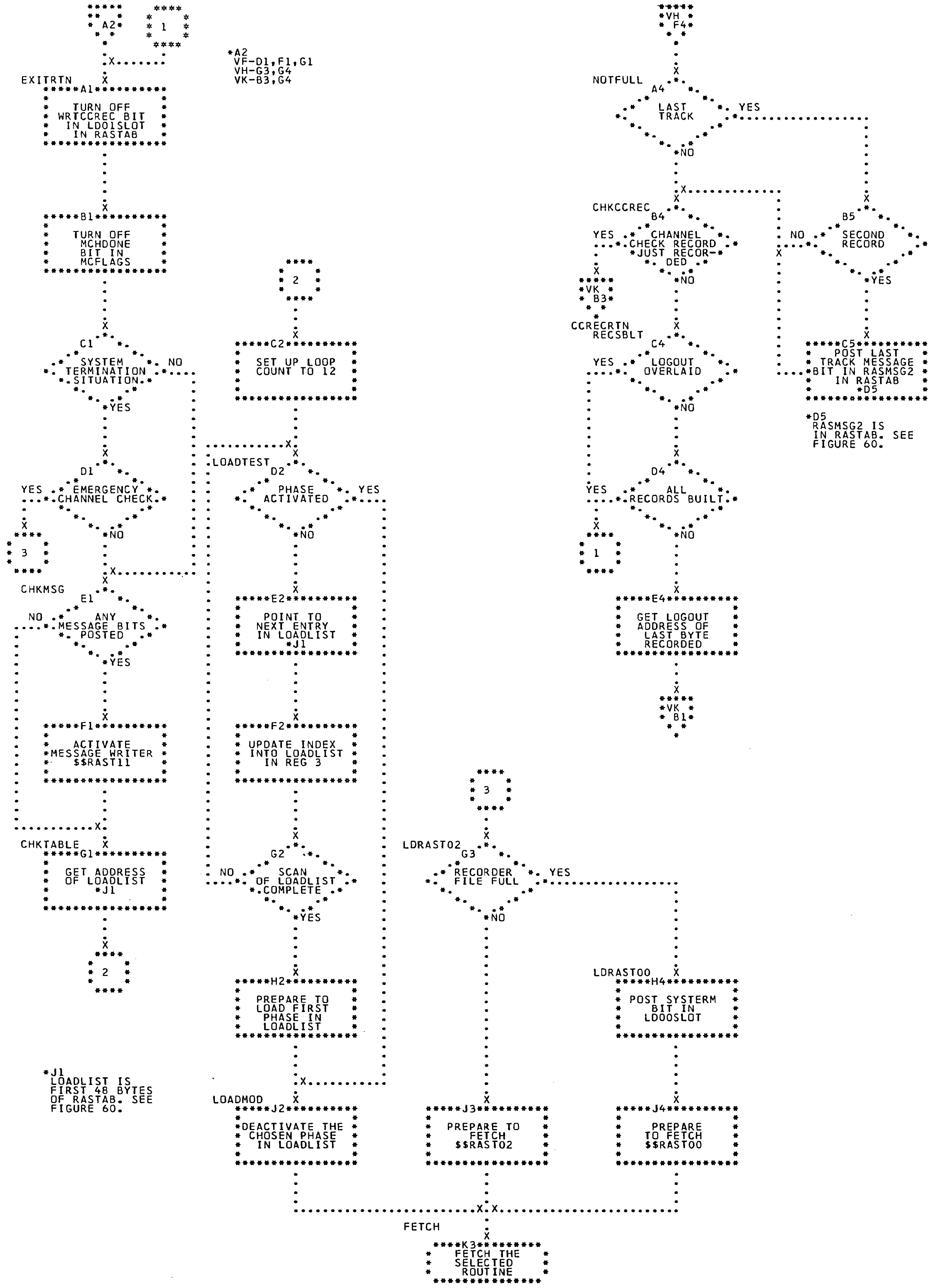


Chart VK. $$RAST01 - MCAR/CCH Record Builder (Part 5 of 5)
Refer to Figure 54.

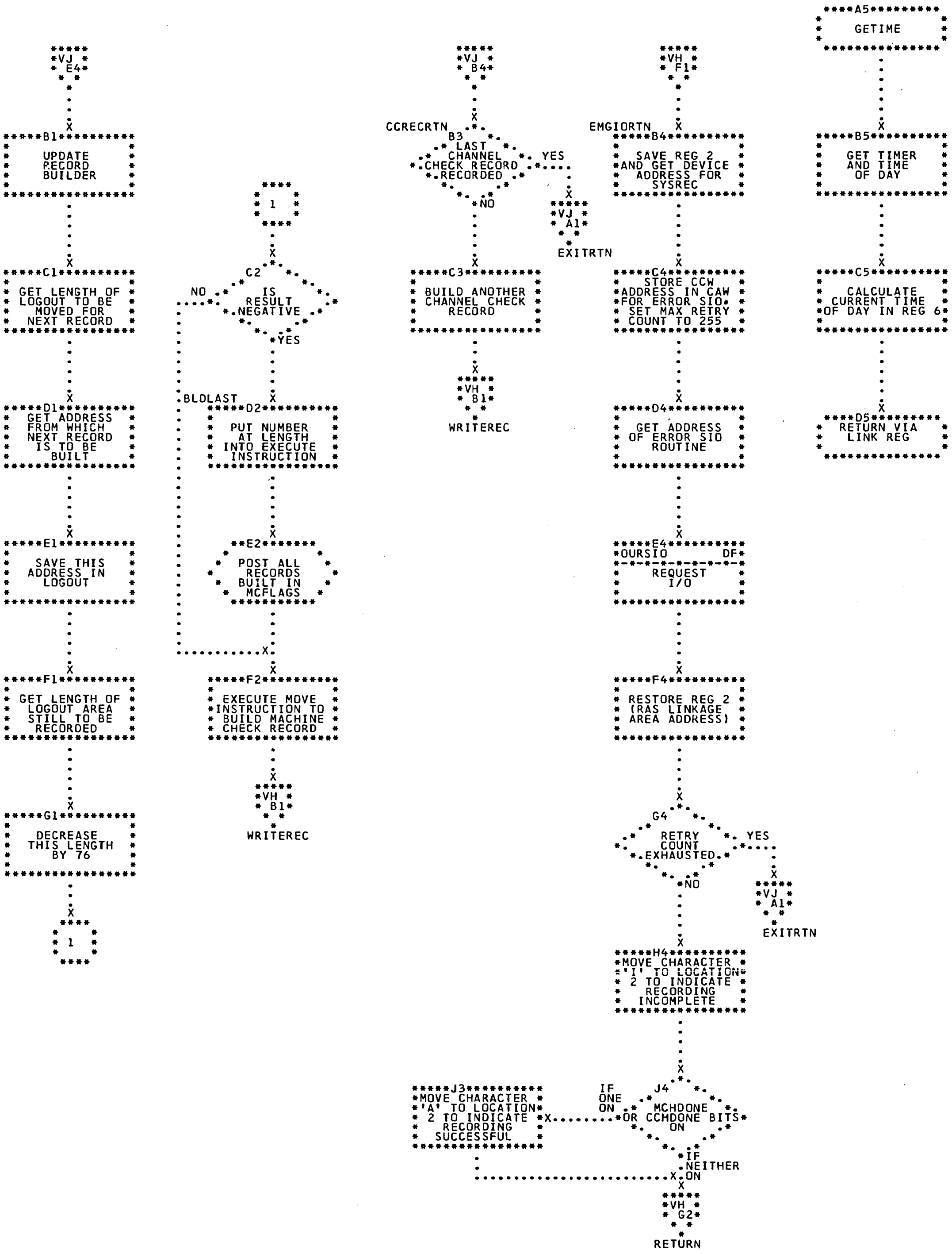


Chart WA. $$RAST02 - Nonresident Channel Check Handler (Part 1 of 3)
Refer to Figure 54.

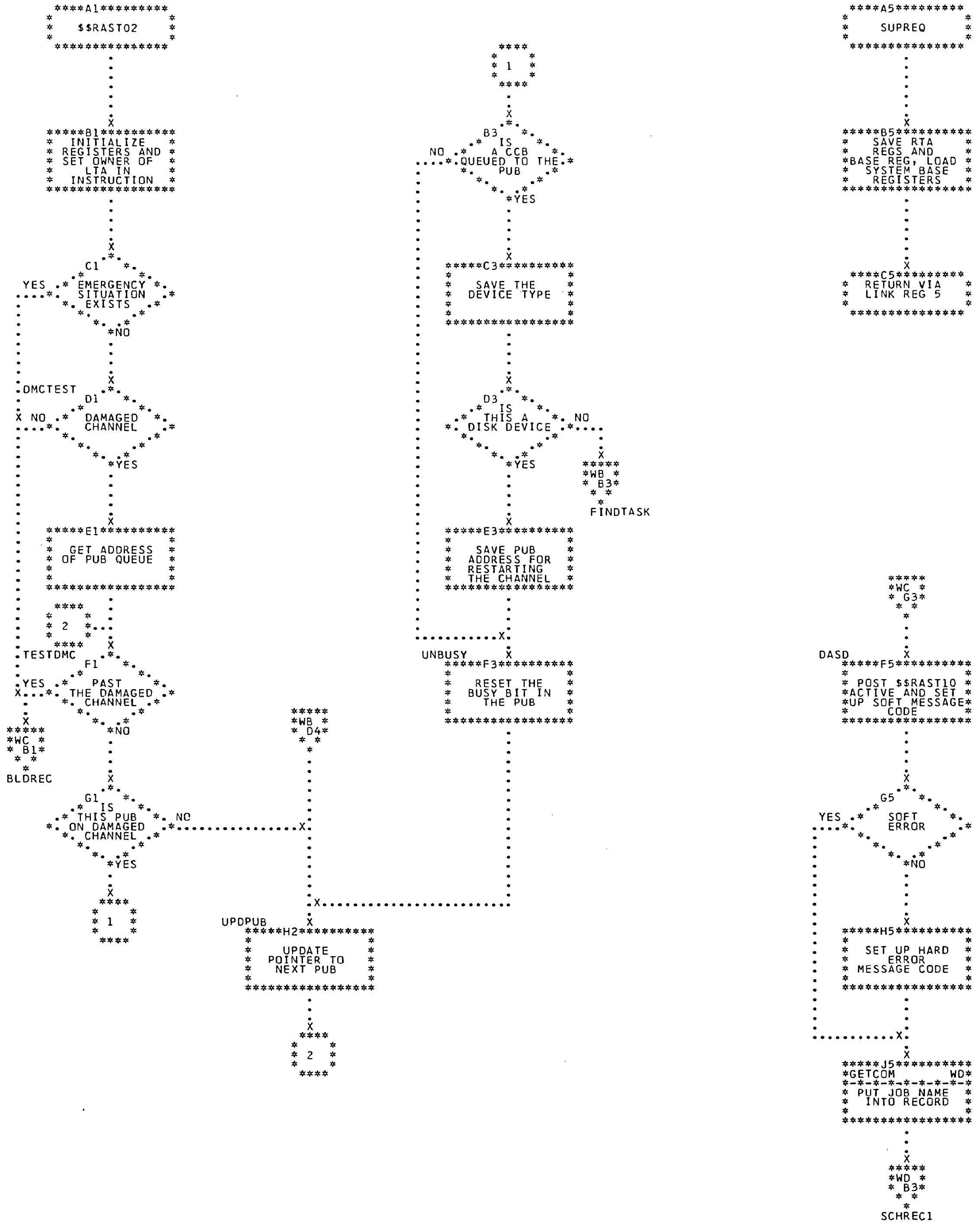


Chart WB. $$RAST02 - Nonresident Channel Check Handler (Part 2 of 3)
Refer to Figure 54.

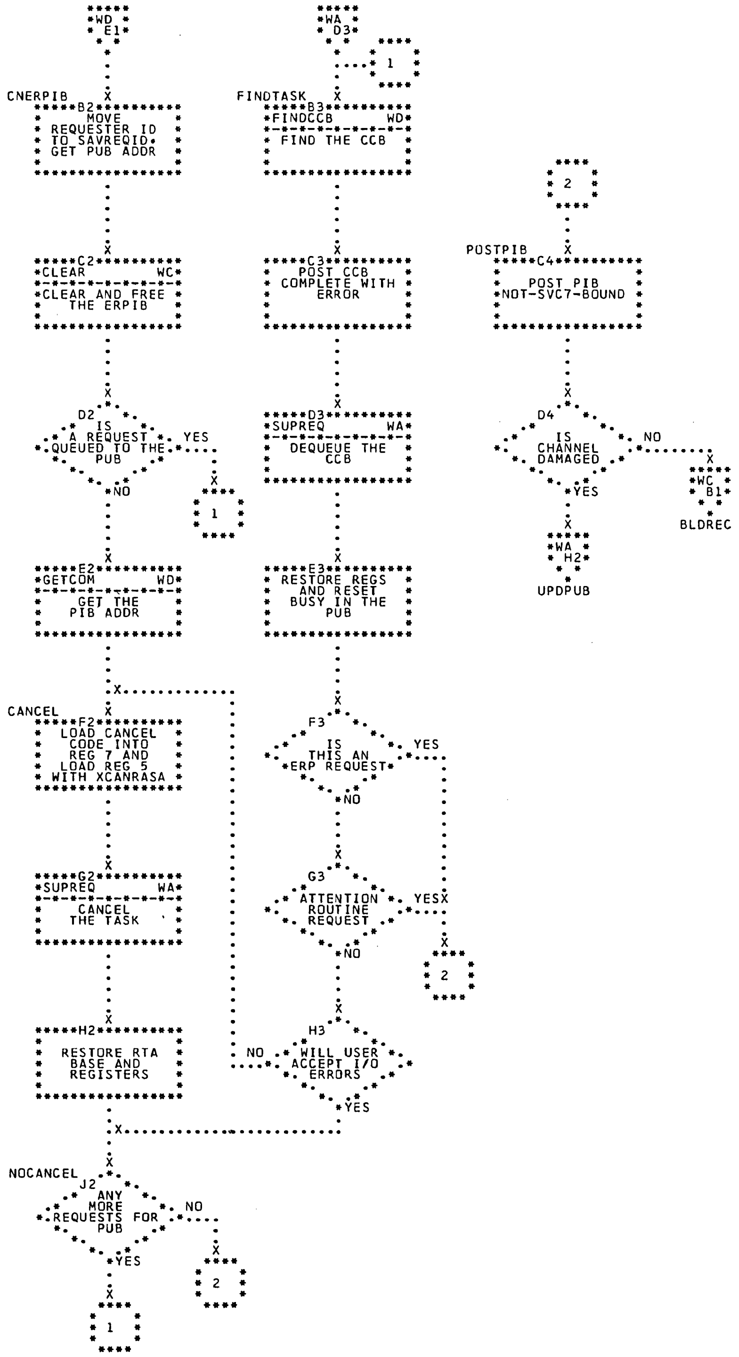


Chart WC. $$RAST02 - Nonresident Channel Check Handler (Part 3 of 3)
Refer to Figure 54.

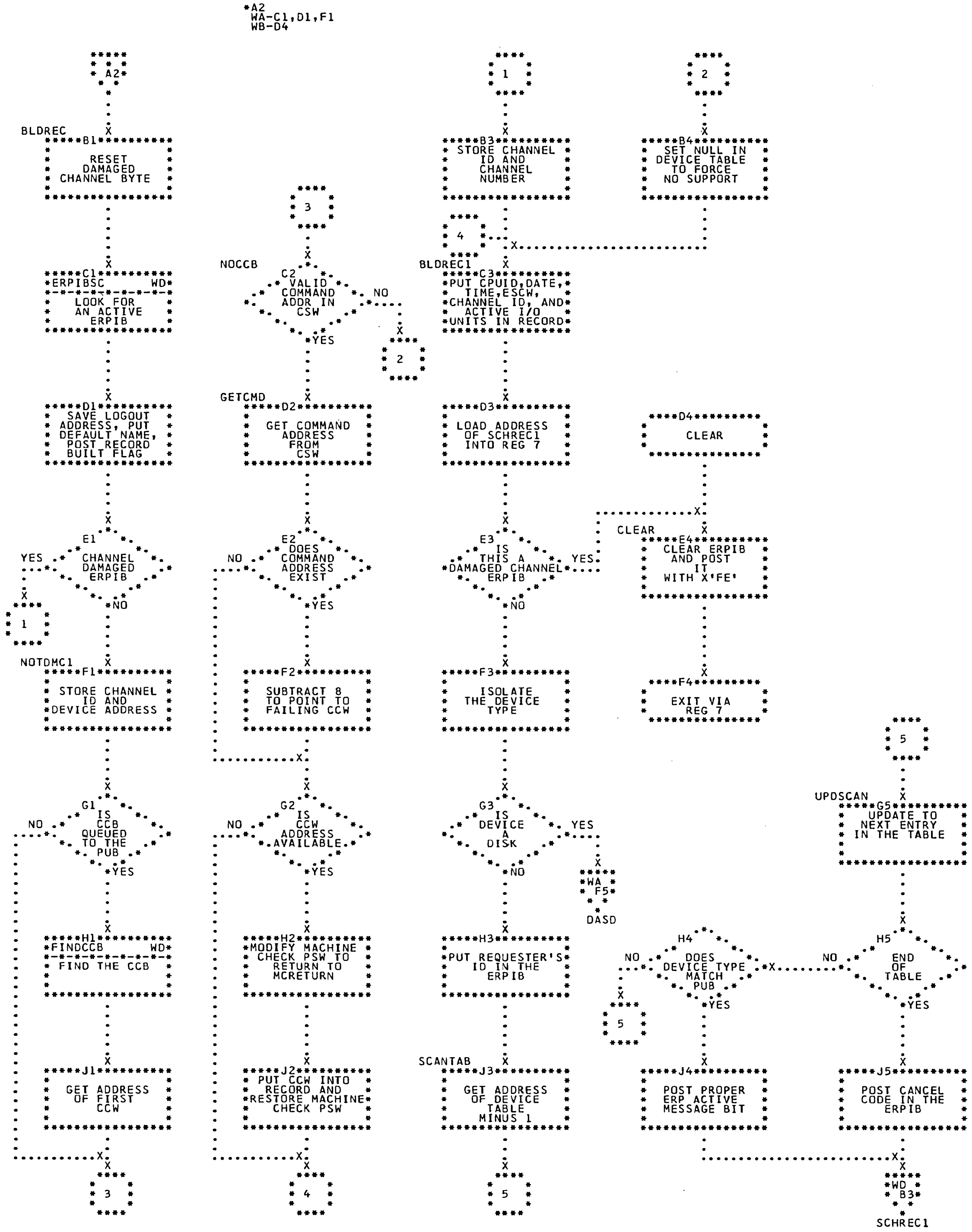


Chart WD. $$RAST02 - Subroutines
Refer to Figure 54.

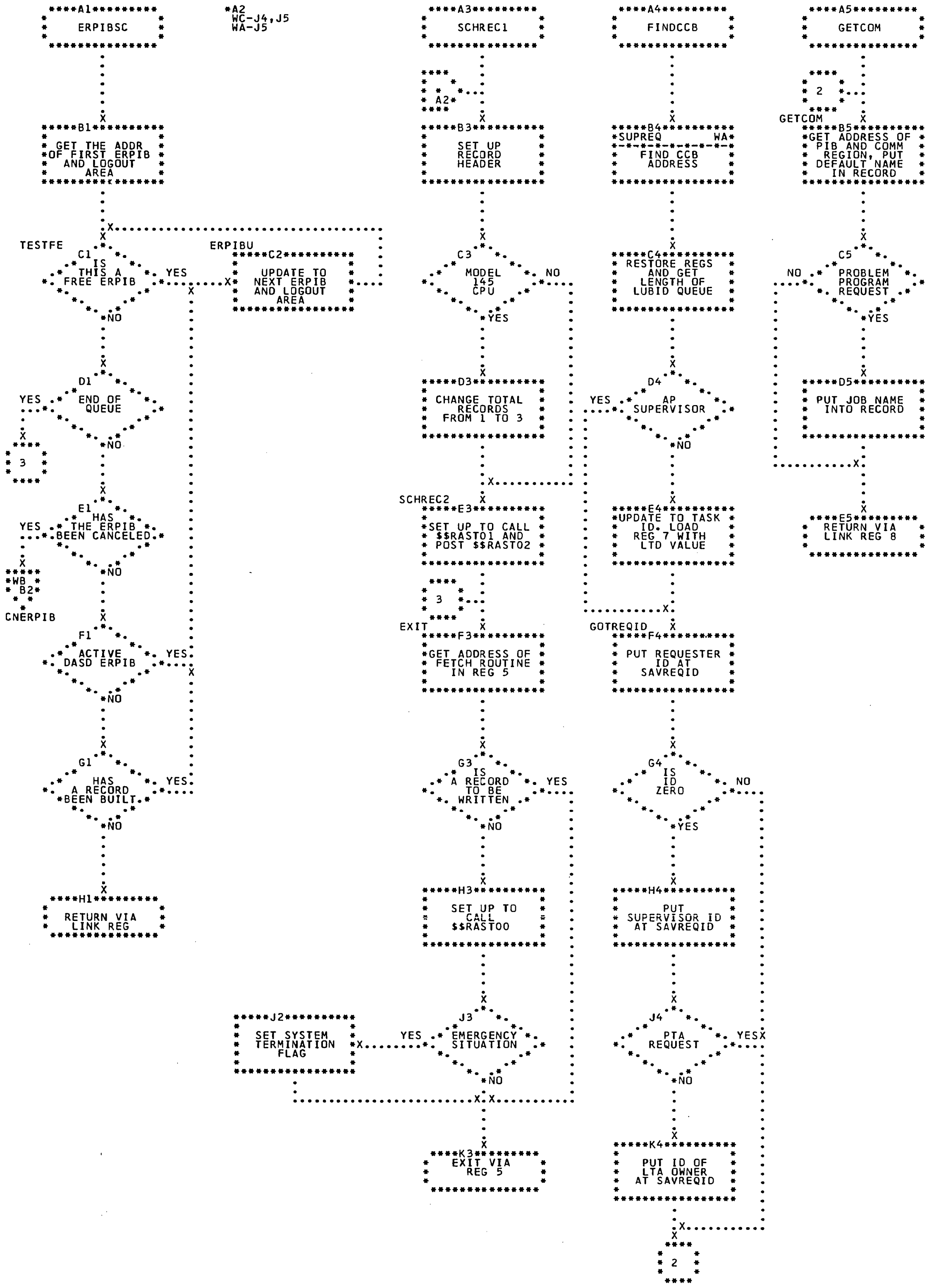


Chart WE. $$RAST03 - Machine Check Repair / EFL Functions (Part 1 of 4)
Refer to Figure 54.

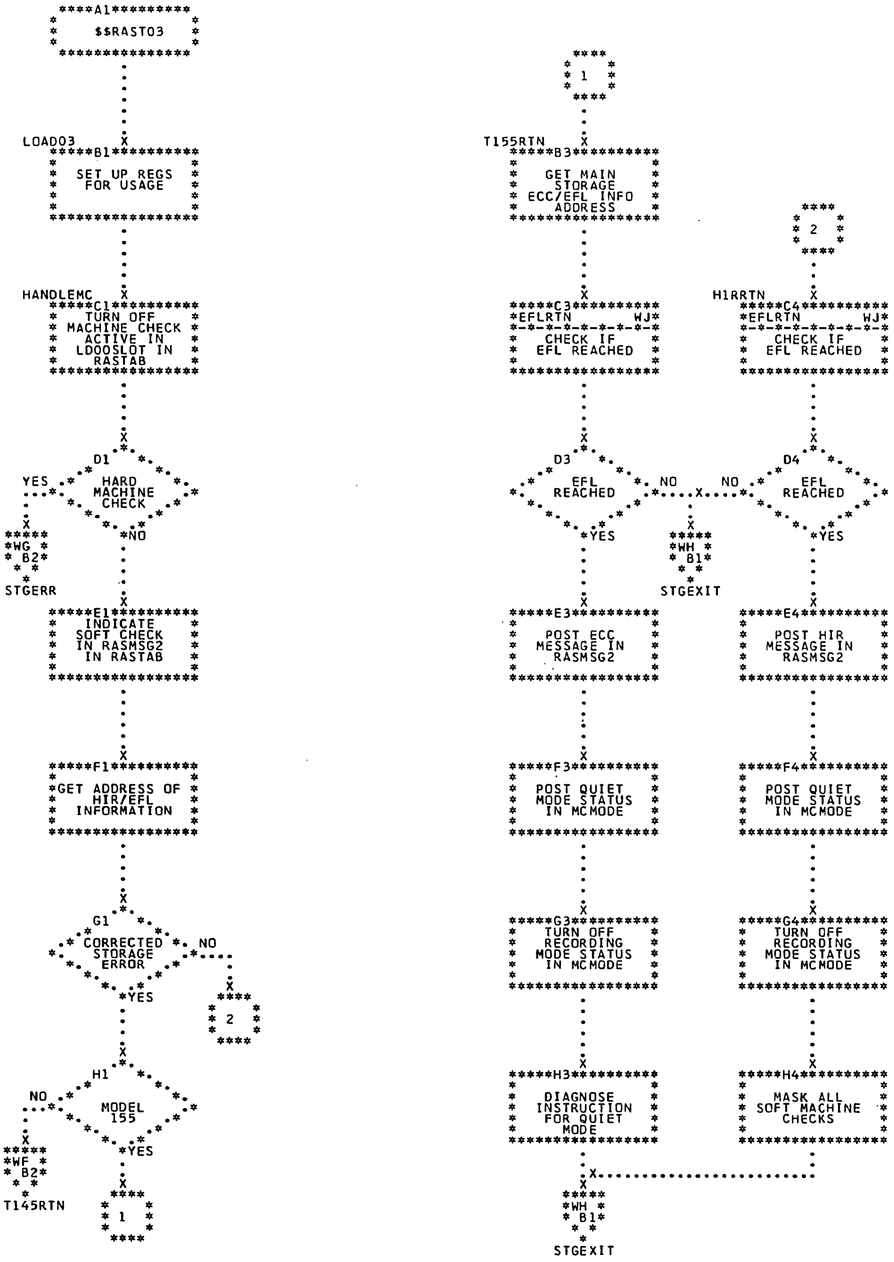


Chart WF. $$RAST03 - Machine Check Repair / EFL Functions (Part 2 of 4)
Refer to Figure 54.

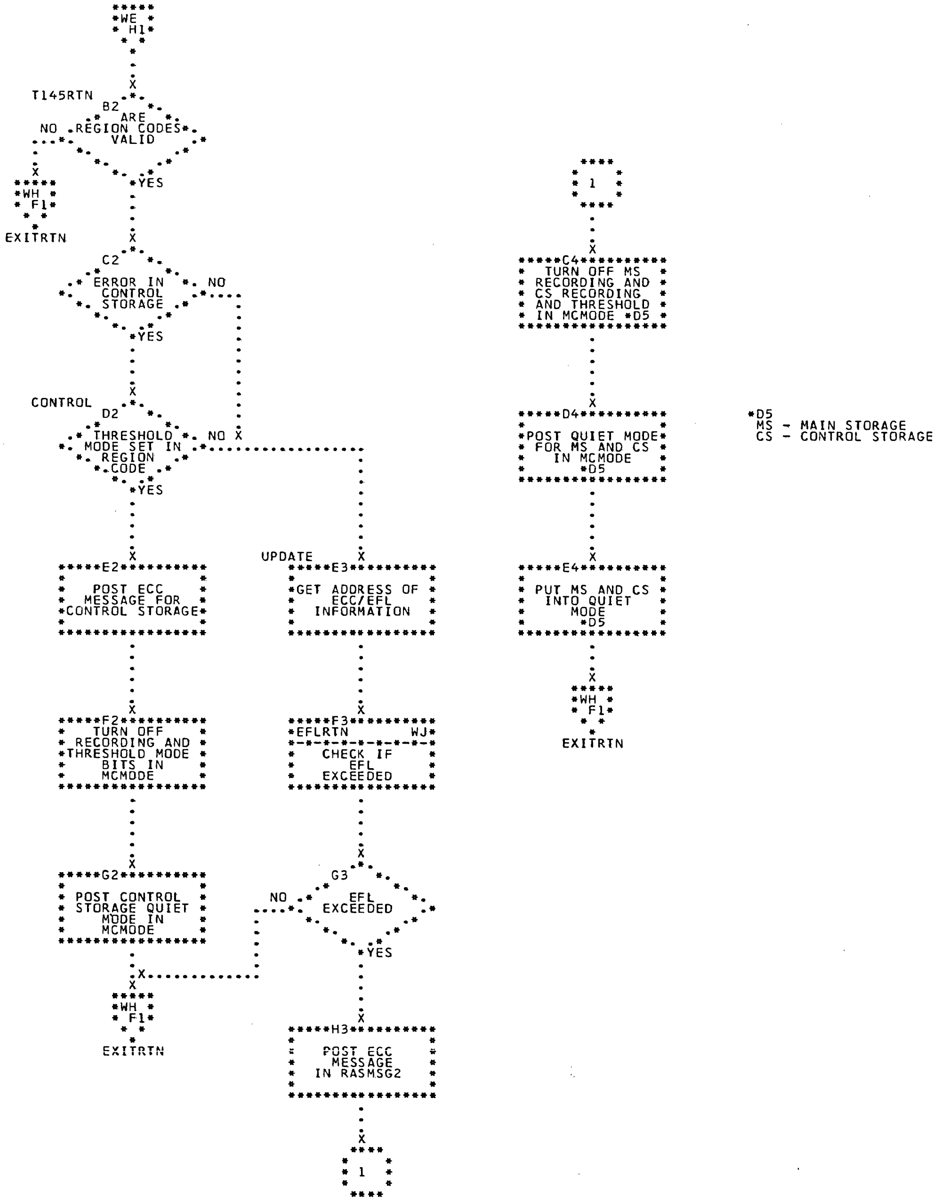


Chart WG. $$RAST03 - Machine Check Repair / EFL Functions (Part 3 of 4)
Refer to Figure 54.

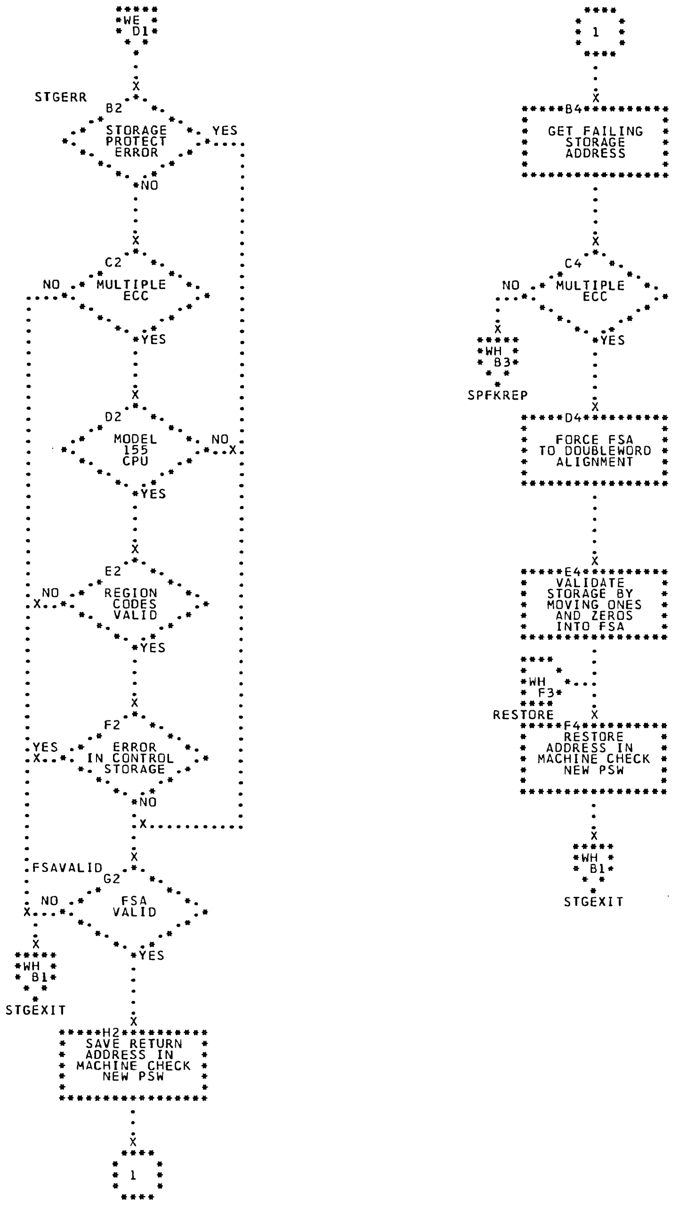


Chart WH. $$RAST03 - Machine Check Repair / EFL Functions (Part 4 of 4)
Refer to Figure 54.

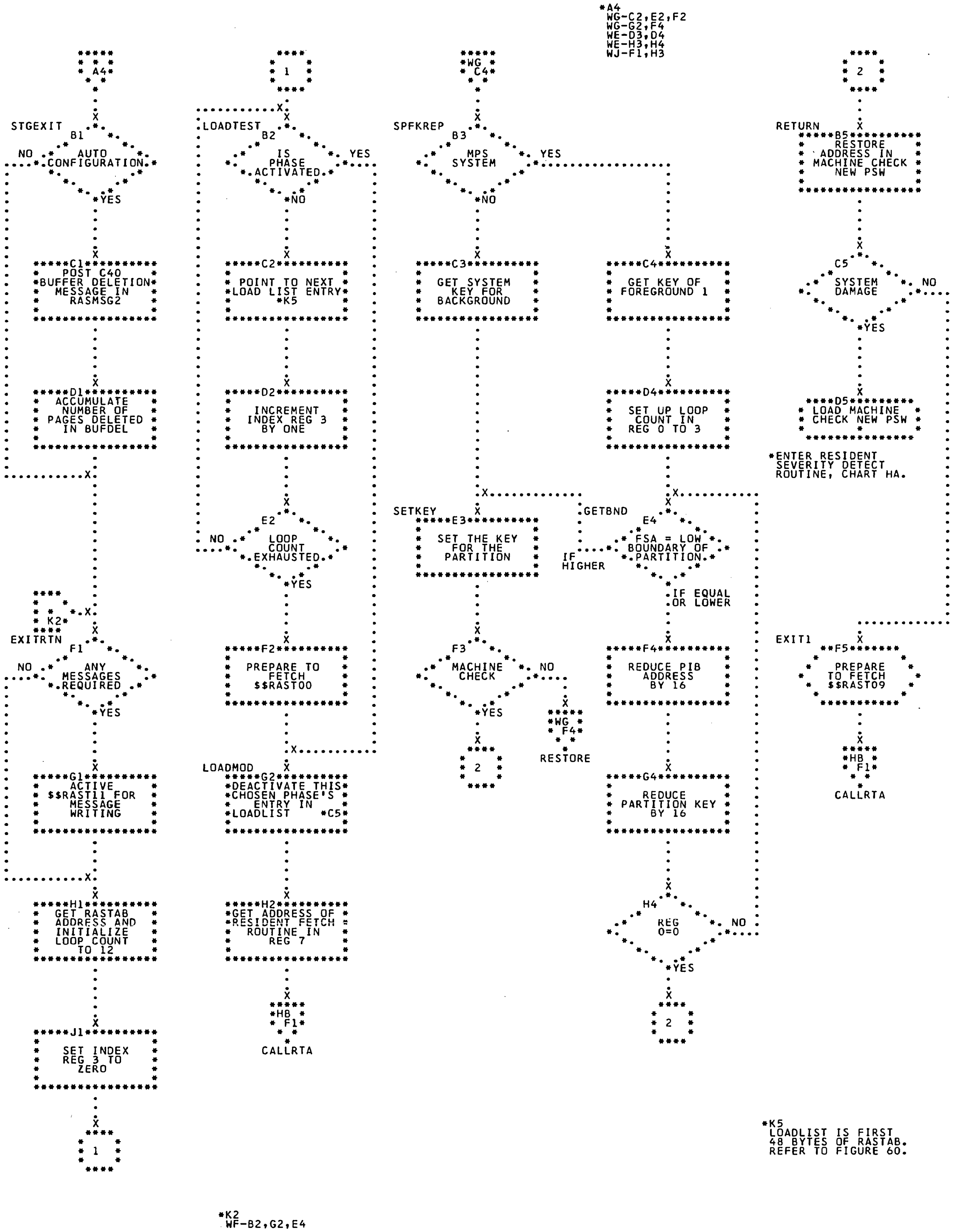


Chart WJ. $$RAST03 - Subroutines
Refer to Figure 54.

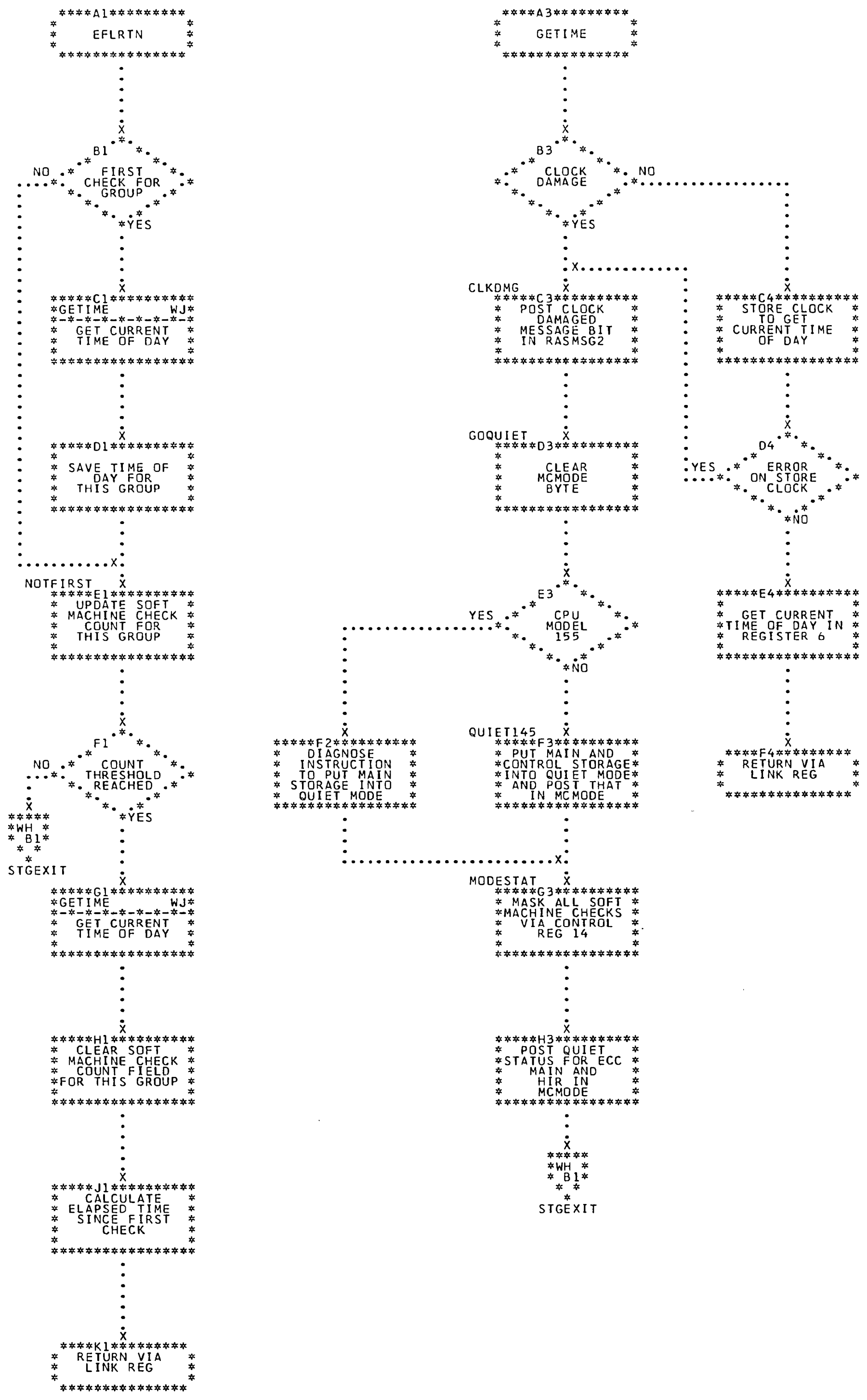


Chart XA. $$RAST04 - Unit Record Channel Check ERP (Part 1 of 4)
Refer to Figure 54.

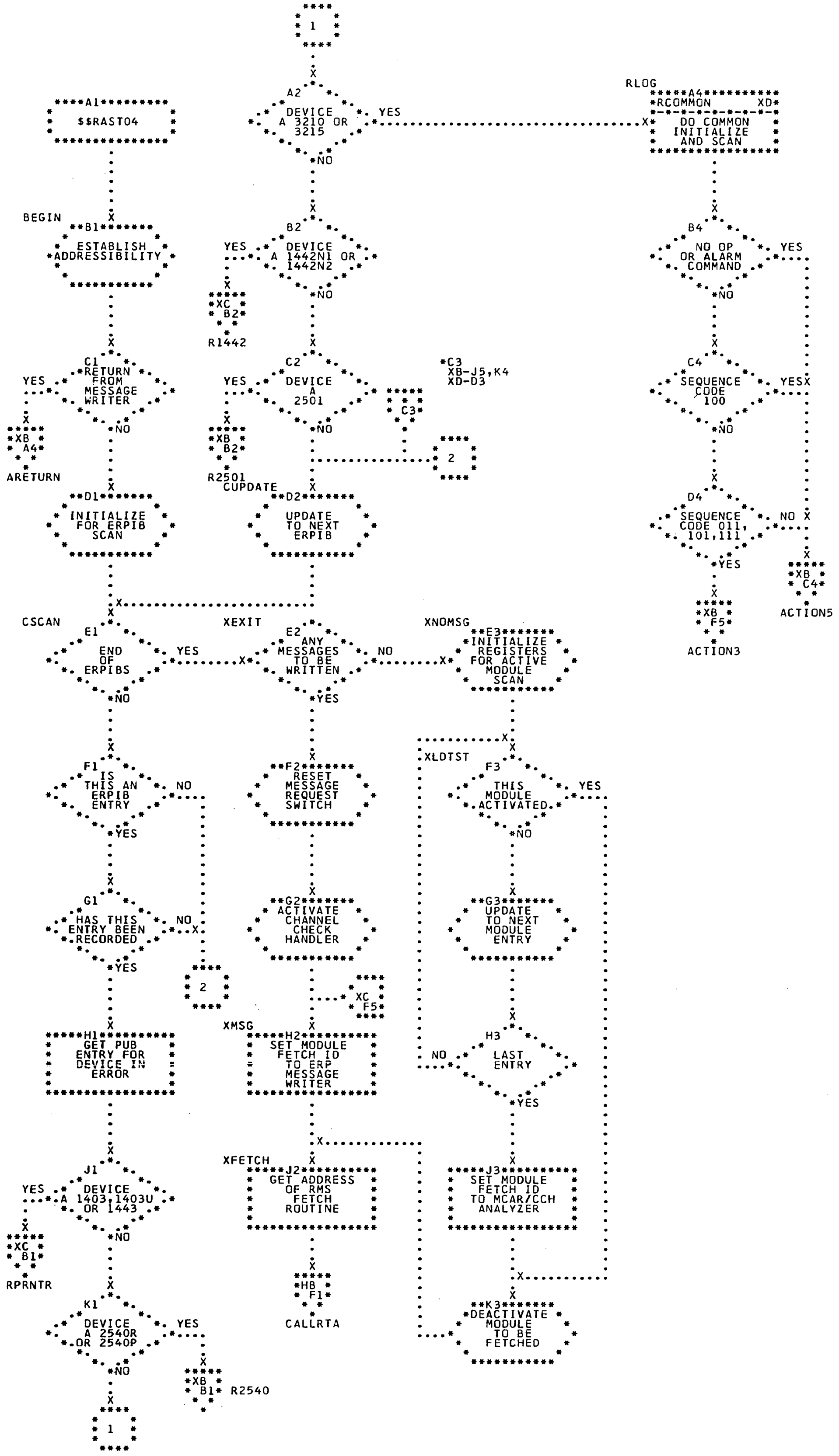


Chart XB. $$RAST04 - Unit Record Channel Check ERP (Part 2 of 4)
Refer to Figure 54.

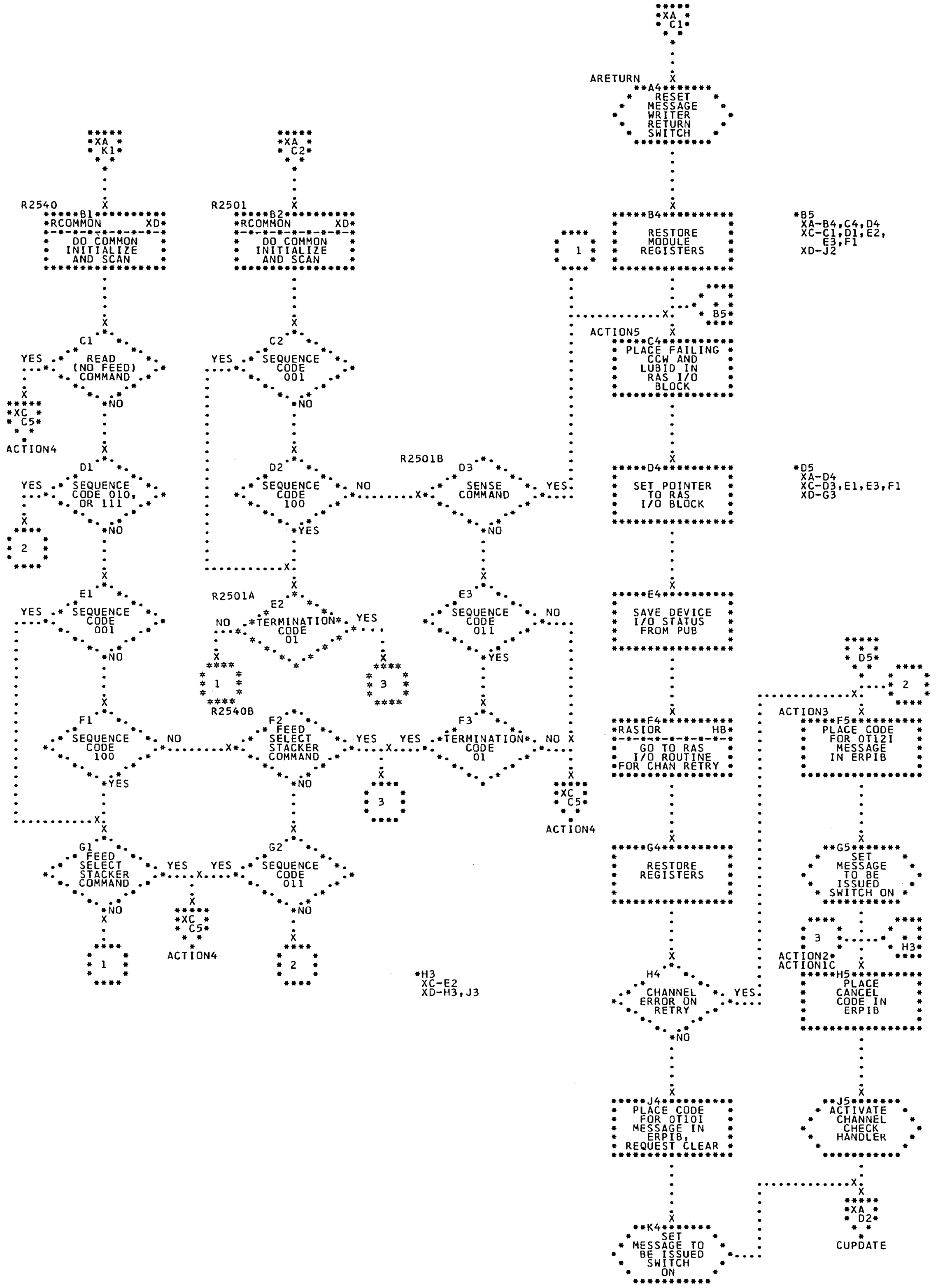


Chart XC. $$RAST04 - Unit Record Channel Check ERP (Part 3 of 4)
Refer to Figure 54.

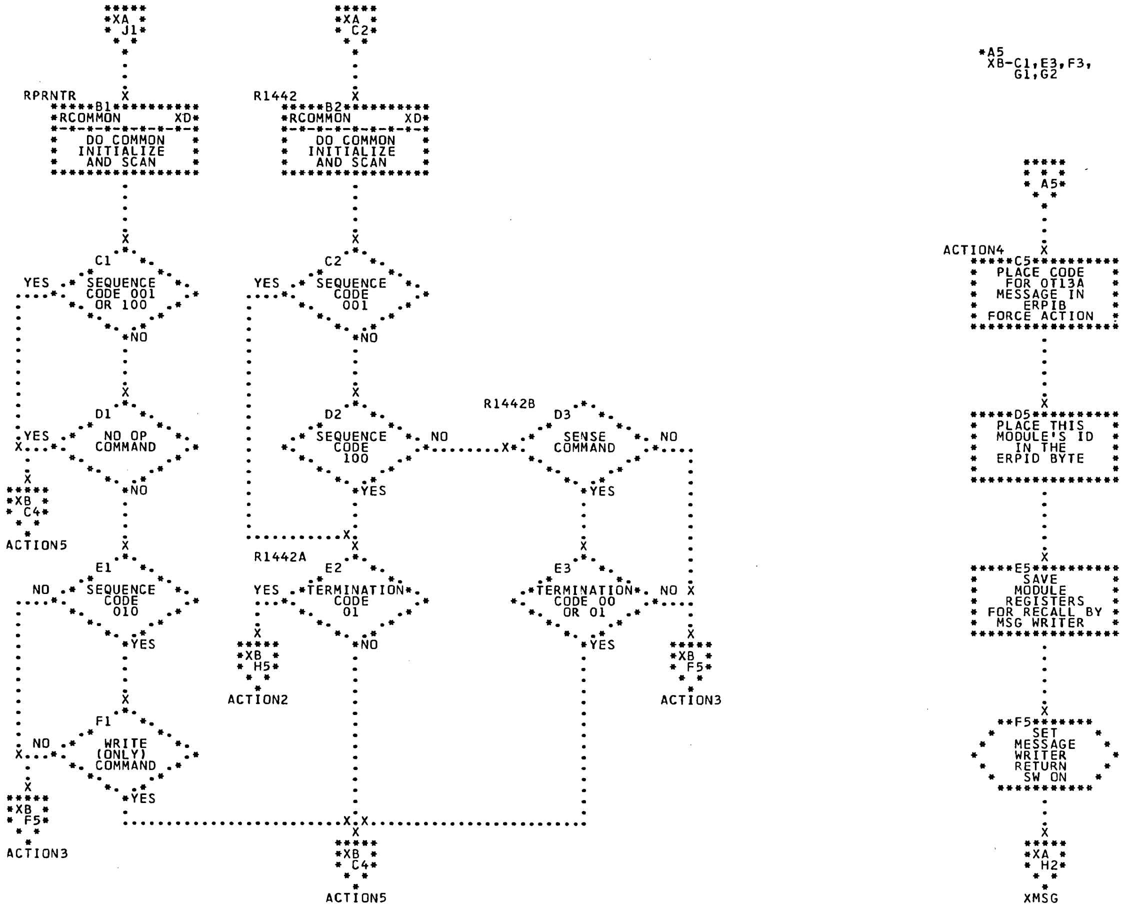
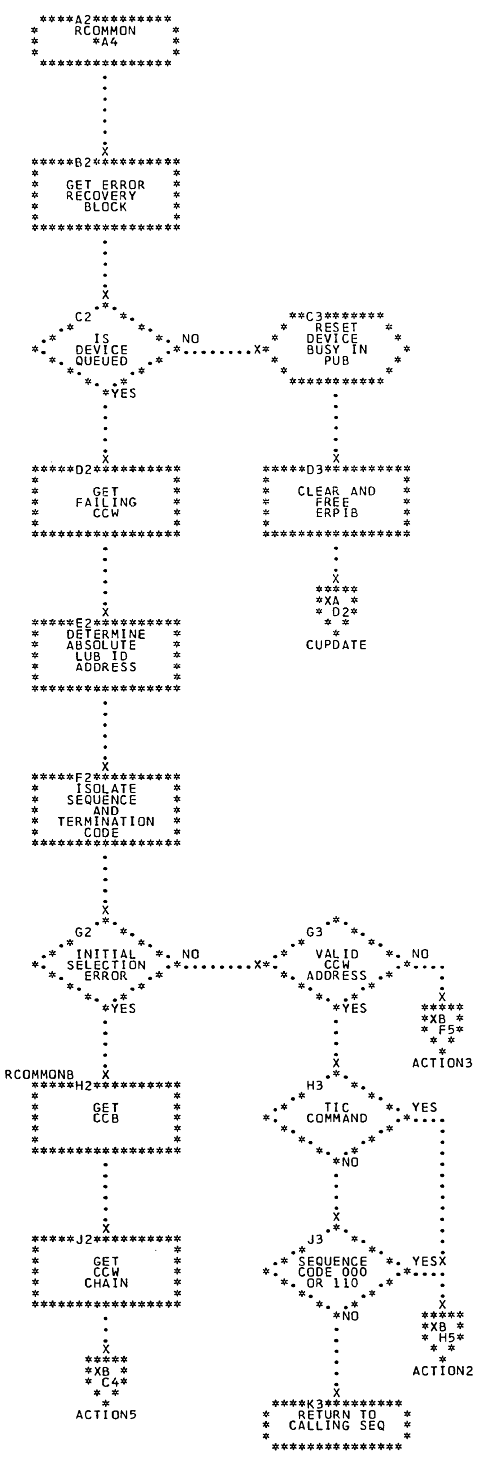


Chart XD. $$RAST04 - Unit Record Channel Check ERP (Part 4 of 4)
Refer to Figure 54.



*A4
THIS ROUTINE PERFORMS
COMMON INITIALIZATION
AND SEQUENCE CHECKING.

Chart XE. $$RAST05 - 2520 Channel Check ERP (Part 1 of 3)
Refer to Figure 54.

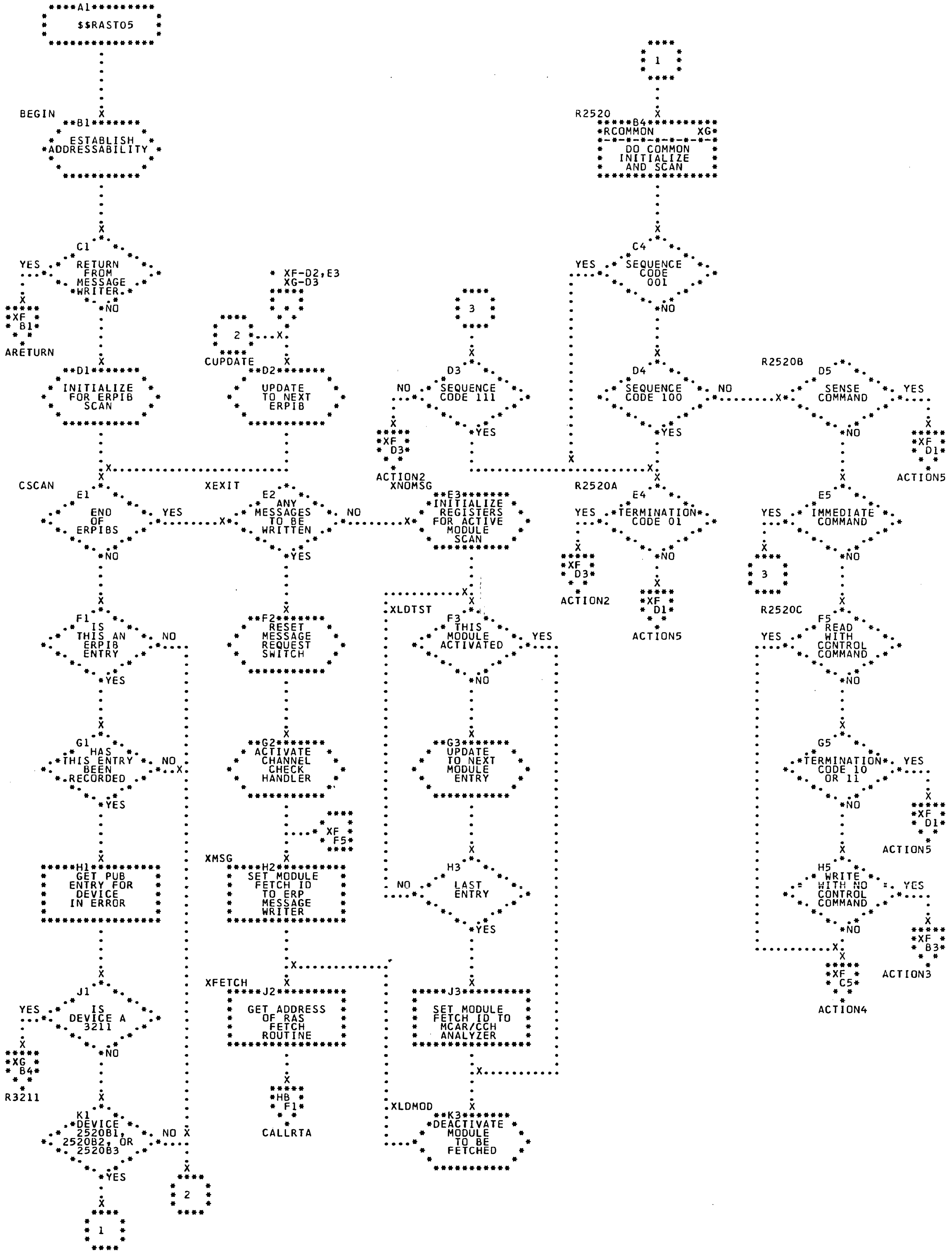


Chart XF. $$RAST05 - 2520 Channel Check ERP (Part 2 of 3)
Refer to Figure 54.

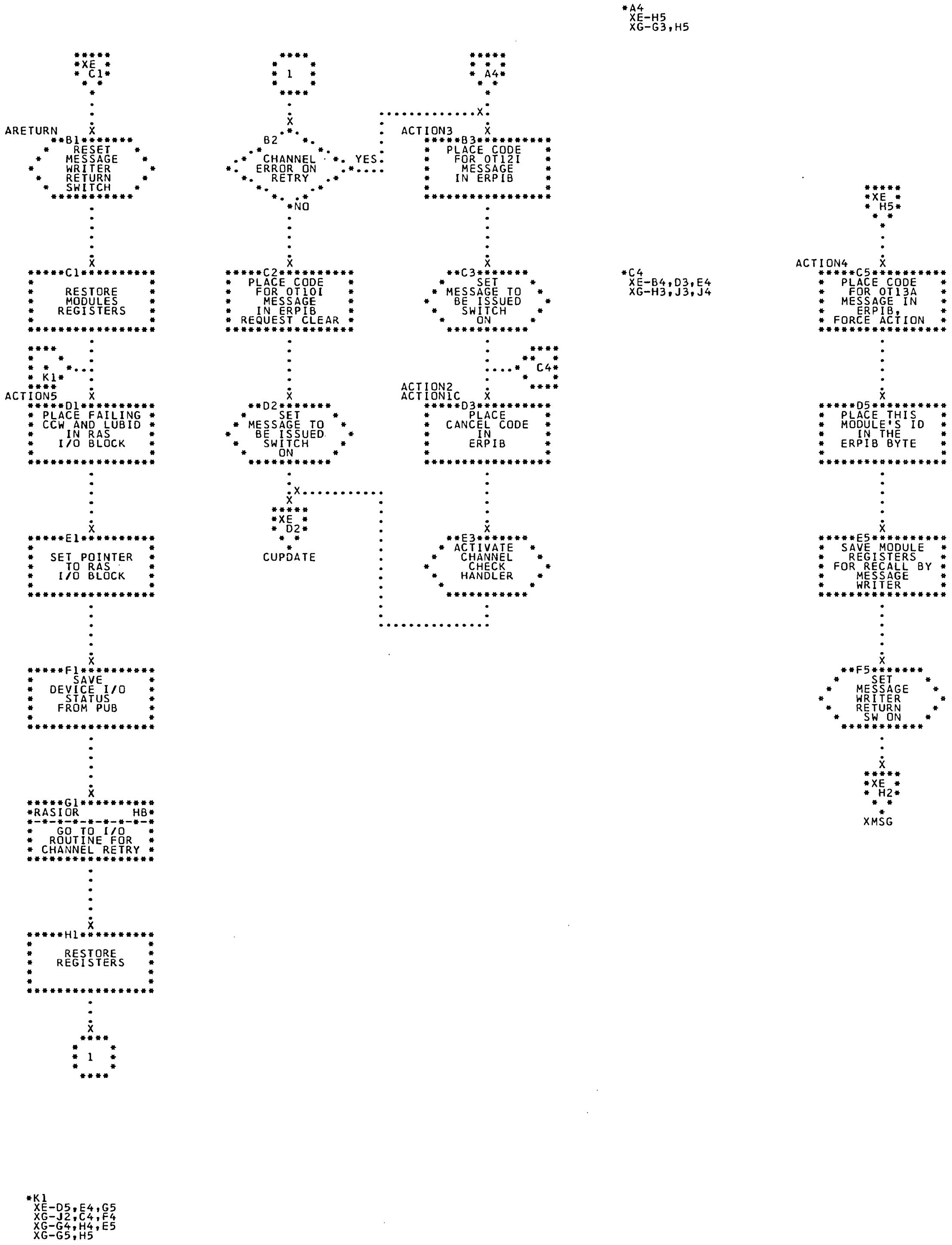


Chart XG. $$RAST05 - 2520 Channel Check ERP (Part 3 of 3)
Refer to Figure 54.

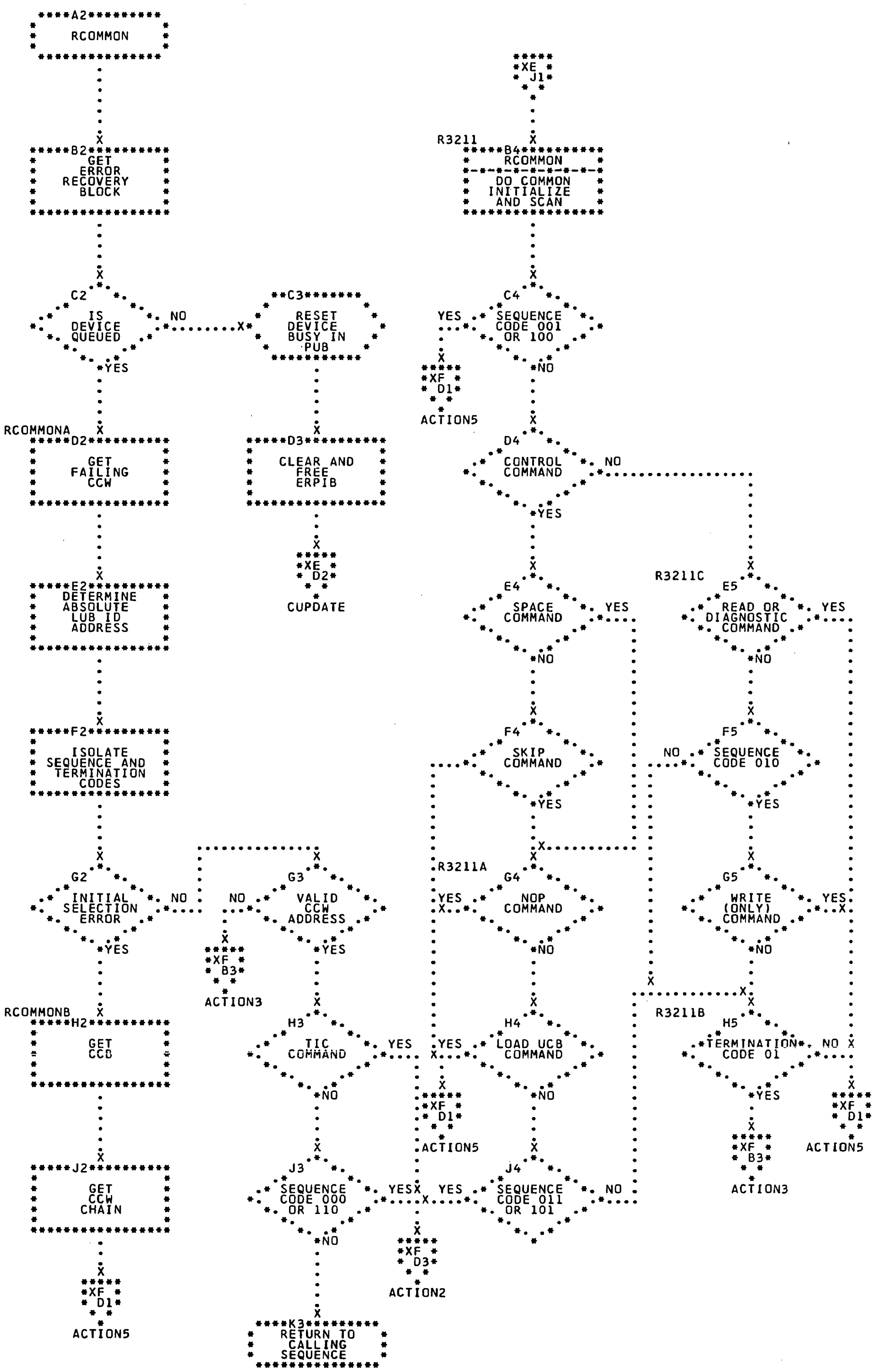


Chart XH. $$RAST07 - Channel Check Handler, Tape ERP (Part 1 of 2)
Refer to Figure 54.

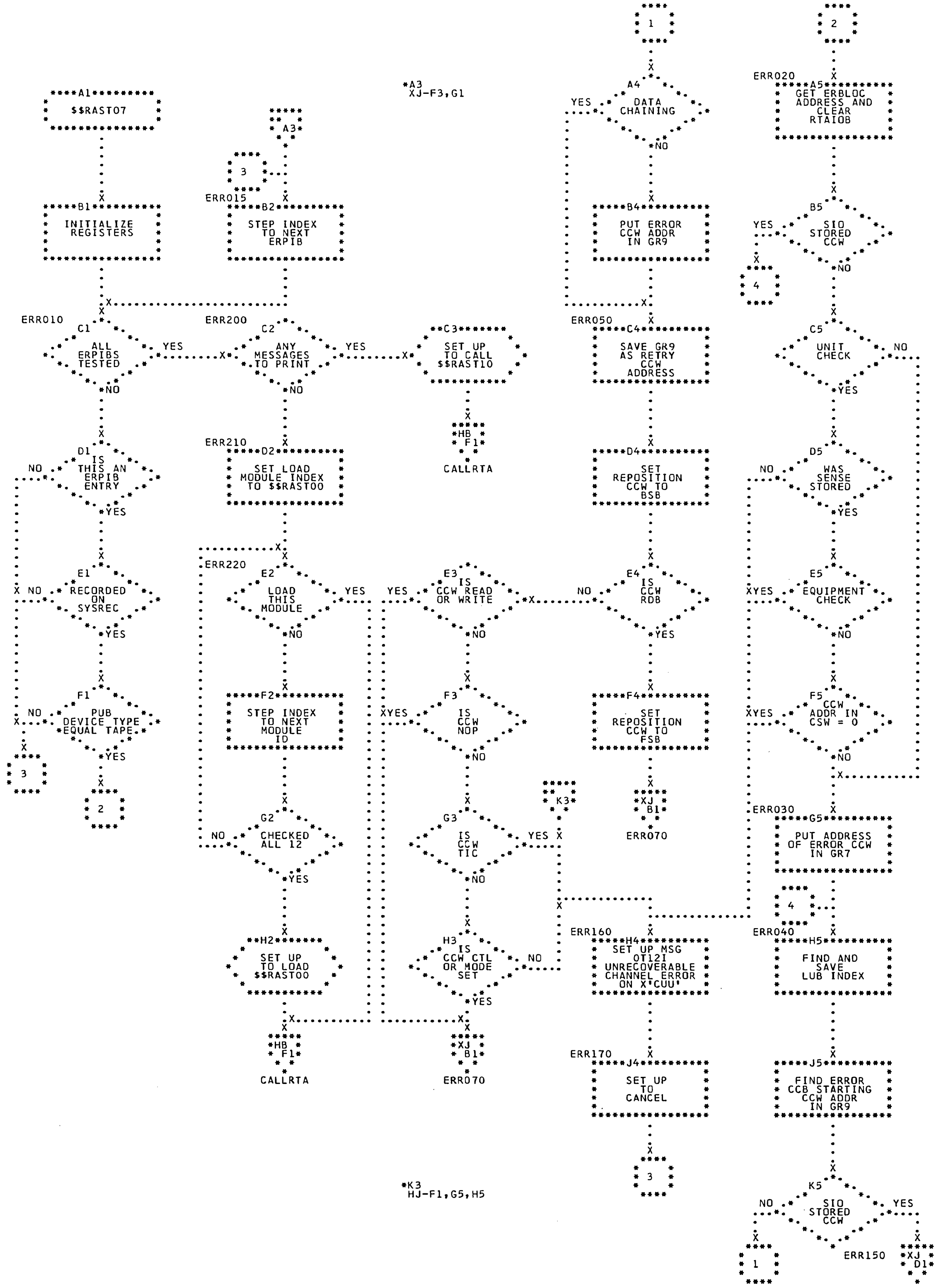


Chart XJ. $$RAST07 - Channel Check Handler, Tape ERP (Part 2 of 2)
Refer to Figure 54.

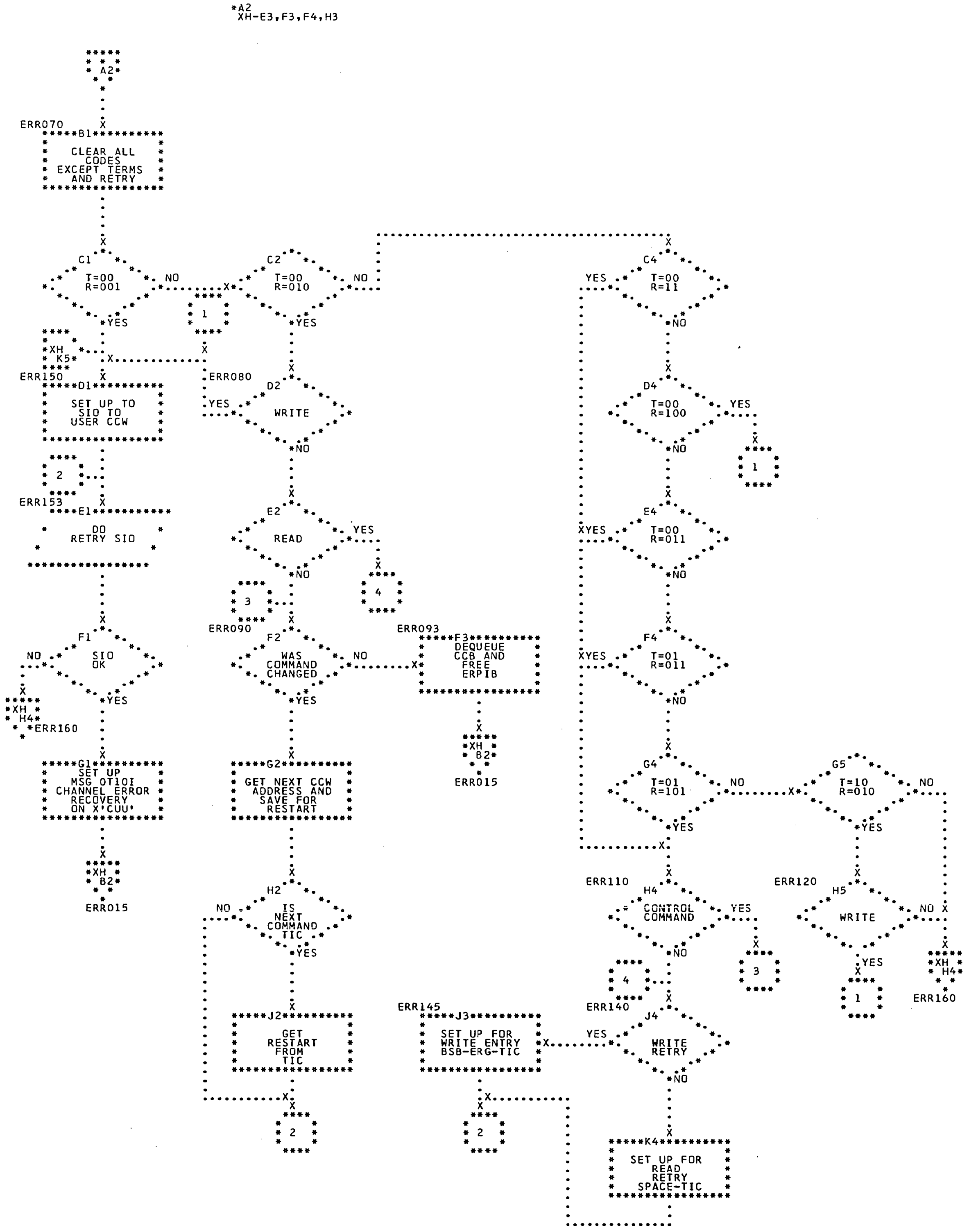


Chart XJA. $$RAST09 - Dynamic Reallocation of Partition (Part 1 of 2)
Refer to Figure 54.

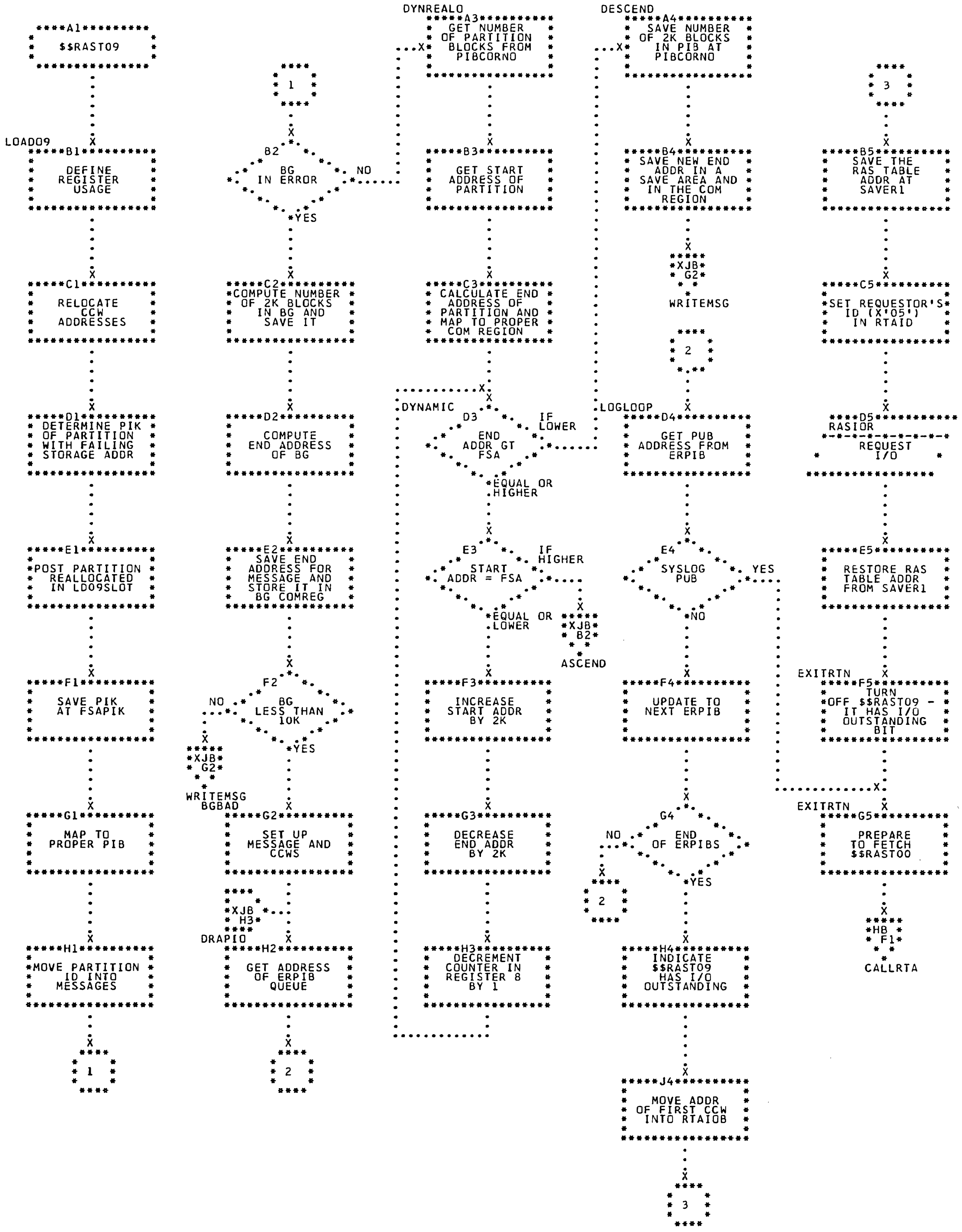


Chart XJB. $$RAST09 - Dynamic Reallocation of Partition (Part 2 of 2)
Refer to Figure 54.

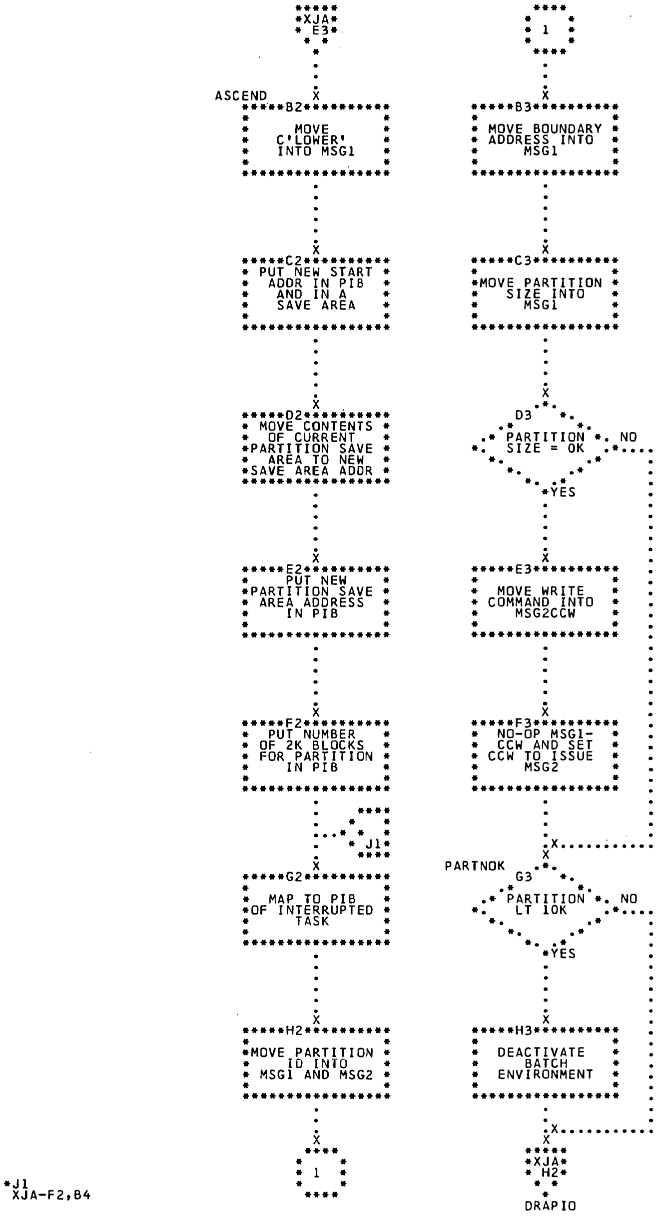


Chart XK. $$RAST10 - ERP Message Writer (Part 1 of 3)
Refer to Figure 54.

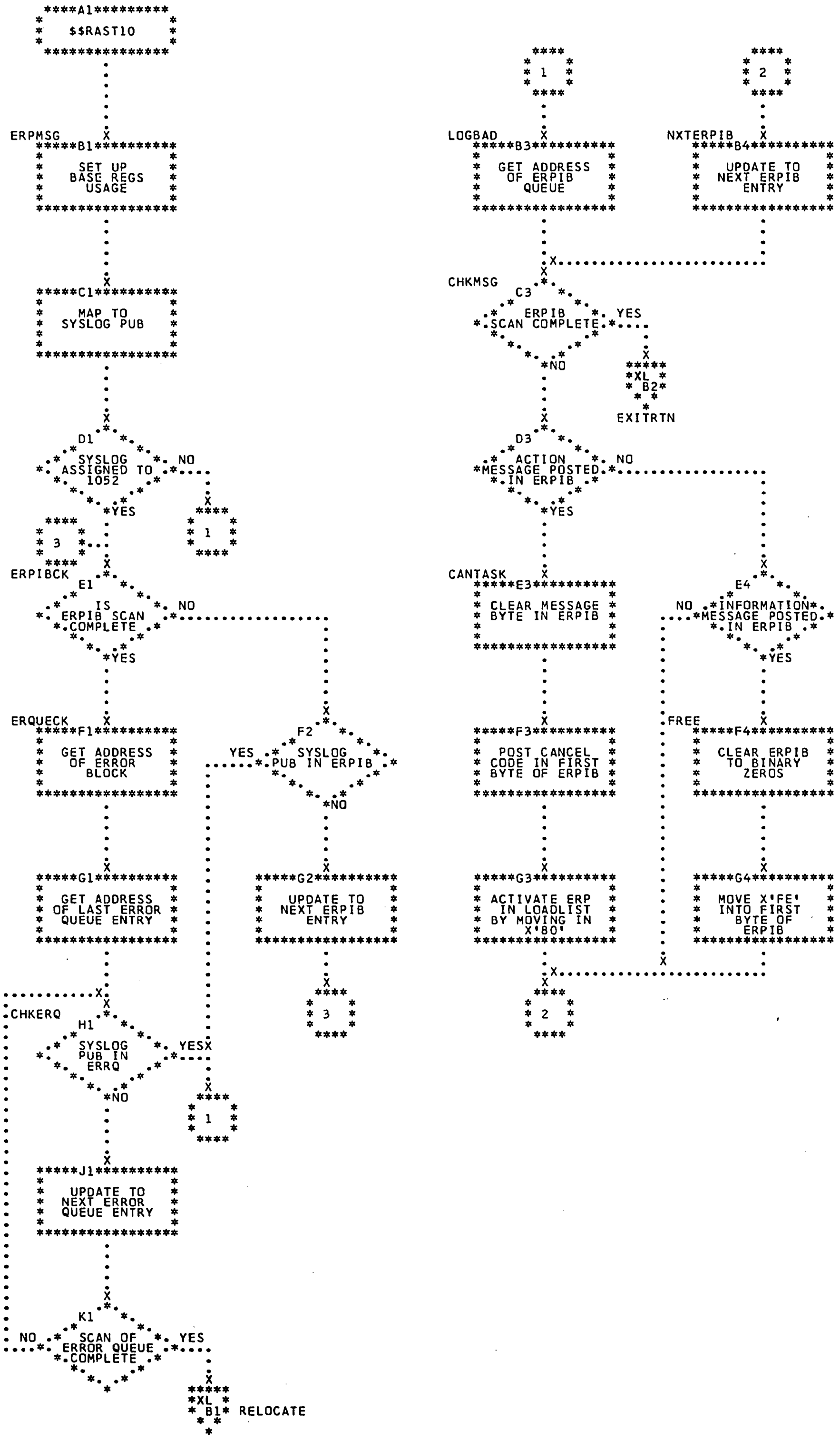


Chart XL. $$RAST10 - ERP Message Writer (Part 2 of 3)
Refer to Figure 54.

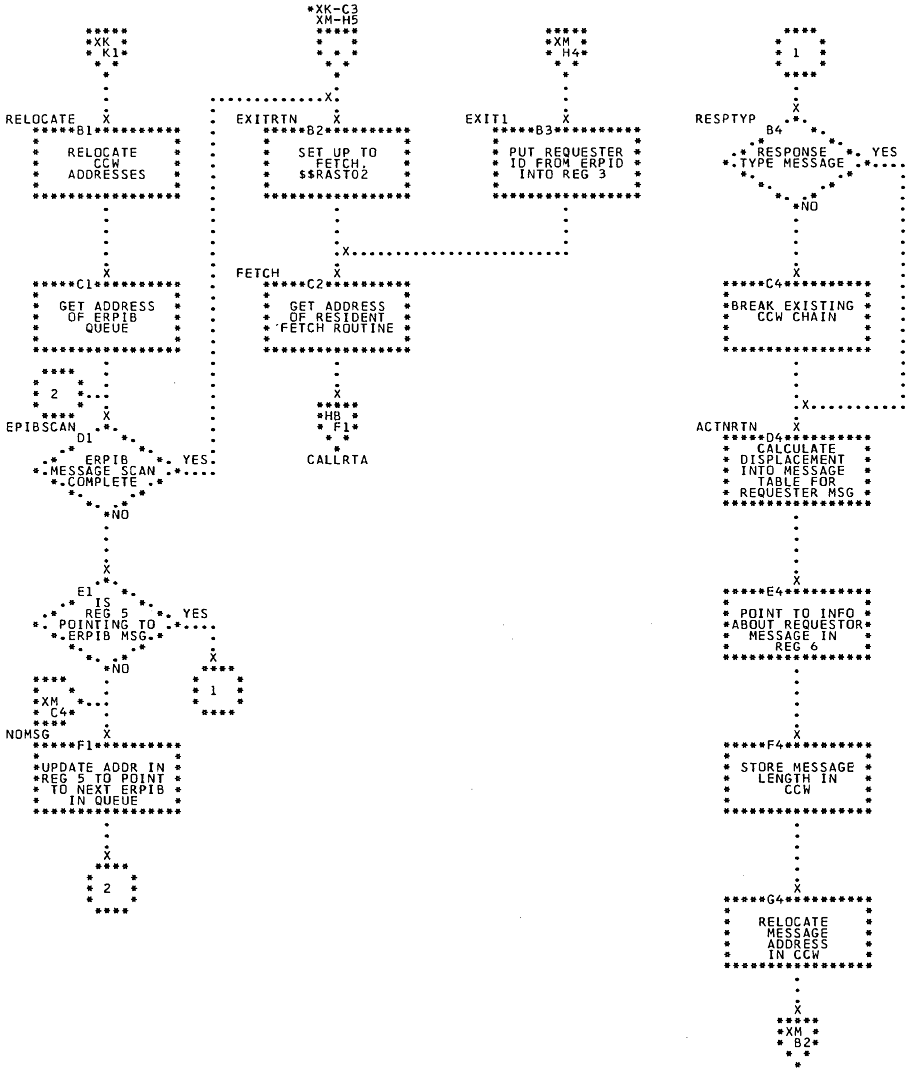


Chart XM. $$RAST10 - ERP Message Writer (Part 3 of 3)
Refer to Figure 54.

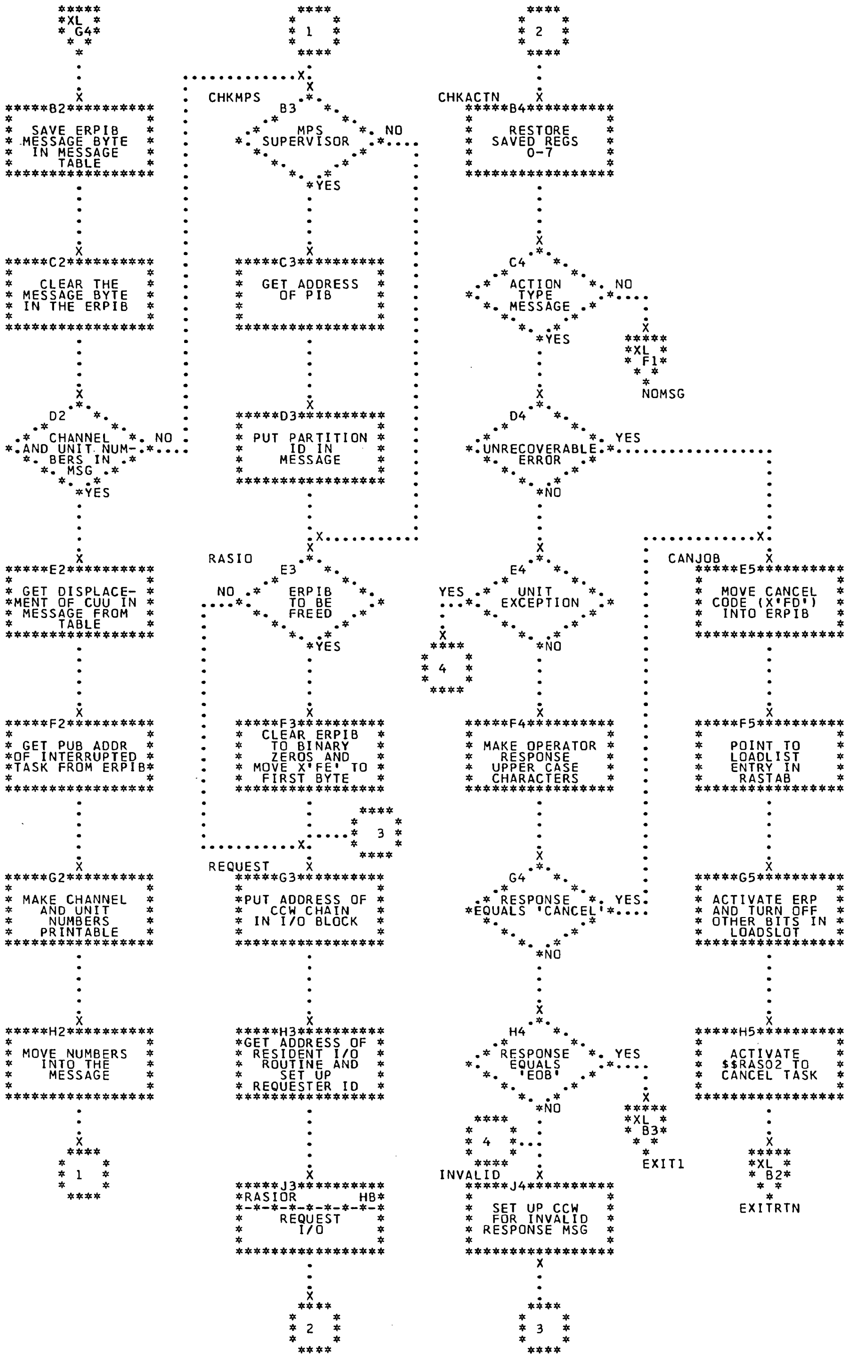
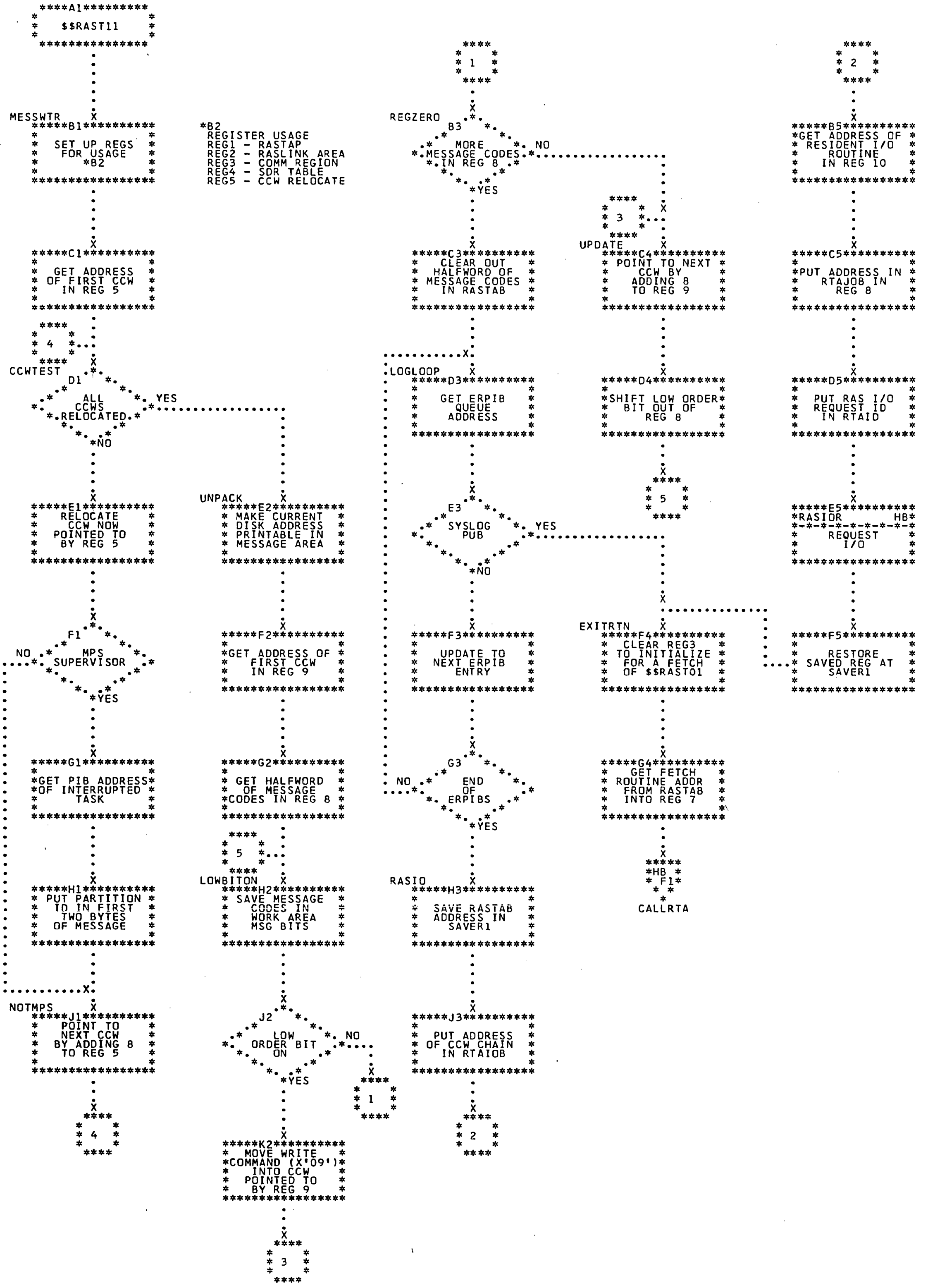


Chart XN. $$RAST11 - RTA Message Writer
Refer to Figure 54.



APPENDIX A: LABEL LIST

Label	Phase or Macro	Chart
AACT	$$ANERRU	SC
AACTION	$$ANERRP	RF
ABTRANS	SGDFCH	EC
ACTIONA	$$ANERRP	RE
ACTION1	$$ANERSA	UL
ACTION1C	$$RAST04	XB
ACTION1C	$$RAST05	XF
ACTION2	$$ANERSA	UK
ACTION3	$$ANERSA	UM
ACTION3	$$RAST04	XB
ACTION3	$$RAST05	XF
ACTION4	$$ANERSA	UN
ACTION4	$$RAST04	XC
ACTION4	$$RAST05	XF
ACTION4A	$$ANERSA	UM
ACTION4B	$$ANERSA	UN
ACTION5	$$ANERSA	UL
ACTION5	$$RAST04	XB
ACTION5	$$RAST05	XF
ACTION6	$$ANERSA	UL
ACTION6	$$ANERR6	UC
ACTION7	$$ANERSA	UM
ACTION7	$$ANERR7	UE
ACTION7A	$$ANERSA	UM
ACTION7B	$$ANERSA	UL
ACTION8	$$ANERSA	UM
ACTION8A	$$ANERSA	UM
ACTNRTN	$$RAST10	XL
ADDTOCT	$$ANERR6	UD
AFTTIO	SGUNCK	DF
ALLBND	FOPT	BCA
ALLBND1	FOPT	BCA
ANNUL	$$ANERR9	UB
APTEST	$$ANERAE	RC
ARETURN	$$RAST04	XB
ARETURN	$$RAST05	XF
ARND1	$$ANERRU	SC
ASCEND	$$RAST09	XJB
ATNCNL	SGSVC	FG
ATNRTN	SGTCON	GD
ATYPE	$$ANERRV	SE
ATYPE	$$ANERRX	SK
ATYPE	$$ANERRN	RB
A01	$$ANERRG	QA
A02	$$ANERRG	QA
A03	$$ANERRJ	QF
A05	$$ANERRJ	QF
A06	$$ANERRJ	QF
A2321	SGTCHS	CH
BALMSG	$$ANERRJ	QF
BALSTCHK	$$ANERRJ	QF
BEGIN	$$ANERSA	UK
BEGIN	$$ANERSA	UP
BEGIN	$$ANERSA	UQ
BEGIN	$$RAST04	XA
BEGIN	$$RAST05	XE
BGBAD	$$RAST09	XJA
BJFTST	$$ANERR1	TG
BKNTAP	$$ANERAI	UG
BLDERPIB	$$RAST00	VD
BLDLAST	$$RAST01	VK
BLDREC	$$RAST01	VF
BLDREC	$$RAST02	WC
BLDREC1	$$RAST02	WC
BSOUT	$$ANERRW	SG
BSOUTMSG	$$ANERAI	UG
BSTTST	SGUNCK	DA
BTAM	$$ANERRC	NM
BUFPAR	$$ANERSA	UL
BUS	$$ANERRX	SK
BUSOUT	$$ANERRA	NLA
BUSOUT	$$ANERRV	SE
BUSOUT	$$ANERRW	SF
BUSOUT	$$ANERR9	UA
BUSOUT	$$ANERAI	UG
BUSOUT	$$ANERSA	UM
BUSRETRY	$$ANERAI	UG
BUS1	$$ANERRV	SE
BUS2	$$ANERRV	SE
BYCNL	$$ANERRZ	TD
BY1	$$ANERRM	NB
BZYTEST	$$RAST00	VE
B01	$$ANERRG	QA
B02	$$ANERRG	QA
CALFET	SGSVC	FF
CALLMW	$$ANERRX	SJ
CALLRTA	MCRAS	HB
CALLSEC2	$$ANERRZ	TC
CALLSEC3	$$ANERRY	TB
CALL0	MCRAS	HB
CALPH4	$$ANERRO	RD
CALPH5	$$ANERRP	RF
CANALL	SGTHAP	MM
CANCEL	$$ANERR1	TG
CANCEL	$$RAST02	WB
CANCOD	$$ANERRS	RL
CANCON	$$ANERRX	SK
CANJOB	$$RAST10	XM
CANRTN	$$ANERRS	RL
CANTASK	$$RAST10	XK
CANTLP	$$ANERRY	TA
CANXIT	FOPT	BE
CBGOA	SGSVC	FQ
CBMOV	SGSVC	FP
CBNON1	SGTCHS	CCA
CBNON2	SGTCHS	CCA
CBOK	SGSVC	FP
CBRET	SGTCHS	CC
CCBQED	SGUNCK	DB
CCBSTR	$$ANERAB	RA
CCBUNAV	$$ANERAE	RC
CCDADI	MCRAS	HH
CCDAMAGE	MCRAS	HD
CCDASDCK	MCRAS	HH
CCDASDI	MCRAS	HH
CCDASDLT	MCRAS	HH
CCDASDTC	MCRAS	HH

CCDEVTST	MCRAS	HE
CCDEXIT	MCRAS	HD
CCENTRY1	MCRAS	HD
CCENTRY2	MCRAS	HE
CCENTRY3	MCRAS	HE
CCEREXIT	MCRAS	HD
CCEXIT1	MCRAS	HD
CCEXIT1	$$RAST00	VD
CCEXIT2	MCRAS	HE
CCEXIT3	MCRAS	HF
CCEXIT4	MCRAS	HF
CCNOT10	MCRAS	HF
CCRECRTN	$$RAST01	VK
CCRTYTST	MCRAS	HE
CCSETDMC	MCRAS	HD
CCT155	MCRAS	HF
CCWTEST	$$RAST11	XN
CDATACK	$$ANERR9	UA
CDC	$$ANERRW	SG
CEDETST	SGTCHS	CL
CHAINCH	$$ANERRB	NN
CHDTCK	$$ANERRX	SJ
CHECK	$$ANERRA	NL
CHECKLST	$$RAST00	VB
CHECKMC	$$RAST00	VB
CHEND	SGTCHS	CL
CHEND1	SGTCHS	CL
CHFAIL	SGUNCK	DF
CHFAIL1	SGUNCK	DF
CHKACTN	$$RAST10	XM
CHKADR	$$ANERRT	SA
CHKADR	$$ANERRW	SF
CHKADR	$$ANERRS	RK
CHKAM	$$ANERRB	NN
CHKCNT	$$ANERRV	SE
CHKDEV	$$ANERRP	RF
CHKDISK	$$ANERRA	NL
CHKERQ	$$RAST10	XK
CHKERR	$$ANERSA	UK
CHKLTA	$$ANERRS	RL
CHKMPS	$$RAST10	XM
CHKMSG	$$RAST01	VJ
CHKMSG	$$RAST10	XK
CHKOCREC	$$RAST01	VJ
CHKSNS	$$ANERSC	UQ
CHKSN1	$$ANERSC	UQ
CHKTABLE	$$RAST01	VJ
CHNDAT	$$ANERSA	UL
CHNDRT	SGTCHS	CP
CHNDTEX	$$ANERAJ	UH
CHNERROR	SMCRR	KA
CHNOK1	SGTCHS	CK
CHNTST	SGTCHS	CP
CKCHST	SGTCHS	CE
CLBPRG	SGTCHS	CA
CLBPTR	SGTCHS	CAA
CLBSUP	SGTCHS	CAA
CLCEX	SGDFCH	EC
CLCINS	SGTCHS	CH
CLEAR	$$RAST02	WC
CLKDMG	$$RAST03	WJ
CMDCHN	SGUNCK	DA
CMDREJ	$$ANERRV	SE
CMDSEQ	$$ANERRV	SD
CMNDREJ	$$ANERR9	UB
CMR	$$ANERRV	SE
CNCEL	SGTHAP	MK
CNCELL	SGTHAP	MK
CNCEL0	SGTHAP	MK
CNCEL1	SGTHAP	ML
CNCEL1A	SGTHAP	ML
CNCEL1B	SGTHAP	ML
CNCEL2	SGTHAP	MK
CNCEL2AA	SGTHAP	MK
CNCEL3	SGTHAP	ML
CNCEL4	SGTHAP	ML
CNCEL5	SGTHAP	ML
CNCL	FOPT	BE
CNCL	$$ANERRU	SC
CNCLLOOP	$$ANERRZ	TD
CNCLSW	$$ANERRY	TB
CNERPIB	$$RAST02	WB
CNLSVE	FOPT	BA
CNO	$$ANERRU	SB
CNTEXT	$$ANERRP	RE
CNTRTN	$$ANERR7	UE
CNTST	$$ANERRV	SD
CNTST	$$ANERRN	RB
COMBIN	$$ANERRA	NL
COMMENCE	$$ANERAD	NK
COMPCLC	SGTCHS	CA
COMR	$$ANERRX	SJ
COMREJ	$$ANERRB	NN
COMRJ	$$ANERRW	SH
COMRJT	$$ANERAI	UG
CONBUF	SGSVC	FP
CONBUF2	SGSVC	FP
CONT	$$ANERRV	SE
CONT	$$ANERRW	SG
CONTINU	SEND	LA
CONTINU	$$ANERAF	NG
CONTINUE	$$ANERR9	UB
CONTINUE	$$ANERRM	NB
CONTROL	$$RAST03	WF
CORCIN	SGTCHS	CK
CORPUB	SGTCHS	CK
CORPUB	SGTCHS	CK
CORREC	SGTCHS	CJ
COUNT	SGTCHS	CG
COUNTRG	$$ANERRP	RE
COUNTRG	$$ANERRQ	RG
CQDSP	SGTCHS	CR
CSBY2	FOPT	BE
CSCAN	$$RAST04	XA
CSCAN	$$RAST05	XE
CSRST	FOPT	BE
CSWCHK	SGUNCK	DF
CSWLOST	$$RAST00	VD
CUPDATE	$$RAST04	XA
CUPDATE	$$RAST05	XE
CUU	$$ANERRO	RD
CYLEND	SGDSK	GB
C01	$$ANERRG	QB
C01	$$ANERRH	QD
C01	$$ANERRJ	QF
C0100	$$ANERRV	SE
C02	$$ANERRV	SD
DASD	$$RAST02	WA
DASD2311	SGTCHS	CH
DAT	$$ANERRX	SJ
DATAADDR	SGDFCH	EE

DATACHK	$$ANERRB	NN
DATACHK	$$ANERAJ	UH
DATACHK	$$ANERSA	UM
DATACHK1	$$ANERSA	UM
DATCHK	$$ANERRV	SE
DCERP	$$ANERRA	NL
DEALSO	SGTCHS	CQ
DECCTR	$$ANERRQ	RH
DELKOTCK	SGTCHS	CN
DEQUE	SGSVC	FF
DEQUER	SGUNCK	DE
DEQUER1	SGUNCK	DE
DEQUER1A	SGUNCK	DE
DESCEND	$$RAST09	XJA
DETFRE	SGTHAP	MB
DEV2311	$$RAST01	VH
DISWHY	SGTCHS	CK
DMCTEST	$$RAST02	WA
DOSVC	$$ANERR6	UD
DOSVC	$$ANERR8	UF
DOTCH	SGTCHS	CF
DRAPIO	$$RAST09	XJA
DSKTST	SGDSK	GA
DTCH	$$ANERRB	NN
DTCRTN	$$ANERR7	UE
DTEXIT	$$ANERAJ	UH
DV1017	$$ANERAI	UG
DV1018	$$ANERAJ	UH
DYNAMIC	$$RAST09	XJA
DYNREALO	$$RAST09	XJA
EDRDHA	SGDSK	GB
EDRDHA1	SGDSK	GB
EDTIC	SGDSK	GB
EDTIC1	SGDSK	GB
EMGENT	MCRAS	HB
EMGIORTN	$$RAST01	VK
EMGWAIT	MCRAS	HC
END	$$ANERR0	TF
END	$$ANERR1	TG
ENDPUBS1	$$ANERRZ	TC
ENDPUBS3	$$ANERRZ	TD
ENTEXT	FOPT	BG
ENTEXT	SGSVC	FL
ENTIO	FOPT	BF
ENTPCK	FOPT	BA
ENTPCK	SGSVC	FJ
ENTPCK	SGSVC	FK
ENTSVC	FOPT	BH
EPIBSCAN	$$RAST10	XL
EQPCHK	$$ANERRU	SC
EQPCHK	$$ANERRV	SD
EQPCHK	$$ANERAI	UG
EQUCHK	$$ANERRX	SK
EQPCHK	$$ANERSA	UN
EQPCHK1	$$ANERSA	UN
EQUIP	$$ANERRA	NL
EQUIPXIT	$$ANERR9	UA
ERPIBCER	MCRAS	HF
ERPIBCK	$$RAST10	XK
ERPIBFIL	MCRAS	HF
ERPIBLUP	MCRAS	HG
ERPIBLUP	$$RAST00	VD
ERPIBU	$$RAST02	WD
ERPMSG	$$RAST10	XK
ERPUBUPD	MCRAS	HG

ERQSDR	$$ANERAC	NF
ERQUECK	$$RAST10	XK
ERR	$$ANERR6	UD
ERRGO	FOPT	BB
ERROR	$$ANERAJ	UJ
ERRORQED	$$ANERAA	NC
ERRQUED	$$ANERAF	NH
ERRQUED1	$$ANERAG	NJ
ERRSEN	SGUNCK	DB
ERRSET	FOPT	BB
ERRSET	FOPT	BB
ERRSET0	FOPT	BB
ERRSET1	FOPT	BB
ERRSIO	SGUNCK	DF
ERRSIO2	SGUNCK	DF
ERRTYP	$$ANERRP	RE
ERR010	$$ANERRE	PC
ERR010	$$RAST07	XH
ERR015	$$RAST07	XH
ERR020	$$RAST07	XH
ERR030	$$RAST07	XH
ERR040	$$RAST07	XH
ERR050	$$RAST07	XH
ERR070	$$RAST07	XJ
ERR080	$$ANERRL	PG
ERR080	$$RAST07	XJ
ERR090	$$ANERRL	PG
ERR090	$$RAST07	XJ
ERR093	$$RAST07	XJ
ERR094	$$ANERRL	PG
ERR095	$$ANERRF	PE
ERR095	$$ANERRL	PG
ERR095	$$ANERAP	PN
ERR095	$$ANERAS	PX
ERR096	$$ANERRL	PG
ERR102	$$ANERRF	PE
ERR105	$$ANERRF	PE
ERR105	$$ANERAS	PX
ERR110	$$ANERRD	PA
ERR110	$$ANERRF	PE
ERR110	$$RAST07	XJ
ERR110	$$ANERAS	PX
ERR120	$$ANERRD	PA
ERR120	$$ANERRF	PF
ERR120	$$RAST07	XJ
ERR140	$$ANERRE	PC
ERR145	$$RAST07	XJ
ERR150	$$RAST07	XJ
ERR150	$$ANERAP	PN
ERR150	$$ANERAQ	PQ
ERR152	$$ANERAP	PN
ERR153	$$RAST07	XJ
ERR155	$$ANERAP	PN
ERR160	$$RAST07	XH
ERR170	$$RAST07	XH
ERR175	$$ANERAP	PN
ERR180	$$ANERAP	PN
ERR20	$$ANERRA	NL
ERR200	$$ANERRF	PE
ERR201	$$ANERAQ	PQ
ERR205	$$ANERAQ	PQ
ERR205	$$ANERAL	PU
ERR208	$$ANERRF	PE
ERR210	$$RAST07	XH
ERR210	$$ANERAQ	PQ

ERR215	$$ANERAQ	PQ
ERR220	$$ANERRF	PE
ERR220	$$ANERAQ	PQ
ERR240	$$ANERAM	PJ
ERR250	$$ANERRF	PE
ERR250	$$ANERAQ	PQ
ERR251	$$ANERAQ	PQ
ERR252	$$ANERAQ	PR
ERR255	$$ANERAM	PK
ERR255	$$ANERAQ	PR
ERR260	$$ANERAQ	PR
ERR265	$$ANERRF	PE
ERR265	$$ANERAL	PU
ERR270	$$ANERAL	PU
ERR275	$$ANERAM	PJ
ERR300	$$ANERAK	PS
ERR301	$$ANERRE	PC
ERR305	$$ANERAK	PS
ERR309	$$ANERAK	PS
ERR310	$$ANERAM	PJ
ERR310	$$ANERAK	PS
ERR312	$$ANERAK	PS
ERR314	$$ANERAK	PS
ERR315	$$ANERAM	PJ
ERR318	$$ANERAM	PJ
ERR320	$$ANERAK	PS
ERR325	$$ANERAK	PS
ERR326	$$ANERAK	PS
ERR335	$$ANERRE	PC
ERR340	$$ANERRE	PC
ERR340	$$ANERAN	PM
ERR340	$$ANERAK	PS
ERR341	$$ANERAN	PM
ERR350	$$ANERRE	PC
ERR350	$$ANERRL	PG
ERR350	$$ANERAM	PJ
ERR350	$$ANERAN	PM
ERR350	$$ANERAS	PX
ERR351	$$ANERAK	PS
ERR355	$$ANERRL	PG
ERR355	$$ANERAM	PJ
ERR355	$$ANERAN	PM
ERR360	$$ANERRL	PG
ERR390	$$ANERAP	PN
ERR395	$$ANERRD	PB
ERR396	$$ANERRD	PB
ERR400	$$ANERAS	PX
ERR401	$$ANERAS	PX
ERR402	$$ANERAS	PX
ERR405	$$ANERRD	PA
ERR405	$$ANERAP	PN
ERR406	$$ANERAN	PL
ERR408	$$ANERAN	PL
ERR410	$$ANERAS	PX
ERR412	$$ANERRL	PG
ERR412	$$ANERAN	PL
ERR600	$$ANERRE	PC
ERR600	$$ANERAP	PP
ERR605	$$ANERAP	PP
ERR610	$$ANERAP	PP
ERR640	$$ANERRF	PF
ERR650	$$ANERRE	PC
ERR650	$$ANERRF	PF
ERR650	$$ANERRL	PG
ERR655	$$ANERRL	PG
ERR655	$$ANERAN	PL
ERR658	$$ANERRF	PE
ERR658	$$ANERRL	PG
ERR660	$$ANERRF	PE
ERR660	$$ANERAM	PK
ERR665	$$ANERRF	PE
ERR665	$$ANERAM	PK
ERR695	$$ANERAN	PL
ERR695	$$ANERAQ	PR
ERR695	$$ANERAK	PS
ERR695	$$ANERAL	PU
ERR696	$$ANERAQ	PR
ERR696	$$ANERAK	PT
ERR700	$$ANERRE	PD
ERR700	$$ANERRF	PF
ERR700	$$ANERRL	PH
ERR700	$$ANERAM	PK
ERR700	$$ANERAN	PM
ERR700	$$ANERAP	PP
ERR700	$$ANERAQ	PR
ERR700	$$ANERAK	PT
ERR700	$$ANERAR	PW
ERR700	$$ANERAS	PX
ERR702	$$ANERAR	PW
ERR703	$$ANERRE	PD
ERR703	$$ANERAP	PP
ERR703	$$ANERAQ	PR
ERR703	$$ANERAK	PT
ERR704	$$ANERAR	PW
ERR705	$$ANERRL	PH
ERR705	$$ANERRL	PH
ERR705	$$ANERAM	PK
ERR705	$$ANERAN	PM
ERR705	$$ANERAR	PW
ERR706	$$ANERRE	PD
ERR706	$$ANERAP	PP
ERR707	$$ANERAN	PM
ERR710	$$ANERRE	PD
ERR710	$$ANERRF	PF
ERR710	$$ANERRL	PH
ERR710	$$ANERAM	PK
ERR710	$$ANERAQ	PR
ERR711	$$ANERAP	PP
ERR713	$$ANERAP	PP
ERR715	$$ANERRF	PF
ERR715	$$ANERAR	PW
ERR720	$$ANERRF	PF
ERR720	$$ANERRL	PH
ERR720	$$ANERAM	PK
ERR720	$$ANERAQ	PR
ERR722	$$ANERRE	PC
ERR722	$$ANERRL	PG
ERR755	$$ANERAN	PL
ERR760	$$ANERAQ	PQ
ERR760	$$ANERAK	PS
ERR760	$$ANERAL	PU
ERR805	$$ANERAL	PU
ERR820	$$ANERAL	PV
ERR825	$$ANERAL	PV
ERR840	$$ANERAL	PV
ERR842	$$ANERAL	PV
ERR870	$$ANERAL	PU
ESTVOUT	SGTCHS	CG
ESTVOUT1	SGTCHS	CG
EXCPIGN	SGTCHS	CAA
EXCPIGN	SGTCHS	CB
EXCP10	SGTCHS	CA
EXCP2	SGTCHS	CB
EXCP3	SGTCHS	CC

EXCP5	SGTCHS	CA
EXCP5	SGTCHS	CB
EXCP6P	SGTCHS	CAA
EXCP7	SGTCHS	CA
EXINTR	$$ANERRR	RJ
EXIT	SGTCHS	CG
EXIT	$$ANERRC	NM
EXIT	$$ANERRS	RK
EXIT	$$ANERRZ	TC
EXIT	$$ANERR1	TG
EXIT	$$ANERR6	UD
EXIT	$$RAST02	WD
EXITA	$$ANERRA	NLA
EXITA	$$ANERRS	RL
EXITA	$$ANERR7	UE
EXITAB	$$ANERRB	NN
EXITB	$$ANERRA	NLA
EXITB	$$ANERRS	RL
EXITBB	$$ANERRB	NN
EXITC	$$ANERRA	NLA
EXITRTN	$$RAST09	XJA
EXITRTN	$$RAST10	XL
EXITRTN	$$RAST00	VC
EXITRTN	$$RAST01	VJ
EXITRTN	$$RAST03	WH
EXITRTN	$$RAST11	XN
EXIT1	SGDFCH	EH
EXIT1	$$ANERR0	TF
EXIT1	$$RAST03	WH
EXIT1	$$RAST10	XL
EXIT2	$$ANERR0	TF
EXPAND	SGDFCH	EE
EXTEOJ	FOPT	BE
EXTRAN	SGUNCK	DC
EXTRT1	SGSVC	FJ
EXTRT1	SGSVC	FN
EXT01	FOPT	BD
EXT02	FOPT	BC
EXT03	FOPT	BC
EXT04	FOPT	BD
EXT1	SGSVC	FL
EXT2	SGSVC	FM
E050	$$ANERRI	QE
E051	$$ANERRI	QE
E06	$$ANERRI	QE
E062	$$ANERRI	QE

FCHRT1	SGDFCH	EA
FCHRT2	SGDFCH	EA
FCHRT3	SGDFCH	EA
FCHRT4	SGDFCH	EA
FCH2260L	$$ANERRC	NM
FCH3	SGSVC	FF
FETCH	$$RAST01	VJ
FETCH	$$RAST10	XL
FETMSGW	$$ANERR9	UB
FGP	SGDFCH	EC
FILEPR	$$ANERRB	NN
FINDPUBL	$$ANERRZ	TC
FINDTASK	$$RAST02	WB
FINDTOD	$$RAST01	VF
FINUP	$$ANERR6	UD
FIODONE	SGDFCH	EH
FLPTR	SGTCHS	CC
FNDQUE	SGTCHS	CCA
FNDQUE1	SGTCHS	CD
FONTERR	$$ANERR9	UB
FREDEV	SGTCHS	CP
FREDEV1	SGTCHS	CP
FREE	$$RAST10	XK
FSAVALID	$$RAST03	WG
FTCH2	$$ANERR6	UC
FTHMSGW	$$ANERRU	SC
F01	$$ANERRG	QB
F010	$$ANERRG	QB
F02	$$ANERRG	QB
F03	$$ANERRG	QB
F1EUTEST	SGUNCK	DB
F2EUTEST	SGUNCK	DB

GELNGTH	$$RAST01	VF
GENENT	FOPT	BF
GENENT	FOPT	BF
GEN1	FOPT	BF
GEN1	FOPT	BG
GETBND	$$RAST03	WH
GETCCB	$$ANERR7	UE
GETCHQ	SGTCHS	CK
GETCMD	$$RAST02	WC
GETCOM	$$RAST02	WD
GETENTRY	SGDFCH	EE
GETJIB	SGTCHS	CH
GETMSG	$$ANERRV	SE
GETPIB	SGTCHS	CR
GETPIB1	SGTCHS	CR
GETSEN	SGUNCK	DB
GIDCK1	$$ANERRZ	TD
GIOADR	SGTCHS	CE
GIOADR	SGTCHS	CF
GO	$$ANERRJ	QF
GO	$$ANERRJ	QF
GO	$$ANERRP	RE
GO	$$ANERRQ	RG
GOMCRR	SEND	LA
GOQUIET	$$RAST03	WJ
GOTCDMR	$$RAST01	VG
GOTCLB	SGTCHS	CH
GOTREQID	$$RAST02	WD
GTSEN1	SGUNCK	DB
G01	$$ANERRG	QB

HALT	SGTCHS	CD
HANDLECC	$$RAST00	VB
HANDLEMC	$$RAST00	VB
HANDLEMC	$$RAST03	WE
HARDCHAN	SGUNCK	DG
HARDWAIT	$$RAST00	VB
HEADQUE	$$ANERAA	NC
HEADQUE1	$$ANERAC	NF
HEADQUE2	$$ANERAF	NH
HEADQUE3	$$ANERAG	NJ
HOLDQUE	$$ANERRY	TA
HRDWAIT	$$RAST00	VA
H01	$$ANERRV	SE
H01	$$ANERRG	QB
H1RRTN	$$RAST03	WE

IDRAEXT	FOPT	BD
IDRAFCH	SGDFCH	EB
IDRAOK	SGDFCH	EDC
IDRANOPQ	SGDFCH	EA
IDRAST1	SGDFCH	EA

IDRAST2	SGDFCH	EF
IDRAST3	SGDFCH	EF
IGEXIT	$$ANERRS	RK
IGEXIT	$$ANERRW	SF
IGEXIT	$$ANERRW	SG
IGNCAN	$$ANERRS	RL
IGON	$$ANERRU	SB
IJBERA35	$$ANERRA	NL
IJBERB33	$$ANERRB	NN
IJBERB35	$$ANERAB	RA
IJBERC35	$$ANERRC	NM
IJBERG20	$$ANERRG	QA
IJBERH20	$$ANERRH	QD
IJBERI20	$$ANERRI	QE
IJBERJ24	$$ANERRJ	QF
IJBERK20	$$ANERRK	QH
IJBERN33	$$ANERRN	RB
IJBERO35	$$ANERRO	RD
IJBERP33	$$ANERRP	RE
IJBERQ33	$$ANERRQ	RG
IJBERR20	$$ANERRR	RJ
IJBERS34	$$ANERRS	RK
IJBERT20	$$ANERRT	SA
IJBERU33	$$ANERRU	SB
IJBERV20	$$ANERRV	SD
IJBERX20	$$ANERRX	SJ
IJBER535	$$ANERAF	NG
IJBER635	$$ANERAG	NJ
IJBER932	$$ANERR9	UA
IJBMVC33	$$ANERR1	TG
IJBPA134	$$ANERRZ	TC
IJBPA233	$$ANERRY	TA
IJBPA333	$$ANERR0	TE
INDIB	SGTCHS	CJ
INERRCNT	$$ANERAI	UG
INHWRITE	SGTCHS	CH
INITCHN1	SGTCHS	CP
INITRG	SGTCHS	CP
INITSIO	SGTCHS	CN
INRQ	$$ANERRW	SG
INSERT	$$ANERRB	NN
INST	SEND	LD
INTERRCC	SGTHAP	MK
INTERV	$$ANERR9	UA
INTPUBSC	SGTCHS	CK
INTREQ	$$ANERRU	SC
INTREQ	$$ANERRV	SD
INTREQ	$$ANERSA	UK
INTREQD	$$ANERAI	UG
INTRTN	SGTCHS	CK
INTVEN	$$ANERRA	NLA
INVAL	$$ANERRY	TB
INVALID	$$RAST10	XM
IOCOMP	$$ANERRQ	RH
IODONE	$$ANERRP	RF
IOERR	$$ANERRH	QD
IOERR	$$ANERRI	QE
IOERR	$$ANERRJ	QG
IOERR	$$ANERRP	RF
IOINTR	$$ANERRR	RJ
IONOP	SGUNCK	DA
IOPSET	SGSVC	FF
IORTN	$$ANERRI	QE
IORTN	$$ANERRJ	QG
IOWAIT	$$ANERSB	UP
IOWAIT	$$ANERSC	UR
IPLEXIT	$$RAST00	VC
IREXIT	$$ANERRT	SA
IREXIT	$$ANERRW	SF
ISSVC51	SGDFCH	EDB
ISSVC51	SGDFCH	EDC
JAENTRY	FOPT	BK
JAISBND	FOPT	BK
JAISPP	FOPT	BK
JANOTSUP	FOPT	BK
JASETSP	FOPT	BC
JAXIT	FOPT	BL
JAXITBR	FOPT	BC
JIBTYP	SGTCHS	CJ
KEYINT	$$ANERRR	RJ
KRTY	$$ANERRS	RK
K01	$$ANERRG	QB
LACSW	$$ANERRO	RD
LASPH	$$ANERRA	NL
LASPHAS	$$ANERRC	NM
LASTRACK	$$RAST01	VH
LASTREC	$$RAST01	VH
LCIDAR	SGDFCH	EC
LDPSW	$$ANERRR	RJ
LDRAST00	$$RAST01	VJ
LDRAST02	$$RAST00	VD
LDRAST02	$$RAST01	VJ
LDREGS	SGTCHS	CK
LGD	SGTCHS	CH
LGDD	SGTCHS	CH
LGDD1	SGTCHS	CH
LGD1	SGTCHS	CH
LMERA	FOPT	BCA
LOADCK	$$ANERSA	UN
LOADMOD	$$RAST00	VC
LOADMOD	$$RAST01	VJ
LOADMOD	$$RAST03	WH
LOADPSW	$$ANERRR	RJ
LOADTEST	$$RAST00	VC
LOADTEST	$$RAST01	VJ
LOADTEST	$$RAST03	WH
LOAD00	$$RAST00	VA
LOAD01	$$RAST01	VF
LOAD03	$$RAST03	WE
LOAD09	$$RAST09	XJA
LOGBAD	$$RAST10	XK
LOGENT	$$ANERRP	RE
LOGENT	$$ANERRQ	RG
LOGERP	$$ANERRU	SC
LOGLOOP	$$RAST09	XJA
LOGLOOP	$$RAST11	XN
LOGPRC	SGTCHS	CFA
LOGPRC1	SGTCHS	CG
LOGPRC2	SGTCHS	CG
LOGRTN	$$ANERRY	TA
LOGTST	$$ANERRU	SC
LOGTST	$$ANERRY	TA
LOGWAIT	$$ANERRY	TA
LOG1	$$ANERRY	TA
LOG2	$$ANERRY	TA
LOOKUP	SGDFCH	ED
LOOP1	$$ANERAE	RC
LOWBITON	$$RAST11	XN

LSTDIB	SGTCHS	CJ
LTA	SEND	LH
LTABSY	SGSVC	FD
LTACCB	$$ANERRM	NB
LTACNL	FOPT	BB
LTARTRN	FOPT	BE
LTKHLD	$$ANERRZ	TD
L01	$$ANERRG	QC
L01	$$ANERRI	QE
MACHEK	SGUNCK	DG
MACHEK	SGUNCK	DG
MACHEK	SGUNCK	DG
MACHEK1	SGUNCK	DG
MAINRT	$$ANERR6	UC
MAINTASK	$$ANERR1	TG
MAINTR	$$ANERR7	UE
MAINTR	$$ANERR8	UF
MCCPUEX1	SMCRR	KG
MCMVLGOT	SMCRR	KE
MCNOTSP	SMCRR	KC
MCPDCOND	MCRAS	HA
MCRBUMP	SMCRR	KE
MCRCHDMG	SMCRR	KA
MCRCHMVN	SMCRR	KD
MCRCHNBC	SMCRR	KD
MCRCHNDM	$$A$SUP1	KB
MCRCNCOD	SMCRR	KE
MCRCPUEX	SMCRR	KG
MCRDVDMG	SMCRR	KD
MCREND01	SMCRR	KD
MCREND02	SMCRR	KE
MCREND03	SMCRR	KG
MCREND04	SMCRR	KH
MCRENTER	SGUNCK	DG
MCRETURN	SMCRR	KC
MCRFULL	SMCRR	KF
MCRGTFDV	$$A$SUP1	KB
MCRGTLST	SMCRR	KD
MCRGTPIB	SMCRR	KE
MCRLOOP1	SMCRR	KA
MCRLOOP2	$$A$SUP1	KB
MCRLOOP3	SMCRR	KG
MCRMPX	SMCRR	KA
MCRMPXST	$$A$SUP1	KB
MCRNEQLD	SMCRR	KF
MCRNLTA	SMCRR	KG
MCRNODMG	SMCRR	KD
MCRNTBSY	SMCRR	KC
MCRNTCIB	SMCRR	KF
MCRNTLTA	SMCRR	KG
MCRNTSUP	SMCRR	KE
MCROBRRT	SMCRR	KJ
MCRPARIT	SGUNCK	DG
MCRRBST	SMCRR	KG
MCRRCHER	SMCRR	KA
MCRRCPU	SMCRR	KG
MCRRDIAG	$$A$SUP1	KB
MCRRRTN	SMCRR	KA
MCRRTSTQ	$$A$SUP1	KB
MCRSAFTR	SMCRR	KG
MCRSCNCH	SMCRR	KA
MCRSCPHM	SMCRR	KH
MCRSEL1	$$A$SUP1	KB
MCRSEL2	$$A$SUP1	KB
MCRSENDD	SGUNCK	DG
MCRSPSW2	SMCRR	KH
MCRSUPIK	SMCRR	KJ
MCRSUPSW	SMCRR	KE
MCSCHDL	MCRAS	HA
MCSELECT	SMCRR	KF
MCSOFT	MCRAS	HA
MCTASK	MCRAS	HA
MESG	$$ANERRB	NN
MESSWTR	$$RAST11	XN
MODCCW	$$ANERRX	SK
MODESTAT	$$RAST03	WJ
MODIFY	SEND	LF
MOVELIST	$$ANERAD	NK
MOVENAME	$$ANERRM	NB
MOVIDRA	SGDFCH	EDC
MOVNAM	$$ANERRM	NA
MOVRIK	SGDFCH	EDB
MOVRIK	SGDFCH	EDC
MPSTASK	$$RAST01	VG
MPSTST	$$ANERRN	RB
MPSTST	$$ANERRQ	RG
MPSYES	SGTCHS	CN
MSGNTR	$$ANERRW	SF
MSGWTR	$$ANERRT	SA
MSGWTR	$$ANERRV	SE
MSGWTR	$$ANERRW	SG
MSGWTR	$$ANERRW	SH
MSGWTR	$$ANERR7	UE
MSGWTR	$$ANERRG	QA
MSGWTR	$$ANERRH	QD
MSGWTR	$$ANERRI	QE
MSGWTR	$$ANERRJ	QF
MSGWTR	$$ANERRK	QH
MSG2	$$ANERAB	RA
MSG3	$$ANERAB	RA
MSG4	$$ANERAB	RA
MVC	$$ANERR1	TG
MVCCW	SGTCHS	CD
MVEPSW	SGUNCK	DF
MVMSG	$$ANERRV	SD
MVZEX	SGUNCK	DB
M01	$$ANERRG	QC
M01	$$ANERRI	QE
M01	$$ANERRK	QH
NDEQUE	$$ANERRC	NM
NEXTCYL	$$RAST01	VH
NEXTPH	$$ANERAE	RC
NGTMBP	SGSVC	FG
NOAP	$$ANERRZ	TD
NOAP1	$$ANERRZ	TC
NOCANCEL	$$RAST02	WB
NOCB	SGTCHS	CN
NOCCB	$$ANERRX	SK
NOCCB	$$RAST02	WC
NOCCB	$$ANERRO	RD
NOCCB1	SGUNCK	DA
NODEQUE	$$ANERRC	NM
NODEQUE	$$ANERAB	RA
NOEMP	$$ANERR9	UB
NOLOADAD	SGDFCH	EE
NOLOG	$$ANERAE	RC
NOLOG	$$ANERRP	RF
NOLOG	$$ANERRQ	RH
NOLSS	$$ANERR9	UB

NOLTA	$$ANERAE	RC
NOLTH	$$ANERRM	NB
NOMSG	$$RAST10	XL
NONREC	$$ANERR9	UA
NOPBR	$$ANERRQ	RG
NOPINS	SGTCHS	CH
NOPINSTR	SGTCHS	CH
NOPRNAME	$$RAST01	VG
NOPUBRS	$$ANERAA	NC
NORELOC	SGUNCK	DAA
NOQUIS	SGUNCK	DH

NORCD	SGDSK	GA
NORCFND	$$ANERRA	NL
NOSO	SGTCHS	CCA
NOSTART	SGUNCK	DA
NOSTATUS	$$ANERRV	SE
NOSWP	SGSVC	FG
NOS01	SGTCHS	CM
NOTBONLY	SGDFCH	EG
NOTBSY	SGTCHS	CL
NOTCLB	SGTCHS	CH
NOTDMC1	$$RAST02	WC
NOTFCH	SGSVC	FE
NOTFIRST	$$RAST03	WJ
NOTFOUND	SGDFCH	ED
NOTFULL	$$RAST01	VJ
NOTIC	SGTCHS	CH
NOTIC	$$ANERR6	UD
NOTMPS	$$RAST11	XN
NOTPD	FOPT	BH
NOTPD1	FOPT	BH
NOTRIA	SGTCHS	CK
NOT2314	SEND	LE
NRFRTY	$$ANERRJ	QF
NRTASTO	SGTCHS	CE
NTFTCH	SGUNCK	DC
NXTERPIB	$$RAST10	XK
NXT1	SGTCHS	CG
N01	$$ANERRG	QC
N01	$$ANERRJ	QF
N1114	SGTCHS	CQ

OBRAREL	$$ANERAA	NC
OBRBYPS	$$ANERRM	NA
OBREXIT	$$ANERAA	ND
OBRIOE	$$ANERAA	NC
OBRIOE1	$$ANERAA	ND
OBRIO2	$$ANERAA	NC
OBRIO3	$$ANERAA	NC
OBRNOCCB	$$ANERRM	NB
OBRNOKEY	$$ANERRM	NB
OBRREL	$$ANERAA	ND
OBRREL1	$$ANERAA	ND
OBRSPR	$$ANERRM	NA
OBRSPR1	$$ANERRM	NA
OFFLINE	SGTCHS	CR
OK	$$ANERR1	TG
ONERET	$$ANERRG	QA
ONERTRY	$$ANERR9	UA
OPCLOSE	SGDFCH	EC
OPFLAG	$$ANERRN	RB
OPTRT1	SGSVC	FM
OPTRT2	SGSVC	FM
OPVNT	$$ANERRW	SG
ORERP	$$ANERRA	NL
OR1287	$$ANERR9	UA
OURSIO	SGUNCK	DF
OVERRUN	$$ANERR9	UB
OVERUN	$$ANERRB	NN
OVRUN	$$ANERRV	SE

PARTNOK	$$RAST09	XJB
PAR40	$$ANERR0	TE
PAR41	$$ANERR0	TE
PAR42	$$ANERR0	TE
PAR43	$$ANERR0	TE
PAR44	$$ANERR0	TE
PAR45	$$ANERR0	TE
PAT	$$ANERRC	NM
PCHDI3	SGTCHS	CJ
PCHKSW	FOPT	BA
PCHKSW	SGSVC	FJ
PCHKSW	SGSVC	FK
PCIL1	SGDFCH	EB
PCIL2	SGDFCH	EB
PCITRT	SGSVC	FM
PCURTN	$$ANERRW	SF
PDABEX	SMICR	JH
PDAGN	SMICR	JF
PDAID	SGDFCH	EE
PDBOCK	SMICR	JF
PDBUFL	SMICR	JB
PDCCBPT	SGSVC	FB
PDCCBT	SGSVC	FB
PDCHAN	SMICR	JE
PDCHAN	SMICR	JF
PDCOMP	SMICR	JE
PDCSWST	SMICR	JD
PDCSWST	SMICR	JF
PDDEQUE	SMICR	JG
PDDEQUE1	SMICR	JG
PDDEQUE2	SMICR	JG
PDDFLT	SMICR	JF
PDEDLT	SGSVC	FB
PDERXT1	SMICR	JE
PDERXT1	SMICR	JF
PDERXT2	SMICR	JE
PDERXT2	SMICR	JF
PDERXT3	SMICR	JF
PDETIO	SMICR	JD
PDETIO	SMICR	JF
PDEXT1	SMICR	JH
PDFSTM	SMICR	JB
PDHERE	SMICR	JC
PDIAGN	SMICR	JB
PDIAGN1	SMICR	JC
PDINTR	SMICR	JA
PDKEY	SMICR	JH
PDMOV	SMICR	JE
PDMPI	SMICR	JA
PDMVCSW	SMICR	JE

PDNF	SMICR	JB
PDNOB	SMICR	JC
PDNONOP	SMICR	JB
PDNOPCK	FOPT	BA
PDNOPCK	SGSVC	FJ
PDNOPCK	SGSVC	FK
PDNOSS	SMICR	JB
PDNOTSS	SMICR	JG
PDNOTZR	SMICR	JC
PDPDEQ	SMICR	JE

PDPRCAN	SMICR	JG
PDPROGCK	SMICR	JG
PDREJDC	SMICR	JF
PDREJT	SMICR	JC
PDSCAW	SMICR	JB
PDSERR	SMICR	JD
PDSERR1	SMICR	JD
PDSERR1	SMICR	JF
PDSERR2	SMICR	JD
PDSERR3	SMICR	JD
PDSIO	SMICR	JC
PDSNO1	SMICR	JE
PDSNO2	SMICR	JD
PDSPK	SMICR	JB
PDSS	SMICR	JC
PDSUPEXT	SMICR	JH
PDSUPV	FOPT	BG
PDSUPV	SGSVC	FL
PDSVC28	SMICR	JC
PDSWBP	SMICR	JH
PDSWZ	SMICR	JH
PDTASK	SMICR	JH
PDTERR1	SMICR	JE
PDTERR1	SMICR	JF
PDTERR2	SMICR	JE
PDTERR5	SMICR	JE
PDTIMER	SMICR	JH
PDTIO	SMICR	JA
PDTIOERR	SMICR	JE
PDTIOERR	SMICR	JF
PDTIOK	SMICR	JB
PDTKY	FOPT	BG
PDTKY	SGSVC	FL
PDUPDT	SMICR	JB
PDYES	SMICR	JE
PHASE	SGDFCH	EC
PHASEH	$$ANERRG	QC
PHASEJ	$$ANERRG	QA
PHASES	$$ANERRP	RF
PHASES	$$ANERRQ	RH
PHASES	$$ANERRR	RJ
PHASE1	$$ANERRG	QB
PHASE2A	$$ANERAE	RC
PHASR	$$ANERRQ	RH
PICKDIR	SGDFCH	EC
POSCHK	$$ANERSC	UQ
POSCHK3	$$ANERSC	UQ
POSCHK4	$$ANERSC	UR
POSTCAN	$$ANERRY	TB
POSTCE	SGTCHS	CP
POSTPIB	$$RAST02	WB
PREFERED	SGDFCH	EC
PREPSBR	$$ANERSC	UQ
PROC	$$ANERRT	SA
PROTCHK	$$ANERRA	NL
PROTECT	SGTCHS	CH
PRTPRG	SGUNCK	DB
PRTPRG1	SGUNCK	DA
PSTBUF	$$ANERRW	SG
PSTEOF	SGTCHS	CQ
PSTERR	$$ANERRT	SA
PSTERR	$$ANERRW	SF
PTERP	$$ANERRA	NL
PTOSW	$$ANERRL	PG
PTRXCH	$$ANERR0	TF
PUBDEQ	SGSVC	FF
PUBSCAN	$$RAST00	VE
PUBSCN3	$$ANERRZ	TD
PURGE	SGTCHS	CM
PUTUTR	$$ANERRU	SC
QIDCK1	$$ANERRZ	TD
QISRT1	SGUNCK	DH
QISRT2	SGUNCK	DH
QISRT3	SGUNCK	DH
QUETEST	$$ANERRP	RE
QUETEST	$$ANERRQ	RG
QUEUP	SGTCHS	CC
QUIET145	$$RAST03	WJ
QUISIO	SGUNCK	DH
Q01	$$ANERRG	QC
RADLDS	SGTCHS	CA
RASDEQ	MCRAS	HG
RASIO	$$RAST01	VH
RASIO	$$RAST10	XM
RASIO	$$RAST11	XN
RASIOE	MCRAS	HC
RASMEXT	MCRAS	HB
RASQOK	MCRAS	HC
RAST02	$$RAST00	VD
RBBY12	SEND	LA
RCHAN	$$ANERR6	UD
RCHAN	$$ANERAJ	UJ
RCHS	$$ANERAJ	UJ
RCOMMONA	$$RAST05	XG
RCOMMONB	$$RAST04	XD
RCOMMONB	$$RAST05	XG
RCVERR	SGUNCK	DC
RDDIR2	SGDFCH	ED
RDHA9	SGDSK	GA
RDRCD	$$ANERRH	QD
RDTXT	SGDFCH	EE
RDVER	$$ANERRK	QH
RDYCANDP	SGTHAP	MK
RDYCNL	SGTHAP	MM
RDYCN1	SGTHAP	MM
RDYCN2	SGTHAP	MM
RDYCN2A	SGTHAP	MM
RDYCN4	SGTHAP	MM
RDYCN4X	SGTHAP	MM
RDYCN4Z	SGTHAP	MM
RDYDUMP	SGTHAP	MK
READUPDT	SGDFCH	EG
RECAL	SGDSK	GA
RECFULL	$$RAST01	VF
RECSBLT	$$RAST01	VJ
RECVERR	$$ANERR8	UF
REFAIL	$$ANERR8	UF
REGZERO	$$RAST11	XN
RELOC	$$ANERRP	RE
RELOCATE	$$RAST10	XL
REPERR	$$ANERRQ	RH
REQUEST	$$RAST10	XM
RERASIO	MCRAS	HC
RESCHK	SGUNCK	DB
RESERR	SGDSK	GA
RESET	$$ANERAE	RC
RESPNS	$$ANERRR	RJ
RESPTYP	$$RAST10	XL
RESTART	$$RAST00	VC
RESTCQP	$$ANERSC	UR

RESTORE	$$RAST03	WG
RESTUSE	$$ANERSB	UP
RESVC	SGSVC	FC
RESVC1	SGSVC	FE
RETOFF	$$ANERR6	UD
RETOFF	$$ANERR7	UE
RETRY	$$ANERRV	SE
RETRY	$$ANERRX	SK
RETRY	$$ANERR9	UB
RETRY	$$ANERR6	UC
RETRY	$$ANERRR	RJ
RETURN	$$RAST01	VH
RETURN	$$RAST03	WH
RETXIT	$$ANERRX	SK
RINGBELL	$$RAST00	VA
RINGTIO	$$RAST00	VA
RLOG	$$RAST04	XA
RMESSAGE	$$RAST00	VA
RPRNTR	$$RAST04	XC
RSETWAIT	SGTCHS	CM
RSTCHPT	$$ANERRY	TA
RSTCHQ	$$ANERRY	TA
RSTFLG	$$ANERRU	SC
RSTFLG	$$ANERRI	QE
RSTFLG	$$ANERRJ	QG
RSTFLG	$$ANERRP	RF
RSTFLG	$$ANERRQ	RG
RSTPUB	SGDFCH	EH
RSTPUB1	SGDFCH	EH
RSTQPT	$$ANERRU	SC
RSTQPT	$$ANERRH	QD
RSTQPT	$$ANERRI	QE
RSTQPT	$$ANERRJ	QG
RSTQPT	$$ANERRP	RF
RSTQPT	$$ANERRQ	RG
RSTREG	SGUNCK	DE
RTARET	MCRAS	HB
RTARET1	MCRAS	HB
RTNTEST	$$RAST00	VA
RTY	$$ANERRV	SD
RTYCT	$$ANERRV	SE
RTYONE	$$ANERRU	SC
RTYRTN	$$ANERRP	RF
R01	$$ANERRG	QA
R01	$$ANERRI	QE
R01	$$ANERRJ	QF
R1442	$$RAST04	XC
R1442A	$$RAST04	XC
R1442B	$$RAST04	XC
R2501	$$RAST04	XB
R2501A	$$RAST04	XB
R2501B	$$RAST04	XB
R2520	$$RAST05	XE
R2520B	$$RAST05	XE
R2540	$$RAST04	XB
SAVEIO	$$RAST00	VE
SCANTAB	$$RAST02	WC
SCHREC2	$$RAST02	WD
SCIL1	SGDFCH	EB
SCIL2	SGDFCH	EB
SCURTN	$$ANERRW	SG
SDM01	$$ANERAF	NG
SDRACC1	$$ANERAC	NE
SDRACC2	$$ANERAC	NE
SDRACC3	$$ANERAC	NE
SDRACC5	$$ANERAC	NE
SDRAREL	$$ANERAC	NE
SDRAW1	$$ANERAC	NE
SDRAW2	$$ANERAC	NE
SDRERAC	$$ANERAC	NE
SDREXIT	$$ANERAC	NF
SDRIO	$$ANERAF	NH
SDRIOE	$$ANERAC	NF
SDRIOX	$$ANERAF	NH
SDRIOX1	$$ANERAG	NJ
SDRIO2	$$ANERAC	NF
SDRMM	SEND	LA
SDRM00	$$ANERAG	NJ
SDRM012	$$ANERAF	NG
SDRM02	$$ANERAF	NG
SDRM03	$$ANERAF	NG
SDRNMCRR	SEND	LG
SDRNO	SEND	LB
SDRNOAD	$$ANERAC	NE
SDROBR	SEND	LF
SDROBRO	SEND	LF
SDROBRW	SEND	LF
SDRQUIS	SGUNCK	DH
SDRQUIS1	SGUNCK	DH
SDRREL	$$ANERAC	NF
SDRREL1	$$ANERAC	NF
SDRSDR	SEND	LF
SDRSDR1	SEND	LF
SDRSDR2	SEND	LG
SDRSDR2X	SEND	LG
SDRSKIP	$$ANERAF	NG
SDRSVC3	SEND	LA
SDRXIO	SEND	LB
SDRXIO1	SEND	LB
SDRXIO2	SEND	LB
SDRXIO3	SEND	LB
SDRYES	SEND	LD
SDR1	SEND	LE
SDR1A	SEND	LE
SDR1B	SEND	LE
SDR1B1	SEND	LE
SDR1B2	SEND	LE
SDR1B3	SEND	LE
SDR1B4	SEND	LE
SDR1B5	SEND	LE
SDR1RES	SEND	LE
SDR1RESX	SGUNCK	DE
SDR1RES1	SEND	LE
SDR2A3	SEND	LC
SDR2A4	SEND	LC
SDR2A5	SEND	LC
SDR2QT	SEND	LB
SDR2QT1	SEND	LB
SDR2QT2	SEND	LB
SDR23	SEND	LD
SECTION1	$$ANERRZ	TC
SECTION3	$$ANERRZ	TD
SEEKTEST	SGTCHS	CH
SEKCH	$$ANERRA	NL
SEKCHK	SGDSK	GA
SEKCHK1	SGDSK	GA
SELBMX	SGTCHS	CN
SELBMX	SGTCHS	CN
SELECT	SGTCHS	CN
SELERR	$$ANERRV	SD
SENSTSTS	$$ANERR9	UA

SETARON	$$ANERRY	TB
SETCNCL	$$ANERR0	TF
SETCNCL	$$ANERRQ	RG
SETDIS	$$ANERRS	RL
SETEBL	$$ANERR8	UF
SETFCPU	MCRAS	HA
SETFLE	$$ANERRX	SJ
SETKEY	$$RAST03	WH
SETLNK	$$ANERAA	NC
SETLT1	SGSVC	FD
SETLT2	SGSVC	FD
SETLT2A	SGSVC	FD
SETOP1	SGSVC	FJ
SETOP1	SGSVC	FN
SETOP2	SGSVC	FJ
SETOP2	SGSVC	FN
SETPOSTL	$$ANERRZ	TD
SETPSN	$$ANERR7	UE
SETRD	$$ANERR8	UF
SETRTRY	$$ANERRQ	RH
SETSK	SGDFCH	EC
SETSKAD	SGDFCH	EC
SETSVAR	SGDFCH	EF
SETUP	$$RAST00	VC
SIO	SGTCHS	CFA
SKCHK	$$ANERRA	NL
SKSLI	$$ANERRB	NN
SPFKREP	$$RAST03	WH
SSCOM	$$ANERRW	SG
STDEXT	SGUNCK	DC
STEPLOOP	$$ANERRZ	TD
STGERR	$$RAST03	WG
STGEXIT	$$RAST03	WH
STMODE	SGTCHS	CG
STMODE1	SGTCHS	CG
STMODE2	SGTCHS	CG
STORE	SGTCHS	CH
STORKE	$$ANERAE	RC
STRTED	SGTCHS	CE
STRTED	SGTCHS	CFA
STRTIO	SGTCHS	CE
STRTIO	SGTCHS	CFA
STRTIO1	SGTCHS	CE
STRTIO1	SGTCHS	CFA
STRTI2	SGTCHS	CFA
SUPEXP	SGTCHS	CA
SUPEXP	SGTCHS	CB
SUPEXT	FOPT	BD
SUPIB	SGTCHS	CR
SVC 37	SGTHAP	MC
SVCALL	$$ANERAE	RC
SVCA6	SGSVC	FR
SVCRTN1	FOPT	BH
SVCWAIT	$$ANERRY	TA
SVCWAIT	$$ANERRP	RF
SVCWAIT	$$ANERRQ	RG
SVCWAIT1	$$ANERR0	TE
SVC00	SGTCHS	CA
SVC00	SGTCHS	CB
SVC01A	SGSVC	FA
SVC02	SGSVC	FC
SVC02A	SGSVC	FC
SVC02J	SGSVC	FC
SVC03	SGSVC	FF
SVC03	SGSVC	FF
SVC04	SGSVC	FF
SVC05	SGSVC	FB
SVC06	SGTHAP	MM
SVC07	SGSVC	FE
SVC08	SGSVC	FG
SVC10	SGSVC	FG
SVC10A	SGSVC	FG
SVC11	SGSVC	FE
SVC11A	SGSVC	FE
SVC11A	SGSVC	FE
SVC11B	SGSVC	FD
SVC11C	SGSVC	FD
SVC12A	SGSVC	FA
SVC13A	SGSVC	FA
SVC15	SGTCHS	CA
SVC15	SGTCHS	CB
SVC18	SGSVC	FN
SVC19	SGSVC	FN
SVC2BND	SGSVC	FC
SVC22	SGSVC	FH
SVC22A	SGSVC	FH
SVC23	SGSVC	FH
SVC24	SGSVC	FH
SVC27	SGTCHS	CB
SVC29	SGSVC	FB
SVC3	$$ANERRA	NL
SVC35	SGTHAP	MA
SVC35A	SGTHAP	MA
SVC36	SGTHAP	MB
SVC37A	SGTHAP	MC
SVC38	SGTHAP	MD
SVC38A	SGTHAP	MD
SVC38B	SGTHAP	MD
SVC38B	SGTHAP	MD
SVC38C	SGTHAP	MD
SVC38C	SGTHAP	MD
SVC38D	SGTHAP	MD
SVC38E	SGTHAP	MD
SVC39	SGTHAP	ME
SVC39A	SGTHAP	ME
SVC39B	SGTHAP	ME
SVC39C	SGTHAP	ME
SVC39D	SGTHAP	ME
SVC39E	SGTHAP	MF
SVC39E1	SGTHAP	MF
SVC39F	SGTHAP	MF
SVC39G	SGTHAP	ME
SVC39H	SGTHAP	MD
SVC39H	SGTHAP	ME
SVC39H1	SGTHAP	ME
SVC39J	SGTHAP	MF
SVC39K	SGTHAP	MF
SVC39L	SGTHAP	MF
SVC39M	SGTHAP	ME
SVC39P	SGTHAP	ME
SVC39P1	SGTHAP	ME
SVC39Q	SGTHAP	MF
SVC40	SGTHAP	MG
SVC40A	SGTHAP	MG
SVC40B	SGTHAP	MG
SVC40C	SGTHAP	MG
SVC40D	SGTHAP	MG
SVC40E	SGTHAP	MG
SVC41	SGTHAP	MH
SVC41A	SGTHAP	MH
SVC41A1	SGTHAP	MH
SVC41A2	SGTHAP	MH
SVC41B	SGTHAP	MH

SVC41C	SGTHAP	MH
SVC42	SGTHAP	MG
SVC42A	SGTHAP	MG
SVC42B	SGTHAP	MG
SVC43	SGSVC	FR
SVC45	SGSVC	FR
SVC51	SGSVC	FS
SVEREG	FOPT	BAA
SVEREG	SGTCON	GC
SVNWAD	SGTCHS	CD
SWITCH	$$ANERRO	RD
SXPC1	SGSVC	FN
SXPC2	SGSVC	FN
SXTRT1	SGSVC	FJ
SXTRT1	SGSVC	FN
SYCLAS	$$ANERRO	RD
SYSFILE	SGTCHS	CJ
SYSFILE1	SGTCHS	CJ
SYSFILE2	SGTCHS	CJ
SYSFILE3	SGTCHS	CQ
SYSFILE4	SGTCHS	CJ
SYSFILE5	SGTCHS	CE
SYSINOUT	SGTCHS	CE
SYSSIN	SGTCHS	CJ
S01	$$ANERRJ	QF
TAPMODE2	$$ANERR9	UB
TCAN2	$$ANERRY	TB
TCAN2A	$$ANERRY	TB
TEST	$$ANERRH	QD
TESTBUSY	$$ANERRP	RE
TESTDMC	$$RAST02	WA
TESTEOJ	SGTCHS	CF
TESTER	$$ANERAD	NK
TESTFE	$$RAST02	WD
TESTIGN	$$ANERRQ	RG
TESTLTA	FOPT	BE
TESTSUB	$$ANERR1	TG
TESTSVC	SGDFCH	EDA
THCHK	SGTHAP	MC
THDLT1	SGTHAP	MB
THDLT2	SGTHAP	MB
THDLT2	SGTHAP	MB
THFREE	SGTHAP	MB
THFREE1	SGTHAP	MB
THRETRY	SGTHAP	MC
THSETUP	SGTHAP	MA
THWAIT1	SGTHAP	MA
THWAIT2	SGTHAP	MA
TKDLET	SGTHAP	MB
TKHDADD	SGTHAP	MA
TKHDQUE	SGTHAP	MA
TKHDRTN	SGTHAP	MA
TKHD1	SGTHAP	MA
TKHELD	SGTHAP	MA
TKPRTY	SGTHAP	MJ
TKPRT1	SGTHAP	MJ
TMEKEY	SGSVC	FG
TMERT1	SGSVC	FL
TMRBPS	SGSVC	FL
TMRSW	SGSVC	FL
TPBUSY	SGTCHS	CD
TPBUSY1	SGTCHS	CD
TPBUSY2	SGTCHS	CCA
TPBUSY3	SGTCHS	CC
TPBUSY4	SGTCHS	CC
TPIGNOR	$$ANERRC	NM
TPRETRN	SEND	LA
TPSDR1	SEND	LA
TRKCHK	SGDSK	GB
TRKEOC	SGDSK	GB
TRNOFF	SGTCHS	CL
TRYNXT	SGTCHS	CH
TSTATD	$$ANERRR	RJ
TSTATTN	SGTCHS	CL
TSTBMX	SGTCHS	CQ
TSTCAN	$$ANERRR	RJ
TSTCCB	$$ANERRN	RB
TSTCCC	$$ANERRU	SB
TSTCDC	$$ANERRU	SB
TSTDEV	SGTCHS	CCA
TSTEOJ	SGTCHS	CE
TSTEQCK	$$ANERR6	UC
TSTERF	SGTCHS	CL
TSTNXT	SGTCHS	CJ
TSTPSN	$$ANERR7	UE
TSTQEF	SGTCHS	CP
TSTRESIO	SGTCHS	CN
TSTRTY	$$ANERRN	RB
TSTSNS	$$ANERAI	UG
TSTSSL	$$ANERRB	NN
TSTSVC	SGDFCH	EDA
TSTTRG	$$ANERRS	RK
TSTUCK	SGTCHS	CKA
TST03U	$$ANERRU	SB
TST2311	$$ANERAA	NC
T01	$$ANERRG	QB
T03	$$ANERRH	QD
T06	$$ANERRH	QD
T145RTN	$$RAST03	WF
T155RTN	$$RAST03	WE
UCBPAR	$$ANERRV	SD
UCSTST	$$ANERRV	SE
UNBUSY	$$RAST02	WA
UNCOMMON	SGTCHS	CE
UNDETERR	$$ANERAI	UG
UNDETR	$$ANERR6	UC
UNDETR	$$ANERR7	UE
UNDTR	$$ANERRT	SA
UNDTR	$$ANERRW	SF
UNKN	$$ANERRB	NN
UNPACK	$$RAST11	XN
UNPCH	$$ANERRO	RD
UNPKSEN	$$ANERRO	RD
UNRCERP	$$ANERRA	NL
UNSUPTD	$$ANERR9	UB
UNTCK1	SGUNCK	DA
UNTCK2	SGUNCK	DA
UNUSENS	$$ANERRU	SC
UNWAIT	SGTHAP	MJ
UNW001	SGTHAP	MJ
UNW002	SGTHAP	MJ
UNW003	SGTHAP	MJ
UNW004	SGTHAP	MJ
UNW005	SGTHAP	MJ
UPDATCCW	$$ANERAI	UG
UPDATE	$$RAST03	WF
UPDATE	$$RAST11	XN
UPDPUB	$$RAST00	VE
UPDPUB	$$RAST02	WA
UPDSCAN	$$RAST02	WC
USRAPPEN	SGTCHS	CKA

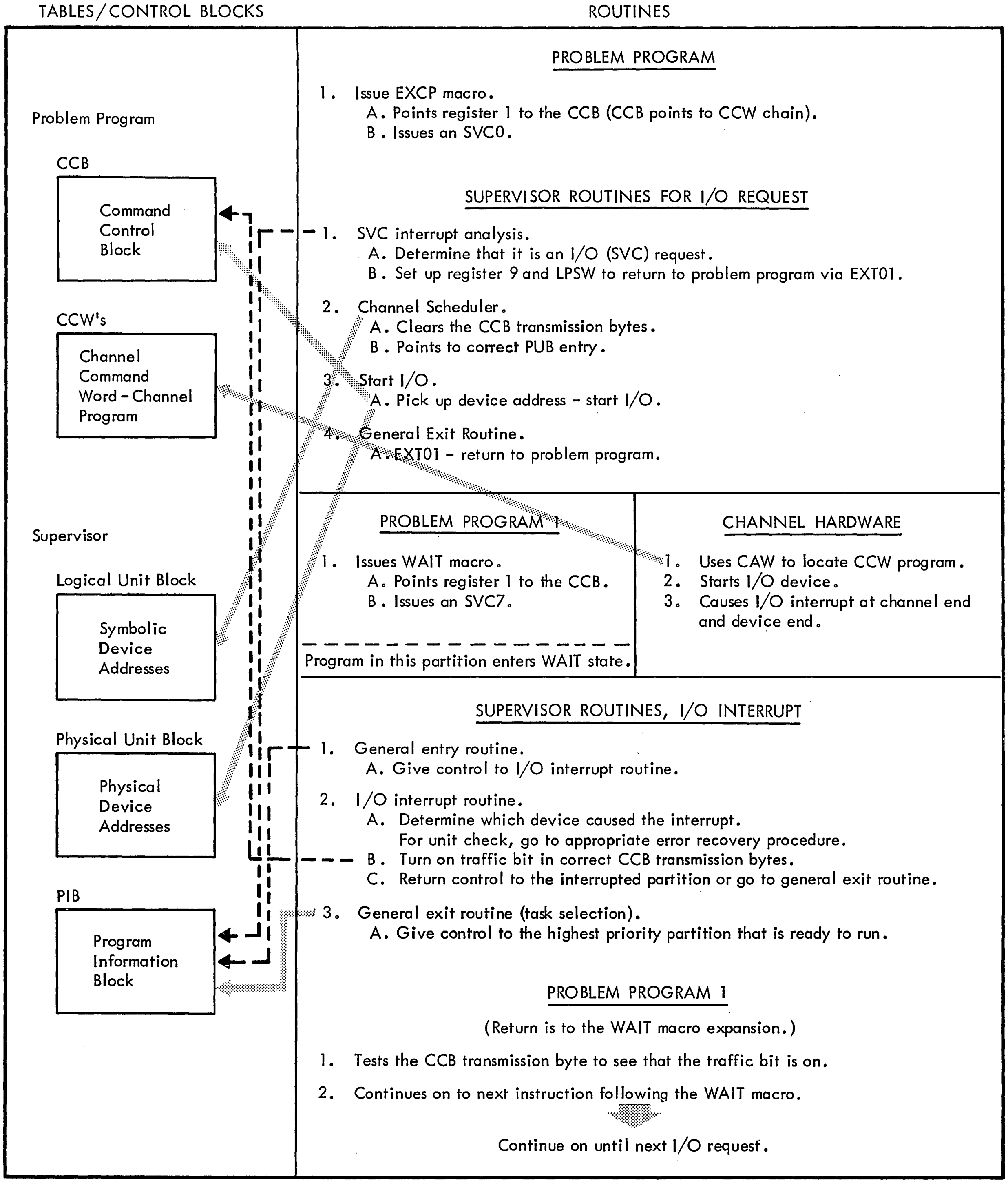
USREXT	SGUNCK	DA
USRSEN	SGUNCK	DB
USRUCK	SGUNCK	DA
VERIF	$$ANERRB	NN
VLDADR1	SGTCON	GC
VLDADR2	SGTCON	GC
VLDADR3	SGTCON	GC
WAIT	$$ANERRY	TA
WAITLOOP	SGDFCH	EH
WAITSVC	$$ANERRP	RF
WRITEREC	$$RAST01	VH
XEXIT	$$RAST04	XA
XEXIT	$$RAST05	XE
XFETCH	$$RAST04	XA
XFETCH	$$RAST05	XE
XIOERR	$$ANERSB	UP
XLDMOD	$$RAST05	XE
XLDTST	$$RAST04	XA
XLDTST	$$RAST05	XE
XMSG	$$RAST04	XA
XMSG	$$RAST05	XE
XNOMSG	$$RAST04	XA
XNOMSG	$$RAST05	XE
XNORMAL	$$ANERSC	UR
XQFULL	$$ANERSB	UP
XTOERR	$$ANERSC	UR
ZEROCT	$$ANERR6	UD
ZERTEB	$$ANERRS	RK
ZERTEBV	$$ANERRS	RK
ZROREG	SGTCHS	CR

APPENDIX B: ERROR MESSAGE CROSS REFERENCE

Message	Phase	Chart
0P08	$$A$SUP1 (Disk)	GA
	$$ANERAI (Paper Tape)	UG
	$$ANERRA (Disk)	NM
	$$ANERRF (Tape)	PF
	$$ANERRG (Data Cell)	QB
	$$ANERRT (MICR Type)	SA
	$$ANERRU (Unit Record)	SC
	$$ANERRV (Unit Record)	SD
	$$ANERRW (MICR Type)	SF,SG
	$$ANERRX (Paper Tape)	SJ
	$$ANERR7 (Tape Cartridge Reader)	UE
	$$ANERR9 (Optical Reader)	UA
	$$ANERSA (3211 Printer)	UK
0P09	$$A$SUP1 (Disk)	GA
	$$ANERAI (Paper Tape)	UG
	$$ANERAM (Tape)	PJ
	$$ANERRA (Disk)	NM
	$$ANERRF (Tape)	PF
	$$ANERRG (Data Cell)	QB
	$$ANERRT (MICR Type)	SA
	$$ANERRU (Unit Record)	SC
	$$ANERRV (Unit Record)	SE
	$$ANERRW (MICR Type)	SF,SG
	$$ANERRX (Paper Tape)	SJ
	$$ANERR6 (Tape Cartridge Reader)	UC,UD
	$$ANERR7 (Tape Cartridge Reader)	UE
	$$ANERR9 (Optical Reader)	UA
	$$ANERSA (3211 Printer)	UK
0P10	$$A$SUP1 (Disk)	GA
	$$ANERAI (Paper Tape)	UG
	$$ANERAM (Tape)	PJ
	$$ANERRA (Disk)	NL
	$$ANERRF (Tape)	PE
	$$ANERRG (Data Cell)	QA
	$$ANERRU (Unit Record)	SC
	$$ANERRV (Unit Record)	SD
	$$ANERRX (Paper Tape)	SJ
	$$ANERR6 (Tape Cartridge Reader)	UC
	$$ANERR7 (Tape Cartridge Reader)	UE
	$$ANERSA (3211 Printer)	UK
0P11	$$A$SUP1 (Disk)	GA
	$$ANERAJ (Paper Tape)	UH
	$$ANERAP (Tape)	PN
	$$ANERAS (Tape)	PX
	$$ANERRB (Disk)	NN
	$$ANERRD (Tape)	PA
	$$ANERRK (Data Cell)	QH
	$$ANERRV (Unit Record)	SE
	$$ANERRX (Paper Tape)	SJ
	$$ANERR7 (Tape Cartridge Reader)	UE
	$$ANERSA (3211 Printer)	UK
0P12	$$ANERRB (Disk)	NN
	$$ANERRK (Data Cell)	QH
0P13	$$ANERRB (Disk)	NN
	$$ANERRK (Data Cell)	QH
	$$RAST10	XL
0P14	$$A$SUP1 (Disk)	GA
	$$ANERRB (Disk)	NN
	$$ANERRF (Tape)	PE,PF
	$$ANERRG (Data Cell)	QB
	$$ANERRV (Unit Record)	SE
	$$ANERR9 (Optical Reader)	UB
0P15	$$A$SUP1 (Disk)	GA
	$$ANERRA (Disk)	NL
	$$ANERRJ (Data Cell)	QF
0P16	$$ANERRB (Disk)	NN
	$$ANERRK (Data Cell)	QH
0P17	$$ANERAM (Tape)	PK
	$$ANERRB (Disk)	NN
	$$ANERRG (Data Cell)	QC
0P18	$$A$SUP1 (Disk)	GA
	$$ANERAI (Paper Tape)	UG
	$$ANERAM (Tape)	PK
	$$ANERRB (Disk)	NN
	$$ANERRG (Data Cell)	QC
	$$ANERRT (MICR Type)	SA
	$$ANERRU (Unit Record)	SC
	$$ANERRV (Unit Record)	SE
	$$ANERRW (MICR Type)	SF,SH
	$$ANERRX (Paper Tape)	SJ
	$$ANERR7 (Tape Cartridge Reader)	UE
	$$ANERR9 (Optical Reader)	UB
	$$ANERSA (3211 Printer)	UK

0P19	$$ANERAI	(Paper Tape)	UG
	$$ANERAM	(Tape)	PJ
	$$ANERRB	(Disk)	NN
	$$ANERRG	(Data Cell)	QC
	$$ANERRT	(MICR Type)	SA
	$$ANERRU	(Unit Record)	SB,SC
	$$ANERRV	(Unit Record)	SE
	$$ANERRW	(MICR Type)	SF,SG
	$$ANERRX	(Paper Tape)	SJ
	$$ANERR6	(Tape Cartridge Reader)	UC
	$$ANERR7	(Tape Cartridge Reader)	UE
	$$ANERR9	(Optical Reader)	UB
	$$ANERSA	(3211 Printer)	UK
0P20	$$A$SUP1	(Disk)	DB,DF,GA, GB
	$$ANERAJ	(Paper Tape)	UJ
	$$ANERAK	(Tape)	PS,PT
	$$ANERAL	(Tape)	PV
	$$ANERAM	(Tape)	PK
	$$ANERAN	(Tape)	PL,PM
	$$ANERAQ	(Tape)	PQ
	$$ANERAR	(Tape)	PW
	$$ANERRE	(Tape)	PD
	$$ANERRF	(Tape)	PE
	$$ANERRL	(Tape)	PG
	$$ANERRH	(Data Cell)	QD
	$$ANERRI	(Data Cell)	QE
	$$ANERRJ	(Data Cell)	QF
	$$ANERR6	(Tape Cartridge Reader)	UD
	$$ANERR8	(Tape Cartridge Reader)	UF
	$$ANERSB	(3211 Printer)	UP
0P21	$$A$SUP1	(Disk)	GA
	$$ANERRA	(Disk)	NL
	$$ANERRJ	(Data Cell)	QF
0P22	$$ANERRG	(Data Cell)	QA
0P23	$$ANERRJ	(Data Cell)	QF
0P24	$$ANERRA	(Disk)	NL
	$$ANERR6	(Tape Cartridge Reader)	UC
0P25	$$ANERRA	(Disk)	NL
	$$ANERR6	(Tape Cartridge Reader)	UC
0P26	$$ANERRA	(Disk)	NL
	$$ANERRG	(Data Cell)	QA
0P27	$$ANERRA	(Disk)	NL
	$$ANERRC	----	NM
	$$ANERRU	(Unit Record)	SB
0P28	$$A$SUP1	(Disk)	GA
	$$ANERAJ	(Paper Tape)	UH
	$$ANERRA	(Disk)	NL
	$$ANERRF	(Tape)	PE
	$$ANERRG	(Data Cell)	QA
	$$ANERRT	(MICR type)	SA
	$$ANERRU	(Unit Record)	SB
	$$ANERRW	(MICR type)	SF,SG
	$$ANERRX	(Paper Tape)	SJ
	$$ANERR6	(Tape Cartridge Reader)	UC
	$$ANERR9	(Optical Reader)	UA
	$$ANERSA	(3211 Printer)	UK
0P29	$$ANERAM	(Tape)	PJ
0P30	$$ANERAM	(Tape)	PJ
0P31	$$ANERRA	(Disk)	NL
	$$ANERRD	(Tape)	PA
	$$ANERRF	(Tape)	PF
	$$ANERR6	(Tape Cartridge Reader)	UC
0P32	$$ANERAM	(Tape)	PJ
0P33	$$ANERRV	(Unit Record)	SD
	$$ANERSA	(3211 Printer)	UK
0P34	$$ANERRW	(MICR type)	SH
0P35	$$ANERR9	(Optical Reader)	UA
0P36	$$A$SUP1	(Disk)	GA
	$$ANERRA	(Disk)	NL
	$$ANERRJ	(Data Cell)	QF
0P37	$$ANERRT	(MICR type)	SA
	$$ANERRW	(MICR type)	SF
0P38	$$ANERR9	(Optical Reader)	UB
0P39	$$ANERR7	(Tape Cartridge Reader)	UE
0P40	$$ANERAI	(Paper Tape)	UG
0P41	$$ANERSA	(3211 Printer)	UK

0P60D	$$ANERRY	TB
0T00I	$$ANERAG	NJ
	$$RAST11	XN
	$$RAST01	VF
0T01I	$$ANERAF	NG
0T02I	$$ANERAF	NG
0T03I	$$ANERAF	NG
	$$RAST11	XN
	$$RAST01	VF
0T04I	$$ANERAG	NH
0T05I	$$RAST11	XN
	$$RAST01	VF
0T06I	$$RAST11	XN
	$$RAST03	WE
0T07I	$$RAST11	XN
	$$RAST03	WE
0T08I	$$RAST11	XN
	$$RAST03	WE
0T09I	$$RAST11	XN
	$$RAST03	WE
0T10I	$$RAST04	XB
	$$RAST05	XF
	$$RAST07	XJ
	$$RAST10	XL
0T11I	$$RAST00	VA
0T12I	$$RAST04	XB
	$$RAST05	XF
	$$RAST07	XH
	$$RAST10	XL
0T13A	$$RAST04	XC
	$$RAST05	XF
	$$RAST10	XL
0T14I	$$RAST11	XN
	$$RAST03	WE
0T15I	$$RAST09	XJA
0T16I	$$RAST03	WE
	$$RAST11	XN
0T17I	$$RAST11	XN
0T18I	$$RAST11	XN
	$$RAST01	VF
0T19I	$$RAST09	XJB
0T20I	$$RAST09	XJB
1I32D	$$ANERR0	TF
1I40D	$$ANERR0	TE
1S02D	$$ANERR0	TF
1S10D	$$ANERR0	TE



PROBLEM PROGRAM

1. Issue EXCP macro.
   - A. Points register 1 to the CCB (CCB points to CCW chain).
   - B. Issues an SVC0.

SUPERVISOR ROUTINES FOR I/O REQUEST

1. SVC interrupt analysis.
   - A. Determine that it is an I/O (SVC) request.
   - B. Set up register 9 and LPSW to return to problem program via EXT01.
2. Channel Scheduler.
   - A. Clears the CCB transmission bytes.
   - B. Points to correct PUB entry.
3. Start I/O.
   - A. Pick up device address - start I/O.
4. General Exit Routine.
   - A. EXT01 - return to problem program.

PROBLEM PROGRAM 1

1. Issues WAIT macro.
   - A. Points register 1 to the CCB.
   - B. Issues an SVC7.

Program in this partition enters WAIT state.

CHANNEL HARDWARE

1. Uses CAW to locate CCW program.
2. Starts I/O device.
3. Causes I/O interrupt at channel end and device end.

SUPERVISOR ROUTINES, I/O INTERRUPT

1. General entry routine.
   - A. Give control to I/O interrupt routine.
2. I/O interrupt routine.
   - A. Determine which device caused the interrupt. For unit check, go to appropriate error recovery procedure.
   - B. Turn on traffic bit in correct CCB transmission bytes.
   - C. Return control to the interrupted partition or go to general exit routine.
3. General exit routine (task selection).
   - A. Give control to the highest priority partition that is ready to run.

PROBLEM PROGRAM 1

(Return is to the WAIT macro expansion.)

1. Tests the CCB transmission byte to see that the traffic bit is on.
2. Continues on to next instruction following the WAIT macro.

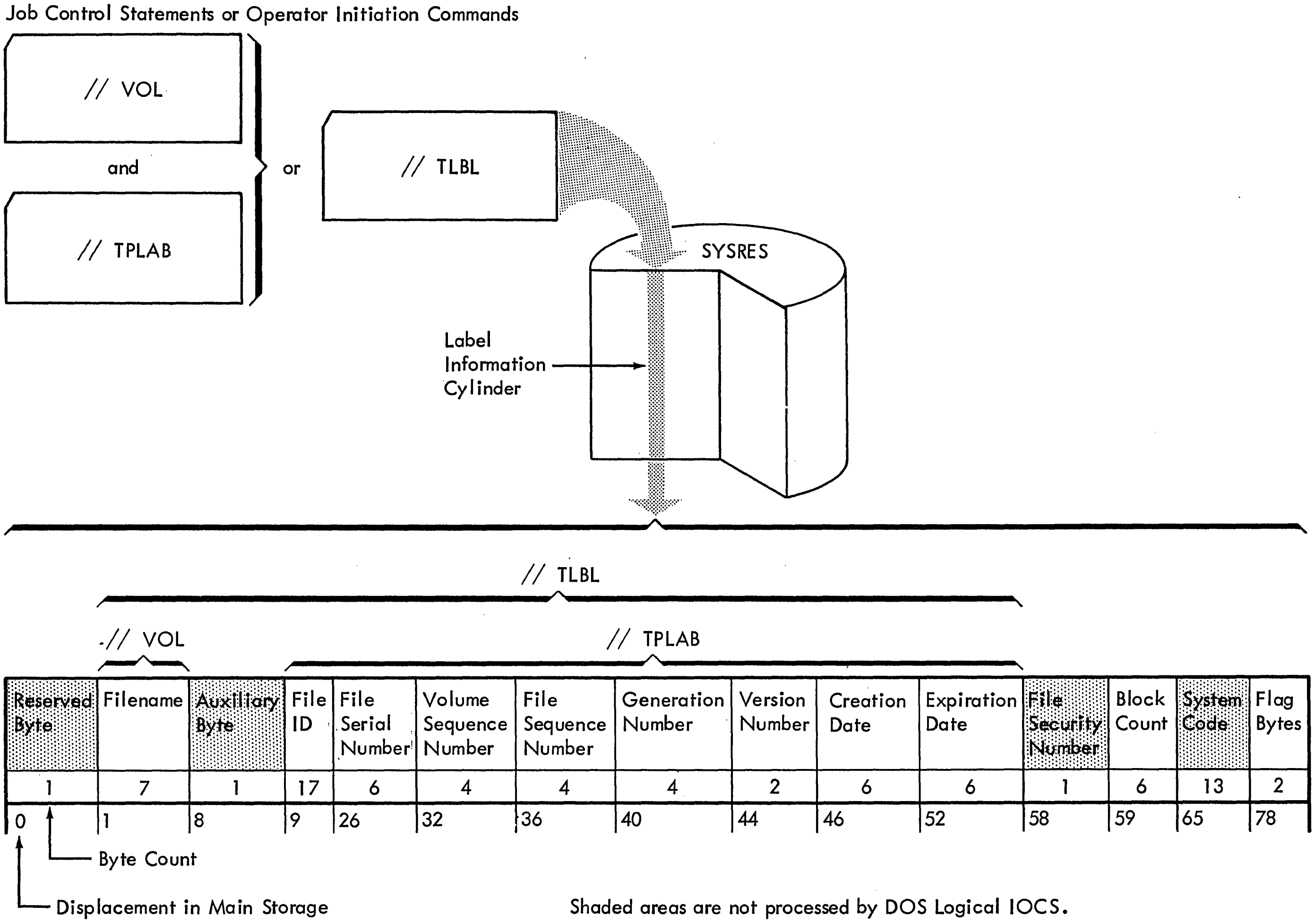
Continue on until next I/O request.

- - - -▶ Indicates putting information into a control block/table.

▨▨▨▶ Indicates testing for information in a control block/table.

Figure 63. I/O Request-I/O Interrupt Sequence

APPENDIX D: LABEL INFORMATION FORMAT ON SYSRES



Reserved Byte	Filename	Auxiliary Byte	File ID	File Serial Number	Volume Sequence Number	File Sequence Number	Generation Number	Version Number	Creation Date	Expiration Date	File Security Number	Block Count	System Code	Flag Bytes
1	7	1	17	6	4	4	4	2	6	6	1	6	13	2
0	1	8	9	26	32	36	40	44	46	52	58	59	65	78

Byte Count

Displacement in Main Storage

Shaded areas are not processed by DOS Logical IOCS.

Figure 64. Format of SYSRES Tape Label Information

1	2	3		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18		19	Field
DLBL-EXTENT Indicator	Filename	DA/IS Switch	File ID		Format ID	File Serial Number	Volume Seq. No.	Creation Date	Expiration Date	Reserved	Open Code	System Code	Volume Serial Number	EXTENT Type	EXTENT Seq. No.	Extent Lower Limit	Extent Upper Limit	Logical (Symbolic) Unit Address	2321 Lower Cell	2321 Upper Cell	Another Extent if DA or ISFMS
1	7	1	44		1	6	2	3	3	2	1	13	6	1	1	4	4	2	1	1	Bytes
0	1	8	9		53	54	60	62	65	68	70	71	84	90	91	92	96	100	102	103	Displacement

Field	Name	Description
1.	DLBL-EXTENT	SD Bit 0: 1 = Next extent on a new pack. Bit 1: 1 = Last extent. Bit 2: 1 = Bypass extent. Bit 3: 1 = New volume on same unit. Bit 4: 1 = Extent limits omitted. Bit 5: 1 = Extent converted to DASD address. Bit 6: 1 = No EXTENT/XTENT card. Bit 7: 1 = Unused. DA or ISFMS Number of extents.
2.	Filename	
3.	DA/IS Switch	Bits 0-3: Unused. Bit 4: 1 = Extent limits omitted. Bit 5: 1 = Extent converted to DASD address. Bit 6 & 7: Unused.
4.	File ID	File identifier including generation and version numbers. If field is missing on DLBL card, Filename padded with blanks is inserted.
5.	Format ID	Numeric 1 is inserted.
6.	File Serial No.	Volume serial number from first extent.
7.	Volume Seq. No.	Always initialized to X'0001'.
8.	Creation Date	Initialized with 3 bytes of X'00'.
9.	Expiration Date	If date is in the form YYDDD, it is converted to YDD. If date is in retention period form, 1 to 4 characters, the field is padded with binary zeros.
10.	Reserved	The retention period, if specified is converted to a 2-byte number and inserted in this field.
11.	Open Code	DLBL type: S = Sequential D= Direct Access C or E = Indexed sequential File Management System where: C = Load create function E = Load extend function
12.	System Code	Initialized to contain DOS/360 VER 3. This field is not processed by DOS.
13.	Volume Serial No.	Volume serial number for extent.
14.	Extent Type	Same codes as in Format - 1 label: X'00' = Next three fields do not indicate any extent. X'01' = Prime data area (ISFMS) or consecutive area, etc., (that is the extent containing the user's data records). X'02' = Overflow area of an ISFMS file. X'04' = Cylinder index or master index of an ISFMS file. X'40' = User label track area. X'8n' = Shared cylinder indicator, where n = 1, 2, or 4.
15.	Extent Seq. No.	Number of extent as determined by the extent card sequence.
16. & 17.	Extent Lower and Upper Limits	Before the OPEN, DLBL/EXTENT information is in the relative track form of HHNNT followed by three bytes of binary zeros. HH = Relative (to 0) start address in tracks. NN = Number of tracks. T = 0 or upper track number for split cylinder in SD files. Following an OPEN on DLBL/EXTENT cards, or whenever DLAB/XTENT cards are used, the extent lower and upper limits are each in the CCHH format.
18.	Logical (Symbolic) Unit Address	This 2-byte field identifies the logical unit with the same code as that used in a CCB. The first byte identifies the unit class: X'00' = System Logical Unit X'01' = Programmer Logical Unit The second byte identifies the logical unit within its class. Thus X'0003' denotes SYSLST and X'0103' denotes SYS003.
19.	2321 Lower Cell 2321 Upper Cell	2321 extent lower and upper cell limit. This 2-byte field contains zeros for 2311/2314/2319 disk.

Note: For Sequential Disk files, a complete 104-byte block is repeated for each new EXTENT.
For Direct Access and ISFMS files, only fields 13 through 18 are repeated for each EXTENT.

Figure 65. Format of SYSRES DASD Label Information

APPENDIX E: PROGRAM KEY DEFINITIONS

PID (Partition Identifier)

The PID is a halfword long, consisting of a zero value in the high-order byte and the key value in the low-order byte. The key value is the key of the partition that was last enabled for interrupts. Key values are X'00', X'10', X'20',...X'60' for All Bound, BG, F2, F1, Attention, Quiesce I/O and Supervisor, respectively.

PID is defined in an AP (asynchronous processing) supervisor only and is found at byte-displacement 46 in the communications region. (This halfword is named PIK in a non-AP supervisor. See PIK below.)

PIK (Program Interrupt Key)

The PIK is a halfword long, consisting of a zero value in the high-order byte and the key value in the low-order byte. The key value is the key of the program that was last enabled for interrupts.

When an interrupt occurs, the value of the PIK indicates to the supervisor which program (task) was interrupted. It can also be used by transient programs and problem programs to determine if they are running as BG, F1, or F2, or, in the AP supervisor, if the last interrupted task was a maintask or a subtask.

The value of the PIK equals the displacement from the beginning of the PIB table to the PIB entry for the program (task). For BG, F2, and F1 tasks, this value equals the storage protect key multiplied by sixteen.

In a non-AP supervisor, PIK is found at displacement 46 in the communications region. In an AP supervisor PIK is found at displacement 18 in the communication region extension. (Also see PID.)

Task	PIK Value
All Bound*	X'00'
BG	X'10'
F2*	X'20'
F1*	X'30'
AR	X'40'
Quiesce I/O	X'50'
Supervisor	X'60'
Subtask**	X'70' - X'F0'

*Multiprogramming generation option only.

**Asynchronous processing generation option only. A total of nine subtask PIBs is generated, thus the displacement hex 70-F0 indicates the maximum range.

The PIK is set by task selection within the general exit routine. The fetch routine sets the PIK to X'60', because it enables itself for interrupts and because it gets control directly from the SVC interrupt routines. Like other completely disabled supervisor routines, the SVC interrupt routines do not change the PIK from the value it had when the interrupt occurred that transferred control.

LID (Logical Transient Identification)

The LID contains the same value as the PIK when the logical transient area is in use (i.e., the LID identifies ownership of the logical transient area). When this transient area is free, the halfword LID contains zeros. The SVC 2 routine sets the LID, and the SVC 11 routine resets it to zero. LID is defined only in an AP supervisor. See also LTK, PIK, and PID.

LTK (Logical Transient Key)

The LTK has the same value as the PIK when the logical transient area is in use. When the transient area is free, the LTK equals zero. The SVC 2 routine sets the LTK, and the SVC 11 routine resets it to zero.

RID (Requestor Identification)

See Figure 17, REQID (Item F).

RIK (Requestor I/O Key)

When a supervisor routine (fetch or physical transient) issues an SVC 0 or SVC 15, the routine puts the value to be used in the CAW storage protect key into the high-order digit of the second byte of the RIK halfword. When this value is zero, the low order digit has these special meanings:

RIK	Meaning
X'01'	This is a SYSLOG I/O request. The channel scheduler is not to type a SYSLOG ID prefix.
X'02'	This has been a fetch I/O request. This special code is required by ERP to recognize fetch requests.

Fetch always sets a X'02' in the RIK. ERP transients put the key of the program requiring ERP into the RIK, when the ERP is a retry of a user EXCP and the ERP transient requires control to return to itself.

Physical transients put a X'01' into the RIK when they are doing a SYSLOG I/O. The PIK for physical transients has a value of X'06', therefore the channel scheduler would type "SP" (supervisor ID) as the SYSLOG ID. The physical transients put the ID of the program referred to by the message into the message.

FIK (Fetch I/O Key)

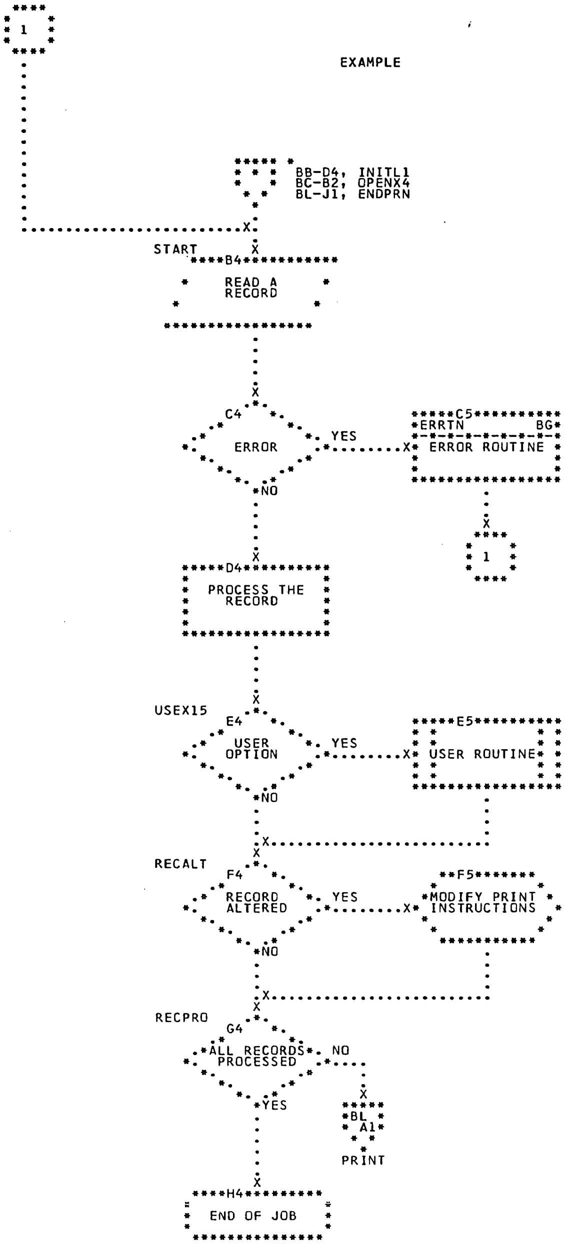
Used by the fetch to validate the phase name address and load address. FIK has the following values:

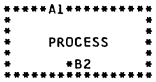
SVC	Contents
1	Key of the problem program requestor.
2	0
3	0
4	0 if the transient issued the SVC 4. Key of the problem program if not a transient.

APPENDIX F: EXPLANATION OF FLOWCHART SYMBOLS

DESCRIPTION

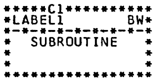
EXAMPLE



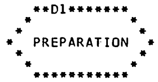


A GROUP OF PROGRAM INSTRUCTIONS THAT PERFORM A PROCESSING FUNCTION OF THE PROGRAM. THE LABEL, IF ANY, IS SHOWN ABOVE THE BLOCK.

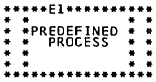
*B2
IF ANY ADDITIONAL EXPLANATION IS REQUIRED, ITS LOCATION ON THE CHART IS IDENTIFIED BY AN ASTERISK AND THE BLOCK ID.



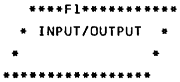
DESCRIPTION OR TITLE OF A ROUTINE THAT IS DETAILED ON ANOTHER FLOWCHART. THE STARTING LABEL OF THE ROUTINE AND THE FLOWCHART ID APPEAR ABOVE THE STRIPE.



AN INSTRUCTION, OR GROUP OF INSTRUCTIONS, THAT CHANGES PORTIONS OF A ROUTINE OR INITIALIZES A ROUTINE FOR GIVEN CONDITIONS.

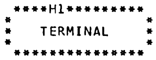


A GROUP OF OPERATIONS NOT DETAILED IN THE FLOWCHARTS IN THIS MANUAL, SUCH AS USER'S ROUTINES.

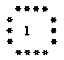


ANY FUNCTION OF AN INPUT/OUTPUT DEVICE OR PROGRAM, USUALLY BRANCHING TO AN I/O ROUTINE TO PERFORM THE FUNCTION STATED IN THE BLOCK.

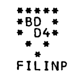
POINTS WHERE THE PROGRAM BRANCHES TO ALTERNATE PROCESSING, BASED UPON VARIABLE CONDITIONS SUCH AS PROGRAM SWITCH SETTINGS AND TEST RESULTS.



THE BEGINNING, END, OR POINT OF INTERRUPTION IN A PROGRAM.



ON-PAGE CONNECTOR. AN ENTRY FROM, OR AN EXIT TO, ANOTHER FUNCTION ON THE SAME FLOWCHART. THE NUMBER IN THE CONNECTOR IDENTIFIES THE CORRESPONDING ENTRY OR EXIT ON THE CHART.



OFF-PAGE CONNECTOR. AN ENTRY FROM, OR AN EXIT TO, A GIVEN POINT ON ANOTHER FLOWCHART. THE CHARACTERS IN THE CONNECTOR IDENTIFY THE CHART AND BLOCK. THE CORRESPONDING LABEL, IF ANY, IS PLACED OUTSIDE THE CONNECTOR. FOR MULTIPLE ENTRIES AND EXITS, AN ASTERISK APPEARS IN THE CONNECTOR AND THE CHARACTERS ARE LISTED NEARBY.

APPENDIX G: MICROFICHE CROSS-REFERENCE INDEX

The index gives the relationship of core-image phase names, relocatable module names, microfiche labels, and microfiche identification numbers.

An asterisk indicates the microfiche label. If the microfiche label differs from both the phase and the module name, it is so indicated in parentheses.

When a phase or module takes up more than one microfiche card, the identification number of only the first card is shown.

The index includes all the macro names and identification numbers. The position of each macro on the microfiche card is further identified by rows A to E. The rows are not indicated for macros that use more than one microfiche card.

For the complete microfiche cross-reference index, see Introduction to DOS Logic, listed in the Preface.

Core Image Phase Name	Relocatable Module Name	Card ID
$$A$SUP1	(see individual macro phase names)	
$$ANERAA*	None	CTL.002.00
$$ANERAB*	None	CTL.003.00
$$ANERAC*	None	CTL.004.00
$$ANERAD*	None	CTL.005.00
$$ANERAE*	None	CTL.006.00
$$ANERAF*	None	CTL.007.00
$$ANERAG*	None	CTL.008.00
$$ANERAI*	None	CTL.009.00
$$ANERAJ*	None	CTL.010.00
$$ANERAK*	None	CTL.011.00
$$ANERAL*	None	CTL.012.00
$$ANERAM*	None	CTL.013.00
$$ANERAN*	None	CTL.014.00
$$ANERAP*	None	CTL.015.00
$$ANERAQ*	None	CTL.016.00
$$ANERAR*	None	CTL.017.00
$$ANERAS*	None	CTL.018.00
$$ANERRA*	None	CTL.019.00
$$ANERRB ($$ANERRA)	None	CTL.019.00
$$ANERRC ($$ANERRA)	None	CTL.019.00
$$ANERRD*	None	CTL.020.00
$$ANERRE*	None	CTL.021.00
$$ANERRF*	None	CTL.022.00
$$ANERRG*	None	CTL.023.00
$$ANERRH*	None	CTL.024.00
$$ANERRI*	None	CTL.025.00
$$ANERRJ*	None	CTL.026.00
$$ANERRK*	None	CTL.027.00
$$ANERRL*	None	CTL.028.00
$$ANERRM*	None	CTL.029.00
$$ANERRN*	None	CTL.030.00
$$ANERRO*	None	CTL.031.00
$$ANERRP*	None	CTL.032.00
$$ANERRQ*	None	CTL.033.00
$$ANERRR*	None	CTL.034.00
$$ANERRS*	None	CTL.035.00
$$ANERRT*	None	IOM.001.00
$$ANERRU*	None	CTL.036.00
$$ANERRV*	None	CTL.037.00
$$ANERRW*	None	IOM.002.00
$$ANERRX*	None	CTL.038.00
$$ANERRY*	None	CTL.039.00
$$ANERRZ ($$ANERRY)	None	CTL.039.00
$$ANERR0 ($$ANERRY)	None	CTL.039.00
$$ANERR1*	None	CTL.040.00
$$ANERR6*	None	CTL.041.00
$$ANERR7*	None	CTL.042.00
$$ANERR8*	None	CTL.043.00
$$ANERR9*	None	IOR.001.00
$$ANERSA*	None	CTL.043.50
$$ANERSB*	None	CTL.043.60
$$ANERSC*	None	CTL.043.70
$$RAST00*	ILVRAS00	CTL.257.00
$$RAST01*	ILVRAS01	CTL.258.00
$$RAST02*	ILVRAS02	CTL.259.00
$$RAST03*	ILVRAS03	CTL.260.00
$$RAST04*	ILVRAS04	CTL.261.00
$$RAST05*	ILVRAS05	CTL.262.00
$$RAST07*	ILVRAS07	CTL.264.00
$$RAST09*	ILVRAS09	CTL.266.00
$$RAST10*	ILVRAS10	CTL.267.00
$$RAST11*	ILVRAS11	CTL.268.00

Macro Name	Card ID	Row
ALLOC	453.001.00	A
ASSGN	453.001.00	B
COMMN	453.003.00	D
COMMNEX	453.003.50	A
CONFG	453.004.00	A
DVCGEN	453.006.00	B
FOPT	453.007.00	C,D
IOTAB	453.008.50	A,B
LUBGEN	453.008.00	E
MAPLOWC	453.008.50	D
MCRAS	453.008.50	E
PIOCS	453.010.00	A
SEND	453.012.50	A-D
SGDFCH	453.013.00	A
SGDSK	453.013.00	B
SGSVC	453.013.00	C-E
SGTCHS	453.014.00	A-D
SGTCON	453.014.01	A
SGTHAP	453.014.01	C-E
SGUNCK	453.014.50	A,B
SMCRR	453.012.00	B,C
SMICR	477.002.00	A,B
STDJC	453.015.00	B
SUPVR	453.015.00	D
TRTAB	453.014.01	B

For a more complete list of data processing terms, refer to IBM Data Processing Techniques, A Data Processing Glossary, GC20-1699.

ASCII (American National Standard Code for Information Interchange): A 128-character, 7-bit code. The high-order bit in the System/360 8-bit environment is zero.

buffer:
1. A storage device in which data is assembled temporarily during data transfer. An example is the IBM 2821 Control Unit, a control and buffer storage unit for card readers, card punches, and printers.
2. During I/O operations, a portion of main storage into which data is read or from which data is written.

CCH (channel check handler): A feature that assesses System/370 channel errors to determine if the system can continue operations.

channel inboard error: An error that occurs between one I/O device and the central processing unit.

chronological area of the recorder file: The area of the recorder file (IJSYSRC) where error records are printed as they occur. The record types included are: OBR, MCRR, MCAR, CCH, BTAM, QTAM, and 2715 error records. This area is present on both the System/360 and System/370 recorder files and differs from the SDR area where cumulative errors are recorded by device type.

core image library: A SYSRES area (or a device of the same type as SYSRES) that stores programs processed by the linkage editor. Each program is in a form that can be executed in main storage.

core wrap mode: The method of operation that records the events of a trace in main storage. It is the default process when no output device for the trace has been specified. The contents can be displayed by either a dump program or manually from the console.

data set security: A feature that provides protection for disk files. A data secured file cannot be accidentally accessed by a problem program.

Disk Operating System: A disk resident system that provides operating system capabilities for 16K and larger IBM System/360 and System/370 systems.

DOS Volume Statistics: A facility that monitors and records the number of temporary read and write errors on currently accessed tape volumes. This facility has two options, Error Statistics by Tape Volume (ESTV) and Error Volume Analysis (EVA).

EREP (environmental recording, editing and printing): A program that processes the data contained on the system recorder file.

ESTV (Error Statistics by Tape Volume): One of the two options of the DOS Volume Statistics. With ESTV support, the system collects data on tape errors by volume for any tape volumes used by the system.

EVA (Error Volume Analysis): One of the two options of the DOS Volume Statistics. With this option, the system issues a message to the operator when a number of temporary read or write errors (specified by the user at system generation time) has been exceeded on a currently accessed tape volume.

F/L Trace (Fetch/Load Trace): A program that records information about phases and transients as they are called from a core image library.

fetch
1. To bring a program phase into main storage from a core image library for immediate execution.
2. The routine that retrieves requested phases and loads them into main storage.
3. The name of a macro instruction (FETCH) used to transfer control to the system loader.
4. To transfer control to the system loader.

GSVC Trace (Generalized Supervisor Calls Trace): A program that records SVC interrupts as they occur. All or a selected group of SVCs can be traced.

I/O (input/output) error logging: The process of recording OBR and SDR records on the system recorder file.

IDRA (independent directory read-in area): A resident area, created by a supervisor option into which the system reads core image library directories for fetch and load operations. Using IDRA frees the physical transient area to perform error recovery procedures.

IOCS (input/output control system): A group of macro instruction routines provided by IBM for handling the transfer of data between main storage and external storage devices.

I/O Trace (Input/Output) Trace): A program that records I/O device activity for all or a selected group of I/O devices.

job accounting interface: A function that accumulates accounting information for each job step to: charge usage of the system, help plan new applications, and help supervise system operation more efficiently.

MCAR (machine check analysis and recording): A feature that records System/370 machine check interrupt error information on the system recorder file and then attempts to recover from the interrupt.

MCRR (machine check recording and recovery): The recording of pertinent data on the system recorder file after either a machine check interrupt or a channel inboard error occurred on System/360 Model 30, Model 40, or Model 50.

MCI (machine check interrupt): The interrupt that occurs if the central processing unit fails to operate.

object module: One or more control sections in relocatable, nonexecutable form. An object module must be processed by the linkage editor before it can be executed in the system.

OBR (outboard recorder): A feature that records pertinent data on the system recorder file when an unrecoverable I/O error occurs.

overlay: A program segment (phase) that is loaded into main storage. It replaces all or part of a previously retrieved section.

PCIL (private core image library): A file referenced in the same manner and for the same purposes as the system core image library, but distinct from the system core image library. PCIL increases available core image library space to enable compiling, linkage editing, and executing in the foreground partition, when a private core image library is assigned to that foreground partition.

PDAID (Problem Determination Aids): Programs that trace a specified event when it occurs during the operation of a program. The traces provided are QTAM Trace, I/O Trace, F/L Trace, and GSVC Trace.

private library: A relocatable, core image, or source statement library that is separate and distinct from the system library.

problem determination: A procedure or process (provided by IBM) that the user can follow after an error message to determine the cause of that error. (See PDAID)

QTAM Trace: A routine that records certain supervisor and I/O activities on tape or in main storage.

RDE (Reliability Data Extractor): A function that provides hardware reliability data that is analyzed by IBM.

RMS (recovery management support): A feature for System/370 that consists of the MCAR (machine check analysis and recording) and CCH (channel check handler) functions. RMS gathers information about System/370 hardward reliability and attempts certain error recovery operations. RMS is a part of the entire reliability, availability, and serviceability support for System/370.

SDR (statistical data recorder): A feature that records the cumulative error status of an I/O device on the system recorder file.

stand-alone dump: A program that displays the contents of main storage from a minimum of 8K bytes to a maximum of 16384K bytes. It helps to determine the cause of an error.

system recorder file: The file that is used to record hardware reliability data.

track hold: A function for protecting DASD tracks that are currently being processed. When track hold is specified in the DTF, a track that is being modified by a task on one partition cannot be concurrently accessed by a task or subtask in another partition.

Indexes to systems reference library manuals are consolidated in the publication, DOS Master Index, GC24-5063. For additional information about any subject listed below, refer to other publications listed for the same subject in the Master Index.

GY24-5151-2

DOS Supervisor and Related Transients (S360-36) Printed in U.S.A. GY24-5151-2

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DOS Supervisor and Related Transients

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IBM Technical Newsletter

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DOS SUPERVISOR AND RELATED TRANSIENTS
PROGRAM LOGIC MANUAL

This Technical Newsletter, a part of Release 26 of the IBM Disk Operating System, provides replacement pages for your publication. These replacement pages remain in effect for subsequent DOS releases unless specifically altered. Pages to be inserted an and/or removed are:

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341-350
391-398
398.1,398.2 (added)
399-404
411,412
417-422

A change to the text or to an illustration is indicated by a vertical line to the left of the change.

Summary of Amendments

This TNL contains documentation changes for:

Enhancements to OLTEP
IBM 3211 Printer Error Recovery Procedures
RMS generation and operation
Maintenance changes and technical correction.

Note: Please insert this page in your publication to provide a record of changes.

IBM Laboratory, Publications Dept., Uithoorn Netherlands

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File Number S360-36 (DOS)
Order No. GY24-5151-2

Program Logic

DOS Supervisor and Related Transients

Program Number 360N-CL-453

This reference publication describes the internal logic of the IBM Disk Operating System, Supervisor and Physical and Recovery Transient Programs. It is for persons involved in program maintenance and for system programmers altering the program design. Program logic information is not needed for normal operation of these programs. This publication is a supplement to the program listing.

Effective use of this manual requires an understanding of IBM System/360 or System/370 operation and of IBM Disk Operating System control and service programs, macro instructions, and operating procedures. Reference publications for this information are listed in the Preface of this manual.

DOS Release 26

Third Edition (June, 1971)

This publication was formerly titled IBM System/360 Disk Operating System, Supervisor and Physical Transients Program Logic Manual. Although titles of some DOS publications (including this one) have been simplified, the change does not affect the contents of the publication.

This edition, with Technical Newsletter GN33-8692, applies to Release 26 of the IBM Disk Operating System and to all subsequent releases until otherwise indicated in new editions or Technical Newsletters. Changes are continually made to the specifications herein; before using this publication in connection with the operation of IBM systems, consult the latest System/360 and System/370 SRL Newsletter, GN20-0360, for the editions that are applicable and current.

This edition, GY24-5151-2, is a major revision of, and obsoletes, GY24-5151-1.

Summary of Amendments

This edition documents addition of, and changes to, the following information: PCIL (Private Core Image Library), JAI (Job Accounting Interface), System/370 RMS (Recovery Management Support), IDRA (Independent Directory Read-in Area), OLTEP (On-Line Test Executive Program), EREP (Environmental Recording, Editing, and Printing) enhancements, IBM 3211 Printer, System/360 Model 22, and certain maintenance enhancements.

Technical Newsletter GN33-8692 contains documentation changes for:

- Enhancements to OLTEP
- IBM 3211 Printer Error Recovery Procedures
- RMS generation and operation
- An interface has been provided for the 2596 Card Read Punch support, which will be released at a future date
- Maintenance changes and technical corrections

Changes or additions to the text and illustrations are indicated by a vertical line to the left of the change.

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CONTENTS

FIGURES

Name	Macro Description	Parameter Option	Option Description
SUPVR	Describes system environment	SYSTEM DISK	System residence (SYSRES) must be on a disk device.
		MPS = NO YES BJF	Indicates multiprogramming support. If YES or BJF is specified, the system generated is capable of supporting two foreground programs. YES or BJF must be specified if TP = QTAM. If BJF is specified, the system generated will support batched mode for both foreground partitions. Multiple communications regions are generated only if MPS = BJF. MPS = YES is implied if MPS = BJF.
		TP = NO BTAM QTAM QTAMn	Specify if Basic or Queued Teleprocessing Access Method (BTAM or QTAM) is desired. When QTAM is specified, SVC support for BTAM is also included. To process QTAM in a system with asynchronous processing support, QTAMn must be specified where n is the maximum number of active QTAM message processing programs in the system. From 2 to 12 programs may be specified with a default value of 2.
		ERRLOG = NO YES RDE n (YES, RDE) (n, RDE)	Specify if the Outboard Recorder (OBR) is to record data pertinent to an error that cannot be retried or corrected after a standard number or retries. Also, specify if the Statistical Data Recorder (SDR) is to record the cumulative error status of an I/O device. n defines the number of records required on the SDR partition of the Recorder File, where n is any number equal to, or greater than, the number of PUBs. YES indicates a number of SDR records equal to the number of PUBs. ERRLOG = RDE supports the Reliability Data Extractor for System/370 only. If RDE is specified without YES or n, YES is assumed. ERRLOG is assumed YES for all System/370 MODEL options if it is not specified.
		MCRR = NO YES	Specify if MCRR is to record pertinent data after a machine check, channel control check, interface control check, or channel data check. MCRR analyzes collected data and cancels the damaged partition(s). No attempt at error retry is made. This parameter is valid only for Models 30, 40, and 50.
		MICR = NO 1412 1419 1419D	Indicates whether the supervisor is to support magnetic ink character readers or optical reader/sorters. If both 1412s and 1419s are present, indicate 1419. 1419D/1275 indicates Dual Address Adapter 1419s. If 1412/1419/1255/1259/1270/1275s are attached to the multiplexor channel, the PIOCS parameter BMPX = YES is not supported.
		AP = NO YES	Indicates asynchronous processing support. This provides the user with the facility to write dependent programs to run concurrently within a partition and still maintain the partition independency of MPS. If YES is specified, global BG20 (MPS = YES or BJF) is forced on whether or not it was specified.
		EU = NO YES RELOC	EU = YES specifies: IBM 1401/1440/1460 Emulator for Models 25, 30, or 40; IBM 1401/1440/1460 or 1410/7010 Emulator and mixed parity tape processing for System/370 CPUs. If foreground emulation is desired on any model, MPS = BJF is required. Foreground emulation on Model 40 requires EU = RELOC.
		ASCII = NO YES	Indicates whether the supervisor is to support the American National Standard Code for Information Interchange (ASCII). YES adds 512 bytes to supervisor size.
CONFG	Describes hardware features	MODEL = 30 nn nnn	nn defines the System/360 model number (Model 30, 40, or 50 must be entered if MCRR option is specified). nnn defines the System/370 model number. (A System/370 model causes generation of MCAR/CCH support. MCRR is not compatible with System/370.)
		SP = NO YES	Indicates the storage protection feature is desired. YES is assumed if MPS = YES or BJF in the SUPVR macro.
		DEC NO YES	Decimal feature.
		FP = NO YES	Floating-point feature.
		TIMER = NO YES	Timer feature. If TIMER = YES the supervisor macro GETIME is supported.
		PORT = NO 155	Causes Model 155 MCAR/CCH functions if MODEL = 145.

Figure 4. Supervisor Macros (Part 1 of 5)

Name	Macro Description	Parameter = Option	Option Description
STDJC	Sets standard values for job control variables.	DECK = $\left\{\begin{matrix}\underline{\text{YES}}\\\text{NO}\end{matrix}\right\}$	Output modules on SYSPCH.
		LIST = $\left\{\begin{matrix}\underline{\text{YES}}\\\text{NO}\end{matrix}\right\}$	Source modules listings from language translators on SYSLST.
		XREF = $\left\{\begin{matrix}\underline{\text{YES}}\\\text{NO}\end{matrix}\right\}$	Language translators output symbolic cross-reference lists on SYSLST.
		ERRS = $\left\{\begin{matrix}\underline{\text{YES}}\\\text{NO}\end{matrix}\right\}$	Compilers summarize all errors in source programs on SYSLST.
		LOG = $\left\{\begin{matrix}\underline{\text{YES}}\\\text{NO}\end{matrix}\right\}$	Listing of all control statements on SYSLST.
		DUMP = $\left\{\begin{matrix}\underline{\text{YES}}\\\text{NO}\end{matrix}\right\}$	Dump of registers and main storage on SYSLST.
		LINES = $\left\{\begin{matrix}\underline{\text{56}}\\\text{nn}\end{matrix}\right\}$	Number of lines per page on SYSLST.
		DATE = $\left\{\begin{matrix}\underline{\text{MDY}}\\\text{DMY}\end{matrix}\right\}$	Format of date.
		CHARSET = $\left\{\begin{matrix}\underline{\text{48C}}\\\text{60C}\end{matrix}\right\}$	Specifies the 48 or 60 character set for language translator input on SYSIPT.
		LISTX = $\left\{\begin{matrix}\underline{\text{NO}}\\\text{YES}\end{matrix}\right\}$	Hexadecimal object module listings from compilers on SYSLST.
		SYM = $\left\{\begin{matrix}\underline{\text{NO}}\\\text{YES}\end{matrix}\right\}$	Assembler output symbol tables on SYSPCH.
		SPARM = $\left\{\begin{matrix}\underline{\text{NO}}\\\text{YES}\end{matrix}\right\}$	Support of assembler variable symbol &SYSPARM
FOPT	Describes functional supervisory options	OC = $\left\{\begin{matrix}\underline{\text{NO}}\\\text{YES}\end{matrix}\right\}$	Operator initiated communications to problem programs. If OC=YES,the facility is available to all programs in MPS. Must be YES if Emulator on System/370 is used. OLTEP=YES forces OC=YES.
		PC = $\left\{\begin{matrix}\underline{\text{NO}}\\\text{YES}\end{matrix}\right\}$	Problem program routine for program check. If PC = YES, the facility is available to all programs in MPS.
		IT = $\left\{\begin{matrix}\underline{\text{NO}}\\\text{BG}\\\text{F1}\\\text{F2}\end{matrix}\right\}$	Problem program ability to set timer intervals and specify a timer interrupt routine. BG, F1, or F2 indicates which program has the facility. When IT is specified for a partition, TIMER = YES is assumed in the CONFG macro. Timer support is available to only one program in MPS.
		AB = $\left\{\begin{matrix}\underline{\text{NO}}\\\text{YES}\end{matrix}\right\}$	Provides for valid use of the STXIT (AB) macro. If AB = YES, the facility is available to all programs in MPS.
		TEB = $\left\{\begin{matrix}\underline{\text{NO}}\\\text{n}\end{matrix}\right\}$	Tape error statistics are to be accumulated and logged, where n is the number of 2400-series tape units and tape cartridge readers (maximum of 225) attached to the system. **
		TEBV = $\left\{\begin{matrix}\underline{\text{NO}}\\\left(\left\{\begin{matrix}\text{DASD}\\\text{SYSLOG}\end{matrix}\right\},\text{n}\right)\end{matrix}\right\}$	Tape Error Statistics by Volume are to be accumulated and logged on SYSLOG or a DASD device, where n is the number of 2400 series tape drives attached to the system. **
		EVA = $\left\{\begin{matrix}\underline{\text{NO}}\\(\text{rth, wth, n})\end{matrix}\right\}$	Error Volume Analysis is supported where rth is the read error threshold, wth is the write error threshold, and n is the number of 2400 series tape drives attached to the system. **

** The n specified in TEB, TEBV, and EVA must be identical if two or more of these options are specified, and then TAPE=9 is assumed.

Figure 4. Supervisor Macros (Part 2 of 5)

Name	Macro Description	Parameter Option	Option Description
FOPT (cont'd)		SKSEP = NO YES n	Specifies if SEEKs are to be separated from the remainder of channel programs. Seek separation allows other devices on the channel to be accessed (including other seeks) during the seek. YES indicated support for all DASD types specified by the DVCGEN macro at system generation time. n is the number of DASD to be supported and cannot be less than the number of DASD specified at system generation. The maximum number is 254.
		CE = NO YES n	Specify the number of bytes to be aalocated to the problem determination programs. 800 is the minimum number of bytes that can be specified. For the actual number of bytes allocated, see Figure 1-6.
		CCHAIN = NO YES	Command chaining support for retry on I/O operations. When an error occurs and CCHAIN = YES, the user is allowed to retry at the last CCW executed instead of at the first CCW in the channel program as is the case in a normal retry. This option requires that the appropriate bit be set in the CCB.
		PTO = NO YES	Physical Transient Overlap allows tasks to be selected during the time of FETCH, LOAD, MVCOM, and ERP I/O. PTO is valid only when MPS = YES or MPS = BJF in the SUPVR macro.
		CBF = NO n	Console Buffering provides immediate return to the caller when write I/O to SYSLOG is issued where SYSLOG is a 1052. n indicates the number of buffers to be generated. 1 to 50 buffers may be specified. 1 is assumed if the operand is invalid.
		IDRA = NO YES	Independent Directory Read-in Area feature. YES option causes generation of the IDRA area in supervisor. IDRA reduces contention for the PTA in fetch operations when ERP is active. Use of IDRA requires MPS = YES or BJF and PTO = YES.
		TRKHLD = NO n	If n is specified, coding to support the HOLD and FREE track macros. TRKHLD = n specifies the number of tracks to be held at any one time, and a Track Hold Table (See Figure 24) is generated for that number. If n is not in the range of 1 to 225, 10 is assumed.
		WAITM = NO YES	Provides for valid use of the WAITM macro, waiting for one of a number of events to occur before continuing with task execution. Waits are performed on Event Control Blocks, which may be of the special form as in Figure 34. Other blocks that may be used as ECBs are CCBs, TECBs, and MICR CCBs since posting is done in bit 0 byte 2 of the block.
		**RETAIN = NO YES	Specifies if the data link to the Remote Analysis Center is to be supported. RETAIN = YES is valid only if a S/370 CPU was specified in the MODEL option.
		DASDFP = NO (n,n,2311) (n,n,2314) (n,n,2321)	Supervisory DASD file protection, where (n,n) indicates the range of channels to which DASDs may be attached. Specifying 2311 or 2314 indicates support for both. 2321 option indicates support for 2321 device as well as for 2311 and 2314. DASDFP prevents the user from writing outside the extents of his file in case of program error. Extents are protected to the nearest cylinder.
		*SYSFIL = NO (2311 [,n1, n2]) (2314 [,n1, n2])	System input and system output (SYSRDR, SYSIPT, SYSLST, SYSPCH) files may be assigned to a 2311, 2314, or both. Specifying either indicates support for both. If MPS=BJF in the SUPVR macro, support is given for foreground logical units when running in batched mode. n1 = residual capacity (in records) for beginning of operator notification when SYSLST is assigned to a 2311 or 2314. 100 ≤ n1 ≤ 65536 If n1 is omitted, 1000 is assumed.

* Valid when at least 24K bytes of main storage are available.

** YES is valid only on a S/370 CPU; YES is the default for a S/370 MODEL. NO is the default for a S/360 MODEL.

Figure 4. Supervisor Macros (Part 3 of 5)

Name	Macro Description	Parameter = Option	Option Description
FOPT (cont'd)		*SYSFIL (cont'd)	n2 =residual capacity (in records) for beginning of operator notification when SYSPCH is assigned to a 2311 or 2314. 100≤ n2 ≤ 65536 If n2 is omitted, 1000 is assumed.
		PCIL = $\left\{\begin{matrix}\underline{\text{NO}}\\ \text{YES}\end{matrix}\right\}$	Provides supervisor support for private core image library.
		JA = $\left\{\begin{matrix}\underline{\text{NO}}\\ \text{YES}\\ \text{n1,n2,n3}\end{matrix}\right\}$	NO defaults to no Job Accounting Interface support. YES specifies basic JA support. (n1,n2,n3) gives additional support to count SIOs issued to I/O devices by partition. n1,n2, and n3 refer to the number of devices in BG, F2, and F1 for which SIOs are to be counted. Choose values for each n from 0 to 255 to specify the number of devices accessed by partition; if any n value is omitted, it defaults to zero.
		JALIOCS = $\left\{\begin{matrix}\underline{\text{NO}}\\ \text{(n1,n2)}\end{matrix}\right\}$	NO defaults to 16 bytes in the user save area and zero bytes for the alternate label area. Set n1 from 0 to 1024 bytes for the user save area; if omitted, it defaults to 16 bytes. Set n2 from 0 to 224 bytes for the alternate label area (usually =number specified by LBLTYP); if omitted, it defaults to zero bytes.
		OLTEP = $\left\{\begin{matrix}\underline{\text{NO}}\\ \text{YES}\end{matrix}\right\}$	Specify if the on-line testing function is desired. If MODEL= a System/370 CPU, then OLTEP=YES is assumed. OLTEP=YES forces OC=YES.
PIOCS	Describes the system I/O configuration	SELCH = $\left\{\begin{matrix}\underline{\text{YES}}\\ \text{NO}\end{matrix}\right\}$	Selector channels attached to the system.
		BMPX = $\left\{\begin{matrix}\underline{\text{NO}}\\ \text{YES}\end{matrix}\right\}$	Burst Mode devices are supported on multiplexor channel. If 1412-1419s or 1287-1288s are attached to the multiplexor channel, BMPX =YES is not supported.
		CHANSW = $\left\{\begin{matrix}\underline{\text{NO}}\\ \text{TSWTCH}\\ \text{RWTAU}\end{matrix}\right\}$	Channel switching tape control unit. RWTAU =2404 or 2804, TSWTCH =2816.
		TAPE = $\left\{\begin{matrix}\underline{\text{NO}}\\ 9\\ 7\end{matrix}\right\}$	Indicates required tape PIOCS support. 9 =nine track only, 7 =seven or nine track, NO =No tape units attached. NO is the assumed value.
		MRSLCH = $\left\{\begin{matrix}\underline{\text{NO}}\\ \text{YES}\end{matrix}\right\}$	MICR tape device assigned to a selector channel.
ALLOC	Partitions storage for MPS (optional macro).	F1 =nK, F2 =nK	Specifies storage partitioning MPS, where n must be a multiple of 2. Must be at least 10K if MPS =BJF.
IOTAB	Describes installation requirements for I/O tables.	IODEV = $\left\{\begin{matrix}\underline{10}\\ \text{n}\end{matrix}\right\}$	Number of I/O devices attached to the system.
		BGPGR = $\left\{\begin{matrix}\underline{10}\\ \text{n}\end{matrix}\right\}$	Number of symbolic units of the class SYSnnn for the background program.
		F1PGR = $\left\{\begin{matrix}\underline{5}\\ \text{n}\end{matrix}\right\}$	Number of symbolic units of the class SYSnnn for F1. Valid only in MPS (minimum 5). Otherwise zero is assumed when MPS =NO.
		F2PGR = $\left\{\begin{matrix}\underline{5}\\ \text{n}\end{matrix}\right\}$	Number of symbolic units of the class SYSnnn for F2. Valid only in MPS (minimum 5). Otherwise zero is assumed when MPS =NO.
		CHANQ = $\left\{\begin{matrix}\underline{6}\\ \text{n}\end{matrix}\right\}$	Number I/O requests in the channel queue. 6 is the minimum value generated. In a supervisor with CBF option specified, the minimum value is 6 plus the number of console buffers generated.
		JIB = $\left\{\begin{matrix}\underline{5}\\ \text{n}\end{matrix}\right\}$	Number of Job Information Blocks (JIBs) for the system. Requirements are: 1. One JIB for each temporary logical unit assignment. 2. One JIB for each alternate logical unit assignment. 3. One JIB for each open 2311 or 2314 extent with the DASD file protect feature. 4. Two JIBs for each open 2321 extent with the DASD file protect feature.

*Valid when at least 24K bytes of main storage are available.

Figure 4. Supervisor Macros (Part 4 of 5)

Name	Macro Description	Parameter = Option	Option Description
DVCGEN	Specifies I/O devices. Each device type requires a separate DVCGEN macro. (See note 1 forr DVCGEN rules. This is an optional macro.)	CHUN = {X'cuu'}	Specify the hexadecimal number of the channel and unit for the device.
		DVCTYP = {xxxxxx}	Specify the device type. See Figure 29.
		CHANSW = $\left\{\begin{matrix}\underline{\text{NO}}\\ \text{YES}\end{matrix}\right\}$	Specify if the device is attached to more than one selector channel. If it is, the device can be switched.
		MODE = {X'ss'}	1. 2400T9. MODE specifies the tape mode. X'C0' is the default value. 2. 2400T7. MODE specifies the tape mode. X'90' is the default value. See Figure 30 for other values. 3. 2702. MODE designates the SADxxx command. X'00' is the default value. X'00' SAD0 X'01' SAD1 X'02' SAD2 X'03' SAD3 4. 2260 (Local). MODE is used to specify the 1053 printer when CHUN = X'cuu' refers to a 1053 attached to a 2848. The operand must be entered as MODE = X'01' 5. 1412/1419. MODE designates the external interrupt bit associated with Magnetic Ink Character Readers. The modes X'01' through X'20' correspond to external interrupt PSW bits 31 through 26 respectively. For the dual address adapter 1419, this parameter is needed for both the 1419P and the 1419S device types. X'01' Device attached to external line 7. X'02' Device attached to external line 6. X'04' Device attached to external line 5. X'08' Device attached to external line 4. X'10' Device attached to external line 3. X'20' Device attached to external line 2. 6. 1018 Paper Tape Punch with 2826 Paper Tape Control Unit Model 1. This parameter specifies whether or not the Error Correction feature is present: X'00' feature not present X'01' feature present
ASSGN	Sets standard I/O assignments. A separate macro is required for each standard assignment desired. (Optional macro)	$\left\{\text{SYSxxx,X'cuu'},\left\{\begin{matrix}\underline{\text{BG}}\\ \text{F1}\\ \text{F2}\end{matrix}\right\}\right\}$	SYSxxx is any symbolic logical unit (SYSIPT, SYSLOG, etc.) or programmer logical unit (SYS000, SYS001, etc.). X'cuu' is the hexadecimal number of the channel and unit to which the symbolic device is attached. $\left\{\begin{matrix}\underline{\text{BG}}\\ \text{F1}\\ \text{F2}\end{matrix}\right\}$ indicates the specific partition to which the ASSGN is being made.
SEND	Indicates end of supervisor generation.	[n]	Specifies the beginning address of the problem program area. An area should be reserved for supervision expansion and maintenance. The parameter is optional. If not specified, no area is reserved beyond the assembled last address of the supervisor.

Note 1: Rules for using DVCGEN

1. A separate DVCGEN macro instruction is required for each device.
2. The total number of DVCGEN macros must not exceed the total number of devices specified in the IODEV parameter of the IOTAB macro.
3. DVCGEN macros must be specified in ascending channel address sequence.
4. Switchable units (attached to more than one selector channel) must be defined once. They are defined on the lowest channel on which they are addressable.
5. The sequence of the DVCGEN cards determines the priority of the devices on their channel. Switchable units must be the last devices for each channel, and must be on consecutive channels.
6. The specifications of these macros may be altered by IPL ADD and DEL statements. See IPL PLM, GY24-5086.
7. Rules for SYSxxx:
   a. The ASSGN macro allows SYSRDR, SYSLST, SYSPCH, and SYSIPT to be assigned to a tape or DASD. However, IPL unassignes any such assignments.
   b. SYSLOG must also be assigned in BG, if assigned in foreground partition.
   c. SYSLNK cannot be specified in either foreground partition.

Figure 4. Supervisor Macros (Part 5 of 5)

Macro	Type	Code Generated	Critical Globals Set
SUPVR	generation	Defines low main storage	BG10 BG25 BG13 BG27 BG14 BG35 BG19 BG36 BG20 BG50 BG21 BG51 BG24 BG100 AG11
CONFG	generation	None	BG1 BG23 BG2 BG39 BG22 BG51 AG12
STDJC	generation	None	BG34 BG81
FOPT	generation	General cancel SVEREG routine General exit Background communication region and extension General entry SVC interrupt handler	BG0 BG60 BG2 BG61 BG4 BG62 BG5 BG71 BG6 BG72 BG7 BG73 BG8 AG2A BG14 AG7 BG15 AG10 BG16 AG13 BG18 AG21 BG26 AG22 BG30 AG23 BG32 AG28 BG33 AG31 BG38 AG32 BG40 AG39 BG52
PIOCS	generation	None, directly calls inner macros.	BG3 BG11 BG9 BG12 BG10 BG31
SGTCHS	inner	Channel scheduler Start I/O SIO accounting I/O interrupt	none
SGUNCK	inner	Unit check Error recovery exits	none
SGTCON	inner	VLDADR1 subroutine, ATNRTN routine, CCW chain, disk information blocks. error recovery block, SVC interrupt table, PC option table, and OC option table, physical transient save area, IDRA save area, logical transient save area.	none
SGDFCH	inner	Fetch subroutine	none
SGSVC	inner	Supervisor interrupts Program check interrupts External interrupts Console buffering routine	none
SGDSK	inner	Disk error recovery	none
SGTHAP	inner	Track hold, track free, set abnormal exit routine address, and asynchronous processing routines.	none
SMICR	inner	External interrupts for MICR type devices Program checks in stacker select routine Error recovery for test I/O and start I/O	none
ALLOC	generation	None	none

Figure 5. Macro Functions (Part 1 of 2)

Macro	Type	Code Generated	Critical Globals Set
IOTAB	generation	Supervisor table expansions- SYSCLB LUB,PIBs, SVC Interrupt table, channel queue table (CHANQ), PUB, JIB, TEB, and TEBV.	AG2D
LUBGEN	inner	Generates NICL, FICL, and unassigned LUB tables, console buffers, and track hold table entries.	none
DVCGEN	generation	Overlays for PUB table entries.	AG8
ASSGN	generation	Overlays for LUB table entries.	none
SEND	generation	Generates console buffer and PTO patch areas; JAI partition tables, user save area, and label area; OBR/SDR routines. Calls inner macros COMMN for F1, F2, communications regions, COMMNEX for F1, F2, communications region extensions, TRTAB for ASCII translation tables, MCRAS for RMS resident coding and RTA. Defines end of supervisor nucleus, beginning of IDRA, A and B transient areas, start of problem program area, CE area, and BG save area.	none
SMCRR	inner	Machine check recording and recovery record builder.	none
COMMN	inner	Communications regions for all partitions.	none
COMMNEX	inner	Communications region extensions for all partitions.	none
TRTAB	inner	Generates ASCII translation tables.	none
MCRAS	inner	Generates RMS Monitor and RTA.	none
MAPLOWC	inner	Generates equates to address low core for RMS.	none

Figure 5. Macro Functions (Part 2 of 2)

Global	On Setting	Purpose
BG0	CE=YES or n AP=YES AB=YES EU=YES TRKHLD=n ERRLOG=YES or CLEAR MCRR=YES MICR=1412, 1419 or 1419D JA=YES JA=(n_1,n_2,n_3) ASCII=YES MPS=YES or BJF	Determines the length of the supervisor save area.
BG1	SP=YES	Determines whether the storage protect feature is used.
BG1QT	TP=QTAM	Determines QTAM support.
BG2	TIMER=YES JA=YES JA=(n_1,n_2,n_3)	Determines whether the timer feature is used. Does not force BG0.
BG3	CHANSW=TSWTCH or RWTAU	Determines whether channel switching is supported (2816).
BG4	TEB=n	Determines if tape error statistics are to be accumulated and logged.
BG5	PTO=YES	Determines if physical transient overlap option is supported.
BG6	OC=YES OLTEP=YES	Determines if the asynchronous user interrupt key routine is supported. Does not force BG0.
BG7	IT=F1, or F2, or BG	Determines whether the internal timer option is supported. Does not force BG0.
BG8	PC=YES	Determines if the user program check routine is supported.
BG9	CHANSW=RWTAU	Determines whether channel switching is supported (2404, 2804).
BG10	SELCH=YES	Determines whether selector channels are supported.
BG11	BMPX=YES	Determines whether burst mode devices will be supported on the multiplexor channel.
BG12	TAPE=7 or 9	Determines the type of tape support required.
BG13 *	AP=YES	Determines if asynchronous processing is supported. If yes, force on BG0, BG14, BG20.
BG14	WAITM=YES AP=YES	Determines if the wait multiple function is supported. Force on if AP is specified. Does not force on BG0.

Figure 6. Global Settings (Part 1 of 5)

Global	On Setting	Purpose
BG15 *	AB=YES	Determines if user abnormal termination routine is supported. Forces on BG0.
BG16 *	TRKHLD=n	Determines if the track hold function is supported. BG20 must be on (if it is not, it defaults to NO).
BG18	CBF=n	Determines if console buffering option is supported.
BG19 *	MCRR=YES	Determines whether MCRR option is supported.
BG20	MPS=YES or BJF AP=YES	Determines whether multiprogramming support is required. Forces BG0.
BG21	TP=BTAM or QTAM	Determines whether teleprocessing support is required.
BG22	DEC=YES	Determines if the decimal feature is used. Does not force BG0.
BG23	FP=YES	Determines if the floating point feature is used. Does not force BG0.
BG24	MPS=BJF	Determines if batched jobs will be run in foreground partitions. Forces BG0.
BG25	ERRLOG=any invalid setting	Indicates ERRLOG is set with an invalid option. Causes a message and terminates supervisor assembly.
BG26	PCIL=YES	Determines if PCIL is supported.
BG27	ERRLOG=RDE	Determines if RDE Support is required.
BG30	CCHAIN=YES	Determines if command chaining support for retry on I/O operation is used. Does not force BG0.
BG31	TAPE=9	Determines if 9 track tape support is required.
BG32	DASDFP=n,n	Determines whether the DASD file protect feature is supported. Does not force BG0.
BG33	SYSFIL=2311 or 2314	Determines if logical system I/O units are a disk device. Does not force BG0.
BG34	DATE=MDY	Determines the type of date configuration to be supported.
BG35	MICR=1412, 1419, 1419D, 1270, 1275	Determines if any MICR type device is supported. Forces BG0.
BG36	MICR=1419D	Determines if 1419D (MICR type device with dual address adapter) only is supported. Forces BG0.

Figure 6. Global Settings (Part 2 of 5)

Global	On Setting	Purpose
BG38	OLTEP=YES	Indicates whether OLTEP is supported; forces BG6.
BG39	MODEL=a S/370 CPU	Indicates RMS support for System/370.
BG40	RETAIN=YES	Indicates RETAIN/370 is Supported.
BG41	DECK=YES	Job control options.
BG42	LIST=YES	Job control options.
BG43	LISTX=YES	Job control options.
BG44	SYM=YES	Job control options.
BG45	XREF=YES	Job control options.
BG46	ERRS=YES	Job control options.
BG47	CHARSET=48C	Job control options.
BG48	DUMP=YES	Job control options.
BG49	LOG=YES	Job control options.
BG50	EU=YES	Determines if emulator interface is generated. Forces on BG0.
BG51	EU=RELOC	Determines if the relocatable version of CS/40 is used. Forces on BG0, BG50.
BG52	IDRA=YES	Indicates whether IDRA is supported.
BG60 *	TEBV=(device,n)	Determines if the Tape Error Statistics by Volume is supported. Does not force BG0.
BG61	TEBV=(DASD,n)	Determines if TEBV Device is DASD. Does not force BG0.
BG62 *	EVA=(rth,wth,n)	Determines if Error Volume Analysis is supported. Does not force BG0.
BG71	JA=YES or JA=(n_1,n_2,n_3)	Indicates whether JAI is supported.
BG72	JA=(n_1,n_2,n_3)	Indicates whether count of SIOs is made.
BG73	JALIOCS=(n_1,n_2)	Indicates whether JAI label processing is supported.

Figure 6. Global Settings (Part 3 of 5)

If OLTEP is the issuing program, an HIO instruction is issued to the device if there is I/O pending for the device. If MPS=YES was specified during system generation, OLTEP uses SVC 25 to dequeue an unstarted I/O operation to a shared device. The channel queue entry is removed from the channel queue, and in this case an HIO instruction is not executed.

The supervisor returns to the highest priority program ready to run. The device busy flag is reset at this time. Unless SVC 25 is issued by OLTEP or a teleprocessing device, this SVC is ignored and results in cancelation. If OLTEP was a supervisor option and teleprocessing was not, issuing as SVC 25 by a program other than OLTEP results in cancelation.

SVC 26: Validate address limits. The program issuing an SVC 26 is canceled if the PSW protection key does not equal 0. (Only job control and B-transient programs can issue an SVC 26.)

The upper address must be specified in general register 2, and the lower address must be specified in general register 1. The upper address must be within main storage, and the lower address must be higher than the end of supervisor address, or the program is canceled (ERR25). Return is to the interrupted program. No task selection is performed.

With MPS option, the PIK of the program issuing the SVC 26 must equal the storage protection key for both addresses or the program is canceled (ERR25).

With batch operation, SVC 26 is ignored unless storage protection has been specified.

SVC 27: Same as SVC 25, except that SVC 27 cannot be used by OLTEP. It can be used only to halt I/O on a teleprocessing device. The CCB is not dequeued if the CSW has been stored after an HIO command.

SVC 28: Provides return from user's stacker select routine to the MICR external interrupt routine in the supervisor. This SVC is optional and causes a cancel if issued at any point other than in a stacker select routine with MICR devices.

SVC 29: Provides supervisory support for the WAITM macro (except for MICR type devices). If WAITM=YES has been specified in the FOPT macro, WAITM coding is generated to load general register 1 with the address of the ECB list name and to issue the SVC 29. However, when MICR type devices are used, SVC 47 is issued to identify the wait on the MICR CCB.

All interrupts are disabled and the CCBs are all checked for the traffic bit. When a CCB is found with the traffic bit posted, SVC 29 returns to the interrupted program.

If all CCBs are checked and no traffic bits are posted, one of two courses is taken:

- With MPS option - Cause user to become I/O-bound, disable for I/O interrupts only, and return to task selection.
- Without MPS option - Set wait bit in SVC old PSW, disable for I/O interrupts only, and return to interrupted program.

SVCs 30, 31, and 32: Reserved for QTAM. Refer to the QTAM PLM listed in the Preface.

SVCs 33 and 34: Reserved for internal macros COMRG and GETIME, respectively. Their use by other programs results in a branch to EXT01 (see Chart BG).

SVC 35: Protects a track from use by more than one task at a time. A X'FF' is moved to byte 2 of the SVC old PSW to indicate track hold. A requesting task not owning a held track is made inactive and must wait until the track is free. If more than sixteen holds on a track are attempted, the requesting task is canceled.

Exits are to EXCP3 to execute the I/O, or to RESVC if the track is already held. At RESVC, the problem program old PSW is set to execute the SVC 35 again, and a branch to EXT03 is taken for task selection. See Figure 24 for the Track Hold Table.

SVC 36: Frees a track that is held by the task issuing the FREE. An attempt to free a track not owned by the requestor results in cancellation of that task.

Exits on a successful FREE are to EXT03 for task selection, or to the DETACH routine if the FREE was issued by that routine.

SVC 37: Establishes linkage from the supervisor to a problem program abnormal termination (AB) routine. It stores the routine's entry point and save area address in the AB table. (The save area is a 72-byte area in which the old PSW and general registers 0-15 are stored.) Return is to the STXITing program.

SVC 38: Initializes a subtask. The main task's PIB and save area are copied to the subtask's PIB and save area. The subtask's PIB flag is set to X'83' to indicate 'ready-to-run.' Bit 0 of the maintask's R1 is set to 0 to indicate a successful attach, and absolute priority is established for the subtask. A subtask attempting to issue an ATTACH is canceled. Exit is to EXT03 for task selection.

SVC 39: Performs normal termination of a subtask. DETACH may be issued by either the subtask being terminated or by the main task.

The subtask's PIB is set inactive (byte 0 = X'80'), and its ECB (see Figure 34) is posted for termination. This routine calls the free routine to free any tracks held by this subtask, and a waiting task is removed from the wait state. Exit is to EXT03 for task selection.

SVC 40: Used for intertask communication. POST may be issued by either a maintask or a subtask. It is issued so that a task is aware of the termination of an event. Normal completion of the specified event is posted in the ECB (byte 2, bit 0 = 1). If the SAVE= parameter is present, only the task waiting for this ECB is taken out of the wait state; otherwise, all waiting tasks are removed from the wait state. Exit from this routine is to EXT03 for task selection.

SVC 41: Informs the system that a resource (shared data area) is now available for use by another task. A task may issue the DEQ macro only to a resource that it currently owns. If it attempts to issue the DEQ macro to some other resource, the task is canceled.

If any other tasks are waiting for the resource, the highest priority task ready to run is removed from the wait state and gains control. If no other task is waiting for the resource, control returns to the task that issued the DEQ.

If a task terminates without DEQuing all of its ENQued resources, either in its normal coding or in its abnormal termination exit routine, any task subsequently attempting to ENQ the resource is canceled. See Figure 35 for the Resource Control Block (RCB).

Normal exits are to EXT01 or EXT03.

SVC 42: ENQ prevents tasks from simultaneous manipulation of a shared data area (resource). This is accomplished, using the TS instruction, by setting to ones all bits of byte 0 of the specified resource control block (RCB). Then the event control block (ECB) address is placed in bytes 4-7 of the RCB.

A task attempting to ENQ a resource that is already enqueued by another task is placed in a queue and put in a waiting condition. The old PSW is set to reexecute the SVC 42 and task selection is performed.

A task is canceled if it attempts to nest ENQ(s) of a resource or if it attempts to ENQ a resource that is still owned by a terminated task.

When a task is finished with a resource, it should inform the system by issuing the DEQ macro. If it does not, tasks subsequently requesting that resource are canceled. See Figure 35 for the Resource Control Block.

SVC 43: Supplies supervisory support for the creation and updating of SDR records for devices not explicitly supported by the system. The address of the compressed SDR record area must be supplied in general register 1 before the SVC is issued. The SDR record area must be 22 bytes long: 2 bytes reserved for the SDR processor, 1 byte initialized to zeroes, and a 19 byte SDR record with the 16 error counters compacted to 8 bytes. The SVC 43 causes a branch to the SDRSDR routine in the supervisor to complete processing of the record. Immediately following the SVC, the WAIT macro must be issued on the address in register 1.

Example:

```
LA 1,SDRAREA
SVC 43
WAIT (1) or SDRAREA
```

This SVC is available only with the I/O Error Logging option (ERRLOG). See Chart 08 for the SDRSDR update routine.

SVC 44: Supplies supervisory support for external creation of OBR records for devices not explicitly supported by the system. The address of the OBR record area must be supplied in general register 1 before the SVC is issued. The OBR record area must be 83 bytes long: 2 bytes reserved for the OBR processor, 1 byte initialized to zeroes, and an 80 byte OBR record. The SVC 44 causes a branch to the SDROBR routine in the supervisor to write the OBR record. Immediately following the SVC, the WAIT macro must be issued on the address in register 1.

Example:

```
LA 1,OBRAREA
SVC 44
WAIT (1) or OBRAREA
```

This SVC is available only with the I/O Error Logging option (ERRLOG). See Chart 08 for the SDROBR update routine.

SVC 45: Provides emulator interface for CPU Models 30 and 40, or System/370 models. On System/370, this SVC serves two purposes:

1. When register 1 contains zero, SVC 45 sets communication region byte 134, bit 1 on, indicating that the emulator is active.
2. When register 1 contains a PUB address, SVC 45 switches the parity bit in the PUB.

SVC 46: Provides OLTEP with the facility to operate in the supervisory state. In the initial issuing of the SVC, register 1 contains an entry point in OLTEP. The next time the SVC is issued, register 1 is zeroed out, forcing task selection.

SVC 47: Provides identification to the supervisor for MICR type device waits. The SVC results in exiting to task selection (EXT03) rather than reissuing the SVC (RESVC) as is done when SVC 29 is issued.

SVC 48: Reserved for future use.

SVC 49: Reserved for future use.

SVC 50: Reserved for LIOCS error recovery.

SVC 51: Provides OLTEP with the ability to find the length of a core image library without loading the phase. Registers 0 and 1 must be initialized before issuing SVC 51. Register 0 must be pointed at a twelve-byte save area for the phase header, and register 1 must be pointed at the eight-byte phase name. The first 12 bytes of the phase header are moved to the save area. The save area is not altered if the phase is not in the core image library. If any program except OLTEP issues an SVC 51, that program is canceled.

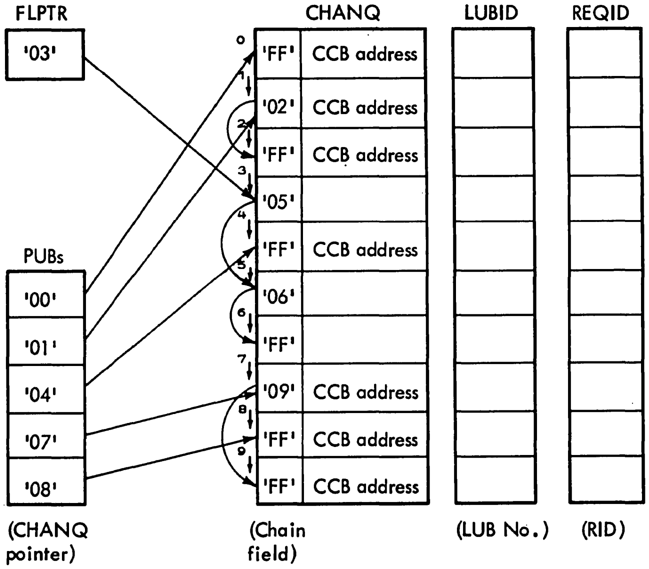


Figure 32. Example of the CHANQ Table Operation

SVC 52: Provides an interface between the supervisor and $$BEOJ4. SVC 52 allows the forced dequeuing of channel queue entries that belong to devices assigned to the partition or task that is being canceled or has reached end-of-job.

Macro Supported	SVC		Function
	Dec.	Hex.	
EXCP	0	0	Execute channel programs.
FETCH	1	1	Fetch any phase.
	2	2	Fetch a logical transient (B-transient).
	3	3	Fetch or return from a physical transient (A-transient).
LOAD	4	4	Load any phase.
MVCOM	5	5	Modify supervisor communications region.
CANCEL	6	6	Cancel a problem program or task.
WAIT	7	7	Wait for a CCB or TECB.
	8	8	Transfer control to the problem program from a logical transient (B-transient).
LBRET	9	9	Return to a logical transient (B-transient) from the problem program after an SVC 8.
SETIME	10*	A	Set timer interval.
	11	B	Return from a logical transient (B-transient).
	12	C	Logical AND (Reset) to second job control byte (displacement 57 in communications region).
	13	D	Logical OR (Set) to second job control byte (displacement 57 in communications region).
EOJ	14	E	Cancel job and go to job control for end of job step.
	15	F	Same as SVC 0 except ignored if CHANQ table is full. (Primarily used by ERP).
STXIT (PC)	16*	10	Provide supervisor with linkage to user's PC routine for program check interrupts.
EXIT (PC)	17*	11	Return from user's PC routine.
STXIT (IT)	18*	12	Provide supervisor with linkage to user's IT routine for interval timer interrupts.
EXIT (IT)	19*	13	Return from user's IT routine.
STXIT (OC)	20*	14	Provide supervisor with linkage to user's OC routine for external or attention interrupts (operator communications).
EXIT (OC)	21*	15	Return from user's OC routine.
	22*	16	The first SVC 22 seizes the system for the issuing program by disabling multiprogram operation. The second SVC 22 releases the system (enables multiprogram operation).
	23*	17	Load phase header. Phase load address is stored at user's address.
SETIME	24*	18	Provide supervisor with linkage to user's TECB and set timer interval.
	25*	19	Issue HALT I/O on a teleprocessing device, or HALT I/O on any device if issued by OLTEP. For a MPS=YES system, dequeue an unstarted OLTEP I/O request to a shared device.
	26*	1A	Validate address limits.
	27*	1B	Special HIO on teleprocessing devices.

*=Optional

Figure 33. DOS Supervisor Calls (Part 1 of 2)

Macro Supported	SVC		Function
	Dec.	Hex.	
EXIT (MR)	28*	1C	Return from user's stacker select routine (MICR type devices only).
	29*	1D	Provide return from multiple wait macros WAITF and WAITM (except MICR type devices).
QWAIT	30*	1E	Wait for a QTAM element.
QPOST	31*	1F	Post a QTAM element.
	32 33 34	20 21 22	(Reserved). Reserved for internal macro COMRG. Reserved for internal macro GETIME.
HOLD	35*	23	Hold a track for use by the requesting task only.
FREE	36*	24	Free a track held by the task issuing the FREE.
STXIT (AB)	37*	25	Provide supervisor with linkage to user's AB routine for abnormal termination of a task.
ATTACH	38*	26	Initialize a subtask and establish its priority.
DETACH	39*	27	Perform normal termination of a subtask. It includes calling the FREE routine to free any tracks held by the subtask.
POST	40*	28	Inform the system of the termination of an event and ready any waiting tasks.
DEQ	41*	29	Inform the system that a previously enqueued resource is now available.
ENQ	42*	2A	Prevent tasks from simultaneous manipulation of a shared data area (resource).
	43* 44* 45* 46* 47* 48 49 50 51* 52*	2B 2C 2D 2E 2F 30 31 32 33 34	Provide supervisor support for external creation and updating of SDR records. Provide supervisor support for external creation of OBR records. Provide emulator interface. Provide OLTEP with the facility to operate in supervisory state. Provide return from wait multiple WAITF for MICR type device. (Reserved) (Reserved) Reserved for LIOCS error recovery. Return phase length at OLTEP request. Provide an interface between supervisor and end-of-job routines.

* = optional

Figure 33. DOS Supervisor Calls (Part 2 of 2)

	Reserved	Reserved	*	Reserved
Byte	0	1	2	3

*<u>Byte 2</u>

Bit 0: Turned on (X'80') at normal termination of subtask.

Bits 0 and 1: Turned on (X'c0') if the subtask is abnormally terminated.

Bits 2-7: Reserved.

<u>Note</u>: Other blocks that may be used as ECBs are CCBs, TECBs, and MICR CCBs since posting is done in bit 0 of byte 2 of the block.

Figure 34. Event Control Block (ECB)

	*	Unused	**	ECB Address of Current Resource Owner
	X	X X X	X	X X X
Byte	0	1 2 3	4	5 6 7

*Byte 0: Availability byte - All ones when resource is in use.
- All zeros when not in use.

**Byte 4: Flag byte: Bit 0 = 1, another task waiting for the resource.
= 0, no other task waiting for the resource.

<u>Note</u>: The address of the RCB is passed in register 1.

Figure 35. Resource Control Block (RCB)

	Count	Transmission Information	CSW Status Bits	Symbolic Unit Address	Reserved for Logical IOCS	CCW Address	Reserved for Physical IOCS	CCW Address in CSW	Optional Sense CCW
Bytes	0 1	2 3	4 5	6 7	8	9 11	12	13 15	16 23
Used for	Residual Count	Transmitting Information Between Physical IOCS and Problem Program	(Note 1) Byte 4 BIT DESIGNATION 32 Attention 33 Status modifier 34 Control unit end 35 Busy 36 Channel end 37 Device end 38 Unit check 39 Unit exception Byte 5 BIT DESIGNATION 40 Program-controlled interruption 41 Incorrect length 42 Program check 43 Protection check 44 Channel data check 45 Channel control check 46 Interface control check 47 Chaining check	Hexadecimal Representation of SYSnnn SYSRDR = 0000 SYSIPT = 0001 SYSPCH = 0002 SYSLST = 0003 SYSLOG = 0004 SYSLNK = 0005 SYSRES = 0006 SYSSLB = 0007 SYSRLB = 0008 SYSUSE = 0009 SYSREC = 000A SYSCLB = 000B SYS000 = 0100 SYS001 = 0101 SYS221 = 01DD	Buffer Offset: ASCII Input Tapes X'00'-X'63' ASCII Output Tapes Fixed: X'00' Variable: X'00' or X'04' Undefined: X'00'	Address of CCW Associated with this CCB	X'80'-CCB being used by ERP X'40'-Channel Appendage Routine Present for Teleprocessing Device X'20'-Sense Information Desired X'10'-Message Writer X'08'-EU Tape Error X'02'-Tape ERP Read Opposite Recovery X'01'-Seek Separation or Console Buffering	Address of CCW in the CSW Stored at Channel End, or Address of the Channel Appendage Routine for Teleprocessing Devices	8 Bytes Appended to the CCB when Sense Information is Desired

Byte 2

	Traffic Bit (Wait) (Note 5)	End-of-File (/* or /&) 3211-UCSB Parity Check (Line Complete) (Note 2)	Unrecoverable I/O Error	Accept Unrecoverable I/O	Return DASD Data Checks 2671 errors, or 1017/1018 errors to the user	Post at Device End (Note 5)	Return Tape Read Data Check, 1018 Data Check, 2540 or 2520 Equipment Check, DASD Data Checks on Read or Verify Command, or 3211 Passback Requested (Notes 3 & 6)	User Error Routine
Bits	0	1	2	3	4	5	6	7
Set On By	PIOCS	PIOCS	PIOCS	Pr. Pr.	Pr. Pr.	Pr. Pr.	Pr. Pr.	Pr. Pr.

Byte 3

	DASD - Data Check in Count Area MICR - SCU Not Operational 1285/1287/1288 Data Check 3211- Print Check/ Equipment Check	DASD - Track Overrun MICR - Intervention Required 1285/1287 - Keyboard Correction in Journal Tape Mode 1017 - Broken Tape 3211- Print Quality/ Equipment Check	DASD - End of Cylinder MICR - (Note 4) 1287/1288 - Hopper Empty in Document Mode 3211- Line Position Error (Note 7)	2540, 2520- Equipment Check Tape - Read Data Check DASD - Any Data Check 1285/1287 Equipment Check 1017/1018 Data Check 3211- Print Check/ Data Check	Non-Recovery Questionable Condition: Card - Unusual Command Sequence DASD - No Record Found 1285/1287/1288 - Document Jam or Torn Tape 3211- UCSB Parity Check (Command Retry)	No-Record-Found Condition (Retry on 2311, 2314, or 2319)	Carriage Channel 9 Overflow or Verify Error for DASD 1287 Document Mode - Late Stacker Select 1288 - End of Page	Command Chaining Retry from the next CCW to be executed
Bits	0	1	2	3	4	5	6	7
Set On By	PIOCS	PIOCS	PIOCS	PIOCS	PIOCS	Pr. Pr.	PIOCS	Pr. Pr.

PIOCS = Physical IOCS
Pr. Pr. = Problem Program

Note 1. Bytes 4 and 5 contain the status bytes of the Channel Status Word (Bits 32-47). If byte 2, bit 5 is on and device end results as a separate interrupt, device end will be ORed into CCB byte 4.
Note 2. Indicates /* or /& statement encountered on SYSRDR or SYSIPT. Byte 4, bit 7 (unit exception) is also on.
Note 3. DASD data checks on count not returned.
Note 4. For 1255/1259/1270/1275/1412/1419, disengage. For 1275/1419D, I/O Error in external interrupt routine (channel data check or busout check).
Note 5. The traffic bit (Byte 2, bit 0) is normally set on at channel end to signify that the I/O was completed. If byte 2, bit 5 has been set on, the traffic bit and bits 2 and 6 in byte 3 will be set on at device end. Also see Note 1.
Note 6. 1018 ERP does not support the Error Correction Function.
Note 7. This error occurs as an equipment check, data check, or FCB parity check.

Figure 37. Command Control Block (CCB)

Byte	0	1	2	3	4		5
Bit	0 1 2 3 4 5 6 7	8 9 10 11 12 13 14 15	16 17 18 19 20 21 22 23	24 25 26 27 28 29 30 31	32 33 34 35 36	37 38 39	40 41 42 43 44 45 46 47
Name	Command Code	◄── Data Address		──►	Flags	0 0 0	(Ignored)
Field	A	B			C	D	E

6	7
48 49 50 51 52 53 54 55	56 57 58 59 60 61 62 63
◄── Count	──►
F	

FIELD	NAME	DESCRIPTION
A	Command Code	Bits 0-7: Specify the operction to be performed. (See Part 2 of this Figure)
B	Data Address	Bits 8-31: Specify the location of a byte in main storage. It is the first location referred to in the area designated by the CCW.
C	Flags	Bits 32-36: Specify the flag bits used in conjunction with the CCW. Bit 32- Chain-Data (CD) causes the address portion of the next CCW to be used with the current CCW. †Note Bit 33- Chain-Command (CC) causes the command code and data address of the next CCW to be used. The chain data flag (bit 32) takes precedence over this flag. Bit 34- Suppress Length Indication (SLI) causes a possible incorrect length indication to be suppressed. The chain data flag (bit 32) takes precedence over this flag. Bit 35- Skip (SKIP) suppresses the transfer of information to main storage. Bit 36- Program Control Interruption (PCI) causes the channel to generate an interrupt when the CCW is fetched.
D	Reserved	Bits 37-39: (Must contain zeros)*
E	Ignored	Bits 40-47: Not checked
F	Count	Bits 48-63: Specify the number of bytes in the operation

* The transfer in channei command (TIC) is the one exception to this statement.

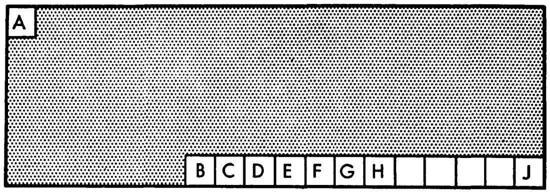
†Note: Chain data cannot be done on 360/30 if a highspeed device is being used. Excmple - 2311,2400 Model 3.

Figure 38. Channel Command Word (CCW) (Part 1 of 2)

MESSAGE CODE (IN HEX)	10-CHARACTER MESSAGE	ERROR
08	C'INTERV REQ'	OPERATOR INTERVENTION REQUIRED
09	C'BUSOUT CHK'	BUS OUT CHECK
10	C'EQUIP CHK '	EQUIPMENT CHECK
11	C'DATA CHECK'	DATA CHECK
12	C'VERIFY CHK'	VERIFY CHECK
13	C'ADDR MRKER'	MISSING ADDRESS MARKER
14	C'OVERRUN '	OVERRUN
15	C'SEEK CHECK'	SEEK CHECK
16	C'DTA CHK CT'	DATA CHECK IN COUNT FIELD
17	C'FILE PROT '	VIOLATED FILE PROTECTION
18	C'COMM REJCT'	COMMAND REJECT
19	C'UNDETR ERR'	UNDETERMINED ERROR
20	C'ERR ON REC'	ERROR DURING RECOVERY ATTEMPT
21	C'NRF-MADDMK'	NO RECORD FOUND & MISSING ADDRESS MARKER
22	C'BALST CELL'	BALLAST CELL ACCESSED ON 2321
23	C'BLNK STRIP'	ACCESSED A PREVIOUSLY UNUSED STRIP
24	C'PROG CHECK'	I/O PROGRAM CHECK
25	C'PROT CHECK'	STORAGE PROTECTION CHECK
26	C'INVAL SEEK'	SEEK ADDRESS NOT VALID
27	C'UNKNWN DEV'	DEVICE IN ERROR NOT RECOGNIZED
28	C'CHAN DTCHK'	CHANNEL DATA CHECK
29	C'BK INTO LP'	BACKSPACE INTO LOADPOINT
30	C'CONVRT CHK'	TAPE CONVERT CHECK
31	C'DVC NOT OP'	DEVICE NOT OPERATIONAL
32	C'NON COMPAT'	NONCOMPATIBLE TAPE ON DRIVE
33	C'BUF PARITY'	PARITY ERROR IN PRINTER BUFFER
34	C'BCH NM OFF'	BATCH NUMBERING SWITCH OFF ON MICR
35	C'NON RECOV '	NON-RECOVERY ON 1285
36	C'NO REC FND'	NO RECORD FOUND
37	C'DISEN FAIL'	DISENGAGE FAILURE ON MICR
38	C'INVLD FONT'	INVALID FONT ON 1287 IN DOCUMENT MODE
39	C'POSN CHECK'	POSITION CHECK ON 2495 TCR
40	C'BROKN TAPE'	BROKEN TAPE ON 1017
41	C'LOAD CHECK'	BUFFER LOAD CHECK ON 3211

Figure 46. Physical Transients Error Messages

552-Byte Physical Transient Area



The labels which are associated with these bytes are as designated below. Byte A is the first byte of the Physical Transient Area, Byte J is the last. Bytes B through H constitute the interphase communications area. When phases Z, Y and 0 are fetched or refetched, these bytes (B through H) are not overlaid and remain with information for the other phases.

Byte	Label	Phase
A	IJBPAR1	Z
	IJBPAR2	Y
	IJBPAR3	0
B	PARLTK	Z
	PARCOMM-1	
C	IJBPAR1+504	
	PARCOMM	Z
	IJBPAR2+504	
	PARCOMM2	Y
	PARCOMMC	Z
	PARCOMMD	Y
F	PARCOMMC+3	
	PARCOMMD+3	

Note: Bytes C, D and E are used to indicate the program(s) F1, F2 or BG, to be canceled.

Bytes F, G and H indicate the programs which use devices which require operator intervention.

Byte B indicates that a canceled program has fetched a logical transient.

D, E, G, H Addressed by incrementing or decrementing one of these labels.

Figure 47. Interphase Communication Area (For A-Transients $$ANERRZ, Y, and 0)

1403-1443 ERROR RECOVERY

- CSW Bit 44--Channel Data Check

  Action: If initial selection, one retry--take equipment error exit (initial selection: cancel, retry. Channel end: cancel, retry, ignore).

  Message: 0P28 CHAN DTCHK.

- Byte 0, Bit 3--Equipment Check

  Action: Take equipment error exit (cancel, ignore).

  Message: 0P10 EQUIP CHK.

- Byte 0, Bit 5--Code General Storage Parity Error (1403 only)

  Action: Take equipment error exit (cancel). UCS buffer must be reloaded.

  Message: 0P33 UCB PARITY.

- Byte 0, Bit 1--Intervention Required

  Action: Take operator intervention exit.

  Message: 0P08 INTERV REQ.

- Byte 0, Bit 2--Bus Out Check

  Action: If initial selection, one retry; otherwise, take equipment error exit (initial selection: cancel, retry. Channel end: cancel, retry, ignore).

  Message: 0P09 BUSOUT CHK.

- Byte 0, Bit 7--Channel 9

  Action: Post CCB, take continue exit.

  Note: This test is main storage resident.

- Byte 0, Bit 0--Command Reject

  Action: If command code is UCS enable or inhibit data check, take continue exit; otherwise, take program check exit. This procedure allows UCS-oriented programs to operate on non-UCS hardware.

  Message: 0P18 COMM REJCT.

- Byte 0, Bit 4--Data Check (1403 Only)

  Action: Take equipment error exit (cancel, ignore).

  Message: 0P11 DATA CHECK.

3211 PRINTER ERROR RECOVERY

- CSW Bit 44--Channel Data Check

  Action: If initial selection, one retry--take equipment error exit (initial selection: cancel, retry. Channel end: cancel, retry, ignore).

  Message: 0P28 CHAN DTCHK.

- Byte 0, Bit 3--Equipment Check

  Action: Check the following bits of sense byte 1 in the order indicated; if a bit is on when tested, the system takes the action indicated in the discussion of these bits.

  Bit 0, Command retry
  Bit 1, Print check
  Bit 2, Print quality
  Bit 3, Line position
  Bit 6, Mechanical motion

  If none of the preceding conditions occurred, then a transparent sync check or a train overload condition occurred.

  Action: Provide information type message and continue processing.

  Message: 0P10 EQUIP CHK.

- Byte 0, Bit 2--Bus Out Check

  Action: Provide an intervention required message. The operator should then make the device ready to continue processing.

  Message: 0P09 BUSOUT CHK.

- Byte 0, Bit 4--Data Check

  Action: Check the following bits of sense byte 1 in the order indicated; if a bit is on when tested, the system takes the action indicated in the discussion of these bits.

  Bit 1, Print check
  Bit 3, Line position

If neither of the preceding conditions has occurred, take the following action:

Action: Provide information, type message, and take cancel exit. (Permanent error.)

Message: OP11 DATA CHK.

- Byte 0, Bit 5--Buffer Parity Check

  Action: First, check the following bits of sense byte 1 in the order indicated; if a bit is on when tested, the system takes the action indicated in the discussion of these bits.

  Bit 1, Print check
  Bit 3, Line position

  If neither of the preceding conditions has occurred, the system attempts to read the contents of the 3211 buffers. If the attempt is successful, take the following action:

  Action: Provide an information message. If a user routine is available, then go to it; otherwise, continue processing.

  If the attempt to read the contents of the 3211 buffers is not successful, take the following action:

  Action: Provide a message that allows the operator to respond IGNORE or CANCEL.

  For equipment checks, the operator must examine the sense information for the intervention required bit along with the equipment check. If intervention is required, the operator must make the device ready.

  Message: OP33 BUF PARITY.

- Byte 0, Bit 0--Command Reject

  Action: Provide information, type message, and take cancel exit. (Permanent error.)

  Message: OP18 COMMREJCT.

- Byte 0, Bit 6--Load Check

  Action: An error condition occurred when either the UCSB or the FCB was loaded. Provide information, type message, and take cancel exit. (Permanent error.)

  Message: OP41 LOAD CHECK.

- Byte 0, Bit 1--Intervention Required

  Action: First, sense byte 1, bit 4 is tested for a forms check; if the bit is on, the action indicated in the discussion for this bit is taken. Otherwise, an interlock condition has occurred on the 3211. The probable causes are:

  Gate not latched
  Train not positioned
  Stop key active
  Vacuum low
  Train overload

  Action: Provide an intervention required message. The operator should then make the device ready to continue processing.

  Message: OP08 INTERV REQ.

- Byte 1, Bit 0--Command Retry

  Action:

  - For message OP10, a print line buffer parity check occurred. The recovery procedure depends upon the user's error option for Command Retry (CCB byte 2, bit 5).

    a. If the Command Retry option is specified, reissue the failing CCW. If the retry is unsuccessful, the error is considered uncorrectable. Provide information, type message, and take cancel exit. (Permanent error.)

    b. If the Command Retry option is not specified, issue a "Skip to channel 0" (X'38') command to allow the carriage to perform the suppressed command. Provide information, type message, and take cancel exit. (Permanent error.)

  - For message OP33, a UCSB parity check occurred.

    Action: This action depends upon the user's error routine to reload the

UCSB. After the UCSB is reloaded, reissue the failing CCW. If the retry is unsuccessful, the error is considered uncorrectable. Provide information, type message, and take cancel exit. (Permanent error.)

- Byte 1, Bit 1--Print Check

  Action: For message 0P10, a print check occurred for one or more of the following reasons:

  Hammer fire check
  Sync check
  Coil protection

  For message 0P11, a print check occurred because of an unprintable character. In response to either message, do the following:

  Provide a message that allows the operator to respond IGNORE or CANCEL. If the response is CANCEL, go to the user's error routine if available.

  For equipment checks, the operator must examine the sense information for the intervention required bit along with the equipment check. If intervention is required, the operator must make the device ready.

- Byte 1, Bit 2--Print Quality

  Action: A print quality check occurred because the platen failed to advance or retract, or excessive ribbon motion and/or ribbon skew was detected. Provide a message that allows the operator to respond IGNORE or CANCEL. If the response is CANCEL, go to the user's error routine if available.

  For equipment checks, the operator must examine the sense information for the intervention required bit along with the equipment check. If intervention is required, the operator must make the device ready.

- Byte 1, Bit 4--Forms Check

  Action: A forms check occurred for one of the following reasons:

  The Carriage Detent Switch is off.
  The paper is jammed or the forms are torn.
  The 3211 is out of paper.
  The stacker is full.

  Provide an intervention required message. The operator should then make the device ready to continue processing.

- Byte 1, Bit 6--Mechanical Motion

  Action: Provide information, type message, and take cancel exit. (Permanent error.)

  Note: When certain 3211 errors occur, additional information is provided to the user by turning on bits in the user's CCB. These errors and bit settings are indicated in Figure 37.

1442 ERROR RECOVERY

- CSW Bit 44--Channel Data Check

  Action: If initial selection, one retry; then take equipment error exit (cancel, retry). If data transfer, take operator intervention exit.

  Message: 0P28 CHAN DTCHK.

- Byte 0, Bit 3--Equipment Check

  Action: Take operator intervention exit.

  Message: 0P10 EQUIP CHK.

- Byte 0, Bit 1--Intervention Required

  Action: Take operator intervention exit.

  Message: 0P08 INTERV REQ.

- Byte 0, Bit 2--Bus Out Check

  Action: If initial selection, do one retry; then take equipment error exit (cancel, retry). If data transfer, take operator intervention exit.

  Message: 0P09 BUSOUT CHK.

- Byte 0, Bit 4--Data Check

  Action: Take operator intervention exit.

  Message: 0P11 DATA CHECK.

- Byte 0, Bit 5--Overrun

  Action: Take operator intervention exit.

  Message: 0P14 OVERRUN.

- Byte 0, Bit 0--Command Reject

  Action: Take program check exit.

  Message: 0P18 COMM REJCT.

- CSW Bit 47--Chaining Check

  Action: Take operator intervention exit.

  Message: 0P14 OVERRUN.

2501, 2520, 2540 ERROR RECOVERY

- CSW Bit 44--Channel Data Check

  Action: If initial selection, one retry; then take equipment error exit (cancel, retry). If read data transfer, take operator intervention exit. If punch data transfer, one retry; then take equipment error exit (cancel, retry).

  Message: 0P28 CHAN DTCHK.

- Byte 0, Bit 3--Equipment Check

  Action: Reader--Take operator intervention exit. Punch--CCB option. Take equipment error exit (cancel, ignore). For 2520, Byte 0, Bit 7 indicates punch check.

  Message: 0P10 EQUIP CHK.

- Byte 0, Bit 1--Intervention Required

  Action: Take operator intervention exit.

  Message: 0P08 INTERV REQ.

- Byte 0, Bit 2--Bus Out Check

  Action: One retry; then take equipment error exit (cancel, retry). If the device is a 2520, do not retry if this is not initial selection (cancel, retry).

  Message: 0P09 BUSOUT CHK.

- Byte 0, Bit 4--Data Check (Cannot occur on a 2520 punch)

  Action: Take operator intervention exit.

  Message: 0P11 DATA CHECK.

- Byte 0, Bit 5--Overrun (Cannot occur on 2540 or 2520 punch)

  Action: Take operator intervention exit.

  Message: 0P14 OVERRUN.

- Byte 0, Bit 0--Command Reject

  Action: Take program check exit.

  Message: 0P18 COMM REJCT.

- Byte 0, Bit 6--Unusual Command Sequence (2540 read only)

  Action: Post CCB--take continue exit.

- CSW Bit 47--Chaining Check (2501, 2520 read only)

  Action: Take operator intervention exit.

  Message: 0P14 OVERRUN.

2671 ERROR RECOVERY

- CSW Bit 44--Channel Data Check

  Action: If initial selection, one retry. Take equipment error exit (cancel).

  Message: 0P28 CHAN DTCHK.

- Byte 0, Bit 3--Equipment Check

  Action: Test CCB for ignore option (byte 2, bit 4) and if on, turn on byte 3, bit 1 of the CCB and take equipment error exit (cancel, ignore, retry). Otherwise, take operator intervention exit.

  Message: 0P10 EQUIP CHK.

  Note: When an equipment check occurs, reposition the paper tape to the beginning of the record in error to perform the retry operation. The

The RMS (Recovery Mangement Support) is an automatic DOS feature for IBM System/370. RMS gathers information about hardware reliability and attempts certain error recovery operations. It is part of the entire RAS (reliability, availability, and serviceability) support for System/370.

RMS is supervisor generated and is composed of two functions:

- MCAR (Machine Check Analysis and Recovery) and
- CCH (Channel Check Handler).

However, RMS is not a supervisor option. It is generated automatically for System/370 at SYSGEN. The CONFG macro sets global BG39 when MODEL option shows a System/370 CPU. Figure 54 gives the overview of the RMS function in DOS.

MCAR FUNCTION

MCAR responds to machine check interrupts and attempts recovery. It logs error data on ERDS (Environmental Recording Data Set) on the Recorder File. It provides operator messages via SYSLOG.

When a machine check occurs, MCAR first logs the error, then retries the failure by CPU retry and ECC (Error Correction Code). If successful, a <u>soft MCI</u> (machine check interrupt) message occurs, signifying recovery from a machine check.

If hardware retry is unsuccessful, MCAR determines machine check severity through recovery transient analysis and records pertinent data on SYSREC. RMS controls the recording of data through the EFL (Error Frequency Limit) feature of operating in Quiet or Recording mode. See the MODE Command section.

Hard MCI occurs when:

- CPU retry is unsuccessful, or
- Interrupted instruction cannot be retried, or
- Storage failure is permanent.

In event of a hard MCI, execution of the affected task stops. MCAR assesses damage and continues system operation when possible. It selectively terminates the affected partition. RMS records a full Damage Report on the Recorder File.

The system enters the hard wait state when a hard MCI:

- Interrupts supervisor coding
- Occurs while accessing critical information or phases from SYSRES, or
- Damages privileged coding through permanent storage error

MCAR attempts to notify the operator about:

1. Machine check type
2. Wait state, re-IPL
3. Problem program termination
4. MODE operation change
5. Buffer deletion

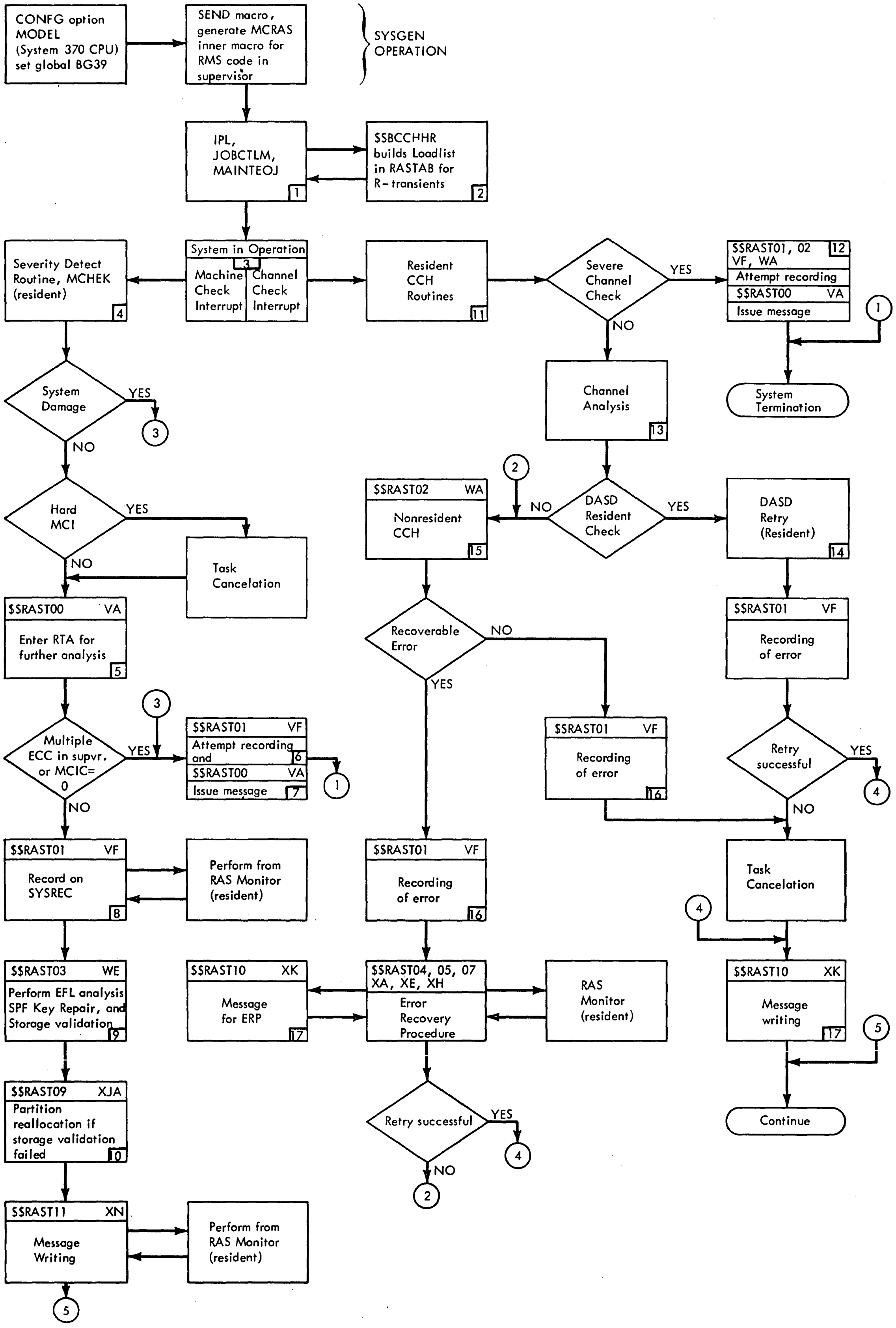


Figure 54. RMS Generation and Operation (Part 1 of 7)

1 A test is made during IPL to determine if RMS support has been included in the supervisor. If RMS support has been generated, a test is made to determine if the CPU is a S/360 or S/370 model.

If the system has been IPLed from a S/360, code to simulate the actions of a S/360 is moved into the machine check and channel check routines. A message is issued to notify the operator that no RMS support exists.

If the CPU is a S/370 model, $$BCCHHR is called.

2 The primary function of the transient $$BCCHHR is to scan the core image directory for all transients whose names begin with '$$RAST' and build a directory in storage for these transients. This directory (Load List) is located in the RAS table where a fullword is reserved for the CHR (Channel, Head, Record) of each RAS phase. The low-order three bytes of each fullword contains the CHR while the high order byte is reserved for switches and flags. Currently twelve fullword entries exist and occupy the first 48 bytes in the RAS table.

All RAS transients have the following format for their names:

$$RASTnn, where nn is a decimal number from 00 to 11. The last two digits in each phase name are used as the index to the RAS table load list. Multiplying this number by four and adding the product to the RAS table address produces the address for the particular entry.

Another function of $$BCCHHR is to determine whether the recorder file is a 2311 or 2314 disk and place the number of records per track and tracks per cylinder in the RAS table at EOR and EOT, respectively. This information is needed by $$RAST01 for the disk (SYSREC) address updating procedure. The channel addresses of the devices to which SYSRES and SYSREC are assigned are placed in the RAS table at RASRES and RASLOG, respectively.

3 When a hardware failure occurs, CPU Retry hardware attempts to re-execute the operation.

If the outcome of the retry is successful, a recoverable machine check is indicated, a logout is made to the CPU logout area, and a machine check interrupt is taken.

If the outcome of the retry is unsuccessful, an unrecoverable machine check is indicated, a logout is made to the CPU logout area, and a machine check interrupt is taken.

A channel error is detected when a CSW is stored with either the interface control check or channel control check bit on. Thus, the logging is done both at I/O interruption time and CC1 time to an I/O instruction under control of CR14 bit 2. A channel error does not cause a machine check interrupt on the Model 145 but does cause a machine check interrupt on the Model 155.

Figure 54. RMS Generation and Operation (Part 2 of 7)

4 The severity detect routine for machine checks categorizes errors into four classes:

1. System damage bit on in MCIC, AMWP bits in machine check old PSW invalid; processing damage to privileged code.

   Action: Give hard wait message and terminate system.

2. Processing damage affected nonprivileged coding; machine check old PSW not completely valid.

   Action: Cancel damaged task and exit to EXT02.

3. Recoverable machine check occurred in privileged code.

   Action: Schedule recovery report and return to interrupted code via old PSW.

4. Recoverable machine check occurred in nonprivileged code.

   Action: Schedule recovery report, and exit to EXT02.

Class 1	The C'A' is posted in location LOWCORE, C'S' is posted in location LOWCORE+1, and RAS ACTIVE and EMEXIT bits are posted in location LD00SLOT.
Class 2	The task is canceled and the MCACT and RAS ACTIVE bits are posted in location LD00SLOT.
Class 3	The RAS ACTIVE and MCACT bits are posted in LD00SLOT.
Class 4	The RAS ACTIVE and MCACT bits are posted in location LD00SLOT.

5 Transient $$RAST00 analyzes the codes stored at locations LD00SLOT and LOWCORE.

If the EMEXIT bit is on, the system will eventually be terminated. If a C'A' is posted at LOWCORE, $$RAST01 is fetched to build and record machine check records and post the SYSTERM bit in LD00SLOT. $$RAST00 is then fetched again to log an appropriate message regarding the recording status and terminate the system. If a C'B' is posted at location LOWCORE, no recording is attempted and the system is terminated.

When neither the EMEXIT or SYSTERM bits are on in LD00SLOT, a further test is made to determine if multiple ECC errors have occurred in the supervisor.

Multiple ECC errors in the supervisor cause a Hard Wait condition. A C'A' is posted in location LOWCORE, SEREP code C'S' is posted in LOWCORE+1, the EMEXIT bit is posted in LD00SLOT, and $$RAST01 is fetched.

Figure 54. RMS Generation and Operation (Part 3 of 7)

6 Transient $$RAST01 attempts to build the machine check records and record them on SYSREC. A code is posted in LOWCORE+2 to indicate the status of the recording effort.

C'A'=recording was attempted but failure occurred on first record.

C'I'=recording was incomplete but at least one record was successfully written on SYSREC.

C'S'=recording of all records was successful.

The SYSTERM bit is posted in LD00SLOT, and $$RAST00 is fetched again.

7 $$RAST00 tests LD00SLOT, finding both the SYSTERM and EMEXIT bits on, it attempts to issue an 0T11I Hard Wait message regarding the recording status and then to terminate the system.

8 If multiple ECC errors are found in the Problem Program or no ECC errors are found, $$RAST01 is fetched.

Other codes stored by $$RAST01 at LOWCORE indicate a channel error.

Code	Meaning
B	Irrecoverable channel check on fetch
C	Channel check on log with RASMSG
D	ECSW not stored
E	ERPIB queue has been exhausted
F	2 channels damaged at some time
G	System reset code in ECSW
H	Retry/reset codes invalid
I	Channel address invalid

$$RAST01 builds machine check records and records them on SYSREC.

Figure 54. RMS Generation and Operation (Part 4 of 7)

9 For the Model 155, ECC/EFL analysis is done by simply checking if a specified error count has been reached within a specified time limit, whereupon a diagnose instruction is used to place the machine in quiet mode. 155 HIR/EFL analysis is done in a similar manner to that of ECC/EFL, but instead of using a diagnose command to switch from full recording to quiet, control register 14 is loaded with bit 4 off.

145 HIR/EFL analysis is identical to that of the Model 155. 145 ECC/EFL analysis differs from the Model 155 to the extent that control storage analysis is necessary, and the EFL is initially set to 16 single bit errors in eight hours rather than eight errors in eight hours. On the occurrence of a single bit error while in control storage threshold mode, a message is issued, via the hardware facility, to indicate that control storage is in quiet mode.

In all Model 155 and 145 analyses, the mode status is posted in a one byte location in the RAS table called MCMODE. The eight bit configuration of the byte is as follows:

Bit 0	HIR recording mode
1	HIR quiet mode
2	ECC recording mode in main storage
3	ECC quiet mode in main storage
4	ECC recording mode in control storage
5	ECC quiet mode in control storage
6	ECC threshold mode in control storage
7	Not used

The following tests are made before storage validation (moving a doubleword of ones and zeros into the failing storage address) is attempted.

1 - Test if failing storage valid
2 - Test to see that the FSA was not in the UCW (Unit Control Storage--Model 155 only)
3 - Check for multiple ECC errors

Only if the preceding conditions exist is storage validation attempted.

In an MPS environment an attempt to set the storage protect key is made in situations where there was a protection error. A rotary scan is initiated to determine which partition owns the failing storage address. Once this is determined, an attempt is made to set the storage protect key for that partition.

If a machine check, other than system damage, is encountered while validating storage or repairing the SPF key, the MCAR REPAIR FAILED message is scheduled for the message writer. If system damage was encountered, the resident severity detect routine is entered by loading the machine check new PSW.

For the Model 155, if auto-configuration has occurred, a message code is posted in RASMSG2 and an information message is issued by $$RAST11. Also, a total of the buffers deleted is kept in a one byte area in the RAS table called BUFDEL.

Possible messages issued at this time:

0T09I	SOFT MACHINE CHECK
0T06I	ECC MCI DISABLED
0T07I	ALL SOFT MCI DISABLED
0T14I	CLOCK DAMAGE. ALL MODES QUIET
0T08I	C40 BUFFER PAGES DELETED=XXX
0T17I	CONTROL STORAGE ECC IN QUIET MODE
0T16I	EFL OVERFLOW

Figure 54. RMS Generation and Operation (Part 5 of 7)

10 $$RAST09 reallocates partition sizes whenever a machine check interrupt, other than system damage, occurs while storage validation or SPF key repair is being performed for multiple bit failures. It also issues messages regarding the size and status of the partition.

Dynamic reallocation for the background partition is as follows:

- If the size of BG from its starting address to the failing storage address is greater than 10K, BG is still considered usable and a new upper boundary address is moved into the communication region.

- If BG is less than 10K a message, BG NOT USABLE, is issued.

Dynamic reallocation for foreground partitions is as follows:

- If the upper half of a partition contains the failing storage address (FSA), the upper boundary address in the communications region is changed to the next integral boundary below the FSA. The beginning address of the partition remains unchanged. If the partition size is reduced below 10K, the batch environment is deactivated.

- If the lower half of a foreground partition contains the FSA, the beginning address in the PIB is changed to the next integral 2K boundary above the FSA. The upper boundary address remains unchanged. Again, if the foreground partition is reduced below 10K, the batch environment is deactivated.

$$RAST00 is fetched to determine if any more errors are pending before continuing. Normally, no more errors are pending and the system continues.

11 This routine gains control from either the SIO or I/O Interrupt routines when a channel check occurs. The ECSW is inspected to determine if enough information is valid to isolate the damage to either a channel or device.

12 When enough valid information cannot be found in the ECSW, a severe damage condition exists and an exit is taken to the resident machine check handler routine.

The EMEXIT bit is posted in location LD00SLOT and the system is terminated. For the various types of errors, see item 8.

LOWCORE is tested and contains something other than C'A' to indicate a channel error.

When an emergency situation exists, an attempt to build the first channel check record is made.

$$RAST01 attempts to build all remaining channel check records and records them on the ERDS. A code is posted indicating the status of the recording effort (see item 6). The SYSTERM bit is posted in LD00SLOT, and $$RAST00 is fetched.

With the EMEXIT and SYSTERM bits on, $$RAST01 attempts to issue an 0T11I Hard Wait message regarding the recording status and then to terminate the system. See item 8.

Figure 54. RMS Generation and Operation (Part 6 of 7)

13 If the damage cannot be isolated to a device, the entire channel is considered damaged. An ERPIB is created, with the PUB field of the ERPIB containing the address of the damaged channel. The CSW and ECSW are saved in the ERPIB for the nonresident channel check handler. If the damage can be isolated to a device the entire ERPIB is filled for the nonresident channel check handler.

14 This routine gains control from the channel check handler when the damaged device is a DASD unit. The operation is retried by restarting the chain of CCWs.

The channel queue pointer byte of the ERPIB is used as an error counter. If the retry count has not been reached and the channel check occurred on an SIO instruction, a branch to the SIO instruction is taken. If the channel check occurred at interrupt time, a branch to restart the operation is taken.

If ten retry attempts fail, the task is canceled. If channel check occurred in the supervisor, the system is terminated.

If retry is successful, a message is issued regarding the error and a recoverable channel check is recorded on SYSREC.

15 $$RAST02 builds the first channel check record. The appropriate ERP is activated.

$$RAST04	Unit record ERP
$$RAST05	Unit record ERP
$$RAST06	Not used
$$RAST07	Tape ERP

16 $$RAST01 builds all but the first channel check records and stores them on the ERDS. All machine check record building is bypassed.

The recording status is posted in LOWCORE+2 on system termination. See item 6 for the status codes.

The ERPs take appropriate action to handle the error depending on the data stored in the ERPIB.

17 $$RAST10 issues all messages pertinent to the ERPs and clears the ERPIBs.

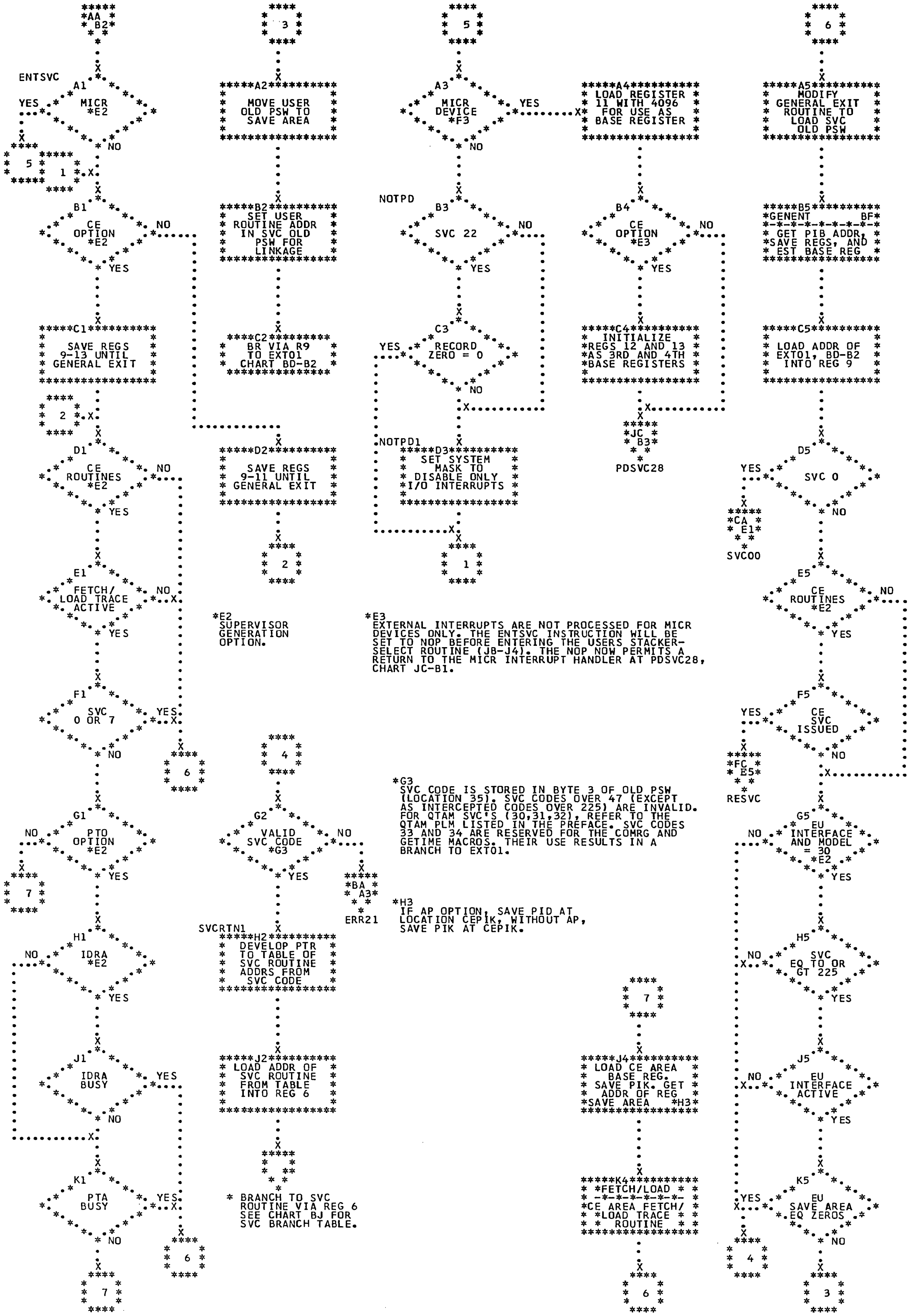
The following messages are possible:

0T10I	CHANNEL ERROR RECOVERY ON CUU
0T12I	IRRECOVERABLE CHANNEL ERROR ON CUU
0T13A	CHANNEL ERROR ON CUU

$$RAST00 is fetched to determine if any more errors are pending before continuing.

Figure 54. RMS Generation and Operation (Part 7 of 7)

Chart BH. $$A$SUP1 - FOPT Macro, SVC Interrupt Handler
Refer to Chart 03.



*E2
SUPERVISOR GENERATION OPTION.

*E3
EXTERNAL INTERRUPTS ARE NOT PROCESSED FOR MICR DEVICES ONLY. THE ENTSVC INSTRUCTION WILL BE SET TO NOP BEFORE ENTERING THE USERS STACKER-SELECT ROUTINE (JB-J4). THE NOP NOW PERMITS A RETURN TO THE MICR INTERRUPT HANDLER AT PDSVC28, CHART JC-B1.

*G3
SVC CODE IS STORED IN BYTE 3 OF OLD PSW (LOCATION 35). SVC CODES OVER 47 (EXCEPT AS INTERCEPTED CODES OVER 225) ARE INVALID. FOR QTAM SVC'S (30,31,32), REFER TO THE QTAM PLM LISTED IN THE PREFACE. SVC CODES 33 AND 34 ARE RESERVED FOR THE COMRG AND GETIME MACROS. THEIR USE RESULTS IN A BRANCH TO EXT01.

*H3
IF AP OPTION, SAVE PID AT LOCATION CEPIK, WITHOUT AP, SAVE PIK AT CEPIK.

* BRANCH TO SVC ROUTINE VIA REG 6 SEE CHART BJ FOR SVC BRANCH TABLE.

Chart BJ. $$A$SUP1 - FOPT Macro, Supervisor Call Branch Table

SVC	OPTIONS	LABEL	CHART
0	ALL	SVC00	CA-F1
1	ALL	SVC01	FA-B1
2	ALL	SVC02	FC-B1
3	ALL	SVC03	FF-A1
4	ALL	SVC04	FF-B4
5	ALL	SVC05	FB-B2
6	ALL	SVC06	MM-B4
7	ALL	SVC07	FE-A3
8	ALL	SVC08	FG-A1
9	ALL	SVC09	FG-A2
10	TIMER NO TIMER	SVC10 ERR21	FG-B5 BA-A3
11	ALL	SVC11	FE-B1
12	ALL	SVC12	FA-B2
13	ALL	SVC13	FA-B4
14	ALL	ERR10	BA-A1
15	MPS NO MPS	SVC15	CA-B1 CB-B1
16	PC, NO IT OR OC PC AND IT OR OC NO PC	SXTRT1 SXTRT1 ERR21	FJ-B5 FN-B4 BA-A3
17	PC, NO IT OR OC PC AND IT OR OC NO PC	EXTRT1 EXTRT1 ERR21	FJ-B4 FN-B2 BA-A3
18	TIMER NO TIMER	SVC18 ERR21	FN-B5 BA-A3
19	TIMER NO TIMER	SVC19 ERR21	FN-B3 BA-A3
20	OC RTN NO OC RTN	SXTRT1 ERR21	FN-B4 BA-A3
21	OC RTN NO OC RTN	EXTRT1 ERR21	FN-B2 BA-A3
22	MPS NO MPS	SVC22 EXT01	FH-B1 BD-B2
23	MPS NO MPS	SVC23 ERR21	FH-B3 BA-A3
24	TIMER NO TIMER	SVC24 ERR21	FH-B5 BA-A3
25	BTAM OR OLTEP NO BTAM AND NO OLTEP	SVC25 ERR21	CA-F1 BA-A3

SVC	OPTIONS	LABEL	CHART
26	STOR PROT NO STOR PROT	SVC26 EXT01	FH-B4 BD-B2
27	BTAM NO BTAM	SVC27 EXT01	CA-F1 BD-B2
28	MICR NO MICR	PDSVC28 ERR21	JC-B3 BA-A3
29	MICR NO MICR	SVC29 ERR21	FB-B3 BA-A3
30 TO 32	RESERVED FOR QTAM: REFER TO QTAM PLM LISTED IN PREFACE		——
33, 34	RESERVED FOR COMRG AND GETIME MACROS		——
35	TRKHLD NO TRKHLD	SVC35 ERR21	MA-A1 BA-A3
36	TRKHLD NO TRKHLD	SVC36 ERR21	MB-A1 BA-A3
37	AB NO AB	SVC37 ERR21	MC-A4 BA-A3
38	AP NO AP	SVC38 ERR21	MD-A1 BA-A3
39	AP NO AP	SVC39 ERR21	ME-A1 BA-A3
40	AP NO AP	SVC40 ERR21	MG-A1 BA-A3
41	AP NO AP	SVC41 ERR21	MH-A1 BA-A3
42	AP NO AP	SVC42 ERR21	MG-A4 BA-A3
43	ERROR OR MCRR NO ERRLOG AND NO MCRR	SDRSDR ERR21	LF-C5 BA-A3
44	ERRLOG OR MCRR NO ERRLOG AND MCRR	SDROBR ERR21	LF-C4 BA-A3
45	EMULATOR INTERFACE NO EMULATOR INTERFACE	SVC45 ERR21	FR-B1 BA-A3
46	OLTEP INTERFACE NO OLTEP INTERFACE	SVC46 ERR21	FR-F4 BA-A3
47	WAITF FOR MICR DEVICES	SVC29	FB-B3
50	USED BY LIOCS FOR ERROR RECOVERY		
51	OLTEP NO OLTEP	SVC51 ERR21	FS-B2 BA-A3
52	MPS NO MPS	SVC52 ERR21	BA-A3

Chart CB. $$A$SUP1 - SGTCHS Macro, Channel Scheduler without MPS
Refer to Chart 04.

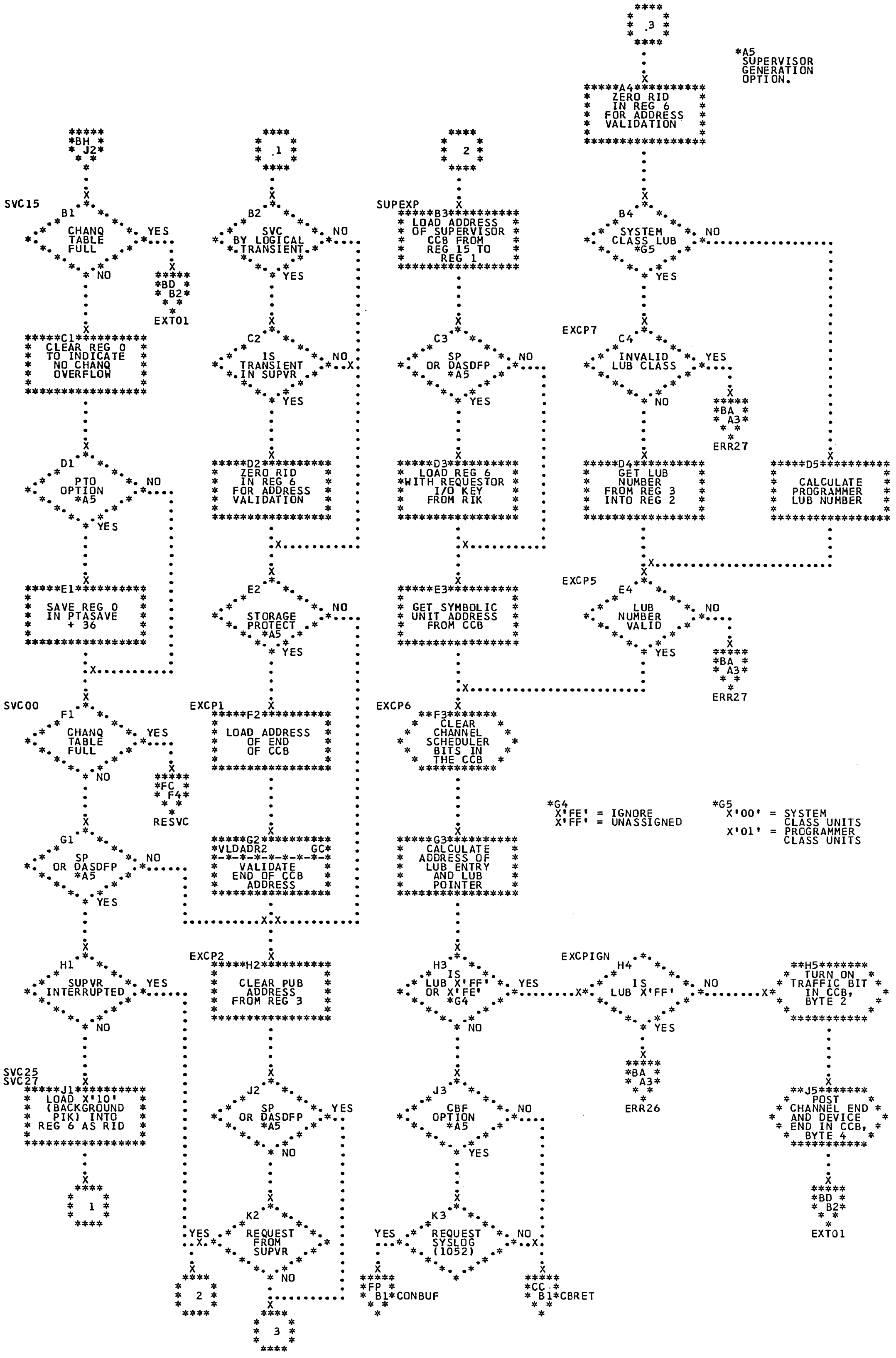


Chart CC. $$A$SUP1 - SGTCHS Macro, Channel Scheduler (Part 1 of 3) Refer to Chart 04.

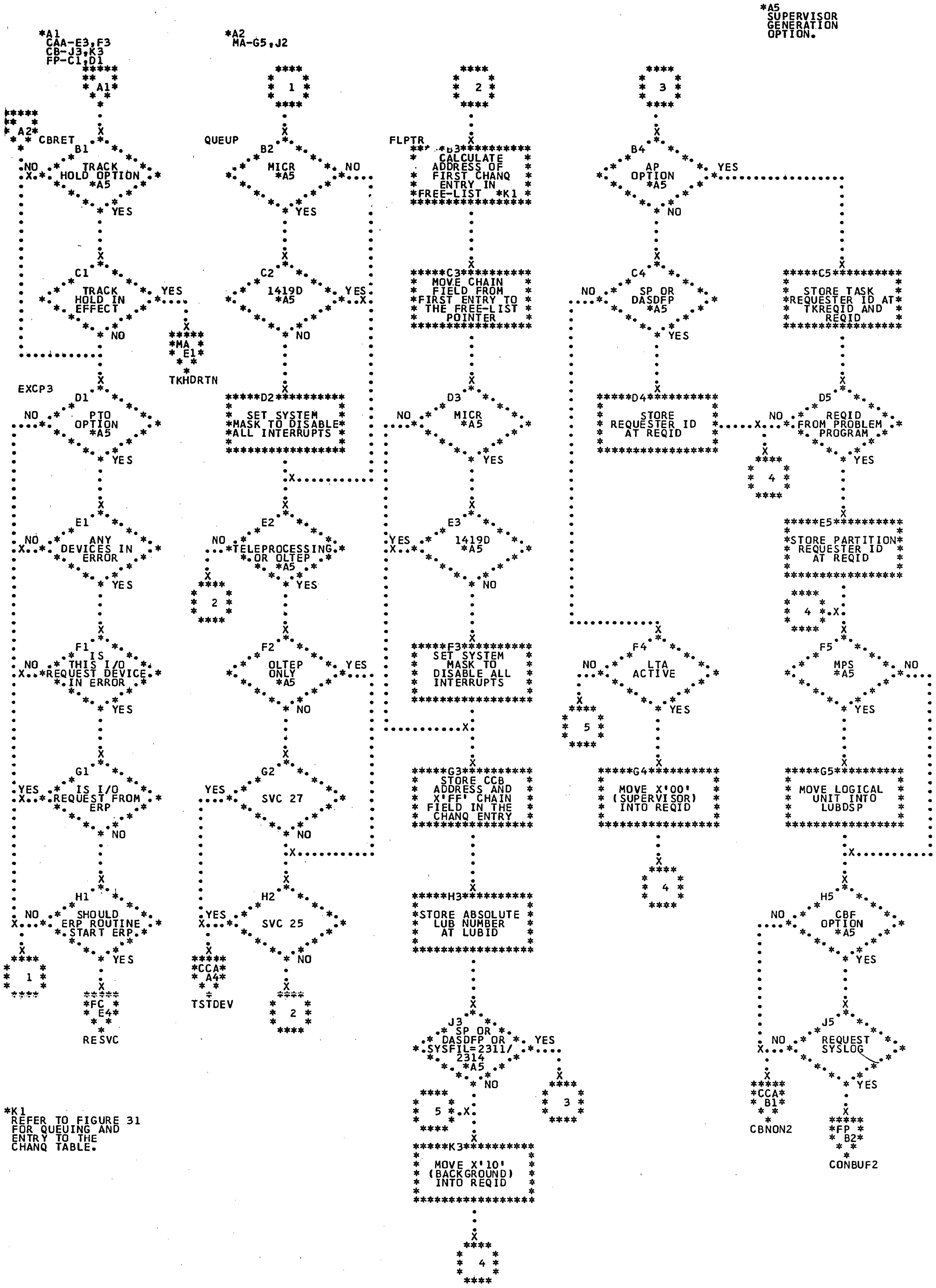


Chart CCA. $$A$SUP1 - SGTCHS Macro, Channel Scheduler (Part 2 of 3)
Refer to Chart 04.

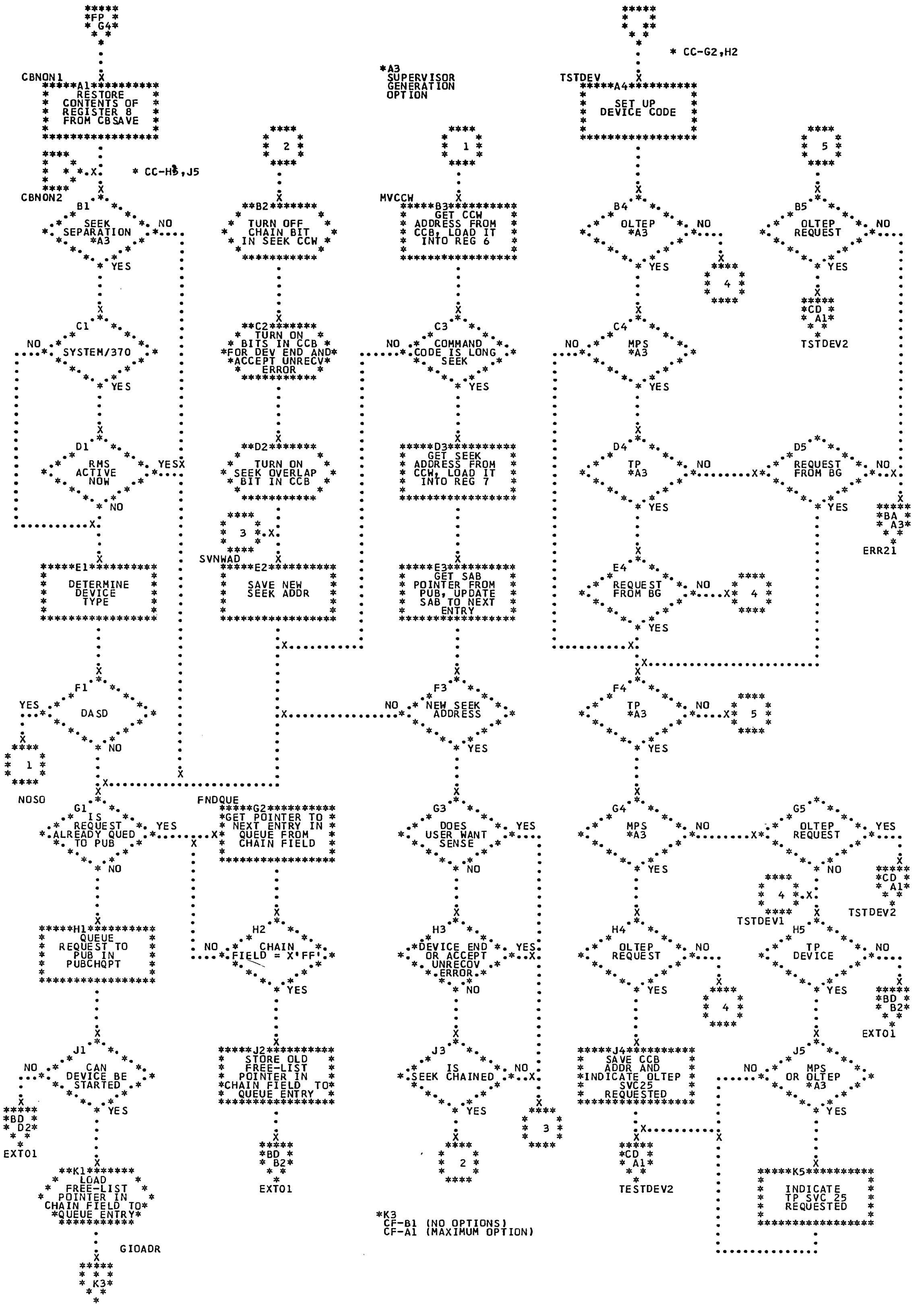


Chart CD. $$A$SUP1 - SGTCHS Macro, Channel Scheduler (Part 3 of 3)
Refer to Chart 04.

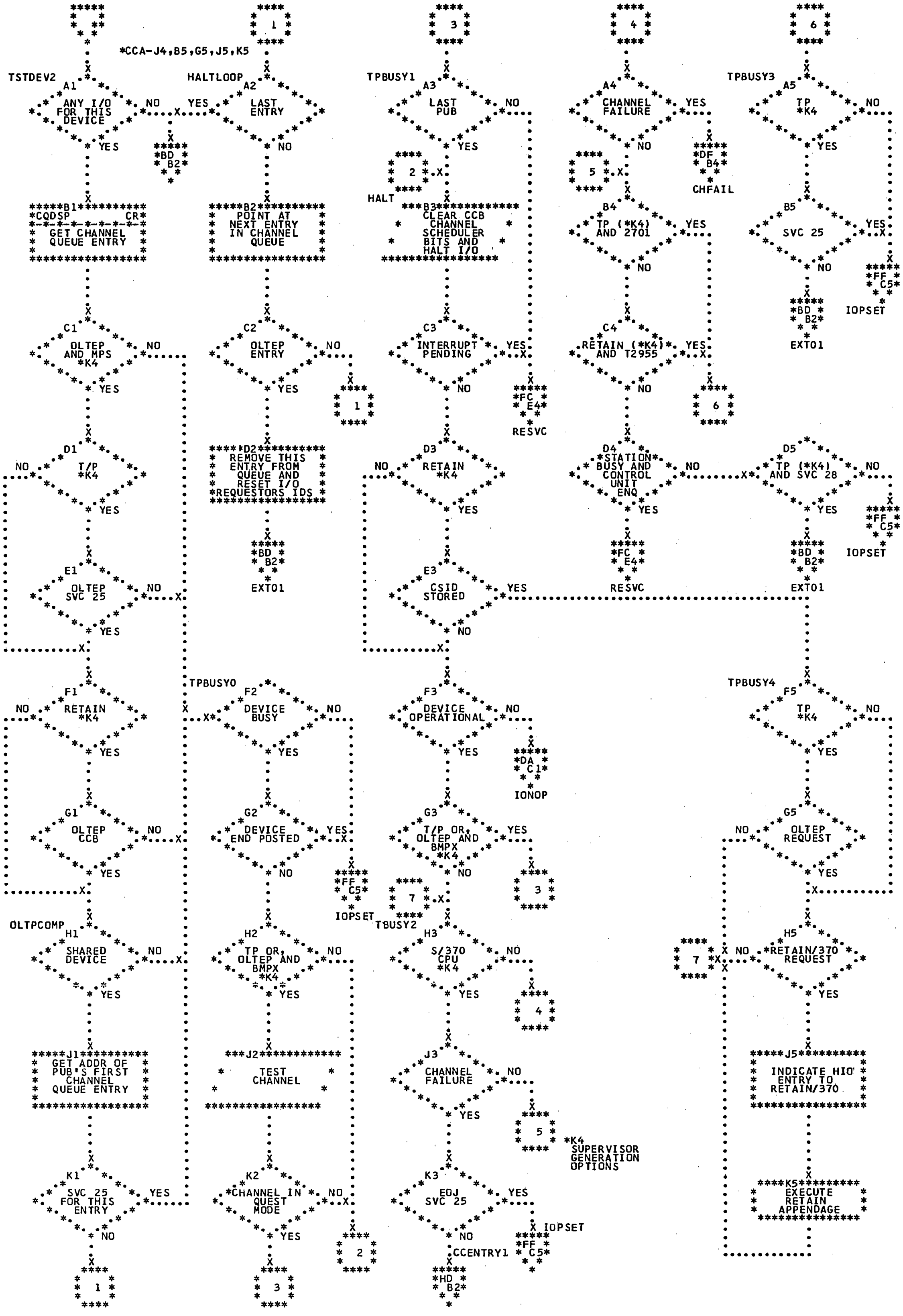


Chart CE. $$A$SUP1 - SGTCHS Macro, Start I/O -- No Options, UNCOMMON Routine
Refer to Chart 04.

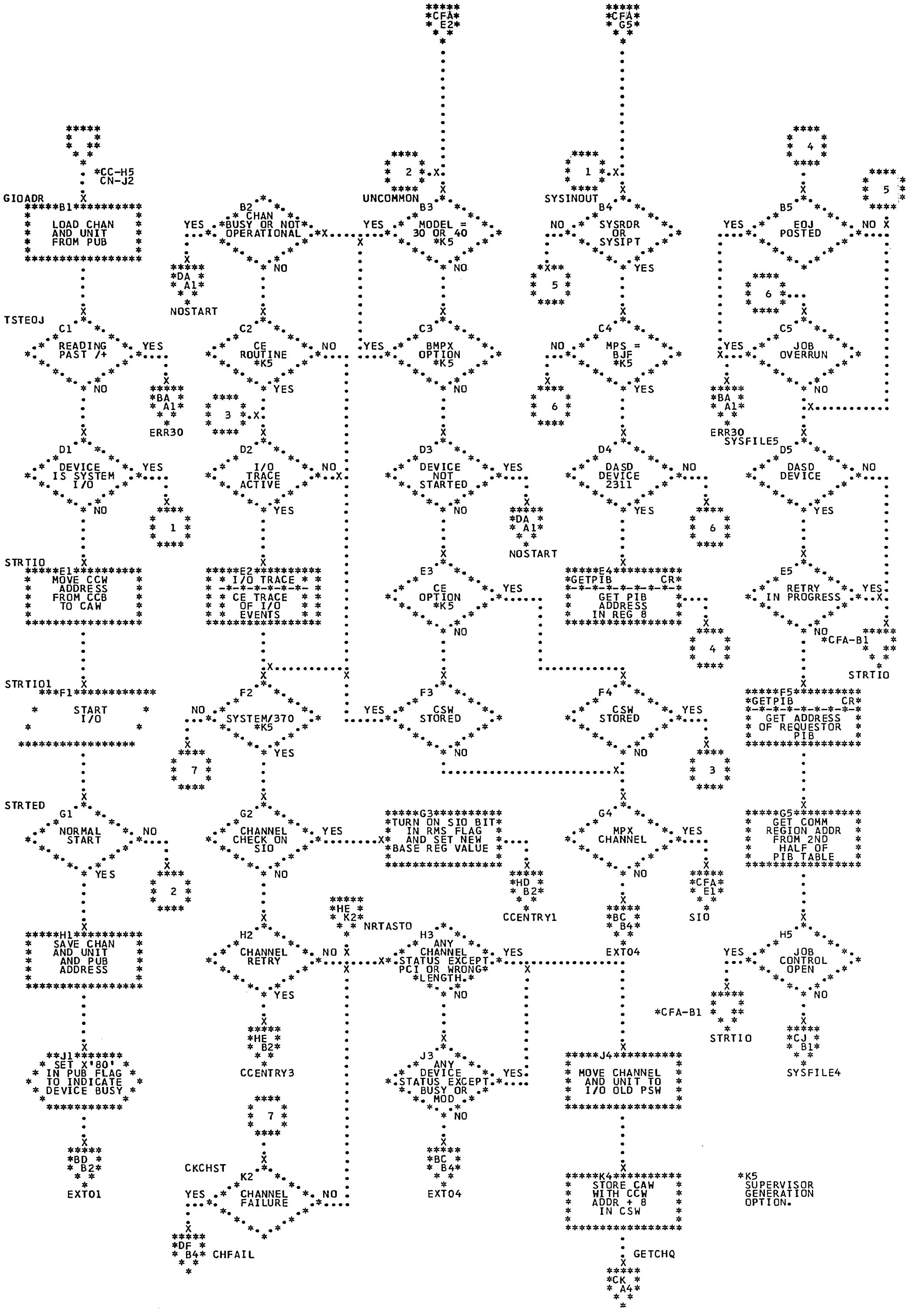


Chart CF. $$A$SUP1 - SGTCHS Macro, Start I/O -- Maximum Options (Part 1 of 5)
Refer to Chart 04.

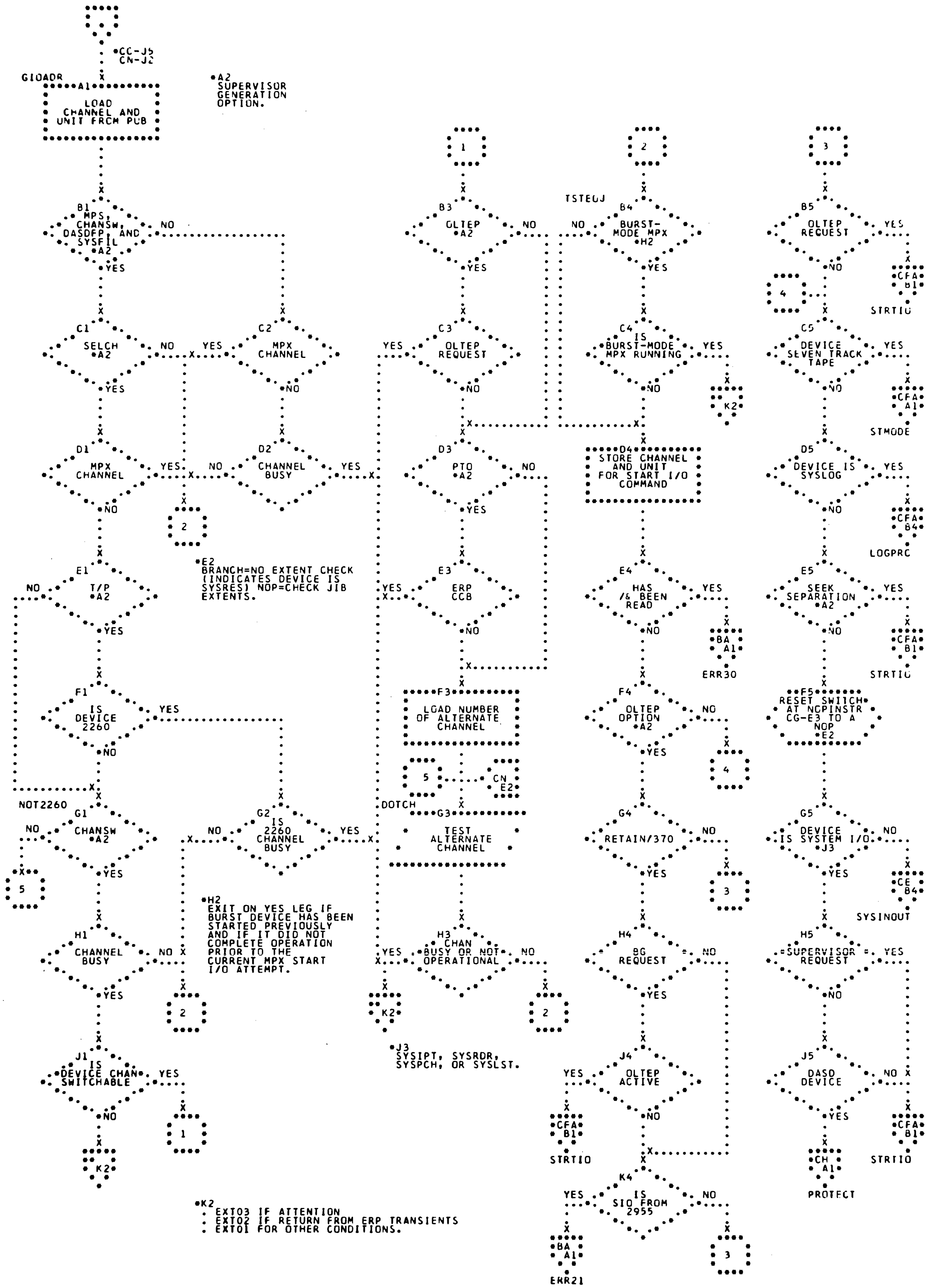


Chart CFA. $$A$SUP1 - SGTCHS Macro, Start I/O -- Maximum Options (Part 2 of 5)
Refer to Chart 04.

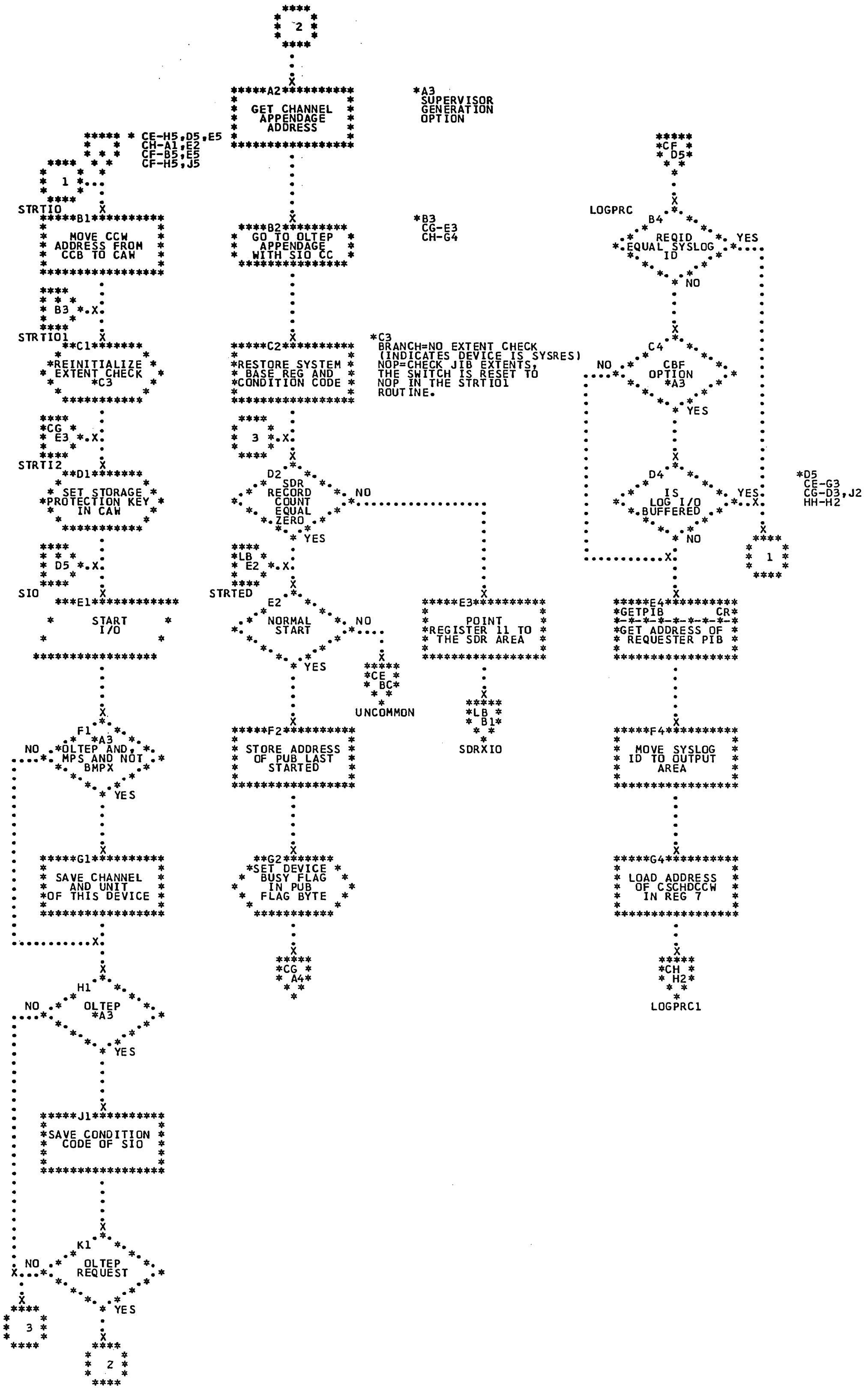


Chart CG. $$A$SUP1 - SGTCHS Macro, Start I/O -- Maximum Options (Part 3 of 5)
Refer to Chart 04.

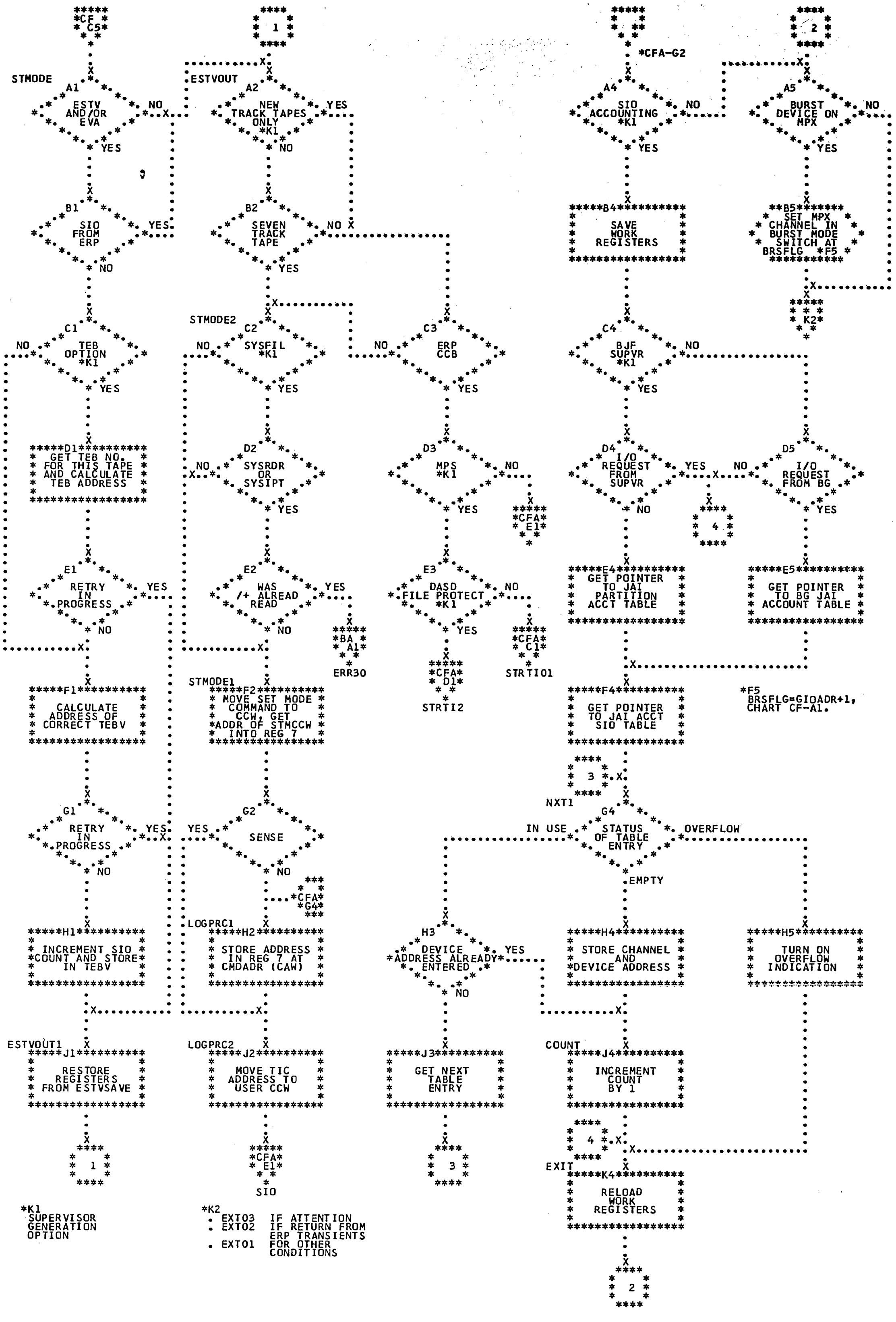
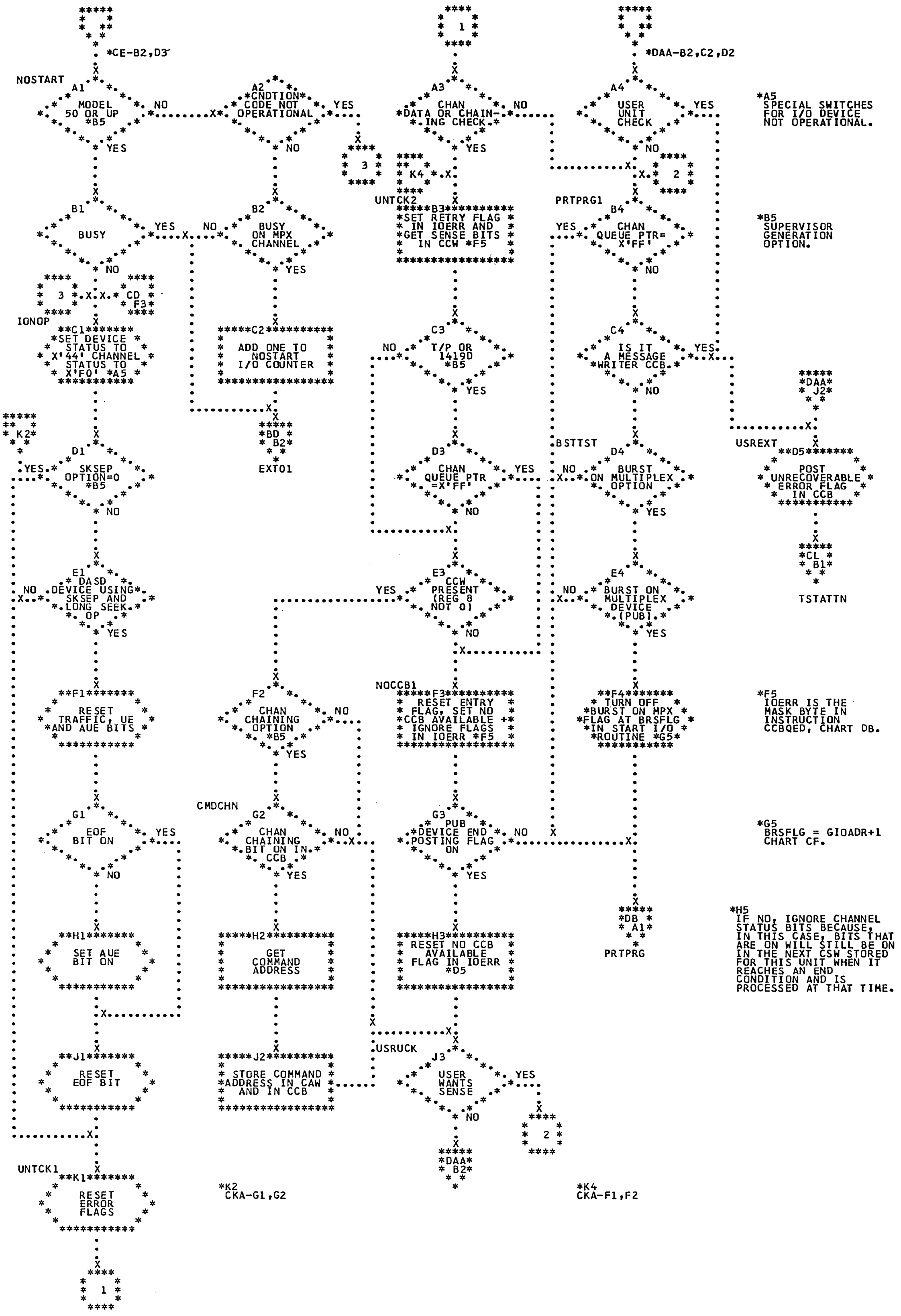


Chart DA. $$A$SUP1 - SGUNCK Macro, Unit Check Entries (Part 1 of 2)
~~Refer to Chart 06.~~



*A5
SPECIAL SWITCHES FOR I/O DEVICE NOT OPERATIONAL.

*B5
SUPERVISOR GENERATION OPTION.

*F5
IOERR IS THE MASK BYTE IN INSTRUCTION CCBQED, CHART DB.

*G5
BRSFLG = GIOADR+1 CHART CF.

*H5
IF NO, IGNORE CHANNEL STATUS BITS BECAUSE, IN THIS CASE, BITS THAT ARE ON WILL STILL BE ON IN THE NEXT CSW STORED FOR THIS UNIT WHEN IT REACHES AN END CONDITION AND IS PROCESSED AT THAT TIME.

*K2
CKA-G1,G2

*K4
CKA-F1,F2

Chart DAA. $$A$SUP1 - SGUNCK Macro, Unit Check Entries (Part 2 of 2)
Refer to Chart 06.

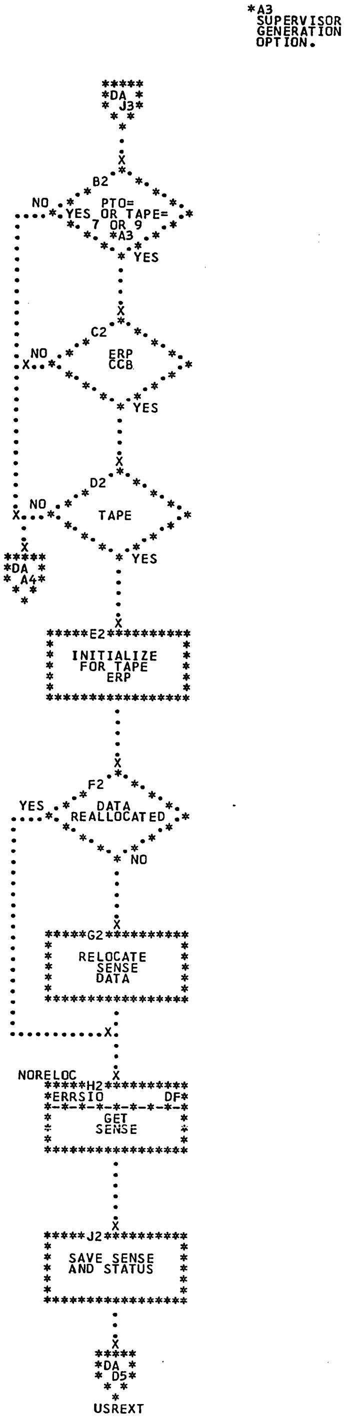


Chart DB. $$A$SUP1 - SGUNCK Macro, Build Error Queue Entry
Refer to Chart 06.

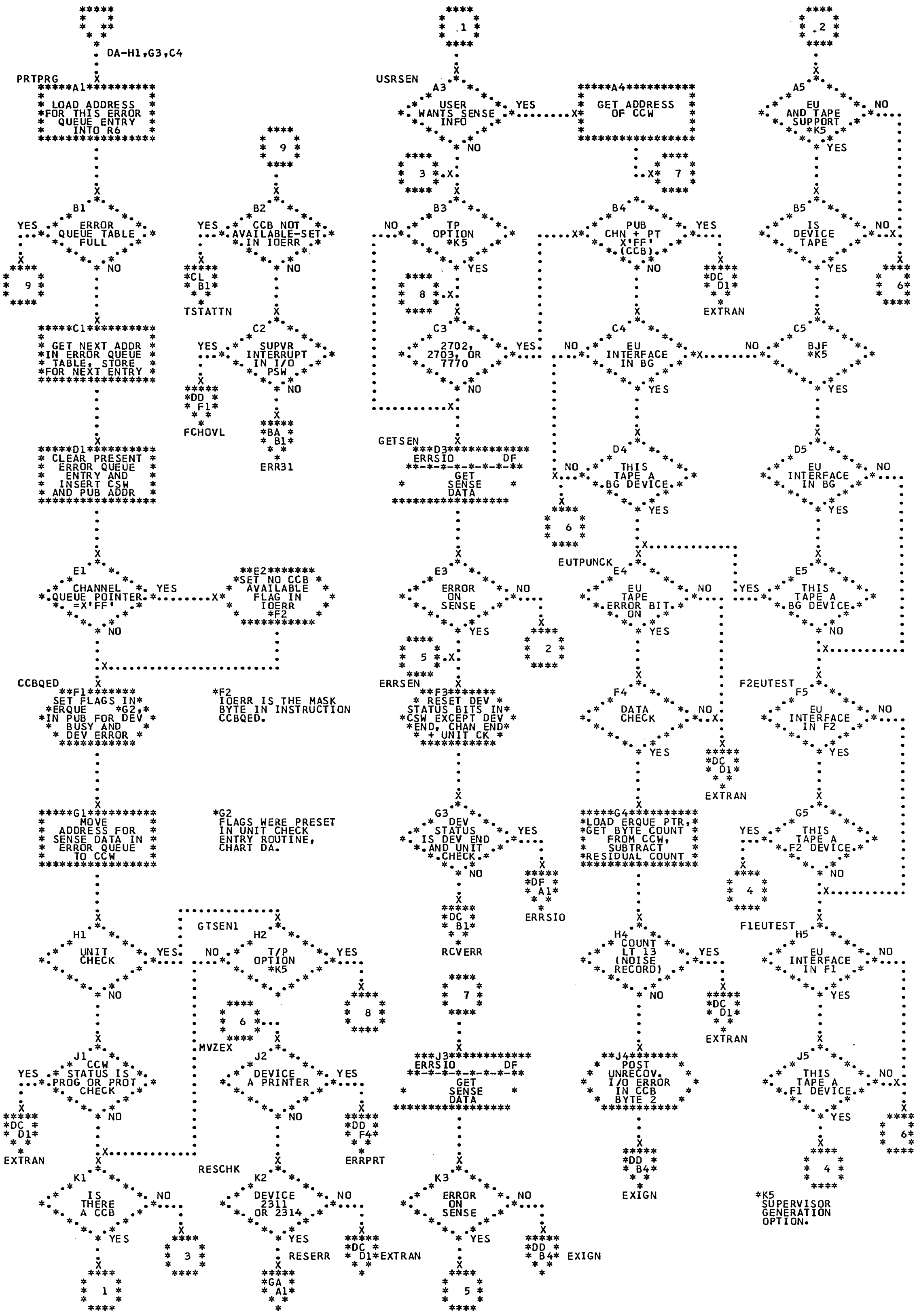


Chart DC. $$A$SUP1 - SGUNCK Macro, Error Recovery Exits (Part 1 of 2) Refer to Chart 06.

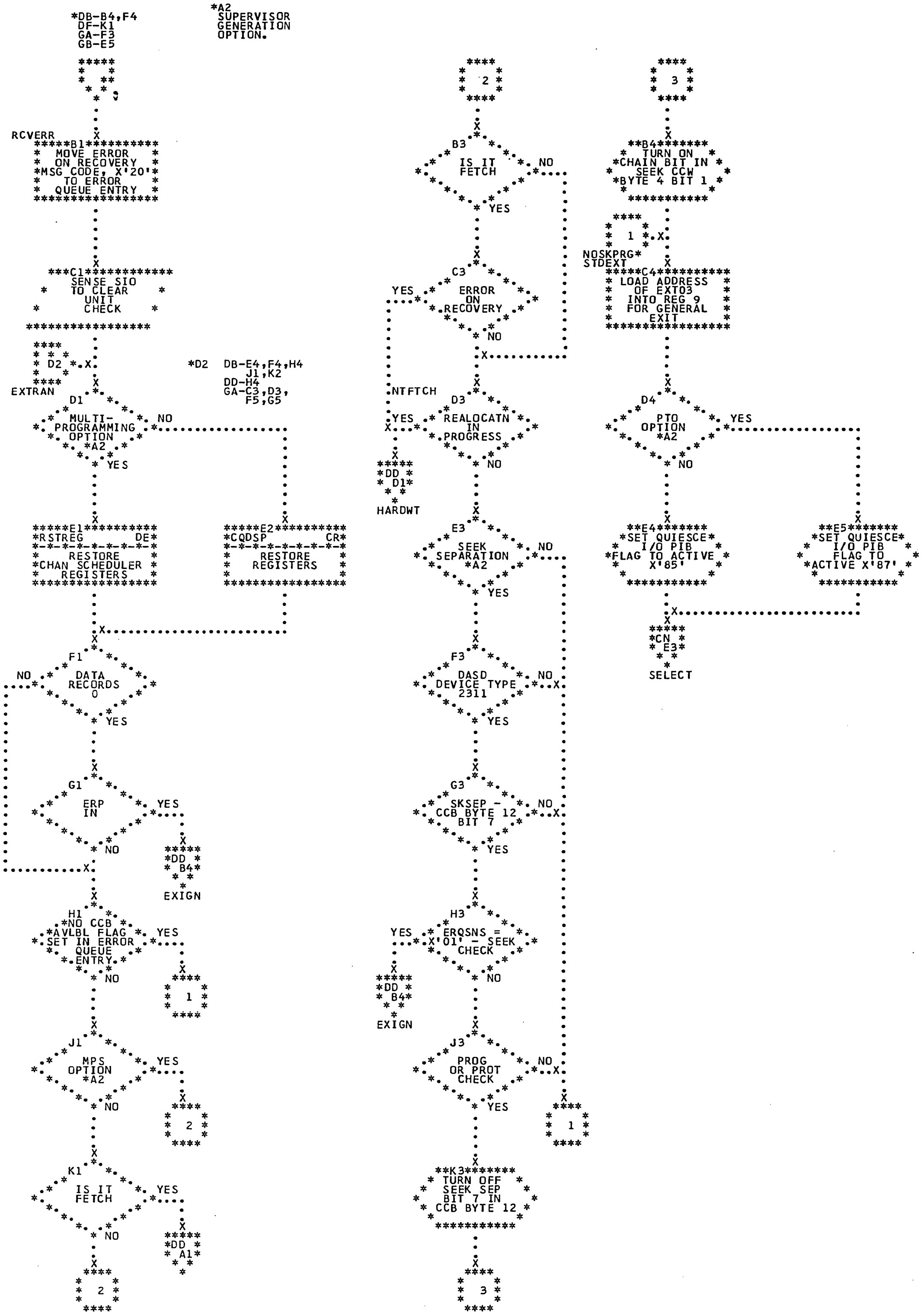


Chart DF. $$A$SUP1 - SGUNCK Macro, Error Start I/O and Channel Failure Subroutines
Refer to Charts 06 and 07.

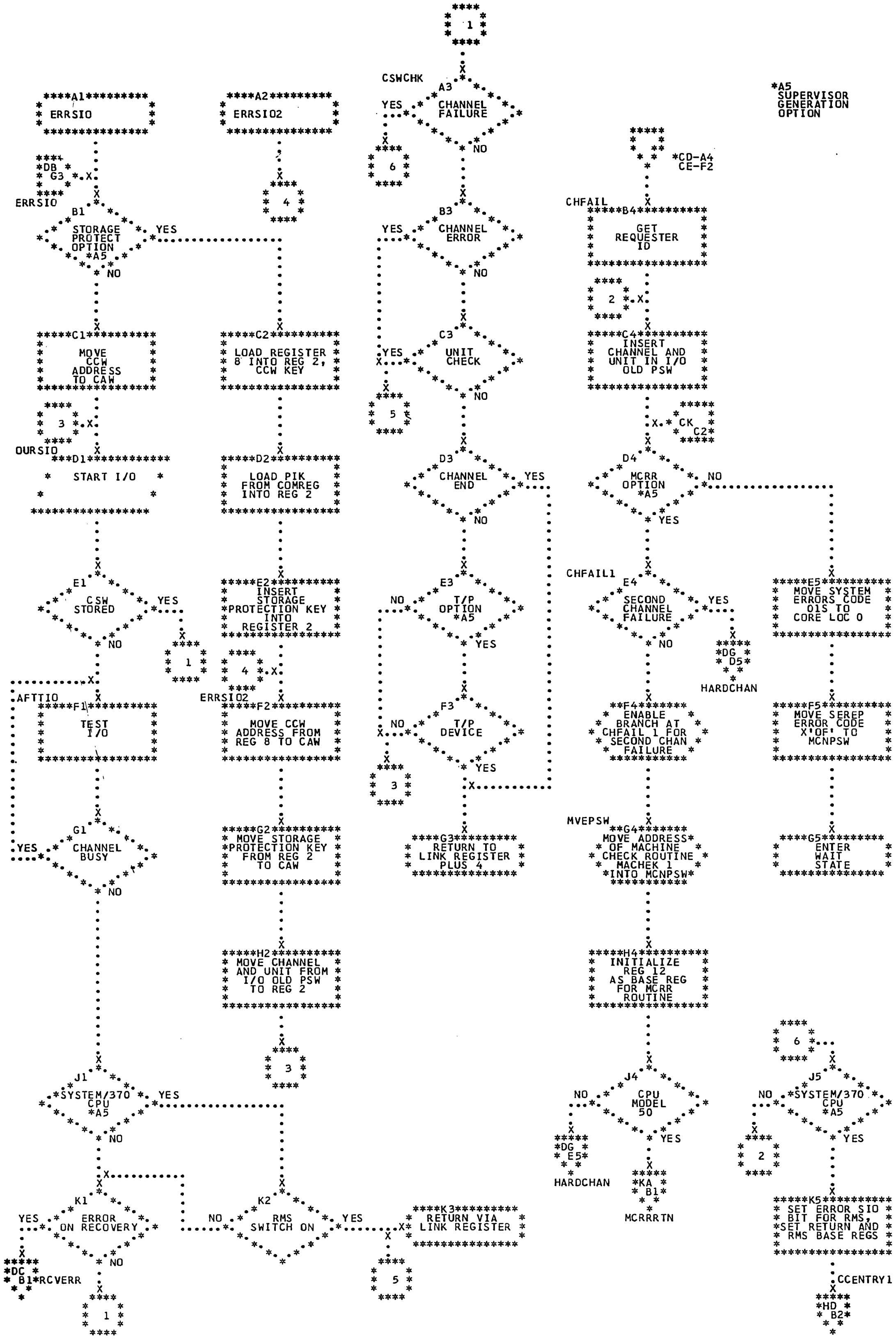


Chart DG. $$A$SUP1 - SGUNCK Macro, Machine Check Interrupt
Refer to Chart 07.

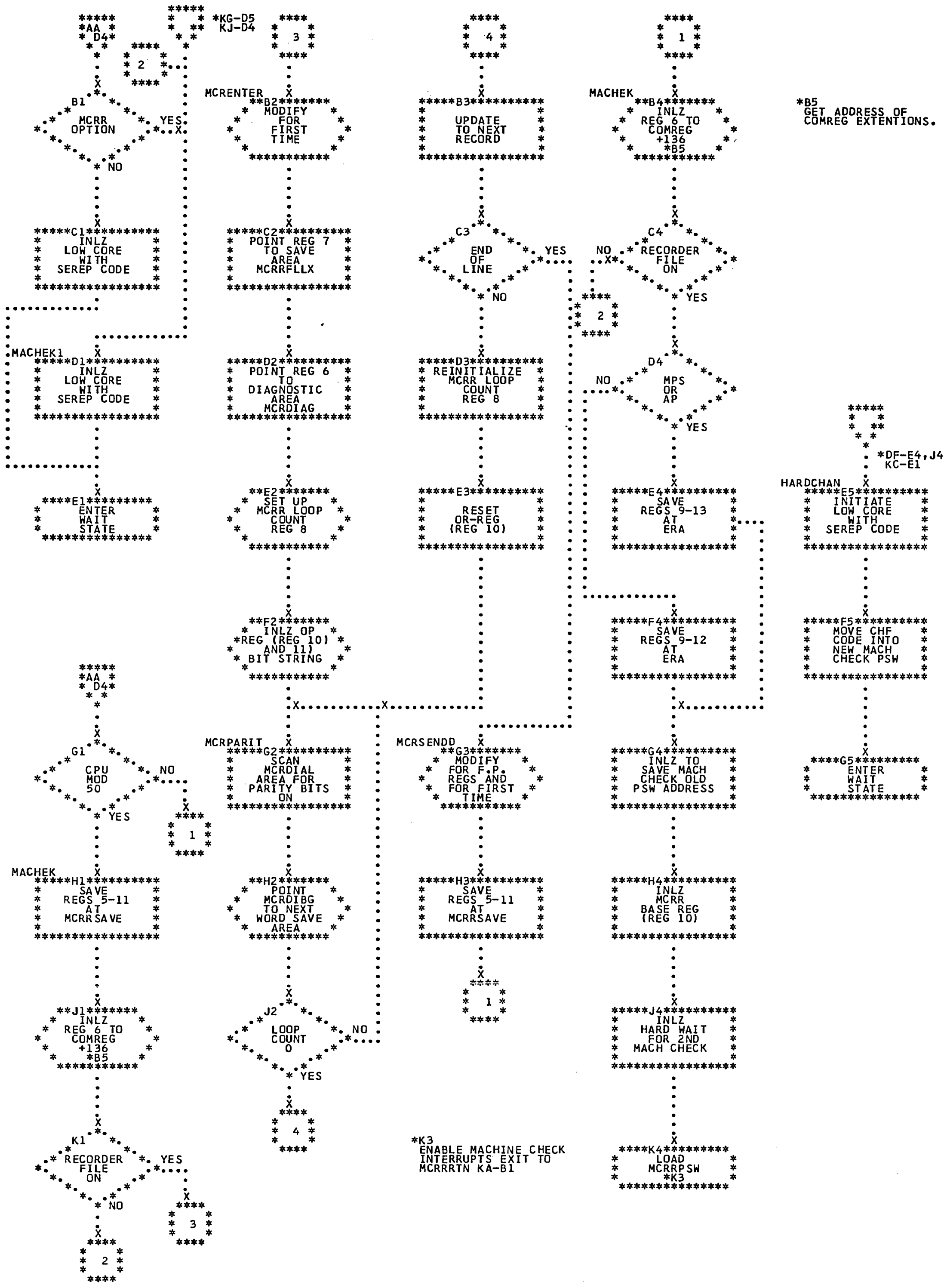


Chart EB. $$A$SUP1 - SGDFCH Macro, Fetch (Part 2 of 9)
Refer to Chart 03.

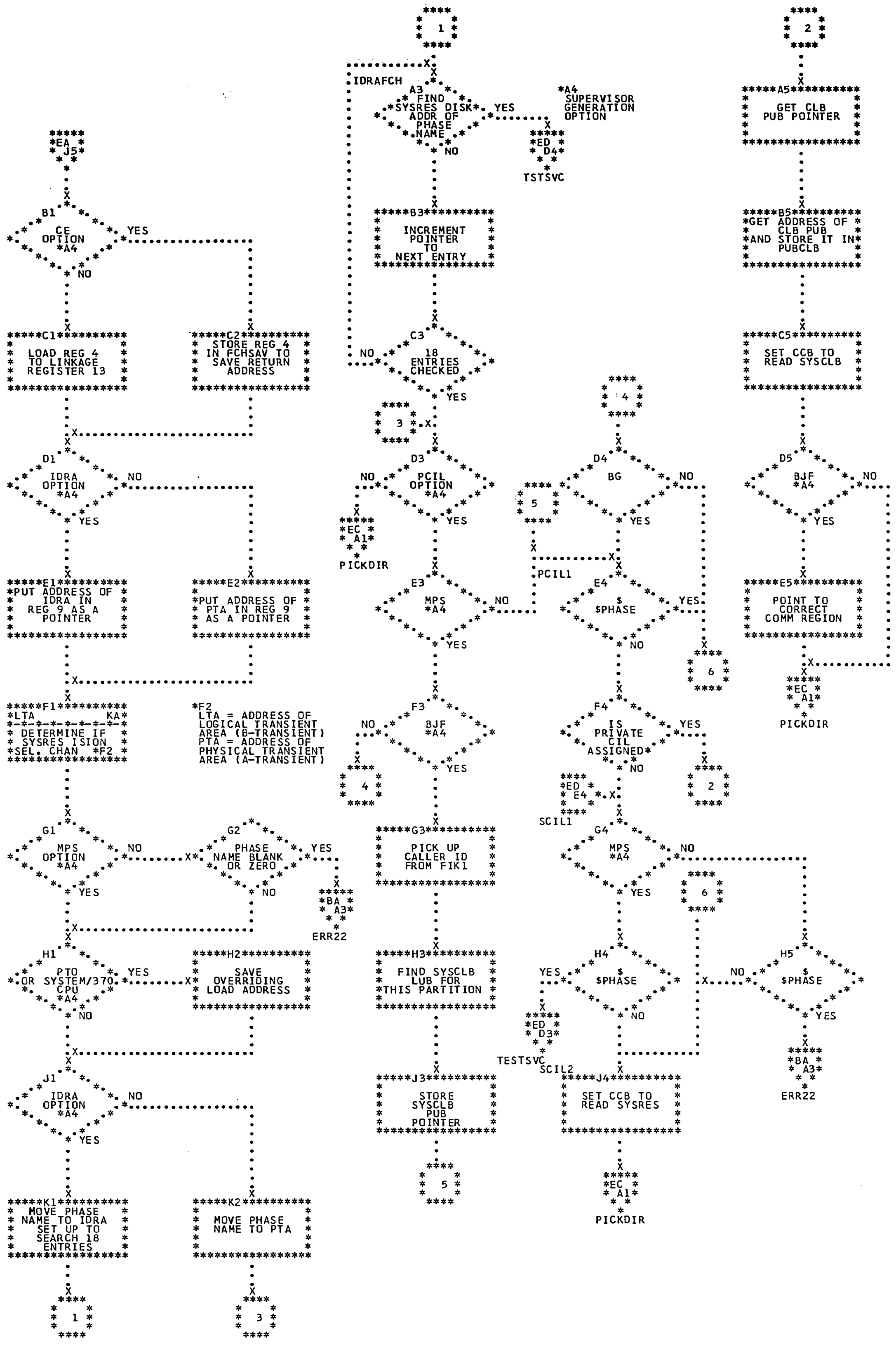


Chart EC. $$A$SUP1 - SGDFCH Macro, Fetch (Part 3 of 9)
Refer to Chart 03.

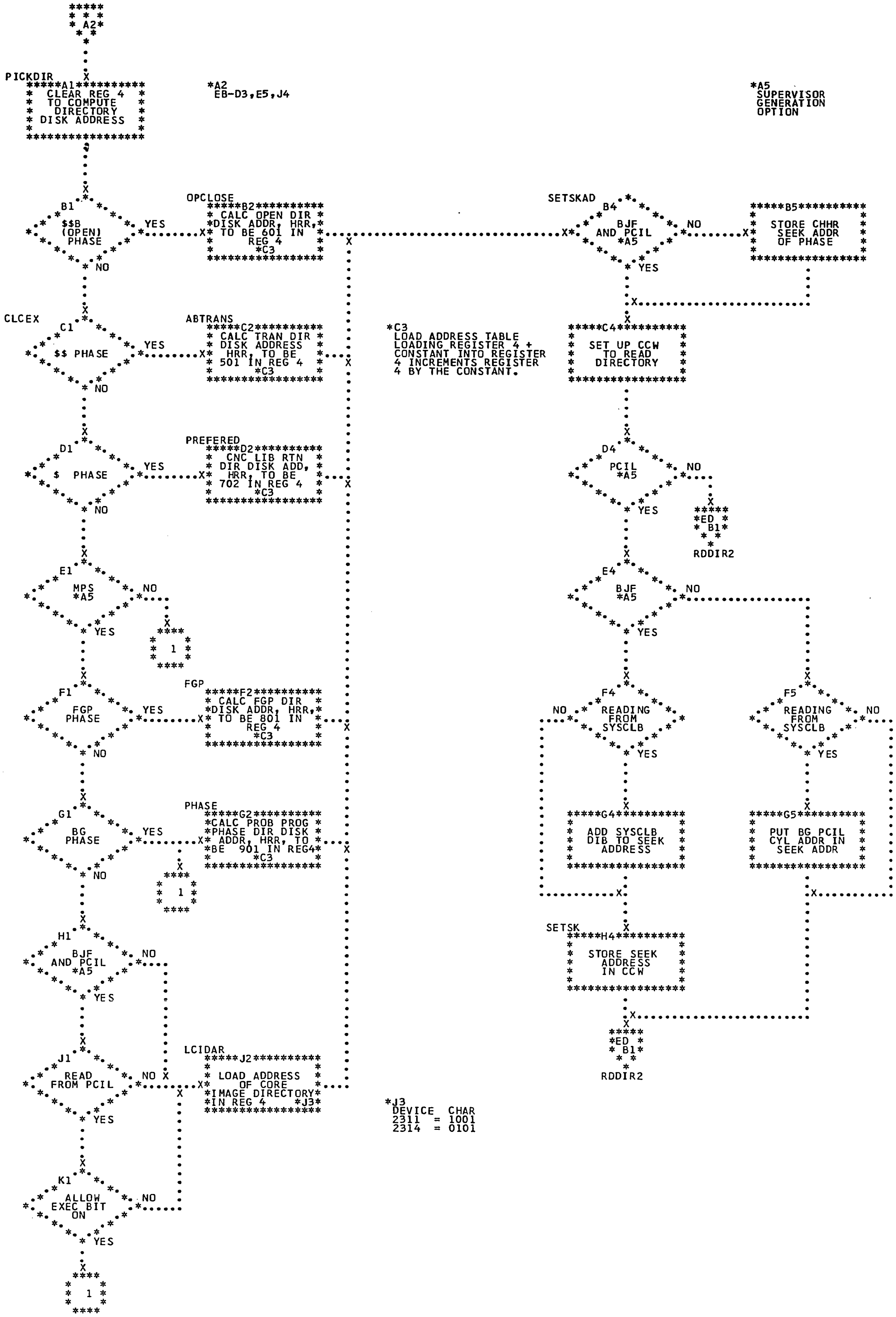


Chart FA. $$A$SUP1 - SGSVC Macro, SVCs 1, 12, and 13
Refer to Chart 03.

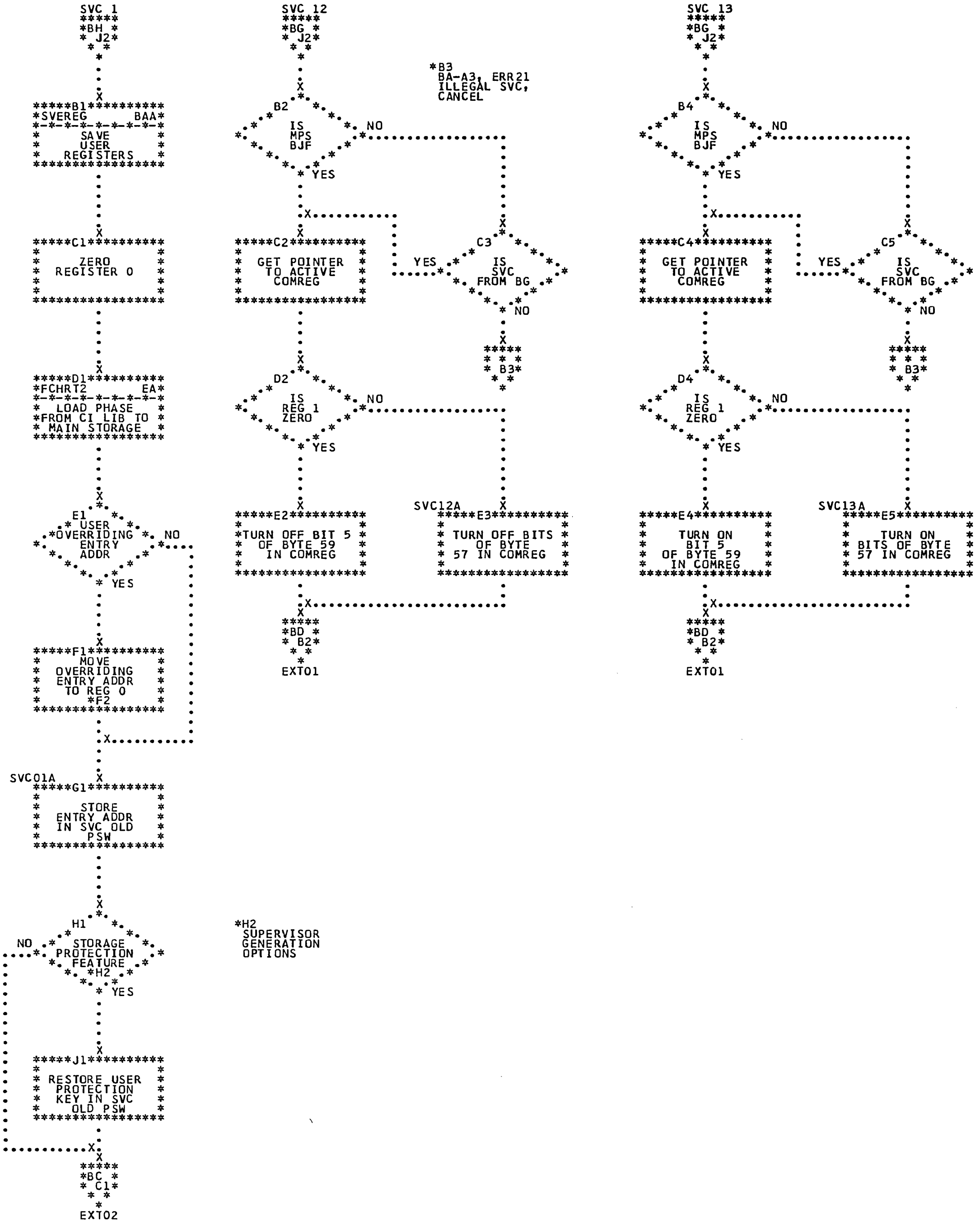
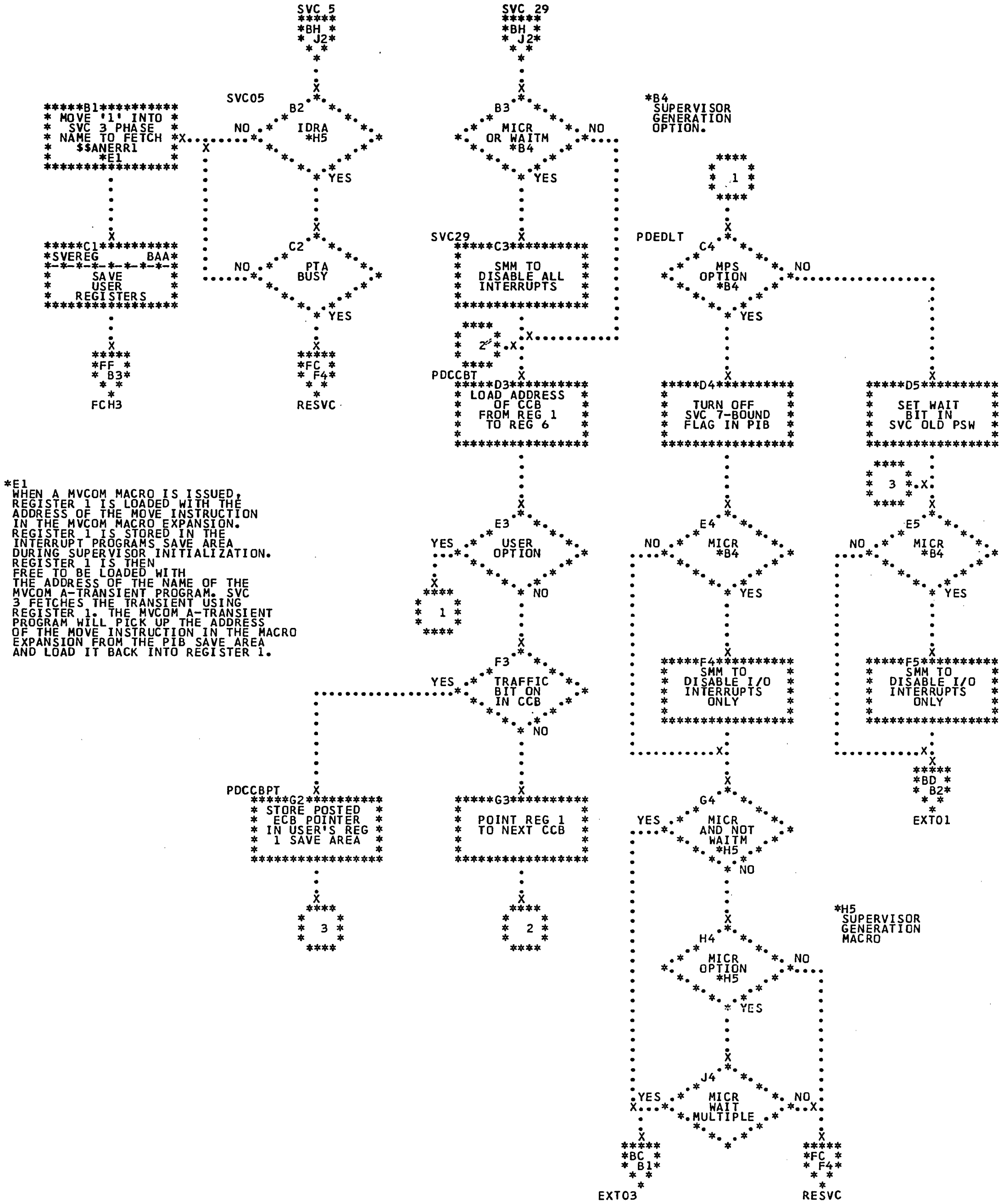


Chart FB. $$A$SUP1 - SGSVC Macro, SVCs 5, 26, and 29
Refer to Chart 03.



*B4
SUPERVISOR
GENERATION
OPTION.

*E1
WHEN A MVCOM MACRO IS ISSUED, REGISTER 1 IS LOADED WITH THE ADDRESS OF THE MOVE INSTRUCTION IN THE MVCOM MACRO EXPANSION. REGISTER 1 IS STORED IN THE INTERRUPT PROGRAMS SAVE AREA DURING SUPERVISOR INITIALIZATION. REGISTER 1 IS THEN FREE TO BE LOADED WITH THE ADDRESS OF THE NAME OF THE MVCOM A-TRANSIENT PROGRAM. SVC 3 FETCHES THE TRANSIENT USING REGISTER 1. THE MVCOM A-TRANSIENT PROGRAM WILL PICK UP THE ADDRESS OF THE MOVE INSTRUCTION IN THE MACRO EXPANSION FROM THE PIB SAVE AREA AND LOAD IT BACK INTO REGISTER 1.

*H5
SUPERVISOR
GENERATION
MACRO

Chart FC. $$A$SUP1 - SGSVC Macro, SVC 2 (Part 1 of 2)
Refer to Chart 03.

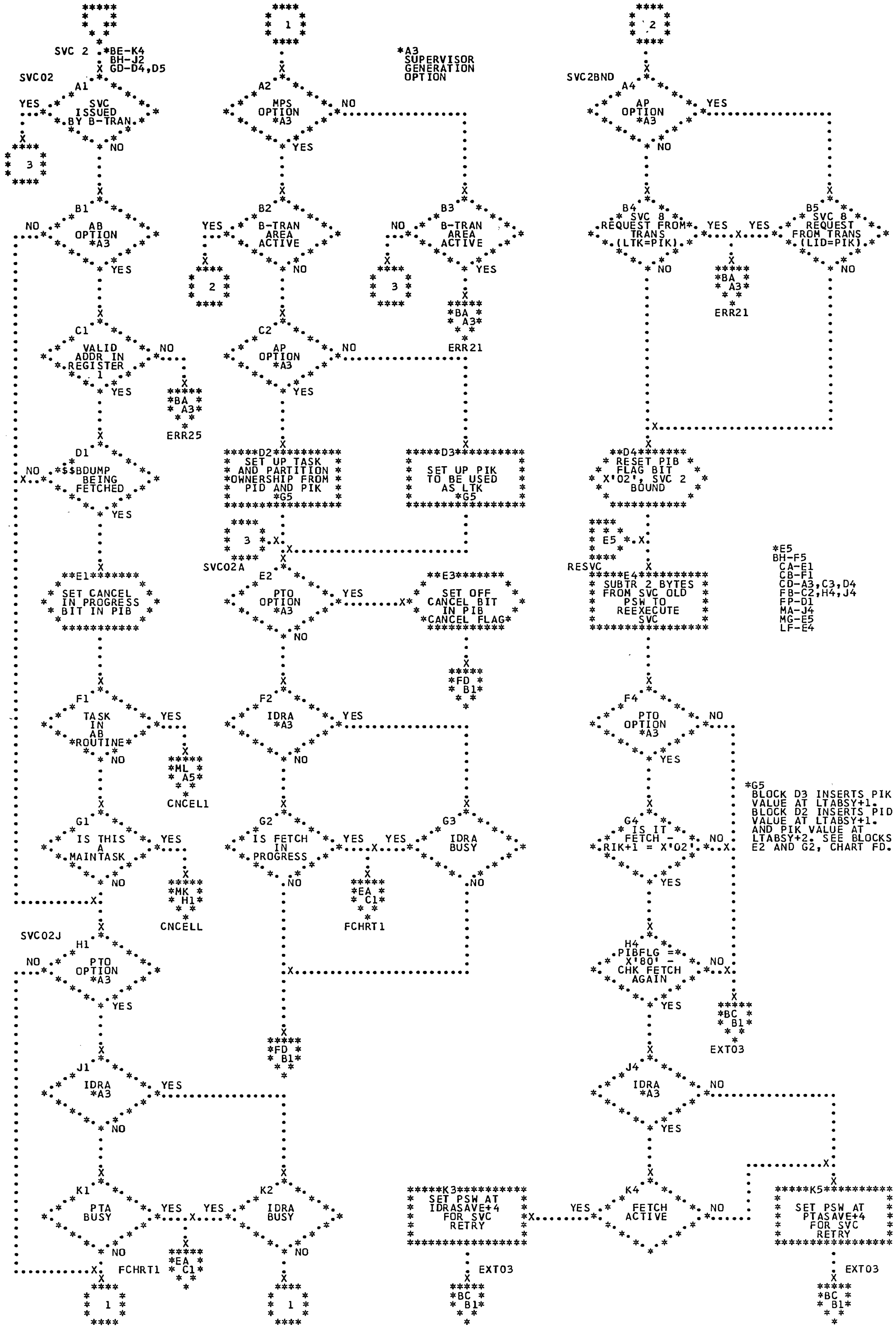
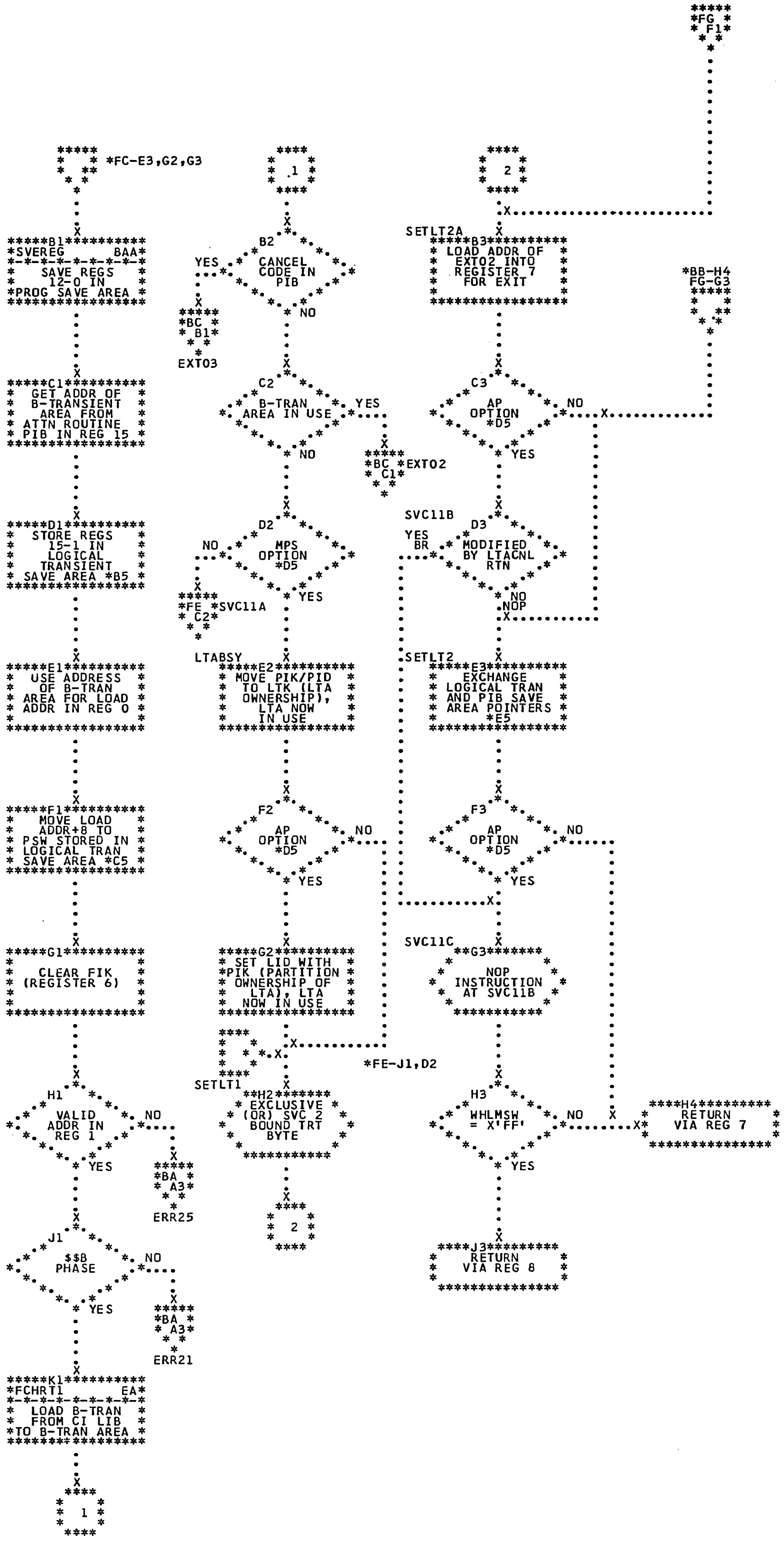


Chart FD. $$A$SUP1 - SGSVC Macro, SVC 2 (Part 2 of 2), SETLT1 and SETLT2 Routines.
Refer to Chart 03.



*B5
REGISTER 15 IS USED AS A BASE REGISTER FOR B-TRANSIENTS.

*C5
ADDRESS OF B-TRANSIENT AREA + 8 BYTES = ENTRY ADDRESS FOR A B-TRANSIENT. THE TRANSIENT NAME IS LOCATED IN THE FIRST 8 BYTES.

*D5
SUPERVISOR GENERATION OPTION.

*E5
ADDRESS POINTERS OF THE LOGICAL TRANSIENT SAVE AREA AND THE PROBLEM PROGRAM USING THE TRANSIENT AREA ARE REVERSED WHEN A LOGICAL TRANSIENT IS ACTIVE.

Chart FE. $$A$SUP1 - SGSVC Macro, SVCs 7 and 11
Refer to Chart 03.

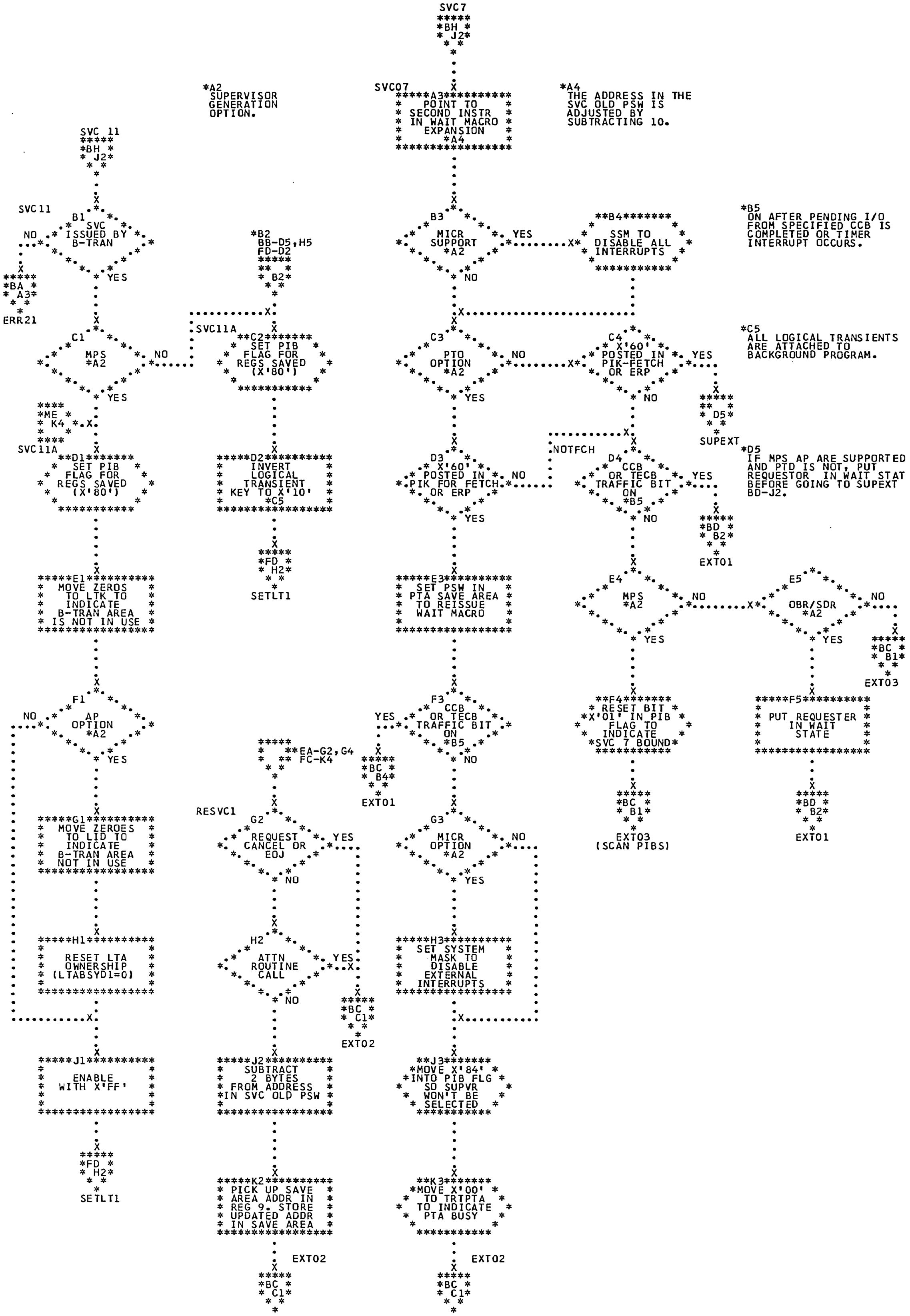


Chart FF. $$A$SUP1 - SGSVC Macro, SVCs 3 and 4
Refer to Chart 03.

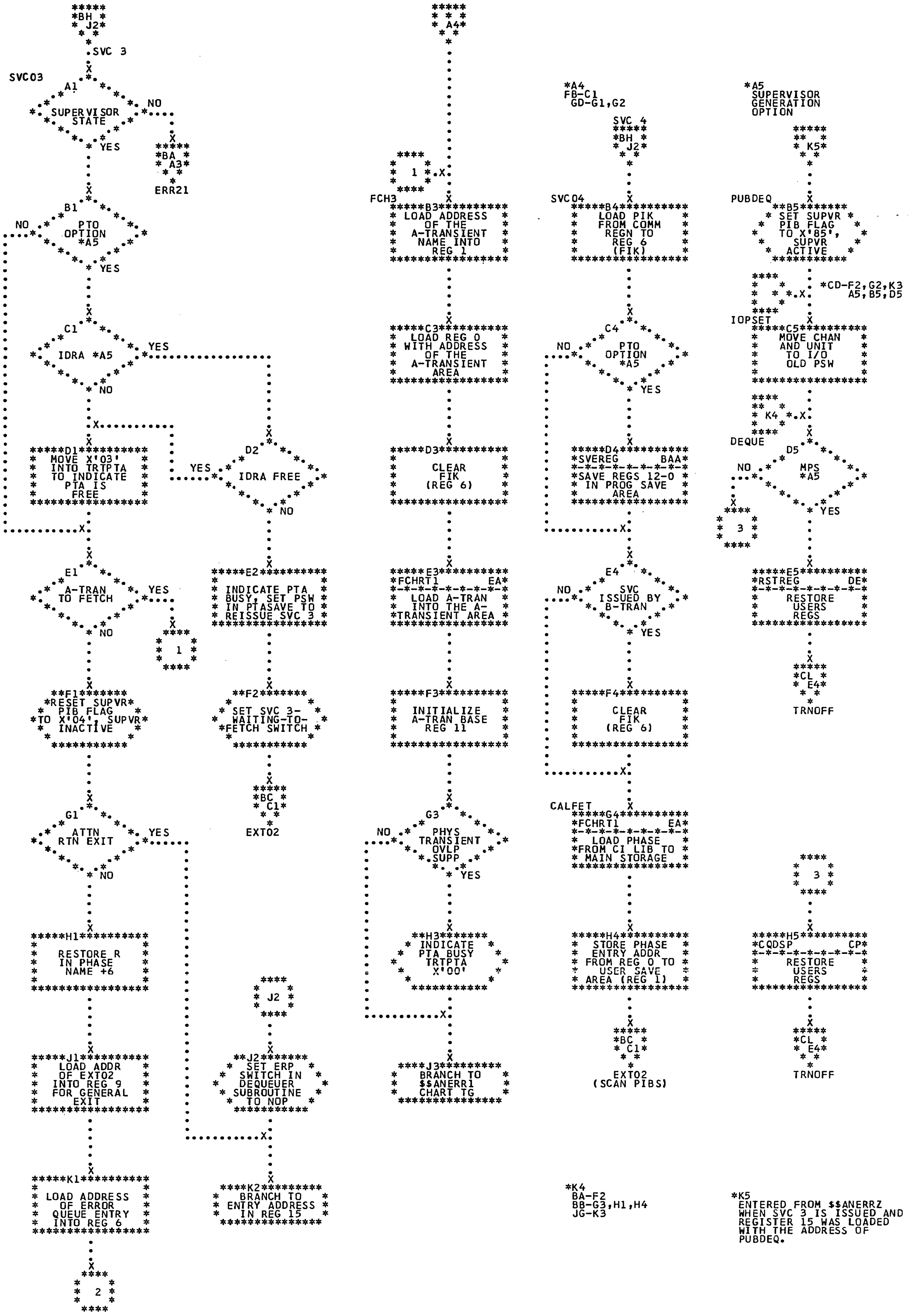
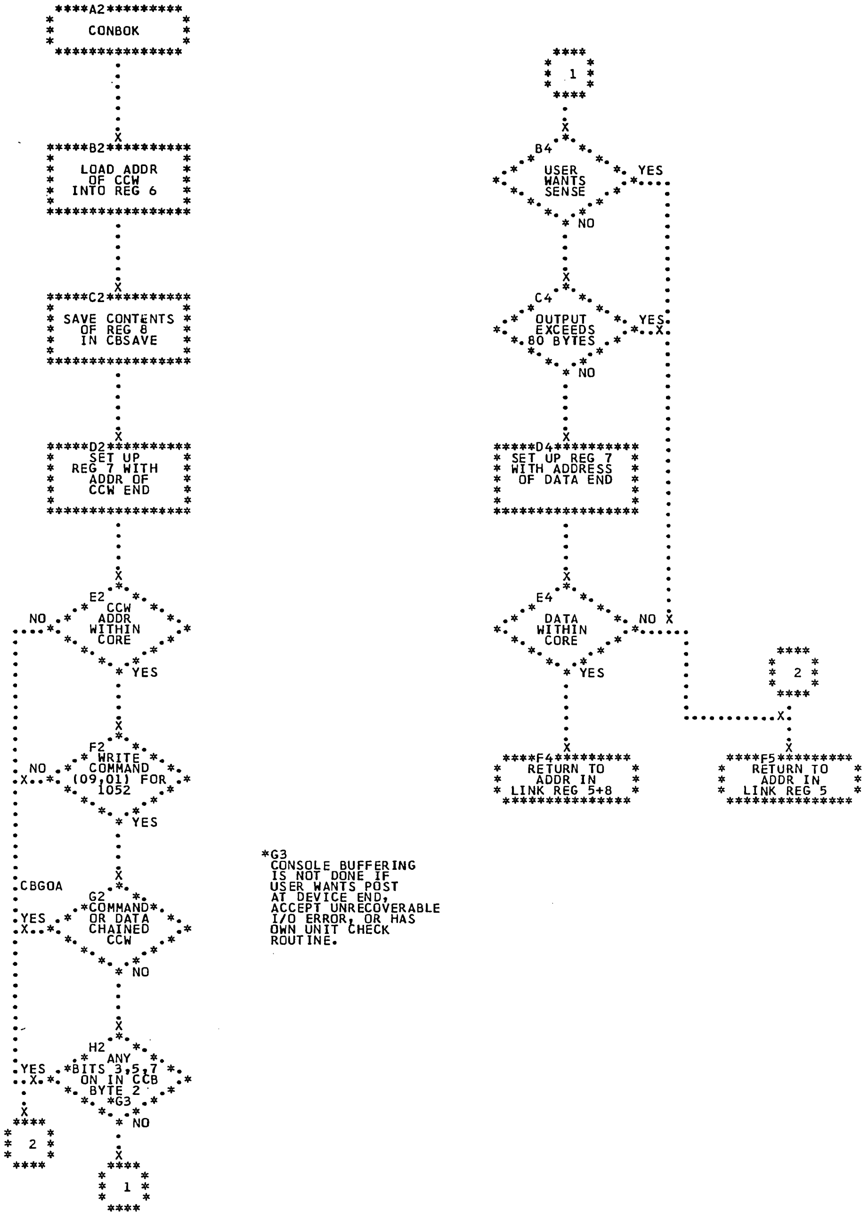


Chart FQ. $$A$SUP1 - SGSVC Macro, Console Buffering Routine (Part 2 of 2)
Refer to Chart 04.



*G3
CONSOLE BUFFERING
IS NOT DONE IF
USER WANTS POST
AT DEVICE END,
ACCEPT UNRECOVERABLE
I/O ERROR, OR HAS
OWN UNIT CHECK
ROUTINE.

Chart FR. $$A$SUP1 - SGSVC Macro, SVCs 43, 45, and 46
Refer to Chart 03.

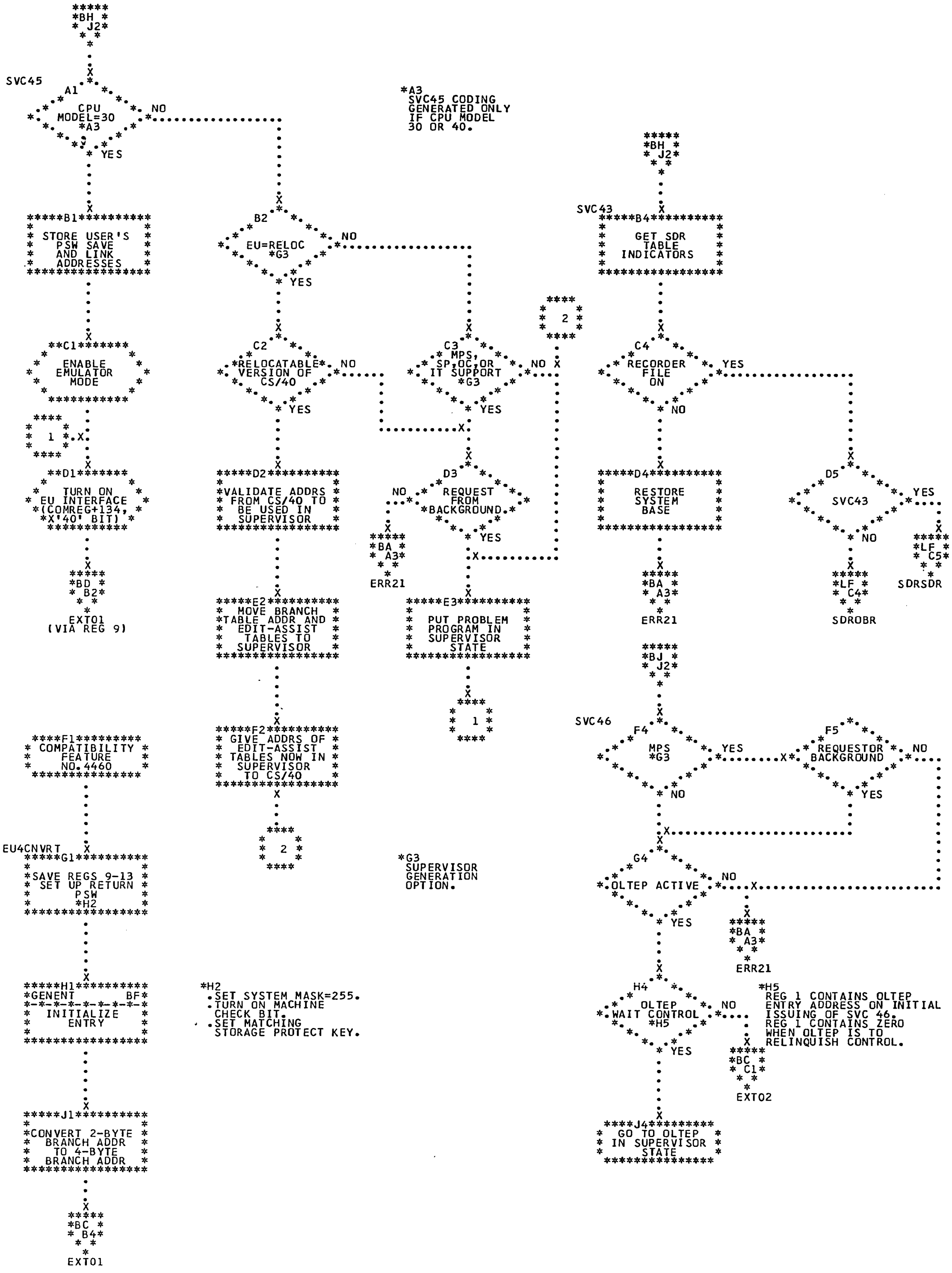


Chart FS. $$A$SUP1 - SGSVC Macro, SVC 51
Refer to Chart 03.

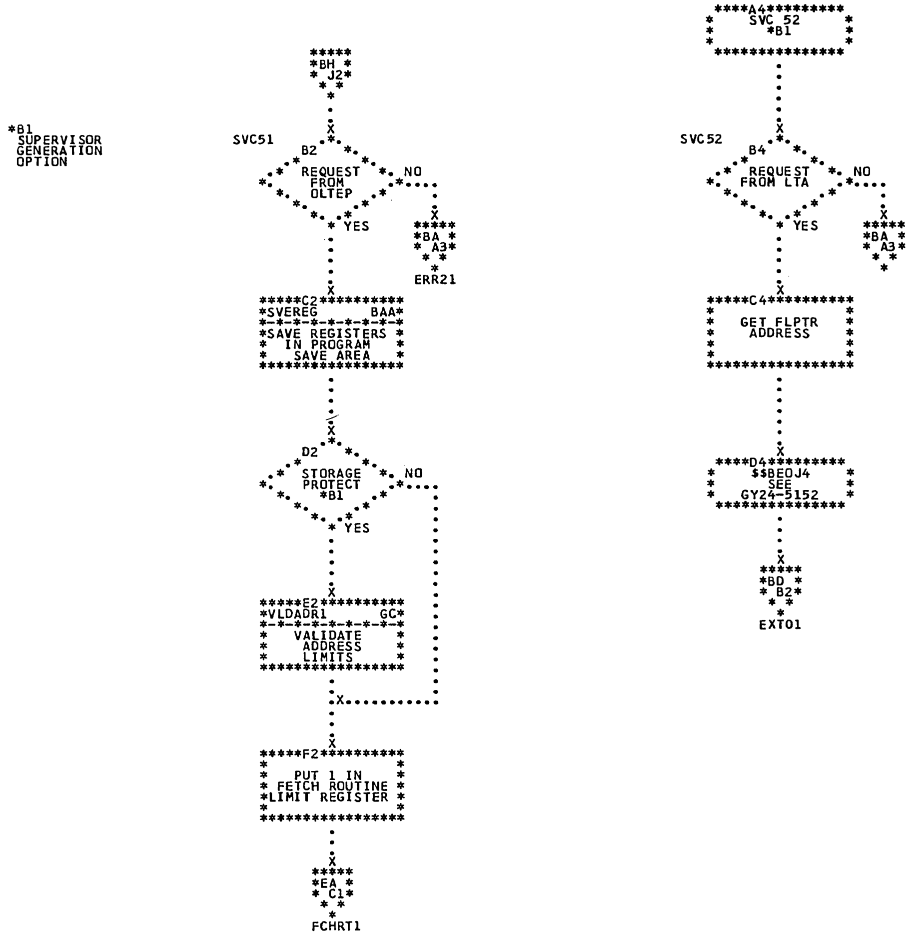


Chart GA. $$A$SUP1 - SGDSK Macro, Disk Error Recovery (Part 1 of 2)
Refer to Chart 06.

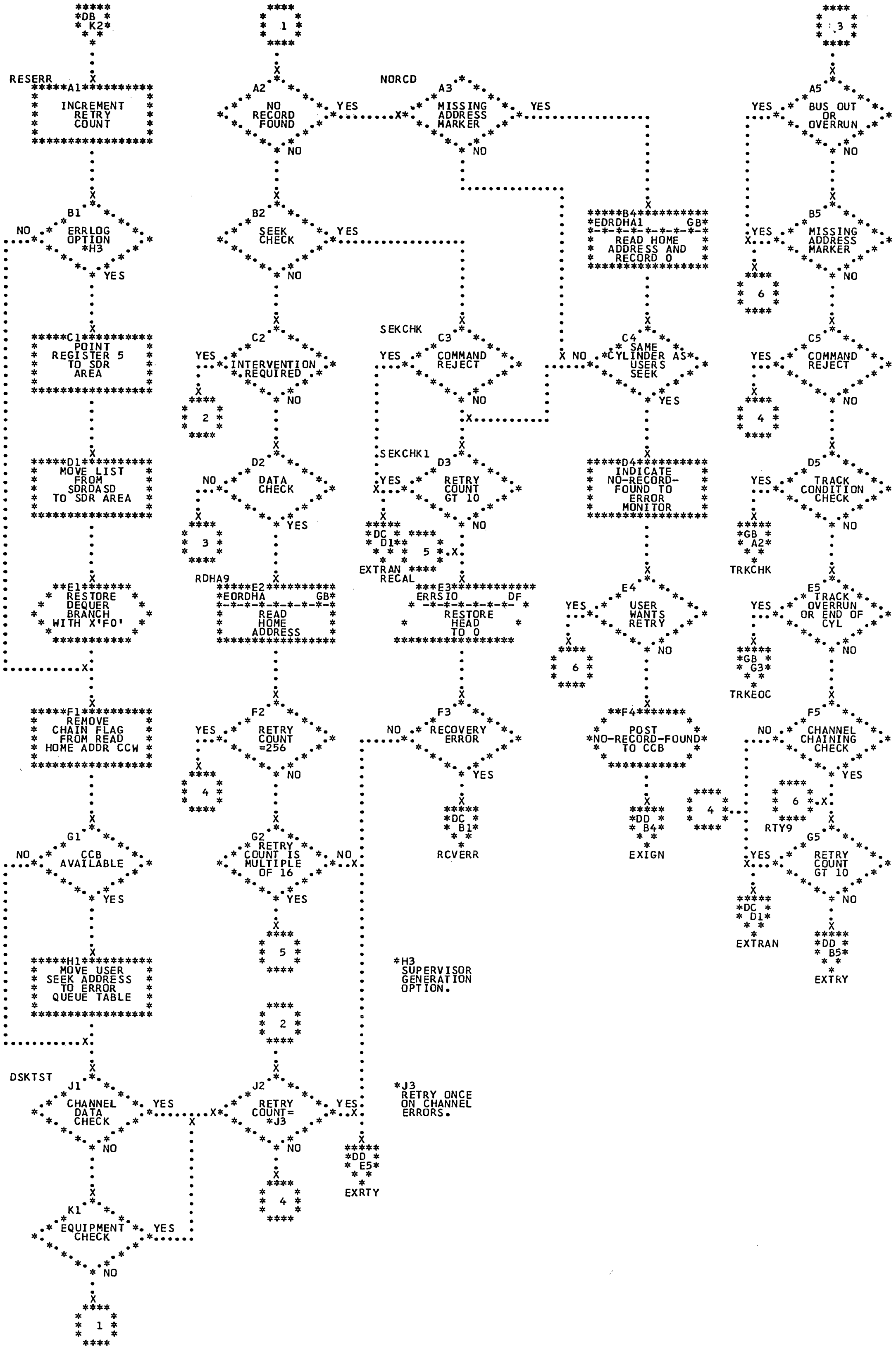
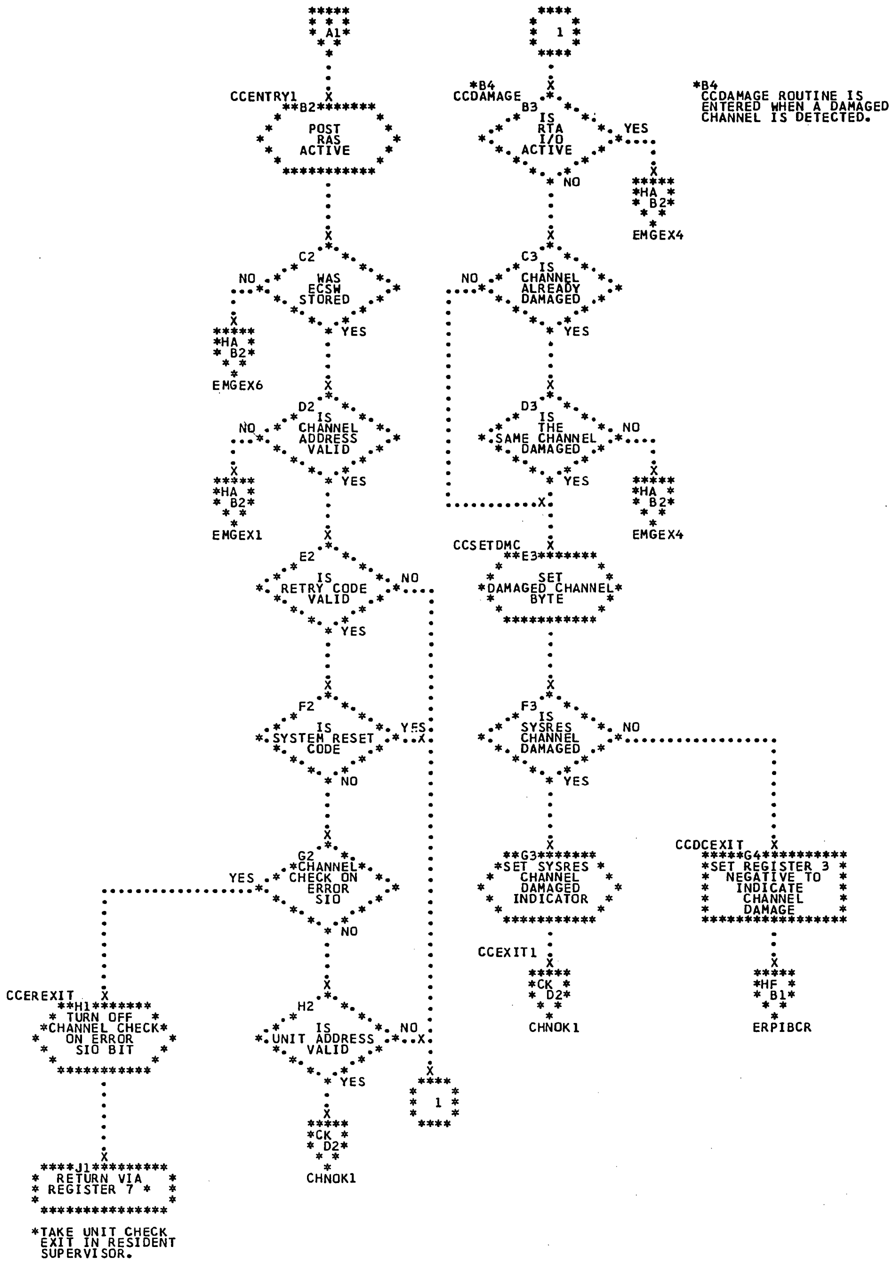


Chart HD. $$A$SUP1 - MCRAS Macro, Resident Channel Check Handler (Part 1 of 4)
Refer to Chart 09.



*B4
CCDAMAGE ROUTINE IS ENTERED WHEN A DAMAGED CHANNEL IS DETECTED.

*TAKE UNIT CHECK EXIT IN RESIDENT SUPERVISOR.

Chart HE. $$A$SUP1 - MCRAS Macro, Resident Channel Check Handler (Part 2 of 4)

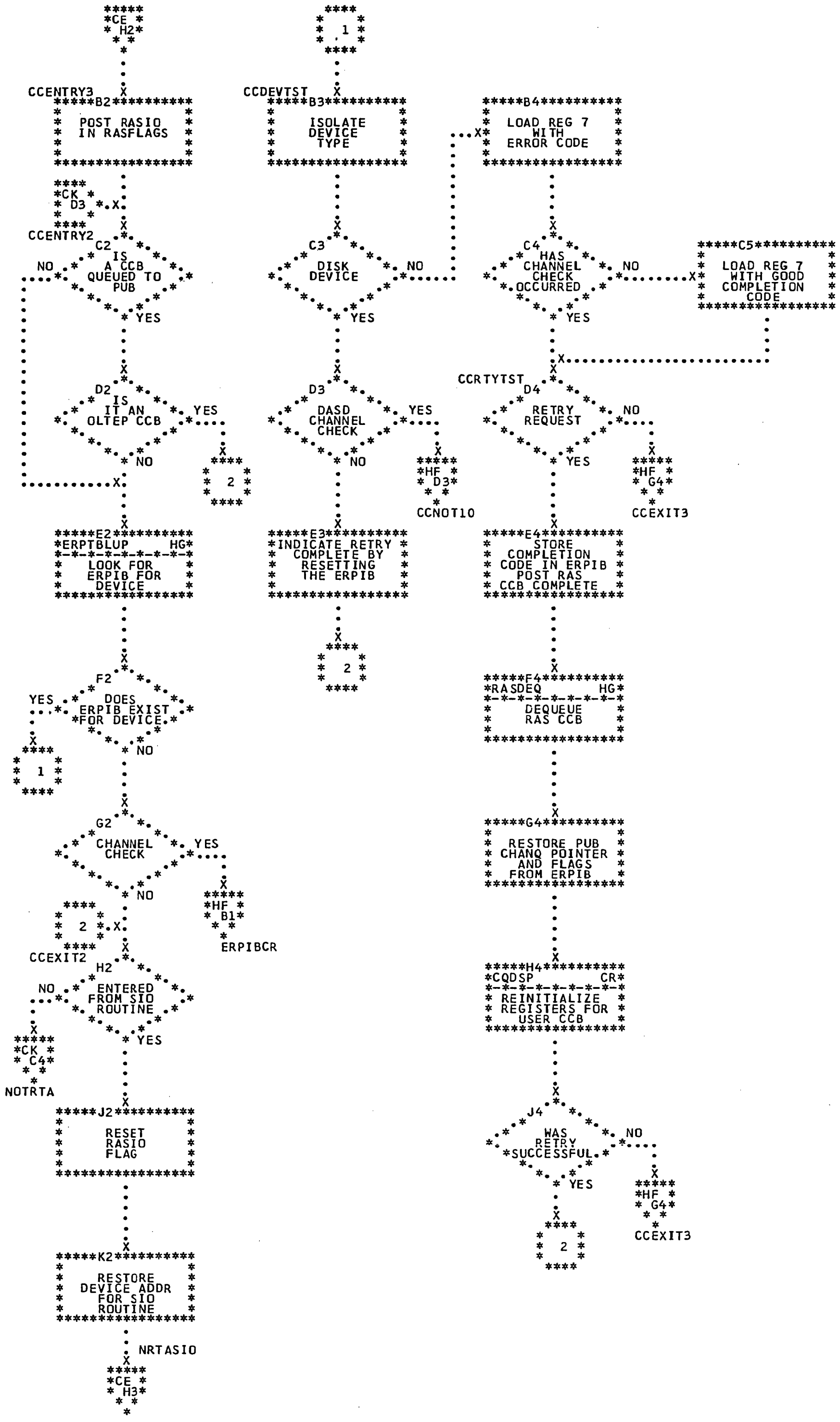


Chart JH. $$A$SUP1 - SMICR Macro, Exit Routine Refer to Chart 02.

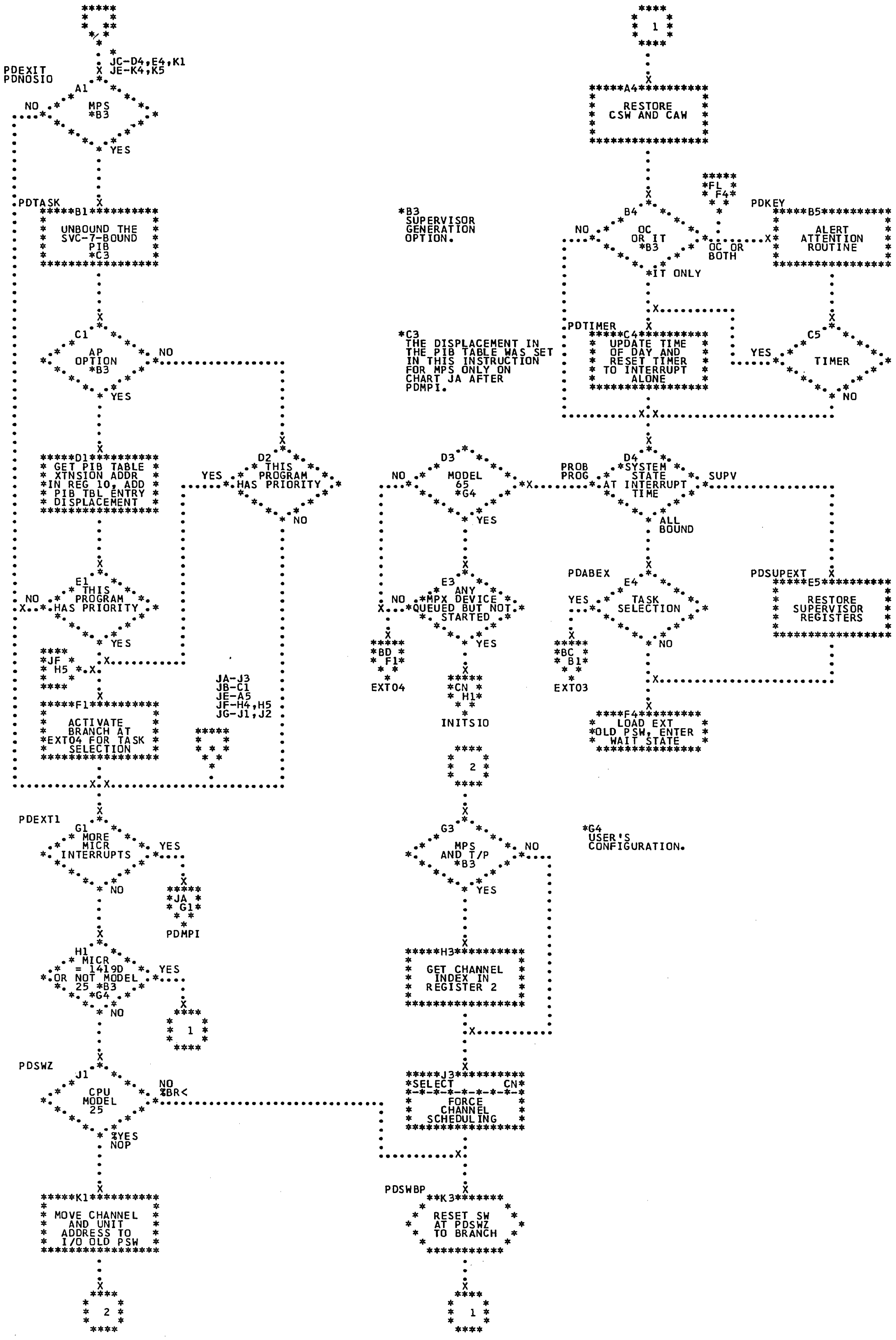


Chart KA. $$A$SUP1 - SMCRR Macro, Channel Inboard Error Record Builder (Part 1 of 4) Refer to Chart 10.

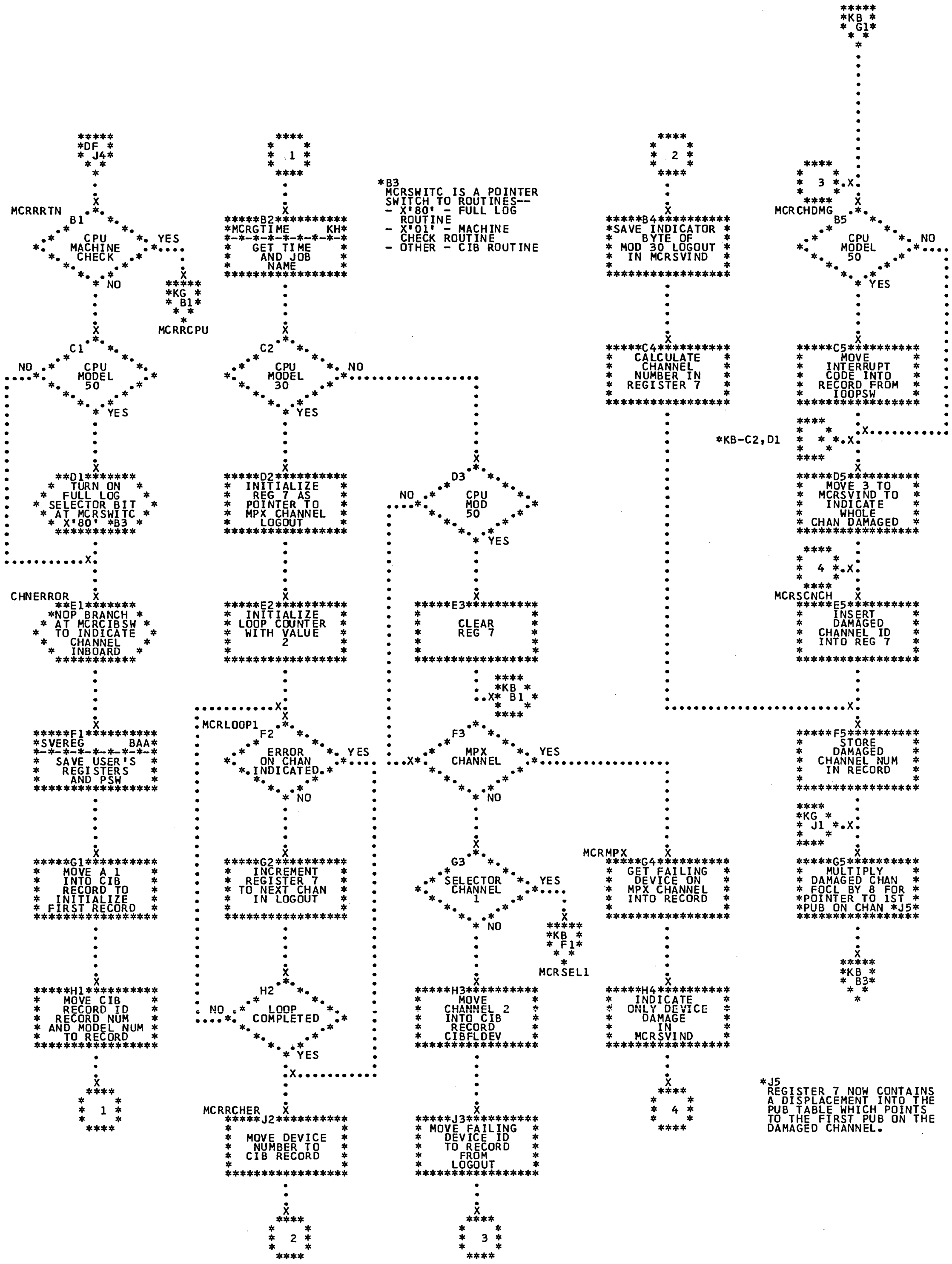
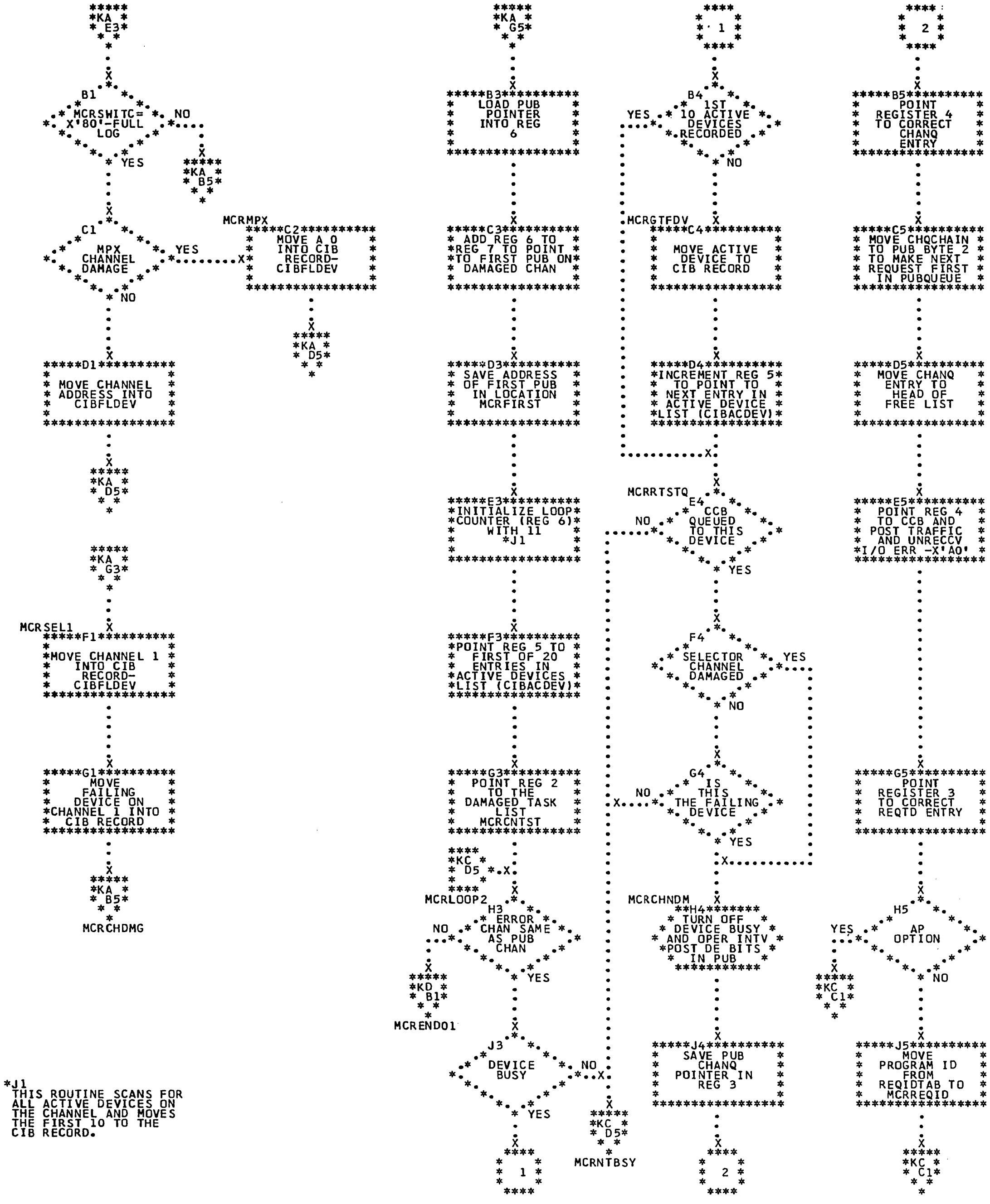
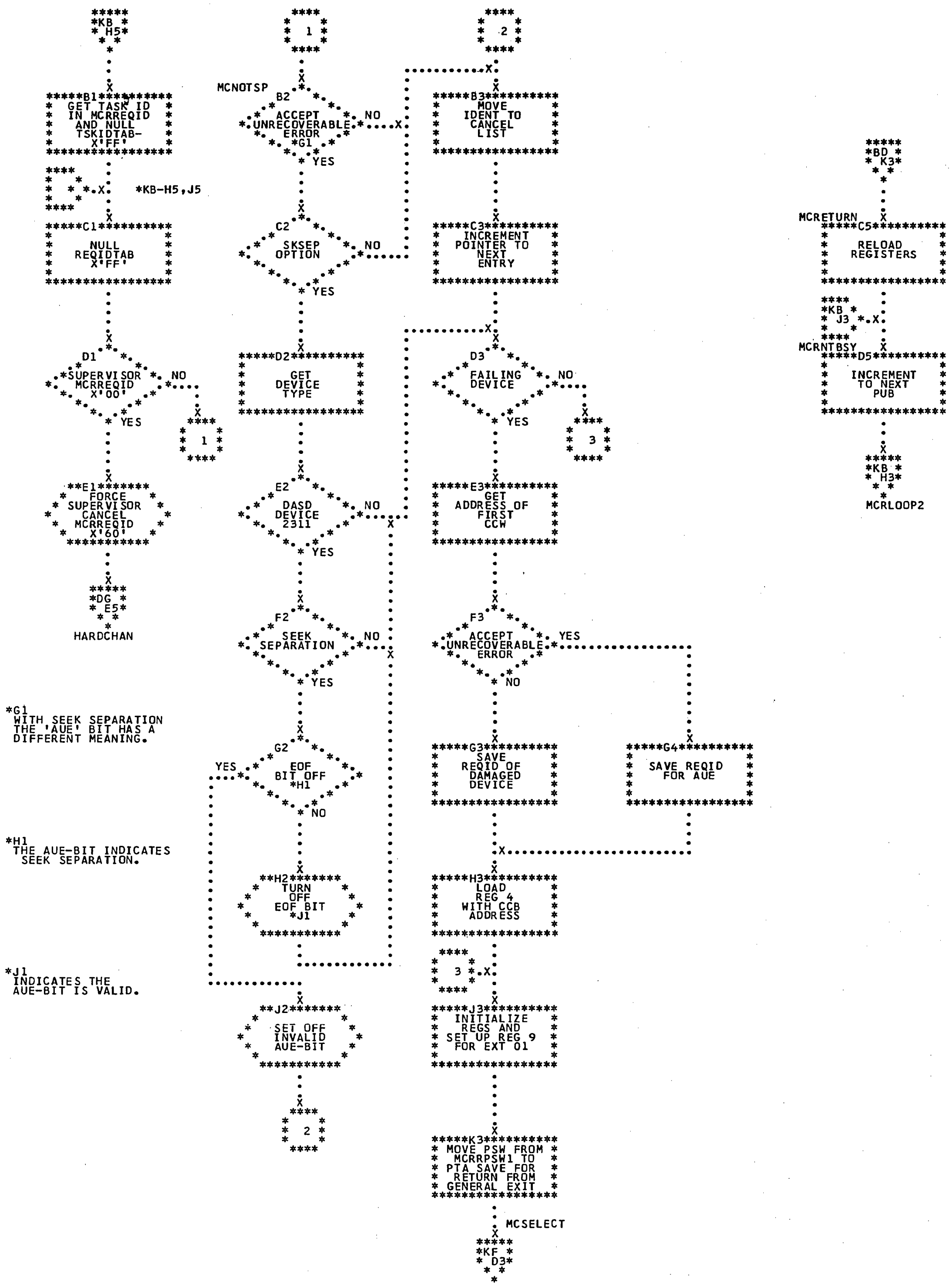


Chart KB. $$A$SUP1 - SMCRR Macro, Channel Inboard Error Record Builder (Part 2 of 4)
Refer to Chart 10.



*J1
THIS ROUTINE SCANS FOR ALL ACTIVE DEVICES ON THE CHANNEL AND MOVES THE FIRST 10 TO THE CIB RECORD.

Chart KC. $$A$SUP1 - SMCRR Macro, Channel Inboard Error Record Builder (Part 3 of 4)
Refer to Chart 10.



*G1
WITH SEEK SEPARATION THE 'AUE' BIT HAS A DIFFERENT MEANING.

*H1
THE AUE-BIT INDICATES SEEK SEPARATION.

*J1
INDICATES THE AUE-BIT IS VALID.

Chart ME. $$A$SUP1 - SGTHAP Macro, DETACH a Task (Part 1 of 2)
Refer to Chart 03.

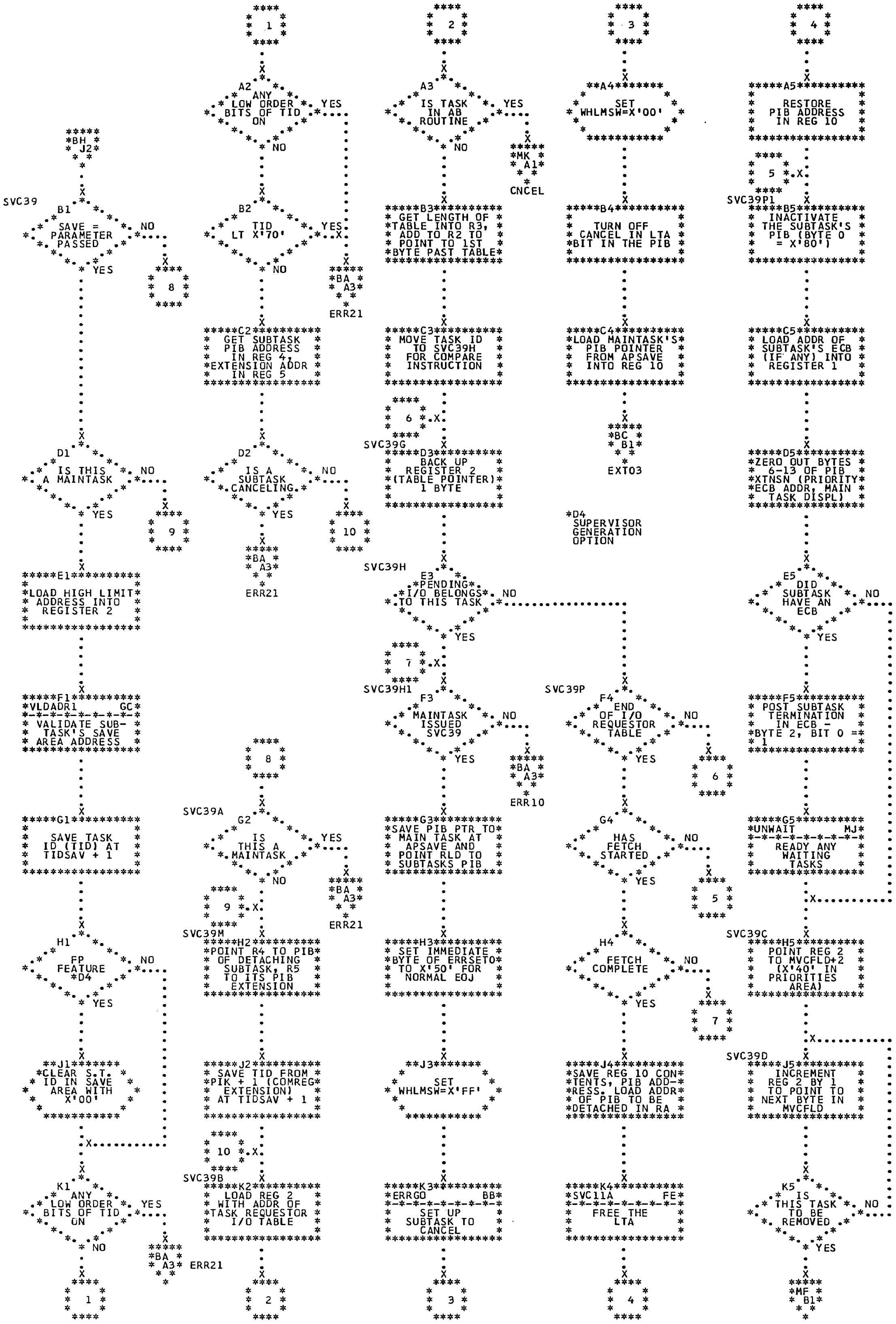


Chart MF. $$A$SUP1 - SGTHAP Macro, DETACH a Task (Part 2 of 2)
Refer to Chart 03.

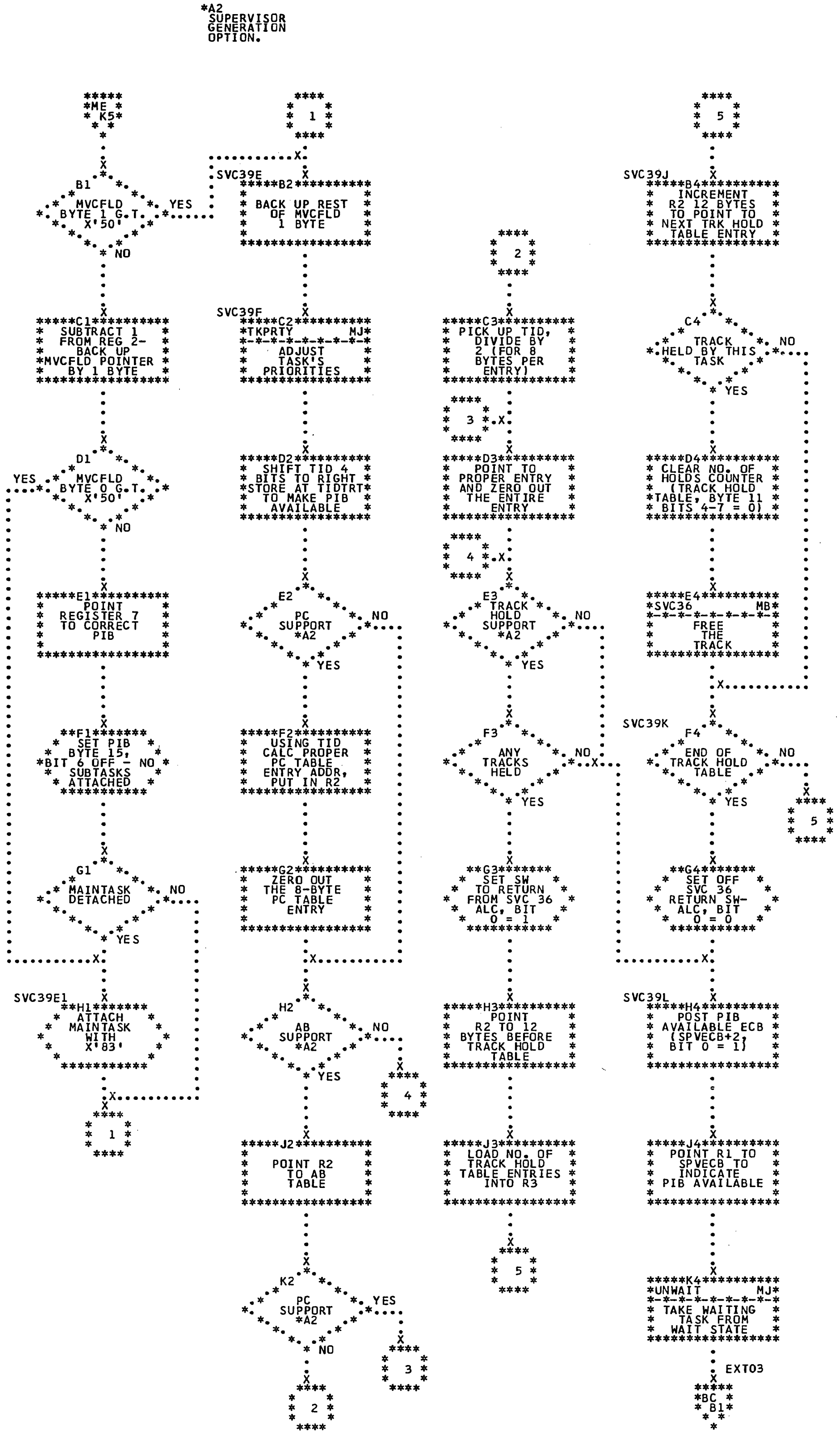


Chart NJ. $$ANERAG - Recorder File Last Track Error Message Writer for OBR/SDR
Refer to Chart 13.

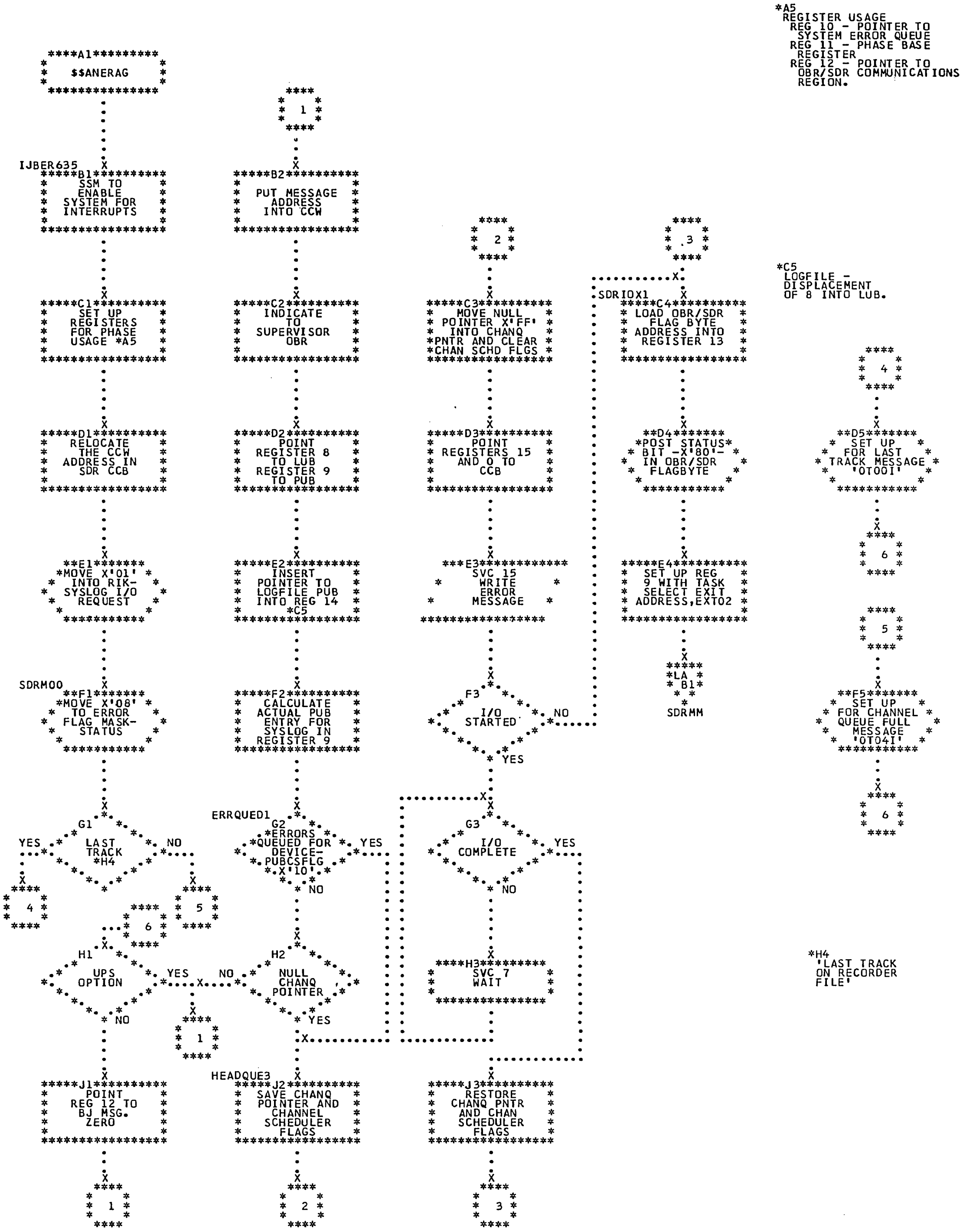
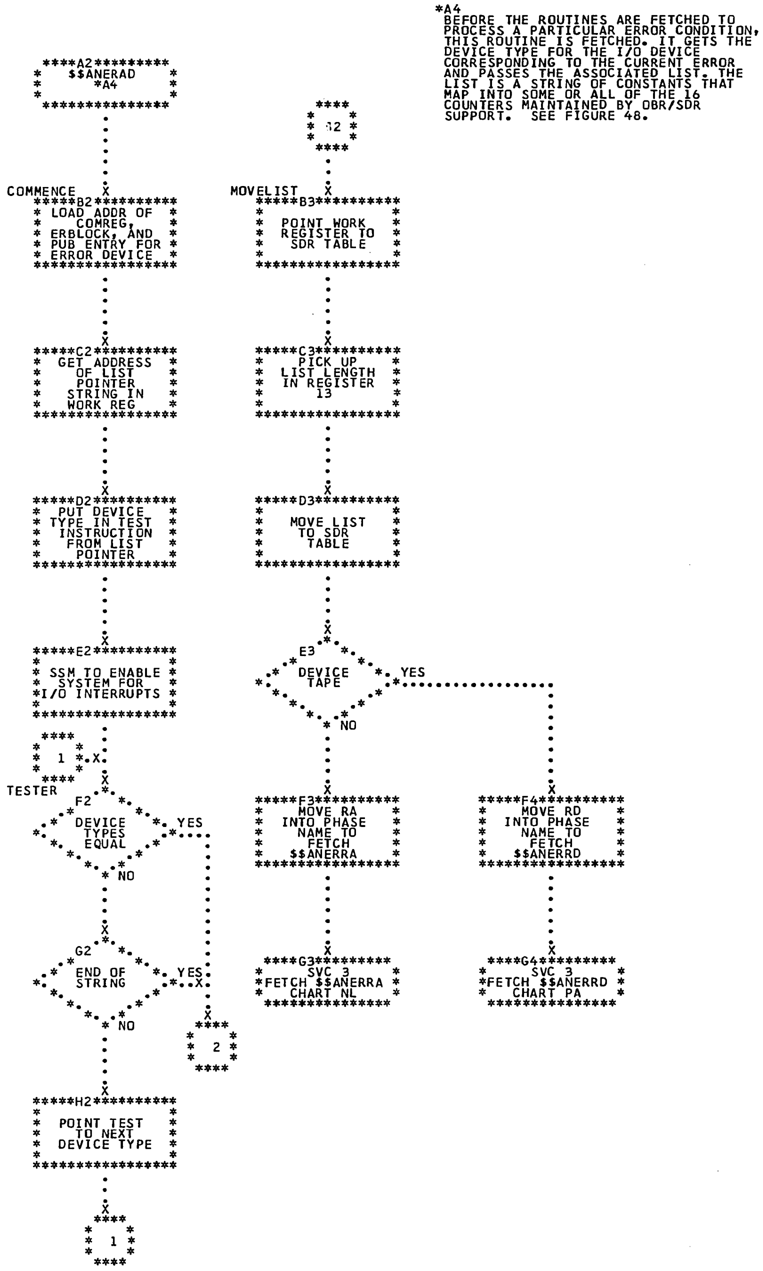


Chart NK. $$ANERAD - List Passer for SDR Processor
Refer to Chart 11.



*A4
BEFORE THE ROUTINES ARE FETCHED TO PROCESS A PARTICULAR ERROR CONDITION, THIS ROUTINE IS FETCHED. IT GETS THE DEVICE TYPE FOR THE I/O DEVICE CORRESPONDING TO THE CURRENT ERROR AND PASSES THE ASSOCIATED LIST. THE LIST IS A STRING OF CONSTANTS THAT MAP INTO SOME OR ALL OF THE 16 COUNTERS MAINTAINED BY OBR/SDR SUPPORT. SEE FIGURE 48.

Chart NM. $$ANERRC - ERP Monitor
Refer to Chart 11.

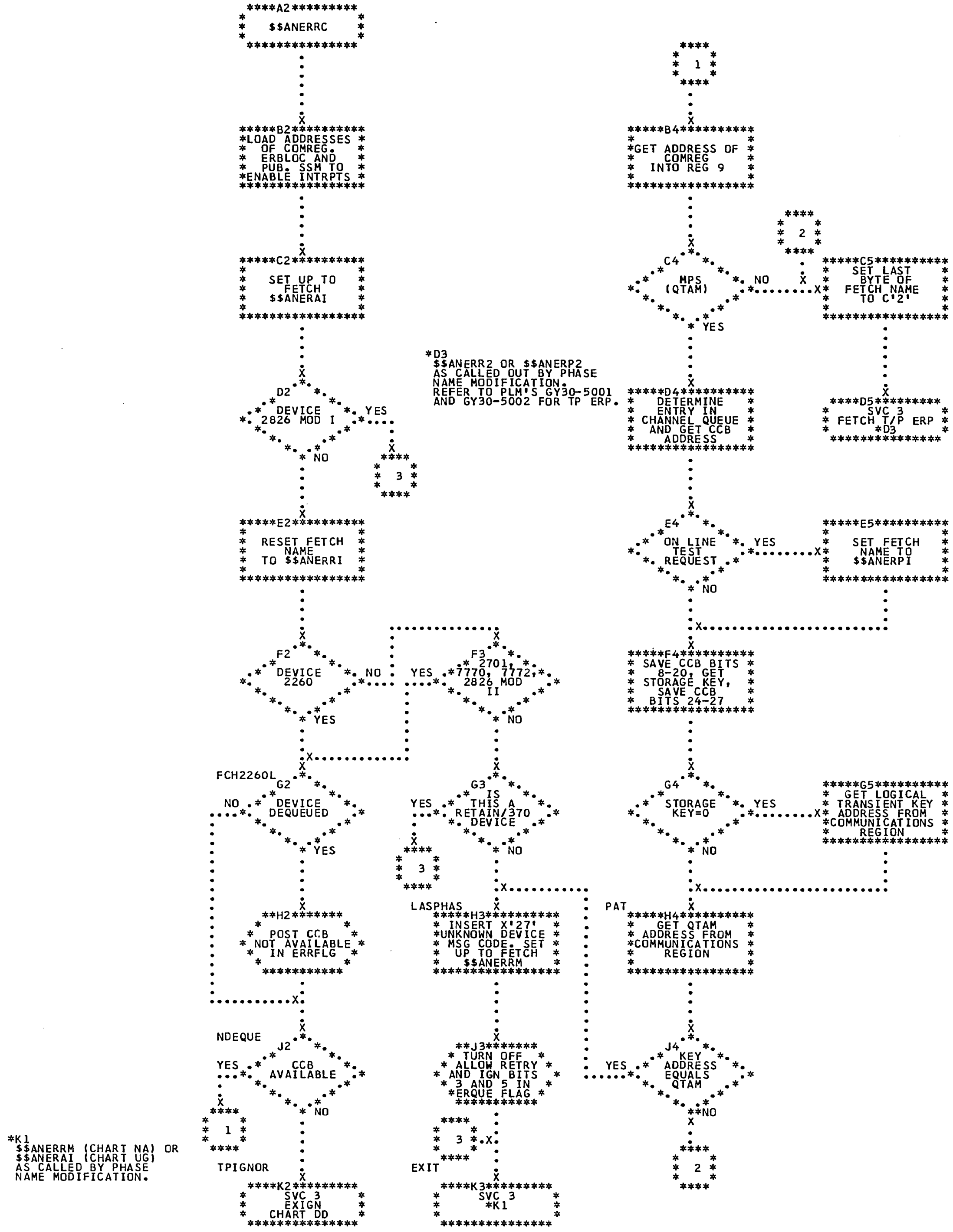


Chart NN. $$ANERRB - Disk ERP
Refer to Chart 11.

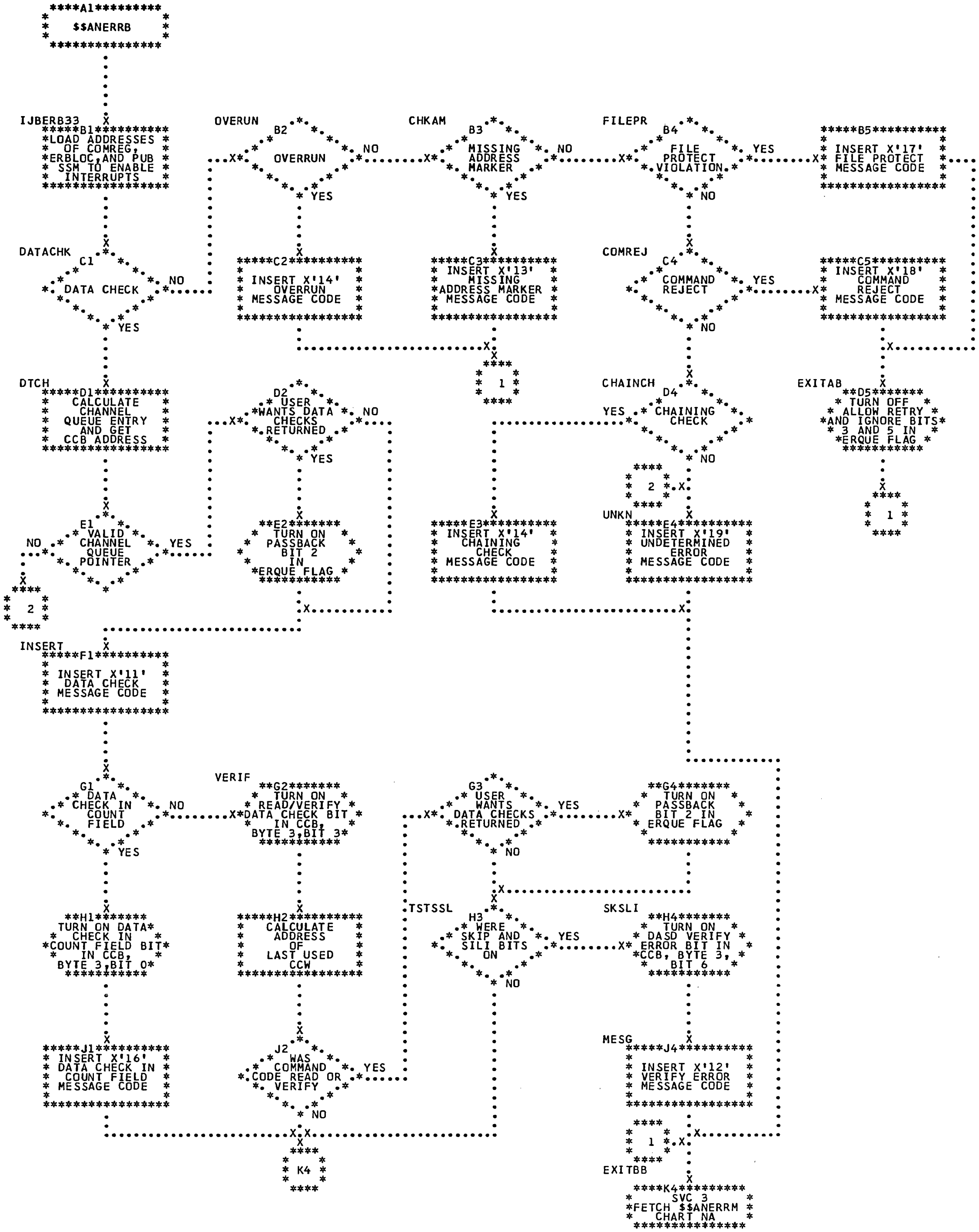


Chart PA. $$ANERRD - Phase 1 of Tape ERP (Part 1 of 2)
Refer to Chart 13.

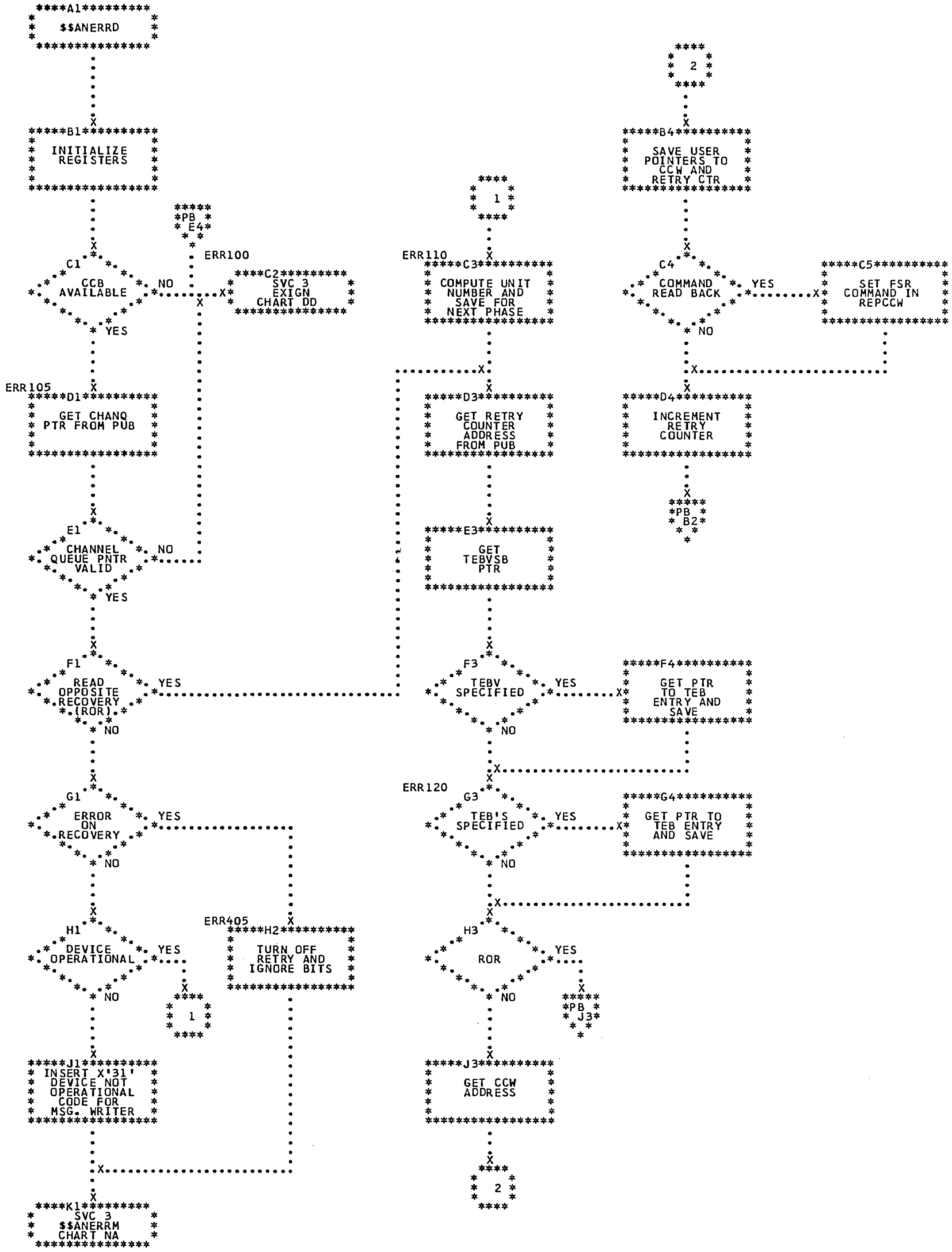


Chart PB. $$ANERRD - Phase 1 of Tape ERP (Part 2 of 2)
Refer to Chart 13.

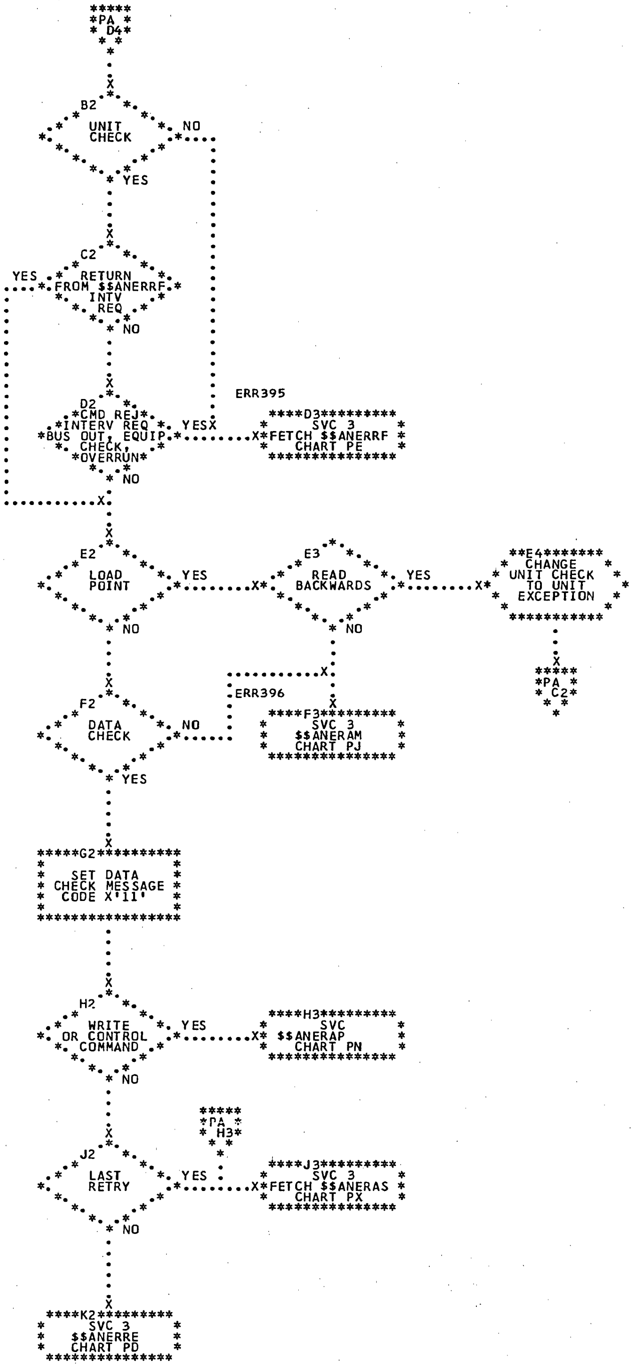


Chart QA. $$ANERRG - Phase 1 of Data Cell ERP (Part 1 of 3)
Refer to Chart 11.

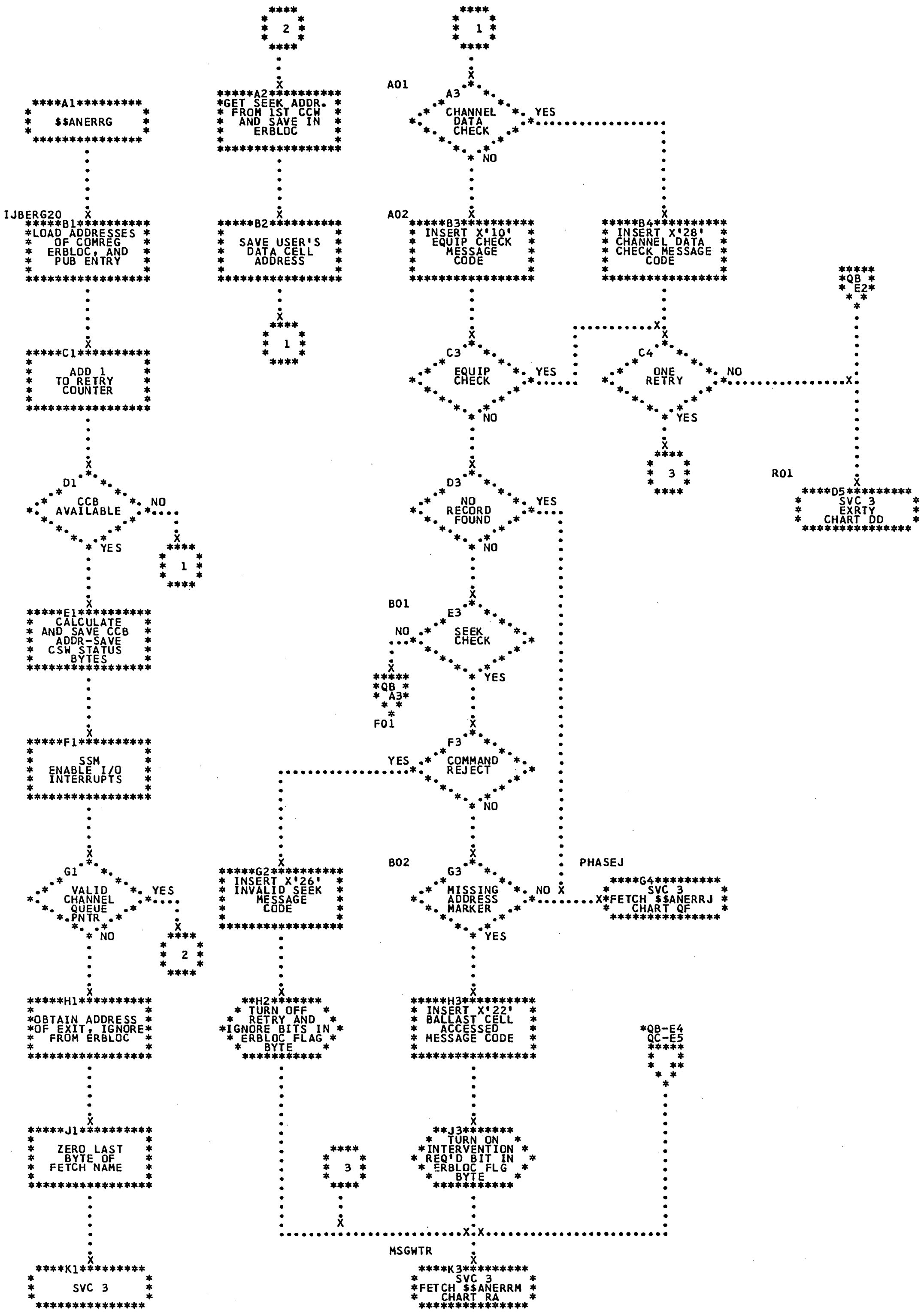


Chart QB. $$ANERRG - Phase 1 of Data Cell ERP (Part 2 of 3)
Refer to Chart 11.

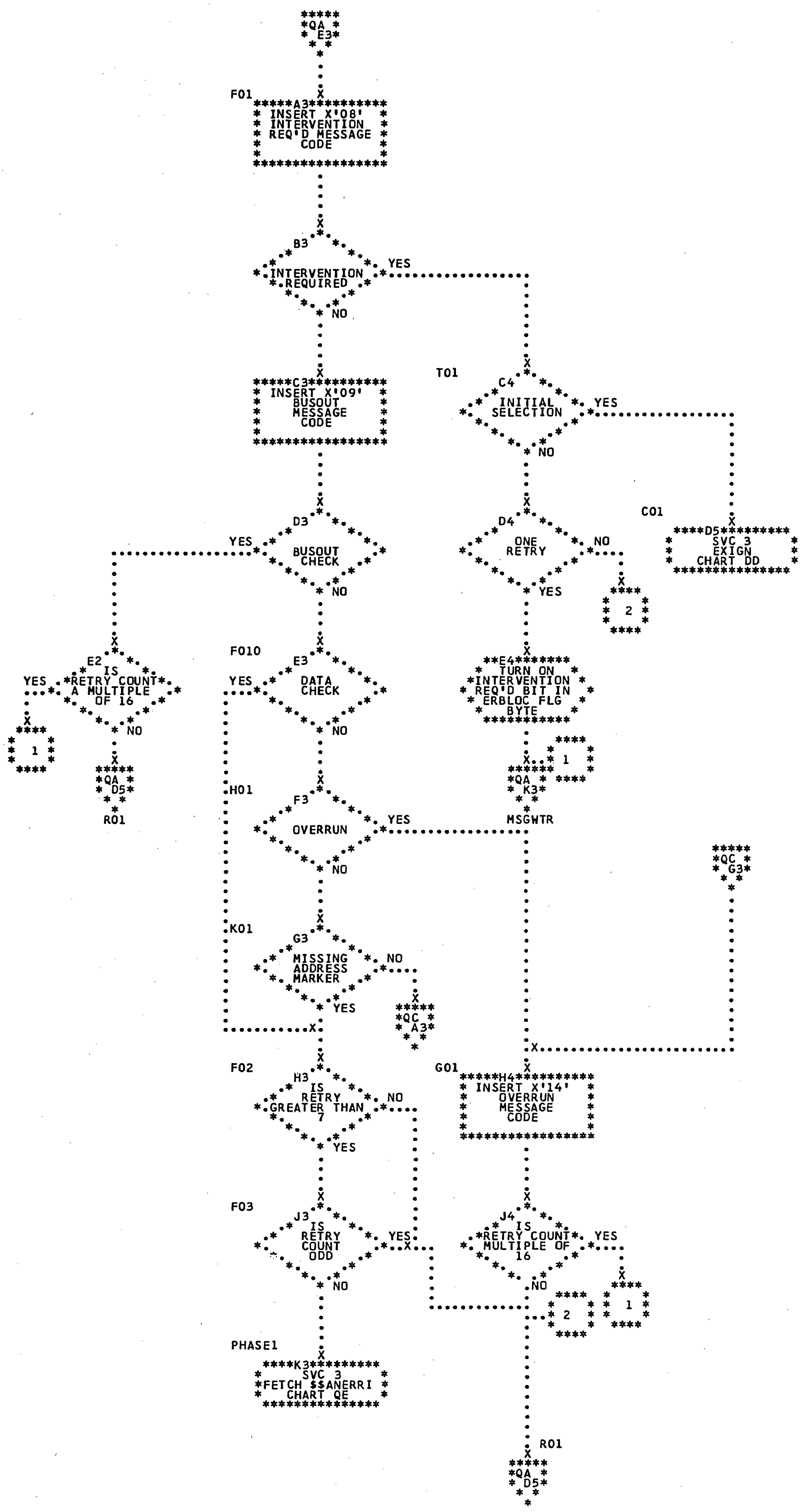


Chart QC. $$ANERRG - Phase 1 of Data Cell ERP (Part 3 of 3)
Refer to Chart 11.

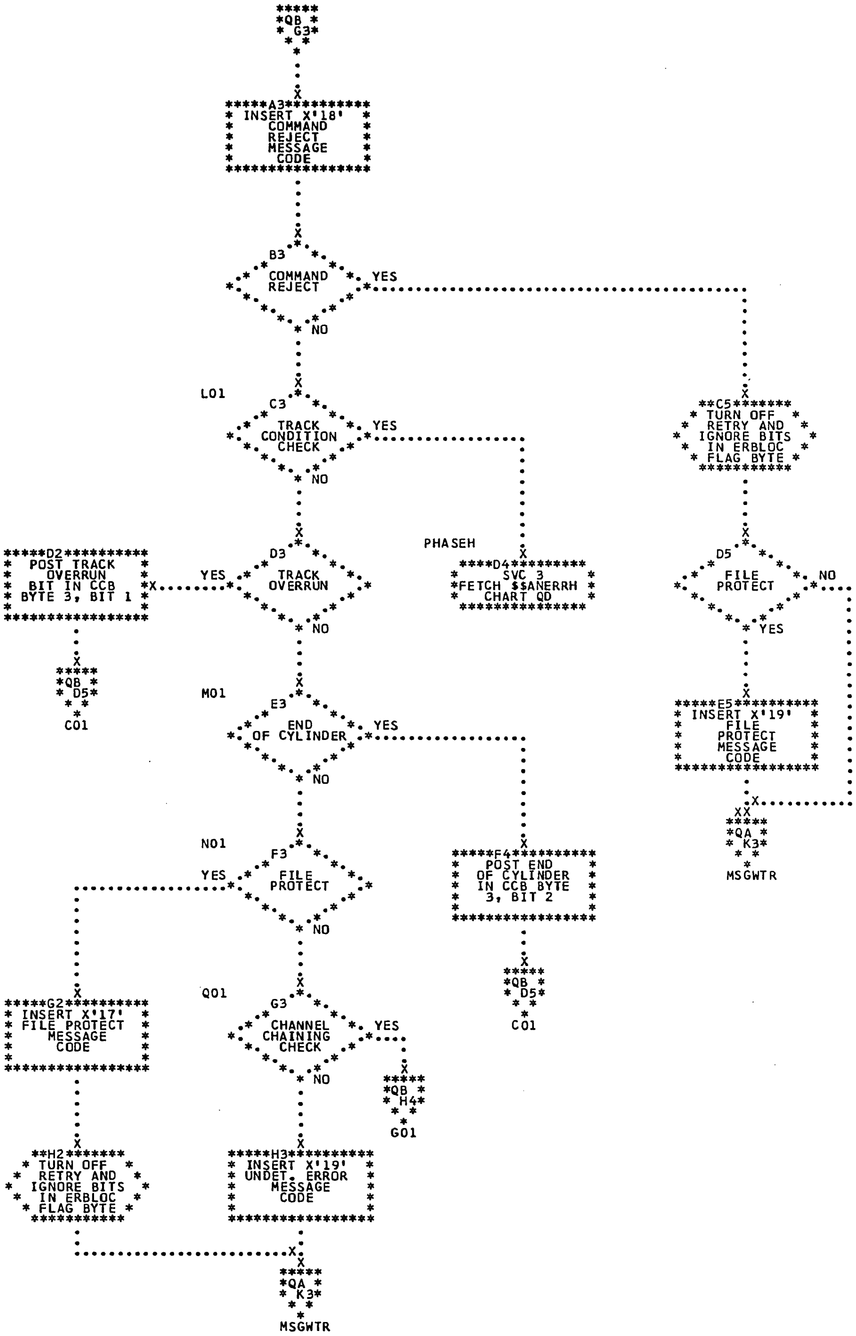


Chart QD. $$ANERRH - Phase 2 of Data Cell ERP
Refer to Chart 11.

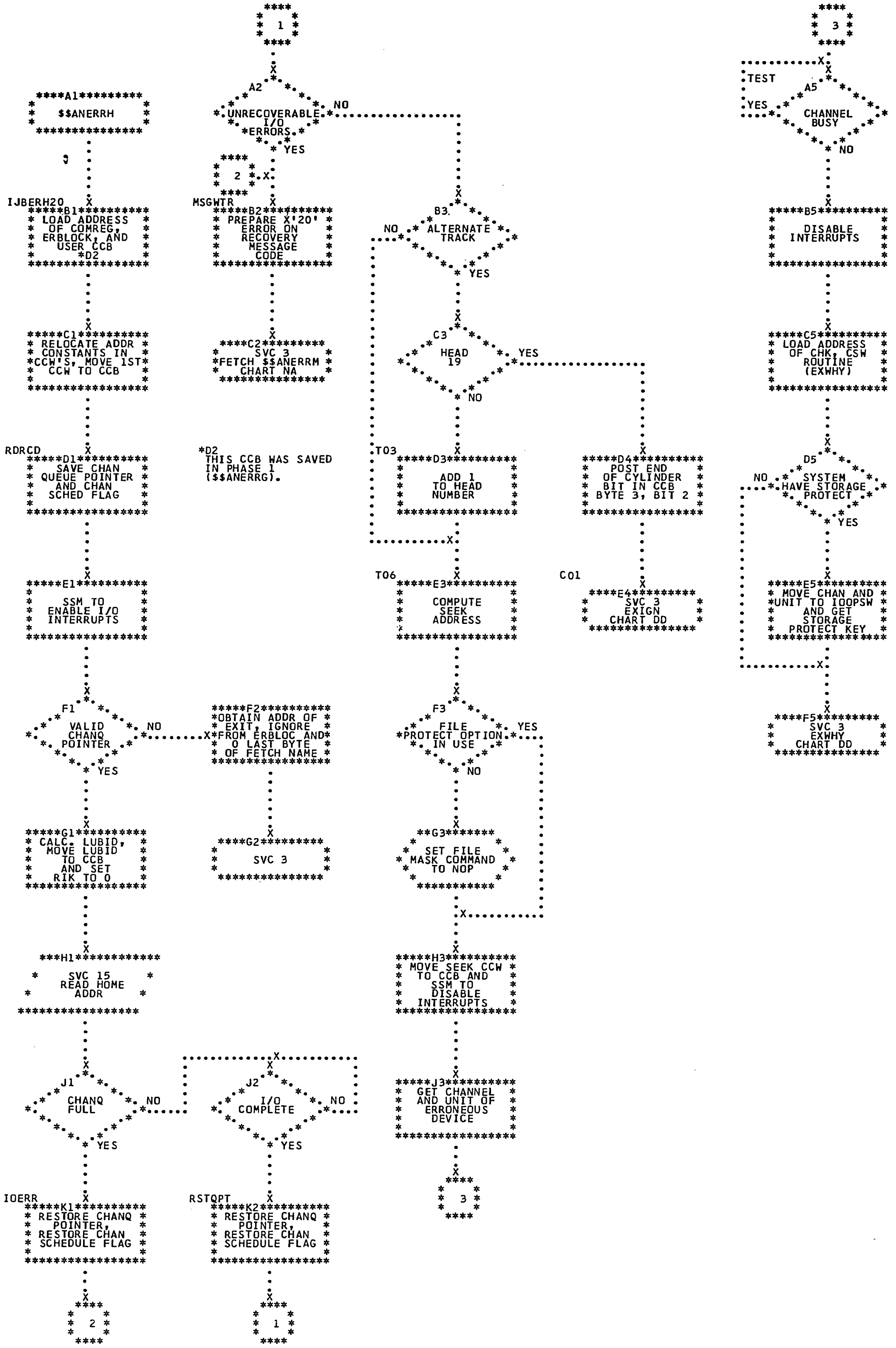


Chart QE. $$ANERRI - Phase 3 of Data Cell ERP
Refer to Chart 11.

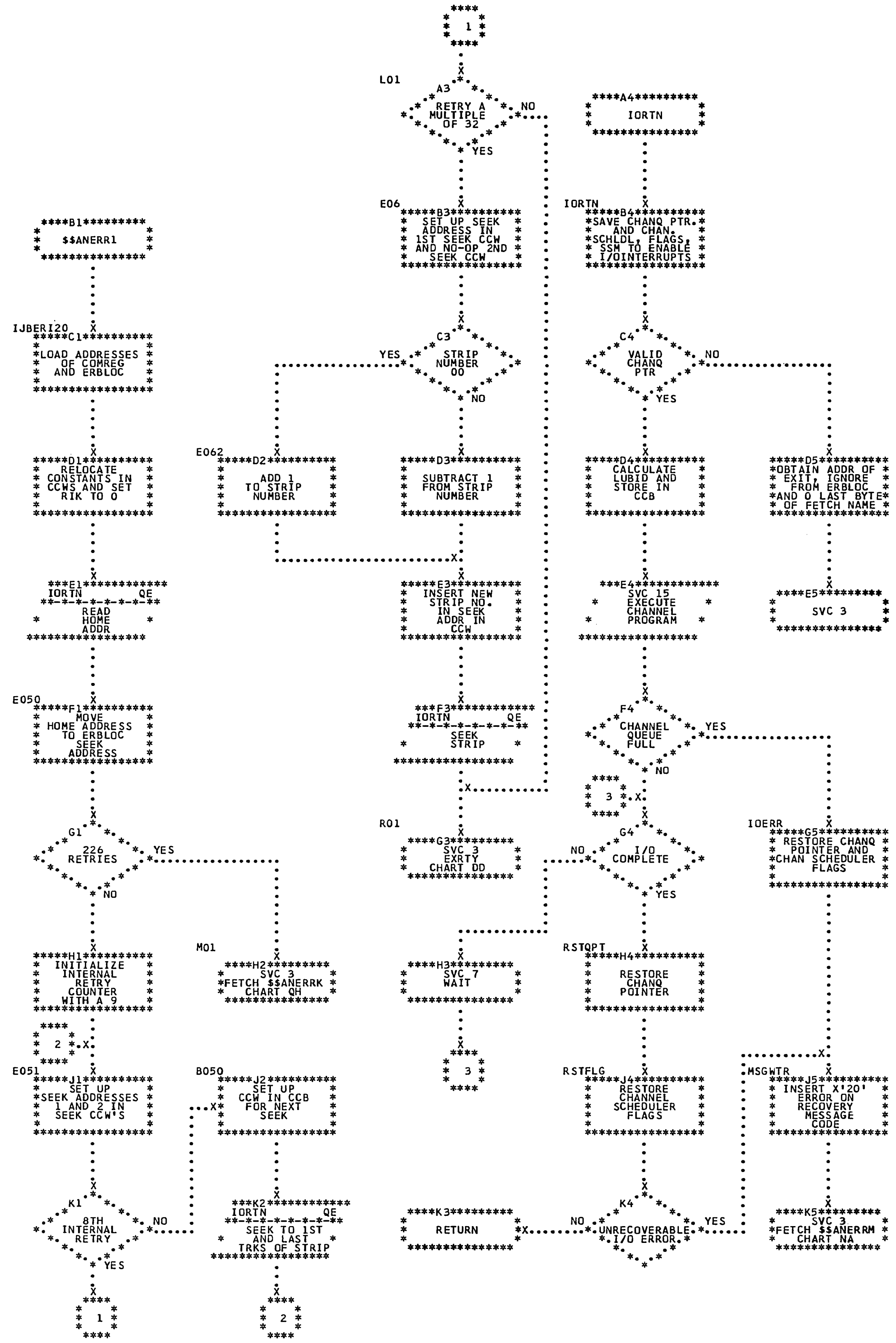


Chart QF. $$ANERRJ - Phase 4 of Data Cell ERP (Part 1 of 2)
Refer to Chart 11.

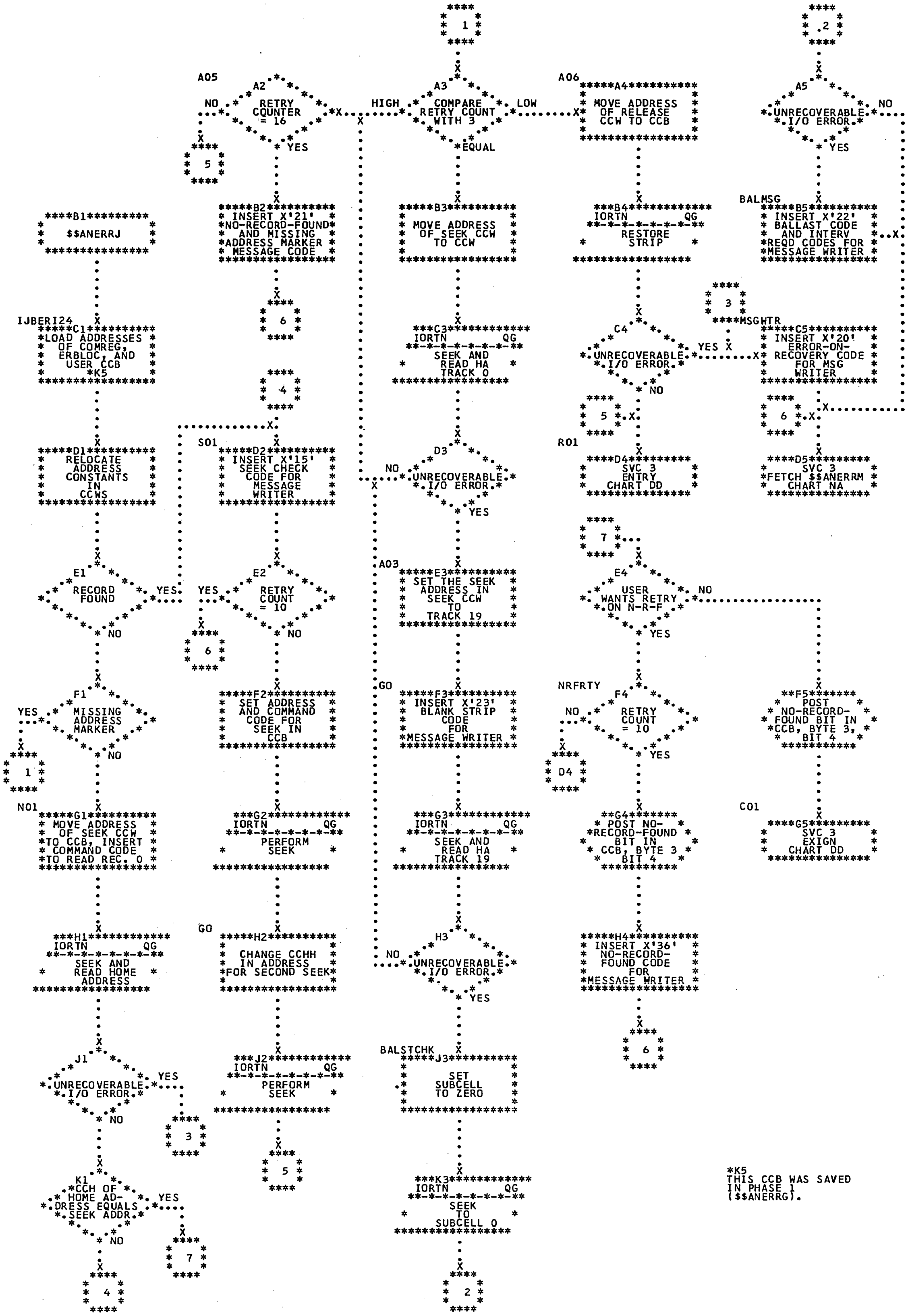


Chart QG. $$ANERRJ - Phase 4 of Data Cell ERP (Part 2 of 2)
Refer to Chart 11.

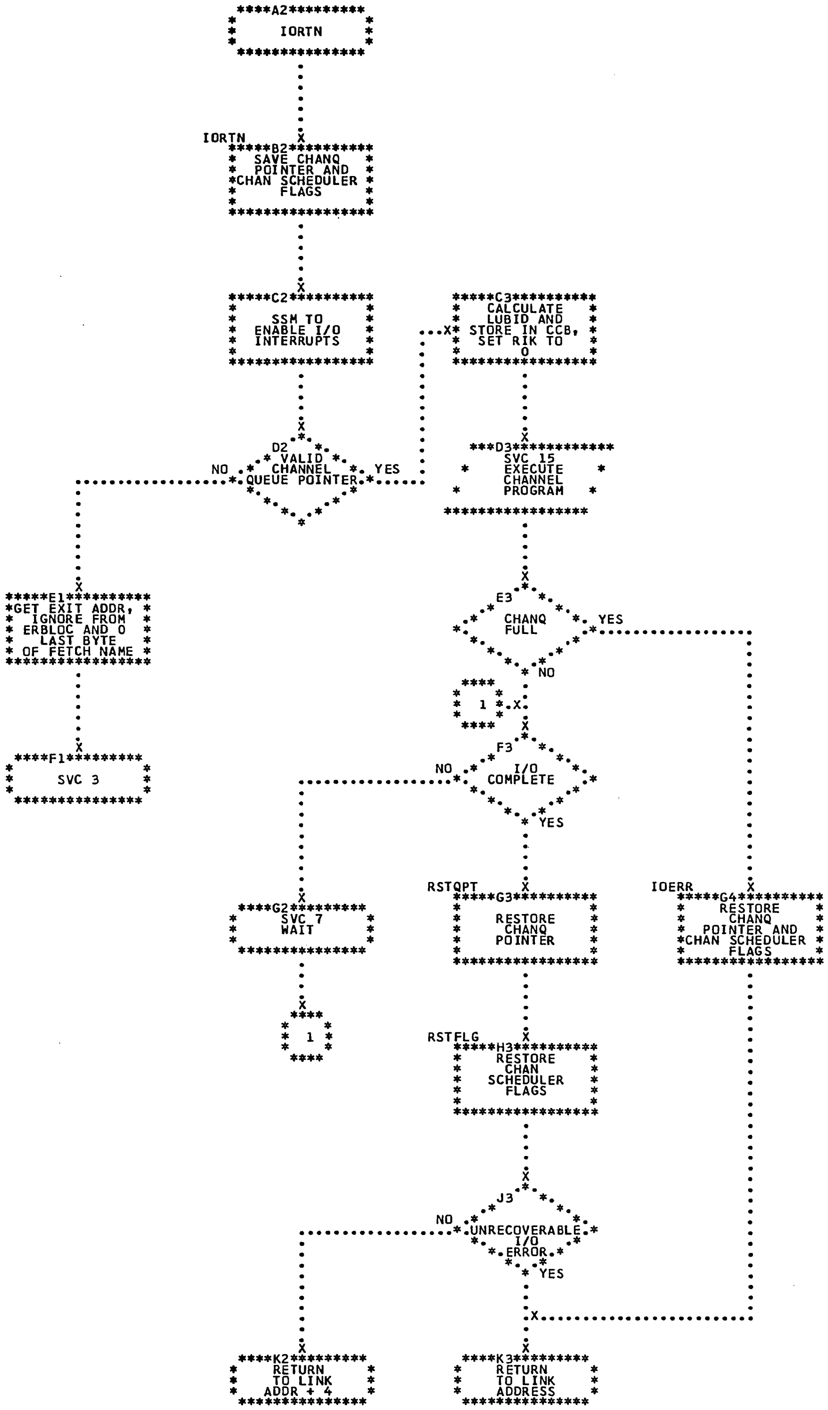


Chart QH. $$ANERRK - Phase 5 of Data Cell ERP
Refer to Chart 11.

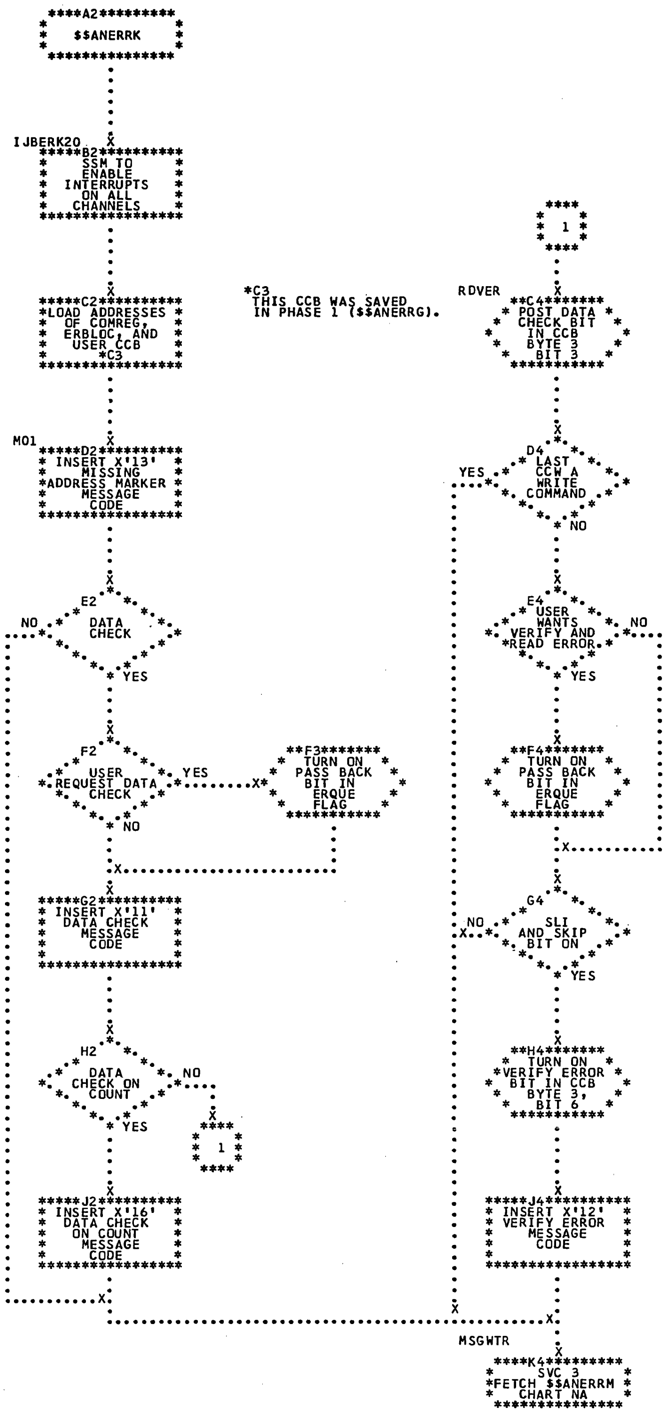


Chart RL. $$ANERRS - Phase 7 of ERP Message Writer (Part 2 of 2) Refer to Chart 14.

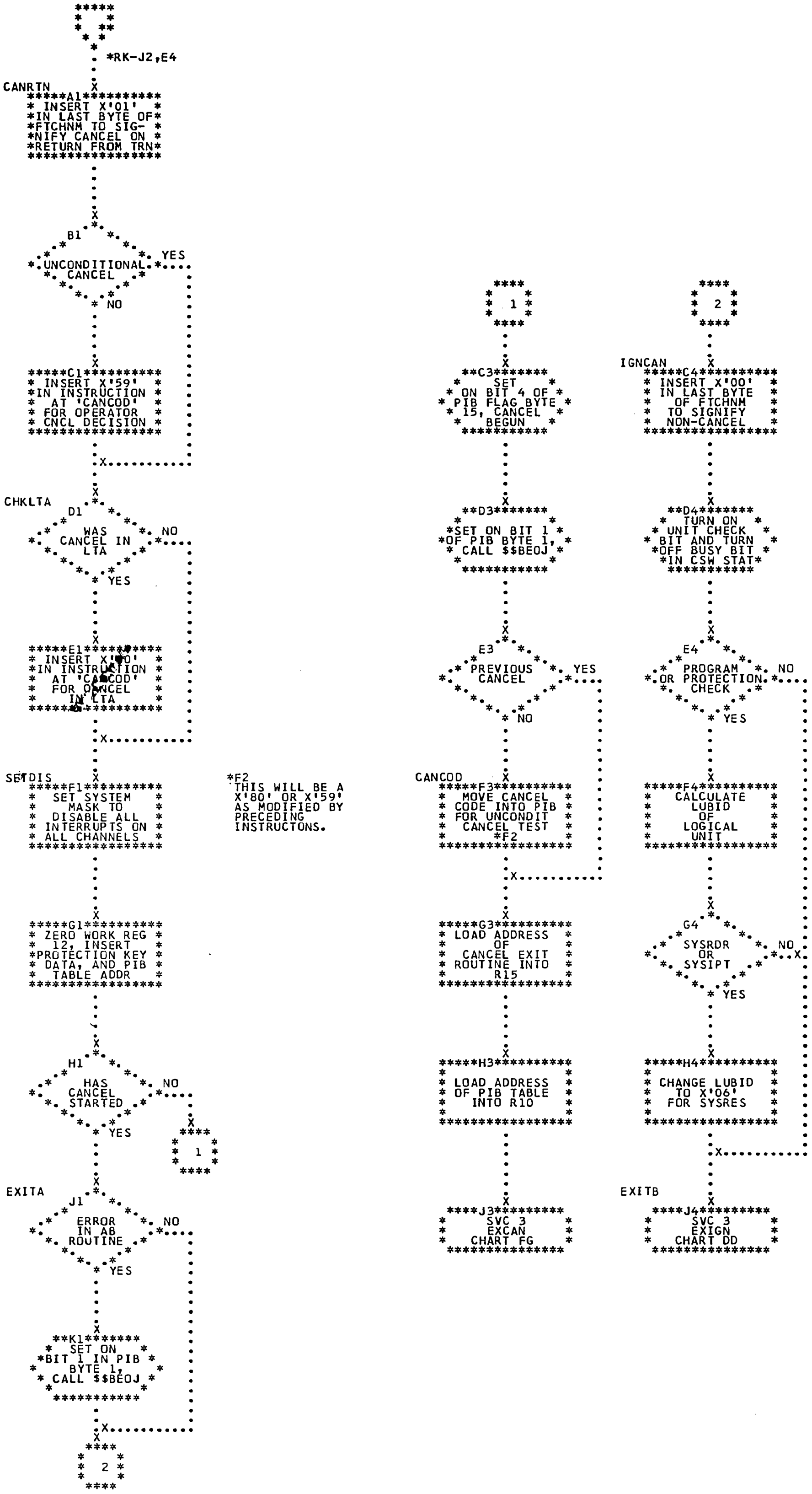


Chart SA. $$ANERRT - MICR (1412/1419) ERP
Refer to Chart 12.

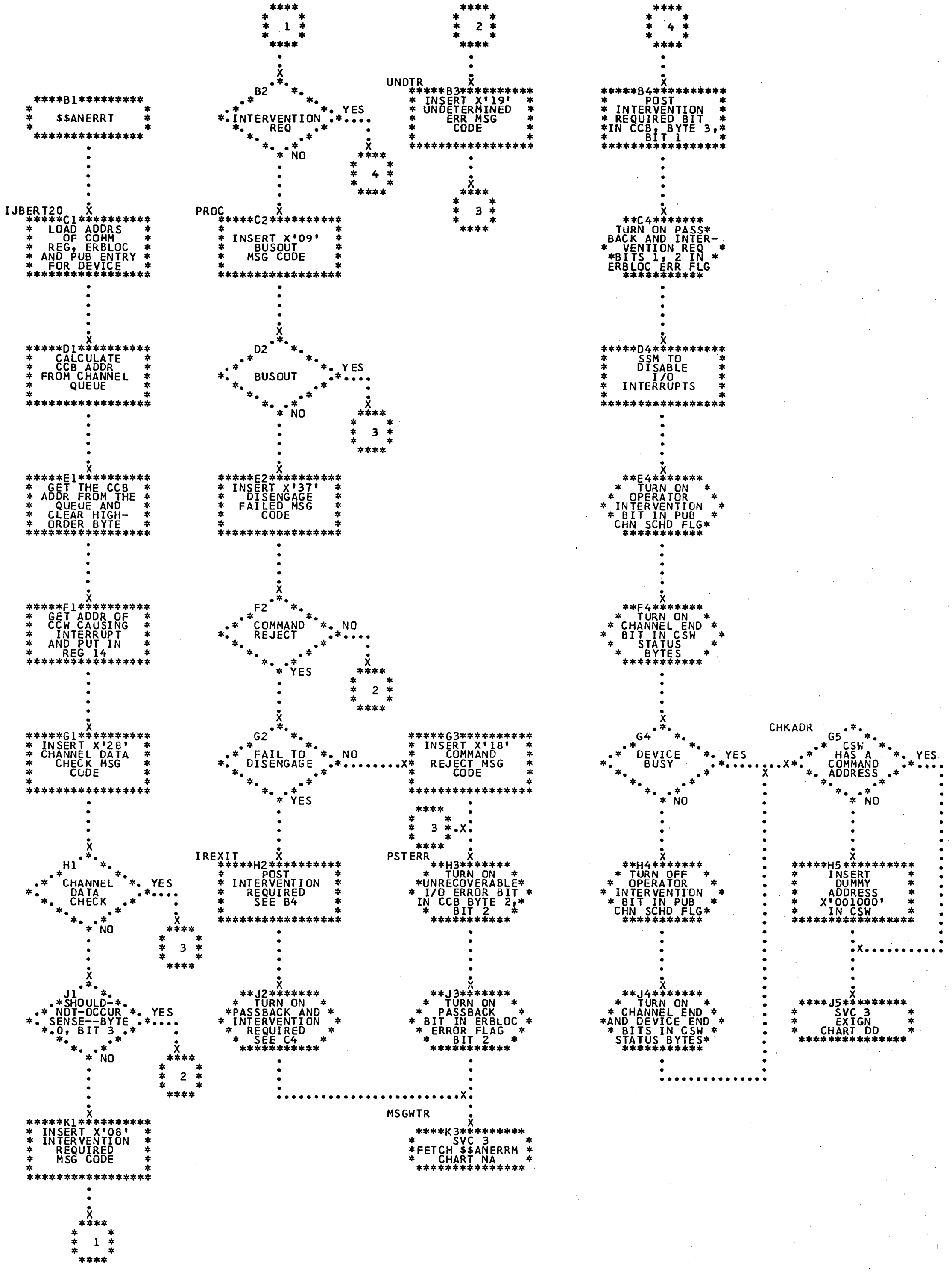


Chart SF. $$ANERRW - MICR (1419D) ERP (Part 1 of 3)
Refer to Chart 12.

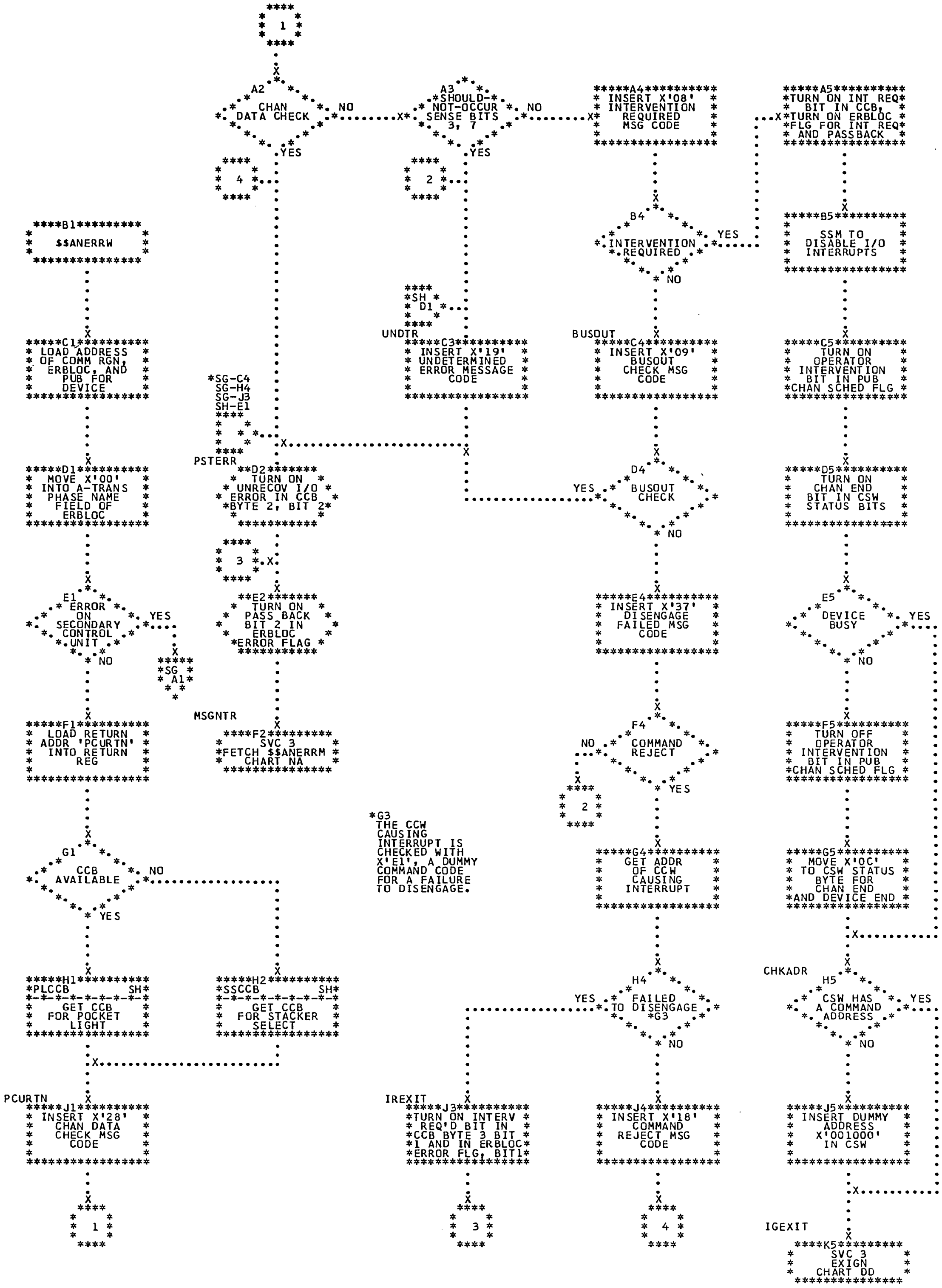


Chart SG. $$ANERRW - MICR (1419D) ERP (Part 2 of 3)
Refer to Chart 12.

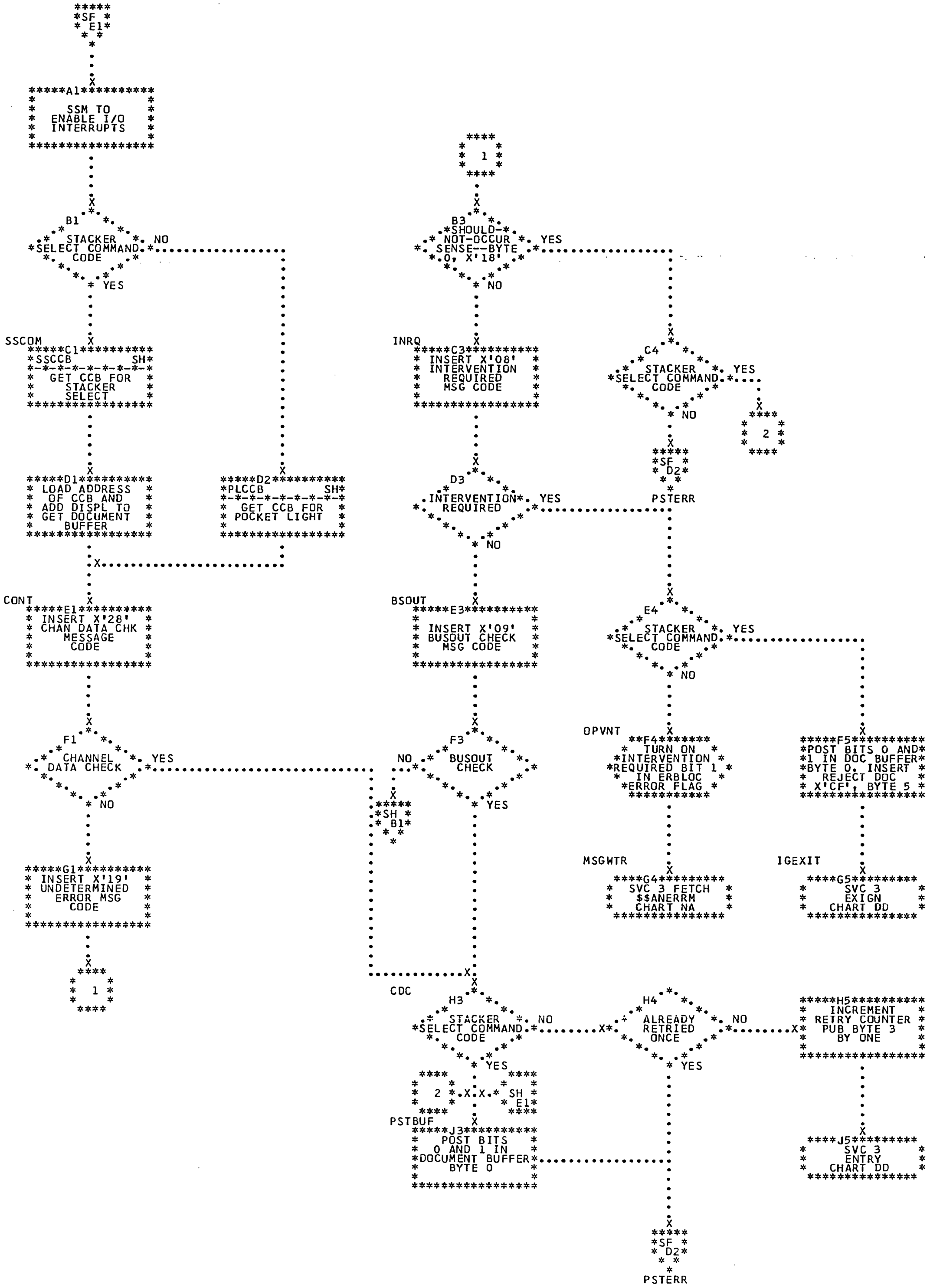
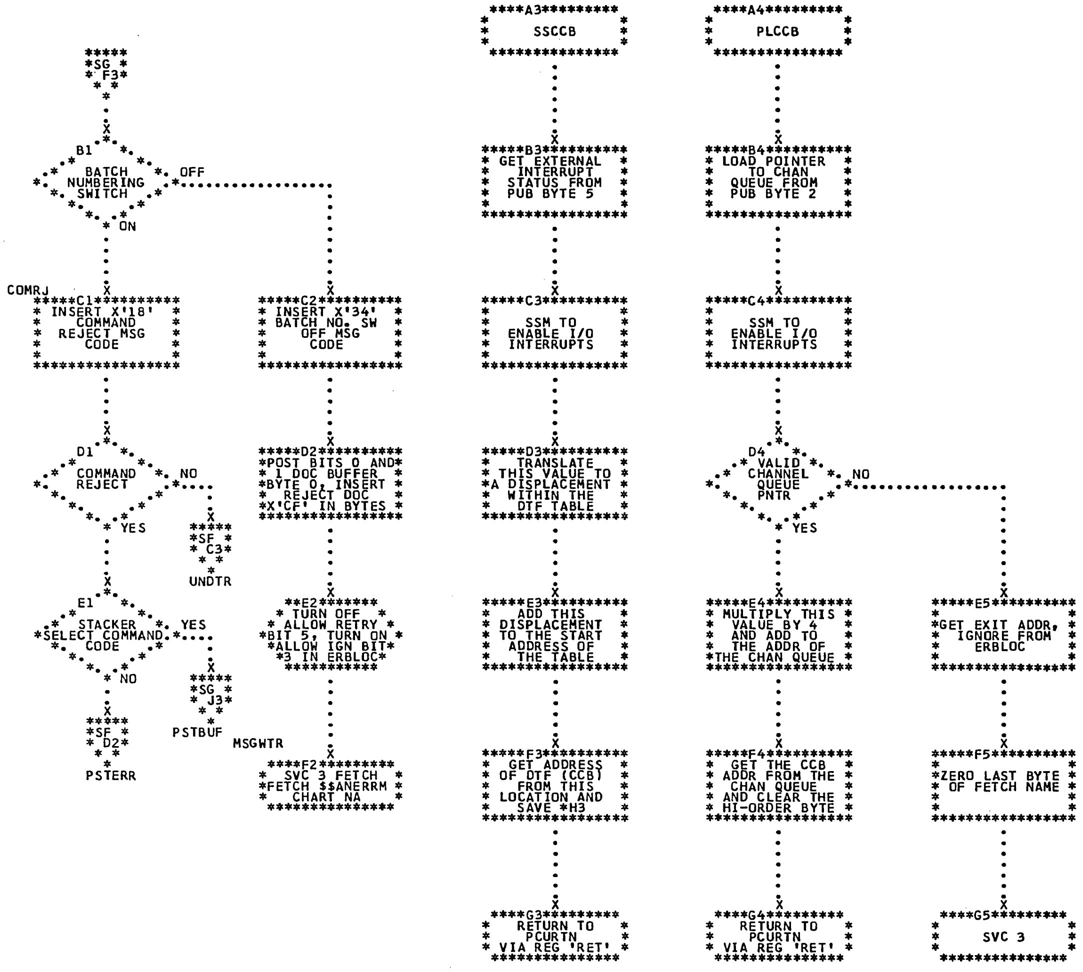


Chart SH. $$ANERRW - MICR (1419D) ERP (Part 3 of 3)
Refer to Chart 12.



*H3
FIRST 16 BYTES
OF DTF CONTAIN
THE CCB.

Chart SJ. $$ANERRX - 2671 Paper Tape ERP (Part 1 of 2)
Refer to Chart 12.

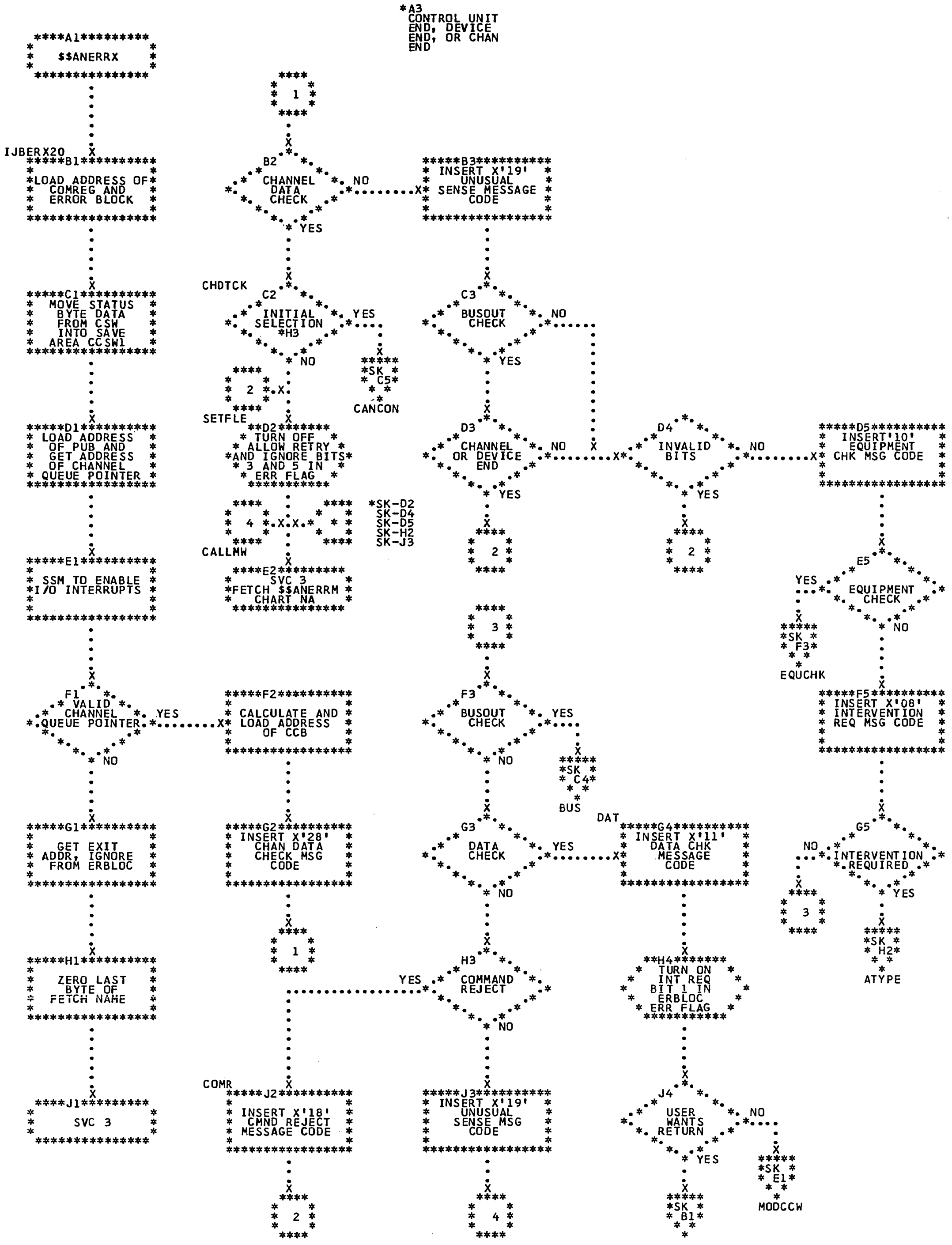


Chart UA. $$ANERR9 - Optical Reader ERP (Part 1 of 2)
Refer to Chart 11.

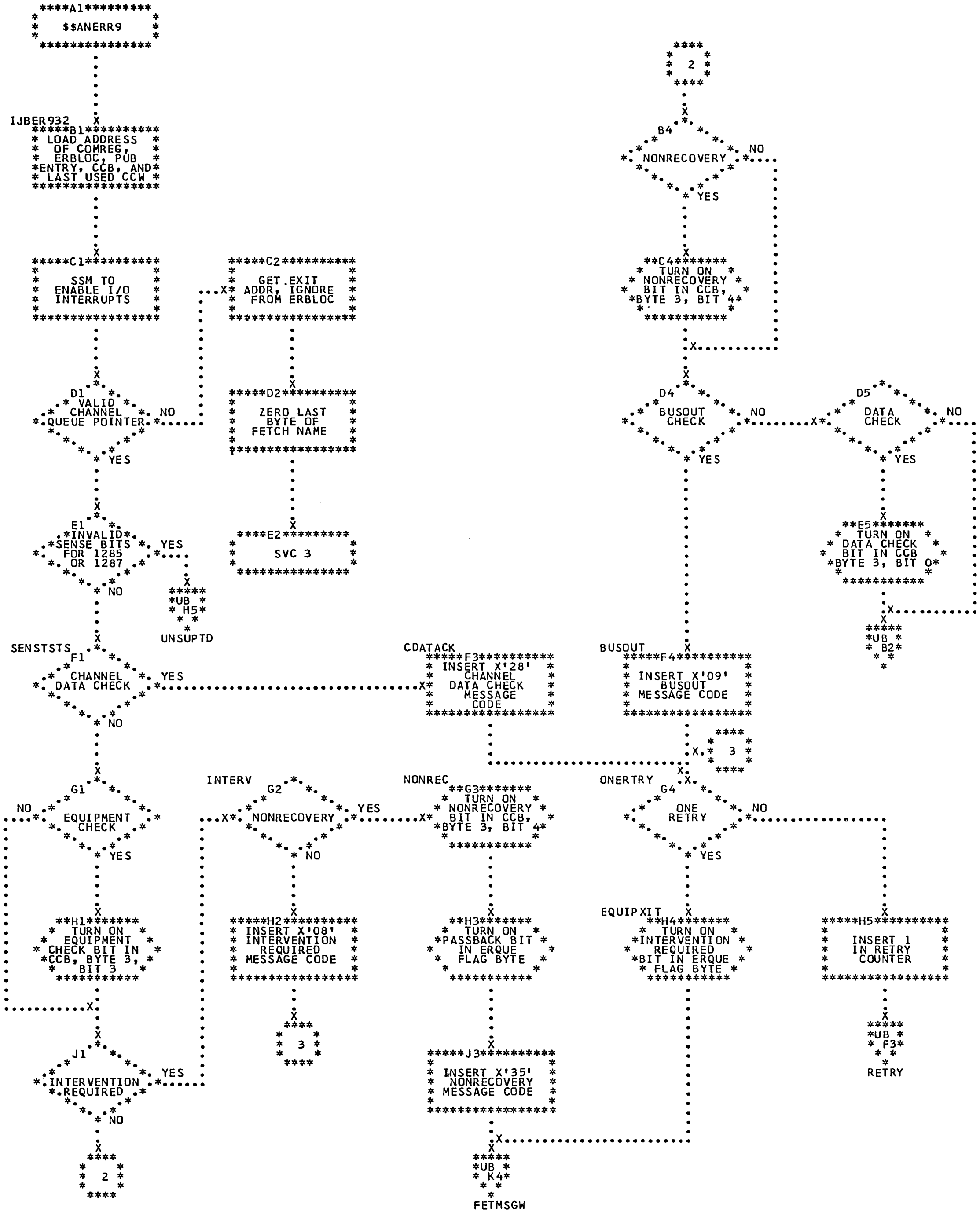


Chart UB. $$ANERR9 - Optical Reader ERP (Part 2 of 2)
Refer to Chart 11.

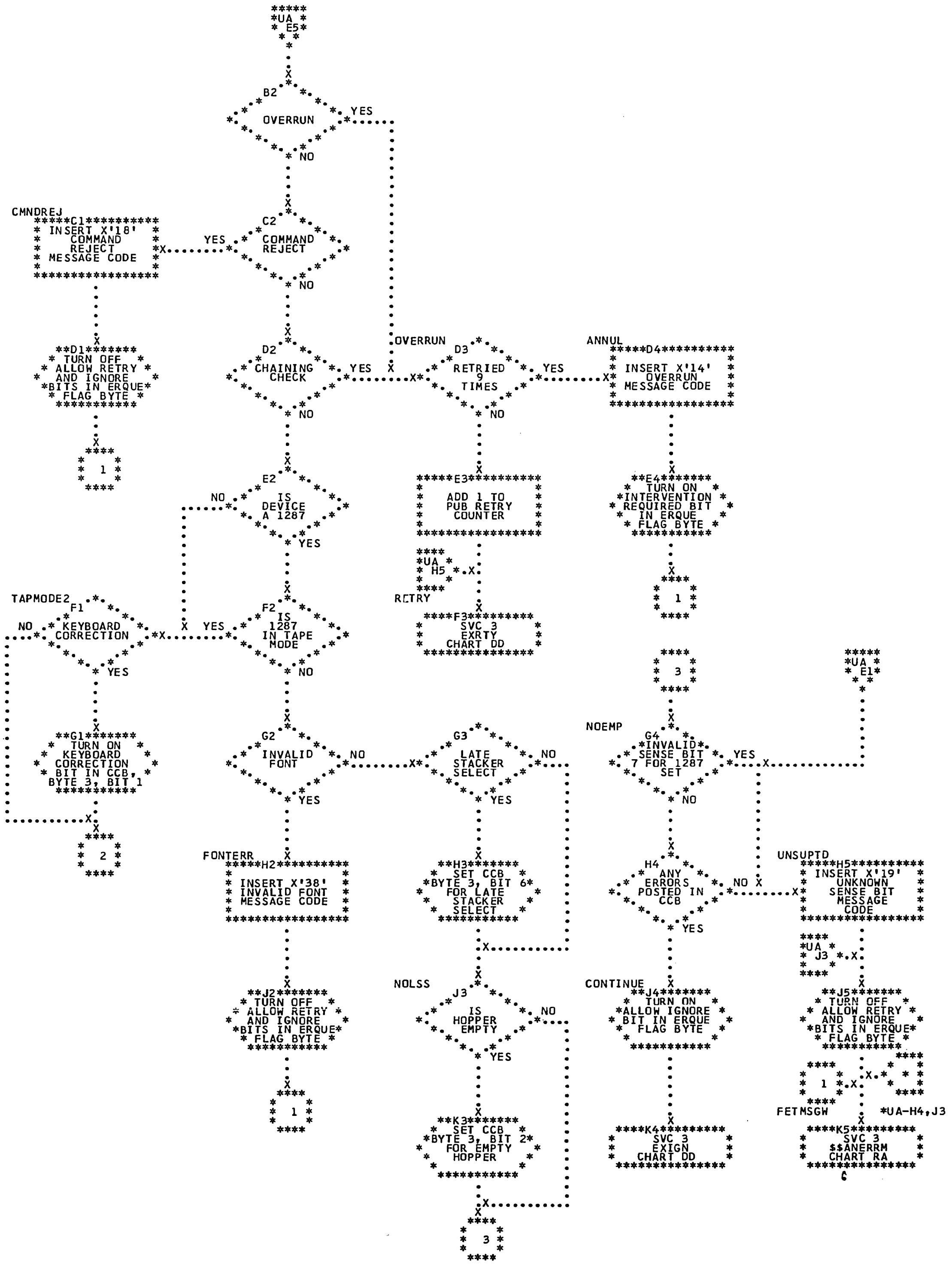


Chart UC. $$ANERR6 - Phase 1 of 2495 ERP (Part 1 of 2)
Refer to Chart 11.

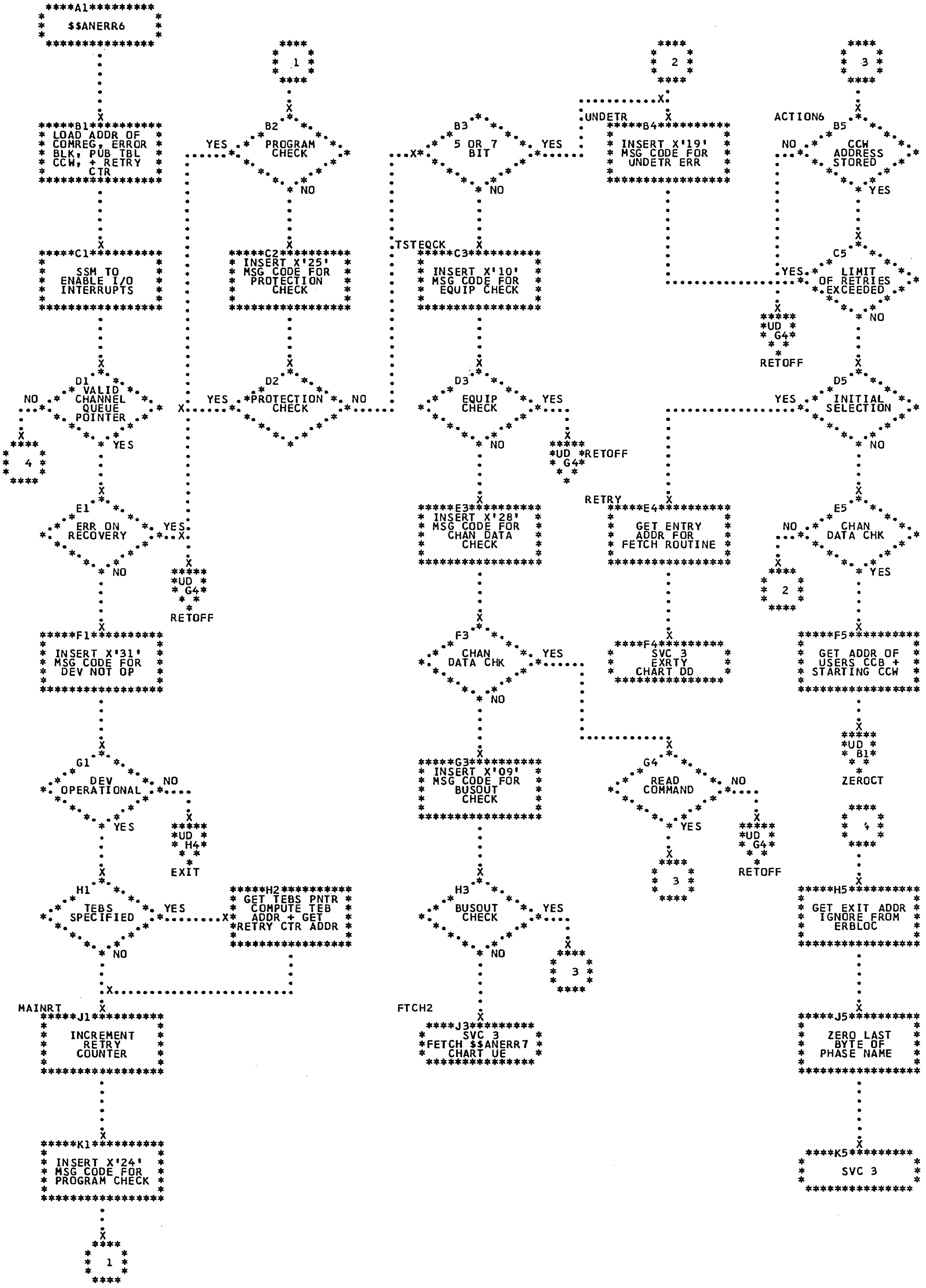


Chart UD. $$ANERR6 - Phase 1 of 2495 ERP (Part 2 of 2)
Refer to Chart 11.

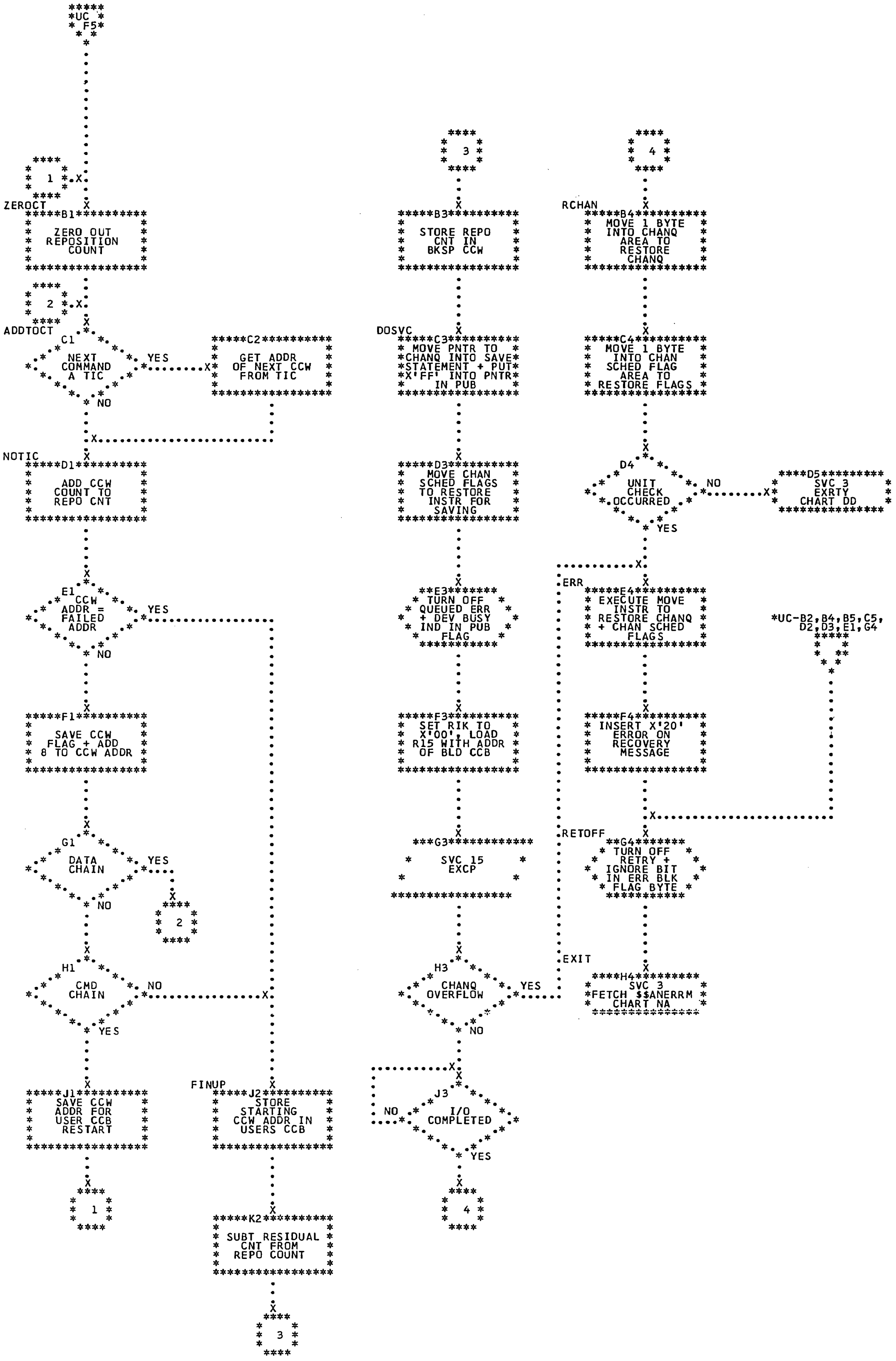


Chart UE. $$ANERR7 - Phase 2 of 2495 ERP
Refer to Chart 11.

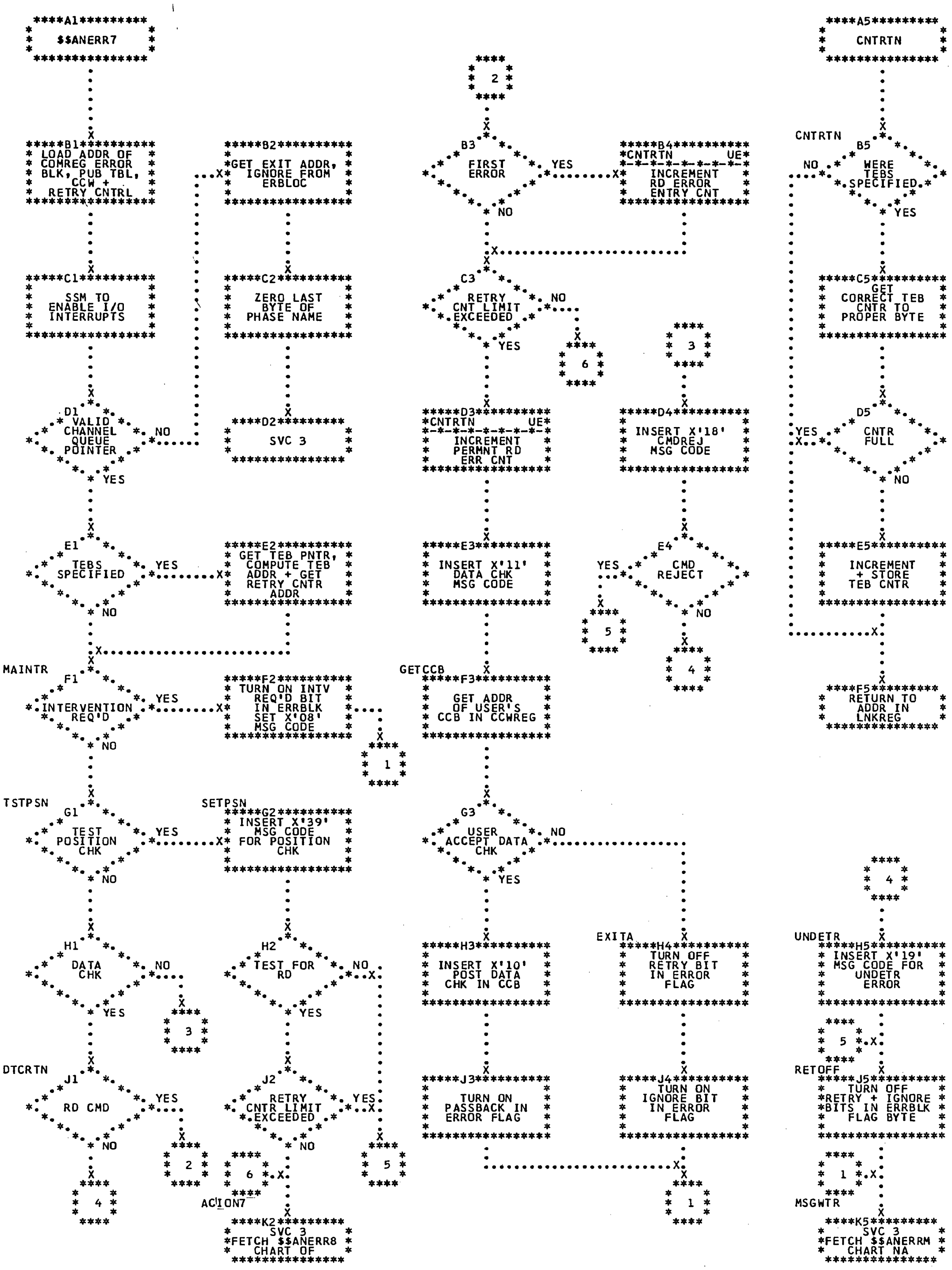


Chart UF. $$ANERR8 - Phase 3 of 2495 ERP
Refer to Chart 11.

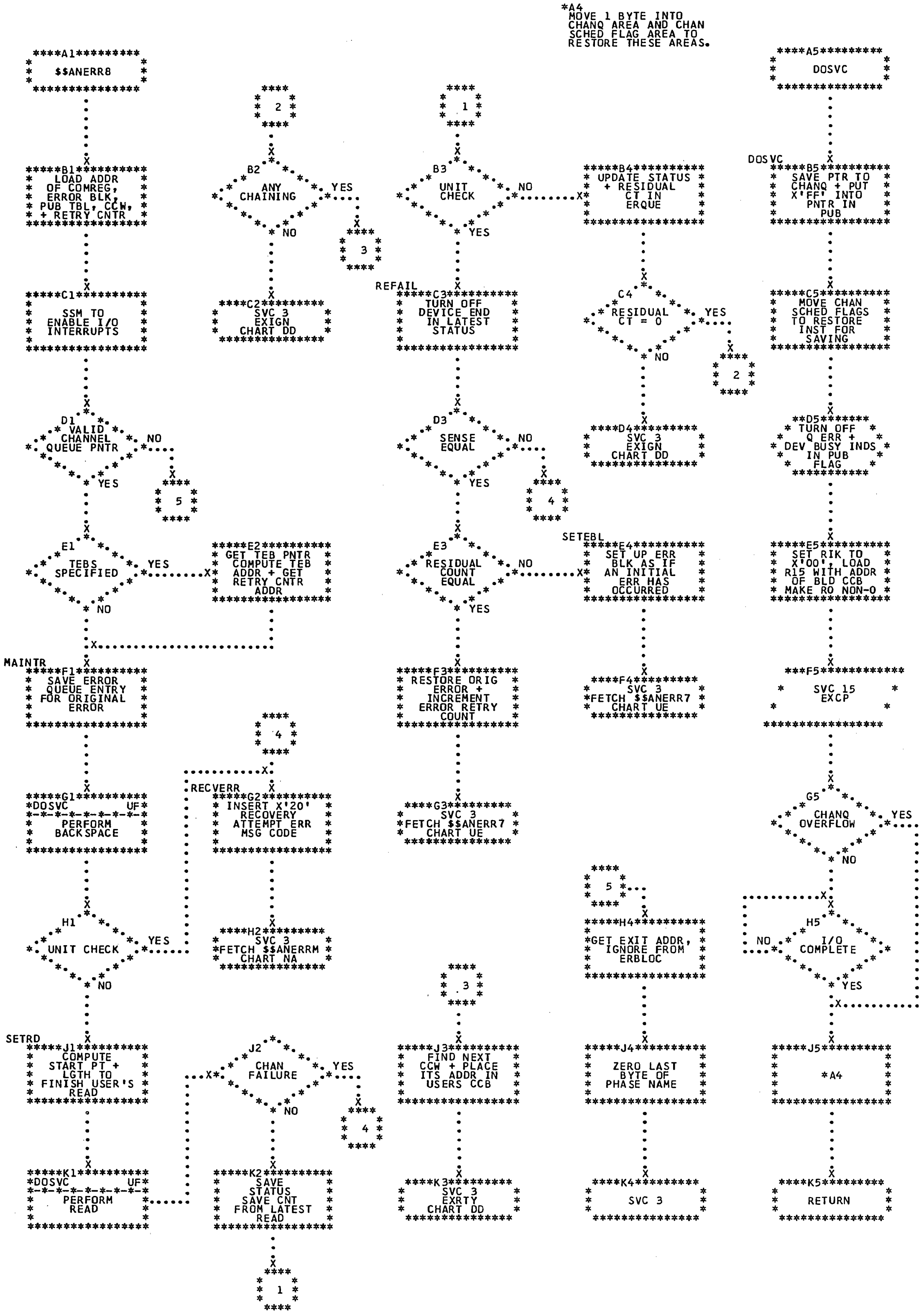


Chart UG. $$ANERAI - Phase 1 of 1017/1018 Paper Tape ERP
Refer to Chart 12.

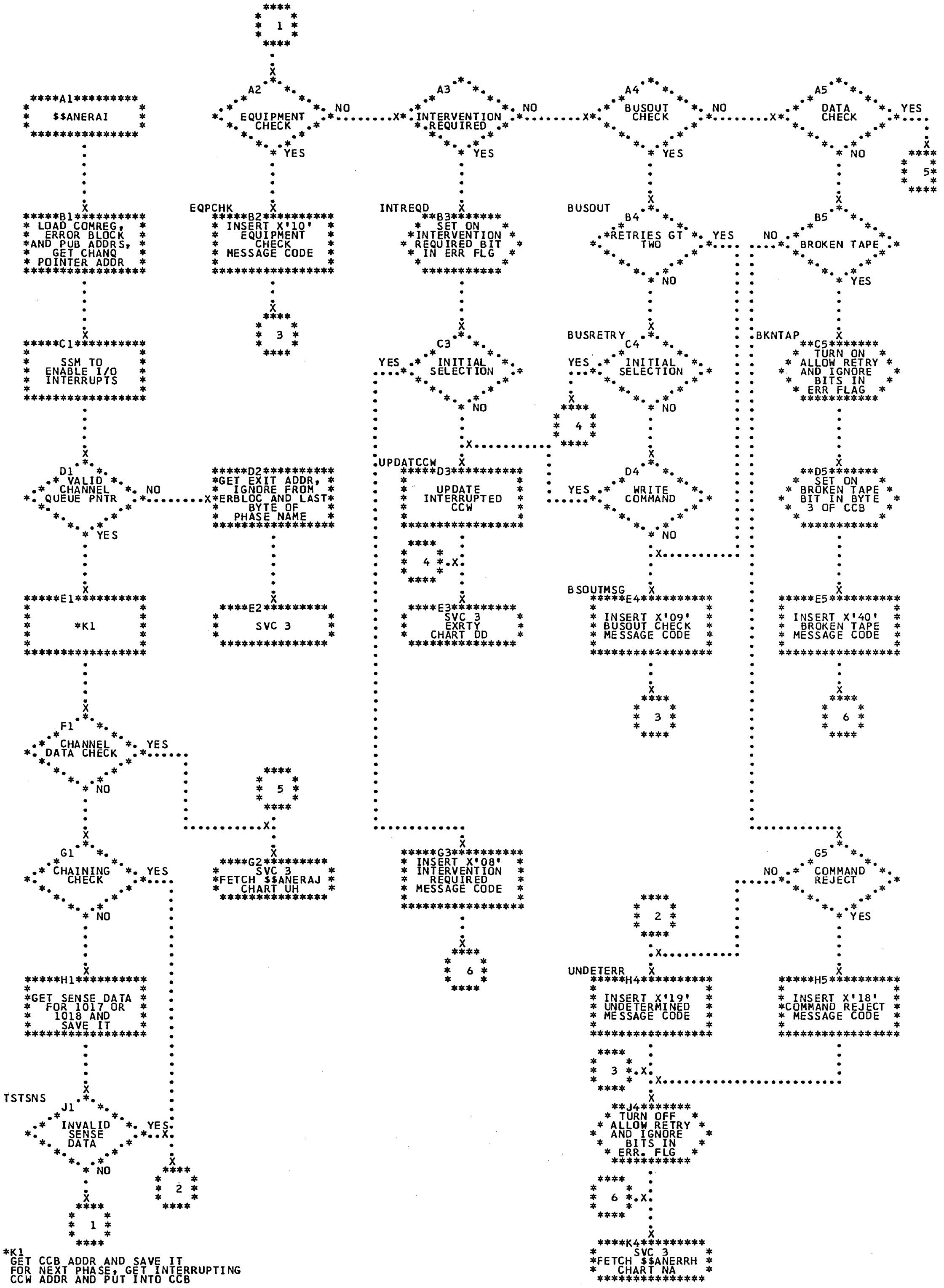


Chart UH. $$ANERAJ - Phase 2 of 1017/1018 Paper Tape ERP (Part 1 of 2)
Refer to Chart 12.

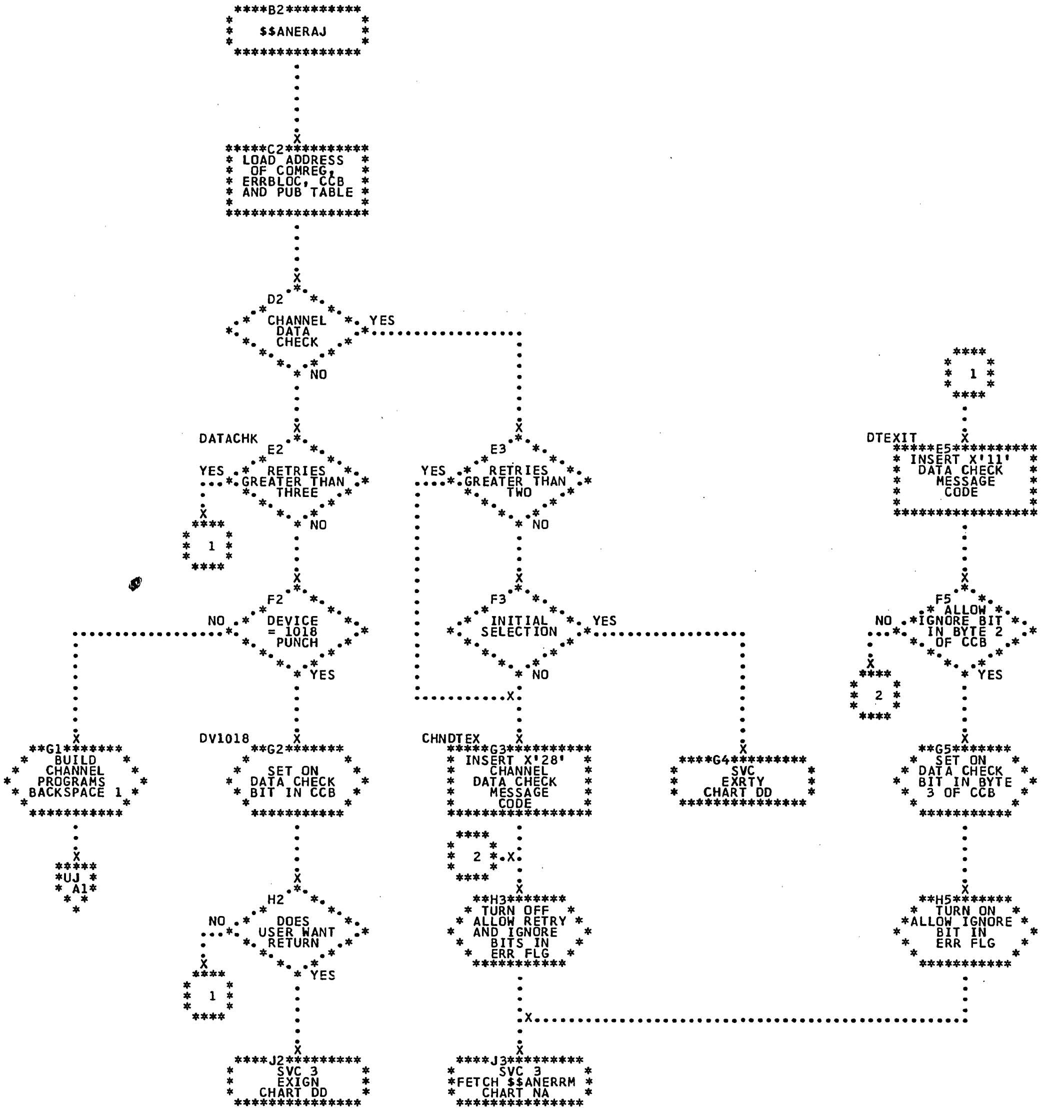


Chart UJ. $$ANERAJ - Phase 2 of 1017/1018 Paper Tape ERP (Part 2 of 2)
Refer to Chart 12.

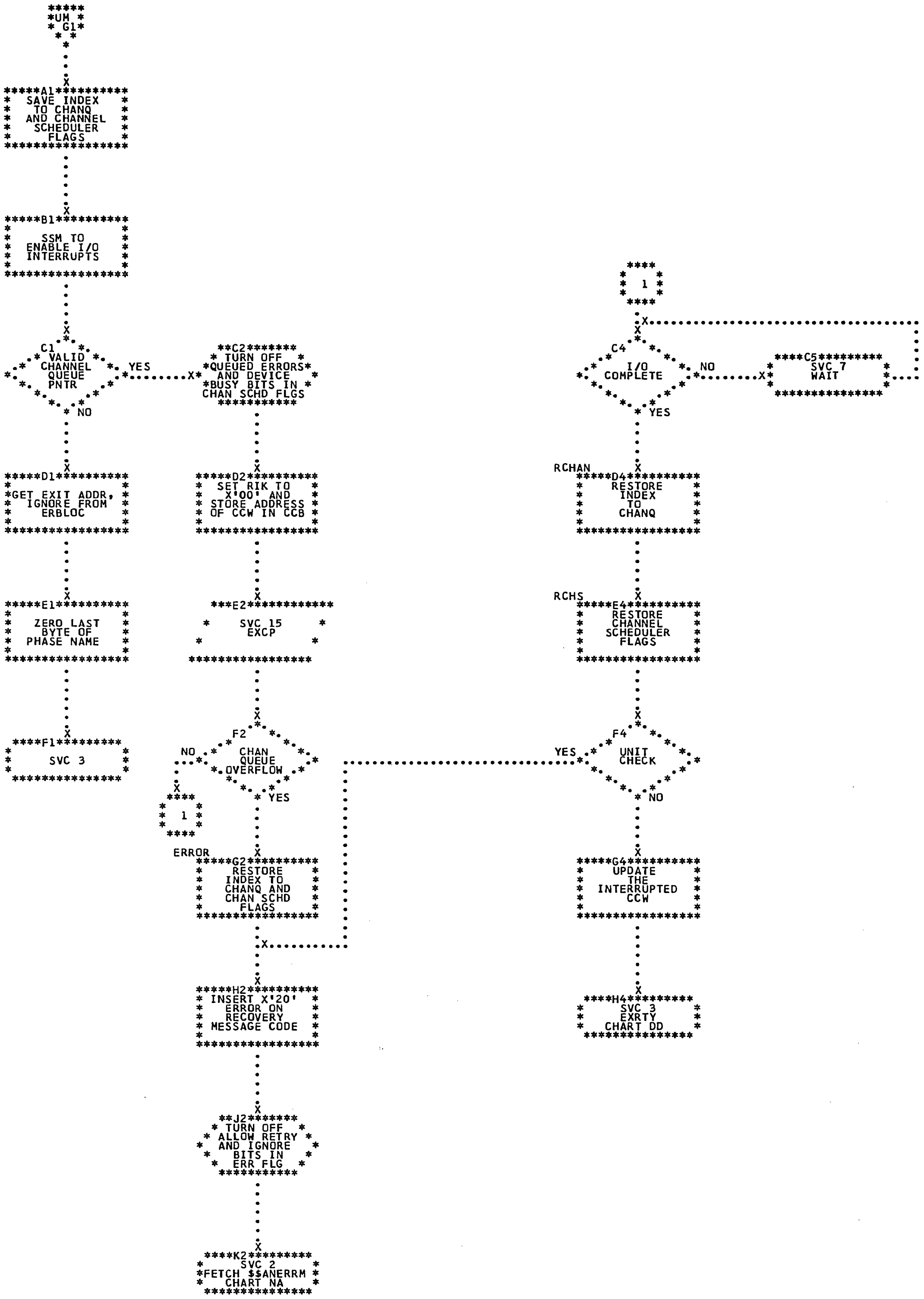
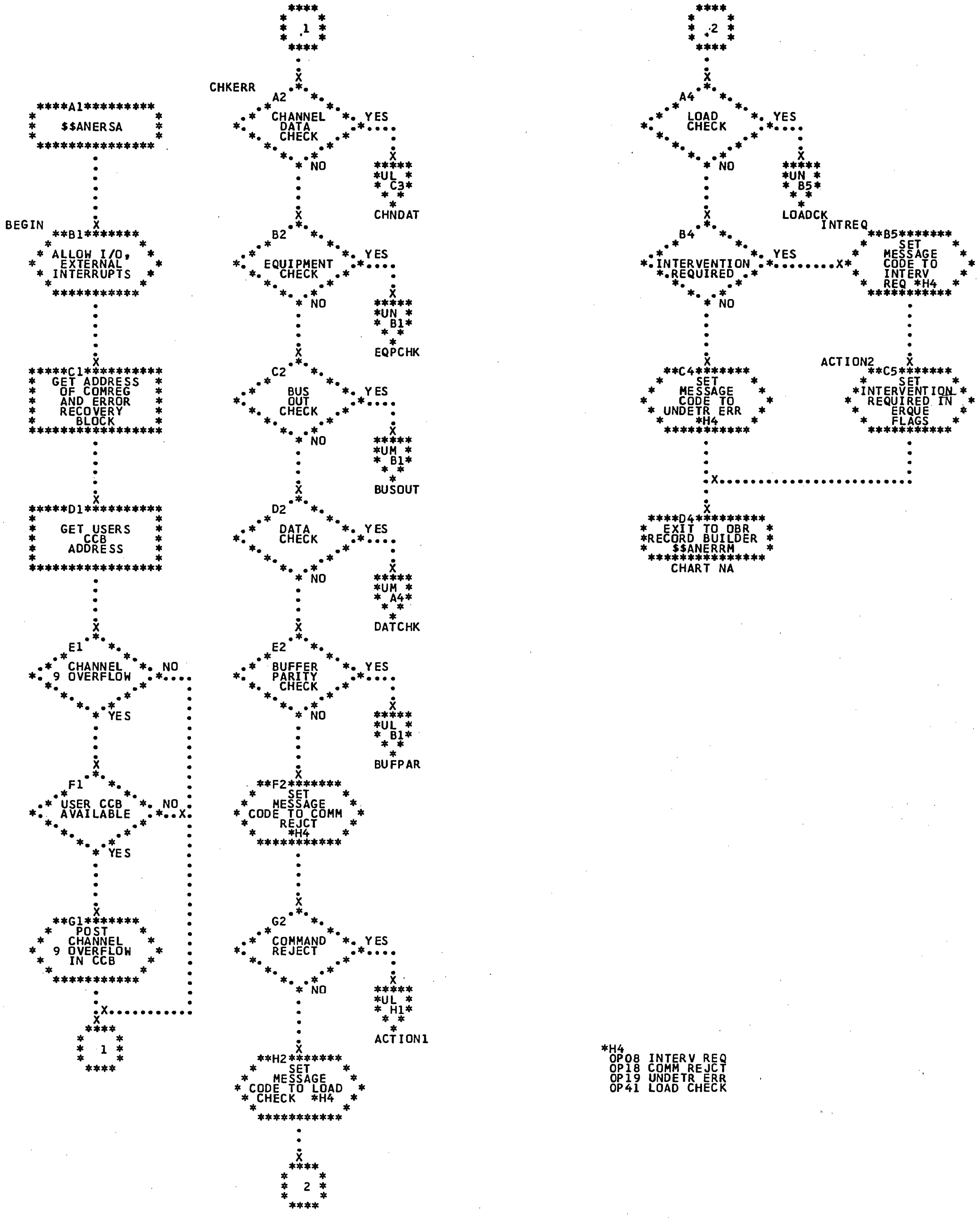


Chart UK. $$ANERSA - 3211 Printer ERP (Phase 1) (Part 1 of 4)
Refer to Chart 12.



*H4
OP08 INTERV REQ
OP18 COMM REJCT
OP19 UNDETR ERR
OP41 LOAD CHECK

APPENDIX A: LABEL LIST

Label	Phase or Macro	Chart
AACT	$$ANERRU	SC
AACTION	$$ANERRP	RF
ABTRANS	SGDFCH	EC
ACTIONA	$$ANERRP	RE
ACTION1	$$ANERSA	UL
ACTION1C	$$RAST04	XB
ACTION1C	$$RAST05	XF
ACTION2	$$ANERSA	UK
ACTION3	$$ANERSA	UM
ACTION3	$$RAST04	XB
ACTION3	$$RAST05	XF
ACTION4	$$ANERSA	UN
ACTION4	$$RAST04	XC
ACTION4	$$RAST05	XF
ACTION4A	$$ANERSA	UM
ACTION4B	$$ANERSA	UN
ACTION5	$$ANERSA	UL
ACTION5	$$RAST04	XB
ACTION5	$$RAST05	XF
ACTION6	$$ANERSA	UL
ACTION6	$$ANERR6	UC
ACTION7	$$ANERSA	UM
ACTION7	$$ANERR7	UE
ACTION7A	$$ANERSA	UM
ACTION7B	$$ANERSA	UL
ACTION8	$$ANERSA	UM
ACTION8A	$$ANERSA	UM
ACTNRTN	$$RAST10	XL
ADDTOCT	$$ANERR6	UD
AFTTIO	SGUNCK	DF
ALLBND	FOPT	BCA
ALLBND1	FOPT	BCA
ANNUL	$$ANERR9	UB
APTEST	$$ANERAE	RC
ARETURN	$$RAST04	XB
ARETURN	$$RAST05	XF
ARND1	$$ANERRU	SC
ASCEND	$$RAST09	XJB
ATNCNL	SGSVC	FG
ATNRTN	SGTCON	GD
ATYPE	$$ANERRV	SE
ATYPE	$$ANERRX	SK
ATYPE	$$ANERRN	RB
A01	$$ANERRG	QA
A02	$$ANERRG	QA
A03	$$ANERRJ	QF
A05	$$ANERRJ	QF
A06	$$ANERRJ	QF
A2321	SGTCHS	CH
BALMSG	$$ANERRJ	QF
BALSTCHK	$$ANERRJ	QF
BEGIN	$$ANERSA	UK
BEGIN	$$ANERSA	UP
BEGIN	$$ANERSA	UQ
BEGIN	$$RAST04	XA
BEGIN	$$RAST05	XE
BGBAD	$$RAST09	XJA
BJFTST	$$ANERR1	TG
BKNTAP	$$ANERAI	UG
BLDERPIB	$$RAST00	VD
BLDLAST	$$RAST01	VK
BLDREC	$$RAST01	VF
BLDREC	$$RAST02	WC
BLDREC1	$$RAST02	WC
BSOUT	$$ANERRW	SG
BSOUTMSG	$$ANERAI	UG
BSTTST	SGUNCK	DA
BTAM	$$ANERRC	NM
BUFPAR	$$ANERSA	UL
BUS	$$ANERRX	SK
BUSOUT	$$ANERRA	NLA
BUSOUT	$$ANERRV	SE
BUSOUT	$$ANERRW	SF
BUSOUT	$$ANERR9	UA
BUSOUT	$$ANERAI	UG
BUSOUT	$$ANERSA	UM
BUSRETRY	$$ANERAI	UG
BUS1	$$ANERRV	SE
BUS2	$$ANERRV	SE
BYCNL	$$ANERRZ	TD
BY1	$$ANERRM	NB
BZYTEST	$$RAST00	VE
B01	$$ANERRG	QA
B02	$$ANERRG	QA
CALFET	SGSVC	FF
CALLMW	$$ANERRX	SJ
CALLRTA	MCRAS	HB
CALLSEC2	$$ANERRZ	TC
CALLSEC3	$$ANERRY	TB
CALL0	MCRAS	HB
CALPH4	$$ANERRO	RD
CALPH5	$$ANERRP	RF
CANALL	SGTHAP	MM
CANCEL	$$ANERR1	TG
CANCEL	$$RAST02	WB
CANCOD	$$ANERRS	RL
CANCON	$$ANERRX	SK
CANJOB	$$RAST10	XM
CANRTN	$$ANERRS	RL
CANTASK	$$RAST10	XK
CANTLP	$$ANERRY	TA
CANXIT	FOPT	BE
CBGOA	SGSVC	FQ
CBMOV	SGSVC	FP
CBNON1	SGTCHS	CCA
CBNON2	SGTCHS	CCA
CBOK	SGSVC	FP
CBRET	SGTCHS	CC
CCBQED	SGUNCK	DB
CCBSTR	$$ANERAB	RA
CCBUNAV	$$ANERAE	RC
CCDADI	MCRAS	HH
CCDAMAGE	MCRAS	HD
CCDASDCK	MCRAS	HH
CCDASDI	MCRAS	HH
CCDASDLT	MCRAS	HH
CCDASDTC	MCRAS	HH

CCDEVTST	MCRAS	HE
CCDEXIT	MCRAS	HD
CCENTRY1	MCRAS	HD
CCENTRY2	MCRAS	HE
CCENTRY3	MCRAS	HE
CCEREXIT	MCRAS	HD
CCEXIT1	MCRAS	HD
CCEXIT1	$$RAST00	VD
CCEXIT2	MCRAS	HE
CCEXIT3	MCRAS	HF
CCEXIT4	MCRAS	HF
CCNOT10	MCRAS	HF
CCRECRTN	$$RAST01	VK
CCRTYTST	MCRAS	HE
CCSETDMC	MCRAS	HD
CCT155	MCRAS	HF
CCWTEST	$$RAST11	XN
CDATACK	$$ANERR9	UA
CDC	$$ANERRW	SG
CEDETST	SGTCHS	CL
CHAINCH	$$ANERRB	NN
CHDTCK	$$ANERRX	SJ
CHECK	$$ANERRA	NL
CHECKLST	$$RAST00	VB
CHECKMC	$$RAST00	VB
CHEND	SGTCHS	CL
CHEND1	SGTCHS	CL
CHFAIL	SGUNCK	DF
CHFAIL1	SGUNCK	DF
CHKACTN	$$RAST10	XM
CHKADR	$$ANERRT	SA
CHKADR	$$ANERRW	SF
CHKADR	$$ANERRS	RK
CHKAM	$$ANERRB	NN
CHKCNT	$$ANERRV	SE
CHKDEV	$$ANERRP	RF
CHKDISK	$$ANERRA	NL
CHKERQ	$$RAST10	XK
CHKERR	$$ANERSA	UK
CHKLTA	$$ANERRS	RL
CHKMPS	$$RAST10	XM
CHKMSG	$$RAST01	VJ
CHKMSG	$$RAST10	XK
CHKOCREC	$$RAST01	VJ
CHKSNS	$$ANERSC	UQ
CHKSN1	$$ANERSC	UQ
CHKTABLE	$$RAST01	VJ
CHNDAT	$$ANERSA	UL
CHNDRT	SGTCHS	CP
CHNDTEX	$$ANERAJ	UH
CHNERROR	SMCRR	KA
CHNOK1	SGTCHS	CK
CHNTST	SGTCHS	CP
CKCHST	SGTCHS	CE
CLBPRG	SGTCHS	CA
CLBPTR	SGTCHS	CAA
CLBSUP	SGTCHS	CAA
CLCEX	SGDFCH	EC
CLCINS	SGTCHS	CH
CLEAR	$$RAST02	WC
CLKDMG	$$RAST03	WJ
CMDCHN	SGUNCK	DA
CMDREJ	$$ANERRV	SE
CMDSEQ	$$ANERRV	SD
CMNDREJ	$$ANERR9	UB
CMR	$$ANERRV	SE
CNCEL	SGTHAP	MK
CNCELL	SGTHAP	MK
CNCEL0	SGTHAP	MK
CNCEL1	SGTHAP	ML
CNCEL1A	SGTHAP	ML
CNCEL1B	SGTHAP	ML
CNCEL2	SGTHAP	MK
CNCEL2AA	SGTHAP	MK
CNCEL3	SGTHAP	ML
CNCEL4	SGTHAP	ML
CNCEL5	SGTHAP	ML
CNCL	FOPT	BE
CNCL	$$ANERRU	SC
CNCLLOOP	$$ANERRZ	TD
CNCLSW	$$ANERRY	TB
CNERPIB	$$RAST02	WB
CNLSVE	FOPT	BA
CNO	$$ANERRU	SB
CNTEXT	$$ANERRP	RE
CNTRTN	$$ANERR7	UE
CNTST	$$ANERRV	SD
CNTST	$$ANERRN	RB
COMBIN	$$ANERRA	NL
COMMENCE	$$ANERAD	NK
COMPCLC	SGTCHS	CA
COMR	$$ANERRX	SJ
COMREJ	$$ANERRB	NN
COMRJ	$$ANERRW	SH
COMRJT	$$ANERAI	UG
CONBUF	SGSVC	FP
CONBUF2	SGSVC	FP
CONT	$$ANERRV	SE
CONT	$$ANERRW	SG
CONTINU	SEND	LA
CONTINU	$$ANERAF	NG
CONTINUE	$$ANERR9	UB
CONTINUE	$$ANERRM	NB
CONTROL	$$RAST03	WF
CORCIN	SGTCHS	CK
CORPUB	SGTCHS	CK
CORPUB	SGTCHS	CK
CORREC	SGTCHS	CJ
COUNT	SGTCHS	CG
COUNTRG	$$ANERRP	RE
COUNTRG	$$ANERRQ	RG
CQDSP	SGTCHS	CR
CSBY2	FOPT	BE
CSCAN	$$RAST04	XA
CSCAN	$$RAST05	XE
CSRST	FOPT	BE
CSWCHK	SGUNCK	DF
CSWLOST	$$RAST00	VD
CUPDATE	$$RAST04	XA
CUPDATE	$$RAST05	XE
CUU	$$ANERRO	RD
CYLEND	SGDSK	GB
C01	$$ANERRG	QB
C01	$$ANERRH	QD
C01	$$ANERRJ	QF
C0100	$$ANERRV	SE
C02	$$ANERRV	SD

DASD	$$RAST02	WA
DASD2311	SGTCHS	CH
DAT	$$ANERRX	SJ
DATAADDR	SGDFCH	EE
DATACHK	$$ANERRB	NN
DATACHK	$$ANERAJ	UH
DATACHK	$$ANERSA	UM
DATACHK1	$$ANERSA	UM
DATCHK	$$ANERRV	SE
DCERP	$$ANERRA	NL
DEALSO	SGTCHS	CQ
DECCTR	$$ANERRQ	RH
DELKOTCK	SGTCHS	CN
DEQUE	SGSVC	FF
DEQUER	SGUNCK	DE
DEQUER1	SGUNCK	DE
DEQUER1A	SGUNCK	DE
DESCEND	$$RAST09	XJA
DETFRE	SGTHAP	MB
DEV2311	$$RAST01	VH
DISWHY	SGTCHS	CK
DMCTEST	$$RAST02	WA
DOSVC	$$ANERR6	UD
DOSVC	$$ANERR8	UF
DOTCH	SGTCHS	CF
DRAPIO	$$RAST09	XJA
DSKTST	SGDSK	GA
DTCH	$$ANERRB	NN
DTCRTN	$$ANERR7	UE
DTEXIT	$$ANERAJ	UH
DV1017	$$ANERAI	UG
DV1018	$$ANERAJ	UH
DYNAMIC	$$RAST09	XJA
DYNREALO	$$RAST09	XJA
EDRDHA	SGDSK	GB
EDRDHA1	SGDSK	GB
EDTIC	SGDSK	GB
EDTIC1	SGDSK	GB
EMGENT	MCRAS	HB
EMGIORTN	$$RAST01	VK
EMGWAIT	MCRAS	HC
END	$$ANERR0	TF
END	$$ANERR1	TG
ENDPUBS1	$$ANERRZ	TC
ENDPUBS3	$$ANERRZ	TD
ENTEXT	FOPT	BG
ENTEXT	SGSVC	FL
ENTIO	FOPT	BF
ENTPCK	FOPT	BA
ENTPCK	SGSVC	FJ
ENTPCK	SGSVC	FK
ENTSVC	FOPT	BH
EPIBSCAN	$$RAST10	XL
EQPCHK	$$ANERRU	SC
EQPCHK	$$ANERRV	SD
EQPCHK	$$ANERAI	UG
EQUCHK	$$ANERRX	SK
EQPCHK	$$ANERSA	UN
EQPCHK1	$$ANERSA	UN
EQUIP	$$ANERRA	NL
EQUIPXIT	$$ANERR9	UA
ERPIBCER	MCRAS	HF
ERPIBCK	$$RAST10	XK
ERPIBFIL	MCRAS	HF
ERPIBLUP	MCRAS	HG
ERPIBLUP	$$RAST00	VD
ERPIBU	$$RAST02	WD
ERPMSG	$$RAST10	XK
ERPUBUPD	MCRAS	HG
ERQSDR	$$ANERAC	NF
ERQUECK	$$RAST10	XK
ERR	$$ANERR6	UD
ERRGO	FOPT	BB
ERROR	$$ANERAJ	UJ
ERRORQED	$$ANERAA	NC
ERRQUED	$$ANERAF	NH
ERRQUED1	$$ANERAG	NJ
ERRSEN	SGUNCK	DB
ERRSET	FOPT	BB
ERRSET	FOPT	BB
ERRSET0	FOPT	BB
ERRSET1	FOPT	BB
ERRSIO	SGUNCK	DF
ERRSIO2	SGUNCK	DF
ERRTYP	$$ANERRP	RE
ERR010	$$ANERRE	PC
ERR010	$$RAST07	XH
ERR015	$$RAST07	XH
ERR020	$$RAST07	XH
ERR030	$$RAST07	XH
ERR040	$$RAST07	XH
ERR050	$$RAST07	XH
ERR070	$$RAST07	XJ
ERR080	$$ANERRL	PG
ERR080	$$RAST07	XJ
ERR090	$$ANERRL	PG
ERR090	$$RAST07	XJ
ERR093	$$RAST07	XJ
ERR094	$$ANERRL	PG
ERR095	$$ANERRF	PE
ERR095	$$ANERRL	PG
ERR095	$$ANERAP	PN
ERR095	$$ANERAS	PX
ERR096	$$ANERRL	PG
ERR100	$$ANERRB	NN
ERR102	$$ANERRF	PE
ERR105	$$ANERRB	NN
ERR105	$$ANERRF	PE
ERR105	$$ANERAS	PX
ERR110	$$ANERRD	PA
ERR110	$$ANERRF	PE
ERR110	$$RAST07	XJ
ERR110	$$ANERAS	PX
ERR120	$$ANERRD	PA
ERR120	$$ANERRF	PF
ERR120	$$RAST07	XJ
ERR140	$$ANERRE	PC
ERR145	$$RAST07	XJ
ERR150	$$RAST07	XJ
ERR150	$$ANERAP	PN
ERR150	$$ANERAQ	PQ
ERR152	$$ANERAP	PN
ERR153	$$RAST07	XJ
ERR155	$$ANERAP	PN
ERR160	$$RAST07	XH
ERR170	$$RAST07	XH
ERR175	$$ANERAP	PN
ERR180	$$ANERAP	PN
ERR20	$$ANERRA	NL

ERR200	$$ANERRF	PE
ERR201	$$ANERAQ	PQ
ERR205	$$ANERAQ	PQ
ERR205	$$ANERAL	PU
ERR208	$$ANERRF	PE
ERR210	$$RAST07	XH
ERR210	$$ANERAQ	PQ
ERR215	$$ANERAQ	PQ
ERR220	$$ANERRF	PE
ERR220	$$ANERAQ	PQ
ERR240	$$ANERAM	PJ
ERR250	$$ANERRF	PE
ERR250	$$ANERAQ	PQ
ERR251	$$ANERAQ	PQ
ERR252	$$ANERAQ	PR
ERR255	$$ANERAM	PK
ERR255	$$ANERAQ	PR
ERR260	$$ANERAQ	PR
ERR265	$$ANERRF	PE
ERR265	$$ANERAL	PU
ERR270	$$ANERAL	PU
ERR275	$$ANERAM	PJ
ERR300	$$ANERAK	PS
ERR301	$$ANERRE	PC
ERR305	$$ANERAK	PS
ERR309	$$ANERAK	PS
ERR310	$$ANERAM	PJ
ERR310	$$ANERAK	PS
ERR312	$$ANERAK	PS
ERR314	$$ANERAK	PS
ERR315	$$ANERAM	PJ
ERR318	$$ANERAM	PJ
ERR320	$$ANERAK	PS
ERR325	$$ANERAK	PS
ERR326	$$ANERAK	PS
ERR335	$$ANERRE	PC
ERR340	$$ANERRE	PC
ERR340	$$ANERAN	PM
ERR340	$$ANERAK	PS
ERR341	$$ANERAN	PM
ERR350	$$ANERRE	PC
ERR350	$$ANERRL	PG
ERR350	$$ANERAM	PJ
ERR350	$$ANERAN	PM
ERR350	$$ANERAS	PX
ERR351	$$ANERAK	PS
ERR355	$$ANERRL	PG
ERR355	$$ANERAM	PJ
ERR355	$$ANERAN	PM
ERR360	$$ANERRL	PG
ERR390	$$ANERAP	PN
ERR395	$$ANERRD	PB
ERR396	$$ANERRD	PB
ERR400	$$ANERAS	PX
ERR401	$$ANERAS	PX
ERR402	$$ANERAS	PX
ERR405	$$ANERRD	PA
ERR405	$$ANERAP	PN
ERR406	$$ANERAN	PL
ERR408	$$ANERAN	PL
ERR410	$$ANERAS	PX
ERR412	$$ANERRL	PG
ERR412	$$ANERAN	PL
ERR600	$$ANERRE	PC
ERR600	$$ANERAP	PP
ERR605	$$ANERAP	PP
ERR610	$$ANERAP	PP
ERR640	$$ANERRF	PF
ERR650	$$ANERRE	PC
ERR650	$$ANERRF	PF
ERR650	$$ANERRL	PG
ERR655	$$ANERRL	PG
ERR655	$$ANERAN	PL
ERR658	$$ANERRF	PE
ERR658	$$ANERRL	PG
ERR660	$$ANERRF	PE
ERR660	$$ANERAM	PK
ERR665	$$ANERRF	PE
ERR665	$$ANERAM	PK
ERR695	$$ANERAN	PL
ERR695	$$ANERAQ	PR
ERR695	$$ANERAK	PS
ERR695	$$ANERAL	PU
ERR696	$$ANERAQ	PR
ERR696	$$ANERAK	PT
ERR700	$$ANERRE	PD
ERR700	$$ANERRF	PF
ERR700	$$ANERRL	PH
ERR700	$$ANERAM	PK
ERR700	$$ANERAN	PM
ERR700	$$ANERAP	PP
ERR700	$$ANERAQ	PR
ERR700	$$ANERAK	PT
ERR700	$$ANERAR	PW
ERR700	$$ANERAS	PX
ERR702	$$ANERAR	PW
ERR703	$$ANERRE	PD
ERR703	$$ANERAP	PP
ERR703	$$ANERAQ	PR
ERR703	$$ANERAK	PT
ERR704	$$ANERAR	PW
ERR705	$$ANERRL	PH
ERR705	$$ANERRL	PH
ERR705	$$ANERAM	PK
ERR705	$$ANERAN	PM
ERR705	$$ANERAR	PW
ERR706	$$ANERRE	PD
ERR706	$$ANERAP	PP
ERR707	$$ANERAN	PM
ERR710	$$ANERRE	PD
ERR710	$$ANERRF	PF
ERR710	$$ANERRL	PH
ERR710	$$ANERAM	PK
ERR710	$$ANERAQ	PR
ERR711	$$ANERAP	PP
ERR713	$$ANERAP	PP
ERR715	$$ANERRF	PF
ERR715	$$ANERAR	PW
ERR720	$$ANERRF	PF
ERR720	$$ANERRL	PH
ERR720	$$ANERAM	PK
ERR720	$$ANERAQ	PR
ERR722	$$ANERRE	PC
ERR722	$$ANERRL	PG
ERR755	$$ANERAN	PL
ERR760	$$ANERAQ	PQ
ERR760	$$ANERAK	PS
ERR760	$$ANERAL	PU
ERR805	$$ANERAL	PU
ERR820	$$ANERAL	PV

ERR825	$$ANERAL	PV
ERR840	$$ANERAL	PV
ERR842	$$ANERAL	PV
ERR870	$$ANERAL	PU
ESTVOUT	SGTCHS	CG
ESTVOUT1	SGTCHS	CG
EXCPIGN	SGTCHS	CAA
EXCPIGN	SGTCHS	CB
EXCP10	SGTCHS	CA
EXCP2	SGTCHS	CB
EXCP3	SGTCHS	CC
EXCP5	SGTCHS	CA
EXCP5	SGTCHS	CB
EXCP6P	SGTCHS	CAA
EXCP7	SGTCHS	CA
EXINTR	$$ANERRR	RJ
EXIT	SGTCHS	CG
EXIT	$$ANERRC	NM
EXIT	$$ANERRS	RK
EXIT	$$ANERRZ	TC
EXIT	$$ANERR1	TG
EXIT	$$ANERR6	UD
EXIT	$$RAST02	WD
EXITA	$$ANERRA	NLA
EXITA	$$ANERRS	RL
EXITA	$$ANERR7	UE
EXITAB	$$ANERRB	NN
EXITB	$$ANERRA	NLA
EXITB	$$ANERRS	RL
EXITBB	$$ANERRB	NN
EXITC	$$ANERRA	NLA
EXITRTN	$$RAST09	XJA
EXITRTN	$$RAST10	XL
EXITRTN	$$RAST00	VC
EXITRTN	$$RAST01	VJ
EXITRTN	$$RAST03	WH
EXITRTN	$$RAST11	XN
EXIT1	SGDFCH	EH
EXIT1	$$ANERR0	TF
EXIT1	$$RAST03	WH
EXIT1	$$RAST10	XL
EXIT2	$$ANERR0	TF
EXPAND	SGDFCH	EE
EXTEOJ	FOPT	BE
EXTRAN	SGUNCK	DC
EXTRT1	SGSVC	FJ
EXTRT1	SGSVC	FN
EXT01	FOPT	BD
EXT02	FOPT	BC
EXT03	FOPT	BC
EXT04	FOPT	BD
EXT1	SGSVC	FL
EXT2	SGSVC	FM
E050	$$ANERRI	QE
E051	$$ANERRI	QE
E06	$$ANERRI	QE
E062	$$ANERRI	QE

FCHRT1	SGDFCH	EA
FCHRT2	SGDFCH	EA
FCHRT3	SGDFCH	EA
FCHRT4	SGDFCH	EA
FCH2260L	$$ANERRC	NM
FCH3	SGSVC	FF
FETCH	$$RAST01	VJ
FETCH	$$RAST10	XL
FETMSGW	$$ANERR9	UB
FGP	SGDFCH	EC
FILEPR	$$ANERRB	NN
FINDPUBL	$$ANERRZ	TC
FINDTASK	$$RAST02	WB
FINDTOD	$$RAST01	VF
FINUP	$$ANERR6	UD
FIODONE	SGDFCH	EH
FLPTR	SGTCHS	CC
FNDQUE	SGTCHS	CCA
FNDQUE1	SGTCHS	CD
FONTERR	$$ANERR9	UB
FREDEV	SGTCHS	CP
FREDEV1	SGTCHS	CP
FREE	$$RAST10	XK
FSAVALID	$$RAST03	WG
FTCH2	$$ANERR6	UC
FTHMSGW	$$ANERRU	SC
F01	$$ANERRG	QB
F010	$$ANERRG	QB
F02	$$ANERRG	QB
F03	$$ANERRG	QB
F1EUTEST	SGUNCK	DB
F2EUTEST	SGUNCK	DB

GELNGTH	$$RAST01	VF
GENENT	FOPT	BF
GENENT	FOPT	BF
GEN1	FOPT	BF
GEN1	FOPT	BG
GETBND	$$RAST03	WH
GETCCB	$$ANERR7	UE
GETCHQ	SGTCHS	CK
GETCMD	$$RAST02	WC
GETCOM	$$RAST02	WD
GETENTRY	SGDFCH	EE
GETJIB	SGTCHS	CH
GETMSG	$$ANERRV	SE
GETPIB	SGTCHS	CR
GETPIB1	SGTCHS	CR
GETSEN	SGUNCK	DB
GIDCK1	$$ANERRZ	TD
GIOADR	SGTCHS	CE
GIOADR	SGTCHS	CF
GO	$$ANERRJ	QF
GO	$$ANERRJ	QF
GO	$$ANERRP	RE
GO	$$ANERRQ	RG
GOMCRR	SEND	LA
GOQUIET	$$RAST03	WJ
GOTCDMR	$$RAST01	VG
GOTCLB	SGTCHS	CH
GOTREQID	$$RAST02	WD
GTSEN1	SGUNCK	DB
G01	$$ANERRG	QB

HALT	SGTCHS	CD
HALTLOOP	SGTCHS	CD
HANDLECC	$$RAST00	VB
HANDLEMC	$$RAST00	VB
HANDLEMC	$$RAST03	WE
HARDCHAN	SGUNCK	DG
HARDWAIT	$$RAST00	VB

HEADQUE	$$ANERAA	NC
HEADQUE1	$$ANERAC	NF
HEADQUE2	$$ANERAF	NH
HEADQUE3	$$ANERAG	NJ
HOLDQUE	$$ANERRY	TA
HRDWAIT	$$RAST00	VA
H01	$$ANERRV	SE
H01	$$ANERRG	QB
H1RRTN	$$RAST03	WE
IDRAEXT	FOPT	BD
IDRAFCH	SGDFCH	EB
IDRAOK	SGDFCH	EDC
IDRANOPQ	SGDFCH	EA
IDRAST1	SGDFCH	EA
IDRAST2	SGDFCH	EF
IDRAST3	SGDFCH	EF
IGEXIT	$$ANERRS	RK
IGEXIT	$$ANERRW	SF
IGEXIT	$$ANERRW	SG
IGNCAN	$$ANERRS	RL
IGON	$$ANERRU	SB
IJBERA35	$$ANERRA	NL
IJBERB33	$$ANERRB	NN
IJBERB35	$$ANERAB	RA
IJBERC35	$$ANERRC	NM
IJBERG20	$$ANERRG	QA
IJBERH20	$$ANERRH	QD
IJBERI20	$$ANERRI	QE
IJBERJ24	$$ANERRJ	QF
IJBERK20	$$ANERRK	QH
IJBERN33	$$ANERRN	RB
IJBERO35	$$ANERRO	RD
IJBERP33	$$ANERRP	RE
IJBERQ33	$$ANERRQ	RG
IJBERR20	$$ANERRR	RJ
IJBERS34	$$ANERRS	RK
IJBERT20	$$ANERRT	SA
IJBERU33	$$ANERRU	SB
IJBERV20	$$ANERRV	SD
IJBERX20	$$ANERRX	SJ
IJBER535	$$ANERAF	NG
IJBER635	$$ANERAG	NJ
IJBER932	$$ANERR9	UA
IJBMVC33	$$ANERR1	TG
IJBPA134	$$ANERRZ	TC
IJBPA233	$$ANERRY	TA
IJBPA333	$$ANERR0	TE
INDIB	SGTCHS	CJ
INERRCNT	$$ANERAI	UG
INHWRITE	SGTCHS	CH
INITCHN1	SGTCHS	CP
INITRG	SGTCHS	CP
INITSIO	SGTCHS	CN
INRQ	$$ANERRW	SG
INSERT	$$ANERRB	NN
INST	SEND	LD
INTERRCC	SGTHAP	MK
INTERV	$$ANERR9	UA
INTPUBSC	SGTCHS	CK
INTREQ	$$ANERRU	SC
INTREQ	$$ANERRV	SD
INTREQ	$$ANERSA	UK
INTREQD	$$ANERAI	UG
INTRTN	SGTCHS	CK
INTVEN	$$ANERRA	NLA
INVAL	$$ANERRY	TB
INVALID	$$RAST10	XM
IOCOMP	$$ANERRQ	RH
IODONE	$$ANERRP	RF
IOERR	$$ANERRH	QD
IOERR	$$ANERRI	QE
IOERR	$$ANERRJ	QG
IOERR	$$ANERRP	RF
IOINTR	$$ANERRR	RJ
IONOP	SGUNCK	DA
IOPSET	SGSVC	FF
IORTN	$$ANERRI	QE
IORTN	$$ANERRJ	QG
IOWAIT	$$ANERSB	UP
IOWAIT	$$ANERSC	UR
IPLEXIT	$$RAST00	VC
IREXIT	$$ANERRT	SA
IREXIT	$$ANERRW	SF
ISSVC51	SGDFCH	EDB
ISSVC51	SGDFCH	EDC
JAENTRY	FOPT	BK
JAISBND	FOPT	BK
JAISPP	FOPT	BK
JANOTSUP	FOPT	BK
JASETSP	FOPT	BC
JAXIT	FOPT	BL
JAXITBR	FOPT	BC
JIBTYP	SGTCHS	CJ
KEYINT	$$ANERRR	RJ
KRTY	$$ANERRS	RK
K01	$$ANERRG	QB
LACSW	$$ANERRO	RD
LASPH	$$ANERRA	NL
LASPHAS	$$ANERRC	NM
LASTRACK	$$RAST01	VH
LASTREC	$$RAST01	VH
LCIDAR	SGDFCH	EC
LDPSW	$$ANERRR	RJ
LDRAST00	$$RAST01	VJ
LDRAST02	$$RAST00	VD
LDRAST02	$$RAST01	VJ
LDREGS	SGTCHS	CK
LGD	SGTCHS	CH
LGDD	SGTCHS	CH
LGDD1	SGTCHS	CH
LGD1	SGTCHS	CH
LMERA	FOPT	BCA
LOADCK	$$ANERSA	UN
LOADMOD	$$RAST00	VC
LOADMOD	$$RAST01	VJ
LOADMOD	$$RAST03	WH
LOADPSW	$$ANERRR	RJ
LOADTEST	$$RAST00	VC
LOADTEST	$$RAST01	VJ
LOADTEST	$$RAST03	WH
LOAD00	$$RAST00	VA
LOAD01	$$RAST01	VF
LOAD03	$$RAST03	WE
LOAD09	$$RAST09	XJA
LOGBAD	$$RAST10	XK

LOGENT	$$ANERRP	RE
LOGENT	$$ANERRQ	RG
LOGERP	$$ANERRU	SC
LOGLOOP	$$RAST09	XJA
LOGLOOP	$$RAST11	XN
LOGPRC	SGTCHS	CFA
LOGPRC1	SGTCHS	CG
LOGPRC2	SGTCHS	CG
LOGRTN	$$ANERRY	TA
LOGTST	$$ANERRU	SC
LOGTST	$$ANERRY	TA
LOGWAIT	$$ANERRY	TA
LOG1	$$ANERRY	TA
LOG2	$$ANERRY	TA
LOOKUP	SGDFCH	ED
LOOP1	$$ANERAE	RC
LOWBITON	$$RAST11	XN
LSTDIB	SGTCHS	CJ
LTA	SEND	LH
LTABSY	SGSVC	FD
LTACCB	$$ANERRM	NB
LTACNL	FOPT	BB
LTARTRN	FOPT	BE
LTKHLD	$$ANERRZ	TD
L01	$$ANERRG	QC
L01	$$ANERRI	QE

MACHEK	SGUNCK	DG
MACHEK	SGUNCK	DG
MACHEK	SGUNCK	DG
MACHEK1	SGUNCK	DG
MAINRT	$$ANERR6	UC
MAINTASK	$$ANERR1	TG
MAINTR	$$ANERR7	UE
MAINTR	$$ANERR8	UF
MCCPUEX1	SMCRR	KG
MCMVLGOT	SMCRR	KE
MCNOTSP	SMCRR	KC
MCPDCOND	MCRAS	HA
MCRBUMP	SMCRR	KE
MCRCHDMG	SMCRR	KA
MCRCHMVN	SMCRR	KD
MCRCHNBC	SMCRR	KD
MCRCHNDM	$$A$SUP1	KB
MCRCNCOD	SMCRR	KE
MCRCPUEX	SMCRR	KG
MCRDVDMG	SMCRR	KD
MCREND01	SMCRR	KD
MCREND02	SMCRR	KE
MCREND03	SMCRR	KG
MCREND04	SMCRR	KH
MCRENTER	SGUNCK	DG
MCRETURN	SMCRR	KC
MCRFULL	SMCRR	KF
MCRGTFDV	$$A$SUP1	KB
MCRGTLST	SMCRR	KD
MCRGTPIB	SMCRR	KE
MCRLOOP1	SMCRR	KA
MCRLOOP2	$$A$SUP1	KB
MCRLOOP3	SMCRR	KG
MCRMPX	SMCRR	KA
MCRMPXST	$$A$SUP1	KB
MCRNEQLD	SMCRR	KF
MCRNLTA	SMCRR	KG
MCRNODMG	SMCRR	KD
MCRNTBSY	SMCRR	KC
MCRNTCIB	SMCRR	KF
MCRNTLTA	SMCRR	KG
MCRNTSUP	SMCRR	KE
MCROBRRT	SMCRR	KJ
MCRPARIT	SGUNCK	DG
MCRRBST	SMCRR	KG
MCRRCHER	SMCRR	KA
MCRRCPU	SMCRR	KG
MCRRDIAG	$$A$SUP1	KB
MCRRRTN	SMCRR	KA
MCRRTSTQ	$$A$SUP1	KB
MCRSAFTR	SMCRR	KG
MCRSCNCH	SMCRR	KA
MCRSCPHM	SMCRR	KH

MCRSEL1	$$A$SUP1	KB
MCRSEL2	$$A$SUP1	KB
MCRSENDD	SGUNCK	DG
MCRSPSW2	SMCRR	KH
MCRSUPIK	SMCRR	KJ
MCRSUPSW	SMCRR	KE
MCSCHDL	MCRAS	HA
MCSELECT	SMCRR	KF
MCSOFT	MCRAS	HA
MCTASK	MCRAS	HA
MESG	$$ANERRB	NN
MESSWTR	$$RAST11	XN
MODCCW	$$ANERRX	SK
MODESTAT	$$RAST03	WJ
MODIFY	SEND	LF
MOVELIST	$$ANERAD	NK
MOVENAME	$$ANERRM	NB
MOVIDRA	SGDFCH	EDC
MOVNAM	$$ANERRM	NA
MOVRIK	SGDFCH	EDB
MOVRIK	SGDFCH	EDC
MPSTASK	$$RAST01	VG
MPSTST	$$ANERRN	RB
MPSTST	$$ANERRQ	RG
MPSYES	SGTCHS	CN
MSGNTR	$$ANERRW	SF
MSGWTR	$$ANERRT	SA
MSGWTR	$$ANERRV	SE
MSGWTR	$$ANERRW	SG
MSGWTR	$$ANERRW	SH
MSGWTR	$$ANERR7	UE
MSGWTR	$$ANERRG	QA
MSGWTR	$$ANERRH	QD
MSGWTR	$$ANERRI	QE
MSGWTR	$$ANERRJ	QF
MSGWTR	$$ANERRK	QH
MSG2	$$ANERAB	RA
MSG3	$$ANERAB	RA
MSG4	$$ANERAB	RA
MVC	$$ANERR1	TG
MVCCW	SGTCHS	CCA
MVEPSW	SGUNCK	DF
MVMSG	$$ANERRV	SD
MVZEX	SGUNCK	DB
M01	$$ANERRG	QC
M01	$$ANERRI	QE
M01	$$ANERRK	QH

NDEQUE	$$ANERRC	NM
NEXTCYL	$$RAST01	VH
NEXTPH	$$ANERAE	RC
NGTMBP	SGSVC	FG
NOAP	$$ANERRZ	TD
NOAP1	$$ANERRZ	TC
NOCANCEL	$$RAST02	WB
NOCB	SGTCHS	CN
NOCCB	$$ANERRX	SK
NOCCB	$$RAST02	WC
NOCCB	$$ANERRO	RD
NOCCB1	SGUNCK	DA
NODEQUE	$$ANERRC	NM
NODEQUE	$$ANERAB	RA
NOEMP	$$ANERR9	UB
NOLOADAD	SGDFCH	EE
NOLOG	$$ANERAE	RC
NOLOG	$$ANERRP	RF
NOLOG	$$ANERRQ	RH
NOLSS	$$ANERR9	UB
NOLTA	$$ANERAE	RC
NOLTH	$$ANERRM	NB
NOMSG	$$RAST10	XL
NONREC	$$ANERR9	UA
NOPBR	$$ANERRQ	RG
NOPINS	SGTCHS	CH
NOPINSTR	SGTCHS	CH
NOPRNAME	$$RAST01	VG
NOPUBRS	$$ANERAA	NC
NORELOC	SGUNCK	DAA
NOQUIS	SGUNCK	DH
NORCD	SGDSK	GA
NORCFND	$$ANERRA	NL
NOSO	SGTCHS	CCA
NOSTART	SGUNCK	DA
NOSTATUS	$$ANERRV	SE
NOSWP	SGSVC	FG
NOS01	SGTCHS	CM
NOTBONLY	SGDFCH	EG
NOTBSY	SGTCHS	CL
NOTCLB	SGTCHS	CH
NOTDMC1	$$RAST02	WC
NOTFCH	SGSVC	FE
NOTFIRST	$$RAST03	WJ
NOTFOUND	SGDFCH	ED
NOTFULL	$$RAST01	VJ
NOTIC	SGTCHS	CH
NOTIC	$$ANERR6	UD
NOTMPS	$$RAST11	XN
NOTPD	FOPT	BH
NOTPD1	FOPT	BH
NOTRIA	SGTCHS	CK
NOT2314	SEND	LE
NRFRTY	$$ANERRJ	QF
NRTASTO	SGTCHS	CE
NTFTCH	SGUNCK	DC
NXTERPIB	$$RAST10	XK
NXT1	SGTCHS	CG
N01	$$ANERRG	QC
N01	$$ANERRJ	QF
N1114	SGTCHS	CQ
OBRAREL	$$ANERAA	NC
OBRBYPS	$$ANERRM	NA
OBREXIT	$$ANERAA	ND
OBRIOE	$$ANERAA	NC
OBRIOE1	$$ANERAA	ND
OBRIO2	$$ANERAA	NC
OBRIO3	$$ANERAA	NC
OBRNOCCB	$$ANERRM	NB
OBRNOKEY	$$ANERRM	NB
OBRREL	$$ANERAA	ND
OBRREL1	$$ANERAA	ND
OBRSPR	$$ANERRM	NA
OBRSPR1	$$ANERRM	NA
OFFLINE	SGTCHS	CR
OK	$$ANERR1	TG
OLTPCOMP	SGTCHS	CD
ONERET	$$ANERRG	QA
ONERTRY	$$ANERR9	UA
OPCLOSE	SGDFCH	EC
OPFLAG	$$ANERRN	RB
OPTRT1	SGSVC	FM
OPTRT2	SGSVC	FM
OPVNT	$$ANERRW	SG
ORERP	$$ANERRA	NL
OURSIO	SGUNCK	DF
OVERRUN	$$ANERR9	UB
OVERUN	$$ANERRB	NN
OVRUN	$$ANERRV	SE
PARTNOK	$$RAST09	XJB
PAR40	$$ANERR0	TE
PAR41	$$ANERR0	TE
PAR42	$$ANERR0	TE
PAR43	$$ANERR0	TE
PAR44	$$ANERR0	TE
PAR45	$$ANERR0	TE
PAT	$$ANERRC	NM
PCHDIB	SGTCHS	CJ
PCHKSW	FOPT	BA
PCHKSW	SGSVC	FJ
PCHKSW	SGSVC	FK
PCIL1	SGDFCH	EB
PCIL2	SGDFCH	EB
PCITRT	SGSVC	FM
PCURTN	$$ANERRW	SF
PDABEX	SMICR	JH
PDAGN	SMICR	JF
PDAID	SGDFCH	EE
PDBOCK	SMICR	JF
PDBUFL	SMICR	JB
PDCCBPT	SGSVC	FB
PDCCBT	SGSVC	FB
PDCHAN	SMICR	JE
PDCHAN	SMICR	JF
PDCOMP	SMICR	JE
PDCSWST	SMICR	JD
PDCSWST	SMICR	JF
PDDEQUE	SMICR	JG
PDDEQUE1	SMICR	JG
PDDEQUE2	SMICR	JG
PDDFLT	SMICR	JF
PDEDLT	SGSVC	FB
PDERXT1	SMICR	JE
PDERXT1	SMICR	JF
PDERXT2	SMICR	JE

PDERXT2	SMICR	JF
PDERXT3	SMICR	JF
PDETIO	SMICR	JD
PDETIO	SMICR	JF
PDEXT1	SMICR	JH
PDFSTM	SMICR	JB
PDHERE	SMICR	JC
PDIAGN	SMICR	JB
PDIAGN1	SMICR	JC
PDINTR	SMICR	JA
PDKEY	SMICR	JH

PDMOV	SMICR	JE
PDMPI	SMICR	JA
PDMVCSW	SMICR	JE

PDNF	SMICR	JB
PDNOB	SMICR	JC
PDNONOP	SMICR	JB
PDNOPCK	FOPT	BA
PDNOPCK	SGSVC	FJ
PDNOPCK	SGSVC	FK
PDNOSS	SMICR	JB
PDNOTSS	SMICR	JG
PDNOTZR	SMICR	JC
PDPDEQ	SMICR	JE
PDPRCAN	SMICR	JG
PDPROGCK	SMICR	JG
PDREJDC	SMICR	JF
PDREJT	SMICR	JC
PDSCAW	SMICR	JB
PDSERR	SMICR	JD
PDSERR1	SMICR	JD
PDSERR1	SMICR	JF
PDSERR2	SMICR	JD
PDSERR3	SMICR	JD
PDSIO	SMICR	JC
PDSNO1	SMICR	JE
PDSNO2	SMICR	JD
PDSPK	SMICR	JB
PDSS	SMICR	JC
PDSUPEXT	SMICR	JH
PDSUPV	FOPT	BG
PDSUPV	SGSVC	FL
PDSVC28	SMICR	JC
PDSWBP	SMICR	JH
PDSWZ	SMICR	JH
PDTASK	SMICR	JH
PDTERR1	SMICR	JE
PDTERR1	SMICR	JF
PDTERR2	SMICR	JE
PDTERR5	SMICR	JE
PDTIMER	SMICR	JH
PDTIO	SMICR	JA
PDTIOERR	SMICR	JE
PDTIOERR	SMICR	JF
PDTIOK	SMICR	JB
PDTKY	FOPT	BG
PDTKY	SGSVC	FL
PDUPDT	SMICR	JB
PDYES	SMICR	JE
PHASE	SGDFCH	EC
PHASEH	$$ANERRG	QC
PHASEJ	$$ANERRG	QA
PHASES	$$ANERRP	RF
PHASES	$$ANERRQ	RH
PHASES	$$ANERRR	RJ
PHASE1	$$ANERRG	QB
PHASE2A	$$ANERAE	RC
PHASR	$$ANERRQ	RH
PICKDIR	SGDFCH	EC
POSCHK	$$ANERSC	UQ
POSCHK3	$$ANERSC	UQ
POSCHK4	$$ANERSC	UR
POSTCAN	$$ANERRY	TB
POSTCE	SGTCHS	CP
POSTPIB	$$RAST02	WB
PREFERED	SGDFCH	EC

PREPSBR	$$ANERSC	UQ
PROC	$$ANERRT	SA
PROTCHK	$$ANERRA	NL
PROTECT	SGTCHS	CH
PRTPRG	SGUNCK	DB
PRTPRG1	SGUNCK	DA
PSTBUF	$$ANERRW	SG
PSTEOF	SGTCHS	CQ
PSTERR	$$ANERRT	SA
PSTERR	$$ANERRW	SF
PTERP	$$ANERRA	NL
PTOSW	$$ANERRL	PG
PTRXCH	$$ANERR0	TF
PUBDEQ	SGSVC	FF
PUBSCAN	$$RAST00	VE
PUBSCN3	$$ANERRZ	TD
PURGE	SGTCHS	CM
PUTUTR	$$ANERRU	SC

QIDCK1	$$ANERRZ	TD
QISRT1	SGUNCK	DH
QISRT2	SGUNCK	DH
QISRT3	SGUNCK	DH
QUETEST	$$ANERRP	RE
QUETEST	$$ANERRQ	RG
QUEUP	SGTCHS	CC
QUIET145	$$RAST03	WJ
QUISIO	SGUNCK	DH
Q01	$$ANERRG	QC

RADLDS	SGTCHS	CA
RASDEQ	MCRAS	HG
RASIO	$$RAST01	VH
RASIO	$$RAST10	XM
RASIO	$$RAST11	XN
RASIOE	MCRAS	HC
RASMEXT	MCRAS	HB
RASQOK	MCRAS	HC
RAST02	$$RAST00	VD
RBBY12	SEND	LA
RCHAN	$$ANERR6	UD
RCHAN	$$ANERAJ	UJ
RCHS	$$ANERAJ	UJ
RCOMMONA	$$RAST05	XG
RCOMMONB	$$RAST04	XD
RCOMMONB	$$RAST05	XG
RCVERR	SGUNCK	DC
RDDIR2	SGDFCH	ED
RDHA9	SGDSK	GA
RDRCD	$$ANERRH	QD
RDTXT	SGDFCH	EE
RDVER	$$ANERRK	QH
RDYCANDP	SGTHAP	MK
RDYCNL	SGTHAP	MM
RDYCN1	SGTHAP	MM
RDYCN2	SGTHAP	MM
RDYCN2A	SGTHAP	MM
RDYCN4	SGTHAP	MM
RDYCN4X	SGTHAP	MM
RDYCN4Z	SGTHAP	MM
RDYDUMP	SGTHAP	MK
READUPDT	SGDFCH	EG
RECAL	SGDSK	GA
RECFULL	$$RAST01	VF

RECSBLT	$$RAST01	VJ
RECVERR	$$ANERR8	UF
REFAIL	$$ANERR8	UF
REGZERO	$$RAST11	XN
RELOC	$$ANERRP	RE
RELOCATE	$$RAST10	XL
REPERR	$$ANERRQ	RH
REQUEST	$$RAST10	XM
RERASIO	MCRAS	HC
RESCHK	SGUNCK	DB
RESERR	SGDSK	GA
RESET	$$ANERAE	RC
RESPNS	$$ANERRR	RJ
RESPTYP	$$RAST10	XL
RESTART	$$RAST00	VC
RESTCQP	$$ANERSC	UR
RESTORE	$$RAST03	WG
RESTUSE	$$ANERSB	UP
RESVC	SGSVC	FC
RESVC1	SGSVC	FE
RETOFF	$$ANERR6	UD
RETOFF	$$ANERR7	UE
RETRY	$$ANERRV	SE
RETRY	$$ANERRX	SK
RETRY	$$ANERR9	UB
RETRY	$$ANERR6	UC
RETRY	$$ANERRR	RJ
RETURN	$$RAST01	VH
RETURN	$$RAST03	WH
RETXIT	$$ANERRX	SK
RINGBELL	$$RAST00	VA
RINGTIO	$$RAST00	VA
RLOG	$$RAST04	XA
RMESSAGE	$$RAST00	VA
RPRNTR	$$RAST04	XC
RSETWAIT	SGTCHS	CM
RSTCHPT	$$ANERRY	TA
RSTCHQ	$$ANERRY	TA
RSTFLG	$$ANERRU	SC
RSTFLG	$$ANERRI	QE
RSTFLG	$$ANERRJ	QG
RSTFLG	$$ANERRP	RF
RSTFLG	$$ANERRQ	RG
RSTPUB	SGDFCH	EH
RSTPUB1	SGDFCH	EH
RSTQPT	$$ANERRU	SC
RSTQPT	$$ANERRH	QD
RSTQPT	$$ANERRI	QE
RSTQPT	$$ANERRJ	QG
RSTQPT	$$ANERRP	RF
RSTQPT	$$ANERRQ	RG
RSTREG	SGUNCK	DE
RTARET	MCRAS	HB
RTARET1	MCRAS	HB
RTNTEST	$$RAST00	VA
RTY	$$ANERRV	SD
RTYCT	$$ANERRV	SE
RTYONE	$$ANERRU	SC
RTYRTN	$$ANERRP	RF
R01	$$ANERRG	QA
R01	$$ANERRI	QE
R01	$$ANERRJ	QF
R1442	$$RAST04	XC
R1442A	$$RAST04	XC
R1442B	$$RAST04	XC
R2501	$$RAST04	XB
R2501A	$$RAST04	XB
R2501B	$$RAST04	XB
R2520	$$RAST05	XE
R2520B	$$RAST05	XE
R2540	$$RAST04	XB
SAVEIO	$$RAST00	VE
SCANTAB	$$RAST02	WC
SCHREC2	$$RAST02	WD
SCIL1	SGDFCH	EB
SCIL2	SGDFCH	EB
SDM01	$$ANERAF	NG
SDRACC1	$$ANERAC	NE
SDRACC2	$$ANERAC	NE
SDRACC3	$$ANERAC	NE
SDRACC5	$$ANERAC	NE
SDRAREL	$$ANERAC	NE
SDRAW1	$$ANERAC	NE
SDRAW2	$$ANERAC	NE
SDRERAC	$$ANERAC	NE
SDREXIT	$$ANERAC	NF
SDRIO	$$ANERAF	NH
SDRIOE	$$ANERAC	NF
SDRIOX	$$ANERAF	NH
SDRIOX1	$$ANERAG	NJ
SDRIO2	$$ANERAC	NF
SDRMM	SEND	LA
SDRM00	$$ANERAG	NJ
SDRM012	$$ANERAF	NG
SDRM02	$$ANERAF	NG
SDRM03	$$ANERAF	NG
SDRNMCRR	SEND	LG
SDRNO	SEND	LB
SDRNOAD	$$ANERAC	NE
SDROBR	SEND	LF
SDROBRO	SEND	LF
SDROBRW	SEND	LF
SDRQUIS	SGUNCK	DH
SDRQUIS1	SGUNCK	DH
SDRREL	$$ANERAC	NF
SDRREL1	$$ANERAC	NF
SDRSDR	SEND	LF
SDRSDR1	SEND	LF
SDRSDR2	SEND	LG
SDRSDR2X	SEND	LG
SDRSKIP	$$ANERAF	NG
SDRSVC3	SEND	LA
SDRXIO	SEND	LB
SDRXIO1	SEND	LB
SDRXIO2	SEND	LB
SDRXIO3	SEND	LB
SDRYES	SEND	LD
SDR1	SEND	LE
SDR1A	SEND	LE
SDR1B	SEND	LE
SDR1B1	SEND	LE
SDR1B2	SEND	LE
SDR1B3	SEND	LE
SDR1B4	SEND	LE
SDR1B5	SEND	LE
SDR1RES	SEND	LE
SDR1RESX	SGUNCK	DE
SDR1RES1	SEND	LE
SDR2A3	SEND	LC
SDR2A4	SEND	LC

SDR2A5	SEND	LC
SDR2QT	SEND	LB
SDR2QT1	SEND	LB
SDR2QT2	SEND	LB
SDR23	SEND	LD
SECTION1	$$ANERRZ	TC
SECTION3	$$ANERRZ	TD
SEEKTEST	SGTCHS	CH
SEKCH	$$ANERRA	NL
SEKCHK	SGDSK	GA
SEKCHK1	SGDSK	GA
SELBMX	SGTCHS	CN
SELBMX	SGTCHS	CN
SELECT	SGTCHS	CN
SELERR	$$ANERRV	SD
SENSTSTS	$$ANERR9	UA
SETARON	$$ANERRY	TB
SETCNCL	$$ANERR0	TF
SETCNCL	$$ANERRQ	RG
SETDIS	$$ANERRS	RL
SETEBL	$$ANERR8	UF
SETFCPU	MCRAS	HA
SETFLE	$$ANERRX	SJ
SETKEY	$$RAST03	WH
SETLNK	$$ANERAA	NC
SETLT1	SGSVC	FD
SETLT2	SGSVC	FD
SETLT2A	SGSVC	FD
SETOP1	SGSVC	FJ
SETOP1	SGSVC	FN
SETOP2	SGSVC	FJ
SETOP2	SGSVC	FN
SETPOSTL	$$ANERRZ	TD
SETPSN	$$ANERR7	UE
SETRD	$$ANERR8	UF
SETRTRY	$$ANERRQ	RH
SETSK	SGDFCH	EC
SETSKAD	SGDFCH	EC
SETSVAR	SGDFCH	EF
SETUP	$$RAST00	VC
SIO	SGTCHS	CFA
SKCHK	$$ANERRA	NL
SKSLI	$$ANERRB	NN
SPFKREP	$$RAST03	WH
SSCOM	$$ANERRW	SG
STDEXT	SGUNCK	DC
STEPLOOP	$$ANERRZ	TD
STGERR	$$RAST03	WG
STGEXIT	$$RAST03	WH
STMODE	SGTCHS	CG
STMODE1	SGTCHS	CG
STMODE2	SGTCHS	CG
STORE	SGTCHS	CH
STORKE	$$ANERAE	RC
STRTED	SGTCHS	CE
STRTED	SGTCHS	CFA
STRTIO	SGTCHS	CE
STRTIO	SGTCHS	CFA
STRTIO1	SGTCHS	CE
STRTIO1	SGTCHS	CFA
STRTI2	SGTCHS	CFA
SUPEXP	SGTCHS	CA
SUPEXP	SGTCHS	CB
SUPEXT	FOPT	BD
SUPIB	SGTCHS	CR
SVC 37	SGTHAP	MC
SVCALL	$$ANERAE	RC
SVCA6	SGSVC	FR
SVCRTN1	FOPT	BH
SVCWAIT	$$ANERRY	TA
SVCWAIT	$$ANERRP	RF
SVCWAIT	$$ANERRQ	RG
SVCWAIT1	$$ANERR0	TE
SVC00	SGTCHS	CA
SVC00	SGTCHS	CB
SVC01A	SGSVC	FA
SVC02	SGSVC	FC
SVC02A	SGSVC	FC
SVC02J	SGSVC	FC
SVC03	SGSVC	FF
SVC03	SGSVC	FF
SVC04	SGSVC	FF
SVC05	SGSVC	FB
SVC06	SGTHAP	MM
SVC07	SGSVC	FE
SVC08	SGSVC	FG
SVC09	SGSVC	FG
SVC10	SGSVC	FG
SVC10A	SGSVC	FG
SVC11	SGSVC	FE
SVC11A	SGSVC	FE
SVC11A	SGSVC	FE
SVC11B	SGSVC	FD
SVC11C	SGSVC	FD
SVC12A	SGSVC	FA
SVC13A	SGSVC	FA
SVC15	SGTCHS	CA
SVC15	SGTCHS	CB
SVC18	SGSVC	FN
SVC19	SGSVC	FN
SVC2BND	SGSVC	FC
SVC22	SGSVC	FH
SVC22A	SGSVC	FH
SVC23	SGSVC	FH
SVC24	SGSVC	FH
SVC25	SGTCHS	CB
SVC26	SGSVC	FB
SVC27	SGTCHS	CB
SVC29	SGSVC	FB
SVC3	$$ANERRA	NL
SVC35	SGTHAP	MA
SVC35A	SGTHAP	MA
SVC36	SGTHAP	MB
SVC37A	SGTHAP	MC
SVC38	SGTHAP	MD
SVC38A	SGTHAP	MD
SVC38B	SGTHAP	MD
SVC38B	SGTHAP	MD
SVC38C	SGTHAP	MD
SVC38C	SGTHAP	MD
SVC38D	SGTHAP	MD
SVC38E	SGTHAP	MD
SVC39	SGTHAP	ME
SVC39A	SGTHAP	ME
SVC39B	SGTHAP	ME
SVC39C	SGTHAP	ME
SVC39D	SGTHAP	ME

SVC39E	SGTHAP	MF
SVC39E1	SGTHAP	MF
SVC39F	SGTHAP	MF
SVC39G	SGTHAP	ME
SVC39H	SGTHAP	MD
SVC39H	SGTHAP	ME
SVC39H1	SGTHAP	ME
SVC39J	SGTHAP	MF
SVC39K	SGTHAP	MF
SVC39L	SGTHAP	MF
SVC39M	SGTHAP	ME
SVC39P	SGTHAP	ME
SVC39P1	SGTHAP	ME
SVC39Q	SGTHAP	MF
SVC40	SGTHAP	MG
SVC40A	SGTHAP	MG
SVC40B	SGTHAP	MG
SVC40C	SGTHAP	MG
SVC40D	SGTHAP	MG
SVC40E	SGTHAP	MG
SVC41	SGTHAP	MH
SVC41A	SGTHAP	MH
SVC41A1	SGTHAP	MH
SVC41A2	SGTHAP	MH
SVC41B	SGTHAP	MH
SVC41C	SGTHAP	MH
SVC42	SGTHAP	MG
SVC42A	SGTHAP	MG
SVC42B	SGTHAP	MG
SVC43	SGSVC	FR
SVC45	SGSVC	FR
SVC46	SGSVC	FR
SVC51	SGSVC	FS
SVC52	SGSVC	FS
SVEREG	FOPT	BAA
SVEREG	SGTCON	GC
SVNWAD	SGTCHS	CCA
SWITCH	$$ANERRO	RD
SXPC1	SGSVC	FN
SXPC2	SGSVC	FN
SXTRT1	SGSVC	FJ
SXTRT1	SGSVC	FN
SYCLAS	$$ANERRO	RD
SYSFILE	SGTCHS	CJ
SYSFILE1	SGTCHS	CJ
SYSFILE2	SGTCHS	CJ
SYSFILE3	SGTCHS	CQ
SYSFILE4	SGTCHS	CJ
SYSFILE5	SGTCHS	CE
SYSINOUT	SGTCHS	CE
SYSSIN	SGTCHS	CJ
S01	$$ANERRJ	QF
TAPMODE2	$$ANERR9	UB
TCAN2	$$ANERRY	TB
TCAN2A	$$ANERRY	TB
TEST	$$ANERRH	QD
TESTBUSY	$$ANERRP	RE
TESTDMC	$$RAST02	WA
TESTEOJ	SGTCHS	CF
TESTER	$$ANERAD	NK
TESTFE	$$RAST02	WD
TESTIGN	$$ANERRQ	RG
TESTLTA	FOPT	BE
TESTSUB	$$ANERR1	TG
TESTSVC	SGDFCH	EDA
THCHK	SGTHAP	MC
THDLT1	SGTHAP	MB
THDLT2	SGTHAP	MB
THDLT2	SGTHAP	MB
THFREE	SGTHAP	MB
THFREE1	SGTHAP	MB
THRETRY	SGTHAP	MC
THSETUP	SGTHAP	MA
THWAIT1	SGTHAP	MA
THWAIT2	SGTHAP	MA
TKDLET	SGTHAP	MB
TKHDADD	SGTHAP	MA
TKHDQUE	SGTHAP	MA
TKHDRTN	SGTHAP	MA
TKHD1	SGTHAP	MA
TKHELD	SGTHAP	MA
TKPRTY	SGTHAP	MJ
TKPRT1	SGTHAP	MJ
TMEKEY	SGSVC	FG
TMERT1	SGSVC	FL
TMRBPS	SGSVC	FL
TMRSW	SGSVC	FL
TPBUSY0	SGTCHS	CD
TPBUSY1	SGTCHS	CD
TPBUSY2	SGTCHS	CD
TPBUSY3	SGTCHS	CD
TPBUSY4	SGTCHS	CD
TPIGNOR	$$ANERRC	NM
TPRETRN	SEND	LA
TPSDR1	SEND	LA
TRKCHK	SGDSK	GB
TRKEOC	SGDSK	GB
TRNOFF	SGTCHS	CL
TRYNXT	SGTCHS	CH
TSTATD	$$ANERRR	RJ
TSTATTN	SGTCHS	CL
TSTBMX	SGTCHS	CQ
TSTCAN	$$ANERRR	RJ
TSTCCB	$$ANERRN	RB
TSTCCC	$$ANERRU	SB
TSTCDC	$$ANERRU	SB
TSTDEV	SGTCHS	CCA
TSTDEV1	SGTCHS	CCA
TSTDEV2	SGTCHS	CD
TSTEOJ	SGTCHS	CE
TSTEQCK	$$ANERR6	UC
TSTERF	SGTCHS	CL
TSTNXT	SGTCHS	CJ
TSTPSN	$$ANERR7	UE
TSTQEF	SGTCHS	CP
TSTRESIO	SGTCHS	CN
TSTRTY	$$ANERRN	RB
TSTSNS	$$ANERAI	UG
TSTSSL	$$ANERRB	NN
TSTSVC	SGDFCH	EDA
TSTTRG	$$ANERRS	RK
TSTUCK	SGTCHS	CKA
TST03U	$$ANERRU	SB
TST2311	$$ANERAA	NC
T01	$$ANERRG	QB
T03	$$ANERRH	QD

T06	$$ANERRH	QD
T145RTN	$$RAST03	WF
T155RTN	$$RAST03	WE
UCBPAR	$$ANERRV	SD
UCSTST	$$ANERRV	SE
UNBUSY	$$RAST02	WA
UNCOMMON	SGTCHS	CE
UNDETERR	$$ANERAI	UG
UNDETR	$$ANERR6	UC
UNDETR	$$ANERR7	UE
UNDTR	$$ANERRT	SA
UNDTR	$$ANERRW	SF
UNKN	$$ANERRB	NN
UNPACK	$$RAST11	XN
UNPCH	$$ANERRO	RD
UNPKSEN	$$ANERRO	RD
UNRCERP	$$ANERRA	NL
UNSUPTD	$$ANERR9	UB
UNTCK1	SGUNCK	DA
UNTCK2	SGUNCK	DA
UNUSENS	$$ANERRU	SC
UNWAIT	SGTHAP	MJ
UNW001	SGTHAP	MJ
UNW002	SGTHAP	MJ
UNW003	SGTHAP	MJ
UNW004	SGTHAP	MJ
UNW005	SGTHAP	MJ
UPDATCCW	$$ANERAI	UG
UPDATE	$$RAST03	WF
UPDATE	$$RAST11	XN
UPDPUB	$$RAST00	VE
UPDPUB	$$RAST02	WA
UPDSCAN	$$RAST02	WC
USRAPPEN	SGTCHS	CKA
USREXT	SGUNCK	DA
USRSEN	SGUNCK	DB
USRUCK	SGUNCK	DA
VERIF	$$ANERRB	NN
VLDADR1	SGTCON	GC
VLDADR2	SGTCON	GC
VLDADR3	SGTCON	GC
WAIT	$$ANERRY	TA
WAITLOOP	SGDFCH	EH
WAITSVC	$$ANERRP	RF
WRITEREC	$$RAST01	VH
XEXIT	$$RAST04	XA
XEXIT	$$RAST05	XE
XFETCH	$$RAST04	XA
XFETCH	$$RAST05	XE
XIOERR	$$ANERSB	UP
XLDMOD	$$RAST05	XE
XLDTST	$$RAST04	XA
XLDTST	$$RAST05	XE
XMSG	$$RAST04	XA
XMSG	$$RAST05	XE
XNOMSG	$$RAST04	XA
XNOMSG	$$RAST05	XE
XNORMAL	$$ANERSC	UR
XQFULL	$$ANERSB	UP
XTOERR	$$ANERSC	UR
ZEROCT	$$ANERR6	UD
ZERTEB	$$ANERRS	RK
ZERTEBV	$$ANERRS	RK
ZROREG	SGTCHS	CR

APPENDIX B: ERROR MESSAGE CROSS REFERENCE

Message	Phase	Chart
0P08	$$A$SUP1 (Disk)	GA
	$$ANERAI (Paper Tape)	UG
	$$ANERRA (Disk)	NM
	$$ANERRF (Tape)	PF
	$$ANERRG (Data Cell)	QB
	$$ANERRT (MICR Type)	SA
	$$ANERRU (Unit Record)	SC
	$$ANERRV (Unit Record)	SD
	$$ANERRW (MICR Type)	SF,SG
	$$ANERRX (Paper Tape)	SJ
	$$ANERR7 (Tape Cartridge Reader)	UE
	$$ANERR9 (Optical Reader)	UA
	$$ANERSA (3211 Printer)	UK
0P09	$$A$SUP1 (Disk)	GA
	$$ANERAI (Paper Tape)	UG
	$$ANERAM (Tape)	PJ
	$$ANERRA (Disk)	NM
	$$ANERRF (Tape)	PF
	$$ANERRG (Data Cell)	QB
	$$ANERRT (MICR Type)	SA
	$$ANERRU (Unit Record)	SC
	$$ANERRV (Unit Record)	SE
	$$ANERRW (MICR Type)	SF,SG
	$$ANERRX (Paper Tape)	SJ
	$$ANERR6 (Tape Cartridge Reader)	UC,UD
	$$ANERR7 (Tape Cartridge Reader)	UE
	$$ANERR9 (Optical Reader)	UA
	$$ANERSA (3211 Printer)	UK
0P10	$$A$SUP1 (Disk)	GA
	$$ANERAI (Paper Tape)	UG
	$$ANERAM (Tape)	PJ
	$$ANERRA (Disk)	NL
	$$ANERRF (Tape)	PE
	$$ANERRG (Data Cell)	QA
	$$ANERRU (Unit Record)	SC
	$$ANERRV (Unit Record)	SD
	$$ANERRX (Paper Tape)	SJ
	$$ANERR6 (Tape Cartridge Reader)	UC
	$$ANERR7 (Tape Cartridge Reader)	UE
	$$ANERSA (3211 Printer)	UK
0P11	$$A$SUP1 (Disk)	GA
	$$ANERAJ (Paper Tape)	UH
	$$ANERAP (Tape)	PN
	$$ANERAS (Tape)	PX
	$$ANERRB (Disk)	NN
	$$ANERRD (Tape)	PA
	$$ANERRK (Data Cell)	QH
	$$ANERRV (Unit Record)	SE
	$$ANERRX (Paper Tape)	SJ
	$$ANERR7 (Tape Cartridge Reader)	UE
	$$ANERSA (3211 Printer)	UK
0P12	$$ANERRB (Disk)	NN
	$$ANERRK (Data Cell)	QH
0P13	$$ANERRB (Disk)	NN
	$$ANERRK (Data Cell)	QH
	$$RAST10	XL
0P14	$$A$SUP1 (Disk)	GA
	$$ANERRB (Disk)	NN
	$$ANERRF (Tape)	PE,PF
	$$ANERRG (Data Cell)	QB
	$$ANERRV (Unit Record)	SE
	$$ANERR9 (Optical Reader)	UB
0P15	$$A$SUP1 (Disk)	GA
	$$ANERRA (Disk)	NL
	$$ANERRJ (Data Cell)	QF
0P16	$$ANERRB (Disk)	NN
	$$ANERRK (Data Cell)	QH
0P17	$$ANERAM (Tape)	PK
	$$ANERRB (Disk)	NN
	$$ANERRG (Data Cell)	QC
0P18	$$A$SUP1 (Disk)	GA
	$$ANERAI (Paper Tape)	UG
	$$ANERAM (Tape)	PK
	$$ANERRB (Disk)	NN
	$$ANERRG (Data Cell)	QC
	$$ANERRT (MICR Type)	SA
	$$ANERRU (Unit Record)	SC
	$$ANERRV (Unit Record)	SE
	$$ANERRW (MICR Type)	SF,SH
	$$ANERRX (Paper Tape)	SJ
	$$ANERR7 (Tape Cartridge Reader)	UE
	$$ANERR9 (Optical Reader)	UB
	$$ANERSA (3211 Printer)	UK

RIK (Requestor I/O Key)

When a supervisor routine (fetch or physical transient) issues an SVC 0 or SVC 15, the routine puts the value to be used in the CAW storage protect key into the high-order digit of the second byte of the RIK halfword. When this value is zero, the low order digit has these special meanings:

RIK	Meaning
X'01'	This is a SYSLOG I/O request. The channel scheduler is not to type a SYSLOG ID prefix.
X'02'	This has been a fetch I/O request. This special code is required by ERP to recognize fetch requests.

Fetch always sets a X'02' in the RIK. ERP transients put the key of the program requiring ERP into the RIK, when the ERP is a retry of a user EXCP and the ERP transient requires control to return to itself.

Physical transients put a X'01' into the RIK when they are doing a SYSLOG I/O. The PIK for physical transients has a value of X'60', therefore the channel scheduler would type "SP" (supervisor ID) as the SYSLOG ID. The physical transients put the ID of the program referred to by the message into the message.

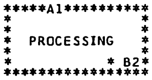
FIK (Fetch I/O Key)

Used by the fetch to validate the phase name address and load address. FIK has the following values:

SVC	Contents
1	Key of the problem program requestor.
2	0
3	0
4	0 if the transient issued the SVC 4. Key of the problem program if not a transient.

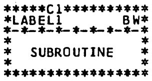
APPENDIX F: EXPLANATION OF FLOWCHART SYMBOLS

DESCRIPTION

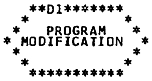


A GROUP OF PROGRAM INSTRUCTIONS THAT PERFORM A PROCESSING FUNCTION OF THE PROGRAM. THE LABEL, IF ANY, IS SHOWN ABOVE THE BLOCK.

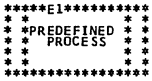
* B2
IF ANY ADDITIONAL EXPLANATION IS REQUIRED, ITS LOCATION ON THE CHART IS IDENTIFIED BY AN ASTERISK AND THE BLOCK ID.



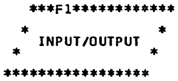
DESCRIPTION OR TITLE OF A ROUTINE THAT IS DETAILED ON ANOTHER FLOWCHART. THE START LABEL OF THE ROUTINE AND THE FLOWCHART ID APPEAR ABOVE THE STRIPE.



AN INSTRUCTION, OR GROUP OF INSTRUCTIONS, THAT CHANGES PORTIONS OF A ROUTINE OR INITIALIZES A ROUTINE FOR GIVEN CONDITIONS.

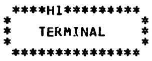


A GROUP OF OPERATIONS NOT DETAILED IN THE FLOWCHARTS IN THIS MANUAL, SUCH AS USER'S ROUTINES.



ANY FUNCTION OF AN INPUT/OUTPUT DEVICE OR PROGRAM, USUALLY BRANCHING TO AN I/O ROUTINE TO PERFORM THE FUNCTION STATED IN THE BLOCK.

POINTS WHERE THE PROGRAM BRANCHES TO ALTERNATE PROCESSING, BASED UPON VARIABLE CONDITIONS SUCH AS PROGRAM SWITCH SETTINGS AND TEST RESULTS.

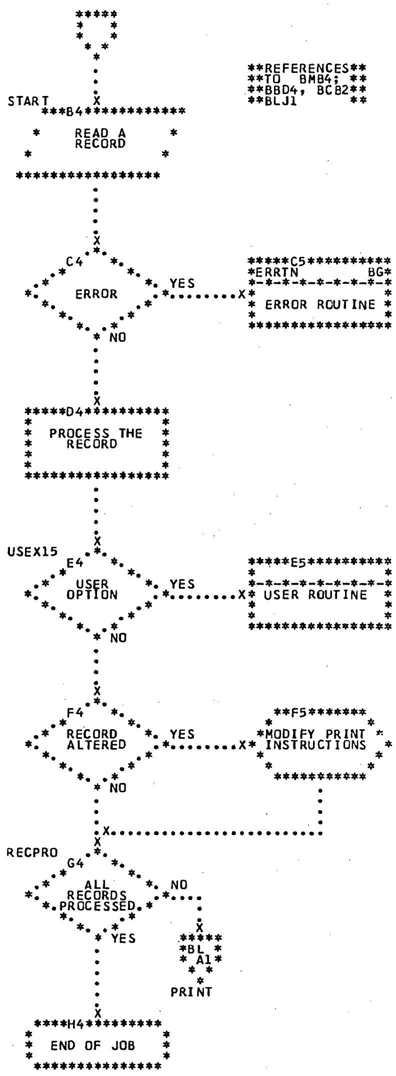


THE BEGINNING, END, OR POINT OF INTERRUPTION IN A PROGRAM.

ON-PAGE CONNECTOR. AN ENTRY FROM, OR AN EXIT TO, ANOTHER FUNCTION ON THE SAME FLOWCHART. THE NUMBER IN THE CONNECTOR IDENTIFIES THE CORRESPONDING ENTRY OR EXIT ON THE CHART.

OFF-PAGE CONNECTOR. AN ENTRY FROM, OR AN EXIT TO, A GIVEN POINT ON ANOTHER FLOWCHART. THE CHARACTERS IN THE CONNECTOR IDENTIFY THE CHART AND BLOCK. THE CORRESPONDING LABEL, IF ANY, IS PLACED OUTSIDE THE CONNECTOR. FOR MULTIPLE ENTRIES AND EXITS, AN ASTERISK APPEARS IN THE CONNECTOR AND THE CHARACTERS ARE LISTED NEARBY.

EXAMPLE



Indexes to systems reference library manuals are consolidated in the publication, DOS Master Index, GC24-5063. For additional information about any subject listed below, refer to other publications listed for the same subject in the Master Index.