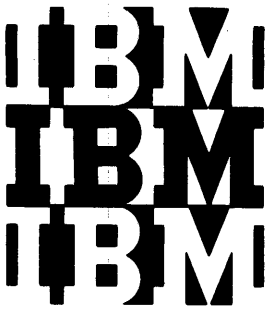
File No. 1130-36
Form Y30-1001-0



Program Logic

IBM 1130 Remote Job Entry Work Station Program Program Logic Manual

Program Number 1130-CQ-009

This Program Logic Manual describes the internal logic of the 1130 RJE Work Station Program under Version 2 of the IBM 1130 Disk Monitor System. This publication is intended for use by personnel involved in program maintenance and by system programmers who are altering the system design. Program logic information is not necessary for the use and operation of the program; therefore, distribution of this publication is limited to persons with program maintenance or modification responsibilities.

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This Program Logic Manual (PLM) is a detailed guide to the internal structure of the 1130 RJE Work Station Program. It supplements the program listings by providing descriptive text and flowcharts; program structure at the machine instruction level is not discussed.

This PLM is divided into three main sections:

Physical Organization: This section describes the different modules and their relationship. System Generation is also included in this section.

System Overview: This section gives a general overall view of how the system works.

Logical Organization: This section describes in detail the functions of each subroutine. The flowcharts are presented after the subroutines and are referred to by chart ID.

Diagrams and tables concerning the work station program are presented in the appendixes.

Prerequisite and Related Literature

The following IBM publications provide information helpful in the effective use of this manual:

IBM System/360 Operating System Remote Job Entry, Form C30-2006.

IBM System/360 Operating System Remote Job Entry, Program Logic Manual, Form Y30-2005.

IBM 1130 Subroutine Library, Form C26-5929.

IBM 1130 Synchronous Communications Adapter Subroutines, Form C26-3706.

IBM 1130 Disk Monitor System, Version 2, Programming and Operator's Guide, Form C26-3717.

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Remote Job Entry (RJE) of the IBM System/360 Operating System (OS/360) allows users to submit jobs via communication lines into the job input stream from remote terminals. The job entry facilities of RJE are the same as those available at the central computing installation itself--job definition and execution, data set creation, access, and maintenance. In fact, any of the elements that can be entered into the job stream at the central location can also be entered at a remote terminal under RJE.

Remote Job Entry controls a flow of data and processes that data as required. Data entered from remote sources is the primary input to the RJE system and consists of job entries and commands. Commands may also be entered by the central operator. Jobs submitted by remote users are passed to OS/360 for scheduling and execution. When the output from these jobs becomes available, it is returned to the user as specified--either immediately or on request.

An IBM 1130 Computing System may be used as an RJE work station. The 1130 work station requires an 1131 CPU (Central Processing Unit), including a console printer-keyboard, with a single disk storage drive and at least 8K words of core storage. The system is connected to a 1200-2400 bit-per-second line via a Synchronous Communications Adapter in binary mode. Three special features are required: (1) card reader, (2) card punch, and (3) line printer.

The principal function of the 1130 RJE program is input and output; that is, the interface between the telecommunication subroutine and the I/O devices.

This document describes the programming logic of the remote work station written for the 1130 using Binary Synchronous Communications (BSC) under the Disk Monitor System Version 2.

SYSTEM GENERATION

The 1130 RJE support consists of two programs, RJE00 and RJE. The RJE00 program is the generation program. The RJE program consists of one initializing mainline program (RJQST) and eight LINKs. Each LINK consists of a mainline program and a set of subroutines constituting the actual RJE program for a specific configuration of the remote station.

The RJE00 program provides the user with the ability to change the line information. This information is located in a disk data file named RJCON (see Appendix B). The file contains information about the type of line and about user-reserved space on disk for user-exit data. This information is used later so that the correct subroutines for the particular installation specified will be loaded into core to build the RJE program. This file must be updated whenever any of the information changes. The function of RJE00 is to update the file RJCON.

The RJE program is loaded by using the usual 1130 Disk Monitor control cards. Program control is given first to a program named RJQST. This program reads, from disk files, information describing the remote configuration and, according to this information, the subroutines needed to build the work station dependent RJE program are loaded into core, overlaying RJQST.

RJQST executes one of eight LINK instructions depending upon the principal I/O device, principal print device, and whether the line is point-to-point or multipoint. The LINK instruction that is executed brings into core the interrupt service subroutines (ISS) needed by this configuration and also one of eight mainline programs (RJLOn). When the Core Load Builder and Core Image Loader brings the RJLOn program into core, all subroutines referenced in a dummy CALL list are also brought in along with RJLOn, overlaying RJQST. RJLOn changes the CALL list to an address table. It is in this way that the RJE program is loaded and ready to go, regardless of the configuration of the particular installation.

The 1130 RJE Work Station Program uses various ISS (available in the 1130 subroutine library) to transfer data to and from the various input/output devices attached to the computer. These subroutines handle all the details peculiar to each device, including the complex interrupt functions. Control is transferred from the main program to the subroutine by a set of instructions known as a calling sequence, or basic linkage. A calling sequence transfers control to a subroutine and, through parameters, gives the subroutine any control information required. Each calling sequence used with subroutines in the 1130 system consists of a CALL or LIBF statement (whichever is required to call the specific subroutine), followed by the declare (DC) statements that make up the parameter list. Each subroutine is self-contained; only those subroutines required by the current job are in core storage during execution. (See IBM 1130 Subroutine Library, Form C26-5929).

The 1130 RJE Work Station Program provides the standard interface to the RJE communications network by using SCAT2 and SCAT3 Binary Synchronous Communications subroutines. The SCAT2 subroutine controls the 1130 Synchronous Communications Adapter (SCA) during point-to-point operation in Binary Synchronous Communication (BSC) mode. The SCAT3 subroutine controls the 1130 Synchronous Communications Adapter (SCA) during multipoint operation in BSC mode. In multipoint, centralized operation, the SCAT3 subroutine permits the 1130 to operate only as a tributary station. Error checking performed by SCAT2 and SCAT3 subroutines consists of a 16-bit Cyclic Redundancy Check (CRC-16). These subroutines also use the alternating acknowledgment method for protection against the loss of blocks of data. (See IBM 1130 Synchronous Communications Adapter Subroutines, Form C26-3706.)

The printer subroutines used are PRNT2 and PRNT3. The PRNT2 subroutine handles all print and carriage control functions of the IBM 1132 Printer and permits concurrent operation of the 1132 Printer and the Synchronous Communications Adapter. Only one line of data can be printed or one carriage operation executed with each call to the printer subroutine. The data in the output area must be in EBCDIC form, packed two characters per word. The PRNT3 subroutine handles all print and carriage control functions for the 1403 Printer. Only one line of data can be printed and/or one carriage operation executed with each call to the printer subroutine. (See IBM 1130 Subroutine Library, Form C26-5929, and IBM 1130 Synchronous Communications Adapter Subroutines, Form C26-3706.)

The CARD1 subroutine performs all I/O functions for the IBM 1442 Card Read Punch: reading, punching, feeding, and stacker selection. The 1130 RJE Work Station Program uses it to read cards and to punch cards. It has an error parameter and can detect errors.

The READ1 subroutine is used for operation of the 2501 Card Reader. It has an error parameter and can detect errors.

The PNCH1 subroutine is used to perform all I/O functions for the IBM 1442-5 Card Punch, that is, punch and feed.

DISKZ is the subroutine used for disk I/O functions. The DISKZ subroutine offers no file protection, no preoperative parameter checks, no write immediate function, and no write without readback check function. This subroutine is designed to operate in an error-free environment.

The TYPE0 subroutine handles the transfer of input and output to and from the console printer and keyboard. (See IBM 1130 Subroutine Library, Form C26-5929.)

MODULES

The 1130 RJE Work Station Program consists of three modules: DIRECTOR, INTRAN, and REVOUT (see Appendix A). The DIRECTOR exercises control over the other two modules and provides services for them. Through its monitoring functions, it exercises control over all input from the work station I/O devices and receipt of output from the central system by passing control to the proper subroutines to handle these functions. The mainline program RJLOn, and the following subroutines make up the DIRECTOR module: BEGIN, CNTRL, RJREQ, RJMSG, RJFIN, WSCAT, CLOSE, NLTYP, RWDSK.

The input transmission module, INTRAN, reads all input from the I/O devices, does some checking, and transmits the input to the central system. It is composed of the following subroutines: WRITE, RJINP, CRDRD, RJKBD, RJDSK, RJCHK.

The receive output module, REVOUT, receives output from the central system and puts it to the appropriate output device or directs it to the user-exit subroutine. This module consists of the following subroutines: READ, RJHDR, RJOUT, PRNTR, PUNCH, UEXIT.

Initial control is given to the initializing mainline program, which establishes the configuration of the remote station and, according to this information, executes one of eight LINK instructions. This mainline program then sets up the address table and inserts the branch address for a level 5 interrupt. By the time the load program gets control, all the subroutines needed to build the 1130 RJE Work Station Program are in core.

The BEGIN subroutine reads the first card in the card reader. It must be an RJSTART command. This is the only command that is sequence checked. It must be the first command in the card reader at work station startup and after a permanent line error. The RJSTART command is valid only when submitted from the card reader. If it is in error or missing, a message is sent to the operator so that he can submit a correct RJSTART command from the card reader. After a correct RJSTART command has been read, the line is initialized and the RJSTART is transmitted over the line to the central system. If the central system does not accept the RJSTART command, an EOT will be sent in response. The 1130 program will issue the following message to the operator: "J23 INPUT ABORTED BY CENTRAL." The central system then will send a message indicating what is wrong with the RJSTART command. The operator must put a correct RJSTART card in the card reader.

When an RJSTART is accepted, the remaining cards, up to a job entry or end-of-file indicator, are read and transmitted to the central system. Then the control subroutine (CNTRL) sends an EOT to the central system and waits for a response. An ENQ from the central system on a nonswitched or switched point-to-point line, or an addressing sequence on a multipoint line, indicates that the central system has output to send and control is given to the READ subroutine to receive this output. An EOT from the central system on a switched line, a timeout on a nonswitched line, or a polling sequence on a multipoint line indicates that the central system does not have any output at this time. In this case the control subroutine checks its input program switches for more input. If neither of the input switches are on, the central system is checked again for output. Communications are maintained on a switched line by exchanging EOTs. If no output is indicated the second time, the input switches are checked again; this loop continues until either input or output is indicated.

If either the card reader or keyboard or disk input switch is on, control is given to the WRITE subroutine, which selects the I/O device that is ready with input. The subroutine for the particular device reads the input. If the input is from the card reader or disk, it is blocked and placed in a line buffer until the buffer is full. The data-link control characters necessary for BSC transmission are appended to the contents of the buffer; then the input is transmitted to the central system.

Efficient data transfer is accomplished by using two buffers assisting in overlapping I/O. That is, when buffer A is filled with input it is written to the line. Buffer B then is filled while the program is waiting for the completion of the line operation. A correct, completed line operation causes buffer B to be written to the line and buffer A to be filled again. The input is transmitted in this way until a complete job entry has been sent (only true for point-to-point configurations), or an end-of-file is encountered in the input stream.

A limited amount of checking is done on input from the card reader and disk. The following cards are recognized: RJSTART, RJEND, JED, JOB, ..(null), // DD Data, /*, and .. DATA . Most of the checking is performed to set program switches. The .. (null) card is an end-of-file indicator. It causes reading to stop and an EOT to be transmitted to the central system from the control subroutine. Only the first JOB or JED cards are recognized in a multipoint configuration. After each job (except in a multipoint configuration) control is returned to the CNTRL subroutine so that an EOT can be sent and available output received. Also, once a // DD Data card is recognized, no other cards are recognized until after a /* is read.

If the input is from the console keyboard, the command is extended with blanks to an 80-character record, and the commands are transmitted one at a time to the central system. Since commands are the only valid input from the console keyboard, a check is made for the identifying characters .. in positions 1 and 2 followed by at least one blank. If these are not present an error message is written to the

operator and the command can be reentered. All commands from the keyboard are ended by an EOF. The CNTRL subroutine sends an EOT to the central system after each command. When an EOF is entered as the first character it indicates the end of the command input stream. The CNTRL subroutine sends an EOT to the central system and the line is turned around.

All transmission of input from the console keyboard is done in slow input mode. This means that a 'D' heading* (to set slow input mode) is sent before any of the input is transmitted and a 'R' heading* (to reset slow input mode) is sent when all the commands from the console keyboard have been transmitted.

When an RJEND command is recognized, program switches are set to indicate a system closedown. The CNTRL subroutine sends an EOT to the central system and waits for a reply. At this time the central system will send all pending messages. On a switched line the central system sends a '5' heading* followed by a DLE/EOT. This indicates that the RJE program is to be terminated. On a nonswitched line, the '5' heading is followed by an EOT only.

If the central system indicates that it has output to send, control is given to the READ subroutine for receipt of this output. A read is issued on the line to obtain the output. Each physical record is tested for a heading*. All job output from the central system should be preceded by a heading.* Therefore, the first record received from the central system should be a heading; if it is not, the output is printed at the line printer until a heading is received that directs the output to a specific I/O device. A heading contains information indicating the record size and format of the output and also the device for this output. All output received after the heading is directed to the device selected until a new heading, redirecting the output, is encountered.

After a heading has been received and processed by the header routine (RJHDR), the remaining output is read from the central system; one buffer is filled while the second buffer is written to an output device, thus overlapping line operations and local I/O operations. Each record from the central system is checked by the 1130 program to determine if it is a heading. This is necessary since the output device can be changed during a transmission. The output is deblocked and written on an output device. Forms-control characters may be contained in the output, and are used if they are present. Control characters are recognized to the extend supported by the 1130 Disk Monitor System subroutines and the hardware. If the heading specifies that the data is to go to the printer without control characters, a skip to channel 1 is executed. BSC control characters are removed from the output by leaving them in the buffer and just removing the text.

The remote I/O device is determined by checking a specified control character in the heading* sent from the central system. The device selected may be the printer, the punch, the console printer, or the output may be directed to the user-exit subroutine. If no user-written subroutine is present for output to the user-exit subroutine, the program writes this output on a disk storage unit (space is reserved for this by the user prior to RJE processing).

Central output may be discontinued at any time by following the operator communication procedure (see section on Operator Communication Request Subroutine). If the operator or the UEXIT subroutine (because of disk error) has requested that output be discontinued, control is returned to the discontinue output procedure in the CNTRL subroutine.

When an EOT is received from the central system, return is given to the CNTRL subroutine.

Note: All subroutines have the attributes of being serially reusable and relocatable. The following mainline programs are only relocatable: RJE00, RJQST, and RJLOn.

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* See Appendix E

RJCON is a disk data file which contains information about the type of communication line and about user-reserved space on disk for user-exit data, if any. It may be necessary to change the data file contents before the 1130 system can be used for RJE. The data file must be updated whenever any information changes. The user supplies this information by executing the program RJE00. If this program is not executed the first time, the RJE work station assumes a nonswitched, point-to-point line and no reserved disk space. After information has been written in the file or assumed, the RJE00 program need not be executed unless the information changes. The information will be used later to insure that the correct subroutines for that particular installation are loaded into core to build the RJE program.

PROGRAM NAME. RJE00 (Charts AA and AB)

ENTRY POINT. RJE00 is the only entry point. This program is loaded and executed by the following control card:

```
// XEQ RJE00
```

FUNCTION. RJE00 reads from the principal I/O device the card following the // XEQ card. This card must contain either the line information and/or the user-exit reserved space addresses that are to be written on the disk data set, RJCON, or the card must be blank. This configuration description card is printed out at the console printer. If this card contains invalid information, the message "J01 INVALID CARD" is written on the console printer and the system exits to the Disk Monitor Supervisor. In this case the operator must restart the generation and enter a valid card.

The card that follows the // XEQ card may specify one or both of the following parameters. If both are specified they may be in any order, but must be separated by a comma.

```
[LINE=P       ]   [UEXIT=(address1,address2)]
[LINE=S       ] , [                         ]
[LINE=M(x,y)  ]   [                         ]
```

Line Information:

- P indicates a nonswitched, point-to-point line
- S indicates a switched, point-to-point line
- M indicates a multipoint line where
  - x is the polling character
  - y is the selection character

UEXIT Information:

- address1 starting address on disk for storing of data
- address2 ending address on disk for storing of data

The format of address1 and address2 is xaaa, where

- x is the logical drive number
- aaa is the sector address (in hexadecimal)

If the LINE parameter is omitted, the line information is not changed. If the UEXIT parameter is omitted, no space is reserved on disk for user-exit data.

The information on this card is written in the file RJCON on the disk. The first word will contain the type of line. Polling and selection characters, if any, are put in the second and third words. If the UEXIT parameter is specified, the addresses are put in the fifth and sixth words.

Four different buffers are used: an 80-word card input buffer (CRDIN), a 320-word disk buffer (RJCON), a 40-word print buffer (PRINT), and an 80-word work area (SPDUT). These are all located within this program.

EXTERNAL SUBROUTINES. None

EXITS.

Normal: Disk Monitor Resident Supervisor
Error : None

Note: This program uses the principal I/O device and print device for reading and printing. The first four words of the program hold the identification FFFFFFD9D1C5F0F0.

INITIALIZATION OF WORK STATION PROGRAM

Initialization of the 1130 RJE Work Station Program at system startup is performed by two mainline programs and one subroutine:

RJQST

RJLOn

BEGIN

This section contains a description of these programs and the subroutines.

Initializing Program

PROGRAM NAME. RJQST (Chart BA)

ENTRY POINT. RJE is the only entry point. Control is first given to this program (RJQST) when the 1130 RJE Work Station Program is executed by the following 1130 Disk Monitor control card: // XEQ RJE.

FUNCTION. This program reads line information from the disk data set RJCON, and reads principal device information from DCOM, which is located on disk. Together this information forms the configuration of the 1130 RJE Work Station Program. According to this configuration, the subroutines needed to build the work station dependent RJE program are loaded into core, overlaying RJQST. This is accomplished by the execution of one of eight LINK instructions. There is one LINK instruction for each possible configuration of an 1130 RJE Work Station Program. The calling sequence is LINK RJLOn, where n stands for 1, 2, 3, 4, 5, 6, 7, or 8. One of the eight LINK instructions is executed depending on the type of line, the principal input device, and the principal print device. Associated with each LINK instruction is a list of dummy CALL statements that contain the subroutines necessary for this particular work station program. When the RJLOn program is loaded, all the subroutines listed in the CALL statements associated with this RJLOn program are also loaded.

The LINK table is as follows:

LINK	table	system subroutines included in Work Station			
LINK	RJL01	SCAT2,	PRNT3,	CARD1	
LINK	RJL02	SCAT3,	PRNT3,	CARD1	
LINK	RJL03	SCAT2,	PRNT2,	CARD1	
LINK	RJL04	SCAT3,	PRNT2,	CARD1	
LINK	RJL05	SCAT2,	PRNT3,	READ1,	PNCH1
LINK	RJL06	SCAT3,	PRNT3,	READ1,	PNCH1
LINK	RJL07	SCAT2,	PRNT2,	READ1,	PNCH1
LINK	RJL08	SCAT3,	PRNT2,	READ1,	PNCH1

If the printer or card reader specified in the DCOM is an invalid device, "J10 INVALID PRINTER" or "J11 INVALID READER" will be written at the console printer. The RJE program then exits to the Disk Monitor. The operator may restart the RJE program after assigning a correct printer or card reader as the principal device.

A 320-word buffer (DAREA) is provided for use in reading from disk. If an error occurs in trying to read DCOM or RJCON, the message "J14 DISK ERROR OCR=" will be written at the console printer. The next action depends on the operator response. He may reply in either of two ways: X (exit to the Disk Monitor) or T (terminate processing by exiting to the Disk Monitor and dumping core).

EXTERNAL SUBROUTINES. None.

EXITS. Normal: One of eight LINK RJL0n where n could be 1, 2, 3, 4, 5, 6, 7, or 8. Error: EXIT or terminal DUMP entry points in Disk Monitor Resident Supervisor according to response given on message.

Note: The first four words of the program contain the identification FFFFFFD9D1C50000.

Load Program

PROGRAM NAME. RJL0n (Chart CA)

Note: This description applies to the programs named RJL01 - RJL08, the only difference being the device subroutines that are indirectly referenced. The first four words of the program hold the identification FFFFFFD9D1D3F0Fn, where n is a number in the range 1 through 8.

ENTRY POINT. RJL0n

FUNCTION. When the Core Load Builder and Core Image Loader bring the RJL0n program into core, all subroutines referenced in the dummy CALL list are also brought into core. This CALL list is sufficient to describe the configuration of the RJE work station. The RJL0n program changes the CALL list to an address table, by taking the entry point address of each subroutine from the Transfer Vector Table and placing this address in the second word of the CALL statement for that subroutine. The second word of the CALL statement is then equated to a general name. When this general name is referenced in other subroutines, the subroutine at this address will automatically be the correct one. Thus, the list of CALL statements becomes a table of entry points to the subroutines in the 1130 RJE Work Station Program. The parameter list used in the user-exit subroutine is located at the beginning of the table. Index register 1 always points to the beginning of the table and is used for all references to that table. The contents of register 1 are stored in the first word of the RJREQ subroutine.

The branch address for a level 5 interrupt (see RJREQ subroutine) is inserted in the Disk Monitor Resident Supervisor.

Register 3 must be saved and restored, in order to preserve its contents, since it is used in calling the system subroutines.

This program also contains program switches used by several subroutines.

EXTERNAL SUBROUTINES. None.

EXITS. Normal: BEGIN subroutine, RJBGP for point-to-point lines and RJBGM for multipoint lines.
Error: None.

Communication Startup Subroutine

SUBROUTINE NAME. BEGIN (Charts DA, DB and DC)

Note: The logic of the subroutine for point-to-point configuration and for multipoint configuration is essentially the same.

ENTRY POINTS.

RJBGP - for point-to-point configuration

RJBGM - for multipoint configuration

FUNCTION. On initial entry to this subroutine, user-exit area addresses are moved from the file RJCON to the RJL0n program. In a multipoint configuration, the selection and polling characters are also obtained from RJCON and stored in the RJL0n program. Addresses to these characters are given to the CNTRL subroutine used for multipoint configurations (RJCM3 - entry point).

The BEGIN subroutine may also be entered as a result of a restart condition.

The first card is read from the card reader and must be an RJSTART command. If it is not an RJSTART command, "J20 RJSTART MISSING" is sent to the operator, who must resubmit a valid RJSTART command at the card reader. An RJSTART command is accepted only from the card reader.

After an RJSTART command has been read, the line is initialized and the command is transmitted immediately on a point-to-point line or on a multipoint line when the work station is polled. If the data set is not ready on a switched line, the message "ESTABLISH LINE CONNECTION" is written at the console printer indicating to the operator that he must dial the central system. If the RJSTART command is accepted by the central system, any cards in the card reader up to and including a JED card, JOB card, or .. (null) card are read. All of these cards are transmitted to the central system except the last one, which remains in the card input buffer (RD420).

Then an 'R' heading is sent over the line to reset slow input mode, which may have been set if the work station program terminated abnormally in a previous run.

A switch is set in a multipoint environment before the exit, suppressing any checking for JOB or JED cards in the input stream in order to avoid turnaround of the line between jobs.

EXTERNAL SUBROUTINES.

RJMSG - prints the following messages when they apply:

"J20 RJSTART MISSING" and
"ESTABLISH LINE CONNECTION."

RWDSK - reads information from the file RJCON.

RJCP2 - for point-to-point configuration and RJCM2 for multipoint configuration (CNTRL) - sends

S E
O R T on line to central.
H X

RJCM3 - (CNTRL) - gives the CNTRL subroutine access to polling and selection characters in a multipoint line configuration.

WSCAT - waits for operation completion on the line.

RJTWP - for point-to-point configuration and RJTWM for multipoint configuration (WRITE) - sends commands to the central system.

RJINP - selects the input device and then branches to the read subroutine for that device.

EXITS. Normal: CNTRL subroutine -- RJCNP to send EOT and to determine the next action in a point-to-point configuration, and RJCNM to send EOT and to determine the next action in a multipoint configuration. The Accumulator (ACC) and the transmit EOT indicator (TMEOT) must be nonzero. Error: RJMSG with message code=1 to indicate disk error or with message code=9 to indicate line error.

CONTROLLING SUBROUTINE (CNTRL)

This is the main subroutine of the DIRECTOR. It sends headings and EOTs, and checks responses from the central system. Program control decisions are the major function of the control subroutine. These decisions are made by interrogation of the program switches for local input devices and monitoring the line for output. The control subroutine of the DIRECTOR delegates program control, on the basis of the program switches, to either the transmit subroutine of INTRAN or the receive subroutine of REVOUT.

SUBROUTINE NAME. CNTRL (Charts EA, EB, EC, ED, EE, EG, and EH)

Note: CNTRL is the symbolic name used for the entry points RJCNP and RJCNM. RDRER is the symbolic name used for the entry points RJCP1 and RJCM1. RHDNG is the symbolic name used for the entry points RJCP2 and RJCM2.

ENTRY POINTS.

RJCNP - entered when an EOT is received or is to be sent (point-to-point configuration).

RJCNM - entered when an EOT is received or is to be sent (multipoint configuration).

There are four conditions under which entrance may be made.

1. Normal end of transmission after output is received: Accumulator=zero.
2. Discontinue input request by the central system: Accumulator=nonzero and ABORT=nonzero.
3. Normal end of transmission after input is sent: Accumulator=nonzero, TMEOT=nonzero, and ABORT=zero.
4. Discontinue output request by operator or program: Accumulator=nonzero, DSCON=nonzero, ABORT=zero, and TMEOT=zero.

RJCP1 - entered when a card reader error has occurred (point-to-point configuration).

RJCM1 - entered when a card reader error has occurred (multipoint configuration).

RJCP2 - entered when SOH R ETX is to be sent (point-to-point configuration).

RJCM2 - entered when SOH R ETX is to be sent (multipoint configuration).

RJCM3 - (multipoint configuration) entered from BEGIN to give the communication subroutines access to the polling and selection characters.

FUNCTION. This subroutine receives control each time there is to be a change in the direction of transmission on the line.

When this subroutine is entered from the line initialization subroutine (BEGIN) or from the WRITE subroutine, an EOT is sent over the line and the response from the central system is checked. If an ENQ is received, an exit is made to the READ subroutine for receipt of the output. On a multipoint line, output is indicated by an

addressing sequence from the central system. No output is indicated by a time-out on a nonswitched line, an EOT on a switched line, or a polling sequence on a multipoint line.

If no output from the central system is indicated, the CNTRL subroutine then checks its switches for input from the card reader or console keyboard. If either of these indicators is on, control is given to the WRITE subroutine to start writing to the line, except in case of keyboard input

```
      S   E
when a O D T heading is first sent over
      H   X
```

the line to indicate slow input mode.

When neither of the input indicators is on, the central system is again checked for output. Communications with the central system are maintained on a switched line by exchanging EOTs. If no output is indicated again, the input indicators are checked again, and this loop continues until either input or output is indicated.

When the CNTRL subroutine is entered from the READ subroutine and the discontinue output indicator (DSCON) is set, an EOT is sent as a response to the last block received before the CNTRL subroutine looks for input to transmit.

When the indicators show that the input was aborted by the central system, the CNTRL subroutine turns off the card input and console-keyboard input indicators and resets some of the program switches before checking for output.

The card reader error subroutine is entered at RJCP1 (RJCM1 for multipoint configuration). It is placed in the CNTRL subroutine because it uses the 'D' and 'R' heading procedures. RJCP2 (RJCM2 for multipoint configuration) is entered to

```
        S   E
send the O R T heading to reset the slow
        H   X
```

input mode.

In multipoint there is an extra entry point, RJCM3. The CNTRL subroutine is entered at this entry point from the BEGIN subroutine at the work station startup to give the communication subroutines access to the selection and polling characters.

When a disk error occurs, a procedure in the CNTRL subroutine sends a certain sequence, depending on the configuration, to the central system. When a disk input error occurs on a point-to-point line, this procedure sends a 'D' heading over the line, followed by an EOT; then a message is written to the operator and an 'R' heading is sent, followed by an EOT. In every case, the next action depends upon the operator response to the message. On a multipoint line, an EOT is sent over the line and a message is written to the operator. The procedure is different for disk output errors. On a point-to-point nonswitched line an EOT is sent to discontinue output and the error message is written to the operator. On a point-to-point switched line, an EOT is sent to discontinue output and a 'D' heading is sent, followed by an EOT; then the message is written to the operator, followed by an 'R' heading and an EOT. On a multipoint line, an EOT is sent to discontinue output and the error message is written to the operator.

EXTERNAL SUBROUTINES. RJTWP for point-to-point configuration and RJTWM for multipoint configuration (WRITE) - sends commands and job entries to the central system.
RJTRP for point-to-point configuration and RJTRM for multipoint configuration (READ) - reads output from the central system.
WSCAT - waits for completion of line operation.
RJMSG - writes messages for disk errors, i.e., codes 10, 11, and 12.
CLOSE - resets the Communications Adapter (only in multipoint configuration).

EXITS. Normal: RJFIN with Accumulator = zero.
Error: RJMSG with message code = 9 for line errors.

TRANSMITTING INPUT (INTRAN) SUBROUTINES

The basic function of INTRAN is to read input from an I/O device at the 1130 Remote Work Station and send it as input to the central system. INTRAN supplies five services in support of this concept: reading from the card reader, reading from the console keyboard, reading from a disk storage unit, blocking records for transmission, and sending blocked records to the central system.

INTRAN is divided into six subroutines that perform its functions:

WRITE
RJINP
CRDRD
RJKBD
RJDSK
RJCHK

A detailed description of each subroutine follows.

Transmit Subroutine

SUBROUTINE NAME. WRITE (Charts FA, FB, FC and FD)

Note: The following description is valid for both point-to-point and multipoint configuration subroutines.

ENTRY POINT.

RJTWP for point-to-point configuration.
RJTWM for multipoint configuration.

FUNCTION. This subroutine reads 80-character records from the 1130 input devices (card reader, disk, console keyboard) and writes them to the communications line. Two 404-word buffers (RJTB1 and RJTB2 for point-to-point lines; RJTB3 and RJTB4 for multipoint lines) located in READ are used in overlapping reading from a local input device and writing to the line.

When a line error is detected, an exit is made to RJMSG with message code = 9 to write the message to the operator.

If an EOT is received in response to the text, the subroutine sets the Accumulator = nonzero and ABORT = nonzero so that upon return to the CNTRL subroutine the abort procedure is executed.

EXTERNAL SUBROUTINES.

RJINP - selects device that has input.
WSCAT - waits for completion of line operation.

EXITS. Normal: Return to calling subroutine.
Error: RJMSG with message code = 9 to indicate a line error.

Input Switch Subroutine

SUBROUTINE NAME. RJINP (Chart GA)

ENTRY POINT. RJINP

FUNCTION. This subroutine selects the device from which the current input is to be read and moved to a line buffer. The selection is made by checking indicators in the RJL0n program that have been set according to operator responses.

EXTERNAL SUBROUTINES.

CRDRD - reads and checks card input from the card reader.
RJKBD - reads a record from the console keyboard.
RJDSK - reads and checks records from disk.

EXITS. Normal: Return to calling subroutine.
Error: RJFIN with Accumulator = nonzero to dump contents of core storage at the printer if no input switch is on.

Card Input Subroutine

SUBROUTINE NAME. CRDRD (Chart HA)

Note: The logic for the 2501 and 1442 Card Readers is identical. CRDRD is the symbolic name used in calling this subroutine since it is not known which card reader is being used.

ENTRY POINTS.

RJRD1 to service 1442 Card Reader.
RJRD2 to service 2501 Card Reader.

FUNCTION. This subroutine reads cards from the card reader, converts them to EBCDIC code, and stores them in a line buffer. Each character from a card is stored in EBCDIC in the first 8 bits of a word. If the card reader is not ready or if a read check occurs, the subroutine goes to a procedure in CNTRL (RDRER) that sends a 'D' heading over the line followed by an EOT, writes a message to the operator and waits for the reply, sends an 'R' heading and then continues according to the operator response. The 80-word input buffer (RD420) is located in CRDRD; the two line buffers (RJTB1 and RJTB2 for point-to-point configuration; RJTB3 and RJTB4 for multipoint configuration) of 404 words each are used alternately as output buffers.

EXTERNAL SUBROUTINES.

RJCHK - checks each record and sets program switches.
RDRER (in CNTRL) - sends headings and writes an error message.

EXITS. Normal: Return to calling subroutine.
Error: None.

Console Keyboard Input Subroutine

SUBROUTINE NAME. RJKBD (Chart IA)

ENTRY POINT. RJKBD

FUNCTION. One record is read from the console keyboard. It is extended with blanks to an 80-character record. The record is then translated to EBCDIC and moved to a line buffer. Since commands are the only acceptable input from the console keyboard, the record must have the identifying

characters .. in positions 1 and 2 followed by at least one blank. Otherwise an error message, "J22 INVALID INPUT", is written to the operator. The system then waits for the operator to type in another command or an EOF to indicate end-of-file. The commands submitted from the console keyboard are transmitted in slow input mode. A "D" heading must be sent over the line initially. This gives the operator three minutes to type in the command. Commands are sent over the line one at a time. An EOT is sent after each command by a procedure in the subroutine CNTRL but the line is turned around only after all the commands are sent. Consequently, the only valid reply from the central system after a command is sent from the console keyboard is an EOT on switched lines, and timeout otherwise.

If the first thing the operator types in is an EOF, this indicates he has finished sending commands. In this case an 'R' heading is sent to the central system by a procedure in the subroutine CNTRL to reset slow input mode. This is followed by an EOT and then the CNTRL subroutine waits for a reply.

Part of the line buffer located in the READ subroutine is used as an input and output buffer.

EXTERNAL SUBROUTINES.

- RJCP2 - for point-to-point configuration and RJCM2 for multipoint configuration (CNTRL) - indicates end of slow input mode.
- RJMSG - prints error message.
- NLTYP - returns carriage on console printer.

EXITS. Normal: Return to calling subroutine.
Error: None.

Disk Input Subroutine

SUBROUTINE NAME. RJDSK (Chart JA)

ENTRY POINT. RJDSK

FUNCTION. This subroutine reads 80-character logical records from a disk unit and blocks them in a line buffer. When an error in reading from the disk is encountered or when the end of a disk unit is reached without an end-of-file indication in the data, a return is made to the calling subroutine with message code = 10 indicating a message is to be written to the operator. End-of-file is reached on a disk unit when the number of disk blocks specified in a .. DATA card, an RJEND command, a NULL statement, or another .. DATA card is read.

The 320-word disk buffer (RJDSB) is located in this subroutine. The two line buffers (RJTB1 and RJTB2 for point-to-point lines; RJTB3 and RJTB4 for multipoint lines), 404 words each, are located in the READ subroutine and used alternately as output buffers.

EXTERNAL SUBROUTINES.

- RJCHK - checks each record in order to set program switches.
- RWDSK - reads a disk sector. Accumulator must contain a zero to indicate the read function. The Extension (EXT) must contain the address of the disk input buffer.

EXITS. Normal: Return to calling subroutine.
Error: Return to calling subroutine with message code = 10 and the TMEOT indicator turned on; the disk and card input indicators are turned off to terminate the input stream after a disk error.

Check Subroutine

SUBROUTINE NAME. RJCHK (Charts KA and KB)

ENTRY POINT. RJCHK

FUNCTION. This subroutine checks all records read by CRDRD or RJDSK subroutines and sets program switches located in the RJL0n program for the following recognized statements: RJSTART, RJEND, JED, JOB, DD Data, /*, .. (null) and .. DATA. The subroutine will not recognize JOB or JED statements in a multipoint configuration except for the first one (also the first JED or JOB statement after a restart condition has occurred).

The message "J21 .. DATA INVALID", is written to the operator if any of the parameters in the .. DATA command are invalid. The RJSTART command is not recognized if read by RJDSK. When a DD Data statement is read, none of the above statements are recognized until after a /*.

EXTERNAL SUBROUTINES. RJMSG - with message code = 6 to write message to operator.

EXITS. Normal: Return to calling subroutine.
Error: None.

RECEIVING OUTPUT (REVOUT) SUBROUTINES

The basic function of REVOUT is to read output from the central system and send it to an I/O device located at the 1130 Remote Work Station. Specifically REVOUT deals with processing headers, reading out-

put from the central system, selecting the output path, and writing the output to the I/O device.

REVOUT is divided into six subroutines that perform these functions:

READ
RJHDR
RJOUT
PRNTR
PUNCH
UEXIT

A detailed description of each subroutine follows.

Receiving Subroutine

SUBROUTINE NAME. READ (Charts LA and LB)

Note: The description is valid for both point-to-point and multipoint lines.

ENTRY POINTS.

RJTRP - entry point for point-to-point configuration.
RJTRM - entry point for multipoint configuration.

FUNCTION. This subroutine reads output from the central system. Two line buffers (RJTB1 and RJTB2 for point-to-point lines; RJTB3 and RJTB4 for multipoint lines) of 404 words each, are used so that output can be received from the central system at the same time that the local output device is being serviced. Each record is checked to see if it is a heading. When a heading is received, the RJHDR subroutine is called to process this information. After the heading is processed and the line buffer is filled, an exit is made to the RJOUT subroutine to select the output device.

When an EOT is received after output from the central system, return is made to the CNTRL subroutine with the ACC = zero. If the previous heading specified the UEXIT subroutine as the destination for the output, a branch is made to the UEXIT subroutine in order to indicate the end of user-exit output before going to the CNTRL subroutine.

A line error in reading the output from the central system causes an exit to the RJMSG subroutine with message code = 9. This prints the message "J51 LINE ERROR OCR=" at the console printer. Action then depends upon the operator response. This is discussed in the section on the RJMSG subroutine.

If a DLE/EOT is received from the central system on a switched line, this subroutine checks to see if a '5' heading has just been received, and if so, an exit is made to the RJFIN subroutine for closedown. If a '5' heading has not been received, the DLE/EOT means that the central system found an irrecoverable error and is breaking its line connection with the 1130 work station. If this is the case, the DLE/EOT is regarded as a line error. The only way communication can be reestablished is by redialing and issuing another RJSTART command. (DLE/EOT is always followed by disconnection on a switched line.)

Before each read operation, the discontinue output indicator (DSCON) is checked. If this indicator is set, no more output is read from the central system and return is made to the CNTRL subroutine with a nonzero in the Accumulator to indicate sending an EOT to the central system instead of an ACK in reply.

EXTERNAL SUBROUTINES.

WSCAT - waits for completion of line operation.
RJHDR - processes the headings received.
UEXIT - when it is indicated that all of the UEXIT output has been received.
RJOUT - directs the output to the current output device.

EXITS. Normal: Return to calling subroutine; or RJFIN with ACC = 0 for closedown after a '5' heading on a switched line.
Error: RJMSG with message code = 9 for line error message to be written at the console printer.

Header Processing Subroutine

SUBROUTINE NAME. RJHDR (Chart MA)

ENTRY POINT. RJHDR

FUNCTION. This subroutine processes the information in the headings* received from the central system and stores the result in the RJL0n program. When the '5' heading is received, the status of some of the indicators in the RJL0n program is changed to indicate central RJE closedown.

EXTERNAL SUBROUTINES. None.

EXITS. Normal: Return to calling subroutine.
Error: None.

Output Switch Subroutine

SUBROUTINE NAME. RJOUT (Chart NA)

ENTRY POINT. RJOUT

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* See Appendix E

FUNCTION. This subroutine uses the information found in the device ID of the heading* to direct the output to the correct device. It also removes the line control characters from the line buffer, and passes control to the correct subroutine for processing the last line buffer received.

If a new heading is received changing the destination of the output, and if the previous heading has specified the UEXIT subroutine as the destination, a branch is made to the UEXIT subroutine to indicate that it has received all of its output. Then control is passed to the PRNTR, PUNCH, or UEXIT subroutine, depending on which was specified. When a '5' heading has been received, this subroutine returns directly to the READ subroutine.

EXTERNAL SUBROUTINES.

RJPR1 (PRNTR) - prints data on the 1403 Line Printer or the console printer.
RJPR2 (PRNTR) - prints data on the 1132 Line Printer or the console printer.
RJRP1 (PUNCH) - punches cards on the 1442 Card Read Punch, Models 6 and 7.
RJRP2 (PUNCH) - punches cards on the 1442 Card Punch, Model 5.
UEXIT - writes output on disk, or indicates end-of-file of disk output.

EXITS. Normal: Return to calling subroutine.
Error: RJFIN with ACC = nonzero to dump core in case of invalid device ID.

Print Output Subroutine

SUBROUTINE NAME. PRNTR (Chart OA)

Note: The subroutines for the 1403 and the 1132 Printers are logically identical. PRNTR is the symbolic name used in calling this subroutine since it is not known which printer is being used.

ENTRY POINTS.

RJPR1 - entry point for the 1403 Printer.
RJPR2 - entry point for the 1132 Printer.

FUNCTION. This subroutine prints OS/360 data sets on the line printer and RJE system messages on the console printer or the line printer. Switch 0 on the console is tested to determine the output printer for the RJE system messages. Records with or without control characters are accepted. For data sets with invalid or no control characters, the following format is used: spacing of one line with a skip to channel 1 when channel 12 is sensed. If the printer is not ready, the "PR NR" message is returned. The operator has approximately 21 seconds to make it ready or a line error will occur.

EXTERNAL SUBROUTINES. NLTYP - waits for completion of the operation on the console printer and resets the carriage for a new line.

EXITS. Normal: Return to calling subroutine.
Error: None.

Punch Output Subroutine

SUBROUTINE NAME. PUNCH (Chart PA and PB)

Notes: The description covers all models of the 1442 Card Read Punch supported. PUNCH is the symbolic name used in calling this subroutine since it is not known which model is being used.

ENTRY POINTS.

RJRP1 - for the 1442 Card Read Punch, Models 6 and 7.
RJRP2 - for the 1442 Card Punch, Model 5.

FUNCTION. Records up to 80 characters in length are moved from a line buffer to the card punch. This subroutine handles records with or without control characters. When there are no control characters or the characters are not recognized, stacker 1 is selected. On the 1442 Card Read Punch, Models 6 and 7, the first card of each data set is checked to insure that it is blank before punching. If the card is not blank, the RJMSG subroutine writes the message "PUNCHED OUTPUT" at the console printer. The 80-word output buffer (RD420) is the same as that used for CRDRD if model 6 or 7 of the 1442 is used. The buffer (RP900) for the model 5 of the 1442 Card Punch is 80 words and is located in this subroutine. If the punch is not ready "PU NR" is printed at the console printer, and the operator has approximately 21 seconds to make it ready or a line error will occur.

EXTERNAL SUBROUTINES. RJMSG - writes message at the console printer (only in RJRP1).

EXITS. Normal: Return to calling subroutine.
Error: None.

Disk Output Subroutine

SUBROUTINE NAME. UEXIT (Charts QA and QB)

ENTRY POINTS. UEXIT is the only entry point. The address of the parameter list is in register 1.

FUNCTION. Data directed to the UEXIT subroutine is stored on disk. Each data set

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*See Appendix E.

starts on a sector boundary and is stored in consecutive sectors. A message is written at the console printer giving the data set information and the address of the first sector used for this data set. When the end of the data set is reached, the number of disk blocks written is added to the message.

When no space is defined, when the area reserved is exhausted, or when a permanent disk error occurs, this subroutine sets the indicator (DSCON) to discontinue output. The message "J55 END OF DISK AREA OCR=" or "J53 DISK ERROR OUTPUT OCR=" will be issued to the operator by the CNTRL subroutine.

A 320-word disk buffer (RJDSB) located in the RJDSK subroutine is used for storing the data sets on disk.

EXTERNAL SUBROUTINES.

RWDSK - writes the data set on disk; a 1 must be in the ACC to indicate that the function is write, and the address of the output buffer must be in the Extension.
NLTYP - waits for completion of the console printer operation and resets the carriage.

EXITS. Normal: Return to calling subroutine.
Error: None.

Note: The user may substitute his own subroutine instead of the one supplied by IBM. He must save and restore index registers 1 and 3, if he wants to use them.

SERVICE SUBROUTINES

There are five functions of the DIRECTOR that service both the INTRAN and REVOUT subroutines. These functions are: waiting for the completion of the line operation, resetting the console printer, resetting the Communications Adapter, reading and writing on disk, and issuing messages to the operator. There are five subroutines in the DIRECTOR, referred to as service subroutines, that supply these functions:

WSCAT
NLTYP
RWDSK
RJMSG
CLOSE

A detailed description of each subroutine follows.

Wait for Line Operation Completion Subroutine

SUBROUTINE NAME. WSCAT (Chart RA)

ENTRY POINT. WSCAT

FUNCTION. This subroutine waits for the completion of any line I/O operation that is in progress.

EXTERNAL SUBROUTINES. None.

EXITS. Normal: Return to calling subroutine.
Error: None.

Note: Assembled with the initializing mainline program RJL0n.

End of Console Printer Operation Subroutine

SUBROUTINE NAME. NLTYP (Chart RA)

ENTRY POINTS.

NLTYP - carriage return on the console printer.
WTYPE - waits for completion of the console printer operation.

FUNCTION. This subroutine waits for completion of the console printer operation and resets the console printer by returning the carriage.

EXTERNAL SUBROUTINES. None.

EXITS. Normal: Return to calling subroutine.
Error: None.

Note: Assembled with the initializing mainline program RJL0n.

Read/Write on Disk Subroutine

SUBROUTINE NAME. RWDSK (Chart RB)

ENTRY POINT. RWDSK

FUNCTION. This subroutine reads a sector from or writes a sector on disk. The subroutine calling the RWDSK subroutine must put a 0 or 1 in the Accumulator to indicate which function is to be performed. A zero indicates read and a one indicates write. The address of the input/output buffer should be placed in the Extension. The disk buffer used (RJDSB) is located in the RJDSK subroutine. Upon completion of the function, the Accumulator indicates whether or not the disk operation was completed correctly.

EXTERNAL SUBROUTINES. None.

EXITS. Normal: Return to calling subroutine with ACC = nonzero to indicate disk operation completed correctly.
Error: Return to calling subroutine with ACC = zero to indicate disk operation was not completed correctly.

Note: Assembled with the initializing mainline program RJL0n.

Message Subroutine

SUBROUTINE NAME. RJMSG (Charts SA and SB)

ENTRY POINT. RJMSG

FUNCTION. This subroutine writes messages at the console printer. The RJCON sector on disk contains the messages. A message code placed in MSCOD indicates which message is to be written. For message codes 2, and 4-8, the RJMSG subroutine returns to the calling subroutine after writing the message. For message code 3, the RJMSG subroutine waits for any character to be entered, and then returns to the calling subroutine. For the other valid message codes the subroutine reads the operator response and acts accordingly. If the message code is invalid, the subroutine exits to the RJFIN subroutine with the Accumulator = nonzero to dump core.

Following is a list of actions taken on operator responses:

Response	MSCOD	Action
A	1	Not recognized
	9	Line is closed, and the subroutine exits to BEGIN to restart RJE
	10-12	Card reader stop indicator, STOPR, is reset
	13	No action
B	1, 9	Not recognized
	10-12	Basic keyboard indicator, KBINP, is set
	13	Not recognized
C	1, 9	Not recognized
	10-12	No action
	13	Not recognized
E	1,9-12	Not recognized
	13	Reset disk input indicator (DSKIN), set card reader stop (STOPR), and transmit EOT (TMEOT) indicators; reset other indicators that may have been set
T	1, 9-12	Exit to RJFIN with ACC = nonzero to dump core
	13	Not recognized
X	1, 9	Exit to RJFIN with ACC = zero to exit to Disk Monitor
	10-13	Not recognized

Following is a list of messages and their message codes:

J54	DISK ERROR OCR=*	Message code=1
ESTABLISH LINE CONNECTION		Message code=2
PUNCHED OUTPUT		Message code=3
PROCEED		Message code=4
J20	RJSTART MISSING	Message code=5
J21	.. DATA INVALID	Message code=6
J22	INVALID INPUT	Message code=7
J23	INPUT ABORTED BY CENTRAL	Message code=8
J51	LINE ERROR OCR=*	Message code=9
J52	DISK ERROR INPUT OCR=*	Message code=10
J53	DISK ERROR OUTPUT OCR=*	Message code=11
J55	END OF DISK AREA OCR=*	Message code=12
J56	CARD READER ERROR OCR=*	Message code=13

All the messages above go to the console printer. Indicators in the RJL0n program are set according to the operator response.

EXTERNAL SUBROUTINES.

CLOSE - resets the Communications Adapter.
NLTYP - returns the carriage on the console printer.
RWDSK - reads messages from RJCON on disk.

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* indicates operator response

EXITS. Normal:

	error code	response
RJFIN with ACC = nonzero	1, 9-12	T
RJFIN with ACC = zero	1, 9	X
BEGIN (RJBGP or RJBGM)	9	A
Return to calling subroutine.	All other combinations	

Error: RJFIN with ACC = nonzero for invalid message code.

Note: Assembled with the subroutine RJFIN.

End of Line Operation Subroutine

SUBROUTINE NAME. CLOSE (Chart RA)

ENTRY POINT. CLOSE

FUNCTION. This subroutine resets the Communications Adapter on the 1130.

EXTERNAL SUBROUTINES. None.

EXITS. Normal: Return to calling subroutine.
Error: None.

Note: Assembled with the initializing mainline program RJL0n.

OPERATOR COMMUNICATION REQUEST SUBROUTINE

The operator communication function is an important part of the DIRECTOR. These communications are provided to give the operator the ability to indicate more input, discontinue output on the line, terminate RJE processing, or ignore the request. The operator communication request subroutine (RJREQ) makes these facilities available.

SUBROUTINE NAME. RJREQ (Chart TA)

ENTRY POINTS. RJREQ - by pressing the Program Stop key

FUNCTION. This subroutine allows the operator to request certain actions from the RJE Work Station Program; it is entered as a level 5 interrupt subroutine when the Program Stop key is pressed. If the interrupt was not caused by the Program Stop key, the subroutine exits to ordinary level 5 processing. When the Program Stop key has been pressed, it is necessary to press the Program Start key, otherwise a new interrupt will occur as soon as the level 5 interrupt processing is finished. If the Program Stop key is pressed while RJREQ is being executed or the TYPE0 subroutine is printing at the console printer, return without the intended communication with the operator occurs. In all other cases the message "OCR=" is written at the console printer and the system waits for the operator to respond. Valid responses are A, B, D, N, T. For invalid responses the message is repeated and the operator replies again. The action taken depends on the or operator response.

The following action is taken on valid operator responses:

A - Card reader stop indicator (STOPR) in RJL0n is reset if the RJEND indicator is off.

B - Keyboard input indicator (KBINP) in RJL0n is set if the RJEND indicator is off.

D - Discontinue output indicator (DSCON) in RJL0n is set.

N - No action.

T - Accumulator is set to nonzero to indicate that a dump is desired and the termination subroutine RJFIN is entered.

On all responses but T, the system returns to the interrupt point.

EXTERNAL SUBROUTINES. User subroutine or Disk Monitor to handle level 5 interrupts other than Program Stop.

EXITS. Normal: Return to interrupt point. RJFIN if operator response is T.
Error: None.

Note: For interrupts other than Program Stop, it is assumed that the return is by a Branch Out or Skip on Condition (BOSC) instruction.

TERMINATION SUBROUTINE

The termination subroutine provides three functions necessary for the efficient closedown of the 1130 RJE Work Station Program: resetting the Communications Adapter on the 1130, dumping core if requested, and exiting to the Disk Monitor Resident Supervisor. The RJFIN subroutine supplies these functions with a branch to the CLOSE subroutine for resetting the Communications Adapter.

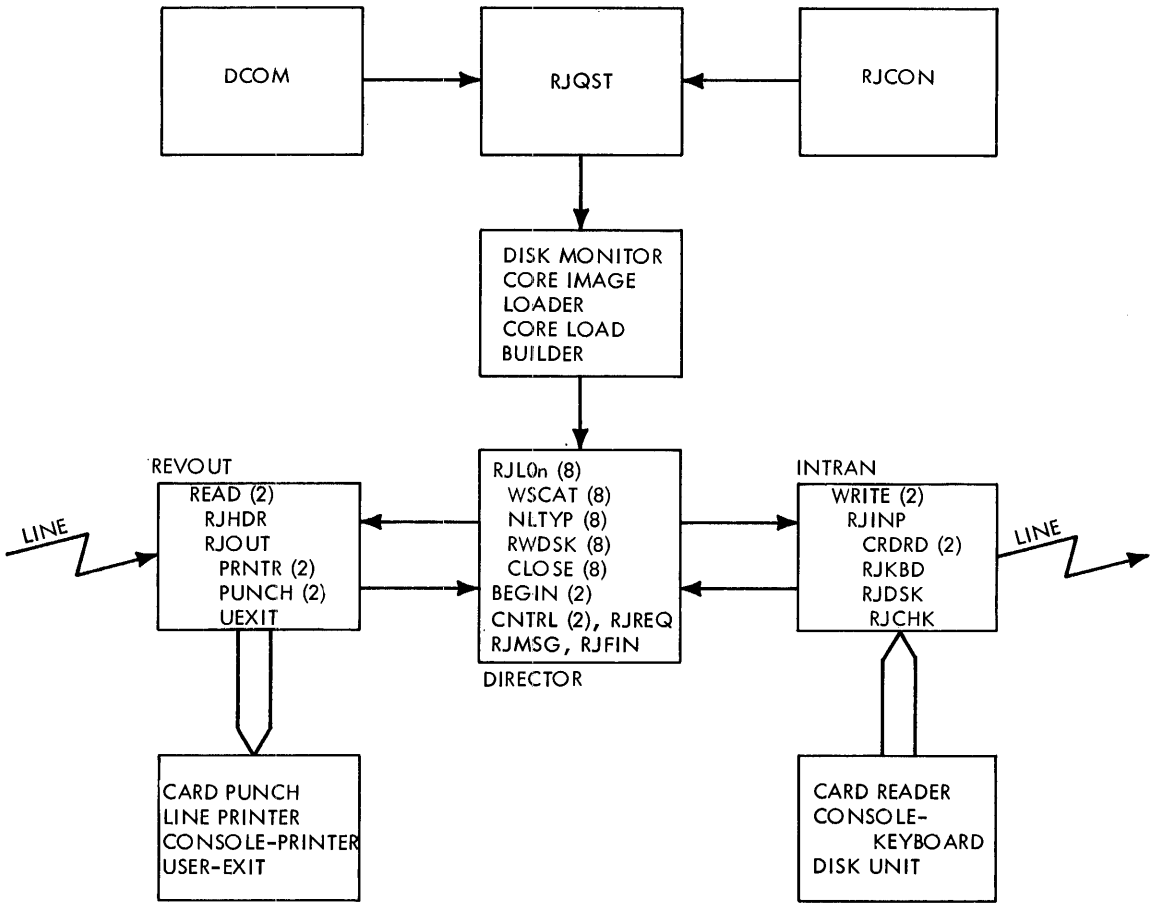
SUBROUTINE NAME. RJFIN (Chart UA)

ENTRY POINT. RJFIN

FUNCTION. This terminating subroutine first checks the Accumulator. If it is nonzero, an exit is made to the terminating DUMP entry point; if the Accumulator is zero, an exit is made to the Supervisor. Before the exit, however, the original level 5 interrupt address is restored.

EXTERNAL SUBROUTINES. CLOSE - resets the Communications Adapter.

EXITS. Normal: If Accumulator is zero, to the Supervisor in the Disk Monitor. If Accumulator is nonzero, to the terminating DUMP in the Disk Monitor.
Error: None.


DCOM
RJQST
RJCON
DISK MONITOR
CORE IMAGE
LOADER
CORE LOAD
BUILDER
REVOUT
READ (2)
RJHDR
RJOUT
PRNTR (2)
PUNCH (2)
UEXIT
LINE
RJL0n (8)
WSCAT (8)
NLTYP (8)
RWDSK (8)
CLOSE (8)
BEGIN (2)
CNTRL (2), RJREQ
RJMSG, RJFIN
DIRECTOR
INTRAN
WRITE (2)
RJINP
CRDRD (2)
RJKBD
RJDSK
RJCHK
LINE
CARD PUNCH
LINE PRINTER
CONSOLE-PRINTER
USER-EXIT
CARD READER
CONSOLE-
KEYBOARD
DISK UNIT

WORD	CONTENTS
0	Configuration Bits 14 and 15=00 for point-to-point nonswitched Bits 14 and 15=01 for point-to-point switched Bits 14 and 15=10 for multipoint
1	Polling character
2	Selection character
3	Reserved
4	Starting sector address for disk output
5	Last sector address for disk output
6-9	Reserved
10-21	Table of displacements of messages in RJCON
22-31	Reserved
32-nn	Messages

Title of Function Name	No. of Routines	Prime Entry	Secondary Entry	Assembled With	Notes
RJE00	1	RJE00			Principal I/O and print device
RJQST	1	RJE			Principal I/O and print device
RJL0n	8	RJL01			SCAT2, PRNT3, CARD1
		RJL02			SCAT3, PRNT3, CARD1
		RJL03			SCAT2, PRNT2, CARD1
		RJL04			SCAT3, PRNT2, CARD1
		RJL05			SCAT2, PRNT3, READ1, PNCH1
		RJL06			SCAT3, PRNT3, READ1, PNCH1
		RJL07			SCAT2, PRNT2, READ1, PNCH1
		RJL08			SCAT3, PRNT2, READ1, PNCH1
CLOSE	8			RJL0n	SCAT2 or SCAT3
NLTYP	8	NLTYP		RJL0n	TYPE0
			WTYPE		
RWDSK	8	RWDSK		RJL0n	DISKZ
WSCAT	8	WSCAT		RJL0n	SCAT2 or SCAT3
BEGIN	2	RJBGP			SCAT2
		RJBGM			SCAT3
CNTRL	2	RJCNP	RJCP1		SCAT2
			RJCP2		
		RJCNM	RJCM1		SCAT3
			RJCM2		
			RJCM3		
WRITE	2		RJTWP	RJCNP	SCAT2
			RJTWM	RJCNM	SCAT3
READ	2		RJTRP	RJCNP	SCAT2
			RJTRM	RJCNM	SCAT3
BUFF1			RJTB1	RJCNP	line buffer addresses
			RJTB3	RJCNM	line buffer addresses
BUFF2			RJTB2	RJCNP	line buffer addresses
			RJTB4	RJCNM	line buffer addresses
RJINP	1	RJINP			device independent
RJDSK	1	RJDSK			DISKZ
RJKBD	1	RJKBD			TYPE0
RJCHK	1	RJCHK			device independent
RJOUT	1	RJOUT			device independent
RJHDR	1	RJHDR			device independent
CRDRD	2	RJRD1			CARD1
		RJRD2			READ1
PUNCH	2		RJRP1	RJRD1	CARD1
		RJRP2			PNCH1
PRNTR	2	RJPR1			PRNT3
		RJPR2			PRNT2
RJREQ	1	RJREQ			TYPE0
RJFIN	1	RJFIN			
RJMSG	1		RJMSG	RJFIN	TYPE0
RJCON					data file on disk
UEXIT	1	UEXIT			DISKZ

OCR=*

ESTABLISH LINE CONNECTION Message code= 2

PUNCHED OUTPUT Message code= 3

PROCEED Message code= 4

DATA rrrr0c0f TO DISK AT Xaaa, bbbb

PR NR

PU NR

J01 INVALID CARD

J10 INVALID PRINTER

J11 INVALID READER

J14 DISK ERROR OCR=*

J20 RJSTART MISSING Message code= 5

J21 .. DATA INVALID Message code= 6

J22 INVALID INPUT Message code= 7

J23 INPUT ABORTED BY CENTRAL Message code= 8

J51 LINE ERROR OCR=* Message code= 9

J52 DISK ERROR INPUT OCR=* Message code=10

J53 DISK ERROR OUTPUT OCR=* Message code=11

J54 DISK ERROR OCR=* Message code= 1

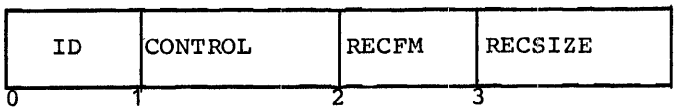
J55 END OF DISK AREA OCR=* Message code=12

J56 CARD READER ERROR OCR=* Message code=13

Every data set transmitted from the central system to a remote CPU is preceded by

```
          S        E
a heading O  text  T  .
          H        X
```

The format of the text of the heading is as follows:



ID--Identifies the destination or device.

Code

F1--printer
F2--punch
F3--printer-keyboard
F4--user-exit

CONTROL--Identifies the control characters contained in the record.

Code

F1--Machine Code
F2--ASA
F3--None

RECFM--Identifies the record format.

Code

F1--fixed unblocked
F2--fixed blocked
F3--variable unblocked
F4--variable blocked
F5--undefined

RECSIZE--Logical record size in unpacked decimal format.

There is one heading that the central system sends that does not follow this format. This exception is the end-of-job heading with the following format:

```
S     E
O  5  T
H     X
```

There are two headings sent from the work station to the central system that tell the central system to set or reset slow input mode.

To set slow input mode:

```
S     E
O  D  T
H     X
```

To reset slow input mode:

```
S     E
O  R  T
H     X
```

1. Approximate Core Storage Requirements for the IBM 1130 RJE Work Station Program:

Configuration	Approximate Core Size in Words
Point-to-point, 1442-6,-7, 1403	7250
Multipoint, 1442-6, -7, 1403	7250
Point-to-point, 1442-6,-7, 1132	7500
Multipoint, 1442-6, -7, 1132	7650
Point-to-point, 2501, 1442-5, 1403	7250
Multipoint, 2501, 1442-5, 1403	7350
Point-to-point, 2501, 1442-5, 1132	7600
Multipoint, 2501, 1442-5, 1132	7750

Chart AA. (RJE00) RJE Generation

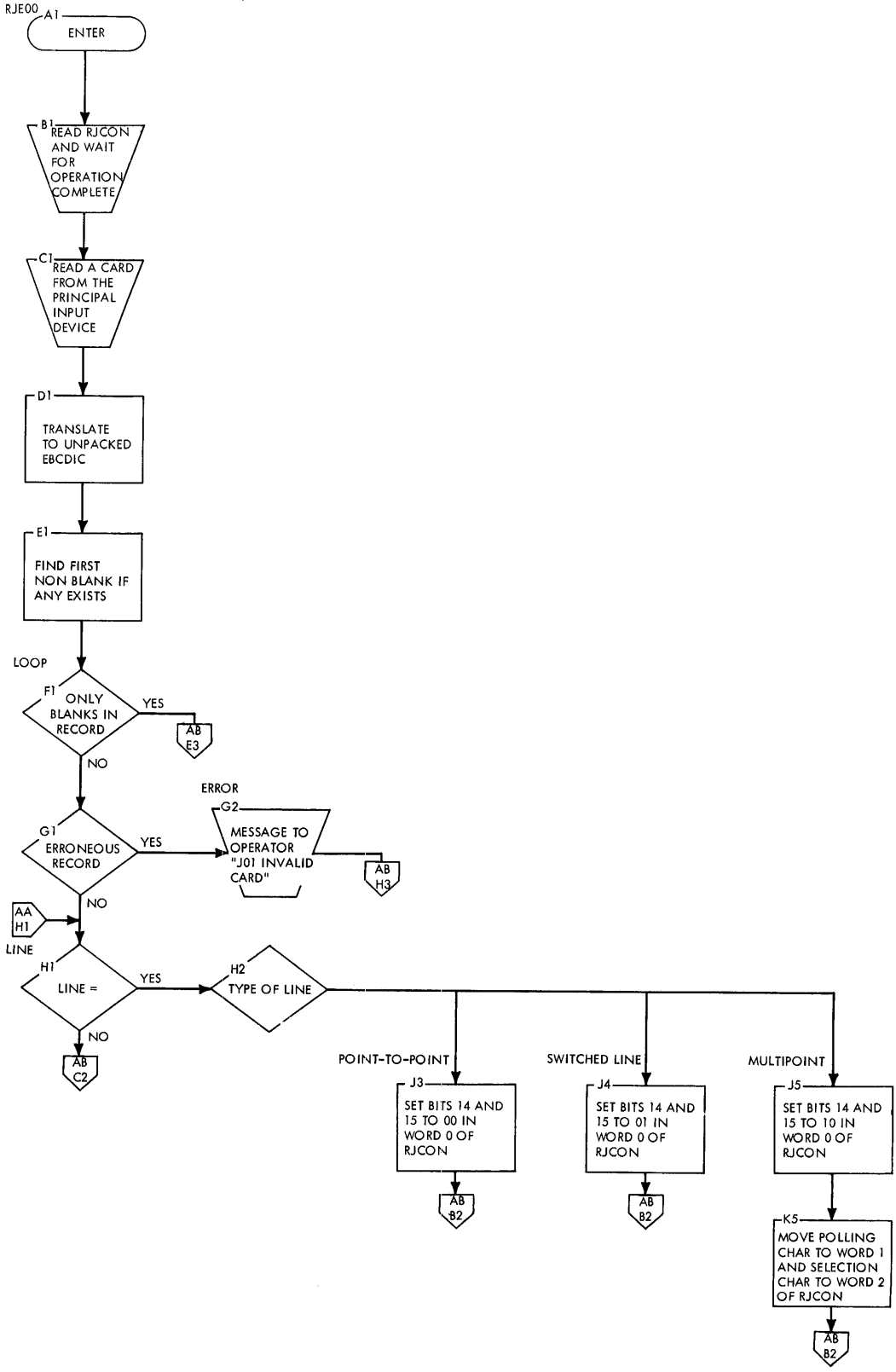


Chart AB. (RJE00) RJE Generation

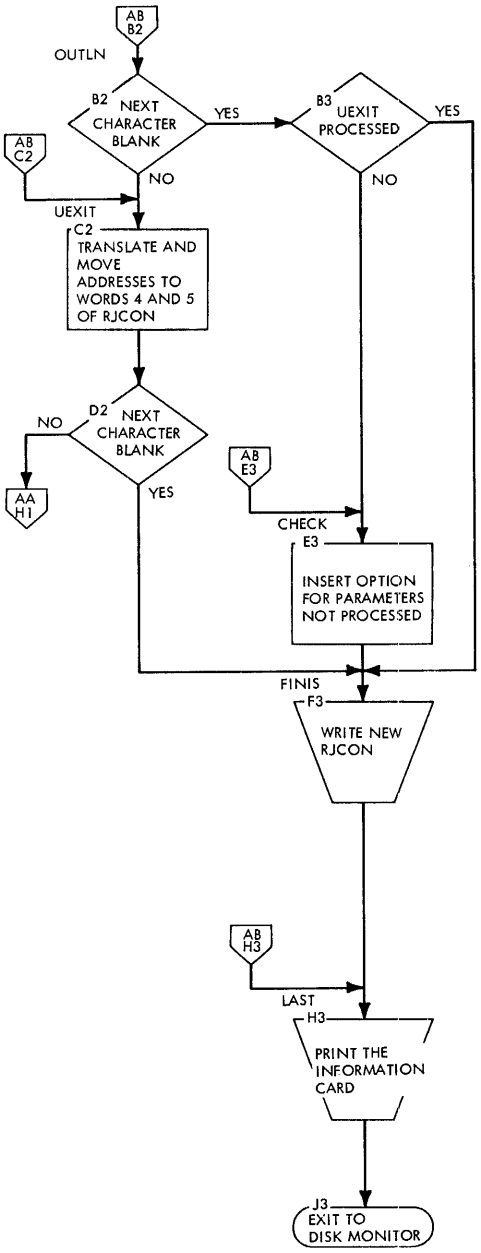


Chart BA. (RJQST) Select RJE Program

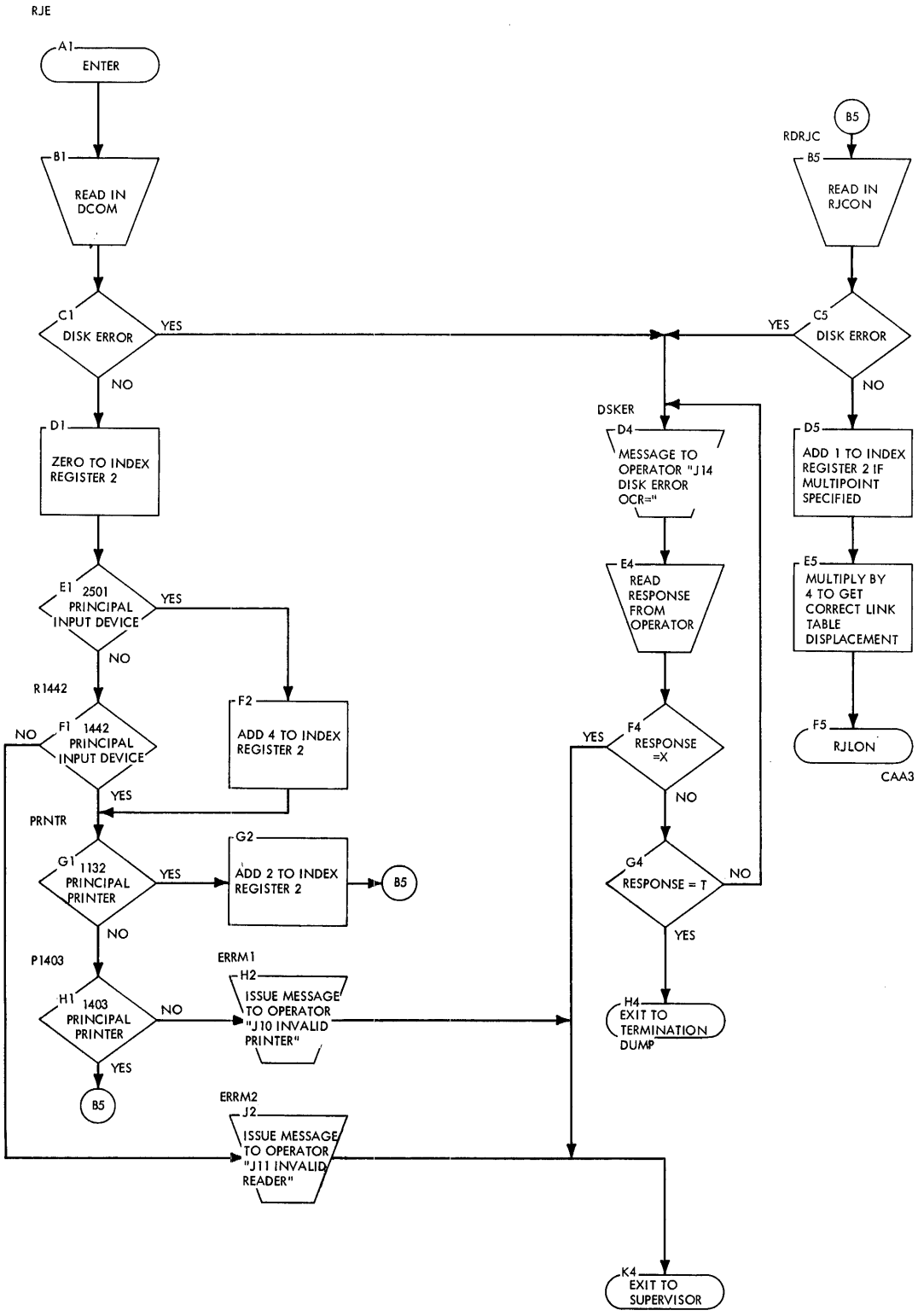


Chart CA. (RJL0n) Initialization of RJE Program

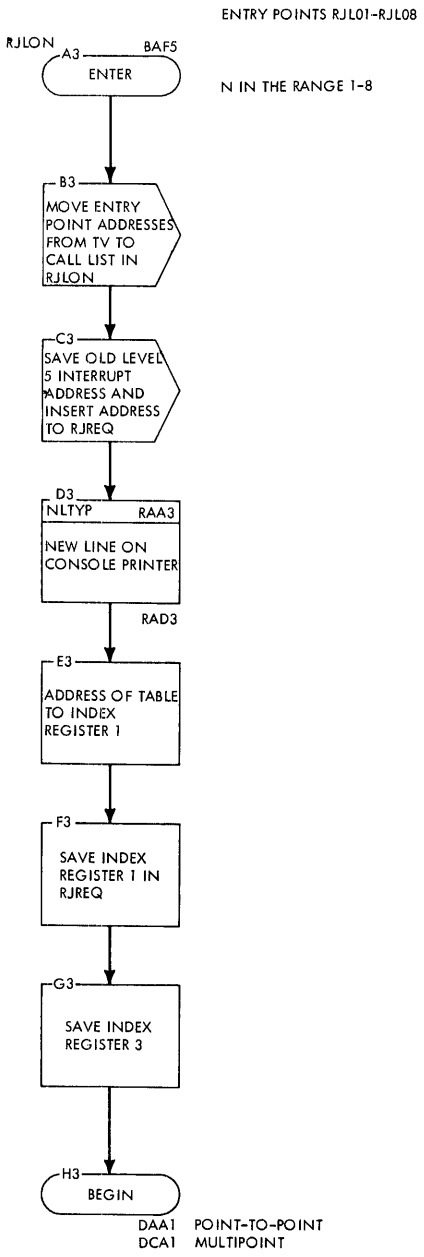


Chart DA. (RJBGP) Begin Point-to-Point

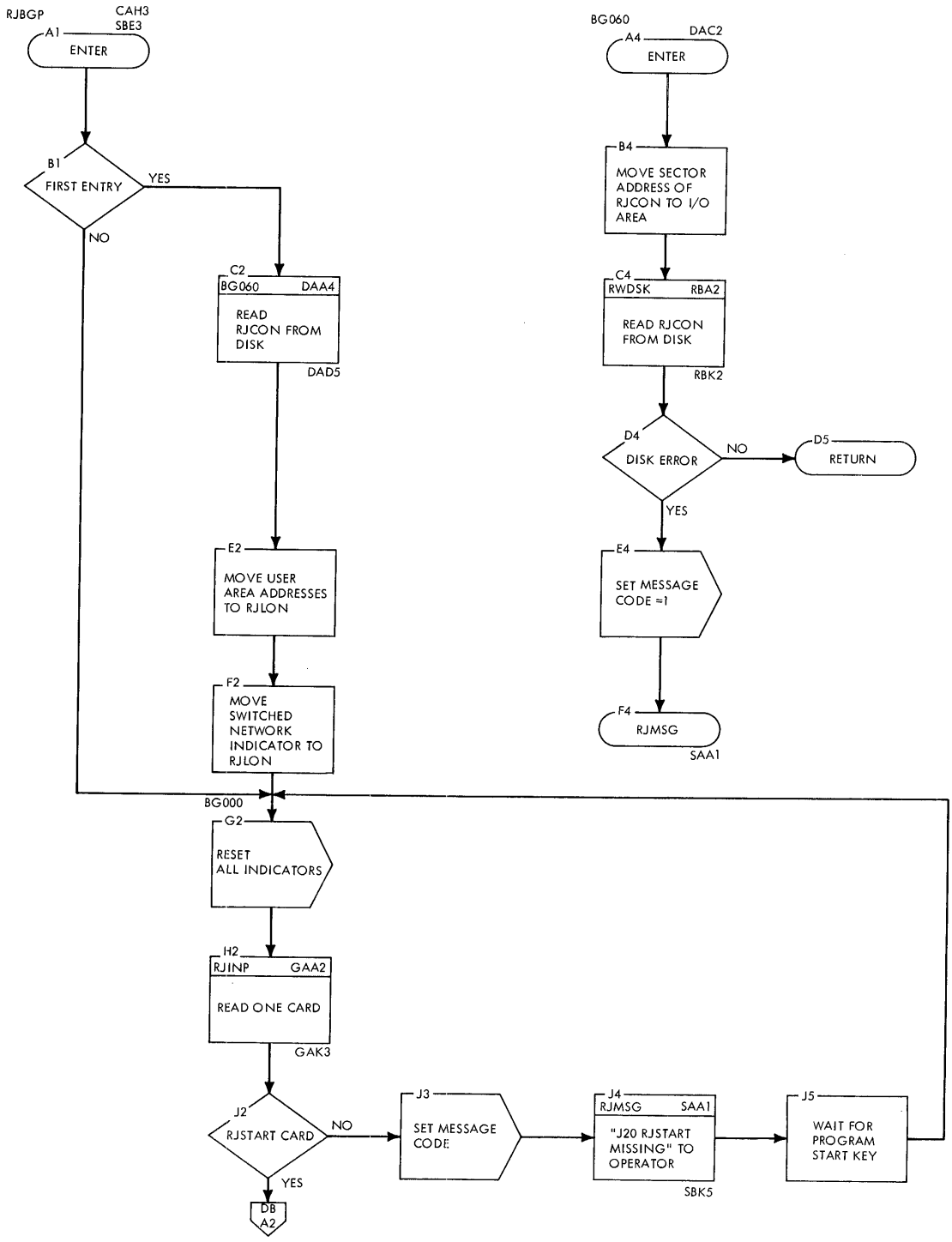


Chart DB. (RJBGP) Begin Point-to-Point

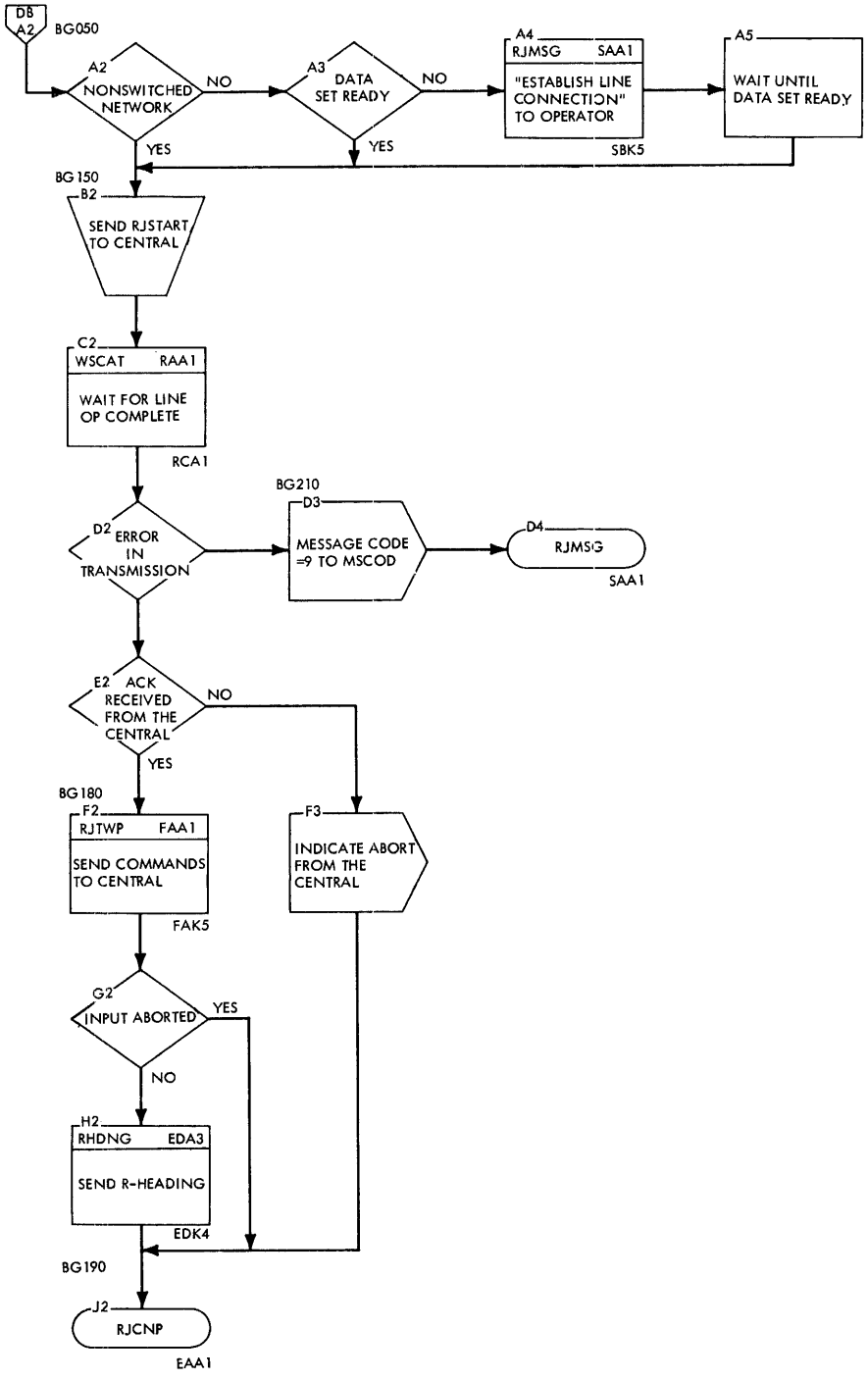


Chart DC. (RJBGM) Begin Multipoint

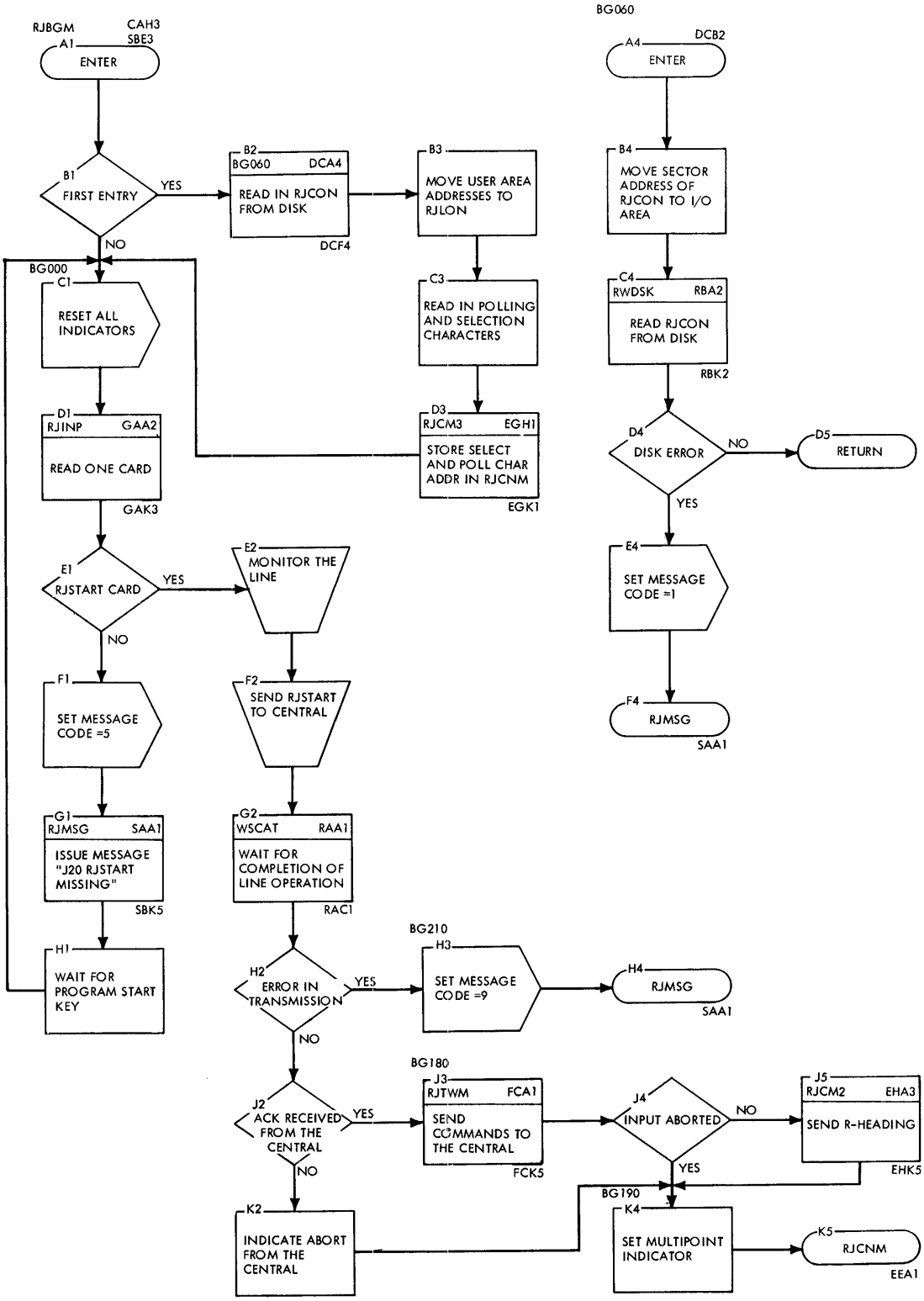


Chart EA. (RJCNP) Control Point-to-Point

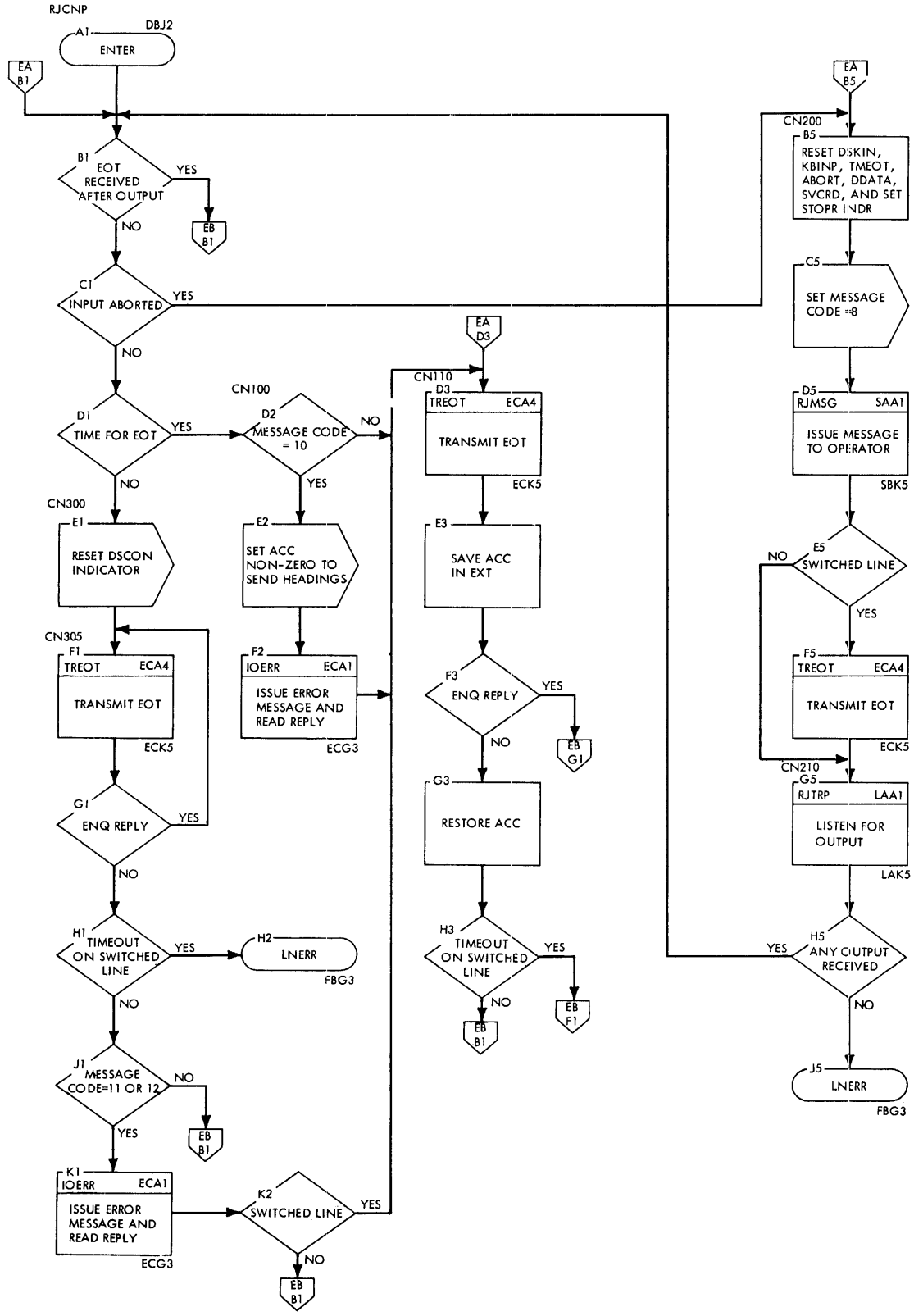


Chart EB. (RJCNP) Control Point-to-Point

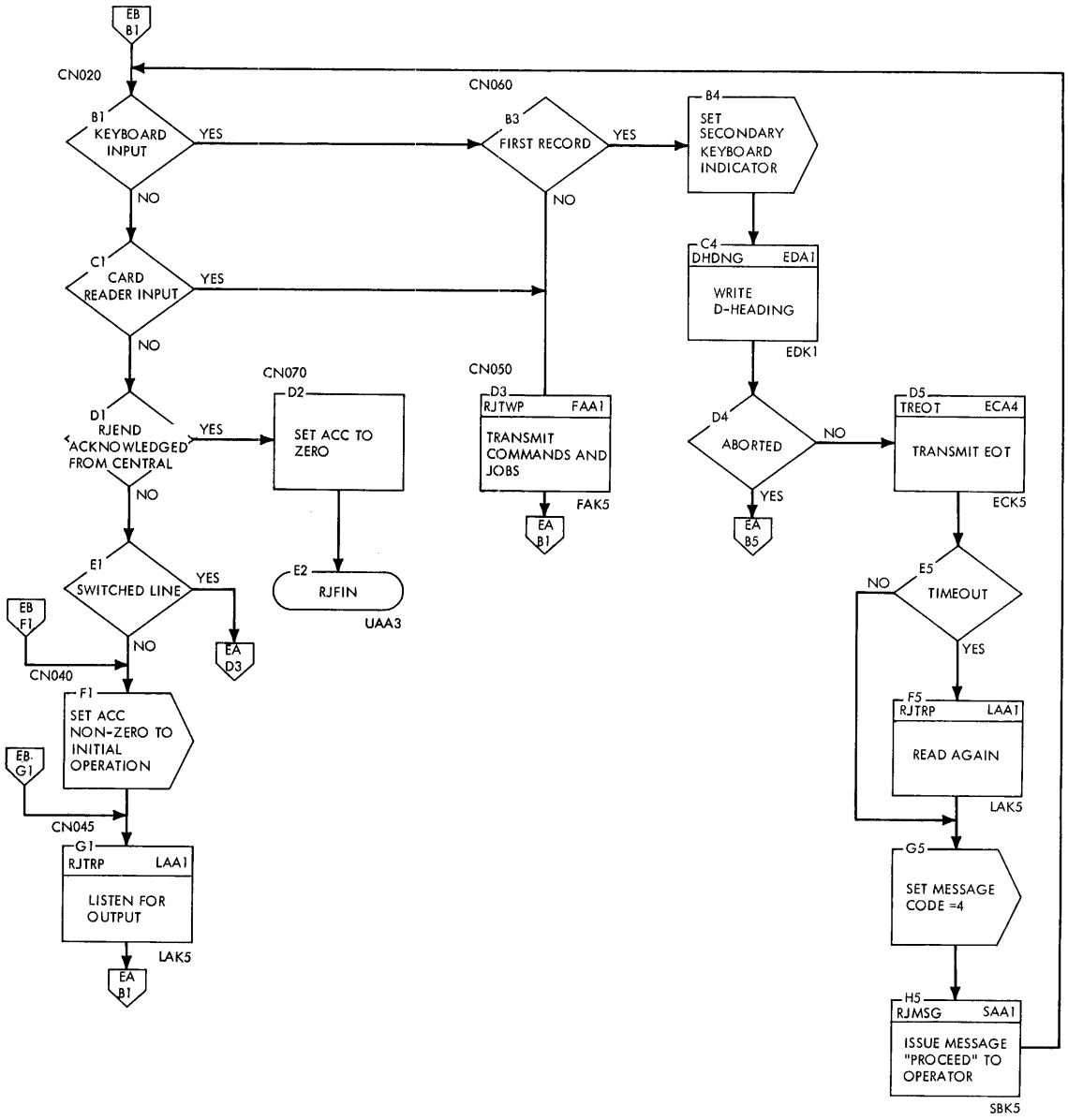


Chart EC. (RJCNP) Control Point-to-Point

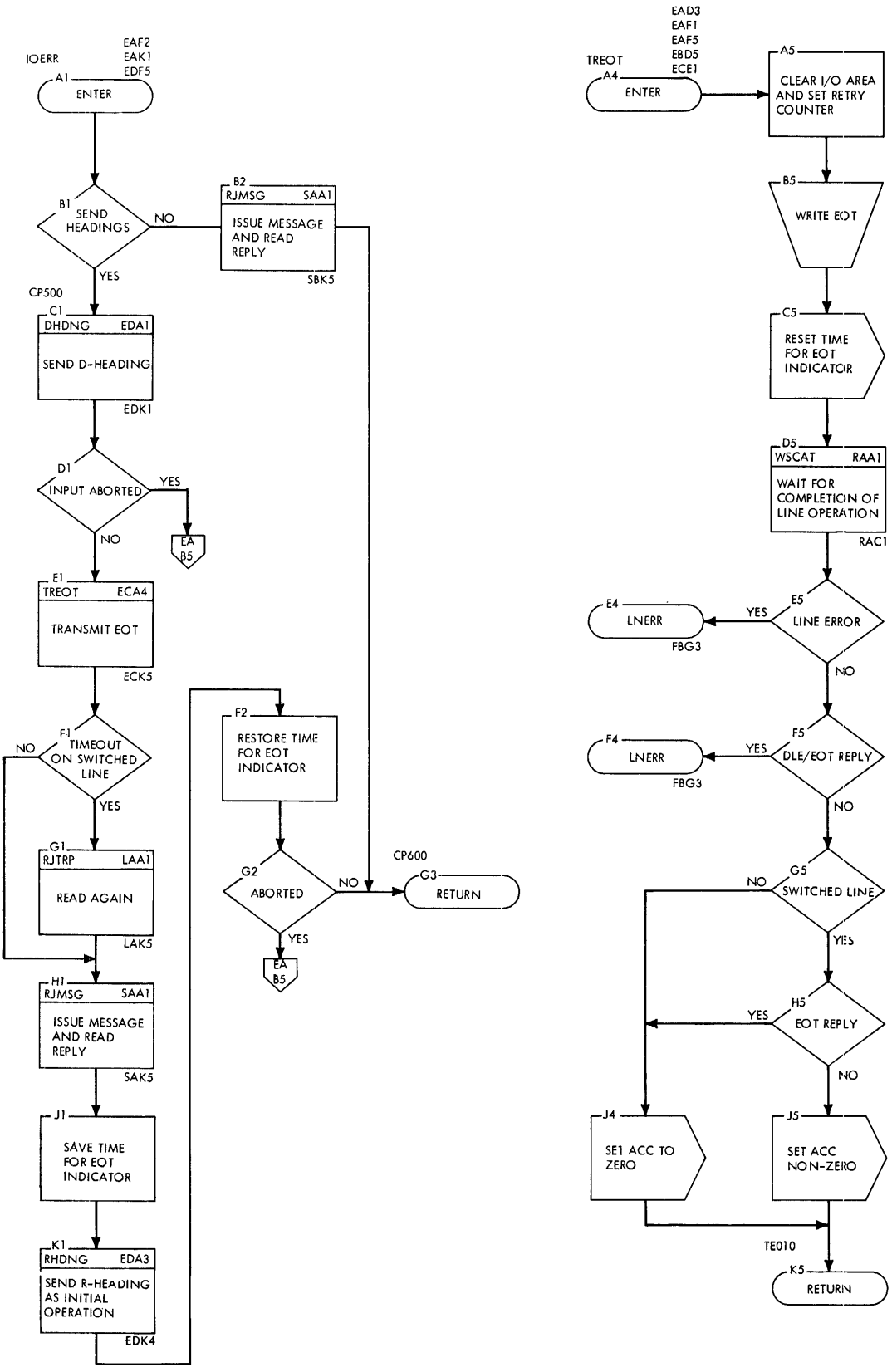


Chart ED. (RJCNP) Control Point-to-Point

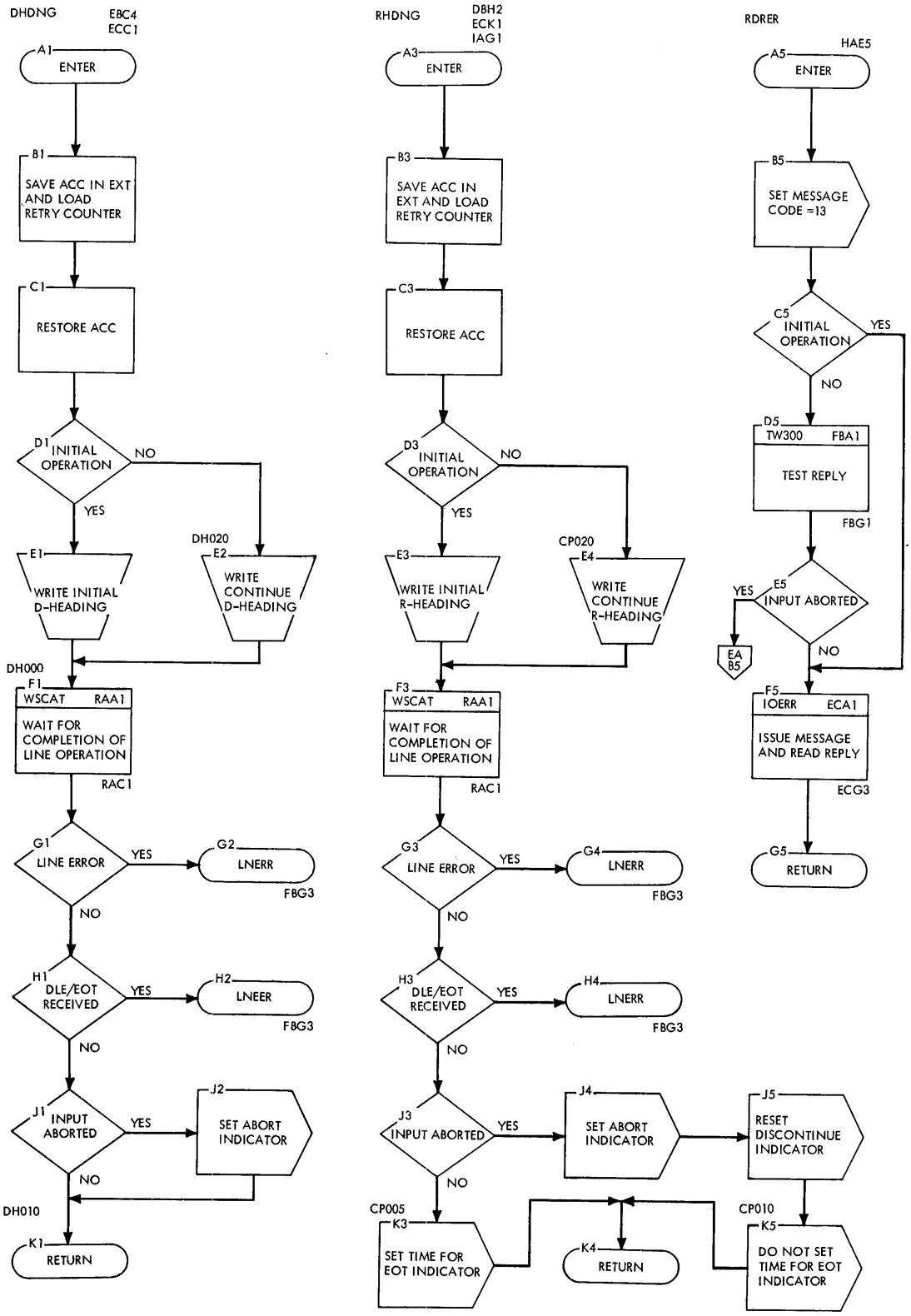


Chart EE. (RJCNM) Control Multipoint

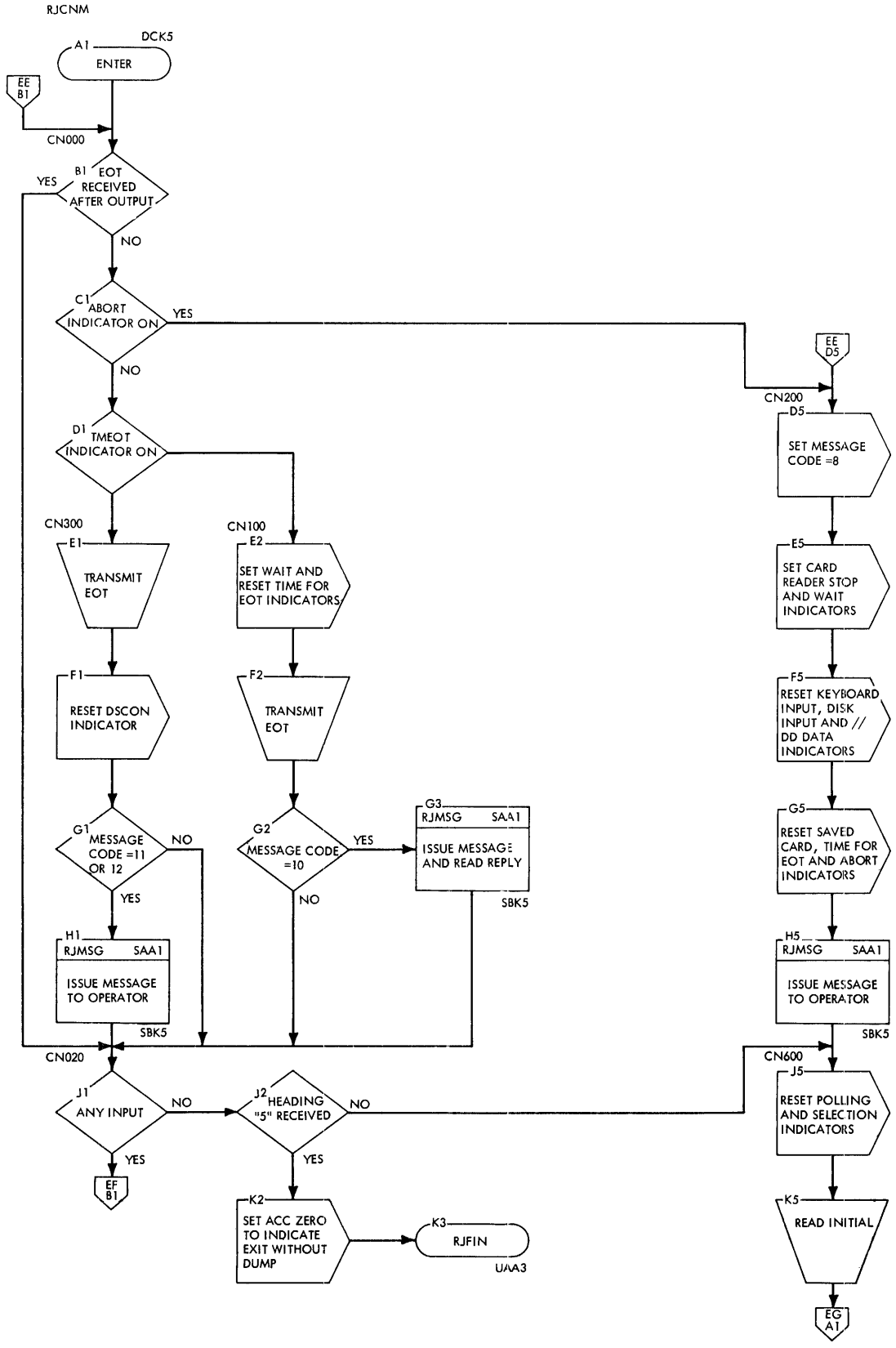


Chart EF. (RJCNM) Control Multipoint

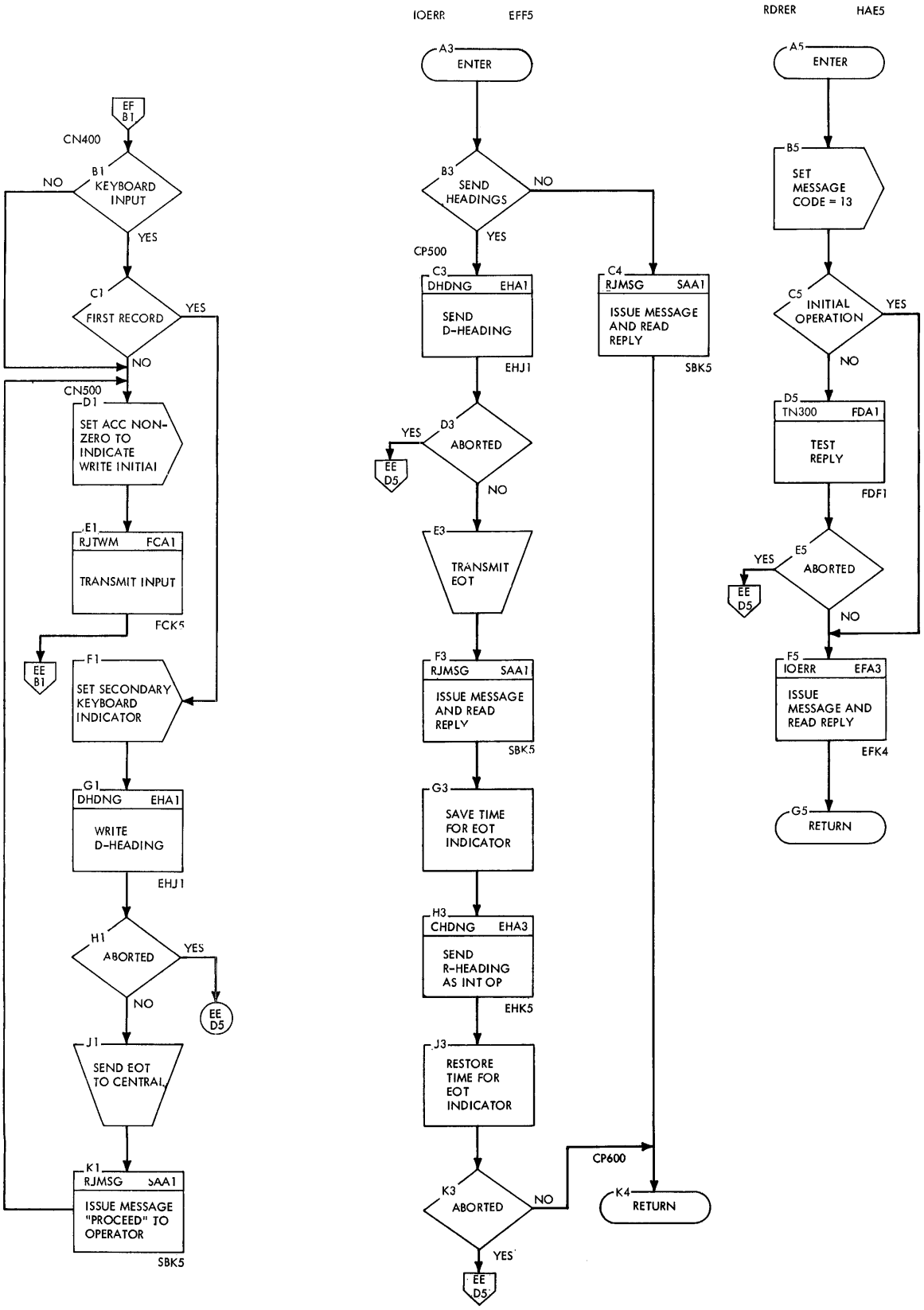
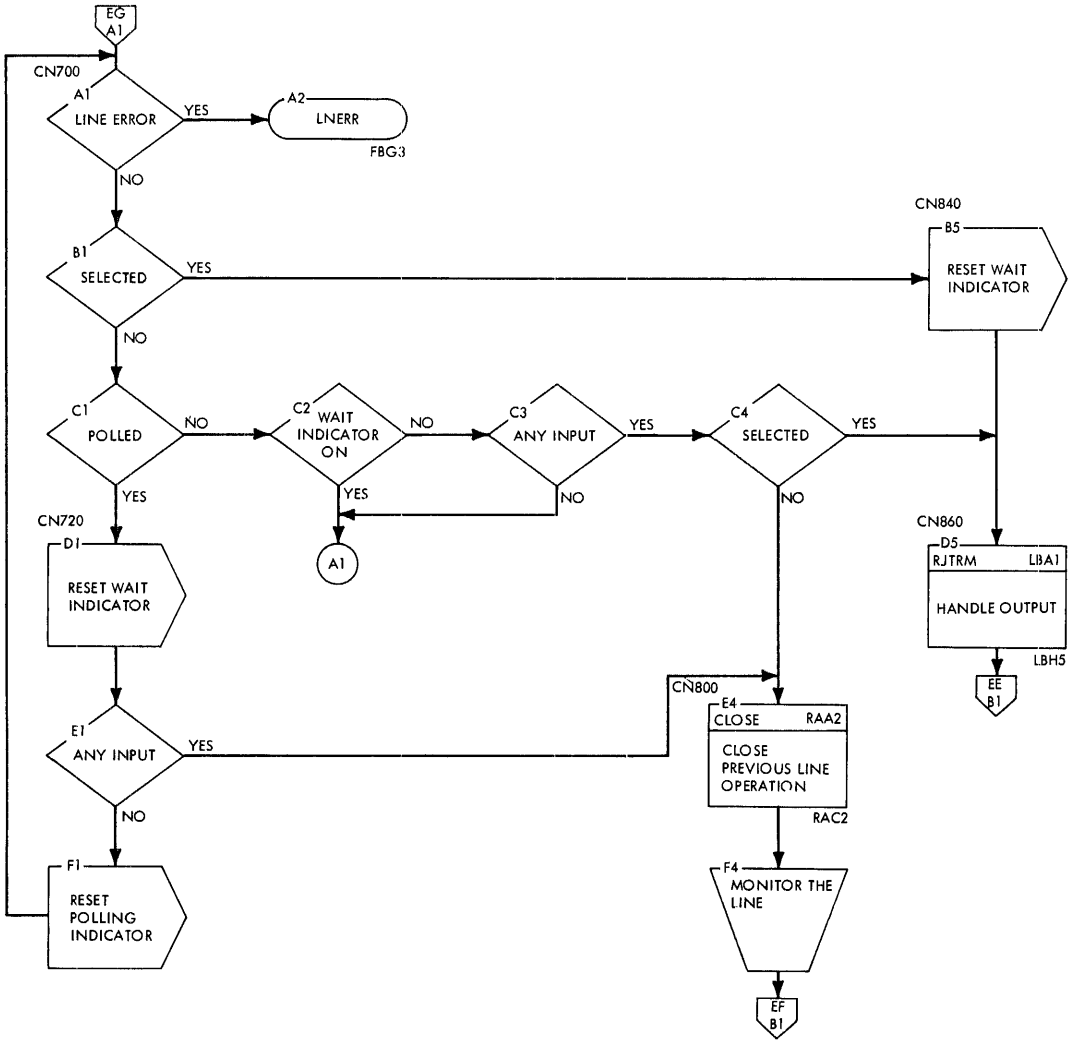


Chart EG. (RJCNM) Control Multipoint



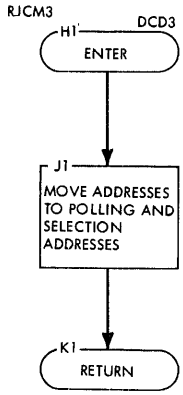


Chart EH. (RJCNM) Control Multipoint

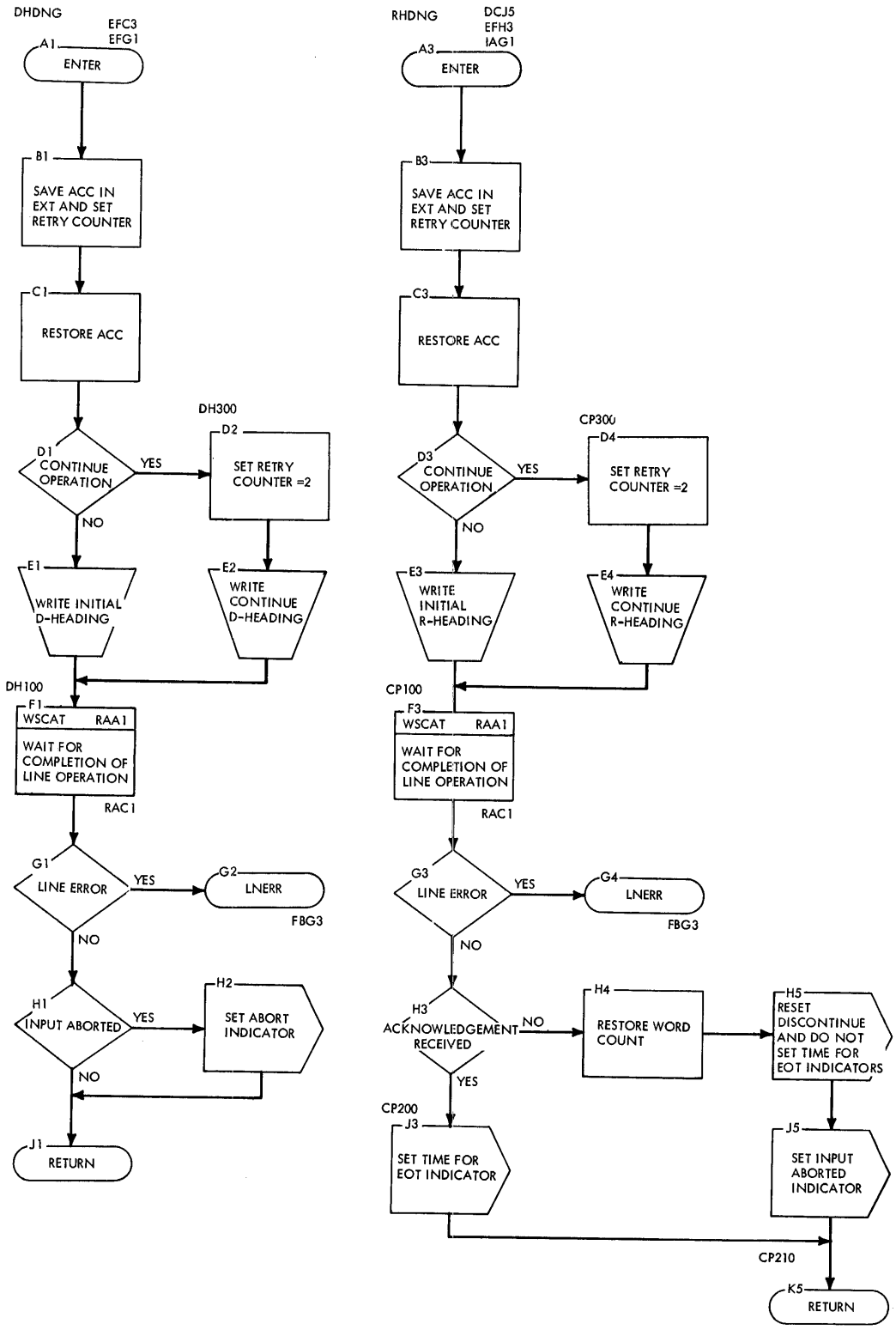


Chart FA. (RJTWP) Write Point-to-Point

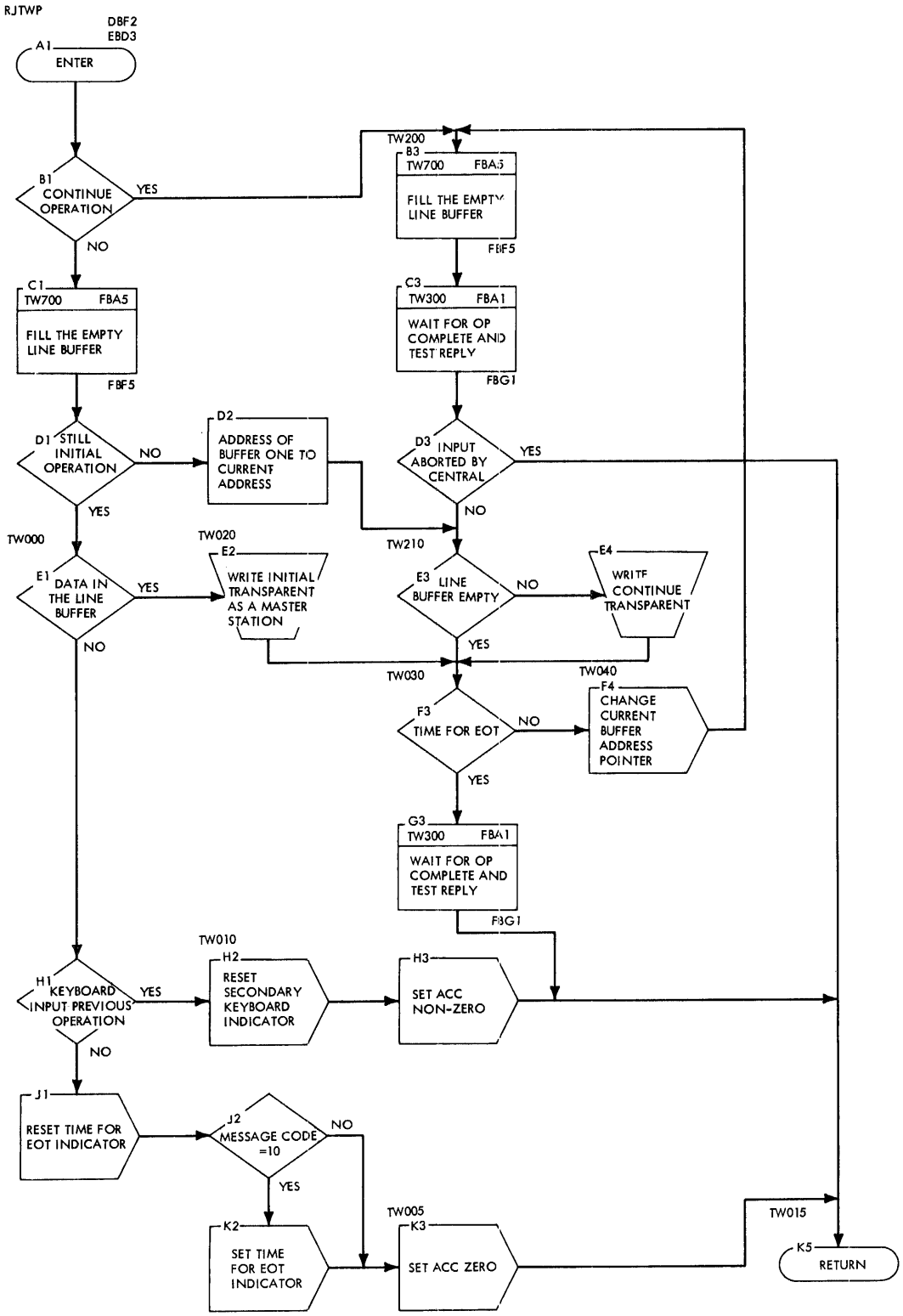


Chart FB. (RJTWP) Write Point-to-Point Subroutines

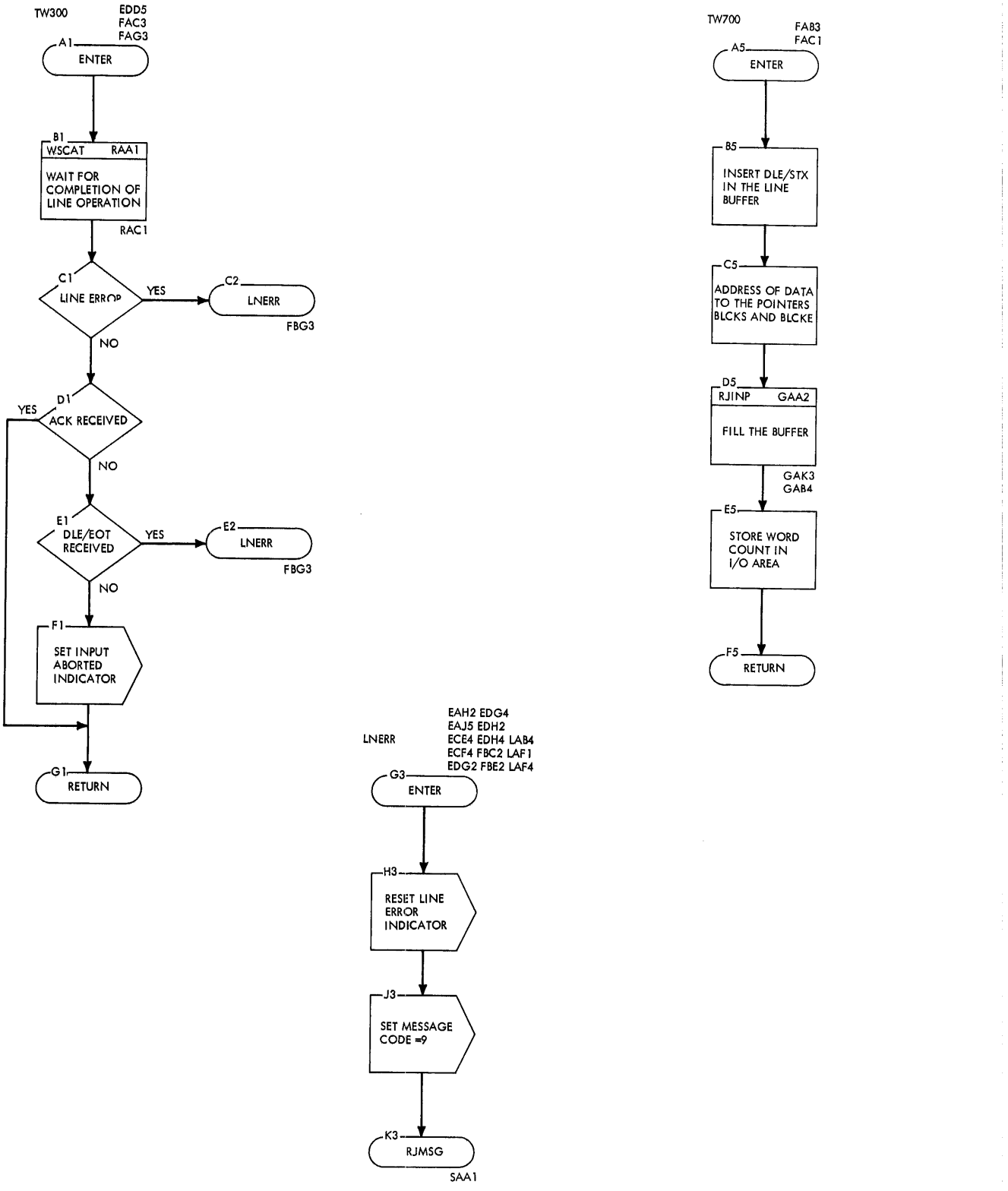


Chart FC. (RJTWM) Write Multipoint

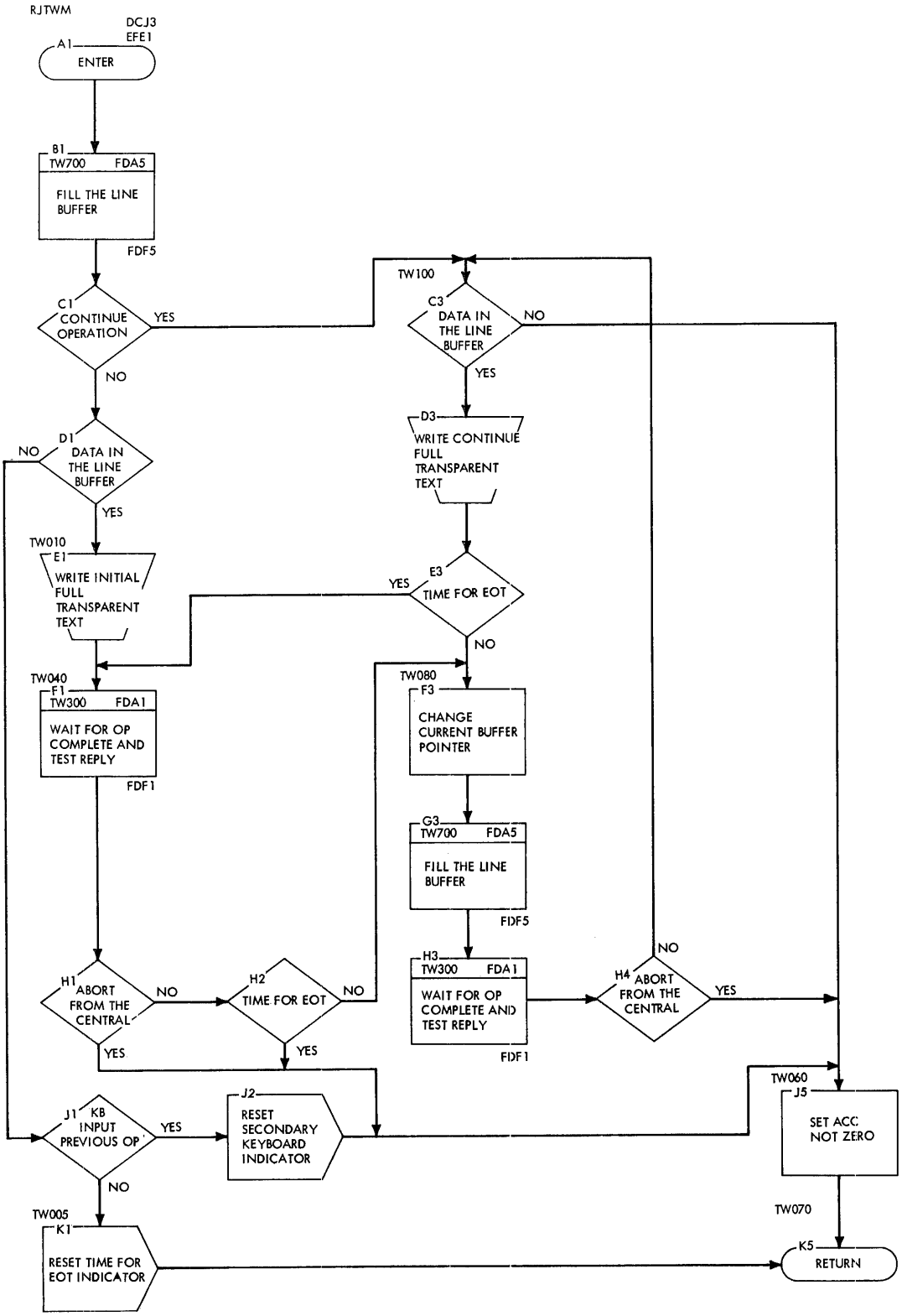
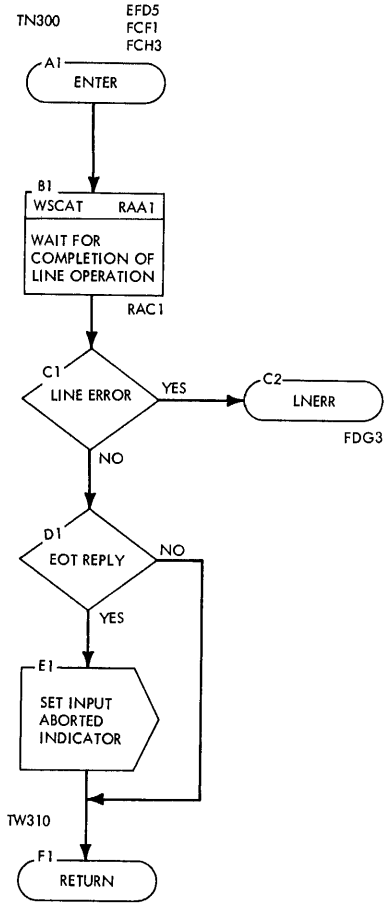
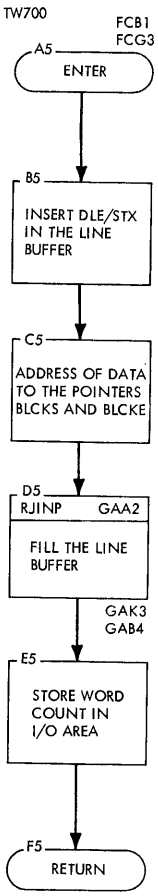


Chart FD. (RJTWM) Write Multipoint Subroutines





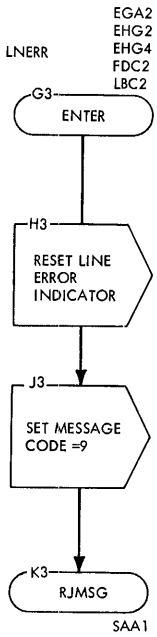


Chart GA. (RJINP) Input Switch

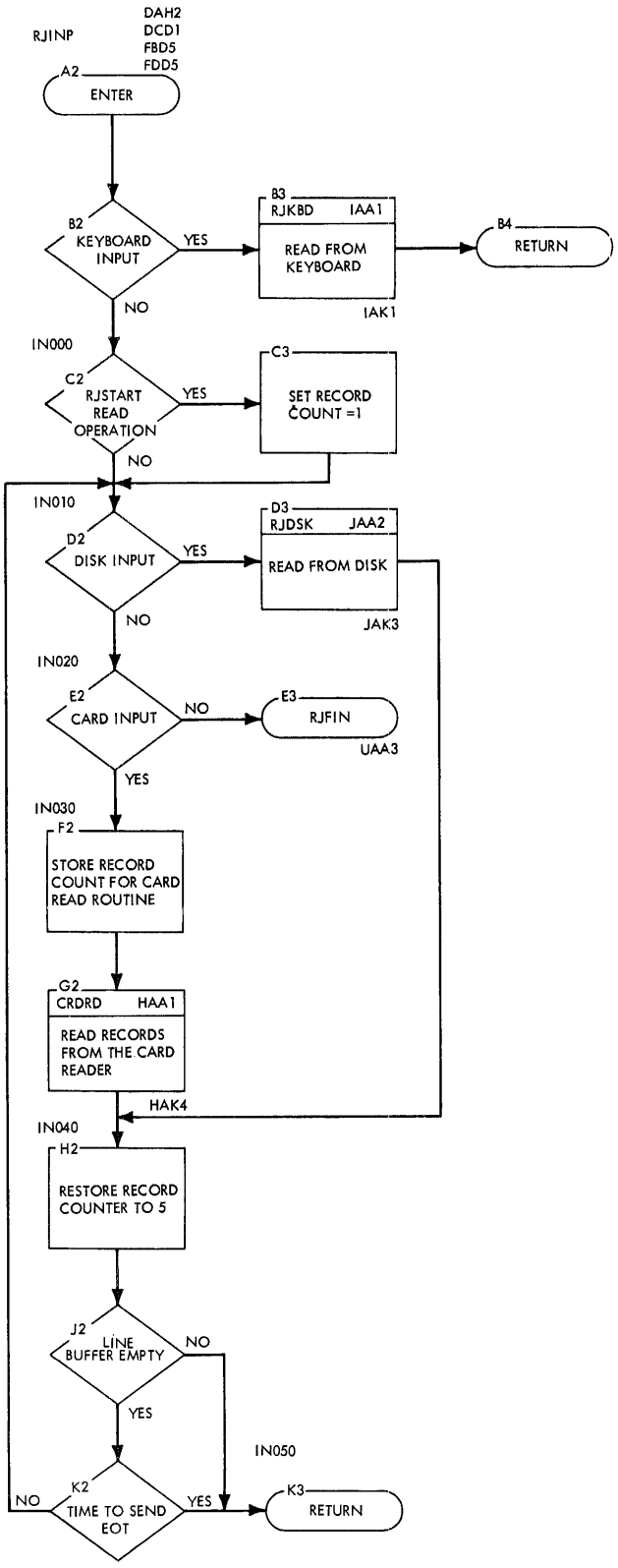


Chart HA. (CRDRD) Card Read Input Routine

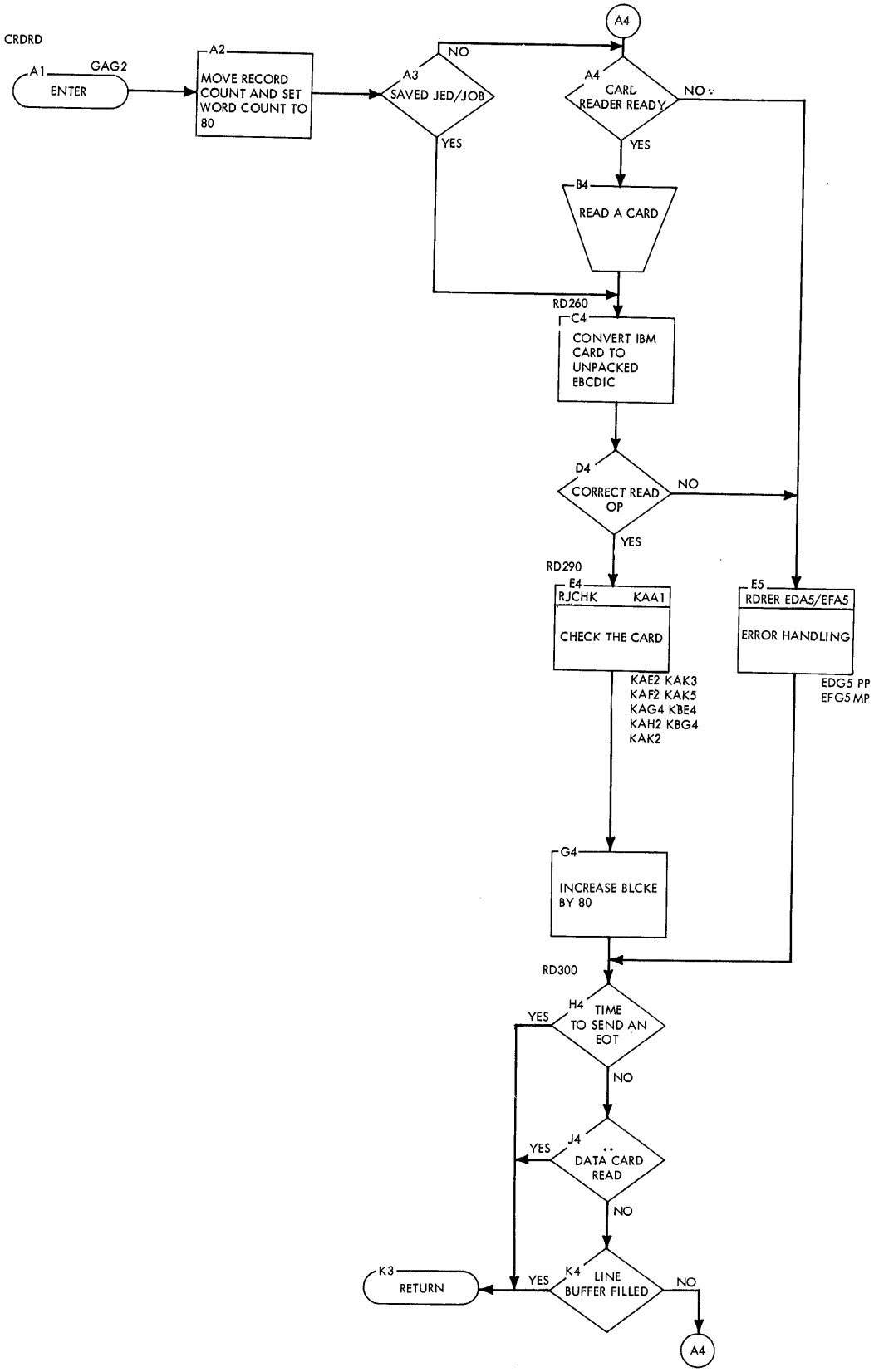


Chart IA. (RJKBD) Console Keyboard Input

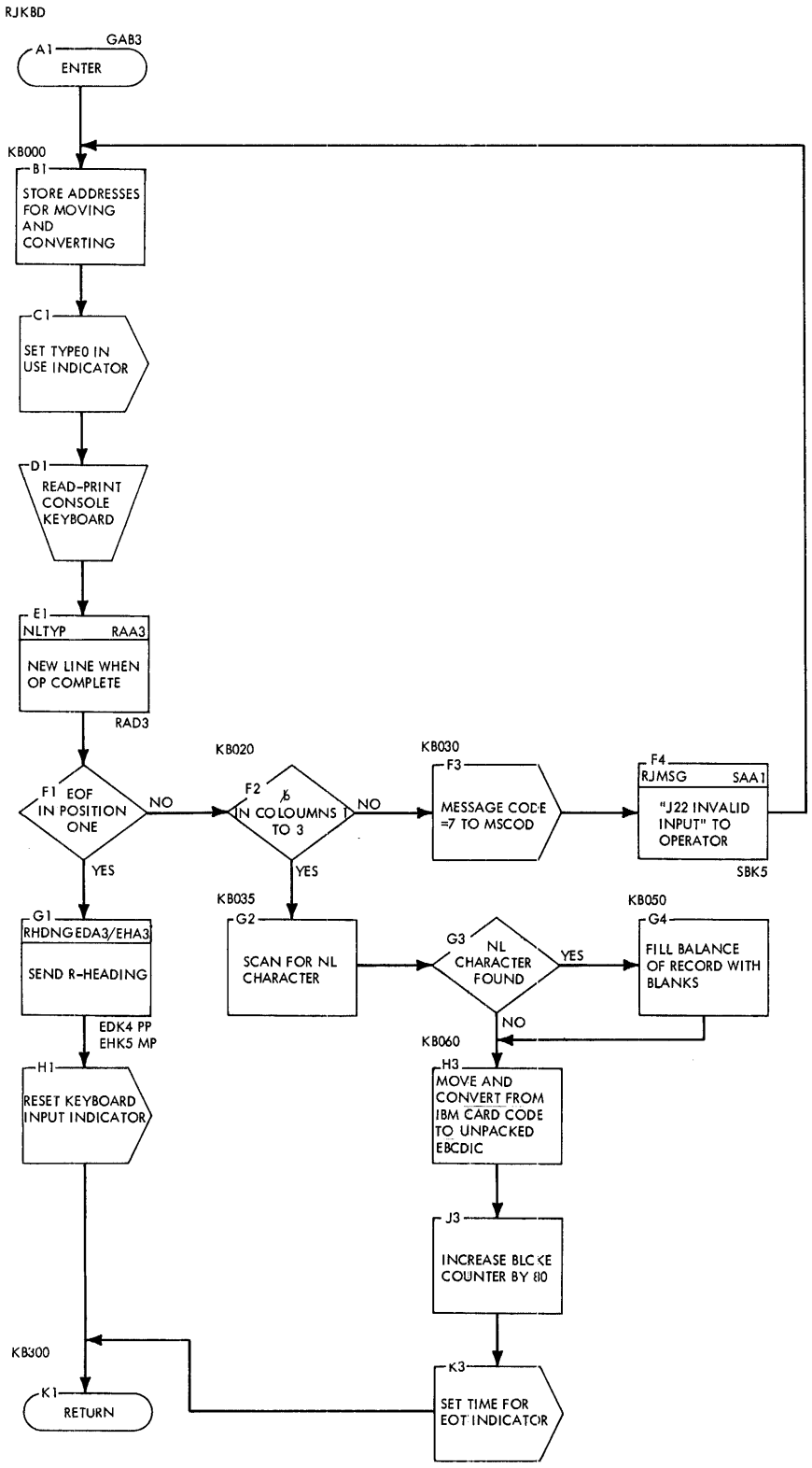


Chart JA. (RJDSK) Disk Input

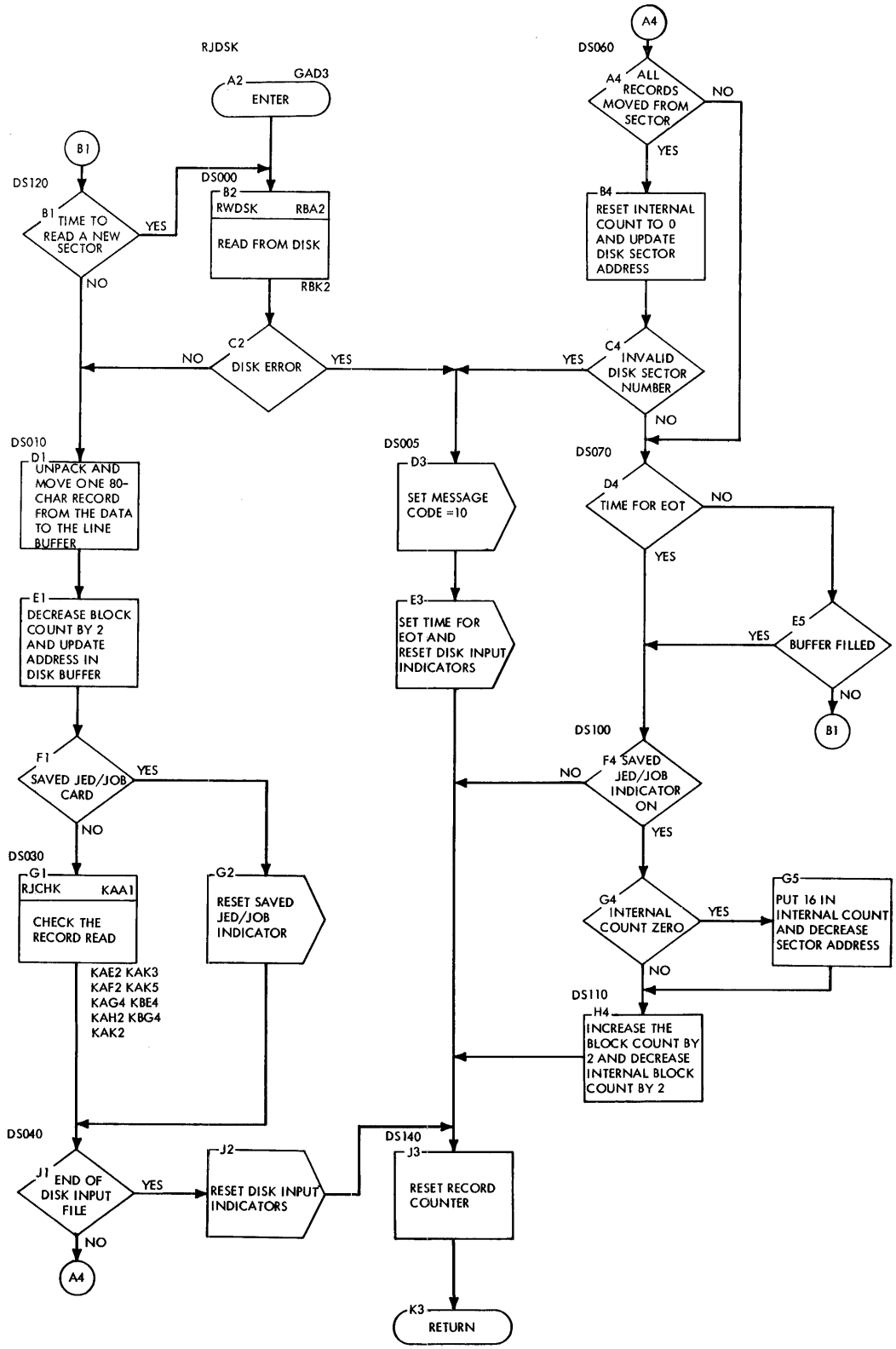


Chart KA. (RJCHK) Card Check Routine

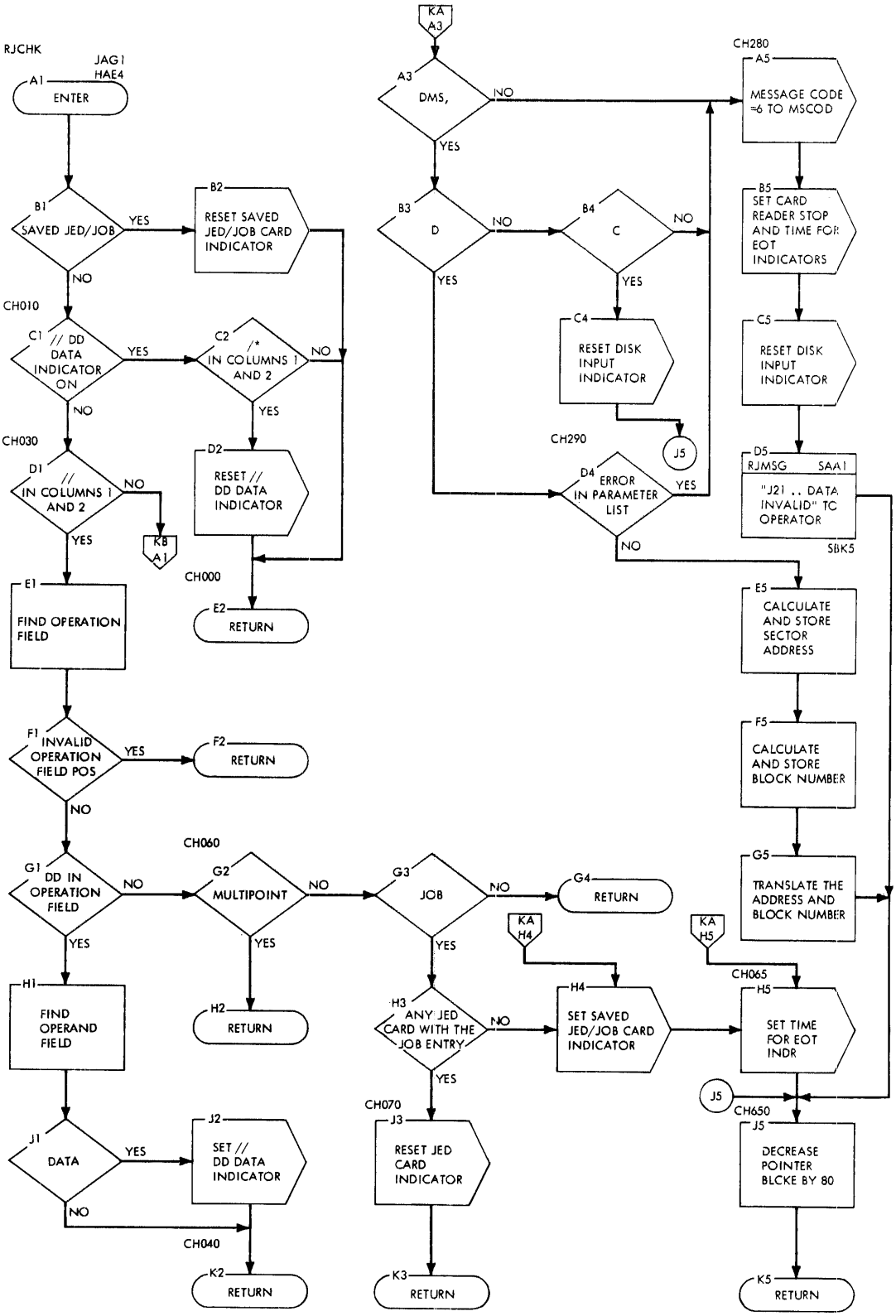


Chart KB. (RJCHK) Card Check Routine

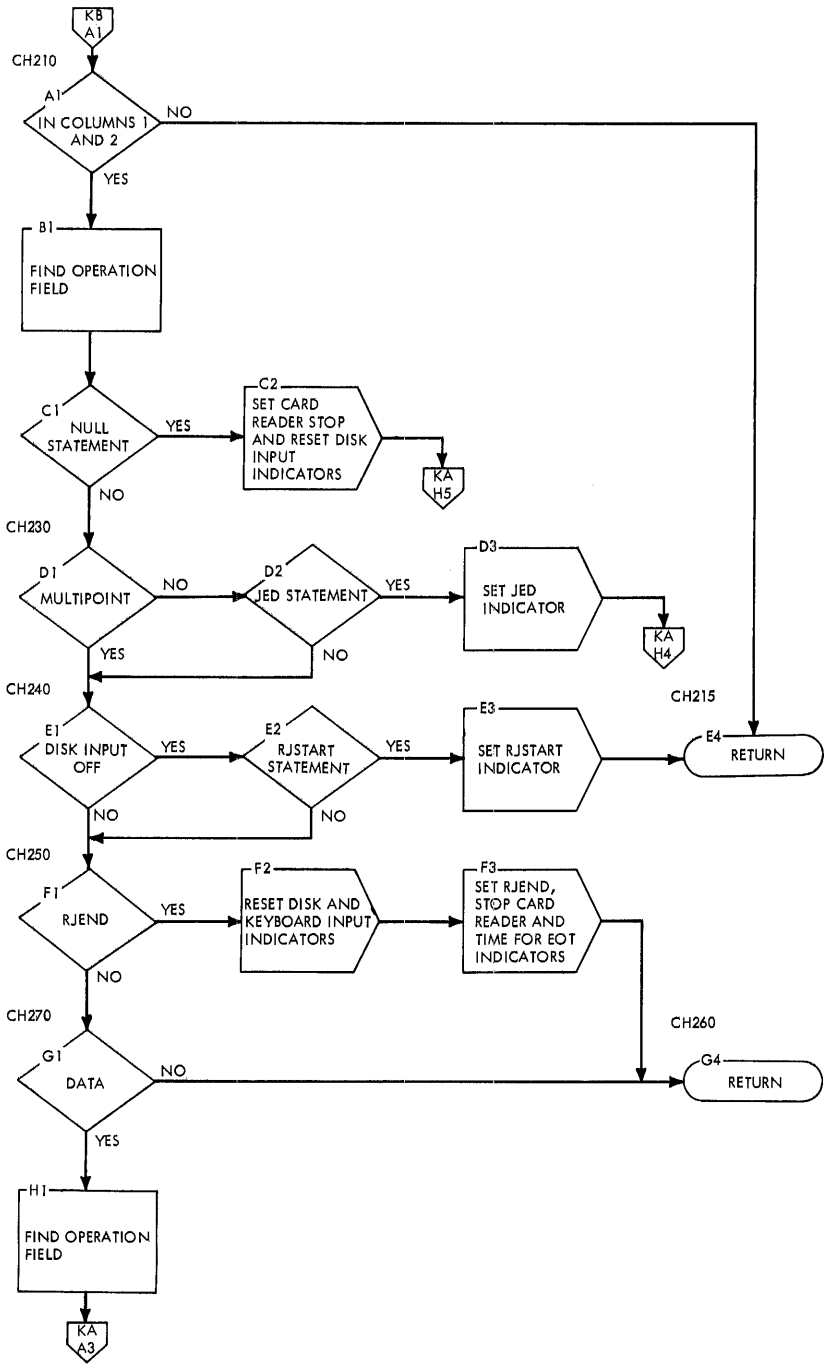


Chart LA. (RJTRP) Read Point-to-Point

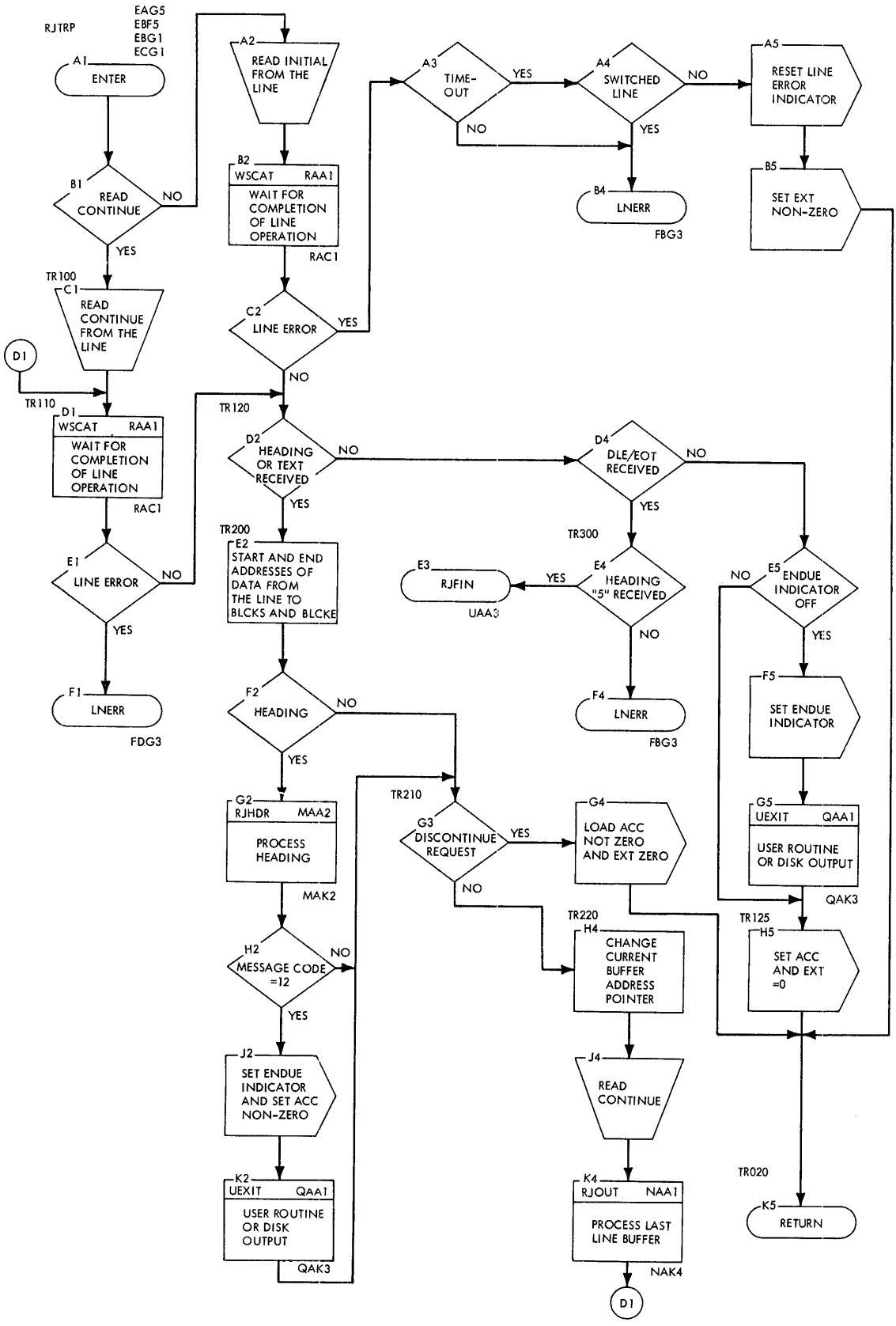


Chart LB. (RJTRM) Read Multipoint

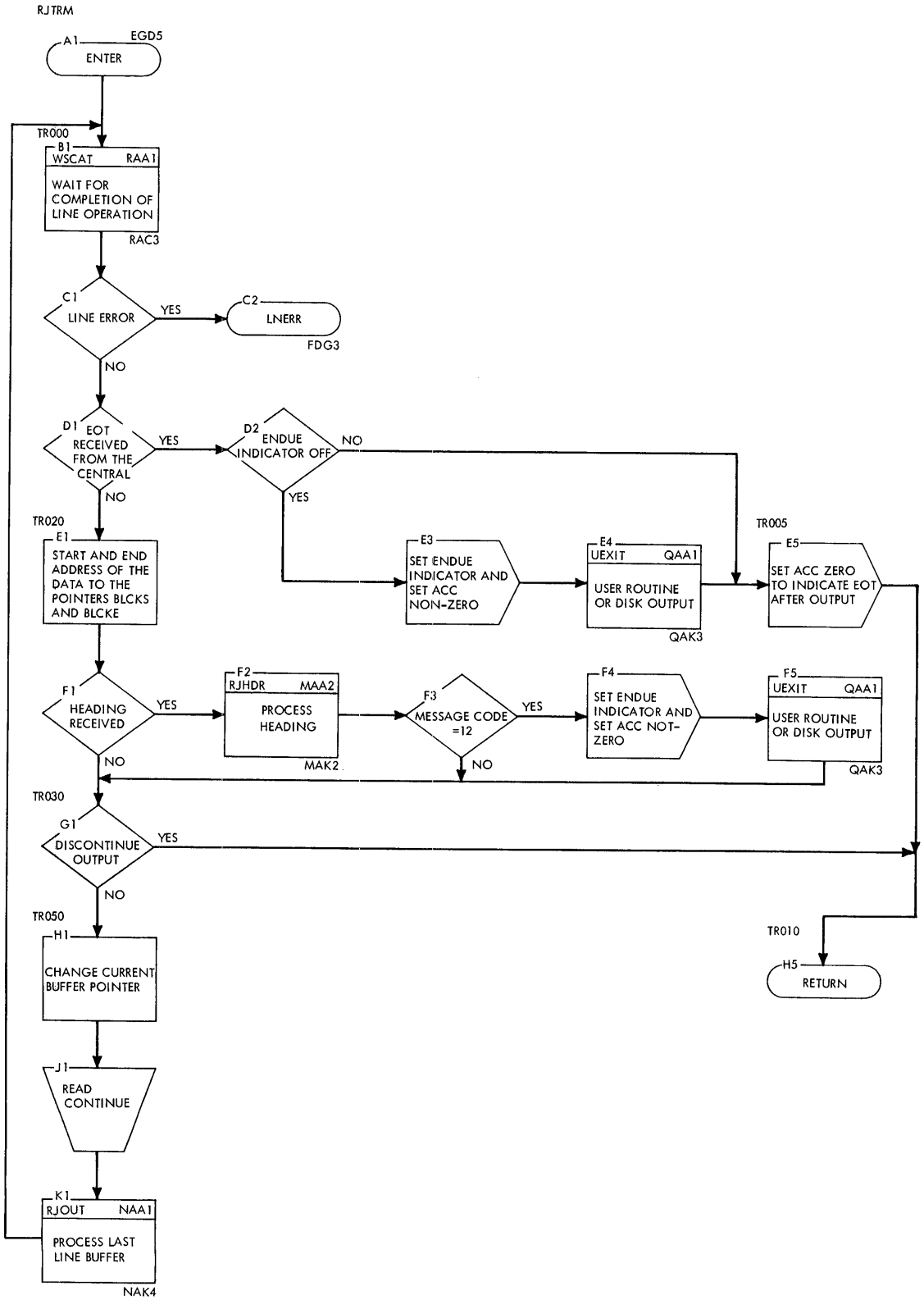


Chart MA. (RJHDR) Heading Processing

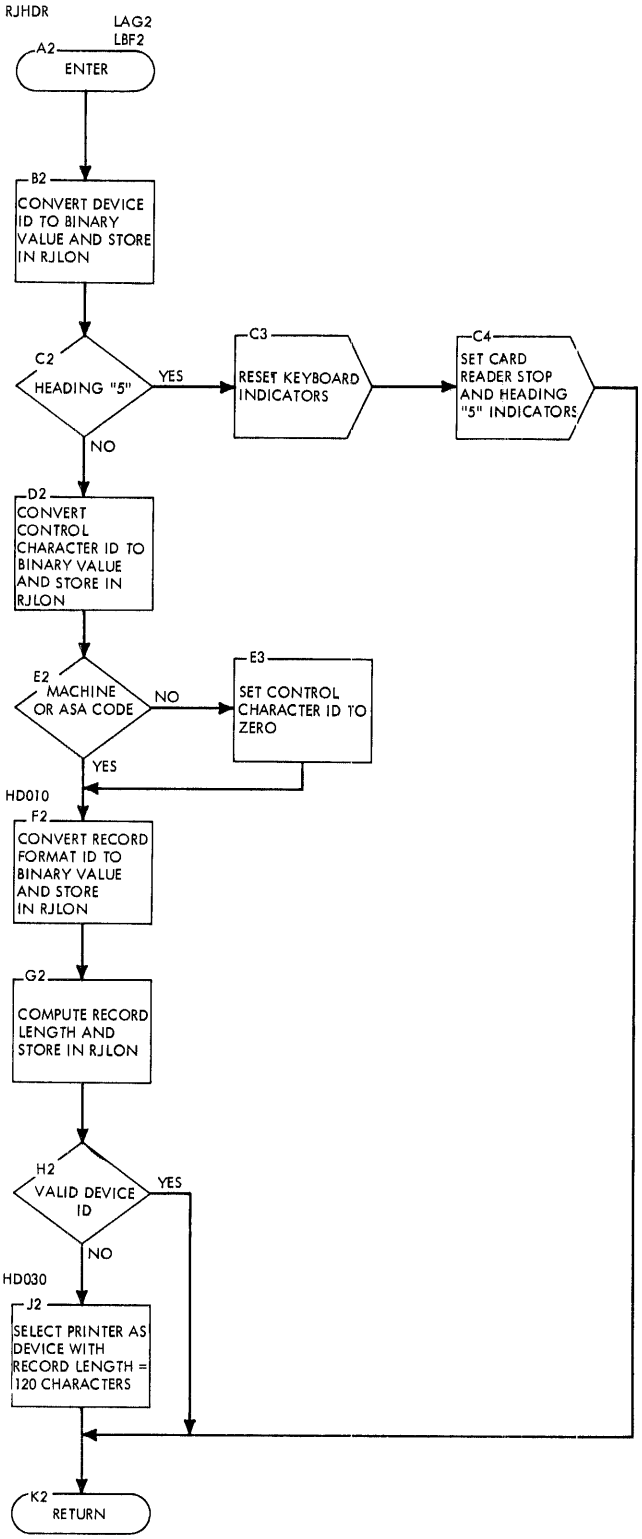


Chart NA. (RJOUT) Output Device Switch

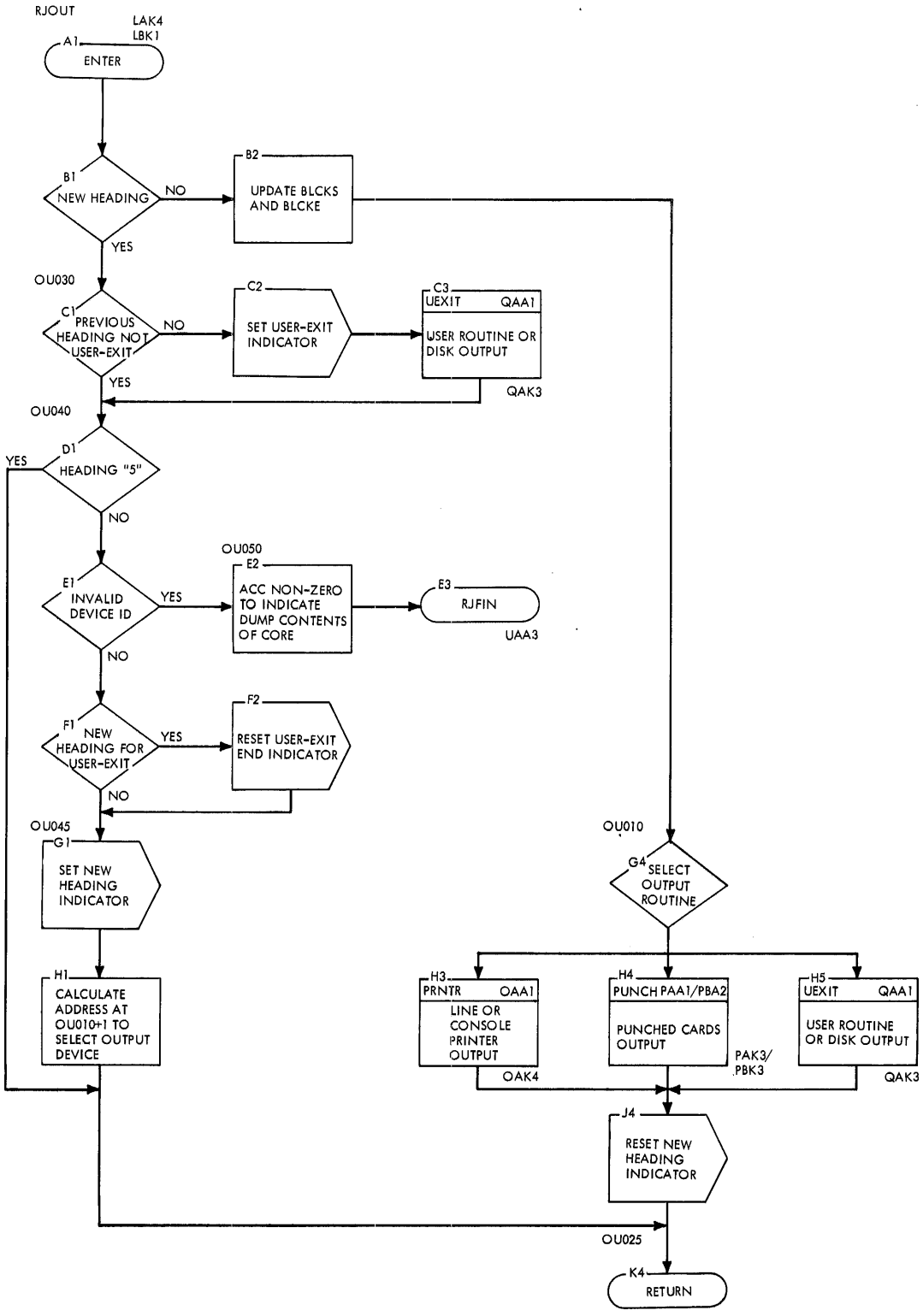


Chart OA. (PRNTR) Printer Output

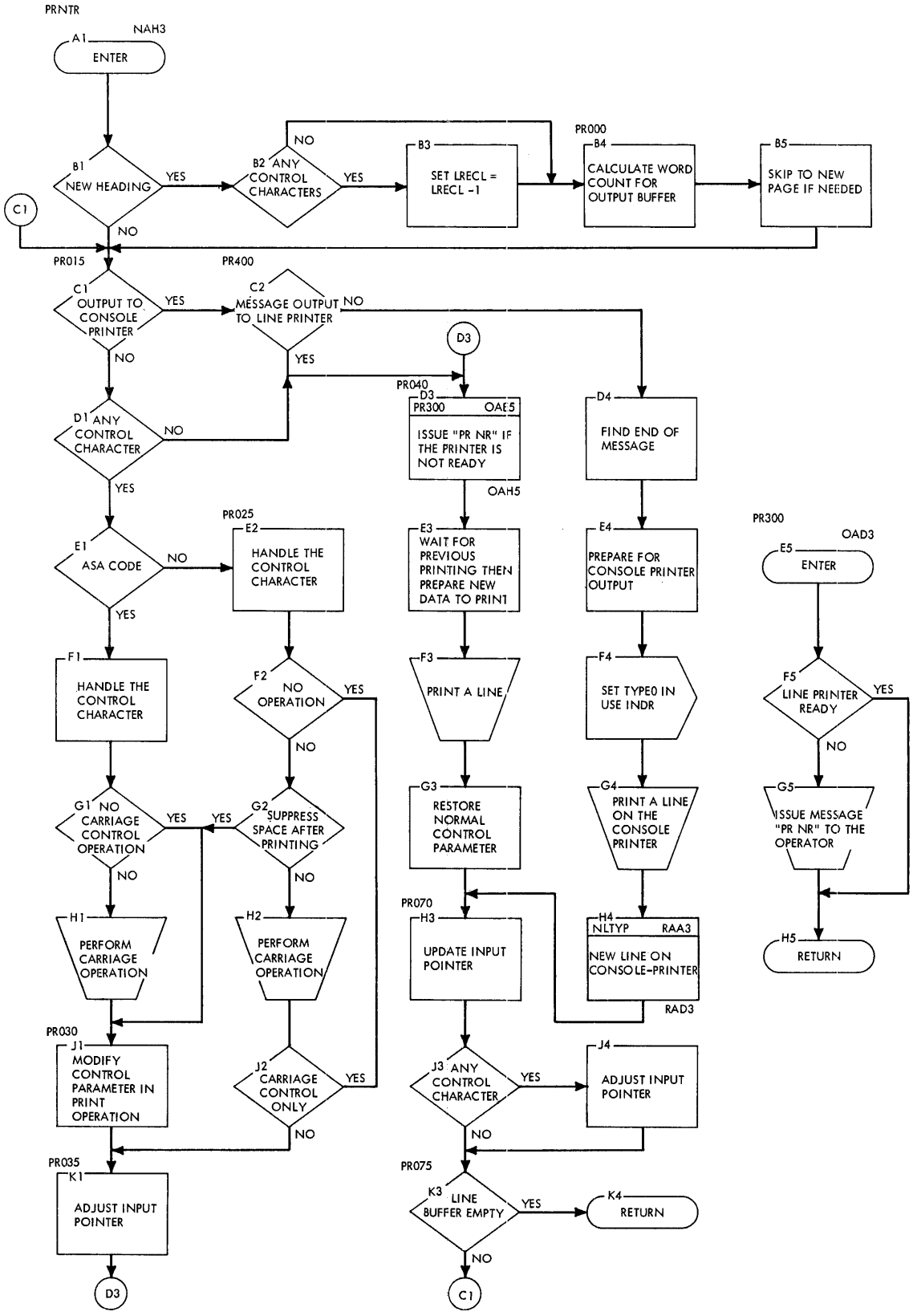


Chart PA. (RJRP1) Punch Output, 1442-6, -7

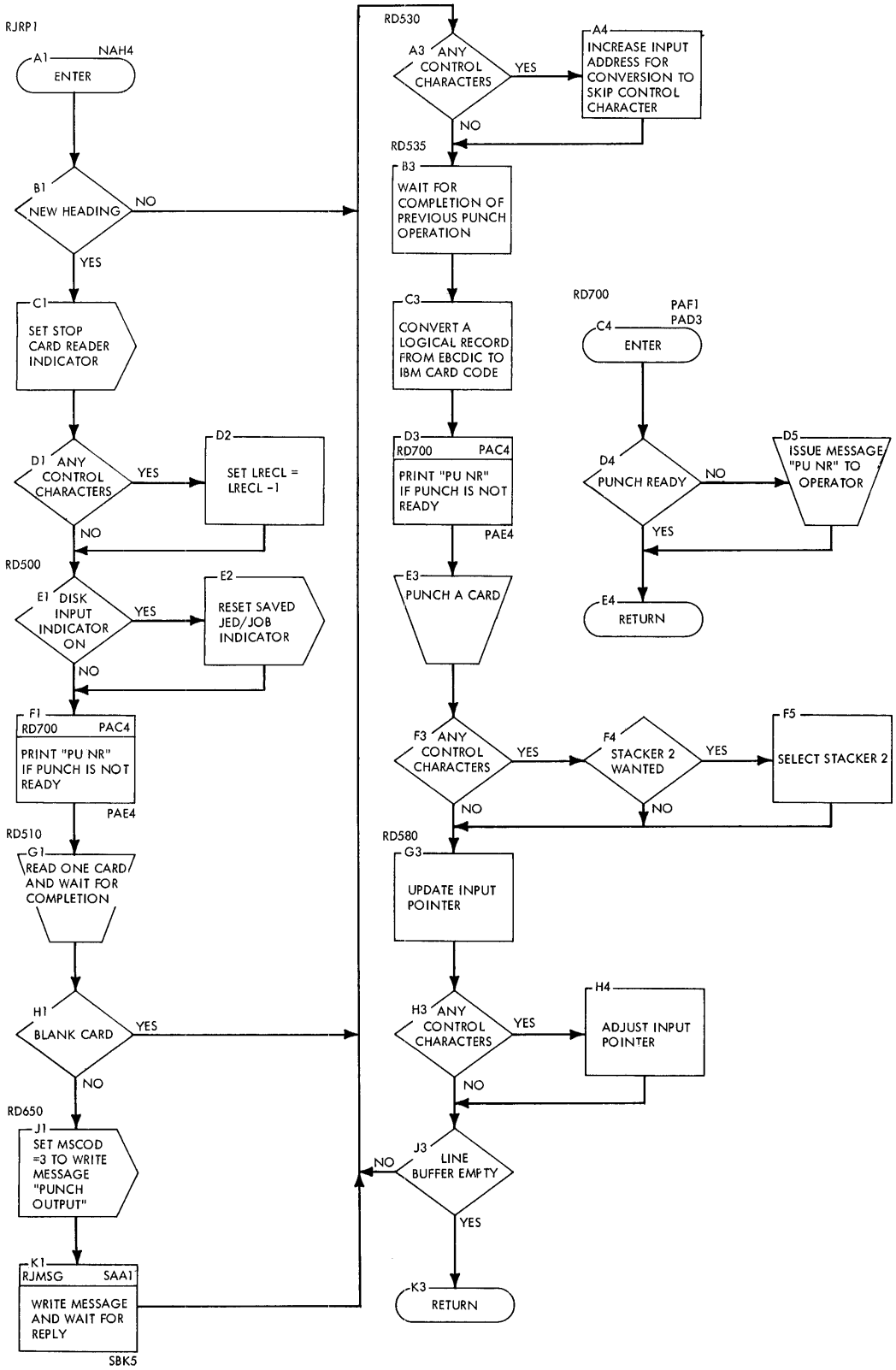


Chart PB. (RJRP2) Punch Output, 1442-5

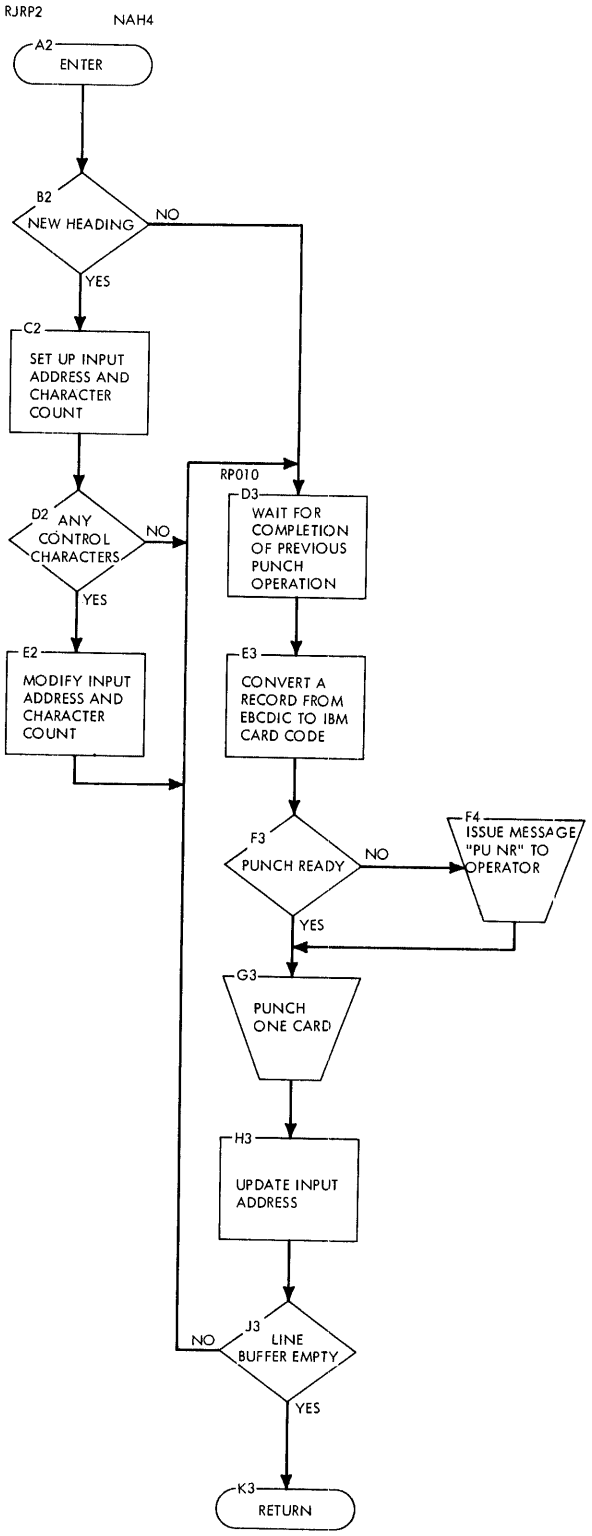


Chart QA. (UEXIT) User-exit Routine

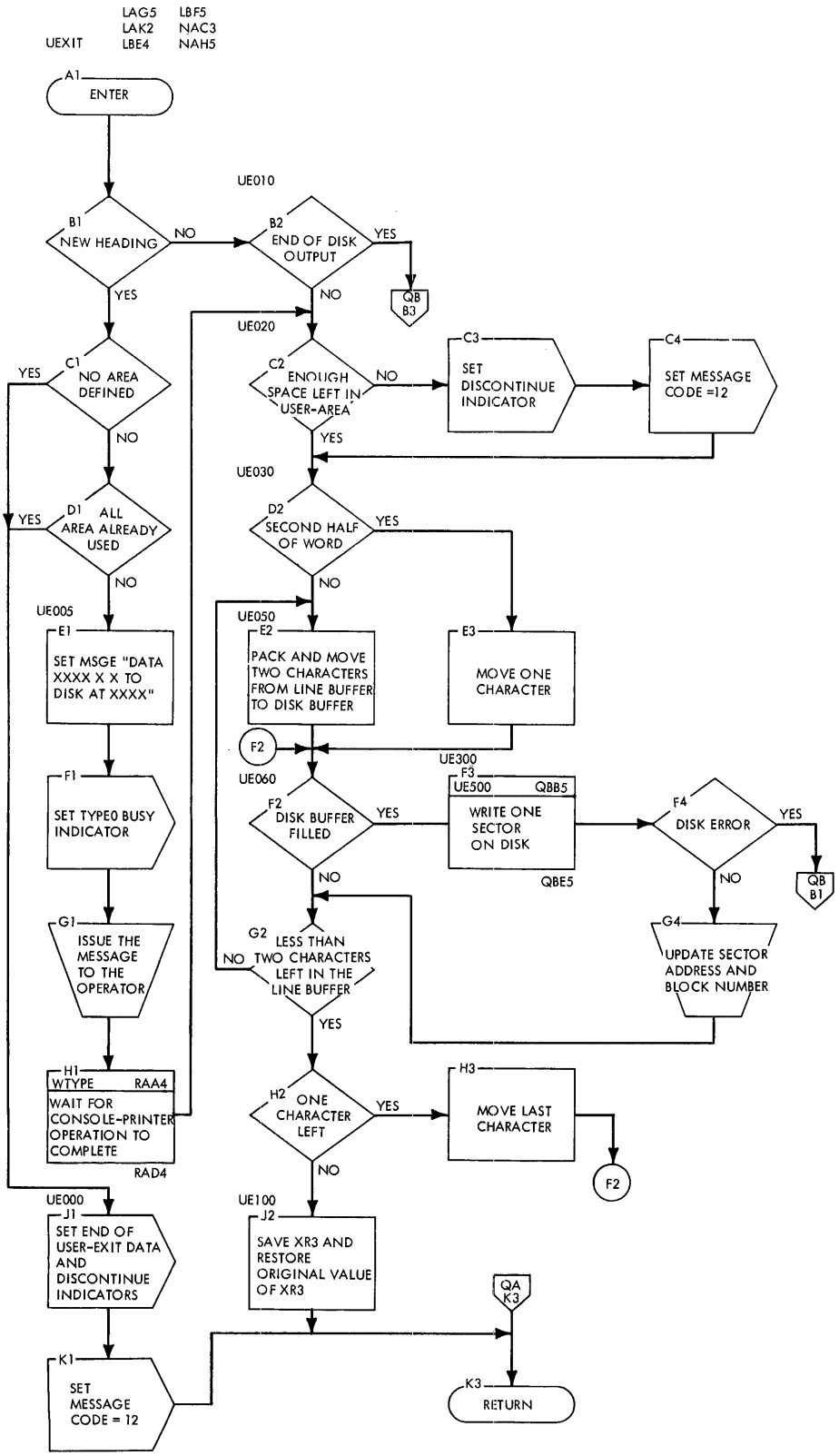


Chart QB. (UEXIT) User-exit Routine

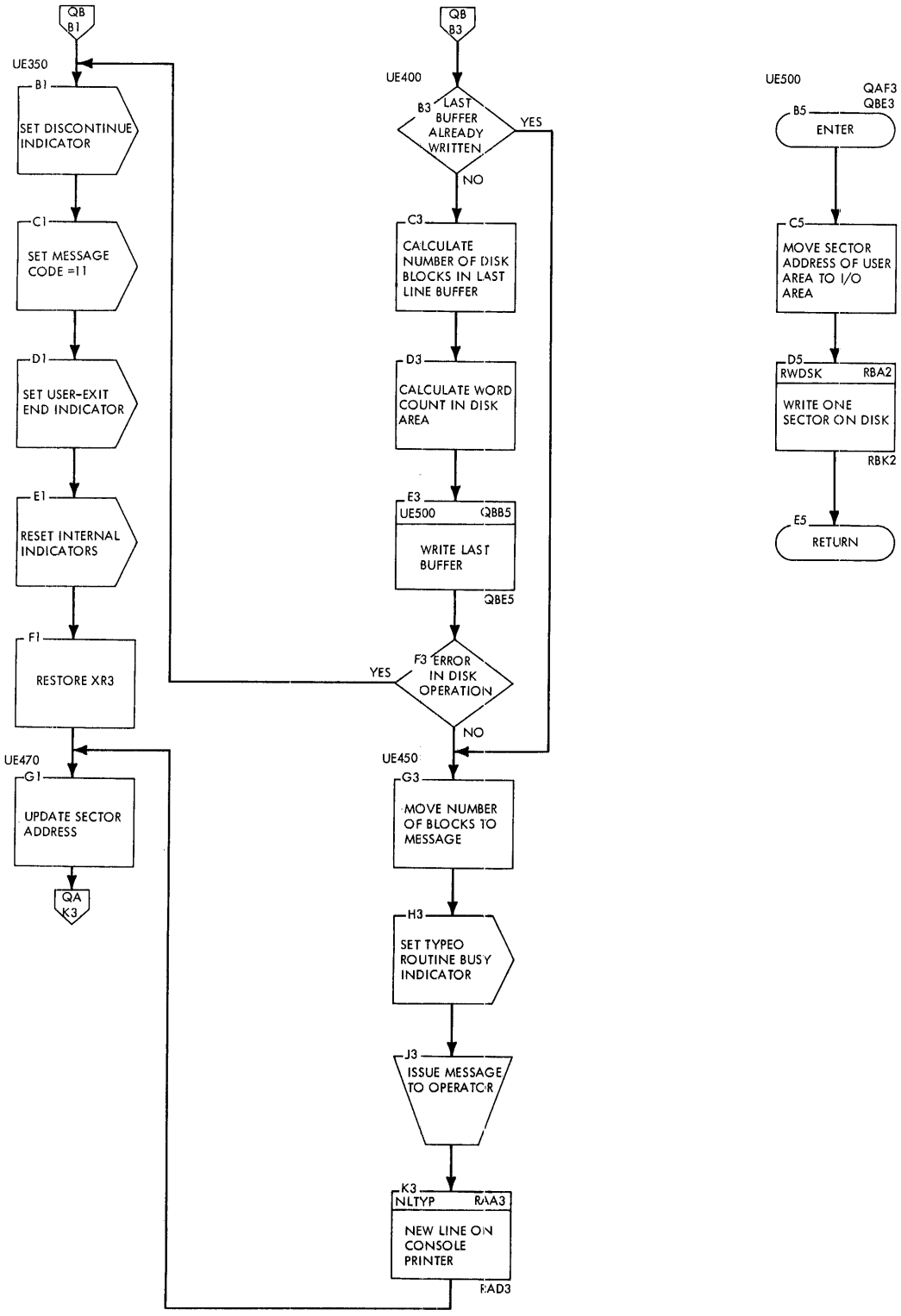


Chart RA. (RJL0n) Miscellaneous Subroutines

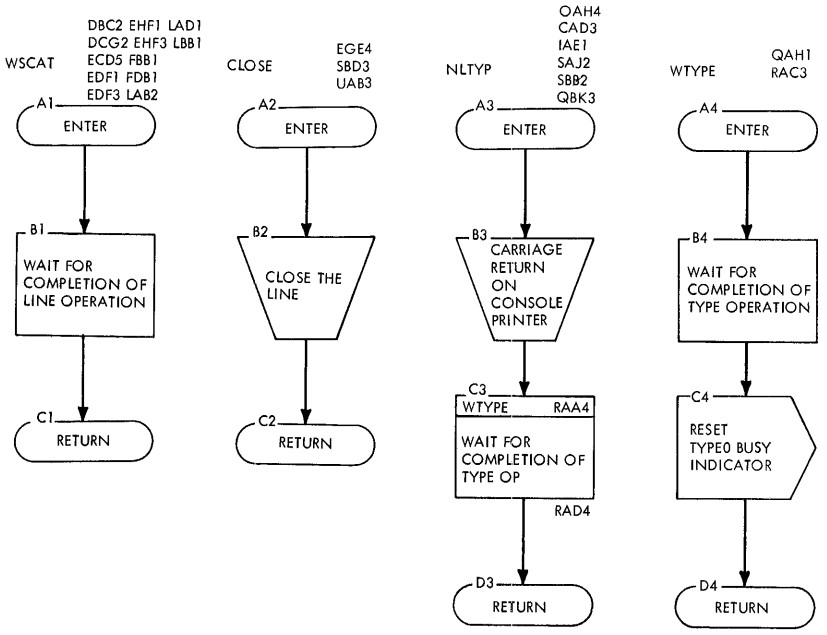


Chart RB. (RWDSK) Read/Write Disk

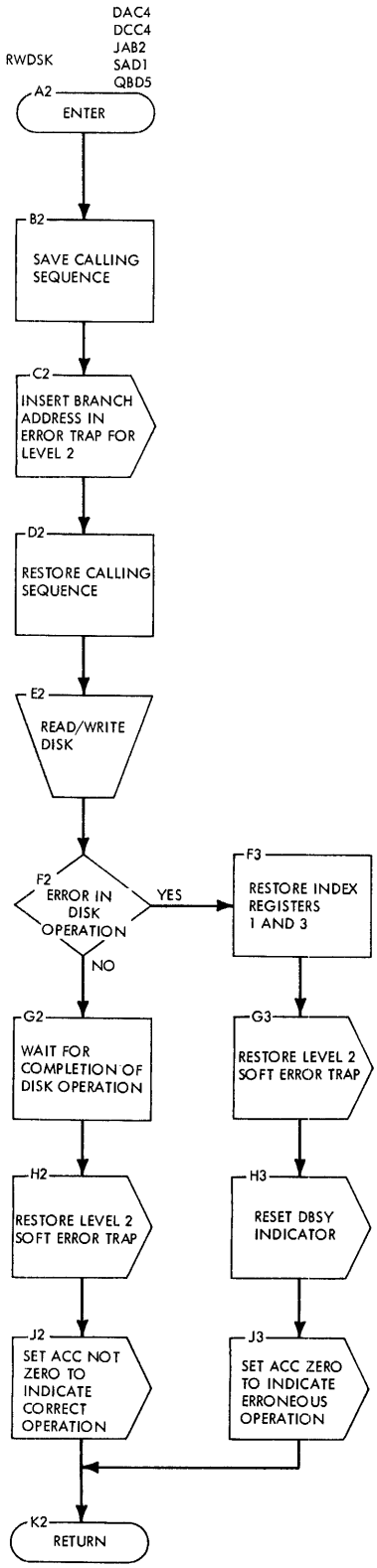


Chart SA. (RJMSG) Message Routine

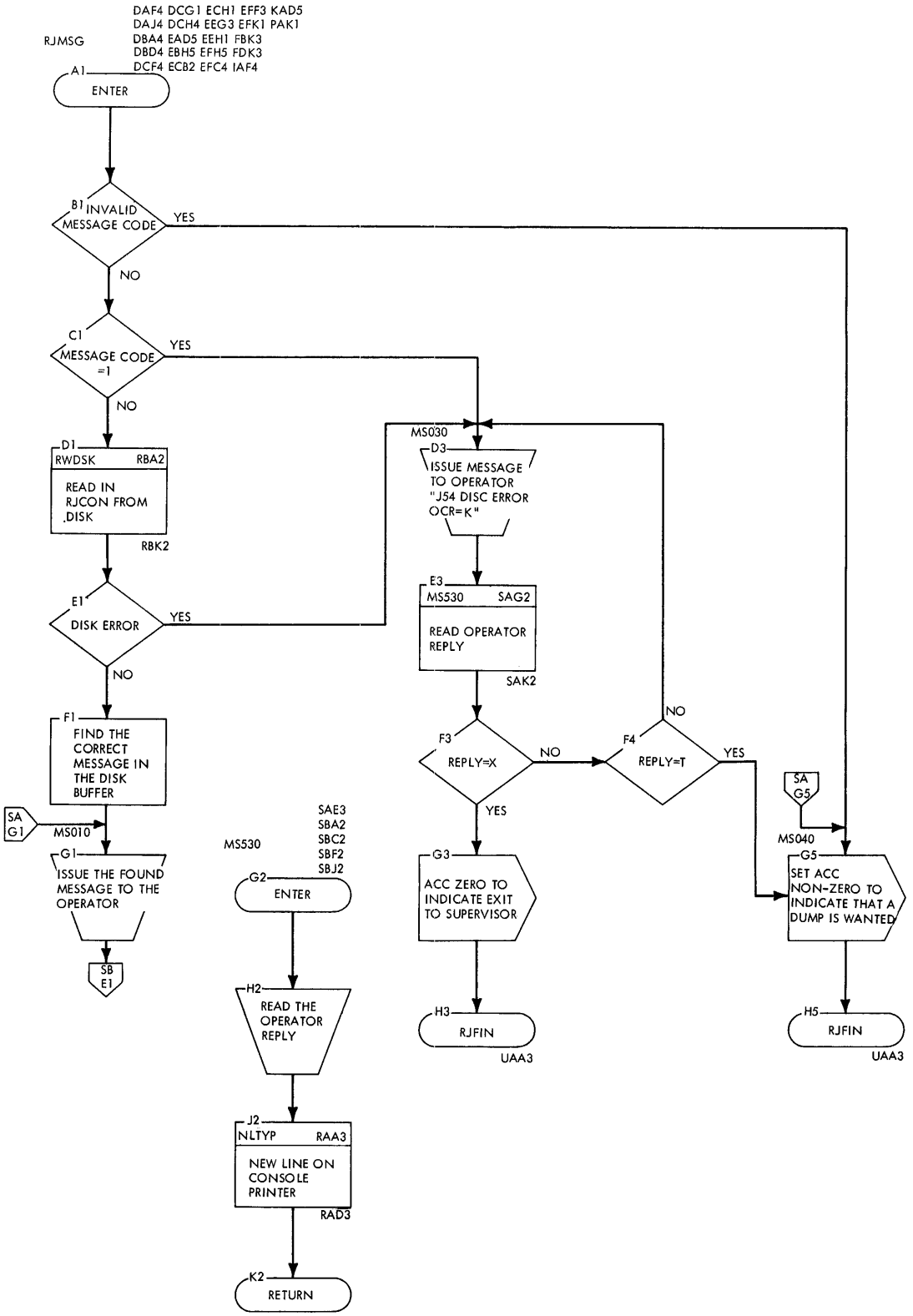


Chart SB. (RJMSG) Message Routine

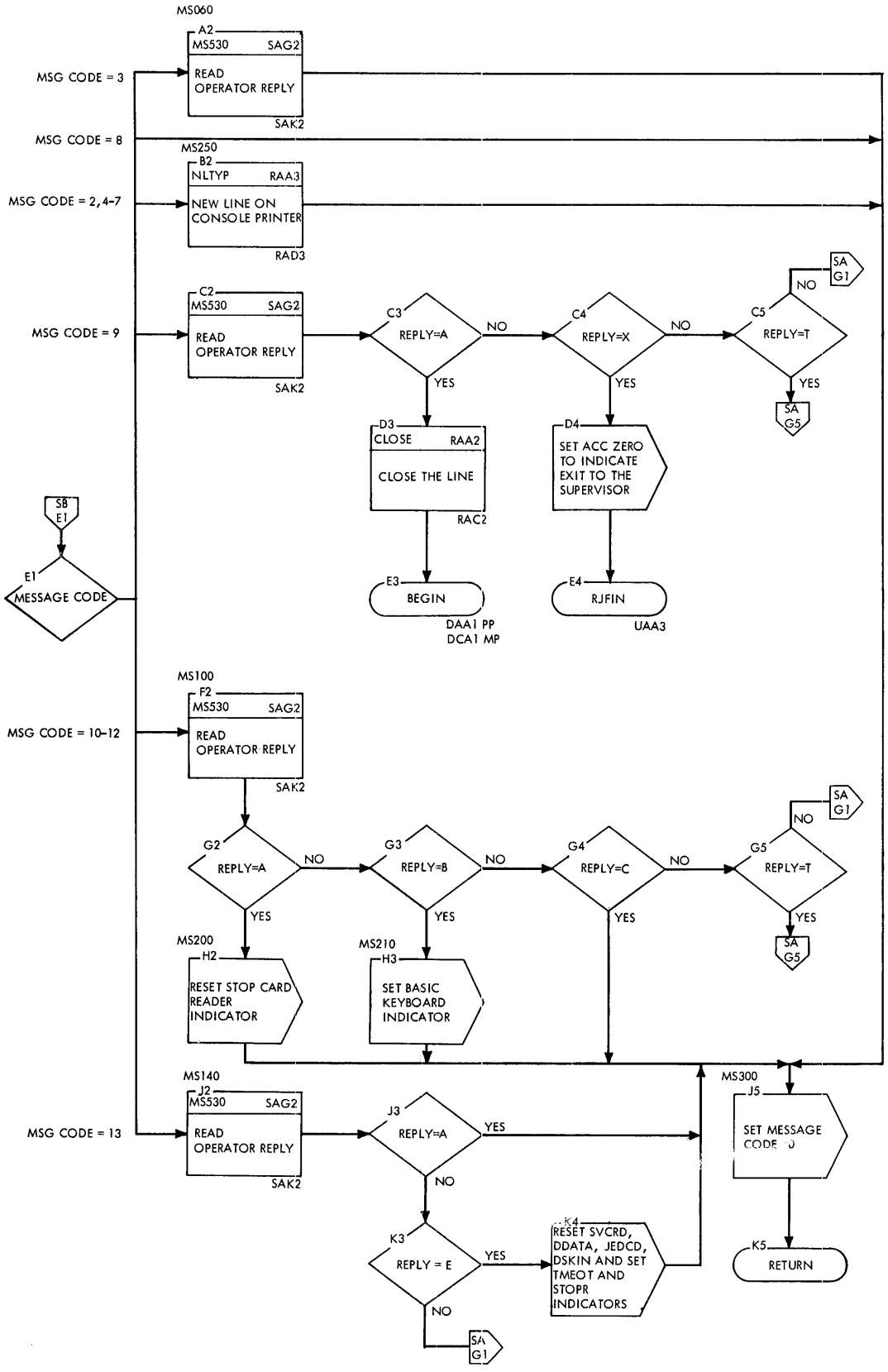


Chart TA. (RJREQ) Operator Request Routine

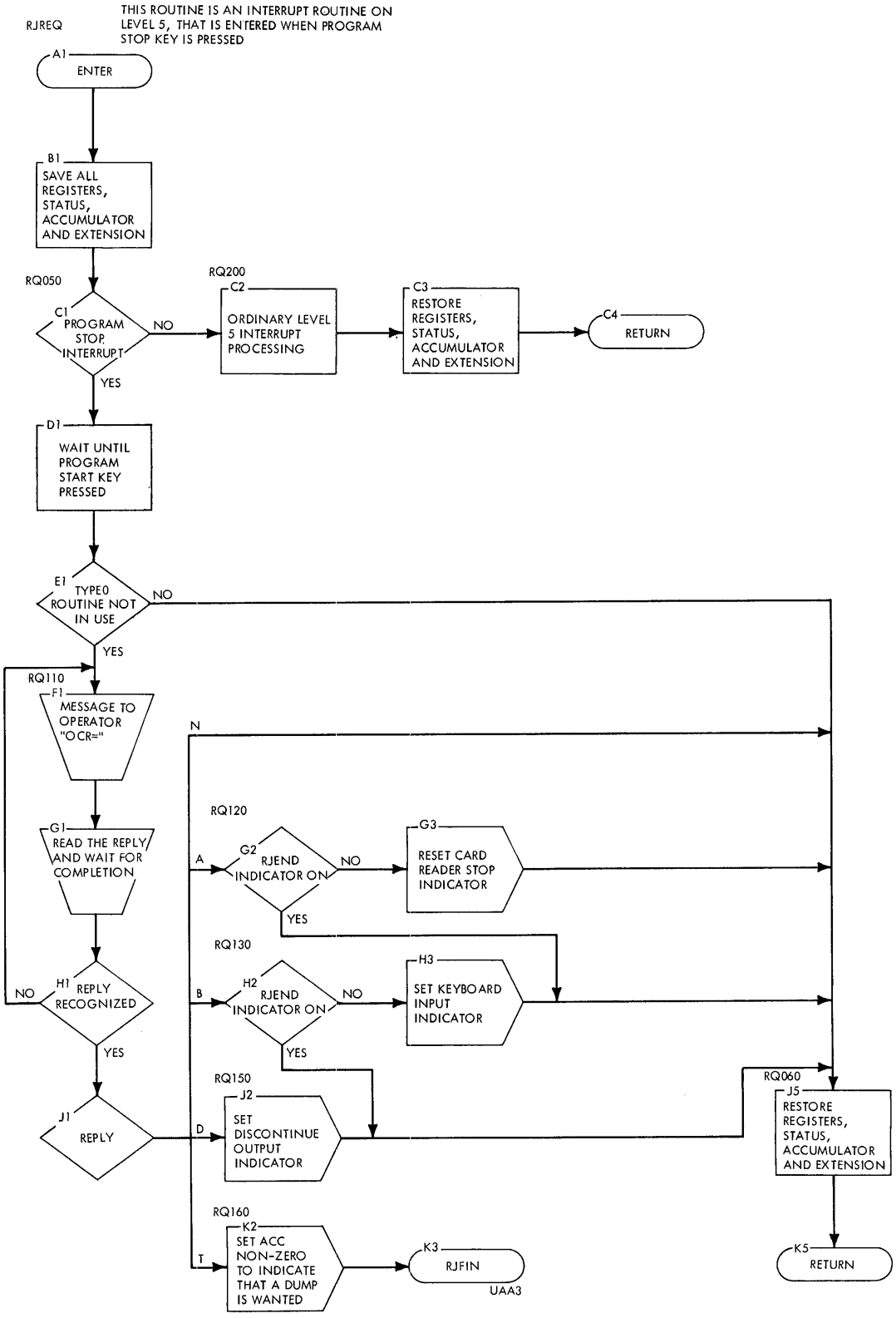
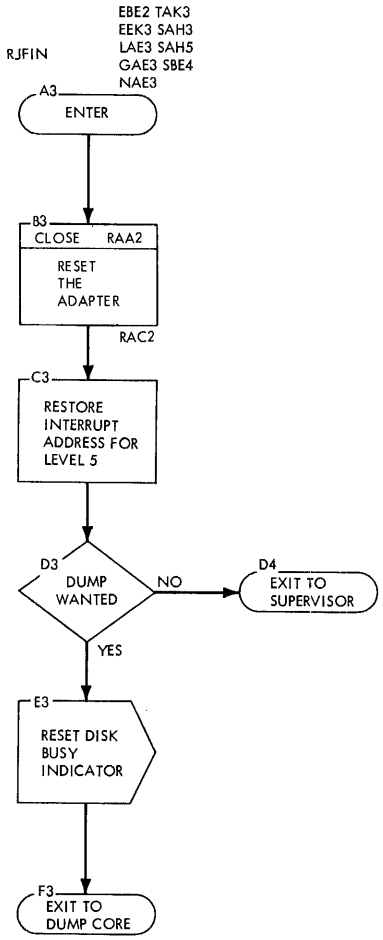


Chart UA. (RJFIN) Termination Routine



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