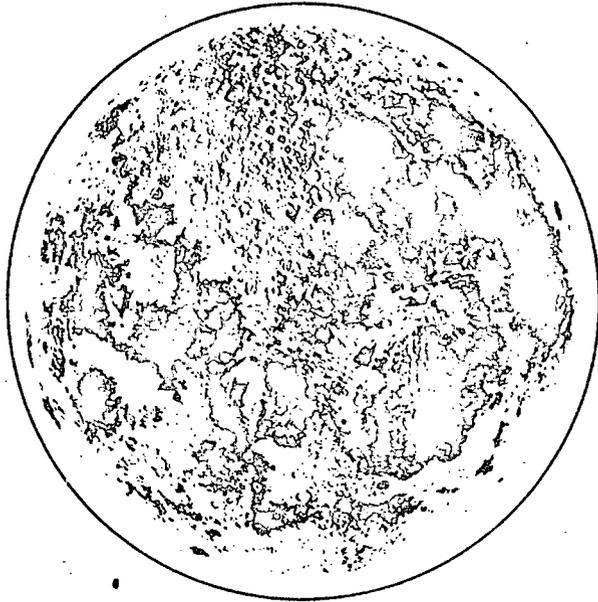


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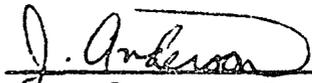
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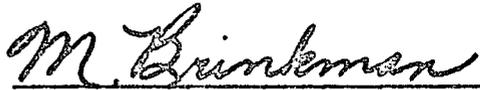
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Houston, Texas

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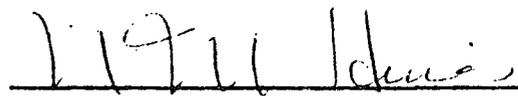


J. Anderson, Cognizant Engineer

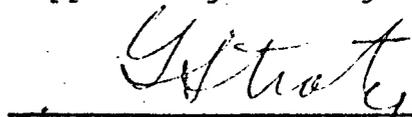
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1.0 SCOPE

The purpose of this volume is to provide the reader with several levels of documentation for this program module of the NASA Medical Directorate Mini-computer Storage and Retrieval System.

The Biomedical Information System Overview (Section 2) describes some of the reasons for the development of the mini-computer storage and retrieval system. It briefly describes all of the program modules which constitute the system.

The General Specifications Section (Paragraph 3.1) describes the purpose and function of the specific program module documented in this volume.

The Technical Specifications (Paragraph 3.2) is oriented to the programmer. It is a technical discussion of the same processing described in general terms in the previous section, but is a high enough level as not to be redundant with the very detailed analysis described in the Subroutine Section 3.3.

The Subroutine Section (Paragraph 3.3) describes each subroutine in enough detail to permit an in-depth understanding of the routines and facilitate program modifications.

The Program Utilization Section (Paragraph 4.0) may be used as a "Users Guide" and is as non-technical as possible.

To eliminate unnecessary reproduction, the program listings are maintained in a separate document which may be obtained from the VARIAN library of computer programs currently maintained in Building 32 at NASA MSC. In addition, another document is to be developed for the Medical Directorate management. The document will describe the mini-computer system on a higher functional level and will illustrate how the mini-computer storage and retrieval system interfaces with the total directorate data management plan.

2.0 BIOMEDICAL INFORMATION SYSTEM OVERVIEW

For several years, the NASA Medical Directorate has been developing a Medical Information Management System (MEDATA). The System, as implemented at NASA, utilized an off-line IBM 1050 for preparation of data input via paper tape and required card deck runs for retrieval of data from the data files. A new phase of development has been implemented utilizing remote terminals and mini-computers. This section describes the development rationale of the remote terminal and mini-computer approach.

Several features of the old MEDATA system presented serious difficulties to the system user and made the system unresponsive. These deficiencies in the system included:

- Input data prepared on punched paper tape
- No online data input capability with the data base (i.e., no remote data entry)
- Data corrections via punched paper tape
- Preparation of retrieval requests via a punched card system
- 48-hour turnaround time required for retrieval outputs.

To improve the overall responsiveness of the system and eliminate these deficiencies, Philco-Ford developed the Varian/MEDATA Storage and Retrieval System (VMSARS) which utilizes the Varian 620I computer systems in Building 32 or 37.

VMSARS consists of the Medical Data Input System (MDIS), the Medical Data Update System (MDUS), and the Medical Data Tape Retrieval System (MDTRS). The Medical Data Input System (MDIS) is used to input data via a CRT. If updates or reviews are desired, the output of MDIS may be updated on the CRT by the Medical Data Update System (MDUS). The data tape (MDIS or MDUS output) is entered into the CAAD MEDATA system where it is sorted and merged into the appropriate Medical Data File. The updated CAAD MEDATA Medical Data Tape File is sent back to the Varian computer system and used as input for the Medical Data Tape Retrieval System (MDTRS) which processes data retrieval requests from remote terminals. The primary advantages of the VMSARS are as follows:

- Use of state-of-the-art input devices such as CRT's and portable acoustic-coupled teleprocessing terminals. (CRT's operate at 2400 bits per second on the telephone lines.)
- Elimination of paper tapes from the system. (Data storage is on magnetic tape.)
- Online data input from remote input station via the telephone lines.
- Error correction capabilities on CRT. (Limited error checking is performed by the computer.)
- Update capabilities on Varian system before data is entered into the CAAD MEDATA system.

- Ease of creation and updating of background forms.
- Capability of transmitting MEDATA retrievals over telephone lines to CRT or TTY.
- Capability of performing online retrievals.

VMSARS was used for the Flight Crew Health Stabilization Program for three months preceding the launch of Apollo 14 and Apollo 15. A Computer Communications Inc. (CCI) CRT and keyboard and an Execuport Typewriter were installed in the surveillance command post at KSC, and a surveillance master file was created. The VMSARS was used to collect data, perform updates, and retrieve data from the surveillance master file.

The overall system, including the CAAD MEDATA system interface, is illustrated in Figure 2-1. The individual programs are described as follows:

MEDICAL DATA INPUT SYSTEM

The Medical Data Input System (MDIS) is designed to collect data from a CRT input station and store the data on a magnetic tape. The medical questionnaire forms are maintained on magnetic tape and are read into computer memory at run time. The user selects the appropriate form to be displayed on the CRT. As each form is completed, the data is stored on magnetic tape. This tape may be further updated, transmitted to another terminal, or input to the 1108 MEDATA system. Hardcopies of any form are produced at the

user's request. The system requires only one tape unit and operates either via the phone lines or directly online with the computer.

MEDICAL DATA UPDATE SYSTEM

The Medical Data Update System (MDUS) updates any tape created by MDIS. Two tape-drives, a CRT, and printer are required. The old data is read from the MDIS output tape and displayed on the CRT. Changes may be made to the data on the CRT; comments or recommendations may be added to the record, and the new updated record written to the update tape. The updated tape may be either transmitted to another terminal or input to the MEDATA system, or both. Hardcopies of the records are produced if requested by the user. Refer to Figure 2-3 for an illustration of the MDUS components.

MEDICAL DATA TAPE RETRIEVAL SYSTEM (MDTRS)

MDTRS permits the user to make data retrievals from the MEDATA master tapes created by the 1108 MEDATA system. The 1108 system builds the MEDATA master tape from several sources, one of which is the MDIS or MDUS created input tapes. MDTRS outputs preprogrammed retrieval questions from the Varian computer to the requester's CRT or typewriter. The user builds his retrieval request by answering these questions. When the retrieval request is complete, MDTRS searches the MEDATA master tape for the data, formats the selected data for output, and outputs the data to the terminal. The CRT may operate on a private telephone line at 2000 bits per second and the typewriter operates on any commercial telephone line at 300 bits per second. Refer to Figure 2-4 for an illustration of MDTRS components.

2.1 OVERVIEW SUMMARY

In summary, the Varian/MEDATA Storage and Retrieval System provides the user with an online input and retrieval capability previously unavailable. The response time is significantly improved over the old paper tape system. There are still two weak points in the system due to hardware constraints. These are (1) the requirement to update the MEDATA master file on the CAAD 1108 computer system, and (2) the use of tape instead of disk for storage of the data base. A more comprehensive storage and retrieval system is being designed to operate on a Varian 620 mini-computer system utilizing a disk memory storage device and an input/output multiplexing device. The new system will permit immediate update of files, faster response for retrieval requests and multiple terminal users operating simultaneously.

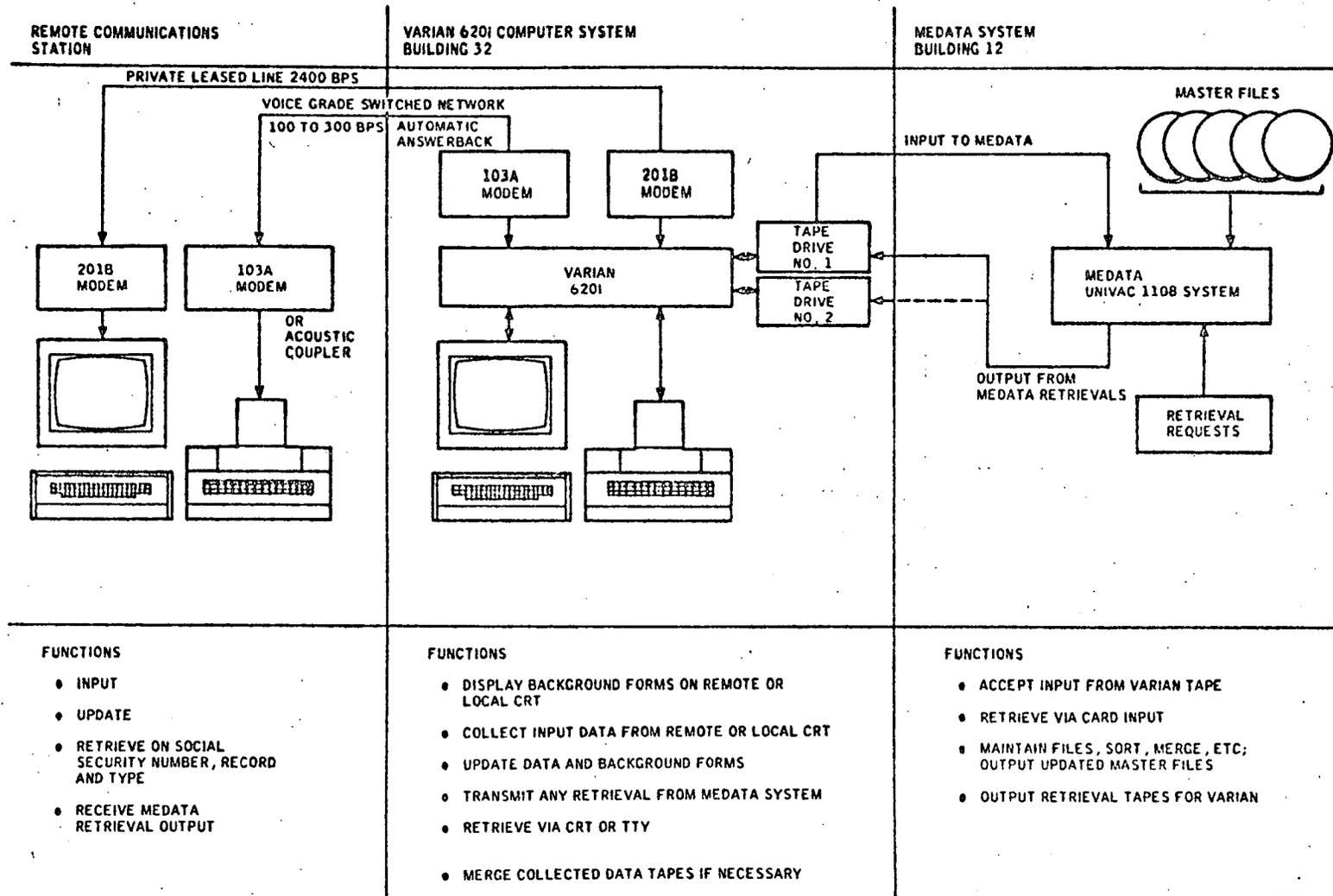
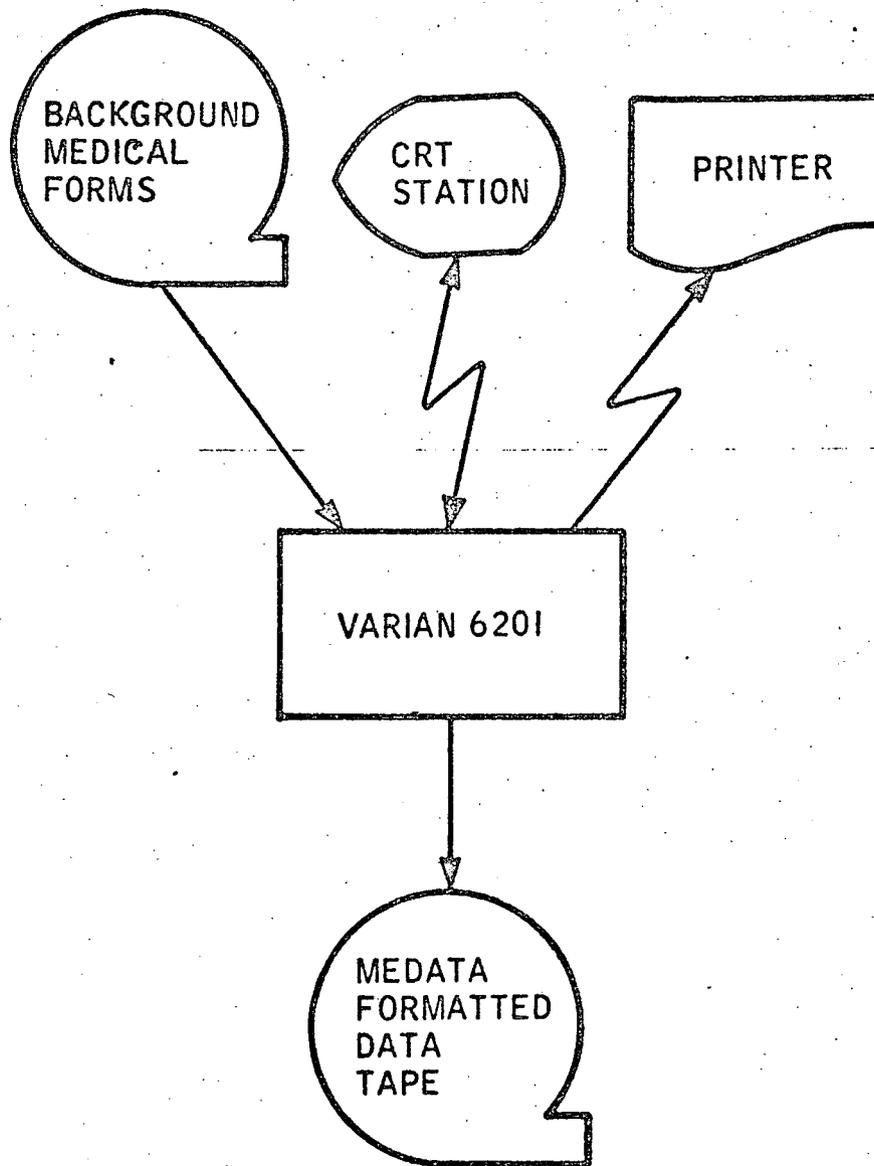
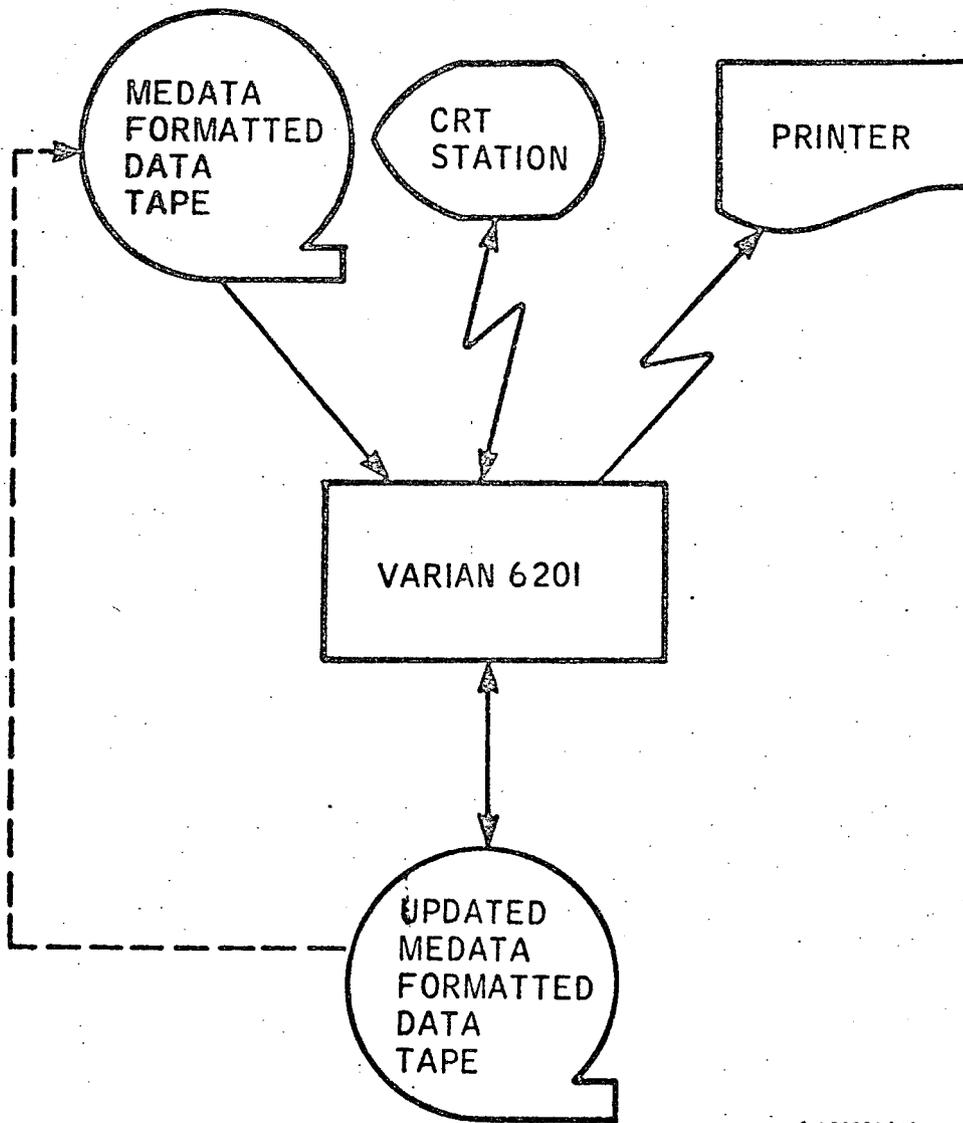


Figure 2-1 Varian/MEDATA Storage and Retrieval System



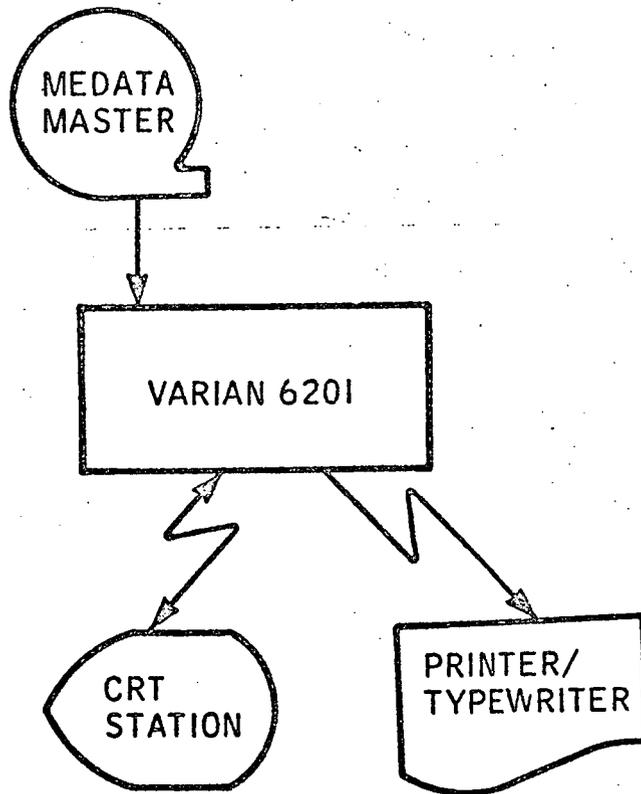
AA20002(A)-1

Figure 2-2 Medical Data Input System



AA20002(A)-2

Figure 2-3 Medical Data Update System



AA20002(A)-4

Figure 2-4 Medical Data Tape Retrieval System (MDTRS)

This document describes in detail one of the three components of VMSARS,
the Medical Data Update System (MDUS).

3.0 MDIS SYSTEM

3.1 GENERAL SPECIFICATIONS

3.1.1 Background

Beginning in the fall of 1969, under a contract to NASA Manned Spacecraft Center, a team of programmers and analysts designed and implemented a storage and retrieval system at M. D. Anderson Hospital, Houston, Texas. The first demonstration of the system, called MEDATA, was done on an IBM 1401. The data base was created using card inputs, and any requests from the data base were made via the computer console typewriter. Operation of the system was viewed and accepted by MSC, and work began immediately for a similar more complete system on an SDS 930 computer. The new system was to accept input both from card and from paper tape punched on an IBM 1050 terminal. Any requests could again be made from the console, but capability was added to accept punched card requests. Once implemented, MEDATA was transferred to an SDS Sigma 5, and began its operation for NASA.

Before the fall of 1969, work had begun on the implementation of MEDATA on the Univac 1108. This system would have greater processing capabilities, but the principle means of input to the data base was still to be card and paper tape. In May of 1970, Philco-Ford Corporation, under contract to NASA, began the design and implementation of a more sophisticated means of input. This system, called the Medical Data Input System (MDIS), was based on a hardware configuration consisting of a Varian 6201 computer, a Cathode Ray Tube (CRT) display, and a magnetic tape drive. The data

was transferred from the CRT display to the computer to the magnetic tape. This tape was then used as input to the MEDATA system on the Univac 1108. The advantages of this system were obvious to the users. They had error correction capabilities that they had never before been allowed. They no longer had to contend with cumbersome paper tapes. From an operational viewpoint, the new system provided a much more efficient means of input.

3.1.2 Functions of the System

3.1.2.1 Input

There are two types of input in MDIS: the forms background input data, and user input medical information. The background data is the same information that a medical examiner sees on a blank collection form. This blank form is completed by the examiner, and then referenced by a MDIS user when he inputs to the CRT display that information collected by the examiner. All of the possible background forms can be grouped onto magnetic tapes, so that at any time a particular set of forms is desired, they may be selected by merely using the correct tape.

3.1.2.2 Processing

Once the user has selected the correct background forms tape to be used, these backgrounds are read into the computer. An index table is created so that any time a user desires a particular form, the table can be referenced to locate the form. Once found, the form is output in segments. These segments, called "pages", are necessary because one form may exceed the size of the CRT screen. As each page is completed the data is input

and saved until the entire form has been accounted for. The data is then recorded onto a magnetic tape and saved.

3.1.2.3 Output

The data that is input from the CRT display is stored and, along with its background data, is output to tape. This tape will eventually be used as an input tape to the Master File maintained by the MEDATA system. Should the user desire a hardcopy of any form, the data will be output to the local teletype.

3.2 TECHNICAL SPECIFICATIONS

3.2.1 System Description

MDIS is an alternative system for input to MEDATA. Prior to its implementation all inputting was done through a paper tape oriented IBM 1050 Data Communications System. The maximum speed of this system was 15 characters per second. With MDIS, transfer rates are greatly increased and typographical errors can easily be corrected.

3.2.2 Input

The input to MDIS is either initialization or user-input data. Initialization data consists of a magnetic tape of the background forms. The format of these forms is strictly governed to such an extent that if a mistake is made in creating a background, that form may be impossible to display. Appendix A contains a detailed description of this format.

User-input data is free form. Transmission of data from the CRT display to the computer is in block mode, which means that an entire screen is transmitted upon command as opposed to one character at a time. An example of CRT input is found in Appendix D.

In Section 3.3.5 the user options that may be input are described.

3.2.3 Processing

Eight functions are performed in the processing of MDIS. They are:

- Initialize background forms
- Select a form
- Build a page of the form
- Output a page to the CRT display
- Input a page from the CRT display
- Build a tape record
- Output a tape record
- Terminate processing

Initialization consists of reading the background forms from tape and storing them in adjacent areas in the tape input buffer, MTN\$. Since each form is one tape record, an index table with the beginning buffer locations of each form is easily created at this time. After this is done, control is transferred to CP00, the control program, which handles all interface between the processing routines and the user at the CRT display.

The user selects a form by keying in a number that is associated with this form. The index table is referenced to determine the location of the requested form, and processing begins. BD00 now formats the first segment of the form for output. The next time BD00 is called it will process the next segment of the form, and so on, until the control program has determined that the last page has been output. After the output to the CRT of each segment of the background, at the user's command, all data on the screen is input. This data is formatted for output to tape, but is not output at this time. It is not until all segments of the form have been viewed by the user and processed by BM00, that the data is output to tape.

When the user has completed all of his inputting for this session, he can request termination. At this point a special software end-of-file record is written to tape (see Appendix A), and at the local teletype a message is output which specifies the number of records written to the output tape.

The user has five options that he may request from his terminal. They are:

- Position cursor
- Redisplay background for current page
- Redisplay background for the first page of current form
- Display a new form
- List last record at teletype

Each of these options is performed by calling special routines or by using special calling sequences to normal processing routines. Routine SC00 positions the CRT display cursor to the beginning of the next answer area following background data.

To redisplay the background of the current page, the control program calls routine OD00. Since the CRT display output buffer still has the background stored in it, the routine need only output the same buffer again.

Redisplay of the first page of the current form and display of a new form are both handled similarly. Routine BD00 is called specifying the number of the form to be displayed. The routine references the index table for the location of the requested form and the formats the first segment for output.

The listing of the routine at the teletype is performed by D000. It reads the record last written to tape and formats the data in a manner similar to BD00.

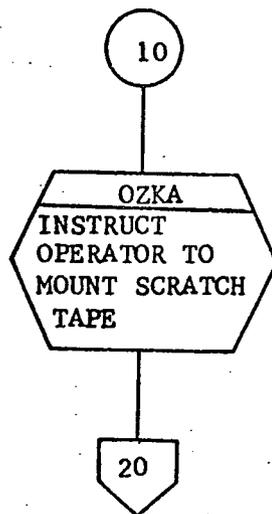
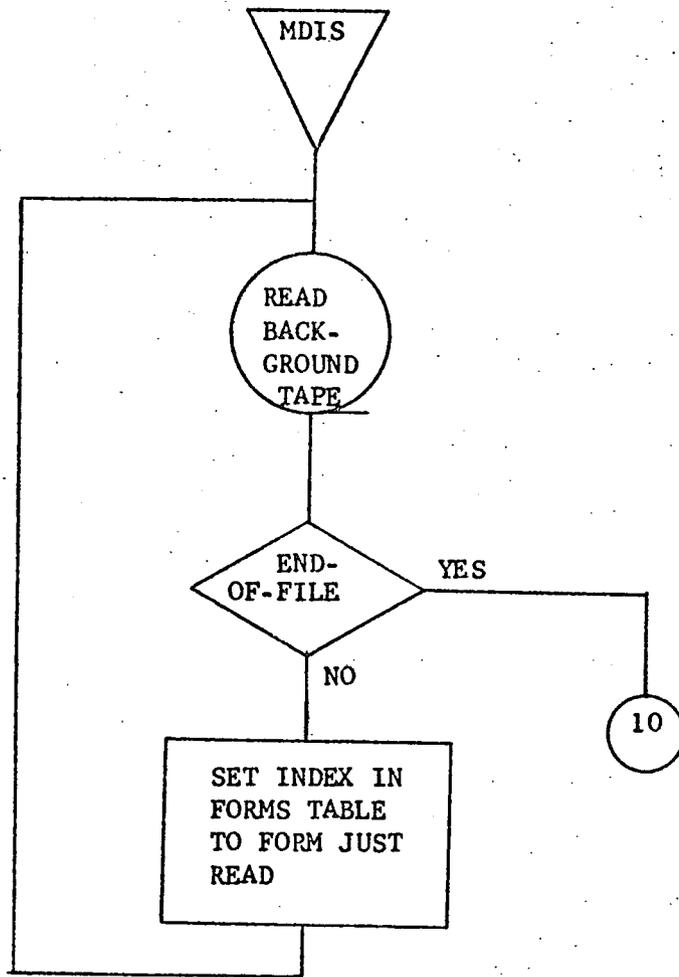
3.2.4 Output

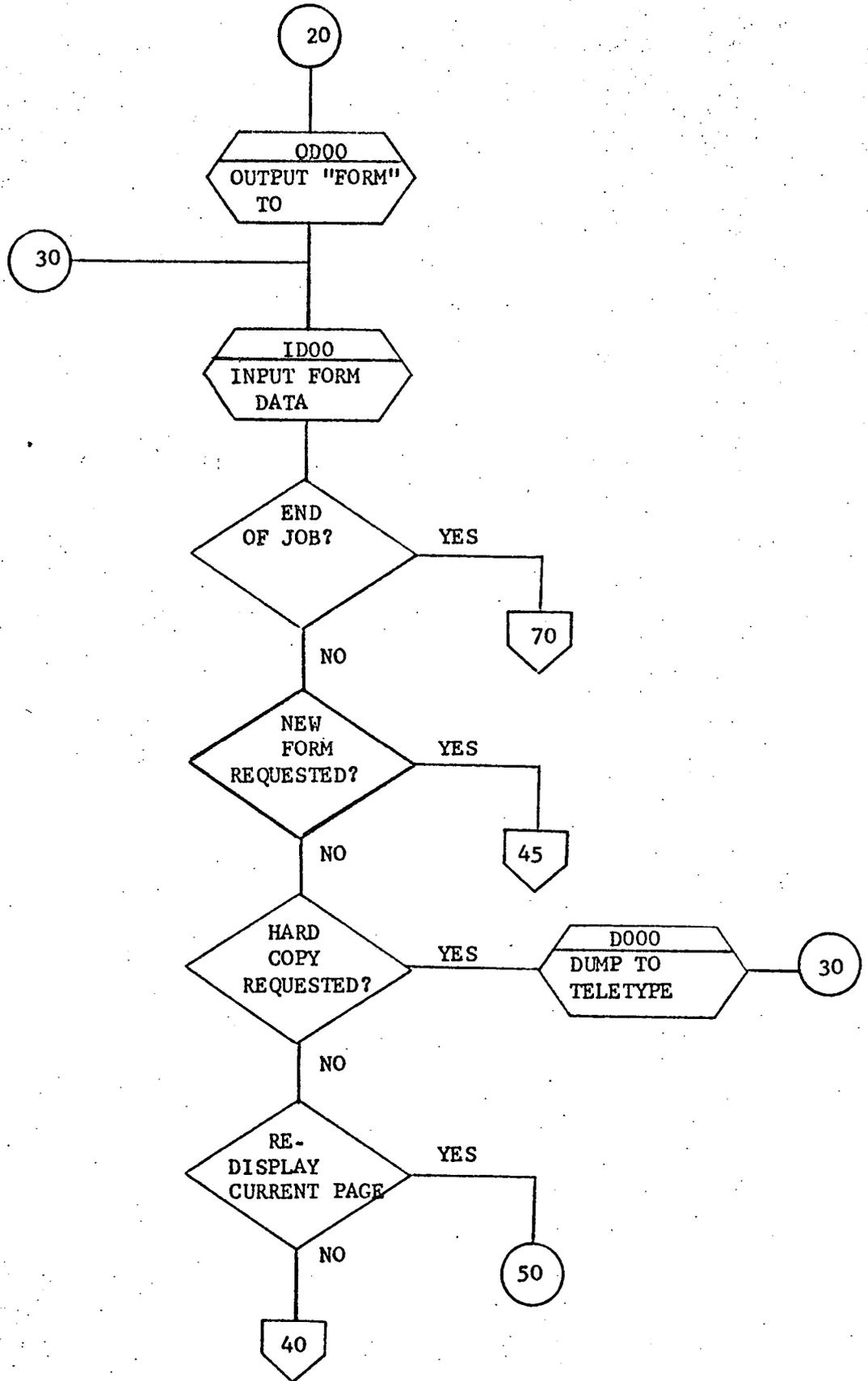
There are two modes of output in MDIS: tape and teletype. The tape output (the input to MEDATA) is outlined in Appendix A. The teletype output is a user-specified hardcopy of the form.

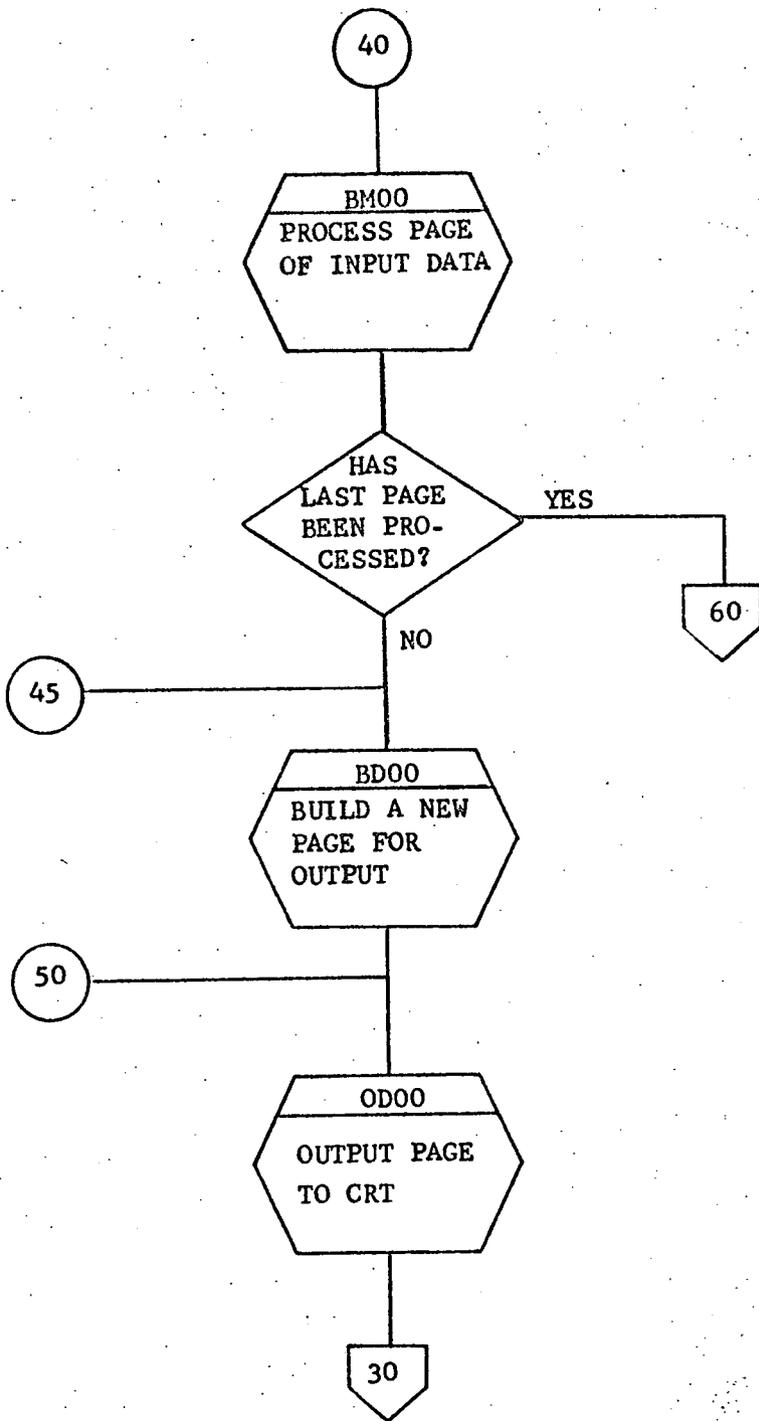
3.2.5 Buffers and Tables

<u>Label</u>	<u>Length (Words)</u>	<u>Contents/Purpose</u>
CRN\$	962	CRT input buffer. Contains the background data and the user data when it is input from the CRT.
CRO\$	974	CRT output buffer. Contains a page of data which is to be output to the CRT.
DPT\$	1	Display output buffer pointer. Used to save the address of the next available location in CRO\$ when building a display page.
FTB\$	200	Form table. Contains the beginning location of the form in MTN\$
LTB\$	30	Line Table. A table that describes each line of data on the CRT. See Appendix C.
MPT\$	1	Tape output buffer pointer. Used to save the next available location in MTO\$ when building a data record.
MTN\$	10,500	Tape input buffer. Storage location for background forms.
MTO\$	2,880	Tape output buffer. Storage location for output data record.

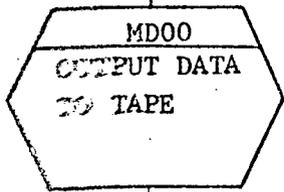
3.2.6 System Flow





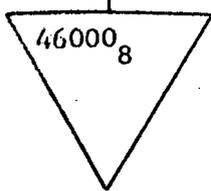
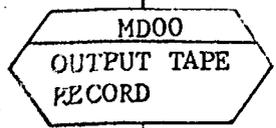
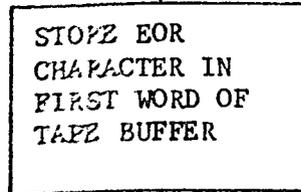


60



45

70



AIDS

3.2.7 Hardware Configuration

Following is a minimum hardware configuration for operation of the MDIS;

- 1 - Varian 620/1 computer with 20 K of core memory
- 1 - CCI CC-30 Communication Station with controller (CRT)
- 1 - tape drive
- 1 - teletype
- 2 - Buffer Interlace Controllers (BIC)
- 1 - Priority Interrupt Module with the following interrupts.

End of Transmission interrupts on both BIC's.

CRT keyboard interrupt

The tape drive and the CRT should be connected to separate BIC's.

3.2.8 System Block Diagram

See Figure 3-1.

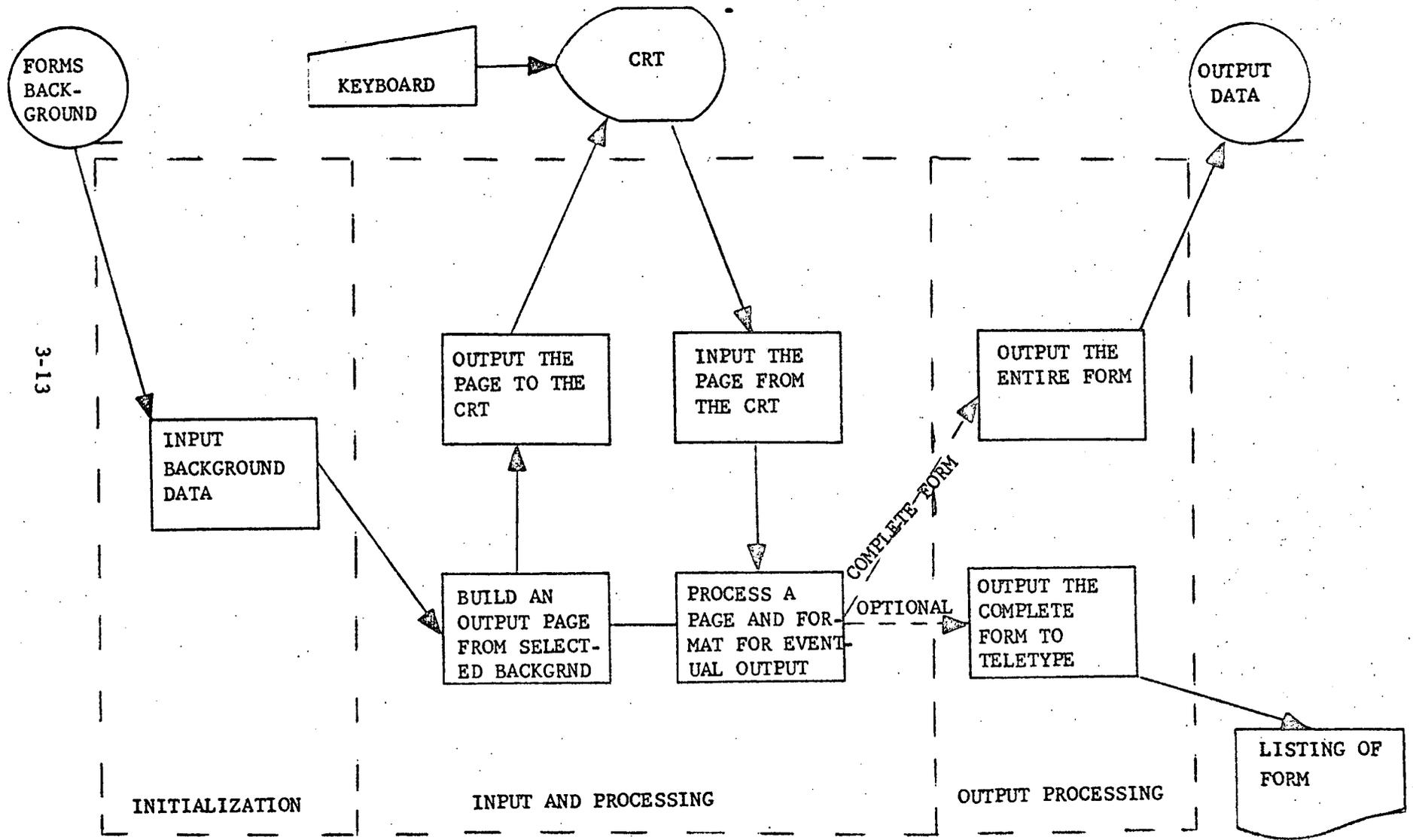


FIGURE 3-1. MDIS SYSTEM BLOCK DIAGRAM

3.3 SUBROUTINES

3.3.1 AI00 - Alpha-to-Integer conversion

3.3.1.1 Purpose

The purpose of this subroutine is to convert a string of ASCII coded digits to their binary value. Specifically, it is used to convert a user-input form number or page number (from the first line of a display page) to a binary value.

3.3.1.2 Technical Description

Three restrictions are placed on the calling routine in order that the converted value be accurate. First, the string of ASCII coded digits must be stored one character per word, right justified. Second, there may not be more than four digits in the string. In the event that there are, the converted value will be -1. The last restriction is that all numbers must be positive, and the string of digits may not be preceded by a sign. There is no validity check of the characters to verify that they are digits. All but the least significant four bits are masked out of the word, and the remaining bits are assumed to be between zero and nine in value. If the characters are digits, this will always be the case, and the conversion will be exact. Otherwise, the results are unpredictable.

The conversion method used is multiplication of each digit by its respective power of ten and sum the products. The resulting sum is stored in the location specified by the calling routine.

3.3.1.2.1 Calling Sequence

CALL A100,A,B,C

PARAMETER	FUNCTION
A	address of the beginning location of the string of ASCII digits
B	address of a word containing the number of digits in the string
C	address of the word where the result is to be stored

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	Saved	Restored
B	Saved	Restored
X	Saved	Restored
Overflow	N/A	May be modified

3.3.1.2.2 General Flow Chart

See Section 3.3.1.5

3.3.1.3 Label Descriptions

3.3.1.3.1 Local

AIFA - a table of the 1st four powers of ten (1, 10, 100, 1000).

AISA - storage location for beginning address of string of ASCII digits.

AIAN - location for saving the sum of products

3.3.1.3.1 Local (Continued)

AIA - save area for A-Reg

AIB - save area for B-Reg

AIX - save area for X-Reg

3.3.1.3.2 Global

None

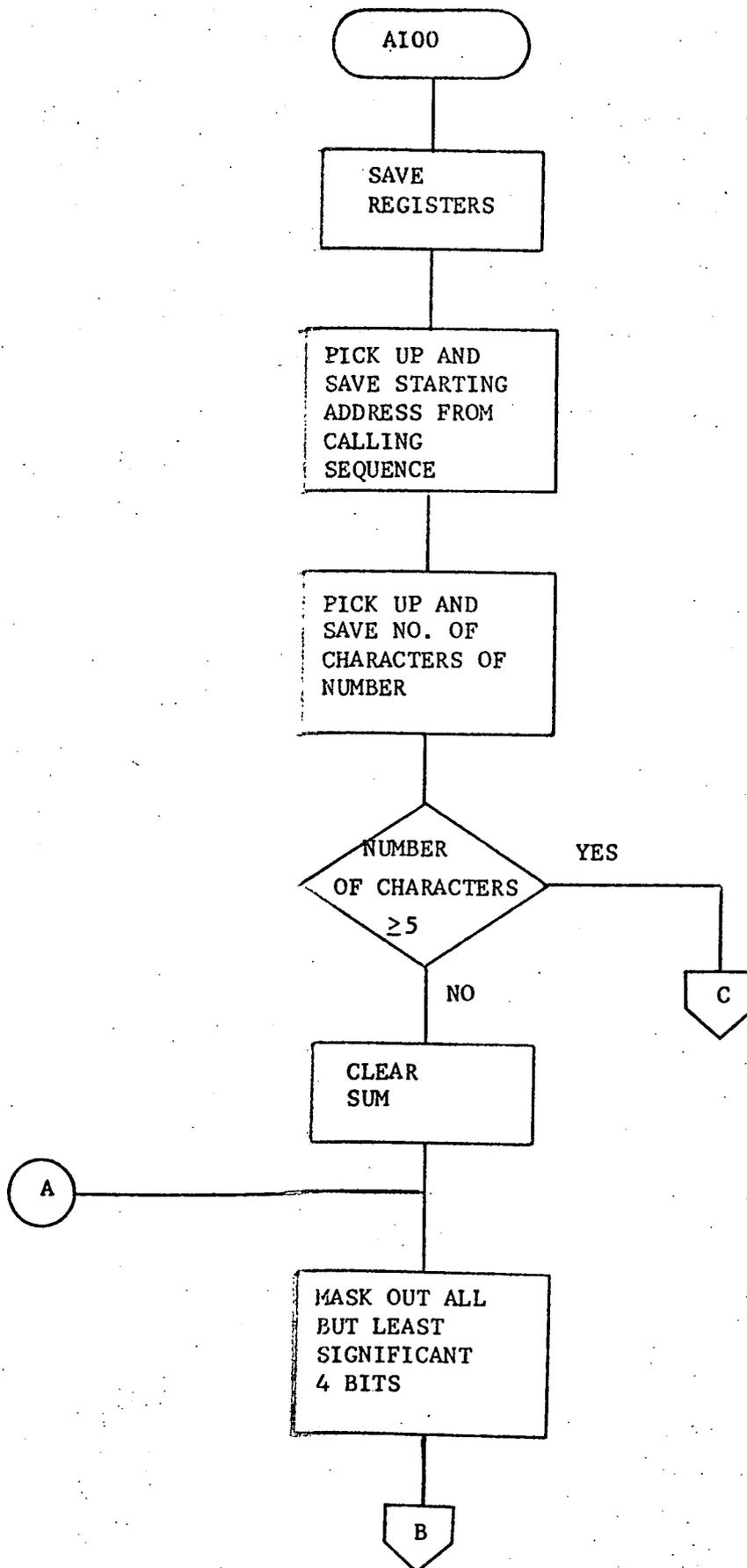
3.3.1.3.3 Entry Points

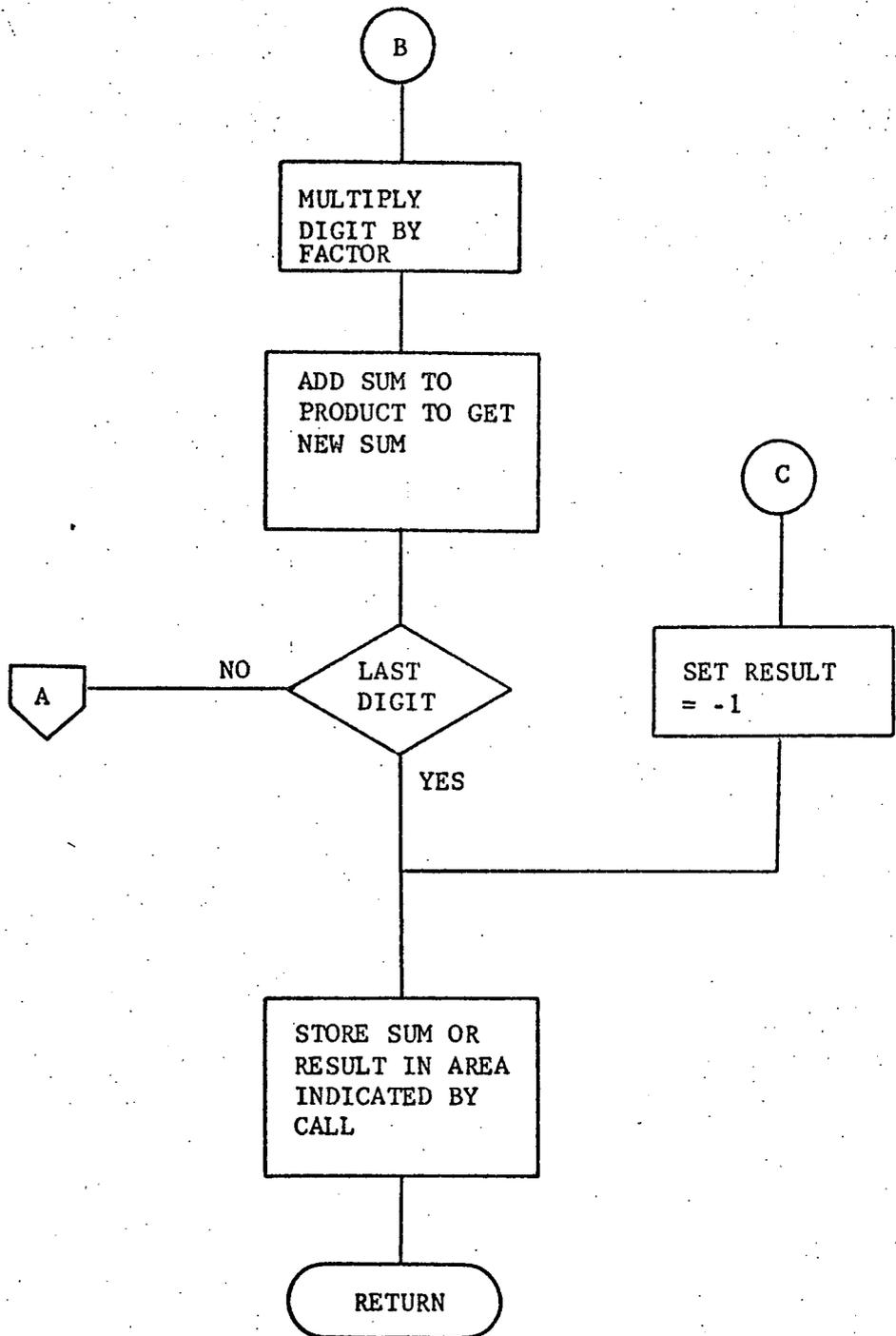
AI00 - primary entry point

3.3.1.3.4 External References

None

3.3.1.4 Detailed Flow Chart





3.3.2 BDOO - Build Display

3.3.2.1 Purpose

The purpose of this subroutine is to format data input for eventual output to the CRT.

3.3.2.2 Technical Description

The function of BDOO is to format the input data for output from the CRT output buffer (CRO\$). Since an entire form will usually fill more than one CRT screen, the data is divided into "pages". To mark this division, EOR (end-of-record) characters have been placed at specific places in the input data so that, when one is encountered during processing, control is returned to the calling routine, which then initiates output to the CRT. The next time BDOO is entered, the processing continues at the point of the last EOR character.

Normally, this procedure is repeated until the entire form has been output. However, since a calling routine may desire a new form to be displayed before the previous one has been completely output, the A-register, upon entry, is used as a flag. If it is zero, processing continues from the last EOR character. Otherwise, the A-register indicates the number of the form requested. The forms table (FTB\$) contains the beginning address of each form. Once the beginning address of the requested form is found, BDOO then may begin processing.

With each page of data BDOO builds a line table (LTBS). There is a one word entry in the table associated with each line on the CRT. Appendix C explains the contents of each word of the line table.

The following is a list of special characters and their usage in the input data.

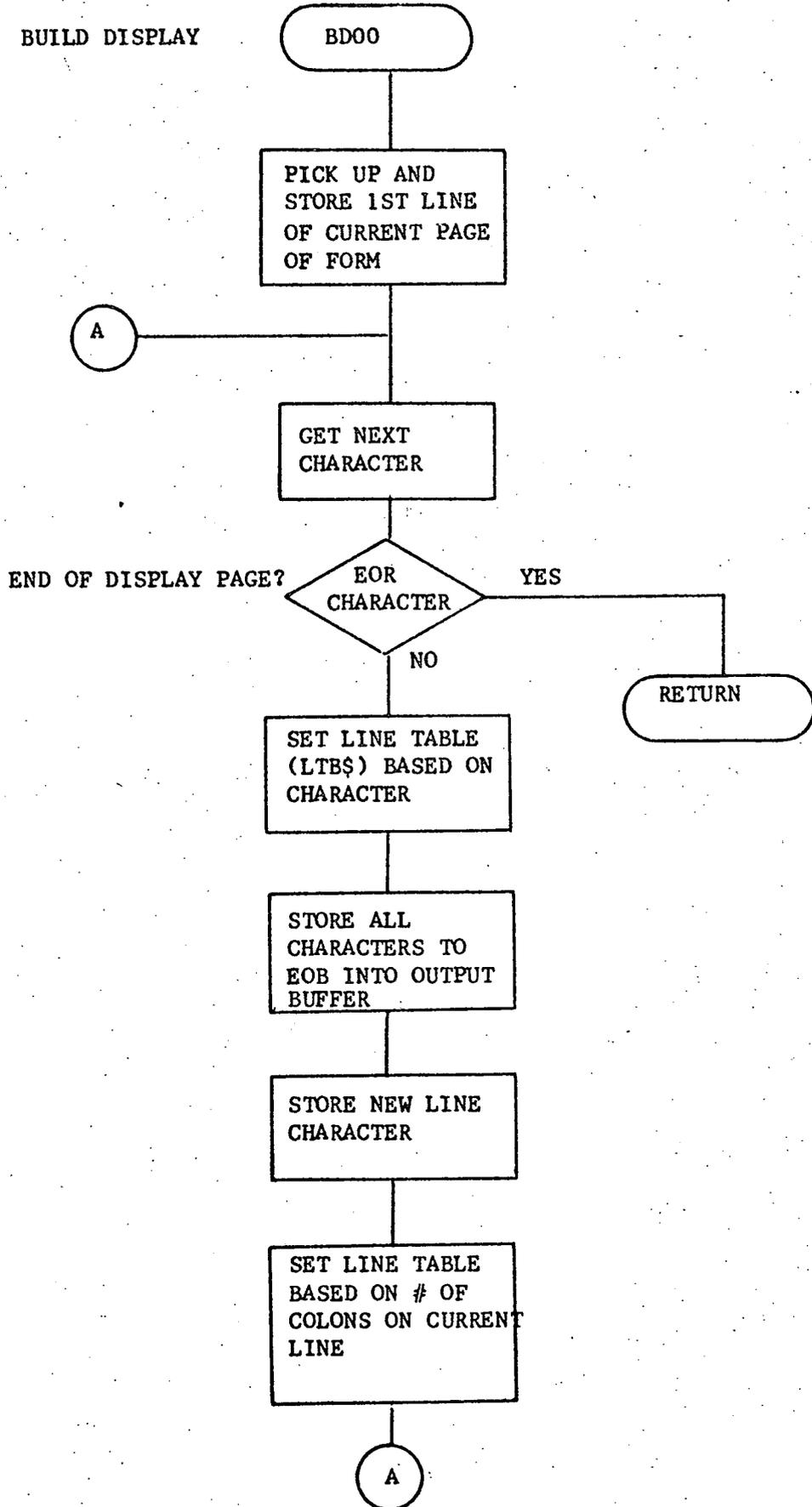
Character	Code	Usage
end-of-block	(243 ₈)	end of every answer. Precedes every heading. Output as "new line" character.
carriage return	(336 ₈)	indicates more data follows. Output as new line.
end-of-record	(244 ₈)	indicates the end of a page of data.
tab	(334 ₈)	space over to 21st position on CRT.

The processing is done on a character-by-character basis. First, the level code and sequence number (if any) are picked out of the input buffer and saved in a line table word. Blanks equal in number to the value of the level code, are then stored in the output buffer. The heading and any answers follow immediately. As each end-of-block character is reached, the procedure is repeated. Once an end-of-record character is encountered, control is returned to the calling routine and the page is output. If a page exceeds the output buffer in length, an error message ("PLEASE SELECT ANOTHER FORM") is output.

3.3.2.2.1 Calling Sequence

CALL BDOO

REGISTERS	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	= 0 indicates continuation of processing from the last EOP character. = 1 indicates begin processing at the beginning of the new requested form.	< 0 indicates output buffer (CRO\$) was exceeded and an error message was output. ≥ 0 normal return
B	N/A	N/A
X	N/A	N/A
Overflow	N/A	N/A



3.3.2.3 Label Description

3.3.2.3.1 Local

- BDBL - (240₈) blank
- BDB2 - ("FORM ", 12₈, 13₈, 11₈, 11₈, "PLEASE SELECT ANOTHER FORM")
error message output when CRO\$ buffer is exceeded.
- BDCC - colon counter; count the number of colons found on one line.
Indicates no answer, one answer, or two answers on a line.
- BDCH - save location for second character of word; first character
unpacked, and second character saved.
- BDCL - (272₈) colon
- BDCS - switch used to indicate which half of the next available word
is to be unpacked.
- BDEB - (243₈) end-of-block character
- BDER - (244₈) end-of-record
- BDE2 - (38) number of words in BDB2 error message
- BDFP - pointer into tape input buffer (MTN\$) that indicates the next
available word to be unpacked for processing.
- BDLP - line table pointer; pointer to next available word in line table.
- BDNF - (199) maximum number of forms allowed (used with input system only)
- BDNL - (12₈) new line character
- BDSC - sequence counter; counts the number of headings having sequence
numbers (or the number of headings in ID Section of form).
- BDSV - three temporary save locations
- BDTB - (334₈) tab
- BDTX - (99) end-of-text character (CCI)

3.3.2.3.2 Global

None

3.3.2.3.3 Entry Point

BD00 - primary entry

3.3.2.3.4 External References

CRO\$ - display output buffer

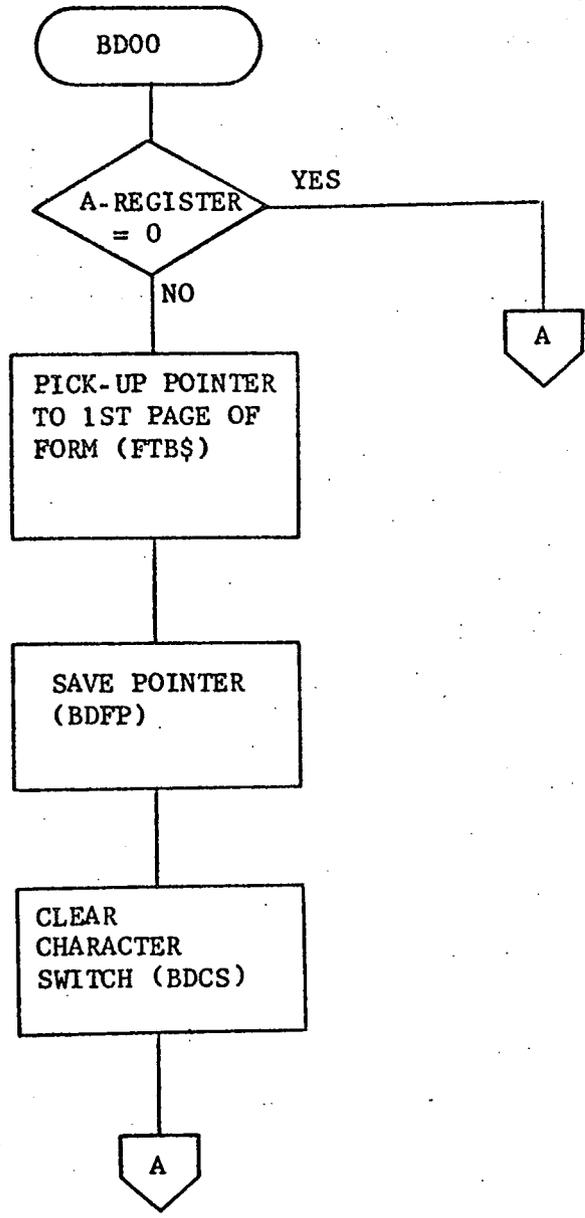
DPT\$ - display pointer; points to next available location relative to CRO\$ for storing output data.

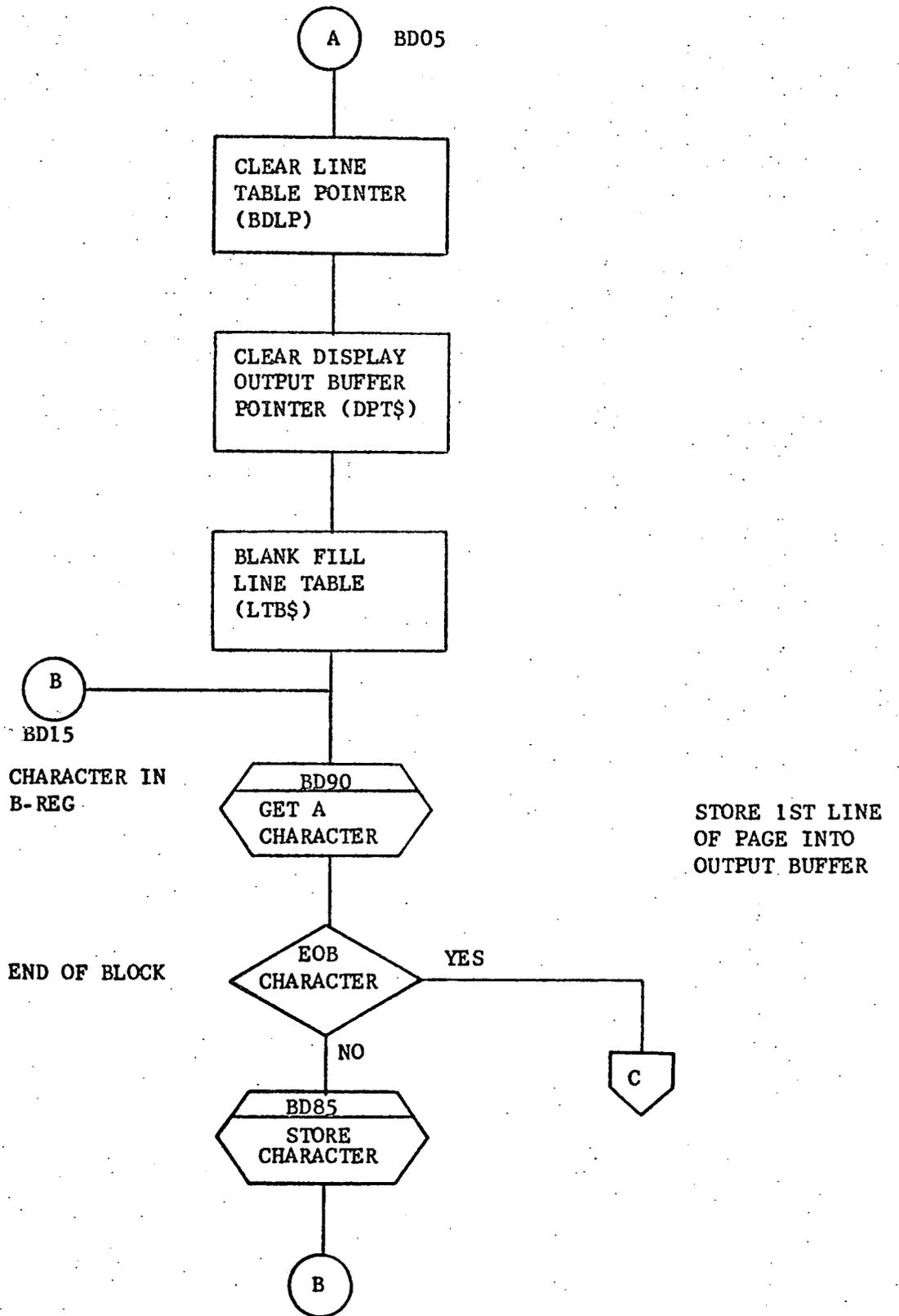
FTB\$ - forms table; pointer to beginning of form in memory

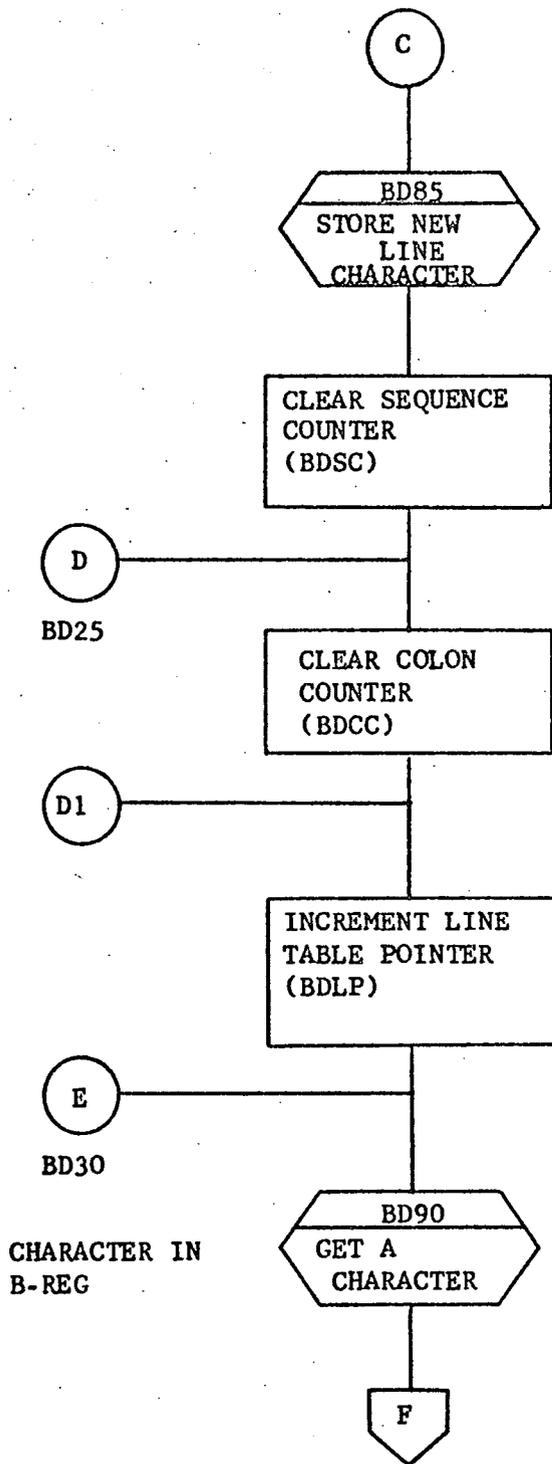
LTB\$ - line table; see Appendix C

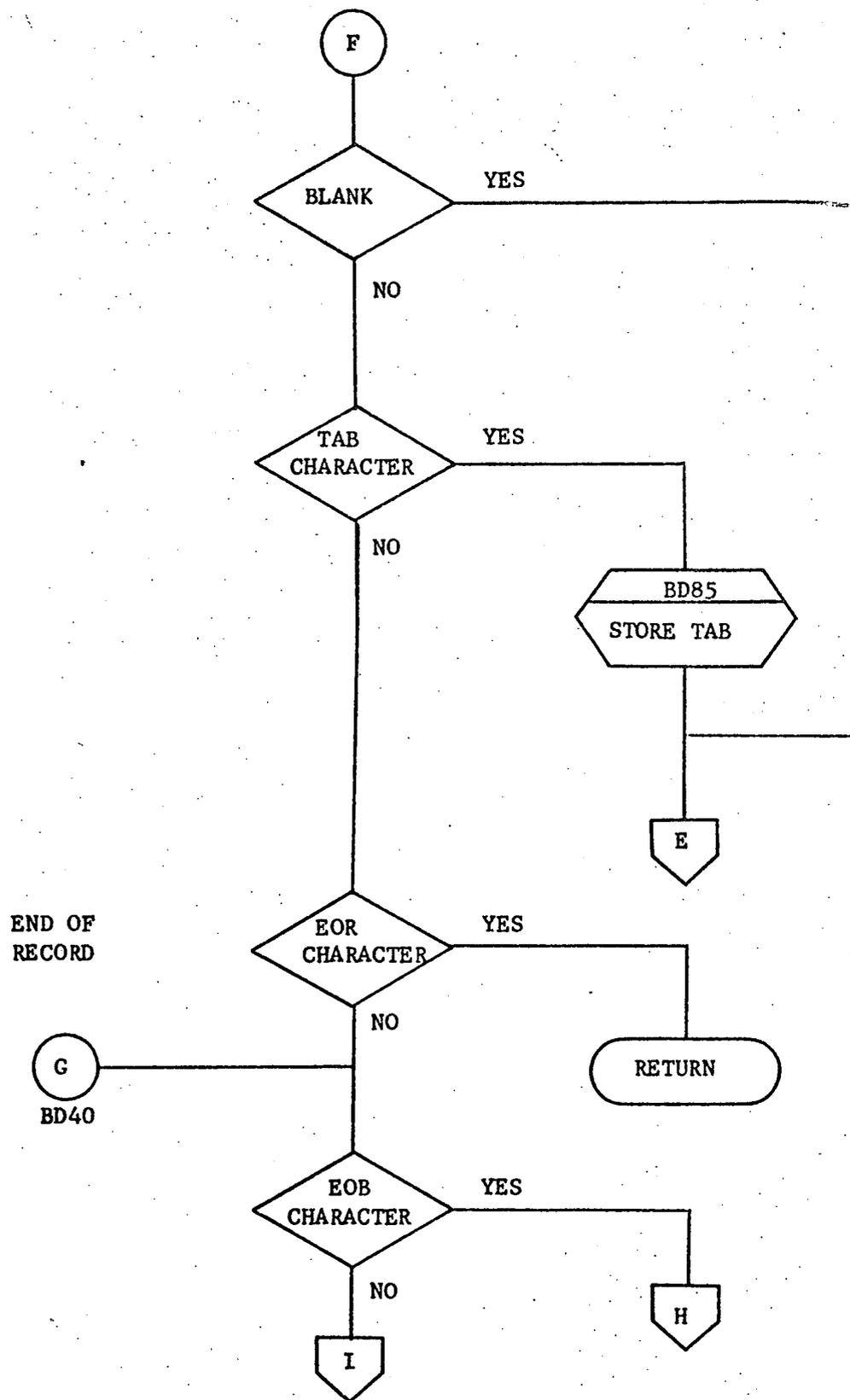
ODOO - output display routine

3.3.2.4 Detailed Flow Chart









H

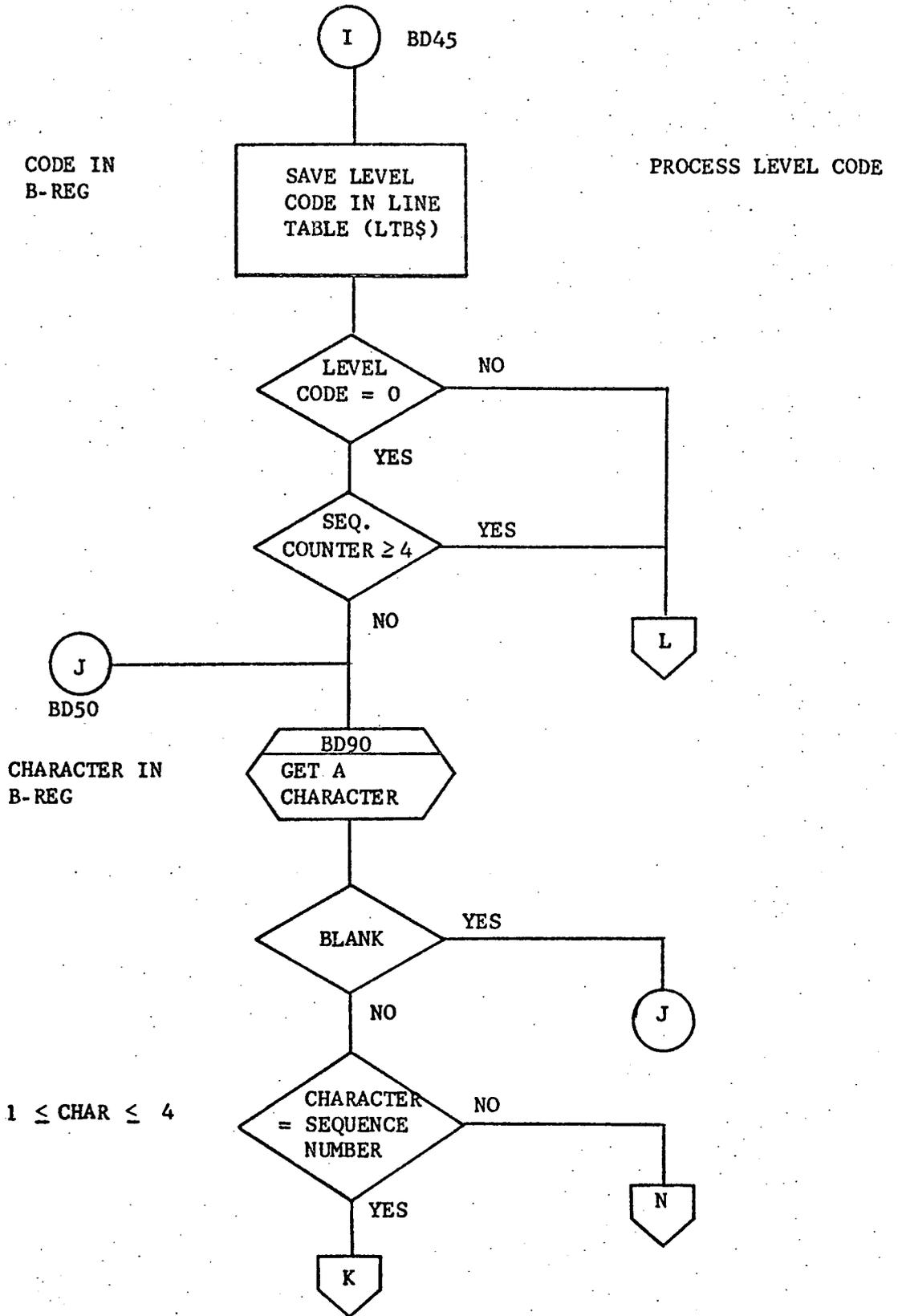
SET MORE LINES
BIT (13) IN LINE
TABLE WORD
(LTBS) FOR
PREVIOUS LINE

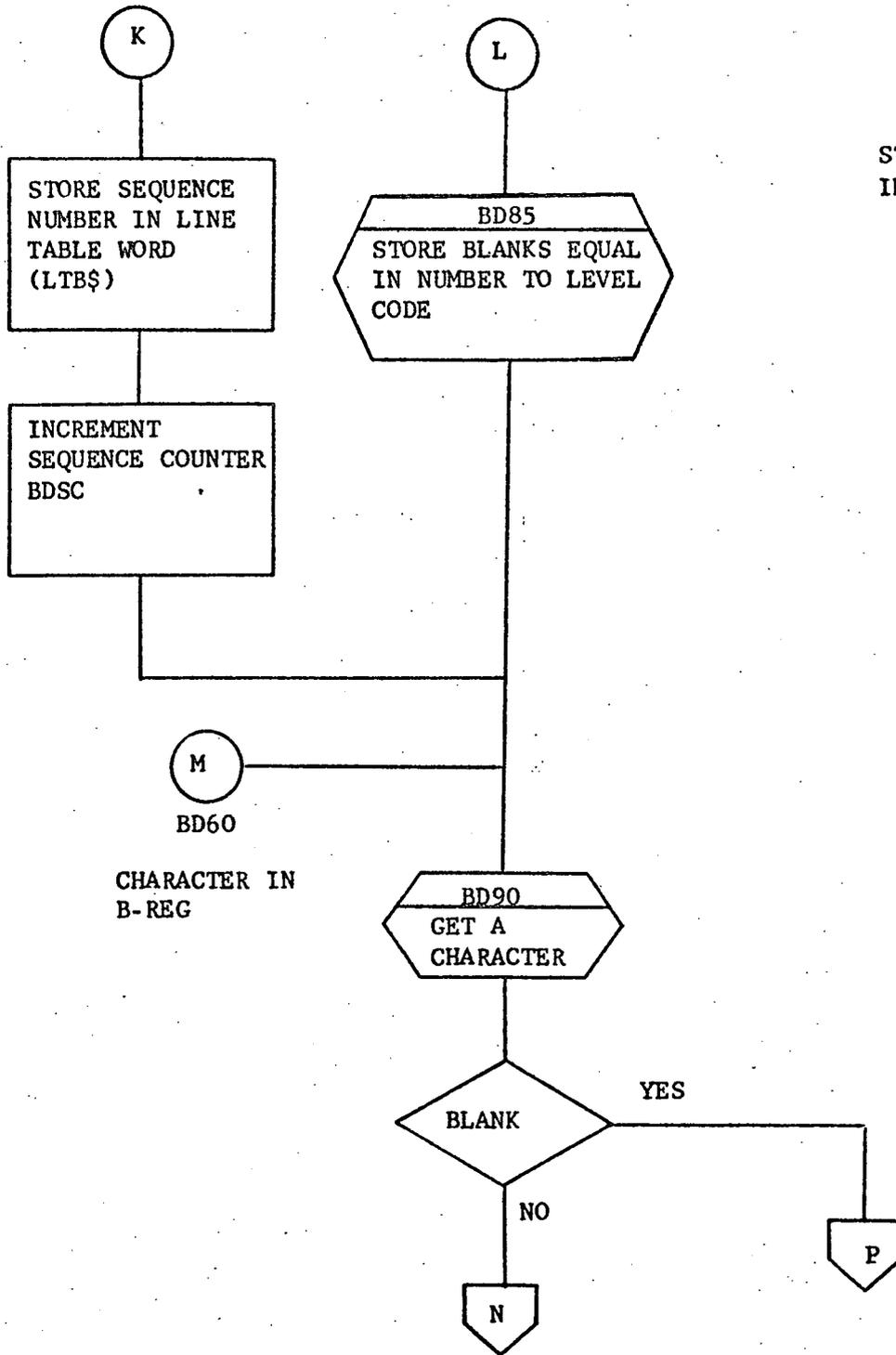
SET CONTINUATION
LINE BIT (15) IN
LINE TABLE WORD
(LTBS) FOR
CURRENT LINE

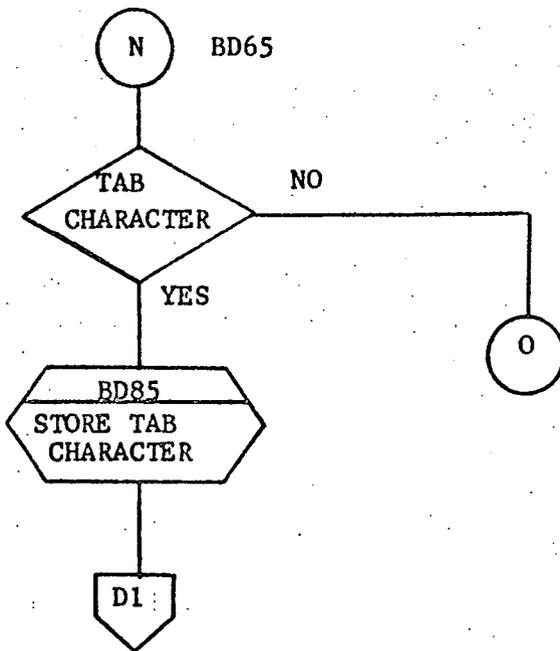
BD85
STORE NEW
LINE CHARAC-
TER

INCREMENT
LINE TABLE
POINTER
(BDLP)

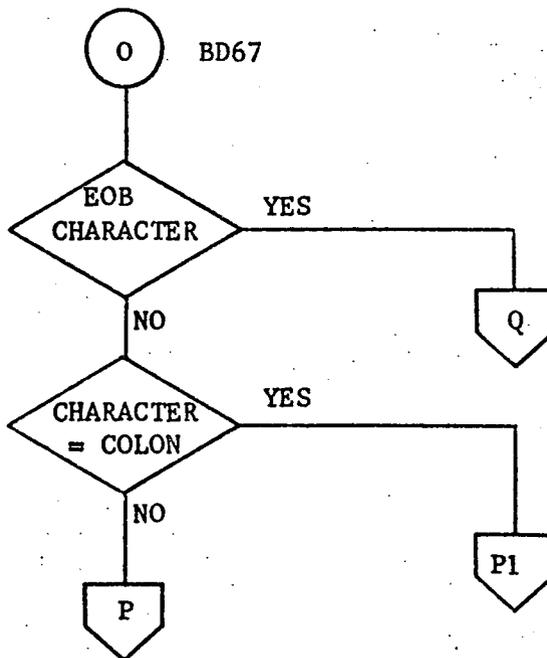
E

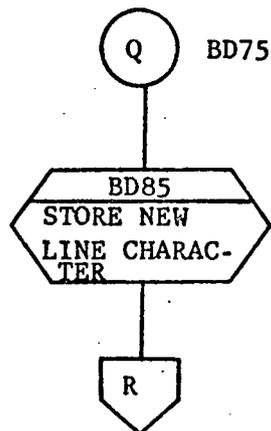
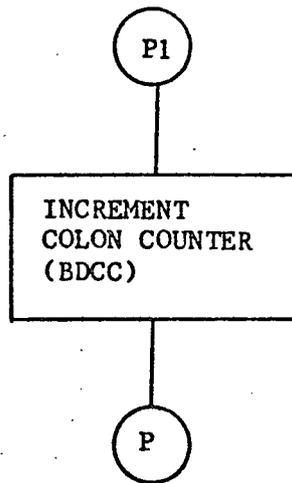
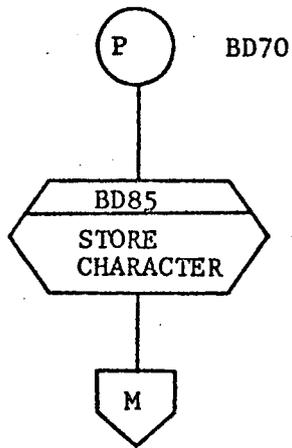


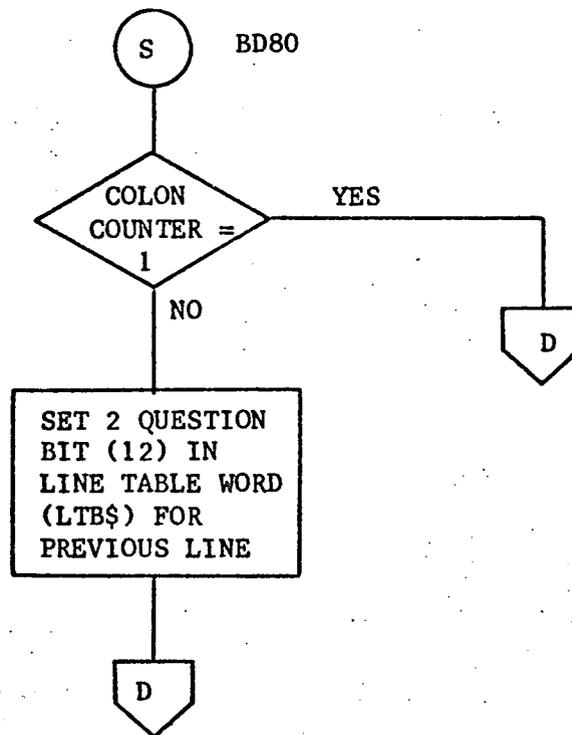
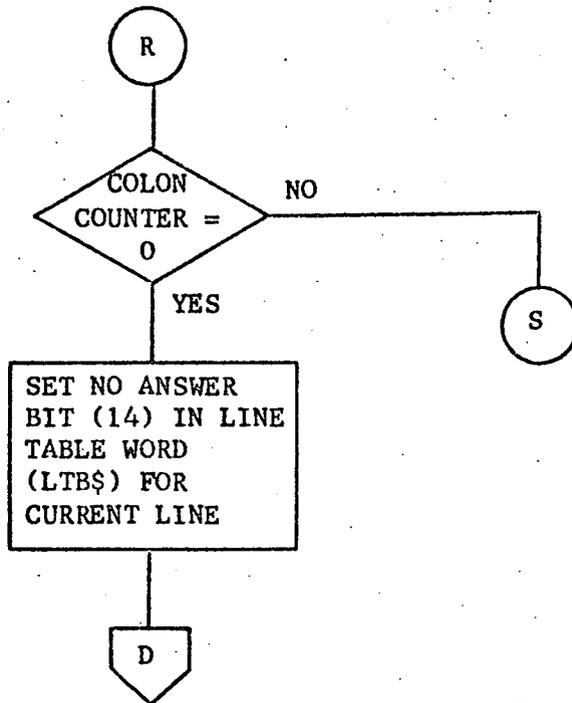


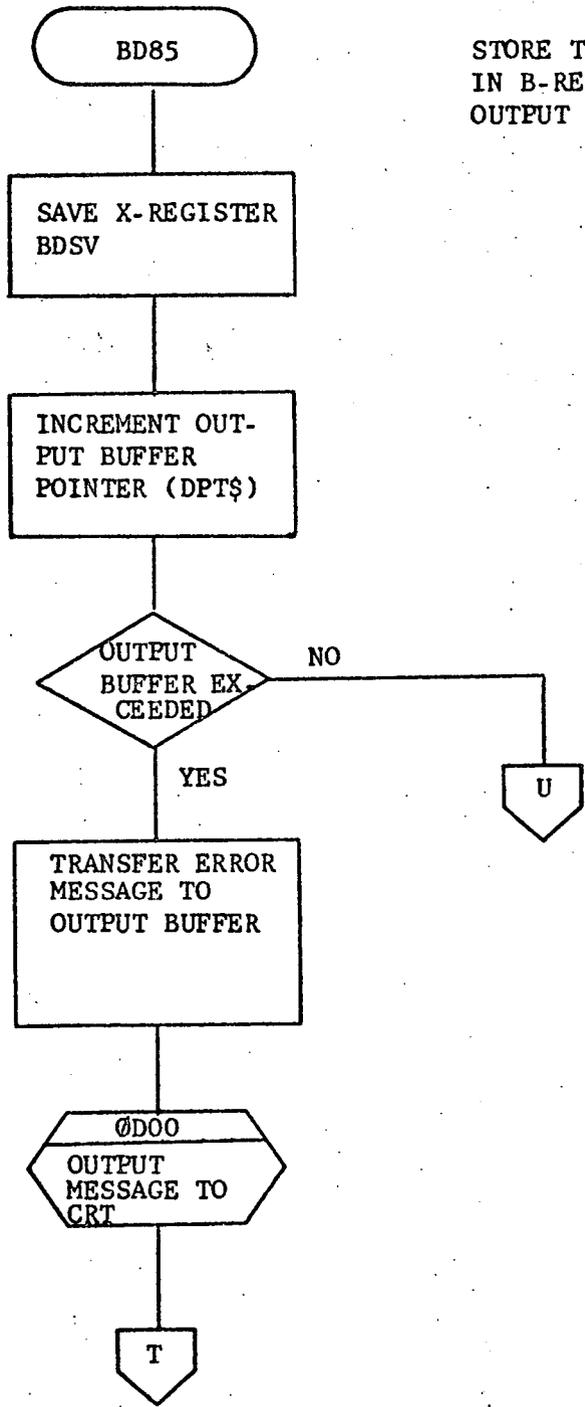


END OF
BLOCK?

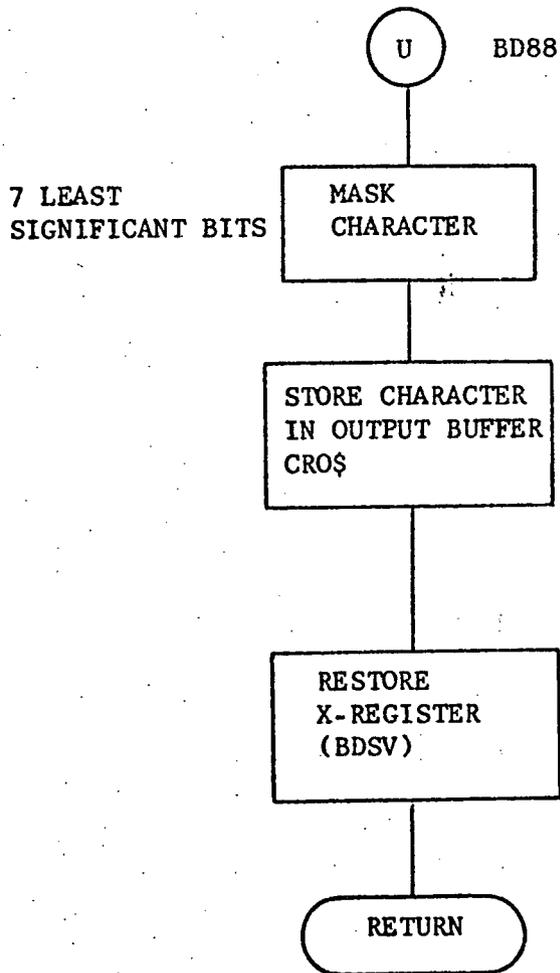
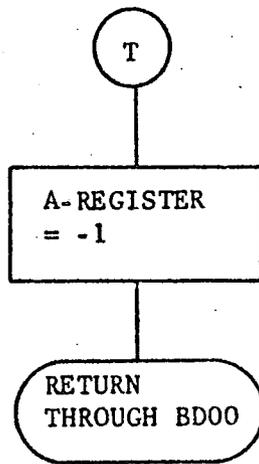


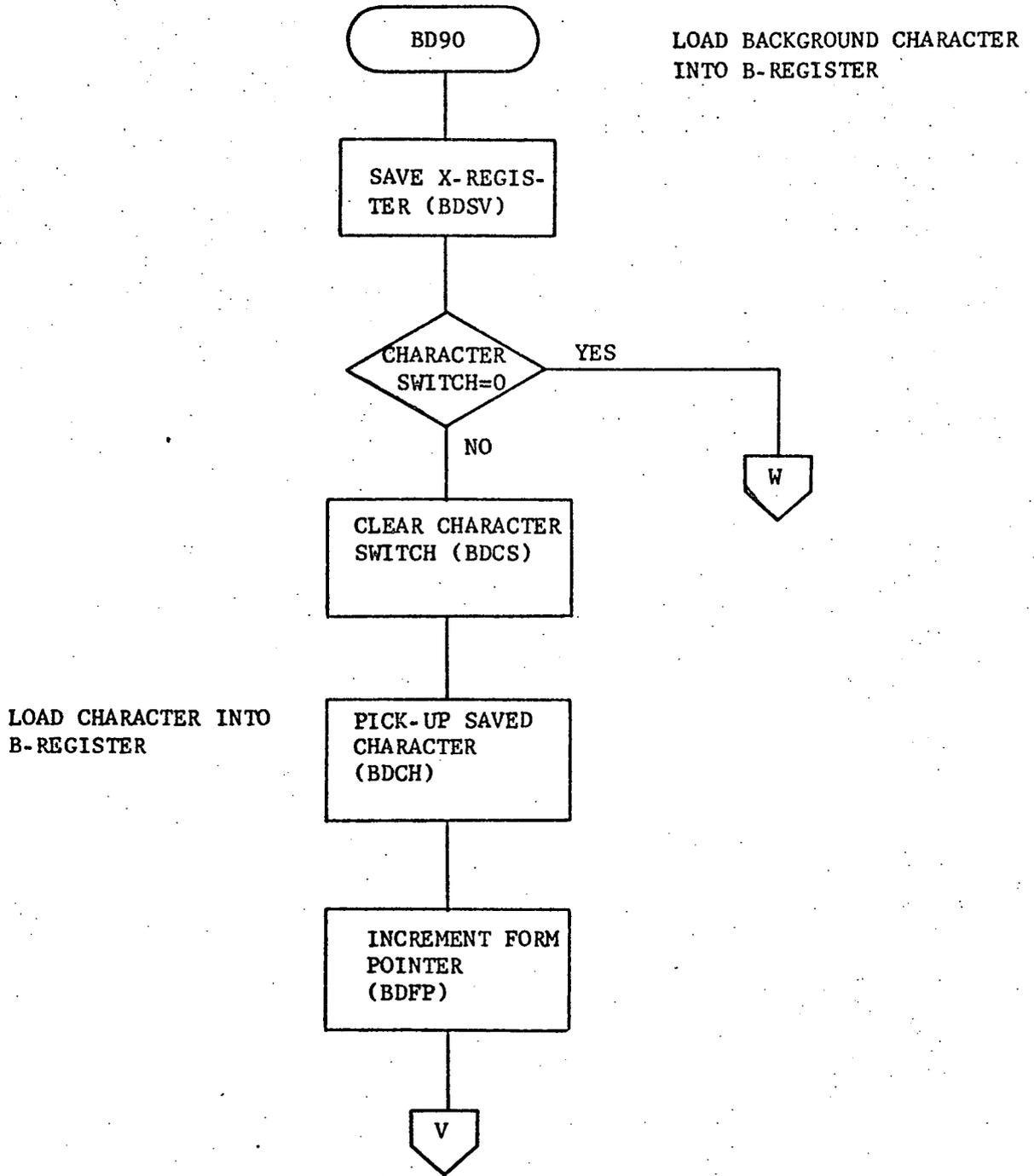


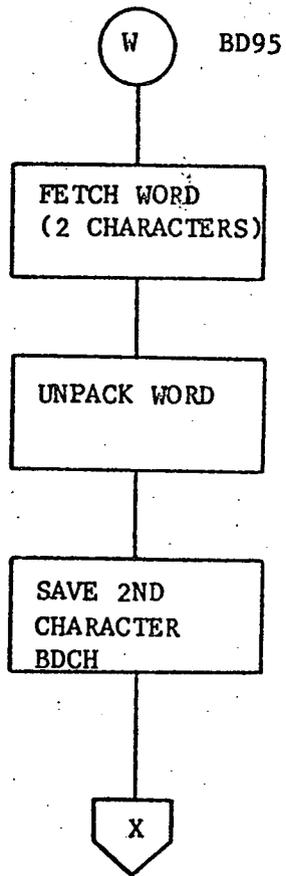
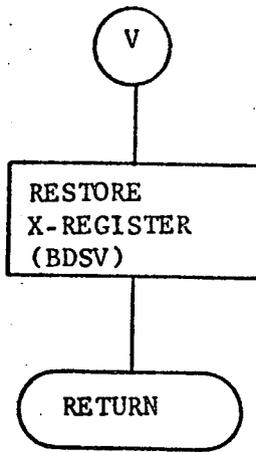


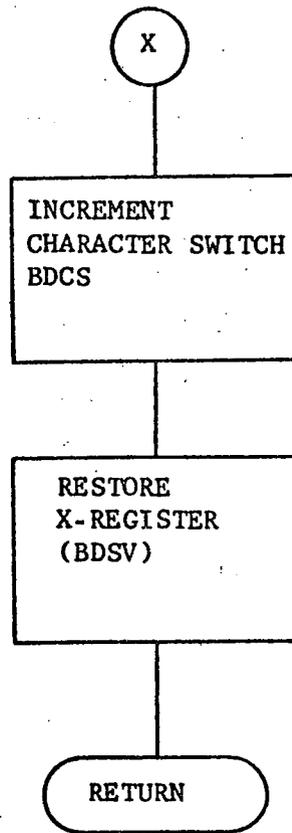


STORE THE CHARACTER,
IN B-REGISTER, INTO
OUTPUT BUFFER









3.3.3 BM00 - build a MEDATA record

3.3.3.1 Purpose

The purpose of this subroutine is to restore the saved codes (saved by BD00) and format the user input data for eventual output to a master tape.

3.3.3.2 Technical Description

BM00 processes the user input data which has been stored in an input buffer.

This processing performs the following functions:

- restoring the special codes saved by BD00;
- storing user data into the output buffer;
- saving the SS NO and DATE response when present;
- inserting the last SS NO and DATE response when one is not present;
- performing a limited amount of error checking;
- checking for a special character (*) which indicates that the user needs more lines in order to complete his answer;
- inserting an "A" (required by MEDATA) at the end of the ID section of each form.

The first two points make up the majority of the processing. The special codes that are restored are found in the Line Table, LTB\$ (see Appendix C). These codes are the level codes and the sequence numbers. In general, once the codes are restored, the remainder of the processing is the fetching of each heading and answer from the display input buffer (CRN\$) and the storing of it into the tape output buffer (MTO\$).

The last five points are all special cases that should be described individually.

First, if a heading has a sequence number of one or four, then that heading is either SS NO or DATE. The answers to each of these headings are saved; if in either case there is no answer, the one saved previously is inserted. This eliminates the necessity of the user inputting the same social security number or date over and over again.

There are only four headings in a form that have a sequence number. These make up the ID section. The letter "A" must immediately follow this section to indicate the end of identification information.

Each character in every answer must be checked for an asterisk. This character signals that the user needs more blank lines in order to complete the answer. When detected, the portion of the answer already processed is stored in the output buffer, and control is passed to XL00.

A limited amount of error checking is performed on each heading and answer. The line table (LTB\$) tells whether or not a heading allows an answer. If it does, a colon must be present following the heading. If not present the A-register is set to the line number (BMLC) on which the error occurred, and control is returned to the calling routine. If the first character following the colon is a left parenthesis, a right parenthesis must also be present. If there is no right parenthesis, the A-register is set to the current line number (BMLC) and control is returned.

If the tape output buffer overflows when storing data into it, an error message (BUFFER LENGTH ERROR) is output, the A-register is set to -1, and control is returned to the calling routine.

There are three characters placed in the output data that serve special purposes.

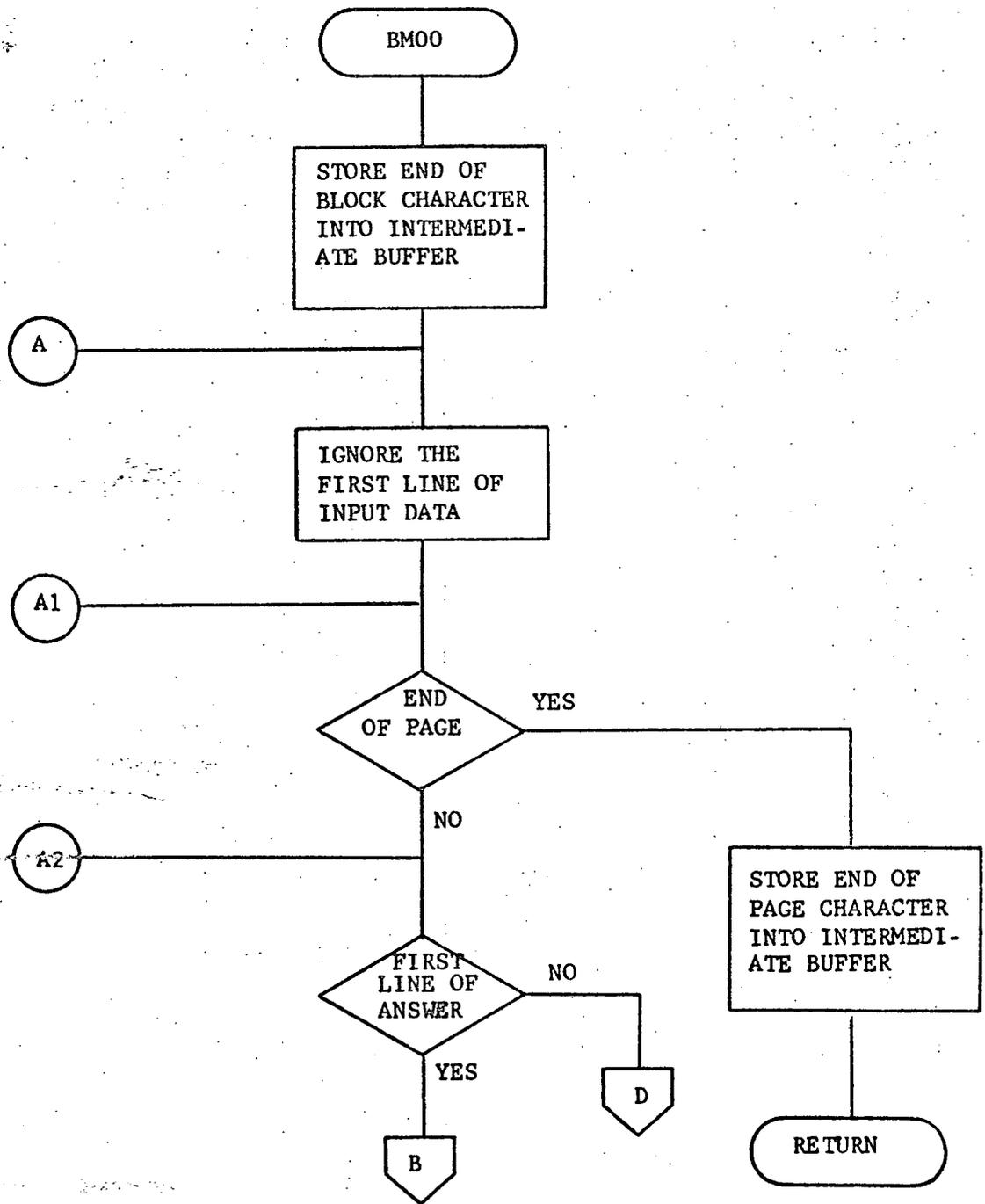
<u>Character</u>	<u>Code</u>	<u>Purpose</u>
end-of-page	(241 ₈)	indicates the end of a CRT screen of data. When the line table word is equal to 4040 ₈ , the last data line has been processed, and the character can then be stored.
end-of-block	(44 ₈)	indicates the end of the answer. When the end of the line is reached, and the line table indicates no more data follows, this character is inserted.
carriage return	(136 ₈)	indicates the end of a CRT line of data, but more data is to follow on the next line.

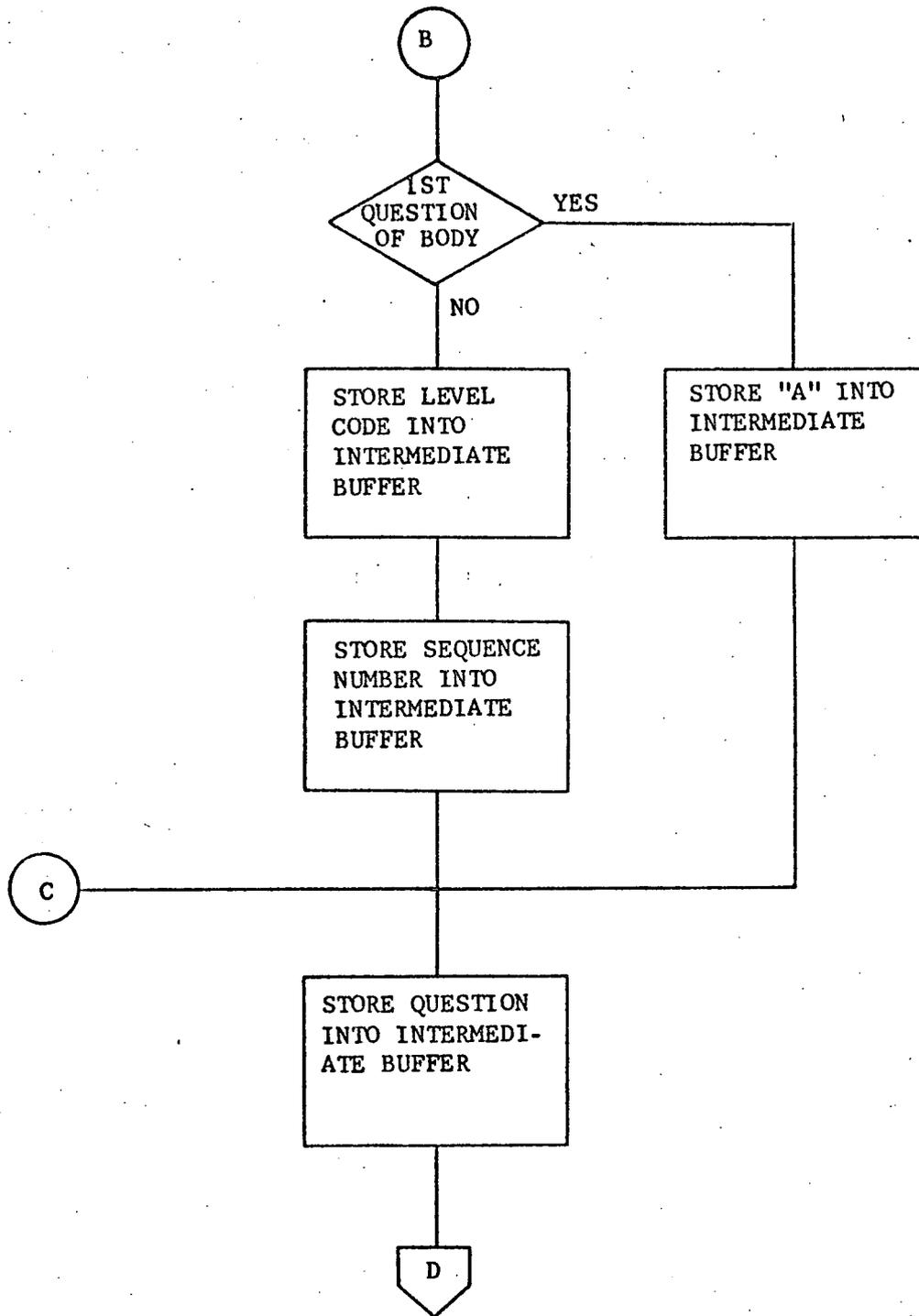
3.3.3.2.1 Calling Sequence

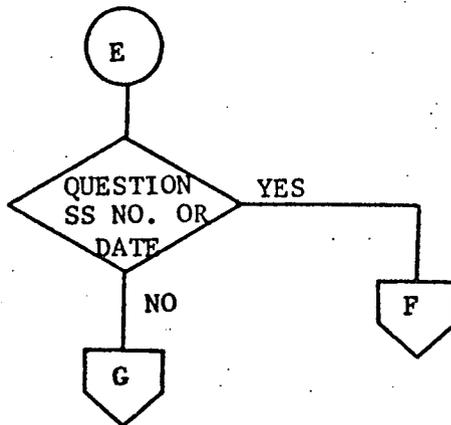
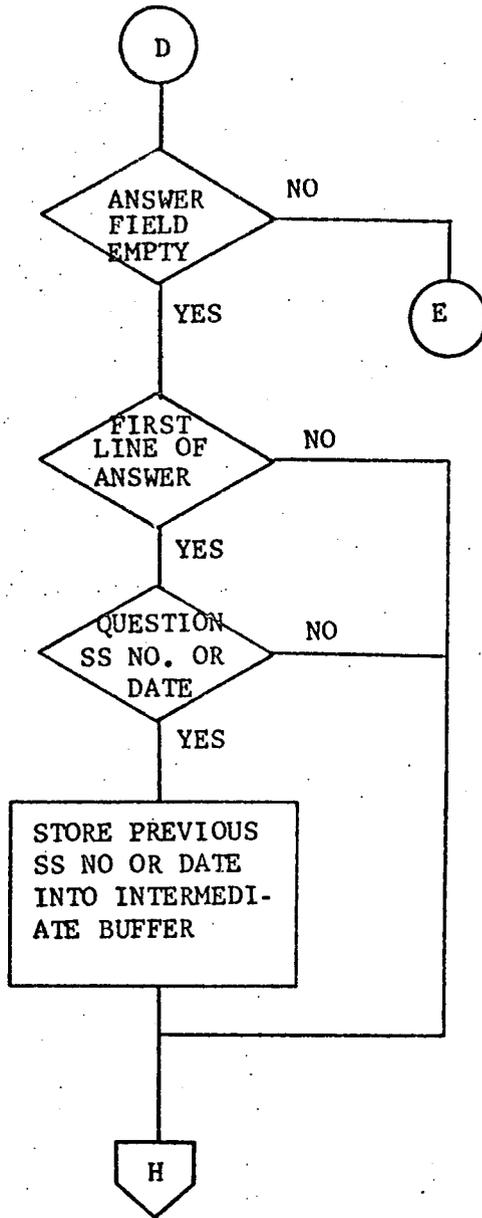
CALL BMOO

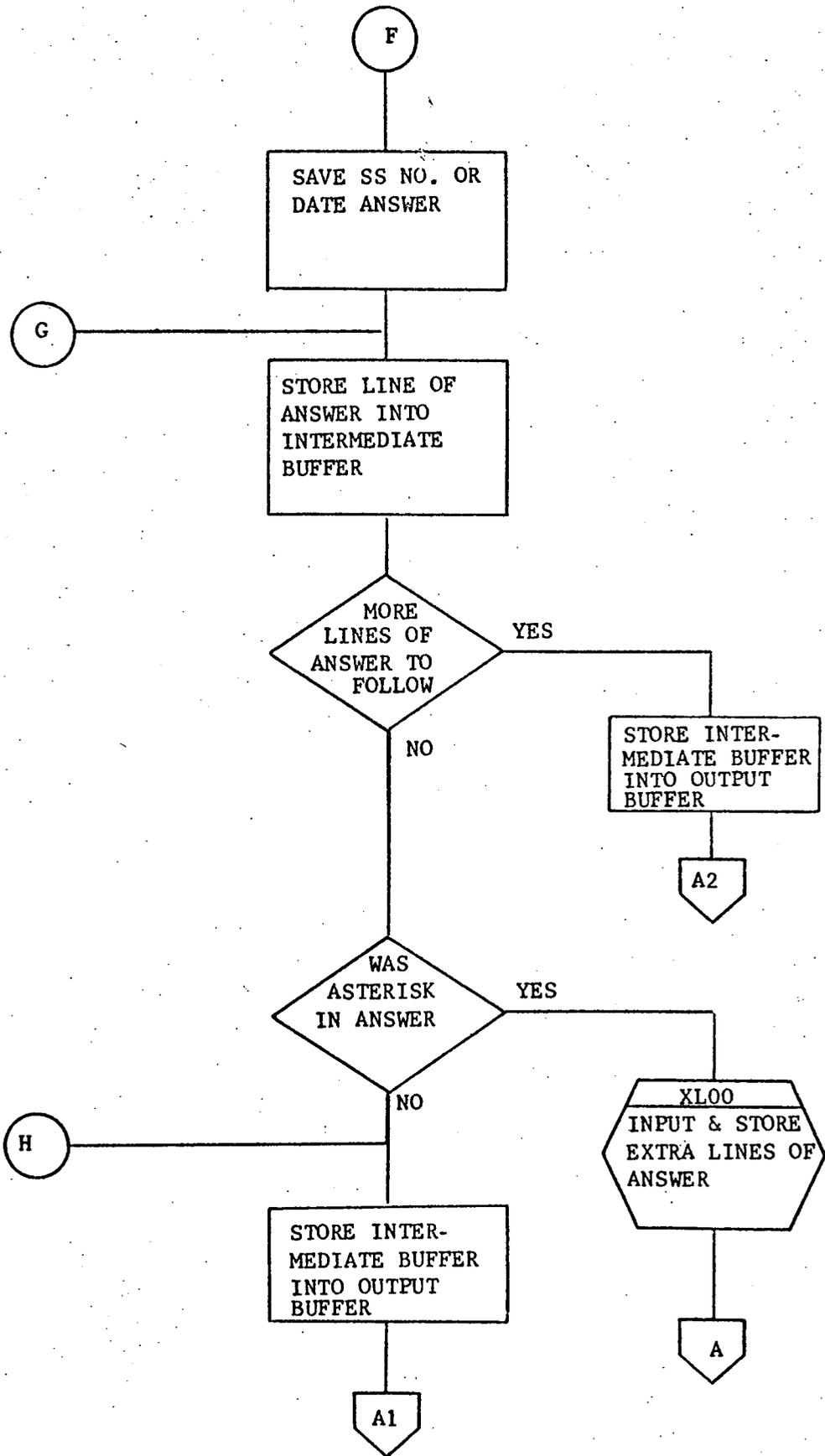
REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	N/A	-1 indicates the output buffer has overflowed. > 0 indicates the line number of a user-input error. = 0 normal return
B	N/A	N/A
X	N/A	N/A
Overflow	N/A	N/A

3.3.3.2.2 General Flow Chart









3.3.3.3 Label Description

3.3.3.3.1 Local

BMAS	(52 ₈) asterisk
BMB	('BUFFER LENGTH ERROR') error message
BMBL	(40 ₈) blank
BMCL	(72 ₈) colon
BMCP	(51 ₈) closed parenthesis
BMCR	(136 ₈) carriage return
BMCS	character switch. Indicates into which half of the word the next character is to be packed in the tape output buffer (MTO\$).
BMDP	display pointer. Indicates the location of the next character to be processed from the input buffer (CRN\$).
BMDT	seven word buffer used for saving the answer to the ID heading DATE.
BME	(19) number of words in the error message BMB.
BMEP	(241 ₈) end-of-page
BMIB	intermediate buffer. 46 word buffer where data is stored prior to being placed in tape output buffer (MTO\$).
BMIF	ID flag. Flag indicates that the heading with a sequence number of four has just been processed and the ID section is complete.
BMIP	intermediate buffer pointer. Indicates next location in intermediate buffer (BMIB) is for storing data.
BMLC	line counter. Indicates the line number on the CRT that is currently being processed.

BMLP line table pointer. Indicates the location in the line table associated with the heading and answer currently being processed.

BMNL (12_g) new line (CCI)

BMOP (50_g) open parenthesis

BMP save location for tape output buffer pointer (MPT\$)

BMPC position counter. Counts the number of character positions on the CRT line that have already been processed.

BMPM storage location containing the maximum number of CRT positions allowed for the heading and answer of the current line being processed (20 or 40).

BMPS temporary save location for saving the intermediate buffer pointer (BMDP)

BMSA temporary save location for saving the display pointer (BMDP).

BMSB temporary save location for saving the contents of the B-register.

BMSS eleven word buffer used for saving the answer to the ID heading SS No.

BMSV two temporary save locations

BMTX (03) end-of-text

BM1F sequence number one flag. Indicates that the heading and answer currently being processed have a sequence number of one.

BM4F sequence number four flag. Indicates that the heading and answer currently being processed have a sequence number of four.

3.3.3.3.2 Global

None

3.3.3.3.3 Entry Point

BM00

3.3.3.3.4 External References

CRN\$ CRT input buffer

CRO\$ CRT output buffer

LTB\$ line table (see Appendix C).

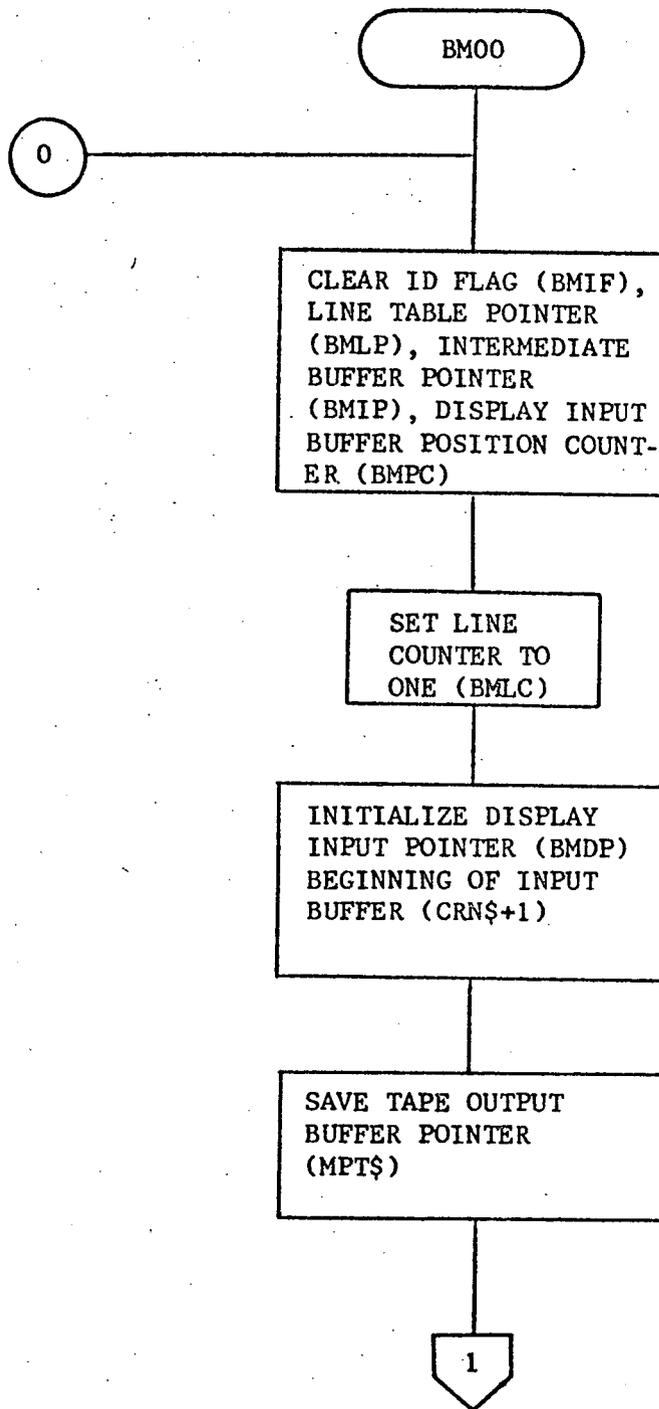
MPT\$ tape output buffer pointer. Points to next available location in buffer.

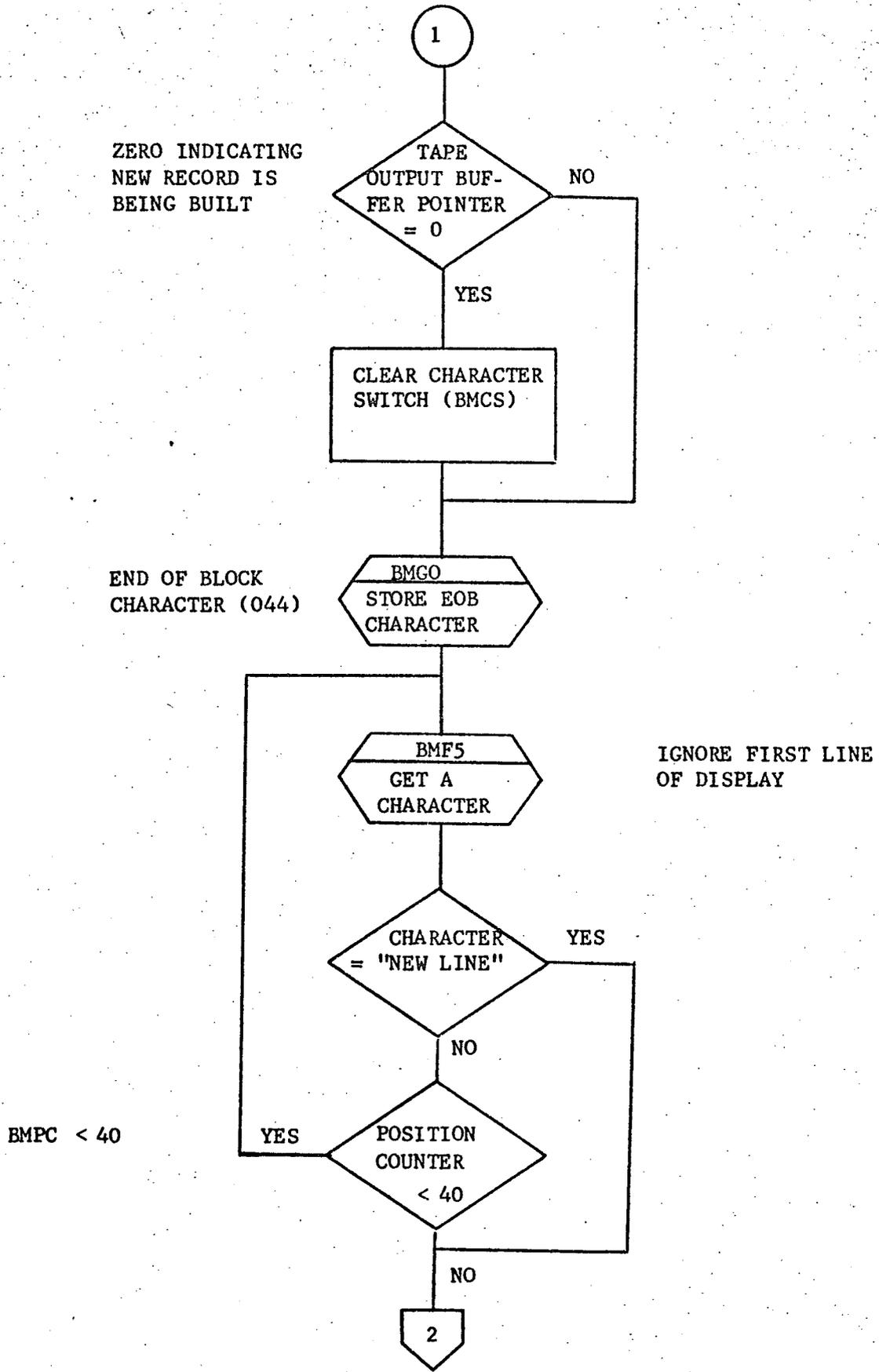
MTO\$ magnetic tape output buffer

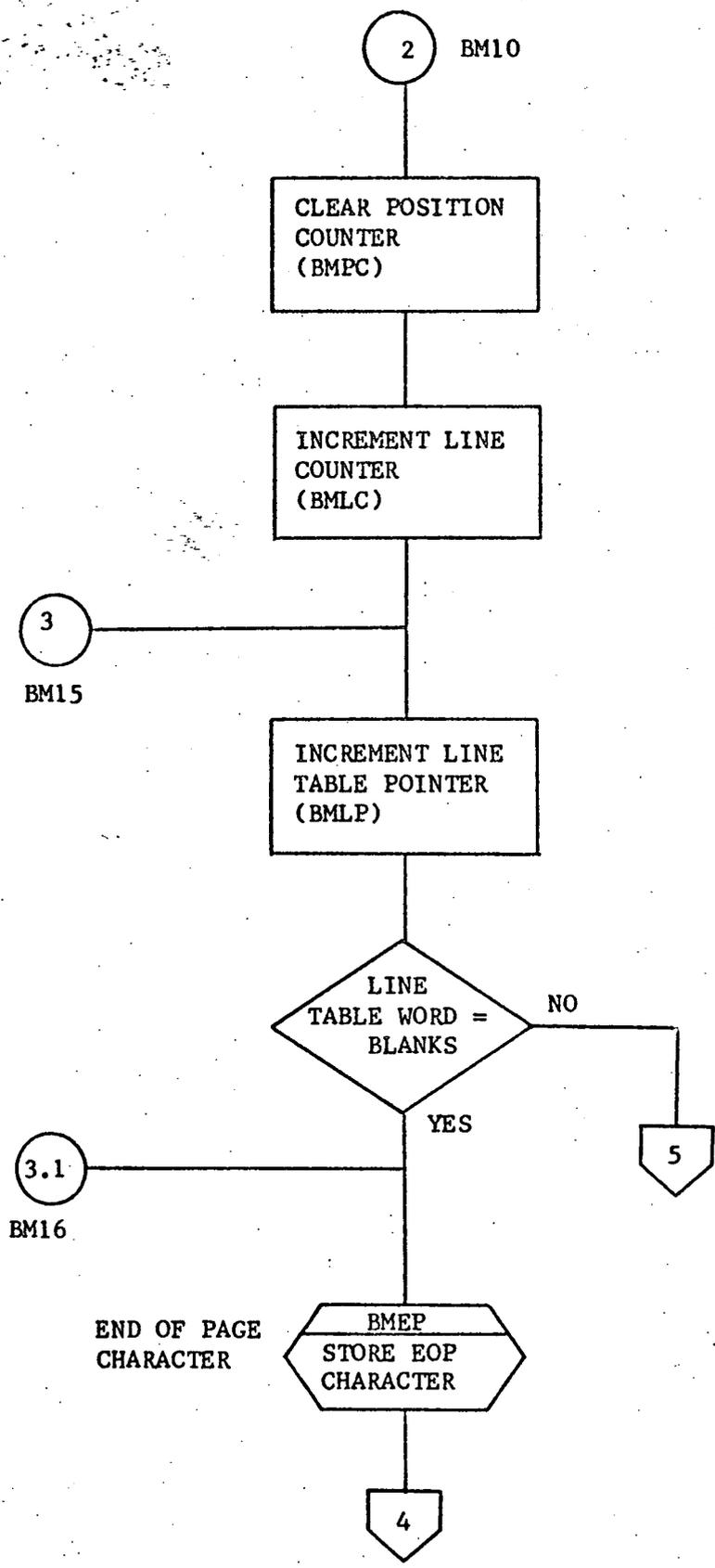
OD00 routine to output a buffer (CRO\$) to the CRT

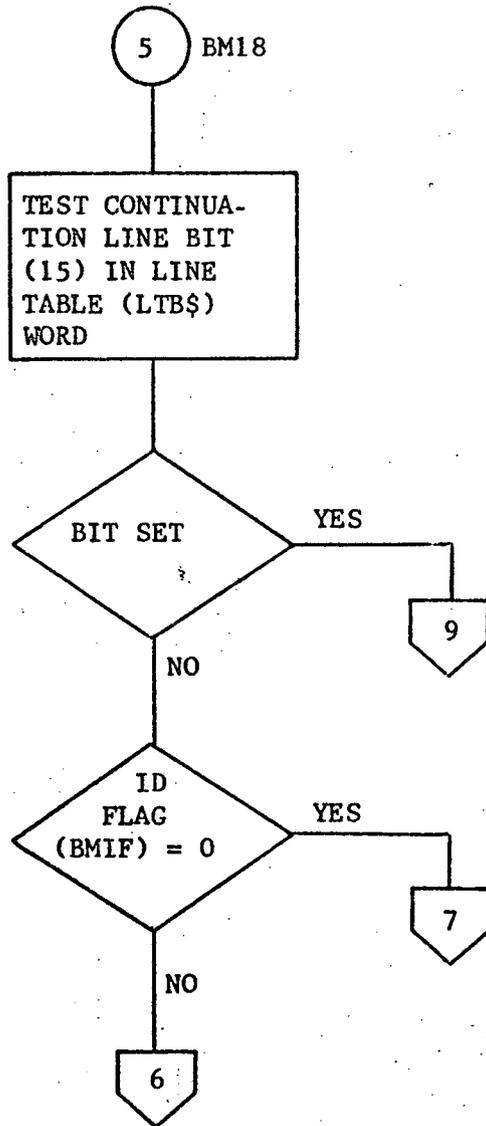
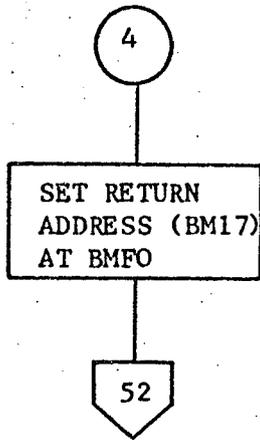
XL00 routine to allow user more lines on which to complete his answer

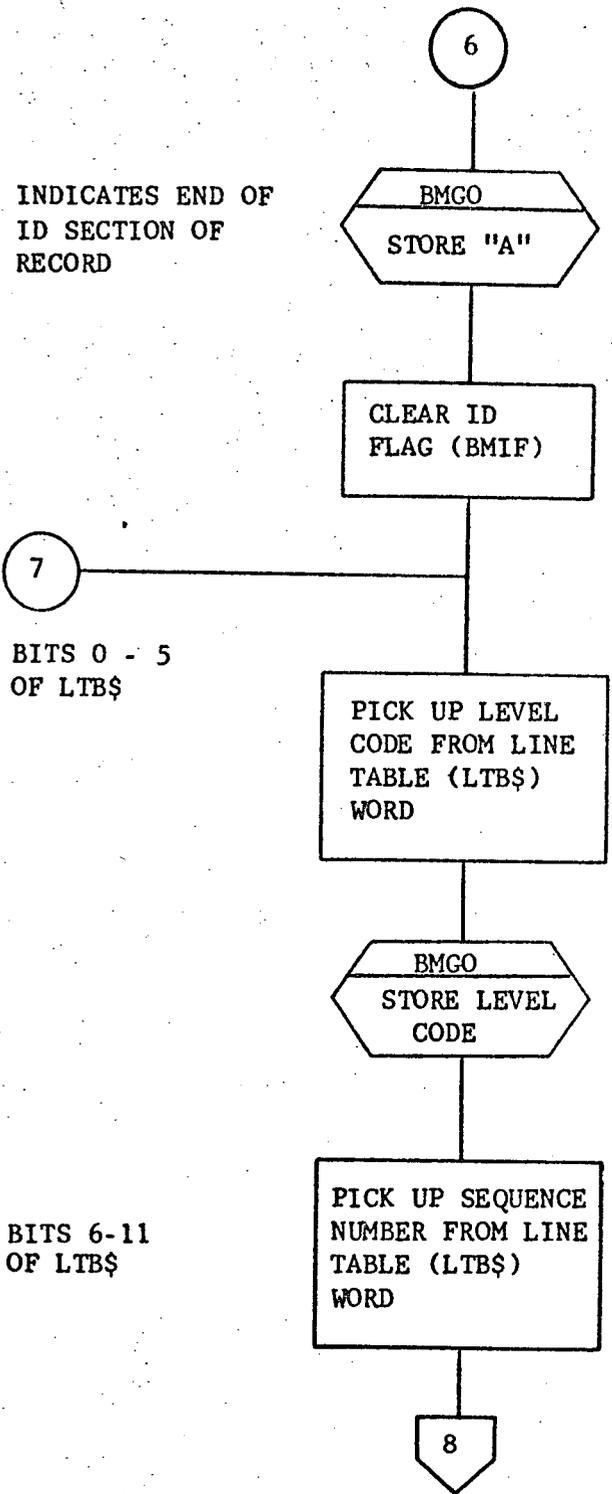
3.3.3.4 Detailed Flow Chart

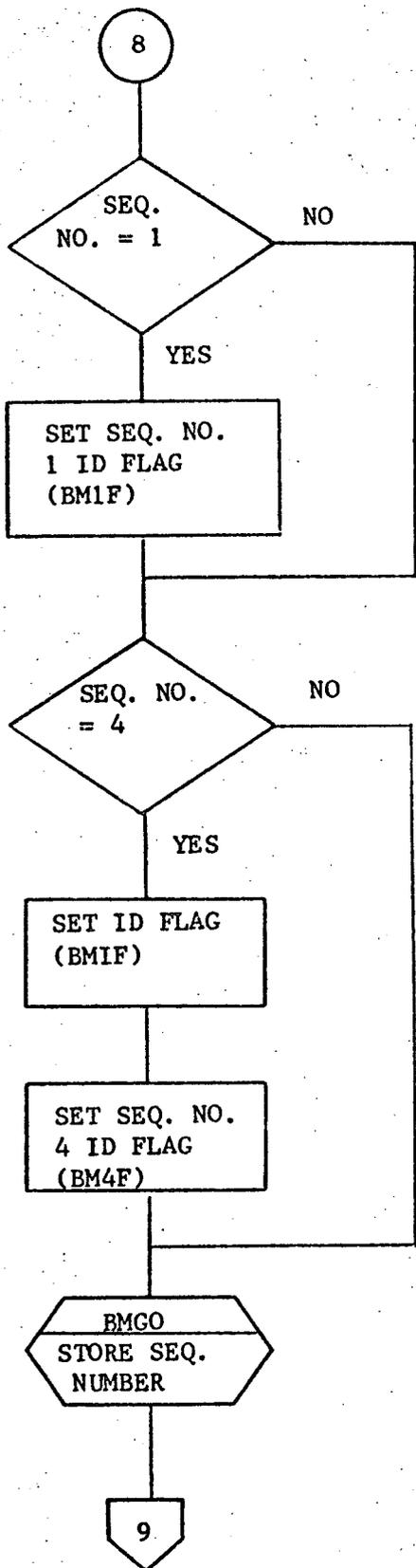


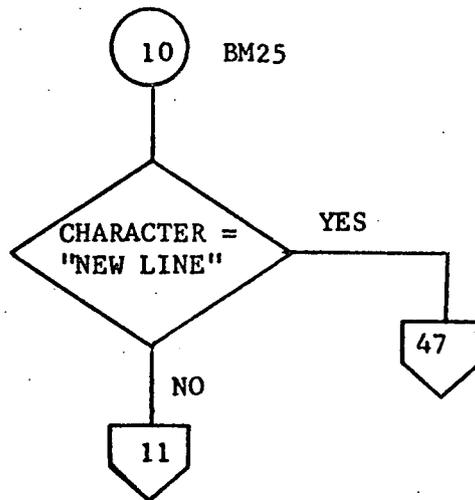
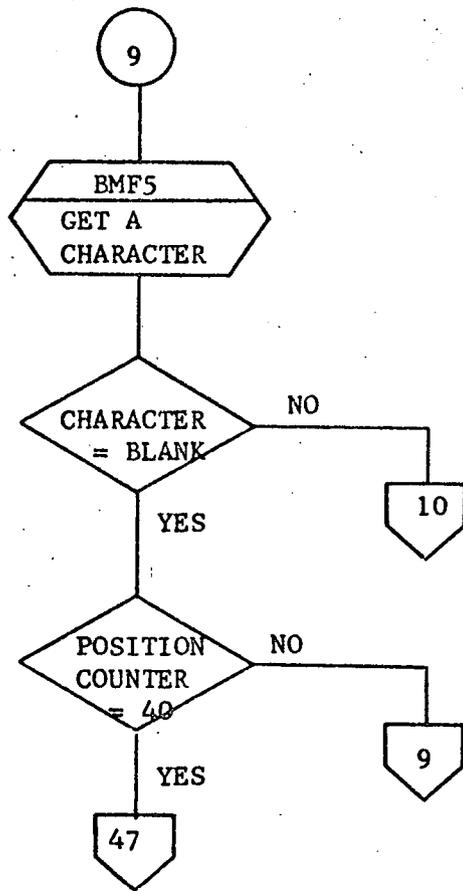


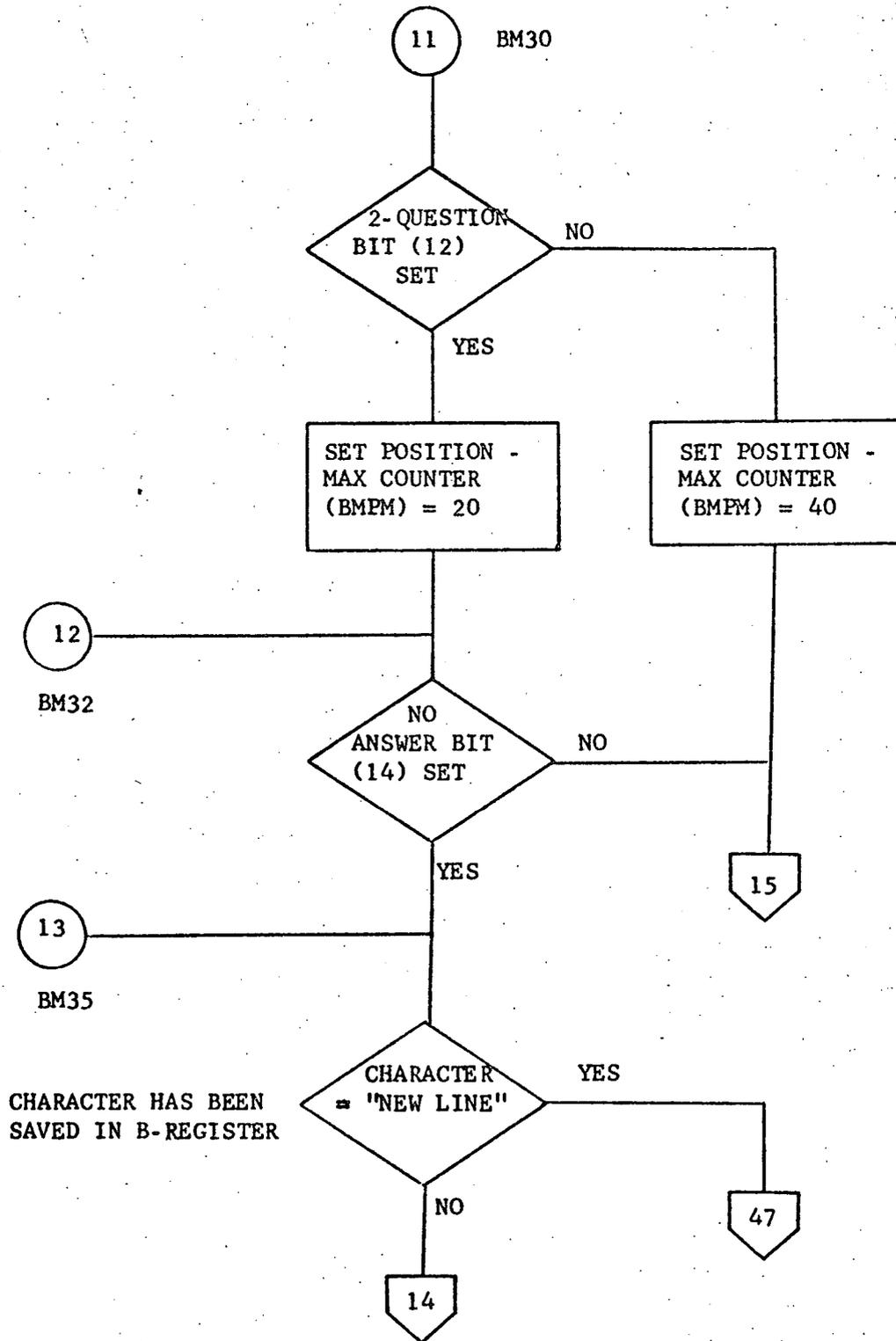






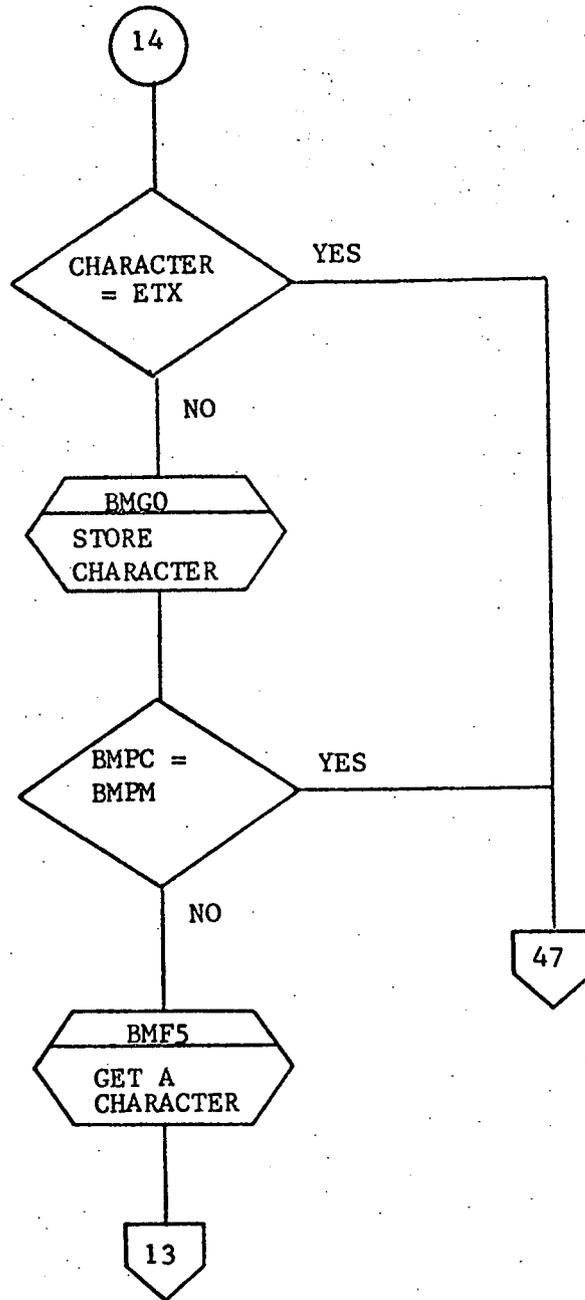


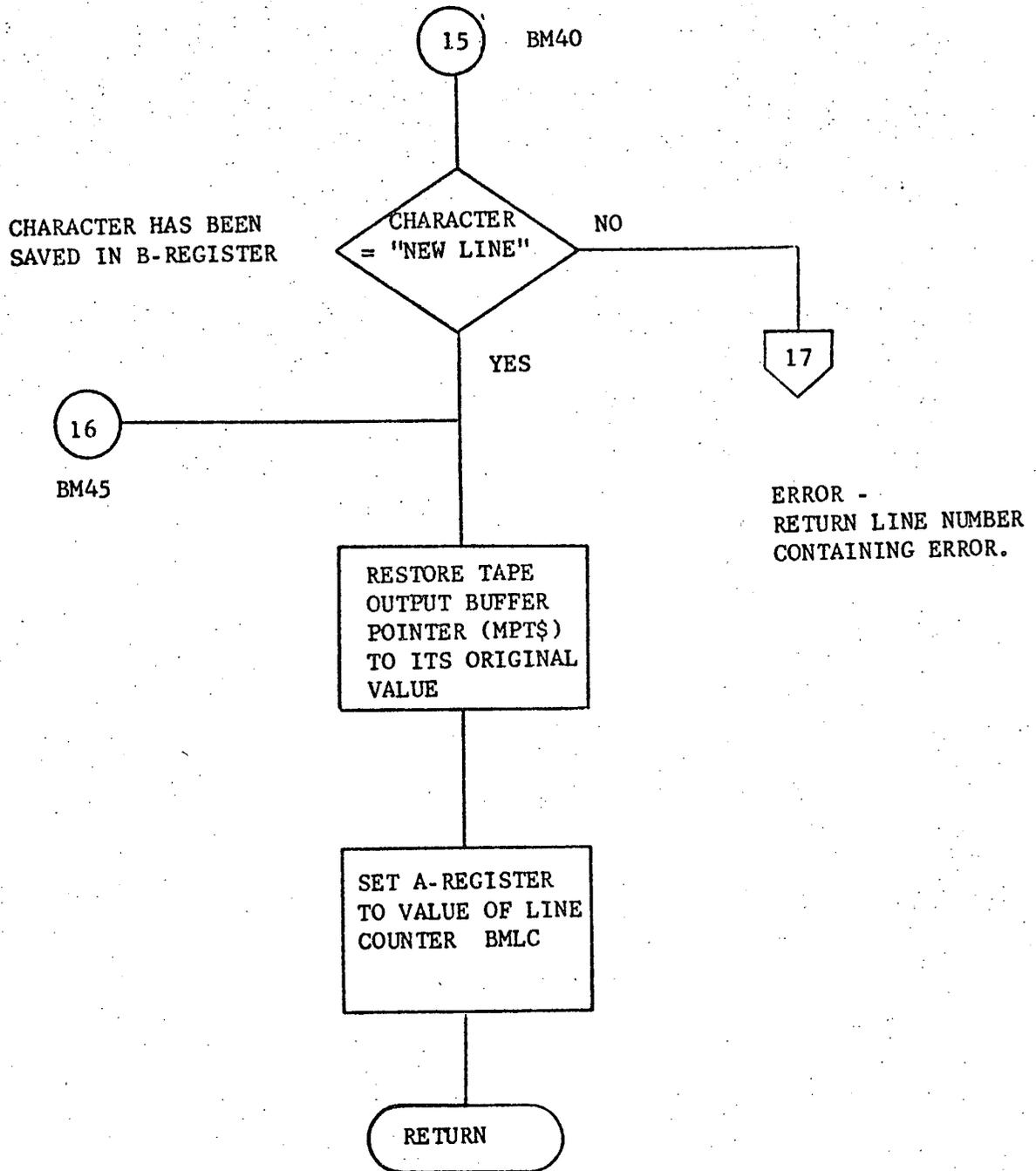




END OF TEXT - LAST
CHARACTER INPUT
FROM DISPLAY

POSITION COUNTER
= POSITION - MAX

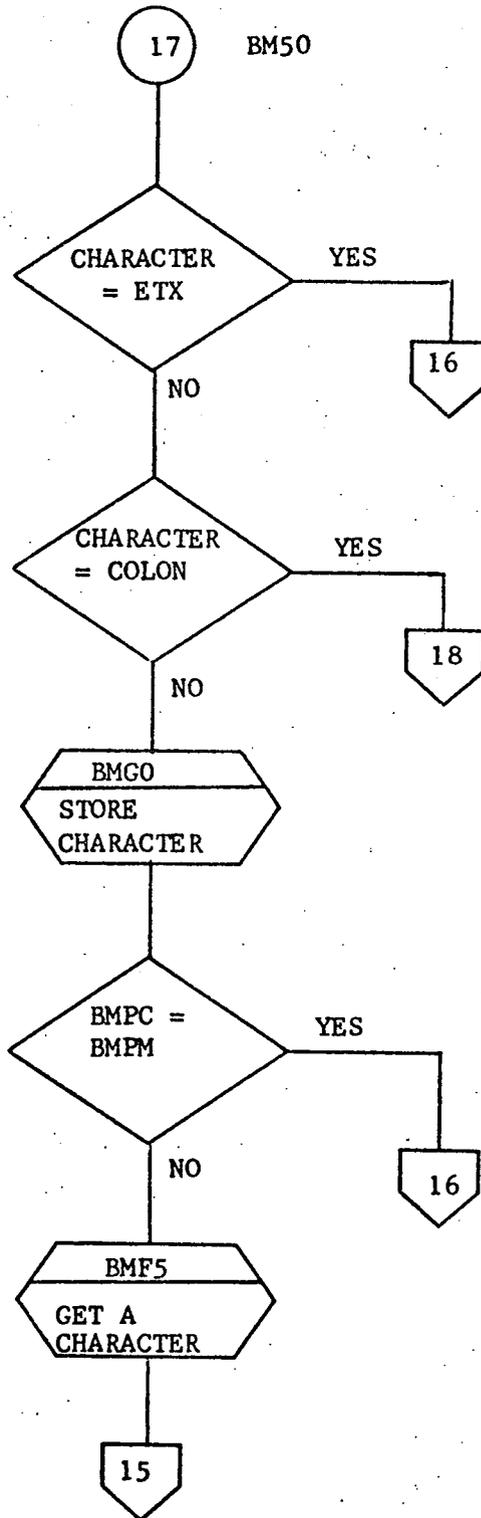


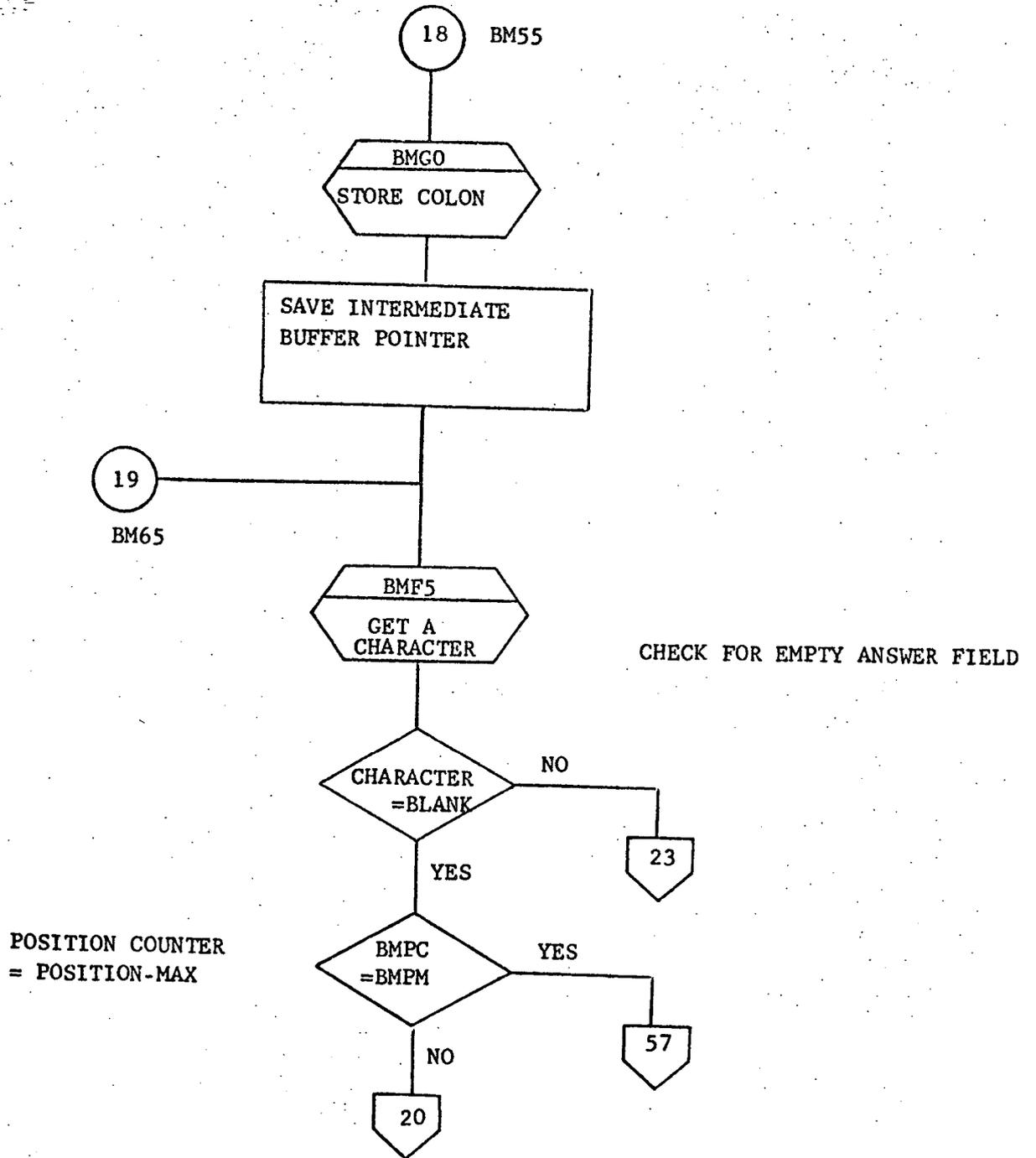


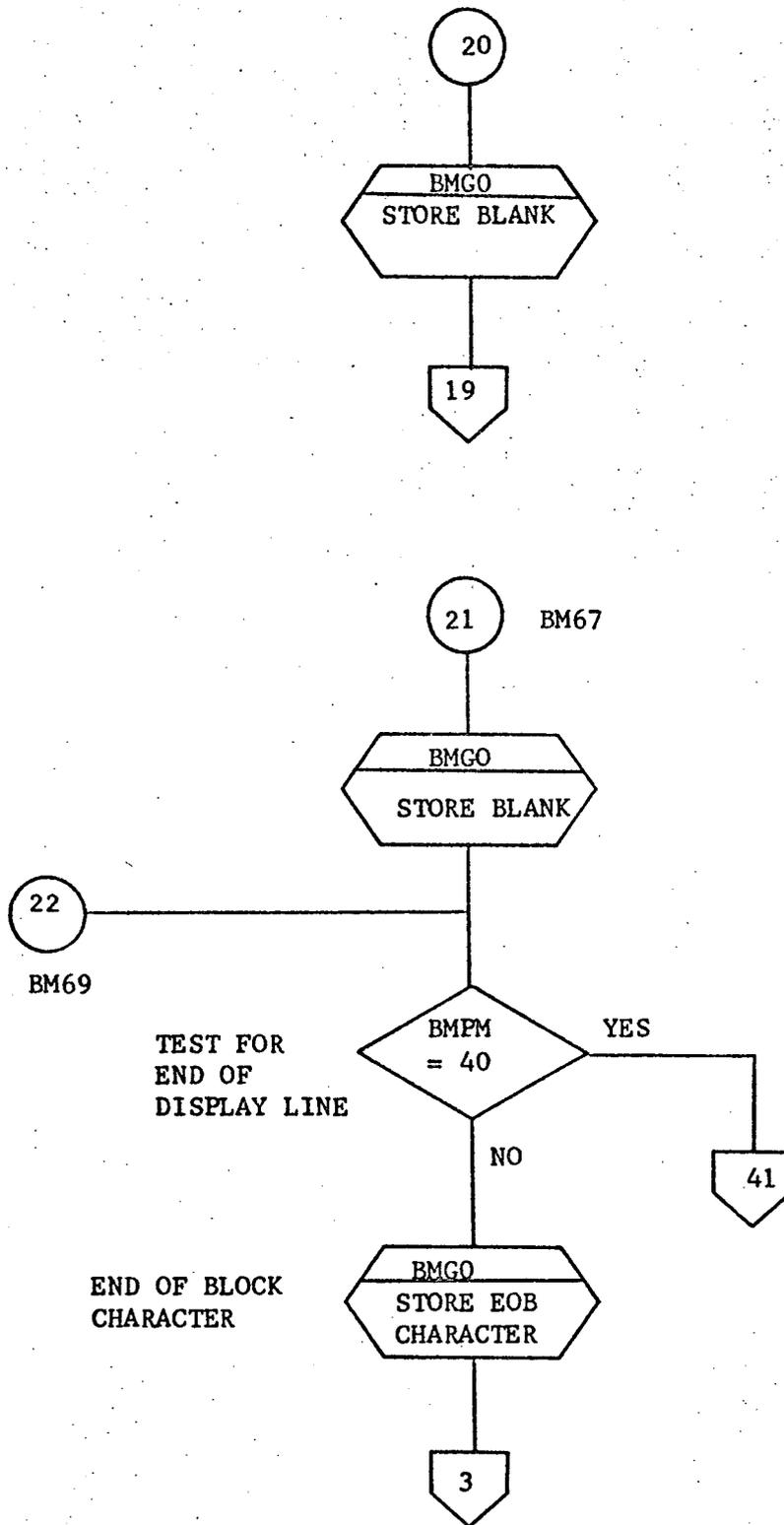
END OF TEXT

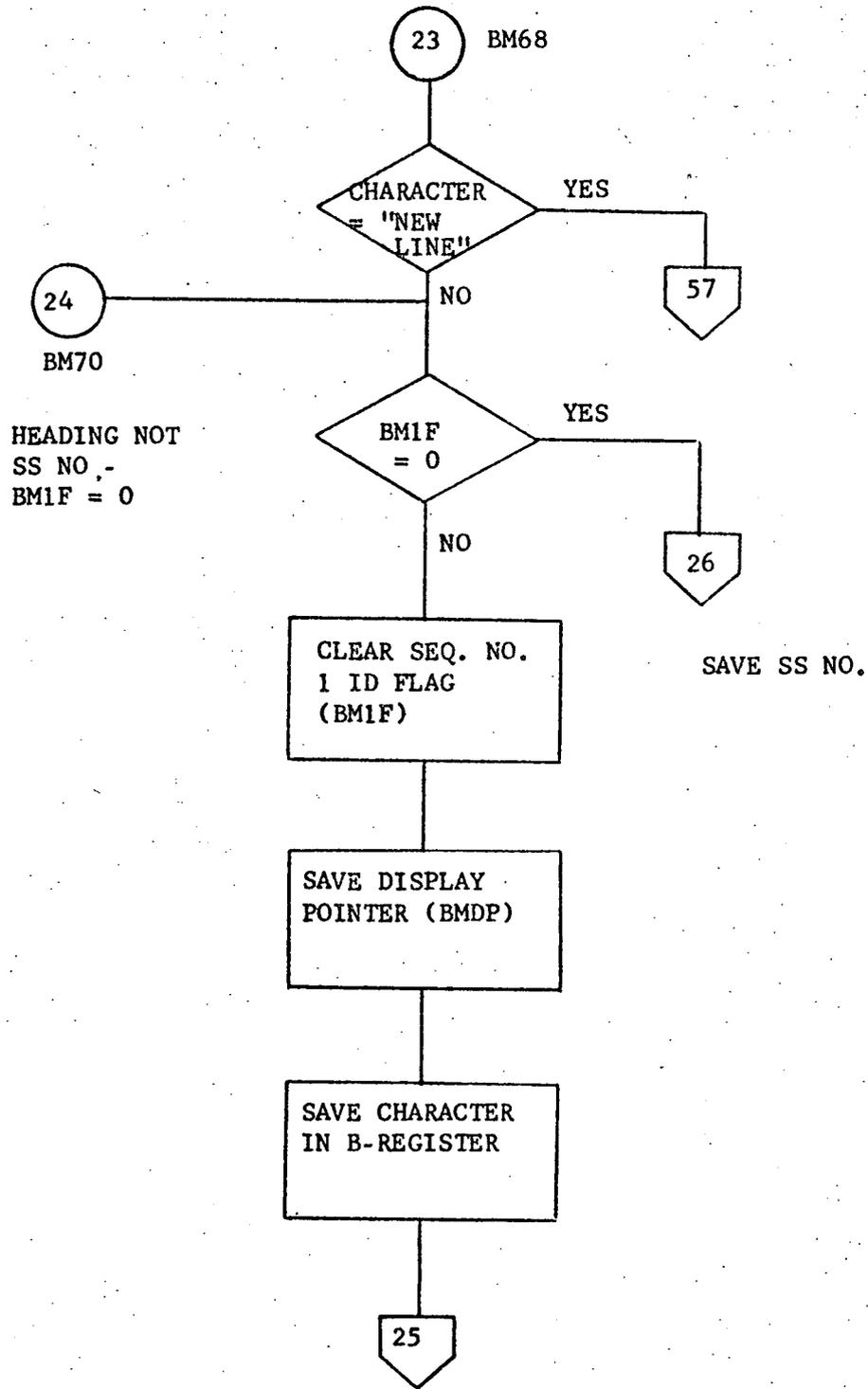
COLON INDICATES
END OF QUESTION
(OR HEADING)

POSITION COUNTER
= POSITION MAX
ERROR









25 BM76

SAVE SS NO.
IN BUFFER
(BMSS)

28

26 BM71

BM4F
= 4

YES

29

NO

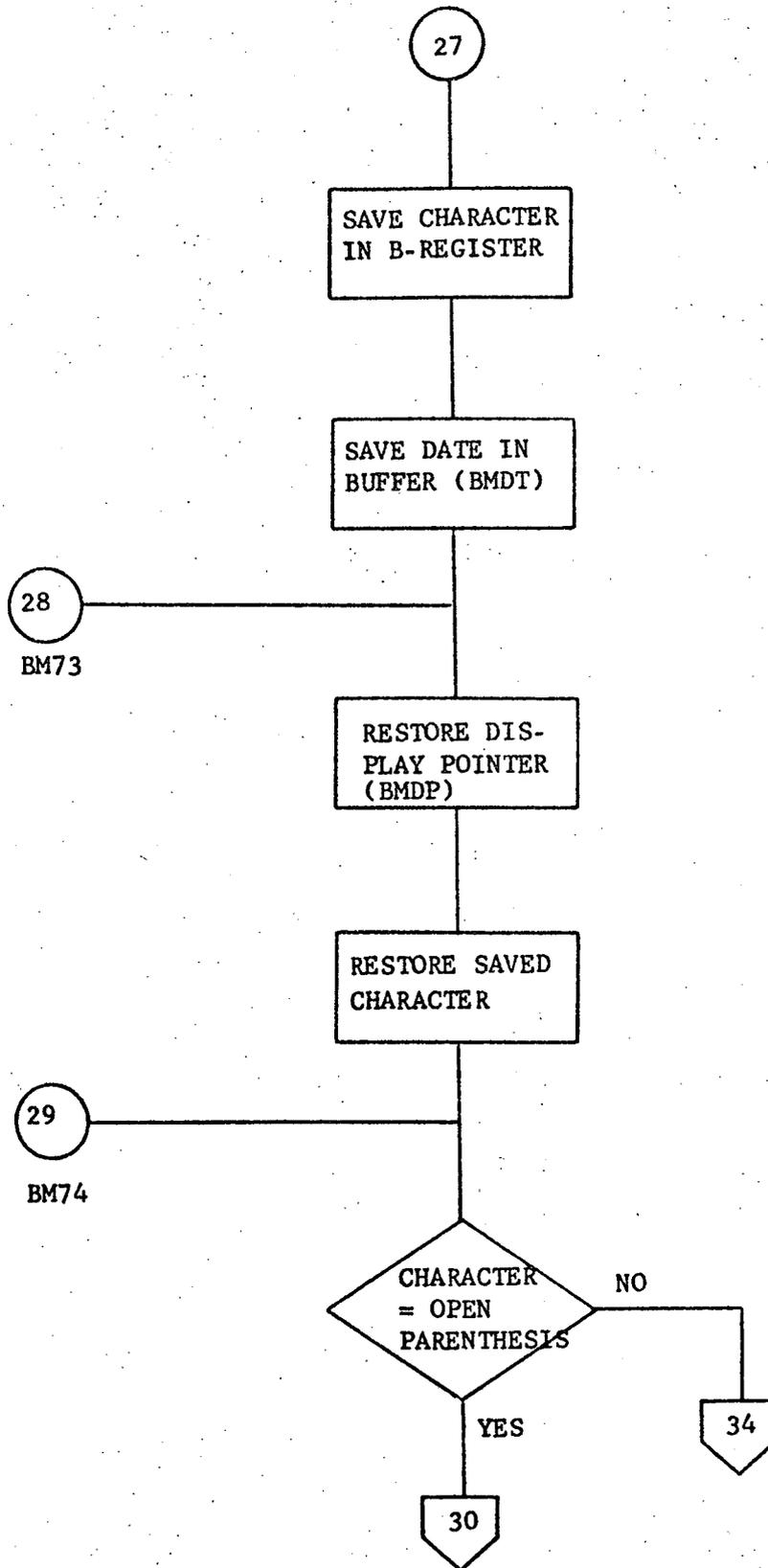
CLEAR SEQ. NO.
4 ID FLAG

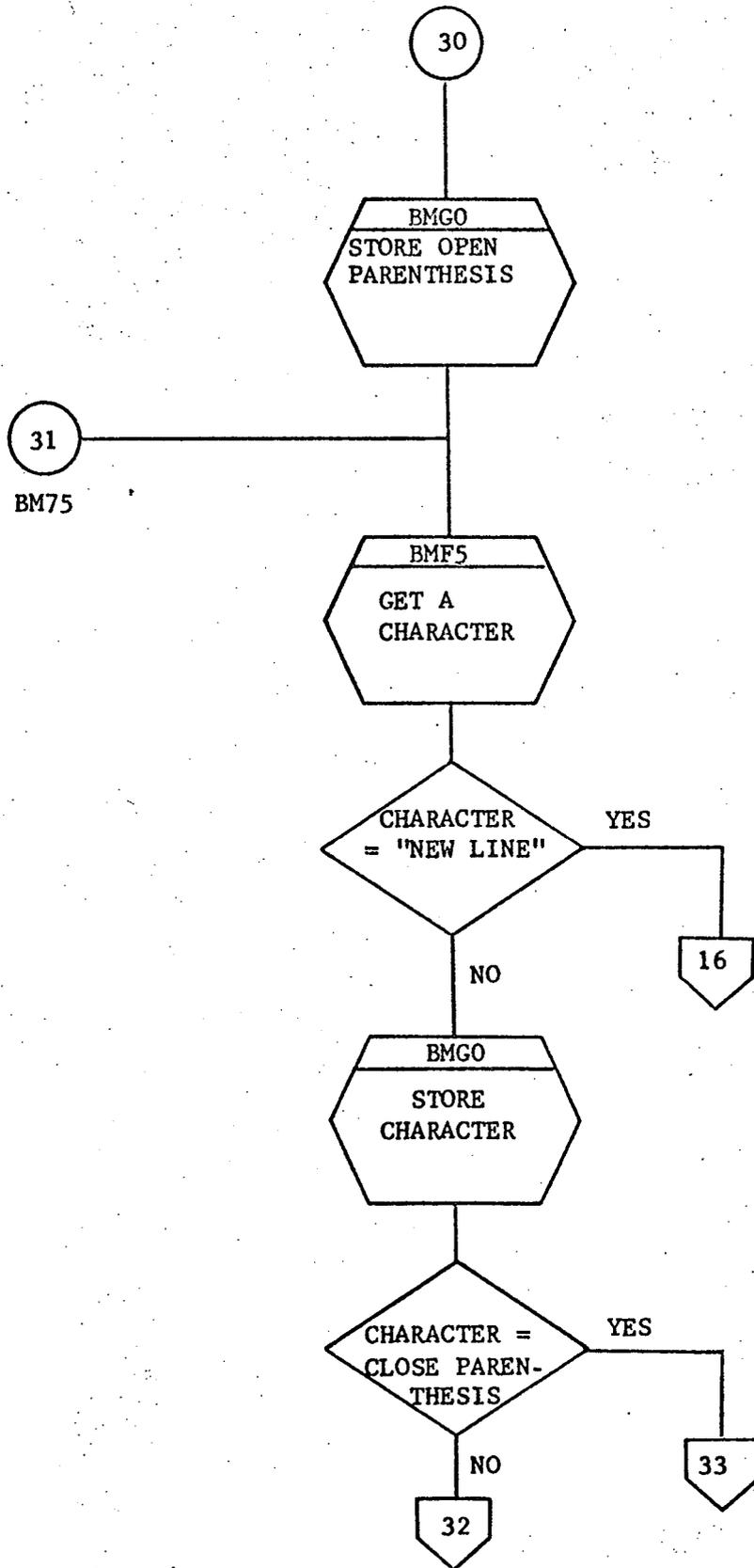
SAVE DISPLAY
POINTER
(BMDP)

27

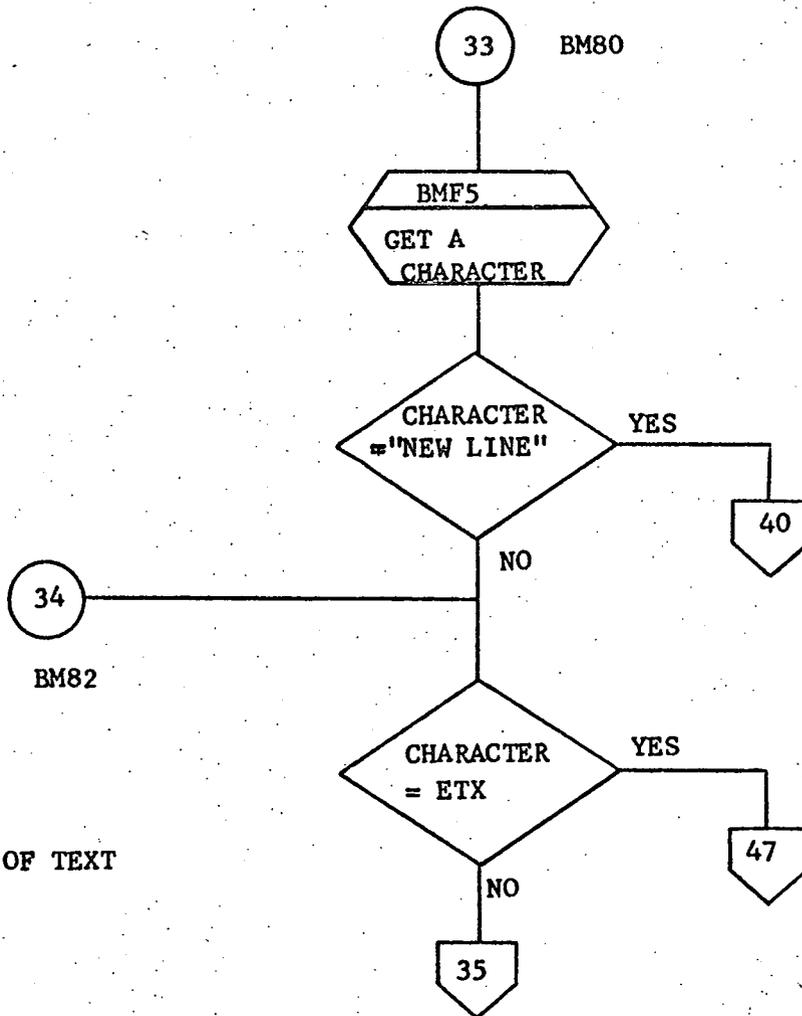
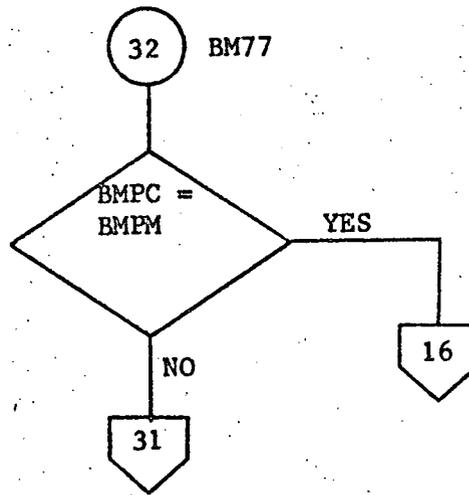
HEADING NOT
DATE -
BM4F = 0

SAVE DATE

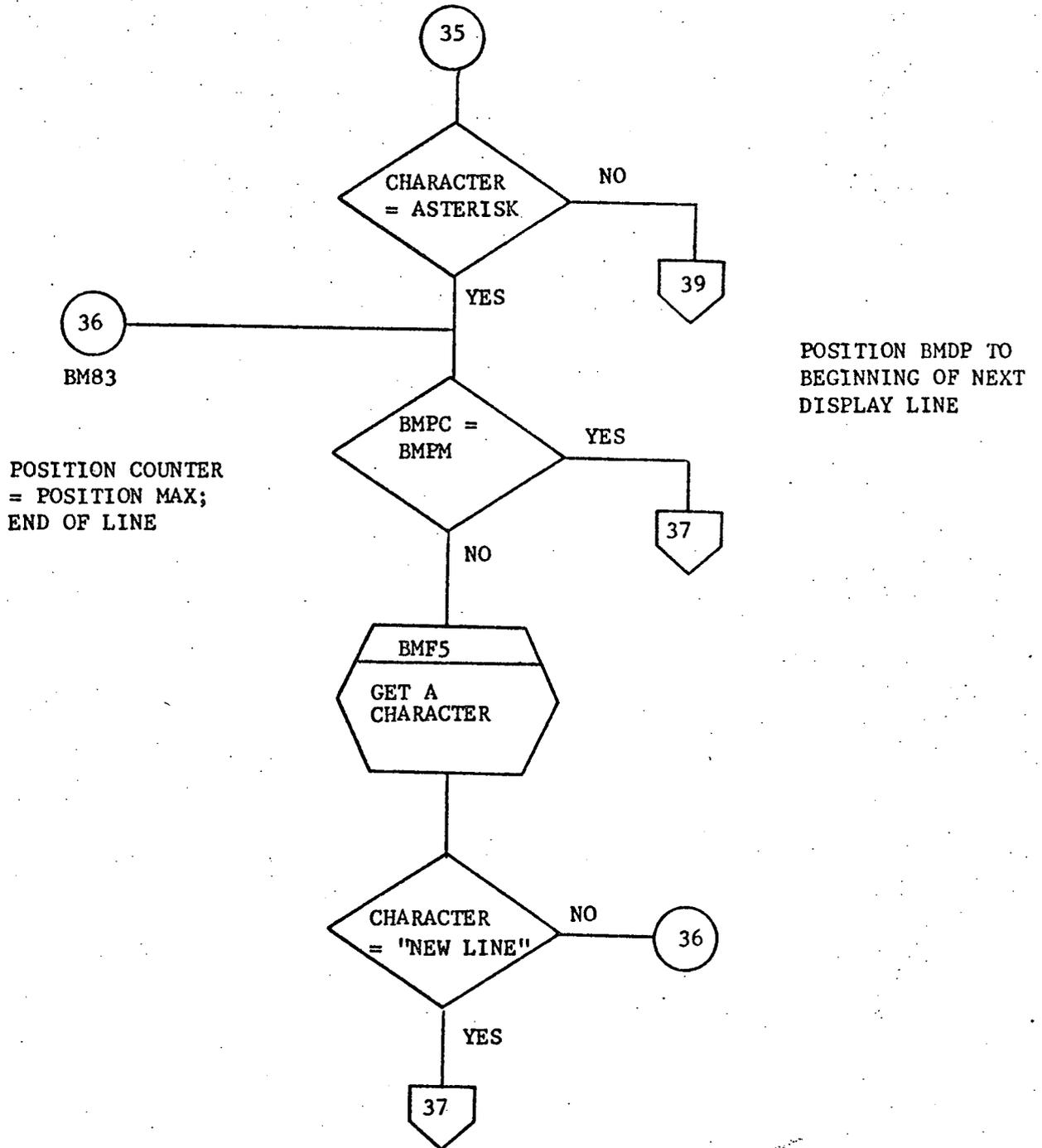




POSITION COUNTER =
POSITION - MAX;
END OF LINE



END OF TEXT



37 BM84

STORE RETURN
ADDRESS (BM86)
AT BMFO

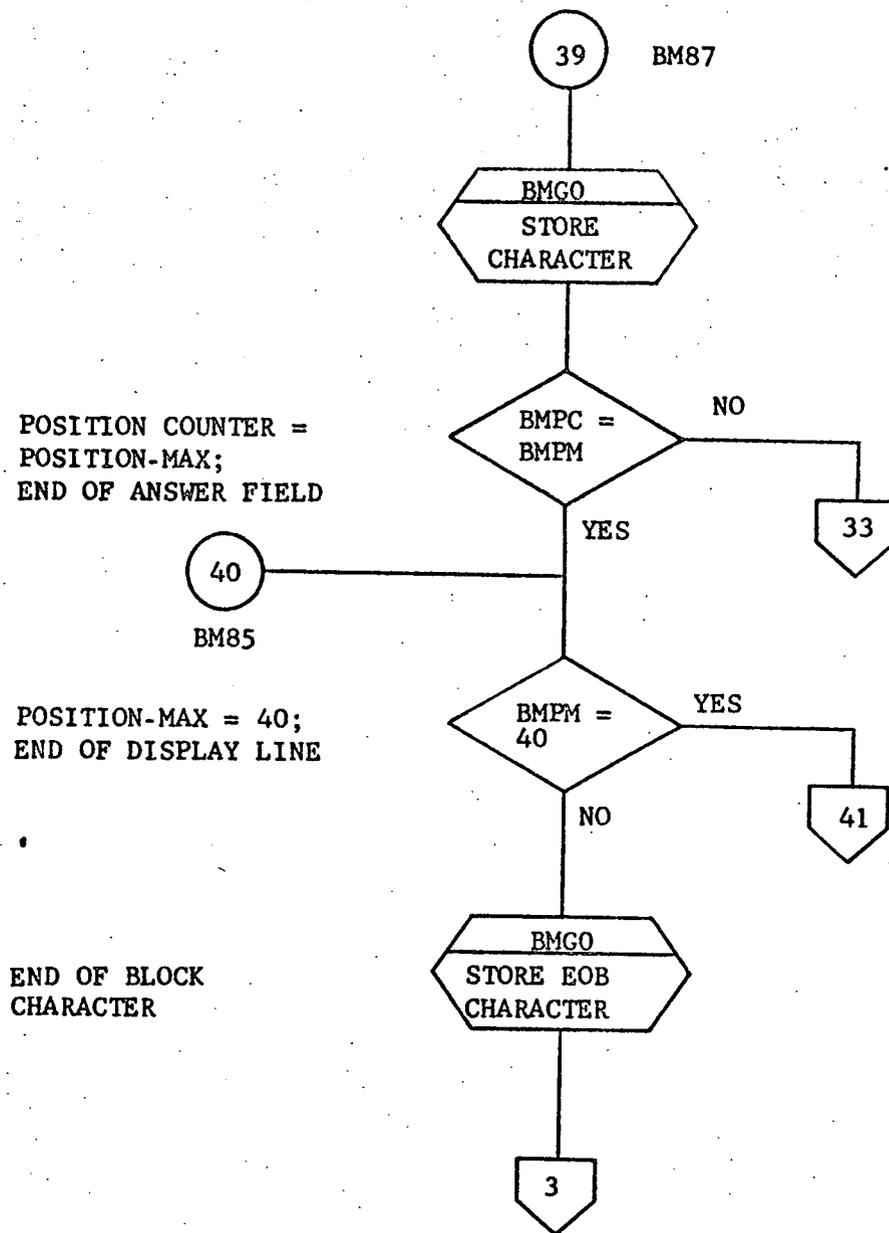
BMFO
STORE CARRIAGE
RETURN

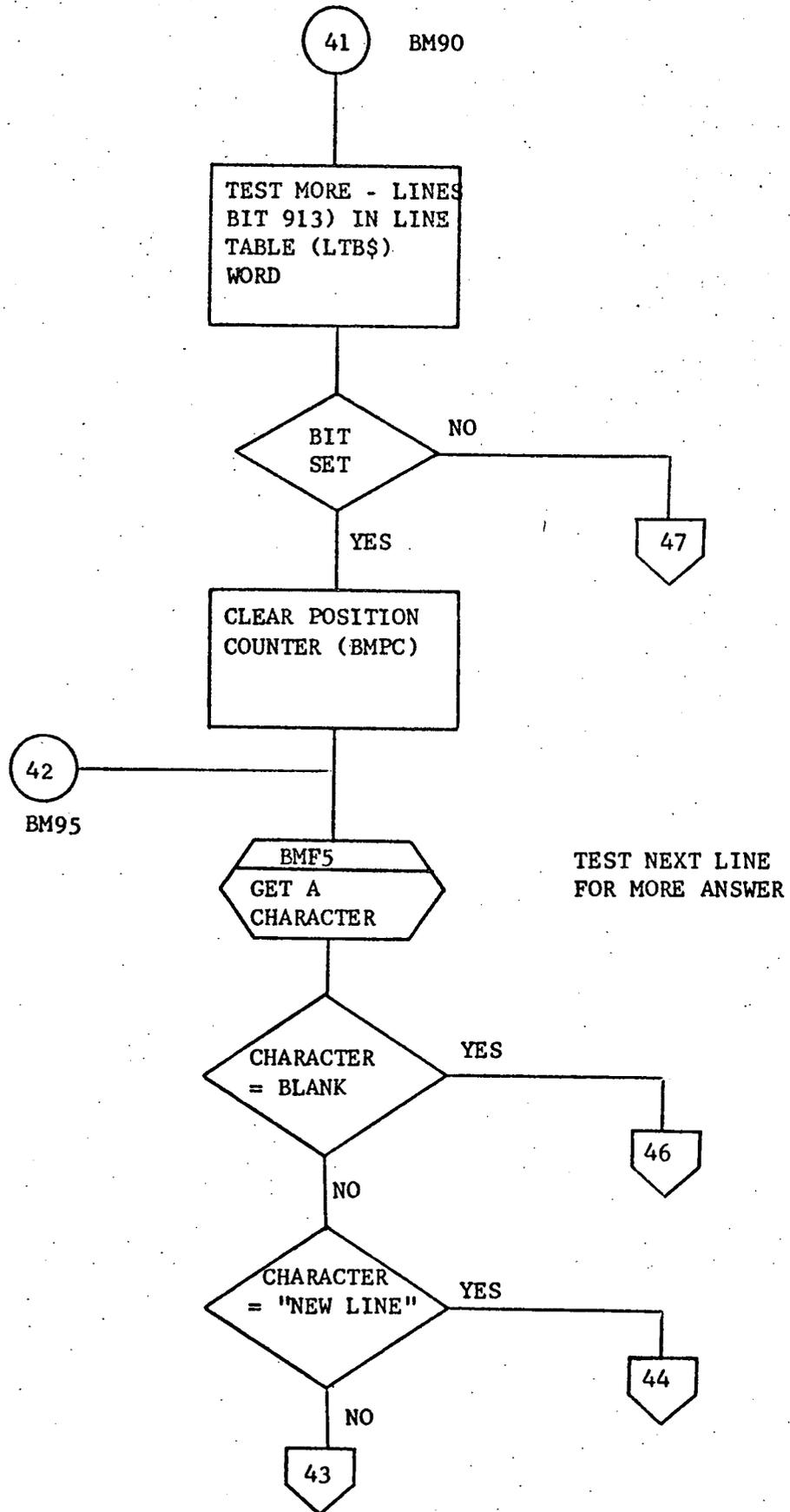
53

38 BM86

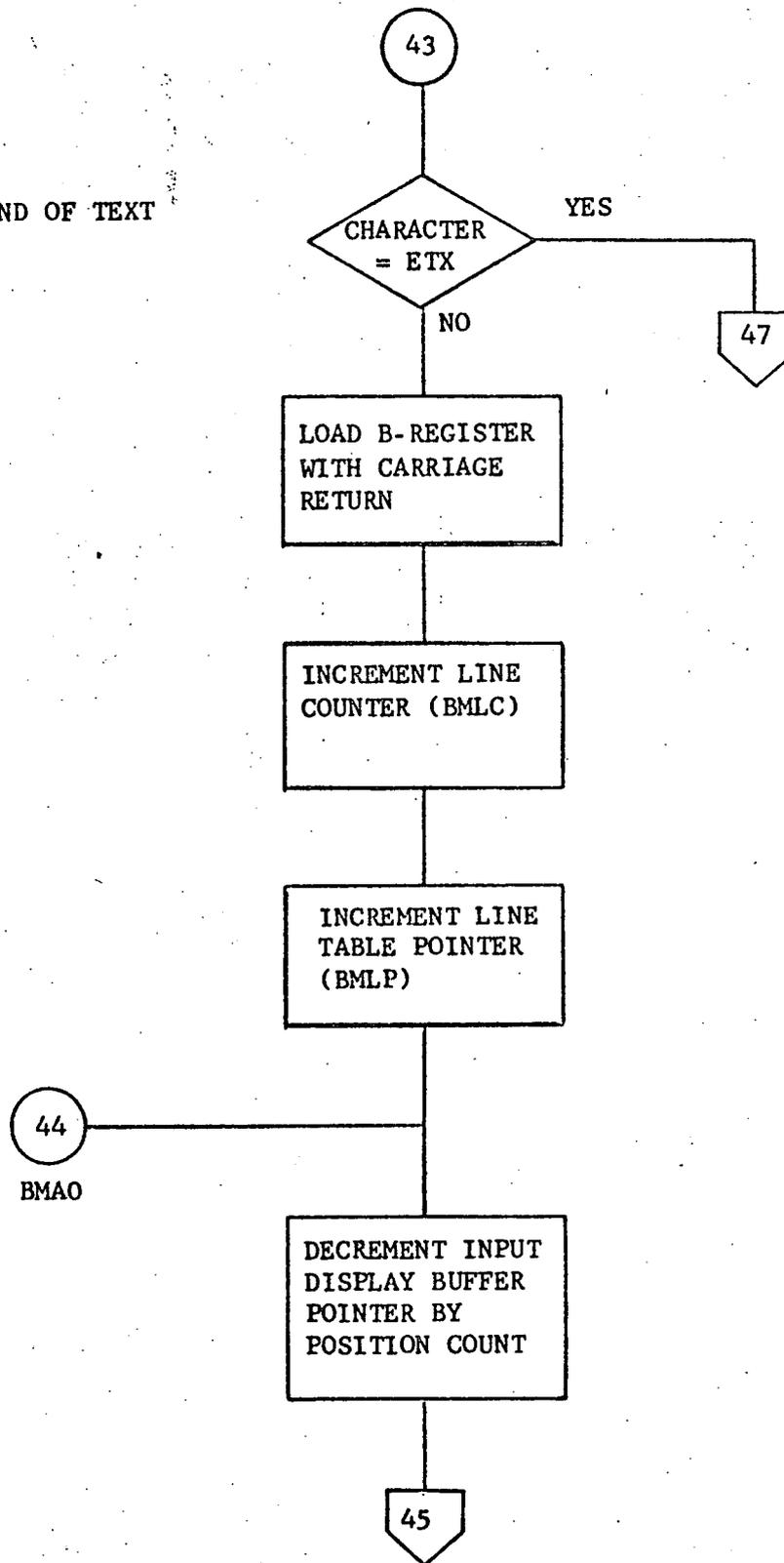
XLOO
INPUT & STORE
EXTRA LINES OF
ANSWER

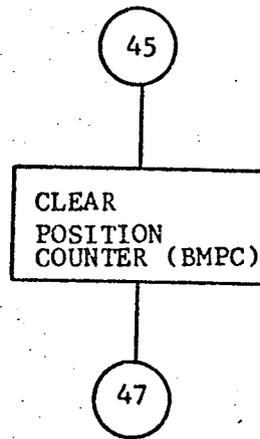
0



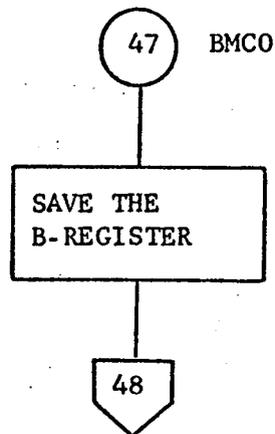
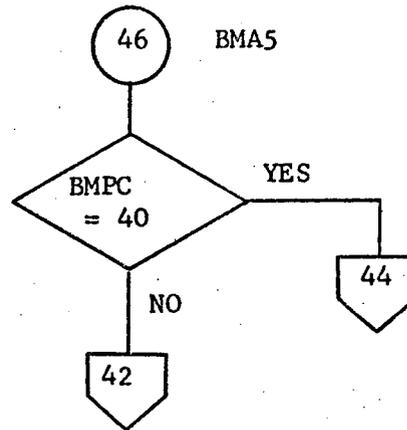


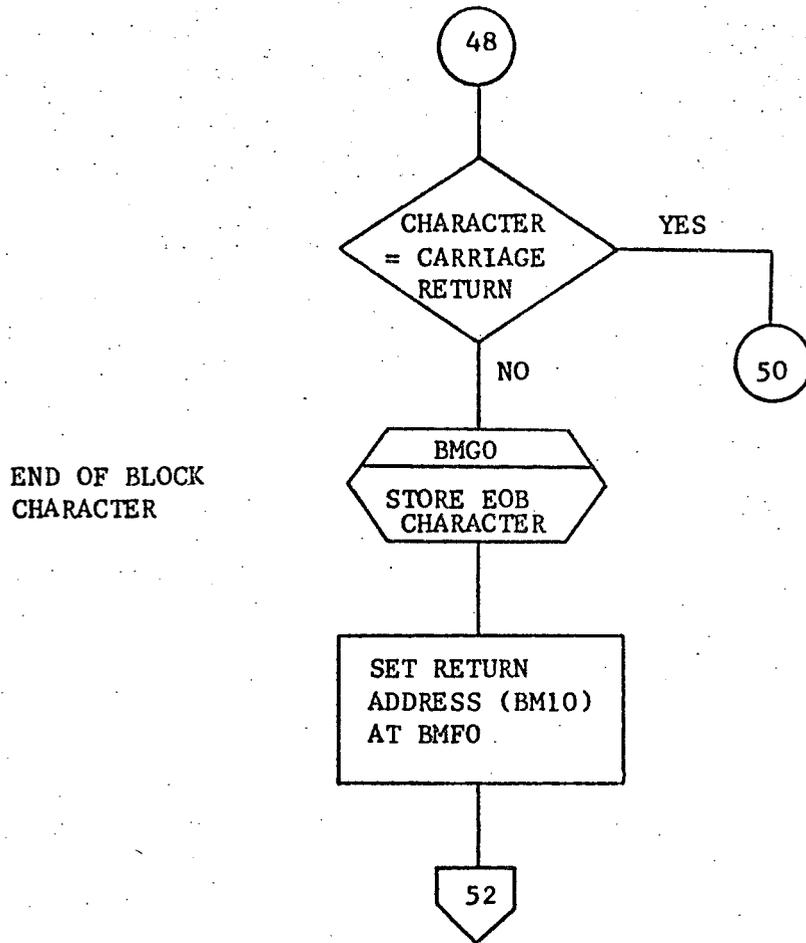
END OF TEXT

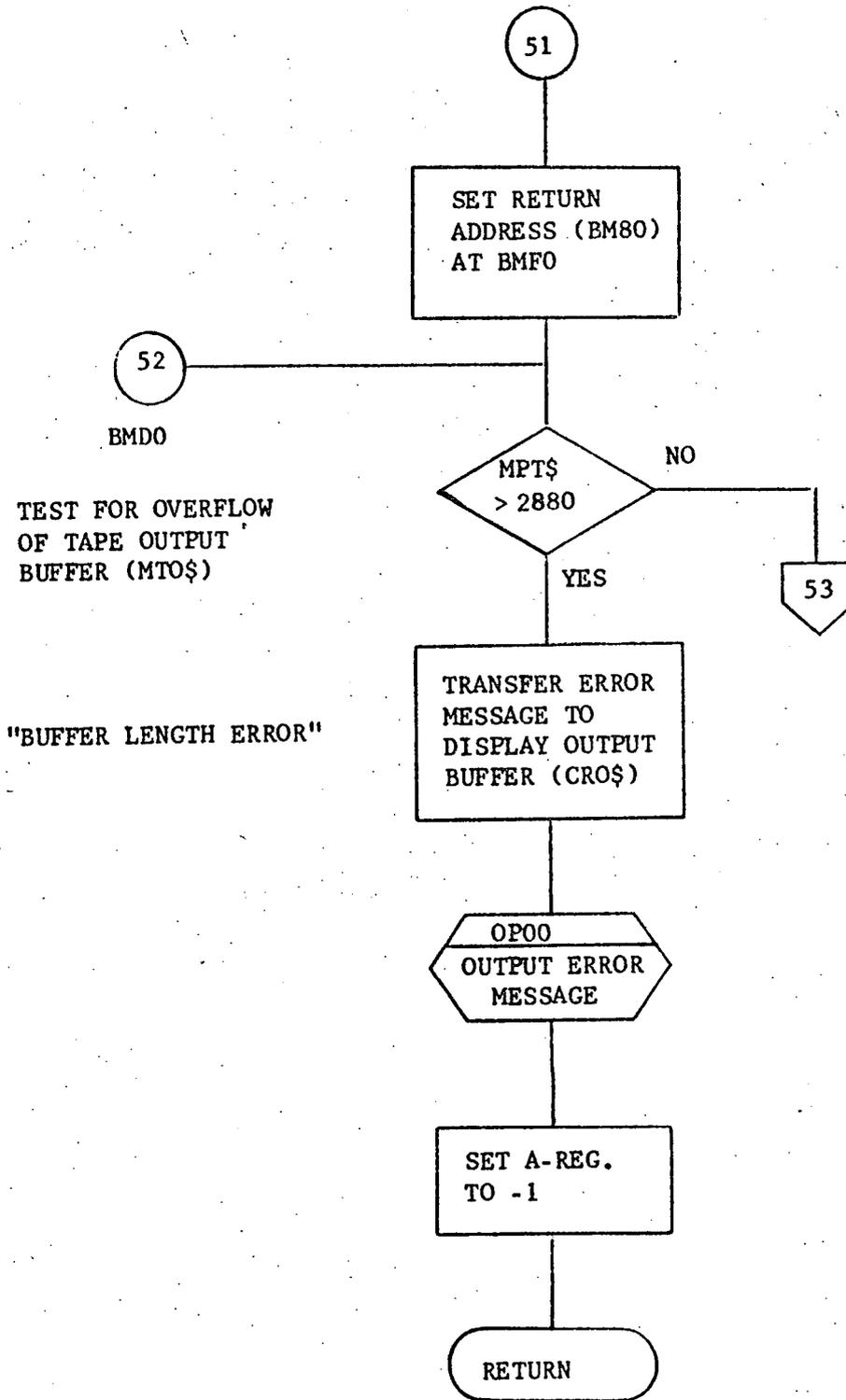


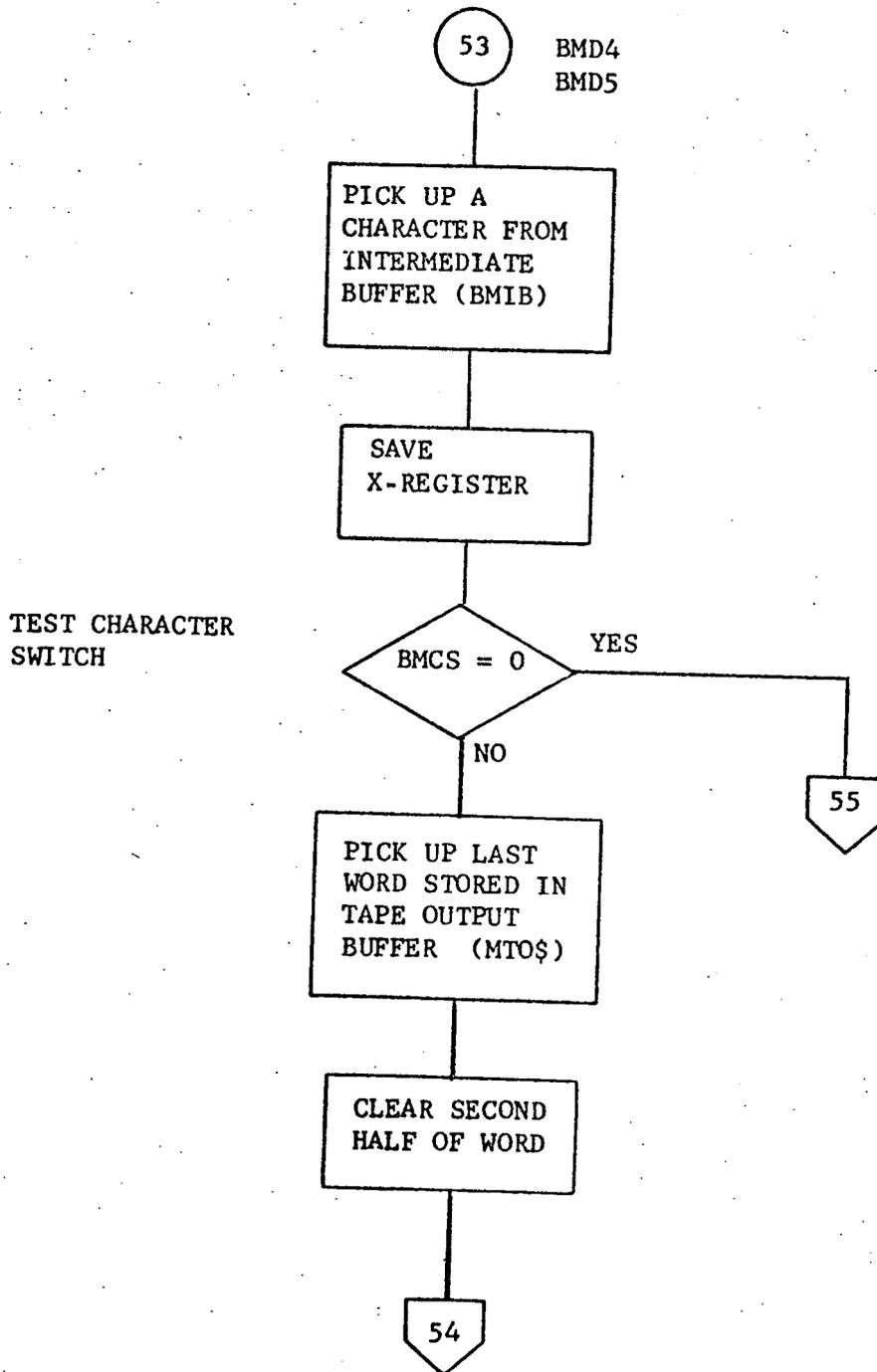


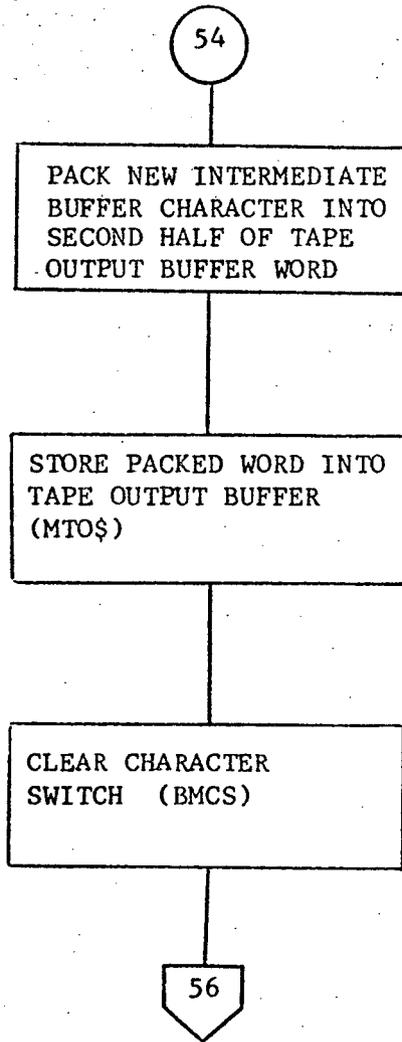
POSITION COUNTER = 40;
END OF DISPLAY LINE

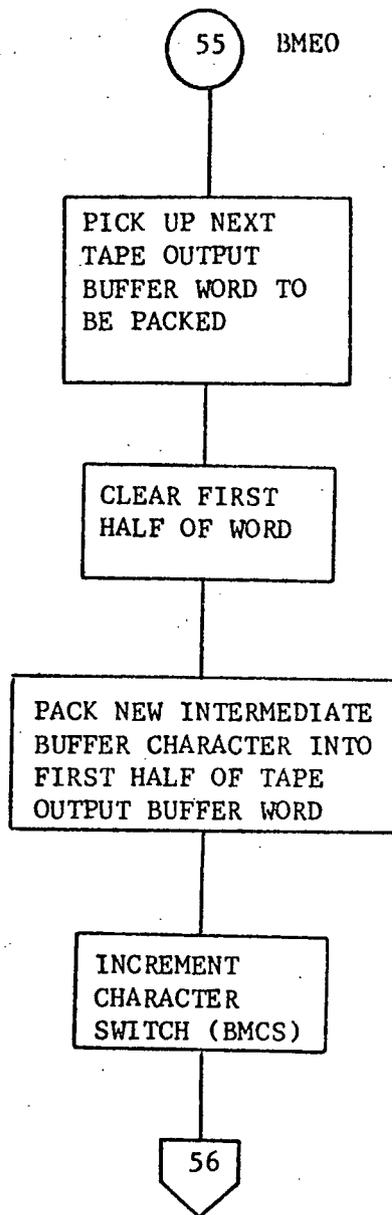


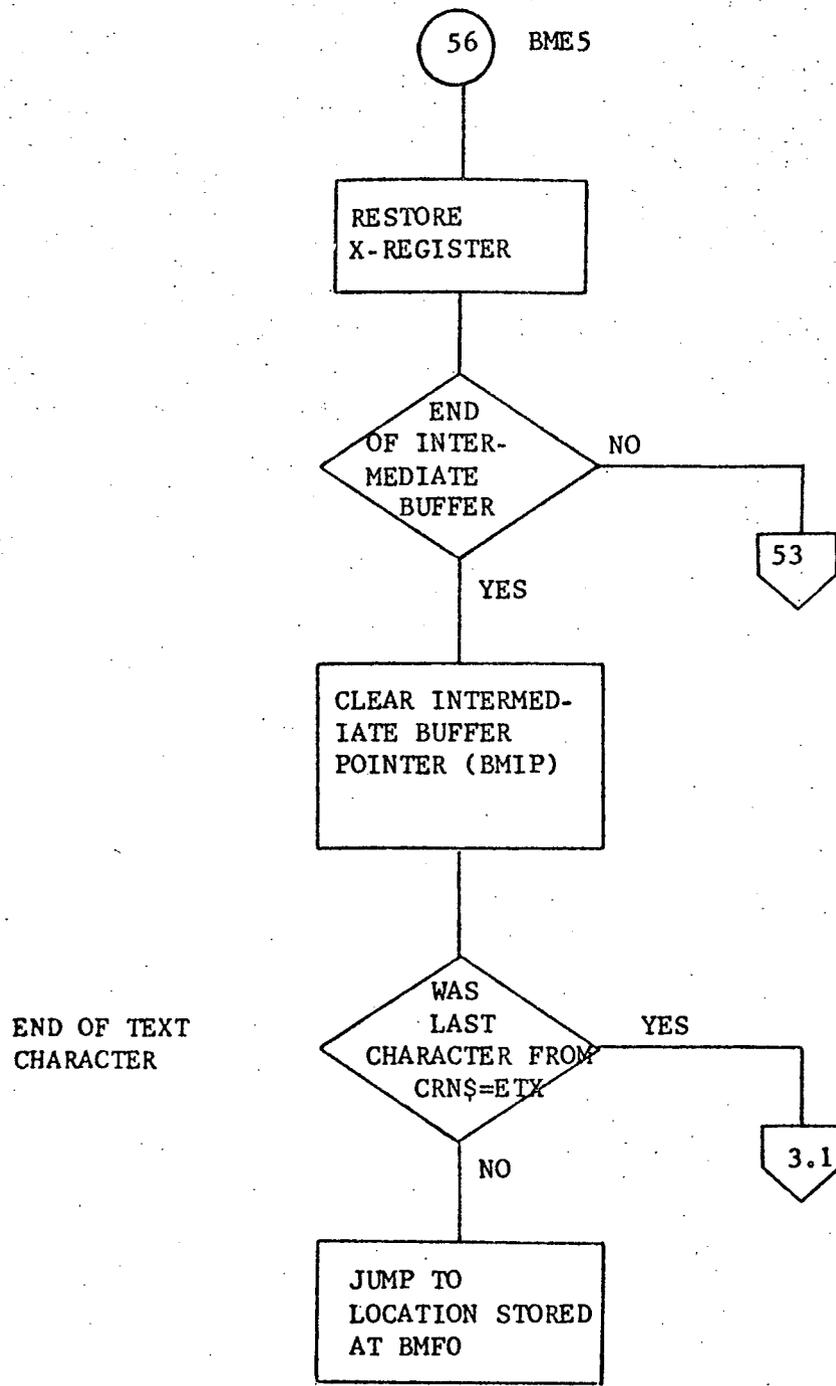




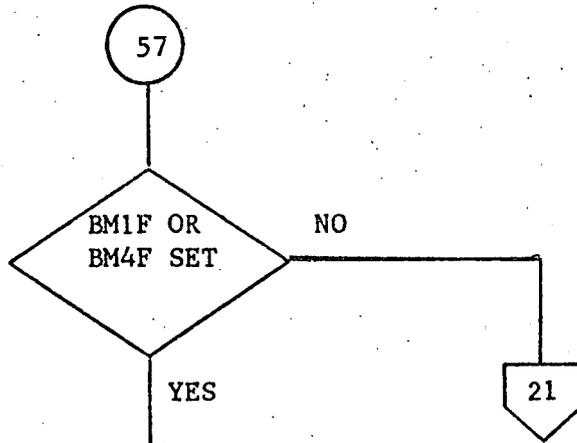




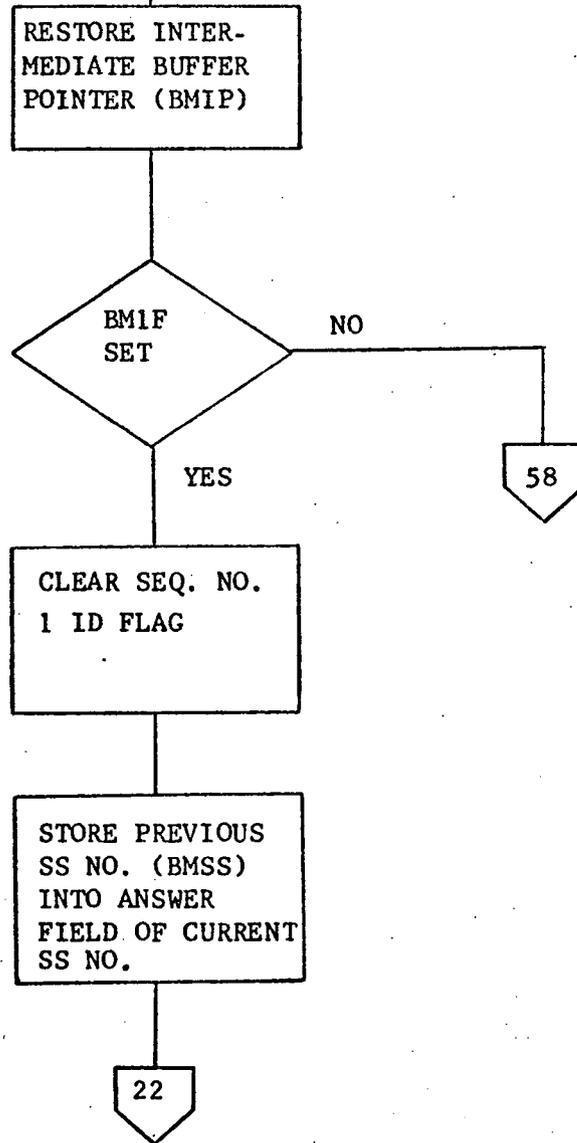


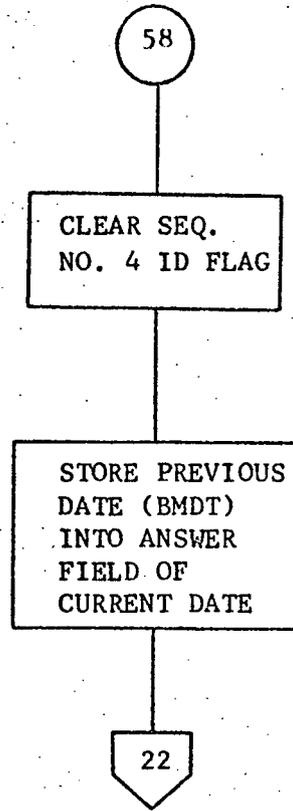


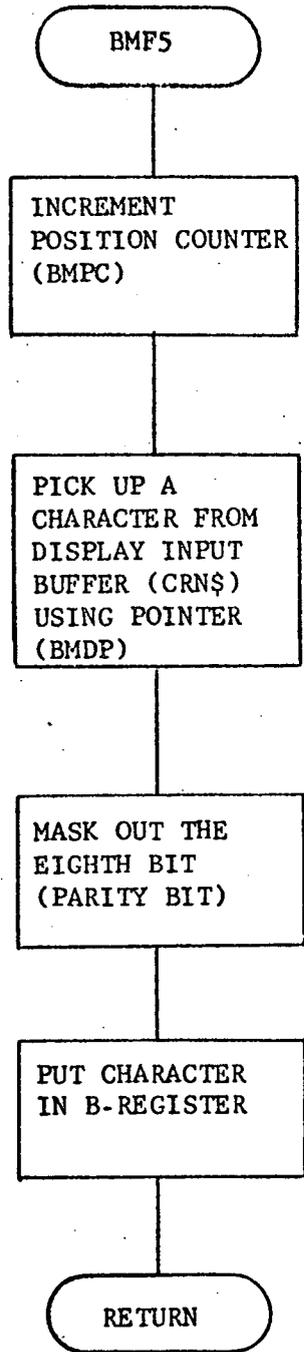
IS EITHER SEQ. NO.
1 OR 4 ID FLAG SET?

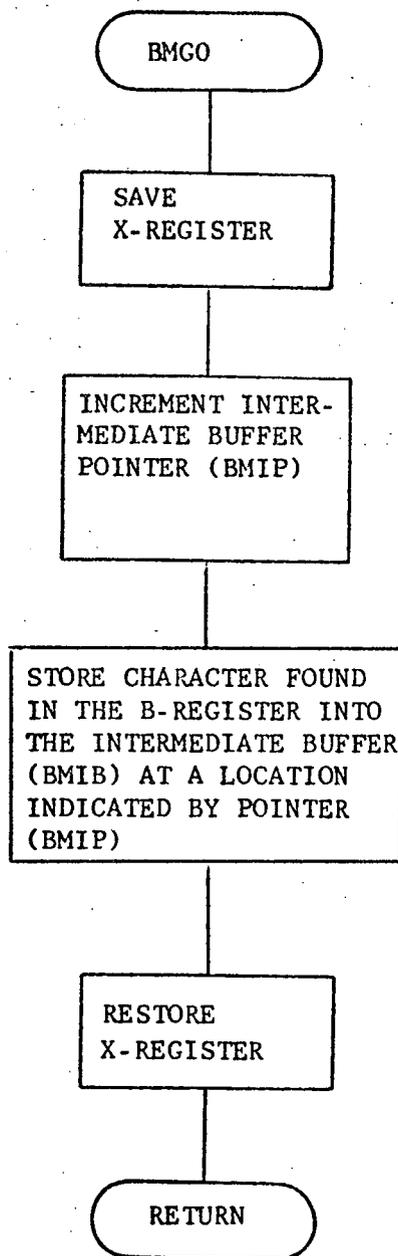


IS SEQ. NO. 1
ID FLAG SET?
(IS CURRENT HEADING
SS NO.?)









STORE CHARACTER
IN INTERMEDIATE
BUFFER

3.3.4 XL00 - Extra Line Generation

3.3.4.1 Purpose

XL00 is a subroutine whose purpose is to allow more answer space for any question on the MEDATA input forms.

3.3.4.2 Technical Description

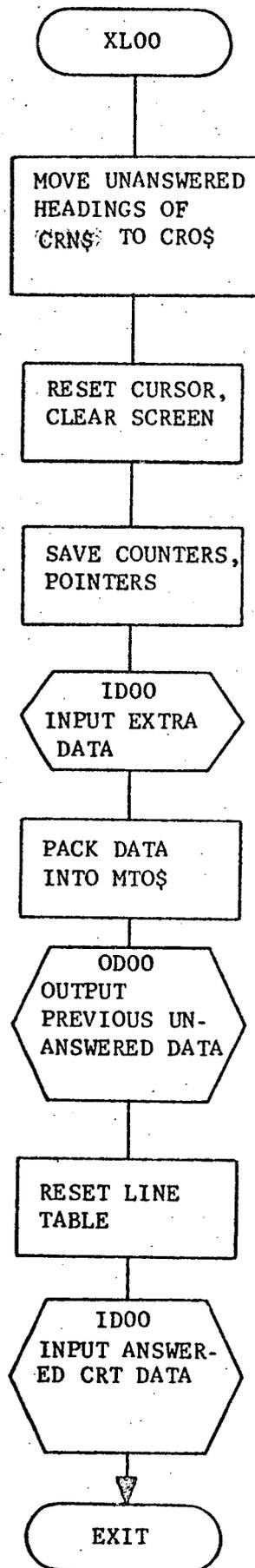
When the user hits the interrupt key the Build Metadata Record Routine (BM00) begins packing the input data from CRN\$ character by character into the CRT Output Buffer (CRO\$). On finding the end of text character, the routine clears the CRT screen and resets the cursor. The user then keys in his extra data, comments, etc. XL00 calls ID00 to input the extra data into CRN\$ and the data is transferred to the tape output buffer with all necessary control characters inserted. XL00 then calls OD00 to output the unanswered remainder of the CRT page located in CRO\$ on which the extra data was inserted. All applicable counters, pointers, etc., and the line table are updated. After all questions on the page have been answered, XL00 calls ID00 to input the data and then returns control to the calling program.

3.3.4.2.1 Calling Sequence

CALL XL00

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	Saved upon entry	Restored upon exit
B	Saved upon entry	Restored upon exit
X	Saved upon entry	Restored upon exit
Overflow	N/A	N/A

3.3.4.2.2 General Flow Chart



3.3.4.3 Label Description

3.3.4.3.1 Local

XLBF (962) number of words to be input from the CRT during an input call to ID00

XLDEV storage buffer containing the message "CRT DEVICE ERROR"

XLFP counter which contains the number of characters stored in the intermediate buffer BMIB

XLEL (40) CRT line character limit

XLER counter used to halt the program in case of an unrecoverable parity or hardware error.

XLID (1) function used to initiate an output to the CRT

XLPR storage buffer containing the message "CRT PARITY ERROR"

XLSA storage location used for storing the original contents of the A-register

XLSE storage location used for storing the original contents of the B-register

XLSTAT storage location containing the status of an input or output operation

XLSE storage location used for storing the original contents of the X-register

XLWC storage location containing the number of words transferred from the input buffer to the output buffer

XLWD (4) number of control parameters necessary to initiate a CRT clear screen - cursor reset

3.3.4.3.2 Global

N/A

3.3.4.3.3 Entry Points

XL00 - primary entry point

3.3.4.3.4 External References

BMBL (0240) storage location containing the value of the space character

BMCR (0215) storage location containing the value of the Carriage Return character

BMDP storage location containing the input buffer display pointer

BMEP (02v1) storage location containing the value of the End of Page character

BMNL (012) storage location containing the value of the New Line character

BMPC storage location containing the input position counter

BMTX (03) storage location containing the value of the End of Text character

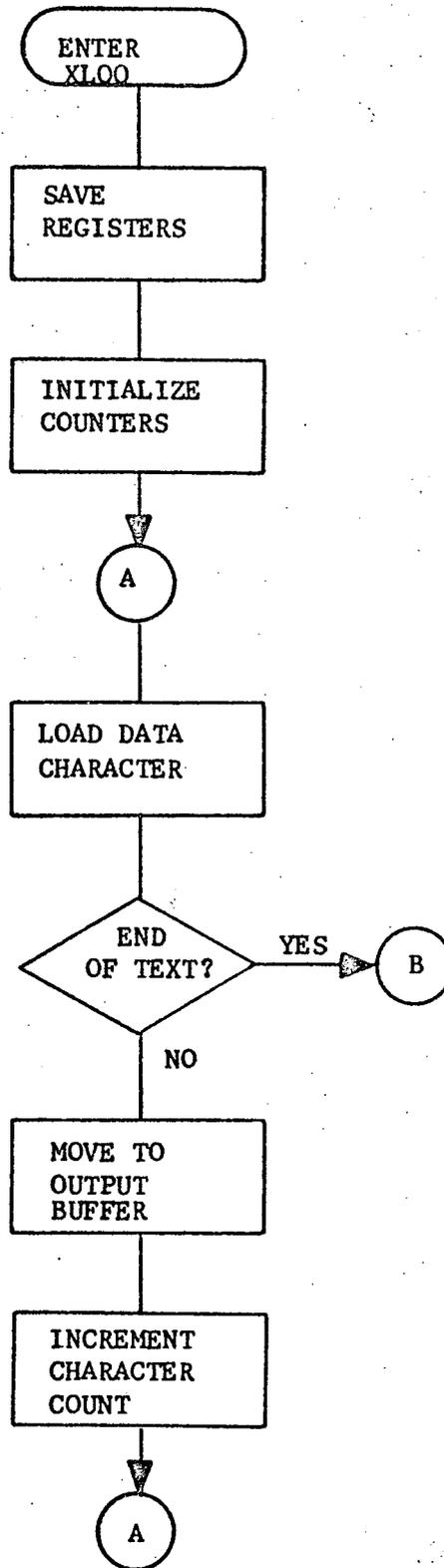
CRN\$ CRT input buffer

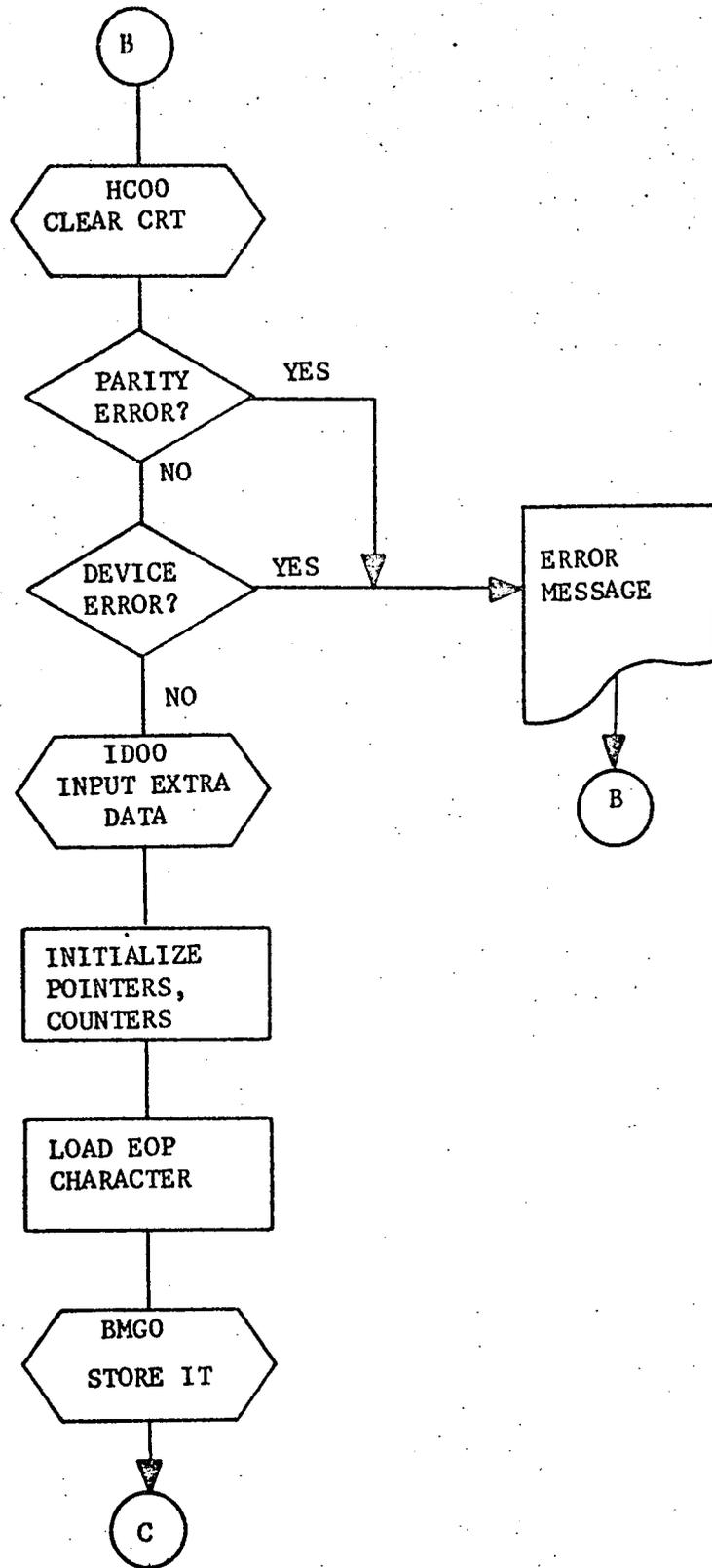
CRO\$ CRT output buffer

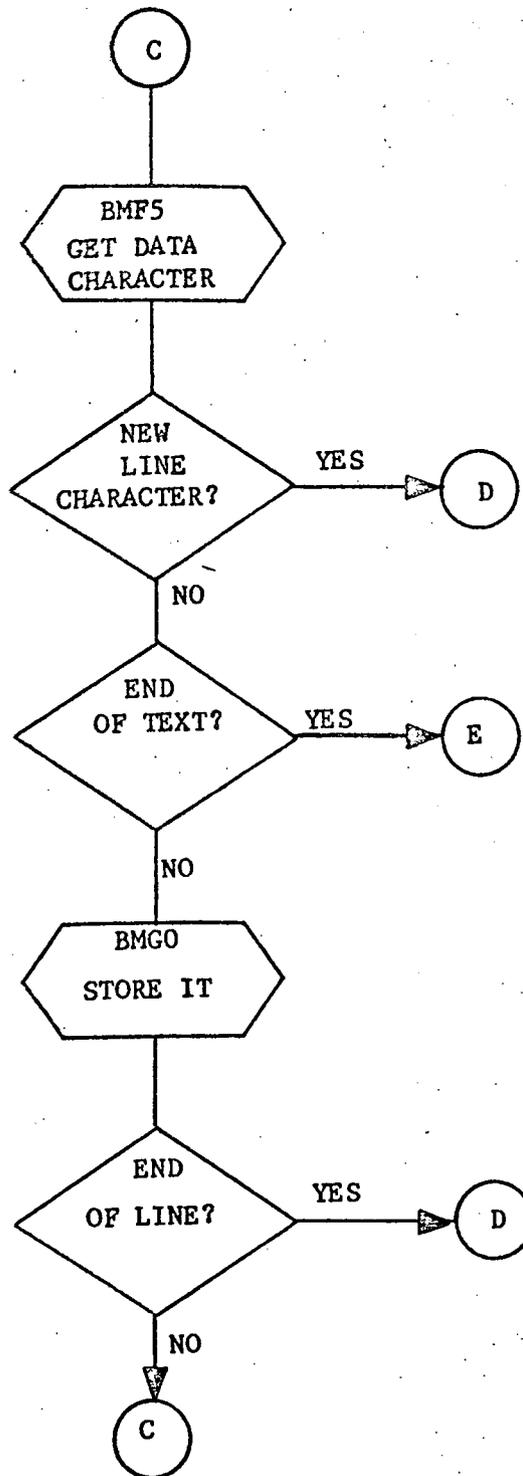
LTB\$ starting address of the Line Table

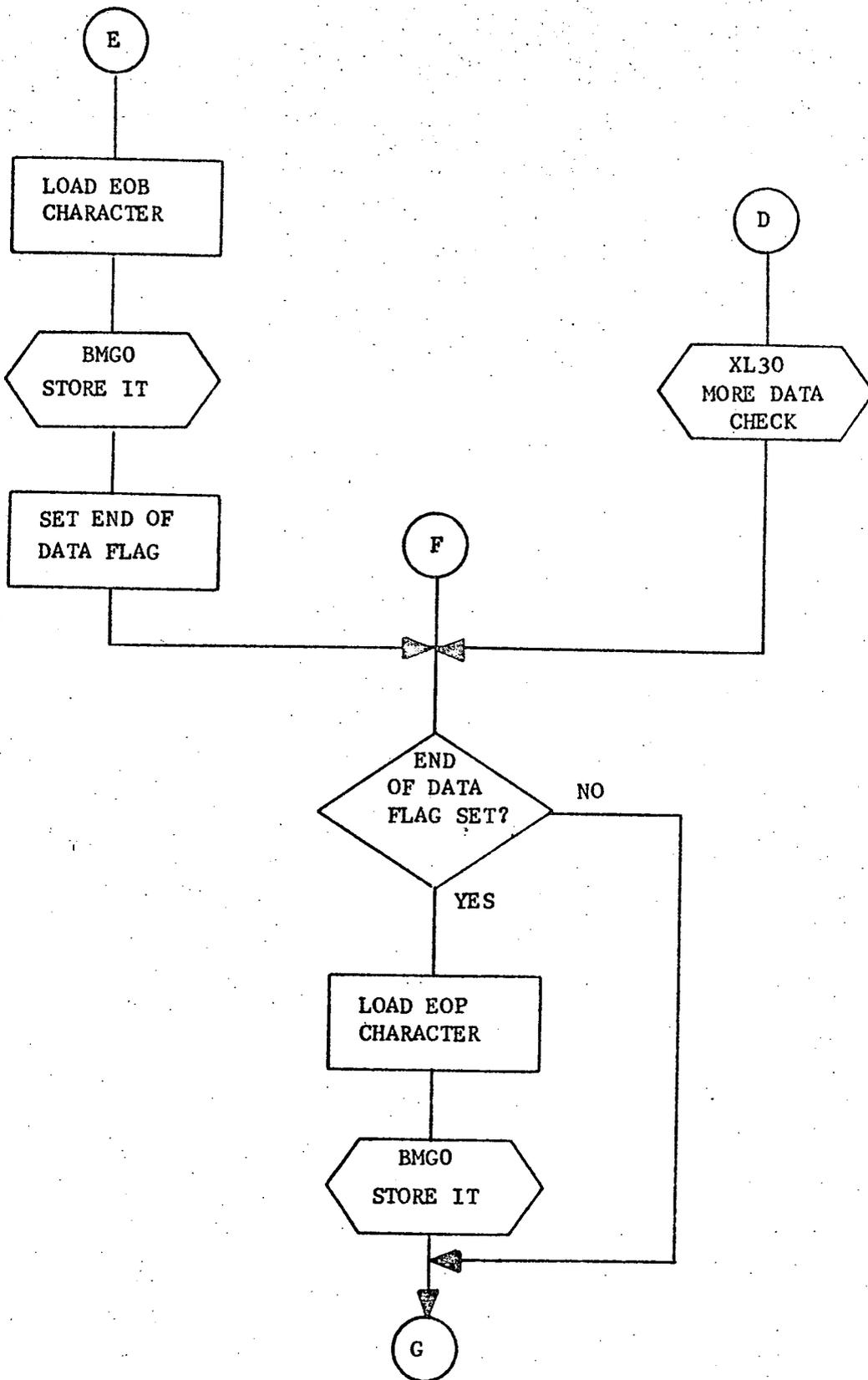
XLRC (12,1,8,4) parameters which initiate a CRT Clear Screen - cursor reset

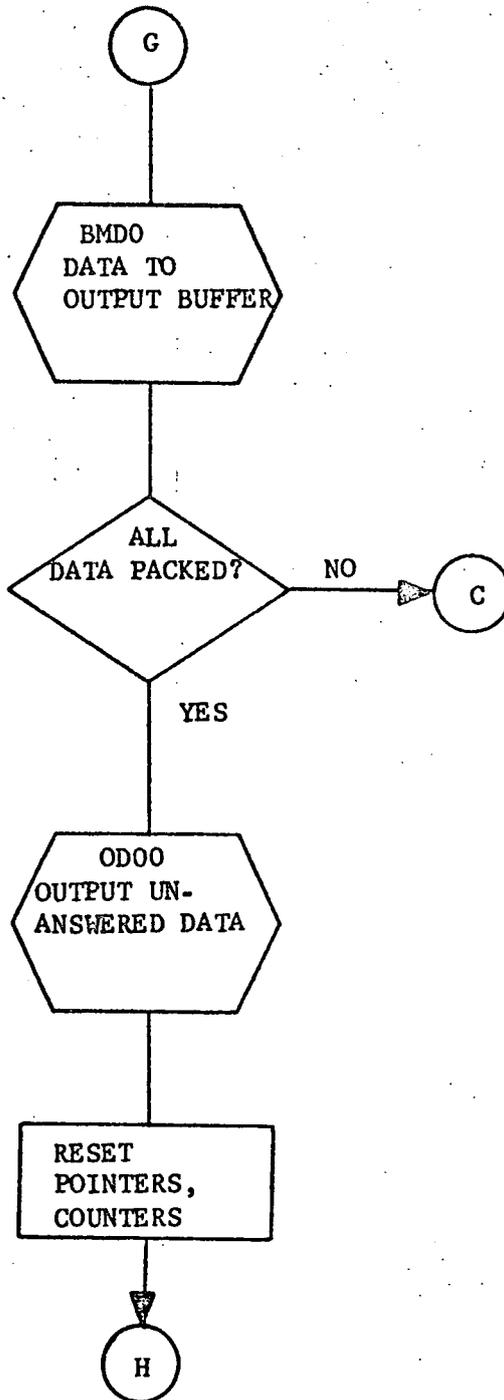
3.3.4.4 Detailed Flow Chart

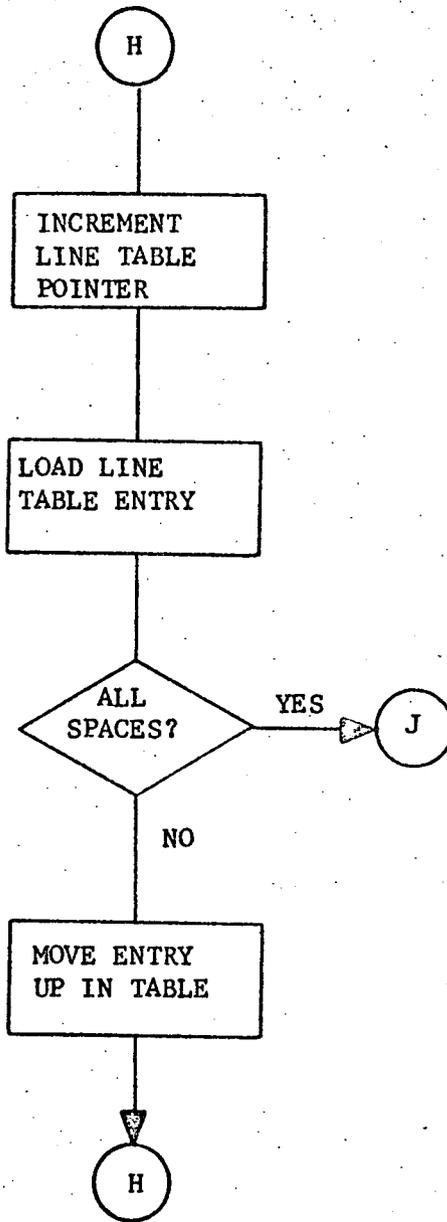


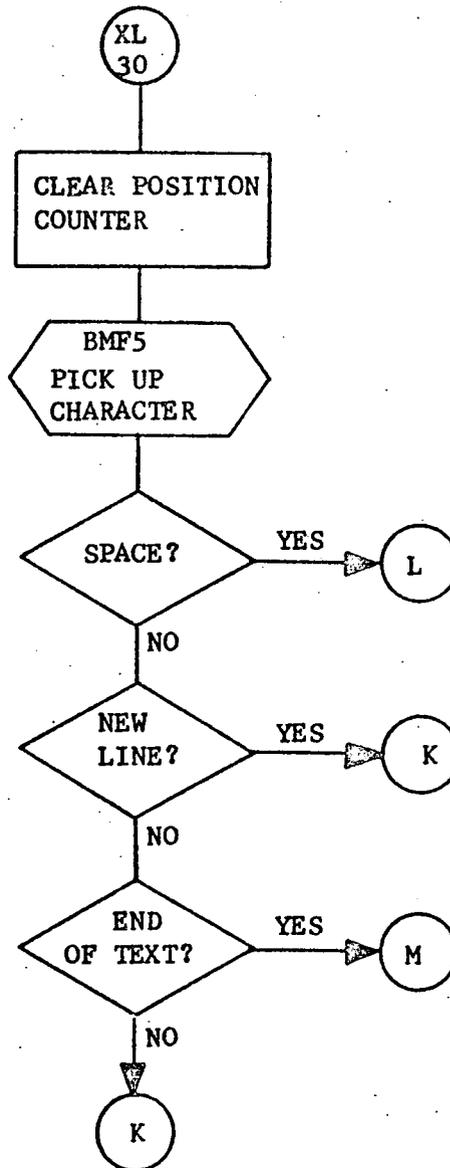
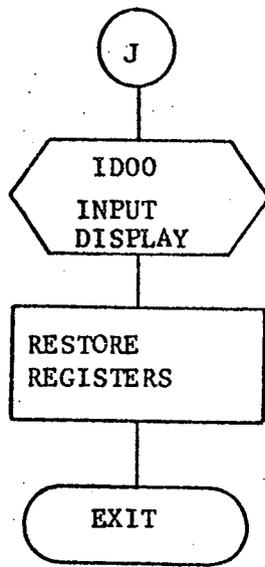


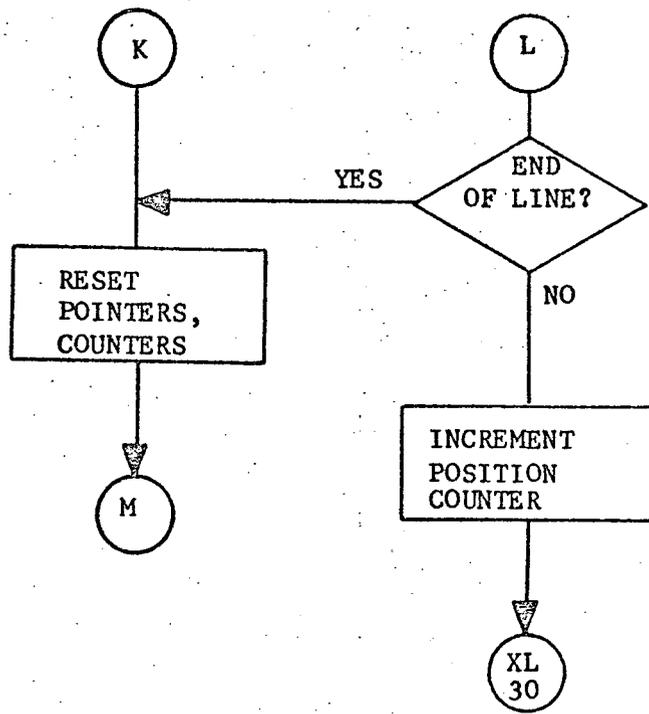


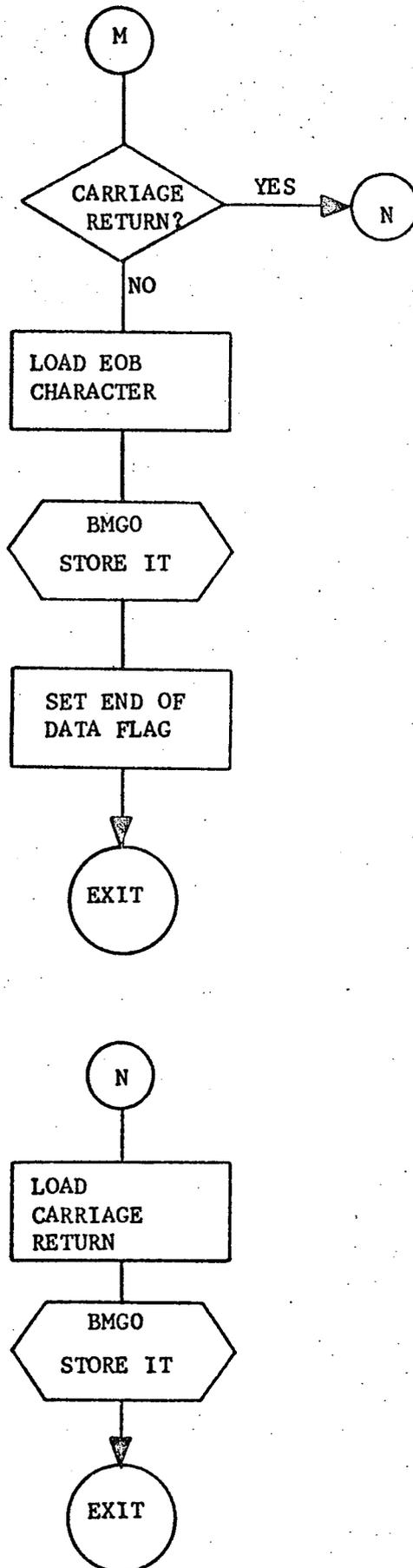












3.3.5 CPOO - Control Program

3.3.5.1 Purpose

The purpose of this routine is to control the processing of the user-input display requests. This processing includes:

- acceptance of a request to display a specified form.
- retrieval and display of a different form or a different page of the same form.
- recognition of an error in the input display.
- compliance with a user request to redisplay the page being displayed or the first page of the form being displayed.

3.3.5.2 Technical Description

After control is received from routine IN00, the user is requested to select a form to be displayed. Once that form is selected and input to CPOO, the request is analyzed. Its contents should consist of a form number and a page number to be displayed. If the form number is illegal, an error message is printed on the CRT. A legal form number causes the forms table to be searched for the address of the beginning of the selected form. It is found and its first page is displayed on the CRT to allow the user to fill in the information for the form. Upon completion of the form, the user transmits his next request to the program by affecting the form number or page number. The possible requests that may be received and the subsequent processing

are described below:

a. Present Page is Complete and Correct

This request is recognized by the condition that neither the form number nor the page number have changed. Upon receipt of this command, CPOO calls on Build Metadata Record (BMOO) to build and store the output record in the tape output buffer (MTO\$). Should this be the last page of the form, CPOO calls Output Metadata Record (MDOO) to write the entire tape output buffer. The Metadata Output Buffer Pointer (MPT\$) is reset and the Metadata Output Buffer blank filled. The page number is reset to one (1) and the Build Display routine (BD00) is called.

b. Error in Data Recording on Current Page

This request is recognized by receipt of a page number of X. The user has recognized a mistake in recording the data for this page and wishes to correct it. CPOO simply recalls routine OD00 for a re-display of the present page of the background form.

c. Error in Current Form

This request is recognized by the receipt of a form number of X. This requires the display of page one of the current form. CPOO blank fills the Metadata Output Buffer (MTO\$) and resets the Metadata Output Buffer Pointer (MPT\$). The page number is reset to one (1). The Build New Display routine is called to build the new CRT Output Buffer. Output Display (OD00) is then called.

d. New Form Request

This request is recognized by a change in form number. The Metadata Output Buffer is blank filled. The page number is set to one (1) and the Metadata Output Buffer Pointer is reset. The Build New Display routine is called with the new form and page number. The Output Display routine is then called.

e. Dump Record Request

This request is acknowledged when a "D" is found in the form number. Routine D000 is called to backspace the output tape one record, read the record in, and dump it to the teletype. After the dump is complete, a form number to display is requested via the CRT.

f. Present Page Complete but Incorrect

This request is the same as request a. but routine CP00 detects some error in the input information and will not accept the record for output onto the tape. The line number of the error is determined, converted to ASCII, and displayed, along with an error message, to allow the user the opportunity of correcting the erroneous data.

g. Terminate Output Request

This request is recognized by the receipt of an asterisk for a form number. The Metadata Output Buffer is blank filled and an End of Record (EOR) is written in the first position of the output buffer. An end of file mark is written on the output tape and it is rewound.

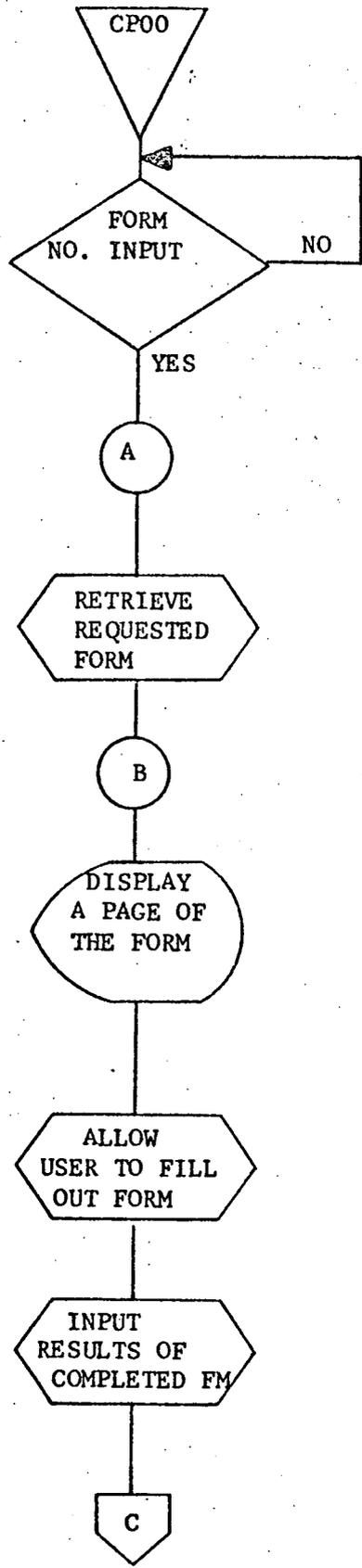
3.3.5.2.1 Calling Sequence

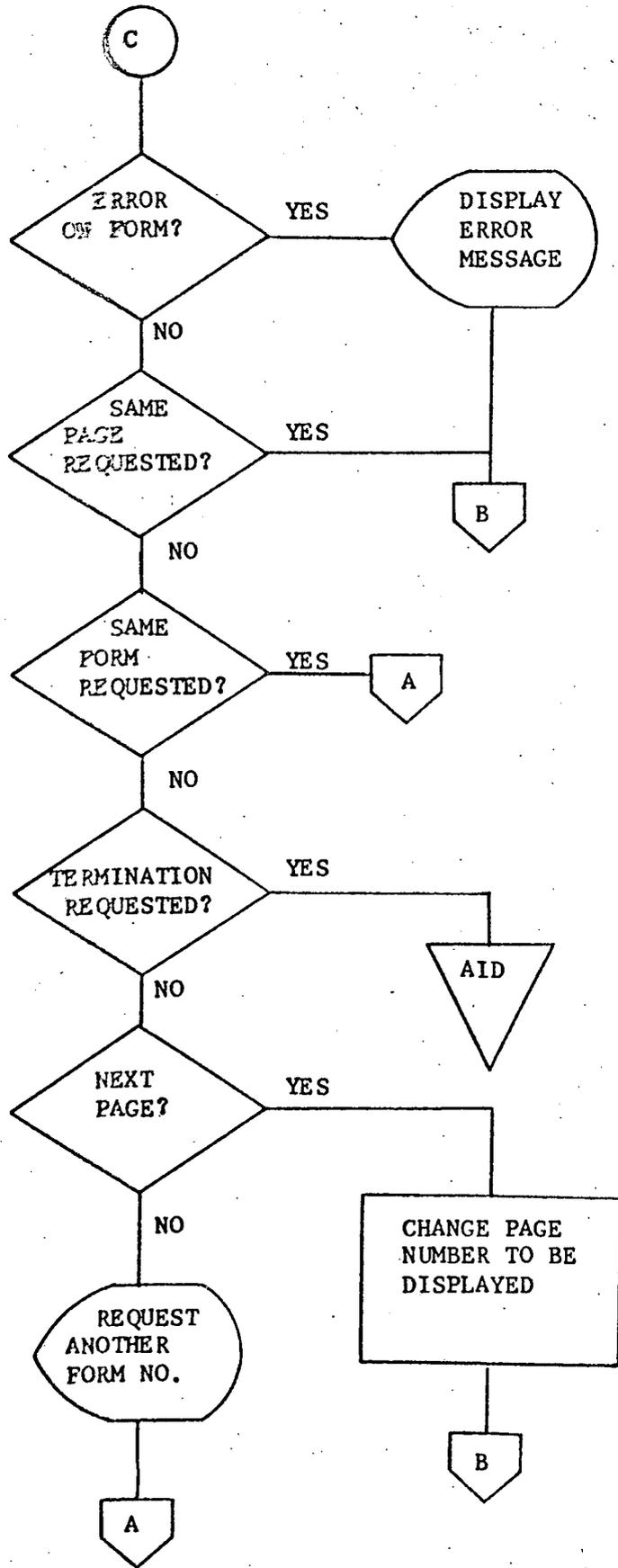
JMP CPOO

PARAMETER

None

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	destroyed	
B	destroyed	
X	destroyed	
Overflow	destroyed	





3.3.5.3 Label Description

3.3.5.3.1 Local Labels

CPBI error message buffer "illegal form number"
CPEB display error message buffer
CPEJ teletype message buffer
CPEL error message buffer length
CPFI input form number
CPFO output form number
CPKB ASCII blank
CPKE end of record character
CPLN line number, two word ASCII buffer
CPNW number of words to display
CPPI page number input
CPPO page number output
CPST status indicator

data constants: CPK1, CPK2, CPK4, CPK7, CPK8, CPKA, CPKS

3.3.5.3.2 Global Labels

None

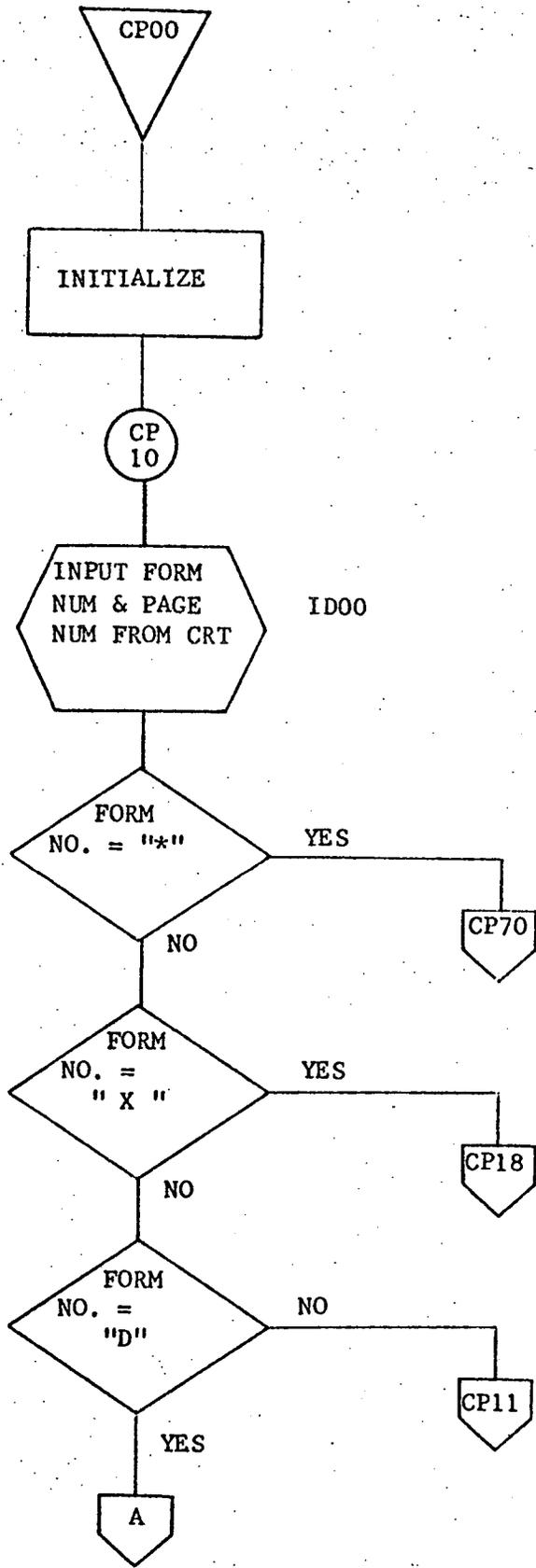
3.3.5.3.3 Entry Points

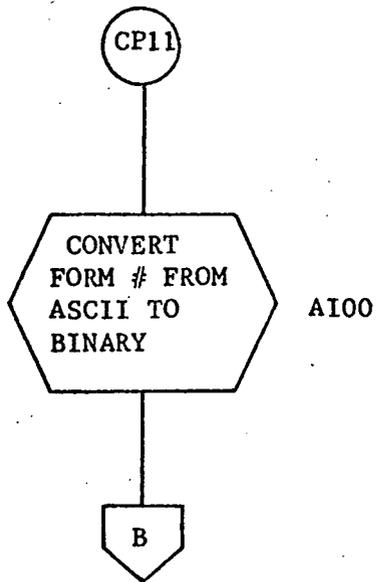
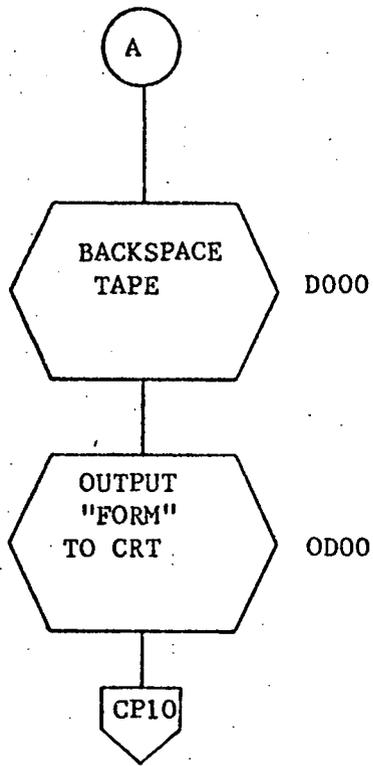
CP00 primary entry point
CP90 blank fill of output buffer
CP98 convert line number from binary to ASCII

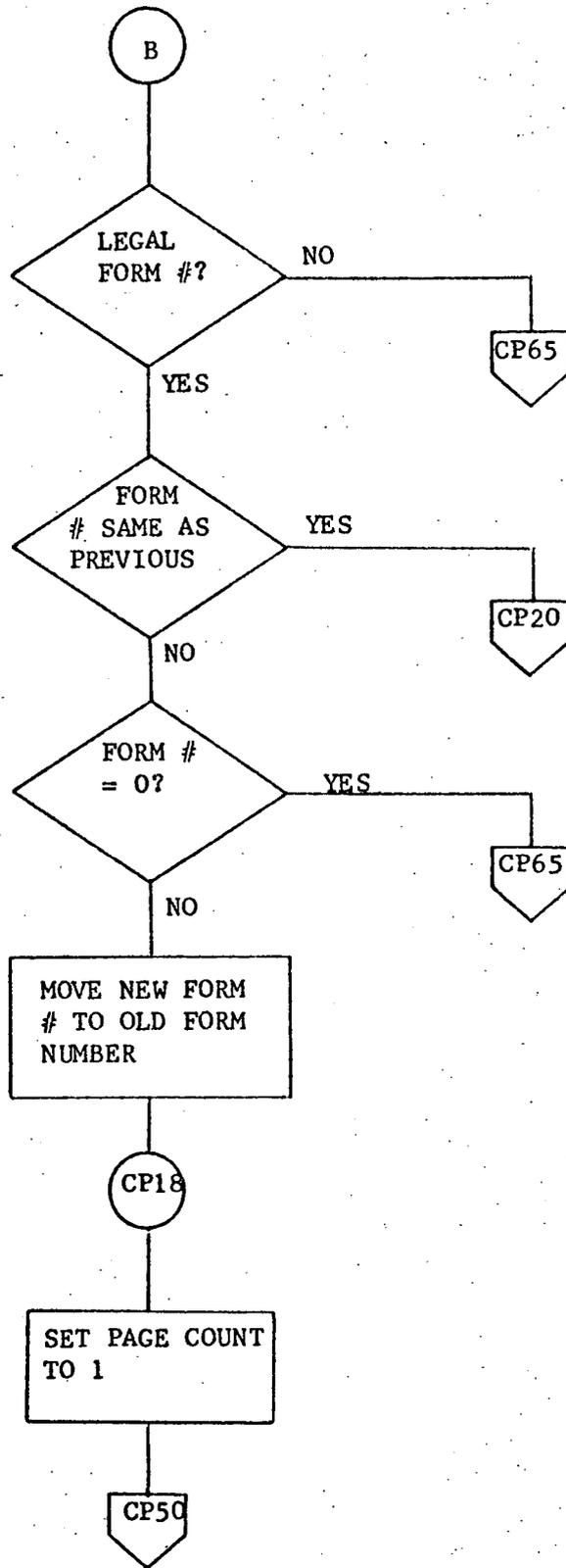
3.3.5.3.4 External References

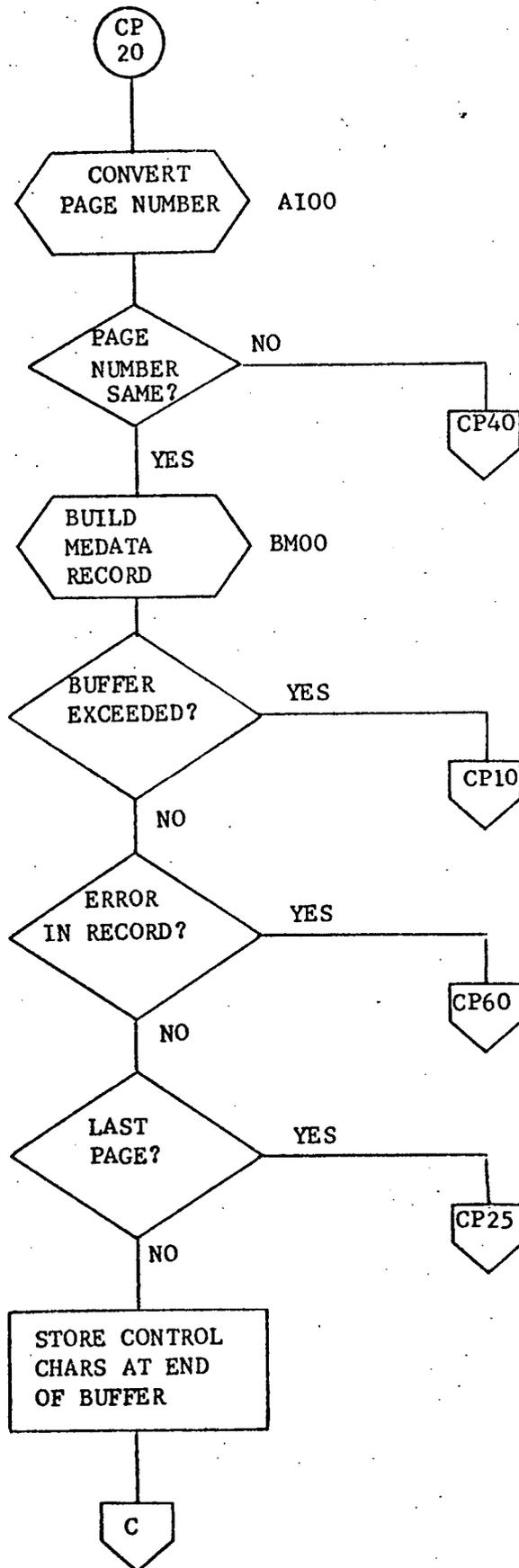
AI00	ASCII to integer conversion entry
BD00	build new display entry
BM00	build Metadata Record entry
CRN\$	input buffer
D000	backspace tape and dump record entry
HCOO	CRT handler entry
HM00	mag tape handler
ID00	input display entry point
MD00	output metadata record entry
MPT\$	output buffer pointer
MTO\$	mag tape output buffer
OD00	output display entry
OZKA	TTY message entry
OZKR	carriage return, line feed to TTY entry
046000	entry to AID II

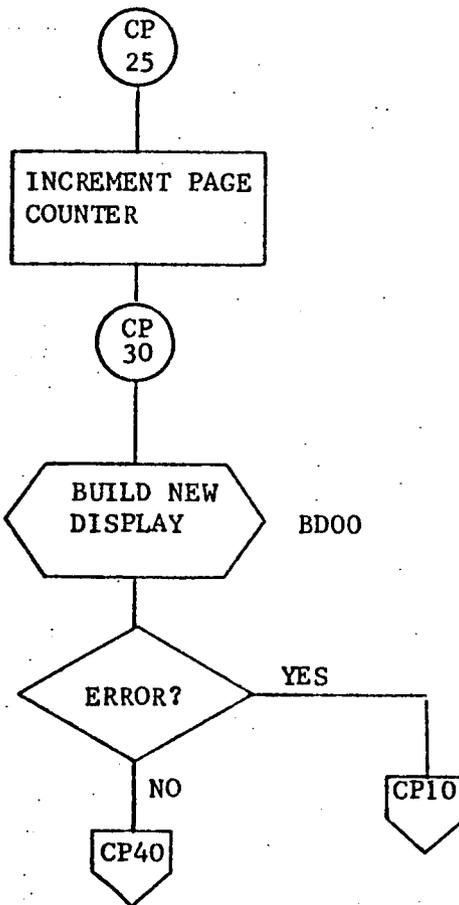
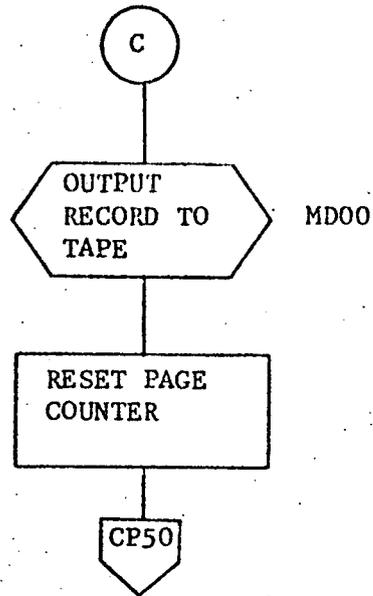
3.3.5.4 Detailed Flow Chart

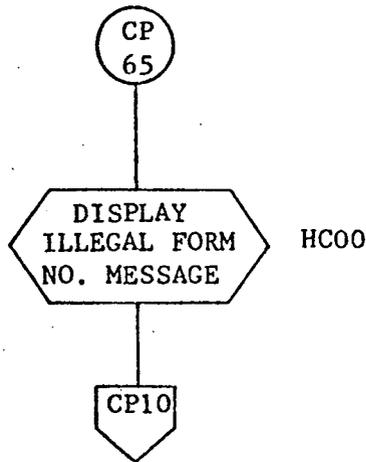
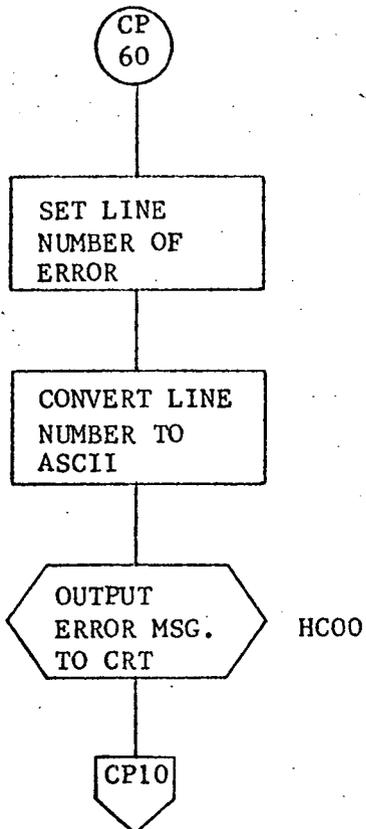


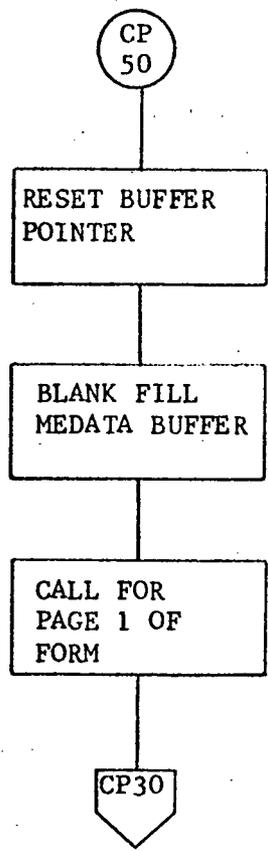
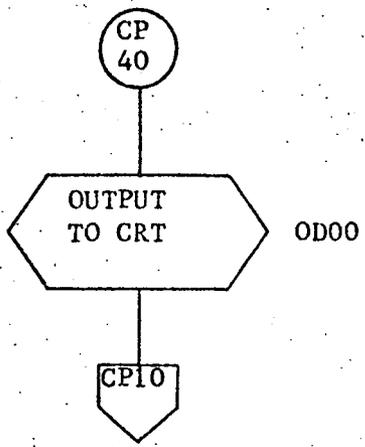












CP
70

BLANK FILL
MEDATA
BUFFER

STORE END OF
RECORD CHAR AT
BEGINNING OF
BUFFER

OUTPUT
BUFFER TO
MAG TAPE

MDOO

WRITE END
OF FILE

HMOO

REWIND
TAPE

HMOO

CONVERT
RECORD COUNT
TO ASCII

OUTPUT
RECORD COUNT
MESSAGE TO
TTY

OZKA

OUTPUT END
OF JOB MSG

OZKA

AID II

3.3.6 D000 (D00) - Dump to Teletype

3.3.6.1 Purpose

The purpose of this routine is to list on the teletype 1) a form already resident in core (D00) or 2) a form that was just written on tape (D000).

3.3.6.2 Technical Description

This subroutine has two entry points. From one entry (D00), the calling routine specifies in the calling sequence the beginning address of the buffer to be printed. This allows output from any location in memory. From the other entry point (D000), the form to be printed is on tape and must be input to the computer before it can be output to the teletype. In both cases, the format of the buffers is the same as the tape format. (See Appendix A). The processing portion of the routine removes all extraneous codes and formats the data similar to the CRT format (See Appendix B). Appendix E has a sample teletype output. A description of the special codes follows.

<u>Character</u>	<u>Code</u>	<u>Purpose/Processing of Code</u>
end-of-block	(224 ₈)	the first one is output as a carriage return and line feed. Any subsequent consecutive such characters are ignored.
end-of-page	(241 ₈)	this character is converted to a carriage return and line feed.

Character	Code	Purpose/Processing of Code
end-of-record	(236 ₈)	this character signals the end of processing (listing).
carriage return	(215)	this character signals the end of processing (listing).
level code		This is a digit from one to nine. It is output as consecutive blanks. The number of blanks is equal to the value of the level code.
sequence number		ignored.

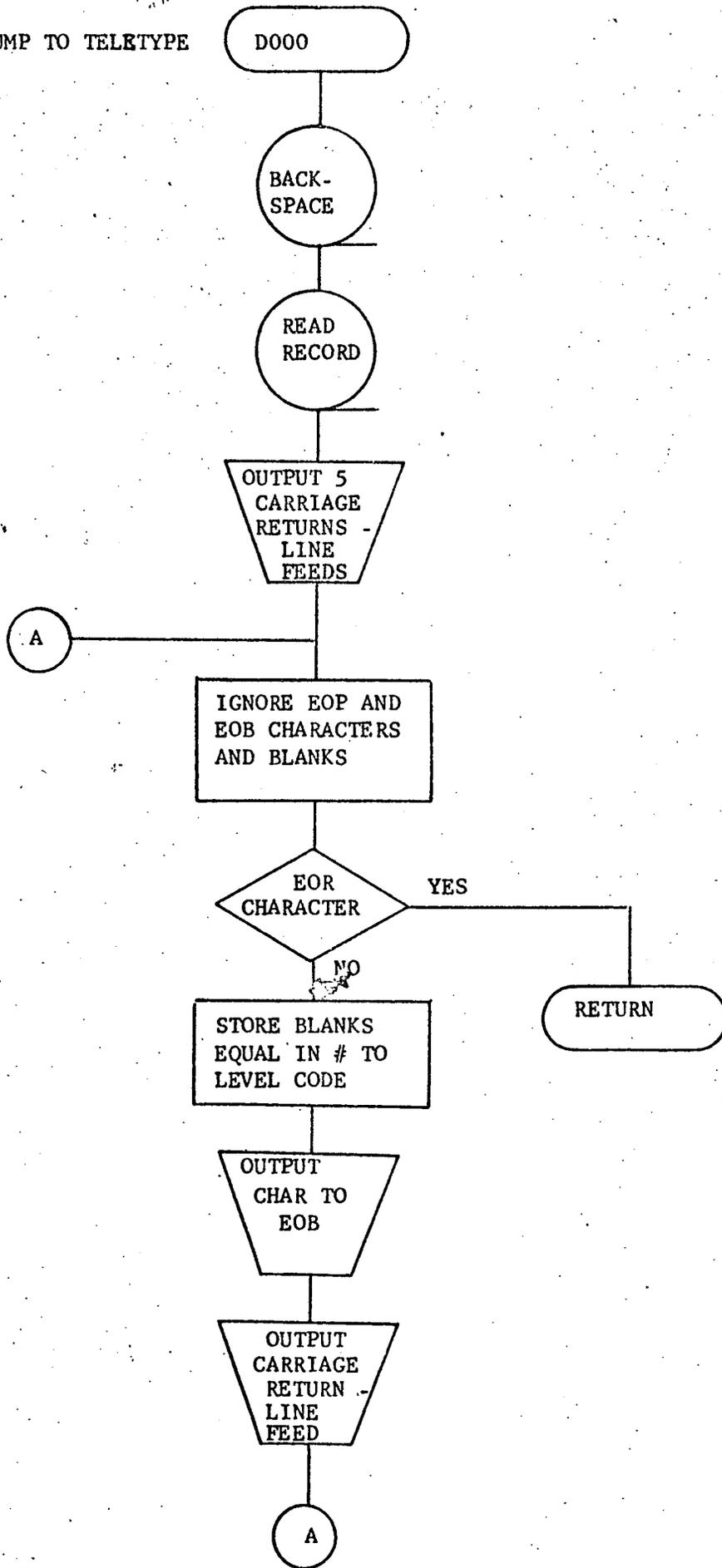
3.3.6.2.1 Calling Sequence

CALL D000 or
CALL D00,A, B

PARAMETER	FUNCTION
A	the address of the beginning location of the buffer containing the form.
B	the number of words in the buffer.

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	N/A	N/A
B	N/A	N/A
X	N/A	N/A
Overflow	N/A	N/A

DUMP TO TELETYPE



3.3.6.3 Label Description

3.3.6.3.1 Local

- DBUF - save location for beginning address of buffer to be output
- DCS - a switch used to determine which character is to be unpacked next
- DEB - the save location for the ending location +1 of the buffer to be output
- DST - the status word used with the tape read
- DSV - save location of the second character of a word containing two characters
- DX - save location for X-register in DGET.

3.3.6.3.2 Global

None

3.3.6.3.3 Entry Point

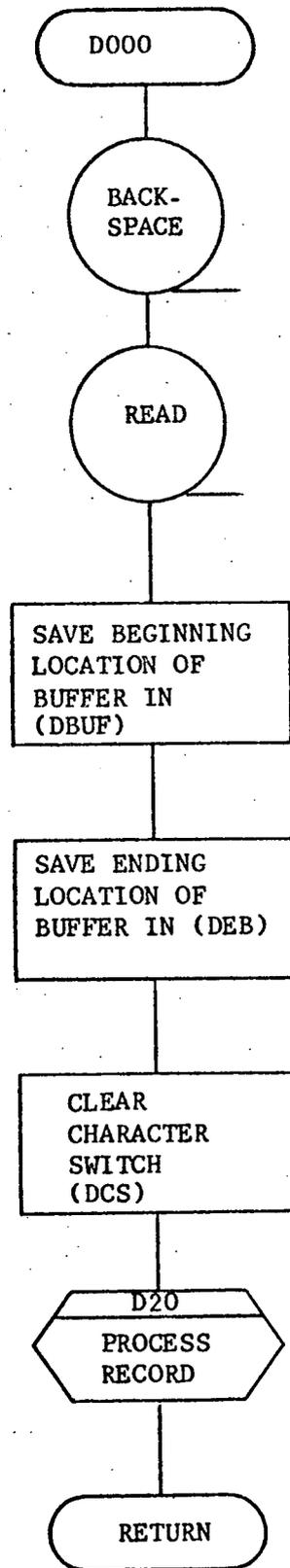
D000 - primary entry point

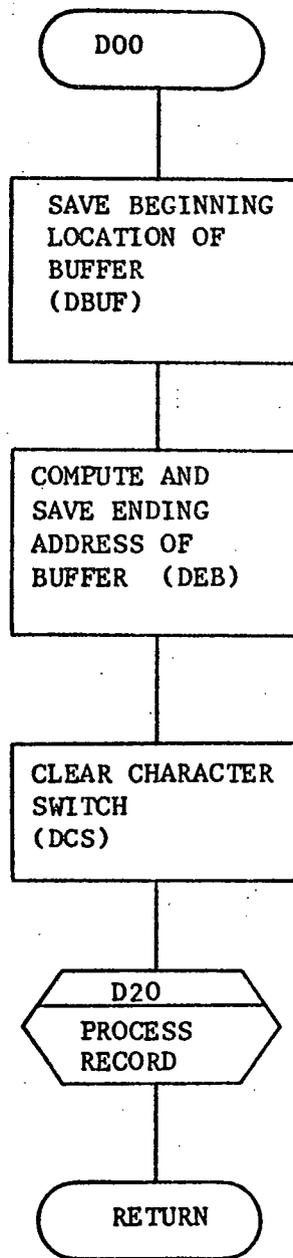
3.3.6.3.4 External References

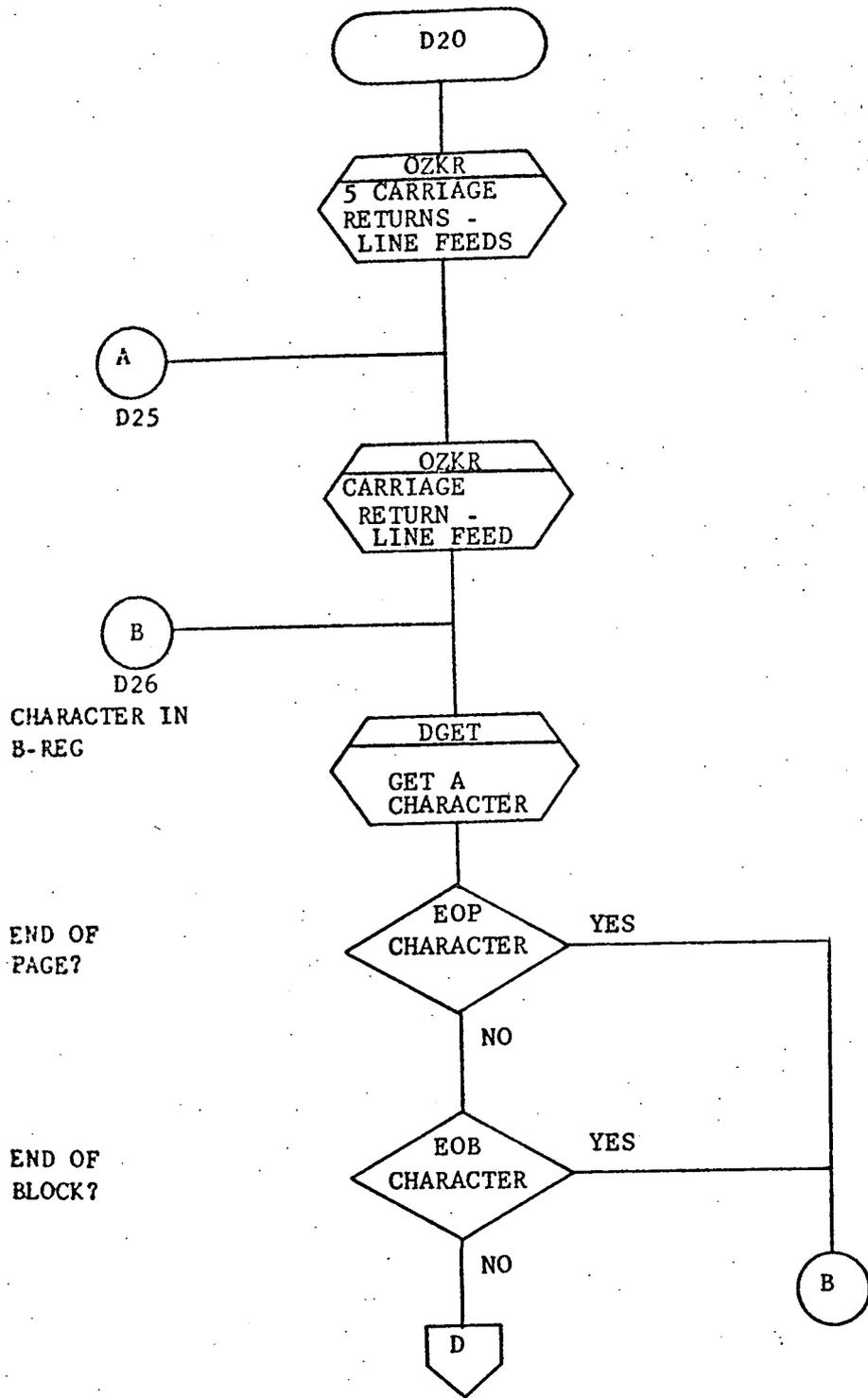
HMOO - tape handler used to manipulate magnetic tape

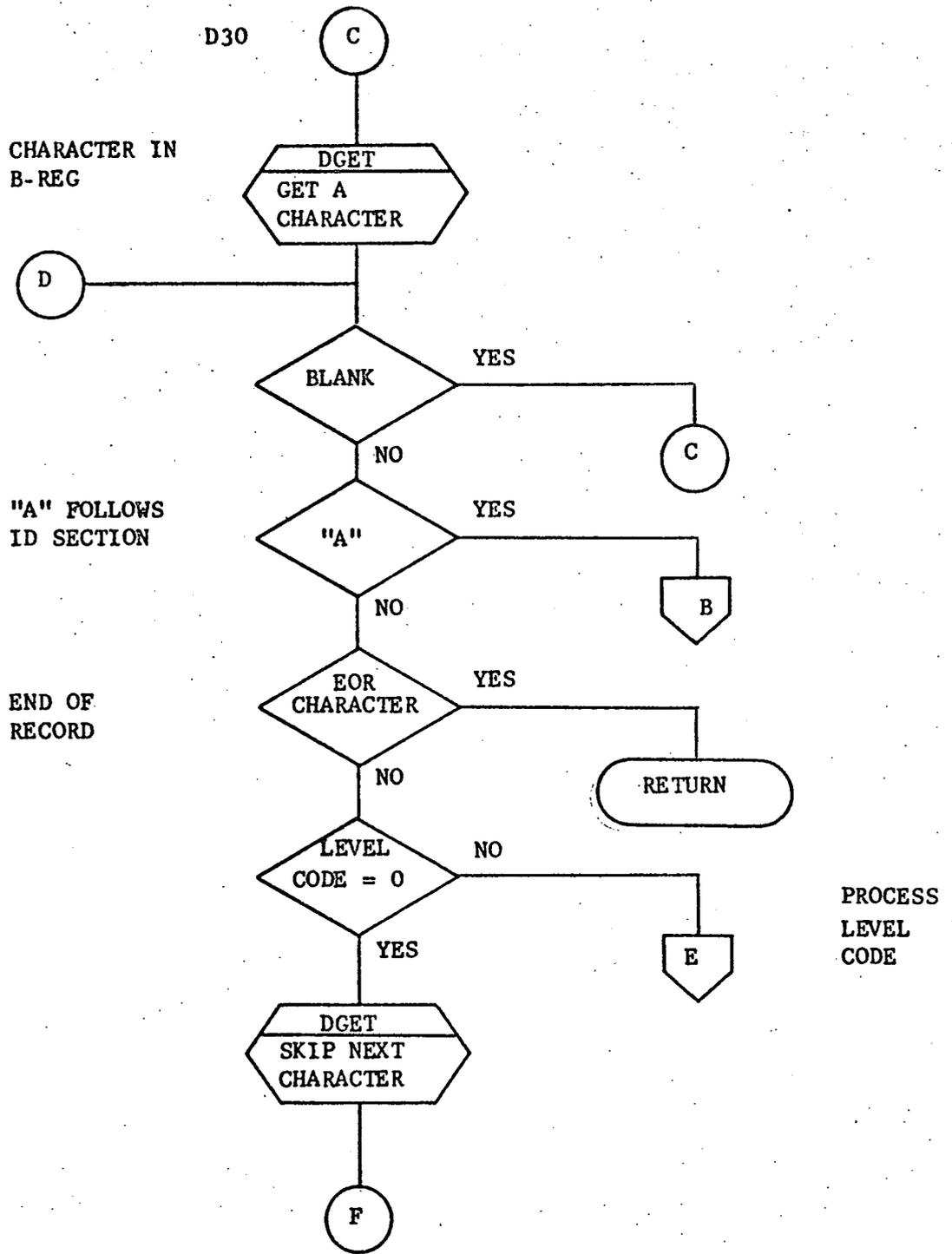
MTO\$ - tape output buffer.

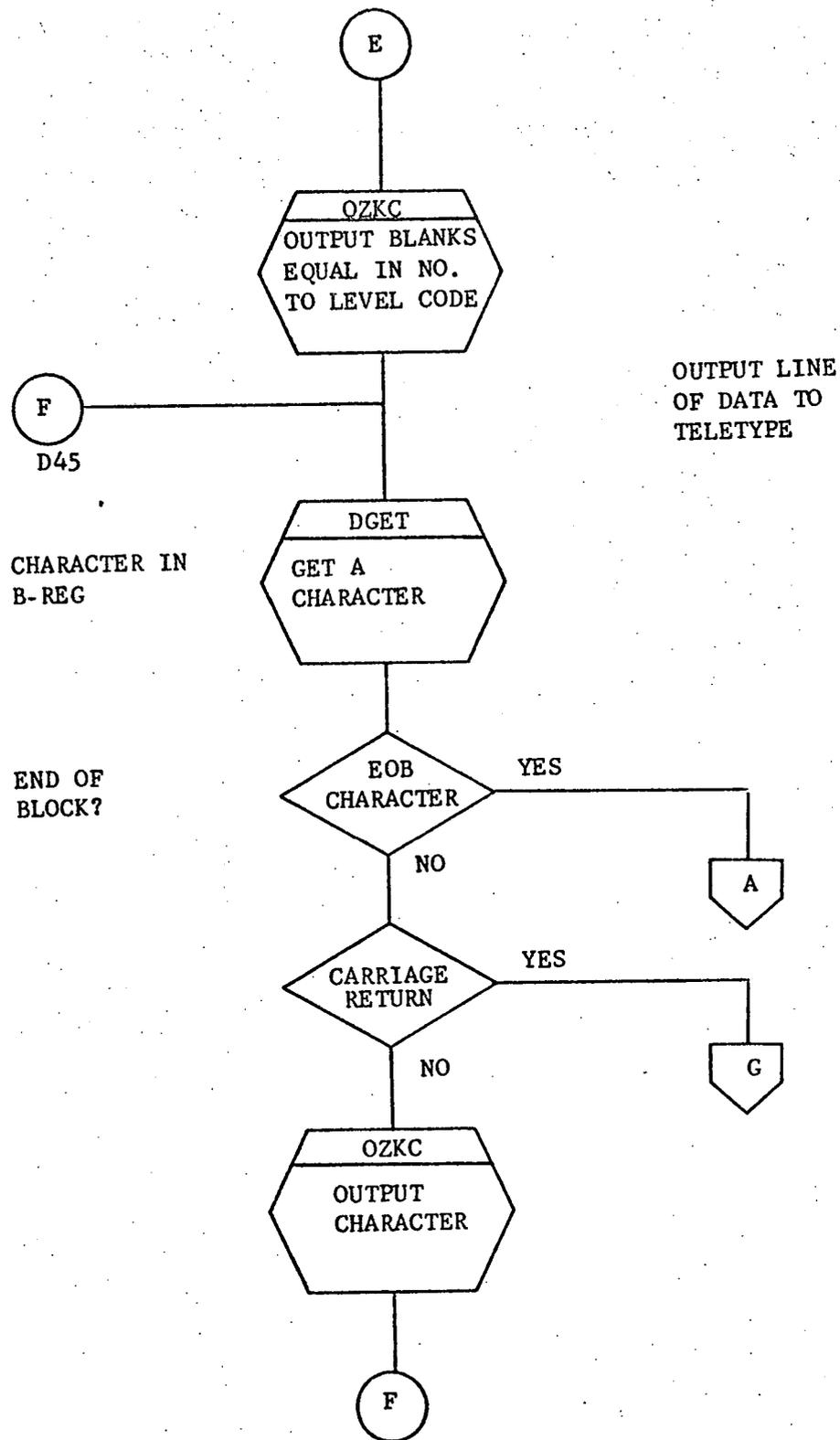
3.3.6.4 Detailed Flow Chart



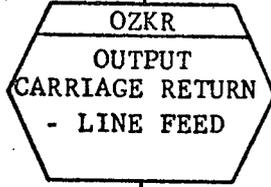




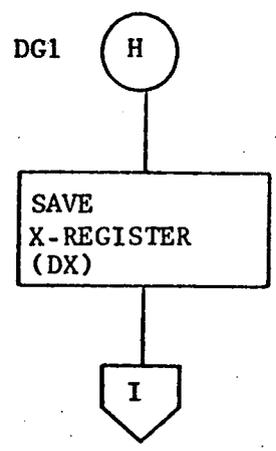
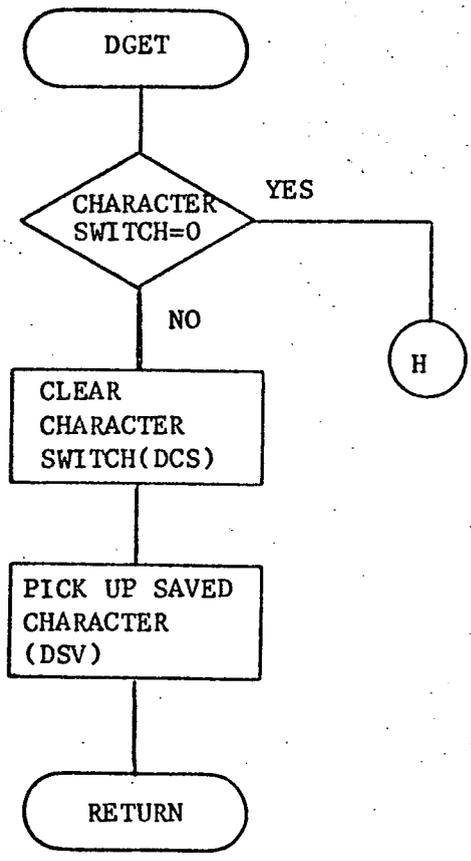


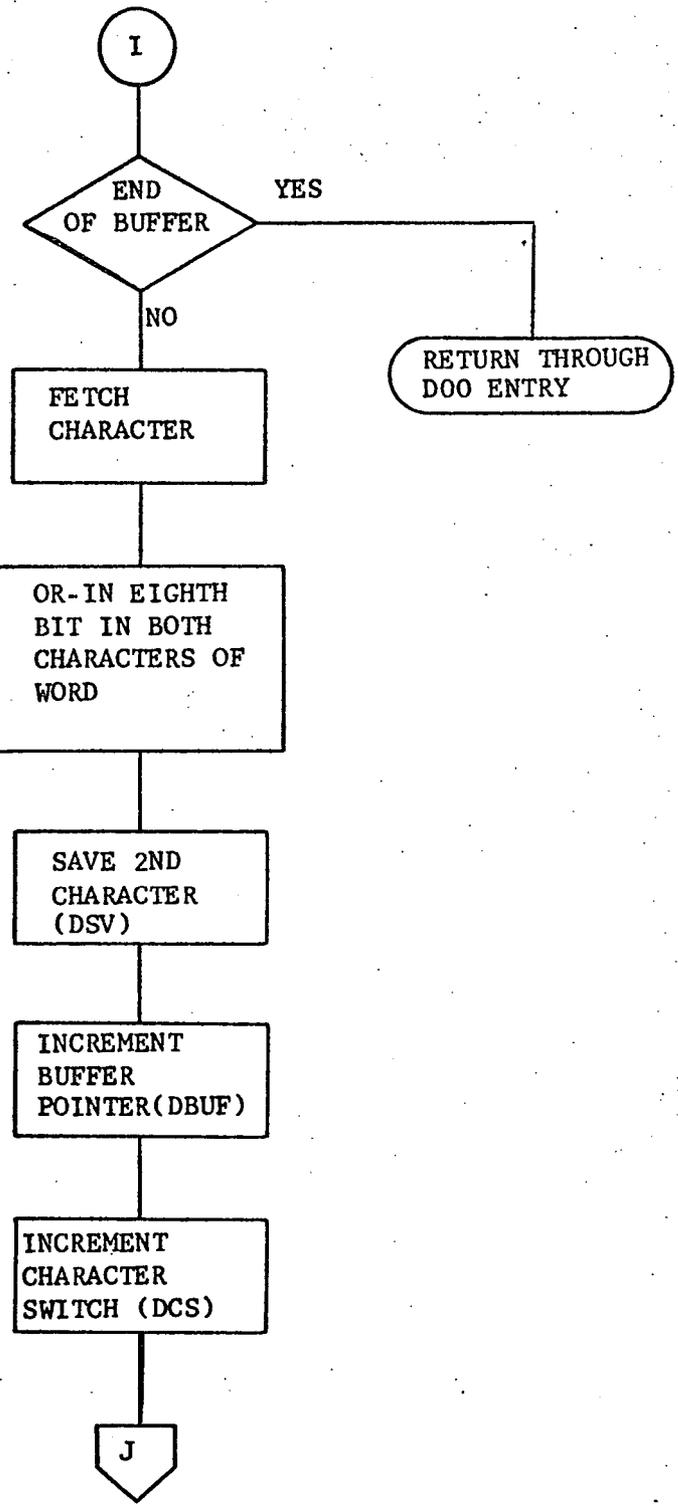


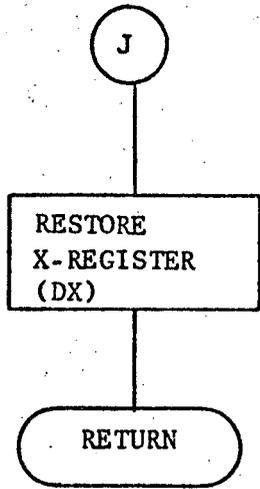
D50



UNPACK A CHARACTER FROM BUFFER (DBUF)







3.3.7 HCOO - CRT Input/Output Routine

3.3.7.1 Purpose

HCOO is a general purpose CRT input/output routine. The purpose of the routine is to reduce the amount of duplicated effort normally inherent in a programming task when individual users develop their own I/O programming for a commonly used peripheral device. HCOO allows processing in the calling program to take place while the data transfer is occurring. In order to accomplish this, HCOO was designed to return control to the user as soon as the I/O was initiated. The CRT status is made available to the user by HCOO at the completion of the data transfer.

3.3.7.2 Technical Description

HCOO performs three input/output functions: input from the CRT, clear the screen and output to the CRT, and output to the CRT without clearing the screen. In addition to the desired I/O function, the calling program provides HCOO with the address of the data buffer, the number of words to transfer, and a status word for HCOO to update. The calling program must supply in the data buffer the CCI CRT function and control characters necessary to obtain the desired results at the CRT display. Reference the CC-30 Communications Station Reference Manual for a description of these functions and control characters.

All data buffers are transferred by HCOO in a block mode under control of the BIC. The beginning and ending address of the buffer to be transferred are loaded into the BIC initial and final registers by HCOO.

HCOO also sets up the Asynchronous Half Duplex Controller for input or output since this is a one-way device only. The Priority Interrupt Module (PIM) is enabled to honor interrupts caused by the BIC End of Transfer and the INT key on the CCI keyboard. If a clear operation is requested by the function argument, a 'halt local I/O' command and a 'clear' control character are sent to the CCI controller on a programmed I/O basis (BIC not used) before the data buffer is output. If input is requested by the calling program, HCOO outputs a 'transmit' control character to the CRT and then sets the Half Duplex Controller up to receive input.

For both input and output, HCOO returns control to the calling program after the BIC transfer has been initiated. HCIN, the interrupt processing subprogram, regains control when the input/output operation is complete, checks for CRT parity error, number of words transferred, etc., and then after setting the user status word, returns to the calling program. (See Calling Sequence for details on STATUS.) The BIC end of transfer interrupt will cause HCIN to regain control on any fixed length data transfer where the calling program knows the exact length of the record. If the length of the record is not known (such as a variable length input), the user must test for completion of transfer by checking for the termination of the CARRIER ON signal at any time for the on-line CRT, or using a time-out routine for the modem CRT. When the user determines that the variable length input is complete, he must call HCIN to get the status and/or number of words transferred. Again, on fixed length records, HCIN will be called automatically when the BIC EOT interrupt occurs.

User interface notes:

- HCOO assumes that the calling program will determine when HCOO should be called to input from the CRT. HCOO facilitates the use of the INT key for this purpose by setting an indicator HCKI when the INT key is depressed. The calling program may then check HCKI at any time to determine if the CRT user desired to input a screen of data.

- There are two control characters that effect the number of characters actually received from the CRT on an input block transfer. They are the new line character (␣) and the end of text character (␣). If the CRT user at the keyboard is free to use these characters at his own discretion, it is very possible to receive variable length records at the computer. This possibility requires the calling program to do two things in relationship to CRT input and the HCOO routine:
 - (1) The receiving buffer should be assigned a buffer area large enough to contain the maximum size record that could originate from the CRT. The number of words passed in the calling sequence should reflect the maximum buffer size.

 - (2) The calling program must periodically check for termination of input as described above.

3.3.7.2.1 Calling Sequence

CALL HCOO,X,Y,Z,STAT

PARAMETER	FUNCTION
X	Address of the I/O function code X = 0 for input X = 1 for output preceded by a clear operation X = 2 for output with no clear operation
Y	Beginning location of data buffer. If Y is an output buffer, the CRT data must be 7 bit ASCII characters, one character per word right justified. All other bits are ignored. If Y is an input buffer, at the completion of the input operation the buffer will contain 7 bit ASCII characters with the 8th bit containing the parity bit (even). Each character will be packed right justified, one character per word with the rest of the word zero.
Z	Number of words (characters) to transfer.
STAT	Status of I/O operation STAT = -1 I/O in progress STAT = -2 CRT parity error STAT = ≥ 0 I/O successfully completed. Number represents the number of words/characters transferred.

Returns

CALL+6

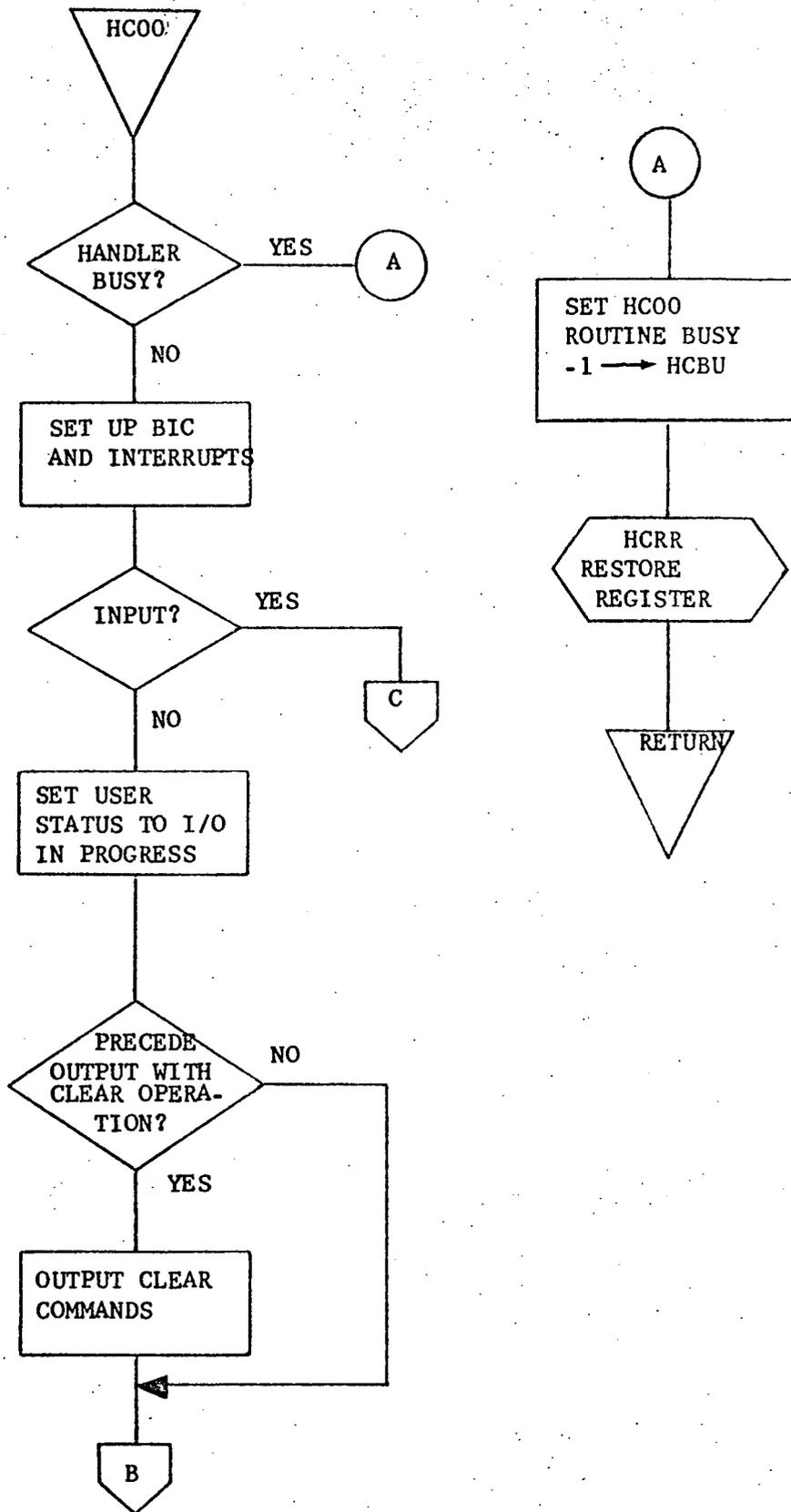
HCOO returns here if a previous I/O request has not been completely processed by HCOO. HCIN must have been entered as a result of a BIC EOT interrupt or a call to HCIN for wrap-up of the I/O function.

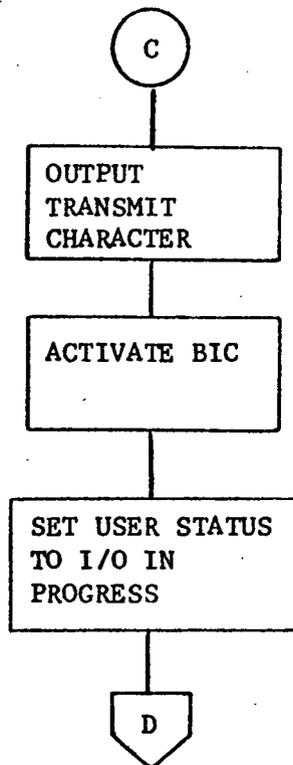
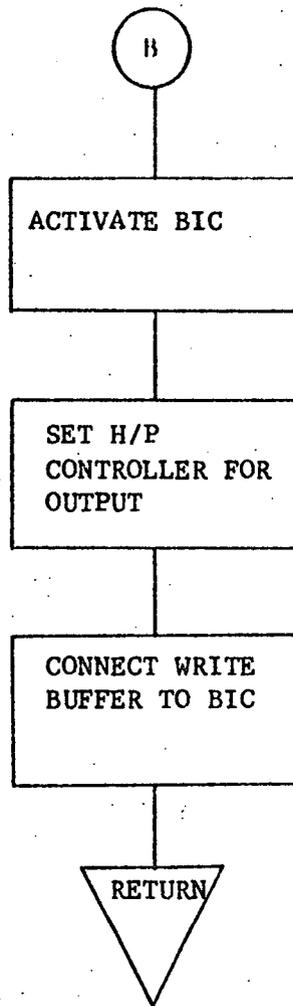
CALL+8

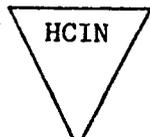
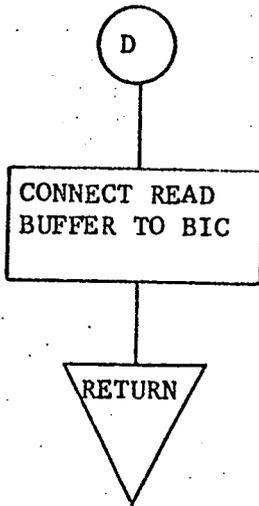
Normal Return. I/O initiated. Calling program must check STAT for completion or determine I/O completion as indicated in the Technical Description.

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	Saved	Restored
B	Saved	Restored
X	Saved	Restored
Overflow	Not used	Not effected

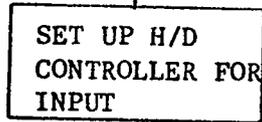
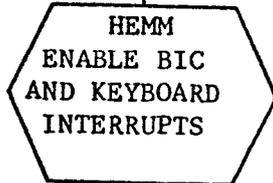
3.3.7.2.2 General Flow Chart



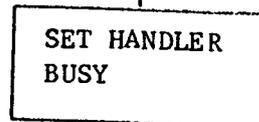
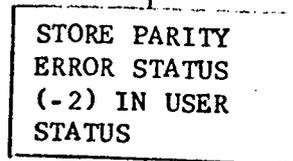




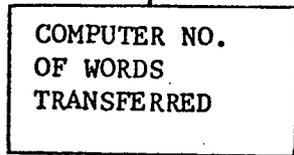
ENTERED AS RESULT OF BIC EOT INTERRUPT OR USER PROGRAM CALL

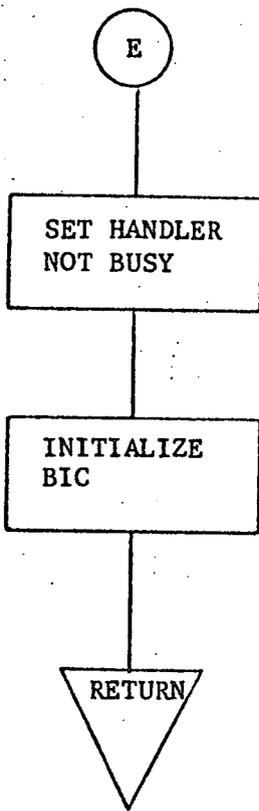


YES



NO





3.3.7.3 Label Description

3.3.7.3.1 Local

HCA Save area for A-Register

HCB Save area for B-Register

HCBU Handler busy indicator - Set to -1 when HCOO still processing previous I/O request

HCCL Clear control character output to CCI controller

HCHL Halt Local I/O function output to CCI controller

HCII Indirect address for subroutine arguments

HCIO Input/output function being performed

HCSB Beginning buffer address. Employed later to compute the number of words transferred.

HCSH SOH control character output to CCI controller

HCTT Transmit control character output to CCI controller

HCX Save area for X-Register

3.3.7.3.2 Global

HCKI Indicator which is incremented by 1 when an interrupt is caused by the INT key being pressed on the CCI keyboard. Used by calling program to determine if user has requested input of CRT data.

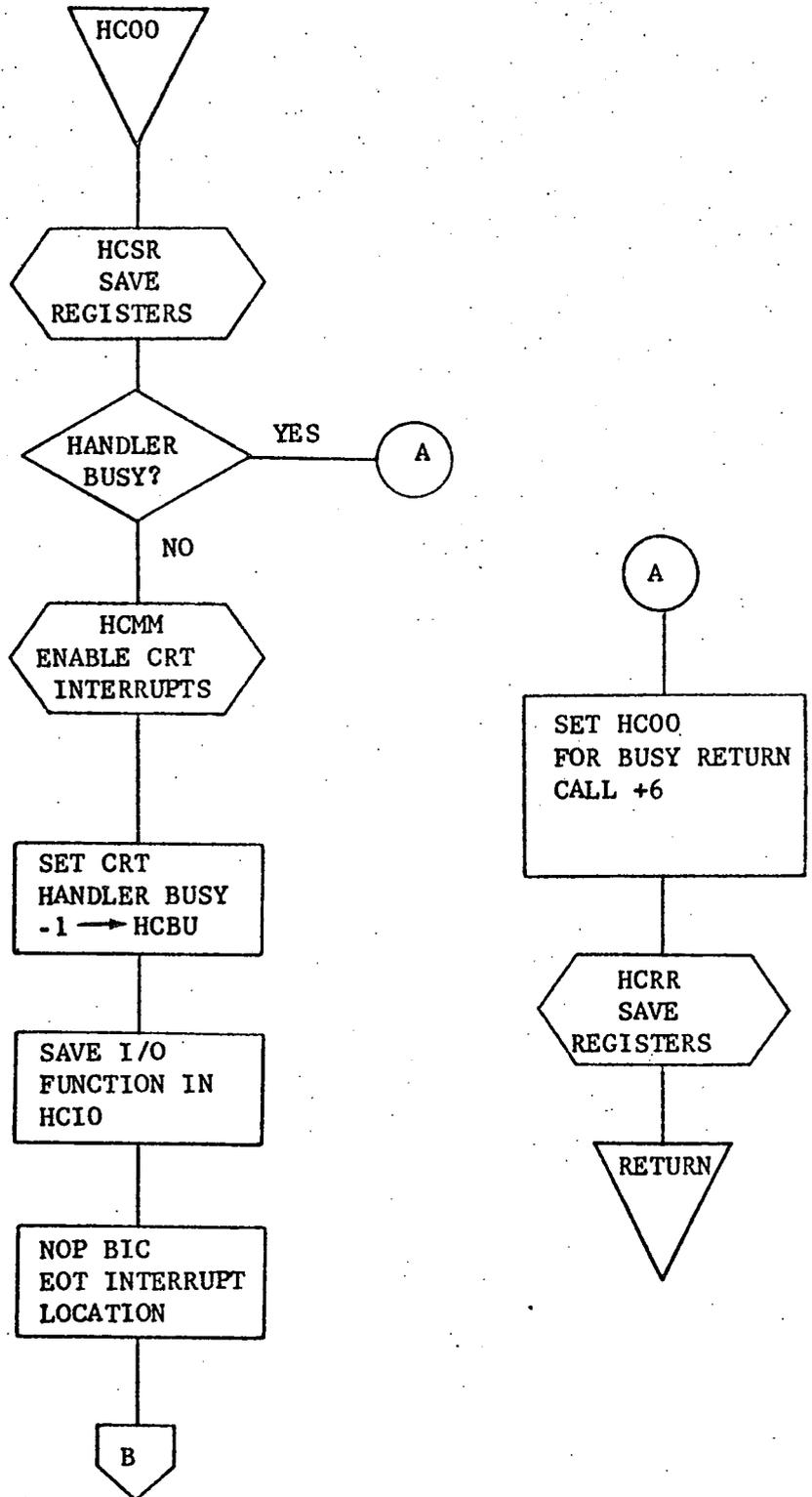
3.3.7.3.3 Entry Points

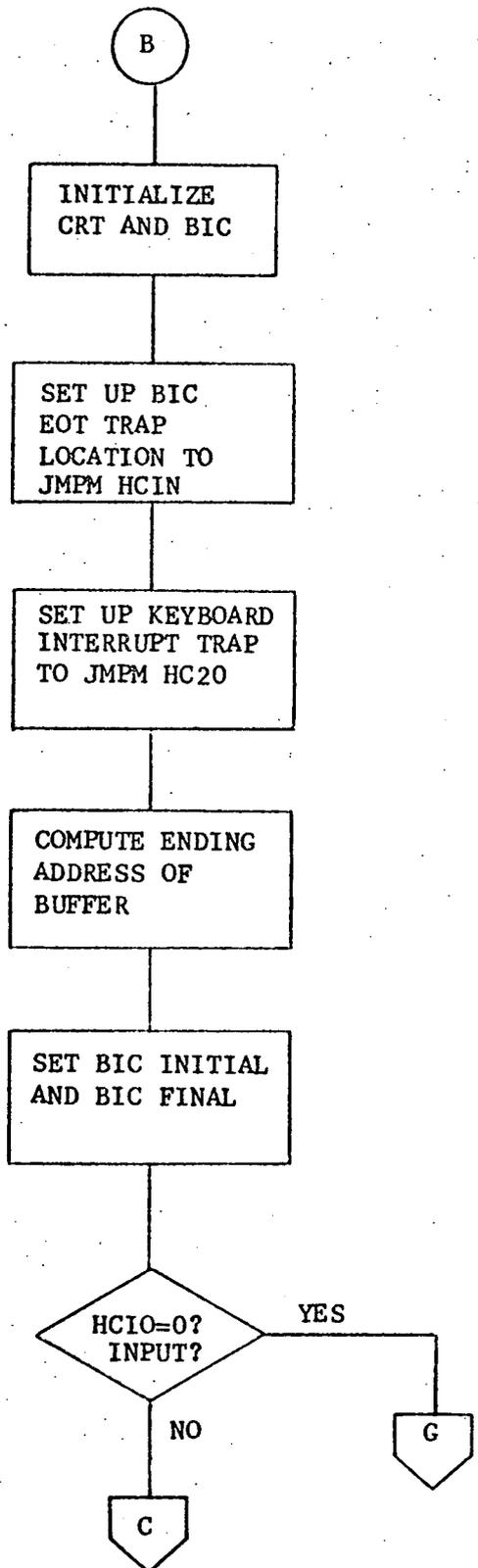
HCIN Entry when calling program has determined I/O is complete and wishes status of CRT device and/or number of words transferred. (Used only when variable length records are input.)

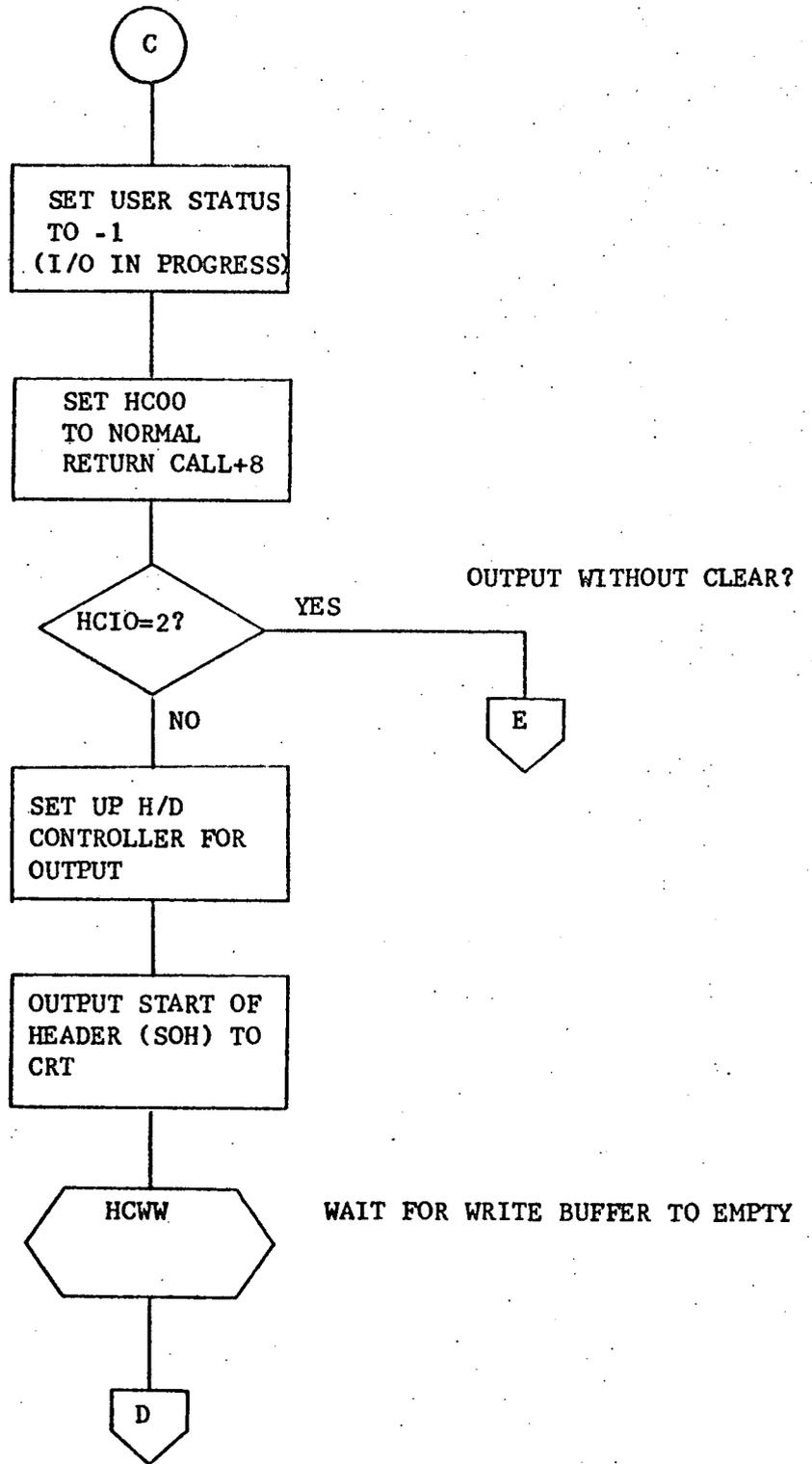
3.3.7.3.4 External References

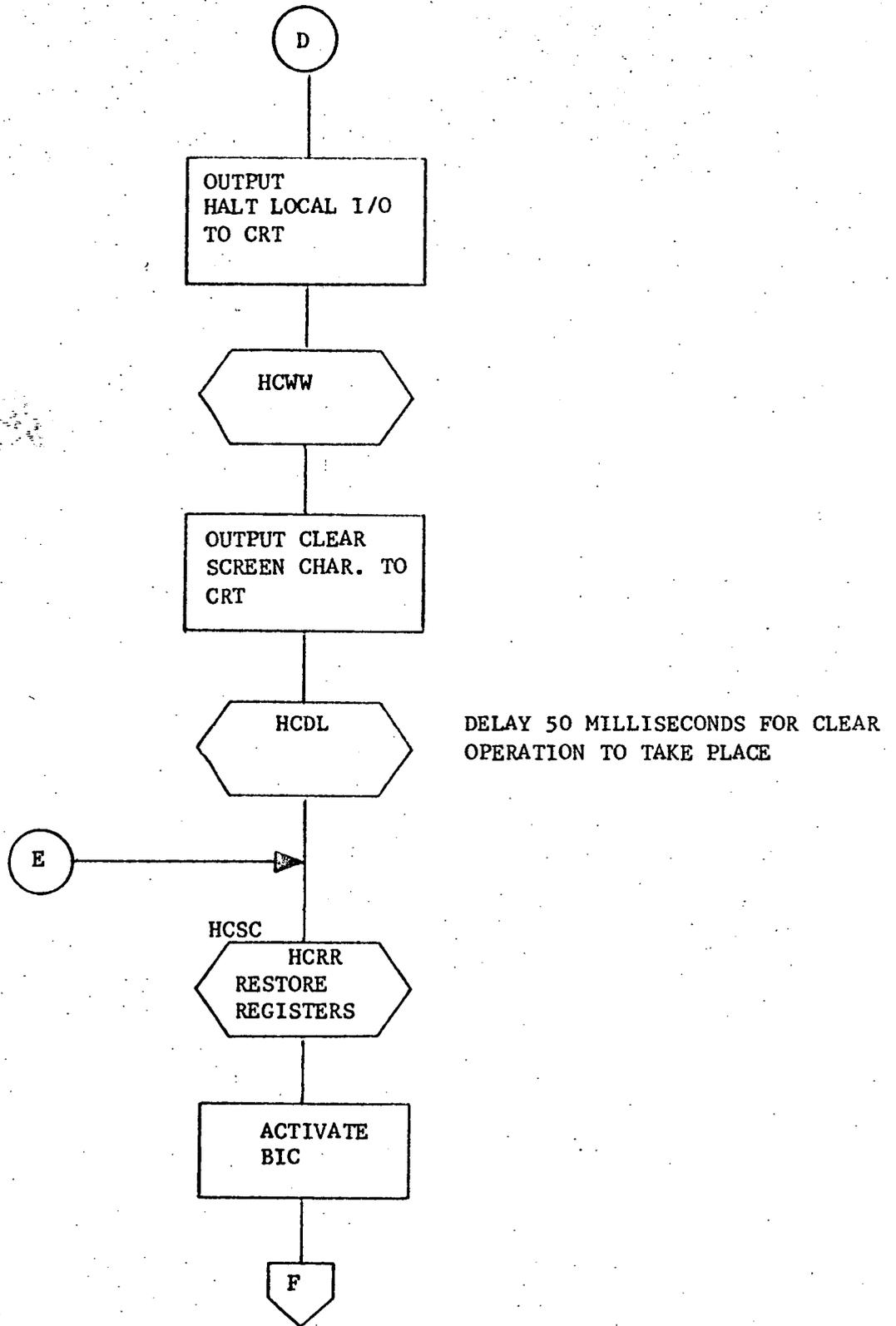
None

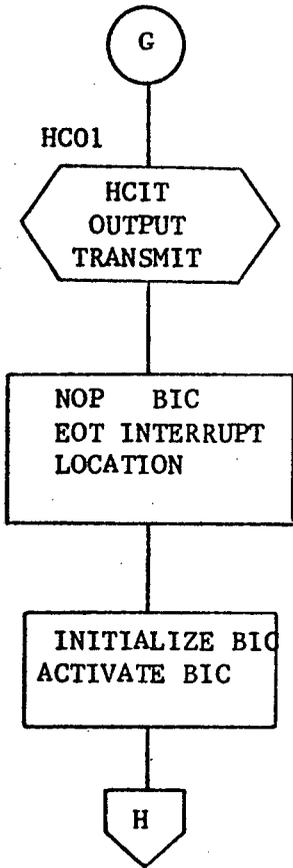
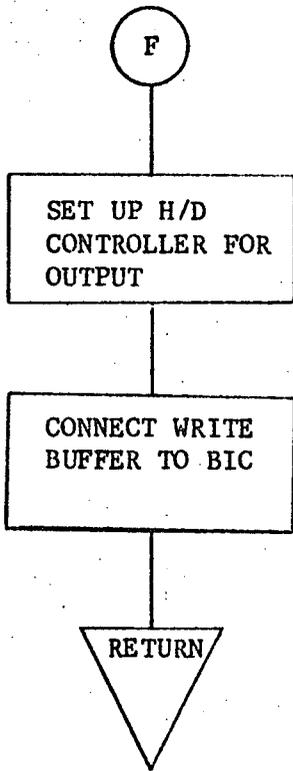
3.3.7.4 Detailed Flow Chart

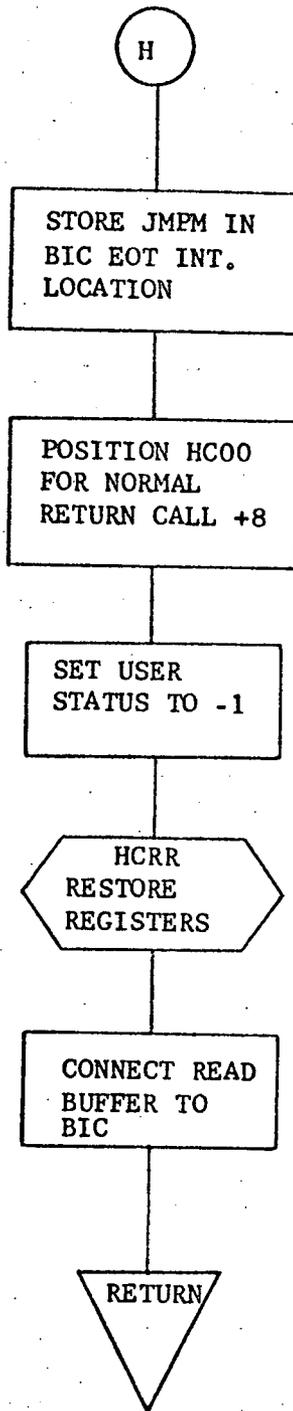




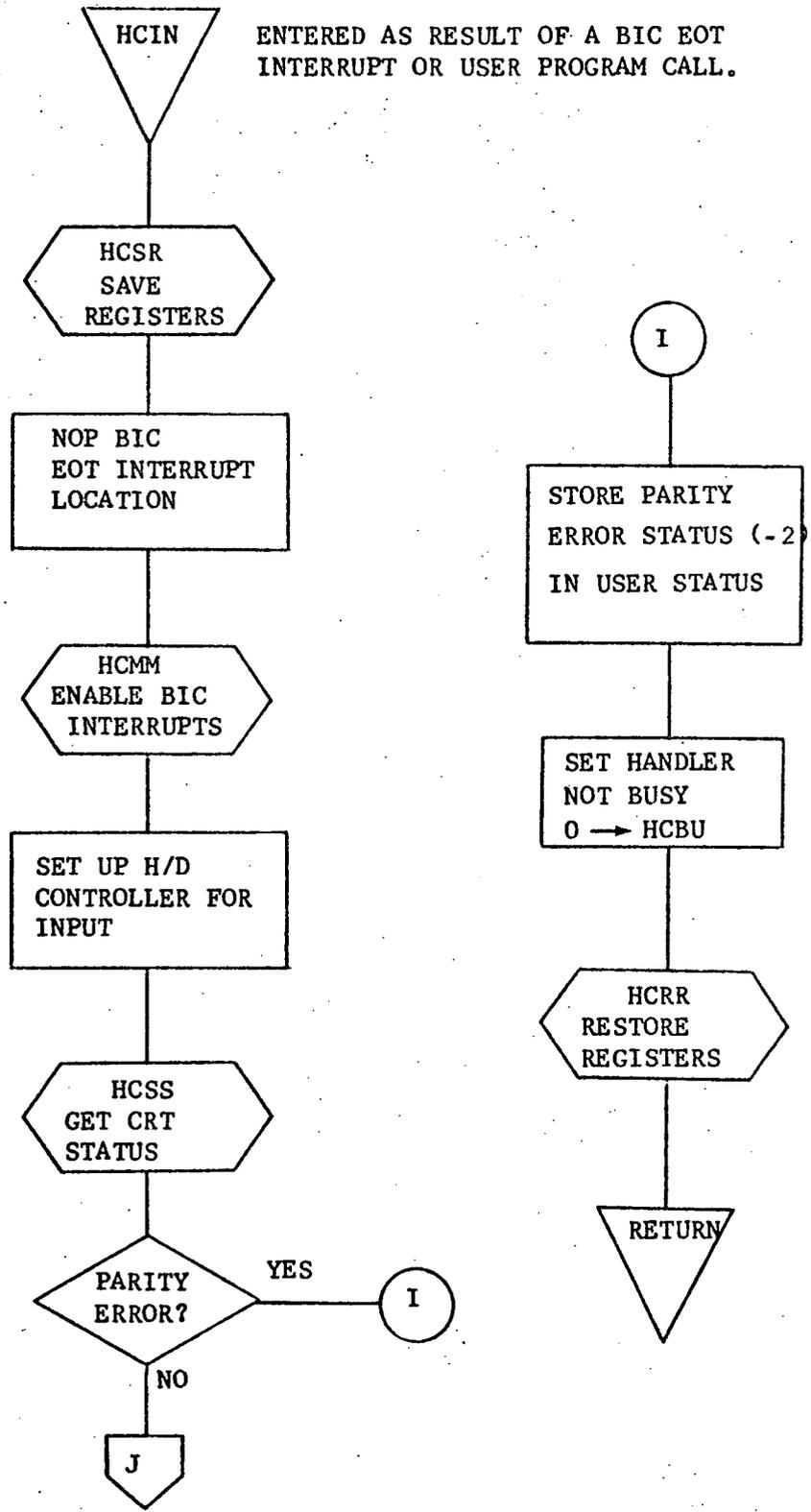


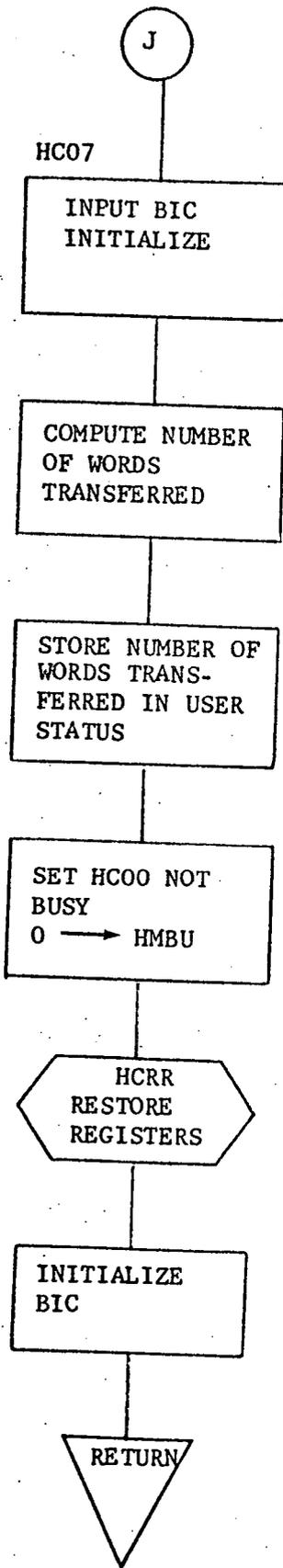






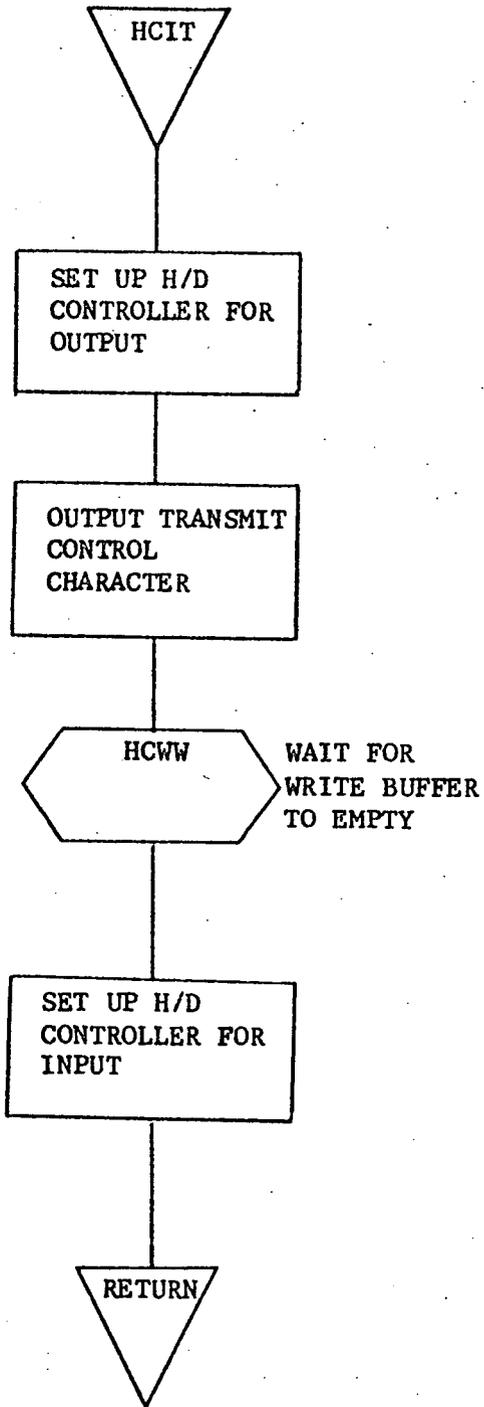
SET USER STATUS TO I/O IN PROGRESS



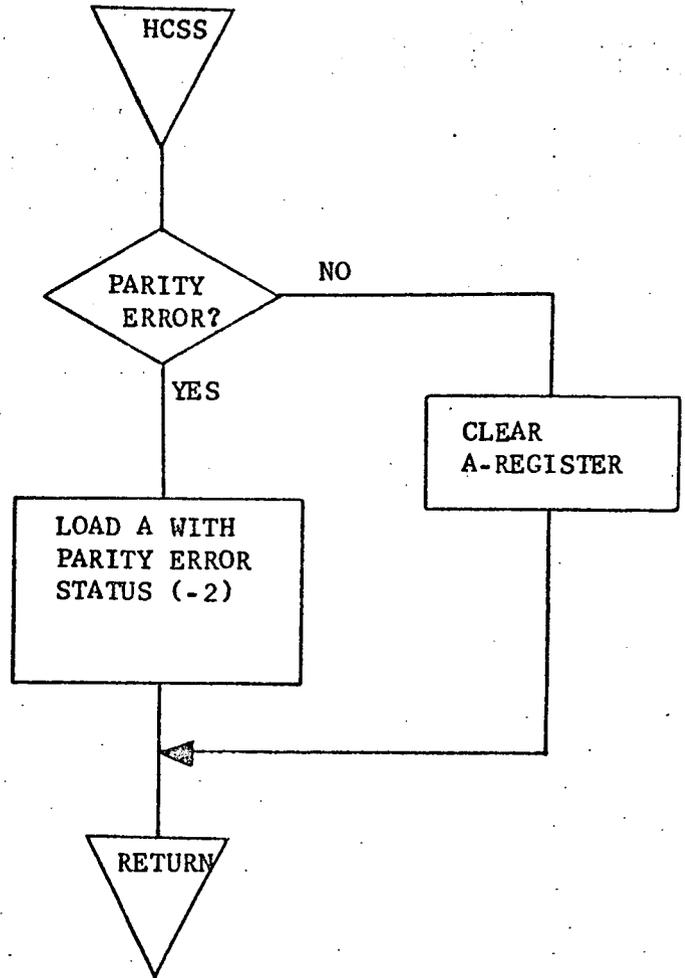


BIC INITIAL CONTAINS THE BUFFER ADDRESS WHERE THE LAST CHARACTER WAS INPUT OR OUTPUT.

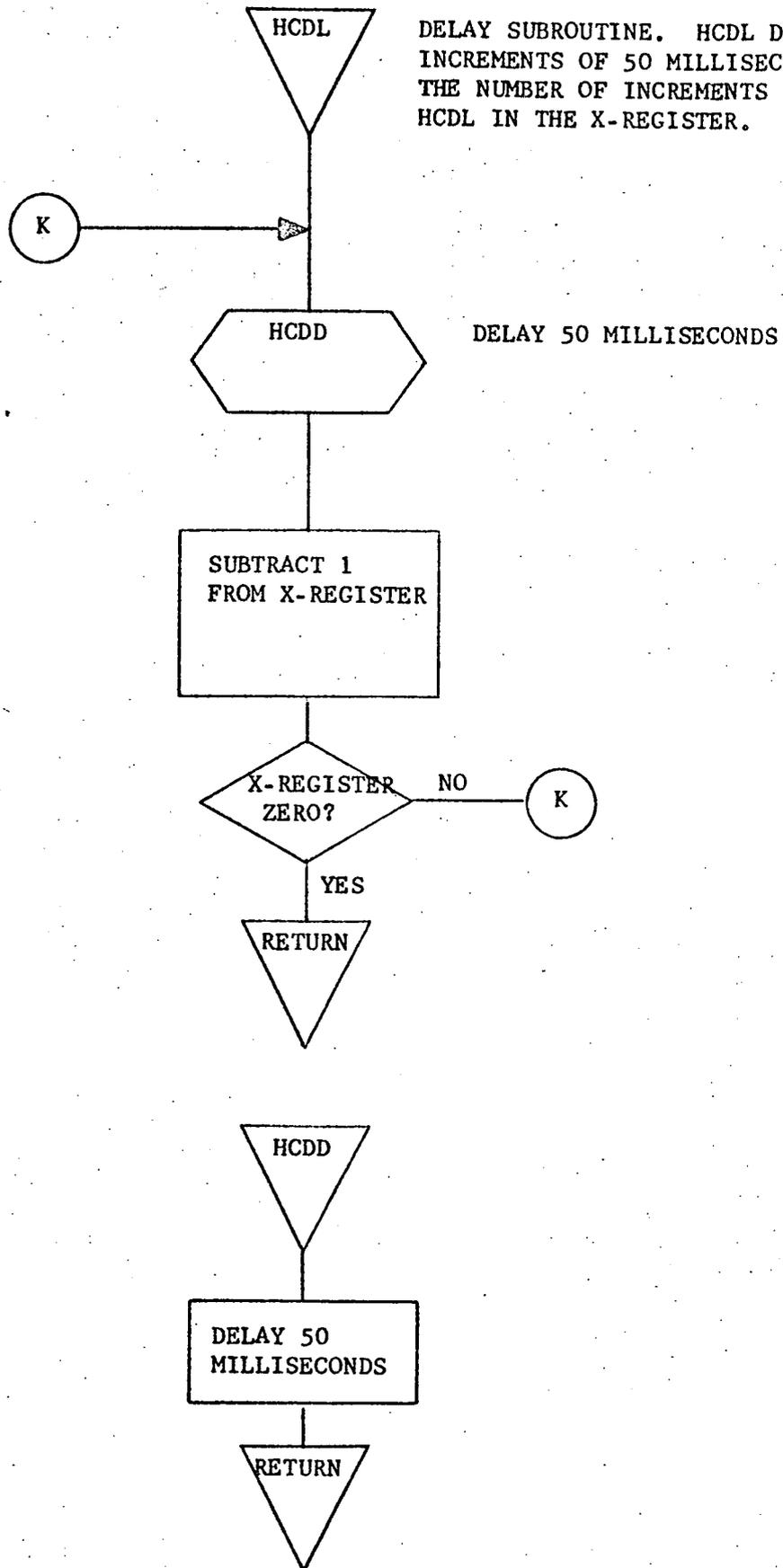
OUTPUT TRANSMIT CHARACTER ROUTINE

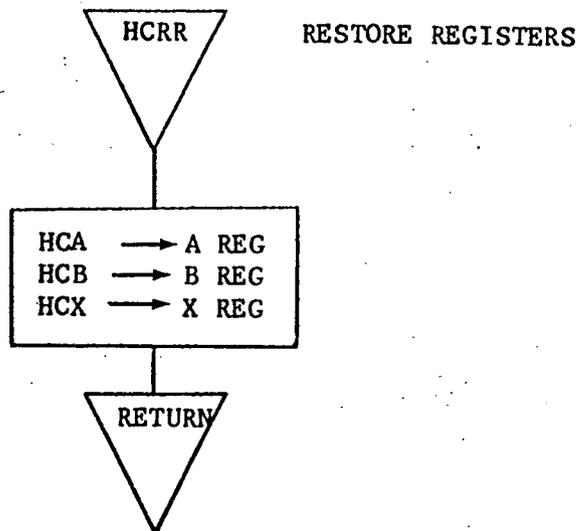
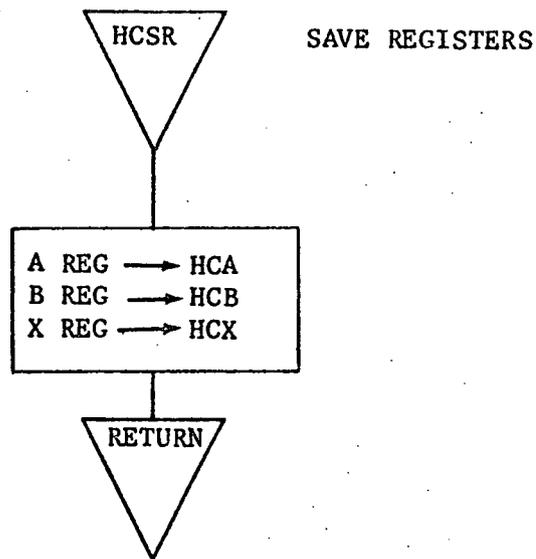
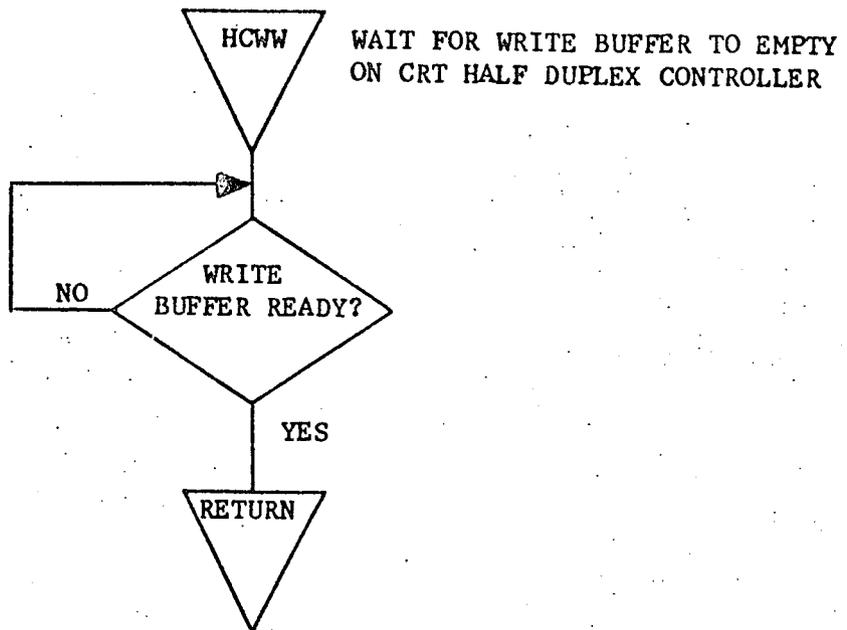


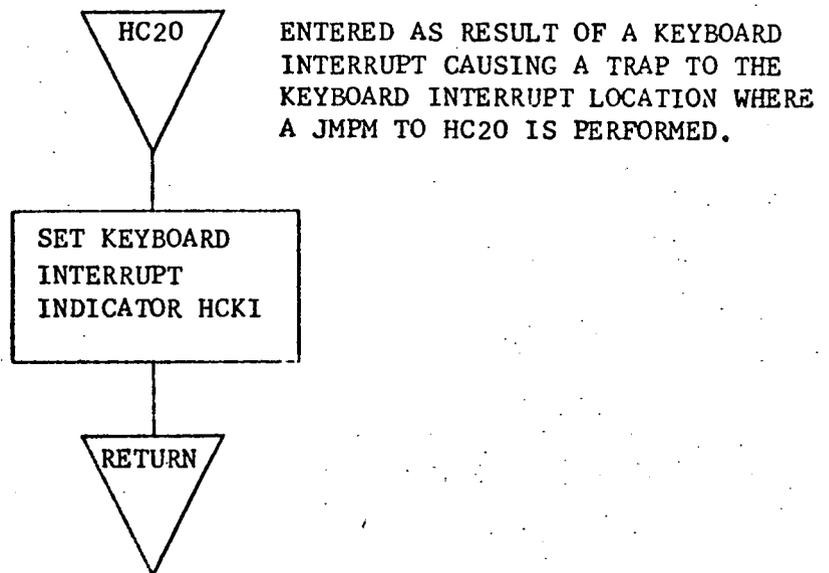
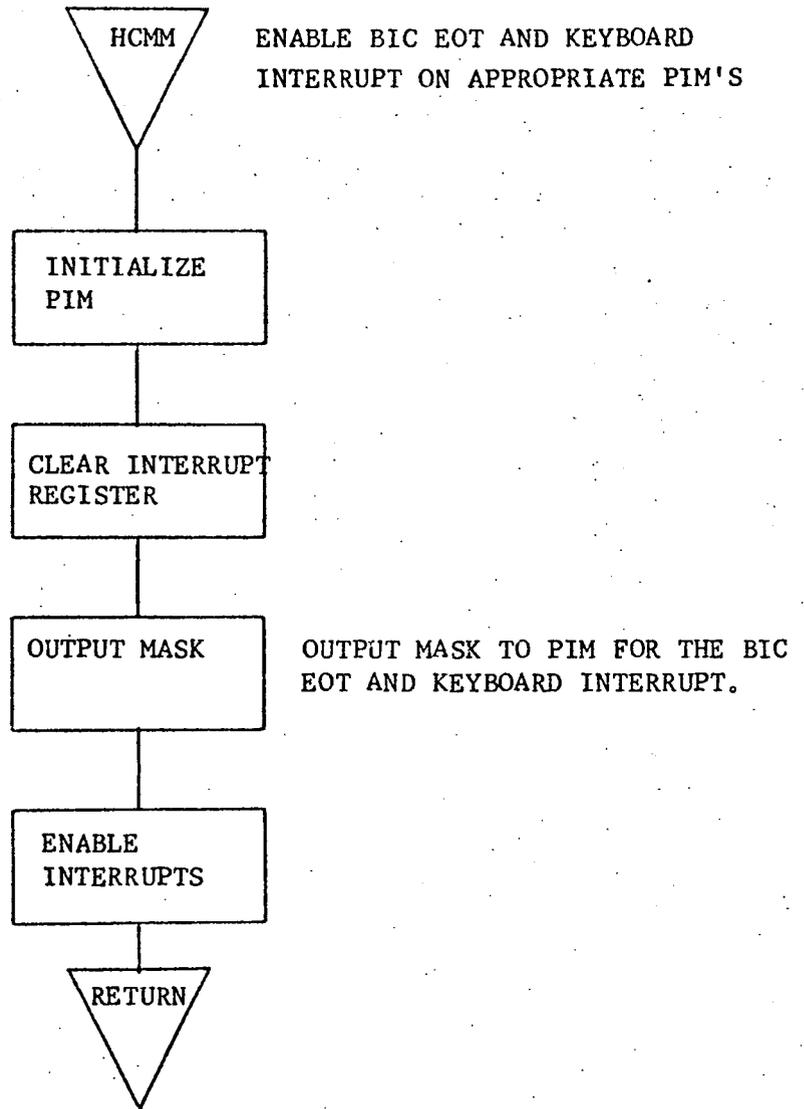
SENSE CRT STATUS ROUTINE



DELAY SUBROUTINE. HCDD DELAYS IN INCREMENTS OF 50 MILLISECONDS. THE NUMBER OF INCREMENTS IS PASSED TO HCDD IN THE X-REGISTER.







3.3.8 HMOO - Magnetic Tape Handler

3.3.8.1 Purpose

HMOO is a general purpose tape routine capable of handling all available tape functions. The purpose of this routine is to reduce the duplication of effort that is inherent when individual users develop their own coding to handle each specific tape I/O operation. The routine currently does not return control to the calling program until I/O is complete or an error is detected, but as soon as additional interrupts are available on the DOC system, the routine will be modified to allow overlapped processing during tape operations.

3.3.8.2 Technical Description

HMOO allows input or output of variable length tape records. The Model 6201-31 Magnetic Tape System Controller is capable of performing 8 functions (see Calling Sequence 3.3.8.2.1) all of which are handled by HMOO. The BIC is used for input and output operations. HMOO first sets up the BIC instructions by using the MTU number received in the call and saves the MTU number for later use in building the actual tape instruction. The starting buffer address is picked up from the call; the ending address is computed by using the number of words to be transferred in the call, and the BIC initial and BIC final addresses are output to the BIC. The tape function is picked up from the arguments and combined with the MTU number to create the tape instruction. The I/O operation is then executed. After completion of the I/O, HMOO checks the status of the MTU and returns that status to the calling program as the fifth parameter of the call.

3.3.8.2.1 Calling Sequence

CALL HM00,A,B,C,D,STAT

PARAMETER	FUNCTION
A	Address of location containing tape function to be performed. 0 = input binary 1 = input BCD 2 = output binary 3 = output BCD 4 = Write End of File 5 = Forward one record 6 = Backspace one record 7 = Rewind
B	Beginning location of buffer (not to exceed (37777_8))
C	Address of location containing number of words to transfer
D	Address of location containing unit number (10_8 or 11_8)
STAT	Address of location containing Status of I/O operation. (Output by HM00 to calling program.)

STAT = ≥ 0 I/O completed successfully. Number indicates number of words transferred.

STAT = -1 User requested I/O still in progress.
(to be implemented)

3.3.8.2.1 Calling Sequence (Continued)

PARAMETER	FUNCTION
-----------	----------

STAT = -2	End of File
-----------	-------------

STAT = -3	Tape Error
-----------	------------

STAT = -4	End of Tape
-----------	-------------

STAT = -5	Beginning of Tape
-----------	-------------------

Busy Return	CALL+7
-------------	--------

Handler busy processing a previous I/O request.

Normal Return	Call +9
---------------	---------

Requested I/O complete. User must check STAT for errors or number of words transferred.

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
----------	---------------------	--------------------

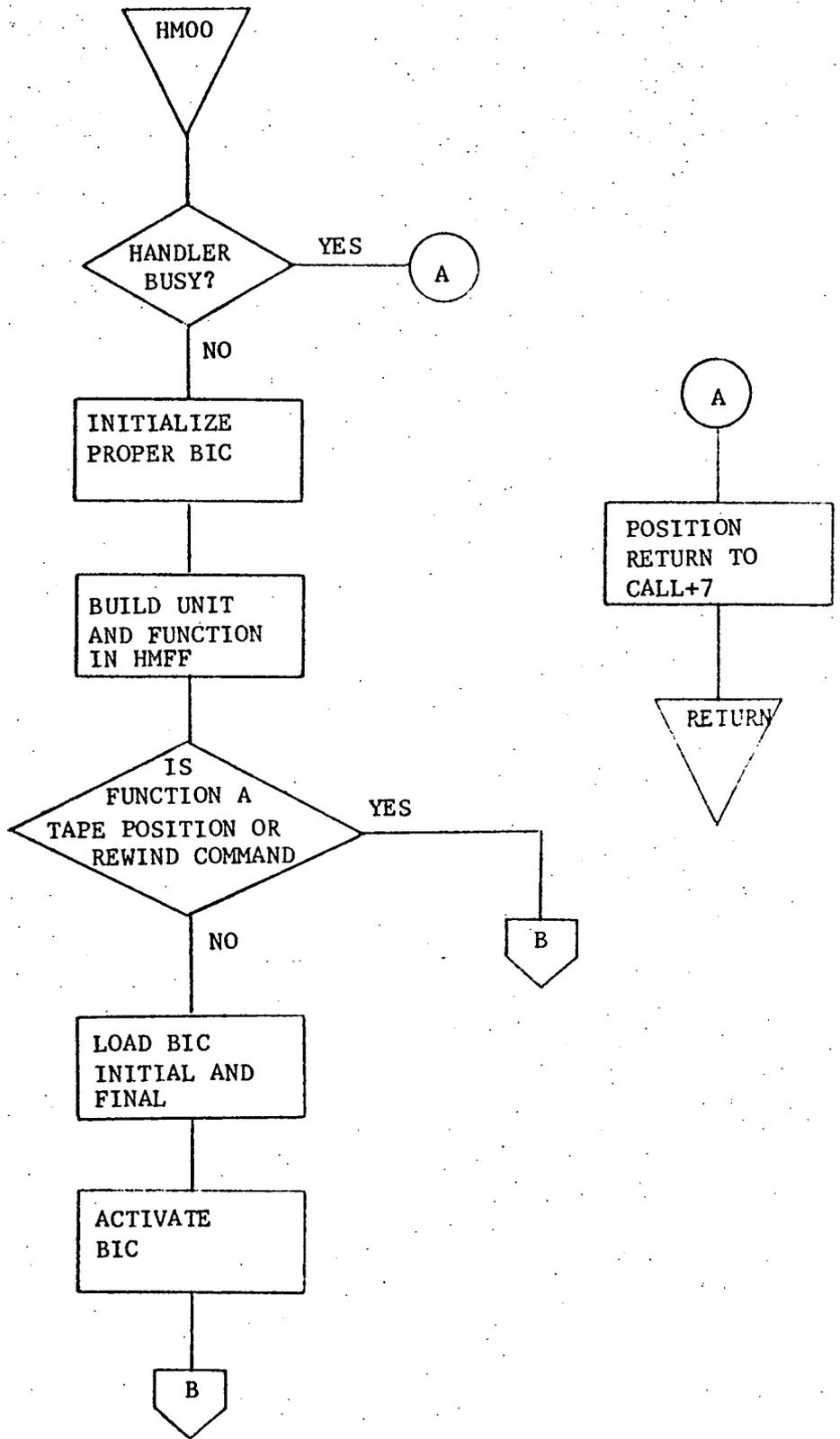
A	Saved	Same as Entry
---	-------	---------------

B	Saved	Same as Entry
---	-------	---------------

X	Saved	Same as Entry
---	-------	---------------

Overflow	Not effected	Same as Entry
----------	--------------	---------------

3.3.8.2.2 General Flow Chart



3.3.8.3 Label Description

3.3.8.3.1 Local

HM1 - HM5, HM15	Locations of BIC instructions initialied by HM00
HM01	Location where tape I/O instruction is constructed and executed.
HMA	Save area for A-register.
HMAB	Indirect address for unit number.
HMA3	Initialize BIC 2 instruction. Used for initialization.
HMA4	Initialize BIC 4 instruction.
HMB	Save area for B-register.
HMBA	Beginning address of buffer. Used to compute number of words transferred.
HMBU	Previous I/O in progress (to be implemented).
HMB3	Sense BIC 2 not busy instruction. Used for initialization.
HMB4	Sense BIC 4 not busy instruction. Used for initialization.
HMC3	Set BIC 2 starting address instruction. Used for initialization.
HMC4	Set BIC 4 starting address instruction. Used for initialization.
HMD3	Set BIC 2 final address instruction. Used for initialization.
HMD4	Set BIC 4 starting address instruction. Used for initialization.
HME3	Enable BIC 2 instruction. Used for initialization.
HME4	Enable BIC 4 instruction. Used for initialization.
HMFF	Tape function being performed.

3.3.8.3.1 Local (Continued)

HMF3 Location containing a "load BIC 2 initial register" instruction. Used for initialization.

HMF4 Location containing a "load BIC 4 initial register" instruction. Used for initialization.

HMUN Unit number.

HMX Save area for X-register.

HMXX Indirect argument pointer.

3.3.8.3.2 Global

HM00 Entry point into subroutine.

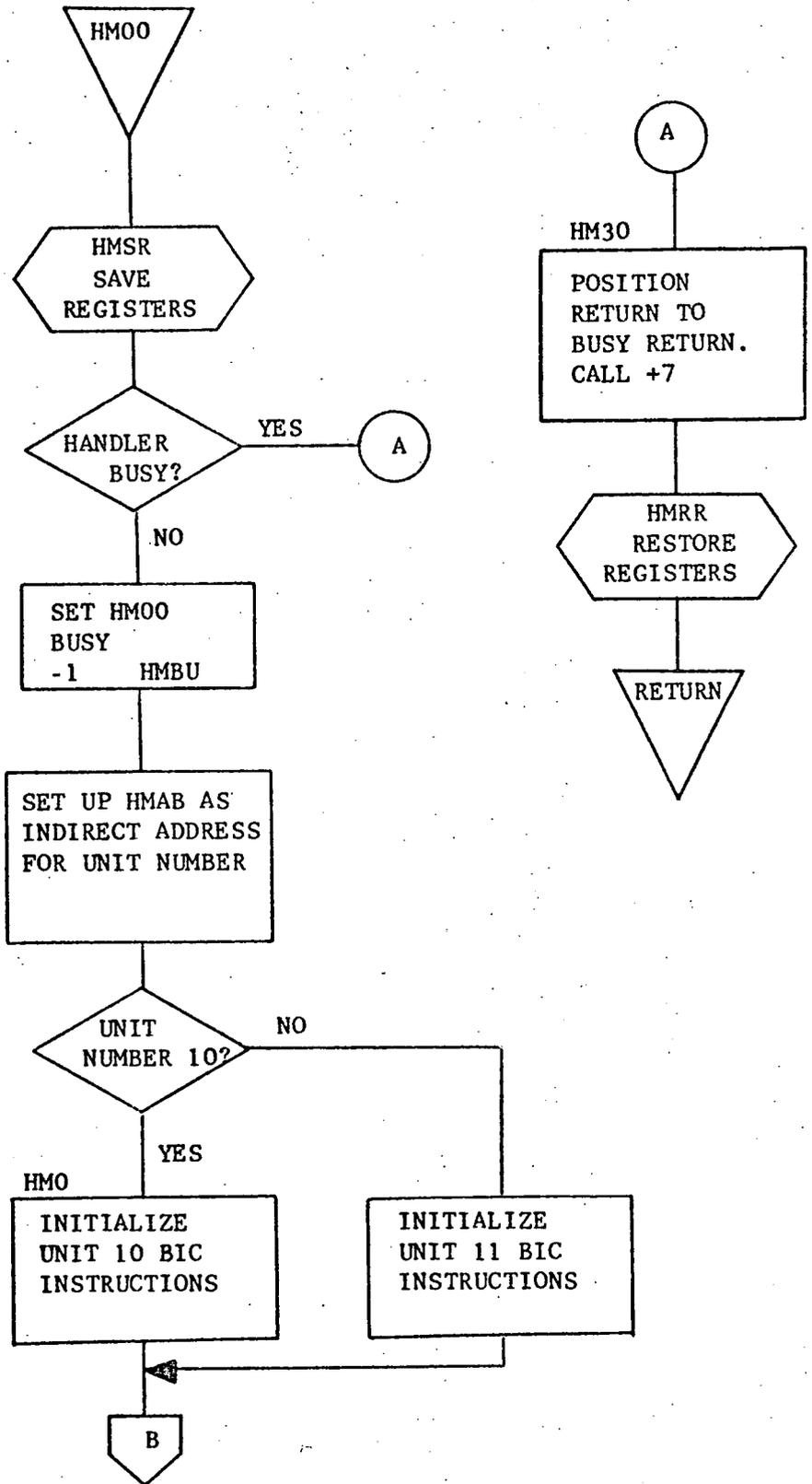
3.3.8.3.3 Entry Points

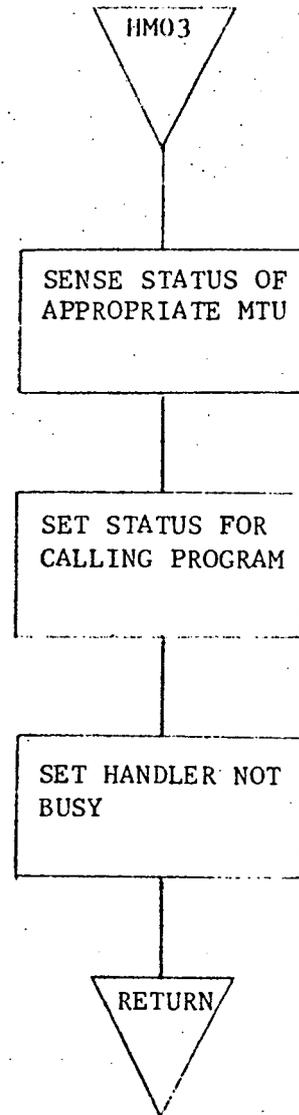
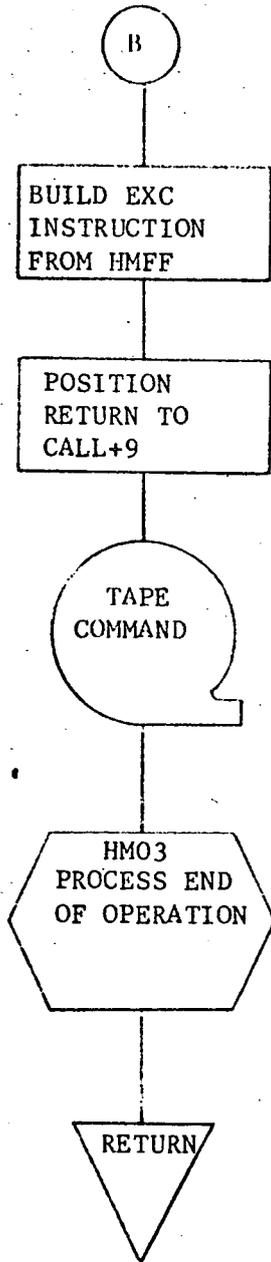
HM00 primary entry point

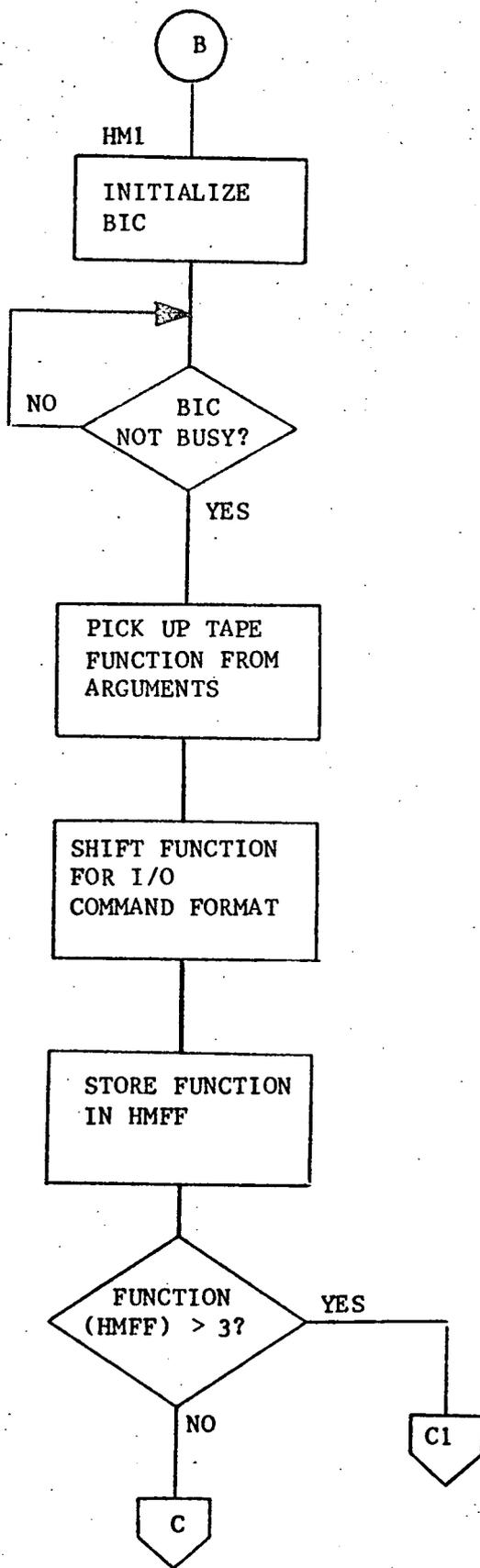
3.3.8.3.4 External References

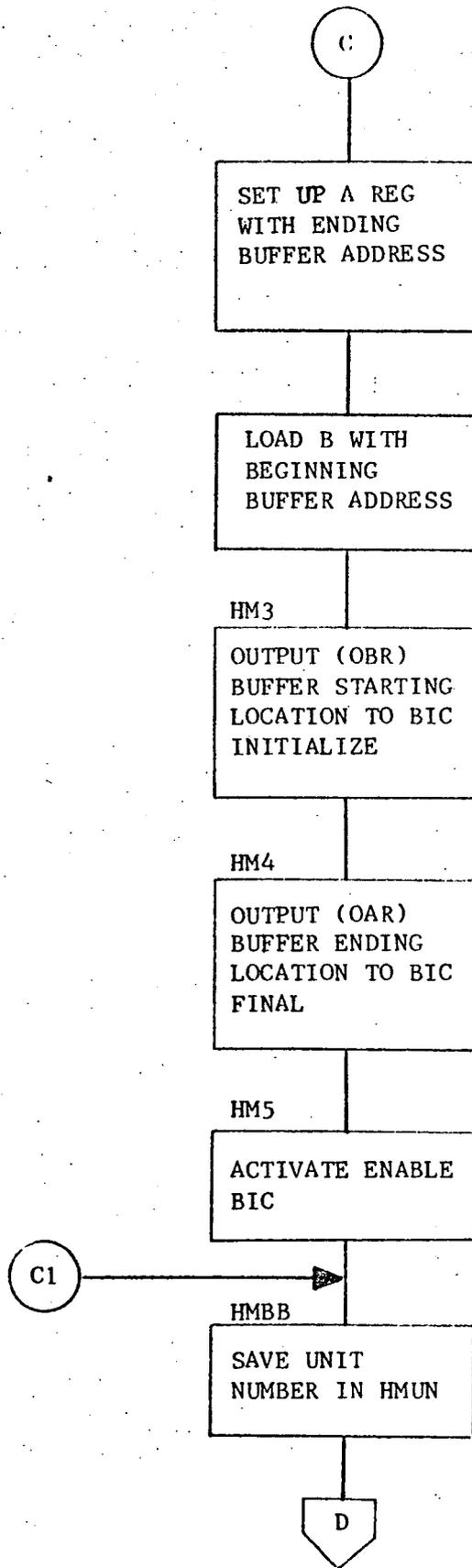
None.

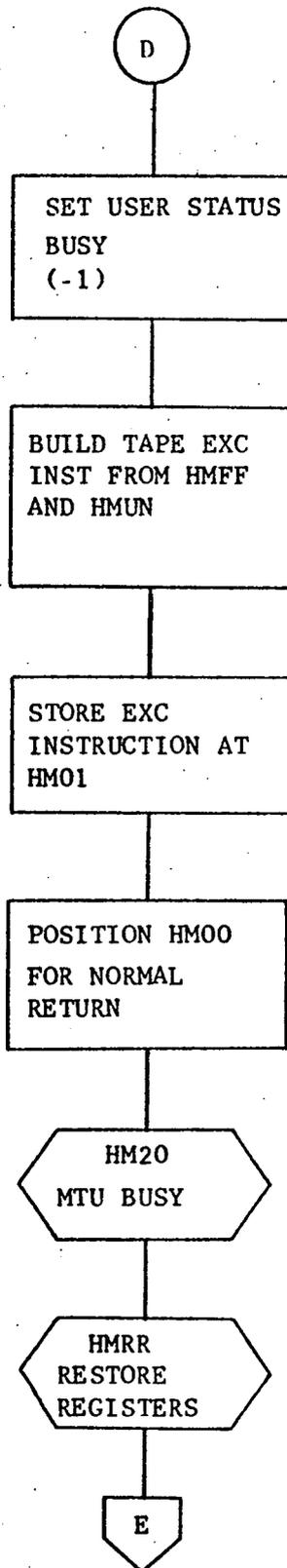
3.3.8.4 Detailed Flow Chart

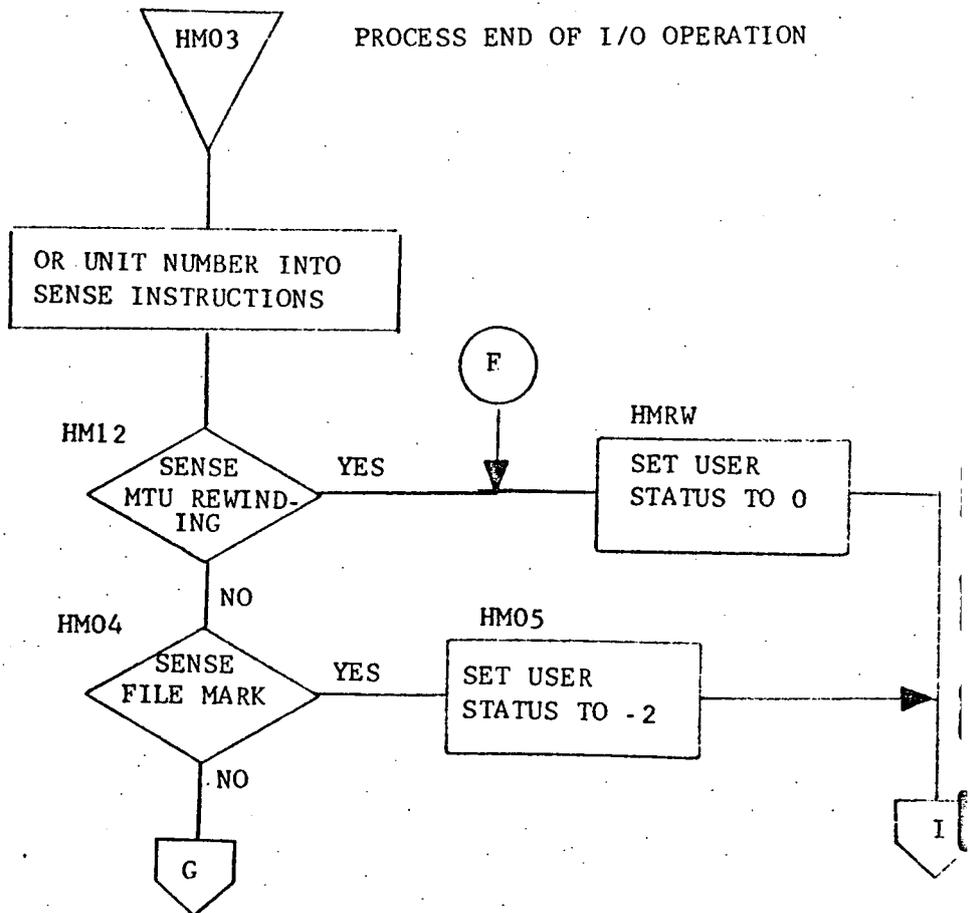
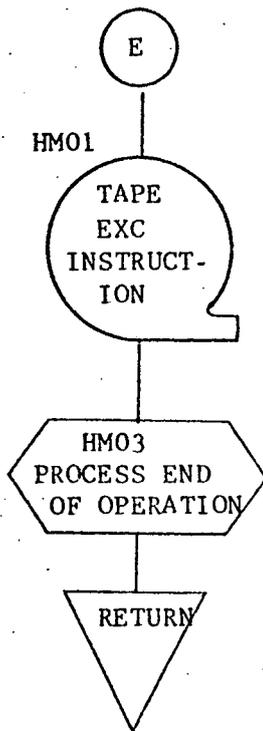


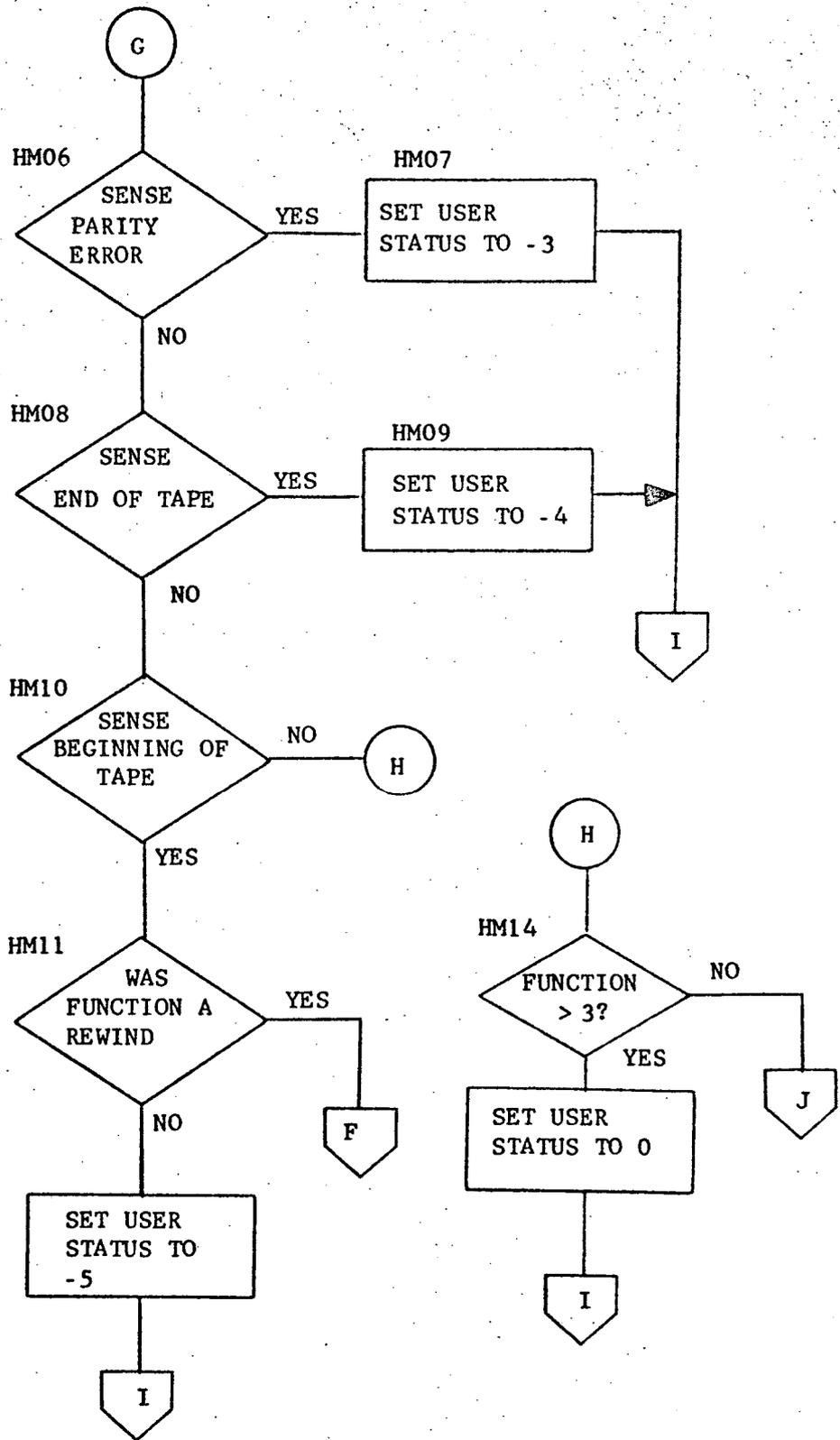


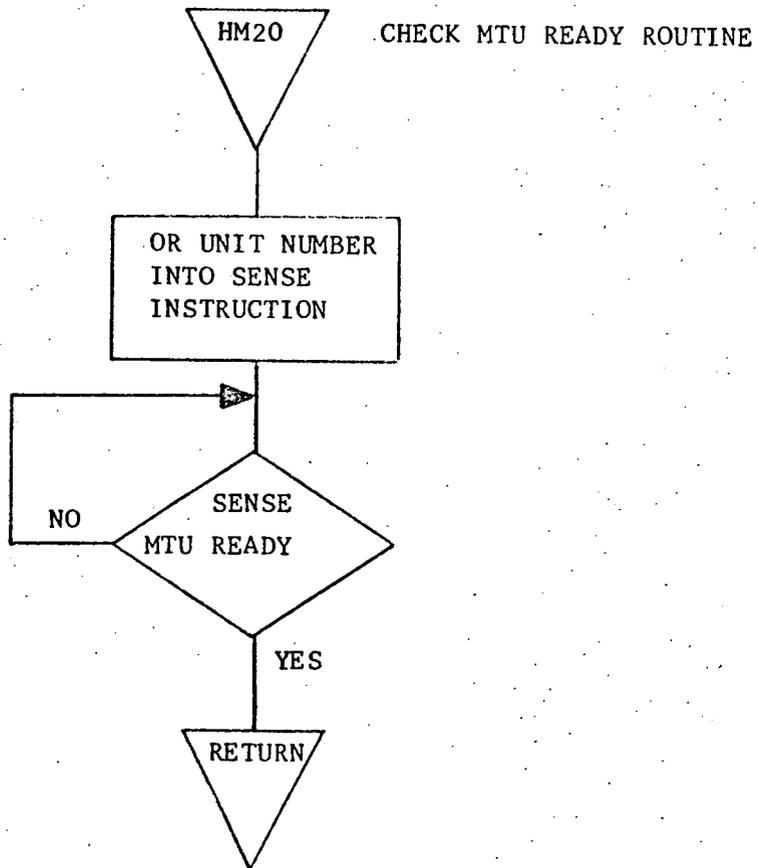
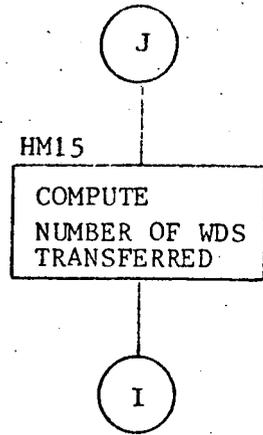
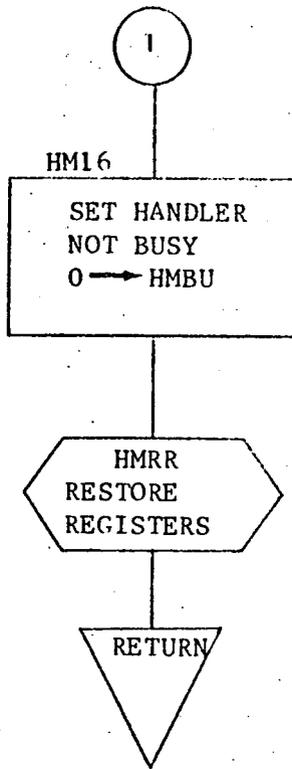


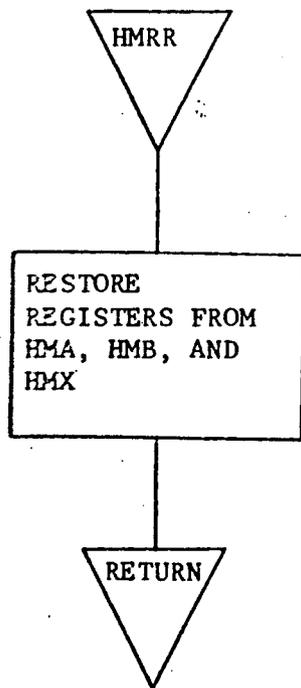
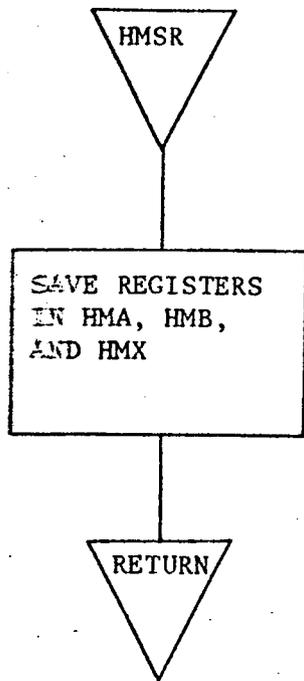












3.3.9 ID00 - Input Display

3.3.9.1 Purpose

This routine inputs a complete display from the CRT upon interrupt from the CRT keyboard.

3.3.9.2 Technical Description

This routine calls the CRT handler (HCOO) to input a display to the input buffer. After the routine is called and the arguments are retrieved, a character is input from the CRT controller buffer. This character must be an interrupt character caused by depressing the interrupt key on the CRT keyboard or a transmit (start of text) character caused by depressing the transmit key on the CRT keyboard. An interrupt key will cause the cursor to be positioned to the end of the next heading on the displayed form. A start of text character causes an entire display to be input via routine HCOO. An initial character other than interrupt or transmit is ignored. If the transmission of data from the CRT to the input buffer is unsuccessful, the appropriate message stating the nature of the problem (parity error or device not ready) is output to the teletype.

Once the input buffer is being filled, the method of detecting the end of transmission varies. If the modem is employed, a delay of 4.5 seconds must occur to allow ample time for transmission to be completed. Otherwise, completed transmission may be sensed.

Routine HCIN is called to process the full input buffer. Upon return from HCIN, control is returned to the calling routine.

3.3.9.2.1 Calling Sequence

CALL ID00, NUM

PARAMETER

FUNCTION

NUM

the address of the number of characters to input

REGISTER

CONTENTS UPON ENTRY

CONTENTS UPON EXIT

A

destroyed

B

destroyed

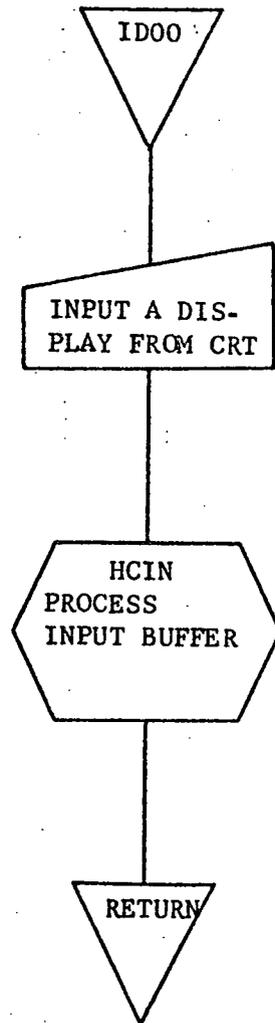
X

destroyed

Overflow

destroyed

3.3.9.2.2 General Flow Chart



3.3.9.3 Label Description

3.3.9.3.1 Local Labels

<u>Symbol</u>	<u>Function</u>
CNT	number of characters to input
HCRT	CRT device address
IDEC	error retry counter
IDRC	address of buffer to be filled
IDWD	number of words to send
ID2	CRT function selector 0 = input 1 = output with clear 2 = output with no clear
SCXX	cursor position indicator; 0 indicates start of new display
STAT	status of I/O operation

3.3.9.3.2 Global Labels

WRDS number of words to input from CRT

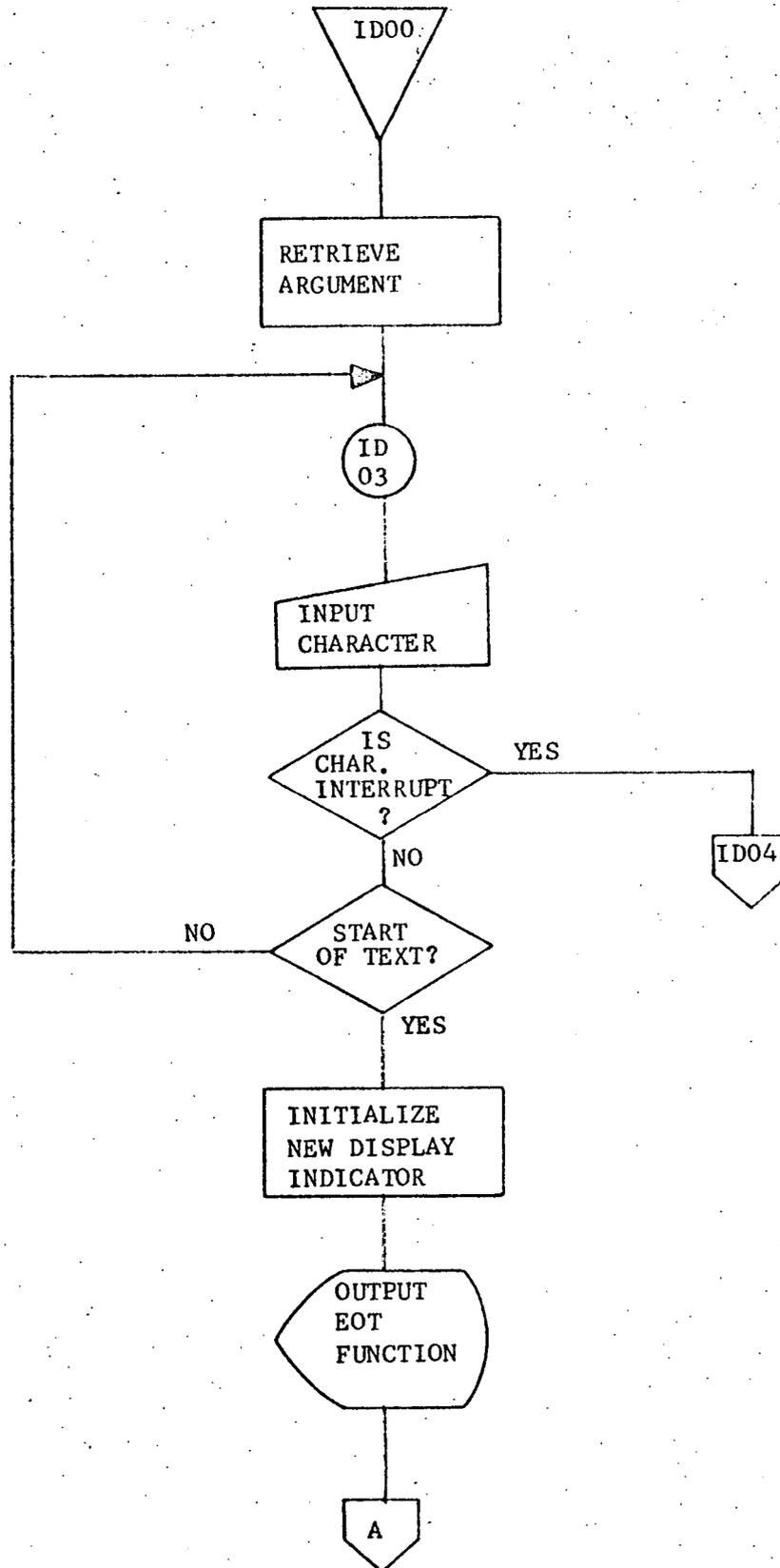
3.3.9.3.3 Entry Points

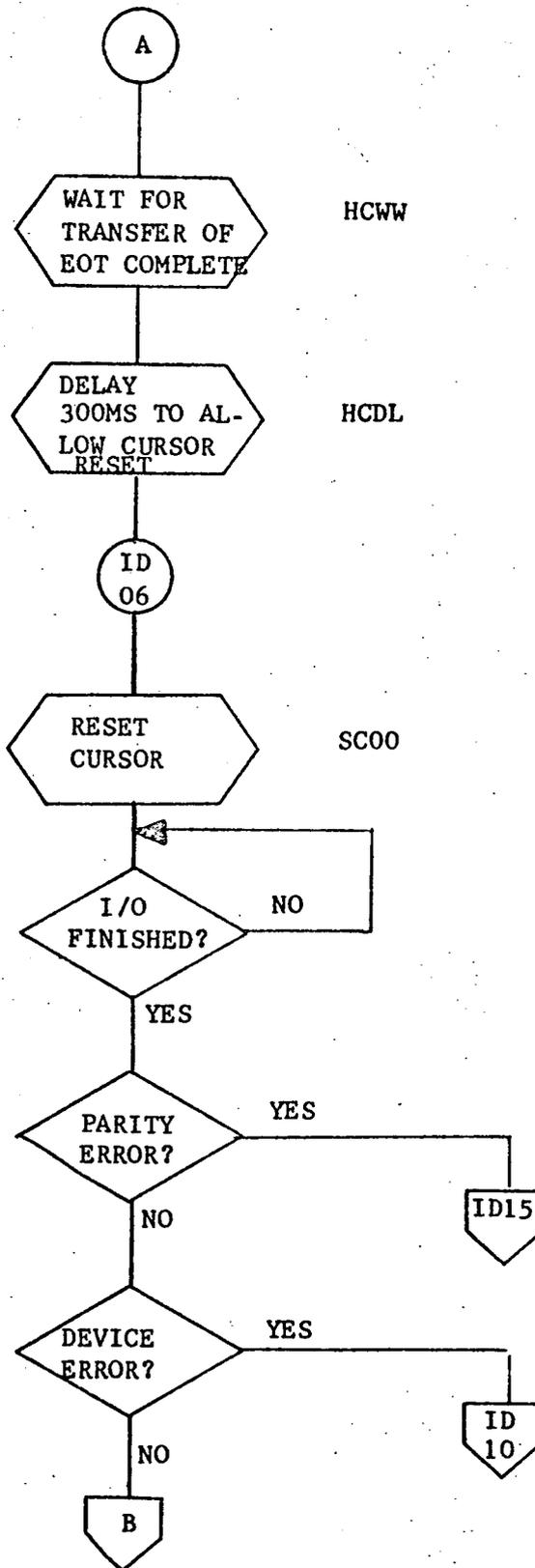
primary entry point ID00

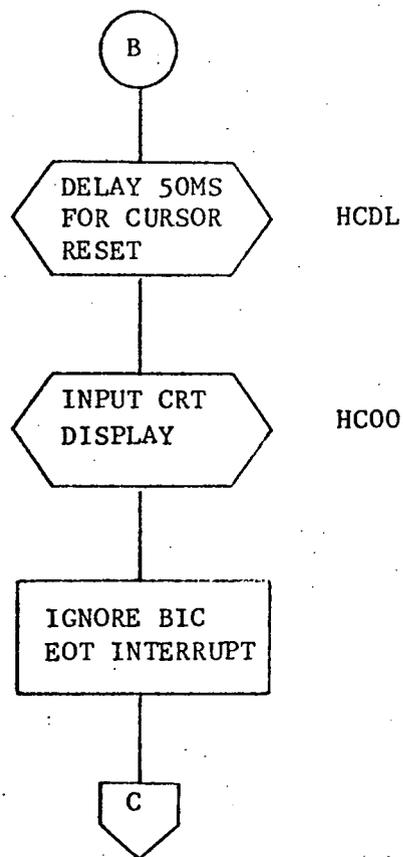
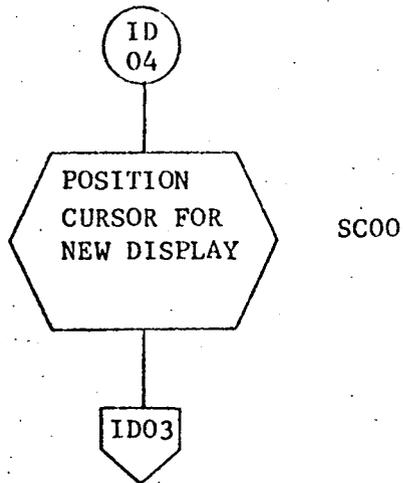
3.3.9.3.4 External References

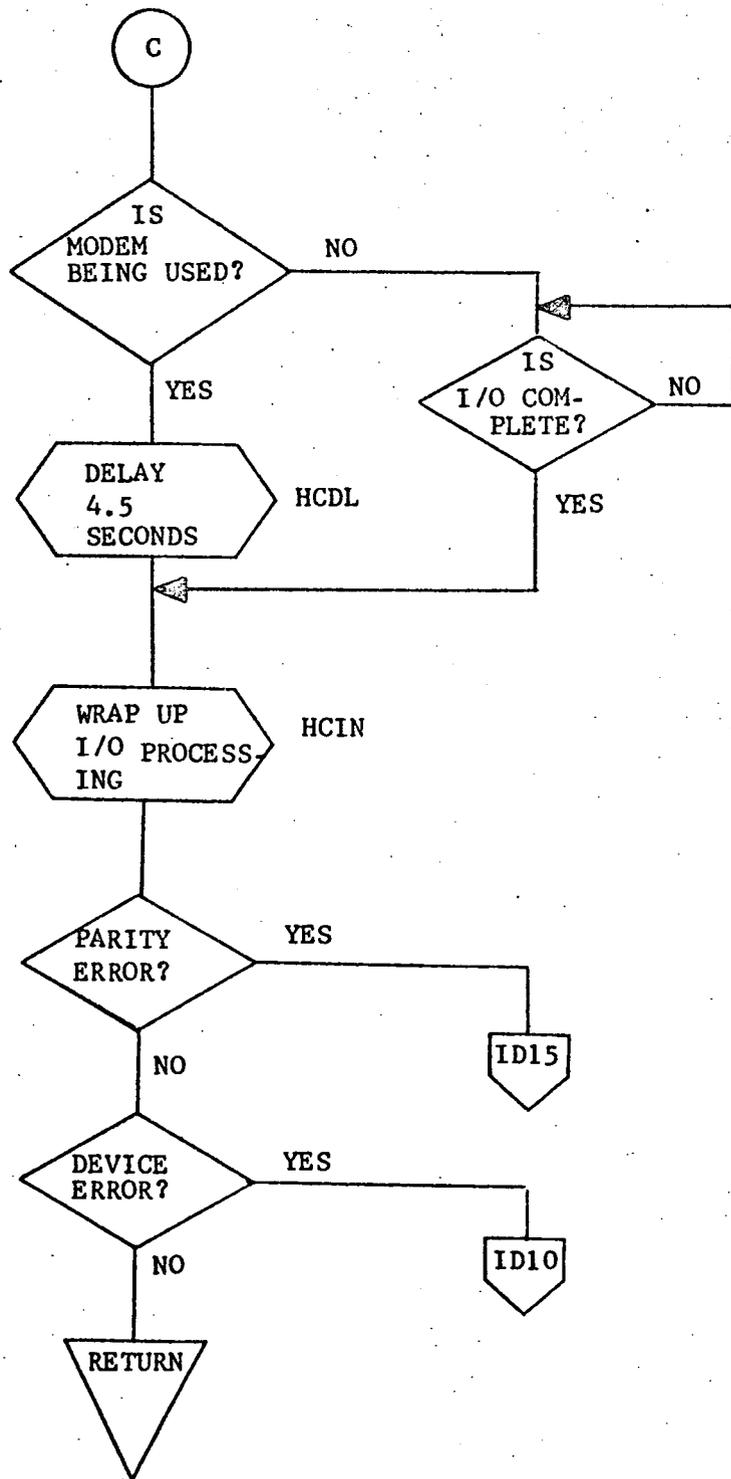
HCDL	delay routine
HCIN	I/O buffer processing routine
HCMM	enable interrupts
HC00	input display routine
HCWW	delay routine for CRT write buffer to empty
OZKA	TTY print message routine
OZKR	carriage return, line feed to TTY
SC00	cursor position routine

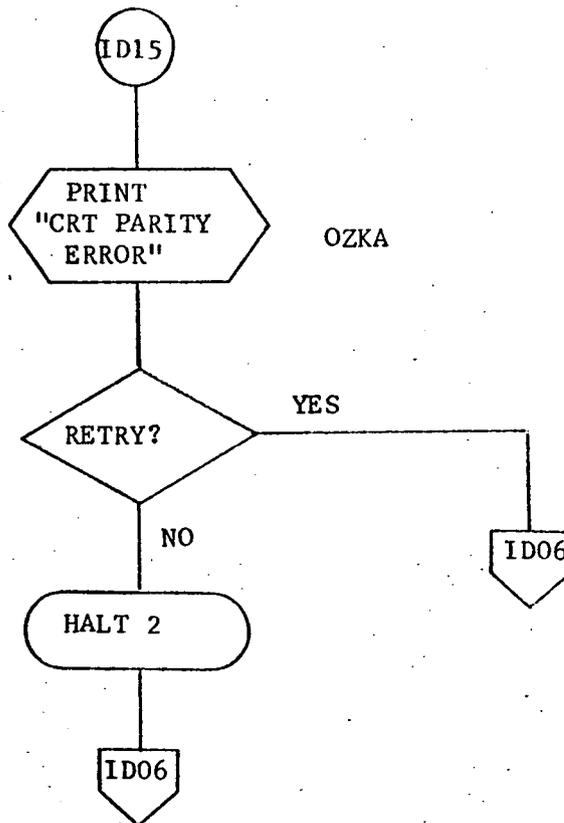
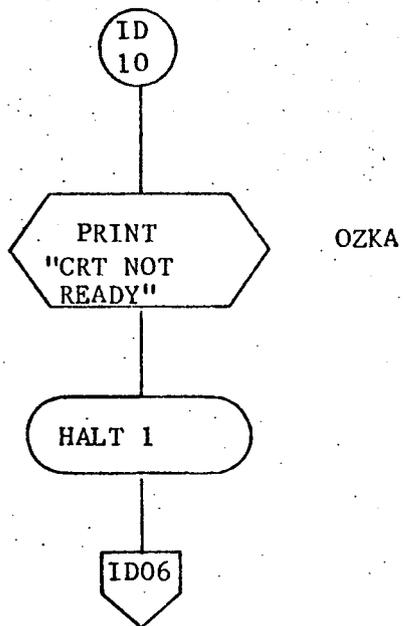
3.3.9.4 Detailed Flow Chart











3.3.10 IN00 - Initialization

3.3.10.1 Purpose

This routine reads the forms background tape into core and establishes a forms table of pointers to the beginning of each form. After all forms are established, the mounting of an output tape is requested via the teletype and a message requesting the desired form number from the user is displayed on the CRT.

3.3.10.2 Technical Description

After the input tape is rewound, the tape input buffer is blanked. One mag tape record representing one form is then read. The form number is converted from ASCII to binary. The beginning address of the form number input is then stored in the forms table using the converted form number as an index.

When a tape read is unsuccessful, the message "TAPE ERROR" is printed on the TTY. When end of file is encountered, the tape is rewound and the message "MOUNT FORMS TAPE. REMEMBER WRITE RING. PRESS RUN WHEN TAPE IS READY." is printed and the computer halts. When an illegal form is input, the message "ILLEGAL FORM NUMBER" is printed.

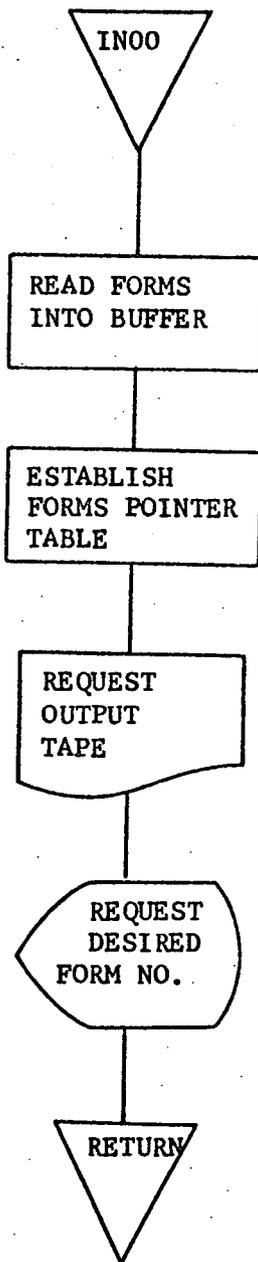
After the new output tape is mounted and the "run" button is pressed, the mounted tape is rewound and the request for the desired form number is displayed on the CRT. Return to Routine CP00 is then made.

3.3.10.2.1 Calling Sequence

CALL IN00

No parameters are passed in the call; the volatile registers are not saved.

3.3.10.2.2 General Flow Chart



3.3.10.3 Label Description

3.3.10.3.1 Local Labels

Symbol	Function
C	counter for mag tape routine
NC	number of characters to display
OP	code for mag tape operation to be performed
WRDS	maximum number of words to read from one mag tape record
LU	logical unit to be referenced for mag tape input and output
TBUF	buffer containing TTY message to mount forms tape
BLNK	2 blank ASCII character codes
PLAC	address of digits of form number
FRMB	"ILLEGAL FORM NUMBER" TTY message buffer
INTE	"TAPE ERROR" TTY message buffer

3.3.10.3.2 Global Labels

Symbol	Function
STAT	status of tape handler (HMOO)
MTN\$	tape input buffer
SAVE	temporary storage buffer

3.3.10.3.3 Entry Point

INOO - Primary entry point

3.3.10.3.4 External References

HM00 - tape handler entry point

AI00 - ASCII to integer conversion routine

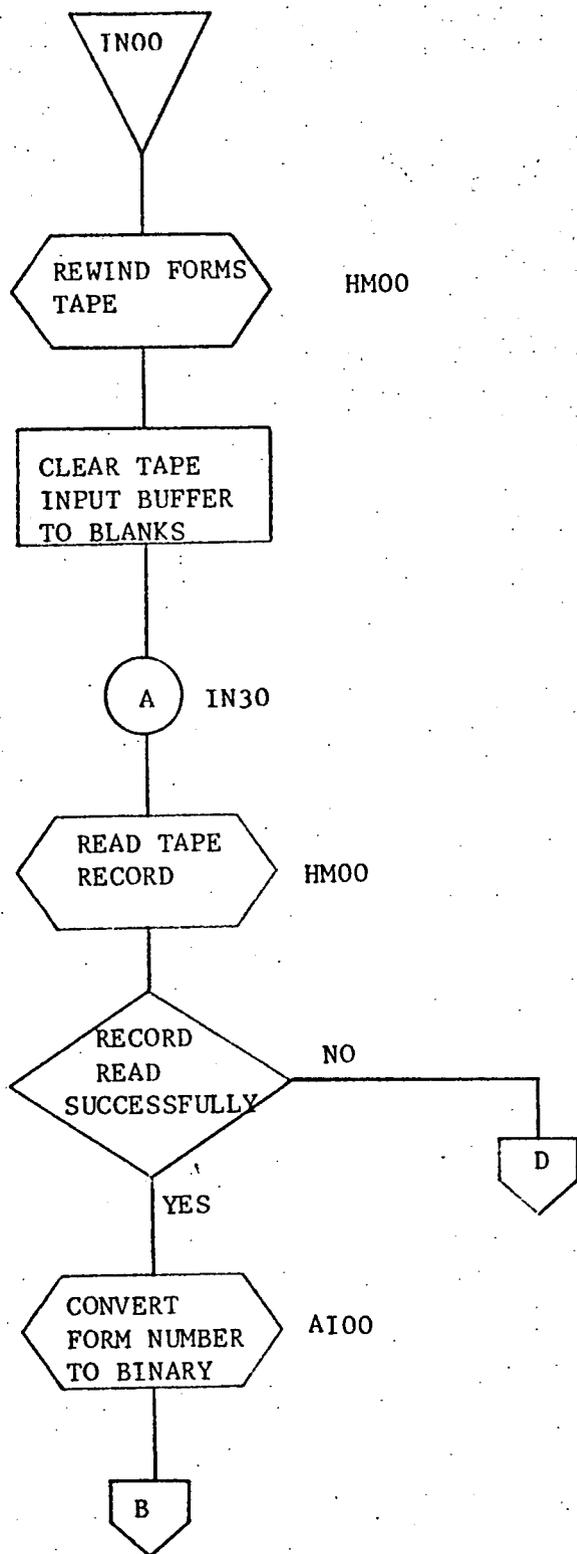
OZKR - carriage return, line feed routine

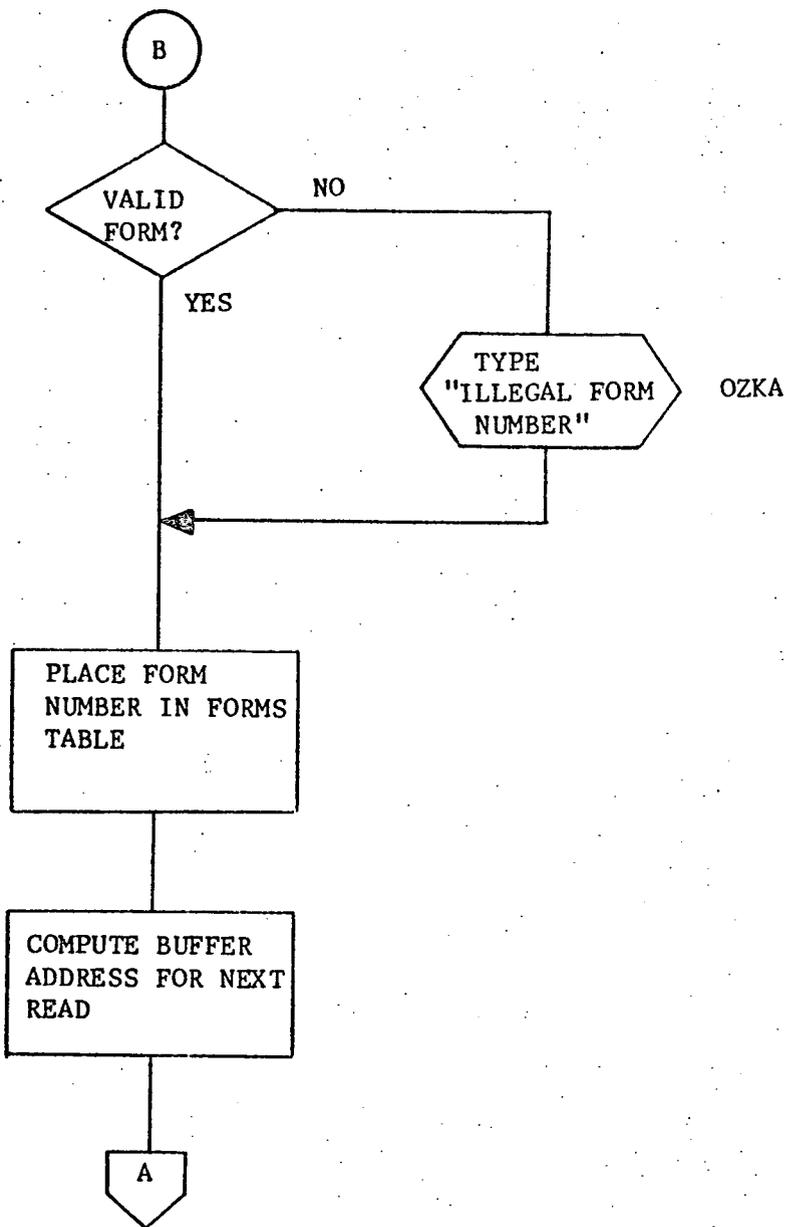
OZKA - teletype print routine

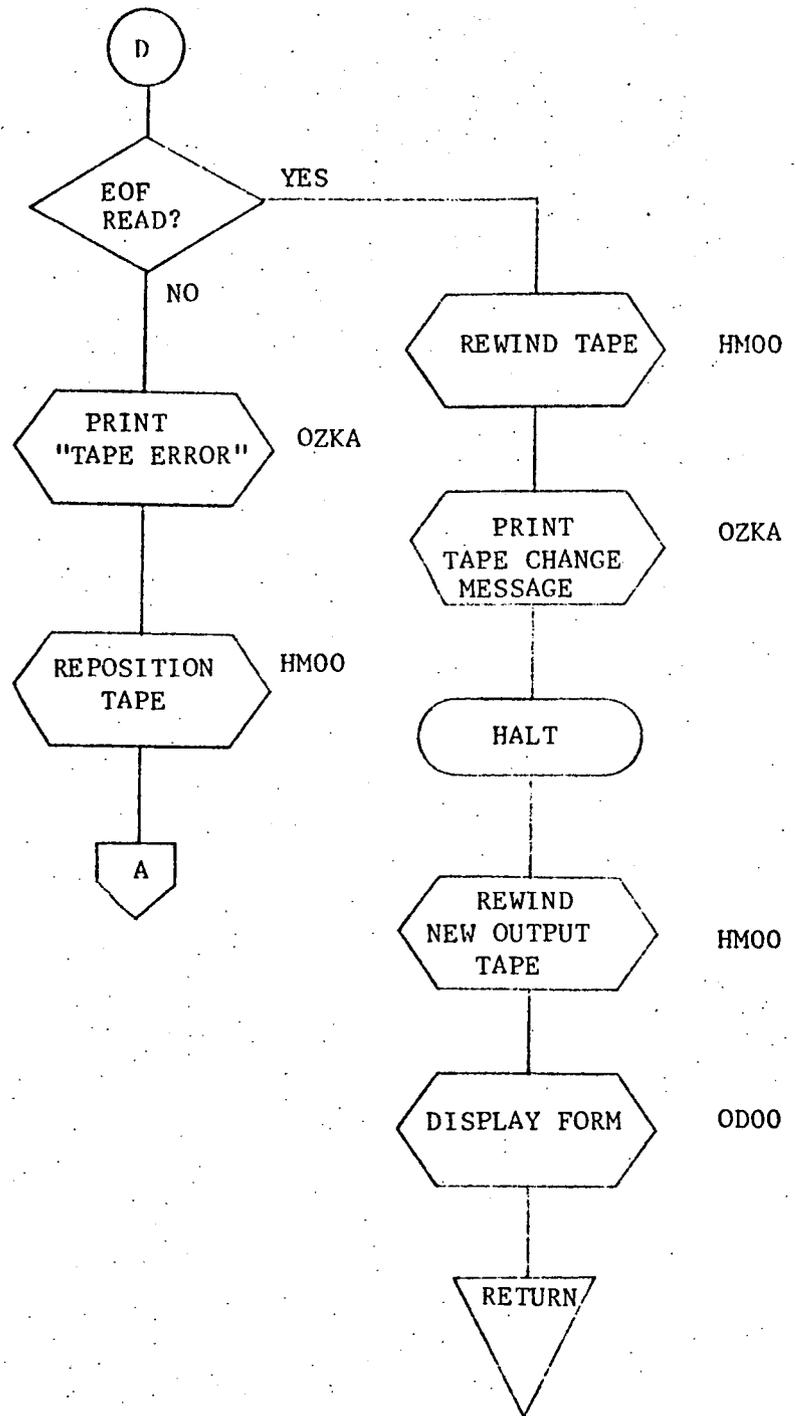
OD00 - output to display routine

CPO0 - calling routine for IN00; control returns to CPO0 from IN00.

3.3.10.4 Detailed Flow Chart







3.3.11 MD00 - Mag Tape Output Routine

3.3.11.1 Purpose

This routine outputs the contents of the buffer MTO\$ to mag tape unit 10.

3.3.11.2 Technical Description

Immediately upon entry to the routine an attempt to write to the mag tape unit is made. When a successful write occurs, the contents of buffer MTO\$ have been transferred to the tape. When the unit is not ready to write, an appropriate teletype message is output. When the number of words transferred does not equal the requested number, a teletype message is output and the write is attempted again.

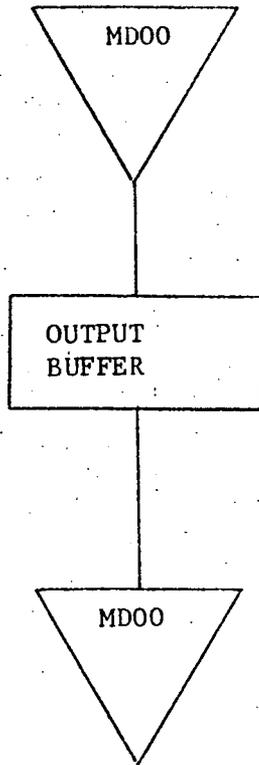
3.3.11.2.1 Calling Sequence

CALL MD00

No arguments are transferred.

Volatile registers are destroyed.

3.3.11.2.2 General Flow Chart



3.3.11.3 Label Description

3.3.11.3.1 Local Labels

Symbol	Function
MDEM	error message buffer for "unit not ready"
MDEQ	error message buffer for "invalid number of words transferred"
MDF	tape handler function - output binary record
MDF1	tape handler function - backspace one record
MDST	tape handler status indicator
MDUN	logical unit number
MDW	number of words to output

3.3.11.3.2 Global Labels

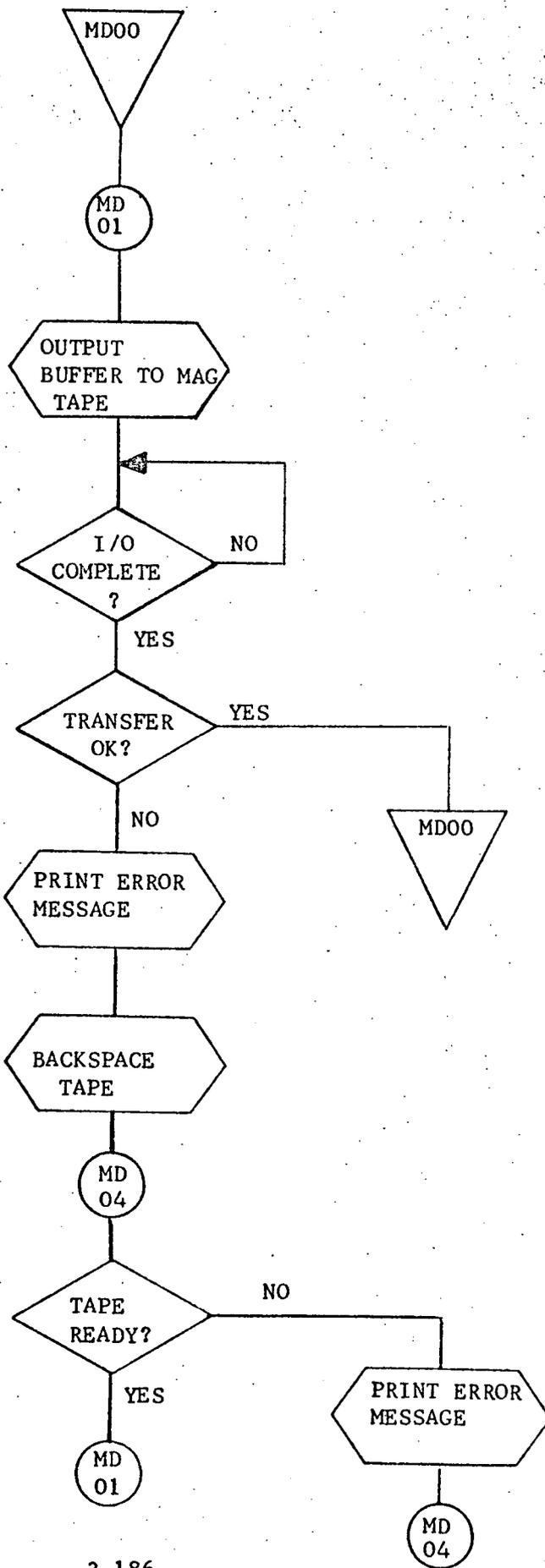
MTO\$	tape output buffer
-------	--------------------

3.3.11.3.3 Entry Points

Primary entry point - MD00

3.3.11.3.4 External References

HM00	mag tape handler
OZKA	TTY output message
OZKR	TTY carriage return and line feed



3.3.12 ODOO - Output Display

3.3.12.1 Purpose

ODOO is a subroutine whose purpose is to output a buffer of data (CROS) to the CRT. This buffer may be any length up to 957 words.

3.3.12.2 Technical Description

Communication with the CRT requires that all message buffers to be transmitted be preceded and followed by special initiation and termination codes respectively. ODOO accepts message buffers from the calling routine, attaches the overhead (initiation and termination codes) information and calls HCOO to clear the screen and output the buffer. (A sample message buffer with the overhead is shown in Figure 3-2.)

The next action is based upon the results of the message transmission.

- If the message transmission is error free, control is returned to the calling routine.
- If the CRT is not ready, the message "CRT NOT READY" is printed at the teletype and the program halts. Depressing the RUN button on the computer console will cause the program to again attempt to output.
- If a parity error occurs, an appropriate error message is typed at the teletype and an automatic retry of the transmission is made. The number of retries is unlimited and an error message is given with each attempt.

3.3.12.2.1 Calling Sequence

CALL ODOO,NO

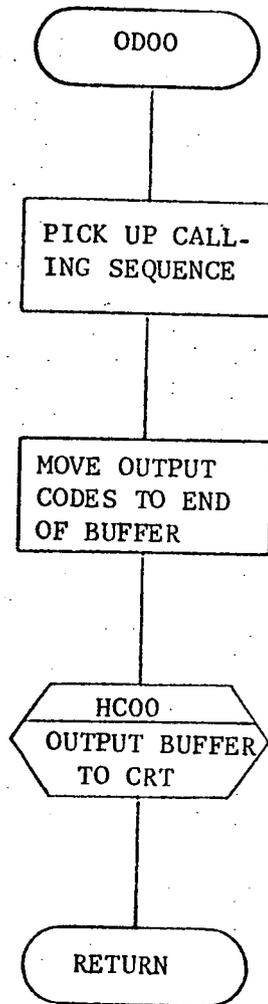
<u>PARAMETER</u>	<u>FUNCTION</u>
NO	A memory location whose contents specify the number of words contained in the buffer (CROS).

<u>REGISTER</u>	<u>CONTENTS UPON ENTRY</u>	<u>CONTENTS UPON EXIT</u>
A	N/A	N/A
B	N/A	N/A
X	N/A	N/A
Overflow	N/A	N/A

Buffer Character Position	Character	Function
1	SOH	Overhead Initiation Codes
2	Halt Local I/O	
3	SOH	
4	Select Alpha Mode	
5	SOH	
6	Enable Refresh	
7	Cursor Reset	
8	B	Message
9	U	
10	F	
11	F	
12	E	
13	R	
14		
15	L	
16	E	
17	N	
18	G	
19	T	
20	H	
21		
22	E	
23	R	
24	R	
25	O	
26	R	
27	Cursor Reset	Overhead Termination Codes
28	SOH	
29	Enable Transmit	
30	End of Transmission	
31	End of Transmission	

Figure 3-2 Sample Output Buffer

3.3.12.2.2 General Flow Chart



3.3.12.3 Label Description

3.3.12.3.1 Local

CONU - (12,1,8,4,4) buffer containing termination codes which must follow each buffer that is output to the CRT.

CONV - (12) total number of control codes preceding and following the user's buffer.

CONW - (4) number of control codes less one which follow the output buffer.

NUM - temporary storage location for the address of the number of words in the output buffer.

NUMT - storage location for the total number of words to be output, including all control codes.

X - (1) function code to be passed to HCOO indicating output after clearing CRT screen.

3.3.12.3.2 Global

- CNT - temporary storage location for the address of the number of words to input from the CRT.
- DEV - ("CRT NOT READY") error message output to teletype in the event the CRT device is not ready.
- PARE - ("PARITY ERROR FROM DISPLAY DEVICE") error message output to teletype in the event of a parity error from the CRT.

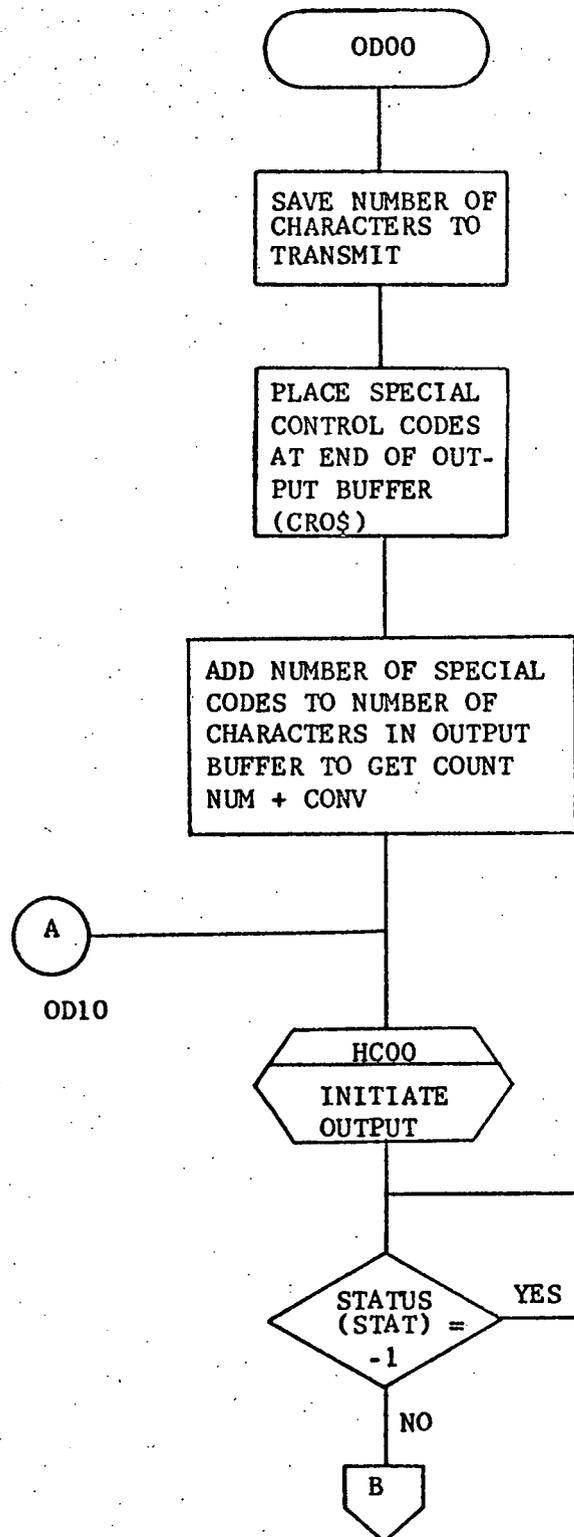
3.3.12.3.3 Entry Point

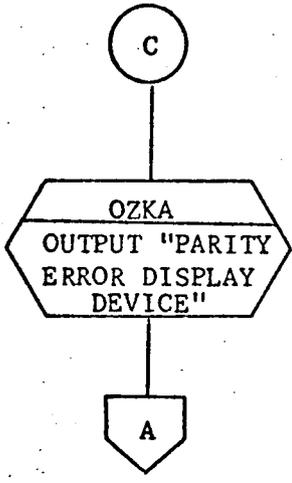
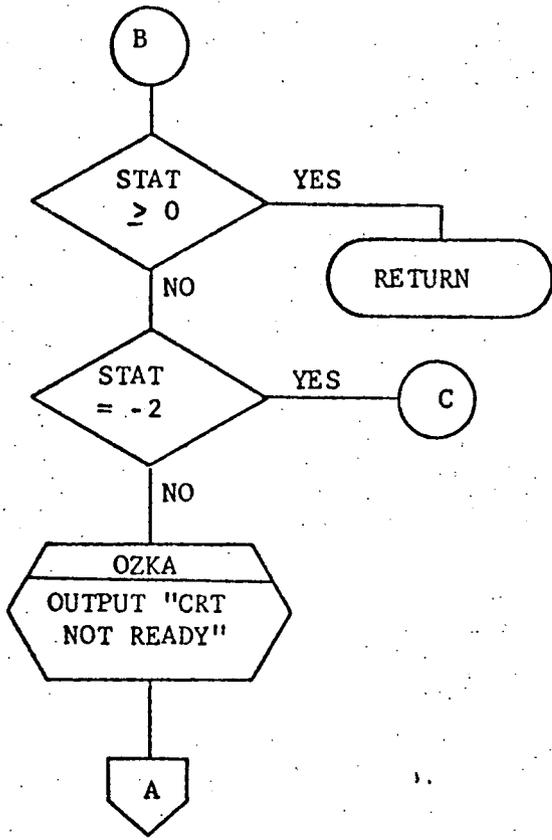
- OD00 - primary entry point.

3.3.12.3.4 External References

- CONT - Beginning location of initiation codes which must immediately precede output buffer.
- CRO\$ - CRT output buffer
- HCOO - CRT handler for input and output
- OZKA - teletype routine that outputs a buffer to the teletype
- OZKR - teletype driver to output one carriage return and one line feed
- STAT - status word from the CRT handler HCOO.
- WRDS - storage location for the number of words to input from the CRT.

3.3.12.4 Detailed Flow Chart





3.3.13 OZKA - Print Buffer on TTY

3.3.13.1 Purpose

This routine outputs characters to the ASR-35 teletype.

3.3.13.2 Technical Description

This routine outputs a buffer to the ASR-35 teletype. Each buffer word should contain two eight bit ASCII characters. Both the beginning location to be output and the number of characters to print are specified by the calling routine.

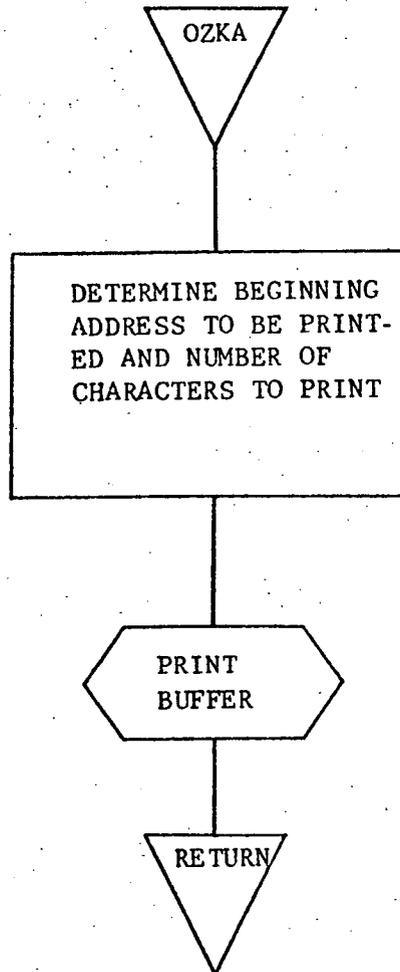
3.3.13.2.1 Calling Sequence

CALL OZKA,START,N

PARAMETER	FUNCTION
START	beginning address to be printed
N	number of characters to print

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	Saved	Restored
B	Saved	Restored
X	Saved	Restored
Overflow	Destroyed	

3.3.13.2.2 General Flow Chart



3.3.13.3 Label Description

3.3.13.3.1 Local Labels

<u>Symbol</u>	<u>Function</u>
OZ\$1	contains address of next word to be output

3.3.13.3.2 Global Labels

<u>Symbol</u>	<u>Function</u>
SAVE	buffer used to save volatile registers

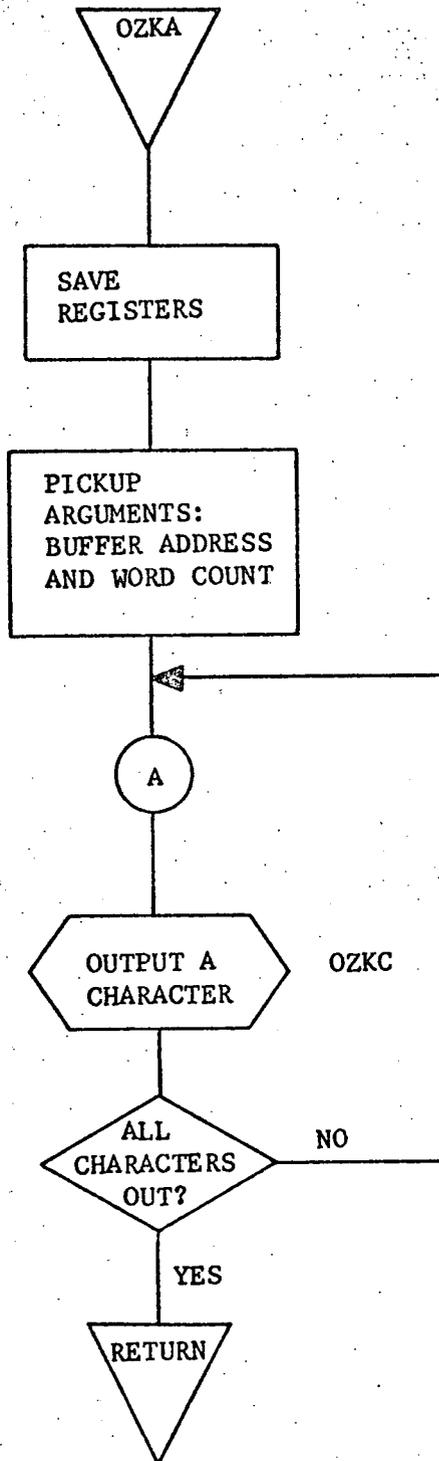
3.3.13.3.3 Entry Point

primary entry point - OZKA

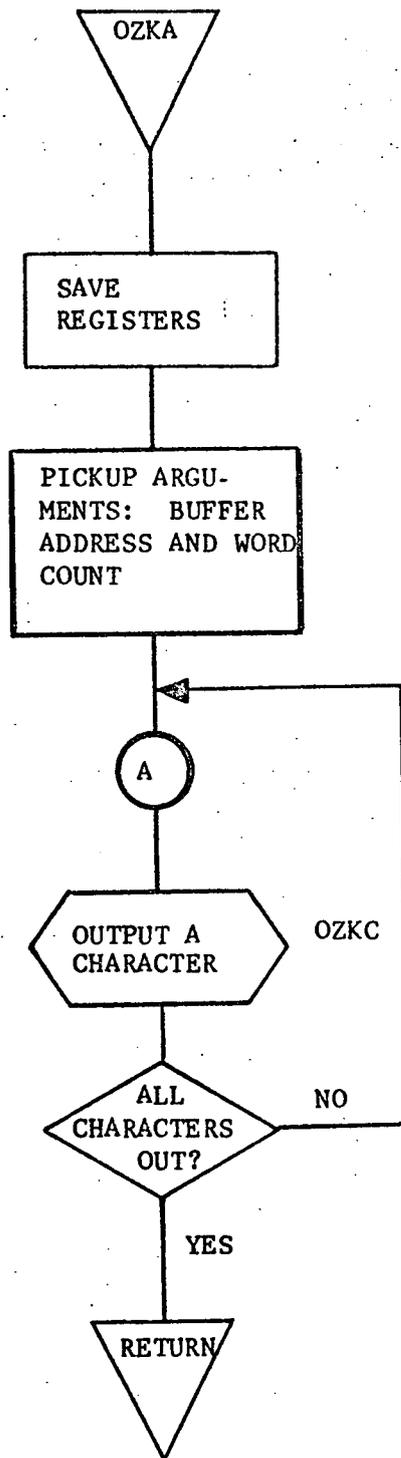
3.3.13.3.4 External References

OZKC - routine which outputs one character to the TTY

3.3.13.4 Detailed Flow Chart



3.3.13.4 Detailed Flow Chart



3.3.14 OZKC - Output Character to TTY

3.3.14.1 Purpose

This routine outputs one character to the ASR-35 teletype.

3.3.14.2 Technical Description

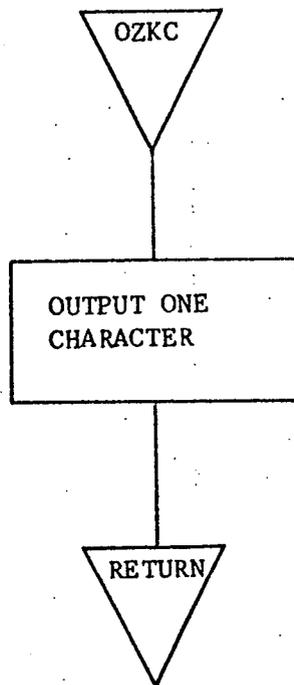
NA

3.3.14.2.1 Calling Sequence

CALL OZKC

The A-register contains the character to be output.

3.3.14.2.2 General Flow Chart



3.3.14.3 Label Description

3.3.14.3.1 Local Labels

None

3.3.14.3.2 Global

None

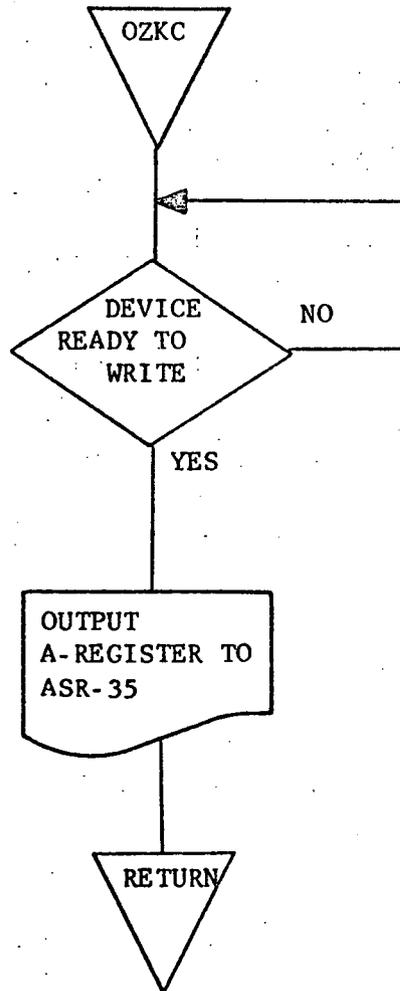
3.3.14.3.3 Entry Point

Primary entry point OZKC

3.3.14.3.4 External References

None

3.3.14.4 Detailed Flow Chart



3.3.15 OZKR - Output Carriage Return and Line Feed.

3.3.15.1 Purpose

This routine outputs a carriage return and a line feed each time it is called.

3.3.15.2 Technical Description

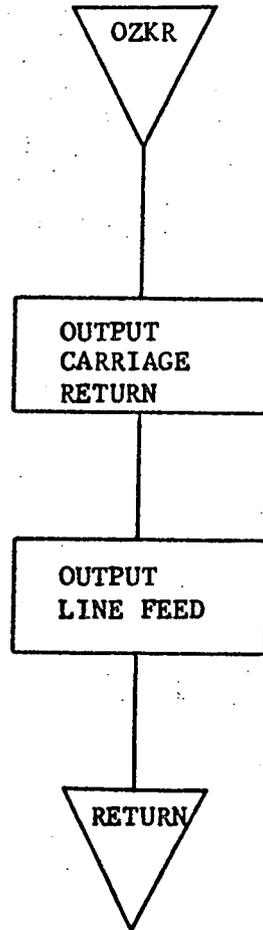
NA

3.3.15.2.1 Calling Sequence

CALL OZKR

No arguments are passed; no registers are used to transfer information.

3.3.15.2.2 General Flow Chart



3.3.15.3 Label Description

3.3.15.3.1 Local

None

3.3.15.3.2 Global

SAVE - used to save the A-register.

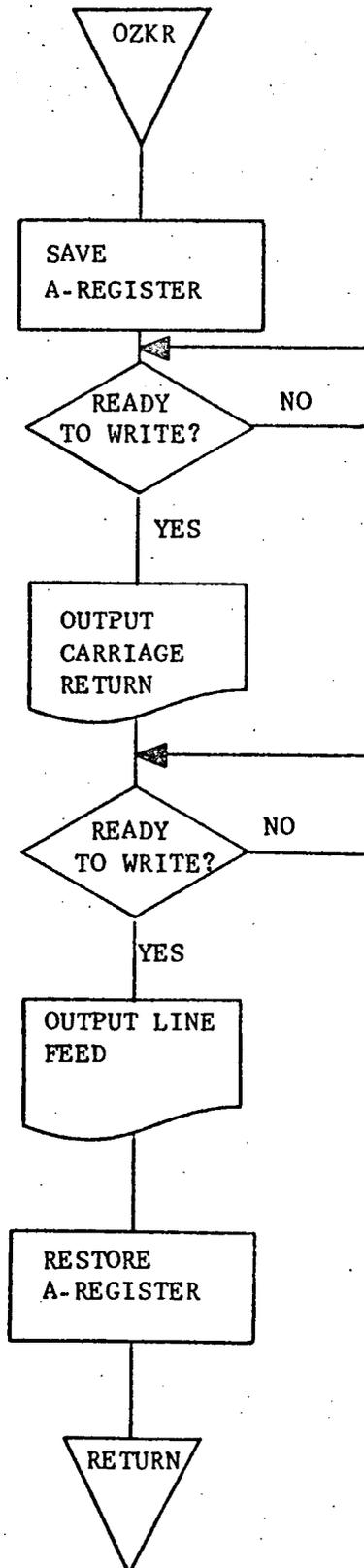
3.3.15.3.3 Entry Point

Primary entry point - OZKR

3.3.15.3.4 External References

None

3.3.15.4 Detailed Flow Chart



3.3.16 PINT - Power Fail - Restart

3.3.16.1 Purpose

This routine provides protection against program failure whenever a physical power failure occurs.

3.3.16.2 Technical Description

When a power failure occurs, the location counter and the volatile registers are saved and a halt occurs. Upon restoration of adequate power, the volatile registers are reinstated and processing resumes at the address specified by the value saved for the location counter.

3.3.16.2.1 Calling Sequence

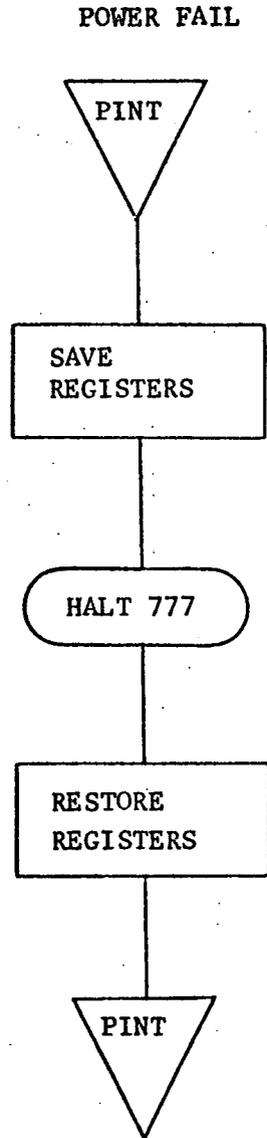
CALL PINT

PARAMETER	FUNCTION
-----------	----------

None

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	Saved	Restored
B	Saved	Restored
X	Saved	Restored
Overflow	Saved	Restored

3.3.16.2.2 General Flow Chart



3.3.16.3 Label Description

3.3.16.3.1 Local

AR Contents of A-register
BR Contents of B-register
XR Contents of X-register
OF Contents of overflow indicator

3.3.16.3.2 Global

None

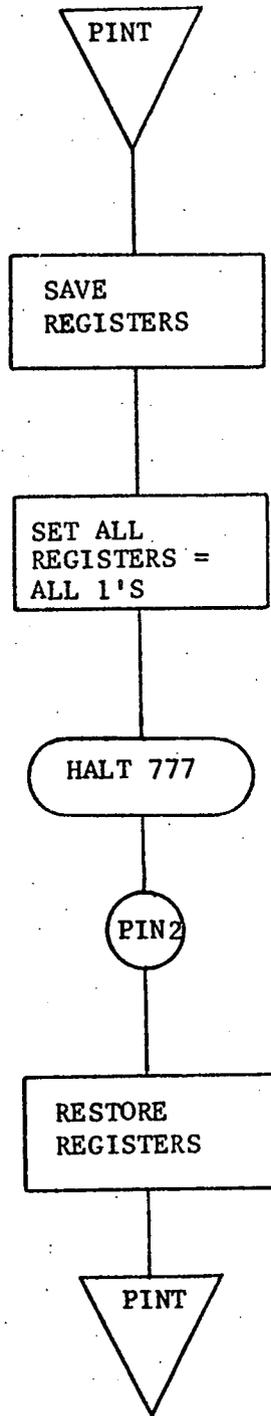
3.3.16.3.3 Entry Points

PINT - entry for power failure
PIN2 - entry for power restoration

3.3.16.3.4 External References

None

3.3.16.4 Detailed flow chart



3.3.17 SC00 - Set Cursor

3.3.17.1 Purpose

SC00 is a subroutine whose purpose is to position the CRT cursor to the next answer line on the MEDATA input forms.

3.3.17.2 Technical Description

Feedback from users of the MEDATA input system showed that manually positioning the CRT cursor from question to question proved to be both cumbersome and time consuming. SC00 automatically positions the cursor to one of several positions for the current CRT data line, depending on the data conditions. Figure 3-3 shows the data conditions which may exist and the corresponding cursor positioning for each condition. The user positions the cursor to the next data line by depressing the interrupt key on the keyboard. If the interrupt key is depressed when the cursor is already positioned to the bottom line of the input form, the cursor is automatically positioned back to the top line.

DATA CONDITION

CURSOR POSITION

- | | |
|--|---|
| 1. New line character detected before the tab position (Column 21) and after a colon on this line. | position to new line character |
| 2. New Line character found before a colon on this line. | advance to next line |
| 3. Colon supercedes tab and first non-space character after colon is a left parenthesis. | position to character immediately following the left parenthesis. |
| 4. Colon precedes tab and all spaces between the colon and tab. | position to tab |
| 5. Colon precedes tab and at least one non-space character between the colon and tab. | position to character immediately following the colon. |
| 6. Colon precedes tab and first non-space character after colon is left parenthesis. | position to character immediately following left parenthesis. |
| 7. Colon supercedes tab and first non-space character after colon unequal left parenthesis. | position to character immediately following the colon. |
| 8. Colon supercedes tab and all spaces following colon. | position to character immediately following the colon. |

Figure 3-3 Cursor Positioning Criteria

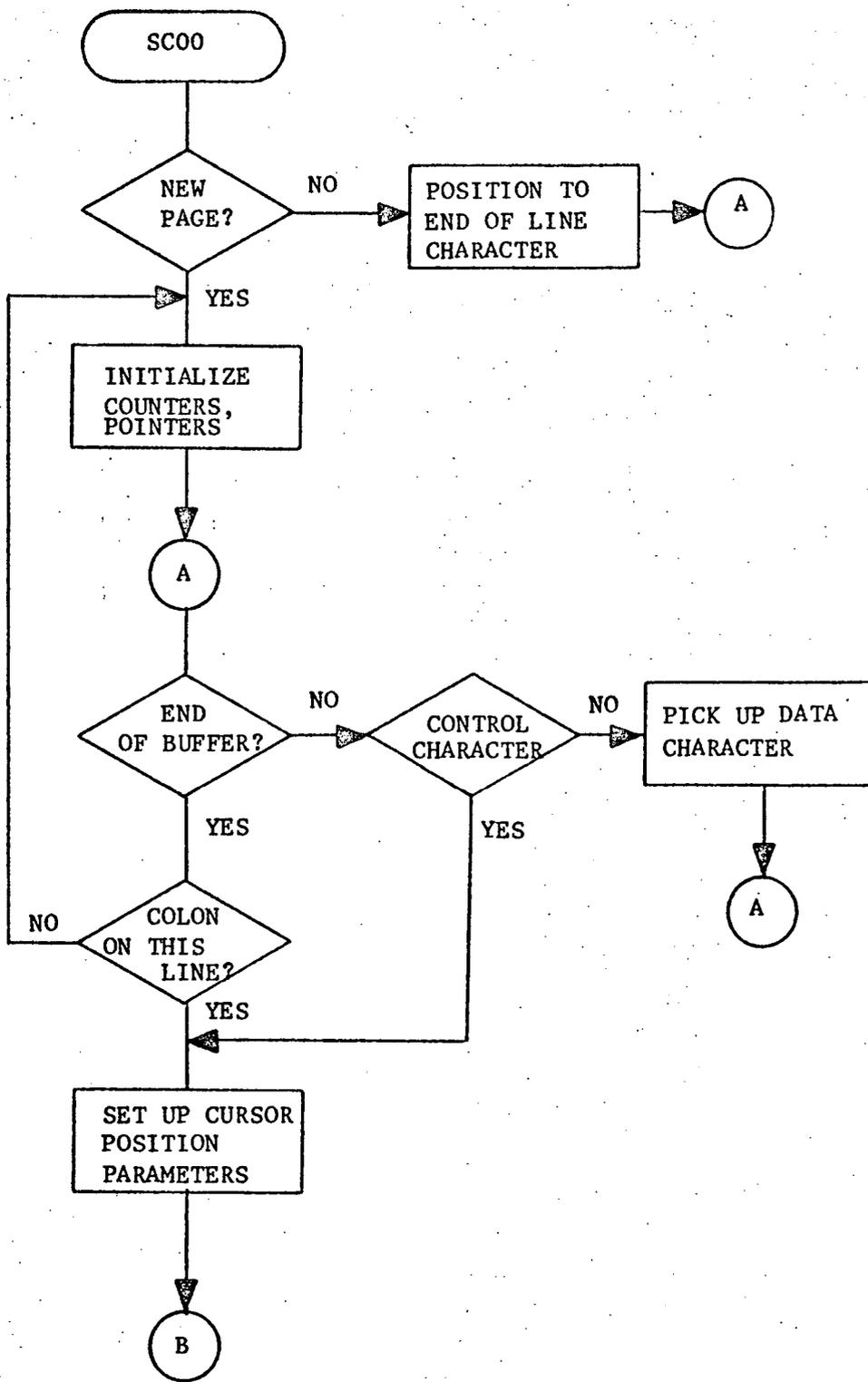
3.3.17.2.1 Calling Sequence

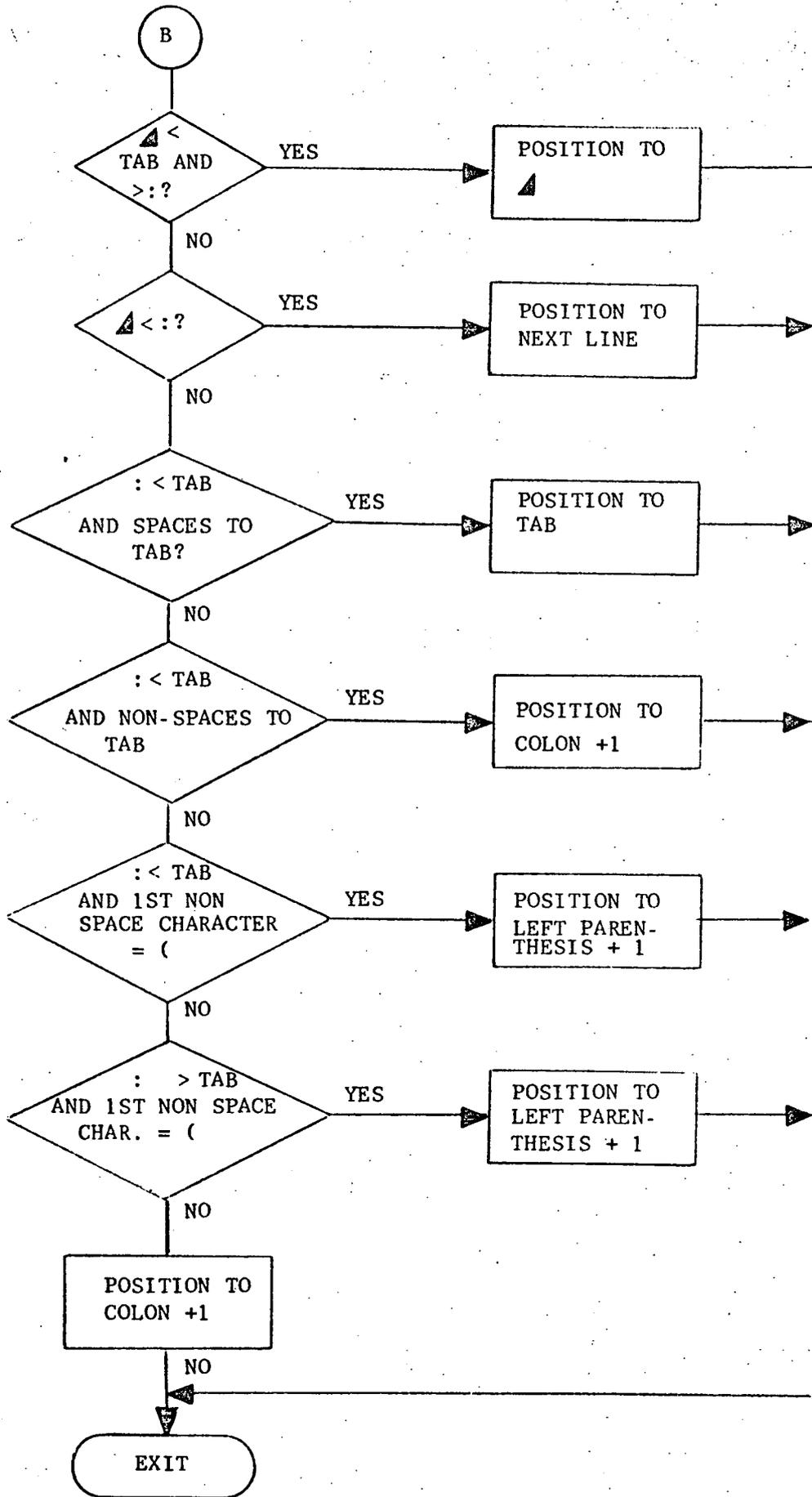
CALL SC00, SCXX

PARAMETER	FUNCTION
SCXX	if SCXX is equal to zero, the cursor is to be reset to the first answer area on the page and if SCXX does not equal zero, the cursor is to be set to the answer area on the next data line.

REGISTER	CONTENTS UPON ENTRY	CONTENTS UPON EXIT
A	saved upon entry	restored upon exit
B	saved upon entry	restored upon exit
X	saved upon entry	restored upon exit
Overflow	N/A	N/A

3.3.17.2.2 General Flow Chart





3.3.17.3 Label Description

3.3.17.3.1 Local

ASTAT storage location containing the status of an I/O operation

SCA storage location used for storing the original contents of the A-register

SCB storage location used for storing the original contents of the B-register

SCCOL storage location which contains the number of the current column being processed

SCCSAV storage location used to save the column position whenever a cursor reset control character is detected

SCDATA flag which is set whenever an answer to a particular question is detected

SCEM (1,5,0,0,010,4) CRT parameters necessary to initiate a cursor reset

SCKOL flag which is set whenever a colon is found on a question line

SCNW (7) storage locations containing the number of control parameters needed to initiate a cursor reset

SCROW storage location which contains the number of the current row being processed

SCRSAV storage location used to save the row position whenever a cursor reset control character is detected

SCTAB flag which is set whenever the tab column position (column 21) has been processed for a data line

SCX storage location used for storing the original contents of the X-register

3.3.17.3.2 Global

N/A

3.3.17.3.3 Entry Points

SC00 - primary entry point

3.3.17.3.4 External References

3.3.17.3.4.1 Labels

CRO\$ CRT Output Buffer

DPT\$ display output buffer pointer. This pointer is used in SC00 to determine when a buffer has been processed.

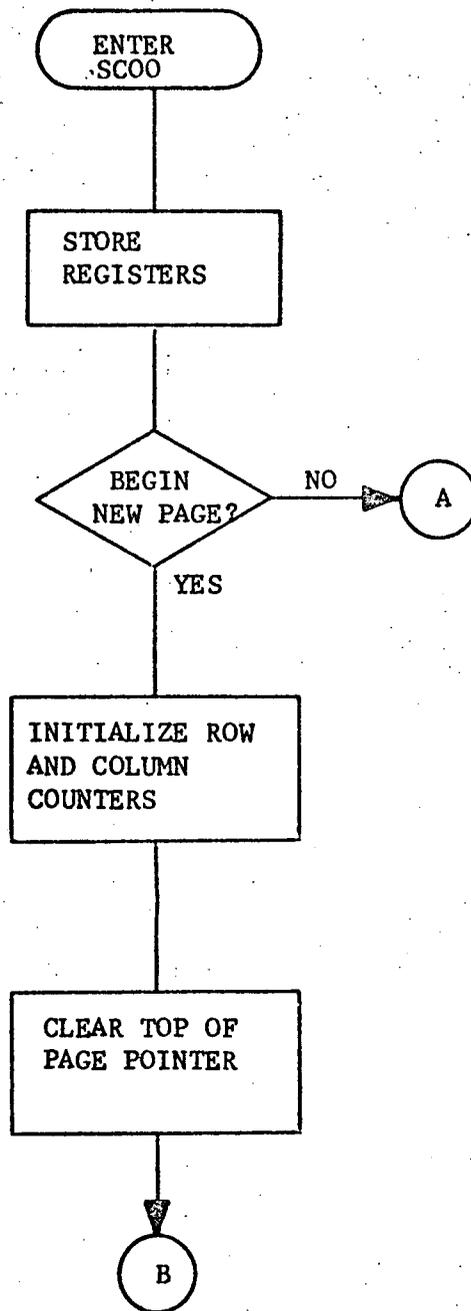
SCXX counter which tells the routine if a new CRT page is to be processed

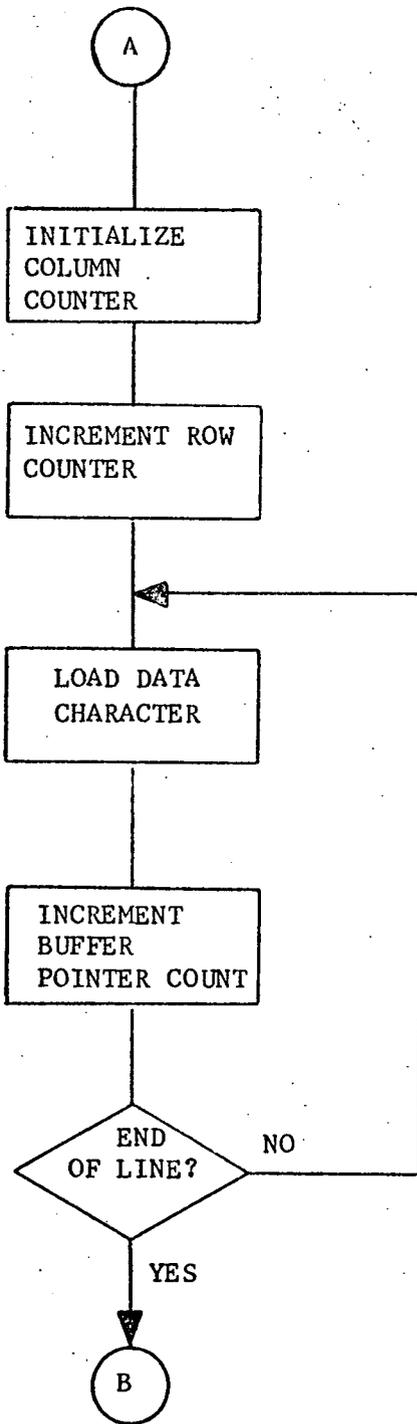
3.3.17.3.4.2 Subroutines

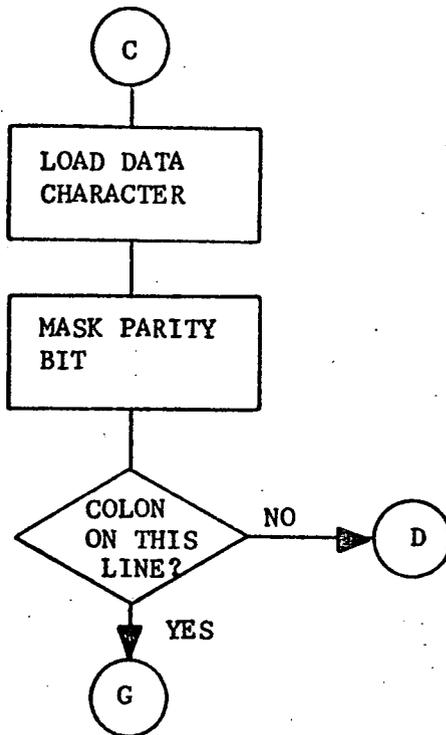
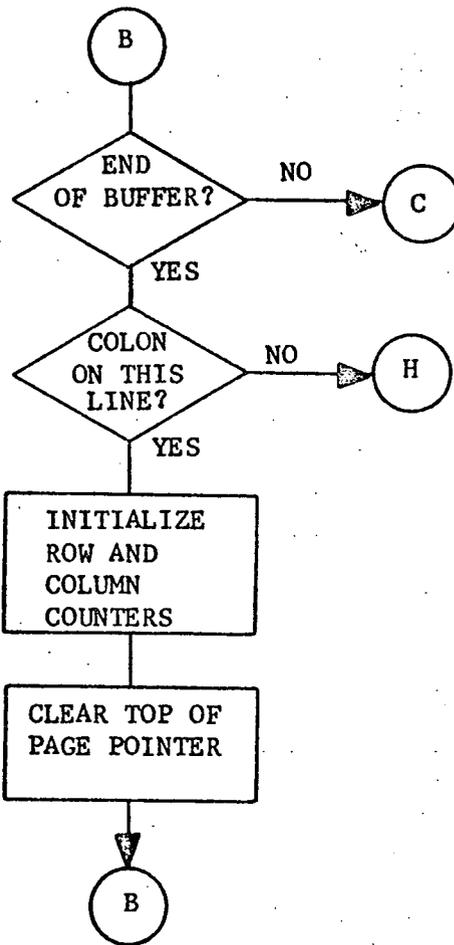
HCDL Time Delay

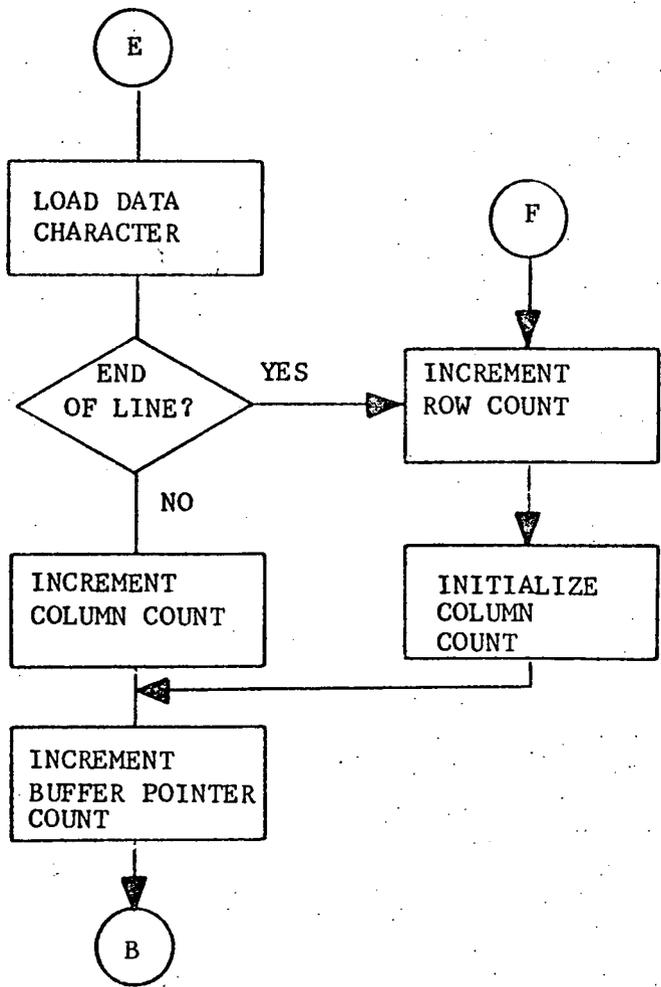
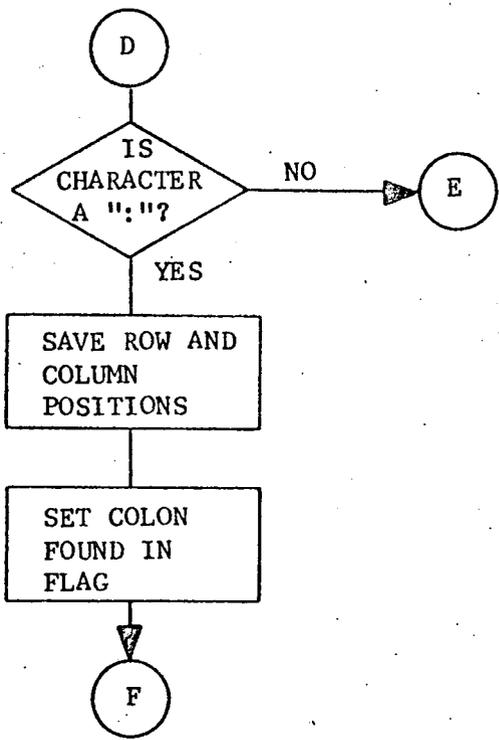
HCOO CRT Handler

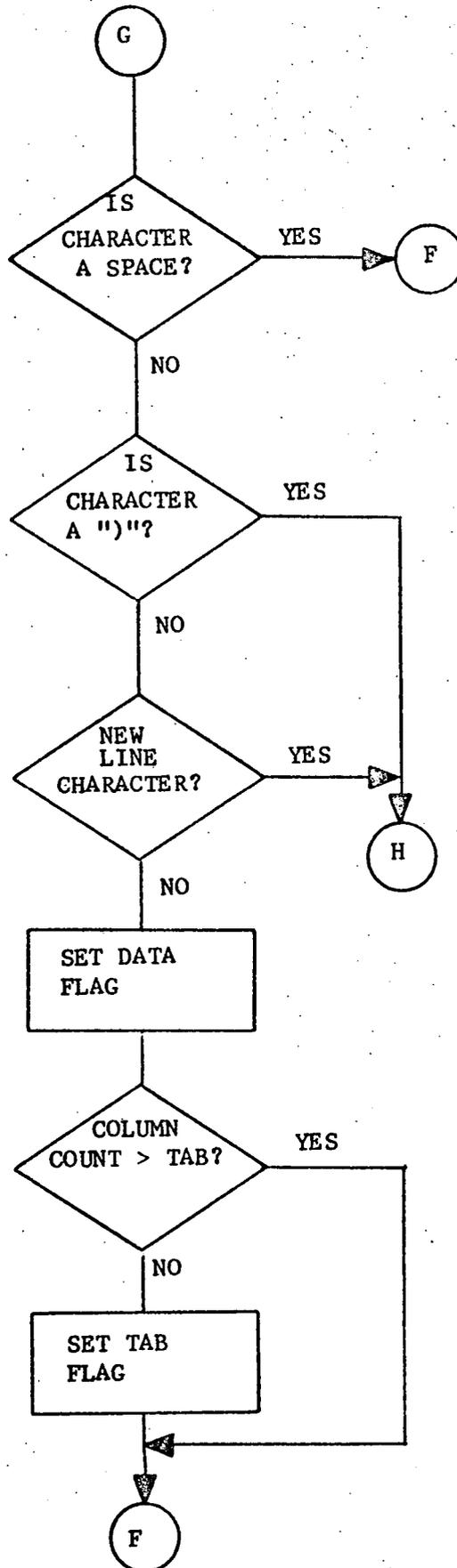
3.3.17.5 Detailed Flow Chart

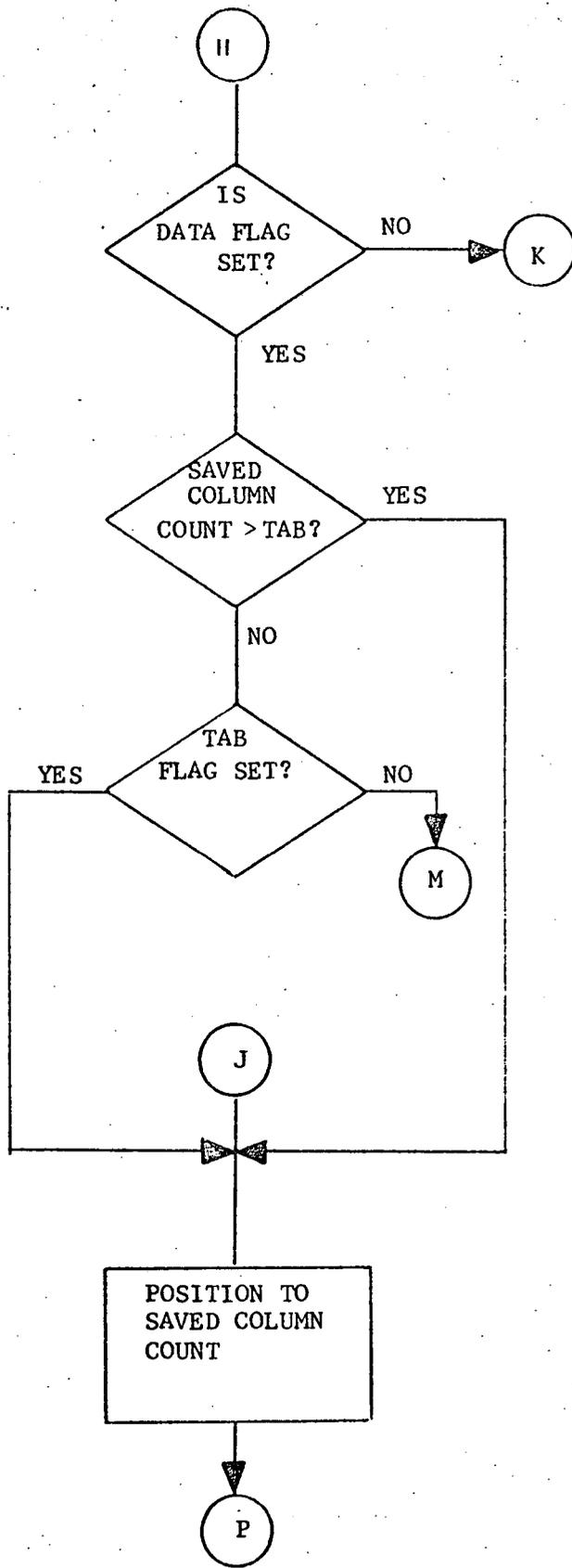


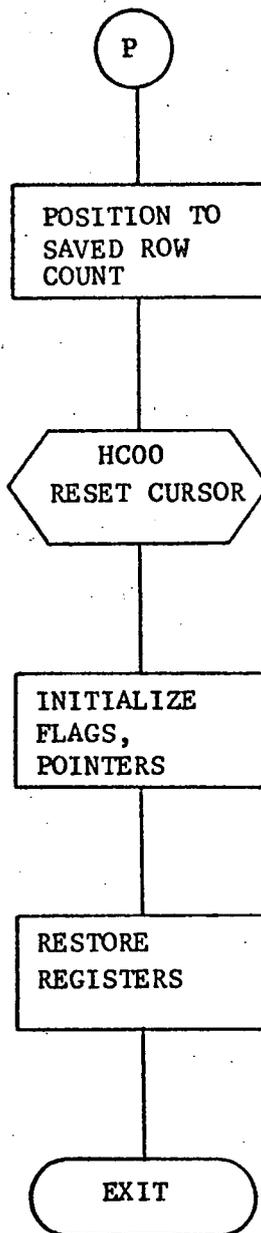


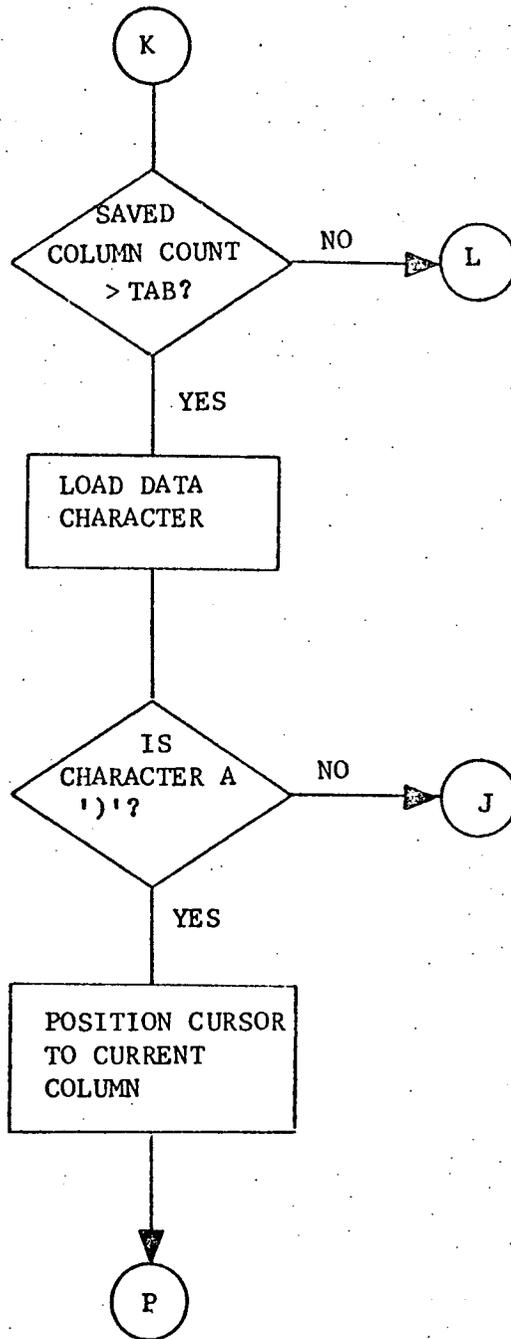


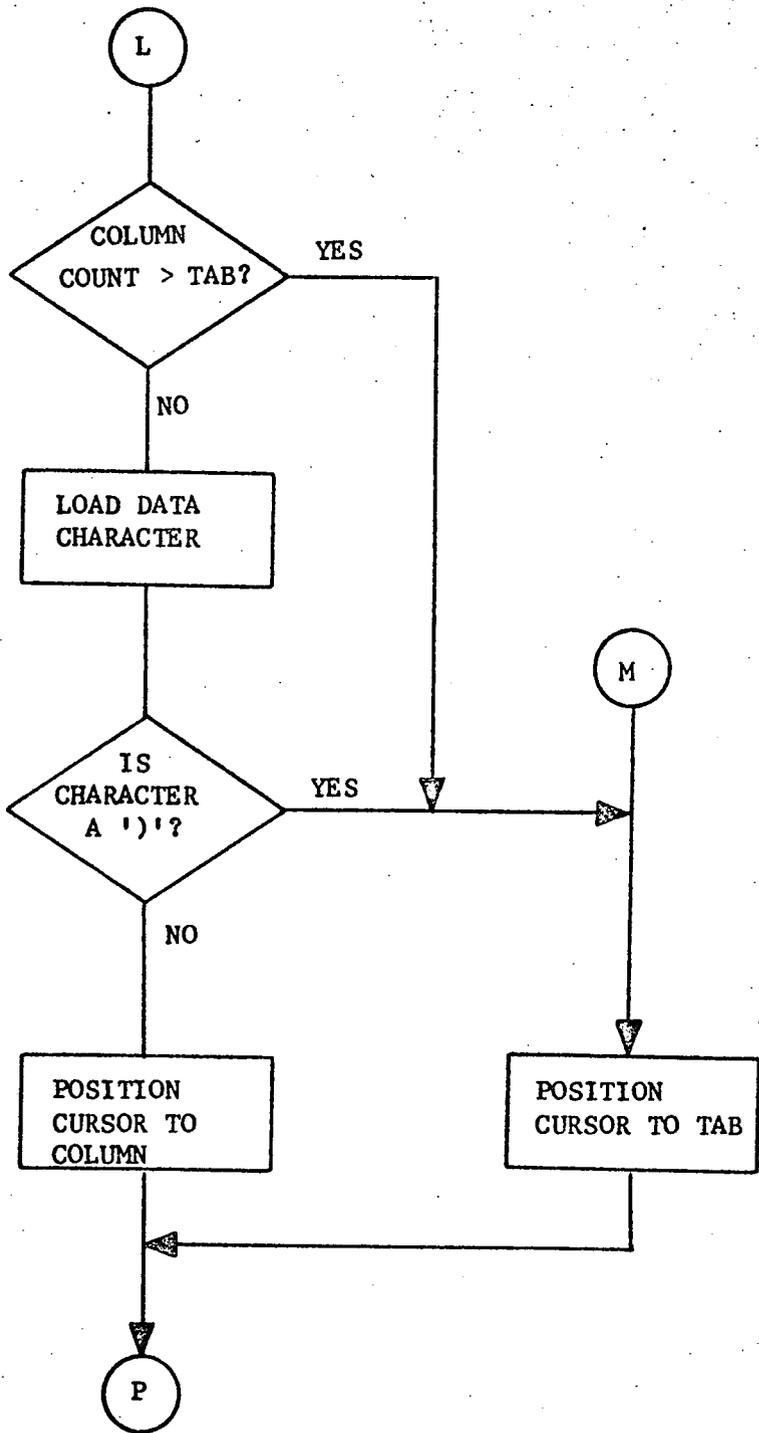












4.0 PROGRAM UTILIZATION

The Varian MEDATA input system (MDIS) is a user-oriented medical information storage and retrieval system designed to permit an on-line question and answer environment. The use of Cathode Ray Tube (CRT) displays permits easy viewing, on-line data form preparation, and subsequent corrections or modifications in the preparation of the medical data forms. The medical data forms are maintained on magnetic tape and are read into computer memory at run time. The user selects the required form and the background is displayed on the CRT. As each form is completed, the data is stored on magnetic tape. This tape may be either updated, transmitted to another terminal, or input to the Building 12 UNIVAC 1108 MEDATA system. The user has the capability of producing hardcopies for any form requested. All background forms are maintained on punched cards and any form can be modified or new forms added by changing the card deck and creating a new background forms tape with an "off-line" utility program.

4.1 COMPUTER OPERATOR INSTRUCTIONS

The following procedures should be followed by the computer operator in preparing MDIS for use:

MDIS OPERATIONAL SETUP PROCEDURES

- Load the MDIS program from either paper tape or magnetic tape.
- Turn on the CCI 301 Display Controller by setting the OFF/ON switch to the ON position.
- Turn on the CRT by pulling the OFF/ON switch.

After allowing several seconds for the unit to warm up, press the MASTER CLEAR and the CLEAR keys on the keyboard in that order. The cursor will appear on the screen.

- Turn on the Magnetic Tape Unit by setting the OFF/ON switch to the ON position.
- Mount the user specified master forms tape. Each set of forms (Surveillance, Flight Crew, etc.) is stored on one tape, hence the user must specify which set he wants.
- Begin program execution at location zero (0) by typing in "GO" on the teletype keyboard.
- The program will respond with the message "MOUNT OUTPUT TAPE. REMEMBER WRITE RING. PRESS RUN WHEN TAPE IS READY." Mount a scratch tape with a write ring attached and position the tape to load point.

MDIS OPERATIONAL WRAPUP PROCEDURES

- After the user has completed filling out the forms, the computer will print the message "TERMINAL INPUT COMPLETE, LOG OUTPUT TAPE, CALL PHILCO". Dismount the tape, label the tape, and notify Philco-Ford that the tape is ready for further processing.

4.2 OPERATIONAL PROCEDURES

MAKING CONTACT WITH THE COMPUTER

After the steps in Section 4.1 have been completed by the operator, the user must begin by typing in FORM XXX in the upper left hand corner of the screen where XXX is the number of the form desired. Then press the TRANS key and wait for a response from the computer. The first page of the form called will appear on the CRT screen. Each set of forms (Surveillance, Flight Crew, Laboratory, etc.) is stored on one tape. The computer operator must know which set of forms the user wants during system preparation time.

FORM AND PAGE ADVANCING

Most forms consist of several pages of full CRT screens of data. To advance from one page to the next, simply press TRANS. An XX appears after the page number when the last page for that form appears. After the last page has been transmitted back to the computer by pressing TRANS, the entire background form, including questions and answers, will be output to the magnetic tape. The computer will then cycle back to the first page of the same form. A new form may be requested by changing the form number to the form required and pressing TRANS.

ERROR CORRECTION AND MODIFICATION

Because the entire page is held in the CCI 301 Display Controller and is not transmitted to the computer until the user presses TRANS, it is always possible to correct errors before transmitting the page to the computer. To erase data, it is necessary only to position the cursor to the character to be erased and press the space bar. To replace data, position the cursor and type over the data. To refresh the current background, place an X in the page number and press TRANS. This will delete all answers and refresh all headings and questions. If the X option is used, no data is stored in the computer for the transmitted page. To reinitialize to the first page of the current form, place an X in the first position of the form number and press TRANS. This option works just like the refresh page option except that it blanks out the answers for the entire form and goes back to page one of the form.

CURSOR POSITIONING

Pressing the INT key will automatically position the cursor down to the next answer area on the page. If INT is pressed while the cursor is positioned at the bottom line of the page the cursor will recycle to the first answer area on top of the page.

EXTRA LINE CAPABILITY

In the case where the user desires to enter an answer which is longer than the allocated answer space, pressing the asterisk key followed by the TRANS will cause the CRT screen to be cleared and the cursor positioned to the home position. The user can then type in his extra data, and on completion, press the LINE and TRANS keys in that order. The computer will output the remaining unanswered portion of the current page being processed.

IDENTIFICATION CARRY-OVER

The Social Security Number and Date is carried over from page to page and form to form. This eliminates the requirement for the user to retype repetitious information page after page.

HARDCOPY CAPABILITY

To obtain a hardcopy of the form to be printed out at the computer, the following procedure is followed: after having transmitted the form and cycled to page one of that form, place a "D" in the first position of the form number and press TRANS. The computer will backspace the output tape and read one record to obtain the last form that was just completed and type it out on the teletype. When the form is completely printed, the computer will display FORM on the screen. Type in the desired form number and press TRANS to continue filling out forms.

PROGRAM TERMINATION

To terminate the program, change the form number to "***" and press TRANS. The computer will write an End of File on the output tape, rewind the tape, and type out terminating instructions to the operator.

4.3 INPUT DESCRIPTION

A magnetic tape, containing the background forms, is created off-line from data cards coded by the system user. This method permits easy design of new forms and modifications to old ones. Each form data card contains a sequence number (if required), question heading, answer area, and any control characters required by MEDATA. The magnetic tape containing the background forms is read into the computer at run time. After the required form has been read into the computer and displayed on the CRT, the user inputs his answers into the corresponding answer areas.

4.4 OUTPUT DESCRIPTION

4.4.1 Reports

The system contains the option of obtaining a hard copy of the forms being output to magnetic tape by dumping the data forms out to the on-line Teletype. See Appendix E for a sample form.

4.4.2 Tapes

The system creates, as output, a magnetic tape containing the user input medical data forms in a format acceptable to the Building 12 UNIVAC 1108 MEDATA system. All control characters required by the MEDATA system

have been added to each individual tape record before output. After generation of the data has been completed, the tape is delivered to the Data Reduction Computer of the Computation and Analysis Division. Here the data is merged with the data contained on the MEDATA master file.

4.4.3 Messages

4.4.3.1 Diagnostics

MESSAGE	EXPLANATION	CORRECTIVE MEASURE
ILLEGAL FORM NUMBER	User has called for an invalid form	Input another form number and press TRANS
ERROR LINE	User has accidentally erased or typed over a colon or right parenthesis	Replace the colon or parenthesis
PLEASE SELECT ANOTHER FORM	An error has been detected in the background form which will not allow the form to be displayed properly	Select another form and press TRANS

4.4.3.1 Diagnostics (Continued)

MESSAGE	EXPLANATION	CORRECTIVE MEASURE
BUFFER LENGTH ERROR	Occurs in the case where the length of the Tape Output Buffer (MTO\$) has been exceeded	Key in the letters "FORM" in the upper left hand corner of the CRT screen and select a new form

4.4.3.2 Advisory

MESSAGE	USER ACTION
FORM	Input the number of the required form
TERMINAL INPUT COM- PLETE, LOG OUTPUT TAPE, CALL PHILCO	Dismount master tape and notify Philco that processing has been completed
RECORD COUNT IS - -	A count of the number of data records processed
MOUNT OUTPUT TAPE. REMEMBER WRITE RING. PRESS RUN WHEN TAPE IS READY	Remind the user to mount the output master tape before proceeding
PARITY ERROR FROM DISPLAY DEVICE	No user action required. Program will retry.

4.4.3.2 Advisory

MESSAGE	USER ACTION
CRT NOT READY	Ready the CRT and then press RUN on the computer console
TAPE UNIT NOT READY	Ready the magnetic tape unit
NUMBER OF WORDS TRANSFERRED IN ERROR	This message will occur only in the case of a hardware error. The program will retry the write.
CRT DEVICE ERROR	No user action required. The program will retry the Input/Output operation

4.5 RESTRICTIONS

Following are a list of commonly made user errors in operating the system.

- Use of space bar to position cursor. Do not use the space bar to position the cursor. If the cursor is under a display character and the user presses "space", it will replace the character with a space. Use the keys which are provided for cursor positioning.
- Placing data after the new line Character "▲".
A new line character "▲" has been placed at the end of each line as it went out to the CRT from the computer. If the user wishes to extend that line, type over the line character and place a new one at the end of the line by pressing the LINE key. Note that no characters placed after the new line character on any one display line are transmitted to the computer.

4.5 RESTRICTIONS (Continued)

- Changing the form number before transmitting the last page of data on a particular form. In order for the data typed in on a form to be recorded on tape at the computer, the user must press TRANS for the last completed page and let the system cycle back to page one before changing the form number.
- Restricted use of \$, L, *, and < . These four special characters are used for control purposes only and may not be used in the body of an answer.

APPENDIX A
INPUT AND OUTPUT TAPES
DESCRIPTIONS

INPUT TAPE

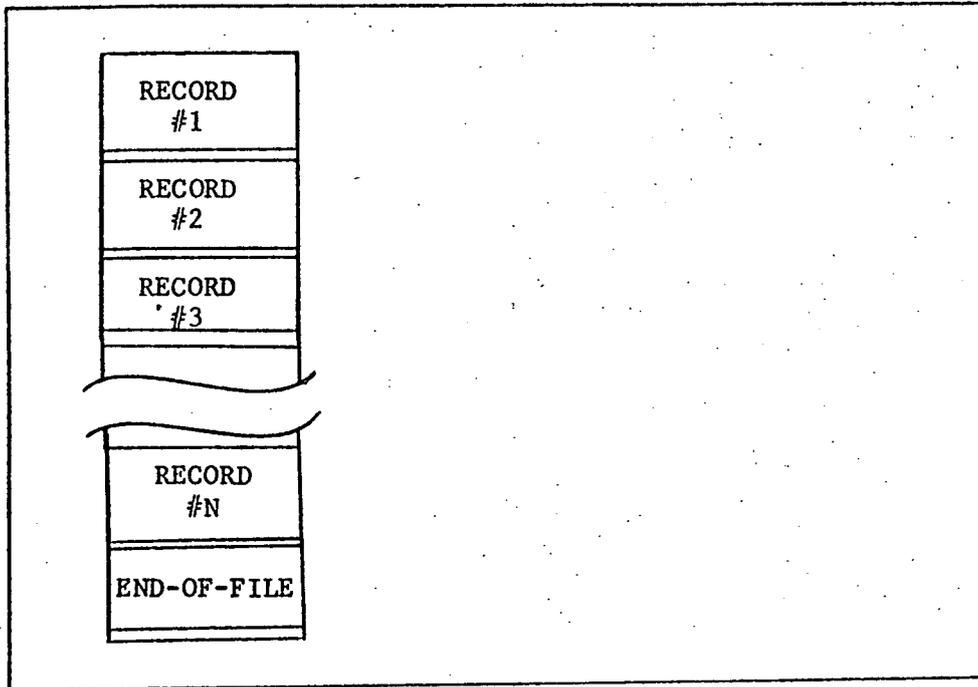


FIGURE A-1. INPUT FILE STRUCTURE

FILE

The input data tape is composed of one multi-record file. As Figure A-1 illustrates, that file is composed of N variable length records.

INPUT TAPE (Continued)

- Level code This is a one digit code between zero and nine inclusive, found within an Item, and it specifies the position or rank in a hierarchical or outline structure of the Item. (i.e., the number of spaces to be indented).
- Sequence number This is a digit from one to four inclusive. It indicates the order in which the ID Items are to be saved on the Master File. The sequence number four must be assigned to Item 4.
- Block character (243₈) The purpose of the block or end-of-block character is to separate all Items on a record.
- End-of-page character (end-of-record) (244₈) This character may follow any Item in the Body Section of the record, and it serves to delimit CRT display data "pages". These pages are the data necessary to fill a CRT screen.
- Heading-Answer pair This is the main component of a data record Item. It will be in one of two forms: Heading and Answer, or Heading alone. If there is an Answer with the Heading, it is preceded by a colon. The number of characters in a heading plus the value of the level code cannot exceed twenty-four. (Thus, if the level code is four, the Heading cannot exceed twenty characters.) The Answer in the Identification Section cannot exceed seventy-two characters; the Answer in the Body Section may be any length.

INPUT TAPE (CONTINUED)

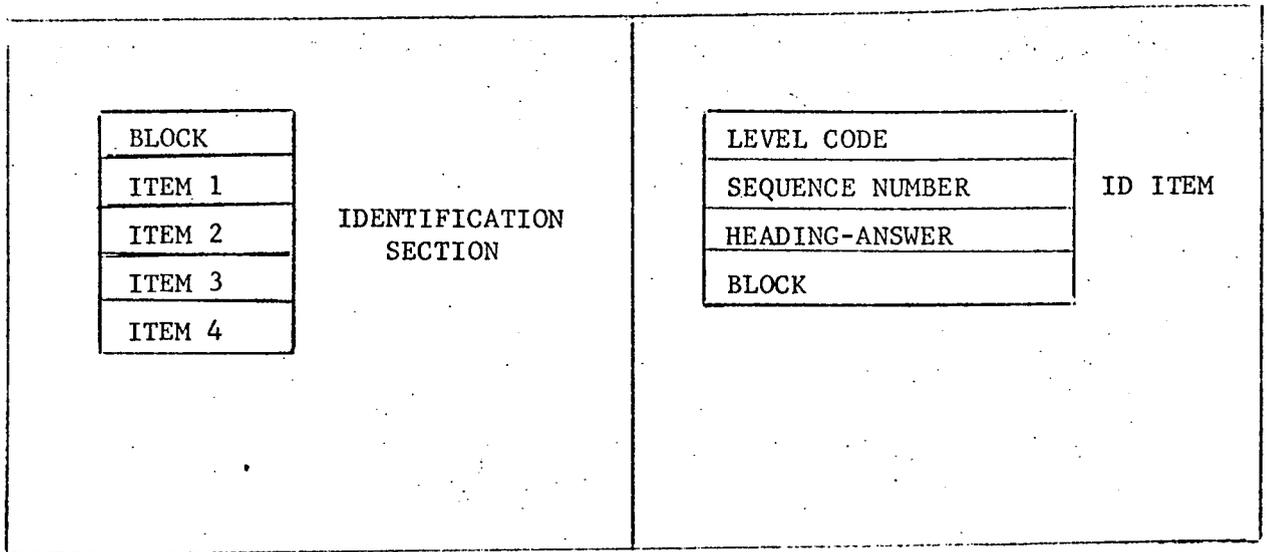


FIGURE A-3. IDENTIFICATION SECTION DESCRIPTION

IDENTIFICATION SECTION

The Identification Section of a data tape record is made up of four Items preceded by a block character, as shown in Figure A-3. For each Heading-Answer pair in an Item, there is a level code and a sequence number associated with it. The level code is always zero. All possible sequence numbers (1, 2, 3, 4) must occur in ID Items. They may occur in any order with one exception. Sequence number 4 must be associated with Item 4. The only other restriction in the ID Section is that the Heading associated with Item 4 must be DATE.

INPUT TAPE (Continued)

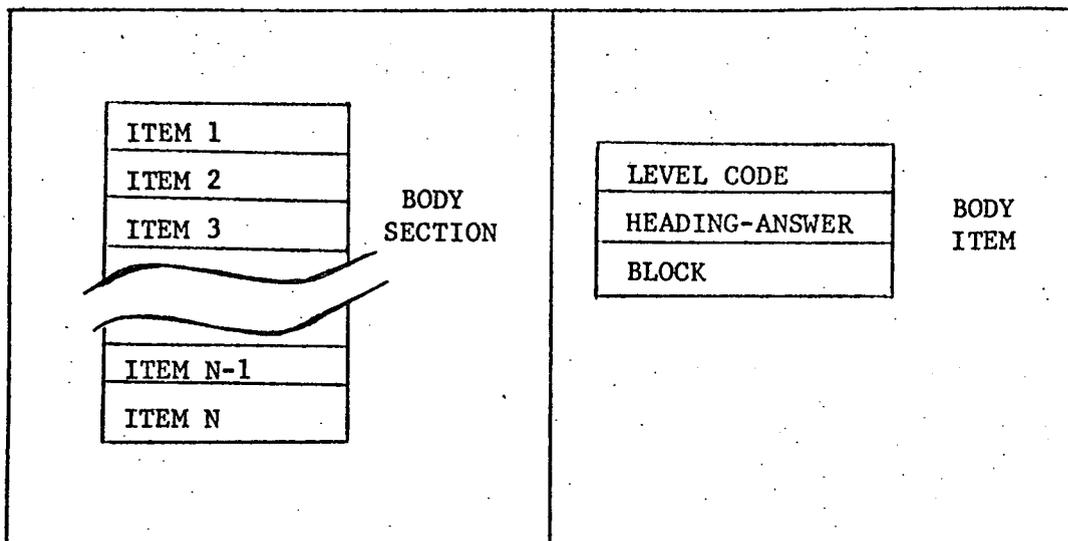


FIGURE A-4. BODY SECTION DESCRIPTION

BODY SECTION

The Body Section consists of a variable number of Items. A Body Item is like an ID Item except it contains no sequence number, and its Answer may be longer. If the Answer portion is to be longer than one line, consecutive block characters are used, one for each line.

OUTPUT TAPE

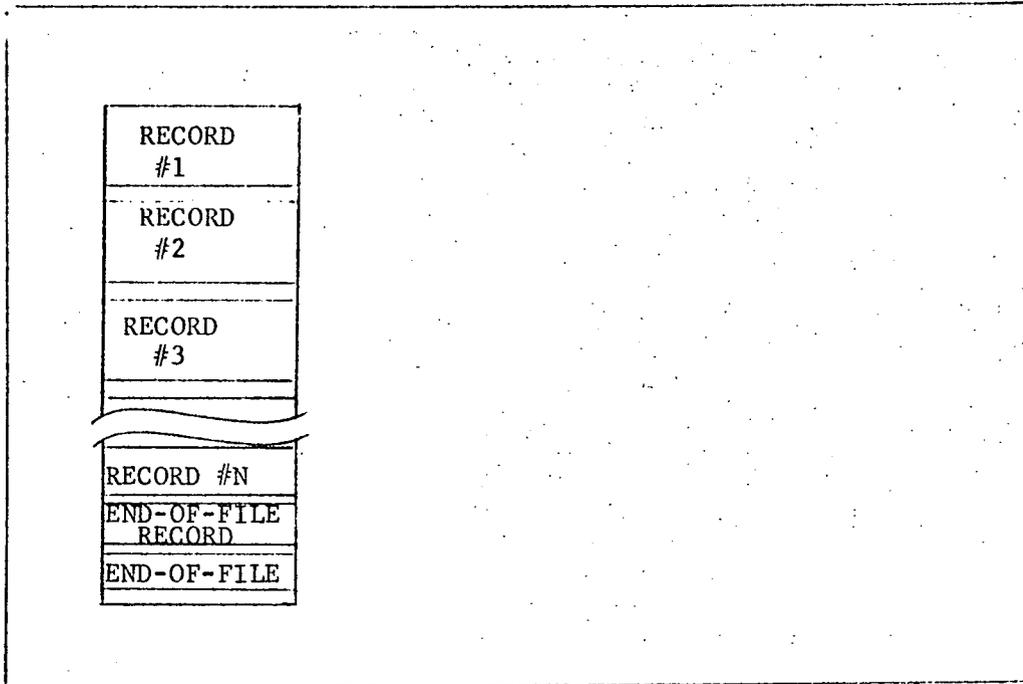


FIGURE A-5. OUTPUT FILE STRUCTURE

FILE

The output data tape is composed of one multi-record file. As Figure A-5 illustrates, that file is composed of N fixed length records, a software end-of-file record, and a hardware end-of-file mark.

OUTPUT TAPE (Continued)

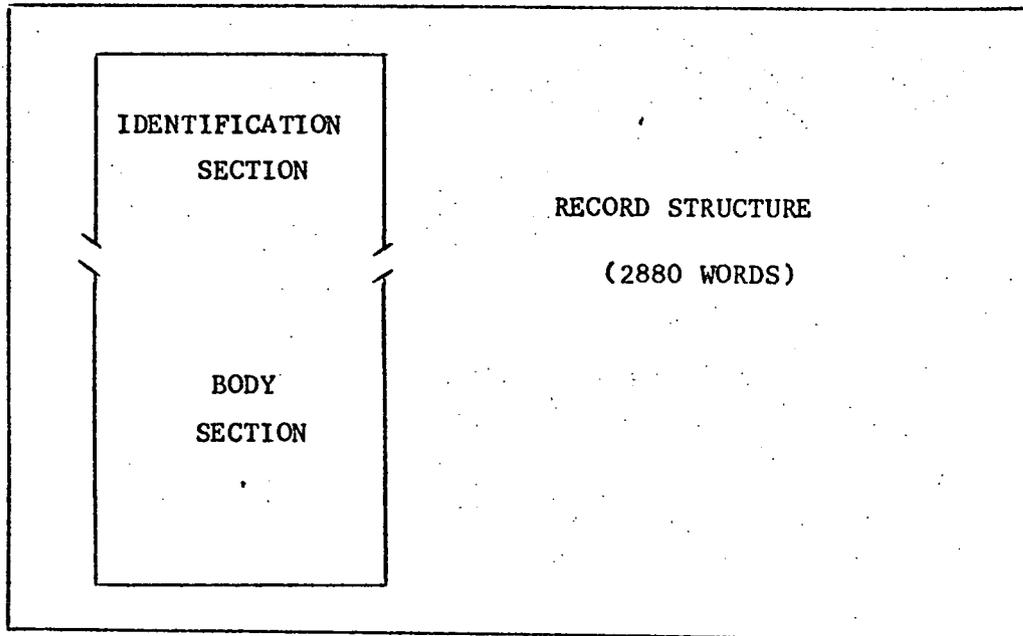


FIGURE A-6 OUTPUT RECORD STRUCTURE

DATA RECORD

Each tape record contains the background data and input data for an entire form. While a record is a fixed length of 5760 ASCII characters, the data for the form may be somewhat shorter, in which case, the remainder of the 2880 word record is blank filled. Figure A-6 shows the record structure. In general, it is composed of two distinct sections, each of variable length:

- (1) Identification Section
- (2) Body Section.

These two sections are very similar to the input tape record. The definitions for the output record are the same as those of the input record with the following exceptions and additions:

OUTPUT TAPE (Continued)

Block character (44g)

End-of-page character (241g)

End-of-record (137g) This character is the last data character of a form. Since the record is fixed length, all words following the end-of-record character are blank filled.

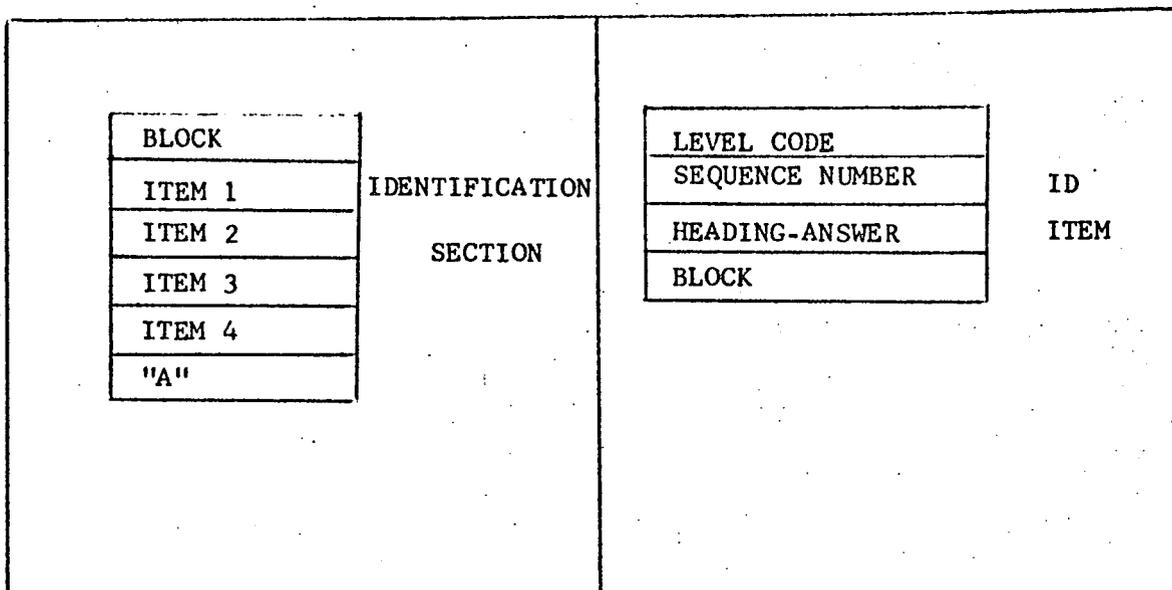


FIGURE A-7. IDENTIFICATION SECTION DESCRIPTION

IDENTIFICATION SECTION

The Identification Section of a data tape record is made up of four Items preceded by a block character, and followed by the alphabetic character "A", as shown in Figure A-7. For each Heading-Answer pair in an Item, there is a level code and a sequence number associated with it. The level code is always zero. All possible sequence numbers (1,2,3,4) must occur in ID Items. They may occur in any order with one exception. Sequence number 4 must be associated with Item 4. The only other restriction in the ID Section is that the Heading associated with Item 4 must be DATE.

OUTPUT TAPE (Continued)

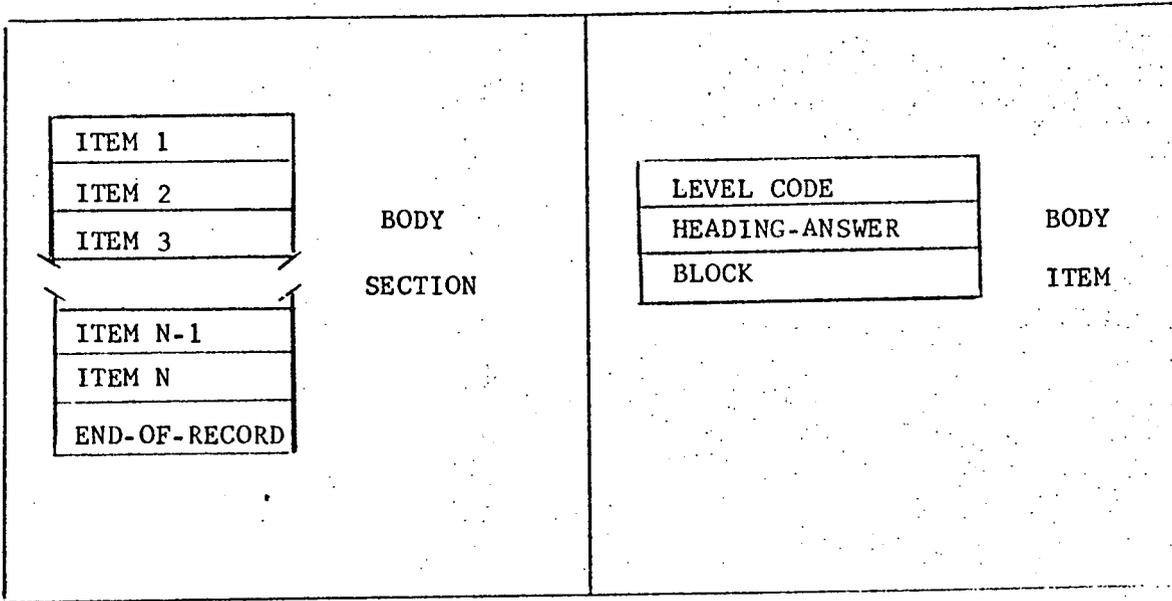


FIGURE A-8. BODY SECTION DESCRIPTION

BODY SECTION

The Body Section consists of a variable number of Items, followed by an end-of-record character. A Body Item is like an ID Item except it contains no sequence number, and its Answer may be any length. If the Answer is longer than one line, a carriage return character is stored at the end of the line.

OUTPUT TAPE (Continued)

END-OF-FILE RECORD

The last record on the file is the end-of-file record. It is used as a software end-of-file and consists of an end-of-record character in the first word of the 2880 word record. The remainder of the record is ignored.

Appendix B

CRT Data Format

The data displayed at the CRT is composed of two data types and two special CRT characters. The data types are:

1. Blind headings. A series of 24 or less characters which is used as a descriptor for the heading-answer pairs that follow.
2. Heading-answer pair. This data type is composed of a heading of 24 or less characters and an answer of variable length. The answer field may be filled, or it may be made up of one or more blank lines.

The two special characters are:

1. LINE. (▲) 12_8 This character is found at the end of most lines. Any data following this character and on the same line will be ignored.
2. ETX. (▶) 3_8 This character may be input by the user from the CRT keyboard. Any data following this character, whether it be on the same line or subsequent lines, will not be input to the computer. In the event this character is not displayed by the user, the very last code to be input to the user is this character code. Thus, in all cases, it is the last character to be transmitted.

Appendix C

LTBS Line Table Format

Each display line has a corresponding Line Table word. The format of each word is as follows:

<u>Bits</u>	<u>Description</u>
0 - 5	Level code
6 - 11	Sequence number
12	Two question bit. If set, it indicates that the next word contains line table data on a question that is also on the current line.
13	More lines bit. If set, it indicates that the answer field requires more than one line, and the following line is a continuation of that field.
14	No answer bit. If set, it indicates that the current line contains a blind heading.
15	Continuation line bit. If set, it indicates that the current line may contain data that is merely a continuation of the answer field of the previous line.

APPENDIX D

SAMPLE INPUT

SAMPLE TAPE INPUT

```

FORM 001 PAGE 01 METADATA#
02RECORD:  REGISTRY#
03TYPE:    IDENTIFICATION#
01SS NO:\04DATE:#
0NAME:#
0PURPOSE:      ( )#
#
0BLOOD TYPE:   #
0RACE:         #
0SEX:         #
0HANDEDNESS:  #
0SHOE SIZE:   ( )#
0BIRTHDATE:   #
0BIRTHPLACE:#
0POSITION:#
0AGENCY:      #
0ORGANIZATIONAL UNIT:#
0GOVERNMENT SERVICE#
1MILITARY#
2FROM:        ( )#
2TO:          #
1CIVILIAN#
2FROM:        ( )#
2TO:          #
$FORM 001 PAGE 02 XX METADATA#
0RATING OR SPECIALTY:#
#
1TIME IN THIS CAPACITY#
2TOTAL:       ( )HRS#
2LAST 6 MO:   ( )HRS#
0PRESENT HOME ADDRESS:#
#
0NEXT OF KIN:  #
1RELATIONSHIP: #
1ADDRESS:#
#
0PHYSIOLOGICAL TRAINING:#
0OTHER INFORMATION:#
0COMMENTS:#
#
0TYPED:#
$ ←
    
```

- # - block character
- \ - tab character
- \$ - end-of-page character
- ← - end-of-form character

This printout shows data by lines.
 On the tape, all data is packed.

SAMPLE CRT INPUT

FORM 001 PAGE 001 METADATA
RECORD: REGISTRY
TYPE: IDENTIFICATION
SS NO: [REDACTED]
DATE: 01JUN71
NAME:
PURPOSE: (71) DEMONSTRATION

BLOOD TYPE:
RACE: CAUC
SEX: FEM
HANDEDNESS: LEFT
SHOE SIZE: (7C)
BIRTHDATE: 23MAY45
BIRTHPLACE: LOS ANGELES, CALIFORNIA
POSITION:
AGENCY:
ORGANIZATIONAL UNIT:
GOVERNMENT SERVICE
MILITARY
FROM: ()
TO:
CIVILIAN
FROM: (67)
TO: PRESENT

APPENDIX E

SAMPLE OUTPUT

SAMPLE TAPE OUTPUT

```

$
02RECORD: REGISTRY$
03TYPE: IDENTIFICATION$
01SS NO: ██████████
04DATE: 01JUN71$
AO NAME: $
0 PURPOSE: (71)DEMONSTRATION$
$
0 BLOOD TYPE: $
0 RACE: CAUC$
0 SEX: FEM$
0 HANDEDNESS: LEFT$
0 SHOE SIZE: (7C )$
0 BIRTHDATE: 23MAY45 $
0 BIRTHPLACE: LOS ANGELES, CALIFORNIA $
0 POSITION: $
0 AGENCY: $
0 ORGANIZATIONAL UNIT: $
0 GOVERNMENT SERVICE$
1 MILITARY$
2 FROM: ( )$
2 TO: $
1 CIVILIAN$
2 FROM: (67)$
2 TO: PRESENT$
1$
0 RATING OR SPECIALTY: DIETICIAN$
$
1 TIME IN THIS CAPACITY$
2 TOTAL: ( )HR$
2 LAST 6 MO: ( )HR$
0 PRESENT HOME ADDRESS: 1429 LAPLACE$
HOUSTON, TEXAS 77043$
0 NEXT OF KIN: $
1 RELATIONSHIP: $
1 ADDRESS: $
$
0 PHYSIOLOGICAL TRAINING: $
0 OTHER INFORMATION: $
0 COMMENTS: $
$
0 TYPED: JB/NRD
! ←
    
```

\$ - block character
 ! - end-of-page character
 ← - end-of-record character

This printout shows data by lines.
 On the tape, all data is packed.

SAMPLE CRT OUTPUT

FORM 001 PAGE 01 MEDATA
RECORD: REGISTRY
TYPE: IDENTIFICATION
SS NO:
DATE:
NAME:
PURPOSE: ()

BLOOD TYPE:
RACE:
SEX:
HANDEDNESS:
SHOE SIZE: ()
BIRTHDATE:
BIRTHPLACE:
POSITION:
AGENCY:
ORGANIZATIONAL UNIT:
GOVERNMENT SERVICE
MILITARY
FROM: ()
TO:
CIVILIAN
FROM: ()
TO:

