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IBM 1130 Disk Monitor System, Version 2, Programmer's and Operator's Guide

Program Numbers: 1130-OS-005
1130-OS-006

Eleventh Edition (June 1974)

This is a reprint of GC26-3717-9 incorporating changes released in Technical Newsletter GN34-0183 dated February 1974.

This edition applies to version 2, modification 12, of the IBM 1130 Disk Monitor Programming System; to version 1, modification 5, of the IBM 1130 Remote Job Entry Work Station Program, and to all subsequent versions and modifications until otherwise indicated in new editions or Technical Newsletters. Changes are periodically made to the information herein. Before using this publication in connection with the operation of IBM systems, consult the latest SRL Newsletter, GN20-1130, for the editions that are applicable and current.

Text for this manual has been prepared with the IBM Selectric ® Composer.

Some illustrations in this manual have a code number in the lower corner. This is a publishing control number and is not related to the subject matter.

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Preface

This publication contains reference information for controlling and operating the 1130 Disk Monitor System, Version 2. The publication assumes you are familiar with the programming language needed to do your jobs.

Chapter 1 of this publication describes how you use this book. The rest of the chapters:

- Describe the disk monitor system (DM2) programs and disk areas
- Describe the control records for controlling the functions of the disk monitor system
- Provide tips and techniques for more efficient use of DM2
- Provide sample operating procedures for loading, reloading, and using DM2
- Describe the 1130 RJE Work Station Program

The minimum system configuration required to operate the IBM 1130 Disk Monitor System, Version 2, Program Number 1130-OS-005 (card input/output) is:

- An IBM 1131 Central Processing Unit, Model 2A or 4A (with an internal single disk storage drive and 4096 words of core storage)
- An IBM 1442 Card Read Punch, Model 6 or 7, or an IBM 2501 Card Reader, in combination with an IBM 1442 Card Punch, Model 5

or

- An IBM 1131 Central Processing Unit, Model 1B (with 8192 words of core storage)
- An IBM 1133 Multiplex Control Enclosure
- An IBM 2311 Disk Storage Drive, Model 12
- An IBM 1442 Card Read Punch, Model 6 or 7, or an IBM 2501 Card Reader, in combination with an IBM 1442 Card Punch, Model 5

The minimum system configuration required to operate the IBM 1130 Disk Monitor System, Version 2, Program Number 1130-OS-006 (paper tape input/output) is:

- An IBM 1131 Central Processing Unit, Model 2A (with an internal single disk storage drive and 4096 words of core storage)
- An IBM 1134 Paper Tape Reader
- An IBM 1055 Paper Tape Punch

The following publications provide further information about the 1130 computing system:

IBM 1130 Functional Characteristics, GA26-5881
IBM 1130 Operating Procedures, GA26-5717
IBM 1130/1800 Assembler Language, GC26-3778
IBM 1130/1800 Basic FORTRAN IV Language, GC26-3715
IBM 1130 RPG Language, GC21-5002
IBM 1130 Subroutine Library, GC26-5929
IBM 1130 MTCA IOCS Subroutines, GC33-3002
IBM 1130 Synchronous Communications Adapter Subroutines, GC26-3706
IBM 1130/1800 Plotter Subroutines, GC26-3755
IBM System/360 Operating System and 1130 Disk Monitor System: System/360 1130 Data Transmission for FORTRAN, GC27-6937
IBM System/360 Operating System and 1130 Disk Monitor System: User's Guide for Job Control from an IBM 2250 Display Unit Attached to an IBM 1130 System, GC27-6938
IBM System/360 Operating System: Remote Job Entry, GC30-2006

Publications that provide information about IBM 1130 COBOL, a program product, are:

IBM 1130 COBOL General Information Manual, GH20-0799
IBM 1130 COBOL Language Specifications Manual, SH20-0816

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2311 Disk Storage Drive

New Hardware Feature. The 2311 Disk Storage Drive is a new feature that adds a larger online storage capacity and quicker online storage retrieval.

DCIP Function

New Programming Feature. The DCIP initialize and copy functions now have a wait for verifying that the console entry switches you turn on for the physical drive number and cartridge ID are correct before initialization and copying begins.

FORTRAN Messages

New Programming Feature. Messages describing errors in FORTRAN statements now indicate which statement is in error.

Chapter 1. How to Use This Publication

Chapters 2, 3, and 4 include information for the systems planner who is interested in the contents and organization of disks, core storage, and the functions of the programs and storage areas that comprise the IBM 1130 Disk Monitor System, Version 2. The information in these chapters assists you in planning the contents of your disks, as well as maintaining them. The disk maintenance programs are described in Chapter 4.

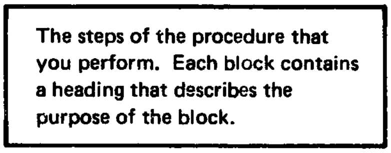
Chapters 5 and 6 contain information that is frequently referenced by programmers. Chapter 5 contains descriptions of all control records that control the functions of the disk monitor system (DM2). Use the programming tips and techniques in Chapter 6 for more efficient use of DM2.

Chapters 7, 8, and 9 include operating information for using the disk monitor system. Chapter 7 contains procedures for readying the devices that are a part of your computing system, for performing a cold start of the monitor system, for entering jobs and for displaying, altering, and dumping core storage.

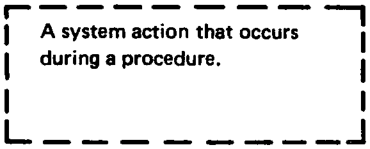
Sample procedures for loading and reloading the system are shown in Chapter 8. You may use these operating procedures as they are presented, or modify them to meet the needs of your computing system.

Chapter 9 describes stand-alone utility programs. These programs provide for dumping core storage to a print device, for initializing, copying, patching, analyzing, dumping and comparing disks, and for punching paper tapes. Operating procedures for using the utility programs are listed.

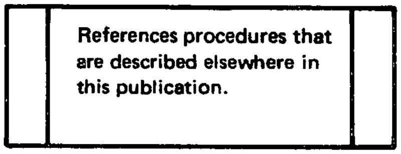
The functions of the flowchart blocks that are used in the sample procedures in Chapters 7, 8, and 9 are:



The steps of the procedure that you perform. Each block contains a heading that describes the purpose of the block.



A system action that occurs during a procedure.



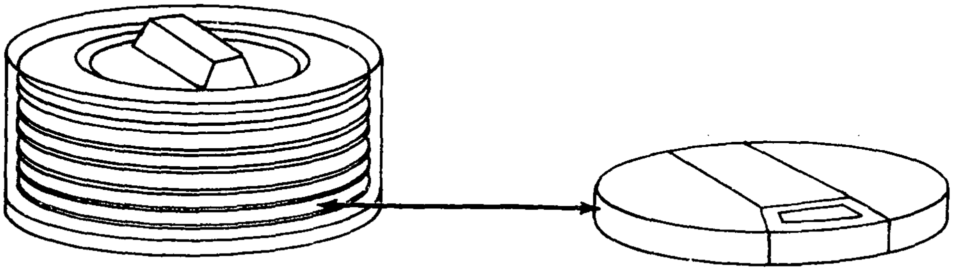
References procedures that are described elsewhere in this publication.

Chapter 10 describes the 1130 RJE Work Station Program.

When errors occur during monitor system processing, refer to Appendix A for error messages and codes, and to Appendix B for wait codes displayed on the console display panel.

The remaining appendixes contain information that you will need to reference at various times, such as, the names of the programs and subroutines in the system library and listings of LET, FLET, SLET, the resident monitor, and sample programs.

The terms *disk, disk cartridge,* and *cartridge* are used in this publication to refer to the single disk in an IBM 2315 Disk Cartridge or to any one of the 3 or 5 usable disks in an IBM 1316 Disk Pack, Model 12 or 11, respectively. Each usable disk in a 1316 Disk Pack is treated by DM2 as one 2315 disk, thus:



A disk in an IBM 1316 Disk Pack is the same as one IBM 2315 Disk Cartridge.

Each disk in the 1131 CPU and 2310 Disk Storage or 2311 Disk Storage Drive is assigned a physical drive number when the devices of an 1130 computing system are installed. Physical drive numbers are assigned in this order:

	Disk locations		
Physical drive number	*1131 CPU*	*2310 Disk Storage* or *2311 Disk Storage Drive*	
0	Internal disk		
1	—	First 2310, first disk	First 2311, first disk
2	—	First 2310, second disk	First 2311, second disk
3*	—	Second 2310, first disk	First 2311, third disk*
4*	—	Second 2310, second disk	First 2311, fourth disk*
5	—	—	First 2311, fifth disk
6	—	—	Second 2311, first disk
7	—	—	Second 2311, second disk
8*	—	—	Second 2311, third disk*
9*	—	—	Second 2311, fourth disk*
10	—	—	Second 2311, fifth disk

*Not used when a 2311 Disk Storage Drive is a Model 12

From one to 5 of these disks, depending on the configuration of your computing system, can be specified for use by assigning logical drive numbers to them. You assign logical drive numbers to disks with a // JOB monitor control record or when you code your program to call SYSUP (see "// JOB" in Chapter 5 and "SYSUP" in Chapter 6). The logical drive numbers do not have to be assigned in the same order as the physical drive numbers. The organization of disks is discussed in Chapter 2.

All hexadecimal addresses in this manual are shown in the form /xxxx.

Symbolic addresses rather than absolute addresses are used throughout this publication. Certain constants are also denoted symbolically. Appendix G contains a listing of the resident monitor.

$xxxx All symbolic labels whose first character is a dollar sign ($) are found in the core communications area (COMMA).

#xxxx All symbolic labels whose first character is a number sign (#) are found in the disk communications area (DCOM).

@xxxx All symbolic labels whose first character is a commercial at sign (@) are considered to have absolute values (such as @HDNG refers to the page heading sector, sector 7, and thus has a value of 7).

Note. The number sign and commercial at sign are not included in the 1403 Printer or 1132 Printer character set; therefore, an equal sign (=) replaces the # and an apostrophe (') replaces the @ in printer listings.

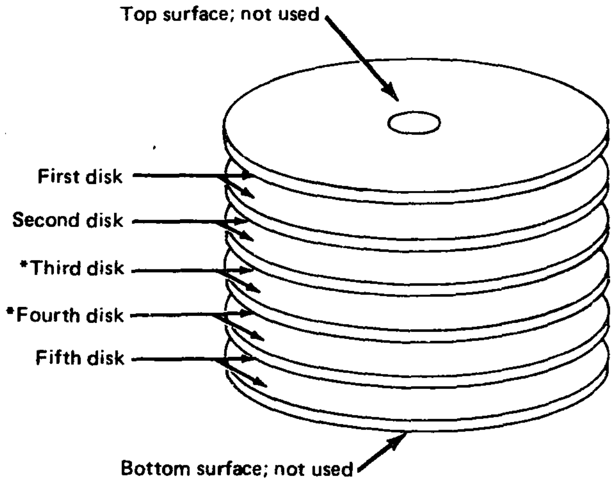
Chapter 2. Disk Organization

Two disk devices are used by the IBM 1130 Disk Monitor System, Version 2 (DM2):

- The IBM 2315 Disk Cartridge in an IBM 1131 Central Processing Unit internal disk drive and in IBM 2310 Disk Storage drives
- The IBM 1316 Disk Pack in IBM 2311 Disk Storage Drives, Models 11 and 12

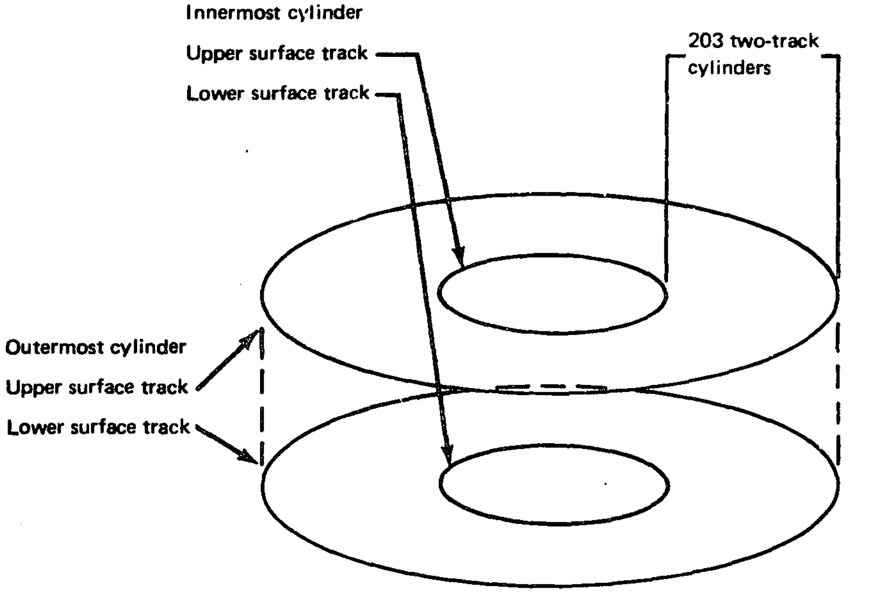
An IBM 2315 Disk Cartridge contains a single disk on which DM2 stores information on the top and bottom surfaces.

An IBM 1316 Disk Pack contains 6 disks mounted on a vertical shaft. The top surface of the top disk and the bottom surface of the bottom disk cannot be used for recording data, which leaves 10 possible recording surfaces. The monitor system programs consider the lower surface of one disk and the top surface of the disk immediately below as a *disk* (disk cartridge or cartridge). The arrangement of disks in a 1316 Disk Pack is illustrated by:



*The third and fourth disks are not used if the 2311 Disk Storage Drive is a Model 12.

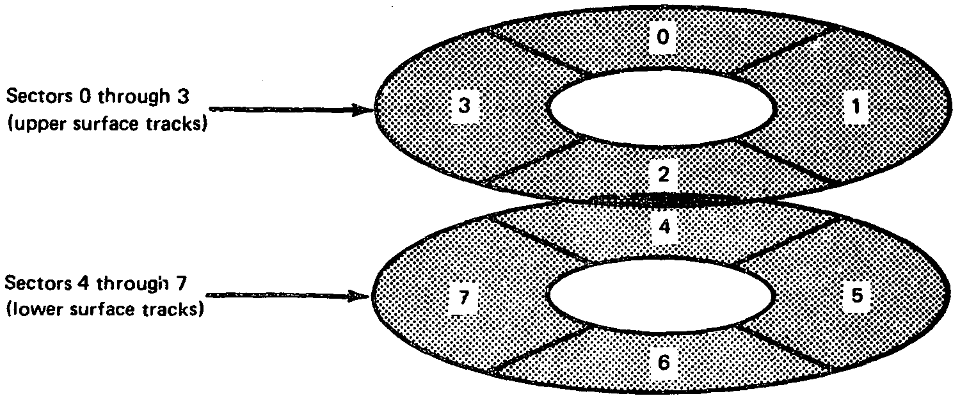
The storage area of all disks used by DM2 is arranged into circular patterns called *tracks.* Two tracks one above the other constitute a *cylinder.* A disk contains 203 concentric cylinders; 200 of these are available to the monitor system. The 3 remaining are reserved for use if defective cylinders are detected. The following illustrates the innermost and the outermost cylinders on a disk.



Note. The thickness of the disk has been greatly exaggerated in order to show the relative positions of the upper and lower surface tracks.

To complete the picture, the 201 intermediate cylinders, or pairs of tracks, should be visualized; they are omitted for the sake of clarity of the diagram.

For convenience in transferring data between core storage and disk storage, each track is divided into 4 equal segments. These segments are called *sectors.* Thus, each cylinder consists of eight sectors. Sectors 0 through 3 divide the upper surface track and 4 through 7 divide the lower. The following illustrates how sectors are numbered.


Sectors 0 through 3 (upper surface tracks)
Sectors 4 through 7 (lower surface tracks)
0
1
2
3
4
5
6
7

A sector contains 321 data words. The first data word is used for the sector address. This address is the number of that sector, counted in sequence from sector 0 on cylinder 0. Another unit of storage within a sector is the *disk block*. Each sector is divided into 16 disk blocks, each 20 words long. A disk storage word contains 16 data bits. The organizational components of disk storage are shown by the following chart.

No. of ⇩ Per ⇨	Word	Disk block	Sector	Track	Cylinder	Disk
Bits	16	320	5,112	20,480	40,960	8,192,000
Data words		20	320 [1]	1,280	2,560	512,000
Disk blocks			16	64	128	25,600
Sectors				4	8	1,600
Tracks					2	400
Cylinders						200

[1] These follow the first actual word of each sector, which is used for the address.

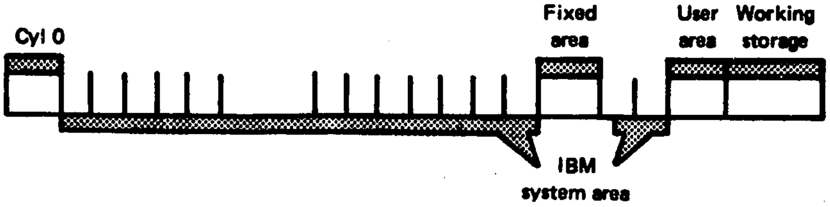
Before continuing with the descriptions of the contents of disk cartridges used by the monitor system, several terms must be defined.

- *System cartridge.* An initialized cartridge that contains the IBM 1130 Disk Monitor System. If your 1130 has only one disk (the internal disk in the 1131 CPU), all cartridges must be system cartridges.
- *Nonsystem cartridge.* An initialized cartridge that does not contain the monitor system.
- *Master cartridge.* A system cartridge that is designated as logical drive 0 by the *cold start* program, or by a monitor // JOB control record. This cartridge continues in use until another cold start, another // JOB control record, or a CALL instruction to SYSUP switches control to a different system cartridge. The disk on an 1130 with only one disk drive (the internal disk in the 1131 CPU) is both a system and a master cartridge.
- *Note:* If your system has only one disk drive (the internal disk in the 1131 CPU, or one 2311), you should cold start after changing cartridges, or packs, to avoid possible errors in the location of disk areas on system cartridges.
- *Satellite cartridge.* On an 1130 with more than one disk drive, this is any cartridge that *is not* the master cartridge. This cartridge can be either a system or a nonsystem cartridge.

The organization of programs and areas on system and nonsystem cartridges is described and illustrated in the following text.

SYSTEM CARTRIDGE

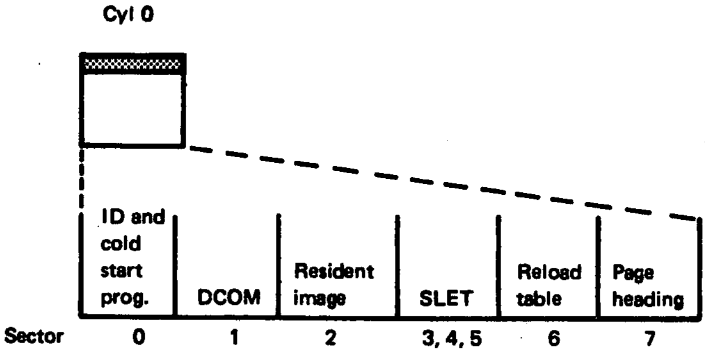
A system cartridge is divided into 5 logical areas as illustrated by the following:



Each area is described in the following text. The last section of this chapter, "Summary of the Contents of Disk Cartridges," contains a chart that indicates when these areas are present, or can be removed, on system cartridges.

Cylinder 0 on a System Cartridge

The contents of cylinder 0 on a system cartridge are defined during disk initialization and system load. The contents of cylinder 0 are as follows:



Sector	Label
0	@ IDAD
1	@ DCOM
2	@ RIAD
3, 4, 5	@ SLET
6	@ RTBL
7	@ HDNG

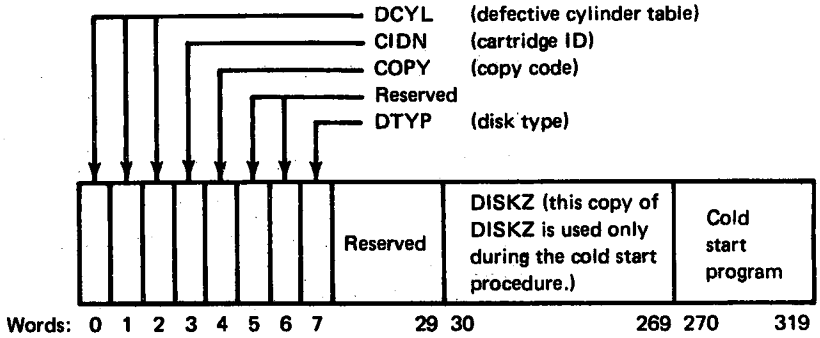
The following is a discussion of each sector.

sector @IDAD

Sector @IDAD on a system cartridge consists of:

- The defective cylinder table
- The cartridge ID
- The cartridge copy code
- The disk type
- A reserved area
- The DISKZ system device subroutine
- The cold start program

The contents of sector @IDAD on a system cartridge are shown in the following illustration.


DCYL (defective cylinder table)
CIDN (cartridge ID)
COPY (copy code)
Reserved
DTYP (disk type)
Reserved
DISKZ (this copy of DISKZ is used only during the cold start procedure.)
Cold start program
Words: 0 1 2 3 4 5 6 7 29 30 269 270 319

The *defective cylinder table* (DCYL) contains the addresses of the first sector of any cylinders that are not capable of accurately storing data. This table is defined during disk initialization. If no defective cylinders are found, each of the 3 words of DCYL contains /0658 (hexadecimal). A cartridge with a maximum of 3 defective cylinders can be used by the monitor system.

The *cartridge ID* (CIDN) is a hexadecimal number in the range /0001 through /7FFF that uniquely identifies the cartridge. The ID is placed on a cartridge when the cartridge is initialized.

The *cartridge copy code* (COPY) identifies the copy number of a cartridge that has been copied from another cartridge. When a disk is initialized, this word is zero. Each time the disk is copied, word 5 of the cartridge being copied to is incremented by one; that is, the copy code of the receiving disk is one greater than the copy code of the source cartridge.

The *reserved areas* of sector @IDAD are for possible future expansion.

The *disk type* (DTYP) is a code that indicates whether or not the disk is a system cartridge. The appropriate code is placed in DTYP when the cartridge is initialized by DCIP or DISC and when the monitor system is loaded onto the disk.

The *DISKZ subroutine* is stored in sector @IDAD and in the system device subroutine area in the IBM system area (see "IBM System Area on a System Cartridge" in this chapter) when the monitor system is loaded on the disk. The cold start program uses DISKZ stored in sector @IDAD. All other times that DISKZ is called, the copy stored in the system device subroutine area is used.

The *cold start program* is placed in sector @IDAD when the monitor system is loaded onto the disk.

sector @DCOM

Sector 1 contains the *disk communications area* (@DCOM). This area contains parameters that are passed from one monitor program to another. These parameters contain information such as:

- The number of LOCALs associated with the program in working storage
- The temporary job indicator switch
- The cartridge IDs for cartridges on the system
- The format of programs in working storage for all cartridges on the system
- The block count of the programs in working storage for all cartridges on the system

These parameters are listed in Appendix G. They are set and reset during the processing of JOB monitor control records or during the DCOM update operation called SYSUP. The parameters obtained from nonsystem disks are merged into DCOM on the master cartridge during one of the previous operations. The parameter table entries for the nonsystem disks are cleared to zero.

sector @RIAD

Sector 2 contains the *resident image* (@RIAD). The resident image is a copy of the skeleton supervisor and the COMMA portion of the resident monitor. (A description of the resident monitor is in Chapter 3, "Monitor System Programs.") The resident image is used to initialize the resident monitor during a cold start.

SLET

Sectors 3, 4, and 5 are the *system location equivalence table* (@SLET). SLET is composed of an identification number, core loading address, word count, and sector address for every phase of every monitor program. Chapter 4 contains information about obtaining a listing of SLET, and a sample of a SLET printout is in Appendix E.

sector @RTBL

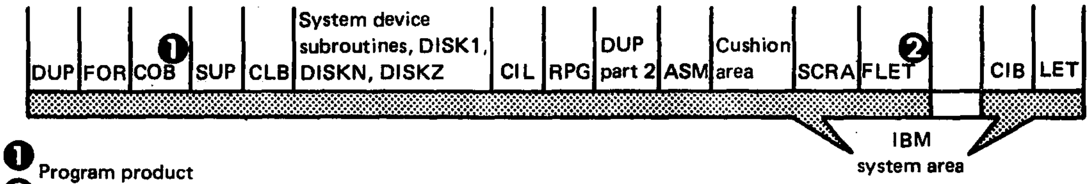
Sector 6 is the *reload table* (@RTBL). This table is established during an initial system load. @RTBL contains a 3-word entry for each monitor system program phase that requests SLET information during a load or reload operation. Each entry consists of the ID number of the requesting phase, the location in the requesting phase where the SLET information is to be placed, and the number of SLET entries to be inserted. The reload table is updated during a system reload when phases that request SLET information are added or modified. The last entry in the reload table is followed by the hexadecimal word /FFFF.

sector @HDNG

Sector 7 (@HDNG) is used to store the heading that appears at the top of each page printed by monitor programs other than RPG.

IBM System Area on a System Cartridge

Monitor programs and disk areas are loaded onto a disk during a system load. This entire area is called the IBM system area, and is illustrated by the following:



❶ Program product

❷ FLET is contained on a disk only if a fixed area is defined on the disk. See "Fixed Area" in this chapter.

The monitor programs in this area are described in Chapter 3. These programs are:

- Disk utility program (DUP)
- FORTRAN compiler (FOR)
- COBOL compiler (COB) program product
- Supervisor (SUP)
- Core load builder (CLB)
- Core image loader (CIL)
- RPG compiler (RPG)
- Assembler (ASM)

The disk areas of the IBM system area are described in the following text.

system device subroutine area

The *system device subroutine area* consists of the following:

- The subroutines used by the monitor programs to operate these print devices

  1403 Printer
  1132 Printer
  Console Printer

- The subroutines used by the monitor programs to operate these I/O devices

  2501 Card Reader/1442 Card Punch, Model 5, 6, or 7
  1442 Card Read/Punch, Model 6 or 7
  1134 Paper Tape Reader/1055 Paper Tape Punch
  Console Keyboard/Printer

- The I/O character code conversion subroutines used in conjunction with the I/O subroutines for these devices

  2501 Card Reader/1442 Card Punch
  1134 Paper Tape Reader/1055 Paper Tape Punch
  Console Keyboard/Printer

- The disk I/O subroutines

  DISKZ
  DISK1
  DISKN

All of the subroutines in the system device subroutine area, except the disk I/O subroutines, are naturally relocatable and are intended for use only by monitor programs. The disk I/O subroutines are located in this area rather than in the monitor system library because they are processed by the core load builder differently from subroutines stored in the monitor system library.

DISKZ is stored twice on a system cartridge; once in sector @IDAD with the cold start program, and once in the system device subroutine area with DISK1 and DISKN. Cold start uses DISKZ in sector @IDAD; all other times that DISKZ is called, the copy that is stored in the system device subroutine area is used.

cushion area

The *cushion area* immediately follows the system programs and provides for the possible expansion of the monitor system programs in a reload operation. This area occupies the remaining sectors of the last cylinder occupied by the system programs, plus the next complete cylinder.

SCRA

The *supervisor control record area* (SCRA) is the area in which supervisor control records (LOCAL, NOCAL, FILES, G2250, and EQUAT) are saved. These records, except the EQUAT record, are read from the input stream (following an XEQ or STORECI control record) and are stored in the SCRA for subsequent processing by the core load builder. The processing of the EQUAT record is similar to that of the other supervisor control records, but it is read from the input stream following a JOB control record.

FLET

The *fixed location equivalence table* (FLET) is a directory to the contents of the fixed area for the cartridge on which it appears. There is one FLET entry for:

- Each program stored in disk core image (DCI) format
- Each data file stored in disk data format (DDF)
- The padding required to permit a DCI program or data file to be stored beginning on a sector boundary

Each FLET entry includes:

- The name of the DCI program or the data file
- The format of the program or data file
- The size, in disk blocks, of the program or data file
- The disk block address of the program or data file

Each cartridge on which you define a fixed area has a FLET (see "Fixed Area" in this chapter). Regardless of the fixed area sizes FLET occupies the cylinder preceding the beginning of the fixed area.

The sector address of the first sector of FLET on a given cartridge is obtained from the location equivalence table (LET). The last item (#FLET) in the first header line of a LET dump contains this sector address. A listing of a LET/FLET dump is in Appendix D.

CIB

The *core image buffer* (CIB) is the disk area in which the portion of a core load that is to reside in core storage below decimal location 4096 in a 4K system (decimal location 5056 in larger systems) is built by the core load builder. The CIB is also used by the core image loader during the transfer of control from one link to the next to save any COMMON defined below decimal location 4096 or 5056.

LET

The *location equivalence table* (LET) is a directory to the contents of the *user area* on the cartridge. On a system cartridge, LET occupies the cylinder preceding the user area. There is one LET entry for:

- Each program stored in disk system format (DSF)
- Each program stored in disk core image (DCI) format
- Each data file stored in disk data format (DDF)
- The padding required to permit a DCI program or data file to be stored beginning on a sector boundary

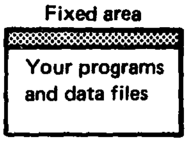
Each LET entry includes:

- The name of the program or data file
- The format of the program (DSF or DCI) or data file
- The size in disk blocks of the program or data file
- The disk block address of the program or data file

A listing of a LET/FLET dump is contained in Appendix D. The starting location of the beginning of LET on each disk on the system is included in the resident monitor.

Fixed Area

The *fixed area* (FX) is the area in which you store programs and data files when you want them to occupy the same sectors at all times. Programs stored in this area must be in disk core image (DCI) format. This is an optional area and is defined on any 1130 cartridge by the use of the DEFINE FIXED AREA operation of the *Disk Utility Program* (DUP). This DUP operation is also used to increase or decrease the size of the fixed area. (See Chapter 3, "Monitor System Programs" for a description of DUP operations.) The contents of the fixed area are illustrated by the following:

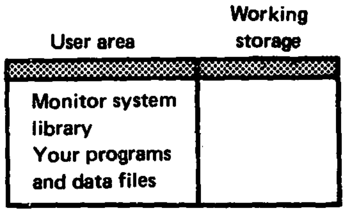


A program or data file stored in the fixed area starts at the beginning of a sector. When a program or a data file is deleted from this area, the fixed area is not packed. Programs and data files stored in this area reside at fixed sector addresses and can be referred to by sector address.

User Area and Working Storage

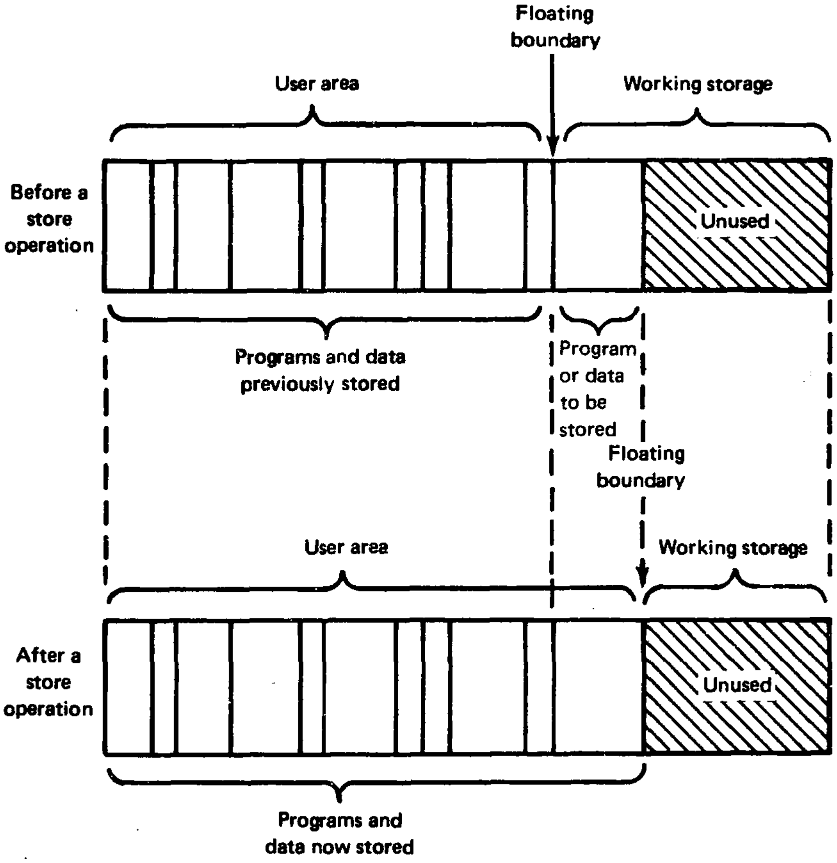
UA

The user area (UA) on a system cartridge contains the monitor system library and programs and data files that you write and store there. Programs are stored in this area in disk system format (DSF) or in disk core image (DCI) format. Data files are stored in disk data format (DDF). The following illustrates the user area and working storage.



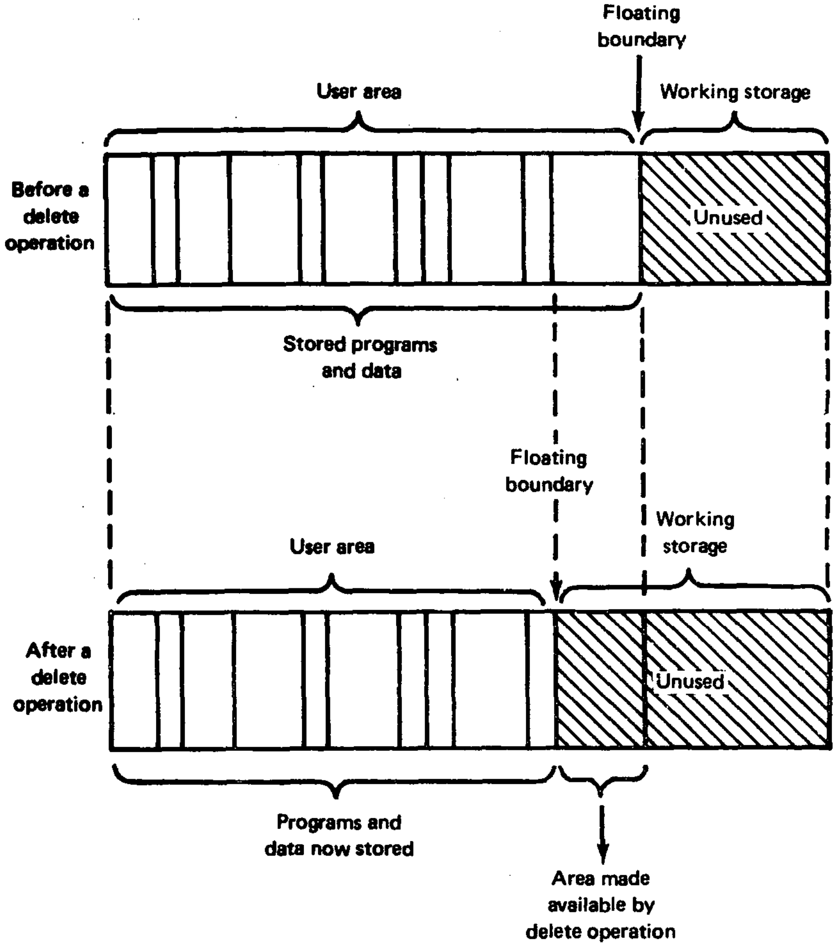
The user area is defined on any 1130 cartridge during disk initialization. The monitor system library is placed in this area during an initial system load. This area occupies as many sectors as are required to contain the system library plus any user programs and/or data files that are stored there.

When a program or a data file is entered, it is placed at the beginning of working storage; that is, immediately following the end of the user area. The area occupied by the new program or data file is then incorporated into the user area during a store operation. Working storage is decreased by the size of the program or data file. The following illustrates the contents of the user area and working storage before and after a store operation.



DSF programs are stored in the user area starting at the beginnning of a disk block; DCI programs and data files are stored starting at the beginning of a sector.

The user area is packed when a program or data file is deleted from this area; that is, the programs and data files are moved so as to occupy the area formerly occupied by the deleted program or data file. During packing, DSF programs are moved to the first disk block boundary in the vacancy; DCI programs and data files are moved to the first sector boundary. All remaining programs and data files are similarly packed. The area gained by packing the user area is returned to working storage as illustrated by:

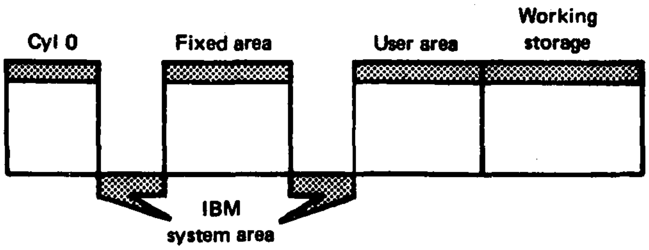


WS

On all cartridges, *working storage* (WS) is the area that is not defined as cylinder 0, the IBM system area, the fixed area, or the user area. Working storage is available to monitor programs and user programs alike as temporary disk storage. This area extends from the sector boundary immediately following the user area to the end of the cartridge.

NONSYSTEM CARTRIDGE

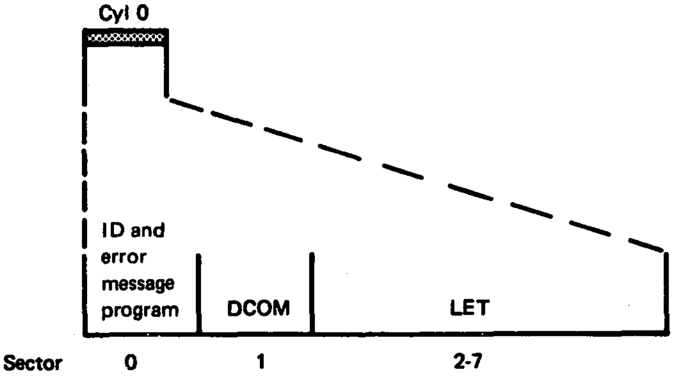
A nonsystem cartridge on an 1130 that has more than one disk drive can be used exclusively for the storage of data and/or programs, and is called a satellite cartridge. The 5 logical areas of a nonsystem cartridge are:



The contents of cylinder 0 and the IBM system area are described in the following sections. The contents of the fixed area, the user area, and working storage are the same as described for system cartridges, except that the user area does not contain the monitor system library. The last section of this chapter, "Summary of the Contents of Disk Cartridges," contains a chart that indicates when these areas are present or can be removed.

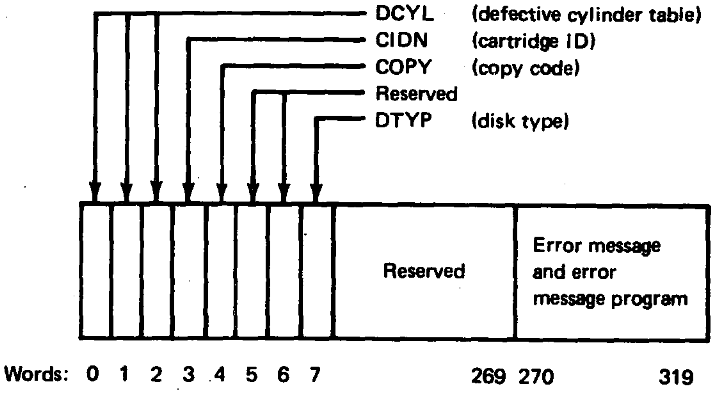
Cylinder 0 on a Nonsystem Cartridge

The contents of cylinder 0 on a nonsystem cartridge are established when the cartridge is initialized, and are illustrated by:



sector @IDAD

The first 8 words of sector @IDAD on a nonsystem cartridge are the same as described for a system cartridge. The remaining words of this sector are a reserved area, an error message program, and an error message. The error message is printed if an attempt is made to cold start a nonsystem cartridge. This message and the program that prints it plus part of the reserved area are overlaid by the cold start program and the DISKZ subroutine when the monitor system is loaded onto a cartridge. Sector @IDAD on a nonsystem cartridge consists of:



sector @DCOM

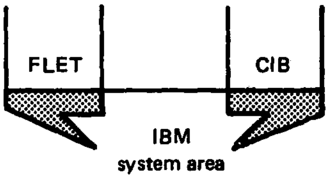
The information in sector @DCOM of cylinder 0 on a nonsystem cartridge is similar to a system cartridge. The difference is that the information on a nonsystem cartridge applies only to that cartridge.

LET

The remaining sectors of cylinder 0 are the *location equivalence table* (LET) for the cartridge. The contents of LET are described under the description of the IBM system area on a system cartridge.

IBM System Area on a Nonsystem Cartridge

The IBM system area of a nonsystem cartridge can contain the *fixed location equivalence table* (FLET) and the *core image buffer* (CIB). This area is illustrated by:



FLET

FLET is described under the description of the IBM system area on a system cartridge. This table is on a nonsystem cartridge only if you define a fixed area on the cartridge.

CIB

The CIB is described under the description of the IBM system area on a system cartridge. This area is optional on a nonsystem cartridge, and can be deleted with the disk maintenance program called DLCIB (see Chapter 4).

SUMMARY OF THE CONTENTS OF DISK CARTRIDGES

Figure 2-1 is a chart of the contents of the 5 logical areas of system and nonsystem cartridges. This chart indicates when these areas are present on system and nonsystem cartridges, and when it can be removed if the area is optional.

Logical area	Subareas	Present
Cylinder 0		On system and nonsystem cartridges
IBM system area	DUP SUP CLB System device subroutines CIL Cushion area SCRA	Only on system cartridges
	CIB	On system and nonsystem cartridges; can be removed from nonsystem cartridges
	Assembler	Only on system cartridges; can be removed
	FORTRAN compiler	Only on system cartridges; can be removed
	RPG compiler	Only on system cartridges; can be removed
	COBOL compiler (program product)	Only on system cartridges; can be removed
	LET	On system and nonsystem cartridges
	FLET	Only if a fixed area is defined by user
Fixed area (FX)	User programs User data files	Only if defined by user
User area (UA)	Monitor system library (only on system cartridges) User programs User data files	On system and nonsystem cartridges. As the result of a system load, the UA contains the monitor system library.
Working storage (WS)		On system and nonsystem cartriages

Figure 2-1. The 5 logical areas of disk cartridges

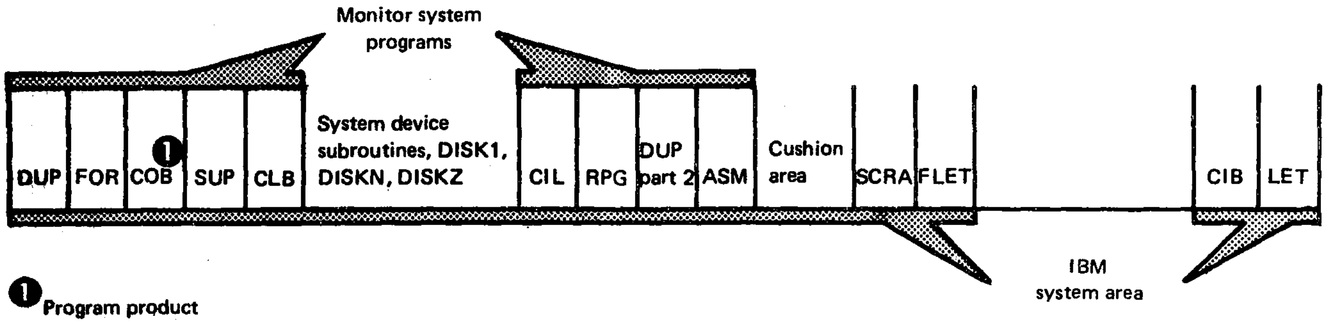
Chapter 3. Monitor System Programs

The IBM 1130 Disk Monitor System provides continuous operation of the 1130 computing system with minimal setup time and operator intervention. The monitor system consists of a system library and 7 interdependent system programs. The monitor system programs perform monitor control functions and include:

- The supervisor (SUP), which performs the control functions of the monitor system and provides the linkage between user programs and monitor programs.
- The Disk Utility Program (DUP), which performs operations that involve the disk, such as storing, moving, deleting, and dumping programs or data files or both.
- The assembler (ASM), which translates source programs written in 1130 Assembler language into object programs.
- The FORTRAN compiler (FOR), which translates source programs written in 1130 basic FORTRAN IV language into object programs.
- The RPG compiler, which translates programs written in 1130 RPG language into object programs.
- The core load builder (CLB), which constructs an executable core load from programs in disk system format (DSF). The DSF program and all associated subprograms are converted into disk core image (DCI) format, and the resultant core load is ready for immediate execution or for storing as a core image program.
- The core image loader (CIL), which transfers core loads into core storage for execution and serves as an interface between some monitor programs.

Although the COBOL compiler (COB) resides in the IBM system area when the monitor system is loaded onto a cartridge, the COBOL compiler is not a monitor program. It is an IBM program product.

A flowchart of the general logic flow of the monitor system programs is included under "Logic Flow of the Monitor System" at the end of this chapter. The monitor system library is a group of disk resident programs that performs I/O functions, data conversion, arithmetic functions, disk initialization, and maintenance functions. This library is discussed in Chapter 4, and the monitor system programs are discussed in the following text. The disk placement of these programs is shown by the following.



SUPERVISOR

The *supervisor* is 2 groups of programs that control the monitor system and link the user and monitor programs. One portion of the supervisor, the skeleton supervisor, is stored in sector @RIAD of cylinder 0. The other portion of the supervisor is stored in the IBM system area.

The skeleton supervisor initially gains control of the monitor system through the cold start program. During a cold start, the skeleton supervisor is loaded from sector @RIAD into the resident monitor section of core storage.

Resident Monitor

The *resident monitor* resides at the beginning of core storage and contains (1) the core communications area (COMMA), (2) the skeleton supervisor, and (3) a disk I/O subroutine (DISKZ, DISK1, or DISKN). Appendix G is a listing of the resident monitor.

COMMA

The *core communications area* (COMMA) consists of parameters required by the core image loader to link from one core image program to another. These parameters are interspersed with parts of the skeleton supervisor in the resident monitor.

skeleton supervisor

The *skeleton supervisor* is interspersed with COMMA in the resident monitor and is composed of:

- Entry points for linking from one core load to another ($LINK), for linking from a core load to monitor system programs ($EXIT), and for dumping core storage ($DUMP).
- Interrupt level subroutines (ILS02 and ILS04) for handling interrupts on levels 2 and 4. Disk devices interrupt on level 2, and since disks are used in all operations of the monitor system, ILS02 is included. Since the console keyboard INT REQ key interrupts on level 4 and can be pressed at any time, the ILS04 subroutine for handling level 4 interrupts is included.
- A preoperative error trap that is entered by all interrupt service subroutines (ISS) when an error is detected before an operation is performed. The trap consists of a WAIT instruction and a branch instruction. (The address of $PRET+1 is displayed in the INSTRUCTION ADDRESS indicator on the console display panel during the wait.) Pressing PROGRAM START causes the branch to be taken, and execution resumes. (Under certain conditions, such as a FORTRAN PAUSE statement, this trap is entered when an error has not occurred.)
- Postoperative error traps (one for each interrupt level) that are entered by all ISS subroutines when an error is detected after an I/O operation has been started. Each trap consists of a WAIT instruction and a branch instruction. (The address of $PST1, $PST2, $PST3, or $PST4 plus one is displayed in the INSTRUCTION ADDRESS indicator on the console display panel during the wait.) Pressing PROGRAM START returns control to the ISS subroutine, which may retry the operation in error.
- The PROGRAM STOP key error trap that is entered when the PROGRAM STOP key is pressed (unless a user-written subroutine associated with interrupt level 5 is in core). If a higher level interrupt level is being serviced when PROGRAM STOP is pressed, the PROGRAM STOP interrupt is masked until the current operation is complete. This trap consists of a WAIT instruction and a branch instruction. (The address of $STOP+1 is displayed in the INSTRUCTION ADDRESS indicator on the console display panel during the wait.) Pressing PROGRAM START continues execution of the monitor system.

disk I/O subroutine

The *disk I/O subroutine* (DISKZ, DISK1, or DISKN) required by the program in control resides in core storage immediately following the skeleton supervisor. DISKZ is the subroutine used by all system programs. DISKZ is initially loaded into core storage with the resident image during a cold start.

Prior to the execution of a core load that requires DISK1 or DISKN, the core image loader overlays DISKZ with the required disk I/O subroutine. When control is returned to the supervisor, the core image loader overlays the disk I/O subroutine currently in core (if DISK1 or DISKN) with DISKZ. Source programs written in assembler, FORTRAN, RPG, or COBOL can call any of the 3 I/O subroutines; however, only one disk I/O subroutine can be referenced in a given core load. The entry in column 19 of an XEQ monitor control record specifies the version of the subroutine to be used during execution of the core load. (Monitor control records are described in Chapter 5.)

Disk-resident Supervisor Programs

The portion of the supervisor that resides in the IBM system area includes programs that analyze monitor and supervisor control records and perform the functions specified, the auxiliary supervisor, and the System Core Dump Program.

monitor control record analyzer

The *monitor control record analyzer* (1) reads a monitor control record from the input stream, (2) prints the control record on the principal print device, and (3) calls the required monitor system program and transfers control to it.

supervisor control record analyzer

The *supervisor control record analyzer* reads a supervisor control record from the input stream, and stores the information in the control record in the supervisor control record area (SCRA) on disk.

auxiliary supervisor

The *auxiliary supervisor* is used by the Cold Start Program, ILS04 subroutine, core image loader, and system loader as a pre-entry to the monitor control record analyzer. The auxiliary supervisor is entered via the $DUMP entry point in the skeleton supervisor. This program sets appropriate parameters in COMMA, writes dummy monitor control records (such as the JOB monitor control record printed during a cold start), and prints error messages for errors detected by the core image loader. Control is then transferred to the monitor control record analyzer through the $EXIT entry point in the skeleton supervisor.

Supervisor Core Dump Program

The *Supervisor Core Dump Program* provides a hexadecimal printout and an EBCDIC translation of the contents of core storage. (A portion of a core dump is shown in Appendix F.) This program is entered through the $DUMP entry point in the skeleton supervisor in 2 ways.

- A special calling sequence during execution of an Assembler or FORTRAN program (see the publications *IBM 1130 Assembler Language,* GC26-3778, and *IBM 1130/1800 Basic FORTRAN IV Language,* GC26-3715). The portion of core storage specified in the assembler or FORTRAN statements, or all of core storage if limits are not specified, is dumped. Execution of the core load in process then continues with the statement following the one that called the dump.
- A manual dump of core storage through $DUMP+1 (see "Manual Dump of Core Storage" in Chapter 7). The contents of core storage are dumped, and the dump program executes a CALL EXIT, which terminates the execution of the core load in progress.

DISK UTILITY PROGRAM

The Disk Utility Program (DUP) allows you to perform the following operations through the use of DUP control records:

- Store programs and data files on disks
- Make programs and data files on a disk available as printed, punched card, or punched paper tape output
- Delete programs and data files from a disk
- Determine the status of disk storage areas through a printed copy of LET and FLET
- Define a fixed area on a disk, and delete monitor system programs from a disk
- Maintain disk macro libraries
- Reassign sector addresses on a disk
- Reserve space for a data file or macro library

DUP control records are described in Chapter 6. DUP error messages are listed in Appendix A.

General Functions of DUP

DUP is called into operation when a DUP monitor control record (// DUP) is recognized by the supervisor. The control portion of DUP is brought into core to read the next DUP control record from the input stream. The DUP control record is printed and analyzed.

The DUP program required to perform the operation specified in the control record is read into core storage from the disk and assumes control. The DUP program performs the functions specified in the control record, and when complete, a message is printed on the principal printer, and control is returned to the control portion of DUP. The next control record is read from the input stream.

If the next record is a monitor control record, other than a comments control record (// *), system control is returned to the supervisor to process the record. Comments monitor control records are printed; blank records are passed. If the record is a DUP control record, DUP maintains control and reads the next record.

ASSEMBLER

The source language and macro capabilities for the assembler are described in the publication *IBM 1130/1800 Assembler Language,* GC26-3778. This section of this chapter contains only a general description of the Monitor System Assembler Program. Assembler control records are described in Chapter 6. Assembler error detection codes and error messages are listed in Appendix A.

The assembler can be deleted from the monitor system if desired (see "*DEFINE" under "DUP Control Records" in Chapter 5). The assembler cannot, however, be operated independently of the monitor system.

A monitor control record, // ASM, is used to call the assembler into operation. The assembler reads assembler control records and the source deck from the principal input device. The assembler interprets and performs the functions specified in the control records and translates the source program into an object program. Control records cause the assembler to:

- Pass the source deck through the assembler twice
- List the source deck and cross-reference symbol table on the principal printer
- Punch object decks into cards
- Print the symbol table on the principal printer, or punch the symbol table into cards
- Save and add to the symbol table on disk
- Specify the interrupt level for assembly of ISS subroutines
- Specify additional sectors for overflow of the symbol table
- Specify the length of COMMON used when linking between FORTRAN and assembler programs
- Specify the use of the macro library during assembly

After assembly is complete, the object program resides in working storage. The program can now be (1) called for execution, (2) stored in either the user area or the fixed area, or (3) punched as a binary deck or tape.

FORTRAN COMPILER

The source language for the FORTRAN compiler is described in the publication *IBM 1130/1800 Basic FORTRAN IV Language,* GC26-3715. This section of this chapter contains only a general description of the monitor system FORTRAN compiler. FORTRAN compiler control records are described in Chapter 6. FORTRAN error codes and error messages are listed in Appendix A.

The FORTRAN compiler can be deleted from the monitor system if desired (see "*DEFINE" under "DUP Control Records" in Chapter 5). The FORTRAN compiler, however, cannot be operated independently of the monitor system.

A monitor control record, // FOR, is used to call the FORTRAN compiler into operation. The compiler reads FORTRAN compiler control records and the source program from the principal input device. The compiler interprets and performs the functions specified in the control records and translates the source program into an object program. Control records cause the compiler to:

- Specify the I/O devices to be used during program.execution
- List the source program, the names of all subprograms associated with the source program, and symbol table information on the principal print device
- Specify that all variables and real constants are stored in 3 words instead of 2
- Specify that all integer variables are stored in one word instead of the standard 2 words
- Print header information at the top of each printed page, and print the program name at the end of a listing
- Trace the values of variables, IF expressions, and computed GO TO statements during program execution
- Specify the origin of an absolute program

After compilation is complete, the program resides in working storage in disk system format (DSF). The program can now be (1) called for execution, (2) stored in the user area or fixed area, or (3) punched in binary form into cards or paper tape.

RPG COMPILER

The source language specifications for the RPG compiler are described in the publication *IBM 1130 RPG Language,* GC21-5002. This section of this chapter contains a general description of the monitor system RPG compiler. RPG compiler control cards are described in Chapter 6. RPG error messages and error notes are described in Appendix A.

The RPG compiler can be deleted from the monitor system if desired (see "*DEFINE" under "DUP Control Records" in Chapter 5). The compiler, however, cannot be operated independently of the monitor system.

A monitor control record, // RPG, is used to call the compiler into operation. The compiler reads the RPG compiler control card and the source program from the principal input device. The compiler interprets and performs the functions specified in the control card and translates the source program into an object program. After compilation is complete, the object program, in disk system format (DSF), resides in working storage. The program can now be (1) called for execution, (2) stored in the user area or the fixed area, or (3) punched in binary form into cards.

CORE LOAD BUILDER

The core load builder constructs an executable core load from a program in disk system format (DSF). The DSF program and all required subroutines (including any LOCALs, SOCALs, and NOCALs) are converted from disk system format into disk core image (DCI) format. The resultant core load is ready for immediate execution or for storing.

The core load builder is called by any of the following programs.

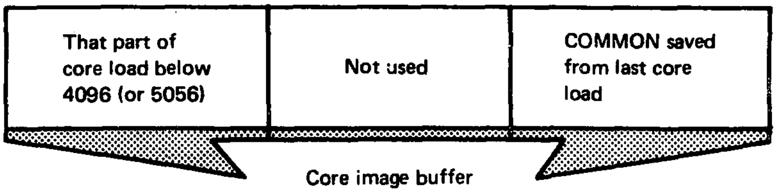
- *Supervisor.* When an XEQ monitor control record is read by the supervisor, the information specified in any supervisor control records that follow is written in the supervisor control record area (SCRA). Then, the core load builder is called to begin construction of the core load. When the core load is complete, the core image loader transfers the core load into core for execution.
- *Disk Utility Program.* When a STORECI control record is read by the Disk Utility Program (DUP), information specified in any supervisor control records that follow are written in the supervisor control record area (SCRA). Then, if the specified program is not in working storage, the program is loaded into working storage, and the core load builder is called to begin construction of the core load. When the core load is complete, DUP stores it as a core image program in the user area or fixed area as specified in the STORECI control record.
- *Core Image Loader.* When a core load calls for a link to another, the core image loader determines the format of the program from its LET or FLET entry. If the format is DSF, the core load builder is called to begin construction of the core image program. When the core load is complete, the core image loader transfers the core load for execution.

Construction of a Core Load

When the core load builder (CLB) is called by one of the previous monitor programs, the core load is constructed by the functions described in this section. The core load builder uses 3 storage areas while constructing a core load. These areas are the core image buffer (CIB), working storage (WS), and core storage.

CLB use of the CIB

The core load builder places in the core image buffer the parts of a core load that are to reside below core location 4096 (decimal) for a 4K system, or 5056 for larger systems, during execution. These parts can be the core image header, the main-line program, and subroutines. The contents of the CIB during core load construction are illustrated by:

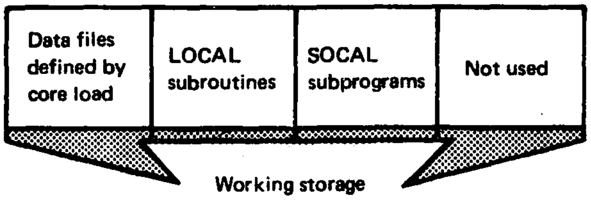


That part of core load below 4096 (or 5056)	Not used	COMMON saved from last core load

Core image buffer

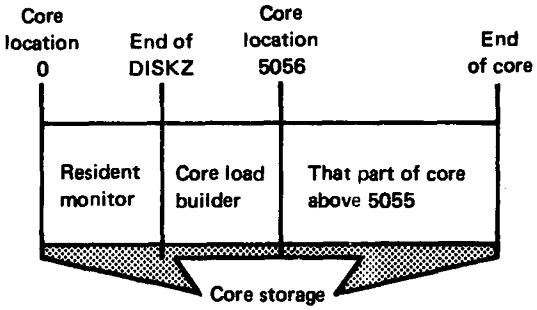
CLB use of WS

The core load builder reserves enough space in working storage for any data files that are specified for use by the core load, as well as any LOCAL and/or SOCAL subroutines that are referenced by the core load (see "Processing Data Files" and "Incorporating Subroutines" in this section). The contents of working storage during core load construction are shown by:

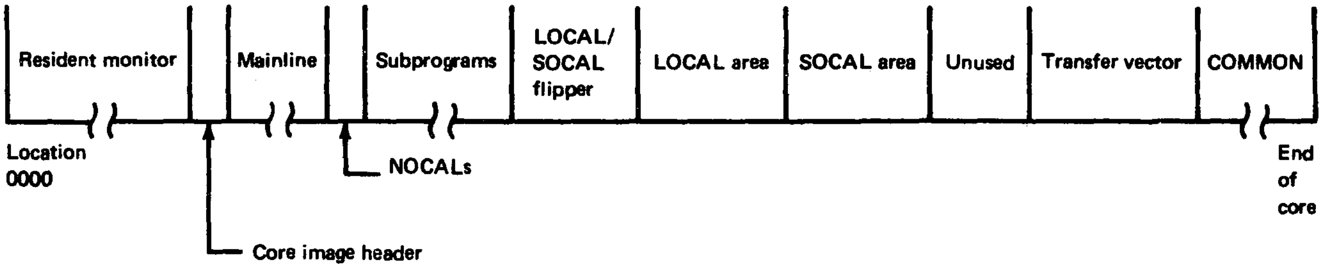


CLB use of core storage

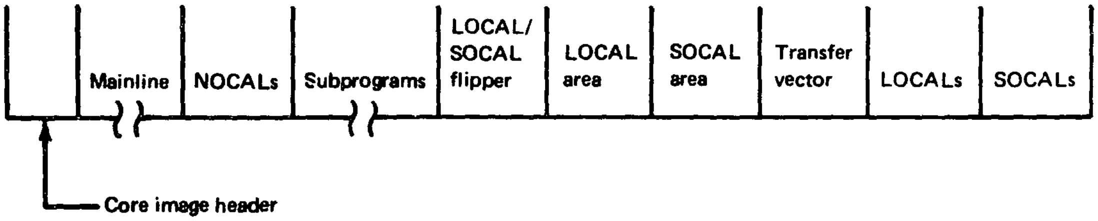
In systems larger than 4K, the core load builder places in core storage the parts of a core load that are to reside above core location 5055 during execution. These parts of a core load can be subroutines and the transfer vector. The contents of core storage during construction of a core load are illustrated by:



When construction of a core load is finished and is executed immediately, the core image loader is called to transfer it into core storage. The layout of a core load in core that is ready for execution is illustrated by:



When a core load is stored immediately following construction, it is placed in the user area or the fixed area as follows:



When the core load builder is called, the core load is built by the following functions, but not necessarily in the order described.

Construction of the Core Image Header

The core image header is established at the beginning of the construction of a core load. Throughout the building of a core load, information is placed in this header. The information placed in the header is used by the core image loader to transfer the core load into core storage and start program execution. The core image header is a part of the core load and resides in core storage during execution.

Note. The area of core storage occupied by the core image header should not be considered as a work area, because FORTRAN subroutines access information in the header during execution.

Assignment of the Origin of a Core Load

The core location where the core image loader begins loading a relocatable core image program is assigned by the core load builder. This loading address is placed in the core image header, and is called the origin. The origin is determined by adding decimal 30 to the next higher-addressed word above the end of the disk I/O subroutine used by the core load. The following chart lists the origin locations (in decimal and hexadecimal) used by the core load builder.

Disk I/O subroutine in core	Core load origin	
	Decimal	Hexadecimal
DISKZ	510	/01FE
DISK1	690	/02B2
DISKN	960	/03C0

The origin of absolute programs is assigned by the assembler or FORTRAN programmer, not by the core load builder. The assembler programmer assigns the origin of a program with the ORG statement in his program. The FORTRAN programmer defines the origin of his program with an *ORIGIN control record. The origin that you define must not be less than those in the preceding chart, depending on the disk I/O subroutine used by the core load. When the programmer assigns an origin, the addresses printed in a program listing are absolute; thus, he can see exactly where his statements and constants are in core during execution.

Note. When DISKZ is in core, the assembler programmer must specify an *even* address in an ORG statement. Also, an ORG statement specifying an even address must not be followed by a BSS or BES statement of an odd number of locations.

Processing the Contents of the SCRA

The core load builder analyzes the LOCAL, NOCAL, FILES, G2250, and EQUAT control records stored in the SCRA on disk, and builds tables for the respective control record types from the information specified. The information placed in these tables is used in later phases of the construction of the core load.

Processing Data Files

The core load builder uses the information in the FILES control records stored in the supervisor control record area (SCRA) to equate data files defined in the mainline program to data files stored on disk. The mainline program statements that define these files are the FORTRAN DEFINE FILE statement and the assembler FILE statement. During compilation or assembly, a define file table is built from the DEFINE FILE statements or FILE statements.

The core load builder compares a file number from a define file table entry with the file numbers specified in the FILES supervisor control records stored in the SCRA. If a match occurs, the name of the disk area associated with the file number on the FILES control record is found in LET or FLET, and the sector address of that disk area (including the logical drive code) is placed in the corresponding define file table entry. If the number in the define file table entry does not match any of the file numbers for FILES control records or if a name is not specified on the FILES control record, the core load builder assigns an area in working storage for the data file. The sector address of the data file, relative to the start of working storage, is placed in the define file table entry. This procedure is repeated for each define file table entry in the mainline program.

Conversion of the Mainline Program

The mainline program is converted from disk system format into disk core image format. The mainline is always converted before any of the other portions of the core load.

Incorporating Subroutines

Subroutines in general

All the subroutines called by other subroutines, by the mainline program and all subroutines specified as NOCALs are included in the core load, except for (1) the disk I/O subroutine, (2) any LOCAL subroutines specified, and (3) SOCAL subroutines employed.

EQUAT subroutines or symbolic names

Subroutines called by the core load that is being built can be replaced if indicated in EQUAT monitor control records stored in the SCRA. Symbolic names in assembler DSA statements are replaced by other symbolic names if so indicated in EQUAT control records.

FLIPR

The LOCAL/SOCAL flipper, FLIPR, is included in each core load in which LOCAL subroutines are specified or in which SOCAL subroutines are employed. FLIPR is entered by special LOCAL/SOCAL linkage through the transfer vector. FLIPR checks to determine if the required LOCAL or SOCAL is already in core. If not, FLIPR reads the required LOCAL or SOCAL into the LOCAL or SOCAL area in core. If the subroutine or subprogram is already in the LOCAL or SOCAL area of core, FLIPR transfers execution control to them.

When execution immediately follows the building of a core load, FLIPR reads a LOCAL or SOCAL, as it is called, from working storage into the LOCAL or SOCAL area of core. If the core image program was stored following the building of a core load, FLIPR reads a LOCAL or SOCAL, as it is called, from the user area or the fixed area (where it was stored following construction of the core load) into the LOCAL or SOCAL area of core.

CLB provision for LOCALs

LOCALs (load-on-call) are subroutines that you specify as overlays with LOCAL supervisor control records when error messages indicate that a core load is too large to fit into core.

If LOCALs are specified for use by a core load, the core load builder reserves an area in the core load as large as the largest LOCAL subroutine specified. LOCAL subroutines will be read by FLIPR into this area as required during execution. LOCAL subroutines are stored in working storage following any data files stored there. If the core load is executed immediately, each LOCAL subroutine is read as it is called from working storage into the LOCAL area by FLIPR. If the core load is stored in disk core image format before it is executed, LOCAL subroutines are stored following the core load, and will be read from the storage area (user area or fixed area) during execution.

CLB provision for SOCALs

SOCALs (system-overlays-to-be-loaded-on-call) are groups of subroutines (by class, type, and subtype) that are made into overlays by the core load builder. SOCALs make it possible for FORTRAN core loads that are too large to fit into core to be loaded and executed. (SOCALs are not built for mainline programs written in assembler or RPG language.)

If, in constructing a core image program from a FORTRAN mainline program, the core load builder determines that the core load will not fit into core, SOCALs are created. An area as large as the largest SOCAL overlay (usually SOCAL 2) is reserved in the core load. SOCAL overlays will be read by flipper into this area as required during execution. The SOCAL overlays are placed in working storage following any data files and LOCALs stored there. If the core load is executed immediately, each SOCAL overlay is read, as it is called, from working storage into the SOCAL area by flipper. If the core load is stored in disk core image format before it is executed, SOCALs are stored following the core load and any LOCALs. SOCALs are then read from the storage are (user area or fixed area) during execution.

The core load builder creates SOCAL overlays by subroutine class, type, and subtype (program types and subtypes are described under "Disk System Format" in Appendix I.) SOCAL overlays are numbered 1, 2, and 3. The classes of subroutines, their types and subtypes, that can be included in each SOCAL overlay are:

SOCAL overlay number includes	Subroutine class	Type	Sub-type
1	Arithmetic	3	2
	Function	4	8
2	Nondisk FORTRAN I/O and "Z" conversion subroutines	3	3
	"Z" device subroutines	5	3
3	Disk FORTRAN I/O	3	1

Each SOCAL overlay does not contain all the subroutines of the specified classes, types, and subtypes that are available in the monitor system library; only those subroutines required by the core load are included in the SOCAL. The names of the subroutines included in the SOCALs associated with a program are listed in a core map. A printout of the core map is obtained by placing an L in column 14 of an XEQ monitor control record (see "Reading a Core Map and File Map" in Chapter 6).

Two options are used by the core load builder in creating SOCAL overlays.

- *SOCAL Option 1.* An attempt is made to make the core load fit into core by using SOCAL overlays 1 and 2. This option reserves enough space in the core load for the largest of the 2 SOCALs (usually SOCAL 2) and approximately 115 additional words that are required for the special SOCAL linkage. SOCALs 1 and 2 are placed in working storage. When this option has been tried and the core load still does not fit into core, the second option is used.
- *SOCAL Option 2.* An attempt is made to make the core load fit into core by using SOCAL overlays 1, 2, and 3. This option reserves enough space in the core load for the largest of the 3 SOCALs (usually SOCAL 2) and approximately 120 additional words that are required for the special SOCAL linkage. If, after both SOCAL options have been tried, the core load still does not fit into core, an error message is printed.

If you specify as a LOCAL subroutine a subroutine that would usually be included in a SOCAL, the core load builder makes that subroutine a LOCAL and does not include it in the SOCAL in which it would ordinarily be placed. Further information is contained in "The Use of SOCALs" in Chapter 6.

Transfer Vector

The transfer vector (TV) is a table included in each core load that provides linkage to subroutines. This table is composed of:

- *CALL TV*—the transfer vector for subroutines referenced by CALL statements
- *LIBF TV*—the transfer vector for subroutines referenced by LIBF statements

Each CALL TV entry is a single word containing the absolute address of an entry point in a subroutine included in the core load that is referenced by a CALL statement. In the case of a subroutine referenced by a CALL statement but specified as a LOCAL, the CALL TV entry contains the address of the special LOCAL linkage instead of the subroutine entry point address. If SOCALs are required, the CALL TV entries for function subroutines contain the address of the special SOCAL linkage instead of the subroutine entry point address.

Each LIBF TV entry consists of 3 words. Word 1 is the link word in which the return address is stored; words 2 and 3 contain a branch to the subroutine entry point. In the case of a subroutine referenced by a LIBF statement but specified as a LOCAL, the LIBF TV entry contains a branch to the special LOCAL linkage instead of to the subroutine entry point address. The core load builder inserts the address in word 1 of the transfer vector entry (link word) into the entry point+2 of the associated LIBF subroutine. If SOCALs are required, the LIBF TV entry for a SOCAL subroutine contains a branch to a special entry in the LIBF TV for the SOCAL of which the subroutine is a part. This special entry provides the linkage to the desired SOCAL.

The core load builder can build a core load that references up to approximately 375 different LIBF *and* CALL entry points; 80 LIBFs plus 295 CALLs (the maximum number of LIBFs allowable is 83 due to the size of the LIBF TV). If the core load is built on an 1130 system with core size of 4K, the maximum number of different LIBF and CALL entry points is approximately 110.

See "Reading the Transfer Vector" in Chapter 6 for more information.

CORE IMAGE LOADER

The core image loader (CIL) has 2 functions:

- Transfer control between some monitor programs
- Transfer core loads into core for execution

On an entry to the skeleton supervisor at $EXIT, $DUMP, or $LINK, the core image loader is called and control transferred to it. The core image loader determines where the skeleton supervisor was entered and calls the appropriate monitor or mainline program.

$EXIT entry

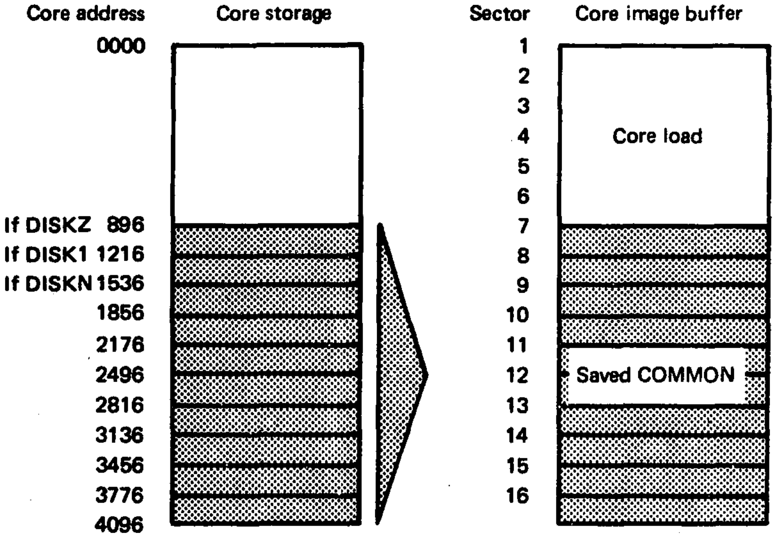
When the skeleton supervisor is entered at the $EXIT entry point, the core image loader calls the DISKZ I/O subroutine if DISKZ is not already in core. Then, the CIL calls and transfers control to the monitor control record analyzer to read monitor control records from the input stream.

$DUMP entry

When the skeleton supervisor is entered at the $DUMP entry point, the core image loader saves words 6 through 4095 (decimal) in the core image buffer. Then the CIL calls and transfers control to the Supervisor Core Dump Program. When the dump is complete, the dump program either restores core from the CIB and transfers control back to the core load in process or terminates execution with a CALL EXIT (see "Disk Resident Supervisor Programs" in this chapter).

$LINK entry

When an entry is made to the skeleton supervisor at the $LINK entry point, the core image loader saves the sector of core referred to as low COMMON. The sector saved depends on the disk I/O subroutine that is in core; locations (in decimal) 896 through 1215 if DISKZ, 1216 through 1535 if DISK1, or 1536 through 1855 if DISKN. Then the CIL determines from COMMA the lowest-addressed word of COMMON if any was defined by the core load just executed. Any COMMON in core below location 4096 (4K system) or 5056 in larger systems is saved in the CIB. The following illustrates the saving of COMMON.

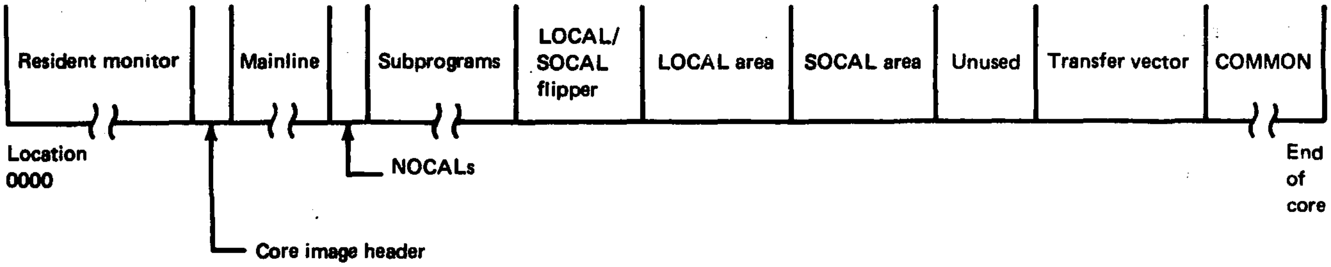


Next, the CIL determines from the LET or FLET entry for the program being called whether the program is in disk system format or in disk core image format.

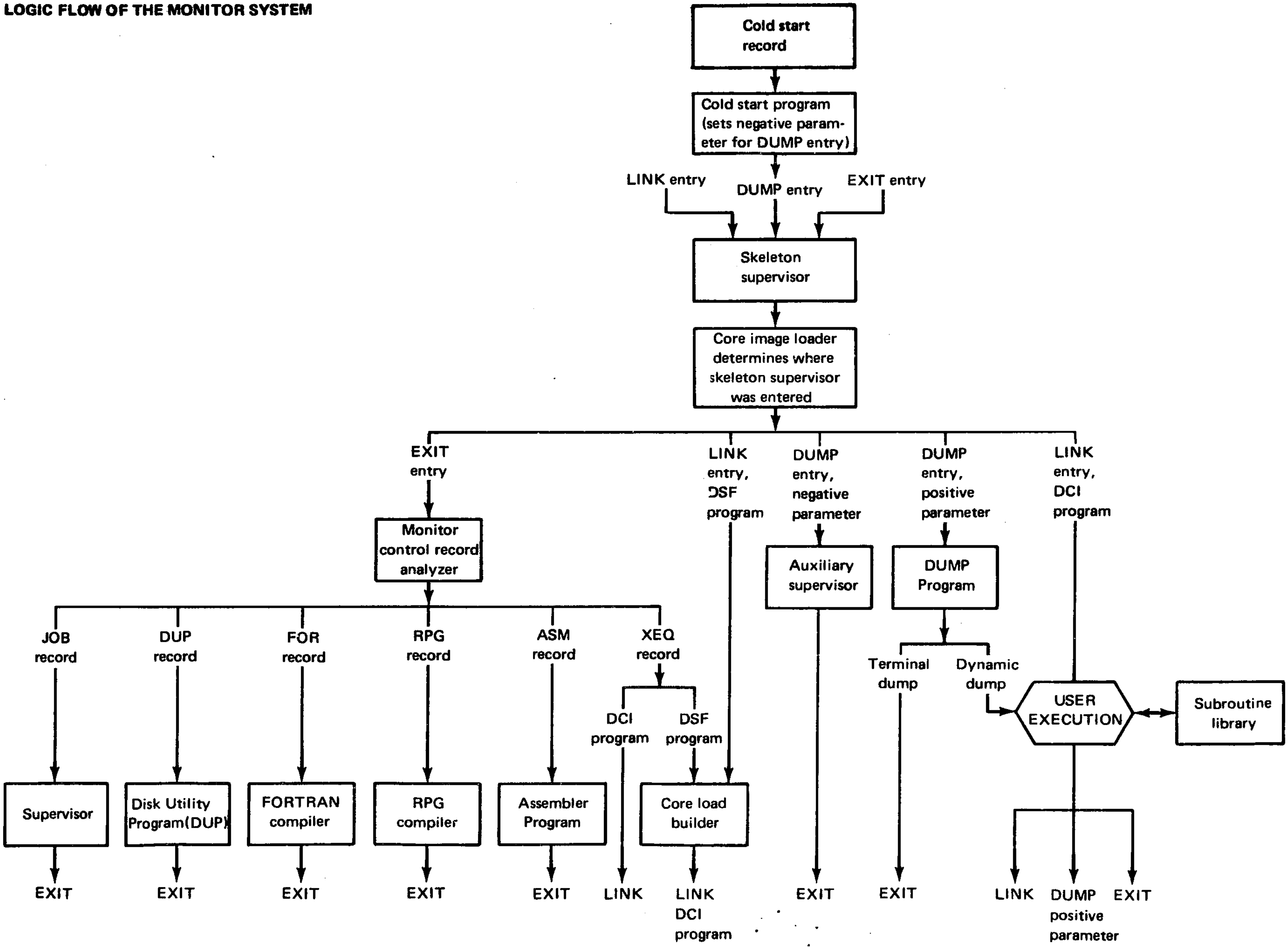
If the called program is in disk system format, the core load builder is called to construct a core load from the mainline program. After the core load is built, the core image loader is called to transfer the core load into core for execution.

If the called mainline program is stored in disk core image format, the disk I/O subroutine required by the core load is called, if it is not already in core. Any COMMON defined by the core load just executed and saved in the CIB is restored, and the called core load is transferred into core for execution.

The following illustration is the layout of a core load in core ready for execution.



LOGIC FLOW OF THE MONITOR SYSTEM



Chapter 4. Monitor System Library

The monitor system library is a group of mainline programs and subroutines that performs the following functions for the monitor system:

- Input/output
- Data conversion
- Arithmetic functions
- Disk initialization
- Disk maintenance
- Paper tape utility

Appendix C is a listing of the names, types and subtypes, required subroutines, and ID fields for the programs and subroutines in the monitor system library.

Monitor system subroutines can be added to or deleted from the monitor system library. You add or delete them with Disk Utility Program (DUP) store and delete functions (see "*STORE" and "*DELETE" under "DUP Control Records" in Chapter 5). Each program in the IBM-supplied system deck used in an initial load is preceded by a DUP *STORE control record.

This chapter contains general information about:

- System library ISS subroutines
- System library utility subroutines
- System library mainline programs

Additional and more detailed information about the system library is contained in the publication *IBM 1130 Subroutine Library*, GC26-5929.

SYSTEM LIBRARY ISS SUBROUTINES

The interrupt service subroutines (ISS), in the monitor system library, manipulate the I/O devices that are part of the computer configuration. Each subroutine has a symbolic name that must be used when the subroutine is available, although only one for each I/O device can be selected for use in any one program (including subroutines). The following is a list of the devices available on the 1130 and the names of the ISS subroutines that are available for each device.

I/O device	I/O device subroutine
1442 Card Read Punch	CARDZ, CARD0, or CARD1
2501 Card Reader	READZ, READ0, or READ1
1442 Card Punch	PNCHZ, PNCH0, or PNCH1
Disk	DISKZ, DISK1, or DISKN
1132 Printer	PRNTZ, PRNT1, PRNT2
1403 Printer	PRNZ, or PRNT3
Console keyboard/printer	TYPEZ, or TYPE0
Console printer	WRTYZ, or WRTY0
1134/1055 Paper Tape Reader Punch	PAPTZ, PAPT1, PAPTN, or PAPTX
1627 Plotter	PLOT1, or PLOTX
1231 Optical Mark Page Reader	OMPR1
Synchronous Communications Adapter	SCAT1, SCAT2, or SCAT3

The last character or digit (Z, 0, 1, or N) of an ISS name indicates the general characteristics of the subroutine:

nameZ

The *nameZ* versions are designed for use in an error-free environment; preoperative error checking is not provided. FORTRAN and RPG use the nameZ versions of the ISS subroutines.

name0

The *name0* versions are shorter and less complicated than the name1 or nameN versions. The name0 versions handle error conditions automatically.

name1

Use the name1 versions rather than the name0 versions when you write an error exit. The name0 versions handle error conditions automatically.

nameN

The *nameN* versions are available to operate the 1134/1055 Paper Tape Reader/Punch simultaneously and to minimize extra disk revolutions when transferring more than 320 words to or from the disk. DISKN offers more options than DISK1. Depending on your computer configuration, it also offers simultaneous operation of any one of the following disk combinations.

- Up to five 2315 Disk Cartridges
- One 2315 Disk Cartridge (the 1131 CPU internal disk) and one disk in each of one or two 1316 Disk Packs
- One disk in each of two 1316 Disk Packs

Preoperative and postoperative errors that occur during the operations of the I/O device subroutines are included in Appendix B.

Extra space on a system cartridge can be gained by deleting the I/O device subroutines that are in the system library for devices that are not a part of your computer configuration. The following is a list of the subroutines that can be deleted for each device:

Device not in configuration	**I/O device subroutines that can be deleted**	**Disk blocks gained (hexadecimal)**
1442 Card Read Punch (input/output)	CARD0, CARD1, CARDZ	/4E
2501 Card Reader	READ0, READ1, READZ	/62
1442 Card Punch	PNCH0, PNCH1, PNCHZ	/22
1134/1055 Paper Tape Reader/Punch	PAPT1, PAPTN, PAPTX, PAPTZ, PAPEB, PAPPR, PAPHL	/75
1132 Printer	PRNT1, PRNT2, PRTZ2, PRNTZ, DMPD1	/69
1403 Printer	PRNT3, PRNZ, EBPT3, CPPT3, HLPT3, PT3EB, PT3CP, PTH0L	/40
1627 Plotter	PLOT1, PLOTI, PLOTX, FCHRX, ECHRX, SCALF, SCALE, FGRID, EGRID, FCHAR, ECHAR, FPLOT, EPLOT, FRULE, ERULE, POINT, XYPLT	/B0
Synchronous Communications Adapter	SCAT1, SCAT2, SCAT3, PRNT2, PRTZ2, IOLOG, EBC48, HOL48, HXCV, STRTB, HOLCA	/FA
1231 Optical Mark Page Reader	OMPR1	/15
MTCA	MTCA0, MTCAZ, TSM41, TSTTY, FEB41	/9A

You should not delete subroutines that are called by subroutines left in the monitor system library (see Appendix C for lists of the subroutines called by each subroutine in the monitor system library).

The mainline programs required for devices not on the system that can be deleted from the system library are:

Device not in configuration	Mainline programs that can be deleted	Disk blocks gained (hexadecimal)
1134/1055 Paper Tape Reader/Punch	PTUTL	/0A
2310 Disk Storage or 2311 Disk Storage Drive	DLCIB, ID, COPY, DISC, IDENT	/9D

SYSTEM LIBRARY UTILITY SUBROUTINES

A group of subroutines that perform utility functions for the monitor system are included in the monitor system library. These subroutines are:

- SYSUP, disk communications area (DCOM) update subroutine, that you call in an assembler or FORTRAN program when you need to change disk cartridges or packs during execution of a core load. This subroutine updates DCOM on the master cartridge with the IDs and DCOM information from all satellite cartridges that are mounted on the system and that are specified in the special SYSUP calling sequence. Uses and calling sequences of SYSUP are discussed in Chapter 6.
- CALPR, call system print subroutine, that calls the print subroutines into core storage for printing information on the principal printer.
- FLIPR, LOCAL/SOCAL flipper overlay subroutine, that calls LOCAL (load-on-call) and SOCAL (system-load-on-call) subroutines into core storage during execution of a core load. LOCALs, SOCALs, and FLIPR are discussed under "Incorporating Subroutines" in Chapter 3 and in Chapter 6, "Programming Tips and Techniques".
- FSLEN, fetch phase IDs and fetch system subroutines, that performs 2 functions. The first function obtains system program phase ID headers from SLET as requested by monitor system programs. The second function calls system subroutines into core storage as needed.
- RDREC, Read *ID Record, that is called by the disk maintenance programs, discussed in this chapter, to read *ID control records.

Note. SYSUP is the only one of these utility subroutines that can be called by FORTRAN programs. The other subroutines are called as needed by monitor system programs or by assembler language programs.

SYSTEM LIBRARY MAINLINE PROGRAMS

The 1130 system library mainline programs provide for disk maintenance and paper tape utility functions. These programs (except the disk maintenance program, ADRWS) are called for execution with a monitor XEQ control record, and are described in the following sections of this chapter. These programs can be executed in a stacked job stream.

disk maintenance programs

The disk maintenance programs reinitialize cartridges, modify the contents of cartridges, and print information from cartridges. The disk maintenance programs are:

- IDENT that prints cartridge IDs
- DISC that reinitializes satellite cartridges
- DSLET that prints the contents of the system location equivalence table
- ID that changes cartridge IDs
- COPY that copies the contents of one cartridge onto another
- ADRWS that writes sector address in working storage
- DLCIB that deletes the core image buffer from a nonsystem cartridge
- MODIF that modifies the monitor system programs
- MODSF that modifies programs and subroutines in the system library
- DFCNV that converts 1130 FORTRAN and/or commercial subroutine package (1130-SE-25X) disk data files to disk files acceptable to 1130 RPG programs.

For execution, some disk maintenance programs require in addition to the monitor XEQ control record, special control records. The fields and uses of these special control records are described when required in the descriptions of these programs in this chapter.

PTUTL program

The Paper Tape Utility (PTUTL) Program accepts input from the paper tape reader or console keyboard and provides output to the console printer and/or the paper tape punch.

messages and halt codes

Messages printed by the disk maintenance programs are described in Appendix A. Halt codes displayed in the console ACCUMULATOR are described in Appendix B.

The following sections of this chapter describe the functions and calling sequences of the system library mainline programs.

IDENT

The Print Cartridge ID (IDENT) mainline program prints the cartridge ID and physical drive number of each disk cartridge that is mounted on the system and is ready, not just the cartridges that are specified in the current JOB monitor control record (see "Monitor Control Records" in Chapter 5). Invalid cartridge IDs, including negative numbers, are printed.

The IDENT program is called for execution with a monitor XEQ control record:

```
1   5    10   15   20   25   30   35   40   45   50
// XEQ IDENT
```

DISC

The Satellite Disk Initialization (DISC) mainline program requires at least 8K of core storage to run. DISC reinitializes from one to four satellite cartridges; all but the master cartridge. (All new cartridges must be initialized with the stand-alone DCIP utility program, see Chapter 9). On each cartridge being reinitialized, the DISC program:

- Tests disk sectors to determine which, if any, are defective, and fills in the defective cylinder table accordingly
- Writes a sector address on every sector, including defective sectors
- Establishes a file-protected area for the cartridge
- Places an ID on the cartridge
- Establishes a disk communications area, sector @DCOM, a location equivalence table (LET), and a core image buffer (CIB)

If an error occurs during testing, the cylinder on which the error occurred is retested. If the error occurs again, the address of the first sector on that cylinder is written in the defective cylinder table. The monitor system I/O subroutines operate with up to 3 defective cylinders on a cartridge. That is, 3 cylinders that contain one or more defective sectors. A cartridge cannot be initialized if cylinder 0 is defective, or if a sector address cannot be written on every sector.

A message and the program that prints it are written in sector @RIAD. The message is:

```
NONSYST. CART. ERROR
```

This message is printed when an attempt is made to cold start a nonsystem cartridge that is initialized with DISC.

The DISC program is called for execution with a monitor XEQ control record followed by an *ID control record:

```
1   5    10   15   20   25   30   35   40   45   50
// XEQ DISC
*IDFID1,TID1,FID2,TID2,...,FIDn,TIDn
```

*ID fields

FID1 Through FIDn. Replace FID1 through FIDn with the current IDs on the satellite cartridges that are being reinitialized. This program overrides the cartridges that are specified in the current JOB monitor control record.

TID1 Through TIDn. Replace TID1 through TIDn with the new IDs to be placed on the satellite cartridges during initialization. A valid cartridge ID is a hexadecimal number from /0001 to /7FFF.

DSLET

The Dump System Location Equivalence Table (DSLET) mainline program prints the contents of SLET on the principal printer. Each SLET entry printed includes a symbolic name, phase ID, core address, word count, and disk sector address. Appendix E is a printout of a SLET dump.

The DSLET program is called for execution with a monitor XEQ control record:

```
1   5    10   15   20   25   30   35   40   45   50
// XEQ DSLET
```

ID

The Change Cartridge ID (ID) mainline program changes the ID on from one to four satellite cartridges. The ID program is called for execution with a monitor XEQ control record followed by an *ID control record:

```
1   5    10   15   20   25   30   35   40   45   50
// XEQ ID
*IDFID1,TID1,FID2,TID2,....,FIDn,TIDn
```

*ID fields

FID1 Through FIDn. Replace FID1 through FIDn with the IDs currently on the satellite cartridges that are to be changed. These IDs must be coded in the same logical order as those coded in the current JOB monitor control record.

TID1 Through TIDn. Replace TID1 through TIDn with new IDs that you want placed on the satellite cartridges. A valid cartridge ID is a hexadecimal number between /0001 and /7FFF.

COPY

The Disk Copy (COPY) mainline program requires at least 8K of core storage to run. COPY copies the contents from one cartridge (source) onto another (object cartridge). The defective cylinder data and cartridge ID are not copied. The copy code (word 5 of sector @IDAD) on the object cartridge is incremented to one greater than the copy code on the source cartridge. (The stand-alone DCIP program described in Chapter 9 provides a similar disk copy function.)

If a copy is made of a system cartridge from a system with a different configuration, the object cartridge must be reconfigured before a cold start can be performed (see Chapter 8 for information about reconfiguration).

The COPY program is called for execution with a monitor XEQ control record followed by an *ID control record:

```
1   5    10   15   20   25   30   35   40   45   50
// XEQ COPY
*IDFID1,TID1,FID2,TID2,....,FIDn,TIDn
```

*ID fields

FID1 Through FIDn. Replace FID1 through FIDn with the IDs of the cartridges that are being copied. When multiple copies are being made from a single cartridge, replace FID1 through FIDn with the same cartridge ID. This program overrides the cartridges that are specified on the current JOB monitor control record.

TID1 Through TIDn. Replace TID1 through TIDn with the IDs of the object cartridges.

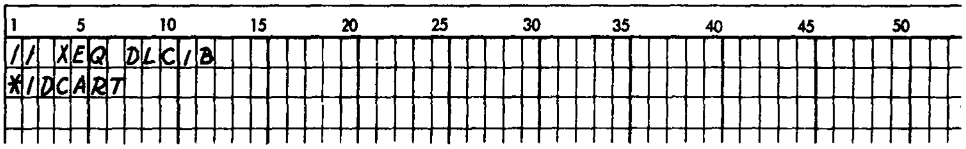
ADRWS

The Write Sector Addresses in Working Storage (ADRWS) mainline program writes a sector address on every sector of working storage of a cartridge. This program is not executed with an XEQ monitor control record as the other disk maintenance mainline programs are. ADRWS is linked to from the Disk Utility Program (DUP) when a DWADR DUP control record is read from the job stream. (The DWADR control record is described under "DUP Control Records" in Chapter 5.)

DLCIB

The Delete Core Image Buffer (DLCIB) mainline program deletes the CIB from a nonsystem cartridge. The areas on the cartridge that followed the CIB before it was deleted are moved back 2 cylinders closer to cylinder 0. The new addresses of the areas moved are placed in DCOM on the master cartridge and in COMMA on the cartridge from which the CIB was deleted.

The DLCIB program is called for execution with a monitor XEQ control record followed by an *ID control record:



```
1   5    10   15   20   25   30   35   40   45   50
// XEQ DLCIB
*IDCART
```

*ID field

CART. Replace CART with the cartridge ID of the nonsystem cartridge from which the CIB is being deleted.

MODIF

The System Maintenance (MODIF) mainline program allows you to make updates to the monitor system programs and/or the system library. This program changes the word of the disk communications area (DCOM) that contains the version and modification level of the monitor system. (Information stored in the user area in disk system format can also be changed with the MODSF disk maintenance program described later in this chapter.)

A card deck or paper tape containing corrections to update the monitor system to the latest version and modification level is supplied by IBM. All modifications included must be run, even if an affected program has been deleted from the system, to update the version and modification level.

The MODIF program is called for execution with a monitor XEQ control record:

```
1   5    10   15   20   25   30   35   40   45   50
// XEQ MODIF
```

Note. A system program phase that contains reload table entries (references to other entries in SLET generated by the system loader during an initial load or reload operation) cannot be replaced with MODIF; a system reload must be used (see Chapter 8 for reload information). MODIF cannot be used if temporary mode is indicated in the current monitor JOB control record. A cold start procedure is recommended prior to a system reload if the reload precedes the execution of MODIF, as in a system modification update.

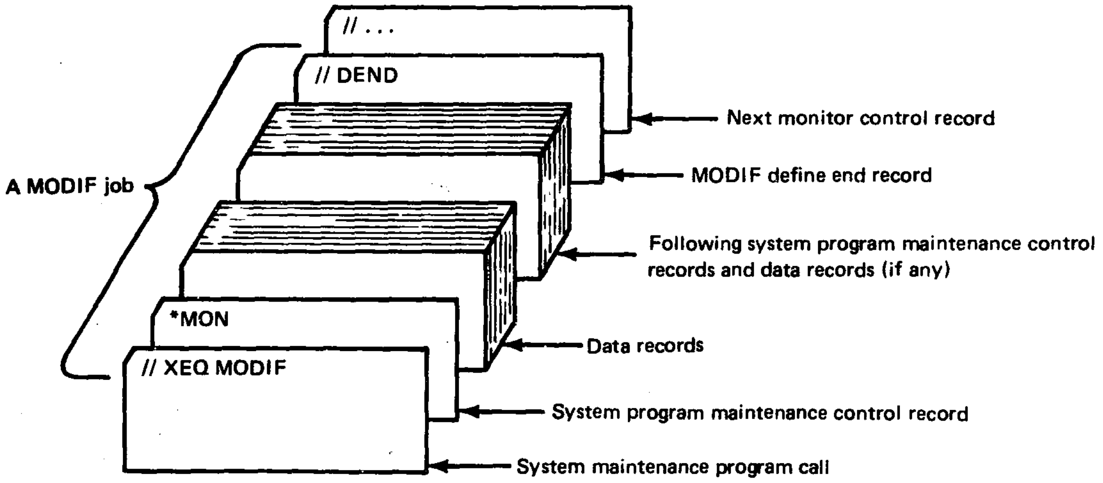
MODIF Patch Control and Data Records

The MODIF patch control records that can follow the monitor XEQ control record are:

- *MON that identifies a monitor program phase that is being modified
- *SUB that identifies a change to the system library
- // DEND that specifies the end of MODIF execution

***MON patch control record**

The *MON patch control record, patch data records, and a // DEND control record modify monitor program phases. A typical input card deck for system program maintenance is:


//...
// DEND
A MODIF job
*MON
// XEQ MODIF
Next monitor control record
MODIF define end record
Following system program maintenance control records and data records (if any)
Data records
System program maintenance control record
System maintenance program call

Each program phase that is changed requires a *MON control record and patch data records that specify the changes. If MODIF determines from SLET that the FORTRAN compiler or the assembler has been deleted from the disk, any modifications that are included for these programs cannot be made; however, the version and modification levels for these programs are updated in DCOM.

*MON patch control record format

Card column	Contents	Explanation
1 through 4	*MON	These characters identify a patch to any of the monitor system programs and/or the system device subroutines.
5	Blank	
6 through 8	vmm	A hexadecimal number; *v* is the monitor version, and *mm* is the monitor modification level.
9	0 or G or R	*0* indicates system modification update. *G* indicates general temporary fix. *R* indicates restricted temporary fix.
10	Blank	
11 through 14	xxxx	The SLET ID (in hexadecimal) of the monitor program phase to which the patch is being made. 0000 indicates an absolute patch (see columns 28 through 31 and 33 through 36).
15	Blank	
16 through 19	nnnn	The numbers (in hexadecimal) of *patch data records* that follow this control record.
20	Blank	
21	B or H	This character identifies the format of the patch data records that follow. *B* indicates binary system format. *H* indicates hexadecimal patch format.
22	Blank	
23 through 26	pppp	A hexadecimal number that specifies the total number of patch control records to be processed. This field is required only on the first patch control record.
27	Blank	
28 through 31	dsss	A hexadecimal number; *d* is the disk drive code, and *sss* is the sector address of the program being patched. Use this field only when columns 11 through 14 contain 0000.

Card column	Contents	Explanation
32	Blank	
33 through 36	cccc	A hexadecimal number that specifies the absolute core address of the first word of the sector specified in columns 28 through 31. Use this field only when columns 11 through 14 contain 0000.
37 through 80	Not used	

additional field information

**MON.* The programs that can be patched are: the FORTRAN compiler, RPG compiler, COBOL compiler (program product), assembler, Disk Utility Program, supervisor, core load builder, core image loader, and the system device subroutines. Modifications to the system device subroutines must be made with a *MON patch, not a *SUB, *DELETE, and *STORE patch.

0 or G or R. A system modification update (0) can be made only on a system of one level lower than the level indicated in columns 6 through 8. A general temporary fix (G) can be made only on a system of the same or one higher level than the level indicated in columns 6 through 8. A general temporary fix does not change the level of the system.

A restricted fix (R) can be made only on a system of the same level as the level indicated in columns 6 through 8.

pppp. A MODIF job can modify more than one system program and can modify both system programs *and* the system library.

In the latter case, the specified count in columns 23 through 26 must include the *SUB patch control record. The // DEND control record is not included in this count.

cccc. Core addresses can be obtained from the microfiche listings.

patch data records

Patch data records are in either hexadecimal patch format or binary system format. These data records specify the beginning address of the patch, and the new data for the patch. Patch data records cannot contain CALLs or LIBFs, and the relocation indicators will not be used.

hexadecimal patch data record format

Card column	Contents	Explanation
1 through 4	aaaa	The beginning core address (in hexadecimal) of the patch. Each patch data record must contain the core address.
5	Blank	
6 through 9, 11 through 14, 16 through 19, . . . 66 through 69		Each 4-column field is one word of patch data (in hexadecimal). Up to 13 words of patch data can be in-cluded in one data record. A blank must separate each word of data.
70 through 72	Blank	
73 through 80	Not used	

Hexadecimal patch records can contain ID/sequence numbers in columns 73 through 80. Zeros must be punched; leading blanks are not assumed.

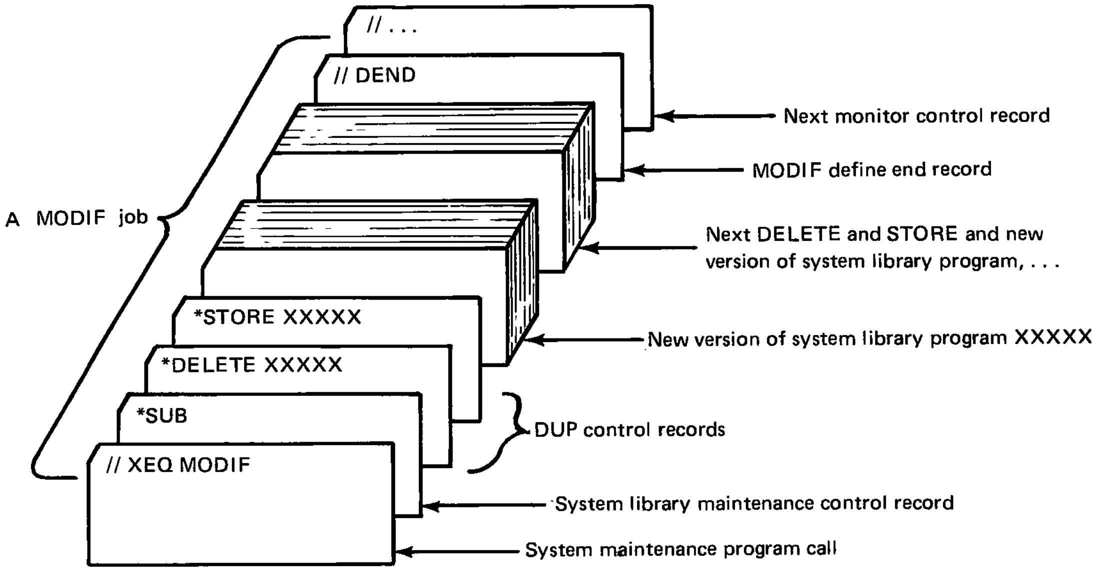
binary system patch data record format

Word	Contents
1	Location
2	Checksum
3	Type code (first 8 bits) 00001010
4 through 9	Relocation indicators
10 through 54	Data words 1 through 45
55 through 60	ID and sequence number or blanks

Note: Checksum verification is not made if word 2 is blank.

*SUB patch control record

The *SUB patch control record, DUP *DELETE and *STORE functions, new versions of system library programs and subroutines, and a // DEND control record are used to modify the system library. A typical input card deck for system library maintenance is:


//...
// DEND
*STORE XXXXX
*DELETE XXXXX
*SUB
// XEQ MODIF
A MODIF job
Next monitor control record
MODIF define end record
Next DELETE and STORE and new version of system library program, . . .
New version of system library program XXXXX
DUP control records
System library maintenance control record
System maintenance program call

Only one *SUB control record is used in a MODIF job; however, any number of deletes and stores can be included after a *SUB control record. When a MODIF job is used to modify system programs *and* the system library, the *SUB control record must be the last patch control record before // DEND in the MODIF job. The *SUB control record is also included in the count of MODIF patch control records coded in columns 23 through 26 of the *MON control record.

*SUB patch control record format

Card column	Contents	Explanation
1 through 4	*SUB	These characters identify a patch to the monitor system library.
5	Blank	
6 through 8	vmm	A hexadecimal number; *v* is the monitor version, and *mm* is the monitor modification level.
9	0 or G or R	*0* indicates system modification update. *G* indicates general temporary fix. *R* indicates restricted temporary fix.
10 through 15	Blanks	
16 through 19	nnnn	The number (in hexadecimal) of delete and store control records that follow this control record.
20 through 80	Not used	

additional field information

0 or G or R. A system modification update (0) can be made only on a system of one level lower than the level indicated in columns 6 through 8.

A general temporary fix (G) can be made only on a system of the same or one higher level than the level indicated in columns 6 through 8. A general temporary fix does not change the level of the system.

A restricted fix (R) can be made only on a system of the same level as the level indicated in columns 6 through 8.

// DEND patch control record

All MODIF jobs must end with a define end control record (// DEND). This record terminates MODIF execution and passes control to the supervisor.

// DEND patch control record format

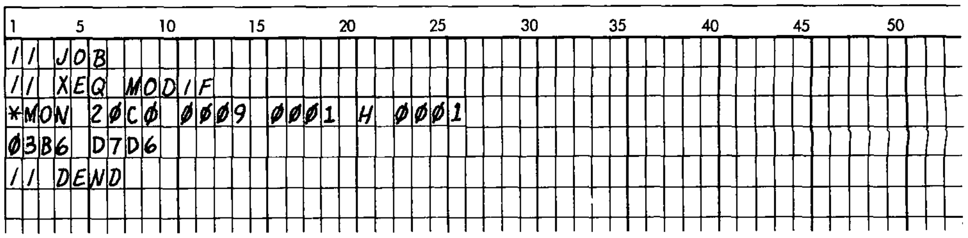
Card column	Contents	Explanation
1 through 7	//ƀDEND	ƀ indicates blank.
8 through 80	Not used	

MODIF Example

This example illustrates how to change an instruction in the Disk Utility Program (DUP). The following data is used to make the change:

- The SLET phase ID of the subroutine is /0009.
- Hexadecimal patch format is used.
- The instruction address (from an assembly listing) is /03B6.
- The instruction is /D7F0.
- The instruction is to be changed to /D7D6.
- The new modification level is 12.
- One patch data record is required.
- Only one patch control record (// DEND) follows the *MON control record.

The coding sequence for making this change is:



```
1   5    10   15   20   25   30   35   40   45   50
// JOB
// XEQ MODIF
*MON 2ØCØ ØØØ9 ØØØ1 H ØØØ1
Ø3B6 D7D6
// DEND
```

The following is printed on the console printer when the example is executed:

```
MODIF EXECUTION 020B

    MON  20C0  0009  0001  H  001
            DAAA   REL–WD   ADDR   OLD    NEW
            002B     0096     03B6   D7F0   D7D6
         SW  0  OFF=PATCH
         SW  0  ON  =ABORT

MODIF COMPLETED                020C
```

Where:

MODIF EXECUTION 020B — Execution of MODIF starts on DM2, Version 11

DAAA — Drive code and sector address of the patch

REL–WD — Relative word within the sector that is to be patched.

ADDR — Instruction address (from an assembly listing)

OLD — Original instruction

NEW — New instruction

SW 0 OFF=PATCH
SW 0 ON =ABORT — The system waits after these 2 lines are printed for operator intervention. Set data entry switch 0 to OFF and press PROGRAM START to write the patch to disk or set data entry switch 0 to ON to prevent the patch from being made.

Note. To prevent the printing of patch information, set data entry switch 1 to ON.

MODIF COMPLETED 020C — The patch is installed, and the new level is 12.

To direct printout to principal printer, set data entry switch 2 to ON.

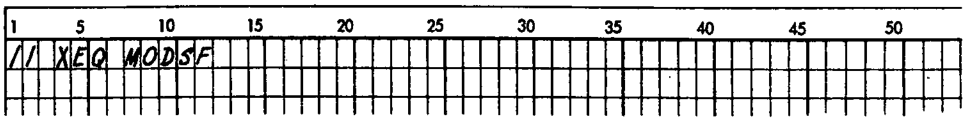
MODSF

The Library Maintenance (MODSF) mainline program allows you to update programs that are stored in the user area in disk system format. (Monitor system programs are modified or replaced with the MODIF program discussed in the previous section of this chapter.)

MODSF updates a program by replacing existing code and/or inserting additional code at the end of the program. Existing code is replaced in the program as it resides in the user area. The existing code of several programs can be updated in one MODSF job, but code can only be added to the last program included in the MODSF job. When additional code is added to a program, MODSF moves the program into working storage before inserting the new code. The modified program is still in working storage when MODSF execution is finished and can be transferred back to the user area with DUP *DELETE and *STORE functions.

On the basis of where the addresses you specify are in the program being modified, MODSF determines whether a particular update is a replacement or an addition of code. A maximum of 31 words can be updated in one MODSF job.

The MODSF program is called for execution with a monitor XEQ control record:



1
5
10
15
20
25
30
35
40
45
50

```
// XEQ MODSF
```

This page intentionally left blank

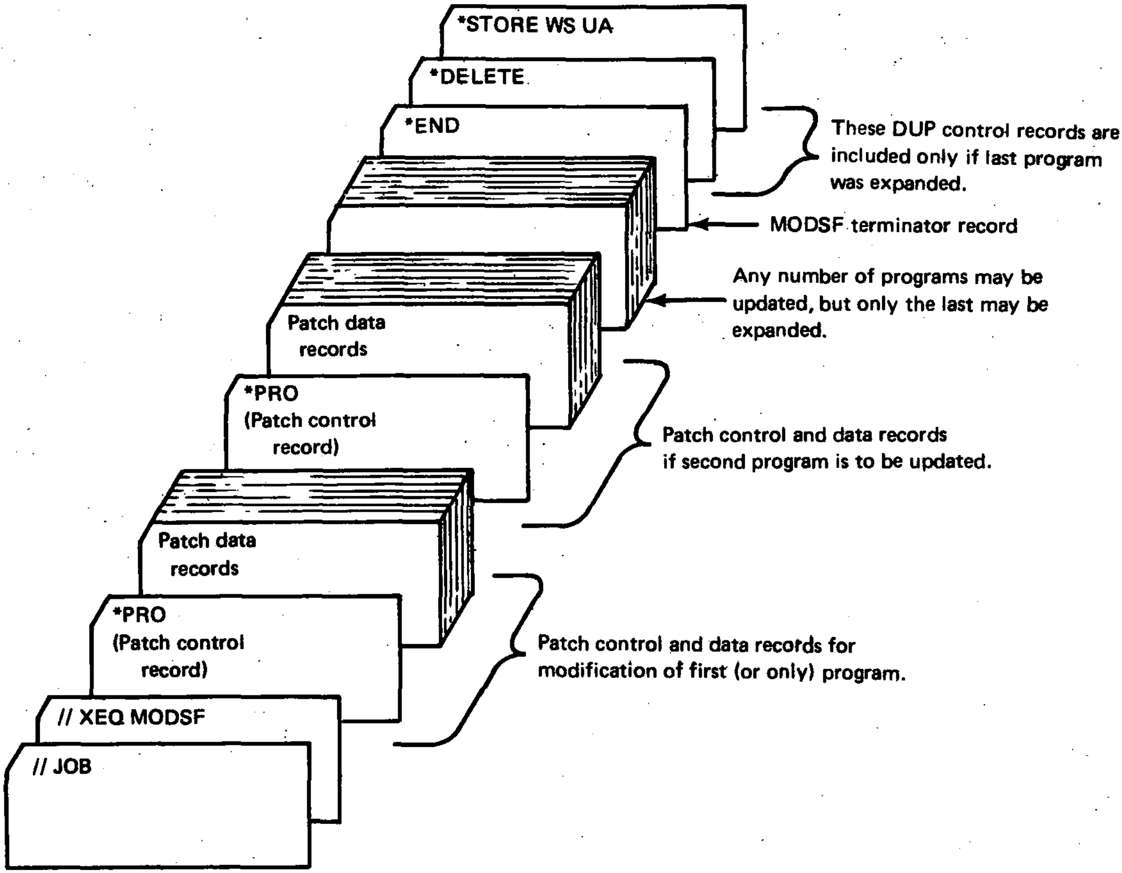
MODSF Patch Control and Data Records

The MODSF patch control records that can follow the monitor XEQ control record are:

- *PRO that identifies the program that is being modified.
- *END that specifies the end of MODSF execution.

*PRO patch control record

The *PRO patch control record, patch data records, and an *END control record are used to modify programs and subroutines stored in the user area. A typical input card deck for library program maintenance is:


*STORE WS UA
*DELETE
*END
These DUP control records are included only if last program was expanded.
MODSF terminator record
Any number of programs may be updated, but only the last may be expanded.
Patch data records
*PRO (Patch control record)
Patch control and data records if second program is to be updated.
Patch data records
*PRO (Patch control record)
Patch control and data records for modification of first (or only) program.
// XEQ MODSF
// JOB

Each program or subroutine that is being modified requires a *PRO control record and patch data records that specify the changes being made.

*PRO patch control record format

Card column	Contents	Explanation
1 through 4	*PRO	These characters identify a MODSF patch control record.
5	Blank	
6 through 8	vmm	A hexadecimal number; *v* is the current monitor version, and *mm* is the current monitor modification level.
9	Blank	
10 through 14	pname	The name of the DSF program being updated. (If the program has secondary entry points, this must be the name of the primary entry point.)
15	Blank	
16 through 19	nnnn	The number (in hexadecimal) of *patch data records* that follow this control record.
20	Blank	
21	m	Indicates addressing mode, where *m* is: *P* for program-address mode, or *D* for disk-displacement mode.
22	Blank	
23 through 26	xxxx	Cartridge ID of the cartridge on which the program being modified is stored. (A cartridge ID is not necessary if the program is stored on the master cartridge.)
27, 37, 47, 57	Blanks	
28 through 31 38 through 41 48 through 51 58 through 61	aaaa aaaa aaaa aaaa	Each of these optional fields specifies an address (in hexadecimal) at which the current content of the program is compared with the values specified beginning in column 33.
32, 42, 52, 62	Blanks	
33 through 36 43 through 46 53 through 56 63 through 66	vvvv vvvv vvvv vvvv	The value (in hexadecimal) that is being compared with the program content at the addresses specified beginning in column 28. These optional fields are used when the aaaa fields are used.
67 through 72	Reserved	
73 through 80	Not used	

additional field information

m. Addresses at which modifications are being made to the program are expressed as either P for P-mode (program-address) or D for D-mode (disk-displacement). In P-mode, each address represents a relative address within the program such as is printed on the left of an assembly listing.

In D-mode, each address represents a relative location on a disk; a location that the number of words indicated by the displacement beyond word 0 of the DSF program header. Each D-mode address corresponds to an address on a DUP *DUMP of the program to the printer.

Note. D-mode should be used if the program or subroutine being updated contains a backward origin. If P-mode is used when a program contains a backward origin, the results of MODSF execution are unpredictable.

aaaa . . . and vvvv . . . These optional fields allow you to verify whether or not a specific update has been made by checking the contents of the program at specified addresses (aaaa . . .) with specified values (vvvv . . .). If the contents of the words checked are not exactly as specified, the MODSF job is terminated. The addresses (aaaa . . .) are interpreted by MODSF as P-mode or D-mode according to the addressing mode specified in column 21 of this control record.

Note. The second word of a LIBF or CALL cannot be verified.

patch data records

Code can be replaced or added in either P-mode or D-mode. You specify the addressing mode in column 21 of the *PRO control record. The patch data records for MODSF are in either P-mode or D-mode format. For the patch data records, choose the format according to the addressing mode you specify in the *PRO control record.

In P-mode, you can update any word in a program, including the relocation code for that word. (You cannot update the program header or any data header in the program text because these are not a part of the program.) You can add words to the end of a program; a relocation code must be specified for each new word. The program length and the disk block count in the program header are automatically updated by MODSF when an addition is made.

Because the object code of a LIBF occupies 2 words as stored on disk but only one word in a subsequent core load of the program, you can only replace a LIBF with another LIBF.

P-mode patch data record format

Card column	Contents	Explanation
1 through 4	aaaa	The address (in hexadecimal) in the program of the first word being changed.
5	Blank	
6	r	Relocation code of the first word being changed; enter: *A* for an absolute expression or the second word of an LIBF or a CALL (relocation code 0), *R* for a relocatable expression or the second word of a DSA statement (relocation code 1), *L* for the first word of an LIBF (relocation code 2)—an update with an *L* relocation code *must* be immediately followed (on the same patch data record) by a second update word with an *A* relocation code, *C* for the first word of a CALL or DSA statement (relocation code 3).
7	Blank	
8 through 11	xxxx	The value (in hexadecimal) that is being inserted in the first location.
12	Blank	
13	r	Relocation code of the second word being changed (see column 6).
14	Blank	
15 through 18 . . . 64 through 67	xxxx	The value that is being inserted in the next location. As many as 9 consecutive words can be updated with one data record. A relocation code must precede each value specified, and a blank must separate a relocation code from a value.
68 through 72	Reserved	
73 through 80	Not used	

In D-mode, you can change any word in a program. You can also change the program header or any data headers in the program text. You must update the program length and the disk block count in the program header when you add code to the end of a program. You must also modify any data headers and indicator data words affected by your changes or additions. Be careful to change only the required information in headers.

D-mode data control record format

Card column	Contents	Explanation
1 through 4	aaaa	Disk displacement (in hexadecimal) of the first word being changed with this data record.
5	Blank	
6 through 9	xxxx	The value (in hexadecimal) that is being inserted in the location specified by columns 1 through 4.
10	Blank	
11 through 14 . . . 66 through 69	xxxx	The next value that is being inserted in the next location. As many as 13 consecutive words can be updated with one data control record. Each value specified must be separated from the next with a blank.
70 through 72	Reserved	
73 through 80	Not used	

*END patch control record

All MODSF jobs must end with a MODSF terminator record (*END). This record terminates MODSF execution and passes control the the supervisor.

*END control record format

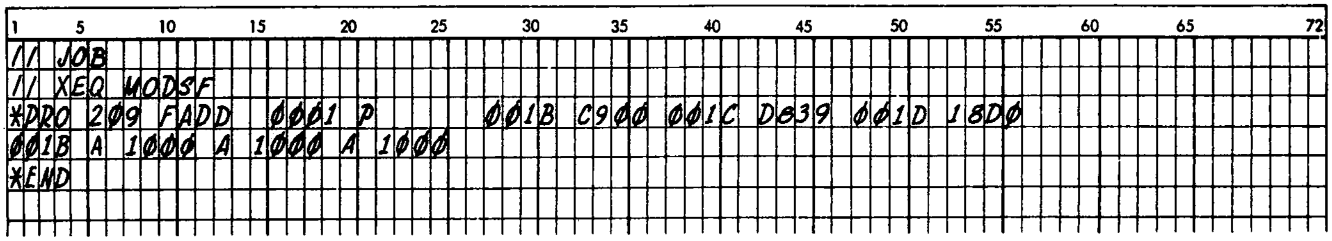
Card column	Contents	Explanation
1 through 4	*END	These characters signify the end of input for MODSF.
5 through 72	Reserved	
73 through 80	Not used	

MODSF Example

This example illustrates how to change three instructions to NOP instructions. The following data is used to make the changes:

- The name of the program is FADD.
- The instruction addresses (from an assembly listing) are 001B, 001C, and 001D (hexadecimal).
- The values that are compared with the contents at these locations are C900, D839, and 18D0, respectively.
- The instructions are all changed to 1000.
- The addressing mode is P.
- One P-mode patch data record is used.
- The modification level is 9.

The coding sequence for making these changes is:



```
// JOB
// XEQ MODSF
*PRO 2Ø9 FADD  ØØØ1 P      ØØ1B C9ØØ ØØ1C D839 ØØ1D 18DØ
ØØ1B A 1ØØØ A 1ØØØ A 1ØØØ
*END
```

When execution is complete, the following messages are printed on the principal printer:

MODIFICATIONS MADE	The changes are made and did not expand the program.
SUCCESSFUL COMPLETION	This message is printed when the *END record is read and the program is not expanded.

DFCNV

The Disk Data File Conversion (DFCNV) mainline program converts 1130 FORTRAN and/or commercial subroutine package (1130-SE-25X) disk data files to disk files acceptable to 1130 RPG. The program operates in a minimum 8K core DM2 system and uses DISK1 and the system device subroutines for the principal input device and principal printer.

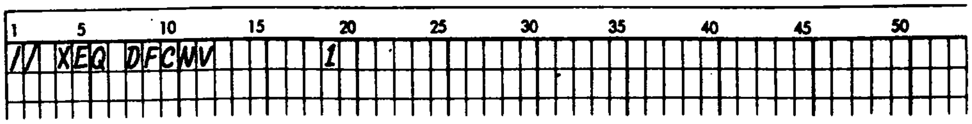
DFCNV accepts all FORTRAN and commercial subroutine package (CSP) disk data formats for conversion to acceptable RPG disk data format. FORTRAN or CSP input to DFCNV can be a disk file created with or without 2-word integers, or a deck of cards produced by a DUP *DUMPDATA operation.

Prior to executing DFCNV, use a DUP *STOREDATA or *DFILE operation to reserve an output file in the user or fixed area and to enter its file name in LET or FLET. The DFCNV output file can be defined on the same disk as the input file or on a cartridge residing on another drive. DFCNV converts one input file to one output file; subsequent DFCNV program executions must be performed to convert more than one file.

RPG programs can process the converted files sequentially or randomly, but not as indexed sequential access method (ISAM) files.

Note. The disk file protection indicators $FPAD-$FPAD+4 in COMMA are modified during the conversion portion of DFCNV. These modified indicators must be restored prior to further monitor processing if unforseen problems, such as accidentally pressing IMM STOP, cause abnormal ending of DFCNV. Normally, these indicators are restored by DFCNV after a successful file conversion.

The DFCNV program is called for execution with a monitor XEQ control record:



```
1   5    10   15   20   25   30   35   40   45   50
// XEQ DFCNV      1
```

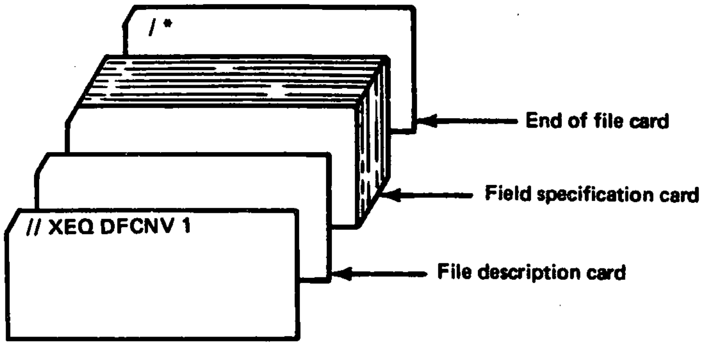
DFCNV Control Records

Three types of control records are required by the conversion program:

- File description
- Field specification
- End-of-file

file description control record

A file description control record is required and must immediately follow the XEQ control record. Only one file description record is used. A typical input card deck for the conversion program is:



The file description control record contains the following information.

file description control record format

Card column	Contents	Explanation
1 through 5	Name	The file name (left-justified) of the file whose data is being converted. This field is ignored if card input is specified in column 31.
6	Blank	
7 through 11	RPG name	The file name (left-justified) of the file where the RPG data is to be placed.
12	Blank	
13 through 17	Number of input records	A right-justified decimal number with leading zeros or blanks and in the range 1 through 32767.
18	Blank	
19 through 21	Input-file record size, in words	A right-justified decimal number with leading zeros or blanks and in the range 1 through 320.
22	Blank	
23 through 25	RPG file record size, in characters	A right-justified decimal number with leading zeros or blanks and in the range 1 through 640.
26	Blank	
27	S or E	*S* indicates standard precision. *E* indicates extended precision.
28	Blank	
29	1 or blank	*1* indicates one-word integers are used.
30	Blank	
31	C or blank	*C* indicates input from cards. Blank indicates that input is from disk.
32	Blank	
33	W or blank	*W* indicates that an object time warning message is to be printed if a real number (see "R-Field Type" in Appendix J) is out of range upon conversion. Blank indicates that the object time warning message is not printed.
34 through 71	Blanks	
72	D	This character identifies this record as a file description record.
73 through 80	Not used	

additional field information

Name. Use the exact name of the FORTRAN or CSP file that is being converted.

RPG name. The RPG file name cannot contain any special characters, although the input file name can contain the character $. DFCNV does not check the RPG file name for $.

computing file sizes

Both the input and RPG file sizes are calculated from the information that you specify in the file description control record. These computed sizes are checked against their corresponding LET or FLET entries for correct size. The following formulas are used to calculate the input and output file sizes.

1. Compute the number of words (*L*) in a record:

   $$L = \frac{C}{2}$$

   where

   C is the record size in characters. Round the answer to the next higher number if the answer has a remainder.

2. Compute the number of records (*N*) that can be contained in one sector:

   $$N = \frac{320}{L}$$

   where

   L is the length in words of each record computed in Step 1, and *320* is the number of words in a sector. Disregard the remainder, if any.

3. Compute the input file size (*I*) in sectors:

   $$I = \frac{R}{N}$$

   where

   R is the number of records in the file, and *N* is the number of records per sector computed in Step 2. Round the answer to the next higher number if the answer has a remainder.

4. Compute the output file size (*O*) in sectors:

   $$O = \frac{R+1}{N}$$

   where

   R is the number of records in the file, and *N* is the number of records per sector computed in Step 2. Round the answer to the next higher number if the answer has a remainder.

These are the same formulas that you use to calculate record and file sizes of sequentially organized files, see "File Processing" in Chapter 6.

field specification control record

The second required control record, field specification, describes the RPG fields for the converted data. Descriptions and examples of each field type supported by the program are in Appendix J.

Caution: DFCNV does not check data format; therefore, you must know *in detail* the format of the fields of your FORTRAN or CSP input file.

You can use as many *complete* field specifications on a field specification control record as can be placed in columns 1 through 71. Column 72 of each record must contain an S. Field specifications must be placed on the control records in the same order as the corresponding fields of the input record. Each field specification must be separated from the next with a comma. Blanks embedded in specifications or blanks between specifications are not allowed. The following is an example of a field specification control record:

```
1   5    10   15   20   25   30   35   40   45   50   55   60   65    72
1-R3.Ø,5-I4.1,12-R7.5,21-B8.2,3Ø-I8.2                                 S
```

Selected field conversion can be done by using the X-field type. See Appendix J for a description of this field type. Data can be rearranged and field size can be modified with the *m* term of field types. When data is rearranged or fields are expanded, you must prevent data overlay in the converted field.

repeat specification option

Identical fields that are sequentially repeated can be specified with only one field specification for any field type except the X-field type. You specify the repeat option by immediately following the specification being repeated with the character R and the total number of identical fields. Each repeat field begins in the first vacant output column after the previous field; that is, columns are not skipped when the repeat specification is used.

For example, the following field specification describes three integer fields, the first beginning in column 15 of the RPG record. Each field is packed and is five characters long with 2 places to the right of the decimal point:

15–I5.2(P)R3

The 3 resulting output fields start in the eighth word of the output record as:

Word:	8	9	10	11	12
Contents:	XXX0	0FYY	Y00F	ZZZ0	0F40

where

XXX, YYY, and ZZZ represent the three integer fields.

optional control record

When any F-field type conversions are specified on the field specification control record, an optional control record is required. This control record must contain the 40 character translation table for CSP A3 format and the character A in column 72. This control record immediately precedes the first field specification control record that specifies F-field type conversion. Only one conversion table is allowed per file; if more than one is included in the control records, the additional tables are ignored. The conversion table must correspond to the original table used to convert to CSP A3 format.

end-of-file control record

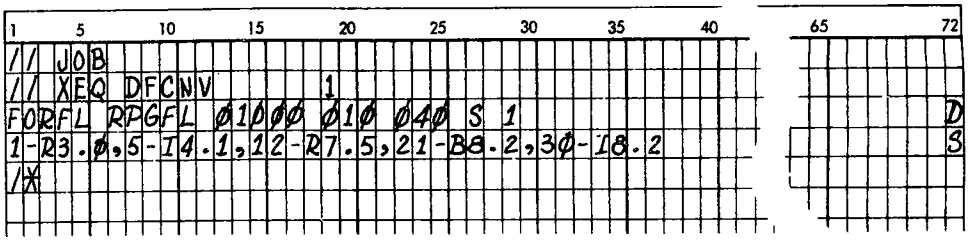
The third required control record for DFCNV is the end-of-file control record. All other DFCNV control records must precede the end-of-file (/*) control record.

DFCNV Example

This example illustrates how to convert the FORTRAN file named FORFL to an RPG file named RPGFL. The FORTRAN file contains 1,000 records, each 10 words long. The file is standard precision with one-word integers. One such FORTRAN record is as follows:

Word:	1	2	3	4	5	6	7
Content:	3A7E	D64B	40D5	D540	D4C1	BC00	0080
Word:	8	9	10				
Content:	03C8	C000	0083				

The RPG file consists of records 40 characters long. The coding for converting the FORTRAN file is:



```
// JOB
// XEQ DFCNV      1
FORFL RPGFL Ø1ØØØ Ø1Ø Ø4Ø S 1                                          D
1-R3.Ø,5-I4.1,12-R7.5,21-B8.2,3Ø-I8.2                                  S
/*
```

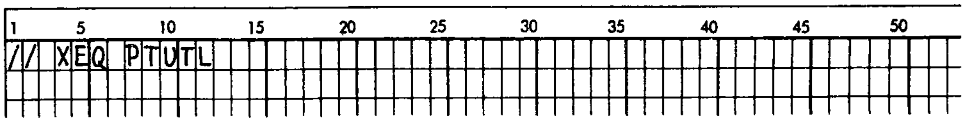
After conversion, the RPG record that corresponds to the previous FORTRAN record is stored on disk as:

Word:	1	2	3	4	5	6	7	8
Content:	F0F0	D440	F9F6	F8F0	4040	40F0	F0F5	F3F1
Word:	9	10	11	12	13	14	15	16
Content:	F2D5	4040	D4C1	D540	40D5	D64B	40F0	F1F4
Word:	17	18	19	20				
Content:	F9F7	F4F0	F040	4040				

PTUTL

The Paper Tape Utility (PTUTL) mainline program accepts input from the keyboard or the 1134 Paper Tape Reader and provides output on the console printer and/or the 1055 Paper Tape Punch. You can make changes and/or additions to FORTRAN and assembler language source records and monitor control records with PTUTL.

The PTUTL program is called for execution with a monitor XEQ control record:



```
// XEQ PTUTL
```

The PTUTL program is also available as an IBM-supplied stand-alone program on tape BP17. The operating procedure for both PTUTL programs is in Figure 9-12, Chapter 9. An example of using this program is also included under "Stand-alone Paper Tape Utility Program (PTUTL)" in Chapter 9.

Chapter 5. Control Records

You use control records to specify operations performed by the Disk Monitor 2 System. The use of these control records provides for stacked jobs with a minimum of operator intervention. The order of control records, source statements, and data in stacked jobs is described under "Stacked Input Arrangement" in Chapter 6.

The control records in this chapter are grouped according to the monitor program that they are associated with. These groups are:

- Monitor control records
- Supervisor control records
- DUP control records
- Assembler control records
- FORTRAN control records
- RPG control records

Each section of this chapter consists of a general function description, the order in which the control records are placed in the input stream, general coding considerations, and a description of each control record.

Other less frequently used control records are included in Chapter 4, "Monitor System Library." The control records described in Chapter 4 apply to specific, infrequently performed procedures.

Note. The System 2501/1442 conversion routine interprets the following character punches as equal: ' and @, + and &, = and #,) and <, (and %.

The characters ', +, =,), and (are printed. The conversion routine is used during analysis of control records, source input for language processors, and DUP input/output data. This routine provides uniformity for 024 and 029 prepared input.

MONITOR CONTROL RECORDS

functions

The monitor control records described in this section define control and load functions that are performed by the monitor system. These functions are:

- Initializing jobs
- Loading the assembler, the language compilers, or the Disk Utility Program into core for execution
- Starting the execution of your programs
- Printing comments during monitor system operations
- Changing print devices during monitor system operations

The JOB monitor control record defines and initializes the beginning of jobs. Other monitor control records are placed behind the JOB control record to specify the operations to be performed during a job. A detailed description of the order of control records, program statements, and data files in the input stream is in Chapter 6 under "Stacked Input Arrangement."

coding

Information must be coded in the indicated card columns in monitor control record formats. Columns 1 and 2 always contain slashes (//). The character ƀ and *reserved* card columns indicate that the columns must be blank. You can replace card columns shown as *not used* with comments.

// JOB

general function

A JOB monitor control record defines the start of a new job. This control record causes the supervisor to initialize a job, which includes:

- The initialization of parameters in the core communications area (COMMA) and in sector @DCOM
- The setting of the temporary mode indicator if the job is executed in temporary mode
- The definition of the cartridges to be used during the current job
- The definition of the cartridge that contains the core image buffer used for the current job
- The definition of the cartridge that contains working storage used during the current job
- The definition of the cartridge that contains the unformatted I/O disk buffer area for use during the current FORTRAN job
- The definition of a new heading printed on each page printed by the principal print device
- The reading of EQUAT supervisor control records into the supervisor control record area (SCRA)

format

Card column	Contents	Explanation
1 through 6	//ƀJOB	
7	Reserved	
8	Temporary mode indicator	*T* or blank. A *T* indicates that temporary mode is desired for this job.
9 through 10	Reserved	
11 through 14	First ID	This is the ID of the master cartridge (logical drive 0).
15	Reserved	
16 through 19	Second ID	This is the ID of the cartridge on logical drive 1.
20	Reserved	
21 through 24	Third ID	This is the ID of the cartridge on logical drive 2.
25	Reserved	
26 through 29	Fourth ID	This is the ID of the cartridge on logical drive 3.
30	Reserved	
31 through 34	Fifth ID	This is the ID of the cartridge on logical drive 4.
35	Reserved	
36 through 39	CIB ID	This is the ID of the cartridge containing the CIB to be used during this job.

Card column	Contents	Explanation
40	Reserved	
41 through 44	Working storage ID	This is the ID of the cartridge containing the working storage to be used by the monitor during this job. See *FILES, for details on working storage for your programs.
45	Reserved	
46 through 49	Unformatted disk I/O ID	This is the ID of the cartridge containing the unformatted disk I/O area to be used during this job.
50	Reserved	
51 through 58	Date, name, etc.	This information is printed at the top of every page of the listing on the principal print device during this job.
59	Not used	
60 and 61	EQUAT record count	This number specifies how many EQUAT records follow this JOB record.
62 through 80	Not used	

additional field information

Temporary Mode Indicator. A T in column 8 causes all programs and/or data files stored by DUP in the user area during the current job to be deleted from the user area when the next // JOB control record is read. Temporary mode places restrictions on some of the DUP operations as shown in the followng chart:

DUP operations	**Restrictions**
DUMP	None
DUMPDATA, DUMPDATAƀE	None
STORE	None
STORECI	To UA only
STOREDATA, STOREDATAE	To UA and WS only
STOREDATACI	To UA only
STOREMOD	Not allowed
DUMPLET	None
DUMPFLET	None
DWADR	Not allowed
DELETE	Not allowed
DEFINE FIXED AREA	Not allowed
DEFINE VOID ASSEMBLER	Not allowed
DEFINE VOID FORTRAN	Not allowed
DEFINE VOID RPG	Not allowed
DEFINE VOID COBOL	Not allowed
DFILE	To UA only
MACRO UPDATE	Not allowed

First ID through Fifth ID. These IDs define the cartridges that are used during the current job. These cartridges can be mounted on the physical disk drives in any order; the order of the IDs on the JOB control record specifies the logical assignments for the cartridges. The first through the fifth IDs correspond to logical drives 0 through 4, and must be specified consecutively. When 3 drives are being used, only the first through the third IDs are specified.

The cartridge-related entries of the core communications area (COMMA) and sector @DCOM are filled according to the logical order specified by the JOB control record. The first ID can be left blank, in which case the master cartridge for the last JOB will also be the master cartridge for the current JOB. A cartridge ID is not required when only one cartridge is used during the current JOB. In this case, the master cartridge from the last JOB or that was specified during a cold start is used.

The first cartridge ID can be used to define a system cartridge that is different from the one currently being used as logical drive 0. The specified cartridge must be the same monitor modification level as the one it replaces.

CIB ID. This is the ID of the cartridge that contains the core image buffer to be used during the current job. The CIB ID is optional. If this ID is omitted, the CIB on the master cartridge is assumed by the system. If the CIB on the specified cartridge has been deleted, the CIB on the master cartridge is assumed for the current job. Core image programs are built faster when the specified CIB is on a cartridge other than the master cartridge.

Working Storage ID. This field specifies the cartridge that contains the working storage that is used during the current job. The working storage ID is optional. If this ID is omitted, working storage on the master cartridge is used except when otherwise specified on DUP control records (see "DUP Control Records" in this chapter).

Core image programs are built faster when the specified working storage is on a cartridge other than the master cartridge. They can be built even faster when the IBM system area, the CIB, and working storage are all on separate cartridges.

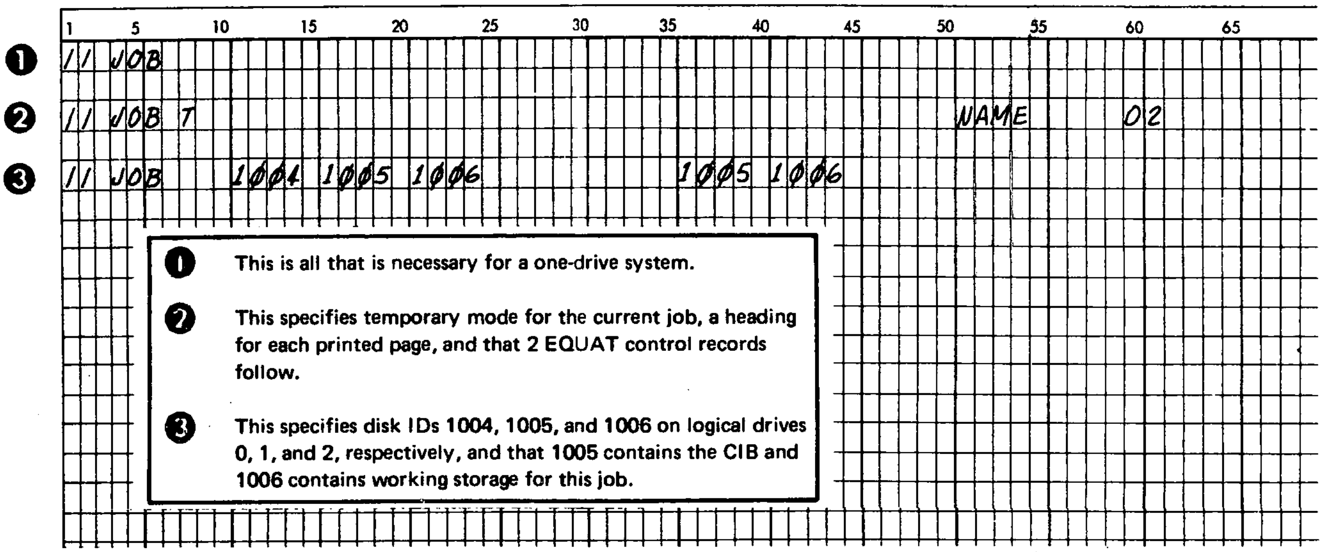
Programs are assembled or compiled faster when system working storage is on another cartridge. (See "*FILES" under "Supervisor Control Records" in this chapter for specifying working storage for use by your programs.)

Unformatted Disk I/O ID. This field specifies the cartridge that contains the unformatted I/O disk buffer area to be used during the current job. The unformatted disk I/O ID is specified when only unformatted I/O (data file named $$$$$) is used during execution of a FORTRAN program. (See "Initializing $$$$$ Data Files for Use With FORTRAN Unformatted I/O" in Chapter 6 for more information.)

Date, Name, Etc. This information is printed on the top of each page printed by monitor system programs, except RPG. This causes a skip to channel 1 on the 1132 or 1403 printer or 5 consecutive carriage returns on the console printer. The page count is reset to one, and the current page heading is replaced with whatever appears in columns 51 through 58 of the JOB control record. HDNG statements (assembler language) and ** records (FORTRAN header control record) cause additional information to be printed.

EQUAT Record Count. This parameter specifies the number of EQUAT supervisor control records (if any) that follow the JOB control record. These records are read and written in the supervisor control record area (SCRA).

// JOB Examples



```
   1   5    10   15   20   25   30   35   40   45   50   55   60   65
❶ // JØB
❷ // JØB T                                          NAME     Ø2
❸ // JOB    1ØØ4 1ØØ5 1ØØ6            1ØØ5 1ØØ6
```

❶ This is all that is necessary for a one-drive system.

❷ This specifies temporary mode for the current job, a heading for each printed page, and that 2 EQUAT control records follow.

❸ This specifies disk IDs 1004, 1005, and 1006 on logical drives 0, 1, and 2, respectively, and that 1005 contains the CIB and 1006 contains working storage for this job.

// ASM

general function

This control record causes the supervisor to read into core storage and transfer control to the assembler. Any assembler control records used and the source program statements to be assembled must follow an ASM control record. Monitor comments control records (// *) cannot follow an ASM control record.

format

Card column	Contents	Explanation
1 through 6	//ƀASM	
7 through 80	Not used	

// FOR

general function

This control record causes the supervisor to read into core storage and transfer control to the FORTRAN compiler. Any FORTRAN control records used and the source statements being compiled must follow a FOR control record. Monitor comments control records (// *) cannot follow this control record.

format

Card column	Contents	Explanation
1 through 6	//ƀFOR	
7 through 80	Not used	

// RPG

general function

This control record causes the supervisor to read into core storage and transfer control to the RPG compiler. RPG control cards and specification statements must follow an RPG control record. Monitor comments control records (// *) cannot follow an RPG control record.

format

Card column	Contents	Explanation
1 through 6	//ƀRPG	
7 through 80	Not used	

// COBOL

general function

This control record causes the supervisor to read into core storage and transfer control to the COBOL compiler (a program product). Monitor comments (// *) control records cannot follow a COBOL control record.

format

Card column	Contents	Explanation
1 through 8	//ƀCOBOL	
9 through 80	Not used	

// DUP

general function

This control record causes the supervisor to read into core storage and transfer control to the control portion of the Disk Utility Program (DUP). A DUP control record (see "DUP Control Records" in this chapter) must follow this control record. Only one // DUP monitor control record is required to process any number of DUP control records. Monitor comments control records (// *) can follow the DUP monitor control record.

format

Card column	Contents	Explanation
1 through 6	//ƀDUP	
7 through 80	Not used	

// XEQ

general function

This control record causes the supervisor to initialize for execution of a core load.

Comments control records (// *) can follow an XEQ control record if supervisor control records do not follow and if data is not entered through the principal input device during execution. The comments control records are printed after execution is complete.

format

Card column	Contents	Explanation
1 through 6	//ƀXEQ	
7	Reserved	
8 through 12	Name	This is the name (left-justified) of the DSF program or DCI program to be executed.
13	Reserved	
14	Core map indicator	*L* or blank. An *L* indicates that a core map is to be printed for this and all DSF programs linked to during this execution.
15	Reserved	
16 and 17	Count	A decimal number (right-justified) that indicates the number of supervisor control records that follow.
18	Reserved	
19	Disk I/O subroutine indicator	This specifies the disk I/O subroutine to be loaded into core by the core image loader for use by the core load during execution.
20	Reserved	
21 through 24	Cartridge ID	The ID of the cartridge that contains the mainline program in its working storage; blanks in this field indicate that the program is in system working storage.
25	Not used	
26	LOCAL-call-LOCAL indicator	A punch in this column enables a LOCAL subroutine to call another LOCAL.
27	Not used	
28	Special ILS indicator	A punch in this column indicates that ILSs for this core load should be chosen from the special ILSs.
29	Not used	
30	XEQ working storage indicator	A punch in this column allows the execution of a DSF or DCI program from working storage if a LET/FLET search fails to find the program named in the name field. When the name field is blank, it allows the execution of a DCI program from working storage.
31 through 80	Not used	

Note: When column 14 is blank, no warning is given if a file is truncated while a FORTRAN core load is being built.

additional field information

Name. This is the name of the program, stored in the user area or fixed area, that is executed.

When this field is omitted, the program to be executed is assumed to be stored in system working storage, or in working storage on the cartridge specified in columns 21 through 24 of this control record.

Core Map Indicator. An L punched in column 14 of this control record causes the printing of a core map for the program being executed and for all programs linked to during execution (see "Reading a Core Map and a File Map" in Chapter 6 for examples of core maps).

Count. A right-justified decimal number in columns 16 and 17 indicates the number of supervisor control records (LOCAL, NOCAL, FILES, EQUAT, and G2250) that follow this control record.

Disk I/O Subroutine Indicator. A decimal number in column 19 identifies the disk I/O subroutine used by the core load during execution.

Column 19	*Disk I/O subroutine*
blank or Z	DISKZ
0 or 1	DISK1
N	DISKN

Any other character is invalid and causes execution to be bypassed. All DSF programs that are linked to during execution must use the same disk I/O subroutine as the program that calls them.

LOCAL-Call-LOCAL Indicator. A punch (any character) in column 26 provides for a LOCAL subroutine to call another LOCAL subroutine during execution, provided the restrictions listed under "LOCAL-Calls-a-LOCAL" in Chapter 6 are met.

Special ILS Indicator. A punch (any character) in column 28 indicates that special interrupt level subroutines (ILSs named with an X before the number, as ILSX4) are used for this core load. If column 28 is blank, the standard set of ILSs is used.

In addition to the functions of the standard ILSs, special ILSs at the beginning of their execution save the contents of index register 3 and set this register to point to the transfer vector. Special ILSs restore the original contents of index register 3 at the end of their execution. Because the special ILSs save and restore the contents of index register 3, you can use this register in your programs.

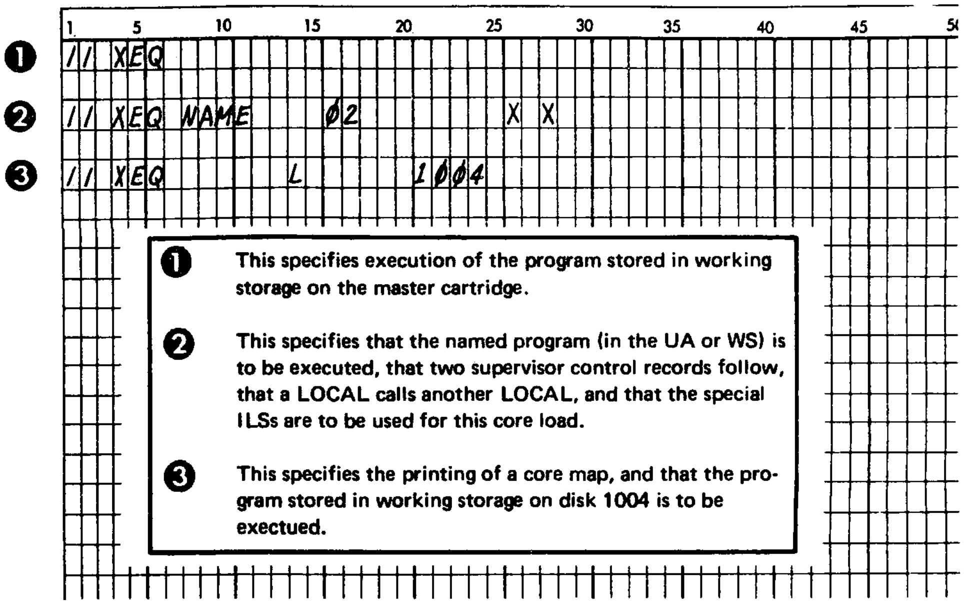
Special ILSs require 5 more words of core storage per ILS than standard ILSs. The special ILSs for interrupt levels 2 and 4 are loaded, together with other subroutines, as part of the core load. You can write ILSs to replace any of the IBM-supplied ILSs, standard or special.

XEQ Working Storage Indicator. A punch (any character) in column 30 allows the execution of any type program from working storage.

Working storage will be checked for a DSF or DCI program if the system fails to find a program in LET/FLET as indicated by the name field. Without this indicator set, the system will search only LET/FLET for the named program.

Working storage will be checked for a DSF or DCI type program when the name field is blank. Without this indicator set, the system will check working storage only for a DSF type program.

// XEQ Examples


1
5
10
15
20
25
30
35
40
45

```
❶ // XEQ
❷ // XEQ NAME    Ø2        X X
❸ // XEQ       L      1ØØ4
```

❶ This specifies execution of the program stored in working storage on the master cartridge.

❷ This specifies that the named program (in the UA or WS) is to be executed, that two supervisor control records follow, that a LOCAL calls another LOCAL, and that the special ILSs are to be used for this core load.

❸ This specifies the printing of a core map, and that the program stored in working storage on disk 1004 is to be exectued.

// * (Comments)

general function

This control record causes the alphameric comments contained on the // * control record to be printed on the principal print device. The information is read and printed, and the next control record is read from the input stream. Comments control records can be used preceding a PAUS monitor control record to instruct the operator as to what he is to do during the pause in monitor system operations.

When the console printer is used to print monitor and supervisor control records as a result of a CPRNT monitor control record, comments control records are printed on the principal printer.

Comments control records cannot immediately follow an ASM, RPG, FOR, or COBOL monitor control record. Comments control records can follow an XEQ control record if supervisor control records do not follow and if data is not entered from the principal input device during execution.

format

Card column	Contents	Explanation
1 through 4	//ƀ*	
5 through 80	Comments	Any alphameric characters can be used.

// PAUS

general function

This control record causes the supervisor to pause at a WAIT instruction. Supervisor operation continues when you press PROGRAM START on the console. This pause allows you to perform operator actions, such as add cards to the card reader, change satellite disk cartridges, or change paper tapes within a JOB stream. The status of the monitor system is not changed during a pause.

Monitor comments control records (// *) preceding a PAUS control record can describe the operator actions performed during the pause.

format

Card column	Contents	Explanation
1 through 7	//ƀPAUS	
8 through 80	Not used	

// TYP

general function

This control record temporarily assigns the console keyboard as the principal input device. The keyboard replaces the card or paper tape reader as the principal input device until a TEND monitor control record is entered through the keyboard.

The use of the keyboard as the principal input device for entering control records, program statements, and data is described under "Entering Jobs from the Console Keyboard" in Chapter 7.

format

Card column	Contents	Explanation
1 through 6	//ƀTYP	
7 through 80	Not used	

// TEND

general function

This control record reassigns the card or paper tape reader as the principal input device. The reassignment is to the device that was the principal device before the TYP monitor control record was read.

A TEND control record can be entered only from the keyboard.

format

Card column	Contents	Explanation
1 through 7	//ƀTEND	
8 through 80	Not used	

// EJECT

general function

This control record causes the 1403 Printer or 1132 Printer, whichever is the principal print device, to skip to a new page and print the page header. When the console printer is assigned as the principal printer, or when a CPRNT monitor control record has been processed, 5 lines are skipped and the page header is printed.

format

Card column	Contents	Explanation
1 through 8	//ƀEJECT	
9 through 80	Not used	

// CPRNT

general function

This control record causes monitor and supervisor control records that follow CPRNT to be printed on the console printer. All other control records and monitor comments control records are printed on the principal print device.

An EJECT monitor control record read after a CPRNT affects the console printer rather than the principal print device.

A CEND monitor control record is used to return the printing of monitor and supervisor control records to the principal print device. A system reload and/or the DEFINE VOID function of the Disk Utility Program (DUP) also restores the original principal print device.

format

Card column	Contents	Explanation
1 through 8	//ƀCPRNT	
9 through 80	Not used	

// CEND

general function

This control record restores the printing device that was the principal printer before a CPRNT monitor control record was processed.

format

Card column	Contents	Explanation
1 through 7	//ƀCEND	
8 through 80	Not used	

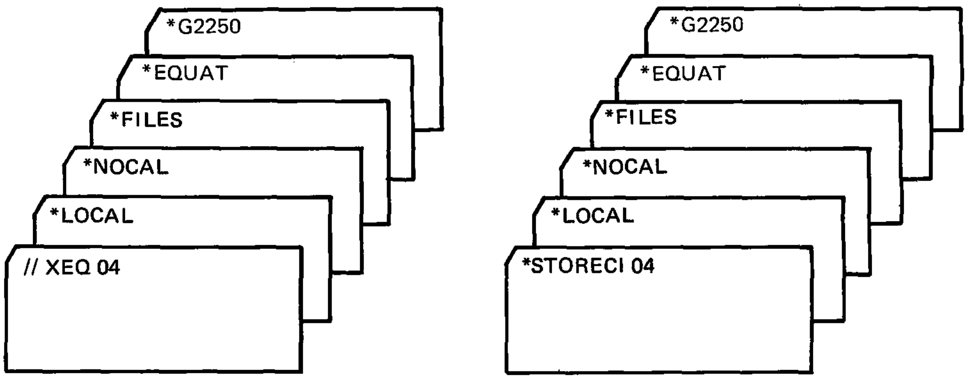
SUPERVISOR CONTROL RECORDS

functions

Supervisor control records are used by the core load builder to:

- Provide for subroutine overlays during execution, *LOCAL
- Include in the core load subroutines that are not called, *NOCAL
- Equate disk storage data files defined in a mainline program during compilation or assembly to specific files that are stored on disk, *FILES
- Provide graphic display capabilities, *G2250
- Substitute a subroutine with another subroutine, *EQUAT

LOCAL; NOCAL, FILES, EQUAT, and G2250 supervisor control records are placed in the input stream following an XEQ monitor control record, which names a mainline program stored in disk system format, or following a STORECI DUP control record.



In either case, the control records are written on disk in the supervisor control record area (SCRA), from which the core load builder reads them for processing during construction of a core load.

Up to 99 supervisor control records can follow an XEQ or STORECI control record. Supervisor control records do not have to be placed in any special order by type; however, all the control records of one type must be kept together.

coding

An asterisk (*) is coded in column one of all supervisor control records. The rest of the information specified in supervisor control records, except the G2250 control record, is coded continuously through column 80. A blank is used as a termination character for each record; therefore, embedded blanks cannot be coded within the characters in a record. A comma (,) followed by a blank is used as a continuation indicator, which means the information is continued on the following record. If sequence numbers are applied to the records, at least one blank must appear before the sequence information. Information specified in the G2250 control record must be coded in the fields indicated in the G2250 format description in this section.

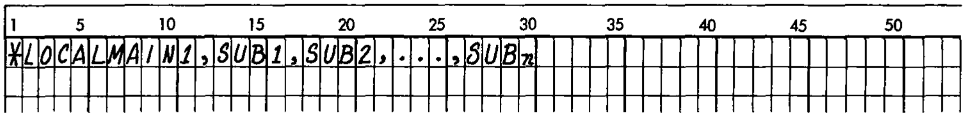
The program name that is coded in all types of supervisor control records can be either the primary entry point name or any secondary entry point name in the program.

*LOCAL

general function

This control record specifies the names of LOCAL (load-on-call) subroutines that are to be read, when called during execution, into the LOCAL overlay area of a core load. (See "Rules for LOCAL and NOCAL Usage" and "LOCAL-Calls-a-LOCAL" in Chapter 6.)

format



```
1   5    10   15   20   25   30   35   40   45   50
*LOCALMAIN1,SUB1,SUB2,...,SUBn
```

Note: Embedded blanks are not allowed in a LOCAL control record.

additional field information

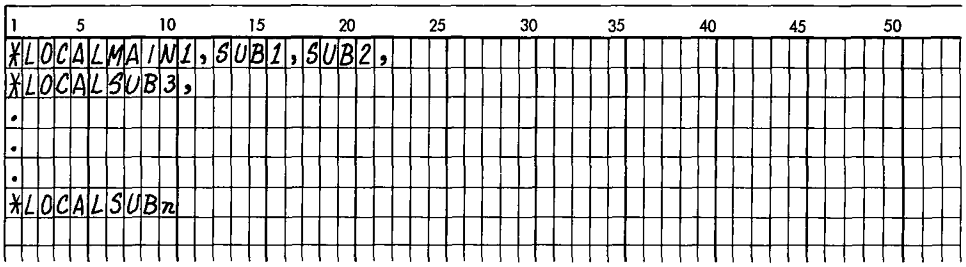
MAIN1. You replace MAIN1 with the name of the DSF mainline program that is already stored in the user area on disk.

,SUB1,SUB2,... SUBn. You replace SUB1 through SUBn with the names of the subroutines that are used as LOCALs with the specified mainline program.

continuation records

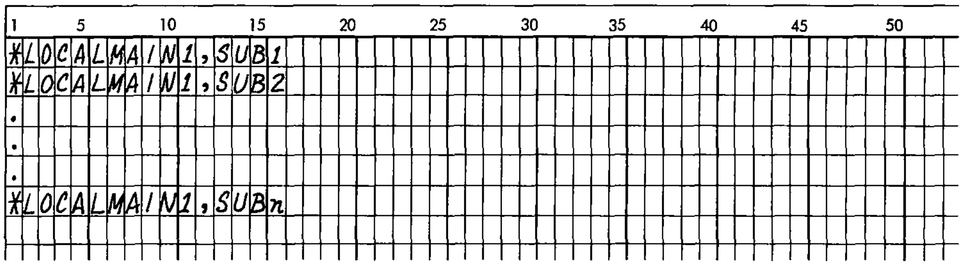
The specification of LOCAL subroutines can be continued from one LOCAL control record to another by placing a comma after the last subroutine specified on each LOCAL control record, except the last. The name of the mainline program is not included on the continuation control records.

continuation example



```
1   5    10   15   20   25   30   35   40   45   50
*LOCALMAIN1,SUB1,SUB2,
*LOCALSUB3,
.
.
.
*LOCALSUBn
```

The results would be the same if the control records were:



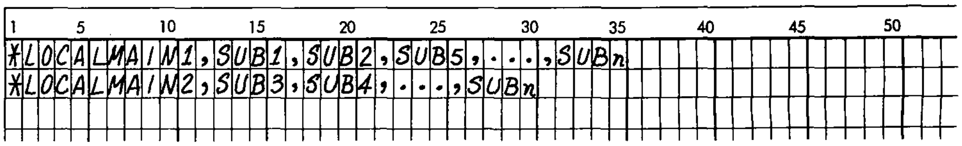
```
1   5    10   15   20   25   30   35   40   45   50
*LOCALMAIN1,SUB1
*LOCALMAIN1,SUB2
.
.
.
*LOCALMAIN1,SUBn
```

All LOCAL subroutines that are used by each mainline program during execution must be specified on LOCAL control records following the XEQ monitor control record that starts execution.

coding for linked programs

Separate LOCAL control records must be used for each mainline program that calls LOCAL subroutines during execution.

example



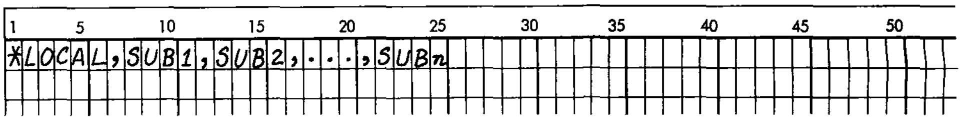
```
1   5    10   15   20   25   30   35   40   45   50
*LOCALMAIN1,SUB1,SUB2,SUB5,...,SUBn
*LOCALMAIN2,SUB3,SUB4,...,SUBn
```

MAIN2. You replace MAIN2 with the name of a mainline program that is called by the program represented by MAIN1.

mainline program in working storage

When the mainline program is to be executed from working storage and the name specified is blank, the name of the mainline program is omitted from LOCAL control records.

example



```
1   5    10   15   20   25   30   35   40   45   50
*LOCAL,SUB1,SUB2,...,SUBn
```

When LOCALs are used in conjunction with a STORECI operation, the name of the mainline must be specified.

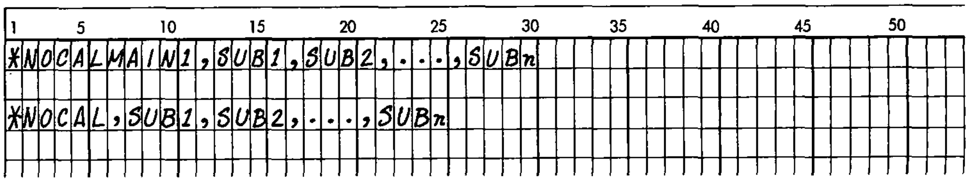
*NOCAL

general function

This control record specifies the names of NOCAL (load-although-not-called) subroutines that are to be associated with a specified mainline program. NOCAL subroutines are included in the core load even though they are not called. (See "The Use of NOCALs" and "Rules for LOCAL and NOCAL Usage" in Chapter 6.)

NOCAL control records are coded in the same format as LOCAL supervisor control records, except that *NOCAL is coded in place of *LOCAL.

format examples



```
1   5    10   15   20   25   30   35   40   45   50
*NOCALMAIN1,SUB1,SUB2,...,SUBn

*NOCAL,SUB1,SUB2,...,SUBn
```

In the first format example, the specified NOCAL subroutines are included in the core load built for the stored mainline program, MAIN1. In the second format example, the specified NOCAL subroutines are included in the core load built for a mainline program in working storage. See "*LOCAL" for information about continuing a control record to another, and coding for linking between programs.

*FILES

general function

This control record equates the file numbers specified in FORTRAN DEFINE FILE statements or in assembler FILE statements to the names of data files that are stored in the user area and fixed area, or in working storage other than system working storage.

All the data files in the user area or fixed area that are used by core loads during execution must be defined on FILES control records following the XEQ monitor control record that starts execution. All files thus defined are available for use by each core load in the execution.

Data files that are equated for a program that is stored in disk core image (DCI) format must be stored in fixed areas for successful execution of the program. (See "Disadvantages of Storing a Program in Disk Core Image Format" in Chapter 6.) When data files are equated for a DCI program and are stored on other cartridges, the data files must be stored in the same location on the other cartridges as they were when the DCI program was stored for successful program execution. Also, the other cartridges must be on the same logical drives as they were when the DCI program was stored. These restrictions are necessary because the core load builder places in the define file table in the DCI program header an absolute sector address, including the drive code, for each equated data file.

No more than 159 data files can be equated for one execution.

format

```
1   5    10   15   20   25   30   35   40   45   50
*FILES(FILE1,NAME1),...,(FILEn,NAMEn)
*FILES(FILE1,NAME1,CAR1),...,(FILEn,NAMEn,CARn)
*FILES(FILE1,,CAR1),...,(FILEn,,CARn)
```

Note: Embedded blanks are not allowed in a FILES control record.

additional field information

FILE1 Through FILEn. You replace these with the file numbers that are specified in the FORTRAN DEFINE FILE statements or assembler FILE statements in your program.

NAME1 Through NAMEn. You replace these with the names of the data files that are stored on disk. Names can be omitted as in the third *FILES record in the format. When omitted, 2 commas are required in the control record format, and the file is placed in working storage on the specified disk.

CAR1 Through CARn. These are the IDs of the cartridges on which the respective data files are stored. The cartridge ID can be omitted. When omitted, the corresponding data file is assumed to be on the cartridge on the lowest logical drive.

continuation records

The specification of data files can be continued from one *FILES control record to another by placing a comma after the last right parenthesis on each *FILES control record, except the last.

continuation example

```
1   5    10   15   20   25   30   35   40   45   50
*FILES(FILE1,NAME1),
*FILES(FILE2,NAME2,CAR2),
.
.
.
*FILES(FILEn,NAMEn,CARn)
```

*G2250

general function

This control record causes the graphic subroutine package (GSP) communication module (GCOM) to be included in a core load immediately following the mainline program. Other supporting subroutines are also loaded into this area depending on the parameters specified in the *G2250 control record. (See the publication *IBM 1130/2250 Graphic Subroutine Package for Basic FORTRAN IV*, GC27-6934, for instructions on properly loading the mainline program, and for information concerning the use of GSP subroutines as LOCALs and core storage layout requirements.

format

Card column	Contents	Explanation
1 through 11	*G2250mlmne	Specifies that graphic support is required for the named mainline program. You replace *mlmne* with the name of the program. If the program being executed is in working storage, the program name is omitted.
12	Reserved	
13	U, blank, or N	*U* indicates the character stroke subroutine containing upper case, numeric, and special characters is loaded. Blank indicates the character stroke subroutine containing upper case, lower case, numeric, and special characters is loaded. *N* indicates that a character stroke subroutine is not loaded.
14	Reserved	
15	Blank or N	Blank indicates the scissoring subroutine is loaded. *N* indicates the scissoring subroutine is not loaded.
16	Reserved	
17	Blank or N	Blank indicates the ICA area expansion subroutine is loaded. *N* indicates the ICA area expansion subroutine is not loaded.
18	Reserved	
19	Blank or N	Blank indicates the index controlled entity subroutine is loaded. *N* indicates the index controlled entity subroutine is not loaded.
20	Reserved	
21	Blank or N	Blank indicates the level controlled direct entry subroutine is loaded. *N* indicates the level controlled direct entry subroutine is not loaded.
22 through 80	Not used	

examples

```
1   5    10   15   20   25   30   35   40   45   50
*G225ØMLMNE N N N N N
*G225ØMLMNE U
*G225ØMLMNE
```

*EQUAT

general function

With this control record, you specify the substitution of subroutines during the building of a core load. This control record can also substitute symbolic names in assembler language DSA statements (limited to assembler programs). The EQUAT control record cannot be used to substitute subroutines for RPG programs.

More than one EQUAT control record can be used if the exact number of records used is punched in columns 60 and 61 of the preceding // JOB monitor control record, or included in the count field of the preceding // XEQ monitor control record or *STORECI DUP control record. (Information about using EQUAT control records is under "Use of the EQUAT Record" in Chapter 6.)

format

```
1   5    10   15   20   25   30   35   40   45   50
*EQUAT(SUB1,SUB2),...(SUBm,SUBn)
```

additional field information

SUB1, SUBm represents the name of the old subroutine. SUB2, SUBn represents the name of the new subroutine. SUB2 is substituted for SUB1. This same order of substitution is used when substituting symbolic names for DSA statements.

Note. The maximum number of pairs of subroutines that can be specified is 25.

During the following functions, the substitution of SUB2 for SUB1 is accomplished in the execution of the mainline program from working storage and the storing of MAIN. Additional substitutions are indicated by supplying *EQUAT records to the subjobs (// XEQ, *STORECI).

example

```
1   5    10   15   20   25                       50   55   60   65
// JOB                                                     1
*EQUAT(SUB1,SUB2)
 .
 .
 .
// XEQ          1
*EQUAT(SUB3,SUB4)
 .
 .
// DUP
*STORECI    WS  UA  MAIN     1
*EQUAT(SUB3,SUB4)
 .
// JOB
```

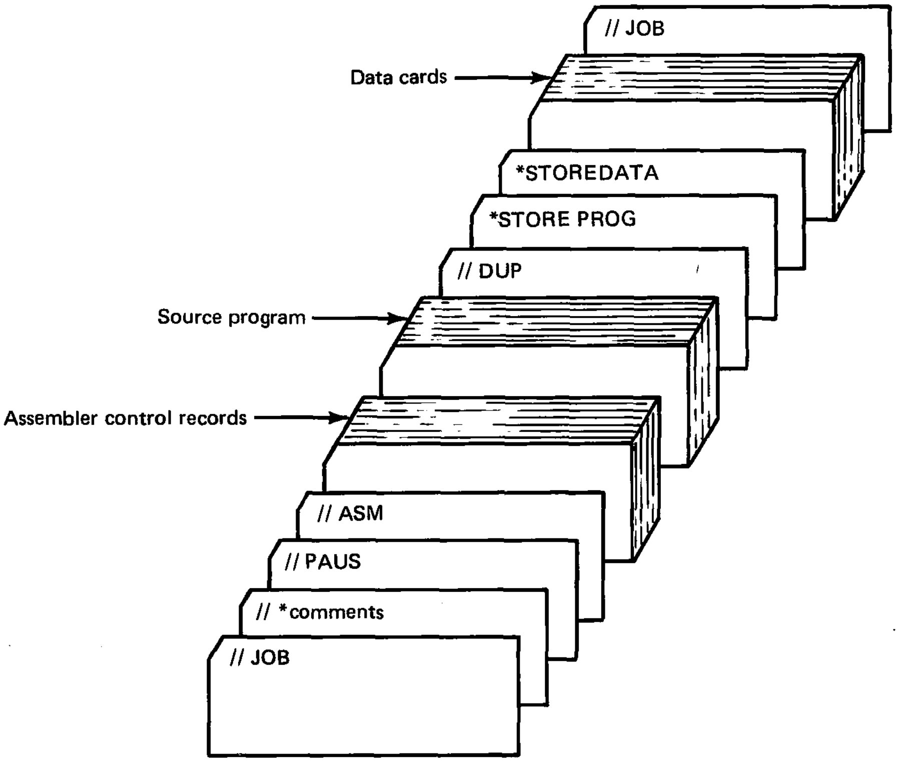
DUP CONTROL RECORDS

functions

DUP control records are used to specify operations to be performed by the Disk Utility Program. The types of operations that DUP control records specify are:

- Dumping and deleting programs and data files from disk
- Storing programs and data files on disk
- Printing the contents of the fixed location equivalence table (FLET) and the location equivalence table (LET)
- Rewriting sector addresses in working storage
- Defining a fixed area on disk
- Deleting monitor system programs from disk
- Allocating disk space for data files and macro libraries
- Calling the Macro Update Program (MUP) into operation

DUP control records are placed in the input stream after a DUP monitor control record (// DUP) as follows:



coding

DUP control records *generally* follow the format described in the following text. *All* fields in the control record, except the *count* field, are left-justified and, unless otherwise stated, are required. Additional field information is included, when necessary, in the description of the specific control record.

Column 1. Column 1 always contains an asterisk (*).

Operation Field. Code the name of the desired DUP operation in columns 2 through 12 (2 through 21 for the DEFINE operation, and 2 through 13 for the MACRO UPDATE operation). Columns 2 through 6 identify the basic operation (*STORE*DATACI); columns 7 through 12 (or 21) identify the extended operation (STORE*DATACI*). Where shown in the control record format, a blank character (ƀ) is required within or following the operation name.

From and To Fields. Code the *from* symbol in columns 13 and 14; that is, the symbol specifying the disk area or I/O device from which information is to be obtained (the source). Code the *to* symbol in columns 17 and 18; that is, the symbol specifying the disk area or I/O device to which information is to be transferred (the destination). The valid *from* and *to* symbols are:

Symbol	Disk area or I/O device
UA	User area on disk
FX	Fixed area on disk
WS	Working storage on disk
CD	Card I/O device. If the 1134 Paper Tape Reader is defined as the principal input device, CD is equivalent to PT.
PT	Paper tape
PR	Principal print device

Note. The symbols UA, FX, and WS, when used, each specify an area on disk but do not identify the cartridge on which the area is found.

Name Field. Code the name of the program, data file, or macro library involved in the specified operation in columns 21 through 25. The name that you specify in this field for a store operation is the name assigned to the program, data file, or macro library, and is used to generate or search for a LET or FLET entry. The name can consist of up to 5 alphameric characters, and must be left-justified in the field. The first character must be alphabetic (A-Z, $, #, @), and blanks (embedded blanks) are not allowed between characters of the name.

When referencing a program or data file stored on disk, the specified name must be an *exact* duplicate of the LET or FLET entry.

A file protection facility exists which is enabled by multi-punching one or more of the name field card columns during program or file definition. Column 21 must not be multi-punched. A delete of that file is not allowed unless the same column is multi-punched on the delete card. Assume that the following control card has an 'A' and an '*' punched in column 25.

```
1   5    10   15   20   25   30   35   40   45   50
*DFILE          UA  AAAA
```

On the printer, it appears as:

```
1   5    10   15   20   25   30   35   40   45   50
*DFILE          UA  AAAA
```

A disk dump of the LET sector containing this entry shows its name code to be:

C104 106F

Name code is derived in the following manner:

1. Find the low order 6-bit equivalent of each alphabetic character (the multi-punched column is represented as /EF).

2. Place these 30 bits in the order of the 5-character name field.

```
    C         1        0          4        1         0       6       F
     00      0001     0000       0100     0001     0000    0110     1111
                   ^               ^            ^           ^
1100    0001    1100     0001    1100    0001     1100    0001     1110   1111
   C       1      C        1       C       1         C       1       E      F
       A               A               A                 A
```

The fifth character is a multi-punched character. Any multi-punching in the corresponding column in a DUP control card name field will access that file if the other characters are the same.

Add 2 high-order bits to denote file type:

11 - Data File
10 - DCI
00 - DSF

4. Mark off bits into 8 groups of 4 bits each.
5. Convert each group to its hexadecimal equivalent.

```
              A       A        A        A
11     00   0001   000001   000001    000001   101111
     C         1      0     4      1     0     6      F
```

A reverse decodes the name code and enables you to determine if a multi-punched column existed in file definition.

1. Strip off the 2 high-order type bits.

2. Separate into 6-bit fields from the right.

3. Add 2 high-order bits per 6-bit alphabetic equivalent.

4. Convert to hexadecimal.

Count Field. The count coded in columns 27 through 30 is a right-justified decimal integer. The function of the *count* field is defined in the individual control record formats for those operations that require it.

From and To Cartridge ID Fields. Code the *from cartridge ID* in columns 31 through 34; that is, the ID of the cartridge that contains the disk area from which information is to be obtained. Code the *to cartridge ID* in columns 37 through 40; that is, the ID of the cartridge that contains the disk area to which information is to be transferred.

Either or both of these cartridge IDs can be omitted. When a cartridge ID is omitted, and the corresponding *from* or *to* field (columns 13 and 14 or 17 and 18) is the user area or fixed area, a search is made of the LET (and FLET) on each cartridge specified in the current JOB monitor control record. The search starts with the cartridge on logical drive zero (the master cartridge) and continues through logical drive 4. If the *from* or *to* field (columns 13 and 14 or 17 and 18) is working storage, a default to system working storage is made when cartridge IDs are omitted. When a cartridge ID is specified, the LET (and FLET) only on the specified cartridge is searched, or working storage on the specified cartridge is used.

The use of the *from* and *to cartridge IDs* makes it possible for DUP (1) to transfer programs and data files from one cartridge to another without deleting them from the source cartridge, and (2) to process a program or data file even though the same name appears in the LET or FLET on more than one cartridge.

Unused Columns. All columns indicated as reserved between column 2 and the last format field on each control record must be left blank. The columns between the last format field and column 80 are not used by DUP and are available for your remarks.

Altering LET and FLET

The 2 tables, location equivalence table (LET) and fixed location equivalence table (FLET), are directories to the contents of the user area and fixed area, respectively, on disk. You can alter the contents of these 2 tables through the use of DUP store and delete operations only.

Before storing a program or data file, DUP searches LET and FLET for the name specified in the control record. When a cartridge is specified in the *to cartridge ID* field on the control record, LET (and FLET) on only that disk is searched for the specified name. When a *to cartridge ID* is not specified, LET (and FLET) on all cartridges defined in the current JOB monitor control record is searched. If the specified name is not found in any LET or FLET, disk storage is allocated for the program or data file. The specified name is assigned to the program or data file and is used to generate a new entry in LET or FLET.

When dumping or deleting a program or data file from the user area or fixed area, the name specified in the control record is searched for in LET and FLET in the same order as the search before a store operation. If the specified name is found, the program or data file is dumped or deleted as specified in the control record.

Information Transfer and Format Conversion

Figure 5-1 summarizes the DUP operations that transfer information from one device or disk area to another device or disk area. In addition, the format conversions that are made during the transfer of information are shown. The different formats are described in Appendix I. The acronyms used in Figure 5-1 for the various formats are:

Acronym	Format
DSF	Disk system format
DDF	Disk data format
DCI	Disk core image format
CDS	Card system format
CDD	Card data format
CDC	Card core image format
PTS	Paper tape system format
PTD	Paper tape data format
PTC	Paper tape core image format
PRD	Printer data format
NCF	Name code format

You should pay particular attention to Figure 5-1 when performing dump, store, and delete operations, such as, dumping to cards and later using the cards to store the information back on the disk. Note that more than one way to dump and store data and porgrams is allowed, such as dumping a program to cards and later storing it back to disk.

From Area Symbols, with Formats		*To* Area Symbols, with Formats																
		UA			FX		WS			CD			PT			PR
		DSF	DDF	DCI	DDF	DCI	DSF	DDF	DCI	CDS	CDD	CDC	PTS	PTD	PTC	PRD
UA	DSF						DUMP	DUMPDATA		DUMP	DUMPDATA		DUMP	DUMPDATA		DUMP DUMPDATA
	DDF							DUMP DUMPDATA			DUMP DUMPDATA			DUMP DUMPDATA		DUMP DUMPDATA
	DCI							DUMPDATA	DUMP		DUMPDATA	DUMP		DUMPDATA	DUMP	DUMP DUMPDATA
FX	DDF							DUMP DUMPDATA			DUMP DUMPDATA			DUMP DUMPDATA		DUMP DUMPDATA
	DCI							DUMPDATA	DUMP		DUMPDATA	DUMP		DUMPDATA	DUMP	DUMP DUMPDATA
WS	DSF	STORE STOREMOD	STOREDATA	STORECI	STOREDATA	STORECI				DUMP	DUMPDATA		DUMP	DUMPDATA		DUMP DUMPDATA
	DDF		STOREMOD STOREDATA		STOREMOD STOREDATA						DUMP DUMPDATA			DUMP DUMPDATA		DUMP DUMPDATA
	DCI		STOREDATA	STOREMOD STOREDATACI	STOREDATA	STOREMOD STOREDATACI					DUMPDATA	DUMP		DUMPDATA	DUMP	DUMP DUMPDATA
CD	CDS	STORE	STOREDATA	STORECI	STOREDATA	STORECI	STORE	STOREDATA								
	CDD		STOREDATA	STOREDATACI	STOREDATA	STOREDATACI		STOREDATA	STOREDATACI							
	CDC		STOREDATA	STOREDATACI	STOREDATA	STOREDATACI		STOREDATA	STOREDATACI							
PT	PTS	STORE	STOREDATA	STORECI	STOREDATA	STORECI	STORE	STOREDATA								
	PTD		STOREDATA	STOREDATACI	STOREDATA	STOREDATACI		STOREDATA	STOREDATACI							
	PTC		STOREDATA	STOREDATACI	STOREDATA	STOREDATACI		STOREDATA	STOREDATACI							

Note: DUMPDATA E and STOREDATAE are the same as DUMPDATA and STOREDATA, respectively, except that information on disk for DUMPDATA E is assumed to be in packed EBCDIC format, and input for STOREDATAE is converted to packed EBCDIC format.

Figure 5-1. Summary of DUP transfer and conversion operations

Restrictions Caused by Temporary Mode

When temporary mode is indicated in the current JOB monitor control record, some DUP operations are restricted or not allowed. The following chart shows the restriction, if any, on DUP operations when temporary mode is indicated.

DUP operations	Restrictions
DUMP	None
DUMPDATA, DUMPDATAE	None
STORE	None
STORECI	To UA only
STOREDATA, STOREDATAE	To UA and WS only
STOREDATACI	To UA only
STOREMOD	Not allowed
DUMPLET	None
DUMPFLET	None
DWADR	Not allowed
DELETE	Not allowed
DEFINE FIXED AREA	Not allowed
DEFINE VOID ASSEMBLER	Not allowed
DEFINE VOID FORTRAN	Not allowed
DEFINE VOID RPG	Not allowed
DEFINE VOID COBOL	Not allowed
DFILE	To UA only
MACRO UPDATE	Not allowed

*DUMP

general function

This control record (1) transfers information from the user area or fixed area to working storage, or (2) makes information from the user area, fixed area, or working storage available as card, paper tape, or printed output. Card, paper tape, and print formats are illustrated in Appendix I.

DSF programs are transferred from the user area or fixed area to output devices in 2 phases. The programs are first moved to system working storage, then to the output device. As a result, information residing in working storage before the DUMP operation is destroyed.

DCI programs and data files are transferred directly from the user area or fixed area to the output device. The contents of working storage remain unchanged.

DUP obtains the number of disk blocks to be dumped from the LET or FLET entry for a DSF program or a data file, or from the appropriate working storage indicator in sector @DCOM if the dump is from working storage. The actual core load length in words of a DCI program is dumped. The word count is obtained from the core image header. Dumps of a DSF program and a DCI program are,contained in Appendix I.

format

Card column	**Contents**	**Explanation**
1 through 6	*DUMPb̸	
7 through 12	Reserved	
13 and 14	*From* symbol	See the following summary chart.
15 and 16	Reserved	
17 and 18	*To* symbol	See the following summary chart.
19 and 20	Reserved	
21 through 25	Name	A name is required except when the dump is from working storage to the printer.
26 through 30	Reserved	
31 through 34	*From* cartridge ID	
35 and 36	Reserved	
37 through 40	*To* cartridge ID	
41 through 80	Not used	

The following chart is a summary of the information transfers and format conversions performed by the DUMP operation.

*DUMP
summary chart

***From* symbols, including formats**	***To* symbols, including formats**
UA(DSF)	WS(DSF)

UA or WS(DSF)	CD(CDS)
	PT(PTS)
	PR(PRD)

UA or FX(DDF)	WS(DDF)

UA, FX, or WS(DDF)	CD(CDD)
	PT(PTD)
	PR(PRD)

UA or FX(DCI)	WS(DCI)

UA, FX, or WS(DCI)	CD(CDC)
	PT(PTC)
	PR(PRD)

additional field information

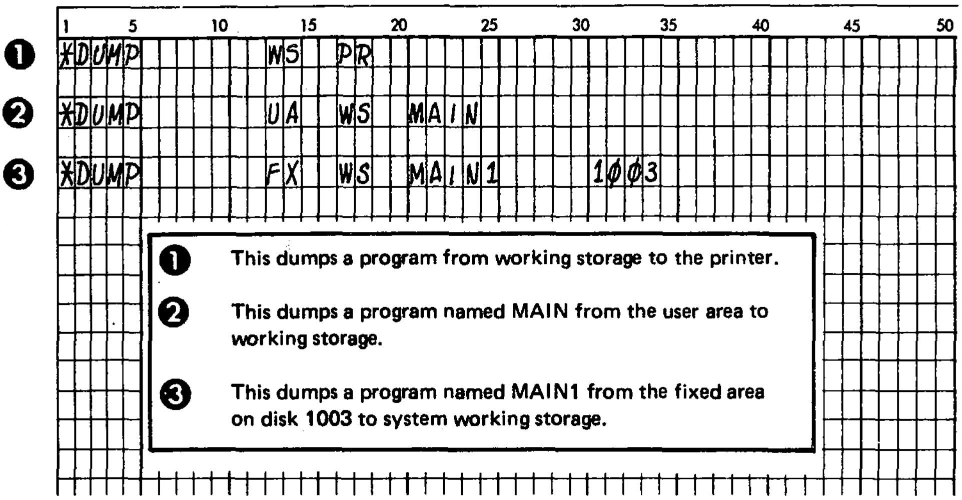
From Symbol. When a dump is from working storage and the corresponding working storage indicator is zero, an error message is printed.

To Symbol. When a dump is to cards and a 1442, Model 6 or 7, is used, each card is checked to see that it is blank before it is punched. If a nonblank card is read, the monitor system prints an error message and waits at $PRET with /100F displayed in the ACCUMULATOR.

Note 1. The program name in a DSF mainline program header is cleared to zeros when the program is transferred from the user area to working storage.

Note 2. The subtype in a subroutine header is set to zero when the subroutine is dumped from the user area to cards.

**DUMP Examples*



```
1   5    10   15   20   25   30   35   40   45   50
*DUMP       WS  PR
*DUMP       UA  WS  MAIN
*DUMP       FX  WS  MAIN1     1003
```

❶ This dumps a program from working storage to the printer.

❷ This dumps a program named MAIN from the user area to working storage.

❸ This dumps a program named MAIN1 from the fixed area on disk 1003 to system working storage.

*DUMPDATA

general function

This control record (1) transfers information from the user area or fixed area on disk to working storage, or (2) makes information from the user area, fixed rea, or working storage available as card, paper tape, or printed output. Card, paper tape, and print formats are illustrated in Appendix I.

The contents of working storage are not changed when dumping to output devices, because information is transferred from the user area, fixed area, or working storage directly to the output devices.

The DUMPDATA operation differs from the DUMP operation in that the information is always in data format after transfer. Also, the amount of information transferred depends on the *count* field, if present, of the DUMPDATA control record or the block count of the program or data file.

format

Card column	Contents	Explanation
1 through 10	*DUMPDATAƀ	
11 and 12	Reserved	
13 and 14	*From* symbol	See the following summary chart.
15 and 16	Reserved	
17 and 18	*To* symbol	See the following summary chart.
19 and 20	Reserved	
21 through 25	Name	A name is required except when the dump is from working storage to the printer.
26	Reserved	
27 through 30	Count	The count (a right-adjusted decimal number) specifies the number of sectors to be dumped. If this field is blank, the working storage indicator or disk block count in LET or FLET is used.
31 through 34	*From* cartridge ID	
35 and 36	Reserved	
37 through 40	*To* cartridge ID	
41 through 80	Not used	

The following chart is a summary of the information transfers and format conversions performed by DUMPDATA.

*DUMPDATA summary chart

From symbols, including formats	*To* symbols, including formats
UA(DSF)	WS(DDF)

UA or WS(DSF)	CD(CDD)
	PT(PTD)
	PR(PRD)

UA or FX(DDF)	WS(DDF)

UA, FX, or WS(DDF)	CD(CDD)
	PT(PTD)
	PR(PRD)

UA(DCI) or FX(DDF)	WS(DDF)

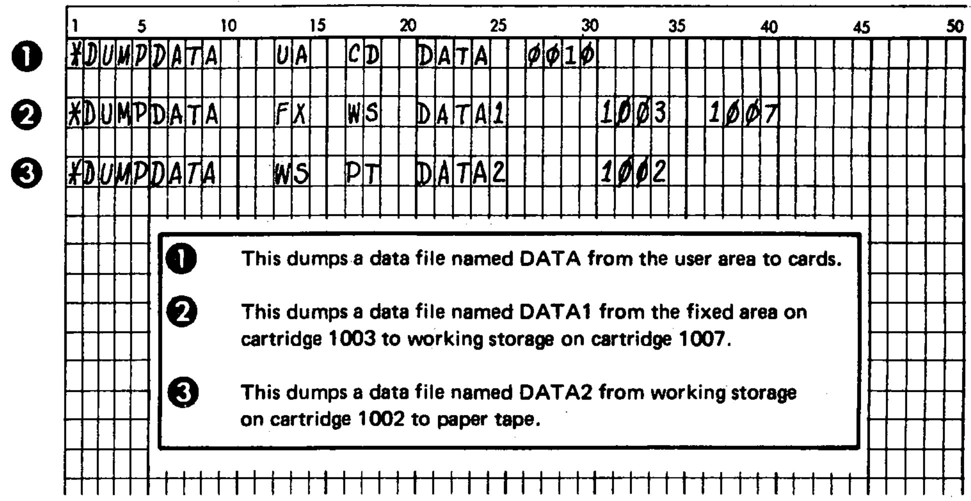
UA, FX, or WS(DCI)	CD(CDD)
	PT(PTD)
	PR(PRD)

additional field information

To Symbol. When a dump is to cards and a 1442, Model 6 or 7, is used, each card is checked to see that it is blank before it is punched. If a nonblank card is read, the monitor system prints a message and waits at $PRET with /100F displayed in the ACCUMULATOR.

Count. This field specifies the number of sectors to be dumped. If present, the count overrides the contents of the working storage indicator or the disk block count in the LET or FLET entry; when present, this number of sectors is dumped regardless of the length of the program or data file.

**DUMPDATA Examples*



```
  1   5    10   15   20   25   30   35   40   45   50
❶ *DUMPDATA UA  CD    DATA  ØØ1Ø
❷ *DUMPDATA FX  WS    DATA1     1ØØ3  1ØØ7
❸ *DUMPDATA WS  PT    DATA2     1ØØ2
```

❶ This dumps a data file named DATA from the user area to cards.

❷ This dumps a data file named DATA1 from the fixed area on cartridge 1003 to working storage on cartridge 1007.

❸ This dumps a data file named DATA2 from working storage on cartridge 1002 to paper tape.

*DUMPDATA E

general function

This control record (1) transfers information from the user area or fixed area to working storage, or (2) makes information from the user area, fixed area, or working storage available as card or printed output.

The DUMPDATA E operation to output devices differs from the DUMPDATA operation in that the information on disk, which is assumed to be in packed EBCDIC form, 40 words per 80 card columns, is converted to card image format. Thus, the information printed on a printer is one line per source card (80 print positions), and card output is an exact, full 80 column duplicate of the input cards in the corresponding STOREDATAE operation. When the destination is working storage, format conversion does not occur.

The contents of working storage are not changed when dumping to output devices, because information is transferred from the user area, fixed area or working storage directly to the output devices.

format

Card column	Contents	Explanation
1 through 11	*DUMPDATAƀE	
12	Reserved	
13 and 14	*From* symbol	See the following summary chart.
15 and 16	Reserved	
17 and 18	*To* symbol	See the following summary chart.
19 and 20	Reserved	
21 through 25	Name	A name is required except when the dump is from working storage to the printer.
26	Reserved	
27 through 30	Count	The count (a right-adjusted decimal number) specifies the number of sectors to be dumped. If this field is blank, the working storage indicator or disk block count in LET or FLET is used.
31 through 34	*From* cartridge ID	
35 and 36	Reserved	
37 through 40	*To* cartridge ID	
41 through 80	Not used	

The following chart is a summary of the information transfers performed by DUMPDATA E.

*DUMPDATA E summary chart

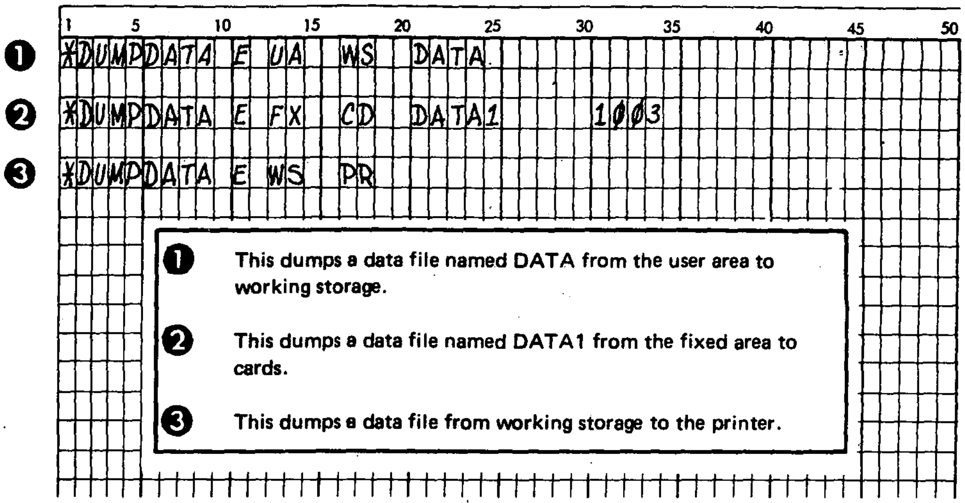
From symbols	*To* symbols
UA or FX	WS
UA, FX, or WS	CD PR

additional field information

To Symbol. When a dump is to cards and a 1442, Model 6 or 7, is used, each card is checked to see that it is blank before it is punched. If a nonblank card is read, the system prints a message and waits at $PRET with /100F displayed in the ACCUMULATOR.

Count. This field specifies the number of sectors to be dumped. If present, the *count* overrides the contents of the working storage indicator or the disk block count in the LET or FLET entry; when present, this number of sectors is dumped regardless of the length of the program or data file.

**DUMPDATA E Examples*



```
         1         2         3         4         5
1   5    0    5    0    5    0    5    0    5    0
❶ *DUMPDATA E UA  WS  DATA
❷ *DUMPDATA E FX  CD  DATA1     1ØØ3
❸ *DUMPDATA E WS  PR
```

❶ This dumps a data file named DATA from the user area to working storage.

❷ This dumps a data file named DATA1 from the fixed area to cards.

❸ This dumps a data file from working storage to the printer.

*DUMPLET

general function

This operation prints the contents of the location equivalence table (LET) on the principal print device. Also, the contents of the fixed location equivalence table (FLET) are printed if a fixed area has been defined on the disk. A program name or data file name can be specified in this control record to dump only the LET or FLET entry for that program or data file. A printout of a DUMPLET operation is in Appendix D.

format

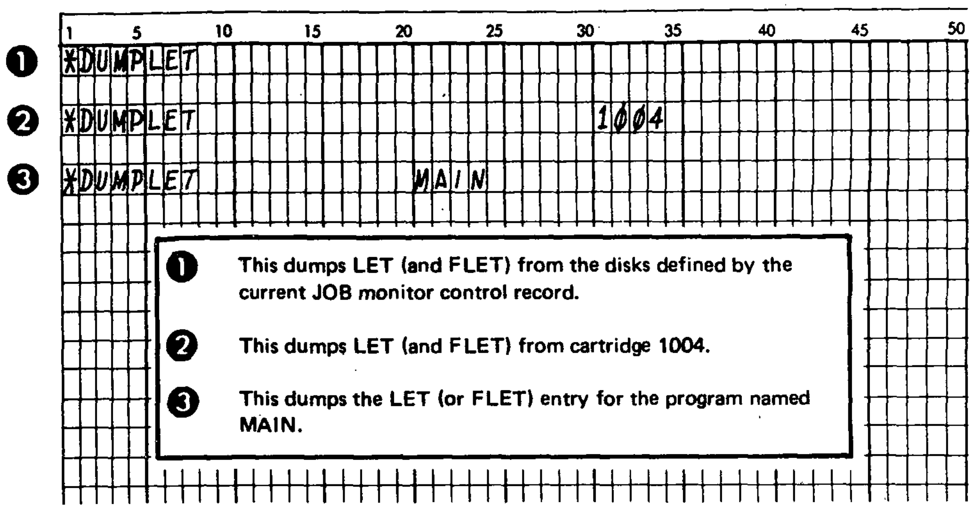
Card column	Contents	Explanation
1 through 8	*DUMPLET	
9 through 20	Reserved	
21 through 25	Name	Name specifies that only the LET or FLET entry for that program or data file is printed.
26 through 30	Reserved	
31 through 34	*From* cartridge ID	The cartridge ID specifies that only the LET (and FLET) on that cartridge is dumped.
35 through 80	Not used	

additional field information

Name. This optional field specifies the name of a program or data file whose LET or FLET entry is to be printed. LET and FLET on all cartridges defined in the current JOB monitor control record are searched unless a cartridge ID is specified in columns 31 through 34. When the name field is omitted, the entire contents of LET (and FLET) are printed.

From Cartridge ID. The *from* cartridge ID specifies that only the LET (and FLET) on that cartridge is printed or searched when a name is specified in columns 21 through 25. When the *from* cartridge ID field is omitted, LET (and FLET) on all cartridges defined by the current JOB monitor control record are printed or searched.

**DUMPLET Examples*


1
5
10
15
20
25
30
35
40
45
50

```
❶ *DUMPLET
❷ *DUMPLET                      1ØØ4
❸ *DUMPLET            MAIN
```

❶ This dumps LET (and FLET) from the disks defined by the current JOB monitor control record.

❷ This dumps LET (and FLET) from cartridge 1004.

❸ This dumps the LET (or FLET) entry for the program named MAIN.

*DUMPFLET

general function

This operation prints the contents of the fixed location equivalence table (FLET) on the principal print device. A program name or data file name can be specified in this control record to dump the FLET entry only for that program or data file.

format

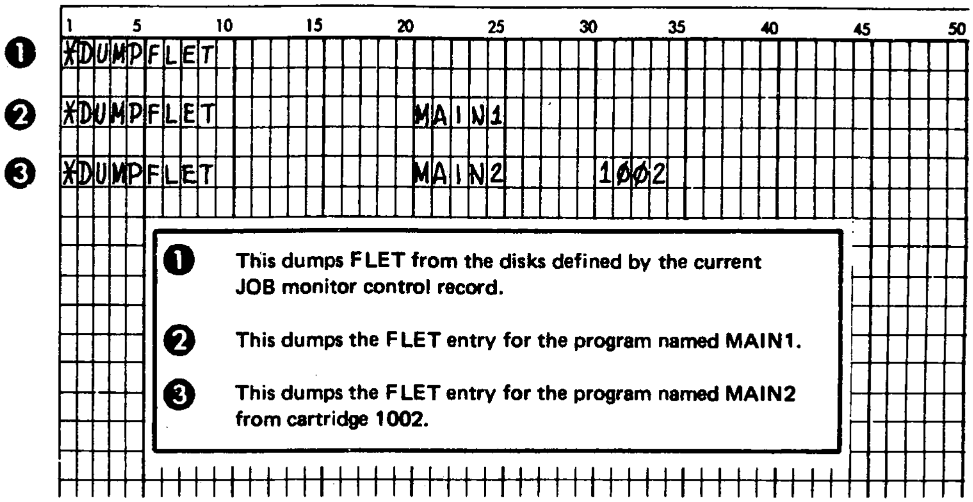
Card column	Contents	Explanation
1 through 10	*DUMPFLETƀ	
11 through 20	Reserved	
21 through 25	Name	Name specifies that only the FLET entry for that program or data file is printed.
26 through 30	Reserved	
31 through 34	*From* cartridge ID	The cartridge ID specifies that only the FLET on that cartridge is printed.
35 through 80	Not used	

additional field information

Name. This optional field specifies the name of a program or data file whose FLET entry is to be printed. FLET on all cartridges defined in the current JOB monitor control record is searched for the name unless a cartridge ID is specified in columns 31 through 34. When the *name* field is omitted, the entire contents of FLET are printed.

From Cartridge ID. The *from* cartridge ID specifies that only the FLET on that cartridge is printed or searched when a name is specified in columns 21 through 25. When the cartridge ID field is omitted, the FLET on all cartridges defined by the current JOB monitor control record is printed or searched.

**DUMPFLET Examples*



```
   1   5    10   15   20   25   30   35   40   45   50
❶  *DUMPFLET
❷  *DUMPFLET           MAIN1
❸  *DUMPFLET           MAIN2     1002
```

❶ This dumps FLET from the disks defined by the current JOB monitor control record.

❷ This dumps the FLET entry for the program named MAIN1.

❸ This dumps the FLET entry for the program named MAIN2 from cartridge 1002.

*STORE

general function

This operation (1) transfers information from working storage to the user area, or (2) accepts information from the input devices and transfers it to working storage or the user area.

All transfer of information from the input devices to the user area is accomplished in 2 phases. The information is first moved to system working storage, then to the user area. Because of this, information residing in working storage before the STORE operation is destroyed, and the appropriate working storage indicator in sector @DCOM is set to zero.

The Disk Utility Program (DUP) makes the required LET entry for the program being stored. The name you specify in columns 21 through 25 is assigned to the program and is used to generate the LET entry. The LET entry includes the program name, the format of the program, the number of disk blocks the program occupies, and the disk block address. An entry is also made in LET for each entry point in the program being stored.

format

Card column	Contents	Explanation
1 through 6	*STORE	
7 through 10	Reserved	
11	Subtype (0, 1, 2, 3, or 8)	For type 3, 4, 5, and 7 subroutines only.
12	Reserved	
13 and 14	*From* symbol	See the following summary chart.
15 and 16	Reserved	
17 and 18	*To* symbol	See the following summary chart.
19 and 20	Reserved	
21 through 25	Name	A name is required except when the STORE operation is to working storage.
26 through 30	Reserved	
31 through 34	*From* cartridge ID	
35 and 36	Reserved	
37 through 40	*To* cartridge ID	
41 through 80	Not used	

The following chart is a summary of the information transfers and format conversions performed by the STORE operation.

*STORE summary chart

From symbols, including formats	*To* symbols, including formats
WS(DSF)	UA(DSF)
CD(CDS)	UA or WS(DSF)
PT(PTS)	UA or WS(DSF)

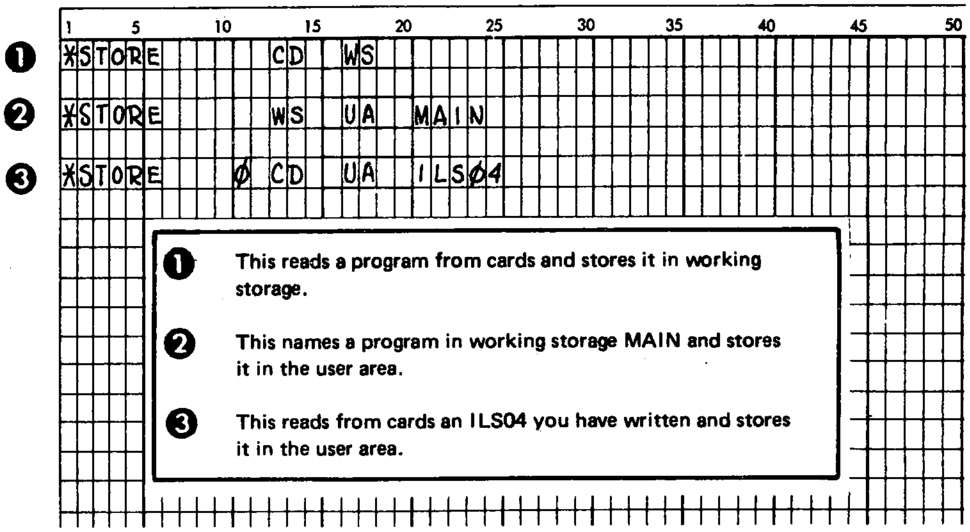
additional field information

Subtype. This optional field places a subtype number in the header of a subroutine, type 3, 4, 5, or 7. The subtype number that can be specified for each type of subroutine is:

Subroutine description	Type	Code in subtype field
In-core subroutines	3, 4	0
Disk FORTRAN I/O subroutines	3	1
Arithmetic subroutines	3	2
Nondisk FORTRAN I/O and "Z"	3	3
"Z" device subroutines	5	3
Function subroutines	4	8
Dummy ILS02, ILS04 stored in monitor system library	7	1
User-written ILS02, ILS04 that replace dummy ILS02, ILS04	7	0

From Symbol. If the STORE operation is from working storage and the corresponding working storage indicator is zero, an error message is printed.

**STORE Examples*



```
1   5    10   15   20   25   30   35   40   45   50
*STORE      CD  WS
*STORE      WS  UA  MAIN
*STORE    Ø CD  UA  ILSØ4
```

1. This reads a program from cards and stores it in working storage.

2. This names a program in working storage MAIN and stores it in the user area.

3. This reads from cards an ILS04 you have written and stores it in the user area.

*STOREDATA

general function

This control record (1) transfers information from working storage to the user area or fixed are, or (2) accepts information from input devices and moves it to working storage, the user area, or fixed area. DUP assumes that input to this operation is in data format; output from this operation is always in data format.

Information is transferred directly from the input devices to the user area or fixed area. Thus, the contents of working storage remain the same if the STORE operation is to the fixed area. Because the boundary between the user area and working storage is moved by store and delete operations, a STOREDATA operation to the user area destroys information residing in working storage before the STOREDATA operation.

DUP makes the required LET or FLET entry. The name you specify in columns 21 through 25 is assigned to the data file or macro library and is used to generate the LET or FLET entry. DUP also supplies the disk block count required in the LET or FLET entry if the source is cards or paper tape. If the source is working storage, the sector count coded in the STOREDATA control record is used.

format

Card column	Contents	Explanation
1 through 10	*STOREDATA	
11 and 12	Reserved	
13 and 14	*From* symbol	See the following summary chart.
15 and 16	Reserved	
17 and 18	*To* symbol	See the following summary chart.
19 and 20	Reserved	
21 through 25	Name	A name is not required when the STOREDATA operation is from cards or paper tape to working storage.
26	Reserved	
27 through 30	Count	If the source is working storage, the count is the number (in decimal) of sectors of data to be stored. This count overrides the contents of the working storage indicator. If the count field is blank, the contents of the working storage indicator are used. If the source is cards, the count is the number (in decimal) of cards to be read. If the source is paper tape, the count is the number (in decimal) of paper tape records to be read.
31 through 34	*From* cartridge ID	
35 and 36	Reserved	
37 through 40	*To* cartridge ID	
41 through 80	Not used	

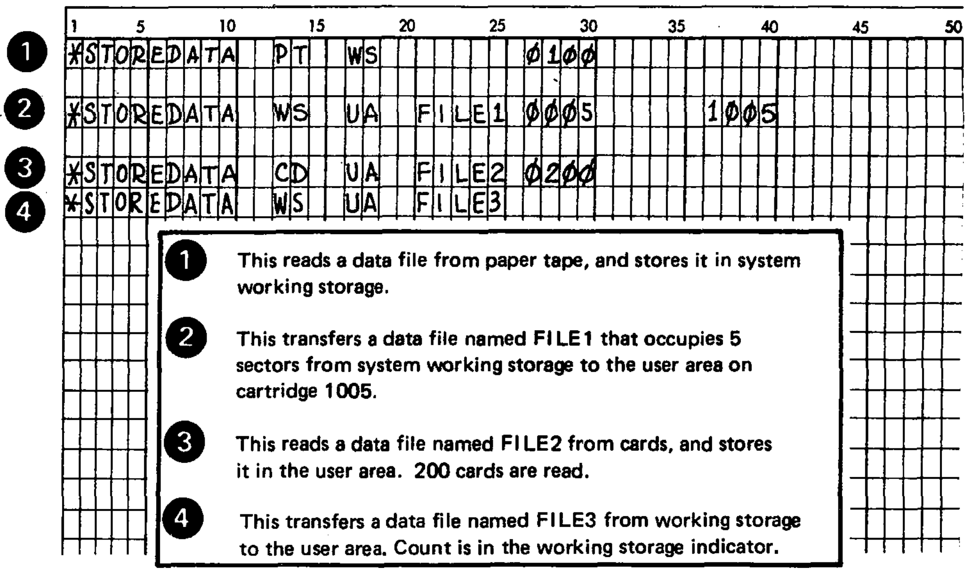
The following chart is a summary of the information transfers and format conversions performed by STOREDATA.

***STOREDATA summary chart**

***From* symbols, including formats**	***To* symbols, including formats**
WS(DSF, DDF, DCI)	UA or FX(DDF)
CD(CDS, CDD, CDC)	UA, FX, or WS(DDF)
PT(PTS, PTD, PTC)	UA, FX, or WS(DDF)

Note. When temporary mode is indicated in column 8 of the current JOB monitor control record, the STOREDATA operation is restricted to storing in the UA and WS only.

**STOREDATA Examples*



```
1   5    10   15   20   25   30   35   40   45   50
*STOREDATA  PT  WS        Ø1ØØ
*STOREDATA  WS  UA  FILE1 ØØØ5      1ØØ5
*STOREDATA  CD  UA  FILE2 Ø2ØØ
*STOREDATA  WS  UA  FILE3
```

1 This reads a data file from paper tape, and stores it in system working storage.

2 This transfers a data file named FILE1 that occupies 5 sectors from system working storage to the user area on cartridge 1005.

3 This reads a data file named FILE2 from cards, and stores it in the user area. 200 cards are read.

4 This transfers a data file named FILE3 from working storage to the user area. Count is in the working storage indicator.

*STOREDATAE

general function

This control record (1) transfers information from working storage to the user area or fixed area, or (2) accepts information from the card reader and transfers it to working storage, the user area, or fixed area.

When input is from cards, the source cards are converted to packed EBCDIC format, that is 2 columns per word, or 8 cards per sector. Thus, the input is assumed to be any of the 256 EBCDIC characters in card code. When the source is working storage, no conversion takes place.

Information is transferred directly from the input device to the user area or fixed area. Thus, when the STOREDATAE operation is to the fixed area, the contents of working storage are not changed. When the STOREDATAE operation is to the user area, the contents of working storage are destroyed because the boundary between the user area and working storage is moved back and forth by delete and store operations.

The Disk Utility Program (DUP) makes the required LET or FLET entry. The name that you specify in columns 21 through 25 is assigned to the data file and is used to generate the LET or FLET entry. Also, DUP supplies the disk block count required in the LET or FLET entry if the source is cards or paper tape. If the source is working storage, the sector count specified in the STOREDATAE control record is used.

format

Card column	Contents	Explanation
1 through 11	*STOREDATAE	
12	Reserved	
13 and 14	*From* symbol	See the following summary chart.
15 and 16	Reserved·	
17 and 18	*To* symbol	See the following summary chart.
19 and 20	Reserved	
21 through 25	Name	A name is not required when the STOREDATAE operation is from cards to working storage.
26	Reserved	
27 through 30	Count	If the source is working storage, the count is the number (in decimal) of sectors of data to be stored. This count overrides the contents of the working storage indicator. If the source is cards, the count is the number (in decimal) of cards to be read.
31 through 34	*From* cartridge ID	
35 and 36	Reserved	
37 through 40	*To* cartridge ID	
41 through 80	Not used	

The following chart is a summary of the information transfers performed by STOREDATAE.

*STOREDATAE summary chart

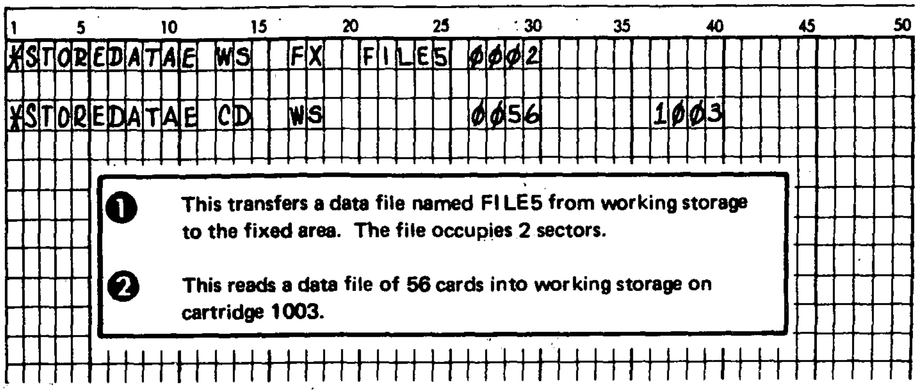
***From* symbols, including formats**	***To* symbols, including formats**
WS	UA or FX
CD	UA, FX, or WS

Note. When temporary mode is indicated in column 8 of the current JOB monitor control record, the STOREDATAE operation is restricted to storing in the UA and WS only.

additional field information

Count. The corresponding dump operation, DUMPDATA E, transfers a whole number of sectors to cards. To avoid unwanted output, the number of cards stored should consequently be a multiple of 8 (blank cards can be added for that purpose).

**STOREDATAE Examples*



```
  1   5   10   15   20   25   30   35   40   45   50
❶ *STOREDATAE WS  FX  FILE5 ØØØ2
❷ *STOREDATAE CD  WS        ØØ56      1ØØ3
```

❶ This transfers a data file named FILE5 from working storage to the fixed area. The file occupies 2 sectors.

❷ This reads a data file of 56 cards into working storage on cartridge 1003.

*STOREDATACI

general function

This control record (1) transfers information from working storage to the user area or fixed area on disk, or (2) accepts information from input devices and moves it to working storage, the user area, or fixed area.

If the input is from cards or paper tape, the STOREDATACI operation assumes the input is in card or paper tape core image format. If the input is from working storage (the information has been previously dumped to working storage or stored in working storage from an input device), the appropriate working storage indicator must indicate disk core image (DCI) format; otherwise, the STOREDATACI operation is not performed. Output from the STOREDATACI operation is always in disk core image format.

All transfer of information from input devices to the user area or fixed area is done directly; that is, the transfer is not made via working storage. Thus, when the STOREDATACI operation stores information from an input device to the fixed area, the contents of working storage are not destroyed. Note, however, the contents of working storage are destroyed when storing from an input device to the user area because the boundary between the user area and working storage is moved back and forth by delete and store operations.

The Disk Utility Program (DUP) makes the required LET or FLET entry. The name that you specify in columns 21 through 25 is assigned to the data file and is used to generate the LET or FLET entry. Also, DUP computes the disk block count required in the LET or FLET entry from the count specified in the STOREDATACI control record.

format

Card column	Contents	Explanation
1 through 12	*STOREDATACI	
13 and 14	*From* symbol	See the following summary chart.
15 and 16	Reserved	
17 and 18	*To* symbol	See the following summary chart.
19 and 20	Reserved	
21 through 25	Name	A name is not required when the STOREDATACI operation is to working storage.
26	Reserved	
27 through 30	Count	The count (a right-justified decimal number) is the number of records (sectors, cards, or paper tape records) in the core image input. The count is not required if the source is working storage; however, when used in this case, the count overrides the contents of the working storage indicator.
31 through 34	*From* cartridge ID	
35 and 36	Reserved	
37 through 40	*To* cartridge ID	
41 through 80	Not used.	

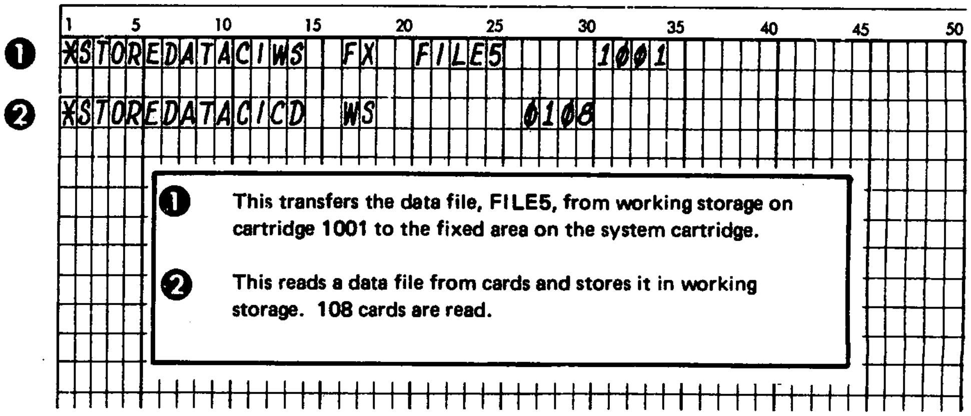
The following chart is a summary of the information transfers and format conversions performed by STOREDATACI.

*STOREDATACI summary chart

From symbols, including formats	*To* symbols, including formats
WS(DCI)	UA or FX(DCI)
CD(CDC, CDD)	UA, FX, or WS(DCI)
PT(PTC, PTD)	UA, FX, or WS(DCI)

Note. When temporary mode is indicated in column 8 of the current JOB monitor control record, the STOREDATACI operation is restricted to storing in the UA only.

**STOREDATACI Examples*



```
    1   5    10   15   20   25   30   35   40   45   50
❶  *STOREDATACI WS  FX  FILE5     1ØØ1
❷  *STOREDATACI CD  WS        Ø1Ø8
```

❶ This transfers the data file, FILE5, from working storage on cartridge 1001 to the fixed area on the system cartridge.

❷ This reads a data file from cards and stores it in working storage. 108 cards are read.

*STORECI

general function

This control record obtains an object program from working storage or from an input device, converts it into a core image program using the core load builder, and stores the core image program in the user area or fixed area.

The core load builder (CLB) is called to build a core image program for the STORECI operation as if execution were to follow; that is, that portion of the core load residing below core location 4096 (decimal) in 4K systems, or 5056 in larger systems, is placed in the system core image buffer, and LOCALs and/or SOCALs are placed in system working storage. (See "Construction of a Core Load" in Chapter 3.) The STORECI operation stores all these portions of the core image program in the user area, fixed area, or working storage.

A DCI program stored in the user area or fixed area includes the transfer vector built by the core load builder; however, neither the disk I/O subroutine nor COMMON, if any, is included.

The Disk Utility Program (DUP) makes the required LET or FLET entry for the core image program as it is stored. The name that you specify in columns 21 through 25 is assigned to the DCI program and is used to generate the LET or FLET entry. Also, DUP obtains the disk block count required in the LET or FLET entry from the core load builder.

format

Card column	Contents	Explanation
1 through 8	*STORECI	
9	Disk I/O subroutine indicator	This column specifies the disk I/O subroutine to be used by the core load during execution.
10	Reserved	
11	LOCAL-can-call-LOCAL indicator	A punch (any character) in this column enables a LOCAL subroutine to call another LOCAL.
12	Special ILS indicator	A punch (any character) in this column indicates that ILSs for this core load should be chosen from the special ILSs.
13 and 14	*From* symbol	See the following summary chart.
15 and 16	Reserved	
17 and 18	*To* symbol	See the following summary chart.
19 and 20	Reserved	
21 through 25	Name	
26	Reserved	
27 through 30	Count	A decimal number (right-justified) that indicates the number of supervisor control records (FILES, LOCAL, NOCAL, EQUAT, and G2250) that follow.
31 through 34	*From* cartridge ID	
35 and 36	Reserved	
37 through 40	*To* cartridge ID	
41	Reserved	
42	Core map indicator	*N* or blank. An *N* indicates that a core map is not to be printed for this core load. A blank causes a core map to be printed.
43 through 80	Not used	

The following chart is a summary of the information transfers and format conversions performed by STORECI.

*STORECI summary chart

From symbols, including formats	*To* symbols, including formats
WS(DSF)	UA or FX(DCI)
CD(CDS)	UA or FX(DCI)
PT(PTS)	UA or FX(DCI)

Note. When temporary mode is indicated in column 8 of the current JOB monitor control record, the STORECI operation is restricted to storing in the UA only.

additional field information

Disk I/O Subroutine Indicator. This column specifies the disk I/O subroutine that is loaded into core by the core image loader for use by the core load during execution. The character punched in this column for each disk I/O subroutine is:

Column 9	*Disk I/O subroutine*
0 or 1	DISK1
N	DISKN
blank or Z	DISKZ

Any other character is invalid and causes the printing of an error message.

LOCAL-Call-LOCAL Indicator. A punch (any character) in column 11 allows a LOCAL subroutine to call another LOCAL subroutine during execution if the restrictions listed under "LOCAL-Calls-a-LOCAL" in Chapter 6 are met.

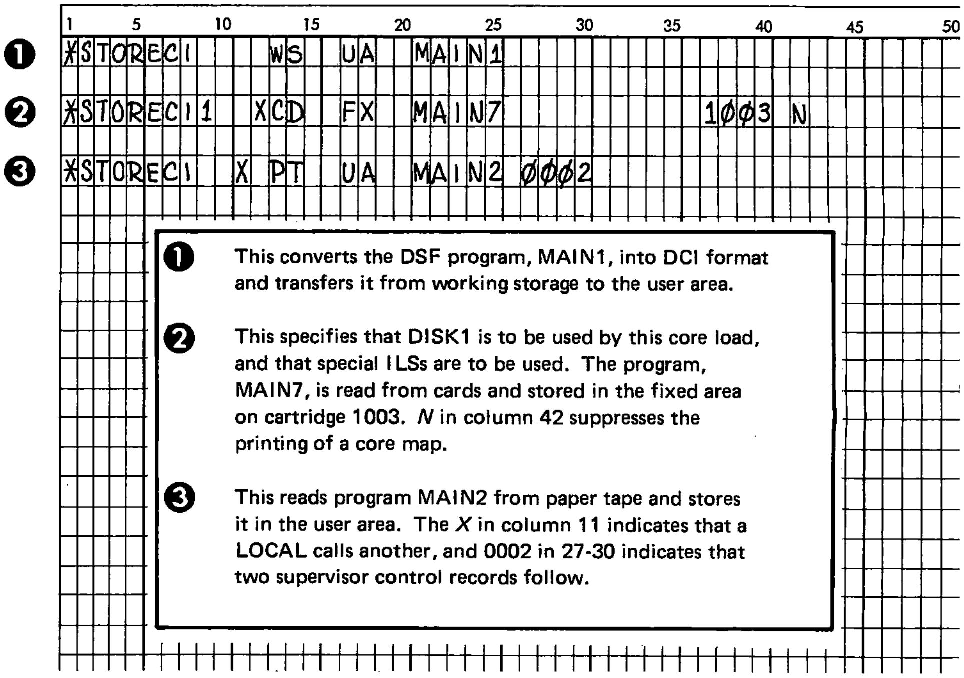
Special ILS Indicator. A punch (any character) in column 12 indicates that special interrupt level subroutines (ILSs named with an X before the number, as ILSX4) are to be used for this core load. If column 12 is blank, the standard set of ILSs is used.

In addition to the functions of the standard ILSs, special ILSs at the beginning of their execution save the contents of index register 3 and set this register to point to the transfer vector. Special ILSs restore the original contents of index register 3 at the end of their execution. Because the special ILSs save and restore the contents of index register 3, you can use this register in your programs.

Special ILSs require 5 more words of core storage per ILS than standard ILSs. The special ILSs for interrupt levels 2 and 4 are loaded, together with other subroutines, as part of the core load. You can write ILSs to replace any of the IBM-supplied ILSs, standard or special.

Count. A right-justified number in columns 27 through 30 that indicates the number of supervisor control records following this control record. DUP reads these control records for use by the core load builder before the STORECI operation is performed. The program name (columns 21 through 25 of this control record) must be used on the LOCAL and NOCAL record. It must not be used on the G2250 record. Data files specified in the FILES supervisor control records that follow must be stored in the fixed area (see "Use of Defined Files" in Chapter 6).

**STORECI Examples*



```
  1   5   10   15   20   25   30   35   40   45   50
❶ *STORECI    WS  UA  MAIN1
❷ *STORECI1  XCD  FX  MAIN7           1ØØ3 N
❸ *STORECI  X PT  UA  MAIN2 ØØØ2
```

❶ This converts the DSF program, MAIN1, into DCI format and transfers it from working storage to the user area.

❷ This specifies that DISK1 is to be used by this core load, and that special ILSs are to be used. The program, MAIN7, is read from cards and stored in the fixed area on cartridge 1003. *N* in column 42 suppresses the printing of a core map.

❸ This reads program MAIN2 from paper tape and stores it in the user area. The *X* in column 11 indicates that a LOCAL calls another, and 0002 in 27-30 indicates that two supervisor control records follow.

*STOREMOD

general function

This control record transfers information from working storage into the user area or fixed area.

If the name specified in columns 21 through 25 is identical to an entry in LET or FLET, the information in working storage overlays the DSF program, DCI program, or data file in the user area or fixed area for that entry. The format of working storage must match the format of the LET or FLET entry that is replaced.

The STOREMOD operation permits you to modify a DSF program, DCI program, or data file stored in the user area or fixed area without changing its name or relative position within the storage area. However, the length of the program or data file in working storage after being changed cannot be greater than the length of the old version of the program or data file that it replaces in the user area or fixed area. No change is made to the LET or FLET entry as a result of this operation.

If the name on the STOREMOD control record does not match an entry in LET or FLET, the contents of working storage are stored by STORE, STOREDATA, or STOREDATACI, when the respective format is DSF, DDF, or DCI. The STOREMOD operation is not allowed when temporary mode is indicated in the current JOB monitor control record.

format

Card column	Contents	Explanation
1 through 10	*STOREMODƀ	
11	Subtype	
12	Reserved	
13 and 14	*From* symbol	The source is *always* working storage.
15 and 16	Reserved	
17 and 18	*To* symbol	See the following summary chart.
19 and 20	Reserved	
21 through 25	Name	
26 through 30	Reserved	
31 through 34	*From* cartridge ID	
35 and 36	Reserved	
37 through 40	*To* cartridge ID	
41 through 80	Not used	

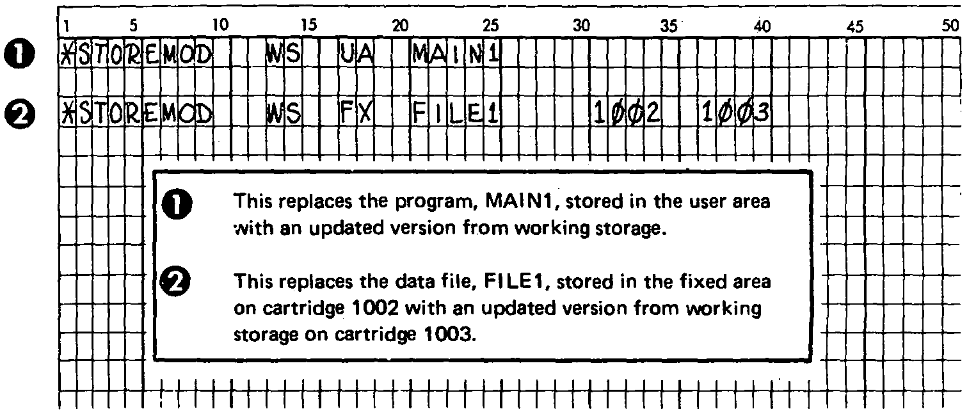
The following chart is a summary of the information transfers and format conversions performed by STOREMOD.

*STOREMOD summary chart

From **symbols, including formats**	*To* **symbols, including formats**
WS(DSF)	UA(DSF)
WS(DDF)	UA or FX(DDF)
WS(DCI)	UA or FX(DCI)

Note: The format and size indicators of a data file in working storage must match those of the existing LET or FLET entry. Since the execution of your program that references data files stored in working storage does not set these indicators, a subsequent STOREMOD does not work. These indicators can be set prior to execution by performing a DUMPDATA operation of the stored data file to WS.

**STOREMOD Examples*



```
1   5    10   15   20   25   30   35   40   45   50
*STOREMOD   WS  UA  MAIN1
*STOREMOD   WS  FX  FILE1     1ØØ2  1ØØ3
```

❶ This replaces the program, MAIN1, stored in the user area with an updated version from working storage.

❷ This replaces the data file, FILE1, stored in the fixed area on cartridge 1002 with an updated version from working storage on cartridge 1003.

*DELETE

general function

This operation removes a specified DSF program, DCI program, or data file from the user area or fixed area. The deletion is accomplished by the removal of the program or data file LET or FLET entry, including the dummy entry for associated padding, if any. The DELETE operation is not allowed if temporary mode is indicated in the current JOB monitor control record.

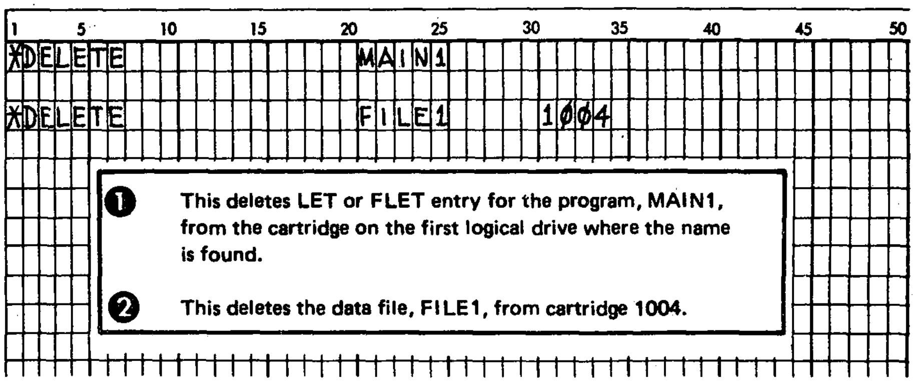
When a program or data file is deleted from the user area, that area is packed so that (1) the areas represented by the remaining LET entries are contigious, and (2) working storage is increased by the amount of disk storage formerly occupied by the deleted program or data file. The contents of working storage are not destroyed by the DELETE operation.

When a DCI program or a data file is deleted from the fixed area, that area is not packed. The FLET entry for the deleted DCI program or data file, including the dummy entry for associated padding, if any, is replaced by a single dummy entry (1DUMY). This 1DUMY entry represents the area formerly occupied by the deleted DCI program or data file, and its padding. DUP store operations can place new entries in the deleted areas of the fixed area.

format

Card column	Contents	Explanation
1 through 8	*DELETEb̸	
9 through 20	Reserved	
21 through 25	Name	
26 through 30	Reserved	
31 through 34	*From* cartridge ID	The deletion is performed on the specified cartridge only. If a cartridge ID is not specified, and the program or data file name (columns 21 through 25) is present in LET or FLET of more than one cartridge specified for this JOB, deletion is from the first logical drive on which the name is found.
35 through 80	Not used	

**DELETE Examples*



```
   1   5    10   15   20   25   30   35   40   45   50
❶  *DELETE             MAIN1
❷  *DELETE             FILE1     1ØØ4
```

❶ This deletes LET or FLET entry for the program, MAIN1, from the cartridge on the first logical drive where the name is found.

❷ This deletes the data file, FILE1, from cartridge 1004.

*DEFINE

general function

This control record performs 4 functions.

- It initially establishes the fixed area and its size on disk.
- It increases or decreases the size of the fixed area.
- It deletes the fixed area and FLET.
- It deletes the assembler, FORTRAN compiler, RPG compiler, or COBOL compiler, or any combination of these 4 programs from the IBM system area on the master cartridge.

define a FX

The definition of a fixed area on disk allows you to store in fixed locations the programs and data files, which you can subsequently refer to by their sector addresses. The fixed area is defined in cylinder increments; the minimum required storage space is one cylinder. When a fixed area is defined, the system uses one cylinder for the fixed location equivalence table (FLET). This cylinder used for FLET is included in the total size of the fixed area; therefore, the initial definition of the fixed area must be at least 2 cylinders.

increase or decrease the FX

The fixed area is increased in cylinder increments. It is decreased in cylinder increments by deleting unused cylinders after the last program or data file stored in the fixed area.

delete FX

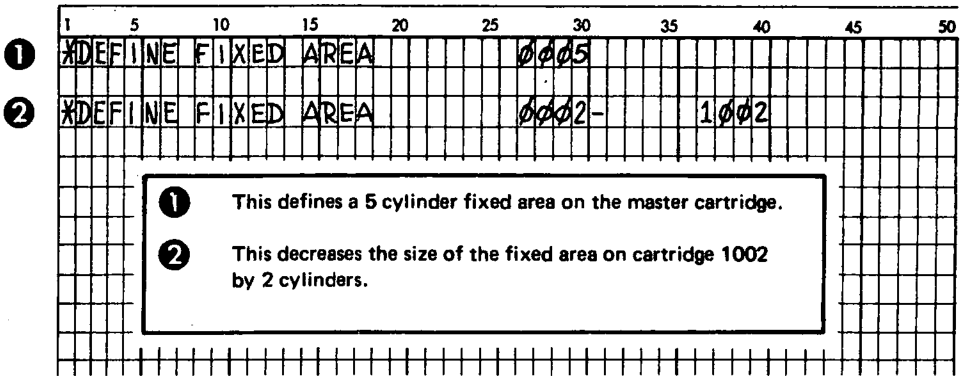
If all DCI programs and data files have been deleted from the fixed area (by using *DELETE), the fixed area and FLET can be deleted by specifying a number in the count field that reduces the fixed area and FLET to one cylinder or less.

format of DEFINE FIXED AREA

Card column	Contents	Explanation
1 through 8	*DEFINEb̸	
9 through 18	FIXEDb̸AREA	
19 through 26	Reserved	
27 through 30	Count	In initial definition of the fixed area, the count is the number (in decimal) of cylinders to be allocated as the fixed area; a minimum of 2 must be specified. After initial definition, the count is the number of cylinders by which the fixed area is to be increased or decreased.
31	Sign	Blank if the fixed area is being increased; a minus sign if the fixed area is being decreased.
32 through 36	Reserved	
37 through 40	Cartridge ID	This ID specifies the cartridge that is being altered; when omitted, the system cartridge is assumed.
41 through 80	Not used	

Note. The DEFINE FIXED AREA operation is not allowed if temporary mode is indicated in the current JOB monitor control record.

**Define Fixed Area Examples*


1
5
10
15
20
25
30
35
40
45
50

```
❶ *DEFINE FIXED AREA        ØØØ5
❷ *DEFINE FIXED AREA        ØØØ2-     1ØØ2
```

❶ This defines a 5 cylinder fixed area on the master cartridge.

❷ This decreases the size of the fixed area on cartridge 1002 by 2 cylinders.

delete the assembler or compiler

Deletion of the assembler, FORTRAN compiler, RPG compiler, or COBOL compiler causes the specified monitor program to be removed from the IBM system area on the master cartridge. The IBM system area is then packed so that remaining programs and areas occupy the area formerly occupied by the deleted monitor program. SLET entries are updated to reflect the new disk storage allocations for the monitor programs. The reload table is used to make adjustments in the programs that use disk storage addresses from SLET.

When the assembler, FORTRAN compiler, RPG compiler, or COBOL compiler is to be deleted, you must perform this deletion before defining a fixed area on the cartridge, or after completely removing a defined fixed area (see the previous discussion of decreasing the size of the fixed area). Once one of these programs is deleted, it can be restored by performing an initial load only.

format of DEFINE VOID

Card column	Contents	Explanation
1 through 8	*DEFINEƀ	
9 through 13	VOIDƀ	
14 through 22	ASSEMBLER or FORTRANƀƀ or RPGƀƀƀƀƀƀ or COBOLƀƀƀƀ	
23 through 80	Not used	

Note. The DEFINE VOID operation is not allowed when temporary mode is indicated in the current JOB monitor control record.

The processing of a DEFINE VOID operation restores the original system principal printer if a CPRNT monitor control record has specified that monitor and supervisor control records be printed on the console printer.

*DWADR

general function

This operation causes a sector address to be written on every sector of working storage on the cartridge specified by the DWADR control record or, if a cartridge ID is not specified, on every sector of system working storage. The operation restores correct disk sector addresses in working storage if they have been modified during execution of your program. The contents of working storage prior to the DWADR operation are destroyed.

A dummy // DUP monitor control record is printed on the principal printer following the printing of the *DWADR control record and the DUP exit message.

format

Card column	Contents	Explanation
1 through 6	*DWADR	
7 through 36	Reserved	
37 through 40	Cartridge ID	This ID specifies the cartridge on which the working storage sector addresses are to be rewritten.
41 through 80	Not used	

Note. The DWADR operation is not allowed if temporary mode is indicated in the current JOB monitor control record.

*DFILE

general function

This operation reserves disk space in either the user area or fixed area as a named data file or macro library. Data is not moved as a result of the DFILE operation; this function provides disk space allocation only. The contents of working storage are not changed except when defining space in the user area; the contents of working storage on that drive are destroyed since the user area and working storage are adjacent areas. (See "Use of Defined Files" in Chapter 6 for a suggested use of this control record.)

DUP makes the required LET or FLET entry. The name specified on the DFILE control record is assigned to the area and is used to generate the LET or FLET entry. DUP uses the sector count specified on the DFILE control record to supply the disk block count in the LET or FLET entry.

format

Card column	Contents	Explanation
1 through 6	*DFILE	
7 through 16	Reserved	
17 and 18	*To* symbol	Area in which the file is to be reserved: UA for user area, FX for fixed area.
19 and 20	Reserved	
21 through 25	File name	The name assigned to the area reserved for the data file or macro library.
26	Reserved	
27 through 30	Count	The number (in decimal) of sectors to be reserved
31 through 36	Reserved	
37 through 40	*To* cartridge ID	
41 through 80	Not used	

Note. The DFILE operation is restricted to reserving space only in the UA when temporary mode is indicated in the current JOB monitor control record.

*MACRO UPDATE

general function

This operation causes execution of the Macro Update Program (MUP). The MUP performs:

- Initialization of a macro library
- Physical or logical concatenation of macro libraries
- Addition, deletion, or name redefinition of stored macros
- Statement addition or deletion within a stored macro
- Punching of stored macros into cards
- Listing of macro library contents either at statement or macro level

The functions to be performed by MUP are indicated by means of MUP control statements. The format and functions of these control statements are described in the publication *IBM 1130/1800 Assembler Language*, GC26-3778. The MUP control statements immediately follow the MACRO UPDATE DUP control record in the job stream.

The Macro Update Program requires an IBM 1131 Central Processing Unit, Model 2 or 3, with 8192 (decimal) or more words of core storage. If the MACRO UPDATE DUP control record is read by a system with 4096 words of core storage, it is considered an invalid control record. The MUP cannot be used if temporary mode is indicated in the current JOB monitor control record.

format

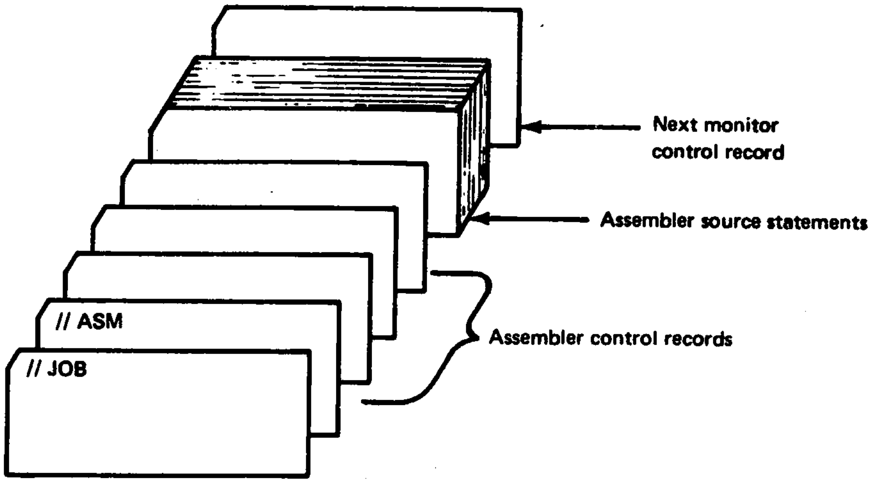
Card column	Contents	Explanation
1 through 13	*MACROƀUPDATE	
14 through 36	Reserved	
37 through 80	Not used	

Note. Keyboard or paper tape input to the MUP of the Disk Utility Program assumes a one-to-one relationship with any corresponding card input record. Thus, position 1 of assembler statements that are input record for MUP corresponds to card column 1 and not to column 21.

ASSEMBLER CONTROL RECORDS

functions

Assembler control records are used to specify optional operations that affect the assembler and assembly output. These control records are placed in the input stream as follows:


Next monitor control record
Assembler source statements
Assembler control records
// ASM
// JOB

Assembler control records can be entered in card or paper tape form along with the source program card deck or paper tape, or they can be entered from the console keyboard (see "Entering Jobs From the Console Keyboard" in Chapter 7).

In most cases, the source program is passed through the assembler only once. This is always true when input is from the keyboard or paper tape reader. When input is from cards, passing the source deck through the assembler a second time (2-pass mode) may be required. Further information about 2-pass mode is presented in the descriptions of the TWO PASS MODE, LIST DECK, and LIST DECK E control records in this section. These 3 control records and the PUNCH SYMBOL TABLE control record are *ignored* when entered from the keyboard or paper tape reader.

coding assembler control records

All assembler control records have the following format:

Card column	Contents	Explanation
1	*	Asterisk
2 through 71	Option	Replace *option* with the keywords for the control record being used.
72 through 80	Not used	

Note. Assembler control records are coded in free form; that is, any number of blanks can occur between the characters of the *option*. However, only one blank can separate the last character of the *option* and the first character of any required numeric field. Remarks can be included after the option or numeric field; however, at least one blank must separate the last character of the option or numeric field and the remarks.

If an assembler control record contains an asterisk in column one, but the *option* is not identical with the format shown for the control record, the control record followed by an assembler error message is printed in the control record listing. The control record in error is ignored; an error does not result, but the specified *option* is not performed.

coding keyboard and paper tape input

Assembler control records are coded the same for card, paper tape, and keyboard input. Assembler language source statements are coded the same for keyboard and paper tape input as for cards, with the following exceptions:

- The source statements do not contain leading blanks corresponding to card columns 1 through 20.
- The source statements are limited to 60 characters

The first record processed by the assembler is checked for an asterisk as the first character. If an asterisk is the first character, the record is considered an assembler control record. This procedure continues until the first nonasterisk character is detected as the first character. For this record, and all following records (up to and including the END statement), the first character of each record is treated as if it were in card column 21; therefore, the first noncontrol record should not be an * comments statement.

Note 1. Paper tape input to the assembler is punched into paper tape in PTTC/8 code, one frame per character. Any delete codes punched in paper tape are passed over by the assembler; assembly is continuous until the end.

Note 2. Keyboard and paper tape input to the Macro Update Program (MUP) of DUP assumes a one-to-one relationship with the corresponding card input. Thus, position one of assembler statements that are input for MUP corresponds to card column 1 and not to column 21.

*TWO PASS MODE

general function

This control record causes the assembler to read the source program deck twice. TWO PASS MODE must be specified when:

- You want a list deck punched by the 1442 Card Read Punch, Model 6 or 7 (see "*LIST DECK" and "*LIST DECK E" in this chapter).
- A one-pass operation cannot be performed because the intermediate output (source records) exceeds the capacity of working storage.

This control record is *ignored* if source statements are entered through the keyboard or the paper tape reader.

format

Card column	Contents	Explanation
1	*	Asterisk
2 through 71	TWO PASS MODE	
72 through 80	Not used	

If a copy of the source deck, including all assembler control records, is placed behind the original, the source deck is read twice, and a stacked job is possible in 2-pass mode.

When a deck is being assembled in 2-pass mode, the assembler is ready to read another card as soon as pass one processing of the END card is completed. Therefore, the source deck or a copy of the source deck must be placed immediately behind the END card of the first-pass deck. A monitor control record after the first END card causes the assembler to execute a CALL EXIT; the assembly is not completed.

If the source deck has not been copied, the END card must be the last card in the hopper. To continue:

1. Press START on the card reader and PROGRAM START on the console to process the END card when the reader goes not ready.
2. Remove the source deck from the stacker and place it in the hopper.
3. Press START on the card reader and PROGRAM START on the console again.

The operation can be made continuous if you remove the source cards from the stacker during pass one and place them behind the END card in the hopper

To complete the assembly at the end of pass 2, press START on the card reader and PROGRAM START on the console to process the END card for the second pass.

*LIST

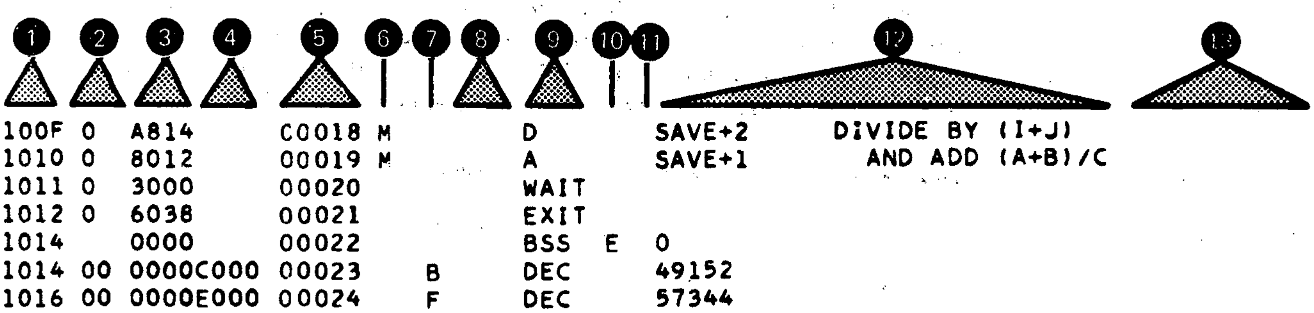
general function

This control record causes the assembler to provide a printed listing of the source program on the principal print device (1403 Printer, 1132 Printer, or console printer). If a LIST control record is not used, only those statements in which assembly errors are detected are listed. When 2-pass mode is specified, all BSS, BES, ORG, and EQU statements that contain errors are listed during pass one of the assembly.

format

Card column	Contents	Explanation
1	*	Asterisk
2 through 71	LIST	
72 through 80	Not used	

The format of a printed listing for an 8K or larger system is shown by:



```
100F 0  A814      C0018 M          D         SAVE+2        DIVIDE BY (I+J)
1010 0  8012      00019 M          A         SAVE+1           AND ADD (A+B)/C
1011 0  3000      00020            WAIT
1012 0  6038      00021            EXIT
1014    0000      00022            BSS   E   0
1014 00 0000C000  00023     B      DEC       49152
1016 00 0000E000  00024     F      DEC       57344
```

❶ Address of the instruction; address of the label, if any

❷ Relocation indicators

❸ One of the following:

a. First word of the assembled code

b. For EBC statements, the number of EBC characters

c. For BSS and BES statements, the number of words reserved for the block

d. For ENT, ILS, and ISS statements, ❸ and ❹ are the entry label in name code

e. For LIBF and CALL statements, ❸ and ❹ are the name of the subroutine in name code

❹ One of the following:

a. Second word of assembled code

b. For ENT, ILS, and ISS statements, ❸ and ❹ are the entry label in name code

c. For LIBF and CALL statements, ❸ and ❹ are the name of the subroutine in name code

❺ Statement number

❻ Error flags, if any

❼ Macro code indicator, if any

❽ Label

❾ Operation code

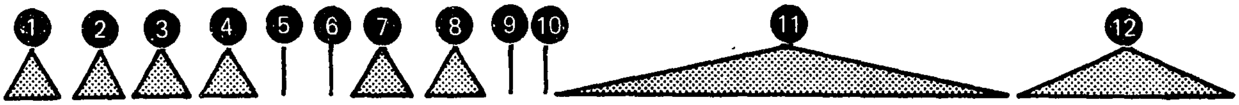
❿ Format

⓫ Tag

⓬ Operands (and your comments)

⓭ ID and sequence number, if any

When LIST is specified for a 4K system, or with 2-pass mode, the format of the printed listing is:



```
100F 0  A814     M        D       SAVE+2     DIVIDE BY (I+J)
1010 0  8012     M        A       SAVE+1       AND ADD (A+B)/C
1011 0  3000              WAIT
1012 0  6038              EXIT
1014    0000              BSS  E  0
1014 00 0000C000    B     DEC     49152
1016 00 0000E000    F     DEC     57344
```

1 Address of the instruction; address assigned to the label, if any

2 Relocation indicators

3 One of the following:

a. First word of the assembled code

b. For EBC statements, the number of EBC characters

c. For BSS and BES statements, the number of words reserved for the block

d. For ENT, ILS, and ISS statements, 3 and 4 are the entry label in name code

e For LIBF and CALL statements, 3 and 4 are the name of the subroutine in name code

One of the following:

a. Second word of assembled code

b. For ENT, ILS, and ISS statements, 3 and 4 are the entry label in name code

c. For LIBF and CALL statements, 3 and 4 are the name of the subroutine in name code

5 Error flags, if any

6 Macro code indicator, if any

7 Label

8 Operation code

9 Format

10 Tag

11 Operands (and your comments)

12 ID and sequence number, if any

A complete sample program listing is in Appendix H.

*XREF

general function

This control record causes the assembler to produce a statement numbered listing and a statement numbered cross-reference symbol table on the principal print device if the core size is 8K or larger. This control record is invalid if the core size is 4K, and, if detected, is ignored. A warning message is printed.

A LIST control record is not needed when XREF is used. When neither an XREF nor a LIST control record is used, only those statements in which assembly errors or warnings are detected are listed. When 2-pass mode is specified, all BSS, BES, ORG, and EQU statements that contain errors are listed during pass one of the assembly.

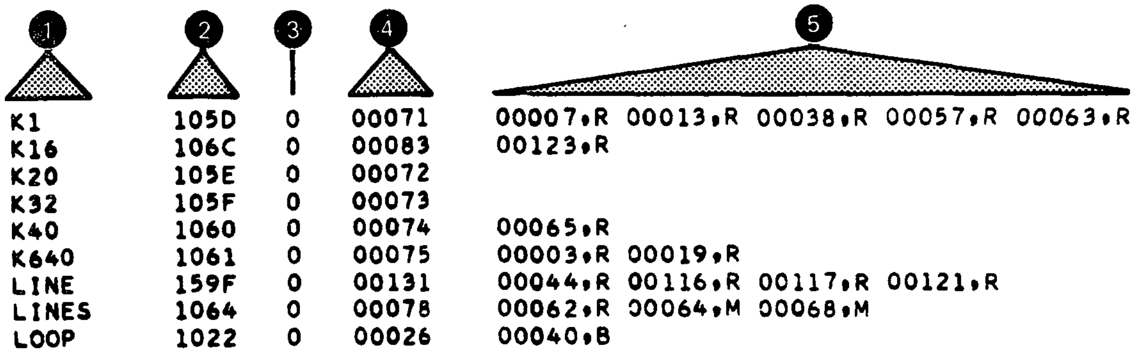
The cross-reference symbol table is not printed if 2-pass mode is specified or if symbol table overflow occurs during assembly. When either of these conditions occur, the XREF control record produces only a listing.

The assembler does not assign sequence numbers to comments statements when a LIST OFF statement in your program is in effect. Because of this, the statement numbers in a cross-reference symbol table listing for the same program may be different from one assembly to another, depending on whether or not the program contains LIST OFF (and LIST ON) statements.

format

Card column	Contents	Explanation
1	*	Asterisk
2 through 71	XREF	
72 through 80	Not used	

The format of the statement-numbered listing is the same as the format shown under "*LIST" for a system with a core size of 8K or larger. The format of the cross-reference symbol table is:



```
K1      105D  0  00071   00007,R 00013,R 00038,R 00057,R 00063,R
K16     106C  0  00083   00123,R
K20     105E  0  00072
K32     105F  0  00073
K40     1060  0  00074   00065,R
K640    1061  0  00075   00003,R 00019,R
LINE    159F  0  00131   00044,R 00116,R 00117,R 00121,R
LINES   1064  0  00078   00062,R 00064,M 00068,M
LOOP    1022  0  00026   00040,B
```

1 Symbol

2 Value of the symbol

3 Relocation indicator

4 Statement number of statement that defines the symbol

5 Statement numbers and associated reference type indicators (B for branch to, M for modification, or R for reference to) for the statements that use the symbols

Multiply defined symbols are flagged in the cross-reference symbol table with the message ***MULTIPLY-DEFINED***. Undefined symbols are listed separately under the header ***UNDEFINED SYMBOLS***. Symbols that refer to the system symbol table are flagged with SYSMB in the statement number field of the cross-reference entry.

A list of the statement numbers of all statements flagged with errors or warnings is printed at the end of the statement numbered listing under the header: ERROR STATEMENT LINE NUMBERS.

*LIST DECK

general function

This control record causes a list deck to be punched when the principal I/O device is a 1442 Model 6 or 7 Card Read Punch. This control record is *ignored* if entered from the 2501 Card Reader, the paper tape reader, or the keyboard.

format

Card column	Contents	Explanation
1	*	Asterisk
2 through 71	LIST DECK	
72 through 80	Not used	

The LIST DECK option requires 2 passes of the source deck (TWO PASS MODE) through the assembler. Object information is punched into columns 1 through 19 during pass two.

The card column contents of a punched list deck card are:

Card column	Contents
1 through 4	Address of the instruction; address assigned to the label, if any.
5	Blank
6 and 7	Relocation indicators
8	Blank
9 through 12	One of the following: 1. First word of the assembled code. 2. For EBC statements, the number of EBC characters. 3. For BSS and BES statements, the number of words reserved for the block. 4. For ENT, ILS, and ISS statements, columns 9 through 16 contain the entry label in name code. 5. For LIBF and CALL statements, columns 9 through 16 contain the name of the subroutine in name code.
13 through 16	One of the following: 1. Second word of the assembled code. 2. For ENT, ILS, and ISS statements, columns 9 through 16 contain the entry label in name code. 3. For LIBF and CALL statements, columns 9 through 16 contain the name of the subroutine in name code.
17	Blank
18 and 19	Error flags, if any
20	Macro code indicator, if any
21 through 25	Label
26	Blank
27 through 30	Operation code
31	Blank
32	Format
33	Tag
34	Blank
35 through 71	Operands (and your comments)
72	Blank
73 through 80	ID and sequence number, if any

*LIST DECK E

general function

This control record causes a list deck to be punched when the principal I/O device is a 1442 Model 6 or 7 Card Read Punch. This control record is *ignored* if entered from a 2501 Card Reader, paper tape reader, or the keyboard.

The LIST DECK E option requires 2 passes of the source deck (TWO PASS MODE) through the assembler. Only error flags, if any, are punched (columns 18 and 19) during the second pass. Assembler error detection codes are described in Appendix A.

format

Card column	Contents	Explanation
1	*	Asterisk
2 through 71	LIST DECK E	
72 through 80	Not used	

*PRINT SYMBOL TABLE

general function

This control record causes the assembler to print a listing of the symbol table on the principal print device. The printed symbols are grouped 5 per line. Multiply defined symbols are preceded by the letter M. Symbols with absolute values in a relocatable program are preceded by the letter A. These M and A flags are not counted as assembly errors.

format

Card column	Contents	Explanation
1	*	Asterisk
2 through 71	PRINT SYMBOL TABLE	
72 through 80	Not used	

*PUNCH SYMBOL TABLE

general function

This control record causes the symbol table to be punched as a series of EQU source cards. Each source card contains one symbol. These cards can be used as source input to the system symbol table when the SAVE SYMBOL TABLE control record is used with an assembly in which they are included.

This control record is *ignored* if entered from the paper tape reader or the keyboard.

format

Card column	Contents	Explanation
1	*	Asterisk
2 through 71	PUNCH SYMBOL TABLE	
72 through 80	Not used	

If the principal input device is the 1442 Model 6 or 7 Card Read Punch, sufficient blank cards must be placed between the source program END card and the next monitor control record when stacked job input is being used. In estimating the number of blank cards required, allow one card for each symbol used in the source program. Unnecessary blank cards are passed. (If a nonblank card is read when punching on the 1442 Model 6 or 7, the assembler waits at $PRET with /100F displayed in the ACCUMULATOR.)

If the system configuration is 2501/1442, place blank cards in the 1442 hopper and press START on the 1442 before beginning the assembly.

Note. Do not place nonblank cards in the 1442 Model 5. The punch may be damaged if an attempt is made to punch a hole where a hole exists. An error *is not* detected.

*SAVE SYMBOL TABLE

general function

This control record causes the symbol table generated by this assembly to be saved on disk as a system symbol table. This system symbol table is saved until another assembly with a SAVE SYMBOL TABLE control record causes a new system symbol table to replace the old one. This control record is also used with the SYSTEM SYMBOL TABLE control record to add symbols to the system symbol table.

Note. The SAVE SYMBOL TABLE requires that the assembly be absolute (an ORG statement defining the core load origin must be used in your program). Thus, all symbols in the system symbol table have absolute values.

When the symbol table punched by a PUNCH SYMBOL TABLE control record is included in the system symbol table being generated by this assembly, place the punched EQU cards after the SAVE SYMBOL TABLE control record.

If any assembly errors are detected, or if the symbol table exceeds 100 symbols, the system symbol table is not saved, and an assembler error message is printed.

format

Card column	Contents	Explanation
1	*	Asterisk
2 through 71	SAVE SYMBOL TABLE	
72 through 80	Not used	

*SYSTEM SYMBOL TABLE

general function

This control record causes a previously built system symbol table to be added to the symbol table for this assembly as the assembly begins. This allows you to refer to symbols in the system symbol table without redefining the symbols in your source program. Also, this control record can be used with a SAVE SYMBOL TABLE control record to add symbols from this assembly to the system symbol table.

Note. All symbols in the system symbol table have absolute values.

format

Card column	Contents	Explanation
1	*	Asterisk
2 through 71	SYSTEM SYMBOL TABLE	
72 through 80	Not used	

*LEVEL

general function

This control record specifies the interrupt levels serviced by an ISS and the associated ILS subroutines. This control record is required for the assembly of an ISS subroutine. The interrupt level number is a decimal number in the range 0 through 5. If the device operates on 2 interrupt levels (for example, the 1442 Card Read Punch), one LEVEL control record is required for each interrupt level on which the device operates. The assembler accepts no more than 2 interrupt levels for a device. At least one blank must separate the word LEVEL and the interrupt level number.

If a LEVEL control record is not used when assembling an ISS subroutine, an error message is printed at the end of the assembly.

format

Card column	Contents	Explanation
1	*	Asterisk
2 through 71	LEVELb̸n	*n* is an interrupt level number (decimal)
72 through 80	Not used	

*OVERFLOW SECTORS

general function

This control record allows you to specify the number of sectors of working storage to be used by the assembler for symbol table overflow and/or macro processing. When this control record is used, the assembler allocates one more sector than the total number specified. This additional sector is used as a working sector by the assembler.

If more than one OVERFLOW SECTORS control record is used, the last record is used to allocate the overflow sectors.

format

Card column	Contents	Explanation
1	*	Asterisk
2 through 71	OVERFLOW SECTORSb̸ n1, n2, n3	*n1* is the number of sectors for symbol table overflow; *n2* is the number of sectors for macro parameter list overflow; *n3* is the number of sectors for temporary macro definition.
72 through 80	Not used	

Note. **If any of the number fields are not specified in an OVERFLOW SECTORS control record, the commas within the record cannot be eliminated.**

additional field information

OVERFLOW SECTORS. The decimal numbers coded after OVERFLOW SECTORS specify the number of sectors to be allocated for (1) symbol table overflow, *n1*, (2) macro parameter list overflow, *n2*, and (3) temporary macro definition overflow, *n3.*

n1

The number of sectors (*n1*) reserved for symbol table overflow is specified as a decimal number in the range 0 through 32. When the entry is zero or not specified, symbol table overflow is not allowed. If the entry is greater than.32, only 32 sectors are assigned for symbol table overflow. If, during assembly, the symbol table overflow exceeds the number of sectors allocated by the OVERFLOW SECTORS control record, an error message is printed. The approximate maximum number of symbols that can be defined in a program is determined by the size of core storage:

Size of core storage (in decimal words)	*Approximate maximum number of symbols*
4096	3500
8192	4165
16384	6895
32768	12355

n2

The macro processor portion of the assembler uses working storage to contain macro parameter list overflow. The OVERFLOW SECTORS control record specifies the number of sectors (*n2*) to be reserved. If n2 is zero or not specified, a comma must be coded, but macro parameter list overflow is not allowed.

compute largest parameter list size

The size (in words) of the total parameter list storage required for an assembly is the size of the largest parameter list within the assembly. The size of a parameter list (in words) can be estimated by using the following formula:

$$\text{Number of words} = 3+N+\sum_{i=1}^{N} \tfrac{1}{2}(m_i+1)$$

where

N is the number of parameters, including nested macros, within a macro call.
M_i is the number of characters per parameter.

For example, the macro call:
EXPND APHA,BETA,C is computed as 3+3+½(5+1)+½(4+1)+½(1+1)=12 words.

compute n2

If the computed size of the largest parameter list within an assembly does not exceed 100 words, parameter list overflow sectors are not required. Otherwise, the number of sectors (*n2*) required can be computed with the following formula:

$$n2=1/100(x-100)$$

where

x equals the size (in words) of the largest parameter list.

n3

The macro processor portion of the assembler uses working storage to store temporary macro definitions (macros that apply only to the assembly in which they are defined). The OVERFLOW SECTORS control record specifies the number of sectors (*n3*) to be reserved for storing the temporary macros. If n3 is zero or not specified, a comma must be coded, but storage of temporary macro definitions is not allowed.

compute n3

The number of working storage sectors (n3) required for storing temporary macro definitions is calculated as: K/40

where

K is the sum of the number of statements in each temporary macro definition.

*COMMON

general function

This control record allows you to specify the length (in words) of COMMON that is shared by the program being assembled and a FORTRAN program compiled prior to this assembly. The number of words of COMMON used by the FORTRAN program can be obtained from a listing of the program. The use of this control record provides for the saving of COMMON when linking between FORTRAN mainlines and assembler mainlines. Variables within COMMON must be assigned specific addresses with EQU statements. Assignment of those variables with code generating instructions causes a R40 error message to be generated.

format

Card column	Contents	Explanation
1	*	Asterisk
2 through 71	COMMONƀ nnnnn	*nnnnn* is the number (in decimal) of words of COMMON to be saved between links.
72 through 80	Not used	

*MACLIB

general function

This control record specifies that the macro library is used during assembly. The MACLIB control record is invalid on 4K systems and with both LIST DECK options.

format

Card column	Contents	Explanation
1	*	Asterisk
2 through 8	MACLIBƀ	
9 through 13	Macro library name	
14 through 71	Reserved	
72 through 80	Not used	

additional field information

Macro library name. This name must be an exact duplicate of the name given to the macro library when it was defined by a STOREDATA or DFILE DUP control record. A MACLIB control record is ignored if an invalid macro library name is specified.

*NOSET

general function

This control record allows object code from assembly to be built and stored although errors are included. If NOSET is an included control record, $NDUP is not set when errors occur. The setting of $NXEQ remains unchanged. Thus, with a lengthy assembly, it is possible to patch the incorrect statements via MODSF until a final assembly is desired.

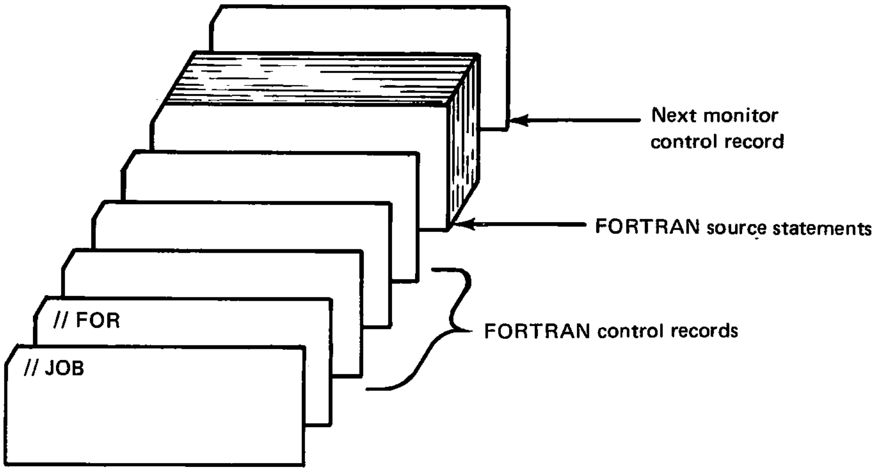
format

Card column	Contents	Explanation
1	*	Asterisk
2 through 6	NOSET	
7 through 71	Reserved	
72 through 80	Not used	

FORTRAN CONTROL RECORDS

functions

FORTRAN control records specify optional operations that affect the FORTRAN compiler and program execution. These control records are placed in the input stream as follows:



FORTRAN control records can be entered in card or paper tape form along with the source program deck or tape, or they can be entered from the console keyboard (see "Entering Jobs from the Console Keyboard" in Chapter 7).

The IOCS, NAME, and ORIGIN control records can be used only with mainline programs; the others can be used with both mainline programs and subprograms.

coding

All FORTRAN control records have the following format:

Card column	Contents	Explanation
1	*	Asterisk
2 through 72	Option	Replace *option* with the keywords for the control record being used.
73 through 80	Not used	

Note. FORTRAN control records are coded in free form; that is, any number of blanks can occur between the characters of the *option.* Remarks are not allowed.

If a FORTRAN control record contains an asterisk in column one, but the *option* is not identical with the format shown for the control record, the asterisk is replaced with a minus sign on the control record listing. The control record in error is ignored; an error does not result, but the specified *option* is not performed. This same action is taken if the specified address is not valid in an ORIGIN control record.

*IOCS

general function

This control record specifies the I/O devices that are used during execution of a FORTRAN core load. Only the devices required should be included. Any number of IOCS control records can be used to specify the required devices.

All I/O devices that are used by FORTRAN subprograms called in a FORTRAN core load must be included on the IOCS control records associated with the mainline FORTRAN program. Assembler language subroutines that are included in a FORTRAN core load can use any of the other I/O device subroutines in addition to those specified on the IOCS control records for the FORTRAN mainline program.

format

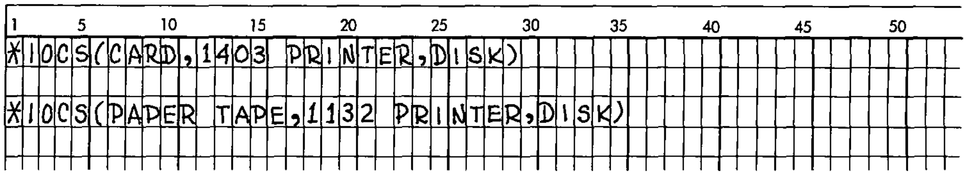
Card column	Contents	Explanation
1	*	
2 through 72	IOCS (d, d, . . . , d)	*d* is a valid device name selected from the following list.
73 through 80	Not used	

Names for I/O devices to be used are specified in the IOCS control record. These names are enclosed in parentheses and separated by commas. The devices, their associated IOCS names, and the I/O subroutines called for each device are:

Device	*IOCS device name	Subroutine called
1442 Card Read/Punch, Model 6 or 7	CARD	CARDZ
2501 Card Reader	2501 READER	READZ
1442 Card Punch, Model 5 (1442 Model 6 or 7 if used as a punch only)	1442 PUNCH	PNCHZ
Console printer	TYPEWRITER	WRTYZ
Keyboard	KEYBOARD	TYPEZ
1132 Printer	1132 PRINTER	PRNTZ
1403 Printer	1403 PRINTER	PRNZ
1134/1055 Paper Tape Reader/Punch	PAPER TAPE	PAPTZ
1627 Plotter	PLOTTER	PLOTX
Disk	DISK	DISKZ
Disk (unformatted disk I/O)	UDISK	DISKZ

Note. CARD is used for the 1442 Card Read/Punch, Model 6 or 7, and 1442 PUNCH is used for the 1442 Card Punch, Model 5 (1442 PUNCH can be used for a 1442, Model 6 or 7, if the function is punch only; 1442 PUNCH uses less core storage). CARD and 1442 PUNCH are mutually exclusive; therefore, the use of both of these names in IOCS control records for the same compilation is not allowed.

**IOCS Examples*


1
5
10
15
20
25
30
35
40
45
50

```
*IOCS(CARD,1403 PRINTER,DISK)

*IOCS(PAPER TAPE,1132 PRINTER,DISK)
```

*LIST SOURCE PROGRAM

general function

This control record causes the source program, as it is entered, to be listed on the principal print device.

format

Card column	Contents	Explanation
1	*	Asterisk
2 through 72	LIST SOURCE PROGRAM	
73 through 80	Not used	

*LIST SUBPROGRAM NAMES

general function

This control record causes the names of all subprograms (including subprograms called by EXTERNAL statements) called by the compiled program to be listed on the principal print device.

format

Card column	Contents	Explanation
1	*	Asterisk
2 through 72	LIST SUBPROGRAM NAMES	
73 through 80	Not used	

*LIST SYMBOL TABLE

general function

This control record causes the absolute or relative addresses for the following items to be listed on the principal print device.

- Variable names
- Numbered statements
- Statement functions
- Constants

The addresses are relative unless an ORIGIN control record specifies the core address where the first word of the core load is placed for execution.

A constant in a STOP or PAUSE statement is treated as a hexadecimal number. This hexadecimal number and its decimal equivalent appear in the list of constants. The hexadecimal number is displayed in the ACCUMULATOR when the system waits at $PRET during the execution of the PAUSE or STOP statement.

format

Card column	Contents	Explanation
1	*	Asterisk
2 through 72	LIST SYMBOL TABLE	
73 through 80	Not used	

*LIST ALL

general function

This control record causes the source program, associated subprogram names, and the symbol table to be listed on the principal print device. When this control record is used, the previously described LIST SOURCE PROGRAM, LIST SUBPROGRAM NAMES, and LIST SYMBOL TABLE control records are not required.

format

Card column	Contents	Explanation
1	*	Asterisk
2 through 72	LIST ALL	
73 through 80	Not used	

The FORTRAN sample program in Appendix H is listed by a LIST ALL control record.

*EXTENDED PRECISION

general function

This control record allocates 3 words of core storage for arithmetic values (real and integer) instead of the standard two and generates linkage to the extended precision subprograms.

The FORTRAN compiler normally operates in standard precision; that is, 2 words (a sign, 23 significant bits, and an exponent) of core storage are allocated for each arithmetic value. Through the use of the EXTENDED PRECISION control record, the compiler can be made to yield 31 significant bits by allocating 3 words of core storage for each arithmetic value.

Standard precision, extended precision, and arithmetic subprograms are discussed in the publication *IBM 1130 Subroutine Library*, GC26-5929.

format

Card column	Contents	Explanation
1	*	Asterisk
2 through 72	EXTENDED PRECISION	
73 through 80	Not used	

*ONE WORD INTEGERS

general function

The FORTRAN compiler normally assigns 2 words of core storage for each real and integer value (see the previous discussion of the EXTENDED PRECISION control record). The ONE WORD INTEGERS control record causes all integer values to be assigned one word of core rather than the standard 2 words, or 3 words when an EXTENDED PRECISION control record is used.

An 1130 FORTRAN integer can have any value in the range of $-2^{15}+1$ to $2^{15}-1$. Any value in this range can be contained in one word (16 bits) of core storage; therefore, integer values can contribute rather significantly to inefficient use of core storage because of the extra word allocated for standard or extended precision. Because of this, the use of the ONE WORD INTEGERS control record conserves core.

Note. If this control record is used, the program does not conform to the USASI Basic FORTRAN standard for data storage, and will require modification for use with non-1130 FORTRAN systems.

format

Card column	Contents	Explanation
1	*	Asterisks
2 through 72	ONE WORD INTEGERS	
73 through 80	Not used	

*NAME

general function

This control record causes the specified program name to be printed at the end of the program listing.

format

Card column	Contents	Explanation
1	*	Asterisk
2 through 72	NAMEƀxxxxx	*xxxxx* is the name of the mainline program and is five consecutive characters (including blanks) starting in the first nonblank column after NAME. At least one blank must separate NAME and the mainline program name.
73 through 80	Not used	

** (Header Information)

general function

This control record causes the information specified in columns 3 through 72 to be printed at the top of each page printed during compilation when a 1403 Printer or 1132 Printer is the principal print device. When the first statement of the program is read, the printer skips to a new page (a skip to channel 1), prints the heading, and begins listing the program statements.

format

Card column	Contents	Explanation
1 and 2	**	Asterisks
3 through 72	Any string of characters	
73 through 80	Not used	

*ARITHMETIC TRACE

general function

This control record causes the value of each variable to be printed each time it is changed during program execution. An asterisk immediately precedes each printed value.

Console entry switch 15 must be turned on, and an IOCS control record specifying the console printer, 1132 Printer, or 1403 Printer must be included in the FORTRAN control records. When more than one of these print devices is specified, the fastest device is used for printing the traced values. Tracing is stopped if console entry switch 15 is turned off. This provides for tracing only a part of a program. Tracing can be restarted by turning console entry switch 15 back on.

You can trace selected portions of your program by placing statements that start and stop tracing in the source program. These statements, CALL TSTRT and CALL TSTOP, are placed where needed in the program. In addition to these statements, console entry switch 15 must be on and an IOCS control record specifying a print device and an ARITHMETIC TRACE control record must be included in the FORTRAN control records.

format

Card column	Contents	Explanation
1	*	Asterisk
2 through 72	ARITHMETIC TRACE	
73 through 80	Not used	

*TRANSFER TRACE

general function

This control record causes the values of IF expressions and computed GO TO indexes to be printed during program execution. Two asterisks immediately precede each printed value of an IF statement. Three asterisks immediately precede the value printed for the index of a computed GO TO statement.

Console entry switch 15 must be turned on, and an IOCS control record specifying the console printer, 1132 Printer, or 1403 Printer must be included in the FORTRAN control records. When more than one of these print devices is specified, the fastest device is used for printing the traced values. Tracing is stopped if console entry switch 15 is turned off. This provides for tracing only a part of a program. Tracing can be restarted by turning console entry switch 15 back on.

You can trace selected portions of your program by placing statements that start and stop tracing in the source program. These statements, CALL TSTRT and CALL TSTOP, are placed where needed in the program. In addition to these statements, console entry switch 15 must be on and an IOCS control record specifying a print device and a TRANSFER TRACE control record must be included in the FORTRAN control records.

format

Card column	Contents	Explanation
1	*	Asterisk
2 through 72	TRANSFER TRACE	
73 through 80	Not used	

*ORIGIN

general function

This control record allows you to specify the core address where the core image loader starts loading a program into core for execution. When an ORIGIN control record is used, absolute addresses are printed in the listing that is produced by the compiler. This allows you to see exactly where the program statements and constants are during execution.

format

Card column	Contents	Explanation
1	*	Asterisk
2 through 72	ORIGINƀddddd *or* ORIGIN/xxxx	This is the starting core address expressed as a decimal number (ddddd) of 3 to 5 digits or as a hexadecimal number (/xxxx) of 1 to 4 digits preceded by a slash.
73 through 80	Not used	

additional field information

ORIGIN. The origin of a program cannot be specified below the disk I/O subroutine that is used by the core load. The origin is determined by adding decimal 30 to the next higher addressed word above the end of the disk I/O subroutine used by the core load. If the address you specify is an odd number, the system uses the next highest even address as the origin. The following chart lists the lowest possible origins. If an invalid address is specified, the control record is ignored.

Disk I/O subroutine in core	Core load origin	
	Decimal	Hexadecimal
DISKZ	510	/01FE
DISK1	690	/02B2
DISKN	960	/03C0

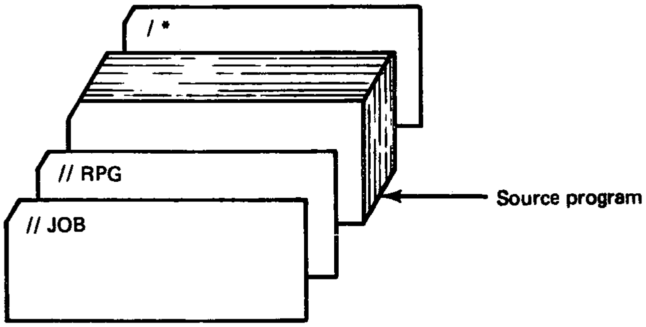
RPG CONTROL CARDS

functions

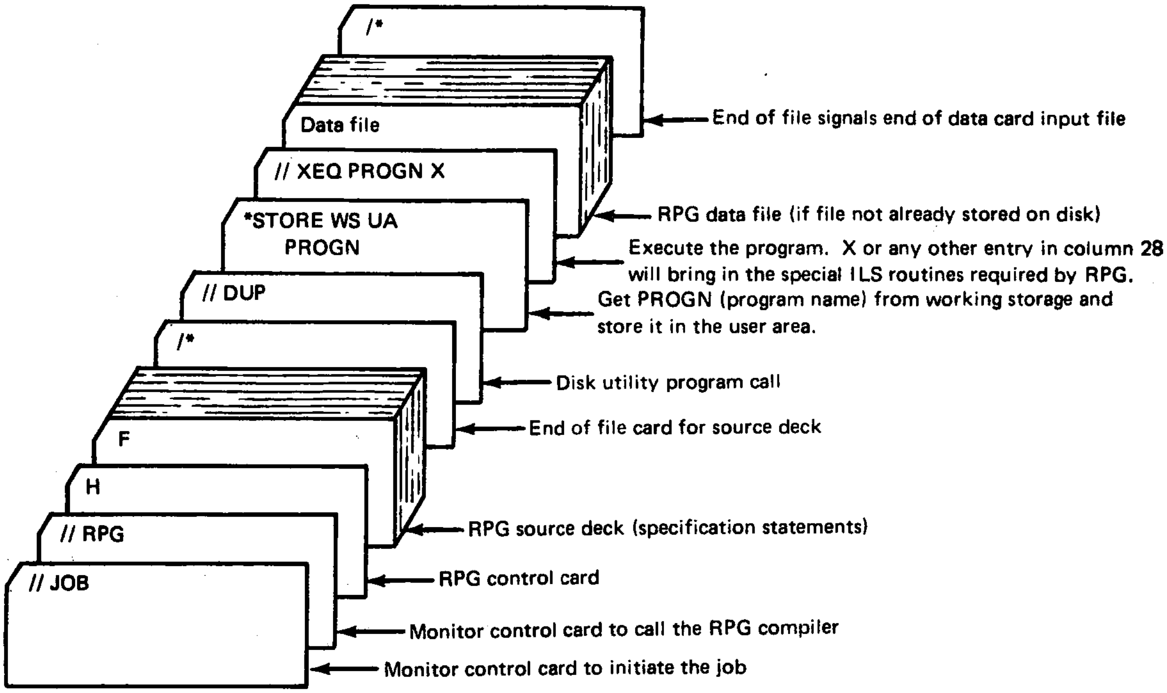
Two RPG control cards specify operations to be performed by the RPG compiler. The first, the RPG control card, acts as a header for the source deck. Information coded in this control card indicates the compiler operations to be performed.

The second control card, the RPG end-of-file control card, is required as the last card of a source program or a data file.

The RPG control cards are placed in the input stream as follows:

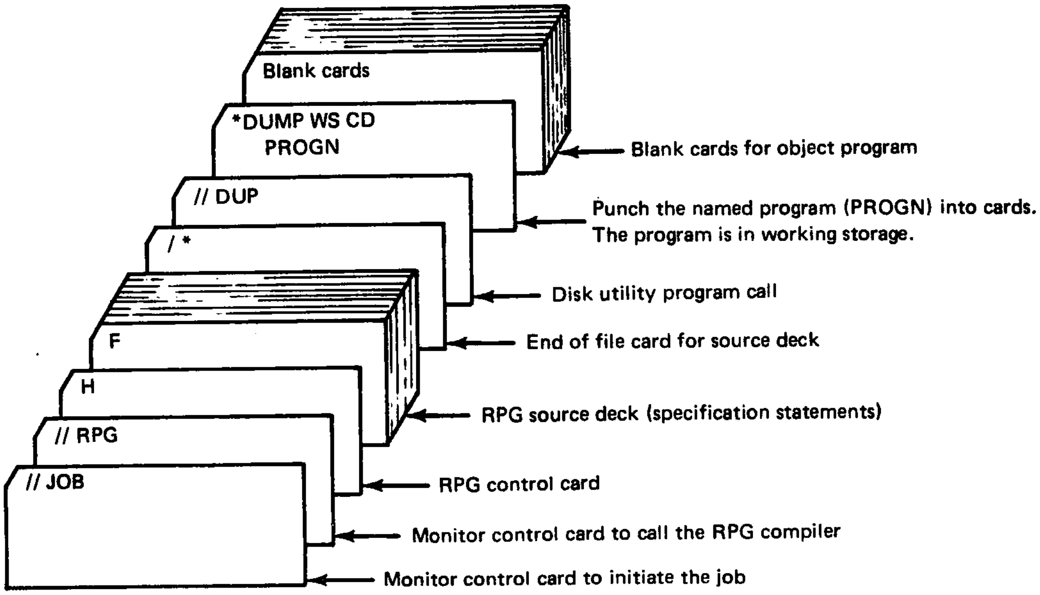


The following illustrates the stacked input required to compile an RPG source program, store the object program in the user area, and execute the object program:

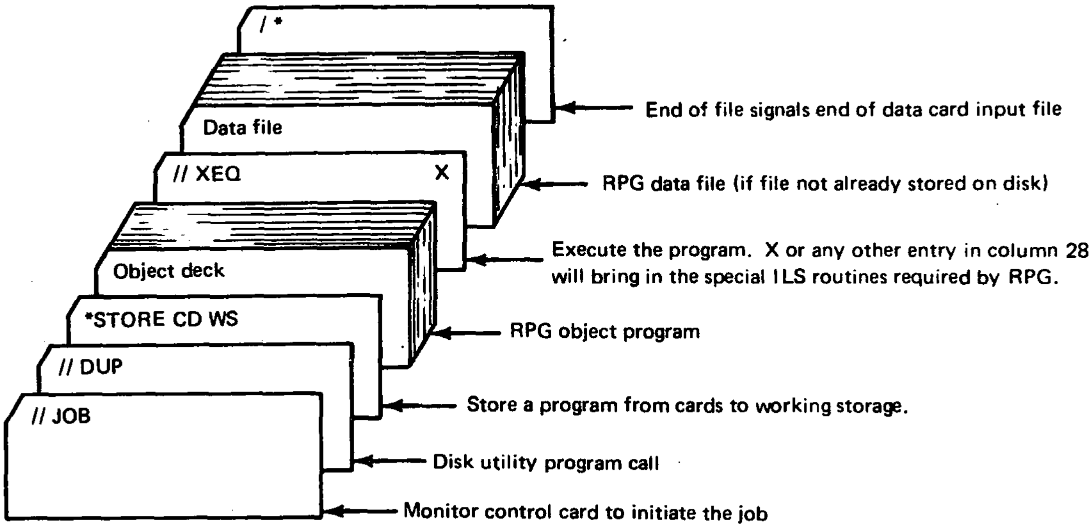

/*
Data file
// XEQ PROGN X
*STORE WS UA
PROGN
// DUP
/*
F
H
// RPG
// JOB
End of file signals end of data card input file
RPG data file (if file not already stored on disk)
Execute the program. X or any other entry in column 28 will bring in the special ILS routines required by RPG.
Get PROGN (program name) from working storage and store it in the user area.
Disk utility program call
End of file card for source deck
RPG source deck (specification statements)
RPG control card
Monitor control card to call the RPG compiler
Monitor control card to initiate the job

If the // DUP and *STORE records are omitted, the program is executed from working storage; however, the program is not available for future execution because it is not saved.

If the program being compiled is not executed often, storing it on cards rather than on disk may be advisable. The following illustrates the stacked input required to compile an RPG program and punch an object deck:


Blank cards
*DUMP WS CD
PROGN
// DUP
/ *
F
H
// RPG
// JOB
Blank cards for object program
Punch the named program (PROGN) into cards. The program is in working storage.
Disk utility program call
End of file card for source deck
RPG source deck (specification statements)
RPG control card
Monitor control card to call the RPG compiler
Monitor control card to initiate the job

Then, the input stacked required to execute the object program from cards is illustrated by:



End of file signals end of data card input file

RPG data file (if file not already stored on disk)

Execute the program. X or any other entry in column 28 will bring in the special ILS routines required by RPG.

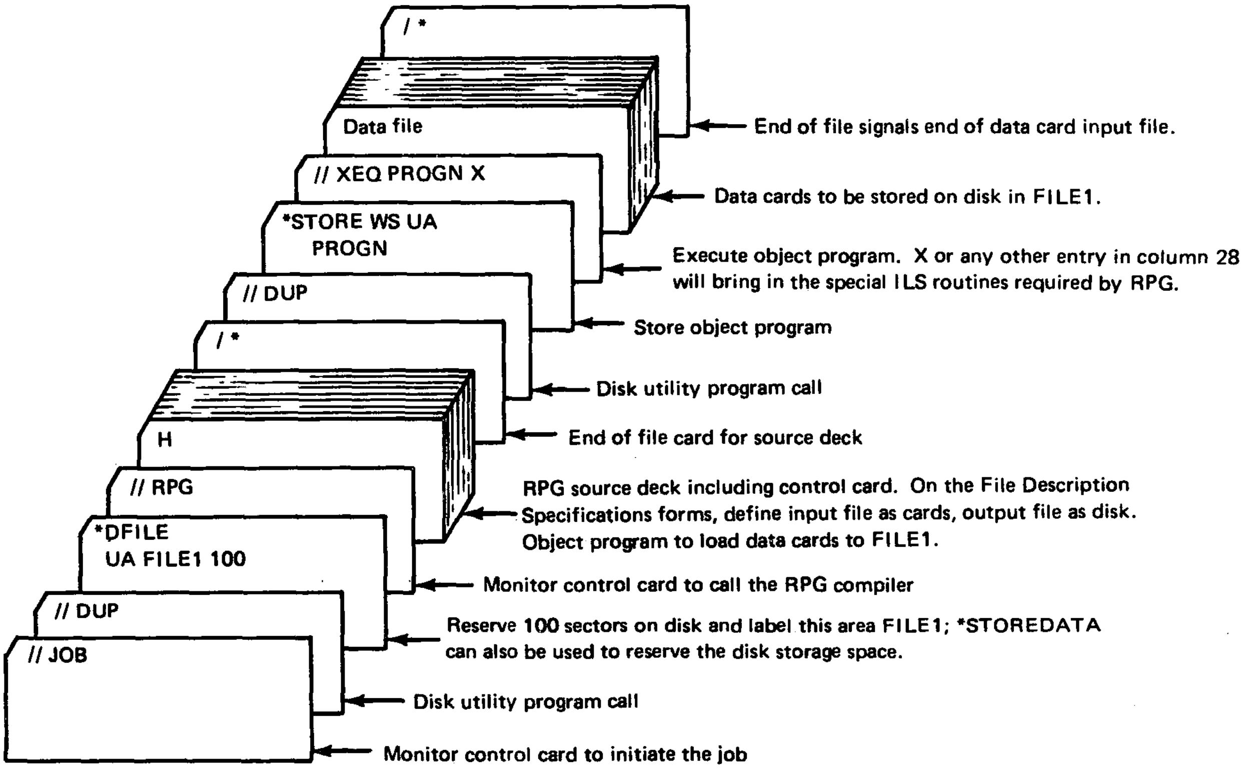
RPG object program

Store a program from cards to working storage.

Disk utility program call

Monitor control card to initiate the job

Most RPG programs require input data during program execution. This data can be on data cards at execution time or can be stored at any time before execution in a predefined data file on disk. The following illustrates how a data file can be built on disk by an RPG program:



End of file signals end of data card input file.

Data cards to be stored on disk in FILE1.

Execute object program. X or any other entry in column 28 will bring in the special ILS routines required by RPG.

Store object program

Disk utility program call

End of file card for source deck

RPG source deck including control card. On the File Description Specifications forms, define input file as cards, output file as disk. Object program to load data cards to FILE1.

Monitor control card to call the RPG compiler

Reserve 100 sectors on disk and label this area FILE1; *STOREDATA can also be used to reserve the disk storage space.

Disk utility program call

Monitor control card to initiate the job

The RPG compiler prints addresses of various routines in the key addresses of object program table. For example, the *close files* routine (located near the end of the mainline program) is included in this table. This routine may require from 2 to 16 additional words (hexadecimal) depending on the type and number of files to be closed. The address of this routine can be helpful when dealing with programs that exceed the available core storage. By adding the number of additional words to the address of the close files routine, the size of the generated mainline program can be determined.

RPG data files may be sequential or indexed-sequential (ISAM). On an ISAM load function, the compiler prints the following information:

- Filename
- Number of sectors required if overflow is not needed
- Number of sectors required if 10 percent overflow is needed

This information can be used to reserve file space for ISAM records. See "Assembler and RPG Disk File Organization and Processing" in Chapter 6 for detailed information about RPG disk data files.

RPG Control Card

general function

This first card of an RPG source program immediately following the RPG monitor control record must be an RPG control card. The information coded in columns 6 and 11 of this card indicate the functions that are to be performed by the RPG compiler. All other entries in the control card are described in the publication *IBM 1130 RPG Language,* GC21-5002.

format

Card column	Contents	Explanation
1 through 5	Described in *IBM 1130 RPG Language*	
6	H	Identifies this card as an RPG control card
7 through 10	Reserved	
11	Blank, B, or D	Blank indicates compilation with a listing of the program. *B* indicates compilation only. *D* indicates a listing only.
12 through 80	Described in *IBM 1130 RPG Language*	

End-of-File Control Card

general function

This control card designates the end of an RPG source program and an RPG data file; therefore, an end-of-file control card must be the last card of an RPG source program and an RPG data file.

format

Card column	Contents	Explanation
1 and 2	/*	
3 through 80	Not used	

Chapter 6. Programming Tips and Techniques

The information in this chapter is planned to help you use the 1130 Disk Monitor System, version 2, more efficiently. The information is presented in the following order:

1. General tips on monitor control and usage
2. Data file processing
3. Tips for the assembler programmer
4. Tips for the FORTRAN programmer
5. RPG object program considerations

TIPS ON MONITOR CONTROL AND USAGE

The tips in this section are of general interest to all programmers of the 1130 DM2 system. These tips include:

- Arranging stacked jobs
- Using temporary job mode
- Using the disk I/O subroutines
- Restoring destroyed cartridges
- Avoiding overprinting
- Using programs and data files more efficiently
- Using LOCALs, NOCALs, and SOCALs
- Using EQUATS
- Reading core maps and file maps
- Reading the transfer vector
- Using SYSUP for changing cartridges during program execution

Stacked Job Input Arrangement

Input to the monitor system includes control records, source programs, object programs, and data that are arranged logically by job. The monitor JOB control record designates the start of a job. You should consider the following when arranging the input for any job:

- Any number of comments (// *) control records can be used before ASM, RPG, FOR, COBOL, DUP, or XEQ monitor control records. Comments control records cannot immediately follow ASM, RPG, FOR, or COBOL control records.

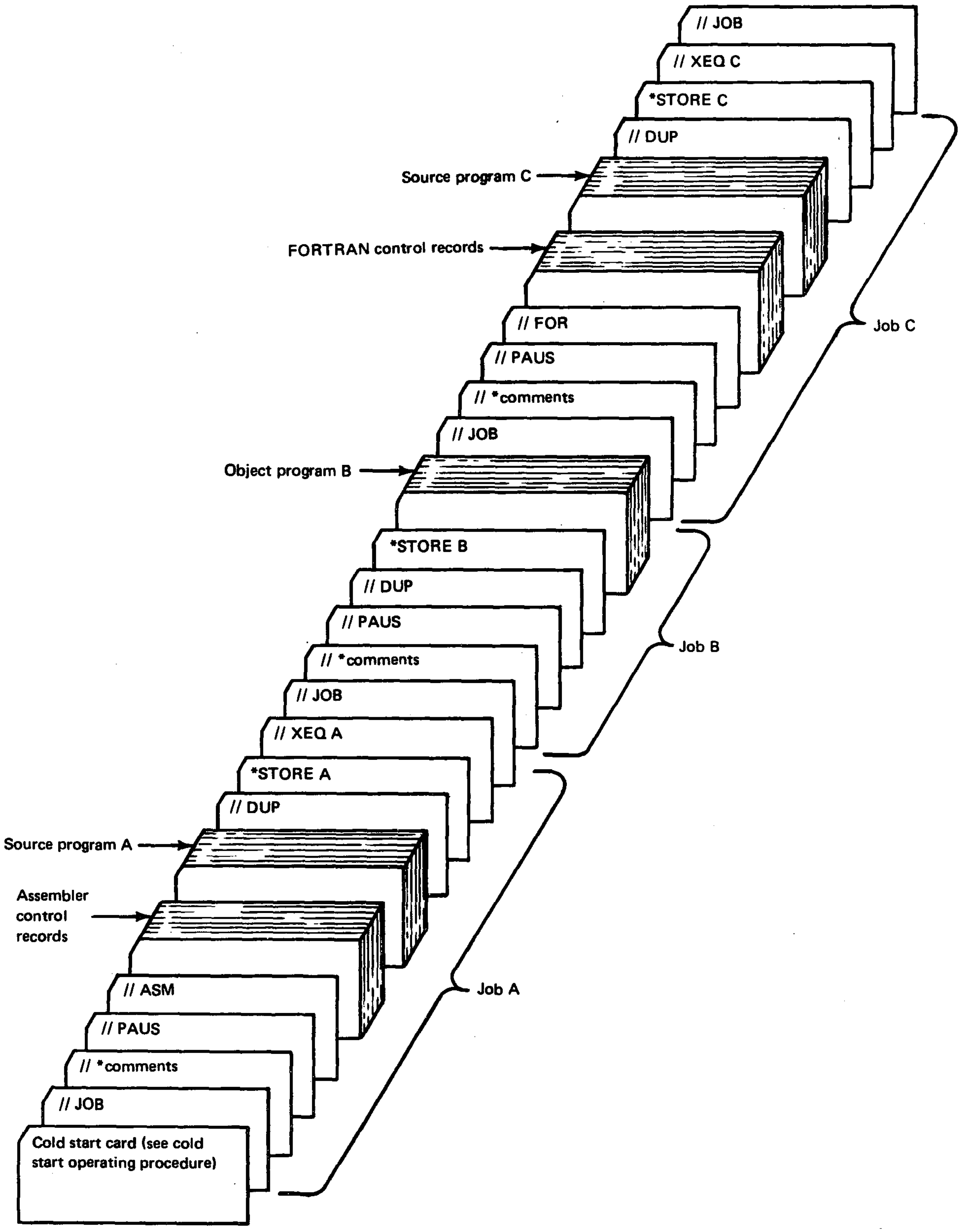
  When an *EQUAT supervisor control record is used after a JOB monitor control record, a comments control record cannot be placed between the JOB record and the EQUAT record. A comments control record cannot be placed between a // DUP control record and the following DUP control record (* . . .).

  When supervisor control records are used after an XEQ or STORECI control record, comments control records cannot be placed between the XEQ or STORECI and the following supervisor control records.

- Any records other than monitor control records that remain after completion of an assembly, compilation, or a subjob (XEQ) are passed until the next monitor control record is read. Also, after a Disk Utility Program (DUP) operation is completed, any records other than monitor control records or other DUP control records are bypassed.

- If an error is detected in an assembly or compilation or during the building of a core load for execution (XEQ), the resulting object program and any program or programs that follow within the current job are not executed. Also, all DUP functions are passed until the next valid ASM, FOR, RPG, or JOB control record is read if an error is detected in an assembly or compilation or during the building of a core load because of a DUP STORECI function.
- If a monitor control record is read by the assembler, by one of the compilers, or during Macro Update Program (MUP) operations, execution of the assembler, compiler, or MUP is ended. The function indicated by the monitor control record is performed.

The following stacked input arrangement assembles or compiles, stores, and executes programs A and C, if source program errors do not occur and if working storage is large enough.


// JOB
// XEQ C
*STORE C
// DUP
Source program C
FORTRAN control records
// FOR
// PAUS
// *comments
// JOB
Job C
Object program B
*STORE B
// DUP
// PAUS
// *comments
// JOB
Job B
// XEQ A
*STORE A
// DUP
Source program A
Assembler control records
// ASM
// PAUS
// *comments
// JOB
Job A
Cold start card (see cold start operating procedure)

If an error occurs in one of the source programs, the DUP *STORE operation is not performed for that program, and all following XEQ requests before the next JOB control records are bypassed. Thus, if the successful completion of one program depends upon the successful completion of the previous one, both programs should be considered as one job and the XEQ control records should not be separated by a JOB record.

How to Use Temporary Job Mode

Temporary job mode (indicated by a T in column 8 of a monitor JOB control record) causes all programs stored in the user area during the temporary job to be deleted automatically when the next JOB control record is processed.

In some cases, the available space in the user area may not be large enough for storage of a newly assembled or compiled program. When this happens, you must use the DUP delete function to clear the user area of old programs, and then store the new program. The necessity for such deletions can be avoided by using temporary mode when running jobs that included programs likely to be replaced at a later time, or that are infrequently used.

Temporary mode is particularly useful when debugging a new program.

Using the Disk I/O Subroutines

All core loads, whether they use disk I/O or not, require one of the 3 disk I/O subroutines. As a minimum, a disk subroutine reads the core load into core and executes CALL EXIT, CALL LINK, CALL DUMP, and/or CALL PDUMP.

uses and how to call

Source programs written in assembler, FORTRAN, RPG, or COBOL can call any of the 3 I/O subroutines; however, only one disk I/O subroutine can be referenced in a given core load. Because of this, all programs and subroutines linked to in a core load must use the same disk I/O subroutine. The subroutine used by a core load is indicated in an XEQ monitor control record or a STORECI DUP control record. (Control records are described in Chapter 5.) Generally, DISKZ is used by FORTRAN, RPG, and COBOL core loads and DISK1 or DISKN by assembler language core loads.

functions

DISKZ is intended for use in an error-free environment, because it does no preoperative error checking. DISKZ is the shortest of the disk subroutines.

DISK1 and DISKN provide more functions than DISKZ. These additional functions include:

- Validity checking of word count and sector addresses
- File protection
- LIBF-type calling sequence
- Validity checking of the function indicator
- Write without readback check option
- Write immediate
- Word count can be on an odd boundary

DISKN provides 2 more functions than those just listed:

- Simultaneous operation of as many as 5 disks
- Faster operation when transferring more than 320 words

More detailed information about the disk I/O subroutines is in the publication *IBM 1130 Subroutine Library,* GC26-5929.

Restoring Destroyed Cartridges

Cartridges containing data and/or programs in the user or fixed area that are difficult to replace can sometimes be restored for use after access to information on the cartridge is destroyed.

use DCIP disk analysis

Use the disk analysis function of the stand-alone utility program DCIP to restore sector addresses if only sector addresses are affected. (DCIP is described in Chapter 9.)

use a system reload

A system reload can be performed if part of the monitor system (except LET, FLET, user and fixed area) is destroyed. Include in the reload the entire monitor system, except the system library.

use DCIP patch

Use the patch function of the stand-alone utility program DCIP to restore individual words that are destroyed on a cartridge.

How to Avoid Overprinting When Using // CPRNT

In order to avoid overprinting when using the monitor CPRNT control record, the FORTRAN programmer should provide for spacing an extra line after the last output statement in a program.

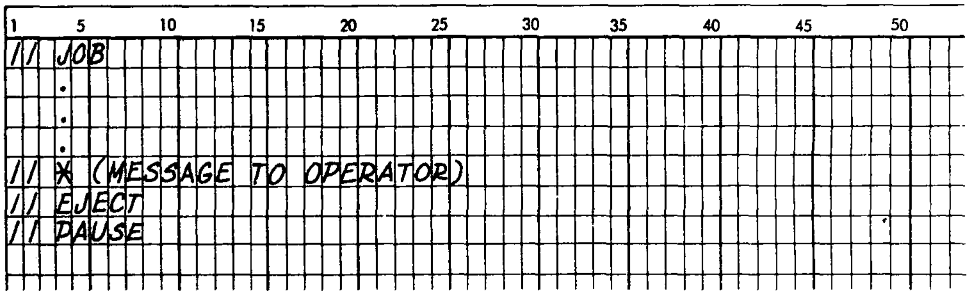
The assembler programmer should provide for spacing after printing following the last output statement in the program.

How to Avoid Overprinting When Linking Between Programs

Overprinting when linking between programs can be avoided by coding your program to space one line before linking to another program. This should be done because the core load builder assumes that a space before printing is not necessary; all monitor programs have a space after print. Overprinting should be avoided because an important core load builder message may not be readable.

Usage of the EJECT Monitor Control Record

An EJECT monitor control record is used during a job to start printing of a new page on the principal printer. For example, comments control records can be placed in a more readable position for the operator if followed by an EJECT control record.

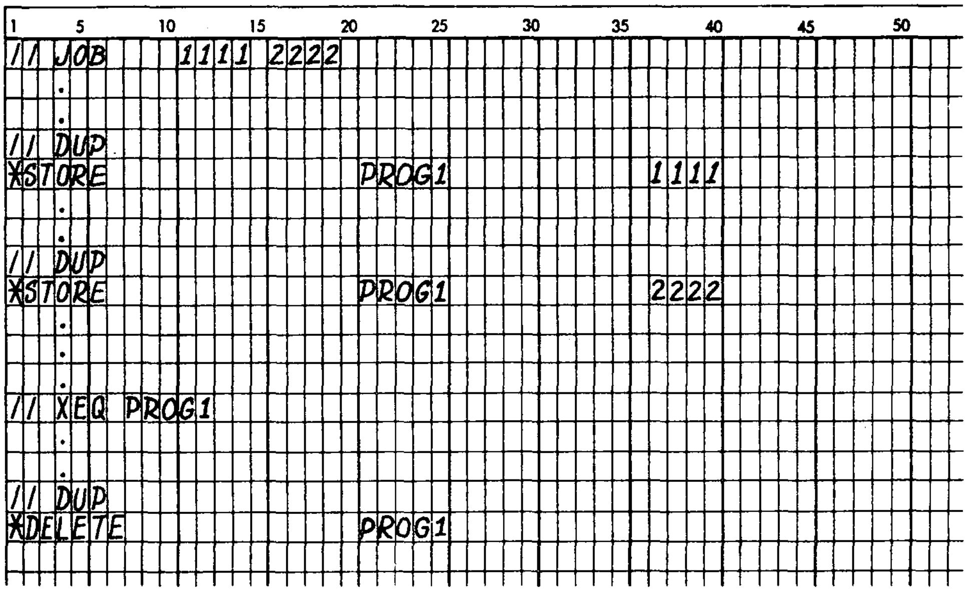

1
5
10
15
20
25
30
35
40
45
50

```
// JOB
   .
   .
   .
// * (MESSAGE TO OPERATOR)
// EJECT
// PAUSE
```

Duplicate Program and Data File Names

Names that are duplicates of IBM-supplied programs should be avoided in DUP store and delete operations. (The names of IBM-supplied programs are in Appendix C.) If a program being stored or deleted has the same name as an IBM program, the results of subsequent operations are not predictable.

Because the DUP store functions check for duplicate names, 2 programs or data files with the same name cannot be stored on one disk. Two programs or data files can, however, have the same name if stored on separate disks. If your system has more than one disk drive, having programs with the same name on more than one disk on the system can cause problems when an attempt is made to execute or delete the named program.



1
5
10
15
20
25
30
35
40
45
50

```
// JOB   1111 2222
   .
   .
// DUP
*STORE             PROG1          1111
   .
   .
// DUP
*STORE             PROG1          2222
   .
   .
   .
// XEQ PROG1
   .
   .
// DUP
*DELETE            PROG1
```

This sequence of control records cause PROG1 on the cartridge labeled 1111 to be executed when you may have wanted PROG1 on 2222 executed. A similar problem can occur in the delete operation. In this example, PROG1 on 1111 is deleted; you may have wanted to delete the program on 2222.

To avoid this problem:

- Assign a unique name to each program and data file.
- If you do not know the contents of a cartridge that is on the system, and the cartridge is not needed for your job, make the drive not ready.

Disadvantages of Storing a Program in DCI Format

Before you decide to convert to and store a program in disk core image (DCI) format, consider the advantages gained in loading time of a DCI program against the following disadvantages.

system maintenance

An important consideration is the effect that system maintenance can have on a DCI program. Subroutines from the IBM-supplied system library that are called by a program are stored with a program in DCI format. If system maintenance changes a subroutine after a DCI program is stored, the subroutine in the system library is changed; however, the copy stored with the DCI program is not. In this case, the DCI program must be deleted and rebuilt (STORECI) after the maintenance modification is made.

size of working storage

If the user or fixed area is expanded after a DCI program is stored, working storage files that are referenced by the DCI program may extend beyond the available working storage during execution. This problem is not recognized until an attempt is made to perform disk I/O operations past the end of the cartridge.

data files not in working storage

Another important consideration concerns DCI programs that reference files that are not placed in working storage during execution. An error occurs if an attempt is made to store in DCI format a program that references a file in the user area, because the location (sector address) of the referenced file may change as a result of program deletions. The DCI program subsequently references such a file by the old sector address. The results are unpredictable.

A similar problem can occur if the DCI program references a file stored in the fixed area, even though the operation is allowed. The file might be deleted and another stored in its place after the DCI program is stored. This problem can be complicated by the fact that not only are sector addresses built into a DCI program, but the logical drive codes are also. In this case, you must make certain that every time the program is executed that all the required disk cartridges are mounted on the same logical drives as when the program was originally stored.

difference in core size

A DCI program can be executed on a system with a configured core size different from the system on which the core load was built, if the size of the core load does not exceed the different core size.

Size Discrepancies in Stored Programs

The disk block count of a program is printed and becomes a part of the LET or FLET entry when the program is stored. When a program is stored from cards to the user or fixed area, the disk block count can be greater than when the same program is stored from working storage. The reason for this discrepancy is that a DSF header is created for each card when a program is stored from cards to disk. Therefore, any 2 headers in the stored file are a maximum of 51 words apart. When the program is stored from working storage, the distance between headers is limited by the disk buffer size, 320 words.

The increased disk block count noted when the program is stored from cards accommodates the expanded size of the file caused by the additional headers.

Dumping and Restoring Data Files

Dumping of important data files to cards is often advisable so that the files can be restored later if the cartridge containing them is destroyed. Use DUMPDATA to dump a file to cards and STOREDATA to store these cards back on disk.

DUMPDATA dumps by *sector* count. For example, the control record:

```
1   5    10   15   20   25   30   35   40   45   50
*DUMPDATA   WS  CD  NAMEF  ØØ3
```

causes 3 sectors to be dumped to 18 cards; 17 cards of 54 words and one card of 42 words. The last 12 words of card 18 do not contain data.

STOREDATA stores by *card* count. To store the cards in this example, the control record:

```
1   5    10   15   20   25   30   35   40   45   50
*STOREDATA  CD  UA  NAMEF  Ø18
```

causes the contents of these 18 cards, excluding the contents of the 12 unused words on card 18, to be stored back in 3 sectors. Note that if you use DUMPDATA to dump to cards, the number of cards (same as the last–highest–sequence number in cc 78–80 of the cards dumped) is the number to enter in the *count* field of the STOREDATA card.

STOREDATA for Cards Not Processed by DUMPDATA

If you use STOREDATA to store cards produced by a function other than DUMPDATA, some of the words in the last card may not be stored. To prevent this, use the following formula (based on the number of cards) to determine the card count to specify in the *count* field of the STOREDATA control record:

1. Use the formula: $\frac{C \times 54}{320} = S$

   where

   C is the actual number of cards; 54 is the number of data words that can be contained in a card; 320 is the number of words that can be contained in a sector, and *S* is the number of sectors required for the file.
2. If this formula produces a remainder that is less than 54 and not zero, add one to the card count to be specified in the STOREDATA control record, and place a blank card at the end of the data deck.

Use of Defined Files

When an *FILES supervisor control record follows a // XEQ monitor control record, the core load builder searches LET and/or FLET for a specified file name. If the name is found, the sector address of the file is inserted in the file table identified by the associated file number specified on the *FILES control record. (A file table is created during program assembly or compilation by the assembler FILE statement or the FORTRAN DEFINE FILE statement, respectively.) If the file name is not found in LET or FLET, the file is defined in working storage.

An *FILES control record after an *STORECI DUP control record is processed in the same way, except that files found in the user area are flagged as invalid.

A suggested way of initially allocating a disk area for a data file in the user area or fixed area is to use the DUP *DFILE function. The number of sectors to be reserved is determined on the basis of the number of records the file is to contain, and the size of each record. Use the following to calculate the number of required sectors for a file:

1. Compute the number (N) of records that can be contained in one sector:

   $$N = \frac{320}{L}$$

   where

   L is the length in words of each record in the file. Disregard the remainder, if any.

2. Compute the number of required sectors (S):

   $$S = \frac{M}{N}$$

   where

   M is the total number of records in the file.
   N is the number of records computed in Step 1.
   Round the answer to the next higher number if the answer has a remainder. This answer is the sector count that you specify in an *DFILE control record to reserve file space in the user area or fixed area.

Mainline Programs that Use All of Core

Before you write a program that occupies all of core storage, consider that extensive rewriting may be required if IBM-supplied subroutines called by the core load are expanded due to modifications.

The Use of LOCALs

A core load that is too large to fit into core for execution can be executed by specifying as LOCALs some of the subroutines called by the core load. Since a core load that utilizes LOCALs does not execute as fast as it does without LOCALs, keep the following in mind when specifying LOCALs:

- Specify infrequently called subroutines as LOCALs.
- Plan your program so as to minimize the number of times that LOCALs are called into core.
- Keep the number of specified LOCALs to a minimum.

Monitor Control
use of LOCALs
use of NOCALs

LOCAL-Calls-a-LOCAL

The assembler language programmer can execute core loads in which a LOCAL calls another LOCAL. Any character punched in column 26 of the XEQ control record causes all DSF core loads for that execution to allow LOCALs to call LOCALs. In a series of LOCAL-call-LOCAL subroutines, you must pass the link word (mainline program return address) in all LOCALs (type 4 or 6 subroutines) that are referenced by CALL statements. The return address must be passed in order to return from the last LOCAL to the place from which the first LOCAL was called. Assembler is the only language that allows the return address to be passed. Therefore, LOCAL-calls-a-LOCAL is restricted to assembler language use.

For a FORTRAN program, the core load builder cannot detect a LOCAL-calls-a-LOCAL condition between FORTRAN format I/O routines and the I/O subroutines that they call. Therefore:

- A FORTRAN format I/O routine and any routine that it calls cannot both be specified as LOCALs in the same core load.
- A user subroutine that contains I/O statements and the FORTRAN I/O routines that are used to execute those statements cannot both be specified as LOCALs in the same core load.

LOCAL and NOCAL Control Record Usage

When using LOCAL and NOCAL control records, keep the following in mind:

- A subroutine cannot be specified as a LOCAL if it calls another subroutine also specified as a LOCAL. For example, if A is a LOCAL subroutine and A calls B and B calls C, neither B nor C can be specified as LOCAL subroutines for the same program. The assembler programmer can avoid this restriction by using the LOCAL-calls-a-LOCAL option discussed in the previous section of this chapter.
- If a subroutine is specified as a LOCAL and SOCALs are employed, the subroutine is made a LOCAL even though it otherwise would have been included in one of the SOCAL overlays.
- If a subroutine is specified as a LOCAL, it is included in the core image program even if it is not called.
- When using LOCAL control records, the total number of mainlines and subroutines specified cannot exceed:

  $$3M + 2S \leqslant 640$$

  where

  M is the total number of mainlines specified in the LOCAL control records.
  S is the total number of subrouitnes specified in the LOCAL control records.

  If execution is from working storage, the mainline program in working storage is counted as one, although it is not specified on a LOCAL record. This restriction also applies to NOCAL control records.
- Only subroutine types 3, 4, 5, and 6 can be named on LOCAL and NOCAL control records. (A description of subprogram types is included in Appendix I.) Subprogram types 3 and 5 are referenced by LIBF statements, and types 4 and 6 with CALL statements. Types 5 and 6 are ISSs; types 3 and 4 are subprograms.
- Conversion tables, such as EBPA and HOLTB, cannot be used as LOCALs. The conversion tables are listed in Appendix C.
- SCAT1, SCAT2, and SCAT3 cannot be used as LOCALs.
- Although a subroutine's instructions or data areas may be altered during execution, later LOCAL/SOCAL reloading may put the subroutine back into its original state.

The Use of NOCALs

NOCALs provide a method of including a subroutine in a core load even though the subroutine is not called. The advantages of NOCALs can be illustrated by the following.

manually executed debug subroutines

You can write debugging subroutines, such as a specialized dump subroutine, and include them in a core load as NOCALs. Then during program execution, you can execute the debugging subroutine by manually branching to its entry point.

If an interrupt service subroutine (ISS) for level 5 is made a NOCAL during a core load, you can execute it by pressing PROGRAM STOP; an interrupt on level 5 is made, and PROGRAM START returns execution to the mainline program. A subroutine to monitor execution of a mainline program or to gather statistical information can be designed.

ISS trace subroutine using NOCAL

The following sample trace subroutine for interrupt level 5, ILS05, determines when the contents of a core location are destroyed by being changed to zero. Location /0500 is used in the example. This subroutine is written and stored as subtype zero in the user area. The sample ISS is assembled as level 5 and stored in the user area. The ISS trace subroutine is specified as a NOCAL when the mainline program is executed; the ISS and associated ILS05 are included as a part of the core load. During a WAIT instruction in the mainline program, the console mode switch is turned to INT RUN to cause a level 5 interrupt after execution of each mainline statement. The trace subroutine is entered and, in this example, waits when core location /0500 becomes zero. A dump of the program can be used to determine the conditions that caused the change to zero.

```
Label       Operation   F T    Operands & Remarks
21    25    27    30   32 33   35    40    45    50    55    60    65    70
***************************************************
*                                                 *
*  EXAMPLE OF ILS SUBROUTINE FOR LEVEL 5          *
*  TO ALLOW TRACING DURING INTERRUPT RUN MODE     *
*                                                 *
***************************************************
      ILS  Ø5
ADDR  DC      /ØØ47
*  ØØ=ENT PT REL TO ISS BEG AND 47=' ISTV+ISS NO
*  CORE LD BLDR PUTS ACTUAL ENT PT OF ISS IN ADDR
INT   DC      *-*
      STD     TEMP      SAVE ACC-EXT
      STS     RETUR     SAVE STATUS
      STX    1 XR1+1     SAVE XR1
      STX    2 XR2+1     SAVE XR2
      BSI  I  ADDR
RETUR LDS     Ø         RESTORE STATUS
      LDD     TEMP      RESTORE ACC-EXT
XR1   LDX  L1 *-*       RESTORE XR1
XR2   LDX  L2 *-*       RESTORE XR2
      BOSC I  INT       EXIT-TURN OFF INT LEVEL
TEMP  BSS  E  2         (ACC-EXT)
      END
***************************************************
*                                                 *
*  EXAMPLE OF ISS TRACE SUBROUTINE                *
*  ENTERED AFTER EACH MAINLINE INSTRUCTION        *
*                                                 *
***************************************************
      ISS  2Ø TRACY     ISS NO. IS 2Ø
TRACY DC      *-*
      LD   L  LOC       SUSPECTED LOCATION
      BSC     +-        TEST AND WAIT FOR OPERATOR
      WAIT               ACTION WHEN FIRST ZERO
      BSC  I  TRACY     RETURN IF STILL NONZERO
LOC   EQU     /Ø5ØØ
      END
```

Note. Provision must be made to test the device status word for the keyboard/console printer if you want to distinguish between level 5 interrupts initiated by the PROGRAM STOP key and interrupts from INT RUN (see *IBM 1130 Functional Characteristics,* GA26-5881).

The Use of SOCALs

restrictions

A subroutine that is included in one SOCAL overlay must not call a subroutine included in another SOCAL overlay or cause another SOCAL overlay to be loaded into core before execution of the current SOCAL is complete. This restriction is required because the IBM-supplied 1130 subroutines that are used in SOCALs are not re-enterable.

Note that disk I/O is used every time a SOCAL is read into core, thus disk I/O is sometimes entered without your direct knowledge.

When the 1627 Plotter is used by a program, the following subroutines must not be in a SOCAL for that program: EADD, FADD, FMPY, EMPY, XMD, XMDS, and FARC. These must instead be incore subroutines. You can accomplish this by:

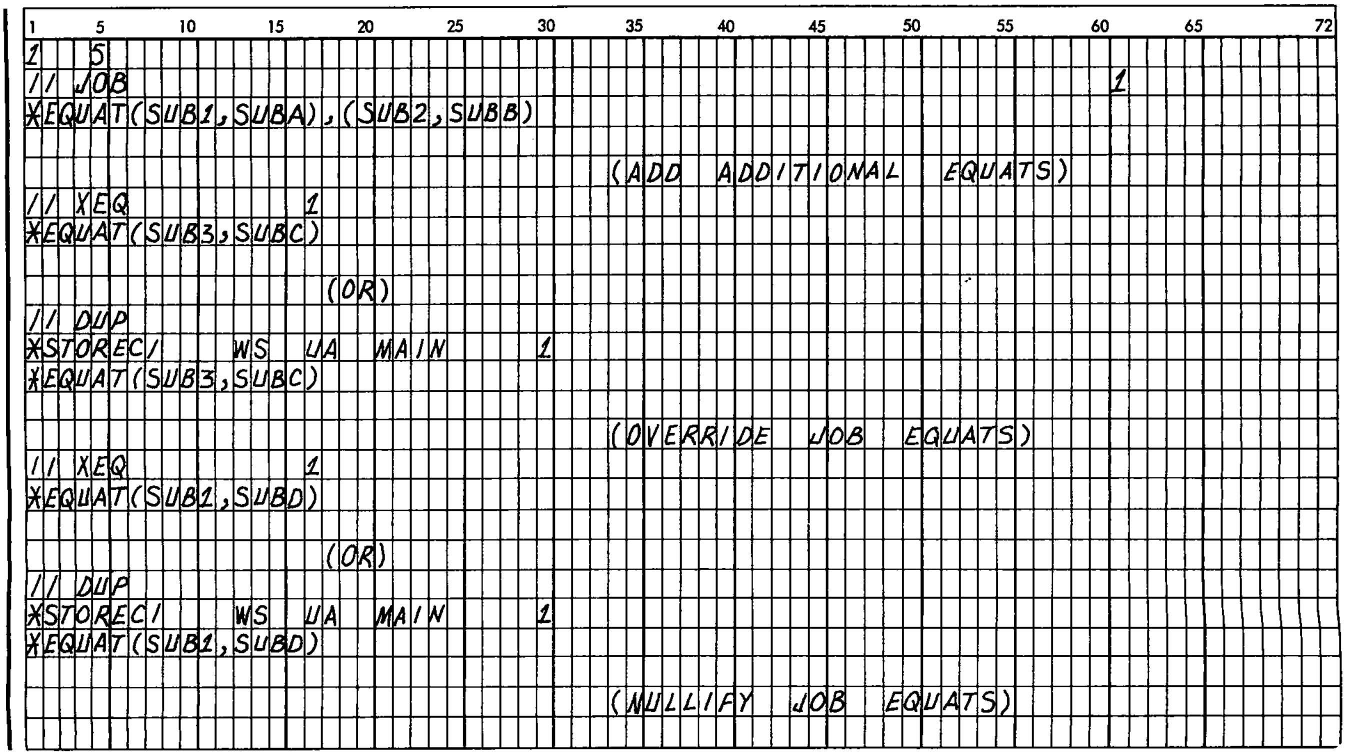
1. Dumping these programs to cards or WS
2. Deleting the programs
3. Storing the programs with subtype zero

decreasing execution time

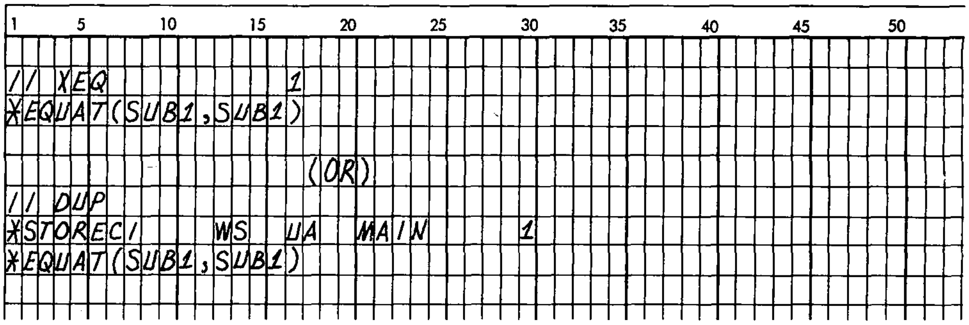
The use of SOCALs increases the length of time for execution of a program. Some of the extra time can be avoided by planning your program so as to minimize the number of times that SOCALs are called into core. Ideally, your program should be written in sections, each employing a single SOCAL; input, computation, and output. Plan input and output carefully so as to separate disk and nondisk operations whenever possible.

The Use of EQUAT

EQUAT records can be applied to both the job and the subjob (XEQ or STORECI). Job EQUAT remain in effect throughout the entire job. Subjob EQUAT remain in effect only for the subjob operation. Subjob EQUAT take precedence over job EQUAT. They can be used to add additional EQUAT, override job EQUAT or nullify job EQUAT as shown in the following examples.



```
1   5    10   15   20   25   30   35   40   45   50   55   60   65     72
1   5
// JOB                                                      1
*EQUAT(SUB1,SUBA),(SUB2,SUBB)
                                (ADD ADDITIONAL EQUATS)
// XEQ         1
*EQUAT(SUB3,SUBC)
                (OR)
// DUP
*STORECI    WS  UA  MAIN     1
*EQUAT(SUB3,SUBC)
                                (OVERRIDE JOB EQUATS)
// XEQ         1
*EQUAT(SUB1,SUBD)
                (OR)
// DUP
*STORECI    WS  UA  MAIN     1
*EQUAT(SUB1,SUBD)
                                (NULLIFY JOB EQUATS)
```



```
// XEQ          1
*EQUAT(SUB1,SUB1)

                 (OR)
// DUP
*STORECI    WS  UA  MAIN     1
*EQUAT(SUB1,SUB1)
```

Reading a Core Map and a File Map

The core maps described in this section are taken from the sample programs supplied with the monitor system. Sample program listings are in Appendix H. These maps include:

- The execution address of the mainline program
- The names and execution addresses of all subroutines in the core load
- The file allocations

The following is the core map from the assembler sample program (program 2):

assembler
core map

```
// XEQ         L
R 41   7908 (HEX) WDS UNUSED BY CORE LOAD
CALL TRANSFER VECTOR
 FSQR    0248
LIBF TRANSFER VECTOR
 FARC    069A
 XMDS    067E
 HOLL    062E
 PRTY    05DE
 EBPA    058E
 FADD    04DD
 FDIV    053C
 FLD     0488
 FADDX   04E3
 FMPYX   049E
 FSTO    046C
 FGETP   0452
 NORM    0428
 TYPEO   0312
 EBPRT   02AC
 IFIX    0280
 FLOAT   0230
SYSTEM SUBROUTINES
 ILS04   00C4
 ILS02   00B3
      01FE (HEX) IS THE EXECUTION ADDR
```

Message R41 (not an error message) indicates that /7908 words of core storage are not occupied by the core load. Only one subroutine (FSQR) is called with a CALL statement, but several subroutines are called with LIBF statements. The ILS02 and ILS04 subroutines are required; however, their addresses indicate that they are a part of the resident monitor and not in the core load. The entry point address to the mainline program is /01FE.

The following is the core map from the FORTRAN sample program run on a 4K system (program 1):

FORTRAN core map on 4K system

```
// XEQ         L  2

*LCCAL,FLCAT,FARC,IFIX,PAUSE,HOLEZ

*FILES(103,FILEA)
FILES ALLCCATICN
  103 02EA  0001  0EDO FILEA
  101 C000  0001  0EDO  02EC
  102 0001  0001  0EDO  02EC
STORAGE ALLOCATION
R 40  03BF (HEX) ACDITIONAL CCRE REQUIRD
R 43  0124 (HEX) ARITH/FUNC SCCAL WD CNT
R 44  06B2 (HEX) FI/O, I/O SOCAL WD CNT
R 45  02B6 (HEX) CISK FI/C SOCAL WD CNT
R 41  0004 (HEX) WDS UNUSED BY CORE LCAD
LIBF TRANSFER VECTOR
 XMCS   09AA SOCAL 1
 EBCTB  0F51 SCCAL 2
 HCLTB  0F15 SCCAL 2
 GETAC  0ED2 SCCAL 2
 NORM   07C0
 FACDX  0955 SCCAL 1
 FSBRX  092C SOCAL 1
 FMPYX  08F8 SCCAL 1
 FDIV   08A6 SOCAL 1
 FSTOX  076C
 FLCX   0788
 SDCOM  0978 SOCAL 3
 SDFX   08E3 SCCAL 3
 SDWRT  0901 SCCAL 3
 SICFX  09A6 SOCAL 2
 SUBSC  07A2
 SICI   09AA SOCAL 2
 SCCMP  0983 SCCAL 2
 SWRT   08A2 SOCAL 2
 SRED   08A7 SCCAL 2
 FSTO   0770
 FLD    078C
 PRNTZ  0DF8 SOCAL 2
 CARDZ  0C48 SCCAL 2
 SFIO   09BF SOCAL 2
 SDFIC  0960 SOCAL 3
 HCLEZ  086A LOCAL
 PAUSE  086A LOCAL
 IFIX   086A LOCAL
 FARC   086A LOCAL
 FLCAT  086A LOCAL
SYSTEM SUBROUTINES
 ILS04  00C4
 ILS02  00B3
 ILS01  0F56
 ILS00  0F6F
 FLIPR  0804
      04C1 (HEX) IS THE EXECUTION ADDR
```

The principal difference between the assembler core map and this FORTRAN core map is that the FORTRAN core map includes a file map.

File 103 is equated to a disk data file named FILEA by the *FILES control record. Under FILES ALLOCATION, file 103 is listed with a beginning sector address of /02EA, is one sector in length, and is stored on a cartridge labeled 0ED0. If file 103 had required more than the 2 sectors available in FILEA, the record count would have been reduced to make the file fit in FILEA, and the file map entry would be:

```
103 /2EA 0002 0ED0 FILEA TRUNCATED
```

Files 101 and 102 are in working storage and are not defined in the *FILES control record. The last entry for each file indicates whether the file is in the user or fixed area, or in working storage. If the file is in the user or fixed area, this entry is the name of the file (FILEA in this case). If the file is in working storage, the last entry for each file is the sector address of working storage.

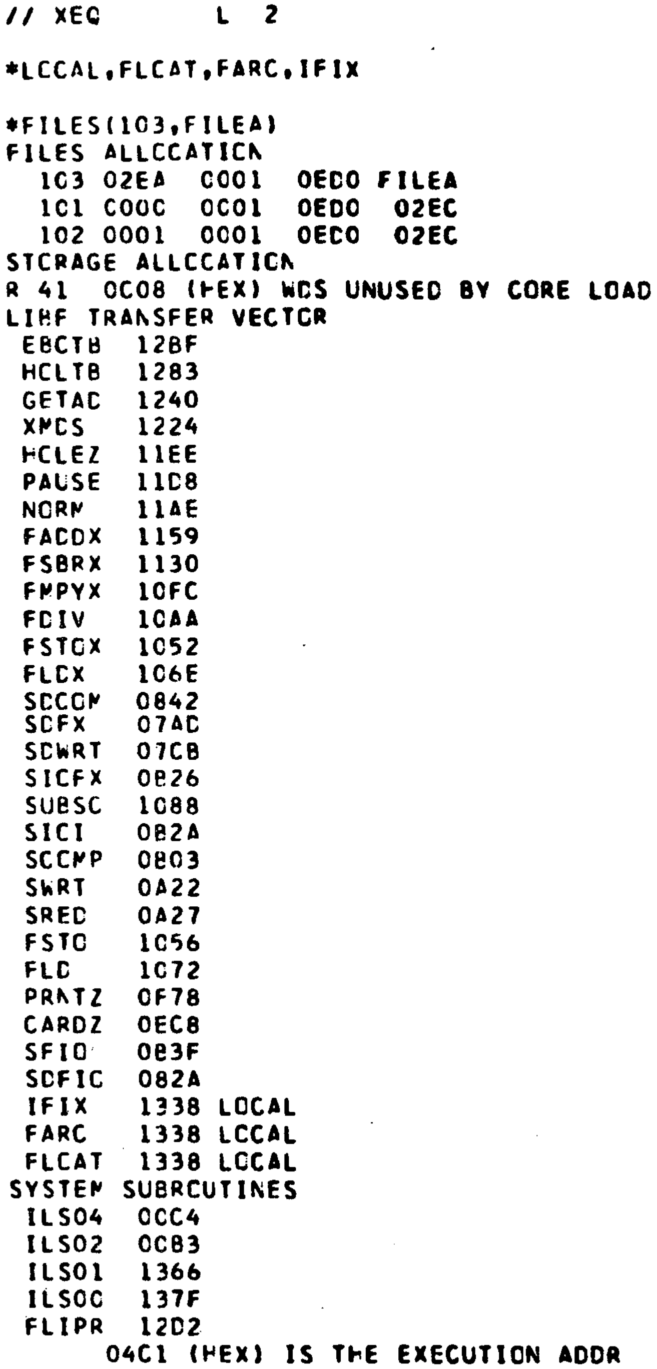
The second entry for each file in the user or fixed area is the absolute sector address of the first sector of the file. For files in working storage, the second entry is the address relative to the first sector of working storage. Thus, the absolute sector address of file 101 is /0000 + /02EC; for file 102, /0001 + /02EC.

Note that this program when run on a 4K system requires both LOCALs and SOCALs. The programmer defines the LOCALs in the *LOCAL control record. These subroutines are identified by the term LOCAL in the core map. The core load builder selects the SOCAL subroutines, and these subroutines are identified by the term SOCAL followed by a SOCAL overlay number in the core map. SOCAL option 2 is used for this program because all 3 SOCAL overlay numbers are used. SOCAL option 1 uses SOCAL overlay 1 and 2 only.

Under STORAGE ALLOCATION, message R40 indicates that the core load exceeds the capacity of core storage before SOCALs are employed by /03BF words. Messages R43, R44, and R45 indicate that SOCALs 1, 2, and 3 require /0124, /06B2, and /02B6 words of core, respectively. This information indicates that since SOCAL 2 is much larger than SOCAL 1, more arithmetic and function subprograms can be called at little extra cost in core. Message R41 indicates that after SOCALs are employed, /0004 words of core are not used by this core load.

The following is the core map from the same FORTRAN sample program (program 1), but run on an 8K system:

FORTRAN core map on 8K system



```
// XEQ        L  2

*LCCAL,FLCAT,FARC,IFIX

*FILES(1C3,FILEA)
FILES ALLCCATICN
  1C3 02EA  C001  0EC0 FILEA
  1C1 C00C  0C01  0ED0  02EC
  102 0001  0001  0EC0  02EC
STCRAGE ALLCCATICN
R 41  0C08 (HEX) WCS UNUSED BY CORE LOAD
LIBF TRANSFER VECTCR
 EBCTB  128F
 HCLTB  1283
 GETAC  1240
 XMCS   1224
 HCLEZ  11EE
 PAUSE  11C8
 NORM   11AE
 FACDX  1159
 FSBRX  1130
 FMPYX  10FC
 FCIV   10AA
 FSTCX  1C52
 FLCX   1C6E
 SCCCM  0842
 SCFX   07AC
 SCWRT  07CB
 SICFX  0B26
 SUBSC  1C88
 SICI   0B2A
 SCCMP  0B03
 SWRT   0A22
 SREC   0A27
 FSTC   1C56
 FLC    1C72
 PRNTZ  0F78
 CARDZ  0EC8
 SFIO   0B3F
 SCFIC  082A
 IFIX   1338 LOCAL
 FARC   1338 LCCAL
 FLCAT  1338 LCCAL
SYSTEM SUBRCUTINES
 ILS04  0CC4
 ILS02  0C83
 ILS01  1366
 ILS0C  137F
 FLIPR  12D2
      04C1 (HEX) IS THE EXECUTION ADDR
```

Note that fewer LOCALs are specified, and that SOCALs are not necessary; the entire program can be contained in 8K core.

The following is the core map from the RPG sample program (problem 3):

RPG core map

```
// XEQ       L             R
R 41  6D16 (HEX) WDS UNUSED BY CORE LOAD
CALL TRANSFER VECTOR
 RGERR  0C24
 HLEBC  0A1A
LIBF TRANSFER VECTOR
 RGSI5  11E4
 RGBLK  11AA
 RGEDT  105A
 RGMV2  0FA6
 RGADD  0DDD
 RGSI1  0D80
 RGMV5  0C72
 RGMV3  0D50
 RGCMP  0CFE
 RGMV1  0C6A
 PRNT1  0A9A
 ZIPCO  097A
 CARDO  087C
SYSTEM SUBROUTINES
 ILSX4  1249
 ILSX2  126D
 ILSX1  1286
 ILSX0  12A3
      020F (HEX) IS THE EXECUTION ADDR
```

The information in the RPG core map that is different from the assembler or FORTRAN core maps is that the special ILS subroutines (named with an X, as ILSX4) are used. The special ILS subroutines are required by RPG and are called when any character is punched in column 28 of the // XEQ control record.

Locating FORTRAN Allocation Addresses

Variable, constant, and statement allocation addresses are relative to the loading address of a FORTRAN program if an *ORIGIN control record is not used. The loading address (origin) is determined by adding decimal 30 to the next higher addressed word above the end of the disk I/O subroutine used by the core load. The following chart lists the lowest possible origins, depending on the disk I/O subroutine in core:

Disk I/O subroutine in core	Core load origin	
	Decimal	Hexadecimal
DISKZ	510	/01FE
DISK1	690	/02B2
DISKN	960	/03C0

The absolute addresses of variables, constants, and statements are found by adding their allocation addresses (obtained from a listing) to the loading address.

If an *ORIGIN control record is used, you designate the loading address (not lower than the addresses in the previous chart). In this case, the allocation addresses printed in a listing are absolute addresses.

The variable allocations that follow are taken from the FORTRAN sample program (program 1) in Appendix H.

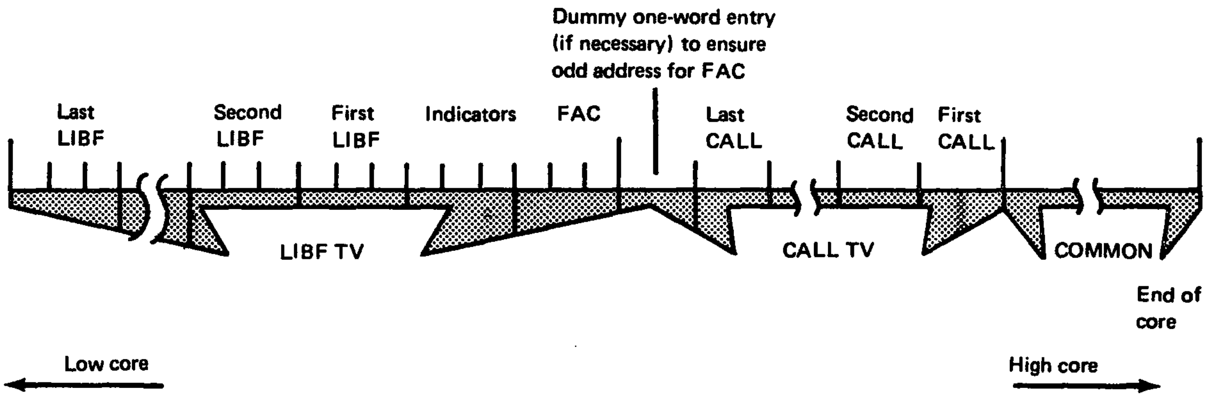
```
VARIABLE ALLOCATICNS
     A(R )=00DC-0016          X(R )=00F0-000E          B(R )=01EC-00F2
    V3(I )=01F2               M(I )=01F3               L(I )=01F4
    L2(I )=01F8              N1(I )=01F9              N (I )=01FA
     K(I )=01FE              IK(I )=01FF              I1(I )=02C0
     D(R )=01EE              V1(I )=01F0              V2(I )=01F1
    M1(I )=01F5              M2(I )=01F6              L1(I )=01F7
     N(I )=01FB               I(I )=01FC               J(I )=01FD
```

The real variable array A is allocated between the loading address + /00DC and the loading address + /0016. Constant and statement allocations are calculated in a similar manner. Notice that the 100-element array A requires 200 core locations (2 words per element). Because all FORTRAN arrays are allocated in reverse order, A (1) is assigned the two relative addresses /00DC and /00DD, A (2) begins at /00DA, and A (3) begins at /00D8.

The relocation factor (the actual core address of the first word) of a FORTRAN subprogram is obtained by subtracting the relative entry point address (from the subprogram compilation listing) from the actual entry point address (in the core map).

Reading the Transfer Vector

The contents of the transfer vector are determined from a core dump by starting at the high end of core and marking off words backwards as illustrated by the following:



Use the following steps to locate contents of the transfer vector:

1. Mark off the number of words in COMMON, if any. For a FORTRAN program, the word count of COMMON is obtained from a program listing. For an assembler program, the word count of COMMON is as you specified in an *COMMON assembler control record.
2. Mark off one word for each CALL-type subroutine, if any. Each word is filled, during building of a core load, with the entry point address of the called subroutine. The subroutines called by a program are listed in a core map and file map.
3. If the last CALL entry is an odd address, mark off an extra word to ensure an odd address beginning for the FAC (real number pseudo accumulator).
4. Mark off the next 3 words for the FAC, which is always present in the transfer vector.
5. Mark off the next 3 words for the indicators. These indicators are always present and are used by various subroutines to indicate overflow, underflow, and divide check.
6. Mark off 3 words for each LIBF-type subroutine. Word one (with the lowest address) contains the return address address. Word 2 always contains /4C00, and word 3 contains the entry point address of the called subroutine. The subroutines called by LIBFs in a program are listed in a core map.

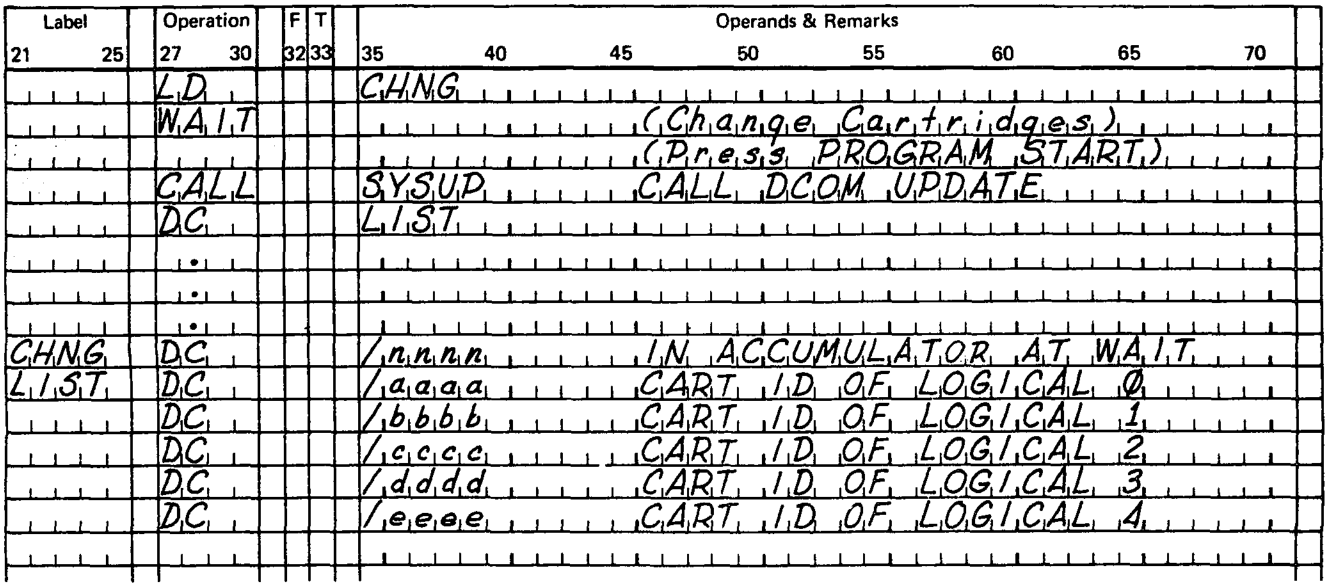
Note. Transfer vector entries contain entry point addresses to special LOCAL/SOCAL linkage if the called subroutines are designated as LOCALs or SOCALs (see "Construction of a Core Load" in Chapter 3).

SYSUP

The system update (SYSUP) mainline program in the system library allows you to change disk cartridges during the processing of a job. SYSUP *must be* called when cartridges are changed. Code your program to call SYSUP immediately after mounting the new cartridges.

This program updates DCOM on the master cartridge (logical drive 0) with the IDs and DCOM information from all satellite cartridges mounted on the system and that are specified in the special SYSUP calling sequence.

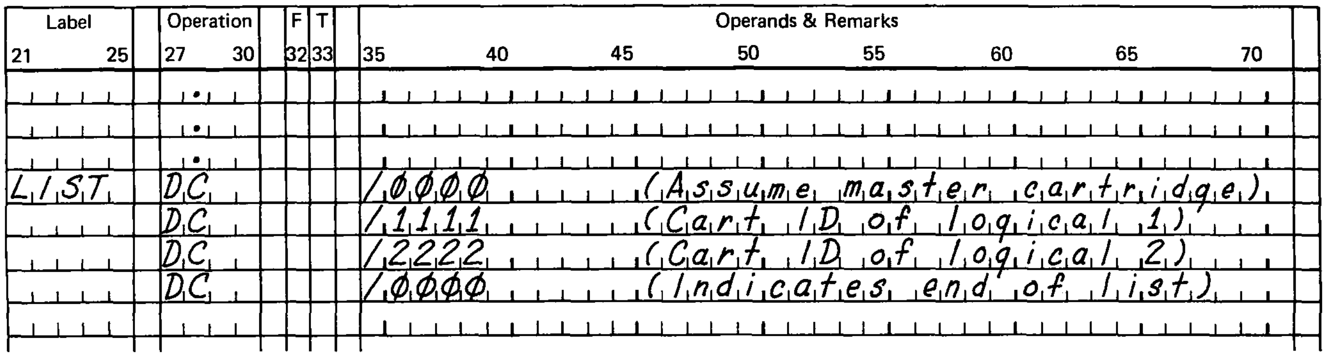
The following is an example of the assembler language SYSUP calling sequence:



```
Label     Operation  F  T   Operands & Remarks
21    25  27    30  32 33   35   40    45    50    55    60    65    70
          LD                CHNG
          WAIT                        (Change Cartridges)
                                      (Press PROGRAM START)
          CALL              SYSUP     CALL DCOM UPDATE
          DC                LIST
           .
           .
           .
CHNG      DC                /nnnn     IN ACCUMULATOR AT WAIT
LIST      DC                /aaaa     CART ID OF LOGICAL Ø
          DC                /bbbb     CART ID OF LOGICAL 1
          DC                /cccc     CART ID OF LOGICAL 2
          DC                /dddd     CART ID OF LOGICAL 3
          DC                /eeee     CART ID OF LOGICAL 4
```

Continuation of the job must be delayed until any newly mounted cartridges are ready. The assembler WAIT statement and the FORTRAN PAUSE statement provide the necessary delay.

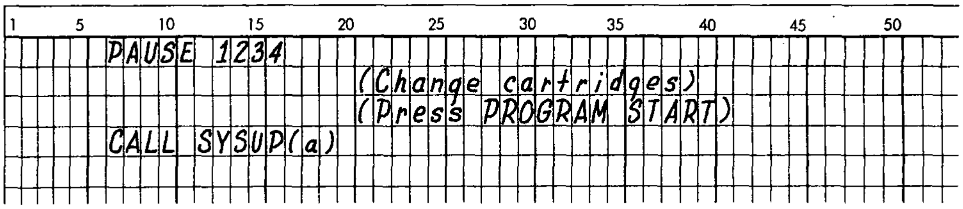
The IDs of the cartridges being used must be specified. If zero is specified for the master cartridge (logical drive 0), the master cartridge for the current job is assumed. When less than 5 cartridges are used, specify the IDs for the cartridges to be used and an ID of zero to indicate to SYSUP that all cartridges have been specified. If, for example, 3 cartridges are used for a SYSUP operation, the cartridge ID list is coded as follows:



```
Label       Operation   F  T   Operands & Remarks
21    25    27    30   32 33   35   40   45   50   55   60   65   70

             .
             .
             .
LIST         DC                /0000          (Assume master cartridge)
             DC                /1111          (Cart ID of logical 1)
             DC                /2222          (Cart ID of logical 2)
             DC                /0000          (Indicates end of list)
```

The FORTRAN calling sequence for SYSUP is:



```
1   5    10   15   20   25   30   35   40   45   50
      PAUSE 1234
                    (Change cartridges)
                    (Press PROGRAM START)
      CALL SYSUP(a)
```

where

a indicates the last item in an array that contains the IDs of the cartridges being used for the SYSUP operation. For example:

CALL SYSUP (K(5))

K is a one-word integer array. Because FORTRAN arrays are stored in reverse order, the first item read by SYSUP is the last item K(5) stored in the array. Thus, K(5) is the entry for logical drive 0, the master cartridge. This item in the array can contain zero, in which case, the master cartridge defined for the current job is assumed.

The array cannot be longer than 5 words, but it can be shorter. If less than 5 words are used, the first item K(1) placed in the array must be zero to indicate to SYSUP that all cartridges have been specified. For example, a 3-cartridge FORTRAN array is specified as (K(4)) with K(1) containing zero.

After execution of SYSUP is completed, a list of the cartridges is printed. Error messages printed during SYSUP operation are included in Appendix A.

Note. The entry in the array must be the decimal equivalent of the cartridge ID in hexadecimal.

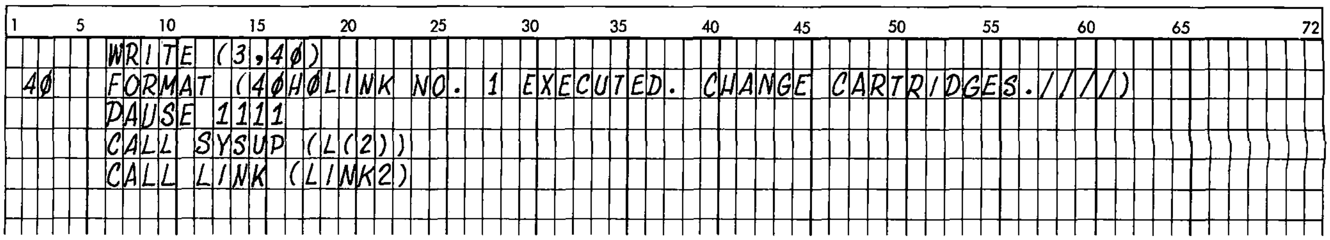
Reeling

Reeling is the process of continuing a long data file from one cartridge to other cartridges and is done with SYSUP and program linking. This operation might be performed as follows.

on a single drive system

Suppose your system has only one disk drive, the internal disk in an 1131 CPU, and you want to sequentially process a long data file that does not fit on one cartridge. The first part of the file can be defined on one cartridge and the second part on another. The program that accesses this file can be written as 2 parts and linked together. The first part processes the first part of the data file, and the second part of the program processes the rest of the data file.

Assume the program is written in FORTRAN, and the termination of the first link consists of a PAUSE (to allow for mounting the second cartridge in place of the first), followed by CALL SYSUP and CALL LINK to the second part of the program. When SYSUP is called, DCOM and COMMA are updated on the second cartridge.


1
5
10
15
20
25
30
35
40
45
50
55
60
65
72

```
      WRITE (3,4Ø)
 4Ø   FORMAT (4ØHØLINK NO. 1 EXECUTED. CHANGE CARTRIDGES.////)
      PAUSE 1111
      CALL SYSUP (L(2))
      CALL LINK (LINK2)
```

The only constraint is that the second cartridge must be a system cartridge. If the FORTRAN compiler is not on the second cartridge, the second part of the program can be compiled on the first cartridge, dumped to cards, and stored on the second cartridge. Sample program 5 in Appendix H illustrates how this is accomplished. For this sample program, both cartridges are system cartridges, both contain a fixed area, but only cartridge 0ED0 includes the FORTRAN compiler. The second part of the program (LINK2) is compiled on the first cartridge, dumped to cards, and stored on cartridge 0ED4 that contains the second part of the data file.

One-word integers are specified for both parts of the program. Thus, the 2-word array referenced in LINK1 contains a zero in L(1), and the second cartridge ID in L(2). Because FORTRAN arrays are stored in reverse order, SYSUP first reads L(2) that identifies the new cartridge on the system and L(1) that indicates no more cartridges.

Another method of using SYSUP that is suitable to any FORTRAN precision is to call an assembler language subroutine, with undefined precision, that calls SYSUP.

on a multidrive system

Sample program 6 in Appendix H illustrates sequential file processing with 2 cartridges and 2 disk drives. If your system has more than one disk drive, you can avoid the SYSUP *and* CALL LINK sequence of sample program 5 by naming both cartridges on the // JOB control record. As in the description of program 5, you must write your program to process the 2 portions of the data file separately, even though they may have the same name. In the case of duplicate names, the *FILES control record can name the 2 files, both with the same name but with different cartridge IDs.

All files referenced in a given core load must be stored in the user or fixed area when the core load is built. This applies to *FILES references and assembler DSA statements alike. If you desire to, you can divide your program into links, each with its own associated file.

reeling in general

If sufficient drives are not simultaneously available for all cartridges involved to be specified, a reeling method must be used. Any cartridge that contains a data file that is named in an *FILES control record must be on the system at the time the *FILES control record is processed after either a // XEQ or *STORECI control record. Similarly, a DCI program that accesses files in a fixed area must be executed with the same cartridges on the same drives as when the program was built.

For example, if sample program 5 in Appendix H is stored in DCI format with cartridge 0ED0 on logical drive 0 and cartridge 0ED4 on logical drive 1, these cartridges must be on the same logical drives each time the program is executed.

These requirements are due to the fact that the core load builder assigns absolute sector addresses, including logical drive codes, for files in the user or fixed area as a core load is built.

DATA FILE PROCESSING

This section describes disk data file organization and processing as follows:

- FORTRAN formatted and unformatted I/O
- Assembler and RPG sequential and indexed sequential access method (ISAM) files

File organization includes defining the required disk space for a new file, and how data is placed in the file. File processing includes how information in files is used and modified.

FORTRAN Disk File Organization and Processing

The FORTRAN READ and WRITE statements call disk I/O subroutines to access disk data files. The disk files are organized sequentially like magnetic tape files, except that random access is possible. This analogy to magnetic tape files is helpful in understanding the processing of the file records. Data conversion is not possible with FORTRAN I/O. The terms formatted and unformatted refer only to the organization of records within files.

The logical unit numbers and maximum record sizes that are used in FORTRAN READ and WRITE statements are listed in Figure 6-1. Avoid the use of the actual logical unit numbers in READ and WRITE statements; the use of integer variables provides for easier program modification.

Logical unit number	Device	Kind of transmission	Record size allowed
1	Console Printer	Output only	120
2	1442 Card Read/ Punch	Input/output	80
3	1132 Printer	Output only	1 carriage control + 120
4	1134/1055 Paper Tape Reader Punch	Input/output	120, plus max. of 80 case shifts for PTTC/8 code, plus NL code
5	1403 Printer	Output only	1 carriage control + 120
6	Keyboard	Input only	80
7	1627 Plotter	Output only	120
8	2501 Card Reader	Input only	80
9	1442 Card Punch	Output only	80
10	UDISK	Unformatted input/output without data conversion	320*

*Unformatted disk I/O comprises 320 word records (including a 2-word header). The first word of the header must contain the count of the physical record within the logical record (see example following). The second word of the header must contain the number of effactive words in the individual physical record. The second word of the header of the last physical record within a logical record must have the sign bit (-) on. Unformatted disk characters are stored in as they appear in core storage.

Example:

```
DIMENSION A (400)      800 words
WRITE (10) A
```

Physical records (maximum record length 320 words due to disk sector size)

Logical record (total number of words to be written)

1	318	DATA WORDS
2	318	DATA WORDS
3	-164	DATA WORDS

164 and sign bit (/80A4). *Not* /FF5C.

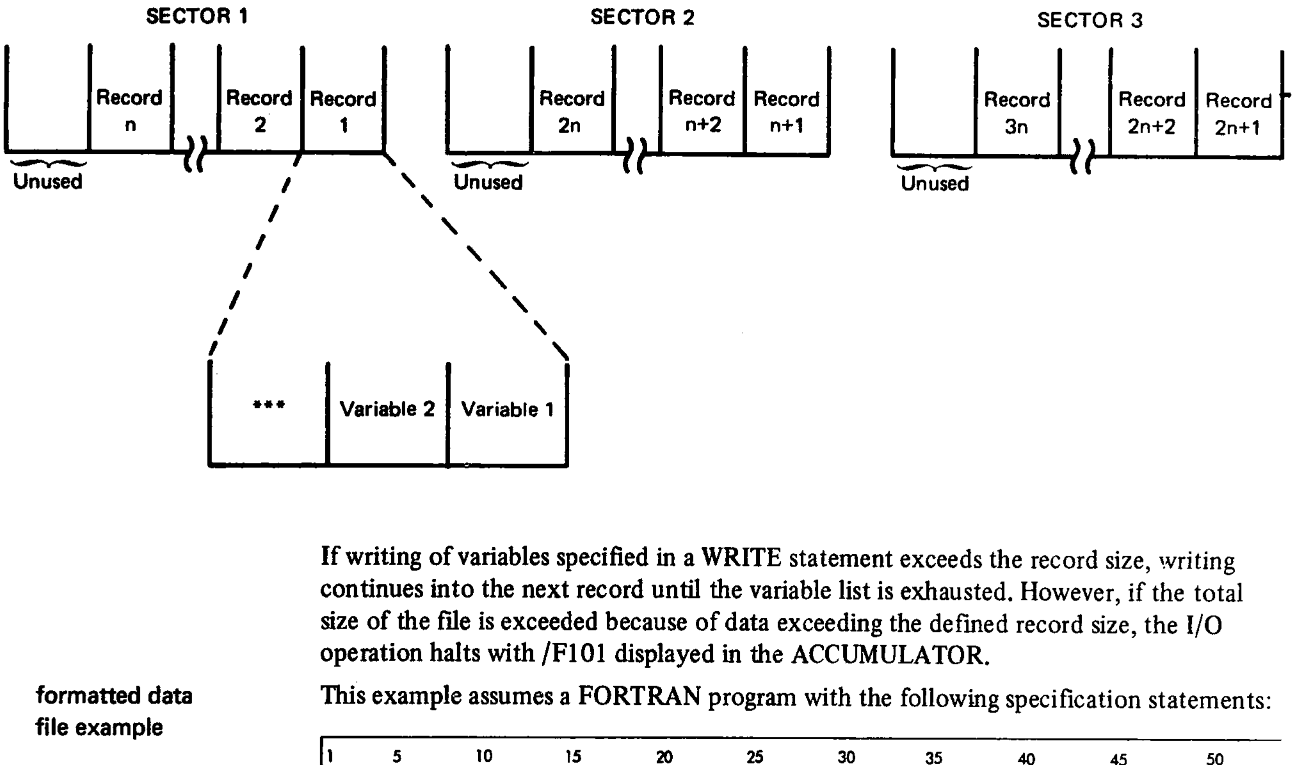
An end-of-file record occupies one sector. Word one of the header must be 1 and word two must be a negative zero (/8000).

Figure 6-1. FORTRAN I/O logical units and record sizes

Formatted FORTRAN I/O Statements

A formatted disk file is created by a FORTRAN DEFINE FILE statement. The file is assigned to working storage unless the file number is equated to an existing file in the user area or fixed area by an *FILES supervisor control record (see "Use of Defined Files" in this chapter). The DEFINE FILE statement specifies the number of records in the file and the record length. In analogous magnetic tape terminology, a formatted file contains fixed length records with a maximum record length of 320 words.

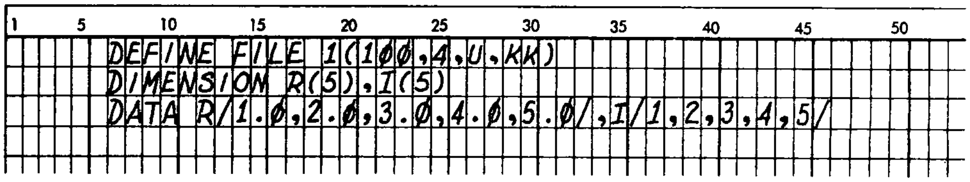
File records are written backwards in the physical sectors; the first record begins at the end of the first sector. Records are filled backwards, with an exact core image of each variable written adjacent to the previously written record. The following illustrates how sectors and records are filled.



If writing of variables specified in a WRITE statement exceeds the record size, writing continues into the next record until the variable list is exhausted. However, if the total size of the file is exceeded because of data exceeding the defined record size, the I/O operation halts with /F101 displayed in the ACCUMULATOR.

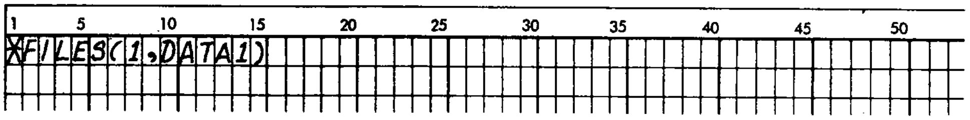
formatted data file example

This example assumes a FORTRAN program with the following specification statements:



```
1   5    10   15   20   25   30   35   40   45   50
      DEFINE FILE 1(1ØØ,4,U,KK)
      DIMENSION R(5),I(5)
      DATA R/1.Ø,2.Ø,3.Ø,4.Ø,5.Ø/,I/1,2,3,4,5/
```

For this example, file 1 is equated to a 2-sector file named DATA1 (in the user area or fixed are) by the following *FILES control record:



```
1   5    10   15   20   25   30   35   40   45   50
*FILES(1,DATA1)
```

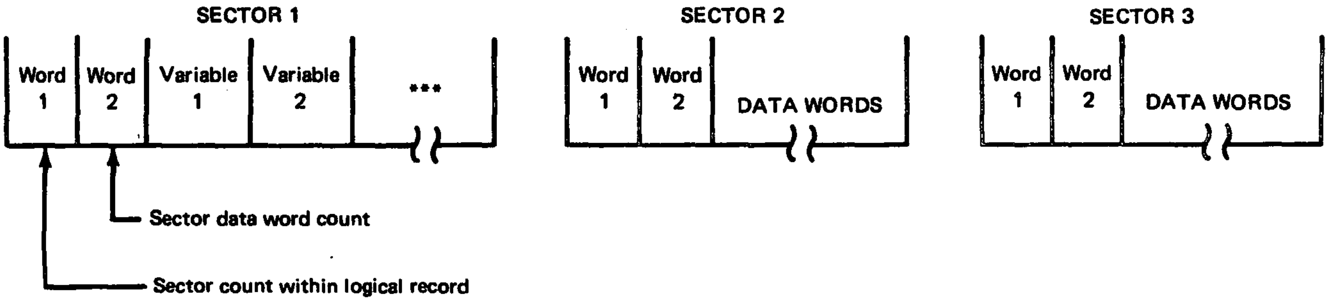
The following shows the contents of the first 2 records of DATA1 after each of the WRITE statements under"I/O executed" is executed. (Assume that the words of DATA1 contained FFFF before execution. XXXX entries indicate unreferenced FORTRAN fill words.)

Precision specified	I/O statements executed	Record 2 of DATA1	Record 1 of DATA1
*ONE WORD INTEGERS	DO 5 J = 1,2 5 WRITE (1'J)I(J)	FFFF FFFF FFFF 0002	FFFF FFFF FFFF 0001
*ONE WORD INTEGERS	DO 5 J = 1,2 5 WRITE (1'J)I(J),R(J),I(J)	0002 4000 0082 0002	0001 4000 0081 0001
*ONE WORD INTEGERS	WRITE (1'1)(I(J),J=1,5)	FFFF FFFF FFFF 0005	0004 0003 0002 0001
None	DO 5 J = 1,2 5 WRITE (1'J)I(J)	FFFF FFFF 0002 XXXX	FFFF FFFF 0001 XXXX
*EXTENDED PRECISION	DO 5 J = 1,2 5 WRITE (1'J)I(J)	FFFF 0002 XXXX XXXX	FFFF 0001 XXXX XXXX
*EXTENDED PRECISION	DO 5 J = 1,2 5 WRITE (1'J)R(J)	FFFF 0082 4000 0000	FFFF 0081 4000 0000
*EXTENDED PRECISION *ONE WORD INTEGERS	WRITE (1'1)I(1),R(1),I(2)	FFFF FFFF FFFF 0002	0081 4000 0000 0001

Unformatted FORTRAN I/O Statements

FORTRAN I/O subroutines can be used for unformatted disk I/O; an analogy to magnetic tape files is that unformatted files contain variable length records. A data file for unformatted I/O must be named $$$$$ and can reside in either the user area or fixed area (see "Initializing $$$$$ Data Files for Use With FORTRAN Unformatted I/O" in this chapter).

The logical record length is determined by the size or the object code of the I/O-statement variable list and is limited only by the total file size. If the length of a record exceeds 318 words, it is segmented to fit into consecutive sectors. Every sector begins with a 2-word header. Word 1 contains the relative sector number within that logical record, and word 2 is the count of the data words following the header. The following illustrates how unformatted sectors are filled:



The last sector of a logical record has a sign bit set in the second word of the header. The remaining words of the last sector are not used. Therefore, an unformatted WRITE statement containing a single one-word integer variable uses only three words of each sector; the 2-word header and the data word.

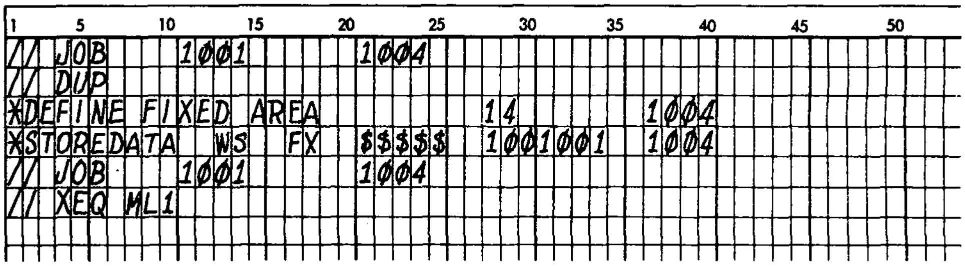
The FORTRAN I/O statements BACKSPACE, REWIND, and END FILE statements are used only with unformatted disk files. These statements provide a further simulation of magnetic tape file processing, and position the I/O pointer to the correct logical record within a file.

Initializing $$$$$ Data Files for Use With FORTRAN Unformatted I/O

You must define in the user area or fixed area a data file with the name $$$$$ prior to executing a FORTRAN mainline program or subroutine that uses unformatted I/O. One file can be defined on each cartridge; however, only one $$$$$ file can be referenced in any one job.

The following example shows the control records for defining a $$$$$ file on a satellite cartridge and executing the program ML1 that uses unformatted I/O, where:

- The satellite cartridge ID is 1004
- The system cartridge ID is 1001
- A data file of 100 sectors is defined


1
5
10
15
20
25
30
35
40
45
50

```
// JOB    1ØØ1      1ØØ4
// DUP
*DEFINE FIXED AREA         14       1ØØ4
*STOREDATA  WS  FX  $$$$$  1ØØ1ØØ1  1ØØ4
// JOB    1ØØ1      1ØØ4
// XEQ ML1
```

Note that an *FILES control record dcfining the $$$$$ file is not required after the XEQ control record.

Sample program 4 in Appendix H uses unformatted I/O and END FILE, BACKSPACE, and REWIND statements. The program writes 3 logical records of different lengths to a $$$$$ data file. Each logical record begins on a sector boundary and extends into additional sectors as required.

After the completion of each WRITE statement (of records A, B, and C), a pointer is moved to the beginning of the next logical record. In the case of the END FILE statement, the pointer is similarly positioned beyond the record generated by END FILE. The second BACKSPACE statement moves the pointer to the beginning of record C, which is subsequently read into area F.

The REWIND statement sets the pointer to logical record A, then a READ statement with no area specified advances the pointer to record B. Only the first half of B is read into area E, since the record lengths are in the ratio 2:1.

Assembler and RPG Disk File Organization and Processing

The disk I/O subroutines supplied with Disk Monitor 2, direct access, sequential access, and indexed sequential access method (ISAM), are used by both assembler and RPG language programmers. The key to the use of the disk I/O subroutines is an understanding of the basic principles of disk file organization and processing.

File Organization

File organization is the method of arranging data records on a direct access storage device; that is, building the file. Two types of file organization are available with DM2; sequential and indexed sequential (ISAM).

sequential file organization

A sequentially organized file is one in which records are placed on the disk in the same order they are read in, one after another. That is, record 6 cannot be written until record 5 is written, record 5 until record 4. Sequential files can be processed sequentially or randomly.

indexed sequential (ISAM) file organization

An indexed sequential file is one in which records are placed on the disk in ascending sequence by a record key. The record key can be a part number, man number, or any other identifying information that is present in the records in the file. In addition, an indexed sequential file uses an index table to indicate to the processing program the general location of desired records. Each index entry contains a cylinder address and the highest record key on that cylinder. For cylinders that have overflowed, the index also contains the overflow sector address and the key of the first sector overflowed from that cylinder (see the descriptions of overflow sectors and areas under "Indexed Sequential Access Method Files" and "Contents of an ISAM File" later in this chapter).

Index tables are analogous to the index card file in a library. If you know the title of a book (the record key), you can look in the card file (index table) until you find the card (index entry) for that book. On the card is a number (cylinder address) where the book (record) is located. You go to the shelf and find (seek) the number (cylinder address) you are looking for. Now you can search for the particular book (record) by title (record key).

Records in an indexed sequentially organized file can be processed sequentially or randomly.

File Processing

File processing is the method of retrieving data records from a file; that is, using the file. Four methods of file processing are available with DM2.

- Sequential processing of sequentially organized files
- Random processing of sequentially organized files
- Sequential processing of indexed sequential (ISAM) files
- Random processing of indexed sequential (ISAM) files

sequential processing of sequential files

When sequentially processing sequential files, all records in the file are processed in the order of the file starting with the first physical record in the file.

random processing of sequential files

When sequential files are randomly processed, the sequence of record processing is not related to the physical sequence of the records in the file. To find a record in a sequentially organized file, your program must specify the record number. The record number indicates the relative position (sequential location) of the record in the file. The disk I/O subroutine calculates the sector address from the record number and reads the proper record.

sequential processing of ISAM files

When sequentially processing ISAM files, all records in the file are available in a sequence determined by the record key. Processing can start at the beginning of the file or at any point within the file.

random processing of ISAM files

To find a random record in an ISAM file, code your program to search the index table using the record's key. The matching index entry points to the cylinder that contains the record. The indicated cylinder is then searched for the desired record; the match is made by record key. This kind of processing can be called processing in a random sequence with record keys.

Calculating Sequentially Organized and ISAM File Sizes

You initially define a file on a disk with the DUP *DFILE or *STOREDATA function. These functions set aside a specified number of sectors for the file, and enter the file name in LET or FLET. This file name that you assign to the file must be used in all future references to the file.

Sequentially Organized Files

The number of sectors required for a file depends on the size of records and the number of records. The records are fixed in length and can be defined as any size between one word (2 characters) and 320 words (640 characters). Records cannot be extended across sector boundaries; thus, a 320 word record (one sector) and a 161 word record each require one sector of disk space. Careful planning is required in calculating optimum record size for your file.

1. Compute the number of words (L) in a record:

   $$L = \frac{C}{2}$$

   where

   C is the record size in characters. Round the answer to the next higher number if the answer has a remainder.

2. Compute the number of records (*N*) that can be contained in one sector:

   $$N = \frac{320}{L}$$

   where

   L is the length in words of each record computed in Step 1. Disregard the remainder, if any. 320 is the number of words in a sector.

3. Compute the number of required sectors (S):

   $$S = \frac{R+1}{N}$$

   where

   R is the number of records in the file, and N is the number of records per sector computed in Step 2. Round the answer to the next higher number if the answer has a remainder. This answer is the sector count that you specify in an *DFILE or *STOREDATA control record to reserve file space in the user area or fixed area.

To change record sizes or add records to a sequential file, the file must be rebuilt. If a revised file requires additional sectors, it must be redefined and rebuilt. A sequentially organized file is built using the sequential access routine. A sequential file can be processed by either the sequential access subroutine or the direct access subroutine. These subroutines are described in the publication *IBM 1130 Subroutine Library*, GC26-5929.

Indexed Sequential Access Method Files

The number of sectors (*S*) required for an ISAM file is computed by the following formula:

$$S = P + I + O + F$$

where

P is the number of prime data sectors, *I* is the number of index sectors, *O* is the number of overflow sectors, and *F* is always one sector for the file label.

compute prime data sectors

The number of prime data sectors (*P*) is computed as follows:

$$P = \frac{R+N-1}{N}$$

where

R is the approximate number of records in the file, and *N* is the number of records per sector. Disregard the remainder, if any. The number of records (*N*) is computed by:

$$N = \frac{320}{L+2}$$

where

L is the length in words of each record. The maximum record length in words is 318; records cannot cross sector boundaries.

compute index sectors

The number of index sectors (*I*) is computed as follows:

$$I = \frac{C+E-1}{E}$$

where

C is the number of prime data cylinders, and *E* is the number of index entries per sector. Disregard the remainder, if any. The number of prime data cylinders is computed as follows:

$$C = \frac{P+7}{8}$$

where

P is the number of prime data sectors. Disregard the remainder, if any. The number of index entries (*E*) per sector is computed by:

$$E = \frac{320}{X} \quad \text{(disregard any remainder)}$$

where

X is the index entry size computed by:

$$X = 2K+3$$

where

K is the key length in words; maximum 25 words (50 characters). If the length of the key in characters is an odd number, add one when calculating the number or words; that is, 49 characters require 25 words.

overflow sectors

You decide on the number of sectors to be provided for overflow before the file must be rebuilt. This overflow area is automatically assigned to start at the sector following the last sector of prime data. This assignment is done by the ISAM load (close) subroutine.

file label

When computing file size, always add one sector for the file label.

If you wish, an assembler language program can be used to perform the preceding calculations. You need know only the index entry size (*X*) as previously discussed, the length of a record in words, the approximate number of records in the file, and an estimate of the number of sectors of overflow area needed. A program to calculate all values previously discussed is included as sample program 7 in Appendix H. The values calculated by the program or by you are required as entries in the disk file information (DFI) tables for the ISAM subroutines. An indexed sequential file is built using the ISAM load subroutine, expanded using the ISAM add subroutine and processed by either the ISAM sequential or ISAM random subroutine. These subroutines are described in the publication, *IBM 1130 Subroutine Library,* GC26-5929.

Contents of an ISAM File

An indexed sequential access method (ISAM) file is composed of:

- File label
- Index
- Prime data area
- Overflow area

The relative position of these components within the ISAM file is:

File label	Index	Prime data area	Overflow area

ISAM file label

The first sector of any ISAM file is the file label. This label contains information required by the ISAM subroutines for processing the file. The file label is built by the ISAM load function, updated by ISAM add, and used by ISAM random and sequential subroutines. All label operations are performed automatically by the ISAM subroutines. The only file label operation that you perform is to reserve one sector for the label when the file is initially defined.

The format of an ISAM label is:

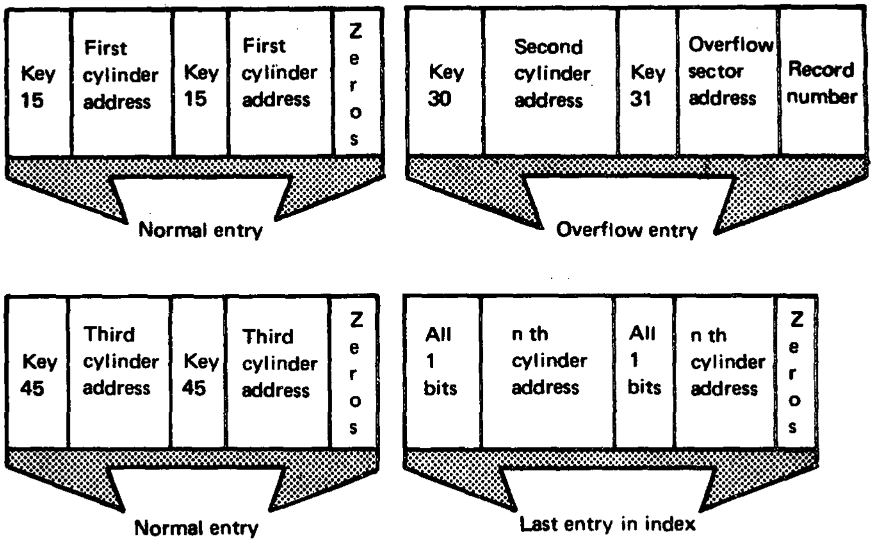
Word number	Label entry description
1	Key length
2	Record length
3	Number of index entries per sector
4	Index entry length
5	Number of records per sector
6	Record number of last prime data record
7	Index entry number of last entry in file
8	Sector address of last prime data record
9	Sector address of last index entry
10	Sector address of next overflow record
11	Record number of next overflow record

ISAM file index

The ability to read or write records anywhere in an ISAM file is provided by the file index. An entry in this index contains a cylinder address and the highest record key that is associated with that cylinder. The ISAM subroutines locate a given record by searching the index for the key and then searching the specified cylinder for the desired record, again searching by key. To increase the efficiency of the ISAM subroutines, one sector of the index is retained in core storage for each file.

The key can be a part number or an employee name or any other identifying information that is contained in any record in the file. The key entries in the index are the numbers in ascending collating sequence of the highest key on each cylinder. The end-of-file record key is the key with the highest possible value; all bits are ones.

The following is a portion of an index table. Note that each entry contains 2 sets of the same information. The second set is overlaid to show overflow data when the affected cylinder overflows.



Key 15	First cylinder address	Key 15	First cylinder address	Zeros

Normal entry

Key 30	Second cylinder address	Key 31	Overflow sector address	Record number

Overflow entry

Key 45	Third cylinder address	Key 45	Third cylinder address	Zeros

Normal entry

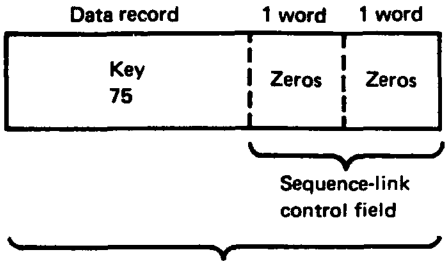
All 1 bits	n th cylinder address	All 1 bits	n th cylinder address	Zeros

Last entry in index

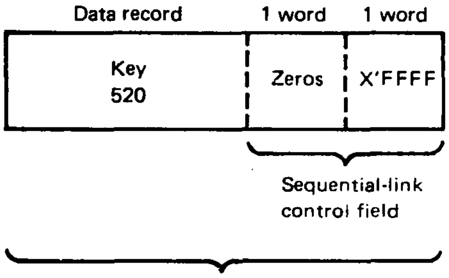
prime data area

The prime data area contains the data records that are placed in the file by the ISAM load subroutine. The records must all be the same length (maximum 318, decimal, words). The ISAM subroutine adds a 2-word control field to each record. This control field, called the sequence-link control field, is used in the overflow area as a chaining indicator. The control field indicates whether or not a cylinder has overflowed.

Prime data area records appear as follows:



Data record on a prime data cylinder



Last data record on a prime data cylinder that has overflowed

overflow area

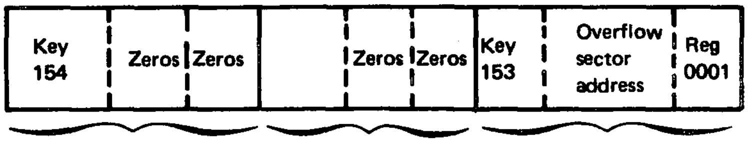
When a new record is added to an indexed sequential file, it is placed according to key sequence. If records were to remain in precise physical order, the insertion of each new record would require all records with higher keys to be shifted up. However, because ISAM files have an overflow area, a new record can be entered into its proper position and only cause records with higher keys to be shifted on that cylinder. The record that is forced off the end of the cylinder by the addition of the new record is written in the overflow area.

The index entry of any cylinder that has overflowed points to the overflow sector address and record number of the record placed in the overflow area. When 2 or more records are added in key order, the overflowed records are chained together through the entries in their sequence-link control field. The entry in the first record points to the second, the second to the third, and the third to the fourth. The last overflow record in the chain has a sequence-link control field of all zeros.

You specify the number of cylinders for the overflow area when you initially define the file. Then the ISAM subroutines place the records in the overflow area in the order that they overflow, not in key sequence.

To illustrate the overflow area, assume that on cylinder 6 of a defined file, the last 3 entries have keys 150, 152, and 154. Key 154 identifies cylinder 6 in the index. When you add a record with key 153, a record on another cylinder, and a record with key 151, the overflow area appears as follows:

Overflow area



First record overflowed. The sequence-link control field is zeros indicating the end of a chain.

Record overflowed from another cylinder

Last record overflowed. The sequence-link control field points to the next key in sequence. In this case it's key 154 in the overflow area.

Key 152 now identifies cylinder 6 in the index; the overflow entry in the index for cylinder 6 points to the overflow area.

Deleting Duplicate Records Caused by a Disk Error During an ISAM Add Operation

If a disk error (/5004 displayed in the console ACCUMULATOR) occurs during an ISAM add operation, a record may be duplicated in the file. To check for a duplicate record, list the file or part of the file using the ISAM sequential retrieve. If a duplicate record is found, one copy must be deleted.

To determine which record to delete, dump the file using a DUP *DUMP function, and check the index entry for the affected cylinder. If the key of the duplicate record is less than or equal to the first key in the index entry, delete the second of the 2 records. If the key of the duplicate record is greater than the first key in the index entry, delete the first of the 2 records. In both cases, the remaining record is the one that is processed by the ISAM random retrieve function.

Note that the duplicate record is not physically deleted; it is deleted by performing a sequential read and flagging the copy that is no longer to be used.

TIPS FOR ASSEMBLER LANGUAGE PROGRAMMERS

The tips in this section are provided to help you with:

- Grouping assembler mnemonics to shorten assembly time
- Using index register 3
- Double buffering for faster I/O operations
- Using the 1403 conversion subroutines
- Writing ISSs and ILSs

Grouping of Assembler Mnemonics

The Monitor System Assembler Program is divided into overlay phases, each phase processing a certain group of mnemonics. Each time a mnemonic is processed during assembly, the overlay phase required to process it is read into core, unless the overlay is already residing in core.

Assembly time can be shortened by grouping mnemonics of a common type in your source program; thus fewer disk reads of overlay phases are required by the assembler. The following is a list of the mnemonics as they are grouped within the assembler program:

1. ABS, FILE, ENT, ISS, ILS, SPR, EPR
2. DCs and imperative instructions, such as A, LD, EOR, BSC
3. DEC and XFLC
4. DMES
5. HDNG, ORG, EQU, BSS, BES, LIST, SPACE, EJCT, DUMP, PDMP
6. LIBF, CALL, DSA, LINK, EXIT, EBC, DN

Assembler Program Use of Index Register 3

In general, index register 3 (XR3) is reserved to point to the transfer vector. Normally, you can use this register in your program; however, if you use LIBF statements, you must code your program to do the following:

1. At the beginning of your program, save the contents of XR3
2. Before each LIBF, save your program's contents of XR3 and restore the original contents (the pointer to the transfer vector) to XR3
3. After each LIBF, restore your program's contents to XR3

Under certain conditions, you cannot use index register 3 even if you code your program to save and restore its contents. These conditions include core loads that overlap I/O operations and core loads that use the synchronous communications adapter. When these conditions exist, you can use index register 3 if you specify that a special set of interrupt level subroutines (named with an X as ILSX4) be included in a core load. You specify the use of the special ILSs in a monitor XEQ control record.

Double Buffering in Assembler Programs

The IBM 2501 Card Reader, Model A2, rated at 1000 cards per minute, presents a special problem when you want maximum performance from card I/O operations. If any conversion of the card data is required, the reading speed can drop to 500 cards per minute. The use of double buffering can prevent the loss of speed.

The principle of double buffering is to read into one buffer while converting and processing the data from another buffer. This scheme uses additional core for the extra buffer and additional programming involved, but in most cases, card throughput should remain at 1000 cards per minute. The following coding example illustrates the double buffering technique used for reading cards from the 2501, and converting them to EBCDIC.

```
Label      Operation   F T           Operands & Remarks
21   25 27   30     32 33 35   40   45   50   55   60   65   70
      LIBF    READØ     PRIME DOUBLE-BUFFERED
      DC      /1ØØØ     *CARD READING. THIS READ
      DC      BUF1      *PERFORMED ONCE ONLY.
*                                                 *
READ  LIBF    READØ     THIS READ WILL NOT START
      DC      /1ØØØ     *UNTIL PREVIOUS READ
SET1  DC      BUF2      *IS COMPLETED
*                                                 *
      LIBF    ZIPCO     BR TO EXECUTE FAST CONVERT
      DC      /11Ø1     IBM CARD CODE TO EBCDIC
SET2  DC      BUF1+1    INPUT AREA ADDRESS
SET3  DC      BUF1+1    OUTPUT AREA ADDRESS
      DC      8Ø        NO. OF COLUMNS TO CONVERT
*                                                 *
      CALL    HLEBC     CONVERSION TABLE FOR ZIPCO
*                                                 *
      LDD     BFADR
      STO     SET1      CHANGE READ BUFFER ADDRESS
      RTE     16        EXCHANGE BUFFER ADDRESSES
      STD     BFADR     *FOR NEXT TIME THRU LOOP.
      A       ONE
      STO     SET2      CHANGE INPUT AND OUTPUT BFR
      STO     SET3      *ADDRESSES FOR CONVERSION.
*                                                 *
*                                                 *
*   CODING FOR REQUIRED PROCESSING SHOULD FOLLOW  *
*                                                 *
*                                                 *

      .
      .
      .
      B       READ
*                                                 *
*                                                 *
*   CONSTANTS AND WORK AREAS                      *
*                                                 *
*                                                 *
ONE   DC      1         CONSTANT VALUE OF 1
BUF1  DC      8Ø        WORD COUNT FOR CARD BFR 1
      BSS     8Ø        CARD BUFFER 1
BUF2  DC      8Ø        WORD COUNT FOR CARD BFR 2
      BSS     8Ø        CARD BUFFER 2
*                                                 *
*                                                 *
*   THE FOLLOWING PAIR OF ADDRESSES ARE EXCHANGED *
*   EACH TIME THROUGH THE CARD READING LOOP       *
*                                                 *
*                                                 *
      BSS  E  Ø         MAKE NEXT LOCATION EVEN
BFADR DC      BUF1      ADDRESS OF CARD BUFFER 1
      DC      BUF2      ADDRESS OF CARD BUFFER 2
```

Assembler Program Use of 1403 Conversion Subroutines

Two monitor system subroutines can be used by assembler object programs to convert from EBCDIC to 1403 Printer code. These subroutines are EBPRT and ZIPCO.

By using the execution times listed in the publication *IBM 1130 Subroutine Library,* GC26-5929 EBPRT requires an average of 156 ms (milliseconds) to convert a 120 character line compared to an estimate of 72 ms per line for ZIPCO.

The speeds at which the 1403 Printer can print a line are:

Model 6 (340 LPM) – 176 ms/line; Model 7 (600 LPM) – 100 ms/line

Considering these speeds, running the printer at rated speed is difficult or impossible, depending on the model when EBPRT is used. If overlapped I/O is attempted, running either model at rated speed is impossible. Because of this, the assembler language programmer is advised to use ZIPCO for all EBCDIC-to-1403 Printer code conversions.

Writing ISSs and ILSs

Interrupt service subroutines (ISSs) for all 1130 devices and interrupt level subroutines (ILSs) for all 1130 interrupts are provided with the monitor system; however, if you want to, you may write your own.

ISS subroutines

These rules must be followed when writing ISSs:

1. Precede the ISS statement (see rule 3) with a LIBR statement if the subroutine is to be called by a LIBF rather than a CALL.
2. Precede the subroutine with an EPT (extended) or an SPR (standard) statement if precision specification is necessary.
3. Precede the subroutine with an ISS statement (only one) that defines the entry point and the ISS number. The ISS numbers used in the IBM-supplied ISS and ILS subroutines are listed in Figure 6-2. The assembler ISS statement is described in the publication *IBM 1130/1800 Assembler Language,* GC26-3778. Note that the ISS numbers assigned by the IBM-supplied subroutines range from 1 through 11. You can assign ISS numbers from 12 through 20; assign these numbers starting with 20.

ISS number	Device	Device interrupt level assignments	n
1	1442 Card Reader Punch	0, 4	+4, +7
2	Input keyboard/console printer	4	+4
3	1134/1055 Paper Tape Reader/Punch	4	+4
4	2501 Card Reader	4	+4
5	Disk storage	2	+5
6	1132 Printer	1	+4
7	1627 Plotter	3	+4
8	Synchronous Communications Adapter	1	+4
9	1403 Printer	4	+4
10	1231 Optical Mark Page Reader	4	+4
11	2250 Display Unit	3	+4

Figure 6-2. I/O device ISS numbers and ILS interrupt levels

4. When assembling an ISS, include an assembler *LEVEL control record for each interrupt level associated with the device.
5. The entry points of an ISS are defined by the related ILS. Consider this when you write an ISS that is to be used with an IBM-supplied ILS. The IBM ILS executes a BSI statement to the ISS entry point plus *n* (see the +n column in Figure 6-2). Your ISS subroutine must return to the ILS via a BSC statement (not a BOSC).

The following listing is an example of an ISS subroutine.

```
// ASM
*XREF
*LEVEL 4
```

```
*************************************************** ISSC0020
*TITLE- READC                                     * ISSC0030
*FUNCTICN/CPERATICN-                              * ISSC0040
*     TFIS 1130 SUBRCUTINE CPERATES TFE PRIMARY   * ISS00050
*     2501 CARD REACER.  IT INITIATES REQUESTED   * ISS00060
*     CPERATICNS, PRCCESSES CPERATICN CCMPLET     * ISSC0070
*     INTERRUPTS, ANC ALTOMATICALLY INITIATES     * ISSC0080
*     ERRCR RECCVERY PRCCEDLRES.                  * ISS00090
*                                                 * ISSC0100
*ENTRY PCINTS-                                    * ISSC0110
*     1. READC CALL ENTRANCE FCR TEST CR READ     * ISSC0120
*              CPERATICNS.  E.G.  LIBF    READO   * ISSC0130
*                                 DC      /1CCO   * ISS00140
*                                 DC      ICBUF   * ISSC0150
*     I                           DC      ICHUF   * ISSC0150
*     2. RE048 CPERATION COMPLETE INTERRUPT ENTRY * ISSC0160
*              PCINT.                             * ISSC0170
*INPUT- NCNE CTHER THAN FROM TFE PARAMETERS IN    * ISS00180
*     LIBF CALLINC SEQUENCE.                      * ISS00190
*CLTPUT- RCLTINE WILL TRANSFER 0 TC 80 COLS FROM  * ISSC0200
*     CARC TC I/C BLFFER AS SPECIFIEC BY CALLING  * ISSC0210
*     SECUENCE.  FCRMAT IS 12 BITS PER BUFFER WORD* ISS00220
*     LEFT JUSTIFIEC.                             * ISSC0230
*EXTERNAL SUBROLTINES- NCNE.                      * ISSC0240
*EXITS-                                           * ISS00250
*  NCRMAT-                                        * ISSC0260
*     1. RE180 IF NC PRE-CP ERROR HAS BEEN CE-    * ISSC0270
*              TECTEC, TFE EXIT FROM RE180 IS     * ISS00280
*              TC TFE CALLER AFTER THE REQUESTED  * ISS00290
*              2501 CPERATICN HAS BEEN INITIATED  * ISSC0300
*     2. RE348 TFE EXIT FROM RE348 IS BACK TO THE * ISS00310
*              CALLFR VIA ILS04 AFTER CP-CCMPLETE * ISS00320
*              PRCCESSINC HAS BEEN FINISHED.      * ISSC0330
*  ERRCR-                                         * ISS00340
*     1. RE180 IF A PRE-CP ERROR OR NCT REACY     * ISSC0350
*              CONDITION IS CETECTEC, SUBROLTINE  * ISS00360
*              WILL BRANCH TC HEX 0C29 VIA RE180  * ISSC0370
*              AND CISPLAY CNE CF TWC CCDES IN    * ISSC0380
*              ACCUMULATCR.                       * ISS00390
*              4000 IS CISPLAYED IF 2501 IS NOT   * ISSC0400
*              READY.  4C01 IS DISPLAYEC IF AN    * ISSC0410
*              ERROR IS CISCOVERED IN CALLING     * ISSC0420
*              PARAMETERS CR AREAS REFERENCED BY  * ISSC0430
*              TFEM.                              * ISS00440
*TAPLES/WCRK AREAS- NCNE.                         * ISS00450
*ATTRIBLTES- RELSABLE, CAN READ UP TC 80 COLUMNS  * ISSC0460
*              CF BINARY CATA.  IF A WORD CCUNT   * ISSC0470
*              CF ZERC IS SPECIFIED, THE READ     * ISSC0480
*              CPFRATICN ACTS AS A FEED.          * ISSC0490
```

```
                   00050            LIBR                                               ISS00510
0000     19141130 00051     1130  ISS  04 READ0     4                                  ISS00520
                   00052      ************************************************** ISS00530
                   00053      *                 LOADER DEFINED LOCATIONS                * ISS00540
                   00054      ************************************************** ISS00550
0000 0  692E      00055     READ0 STX   1 RE144+1     LIBF ENTRANCE                   ISS00560
0001 00 65800000 00056           LDX  I1 *-*         LOADER STORES TV ADDR(+2)       ISS00570
0003 0  7003      00057           MDX     RE060       BR TO PROCESS CALL              ISS00580
0004 0  0000      00058     RE048 DC      *-*         OP-CMPLTE INTERRUPT  (+4)       ISS00590
0005 01 4C00004B 00059           BSC  L  RE336       BR TO PROCESS INT               ISS00600
                   00060      ************************************************** ISS00610
                   00061      *                 LIBF PROCESSING                         * ISS00620
                   00062      ************************************************** ISS00630
                   00063      *      THIS PORTION STORES CALLING SEQUENCE INFO    * ISS00640
                   00064      *      AND CHECKS THE DEVICE STATUS BEFORE ANY I/O * ISS00650
                   00065      *      OPERATION IS INITIATED. A CALLING ERROR OR   * ISS00660
                   00066      *      NOT READY 2501 CAUSES AN ERROR EXIT TO       * ISS00670
                   00067      *      LOCATION 41. IF THE OPERATION WILL CAUSE AN * ISS00680
                   00068      *      INTERRUPT, THE ROUTINE IS SET BUSY AN THEAN * ISS00690
                   00069      *      IOCS COUNTER IS INCREMENTED TO INDICATE      * ISS00700
                   00070      *      AN INTERRUPT IS PENDING.                     * ISS00710
                   00071      ************************************************** ISS00720
0007 0  D042      00072     RE060 STO     RE324       SAVE ACC                        ISS00730
0008 0  2829      00073           STS     RE168       SAVE STATUS                     ISS00740
0009 0  6A27      00074           STX   2 RE156+1     SAVE XR2                        ISS00750
000A 0  C100      00075           LD    1 0           XR1 = ADDR OF CALL+1            ISS00760
000B 0  180C      00076           SRA     12          IS FUNCTION TEST                ISS00770
000C 01 4C200012 00077           BSC  L  REC72,Z     BR IF NOT                       ISS00780
000E 0  C031      00078           LD      RE228       IS SUBR BUSY                    ISS00790
000F 0  4818      00079           BSC     +-          SKIP IF YES                     ISS00800
0010 0  7101      00080           MDX   1 +1          NO, EXIT TO CALL+3              ISS00810
0011 0  7019      00081           MDX     RE120       EXIT TO CALL+2                  ISS00820
0012 0  902F      00082     REC72 S       RE240       IS FUNCTION LEGAL               ISS00830
0013 01 4C200035 00083           BSC  L  RE192,Z     BR IF NOT                       ISS00840
0015 0  C02A      00084     RE084 LD      RE228       IS SUBR BUSY                    ISS00850
0016 01 4C200015 00085           BSC  L  RE084,Z     YES, LOOP                       ISS00860
0018 0  082D      00086     RE096 XIO     RE288-1     IS DEVICE READY                 ISS00870
0019 01 4C040037 00087           BSC  L  RE204,E     BR IF NOT                       ISS00880
001B 00 C5800001 00088           LD   I1 1           OBTAIN WORD COUNT               ISS00890
001D 0  4818      00089           BSC     +-                                          ISS00900
001E 0  7005      00090           MDX     RE108       BR ON Z WD CNT                  ISS00910
001F 01 4C280035 00091           BSC  L  RE192,Z+    BR IF WD CNT NEG                ISS00920
0021 0  9024      00092           S       RE276       0 THRU 80 IS LEGAL              ISS00930
0022 01 4C300035 00093           BSC  L  RE192,Z-    BR IF OVER 80                   ISS00940
0024 0  7101      00094     RE108 MDX   1 +1          XR1 POINTS TO 2ND PARAM         ISS00950
0025 0  C100      00095           LD    1 0           SAVE DATA ADDR                  ISS00960
0026 0  D01D      00096           STO     RE264                                       ISS00970
0027 00 74010032 00097           MDX  L  $IOCT,1     INCREMENT IOCS COUNTER          ISS00980
0029 0  6816      00098           STX   0 RE228       SET SUBR BUSY INDR              ISS00990
002A 0  0819      00099           XIO     RE264       INITIATE READ                   ISS01000
002B 0  7101      00100     RE120 MDX   1 +1          XR1 POINTS TO RTN ADDR          ISS01010
002C 0  C01D      00101           LD      RE324       RESTORE ACC                     ISS01020
002D 0  6906      00102     RE132 STX   1 RE180+1     SET RETURN ADDRESS              ISS01030
002E 00 65000000 00103     RE144 LDX  L1 *-*         RESTORE STATUS                  ISS01040
0030 00 66000000 00104     RE156 LDX  L2 *-*         AND INDEX REGISTERS             ISS01050
0032 0  2000      00105     RE168 LDS     *-*                                         ISS01060
0033 00 4C000000 00106     RE180 BSC  L  *-*         EXIT                            ISS01070
0035 0  C013      00107     RE192 LD      RE312       ERROR CODE - ILLEGAL CALL       ISS01080
0036 0  7004      00108           MDX     RE216       BR TO SET RETURN ADDRS          ISS01090
0037 0  1801      00109     RE204 SRA     1           IS DEVICE BUSY                  ISS01100
0038 01 4C040018 00110           BSC  L  RE096,E     BR IF YES                       ISS01110
003A 0  C00D      00111           LD      RE300       ERROR CODE - DVCE NOT RDY       ISS01120
003B 0  71FF      00112     RE216 MDX   1 -1          XR1 = CALLING ADDRESS           ISS01130
003C 00 6D000028 00113           STX  L1 $PRET       STORE CALL ADDR IN 40           ISS01140
003E 0  6129      00114           LDX   1 $PRET+1     XR1 = EXIT ADDRESS              ISS01150
003F 0  70ED      00115           MDX     RE132       BR TO EXIT                      ISS01160
```

```
                   CC116   ************************************************** ISSO1170
                   CC117   *                CCNSTANTS                       * ISSC1180
                   CC118   ************************************************** ISSO1190
0C4C C   CCCC      CC119   RE228 DC      C         SUBR BUSY INDR             ISSO1200
CC42     CCCC      C012C         BSS  E  0                                    ISSC1210
CC42 C   CCC1      CC121   RE240 DC      +1        CCNSTANT                   ISSO1220
CC43 C   4FC1      C0122   RE252 DC      /4F01     SENSE WITH RESET           ISSO1230
0C44 C   CCCC      C0123   RE264 DC      *-*       I/C BUFFER ADDRESS         ISSO1240
CC45 C   4ECC      CC124         DC      /4ECO     IOCC TC INITIATE READ      ISSC1250
C046 C   CC5C      CC125   RE276 DC      +80       CCNSTANT                   ISSO1260
CC47 0   4FCO      C0126   RE288 DC      /4FCO     SENSE DSW WITHOUT RESET    ISSO1270
0C48 C   4CCC      C0127   RE3CO DC      /4C00     CCNSTANT FCR DVC NCT RDY   ISSO1280
CC49 C   4CC1      CC128   RE312 DC      /4CC1     CST FCR BAC CALL           ISSO1290
CC4A C   CCCC      C0129   RE324 DC      *-*       SAVED ADD                  ISSO1300
CC28               C013C   $PRET ECU     /28       PRE-OPERATIVE ERROR TRAP   ISSO1310
CC32               CC131   $ICCT ECL     /32       I/C COLNTER                ISSO1320
CCPC               CC132   $PST4 ECL     /8C       PCST-CPERATIVE ERRCR TRAP  ISSO1330
                   CC133   ************************************************** ISSO1340
                   CC134   *              OP-COMPLETE INTERRUPT PRCCESSING  * ISSO1350
                   CC135   ************************************************** ISSO1360
                   CC136   *    THIS PCRTICN IS ENTERED FROM AN INTERRUPT   * ISSO1370
                   CC137   *    LEVEL SUBRT. IF NC ERRCR HAS BEEN DETECTED  * ISSC1380
                   CC138   *    THE RCLTINE IS SET NOT BUSY AND THE ICCS    * ISSC1390
                   CC139   *    CCUNTER IS DECREMENTEC TO INDICATE          * ISSC1400
                   C0140   *    INTERRLPT PROCESSING COMPLETED. CTHERWISE   * ISSO1410
                   CC141   *    THE SUBR. GCES TC THE POST-CPERATIVE ERROR- * ISSO1420
                   CC142   *    TRAP ANC WAITS UNTIL THE CPERATCR HAS       * ISSO1430
                   CC143   *    INTERVENEC ANC THE 25C1 BECOMES READY, AT   * ISSC1440
                   CC144   *    WHICH TIME THE CARDS ARE PCSITICNED AND THE * ISSO1450
                   CC145   *    I/C CPERATICN IS RE-INITIATED.              * ISSO1460
                   CC146   ************************************************** ISSO1470
CC4B C   C8F6      CC147   RE336 XIC     RE252-1   SENSE CSW WITH RESET       ISSO1480
0C4C C   1CC3      CC148         SLA     3         IS OPERATICN GK            ISSO1490
CC4D 01  4CC20056  0C149         BSC  L  RE360,C   BR IF ERRCR                ISSO1500
CC4F CC  74FFCC32  CC150         MCX  L  $ICCT,-1  DECREMENT IOCS             ISSC1510
CC51 0   1CCO      CC151         NCP               IN CASE OF SKIP            ISSO1520
0C52 C   1810      C0152         SRA     16                                   ISSO1530
CC53 C   DCEC      C0153         STC     RE228     CLEAR RUUT BUSY INDIC      ISSO1540
CC54 C1  4C8CCCC4  CC154   RE348 BSC  I  RE048     EXIT                       ISSC1550
C056 C   C8EB      CC155   RE360 XIC     RE252-1   SENSE DSW FCR READY        ISSO1560
0C57 C1  4CC4CC5B  CC156         BSC  L  RE365,E   TC ERRCR EXIT IF NCT RDY   ISSC1570
CC59 C   08EA      C0157         XIC     RE264     RE-INITIATE FUNCTICN       ISSO1580
C05A C   7CF9      C0158         MCX     RE348     BR TO EXIT                 ISSO1590
C05B C   CCEC      C0159   RE365 LD      RE300     LD NOT READY ERROR CODE    ISSO1600
CC5C CC  44CC008C  CC16C         BSI  L  $PST4     PCST-OPERATIVE ERRCR TRAP  ISSC1610
0C5E 0   7CF7      C0161         MCX     RE360     TRY AGAIN                  ISSO1620
C06C               CC162         END                                          ISSO1630
```

```
                         CRCSS-REFERENCE

SYMBCL     VALLE  REL CEFN      REFERENCES

REACO      COCC    1  C0055     CCC51,R
REC48      CCC4    1  CC058     C0154,B
REC60      COC7    1  CC072     CCC57,B
REC72      C012    1  C0082     CCC77,B
REC84      C015    1  C0084     CC085,B
REC96      C018    1  C0086     CC11C,B
RE108      C024    1  C0094     CC090,B
RE120      C028    1  C01CC     C0081,B
RE132      C02C    1  C01C2     C0115,B
RE144      C02E    1  C01C3     C0055,M
RE156      0030    1  001C4     C0074,M
RE168      C032    1  C01C5     CCC73,M
RE180      C033    1  C01C6     CC1C2,M
RE192      0035    1  C01C7     C0083,B C0091,B CC093,B
RE204      CC37    1  C0109     CC087,B
RE216      CC38    1  C0112     C0108,B
RE228      C04C    1  C0119     CCC78,R CC084,R CC098,M C0153,M
RE240      C042    1  C0121     C0082,R
RE252      C043    1  C0122     C0147,R C0155,R
RE264      C044    1  00123     00096,M OCC99,R C0157,R
RE276      C046    1  C0125     00092,R
RE288      C047    1  C0126     C0086,R
RE3CO      C048    1  C0127     00111,R C0159,R
RE312      0049    1  C0128     00107,R
RE324      C04A    1  C0129     CC072,M CC1C1,R
RE336      C04B    1  C0147     C0059,B
RE348      C054    1  C0154     C0158,B
RE360      C056    1  C0155     C0149,B C0161,B
RE365      C058    1  C0159     CC156,B
$ICCT      C032    C  C0131     C0097,M C015C,M
$PRET      C028    0  00130     C0113,M CC114,R
$PST4      C08C    0  CC132     C016C,B

   COC CVERFLCW SECTCRS SPECIFIEC
   CCC CVERFLCW SECTCRS REQUIRED
   C32 SYMBCLS CEFINEC
    NC ERRCR(S) ANC   NC WARNING(S)  FLAGGED IN ABOVE ASSEMBLY
```

ILS subroutines

An ILS is included in a core load only if requested by an ISS that is a part of the same core load. The IBM-supplied ILS02 and ILS04 subroutines are a part of the resident monitor unless you delete them from the system library and replace them with ILSs that you write for interrupt levels 2 and 4. These rules must be followed when writing an ILS:

1. Precede the subroutine with an ILS statement that identifies the interrupt level involved.
2. Precede all statements with an ISS branch table. If the associated interrupt level status word (ILSW) is not scanned (that is, a single ISS handles all interrupts on the level involved) in the ILS, a one-word table is sufficient; the minimum table size is one word. A zero must follow the branch table. If the ILSW is scanned, the ISS branch table must include one word for each used bit of the ILSW:

   ISS branch table

   ```
   ILSW bit X (highest bit used)  )
         .                        |
         .                        }  Define one word
         .                        |  for each bit used.
   ILSW bit 1                     |
   ILSW bit 0                     )
   ```

   Each entry in the ISS branch table identifies the entry point within an ISS for the associated ILSW bit. The actual linkage is generated by the core load builder. Before processing by the CLB, each word in the ISS branch table has the following format:

   - Bits 0 through 7 contain an increment that is added to the entry point address of the corresponding ISS subroutine to obtain the interrupt entry point address within the ISS for the ILSW bit. (In IBM-written ISSs, this increment is +4 for the primary interrupt level and +7 for the secondary interrupt level. See column +n in Figure 6-2.)
   - Bits 8 through 15 contain the value of @ISTV plus the ISS number of the ISS associated an ILSW bit. The value of @ISTV can be obtained from the cross-reference symbol table at the end of the resident monitor listing in Appendix G.

   @ISTV is the address of the interrupt transfer vector (ITV) in low core. Any ISS branch table entries that represent unused bits in an ILSW must have the value @ISTV.

   During the building of a core load, the CLB places the entry point address of an ISS in the location of the ITV that corresponds to the ISS number specified in the ISS statement. The CLB generates an ISS entry point address by adding the increment in bits 0 through 7 to the address in the location of the ITV pointed to by bits 8 through 15. Then the CLB replaces the ISS branch table word with this generated interrupt entry point address. (See Step 4 for the use of these addresses.)
3. The ILS entry point must immediately follow the ISS branch table and must be loaded as a zero. The core load builder assumes that the first zero word in the program is the end of the branch table and is also the entry point of the ILS. An interrupt causes a BSI to this entry point.
4. The ILSW bit that is on is determined with a SLCA statement. At the completion of this statement, the specified index register contains a relative value equivalent to that bit position in the ISS branch table. The address in the ISS branch table can then be used by a BSI instruction to reach the ISS that corresponds to an ILSW bit position.
5. To clear the interrupt level when an ILS that you write is used with an IBM-supplied ISS, code your ILS to exit via the return linkage with a BOSC statement.

6. When you write an ILS, it must replace the equivalent IBM-supplied ILS. Delete the IBM ILS, and store your ILS as ILS0x, where x = 0, 1, 2, 3, 4, or 5.
7. The IBM-supplied ILS02 and ILS04 subroutines are stored as subtype one. An ILS that you write to replace either of these must be stored as subtype zero.
8. The ISS branch table for the IBM-supplied version of ILS04 can have no more than 9 entries. An ILS that you write to replace ILS04 can support all 16 possible ISS branch table entries.

The following listing is an example of an ILS subroutine.

```
// ASM
*XREF
                    00001   ************************************************** U1J00020
                    00002   *                                                * U1J00030
                    00003   *NAME - ILSX4                                    * U1J00040
                    00004   *                                                * U1J00050
                    00005   *FUNCTION/OPERATION - INTERRUPT LEVEL SUBROUTINE * U1J00060
                    00006   *   FOR LEVEL 4.                                 * U1J00070
                    00007   *                                                * U1J00080
                    00008   *ENTRY POINT - ENTERED AT IX420 BY A HARDWARE    * U1J00090
                    00009   *   BSI VIA LOCATION 12 DECIMAL.                 * U1J00100
                    00010   *                                                * U1J00110
                    00011   *INPUT - NONE.                                   * U1J00120
                    00012   *                                                * U1J00130
                    00013   *OUTPUT - NONE.                                  * U1J00140
                    00014   *                                                * U1J00150
                    00015   *EXTERNAL SUBROUTINES - NONE.                    * U1J00160
                    00016   *                                                * U1J00170
                    00017   *EXITS -                                         * U1J00180
                    00018   *   NORMAL - BOSC INDIRECT THROUGH IX420         * U1J00190
                    00019   *   ERROR - NONE                                 * U1J00200
                    00020   *                                                * U1J00210
                    00021   *TABLES/WORK AREAS - NONE                        * U1J00220
                    00022   *                                                * U1J00230
                    00023   *ATTRIBUTES - REUSABLE                           * U1J00240
                    00024   *                                                * U1J00250
                    00025   *NOTES - INDEX REGISTERS 1, 2, AND 3, STATUS,    * U1J00260
                    00026   *   ACCUMULATOR AND EXTENSION ARE SAVED UPON     * U1J00270
                    00027   *   ENTRY AND RESTORED AFTER INTERRUPT SERVICED. * U1J00280
                    00028   *                                                * U1J00290
                    00029   ************************************************** U1J00300
                    00030        ILS   04                                        U1J00310
0000 0  0033        00031   IX410 DC        /0033     DEVICD *-* AND ISS NO. *-* U1J00320
0001 0  0033        00032        DC         /0033     DEVICD *-* AND ISS NO. *-* U1J00330
0002 0  0033        00033        DC         /0033     DEVICD *-* AND ISS NO. *-* U1J00340
0003 0  043D        00034        DC         /043D     1231 +4 AND ISS NO. 10     U1J00350
0004 0  043C        00035        DC         /043C     1403 +4 AND ISS NO.  9     U1J00360
0005 0  0437        00036        DC         /0437     2501 +4 AND ISS NO.  4     U1J00370
0006 0  0734        00037        DC         /0734     1442 +7 AND ISS NO.  1     U1J00380
0007 0  0435        00038        DC         /0435     CONSOLE +4 AND ISS NO. 2   U1J00390
0008 0  0436        00039        DC         /0436     1134/1055 +4 AND ISS NO. 3 U1J00400
0009 0  0000        00041   IX420 DC        0         INTERRUPT ENTRY            U1J00420
000A 0  D81B        00042        STD        IX480     SAVE ACC AND EXTENSION,    U1J00430
000B 0  280F        00043        STS        IX430     *STATUS,                   U1J00440
000C 0  6910        00044        STX     1  IX441+1   *XR1,                      U1J00450
000D 0  6A11        00045        STX     2  IX442+1   *XR2,                      U1J00460
000E 0  6B12        00046        STX     3  IX443+1   *XR3                       U1J00470
000F 00 678000E4    00047        LDX    I3  $XR3X     POINT TO TRANSFER VECTOR   U1J00480
0011 0  0818        00048        XIO        IX495-1   SENSE KEYBOARD             U1J00490
0012 0  1002        00049        SLA        2         IS IT INTERRUPT REQUEST    U1J00500
0013 00 44A8002C    00050        BSI     I  $IREQ,+Z  *KEY, BR IF YES            U1J00510
0015 0  1000        00051        NOP                                             U1J00520
0016 0  6109        00052        LDX     1  9         NUMBER OF DEVICES ON LEVEL. U1J00530
0017 0  0810        00053        XIO        IX490-1   SENSE ILSW                 U1J00540
0018 0  1140        00054        SLCA    1  0         SHIFT AND DECREMENT XR1    U1J00550
0019 01 4580FFFF    00055        BSI    I1  IX410-1   BR TO DEVICE ISS           U1J00560
001B 0  2000        00057   IX430 LDS       0         RESTORE STATUS,            U1J00580
001C 00 65000000    00058   IX441 LDX   L1  *-*       *XR1                       U1J00590
001E 00 66000000    00059   IX442 LDX   L2  *-*       *XR2,                      U1J00600
0020 00 67000000    00060   IX443 LDX   L3  *-*       *XR3,                      U1J00610
0022 0  C803        00061        LDD        IX480     *ACC AND EXTENSION         U1J00620
0023 01 4CC00009    00062        BOSC    I  IX420     TURN OFF INTERRUPT, RETURN U1J00630
0026    0002        00064   IX480 BSS    E  2         ACCUMULATOR AND EXTENSION  U1J00650
0028 0  0000        00065        DC         0                                    U1J00660
0029 0  0300        00066   IX490 DC        /0300     IOCC TO SENSE ILSW         U1J00670
002A 0  0000        00067        DC         0                                    U1J00680
002B 0  0F00        00068   IX495 DC        /0F00     SENSE IOCC FOR KEYBOARD    U1J00690
002C                00069   $IREQ EQU       /002C     ADD OF ISS FOR INT REQ     U1J00700
00E4                00070   $XR3X EQU       /00E4     ADDR OF TRANSFER VECTOR    U1J00710
002C                00071        END                                             U1J00720
```

```
SYMBOL      VALUE   REL  DEFN       REFERENCES

IX410       0000    1    00031      00055,B
IX420       0009    1    00041      00062,B
IX430       001B    1    00057      00043,M
IX441       001C    1    00058      00044,M
IX442       001E    1    00059      00045,M
IX443       0020    1    00060      00046,M
IX480       0026    1    00064      00042,M 00061,R
IX490       0029    1    00066      00053,R
IX495       002B    1    00068      00048,R
$IREQ       002C    0    00069      00050,B
$XR3X       00E4    0    00070      00047,R

    000 OVERFLOW SECTORS SPECIFIED
    000 OVERFLOW SECTORS REQUIRED
    011 SYMBOLS DEFINED
     NO ERROR(S) AND    NO WARNING(S)  FLAGGED IN ABOVE ASSEMBLY
```

Assembler INT REQ Service Subroutine

Pressing the interrupt request key (INT REQ) on the console keyboard causes the ILS in use for interrupt level 4 (ILS04 or ILSX4) to execute a BSI I $IREQ. Thus, the function of the INT REQ key depends on the contents of location $IREQ. The system initializes $IREQ with the address $I420 in the resident monitor. This setting terminates the current job, and all control records are bypassed until the next JOB monitor control record is read. You can alter the function of the INT REQ key by coding your program to place, in $IREQ, the address of an INT REQ service subroutine that you have written.

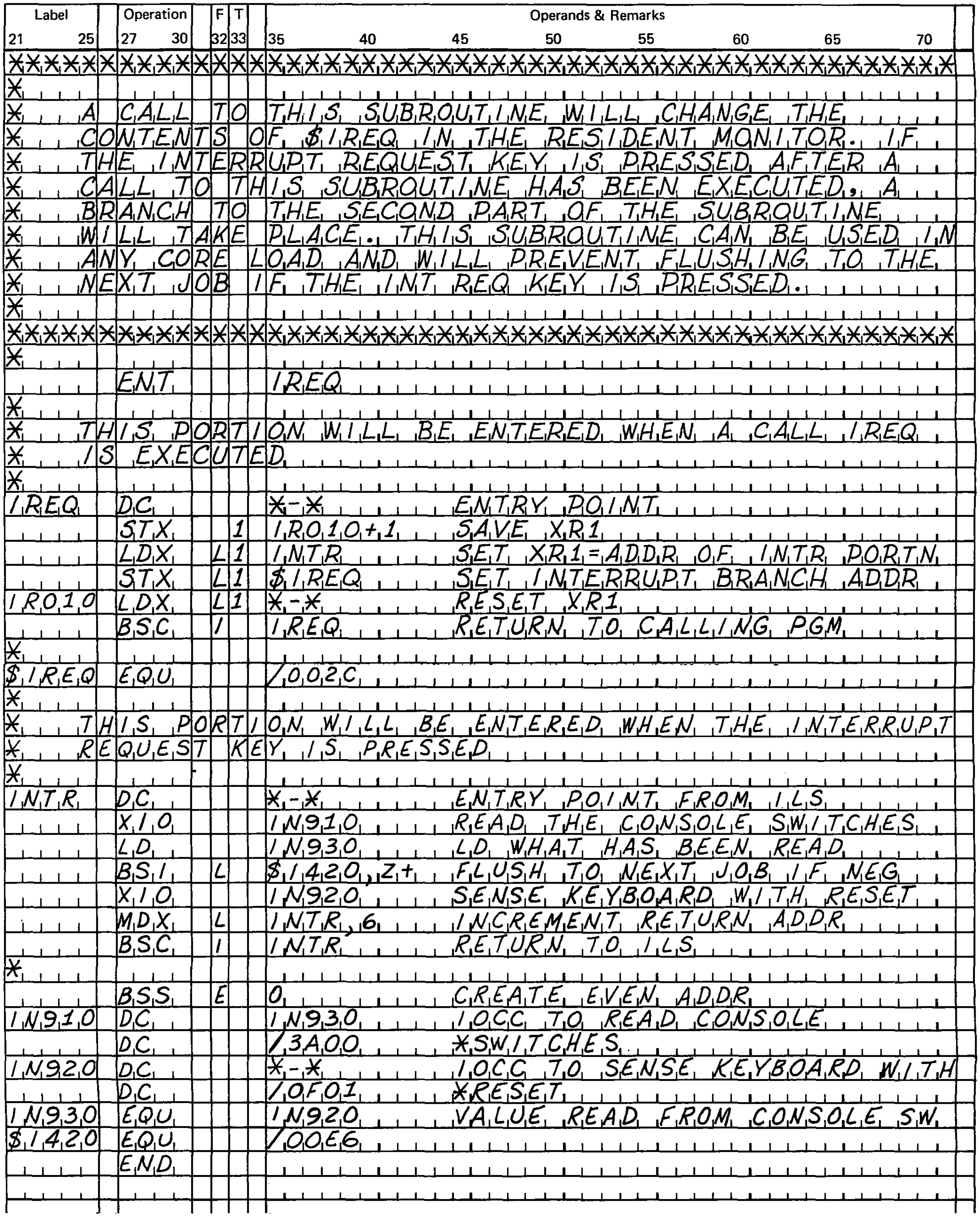
An INT REQ service subroutine that you write can read the console entry switches and set program indicators. You should remember that your subroutine is executed with interrupt level 4 on, preventing recognition of other interrupts on level 4 or 5. Because of this, the following should be kept in mind when you code an INT REQ service subroutine:

- A LIBF or CALL to a subroutine from your service subroutine can cause a recurrent-entry problem. If the called subroutine is already in use when you press INT REQ, the new LIBF or CALL in your subroutine destroys the original return address and disrupts the operation of the called subroutine.
- A LIBF or CALL to an ISS can cause an endless loop if the called ISS operates on level 4 and a test for operation completed is performed by your service subroutine. This loop occurs because the interrupt indicating the operation is complete is delayed until the INT REQ key interrupt is turned off.
- Your subroutine must perform an XIO sense keyboard/console with reset before returning.
- Your subroutine must increment the return address by 6 when returning to the ILS subroutine. A BSC instruction must be used to go back to the ILS where the interrupt is turned off.

Note. When the core load of your program contains the TYPEZ, WRTYZ, TYPE0, or WRTY0 subroutine, the XIO sense keyboard/console with reset can be omitted. In this case, code your subroutine to return to the return address plus one.

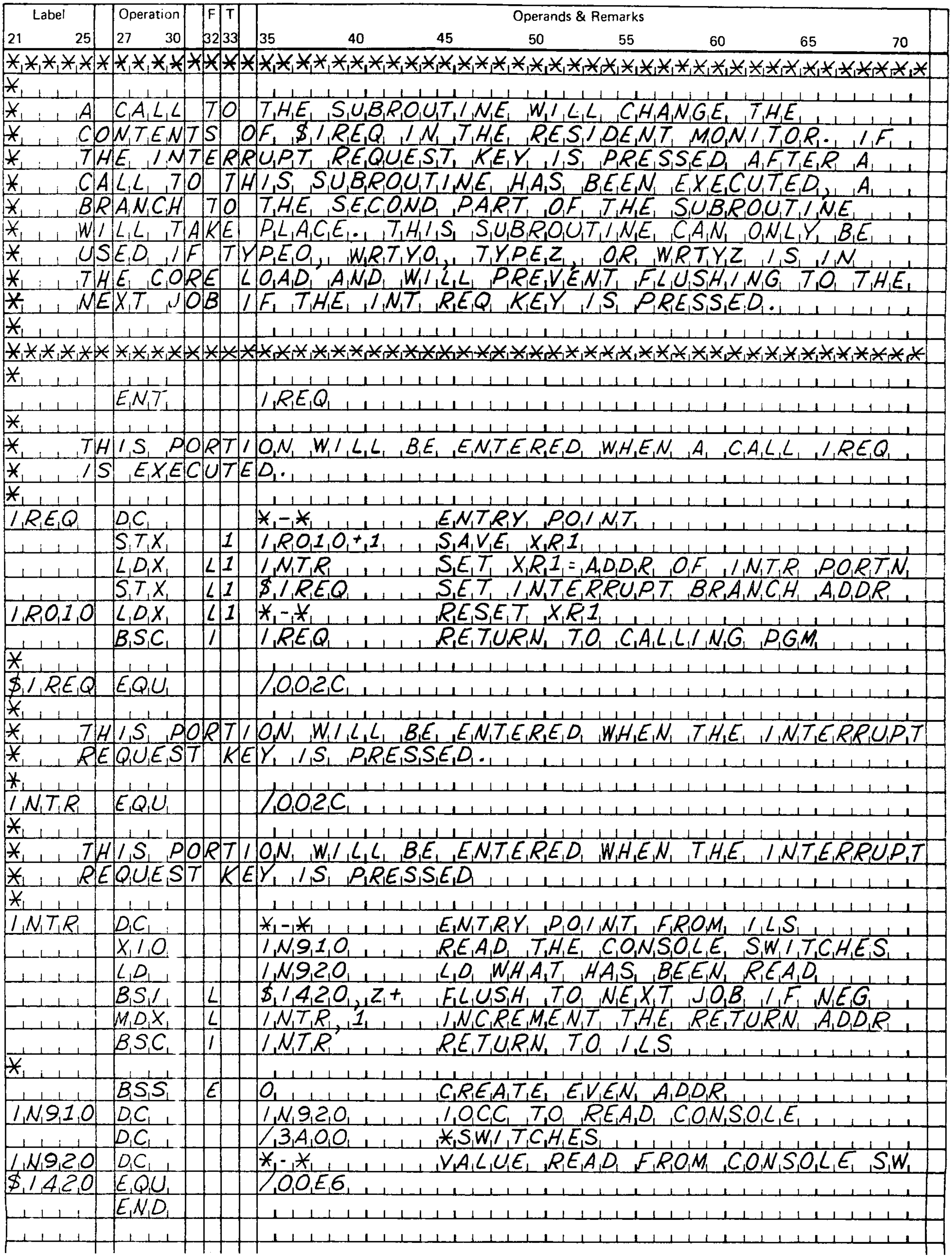
Two sample subroutines are included in this section to illustrate how the function of the INT REQ key can be altered temporarily. These subroutines can be called by either FORTRAN or assembler programs. Both subroutines perform the same function; when INT REQ is pressed, the console entry switches are read. If console entry switch zero is off, program execution continues from where it was interrupted. If console entry switch zero is on, the system exits to the next job. The first of the sample INT REQ service subroutines (Figure 6-3) illustrates the coding that can be used by any core load. The second of the sample INT REQ service subroutines (Figure 6-4) illustrates the coding that can be used by a core load that contains TYPEZ, WRTYZ, TYPE0, or WRTY0.

These programs may not be LOCALed when $IREQ has been modified.


Label
21 25
Operation
27 30
F
32
T
33
Operands & Remarks
35 40 45 50 55 60 65 70

```
***************************************************
*
*   A CALL TO THIS SUBROUTINE WILL CHANGE THE
*   CONTENTS OF $IREQ IN THE RESIDENT MONITOR. IF
*   THE INTERRUPT REQUEST KEY IS PRESSED AFTER A
*   CALL TO THIS SUBROUTINE HAS BEEN EXECUTED, A
*   BRANCH TO THE SECOND PART OF THE SUBROUTINE
*   WILL TAKE PLACE. THIS SUBROUTINE CAN BE USED IN
*   ANY CORE LOAD AND WILL PREVENT FLUSHING TO THE
*   NEXT JOB IF THE INT REQ KEY IS PRESSED.
*
***************************************************
*
      ENT      IREQ
*
*   THIS PORTION WILL BE ENTERED WHEN A CALL IREQ
*   IS EXECUTED
*
IREQ  DC       *-*       ENTRY POINT
      STX   1  IR010+1   SAVE XR1
      LDX  L1  INTR      SET XR1=ADDR OF INTR PORTN
      STX  L1  $IREQ     SET INTERRUPT BRANCH ADDR
IR010 LDX  L1  *-*       RESET XR1
      BSC  I   IREQ      RETURN TO CALLING PGM
*
$IREQ EQU      /002C
*
*   THIS PORTION WILL BE ENTERED WHEN THE INTERRUPT
*   REQUEST KEY IS PRESSED
*
INTR  DC       *-*       ENTRY POINT FROM ILS
      XIO      IN910     READ THE CONSOLE SWITCHES
      LD       IN930     LD WHAT HAS BEEN READ
      BSI  L   $I420,Z+  FLUSH TO NEXT JOB IF NEG
      XIO      IN920     SENSE KEYBOARD WITH RESET
      MDX  L   INTR,6    INCREMENT RETURN ADDR
      BSC  I   INTR      RETURN TO ILS
*
      BSS  E   0         CREATE EVEN ADDR
IN910 DC       IN930     IOCC TO READ CONSOLE
      DC       /3A00     *SWITCHES
IN920 DC       *-*       IOCC TO SENSE KEYBOARD WITH
      DC       /0F01     *RESET
IN930 EQU      IN920     VALUE READ FROM CONSOLE SW
$I420 EQU      /00E6
      END
```

Figure 6-3. INT REQ service subroutine for any core load



```
***************************************************
*
*   A CALL TO THE SUBROUTINE WILL CHANGE THE
*  CONTENTS OF $IREQ IN THE RESIDENT MONITOR. IF
*   THE INTERRUPT REQUEST KEY IS PRESSED AFTER A
*  CALL TO THIS SUBROUTINE HAS BEEN EXECUTED, A
*  BRANCH TO THE SECOND PART OF THE SUBROUTINE
*  WILL TAKE PLACE. THIS SUBROUTINE CAN ONLY BE
*  USED IF TYPEO, WRTYO, TYPEZ, OR WRTYZ IS IN
*   THE CORE LOAD AND WILL PREVENT FLUSHING TO THE
*   NEXT JOB IF THE INT REQ KEY IS PRESSED.
*
***************************************************
*
      ENT         IREQ
*
*   THIS PORTION WILL BE ENTERED WHEN A CALL IREQ
*   IS EXECUTED.
*
IREQ  DC          *-*           ENTRY POINT
      STX      1  IR010+1       SAVE XR1
      LDX     L1  INTR          SET XR1=ADDR OF INTR PORTN
      STX     L1  $IREQ         SET INTERRUPT BRANCH ADDR
IR010 LDX     L1  *-*           RESET XR1
      BSC     I   IREQ          RETURN TO CALLING PGM
*
$IREQ EQU         /002C
*
*   THIS PORTION WILL BE ENTERED WHEN THE INTERRUPT
*   REQUEST KEY IS PRESSED.
*
INTR  EQU         /002C
*
*   THIS PORTION WILL BE ENTERED WHEN THE INTERRUPT
*   REQUEST KEY IS PRESSED
*
INTR  DC          *-*           ENTRY POINT FROM ILS
      XIO         IN910         READ THE CONSOLE SWITCHES
      LD          IN920         LD WHAT HAS BEEN READ
      BSI     L   $I420,Z+      FLUSH TO NEXT JOB IF NEG
      MDX     L   INTR,1        INCREMENT THE RETURN ADDR
      BSC     I   INTR          RETURN TO ILS
*
      BSS     E   0             CREATE EVEN ADDR
IN910 DC          IN920         IOCC TO READ CONSOLE
      DC          /3A00         *SWITCHES
IN920 DC          *-*           VALUE READ FROM CONSOLE SW
$I420 EQU         /00E6
      END
```

Figure 6-4. INT REQ service subroutine for core load using TYPEZ, WRTYZ, TYPE0, or WRTY0

TIPS FOR FORTRAN PROGRAMMERS

The tips in this section will help you when:

- Referencing different data files by using the supervisor *EQUAT control record
- Using valid input data during program execution
- Controlling the console printer during program execution
- Entering data for arrays so as to provide efficient dumping of a DSF program

Tips for Use of the EQUAT Control Record

The supervisor *EQUAT function is used to substitute a subroutine for another called subroutine in core loads that are being built. Thus, a program does not have to be recompiled or reassembled to reference different subroutines.

For example, suppose that your FORTRAN mainline program prints on the 1132 Printer, and you want to have it print on the 1403 instead. Without an EQUAT control record, you would have to change the *IOCS control record and recompile the program. With EQUAT, you have only to specify on the EQUAT control record that PRNZ (the 1403 subroutine) is to be substituted for PRNTZ (the 1132 subroutine) when the core load is built. When EQUAT is used, the core load builder compares each call in the program with the left-hand name of each specified subroutine pair on the EQUAT control record. Each time a match is found, the core load builder substitutes the right-hand name of the EQUAT subroutine pair for the name in the calling statement of the program. Note that the EQUAT control record is associated with the monitor JOB control record, which implies that all core loads that are built for the job be built from the same substitution list.

The use of EQUAT is not restricted to I/O substitutions. You might, for example, have several versions of a subroutine, each stored under a different name. With EQUAT, any of these subroutines can be used without recompiling or reassembling the calling programs.

You must remember that the calling sequence of any substitute pair must be identical since the core load builder does no more than substitute one name for the other. Thus, CARDZ cannot be substituted for PRNZ because the 80-column count associated with CARDZ is incompatible with the 120-word count associated with PRNZ. The equatable FORTRAN I/O subroutines are:

1132 Printer	1403 Printer	2501 Card Reader	1442 Card Reader Punch	Console printer keyboard	1055 Punch 1134 Reader	1627 Plotter	Notes
PRNTZ	PRNZ	———	———	———	———	———	———
———	———	READZ	CARDZ	TYPEZ	———	———	Input only
———	———	———	———	TYPEZ	PAPTZ	*VCHRI,WCHRI	Output only
———	———	———	———	WRTYZ	PAPTZ	*VCHRI,WCHRI	Output only

*VCHRI – extended precision
WCHRI – standard precision

The following lists the possible entries in a FORTRAN *IOCS control record and the subroutine each entry implies:

*IOCS entry	Subroutine called
CARD	CARDZ
2501 READER	READZ
1442 PUNCH	PNCHZ
TYPEWRITER	WRTYZ
KEYBOARD	TYPEZ
1132 PRINTER	PRNTZ
1403 PRINTER	PRNZ
PAPER TAPE	PAPTZ
PLOTTER	PLOTX
DISK	DISKZ
UDISK	DISKZ

The FORTRAN programmer should also remember that the *name of a function subroutine* as stored in the system library must be used in an EQUAT control record; not the function name that is coded in FORTRAN statements.

EQUAT can also be used to allow a FORTRAN program to overlap the operations of the 1132 Printer with the synchronous communication adapter (SCA). The operations of these I/O devices cannot be overlapped unless the 1132 is serviced by PRNT2. EQUAT can change PRNTZ (the subroutine used by FORTRAN I/O for 1132 printing) to the name PRTZ2 (a special subroutine to interface between PRNTZ and PRNT2). 1132 printing is then performed by PRNT2 and can be overlapped with the SCA.

Invalid Characters in FORTRAN Source Cards

Any invalid FORTRAN character in a FORTRAN source card is converted to an ampersand, causing the compiler to print an error message. The error message that is printed depends on the kind of statement in which the invalid character is found. The FORTRAN character set is listed in Appendix C of the publication *IBM 1130/1800 Basic FORTRAN IV Language,* GC26-3715.

FORTRAN Object Program Paper Tape Data Record Format

Data records of up to 80 EBCDIC characters in paper tape PTTC/8 code can be read or written by FORTRAN object programs. Delete and newline codes are recognized. Delete codes and case-shifts are not included in the 80 characters. When a newline code is read before the 80th character, the record is terminated. If the 80th character is not a newline code, the 81st character read is assumed to be a newline code.

Keyboard Input of Data Records During FORTRAN Program Execution

Data records of up to 80 characters can be read from the keyboard by a FORTRAN READ statement. Data values must be right justified in their respective fields.

keyboard operation

If you want to key in less than 80 characters, press EOF to stop transmittal. Also, pressing ERASE FIELD or the backspace key (←) allows you to reenter a record when you make a mistake during data entry. If the keyboard appears to be locked, press REST KB. Select the correct case shift before entering data.

buffer status after keyboard entry

The input buffer is filled with blanks before you enter a data record. Therefore, when you press EOF before you have entered 80 characters, the rest of the buffer remains blank. If more data is necessary to satisfy the list items in the DATA statement, the remaining numeric fields (I, E, or F) are stored in core as zeros, and alphameric fields (A or H) are stored as blanks. Processing is continuous; errors do not result from the previous condition.

Note. Information about buffer status after pressing ERASE FIELD or the backspace key (←) is under "Functions of Console Operator Keys During Monitor System Control" and "Entering Jobs from the Console Keyboard," respectively, in Chapter 7.

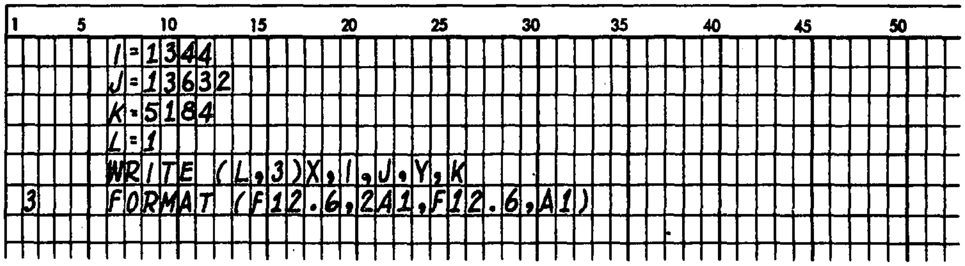
FORTRAN Program Control of the Console Printer

You can code your program to control spacing, tabulating, and shifting on the console printer by assigning unique values for desired operations to variables. These variables must be assigned as integers, and A-conversion must be used in the FORMAT statement for these variables.

The operations that can be performed and the values that are assigned to them include:

Operation	*Value*
Backspace	5696
Carrier return	5440
Line feed	9536
Shift to print black	5184
Shift to print red	13632
Space	16448
Tabulate	1344

As an example of console printer control, assume that a variable, X, is printed in the existing black ribbon shift and that another variable, Y, is printed in red after a tabulation. Following the printing of Y, the ribbon is shifted back to black. The following statements perform these functions:



```
      I=1344
      J=13632
      K=5184
      L=1
      WRITE (L,3)X,I,J,Y,K
 3    FORMAT (F12.6,2A1,F12.6,A1)
```

FORTRAN logical unit 1, as specified in the WRITE statement, is the console printer. The sequence of operations to be performed are:

- Print X
- Tabulate
- Shift to print red
- Print Y
- Shift to print black

Each control variable counts as one character and must be included in the count of the maximum line length.

Length of FORTRAN DATA Statement

An error (DATA statement too long to compile, due to internal buffering) occurs if:

$$(G_1 + G_2 + \ldots + G_n) > 355$$

where

N is the number of constants in this DATA statement.

Each *G* is a constant with the factor:

$$G = 1 + C + (K_1 + K_2 + \ldots + K_v)$$

where

C is the length in words of this constant and V is the number of variables loaded with this constant.

Each such variable has a factor of:

$K = 1$ for a nonsubscripted variable or $K = 2$ for a subscripted variable

// Records Read During FORTRAN Program Execution

Any //ƀ record read by CARDZ, READZ, or PAPTZ during a FORTRAN program execution causes an immediate CALL EXIT. Only the //ƀ characters are recognized by CARDZ, READZ, or PAPTZ. Any other data punched in this record is not available to programs in the monitor system, and the record is not printed. After the //ƀ record is read, the supervisor searches for the next valid monitor control record entered from the reader.

For offline listing purposes, however, this record can contain comments, such as // END OF DATA.

FORTRAN I/O Errors

If input/output errors are detected during execution, the program stops. The error is indicated by a code displayed in the console ACCUMULATOR (see Appendix B for a list of the codes and their causes).

When an output field is too small to contain a number, the field is filled with asterisks and execution continues.

The I/O subroutines used by FORTRAN (PAPTZ, CARDZ, PRNTZ, WRTYZ, TYPEZ, PNCHZ, READZ, PRNZ) wait on any I/O device error or device not in a ready condition. Ready the device, and press PROGRAM START to continue.

Error detection in functional and arithmetic subroutines is possible by the use of source program statements. Refer to “Machine and Program Indicator Tests” in the publication *IBM 1130/1800 Basic FORTRAN IV Language,* GC26-3715.

Dumping FORTRAN DSF Programs to Cards

Arrays are always allocated backwards in core storage by the FORTRAN compiler. Because of this basic principal of the compiler, DSF output may be somewhat inefficient when dumped to cards if arrays are included in DATA statements. Such statements can cause cards to be punched with only one data word each.

To circumvent this inconvenience, write every element of an array explicitly in a DATA statement, starting with the element of the highest order.

RPG OBJECT PROGRAM CONSIDERATIONS

An RPG object program requires the special interrupt level subroutines (ILSs named with an X, as ILSX4). You code any character in column 28 of an XEQ monitor control record and in column 12 of a STORECI DUP control record to cause the special ILSs to be included in a core load. If the program is stored in core image (STORECI), the special ILSs are stored with the program on disk.

The storing of programs in disk core image format on disk is not recommended (see "Disadvantages of Storing a Program in DCI Format" in this chapter).

Chapter 7. Operating the 1130 Disk Monitor System

This chapter contains procedures that are used frequently during the operations of the 1130 Disk Monitor System. These procedures include:

- General procedures for readying the components of the 1130 for operation
- Procedures for performing a cold start of the monitor system
- General operating procedures that are used while the monitor system is in operation

The procedures for readying the 1130 components are performed when a device is to be used and is not ready. The central processing unit must be the first device readied as the console POWER switch, when turned on, supplies power to the entire 1130 computing system. The procedures for the I/O devices need not be performed in the order presented; however, if the disk drives are readied first, other devices can be readied while the disk drives are reaching operating speed. Detailed procedures for changing forms, tapes, and cartridges are not included here; they are in the publication *IBM 1130 Operating Procedures,* GA26-5717.

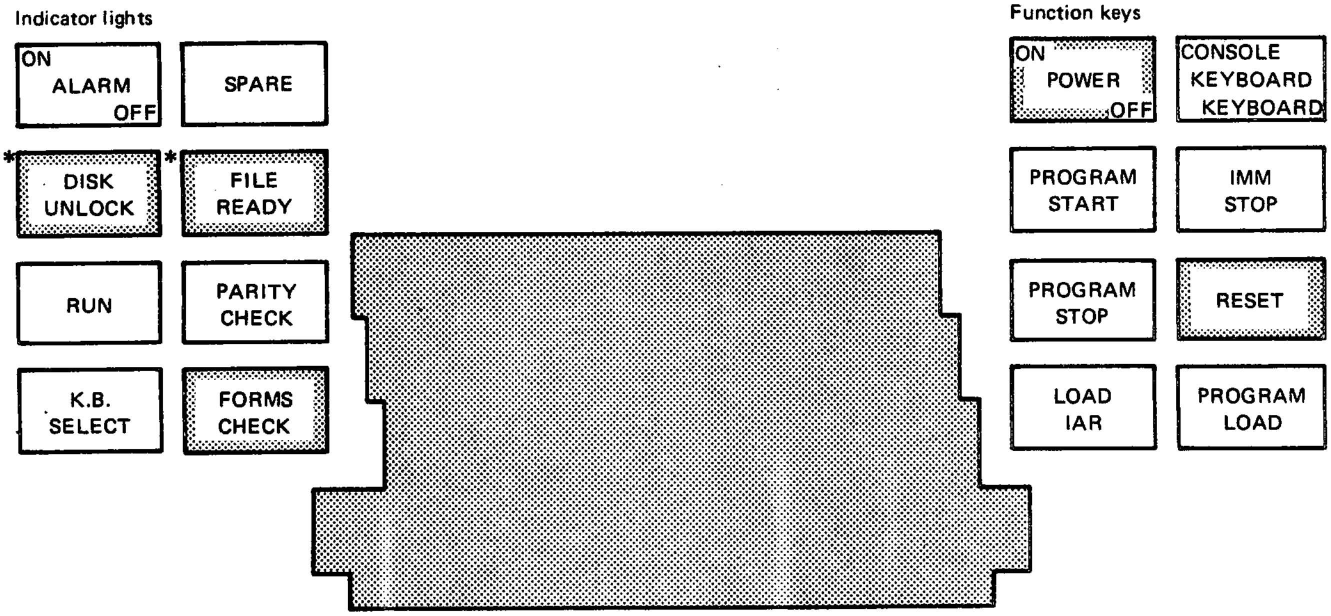
The functions of the cold start program and operating procedures for performing a cold start from cards or from paper tape are described in detail.

The procedures used while the monitor system is in operation are:

- Loading control records, program statements, and data records
- Controlling the system with the PROGRAM STOP, PROGRAM START, INT REQ, and IMM STOP function keys on the console
- Displaying and altering selected core storage locations
- Manually dumping core storage

READYING THE 1131 CENTRAL PROCESSING UNIT (with an internal disk)

Operator action	System response *or* Error indicator and corrective action
1. Move the console POWER switch to ON. This switch supplies power to the entire system, and must be on before any of the I/O devices are readied.	If the FORMS CHECK light comes on, insert or adjust the paper in the console printer. If the DISK UNLOCK light comes on, it indicates that the DISK switch on the disk drive is set to OFF. See step 3.
2. Insert a cartridge in the single disk drive.	
3. Move the DISK switch on the disk drive to ON. The disk drive requires approximately 90 seconds to reach operating speed.	The FILE READY light comes on when the disk drive reaches operating speed. If any other indicator lights on the console are on, press RESET.



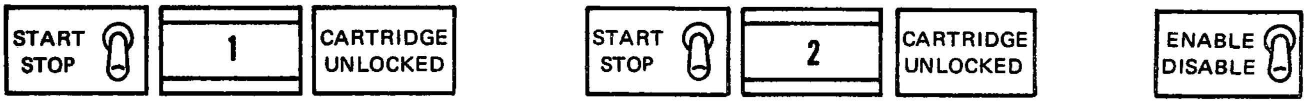
*These indicators are blank on an 1131 CPU that does not contain an internal single disk drive.

READYING THE 1131 CENTRAL PROCESSING UNIT (without an internal disk)

Operator action	System response *or* Error indicator and corrective action
1. Move the console POWER switch to ON. This switch supplies power to the entire system, and must be on before any of the I/O devices are readied.	If the FORMS CHECK light comes on, insert or adjust the paper in the console printer. If any other indicator lights on the console are on, press RESET.
2. Ready the 2311 Disk Storage Drives as described under "Readying the 2311 Disk Storage Drive" in this chapter.	

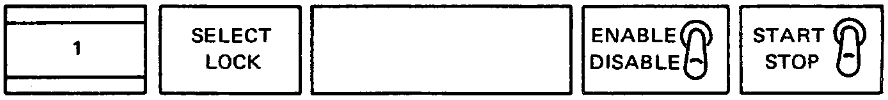
READYING THE 2310 DISK STORAGE DRIVE

Operator action	System response *or* Error indicator and corrective action
1. Be sure system power is turned on.	If the CARTRIDGE UNLOCKED light comes on, it indicates that the START/STOP switch is set to STOP. See step 3.
2. Insert the disk cartridges	
3. Move the START/STOP switch to START.	
4. Be sure the ENABLE/DISABLE switch on the 1133 Multiplex Control Enclosure is in the·ENABLE position.	The READY light on the 1133 is on.
5. Move the START/STOP switch to START position for the cartridges being used. The drives require Approximately 90 seconds to reach operating speed.	The indicators showing the drive numbers come on when the disks reach operating speed.
6. Move the ENABLE/DISABLE switch on the disk storage drive to ENABLE.	



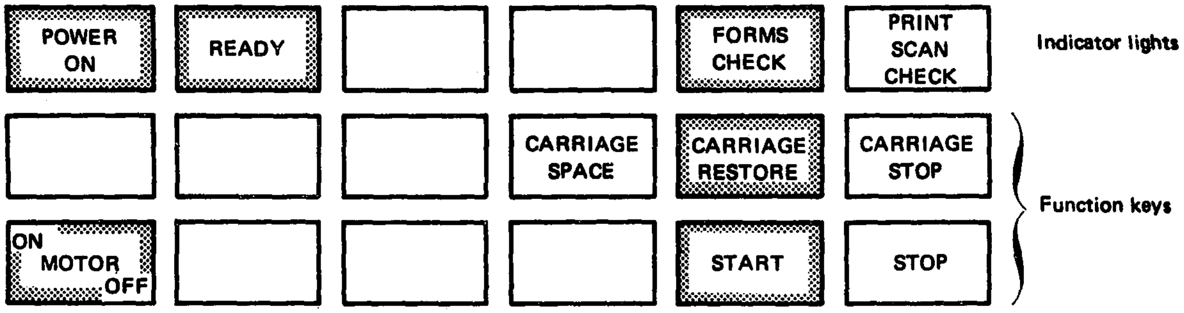
READYING THE 2311 DISK STORAGE DRIVE

Operator action	System response *or* Error indicator and corrective action
1. Be sure system power is turned on.	
2. Be sure the ENABLE/DISABLE switch on the 1133 Multiplex Control Enclosure is in the ENABLE position.	The READY light on the 1133 is on.
3. Insert a disk pack in the 2311, if necessary.	
4. Move the START/STOP switch to the START position. The disks require approximately 60 seconds to reach operating speed.	The green indicator showing the drive number comes on when the disks reach operating speed.
5 Move the ENABLE/DISABLE switch on the disk storage drive to the ENABLE position.	



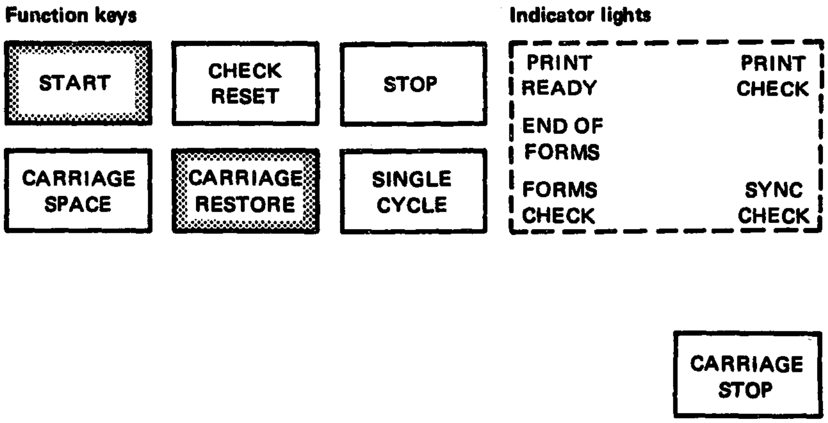
READYING THE 1132 PRINTER

	Operator action	System response *or* Error indicator and corrective action
1.	Move the printer MOTOR switch to ON.	The printer POWER ON light comes on. If the printer FORMS CHECK light comes on, insert or adjust the paper in the printer.
2.	Press CARRIAGE RESTORE.	
3.	Press START.	The READY light comes on.



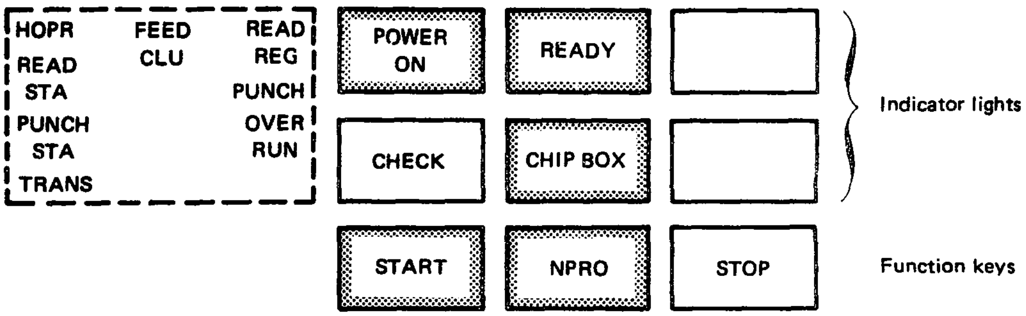
READYING THE 1403 PRINTER

	Operator action	System response *or* Error indicator and corrective action
1.	Be sure system power is turned on.	If any indicator lights on the printer other than PRINT READY are on, correct the condition (see the publication *IBM 1130 Operating Procedures,* GA26-5717).
2.	Be sure the ENABLE/DISABLE switch on the 1133 Multiplex Control Enclosure is in the ENABLE position.	The READY light on the 1133 is on.
3.	Press the CARRIAGE RESTORE key on the printer.	
4.	Press START.	The PRINT READY light comes on.



READYING THE 1442 MODEL 6 AND 7 CARD READ PUNCH

	Operator action	**System response** *or* **Error indicator and corrective action**
1.	Be sure system power is turned on.	The 1442 POWER ON and HOPR indicator lights are on. If the CHIP BOX light is on, empty the chip box. If any indicator lights other than HOPR are on, correct the condition (see Appendix B).
2.	Press the NPRO key.	The HOPR light goes off.
3.	Place the cards to be processed in the hopper, face down, 9-edge first.	
4.	Press the START key.	The READY light comes on.



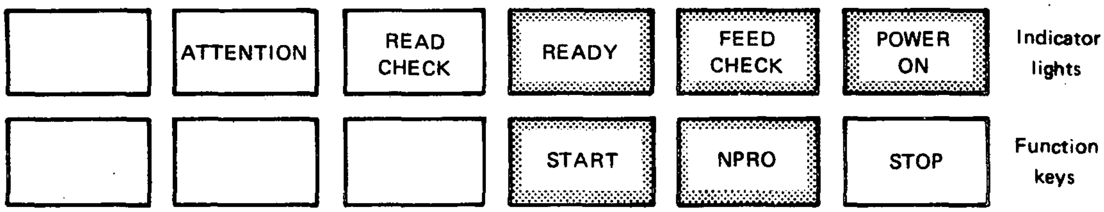
READYING THE 1442 MODEL 5 CARD PUNCH

Operator action

Follow the procedure for readying Models 6 and 7 with one exception; use blank cards in Step 3 rather than cards ready for processing.

READYING THE 2501 CARD READER

Operator action	System response *or* Error indicator and corrective action
1. Be sure system power is turned on.	The card reader POWER ON and FEED CHECK lights are on. If any other indicators are on, correct the condition (see Appendix B).
2. Press NPRO.	The FEED CHECK light goes off.
3. Place cards to be processed in the hopper, face down, 9-edge first.	
4. Press START.	The READY light comes on.



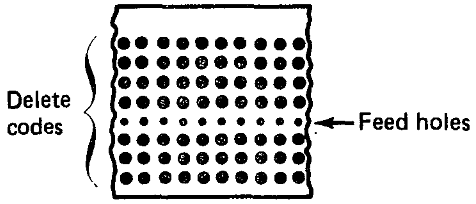
	ATTENTION	READ CHECK	READY	FEED CHECK	POWER ON	Indicator lights
			START	NPRO	STOP	Function keys

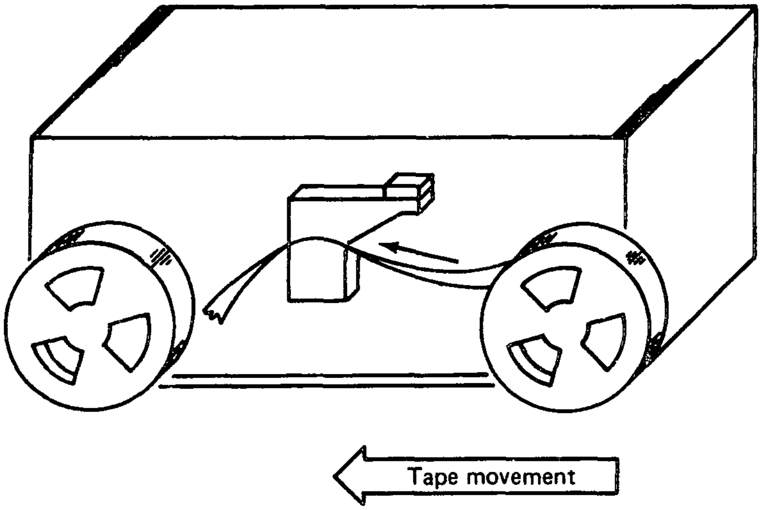
READYING THE 1134 PAPER TAPE READER

Operator action

1. Be sure system power is turned on.

2. Insert a tape to be processed in the paper tape reader; position under the read starwheels any of the delete codes that follow the program ID in the tape leader.

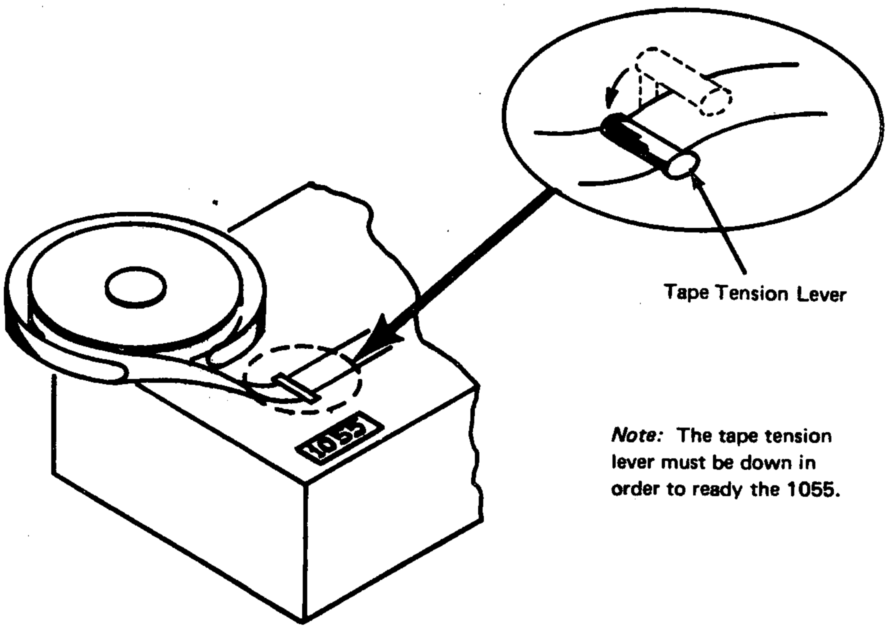




READYING THE 1055 PAPER TAPE PUNCH

Operator action

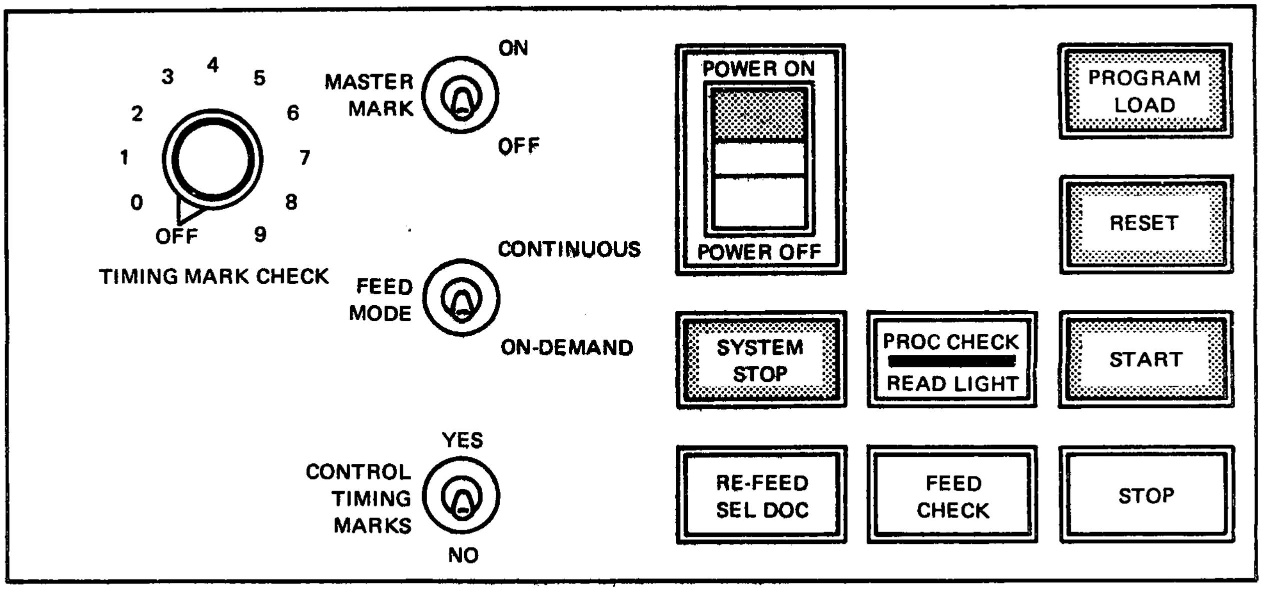
1. Be sure system power is turned on.
2. Insert a blank tape in the paper tape punch.
3. Press the DELETE key on the punch and hold down while performing Step 4. Do not release the DELETE key.
4. With the DELETE key held down, press the FEED key and hold down to punch several inches of delete codes.
5. Release the FEED key *before* the DELETE key.



Note: The tape tension lever must be down in order to ready the 1055.

READYING THE 1231 OPTICAL MARK PAGE READER

Operator action	**System response *or* Error indicator and corrective action**
1. Be sure system power is turned on.	The 1231 POWER ON light is on.
2. Place the data sheets in the hopper with the side to be read facing up and the top edge positioned to feed first.	
3. Move the FEED MODE switch to ON-DEMAND.	
4. Press PROGRAM LOAD.	The PROGRAM LOAD light comes on.
5. Press RESET.	The hopper is raised to the ready position. The RESET light goes off and the START light comes on.
6. Press START.	The PROGRAM LOAD light goes off.
7. Press START again.	The START light goes off. All indicator lights should be off, with one exception: the SYSTEM STOP light can be on.



COLD START PROCEDURE

The cold start procedure is initiated when the cold start record is read by the card reader or the paper tape reader. This record causes the cold start program stored in cylinder 0 of the system cartridge to be read into core storage. The cold start program gains control and reads the resident image and the DISKZ subroutine from cylinder 0 into the resident monitor portion of low core storage. Program control is then assumed by the skeleton supervisor portion of the resident monitor.

During the cold start program, a dummy // JOB control record is printed on the principal printer, and the following cartridge status information is printed:

```
LOG DRIVE     CART SPEC     CART AVAIL    PHY DRIVE
   XXXX          XXXX          XXXX          XXXX

VX -MXX     ACTUAL XXK      CONFIG XXK
```

where

LOG DRIVE is always a single entry of zero.

CART SPEC is the cartridge ID written on the system cartridge when initialized.

CART AVAIL is the same as CART SPEC. When more than one disk drive is on the computer, the IDs of any other disk cartridges that are ready are also listed.

PHY DRIVE is the physical drive number you enter in the console entry switches. This drive is also logical drive zero. When more than one disk drive is on the computer, the physical drive numbers of any other disk cartridges that are ready are also listed.

VX MXX is the version and modification of the monitor system on the current system cartridge.

ACTUAL XXK is the physical core size of the 1130.

CONFIG XXK is the configured core size on the system cartridge.

Note. The monitor system is not supported unless the physical core size at least equals the configured core size.

The monitor system is now operational and is ready to receive the first JOB monitor control record.

Note. If your system has only one disk drive (the internal disk in the 1131 CPU or one 2311), you should cold start after changing cartridges, or packs, to avoid possible errors in the location of disk areas on system cartridges.

If an attempt is made to cold start a nonsystem cartridge, an error message (THIS IS A NONSYSTEM CARTRIDGE or NONSYS. CART. ERROR) is printed on the console printer. Error stops can occur during the cold start procedure. They are listed and explained under "Cold Start Program Error Waits" and "ISS Subroutine Preoperative Error Waits" in Appendix B.

Note. Do not perform a cold start with an uninitialized cartridge online.

The cold start procedure is started from the card reader or the paper tape reader as described in the following procedures.

Card System Cold Start Procedure

1. Ready the devices to be used.
2. If your 1130 has only one disk drive, be sure all console entry switches are off. For systems with more than one disk drive, be sure switches 0 through 11 are off; set switches 12 through 15 to the drive number (in binary) of the physical drive that contains the system cartridge:

   Drive 0–Switches 12 through 15 off
   Drive 1–Switch 15 on
   Drive 2–Switch 14 on
   *Drive 3–Switches 14 and 15 on
   *Drive 4–Switch 13 on
   Drive 5–Switches 13 and 15 on
   Drive 6–Switches 13 and 14 on
   Drive 7–Switches 13, 14, and 15 on
   *Drive 8–Switch 12 on
   *Drive 9–Switches 12 and 15 on
   Drive 10–Switches 12 and 14 on
   *Not used on a 2311 Disk Storage Drive, Model 12

3. Place the cold start card in the card reader wired for cold start. Then place cards to be processed in the card reader.
4. Press START on the card reader. (If both a 2501 and a 1442, Model 6 or 7, are present, make the reader wired for cold start ready and make sure the other reader is not ready by pressing STOP.)
5. Press IMM STOP on the console.
6. Press RESET on the console.
7. Press PROGRAM LOAD on the console.

Paper Tape System Cold Start Procedure

1. Ready the devices to be used, except the paper tape reader.
2. If your 1130 has only one disk drive, be sure all console entry switches are off. For systems with more than one disk drive, be sure switches 0 through 11 are off; set switches 12 through 15 to the drive number (in binary) of the physical drive that contains the system cartridge as follows:

   Drive 0–Switches 12 through 15 off
   Drive 1–Switch 15 on
   Drive 2–Switch 14 on
   Drive 3–Switches 14 and 15 on
   Drive 4–Switch 13 on

3. Insert tape BP15, cold start paper tape record, in the paper tape reader. Position under the read starwheels one of the delete codes after the program ID.
4. Press IMM STOP on the console.
5. Press RESET on the console.
6. Press PROGRAM LOAD on the console.

USING THE 1130 WITH THE MONITOR SYSTEM

When the I/O devices required for a job are online and ready, and the monitor system is running, jobs can be entered from the card reader, the paper tape reader, or the console keyboard. The following procedures describe how jobs are entered.

Entering Jobs from the Card Reader

1. Place the cards to be processed in the card hopper, face down, 9-edge first, and press START on the card reader.
2. Check that the console mode switch is set to RUN.
3. Press PROGRAM START on the console.
4. When the last card is indicated (hexadecimal /1000 for the 1442 Card Reader or /4000 for the 2501 Card Reader) in the ACCUMULATOR on the console display panel, press START on the card reader and PROGRAM START on the console so that the last card is released. This step need not be done if blank cards follow the last card processed.

Entering Jobs from the Paper Tape Reader

1. Insert the tape to be processed in the paper tape reader. Position under the read starwheels one of the delete codes after the program ID.
2. Check that the console mode switch is set to RUN.
3. Press PROGRAM START on the console.

Entering Jobs from the Console Keyboard

A single monitor control record or an entire program including all required control records and data records can be entered from the console keyboard. Monitor control is transferred to the keyboard when a // TYP monitor control record is read from the principal input device.

Control is returned to the principal input device when a // TEND monitor control record is entered from the keyboard. The formats of these 2 control records are described in Chapter 5 under "Monitor Control Records."

starting keyboard operation

When the // TYP control record is read, the console printer performs a carriage return and the KB SELECT light on the keyboard operator's panel comes on. The system is now in a WAIT state at $PRET with /2002 in the accumulator, awaiting keyboard input.

Enter all control records, program statements, and/or data records in their correct format. Use the space bar for blanks. As each character is entered, it is printed on the console printer. Press EOF to indicate the end of each line. When this key is pressed, an NL (new line) character is placed in the next character position of the input buffer, and the typing element is returned to the left margin of the next line.

Up to 80 characters can be entered in one line through the console keyboard. If an error is made during entry of a line, you can either backspace to correct the error or erase the entire line and reenter it.

←

When the TYPEO I/O subroutine is being used, a line is corrected during entry by pressing the backspace (←) key as many times as required until you reach the first character that has to be corrected. The first time that you press the backspace key, the last character printed on the console printer is slashed. The location address of the next character to be entered in the input buffer is decremented by one each time the backspace key is pressed.

For example, assume that you have entered *DELET and want to change it to *DEFINE.

1. Press the backspace key 3 times. (The T is slashed: *DELET̸.)
2. Enter the correct characters. (The corrected line appears as *DELET̸FINE on the console printer. The input buffer now contains *DEFINE; the characters FIN replace LET in the buffer.)

Note. When the TYPEZ I/O subroutine is being used, the backspace key functions the same as the ERASE FIELD key.

ERASE FIELD

A line can be erased when you press ERASE FIELD. This key signals an interrupt response subroutine that the previously entered characters are incorrect and are being reentered. Two slashes are printed on the console printer (when the TYPE0 I/O subroutine is being used), and the typing element is returned to the left margin of the next line. The correct characters that you enter replace the previously entered characters in the input buffer. The previous message is not deleted from the input buffer; if the previous message is longer than the new one, the characters from the previous message remain (following the NL character that terminates the new message).

Note. When the TYPEZ I/O subroutine is being used, the two slashes are not printed when ERASE FIELD is pressed.

REST KB

If the keyboard appears to be locked (keys cannot be pressed), press REST KB (the restore keyboard key). The correct case shift must be selected before data is entered.

stopping keyboard operation

Continue entering control records, program statements, and/or data records as just described until all are entered. Then enter a // TEND control record, and press EOF. Control is returned to the principal input device.

Functions of Console Operator Keys During Monitor System Control

PROGRAM STOP

Pressing PROGRAM STOP causes an interrupt of the monitor system programs. This is a level 5 interrupt and causes an entry to the PROGRAM STOP key trap in the skeleton supervisor, if no user-written subroutines are associated with level 5.

If a higher interrupt level is being serviced when you press PROGRAM STOP, the PROGRAM STOP interrupt is masked until the current operation is complete.

The PROGRAM STOP key trap consists of a wait and a branch. Execution of the monitor system programs is continued when you press PROGRAM START. The status of the monitor system and of core storage is not changed when the system is stopped with the PROGRAM STOP key.

PROGRAM START

Pressing PROGRAM START also continues execution of the monitor system programs from ISS subroutine waits. A code in the ACCUMULATOR on the console display panel indicates the reason for the wait. ISS subroutine waits and their causes are listed in Appendix B.

INT REQ

Pressing the interrupt request (INT REQ) key immediately terminates the current job. System control returns to the supervisor, which searches through the input stream for the next JOB monitor control record. You have the option of programming this key for a different use (see Chapter 6. "Programming Tips and Techniques"). Portions of the monitor system that cannot be interrupted before completion, such as SYSUP, delay the interrupt until the operation is complete when INT REQ is pressed. Because the keyboard remains selected during interrupt request processing when in // TYP mode, you must be careful not to press any keys until the /2002 halt at $PRET is displayed.

IMM STOP

Pressing the immediate stop (IMM STOP) key immediately stops processing.

Note. Do not press IMM STOP when the monitor system is running. The contents of a system cartridge can be destroyed, necessitating a reload of the system.

Displaying or Altering the Contents of a Selected Core Location

select a core location

To select a specific core location to be displayed or altered:

1. Press PROGRAM STOP on the console.
2. Turn the console mode switch to LOAD.
3. Set the console entry switches to the desired 4-character hexadecimal core address. Switches 0 through 3 represent the first hexadecimal character, 4 through 7 the second, 8 through 11 the third, and 12 through 15 the fourth.
4. Press LOAD IAR on the console. The selected address is loaded into the IAR and is displayed in the INSTRUCTION ADDRESS indicator on the console display panel.

display contents of the location

To display the contents of the selected core location:

1. Turn the console mode switch to DISPLAY.
2. Press PROGRAM START. The contents are displayed in the STORAGE BUFFER indicator on the console display panel. Repeatedly pressing PROGRAM START displays the contents of consecutive core locations.

alter contents of location

To alter the contents of the selected core location:

1. Set the new contents (in hexadecimal) in the console entry switches.
2. Turn the console mode switch to LOAD.
3. Press PROGRAM START.

return to system control

After the contents of the selected core location have been displayed and/or altered, return to system control:

1. Turn the console mode switch to RUN.
2. Press PROGRAM START. Execution begins at the location specified in the IAR.

Manual Dump of Core Storage

When a problem occurs during the execution of a core load and a dump of core storage is needed, you can execute a manual dump of core storage:

1. Press PROGRAM STOP.
2. Turn the console mode switch to LOAD.
3. Set the address plus one of the dump entry point ($DUMP+1) to the skeleton supervisor in the console entry switches.
4. Press LOAD IAR on the console.
5. Turn the console mode switch to RUN.
6. Press PROGRAM START.

A dump of the contents of core storage is printed in hexadecimal, then the dump program (see "Disk-Resident Supervisor Programs" in Chapter 3) executes a CALL EXIT to terminate execution of the core load in progress.

If the $IOCT, $DBSY, or $SCAT indicators in the resident monitor are nonzero when the branch to $DUMP+1 is made, the skeleton supervisor begins a loop testing these indicators. When this occurs:

1. Press PROGRAM STOP.
2. Display, and change to zero if necessary, the contents of each of these locations.
3. Restart the manual dump of core storage.

Chapter 8. Monitor System Initial Load and System Reload

initial load

An initial load is the process of loading the complete disk monitor system onto an initialized disk cartridge. An initial load is performed when:

- An 1130 computing system is installed
- Data contained on a system cartridge has been destroyed making the disk unuseable
- The assembler and/or any of the compilers are to be loaded onto a system cartridge

reload

A system reload is the process of loading modifications to the disk monitor system onto a system cartridge. A system reload is performed when:

- Existing phases of system programs are being added or expanded
- New system programs are being added
- The I/O device configuration is being changed

Any combinations of the previous functions can be performed during a reload. The following should be kept in mind when preparing to perform a reload:

- The cushion area must be large enough to absorb the increased length of system programs when they are added or expanded.
- Program additions must follow the last system program currently on the cartridge. Working storage must be equal to or larger than the length of the program being added, plus 31 sectors.
- System configuration is performed each time a system reload is performed. Reconfiguration is necessary when a system cartridge is copied from a system with a different configuration.

Initial load and reload procedures are performed with IBM-supplied system loaders, control records, system programs, and with control records that you punch. The information supplied by IBM is contained on paper tapes for paper tape systems and on disk cartridges for card systems. The contents of the disk cartridge must be dumped to cards before the system can be loaded. A preload operating procedure for dumping the monitor system to cards is contained in this chapter.

This chapter:

1. Describes the general functions and contents of IBM-supplied control records
2. Discusses the general functions, formats, ana uses of the control records that you must punch
3. Presents sample operating procedures for punching paper tape control records, performing a card system preload, initial load, and reload, and performing a paper tape system initial load and reload

You may use these operating procedures as they are presented, or you may modify them to meet the needs of your computing system. For those who are already familiar with similar procedures, the headings in each block can be used as reminders as you perform the procedure. For those who need more information, detailed steps for performing these procedures are provided. Not all steps of each procedure need to be done every time it is used; do only those steps that are necessary.

Appendixes A and B contain descriptions of error messages and halt codes that can occur during the operations of any of the initial load and reload procedures.

IBM-SUPPLIED SYSTEM LOADER CONTROL RECORDS

The IBM-supplied control records for initial load and reload operations are:

- SCON and TERM (for card systems only)
- Phase identification (PHID)
- Type 81

These control records must be used in all initial load and reload operations. The placement of these control records in the card decks and paper tapes is illustrated at the beginning of each of the procedures for load and reload at the end of this chapter.

The general functions and formats of these control records are discussed in the following text.

SCON and TERM Control Records

general function

These control records, together with the REQ control records that you punch, comprise the system configuration control record. They define the beginning and ending of the system configuration control record. A system configuration control record must be included in an initial load, a reload, and a configure operation.

SCON and TERM cards are included with the information supplied from IBM for card systems. For a paper tape system, you punch the SCON and TERM control records in the system configuration tape as described in "Preparation of Load Mode and System Configuration Control Tapes" in this chapter.

SCON and TERM control record formats

Card column	Contents
1 through 4	SCON *or* TERM
5 through 80	Blanks

Phase Identification (PHID) Control Records

general function

Each monitor system program, except the resident monitor and the cold start program, is divided into several parts called phases. PHID control records contain the beginning and ending phase ID numbers of the programs in the monitor system. All numbers in the ID fields of the PHID control records are in ascending sequence and in the order in which the system programs are loaded onto a disk. The ID entries in the PHID control record are loaded into the system location equivalence table (SLET), a directory to the disk locations of the monitor system programs.

When system programs are added or modified during a reload, the PHID control record must be changed to reflect any new phase ID limits ol the programs and/or phases.

format of first PHID card

Card column	Contents
1 through 4	PHID
6 through 8 and 10 through 12	IDs of the first and last phases of DUP
14 through 16 and 18 through 20	IDs of the first and last phases of the FORTRAN compiler
22 through 24 and 26 through 28	IDs of the first and last phases of the COBOL compiler program product
30 through 32 and 34 through 36	IDs of the first and last phases of the supervisor
38 through 40 and 42 through 44	IDs of the first and last phases of the core load builder
46 through 48 and 50 through 52	IDs of the first and last phases of the system I/O device subroutines
54 through 56 and 58 through 60	IDs of the first and last phases of the core image loader
64	*1* (indicates continuation to the second PHID card)
66 through 68	*Vxx* (where *xx* is the disk monitor system version number)
70 through 72	*Mxx* (where *xx* is the version modification number)
73 through 80	Card identification and sequence number

Note: All card columns omitted in this format contain blanks.

format of second PHID card

Card column	Contents
1 through 4	PHID
6 through 8 and 10 through 12	IDs of the first and last phases of the RPG compiler
14 through 16 and 18 through 20	IDs of the first and last phases of DUP, part 2
22 through 24 and 26 through 28	IDs of the first and last phases of the macro assembler
29 through 65	Blanks
66 through 68	*Vxx* (where *xx* is the disk monitor system version number)
70 through 72	*Mxx* (where *xx* is the version modification number)
73 through 80	Card identification and sequence number

Note: All card columns omitted in this format contain blanks.

If you have a paper tape system, the IBM-supplied PHID control record is on tape BP03.

System Program Sector Break Cards (Card Systems)

In order to allow you to load only a portion of a monitor program during a card system reload, each program phase is preceded with a sector break card that identifies the phase. These cards have a 1 punch in column 4, and the monitor system version and modification level are punched in the cards starting in column 67 (VxMxx). A description of the function of sector break cards is in Appendix I.

The following is a list of the monitor system sector break cards.

Phase number	Program or program phase name	ID starting in column 73
XX	RES SKELETON SUPV, COMMA, DISKZ, COLD START PROGRAM Part of system loader	EMN
XX	SYS LDR–PHASE 2–OVERLAY 0	FP2
XX	SYS LDR–PHASE 2–OVERLAY 1	FP2
XX	SYS LDR–PHASE 2–OVERLAY 2	FP2
XX	SYS LDR–PHASE 2–OVERLAY 3	FP2
	DUP	
01	DUP COMMON SUBROUTINES, CCAT	J01
02	DUP CTRL RECORD PROCESSOR	J02
03	DUP STORE PHASE	J03
04	DUP *FILES, *LOCAL, *NOCAL PHASE	J04
05	DUP DUMP PHASE	J05
06	DUP DUMP LET/FLET PHASE	J06
07	DUP DELETE PHASE	J07
08	DUP DEFINE PHASE	J08
09	DUP EXIT PHASE	J09
0A	DUP CARD I/O INTERFACE	J10
0B	DUP KEYBOARD INPUT INTERFACE	J11
0C	DUP PAPER TAPE I/O INTERFACE	J12
0D	DUP UPCOR PHASE SAVED BY DEXIT DURING STORECI	J17
0E	DUP PRINCIPAL INPUT WITH KEYBOARD	J17
0F	DUP PRINCIPAL W/O KEYBOARD	J17
10	DUP PAPER TAPE I/O	J17
11	DUP STORE CI	J17
12	DUP MODIF DUMMY PHASE	J17
	FORTRAN compiler	
1F	FOR INPUT PHASE	K01
20	FOR CLASSIFIER PHASE	K02
21	FOR CHECK ORDER/STMNT NO. PHASE	K03
22	FOR COMMON SUBR OR FUNCTION PHASE	K04
23	FOR DIMENSION, REAL, INTEGER	K05
24	FOR REAL CONSTANT PHASE	K06
25	FOR DEFINE FILE, CALL LINK EXIT	K07
26	FOR VARIABLE, STMNT FUNC PHASE	K08
27	FOR DATA STATEMENT PHASE	K09
28	FOR FORMAT STATEMENT PHASE	K10
29	FOR SUBTRACT DECOMPOSITION PHASE	K11
2A	FOR ASCAN I PHASE	K12
2B	FOR ASCAN II PHASE	K13
2C	FOR DO, CONTINUE, ETC. PHASE	K14
2D	FOR SUBSCRIPT OPTIMIZE PHASE	K15
2E	FOR SCAN PHASE	K16
2F	FOR EXPANDER I PHASE	K17
30	FOR EXPANDER II PHASE	K18
31	FOR DATA ALLOCATION PHASE	K19
32	FOR COMPILATION ERROR PHASE	K20
33	FOR STATEMENT ALLOCATION PHASE	K21
34	FOR LIST STATEMENT ALLOCATION	K22
35	FOR LIST SYMBOL TABLE PHASE	K23
36	FOR LIST CONSTANTS PHASE	K24
37	FOR OUTPUT I PHASE	K25
38	FOR OUTPUT II PHASE	K26
39	FOR RECOVERY (EXIT) PHASE	K27
	COBOL compiler (program product)	
51	PHASE NUMBERS USED BY THE COBOL COMPILER	
5C		
	Supervisor	
6E	SUP PHASE 1–MONITOR CONTROL RECORD ANALYZER	N01
6F	SUP PHASE 2–JOB CONTROL RECORD PROCESSOR	N01
70	SUP PHASE 3–DELETE TEMPORARILY STORED PROGRAM LET	N01
71	SUP PHASE 4–XEQ CONTROL RECORD PROCESSOR	N01
72	SUP PHASE 5–SUPERVISOR CONTROL RECORDS PROCESSOR	N01
73	SYSTEM DUMP-CORE-TO-PRINTER	N02
74	AUXILIARY SUPERVISOR	N03
75	SUP PHASE 8–PHASE 5 OVERLAY 1	N01
76	SUP PHASE 9–PHASE 5 OVERLAY 2	N01
	Core load builder	
78	CORE LOAD BUILDER, PHASE 0/1	OCB
79	CORE LOAD BUILDER, PHASE 2	OCB
7A	CORE LOAD BUILDER, PHASE 3	OCB
7B	CORE LOAD BUILDER, PHASE 4	OCB
7C	CORE LOAD BUILDER, PHASE 5	OCB
7D	CORE LOAD BUILDER, PHASE 6	OCB
7E	CORE LOAD BUILDER, PHASE 7	OCB
7F	CORE LOAD BUILDER, PHASE 8	OCB
80	CORE LOAD BUILDER, PHASE 9	OCB
81	CORE LOAD BUILDER, PHASE 10	OCB
82	CORE LOAD BUILDER, PHASE 11	OCB
83	CORE LOAD BUILDER, PHASE 12	OCB
84	CORE LOAD BUILDER, PHASE 13	OCB

Phase number	Program or program phase name	ID starting in column 73
	System device subroutines, disk I/O	
8C	SYS 1403	PMN
8D	SYS 1132	PMN
8E	SYS CONSOLE PRINTER	PMN
8F	SYS 2501	PMN
90	SYS 1442	PMN
91	SYS 1134	PMN
92	SYS KEYBOARD	PMN
93	SYS 2501/1442 CONVERSION	PMN
94	SYS 1134 CONVERSION	PMN
95	SYS KEYBOARD CONVERSION	PMN
96	DISKZ	PMN
97	DISK1	PMN
98	DISKN	PMN
	Core image loader	
A0	CORE IMAGE LOADER, PHASE 1	PMN
A1	CORE IMAGE LOADER, PHASE 2	PMN
	RPG compiler	
B0	RESIDENT	PR1
B1	ENTER FILES	PR2
B2	ENTER INPUT	PR3
B3	ENTER CALCULATION	PR4
B4	ENTER OUTPUT	PR5
B5	ASSIGN INDICATORS	PR6
B6	ASSIGN FIELD NAMES	PR7
B7	ASSIGN LITERALS	PR8
B8	EXTENDED FILE AND INPUT DIAGNOSTIC	PR9
B9	EXTENDED CALCULATION AND OUTPUT DIAGNOSTIC	PRA
BA	DIAGNOSTIC MESSAGE 1	PRB
BB	DIAGNOSTIC MESSAGE 2	PRC
BC	DIAGNOSTIC MESSAGE 3	PRD
BD	ASSEMBLE 1 I/O	PRE
BE	ASSEMBLE 2 I/O	PRF
BF	ASSEMBLE 3 I/O	PRG
C0	ASSEMBLE 4 I/O	PRH
C1	ASSEMBLE TABLES	PRJ
C2	ASSEMBLE CHAIN AND RAF	PRK
C3	ASSEMBLE INPUT FIELDS	PRL
C4	ASSEMBLE CONTROL LEVELS	PRM
C5	ASSEMBLE MULTI FILE LOGIC	PRN
C6	ASSEMBLE GET ROUTINES	PRO
C7	ASSEMBLE CALCULATIONS 1	PRP
C8	ASSEMBLE CALCULATIONS 2	PRQ
C9	ASSEMBLE OUTPUT FIELDS	PRR
CA	ASSEMBLE PUT ROUTINES	PRS
CB	ASSEMBLE FIXED DRIVER	PRT
CC	TERMINATE COMPILATION	PRU
	DUP part 2	
CD	DUP CTRL—PART 2	PS0
CE	MACRO UPDATE PROGRAM	PS1

Phase number	Program or program phase name	ID starting in column 73
	Assembler	
CF	ASM INITIALIZATION PHASE	PTM
D0	ASM CARD CONVERSION PHASE	PTM
D1	ASM DSF OUTPUT PHASE	PTM
D2	ASM INTERMEDIATE INPUT PHASE	PTM
D3	ASM END STATEMENT PHASE	PTM
D4	ASM ASSEMBLY ERROR PHASE	PTM
D5	ASM CONTROL CARDS 1	PTM
D6	ASM CONTROL CARDS 2	PTM
D7	ASM DUMMY PHASE (SYST SYMBOL TBL)	PTM
D8	ASM SYMBOL TABLE OPTIONS PHASE	PTM
D9	ASM EXIT PHASE	PTM
DA	ASM PROG HEADER MNEMONICS PHASE	PTM
DB	ASM FILE STATEMENT PHASE	PTM
DC	ASM COMMON SUBROUTINES, ASCOM	PTM
DD	ASM PROG CONTROL MNEMONICS PHASE	PTM
DE	ASM IMPERATIVE STATEMENTS PHASE	PTM
DF	ASM DECML EFLC PROCESSING PHASE	PTM
E0	ASM DECIMAL CONVERSION PHASE	PTM
E1	ASM PROG LINKING PHASE	PTM
E2	ASM DMES PROCESSING PHASE	PTM
E3	ASM PUNCH CONVERSION PHASE	PTM
E4	ASM INTERMEDIATE DISK OUTPUT	PTM
E5	ASM SYMBOL TABLE OVERFLOW	PTM
E6	ASM G2250 PH1	PTM
E7	ASM DIVISION OPERATOR PHASE	PTM
E8	ASM CONTROL CARDS 3	PTM
E9	ASM MACRO PHASE 1—SPECIAL OP AND PREPROCESSING	PTM
EA	ASM MACRO PHASE 1A—SPECIAL PSEUDO OPS	PTM
EB	ASM MACRO PHASE 1B—CONDITIONAL ASSEMBLY	PTM
EC	ASM MACRO PHASE 2—MACRO DEFINITION	PTM
ED	ASM MACRO PHASE 2A—MACRO DEFINITION	PTM
EE	ASM MACRO PHASE 2B—MACRO DEFINITION	PTM
EF	ASM MACRO PHASE 3—EXPANSION	PTM
F0	ASM MACRO PHASE 3A—EXPANSION	PTM
F1	ASM MACRO PHASE 3B—EXPANSION	PTM
F2	ASM CROSS REFERENCE—PART 1	PTM
F3	ASM CROSS REFERENCE—PART 2A	PTM
F4	ASM CROSS REFERENCE—PART 2B	PTM
F5	ASM CROSS REFERENCE—PART 2C	PTM
F6	ASM CROSS REFERENCE—PART 3	PTM

Type 81 Control Record

general function

The type 81 control record defines the end of the loading of the monitor system programs and/or phases. After the type 81 control record is read, a record of the principal print device and the principal I/O devices is placed in the system location equivalence table (SLET). (Principal I/O devices are discussed under "System Configuration *Control* Records" in this chapter.) Also during an initial load, the disk communications area (DCOM) and location equivalence table (LET) are initialized, and the reload table is established.

format of type 81 control record

Card column	Contents
1 and 2	Blanks
3	A 6 punch
4	A 1 punch
5 through 80	Blanks

Note. These punches are /8100 in card data format (CDD) in word 3, thus, the name type 81.

If reconfiguration is all that is being done by a reload operation, place the type 81 control records immediately after the PHID control record.

SYSTEM LOADER CONTROL RECORDS THAT YOU PUNCH

The control records that you punch for initial load and reload operations are:

- Load mode that defines whether the operation is an initial load or a reload
- System configuration that defines the I/O devices of your system
- CORE (optional) that allows you to define a core size other than the actual core size of the computer

The general functions, formats, and uses in initial load and reload operations for these control records are described in the following text.

Note. When the 1627 Plotter is used by a program, the following subroutines must not be in a SOCAL for that program: EADD, FADD, FMPY, EMPY, XMD, XMDS, and FARC. These must instead be incore subroutines. You can accomplish this during a system load by storing the programs with subtype zero.

Load Mode Control Record

general function

The load mode control record informs the system loader whether the operation is an initial load or a reload. This control record can also be used to bypass the assembler,. FORTRAN compiler, COBOL compiler, or RPG compiler during an initial load or reload.

format

Card column	Contents	Explanation
1 through 4	MODE	
5 through 7	Blanks	
8	I or R	*I* indicates initial load. *R* indicates reload.
9 through 11	Blanks	
12	A or blank	*A* indicates the assembler is not being loaded or is not on the system being reloaded. Blank indicates the assembler is being loaded or is on the system being reloaded.
13	F or blank	*F* indicates the FORTRAN compiler is not being loaded or FORTRAN is not on the system being reloaded. Blank indicates the FORTRAN compiler is being loaded or FORTRAN is on the system being reloaded.
14	R or blank	*R* indicates RPG is not being loaded or RPG is not on the system being reloaded. Blank indicates the RPG compiler is being loaded or RPG is on the system being reloaded.
15	C or blank	*C* indicates the COBOL compiler (a program product) is being loaded or COBOL is on the system being reloaded. Blank indicates COBOL is not being loaded or COBOL is not on the system being reloaded.
16 through 80	Blanks	

Note. If the assembler or the FORTRAN, RPG, or COBOL compiler is not loaded in an initial load or was deleted by a DUP DEFINE VOID operation, they can be loaded by an initial load operation only. Columns 12, 13, and 14 must contain A, F, or R, respectively, and column 15 must be blank for a reload operation to reflect the status of the cartridge.

card system use

For a card system, a load mode control card is placed in an initial load or reload card deck immediately behind the first part of the system loader. The order of cards for an initial load and reload is illustrated in Figures 8-2 and 8-4 under "Card System Initial Load Operating Procedure" and "Card System Reload Operating Procedure," respectively, in this chapter.

paper tape system use

For a paper tape system, this control record is entered between the IBM-supplied tapes, BP01 and BP03, as illustrated in Figures 8-7 and 8-9 under "Paper Tape System Initial Load Operating Procedure" and "Paper Tape System Reload Operating Procedure" in this chapter. A procedure for punching a load mode control tape is included under "Preparation of Load Mode and System Configuration Control Tapes" in this chapter.

System Configuration Control Records

general function

System configuration control records (REQ) allow you to define the system I/O devices that are a part of your computer system. Punch one control record for each device. Missing or extra REQ records may cause initial load operations to fail.

format

	Card columns			
Device	1 through 3	9 and 10[1]	15 through 20	
1442 Card Read/Punch Card Punch	REQ	1	1442-5 1442-6 1442-7	whichever is applicable
Paper Tape Reader and/or Punch	REQ	3	1134	Unit ID is optional
2501 Card Reader	REQ	4	2501	
1132 Printer	REQ	6	1132	
1403 Printer	REQ	9	1403	

Note. I/O devices not listed are initialized as part of the system; REQ control records are not required. If an REQ control record is punched for a 1442, columns 15 through 20 must be coded to indicate the model.

[1] ISS numbers, right justified. Maximum entry number ISS 20.

card system use

For a card system, REQ cards are placed in an initial load or reload card deck between the IBM-supplied SCON and TERM cards. If the optional CORE card is used, it must be placed before or after the REQ cards, not between any of them. The order of cards for an initial load and reload is illustrated in Figures 8-2 and 8-4 under "Card System Initial Load Operating Procedure" and "Card System Reload Operating Procedure," respectively, in this chapter.

paper tape system use

For a paper tape system, these control records are punched in the system configuration tape. The procedure for punching this tape is included in "Preparation of Load Mode and System Configuration Control Tapes" in this chapter. The system configuration tape is entered between the IBM-supplied tapes, BP02 and BP03, as illustrated in Figures 8-7 and 8-9 under "Paper Tape System Initial Load Operating Procedure" and "Paper Tape System Reload Operating Procedure" in this chapter.

principal I/O devices

When more than one input device or output device of a type is configured for a system, the fastest device defined in the REQ control records is used by the system. The following chart lists the principal I/O devices selected by the system.

Device specified on REQ control records	Principal I/O device
2501, 1442, paper tape	2501 input, 1442 output
1442, paper tape	1442 input/output
Paper tape	Paper tape input/output
1403, 1132	1403 output

When both a 1403 Printer and an 1132 Printer are configured, the 1403 is used by the system as the principal printer. You can specify the use of the console printer as the principal print device with // TYP and // CPRNT monitor control records. (These control records are described in Chapter 5.)

CORE Control Record

general function

This control record is an optional record that allows you to define a core size that is different than the actual size of core.

format

Card column	Contents	Explanation
1 through 4	CORE	
5	Blank	
6 through 8	04K, 08K, 16K, or 32K	The entry chosen specifies the core size you are defining.
9 through 80	Blanks	

card system use

For a card system, a CORE control card is placed in an initial load or reload card deck before or after the REQ card and between the IBM-supplied SCON and TERM cards. The order of cards for an initial load and reload is illustrated in Figures 8-2 and 8-4 under "Card System Initial Load Operating Procedure" and "Card System Reload Operating Procedure," respectively, in this chapter.

paper tape system use

For a paper tape system, this control record (when used) is punched in the system configuration tape. The procedure for punching this tape is included in "Preparation of Load Mode and System Configuration Control Tapes" in this chapter. The system configuration tape is entered between the IBM-supplied tapes, BP02 and BP03, as illustrated in Figures 8-7 and 8-9 under "Paper Tape System Initial Load Operating Procedure" and "Paper Tape System Reload Operating Procedure" in this chapter.

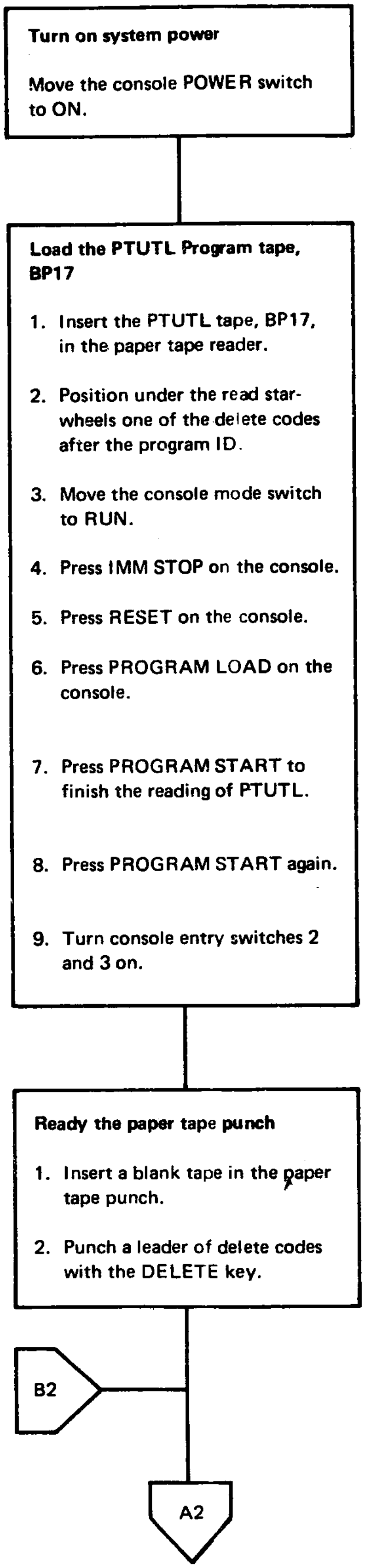
Preparation of Load Mode and System Configuration Control Tapes

Paper tape control records must be punched in PTTC/8 (perforated tape transmission code). The load mode and system configuration control tapes are punched by using the Paper Tape Utility Program (PTUTL). Initially, these control records are punched by using the stand-alone PTUTL tape, BP17, that is supplied by IBM.

The materials that you need to prepare the load mode and system configuration control tapes are:

- The Paper Tape Utility Program (PTUTL) tape, BP17
- A blank tape

The preparation of the load mode and system configuration control tapes do not have to be punched consecutively as in the procedure in Figure 8-1. These control records can be prepared separately by using the portions of the procedure that are applicable to the record being punched.



Turn on system power

Move the console POWER switch to ON.

Load the PTUTL Program tape, BP17

1. Insert the PTUTL tape, BP17, in the paper tape reader.
2. Position under the read starwheels one of the delete codes after the program ID.
3. Move the console mode switch to RUN.
4. Press IMM STOP on the console.
5. Press RESET on the console.
6. Press PROGRAM LOAD on the console.
7. Press PROGRAM START to finish the reading of PTUTL.
8. Press PROGRAM START again.
9. Turn console entry switches 2 and 3 on.

Ready the paper tape punch

1. Insert a blank tape in the paper tape punch.
2. Punch a leader of delete codes with the DELETE key.

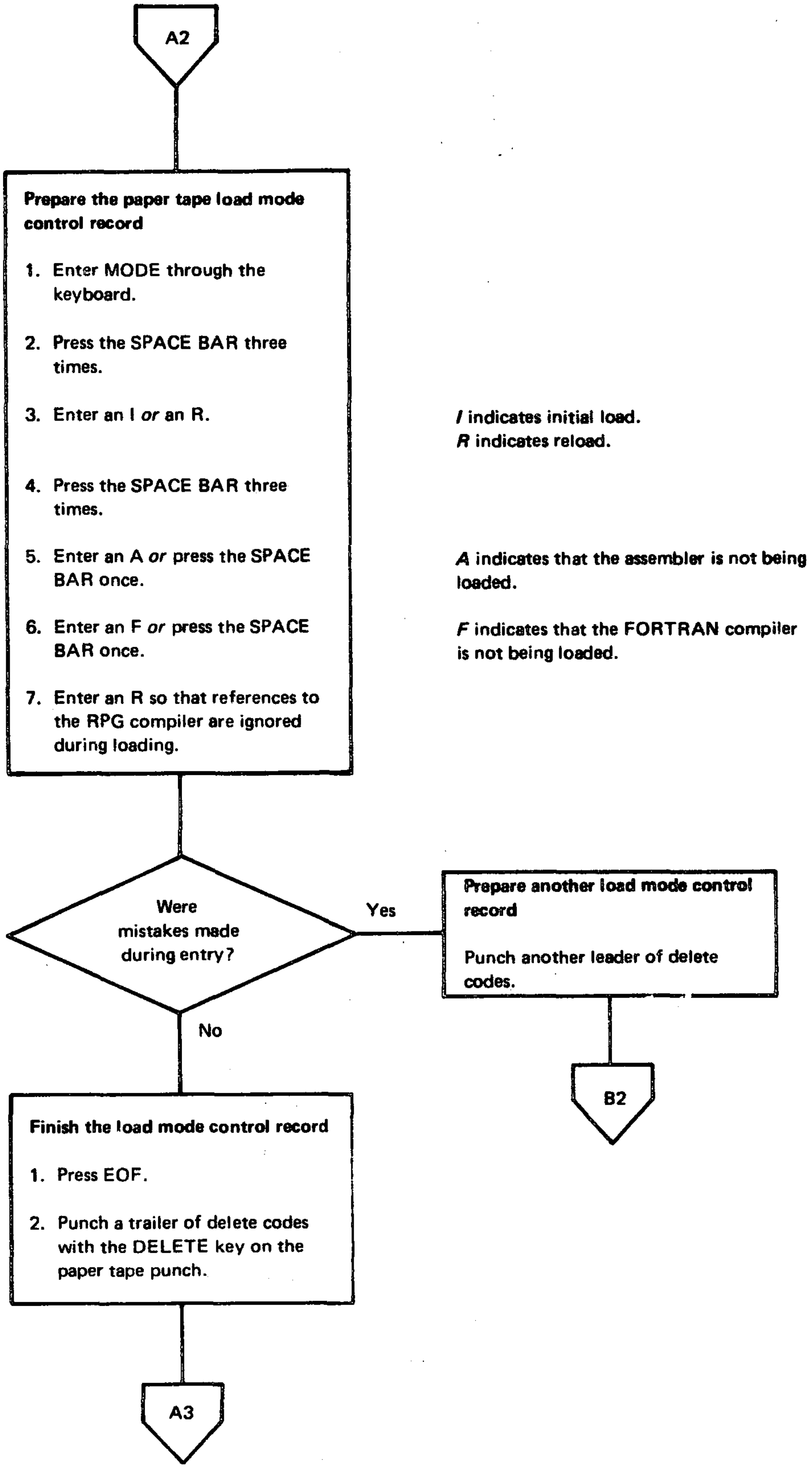
The core image loader is read into core storage, and the system waits with /006C displayed in the ACCUMULATOR.

When the reading of BP17 is complete, the system waits with /00C9 in the ACCUMULATOR.

The system waits again with /1111 in the ACCUMULATOR.

2 indicates keyboard input.
3 indicates that records are to be punched by the paper tape punch.
Complete operating procedures for PTUTL are in Chapter 8.

Figure 8-1 (Part 1 of 4). Preparation of paper tape load and reload control tapes



Prepare the paper tape load mode control record

1. Enter MODE through the keyboard.
2. Press the SPACE BAR three times.
3. Enter an I *or* an R.
4. Press the SPACE BAR three times.
5. Enter an A *or* press the SPACE BAR once.
6. Enter an F *or* press the SPACE BAR once.
7. Enter an R so that references to the RPG compiler are ignored during loading.

I indicates initial load.
R indicates reload.

A indicates that the assembler is not being loaded.

F indicates that the FORTRAN compiler is not being loaded.

Were mistakes made during entry?

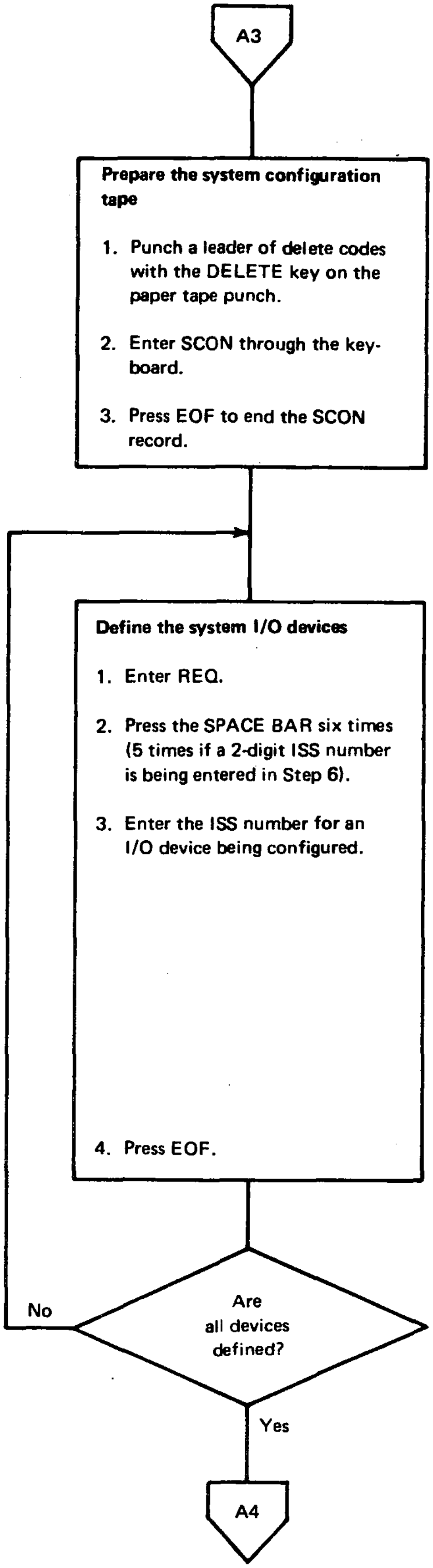
Prepare another load mode control record

Punch another leader of delete codes.

Finish the load mode control record

1. Press EOF.
2. Punch a trailer of delete codes with the DELETE key on the paper tape punch.

Figure 8-1 (Part 2 of 4). Preparation of paper tape load and reload control tapes



Prepare the system configuration tape

1. Punch a leader of delete codes with the DELETE key on the paper tape punch.
2. Enter SCON through the keyboard.
3. Press EOF to end the SCON record.

If errors are made during the preparation of this tape, repeat from here.

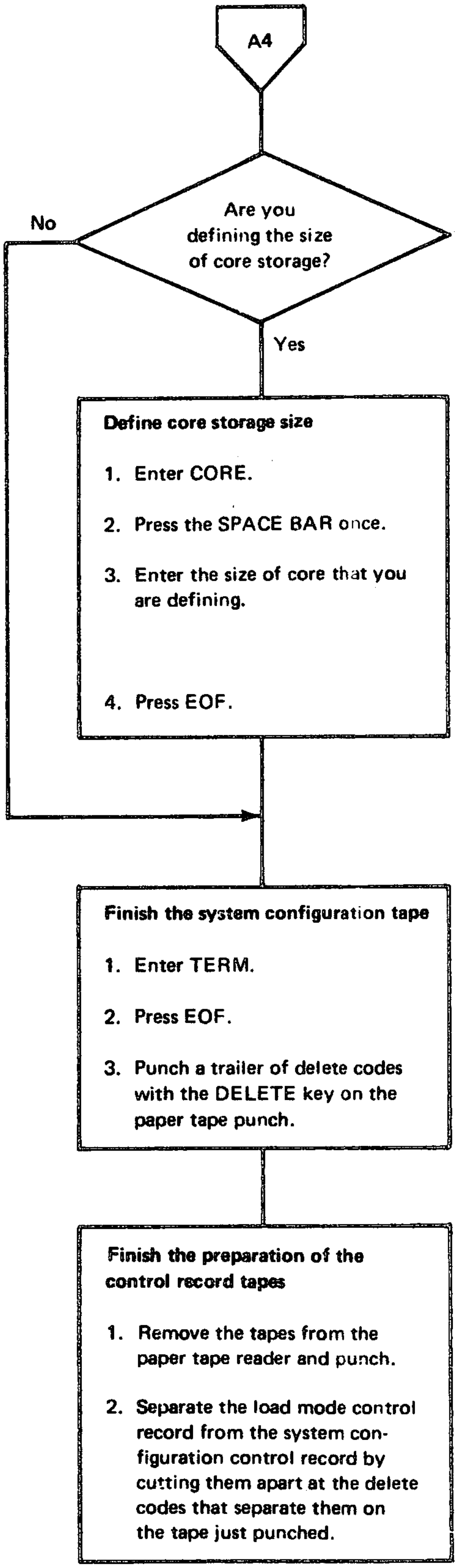
Define the system I/O devices

1. Enter REQ.
2. Press the SPACE BAR six times (5 times if a 2-digit ISS number is being entered in Step 6).
3. Enter the ISS number for an I/O device being configured.
4. Press EOF.

I/O device	*ISS number*
1442 Card Read Punch/Card Reader	1
Paper tape reader and/or punch	3
2501 Card Reader	4
1132 Printer	6
1403 Printer	9

Note: Maximum ISS entry is 20.

Figure 8-1 (Part 3 of 4). Preparation of paper tape load and reload control tapes



Define core storage size

1. Enter CORE.
2. Press the SPACE BAR once.
3. Enter the size of core that you are defining.
4. Press EOF.

04K defines core size of 4K.
08K defines core size of 8K.
16K defines core size of 16K.
32K defines core size of 32K.

Finish the system configuration tape

1. Enter TERM.
2. Press EOF.
3. Punch a trailer of delete codes with the DELETE key on the paper tape punch.

Finish the preparation of the control record tapes

1. Remove the tapes from the paper tape reader and punch.
2. Separate the load mode control record from the system configuration control record by cutting them apart at the delete codes that separate them on the tape just punched.

Figure 8-1 (Part 4 of 4). Preparation of paper tape load and reload control tapes

CARD SYSTEM INITIAL LOAD OPERATING PROCEDURE

The materials that you need to perform a card system initial load procedure are:

- An initialized disk.
- IBM-supplied system cards
- Load mode and REQ (and CORE, if used) cards that you punched. An I must be punched in column 8 of the load mode card

The initial load cards and card decks that are being used in the initial load procedure must be arranged in the order shown in Figure 8-2.

Note. If your computing system has 2311 Disk Storage Drives, replace the DISKN subroutine included in the system device subroutines with the DISKN subroutine included with the stand-alone utilities. The DISKN included in the system device subroutines is identified by the letters PMN beginning in card column 73. The sequence numbers are included in the materials supplied with the modification level of your system. The DISKN included with the stand-alone utilities is identified by the letters PMNDN beginning in card column 73.

You perform a card system initial load procedure as shown in Figure 8-3.

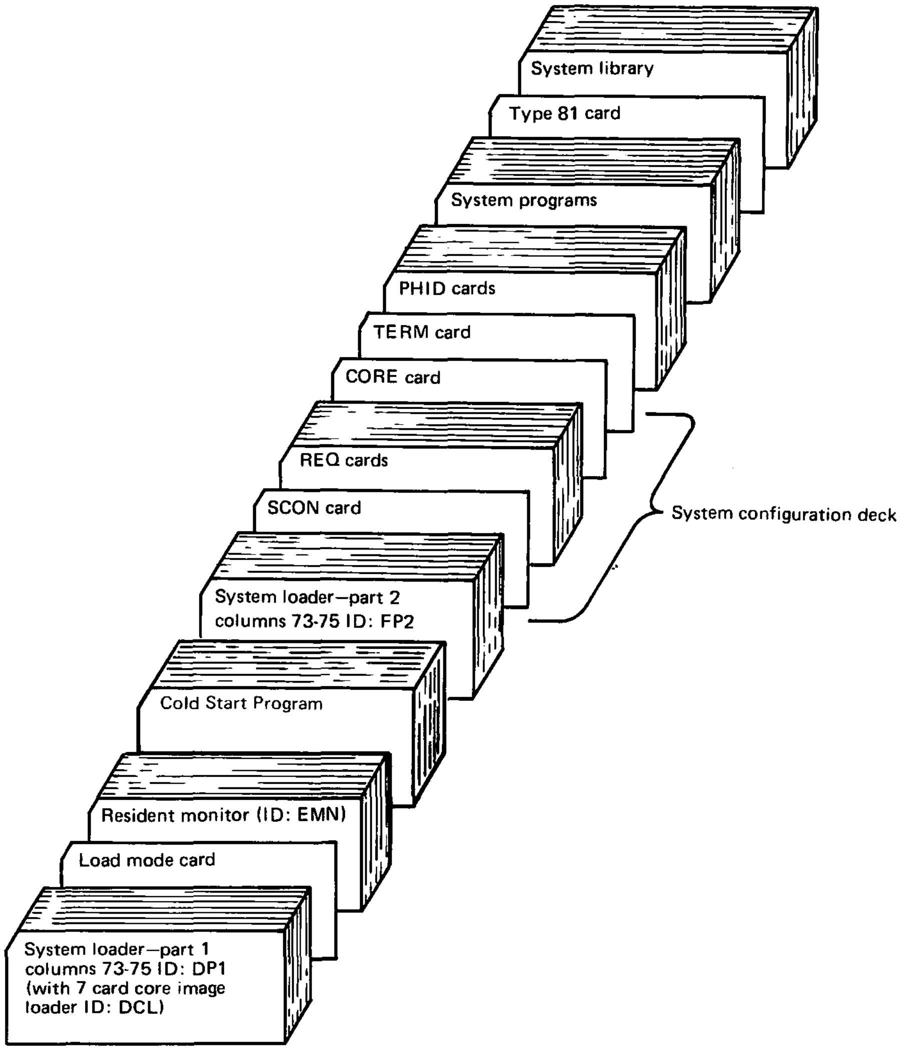
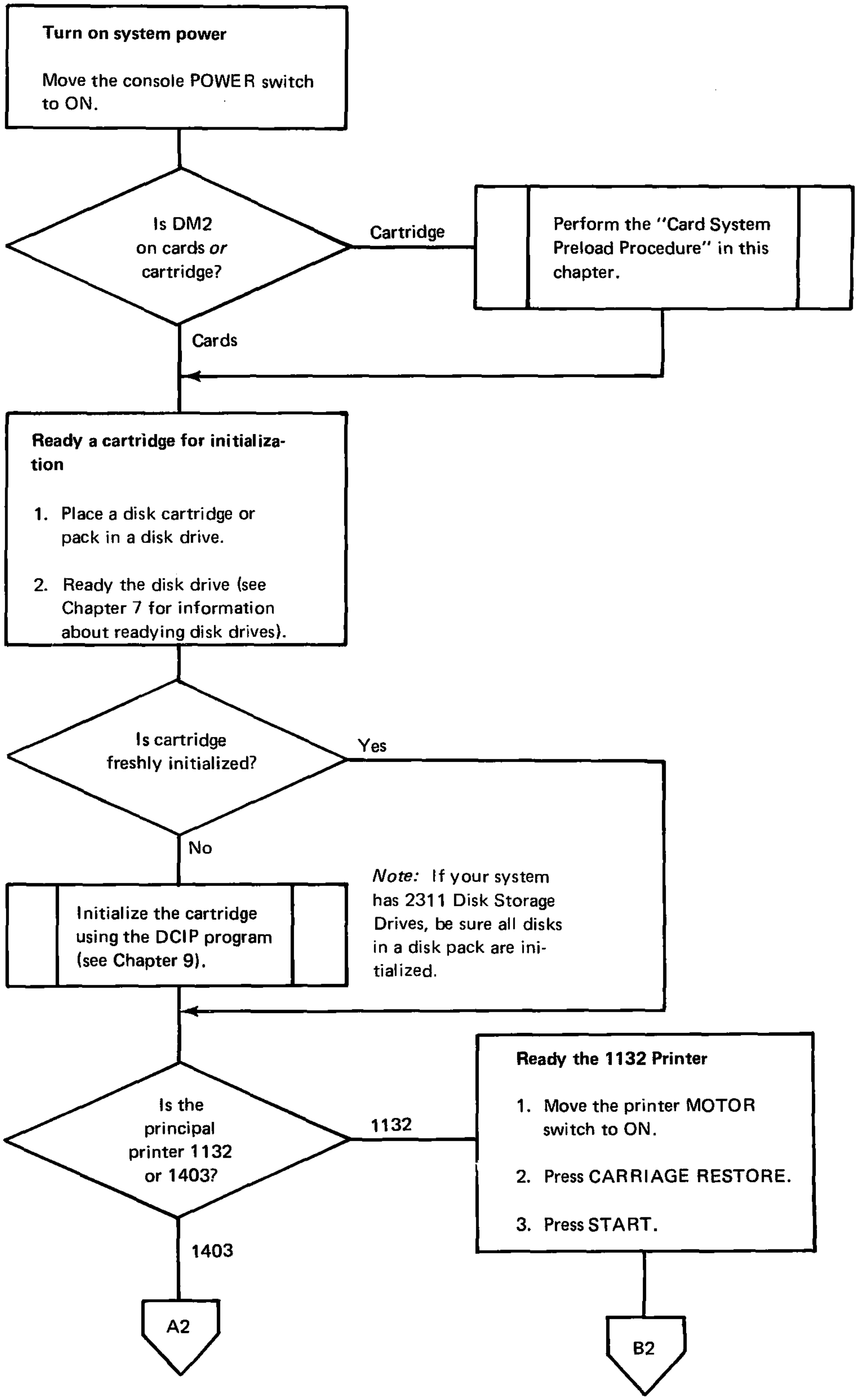


Figure 8-2. Card system initial load cards



Turn on system power

Move the console POWER switch to ON.

Is DM2 on cards *or* cartridge?

Perform the "Card System Preload Procedure" in this chapter.

Ready a cartridge for initialization

1. Place a disk cartridge or pack in a disk drive.
2. Ready the disk drive (see Chapter 7 for information about readying disk drives).

Is cartridge freshly initialized?

Initialize the cartridge using the DCIP program (see Chapter 9).

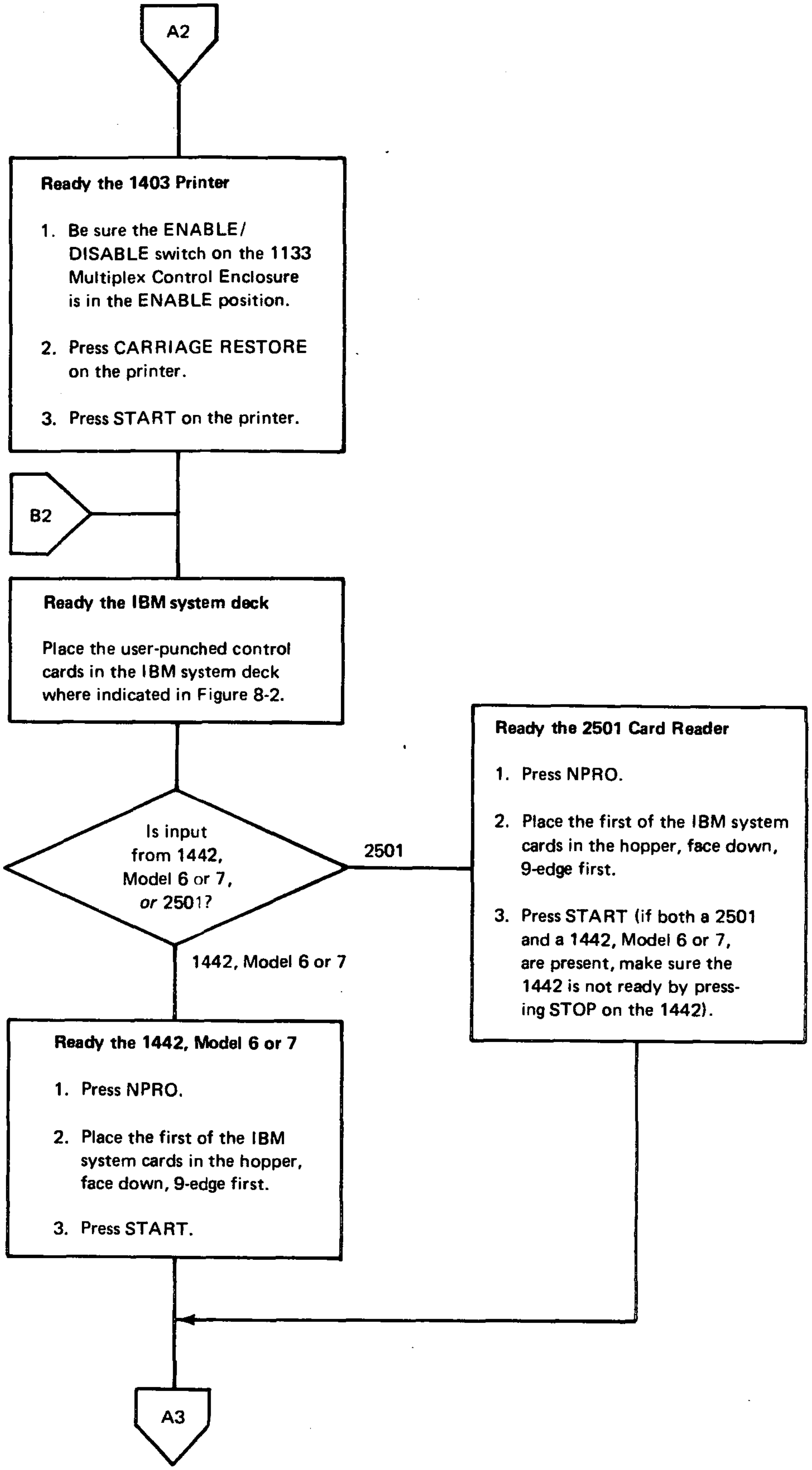
Note: If your system has 2311 Disk Storage Drives, be sure all disks in a disk pack are initialized.

Is the principal printer 1132 or 1403?

Ready the 1132 Printer

1. Move the printer MOTOR switch to ON.
2. Press CARRIAGE RESTORE.
3. Press START.

Figure 8-3 (Part 1 of 3). Card system initial load procedure



Ready the 1403 Printer

1. Be sure the ENABLE/ DISABLE switch on the 1133 Multiplex Control Enclosure is in the ENABLE position.
2. Press CARRIAGE RESTORE on the printer.
3. Press START on the printer.

Ready the IBM system deck

Place the user-punched control cards in the IBM system deck where indicated in Figure 8-2.

Is input from 1442, Model 6 or 7, *or* 2501?

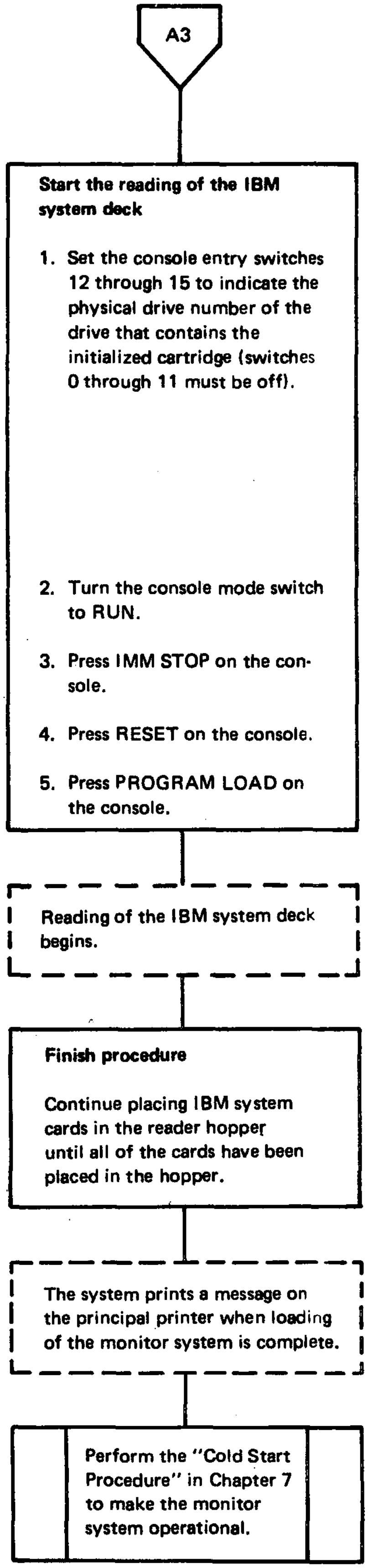
Ready the 2501 Card Reader

1. Press NPRO.
2. Place the first of the IBM system cards in the hopper, face down, 9-edge first.
3. Press START (if both a 2501 and a 1442, Model 6 or 7, are present, make sure the 1442 is not ready by pressing STOP on the 1442).

Ready the 1442, Model 6 or 7

1. Press NPRO.
2. Place the first of the IBM system cards in the hopper, face down, 9-edge first.
3. Press START.

Figure 8-3 (Part 2 of 3). Card system initial load procedure



Start the reading of the IBM system deck

1. Set the console entry switches 12 through 15 to indicate the physical drive number of the drive that contains the initialized cartridge (switches 0 through 11 must be off).

Drive 0 – all off
Drive 1 – switch 15 on
Drive 2 – switch 14 on
*Drive 3 – switches 14 and 15 on
*Drive 4 – switch 13 on
Drive 5 – switches 13 and 15 on
Drive 6 – switches 13 and 14 on
Drive 7 – switches 13, 14, and 15 on
*Drive 8 – switch 12 on
*Drive 9 – switches 12 and 15 on
Drive 10 – switches 12 and 14 on

*Not used on a 2311 Disk Storage Drive, Model 12

2. Turn the console mode switch to RUN.
3. Press IMM STOP on the console.
4. Press RESET on the console.
5. Press PROGRAM LOAD on the console.

Reading of the IBM system deck begins.

Finish procedure

Continue placing IBM system cards in the reader hopper until all of the cards have been placed in the hopper.

If the system halts (halt codes displayed in the ACCUMULATOR on the console display panel), refer to Appendix B. If the system prints a message on the console printer, refer to Appendix A.

The system prints a message on the principal printer when loading of the monitor system is complete.

Perform the "Cold Start Procedure" in Chapter 7 to make the monitor system operational.

Figure 8-3 (Part 3 of 3). Card system initial load procedure

CARD SYSTEM RELOAD OPERATING PROCEDURE

The materials that you need to perform a card system reload procedure are:

- A system cartridge
- An IBM-supplied cold start card and blank cards-(2 are enough)
- IBM-supplied system cards
- Load mode and REQ (and CORE, if used) cards that you punched. An R must be punched in column 8 of the load mode card

The reload cards that are being used in the system reload must be arranged in the order shown in Figure 8-4.

system reconfiguration

Reconfiguration is done each time a reload procedure is performed and is necessary when a system cartridge is copied from a system with a different configuration. If reconfiguration is all that is being done by a reload operation, place the type 81 control record immediately after the PHID control records.

phase and program revision or addition

Be sure the phase identification (PHID) control records reflect the phase ID limits of the system programs being added or in which phases are being revised or added. The programs or phases being revised or added by the reload procedure must be placed in ascending phase ID sequence immediately behind the IBM-supplied PHID control records.

The record immediately following the last phase being loaded must be an end-of-program card (see "End-of-Program (EOP) Card" in Appendix I). In this case, the EOP card can have words 1, 2, and 4 through 54 blank. The message END OF RELOAD is printed on the console printer when a system reload is complete.

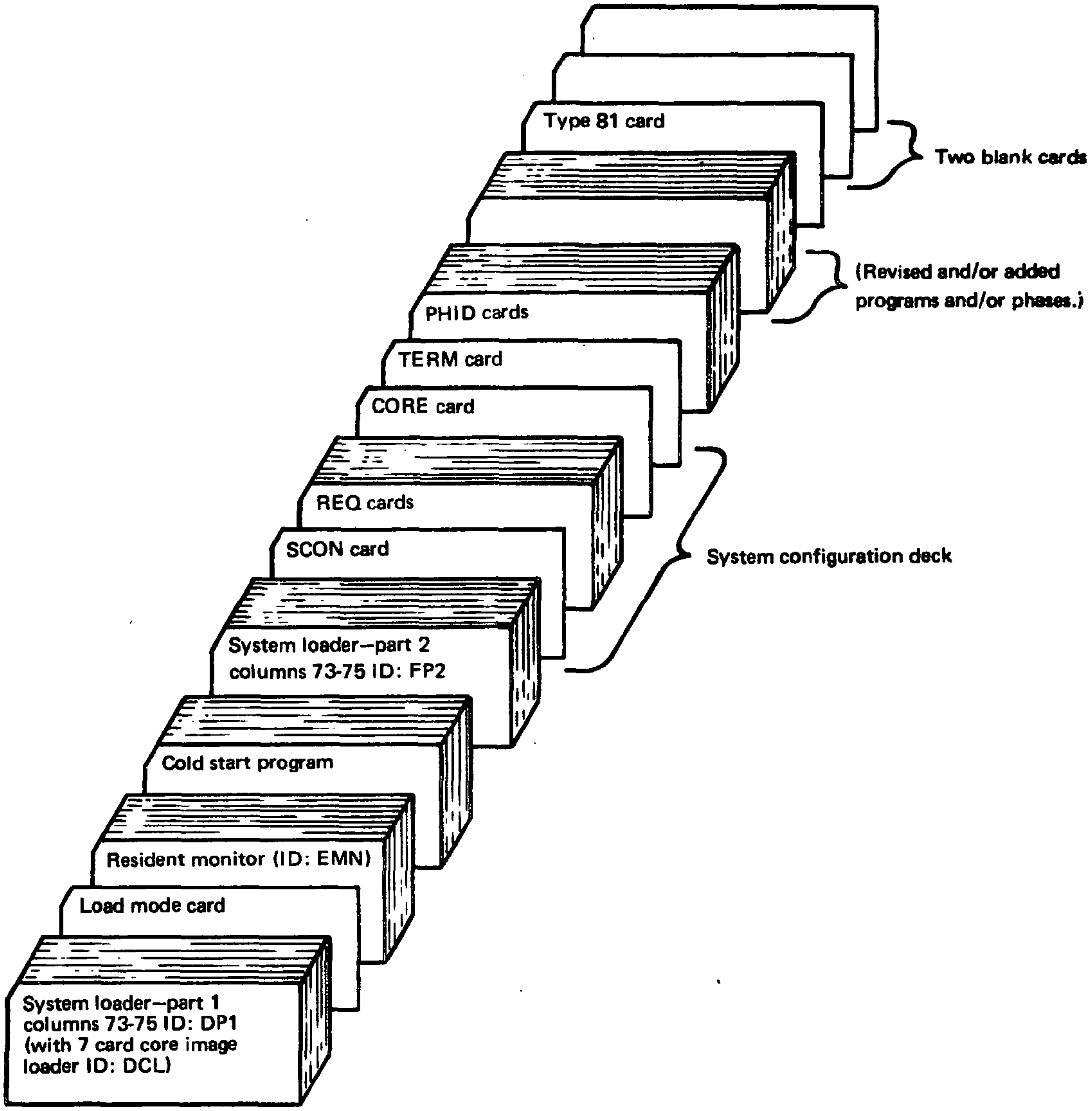

Type 81 card
Two blank cards
(Revised and/or added programs and/or phases.)
PHID cards
TERM card
CORE card
REQ cards
SCON card
System configuration deck
System loader—part 2 columns 73-75 ID: FP2
Cold start program
Resident monitor (ID: EMN)
Load mode card
System loader—part 1 columns 73-75 ID: DP1 (with 7 card core image loader ID: DCL)

Figure 8-4. Card system reload cards

The reload function can link to MODIF if a // XEQ MODIF control record follows directly after the type 81 control card. This function can be performed together with any combination of the reload functions. The END OF RELOAD message is not printed, but the // XEQ MODIF control record is printed on the principal printer. You perform a card system reload procedure as shown in Figure 8-5.

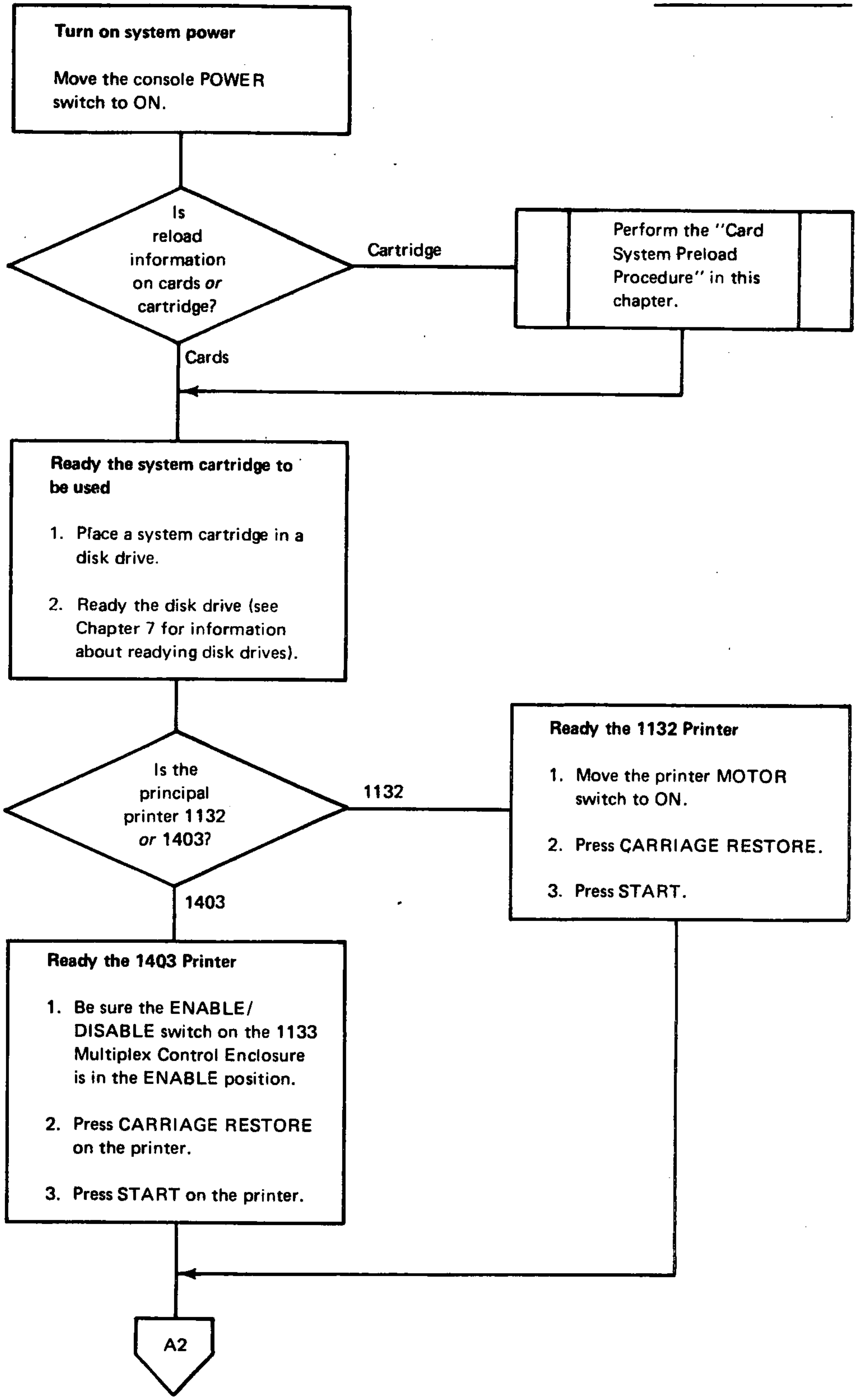
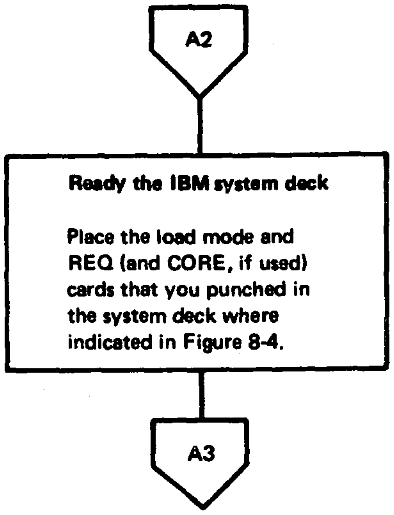

Turn on system power
Move the console POWER switch to ON.
Is reload information on cards *or* cartridge?
Cartridge
Perform the "Card System Preload Procedure" in this chapter.
Cards
Ready the system cartridge to be used
1. Place a system cartridge in a disk drive.
2. Ready the disk drive (see Chapter 7 for information about readying disk drives).
Is the principal printer 1132 *or* 1403?
1132
Ready the 1132 Printer
1. Move the printer MOTOR switch to ON.
2. Press CARRIAGE RESTORE.
3. Press START.
1403
Ready the 1403 Printer
1. Be sure the ENABLE/DISABLE switch on the 1133 Multiplex Control Enclosure is in the ENABLE position.
2. Press CARRIAGE RESTORE on the printer.
3. Press START on the printer.
A2

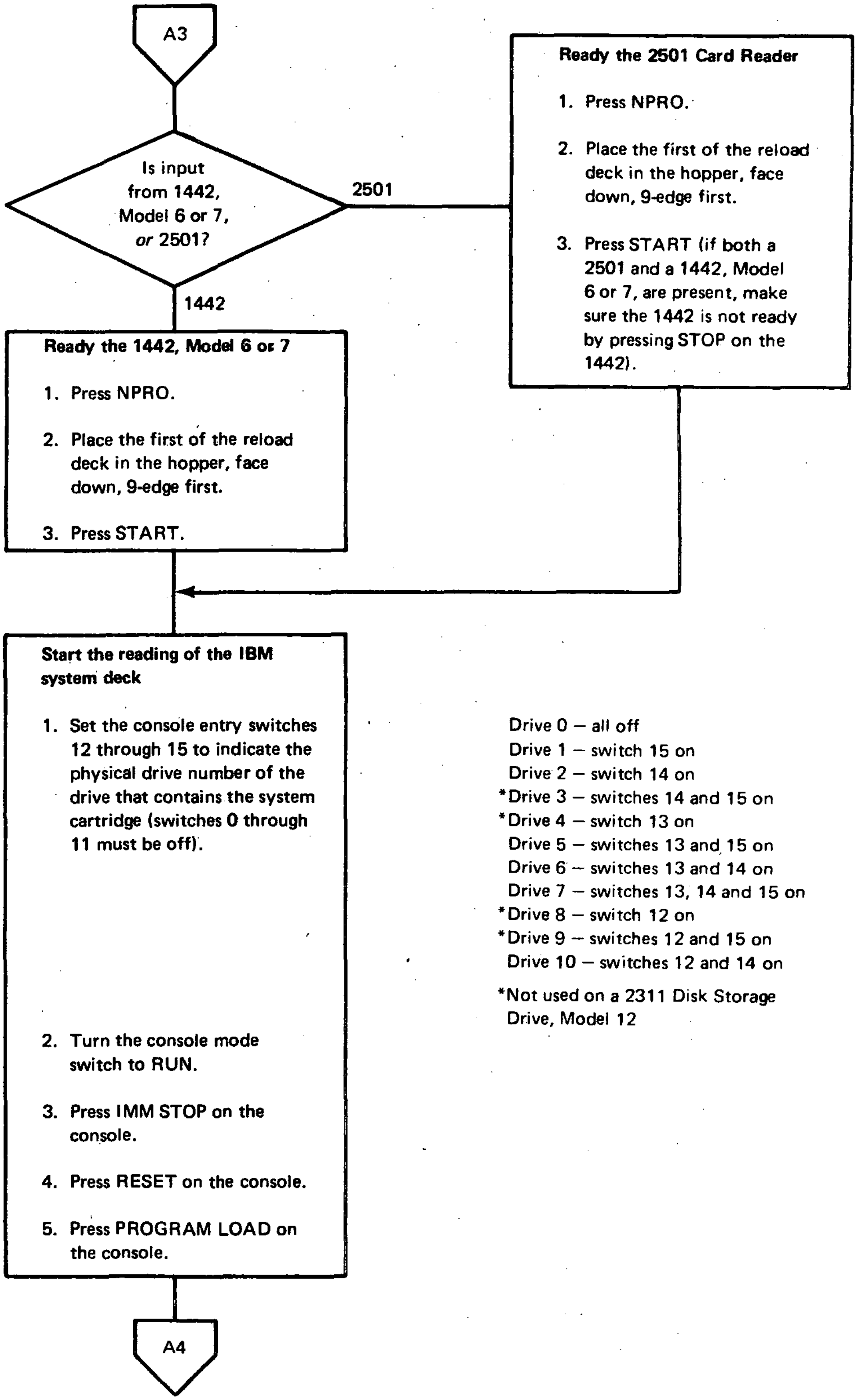
Figure 8-5 (Part 1 of 4). Card system reload procedure



Ready the IBM system deck

Place the load mode and REQ (and CORE, if used) cards that you punched in the system deck where indicated in Figure 8-4.

Figure 8-5 (Part 2 of 4). Card system reload procedure



Ready the 2501 Card Reader

1. Press NPRO.
2. Place the first of the reload deck in the hopper, face down, 9-edge first.
3. Press START (if both a 2501 and a 1442, Model 6 or 7, are present, make sure the 1442 is not ready by pressing STOP on the 1442).

Ready the 1442, Model 6 or 7

1. Press NPRO.
2. Place the first of the reload deck in the hopper, face down, 9-edge first.
3. Press START.

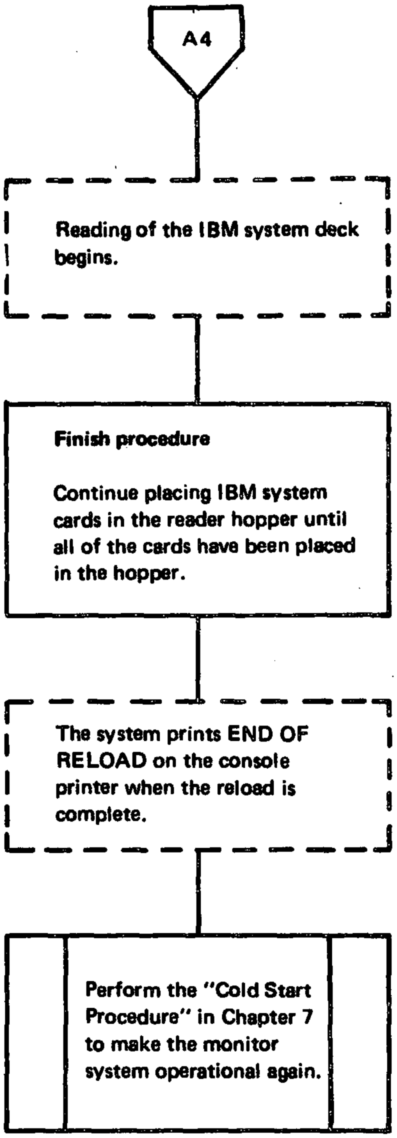
Start the reading of the IBM system deck

1. Set the console entry switches 12 through 15 to indicate the physical drive number of the drive that contains the system cartridge (switches 0 through 11 must be off).
2. Turn the console mode switch to RUN.
3. Press IMM STOP on the console.
4. Press RESET on the console.
5. Press PROGRAM LOAD on the console.

Drive 0	– all off
Drive 1	– switch 15 on
Drive 2	– switch 14 on
*Drive 3	– switches 14 and 15 on
*Drive 4	– switch 13 on
Drive 5	– switches 13 and 15 on
Drive 6	– switches 13 and 14 on
Drive 7	– switches 13, 14 and 15 on
*Drive 8	– switch 12 on
*Drive 9	– switches 12 and 15 on
Drive 10	– switches 12 and 14 on

*Not used on a 2311 Disk Storage Drive, Model 12

Figure 8-5 (Part 3 of 4). Card system reload procedure



A4

Reading of the IBM system deck begins.

Finish procedure

Continue placing IBM system cards in the reader hopper until all of the cards have been placed in the hopper.

The system prints END OF RELOAD on the console printer when the reload is complete.

Perform the "Cold Start Procedure" in Chapter 7 to make the monitor system operational again.

If the system halts (halt codes displayed in the ACCUMULATOR on the console display panel), refer to Appendix B. If the system prints a message on the console printer other than END OF RELOAD, see Appendix A.

Figure 8-5 (Part 4 of 4). Card system reload procedure

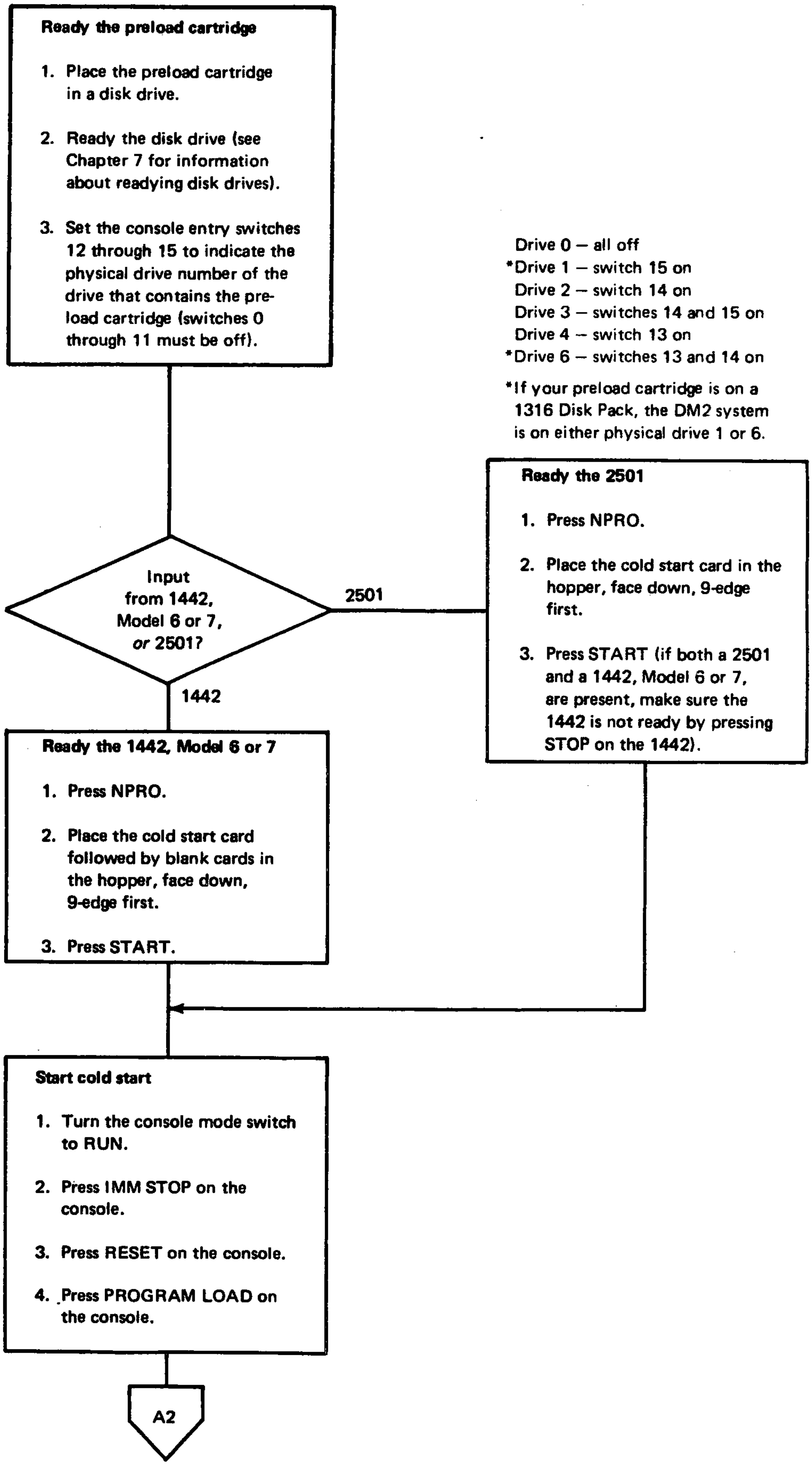
CARD SYSTEM PRELOAD OPERATING PROCEDURE

The materials that you need to perform a card system preload procedure are:

- A preload (UCART) cartridge
- An IBM-supplied cold start card
- Blank cards; the dump of the monitor system requires approximately 5400 cards

The dump is accomplished by loading the Monitor II cold start card supplied with the cartridge from IBM. The format of the preload cartridge is such that the same cold start card that is used to make the monitor system operational is used to call the *disk-to-card* dump program (UCART).

You perform a card system preload procedure as shown in Figure 8-6.



Ready the preload cartridge

1. Place the preload cartridge in a disk drive.

2. Ready the disk drive (see Chapter 7 for information about readying disk drives).

3. Set the console entry switches 12 through 15 to indicate the physical drive number of the drive that contains the preload cartridge (switches 0 through 11 must be off).

Drive 0 – all off
*Drive 1 – switch 15 on
Drive 2 – switch 14 on
Drive 3 – switches 14 and 15 on
Drive 4 – switch 13 on
*Drive 6 – switches 13 and 14 on

*If your preload cartridge is on a 1316 Disk Pack, the DM2 system is on either physical drive 1 or 6.

Ready the 2501

1. Press NPRO.

2. Place the cold start card in the hopper, face down, 9-edge first.

3. Press START (if both a 2501 and a 1442, Model 6 or 7, are present, make sure the 1442 is not ready by pressing STOP on the 1442).

Ready the 1442, Model 6 or 7

1. Press NPRO.

2. Place the cold start card followed by blank cards in the hopper, face down, 9-edge first.

3. Press START.

Start cold start

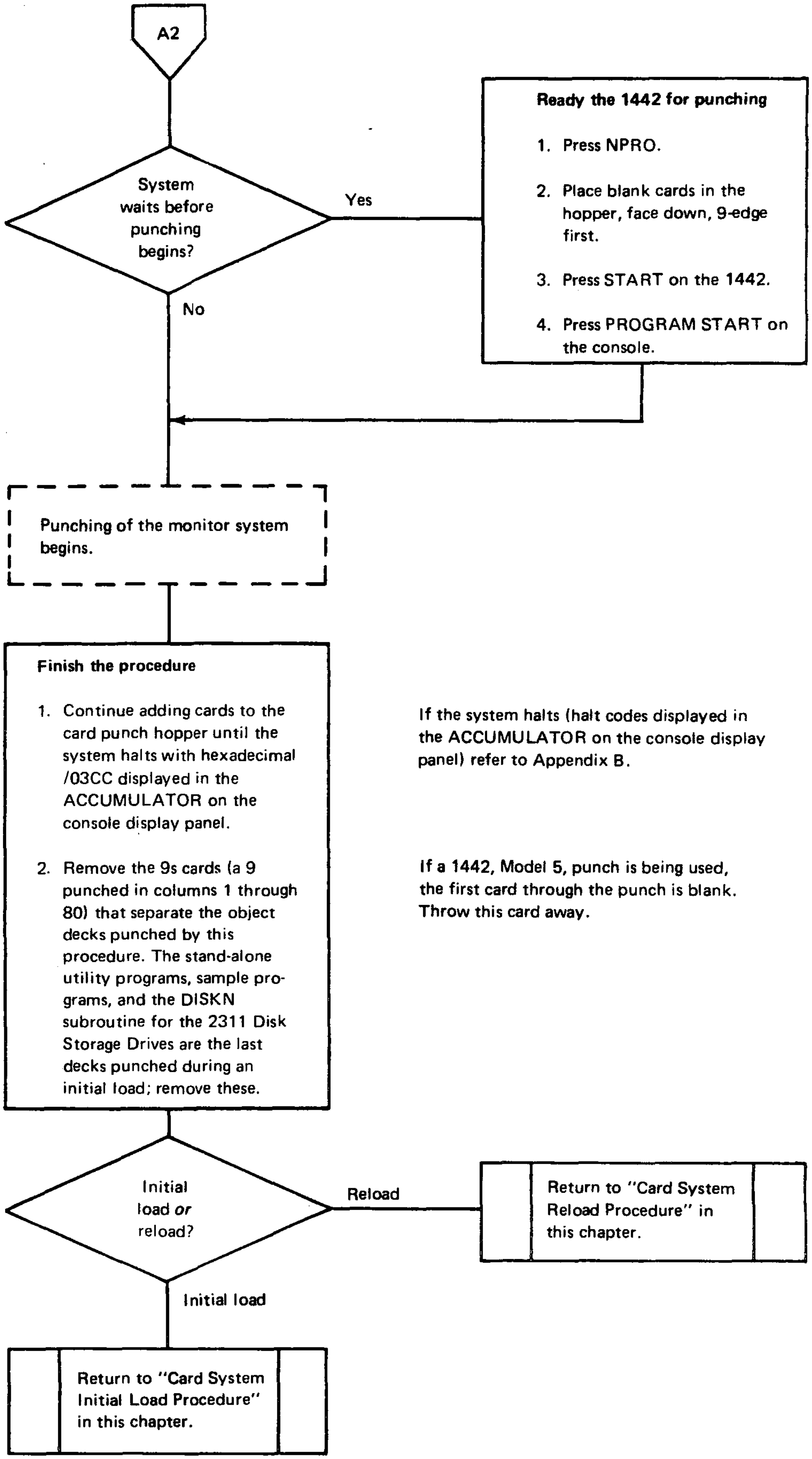
1. Turn the console mode switch to RUN.

2. Press IMM STOP on the console.

3. Press RESET on the console.

4. Press PROGRAM LOAD on the console.

Figure 8-6 (Part 1 of 2). Card system preload procedure


A2
System waits before punching begins?
Yes
No
Initial load *or* reload?
Reload
Initial load

Ready the 1442 for punching

1. Press NPRO.
2. Place blank cards in the hopper, face down, 9-edge first.
3. Press START on the 1442.
4. Press PROGRAM START on the console.

Punching of the monitor system begins.

Finish the procedure

1. Continue adding cards to the card punch hopper until the system halts with hexadecimal /03CC displayed in the ACCUMULATOR on the console display panel.
2. Remove the 9s cards (a 9 punched in columns 1 through 80) that separate the object decks punched by this procedure. The stand-alone utility programs, sample programs, and the DISKN subroutine for the 2311 Disk Storage Drives are the last decks punched during an initial load; remove these.

If the system halts (halt codes displayed in the ACCUMULATOR on the console display panel) refer to Appendix B.

If a 1442, Model 5, punch is being used, the first card through the punch is blank. Throw this card away.

Return to "Card System Reload Procedure" in this chapter.

Return to "Card System Initial Load Procedure" in this chapter.

Figure 8-6 (Part 2 of 2). Card system preload procedure

PAPER TAPE SYSTEM INITIAL LOAD OPERATING PROCEDURE

The materials that you need to perform a paper tape system initial load procedure are:

- An initialized disk cartridge
- DCIP (Disk Cartridge Initialization Program) tape, BP16
- IBM-supplied system tapes, BP01-BP14
- Load mode control record tape and system configuration record tape that you punched

If the assembler or the FORTRAN compiler is not being loaded, the corresponding tapes (BP05 or BP07) can be omitted; however, if they are not loaded, they cannot be loaded during a system reload procedure. The assembler and the FORTRAN compiler can be loaded during an initial load procedure only.

Load only those system library tapes (BP09 through BP14) that are required for your system. Tapes BP01-BP14 that are being used in the initial load must be arranged in the order shown in Figure 8-7.

Tape BP15 is the cold start record that is used to make the monitor system operational after the initial load is complete. Tapes BP16-BP20 are stand-alone utilities and are not loaded as part of the monitor system. However, you use BP17 (PTUTL) to punch the load mode and system configuration tapes that are used during initial load and BP16 (DCIP) to initialize the disk cartridge during initial load. Tapes BP21 and BP22 are sample programs that you can execute under monitor system control after the initial load is complete (see "Entering Jobs From the Paper Tape Reader" in Chapter 7).

You perform a paper tape system initial load procedure a shown in Figure 8-8.

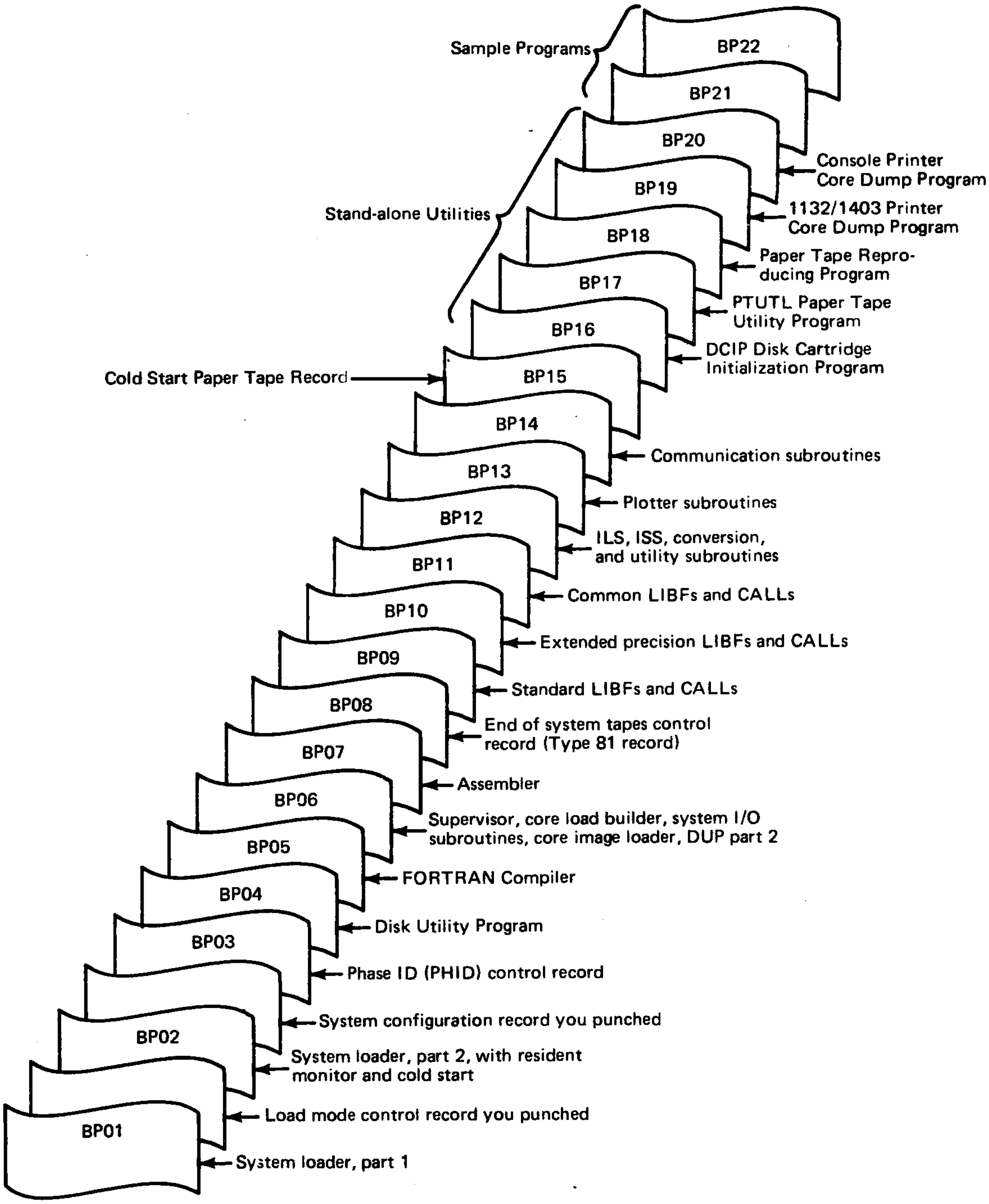
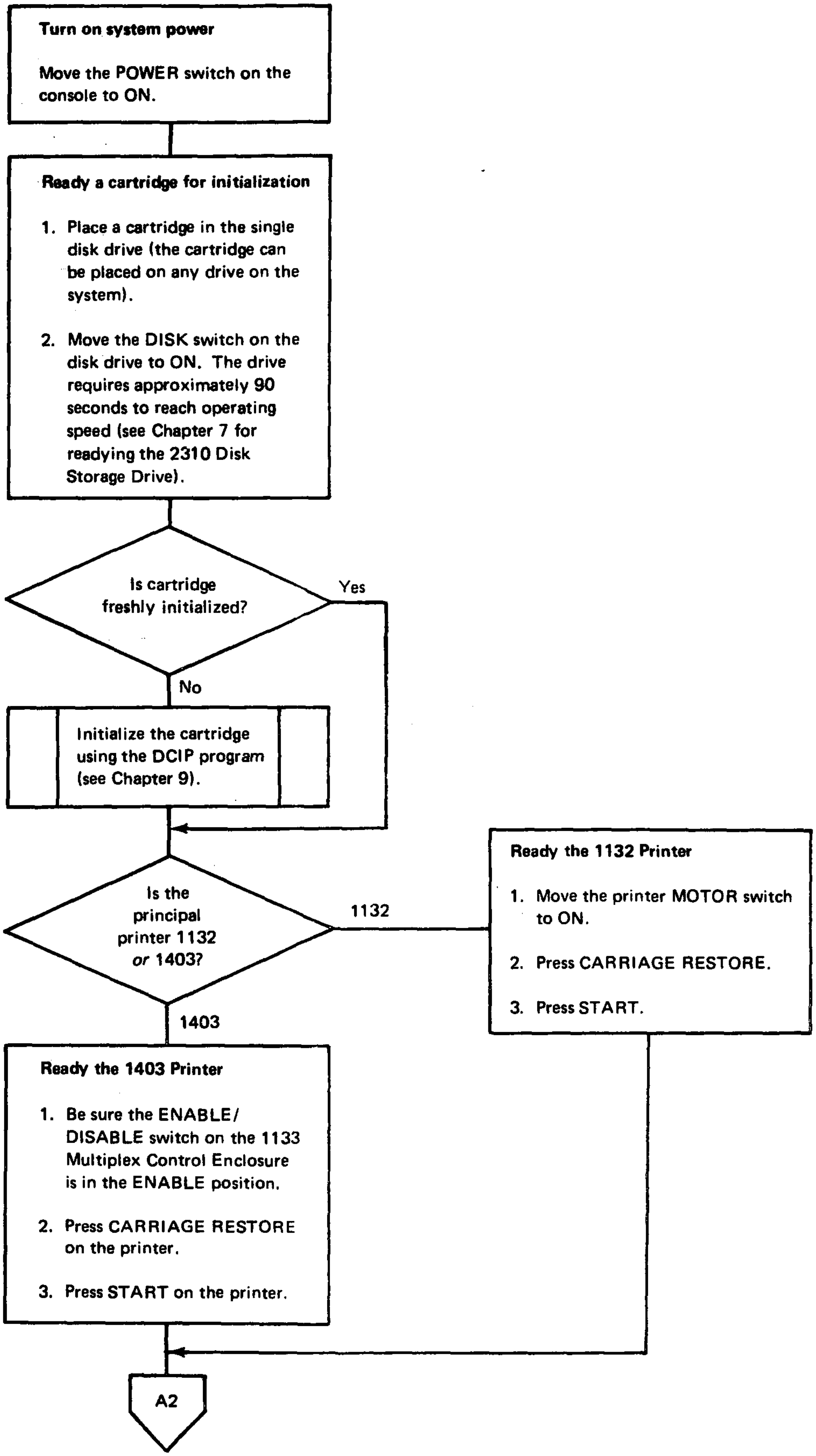

Sample Programs
BP22
BP21
BP20
Console Printer Core Dump Program
BP19
1132/1403 Printer Core Dump Program
Stand-alone Utilities
BP18
Paper Tape Reproducing Program
BP17
PTUTL Paper Tape Utility Program
BP16
DCIP Disk Cartridge Initialization Program
Cold Start Paper Tape Record
BP15
BP14
Communication subroutines
BP13
Plotter subroutines
BP12
ILS, ISS, conversion, and utility subroutines
BP11
Common LIBFs and CALLs
BP10
Extended precision LIBFs and CALLs
BP09
Standard LIBFs and CALLs
BP08
End of system tapes control record (Type 81 record)
BP07
Assembler
BP06
Supervisor, core load builder, system I/O subroutines, core image loader, DUP part 2
BP05
FORTRAN Compiler
BP04
Disk Utility Program
BP03
Phase ID (PHID) control record
System configuration record you punched
BP02
System loader, part 2, with resident monitor and cold start
Load mode control record you punched
BP01
System loader, part 1

Figure 8-7. Paper tape system load tapes



Turn on system power

Move the POWER switch on the console to ON.

Ready a cartridge for initialization

1. Place a cartridge in the single disk drive (the cartridge can be placed on any drive on the system).
2. Move the DISK switch on the disk drive to ON. The drive requires approximately 90 seconds to reach operating speed (see Chapter 7 for readying the 2310 Disk Storage Drive).

Is cartridge freshly initialized?

Initialize the cartridge using the DCIP program (see Chapter 9).

Is the principal printer 1132 *or* 1403?

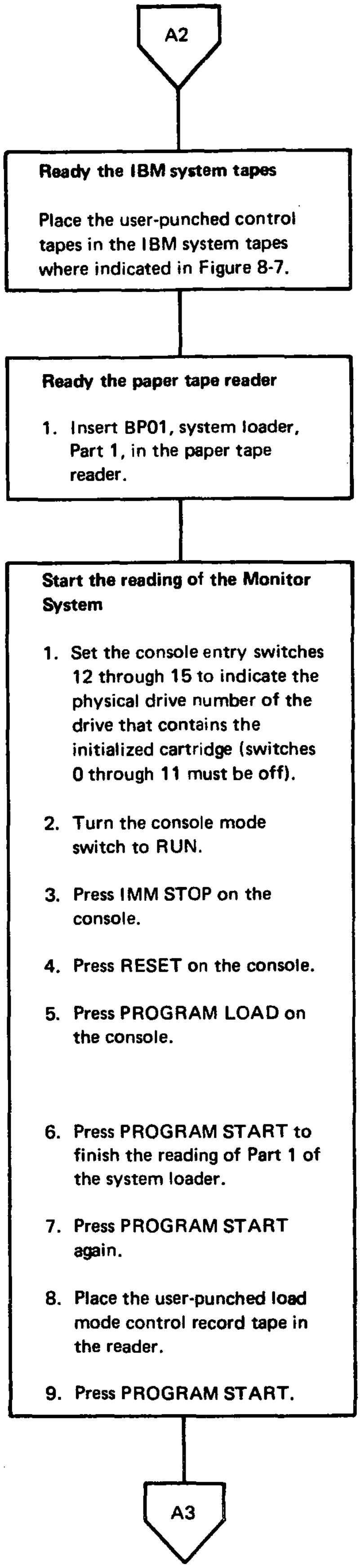
Ready the 1132 Printer

1. Move the printer MOTOR switch to ON.
2. Press CARRIAGE RESTORE.
3. Press START.

Ready the 1403 Printer

1. Be sure the ENABLE/DISABLE switch on the 1133 Multiplex Control Enclosure is in the ENABLE position.
2. Press CARRIAGE RESTORE on the printer.
3. Press START on the printer.

Figure 8-8 (Part 1 of 3). Paper tape system initial load procedure



Ready the IBM system tapes

Place the user-punched control tapes in the IBM system tapes where indicated in Figure 8-7.

Ready the paper tape reader

1. Insert BP01, system loader, Part 1, in the paper tape reader.

When loading tapes, position under the read starwheels any of the delete codes that follow the program ID in the tape leader.

Start the reading of the Monitor System

1. Set the console entry switches 12 through 15 to indicate the physical drive number of the drive that contains the initialized cartridge (switches 0 through 11 must be off).

Drive 0 – all off
Drive 1 – switch 15 on
Drive 2 – switch 14 on
Drive 3 – switches 14 and 15 on
Drive 4 – switch 13 on

2. Turn the console mode switch to RUN.
3. Press IMM STOP on the console.
4. Press RESET on the console.
5. Press PROGRAM LOAD on the console.

The core image loader is read into core storage from BP01, and the system waits with /006C displayed in the ACCUMULATOR.

6. Press PROGRAM START to finish the reading of Part 1 of the system loader.

When reading of BP01 is complete, the system waits with /00C9 displayed in the ACCUMULATOR.

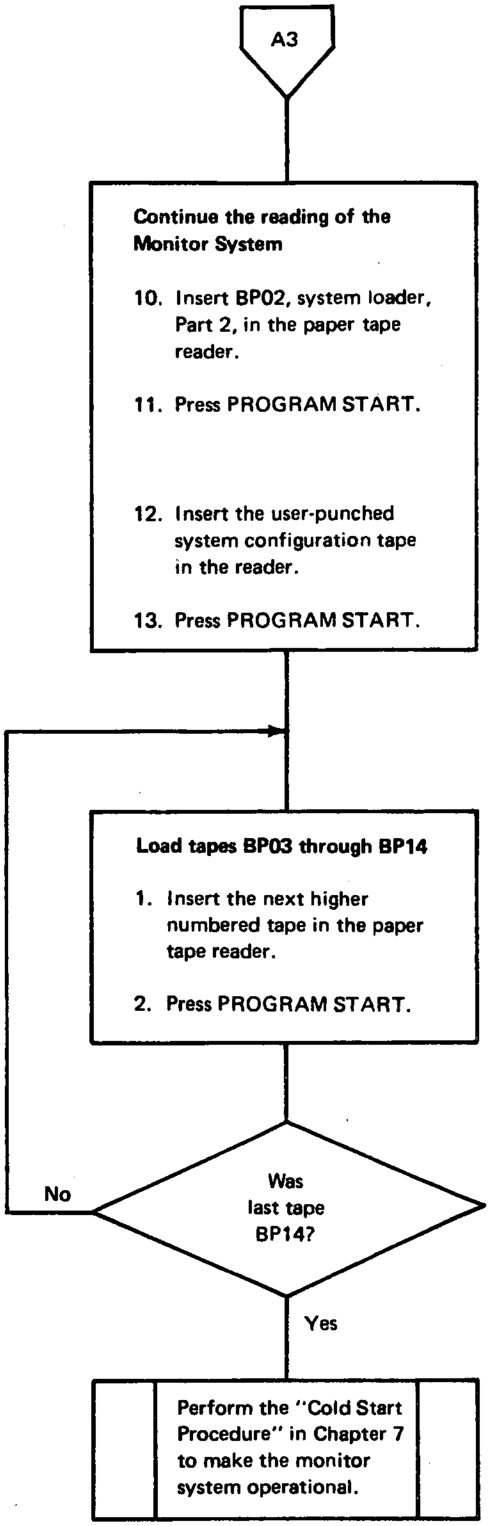
7. Press PROGRAM START again.

The system waits again with /3000 displayed in the ACCUMULATOR.

8. Place the user-punched load mode control record tape in the reader.
9. Press PROGRAM START.

The system waits with /3000 in the ACCUMULATOR when reading of the tape is complete.

Figure 8-8 (Part 2 of 3). Paper tape system initial load procedure



Continue the reading of the Monitor System

10. Insert BP02, system loader, Part 2, in the paper tape reader.

11. Press PROGRAM START.

The system waits with /3000 displayed in the ACCUMULATOR when reading of BP02 is complete.

12. Insert the user-punched system configuration tape in the reader.

13. Press PROGRAM START.

The system waits with /3000 displayed in the ACCUMULATOR when reading of the user-punched tape is complete.

Load tapes BP03 through BP14

1. Insert the next higher numbered tape in the paper tape reader.

2. Press PROGRAM START.

The system waits with /3000 displayed in the ACCUMULATOR when reading of each tape is complete.

Perform the "Cold Start Procedure" in Chapter 7 to make the monitor system operational.

Figure 8-8 (Part 3 of 3). Paper tape system initial load procedure

PAPER TAPE SYSTEM RELOAD OPERATING PROCEDURE

The materials that you need to perform a paper tape system reload procedure are:

- A system cartridge
- Cold start paper tape record, BP15
- System tapes
- Load mode control record tape and system configuration record tape that you punched

The paper tapes to be used in the reload must be arranged in the order shown in Figure 8-9. The tapes for the system programs and/or phases that are being added or expanded must be arranged in ascending tape number order. Also, all programs being loaded must have phase ID numbers within the limits of the IDs punched in the PHID tape, BP03.

Note. If the assembler and/or FORTRAN compiler have been deleted or were not loaded during an initial load, they cannot be loaded during a system reload procedure. An initial load must be performed to load these 2 programs onto a cartridge.

You perform a paper tape system reload procedure as shown in Figure 8-10.

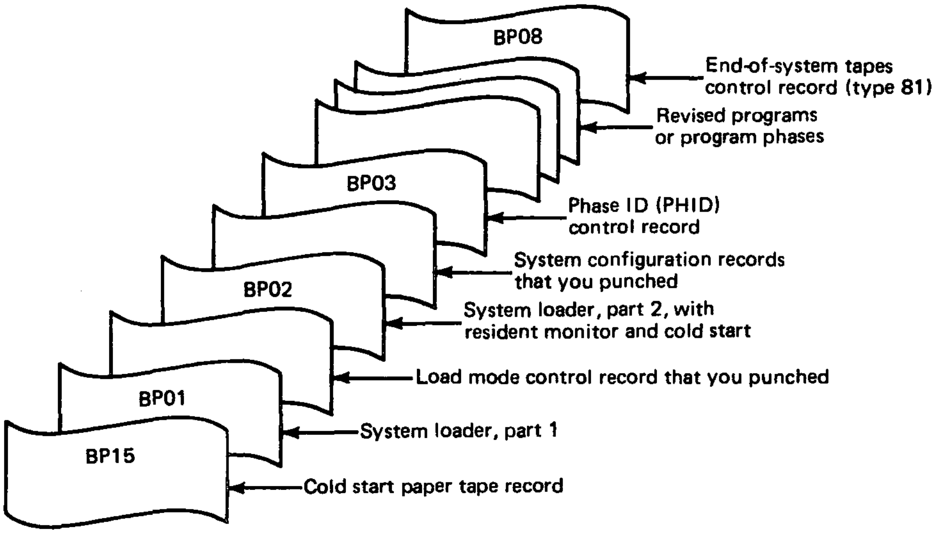
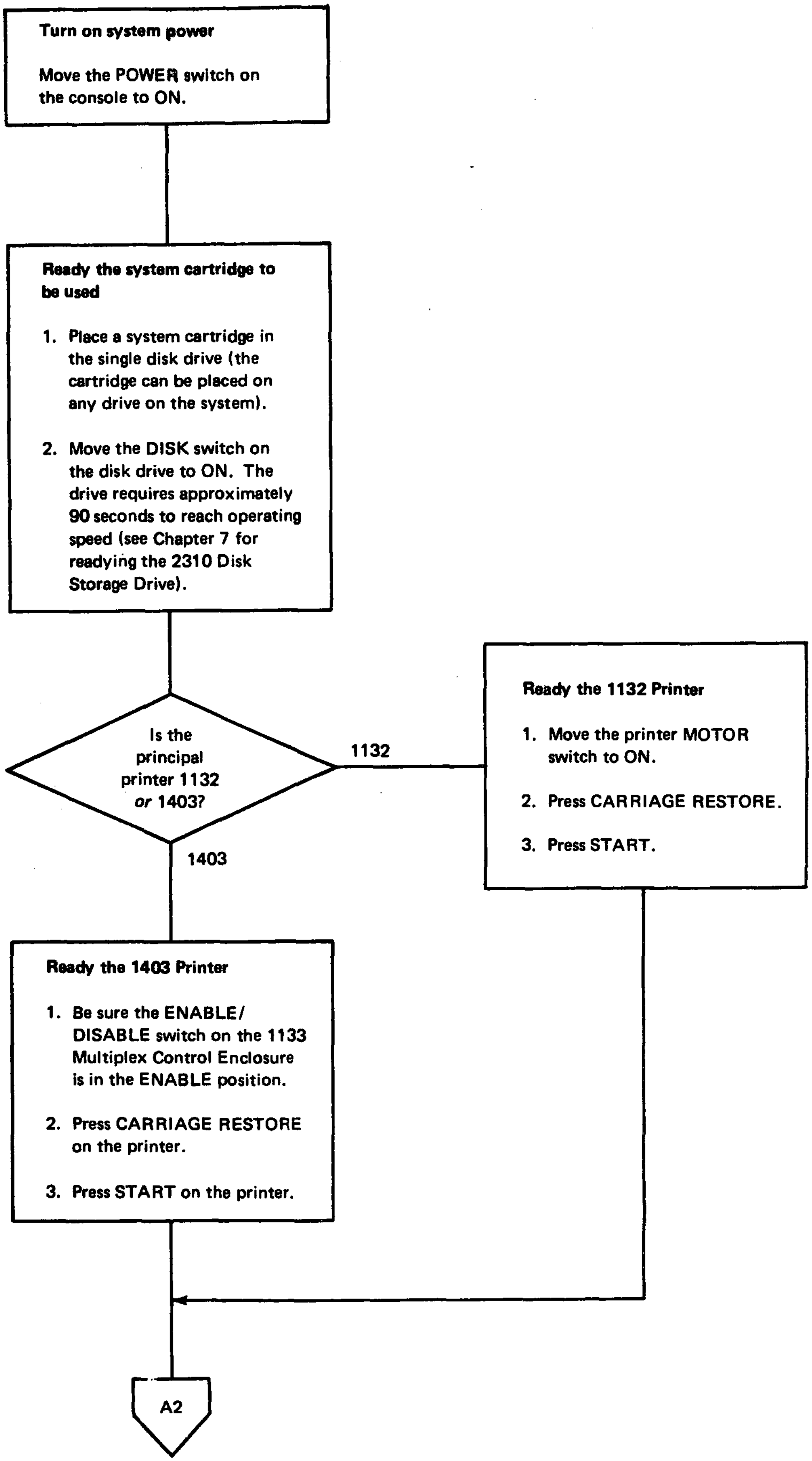

BP08
End-of-system tapes control record (type 81)
Revised programs or program phases
BP03
Phase ID (PHID) control record
System configuration records that you punched
BP02
System loader, part 2, with resident monitor and cold start
Load mode control record that you punched
BP01
System loader, part 1
BP15
Cold start paper tape record

Figure 8-9. Paper tape system reload tapes



Turn on system power

Move the POWER switch on the console to ON.

Ready the system cartridge to be used

1. Place a system cartridge in the single disk drive (the cartridge can be placed on any drive on the system).
2. Move the DISK switch on the disk drive to ON. The drive requires approximately 90 seconds to reach operating speed (see Chapter 7 for readying the 2310 Disk Storage Drive).

Is the principal printer 1132 *or* 1403?

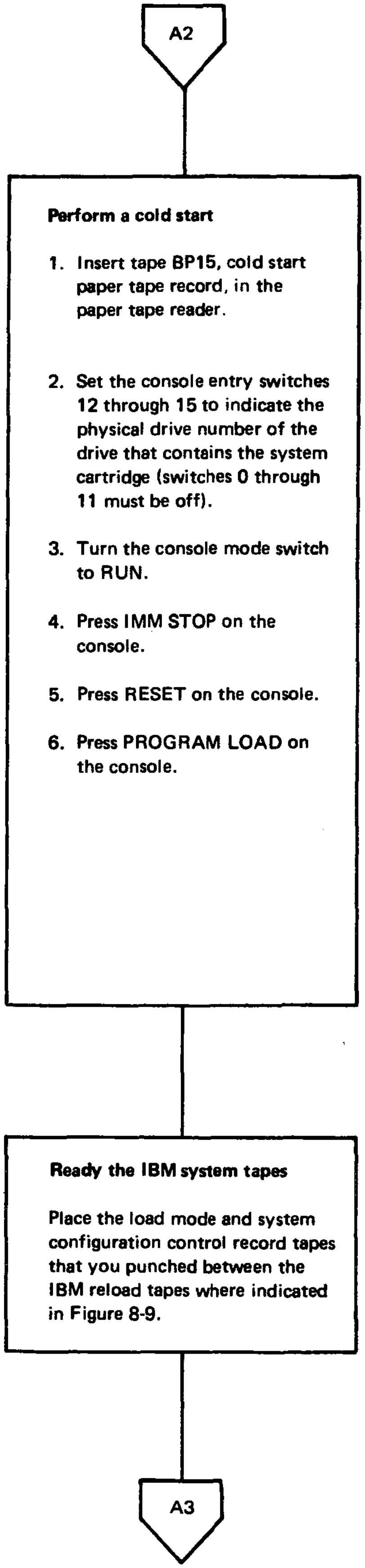
Ready the 1132 Printer

1. Move the printer MOTOR switch to ON.
2. Press CARRIAGE RESTORE.
3. Press START.

Ready the 1403 Printer

1. Be sure the ENABLE/ DISABLE switch on the 1133 Multiplex Control Enclosure is in the ENABLE position.
2. Press CARRIAGE RESTORE on the printer.
3. Press START on the printer.

Figure 8-10 (Part 1 of 4). Paper tape system reload procedure



Perform a cold start

1. Insert tape BP15, cold start paper tape record, in the paper tape reader.

A cold start is recommended prior to a reload operation in order to restore certain parameters in DCOM on the system cartridge.

2. Set the console entry switches 12 through 15 to indicate the physical drive number of the drive that contains the system cartridge (switches 0 through 11 must be off).

Drive 0 – all off
Drive 1 – switch 15 on
Drive 2 – switch 14 on
Drive 3 – switches 14 and 15 on
Drive 4 – switch 13 on

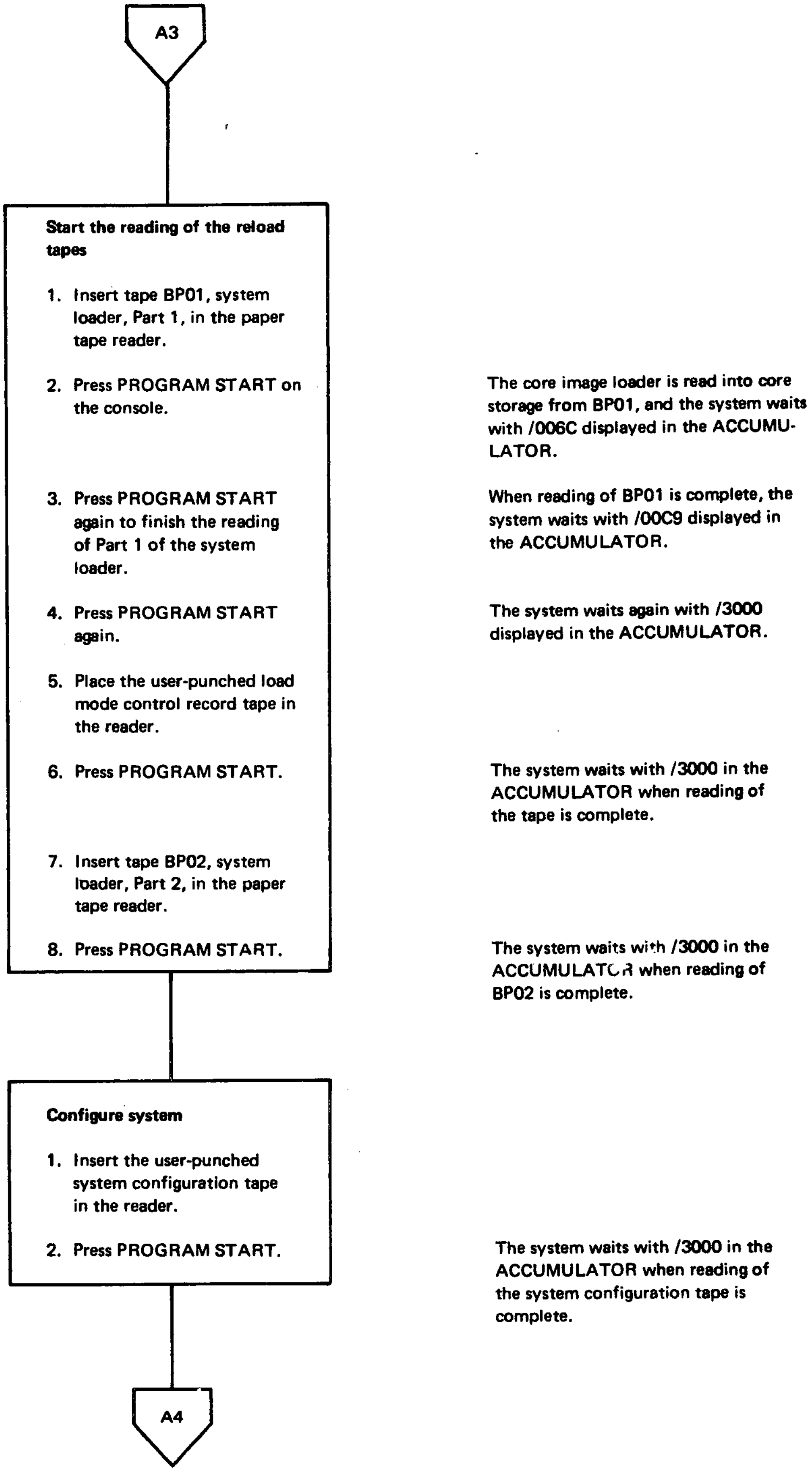
3. Turn the console mode switch to RUN.
4. Press IMM STOP on the console.
5. Press RESET on the console.
6. Press PROGRAM LOAD on the console.

The system waits with /3000 in the ACCUMULATOR when reading of the cold start record is complete.

Ready the IBM system tapes

Place the load mode and system configuration control record tapes that you punched between the IBM reload tapes where indicated in Figure 8-9.

Figure 8-10 (Part 2 of 4). Paper tape system reload procedure



A3

Start the reading of the reload tapes

1. Insert tape BP01, system loader, Part 1, in the paper tape reader.
2. Press PROGRAM START on the console.

   The core image loader is read into core storage from BP01, and the system waits with /006C displayed in the ACCUMULATOR.

3. Press PROGRAM START again to finish the reading of Part 1 of the system loader.

   When reading of BP01 is complete, the system waits with /00C9 displayed in the ACCUMULATOR.

4. Press PROGRAM START again.

   The system waits again with /3000 displayed in the ACCUMULATOR.

5. Place the user-punched load mode control record tape in the reader.
6. Press PROGRAM START.

   The system waits with /3000 in the ACCUMULATOR when reading of the tape is complete.

7. Insert tape BP02, system loader, Part 2, in the paper tape reader.
8. Press PROGRAM START.

   The system waits with /3000 in the ACCUMULATCR when reading of BP02 is complete.

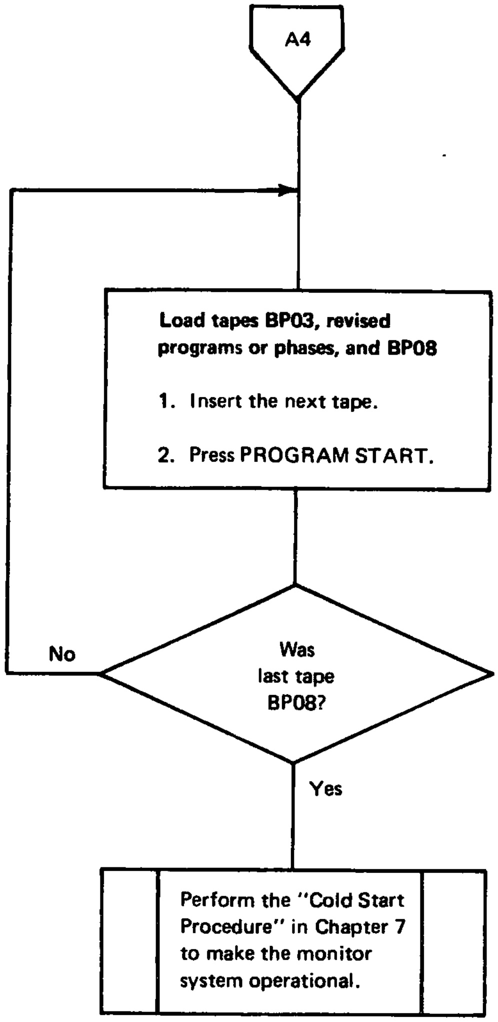
Configure system

1. Insert the user-punched system configuration tape in the reader.
2. Press PROGRAM START.

   The system waits with /3000 in the ACCUMULATOR when reading of the system configuration tape is complete.

A4

Figure 8-10 (Part 3 of 4). Paper tape system reload procedure


A4
Load tapes BP03, revised programs or phases, and BP08
1. Insert the next tape.
2. Press PROGRAM START.
Was last tape BP08?
No
Yes
Perform the "Cold Start Procedure" in Chapter 7 to make the monitor system operational.

The system waits with /3000 in the ACCUMULATOR when reading of each tape is complete.

Figure 8-10 (Part 4 of 4). Paper tape system reload procedure

Chapter 9. Stand-alone Utility Programs

The stand-alone utility programs are each self-loading and complete with subroutines. These programs are separate from the monitor system library and enable you to perform operations without monitor system control. The stand-alone utility programs are:

- Console Printer Core Dump
- Printer Core Dump
- Disk Cartridge Initialization Program (DCIP)
- Paper Tape Reproducing
- Paper Tape Utility (PTUTL)

The first 3 of these are available in cards and paper tapes; the last 2 on paper tape only.

This chapter:

1. Describes the general functions of each of the stand-alone utility programs.
2. Presents sample operating procedures for using these programs.

You may use these operating procedures as they are presented, or you may modify them to meet the needs of your computing system. For those who are already familiar with similar procedures, the headings in each block can be used as reminders as you perform the procedure. For those who need more information, detailed steps for performing these procedures are provided. Not all steps of each procedure need to be done every time the procedure is used; do only those steps that are necessary.

Appendix B lists the halt codes that are displayed in the ACCUMULATOR on the console display panel if errors occur during these procedures.

CONSOLE PRINTER CORE DUMP

Selected portions of core storage are printed on the console printer when you use the Console Printer Core Dump Program.

dump format

Each core location is dumped as a 4-digit hexadecimal word with a space separating each word. The first word dumped is from the starting address that you specify through the console entry switches.

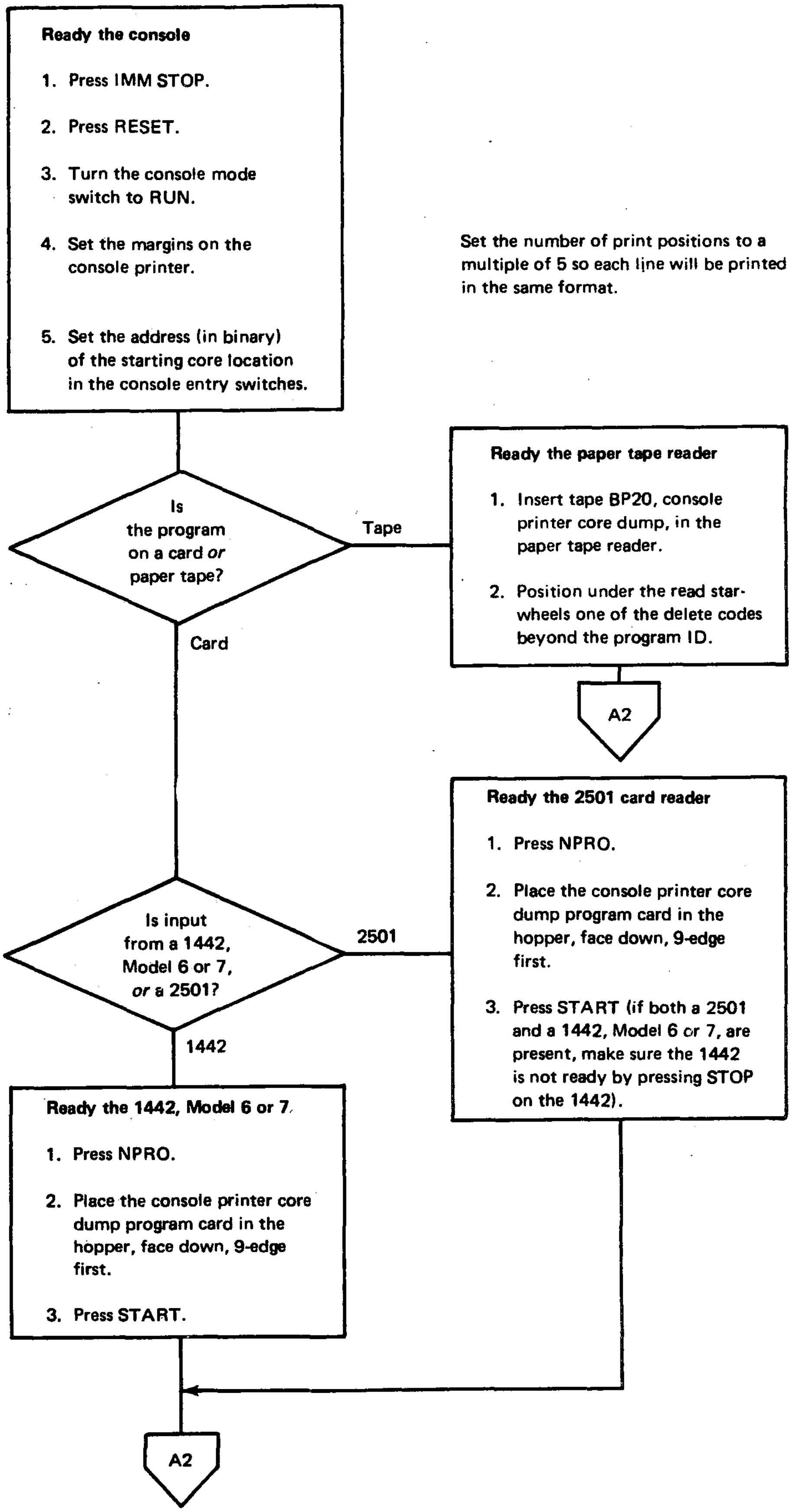
The materials that you need to use the Stand-alone Console Printer Core Dump Program are:

- Console Printer Core Dump Program card

-or-

- Console Printer Core Dump Program paper tape, BP20

Figure 9-1 is the operating procedure for the stand-alone Console Printer Core Dump Program.



Ready the console

1. Press IMM STOP.
2. Press RESET.
3. Turn the console mode switch to RUN.
4. Set the margins on the console printer.
5. Set the address (in binary) of the starting core location in the console entry switches.

Set the number of print positions to a multiple of 5 so each line will be printed in the same format.

Is the program on a card *or* paper tape?

Ready the paper tape reader

1. Insert tape BP20, console printer core dump, in the paper tape reader.
2. Position under the read star-wheels one of the delete codes beyond the program ID.

Is input from a 1442, Model 6 or 7, *or* a 2501?

Ready the 2501 card reader

1. Press NPRO.
2. Place the console printer core dump program card in the hopper, face down, 9-edge first.
3. Press START (if both a 2501 and a 1442, Model 6 or 7, are present, make sure the 1442 is not ready by pressing STOP on the 1442).

Ready the 1442, Model 6 or 7

1. Press NPRO.
2. Place the console printer core dump program card in the hopper, face down, 9-edge first.
3. Press START.

Figure 9-1 (Part 1 of 2). Console printer core dump operating procedure

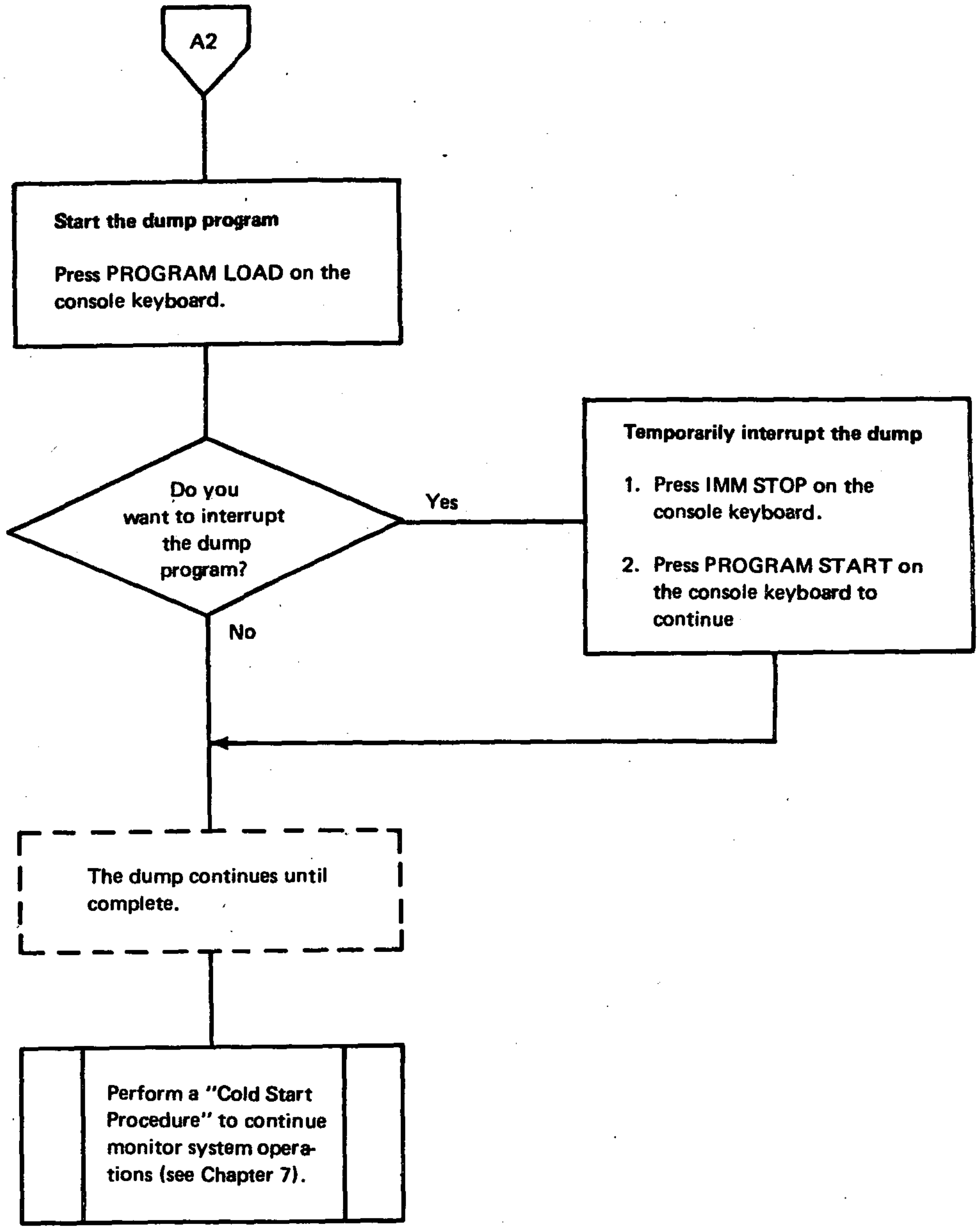

A2
Start the dump program
Press PROGRAM LOAD on the console keyboard.
Do you want to interrupt the dump program?
Yes
No
Temporarily interrupt the dump
1. Press IMM STOP on the console keyboard.
2. Press PROGRAM START on the console keyboard to continue
The dump continues until complete.
Perform a "Cold Start Procedure" to continue monitor system operations (see Chapter 7).

Figure 9-1 (Part 2 of 2). Console printer core dump operating procedure

PRINTER CORE DUMP PROGRAM

This program dumps core storage (in hexadecimal) beginning at location $ZEND on either the 1403 Printer or the 1132 Printer. The printer selected is the one that is ready; when both are ready, the 1403 is selected.

dump format

Each line begins with a 4-digit hexadecimal address that is followed by sixteen 4-digit hexadecimal words. A space separates the address and each word in the printed line. An additional space is inserted between each group of 4 words.

To decrease dump time, the program does not print consecutive duplicate lines. Before printing a line, the program compares the next 16 words of core with those just printed. If they are identical, the program goes on to the next 16 words of core. The program continues comparing lines until the first line not identical to the last line printed is found. The printer then spaces a line and the 16 words of the unidentical line are printed. The address printed at the beginning of this line is that of the first word of the unidentical line.

The materials that you need to use the Stand-alone Printer Core Dump Program are:

- Printer Core Dump Program card deck, SDMP punched in column 73 through 76

-or-

- Printer Core Dump Program paper tape, BP19

Figure 9-2 is the operating procedure for the stand-alone Printer Core Dump Program.

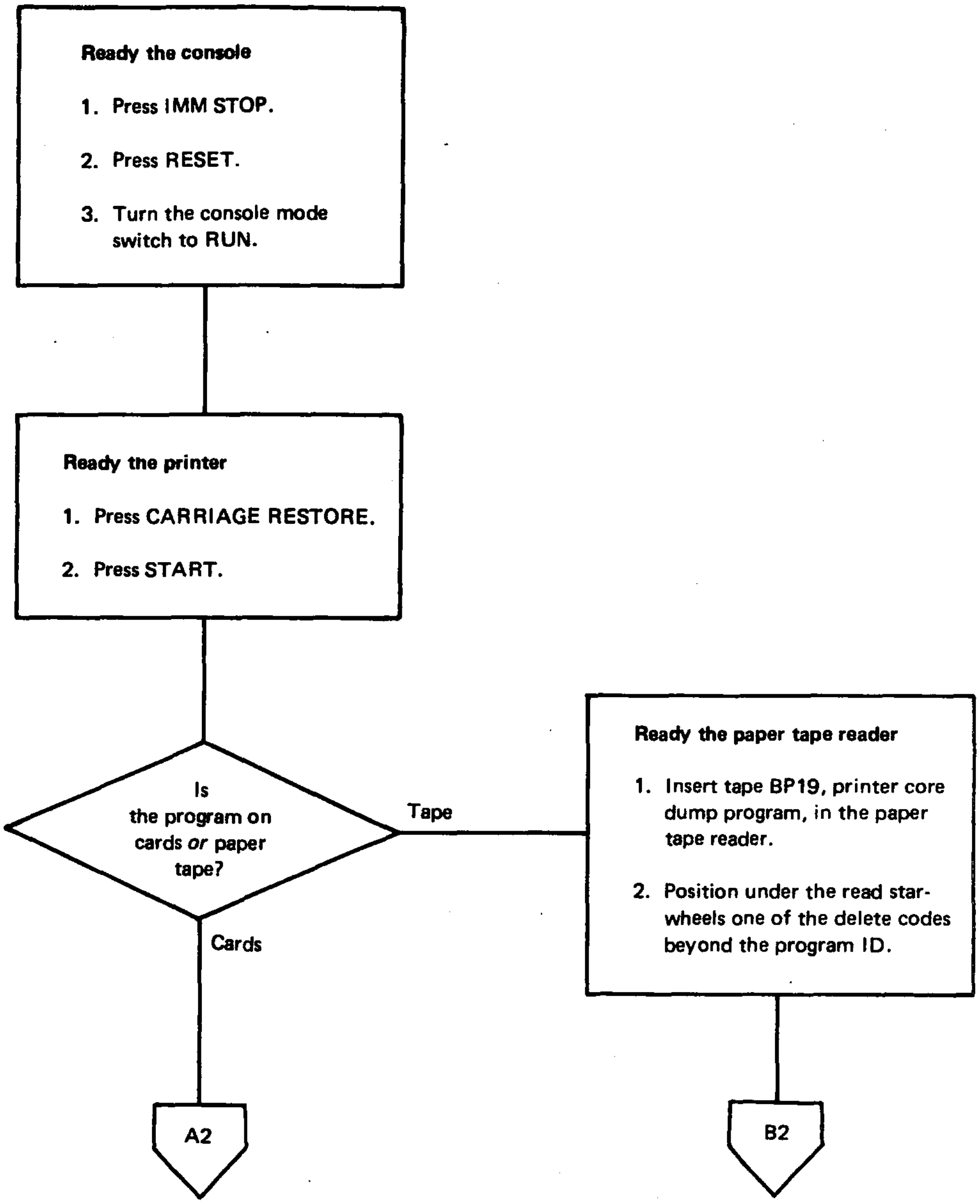
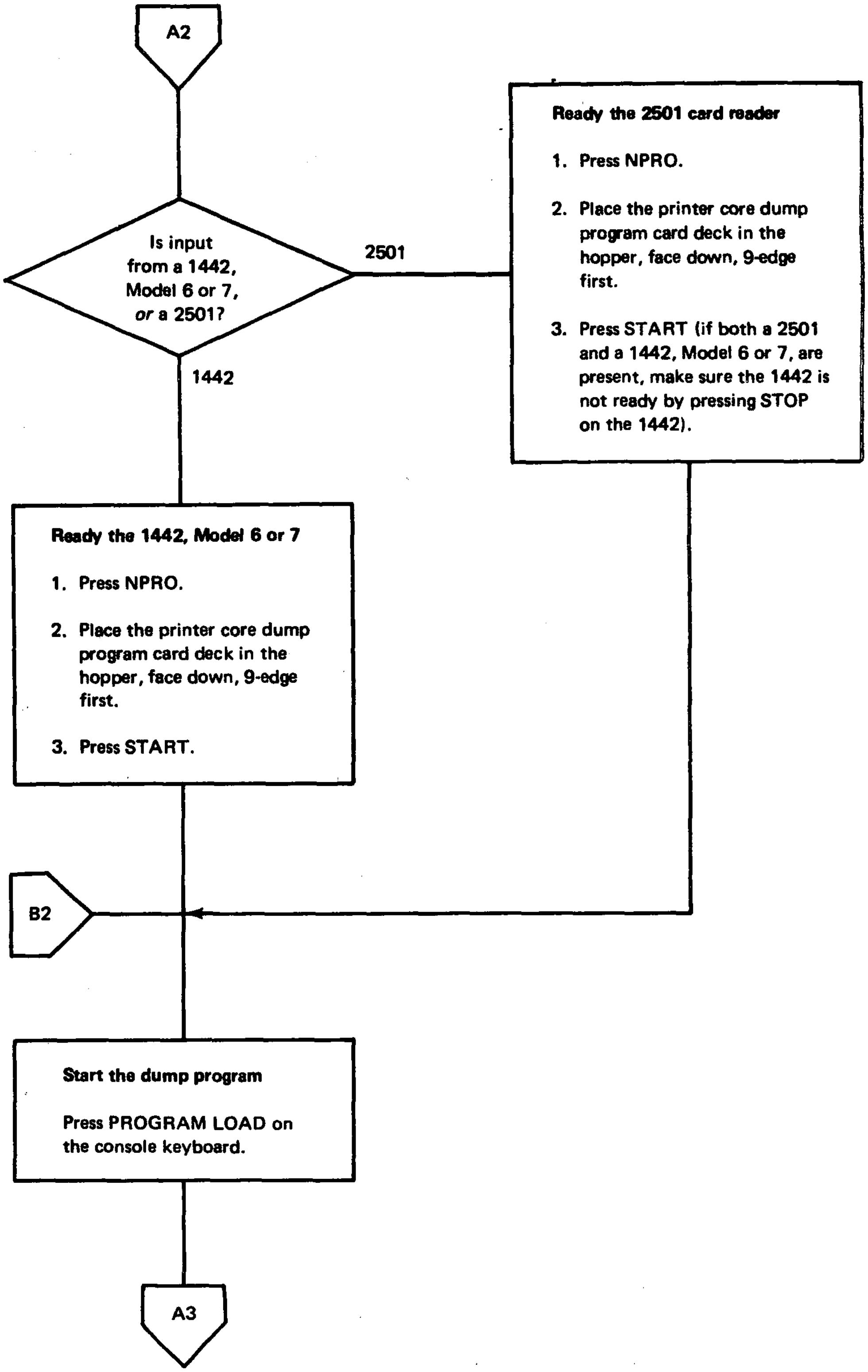

Ready the console
1. Press IMM STOP.
2. Press RESET.
3. Turn the console mode switch to RUN.
Ready the printer
1. Press CARRIAGE RESTORE.
2. Press START.
Is the program on cards *or* paper tape?
Tape
Cards
Ready the paper tape reader
1. Insert tape BP19, printer core dump program, in the paper tape reader.
2. Position under the read star-wheels one of the delete codes beyond the program ID.
A2
B2

Figure 9-2 (Part 1 of 3). Printer Core Dump Program operating procedure



Is input from a 1442, Model 6 or 7, *or* a 2501?

Ready the 2501 card reader

1. Press NPRO.
2. Place the printer core dump program card deck in the hopper, face down, 9-edge first.
3. Press START (if both a 2501 and a 1442, Model 6 or 7, are present, make sure the 1442 is not ready by pressing STOP on the 1442).

Ready the 1442, Model 6 or 7

1. Press NPRO.
2. Place the printer core dump program card deck in the hopper, face down, 9-edge first.
3. Press START.

Start the dump program

Press PROGRAM LOAD on the console keyboard.

Figure 9-2 (Part 2 of 3). Printer Core Dump Program operating procedure

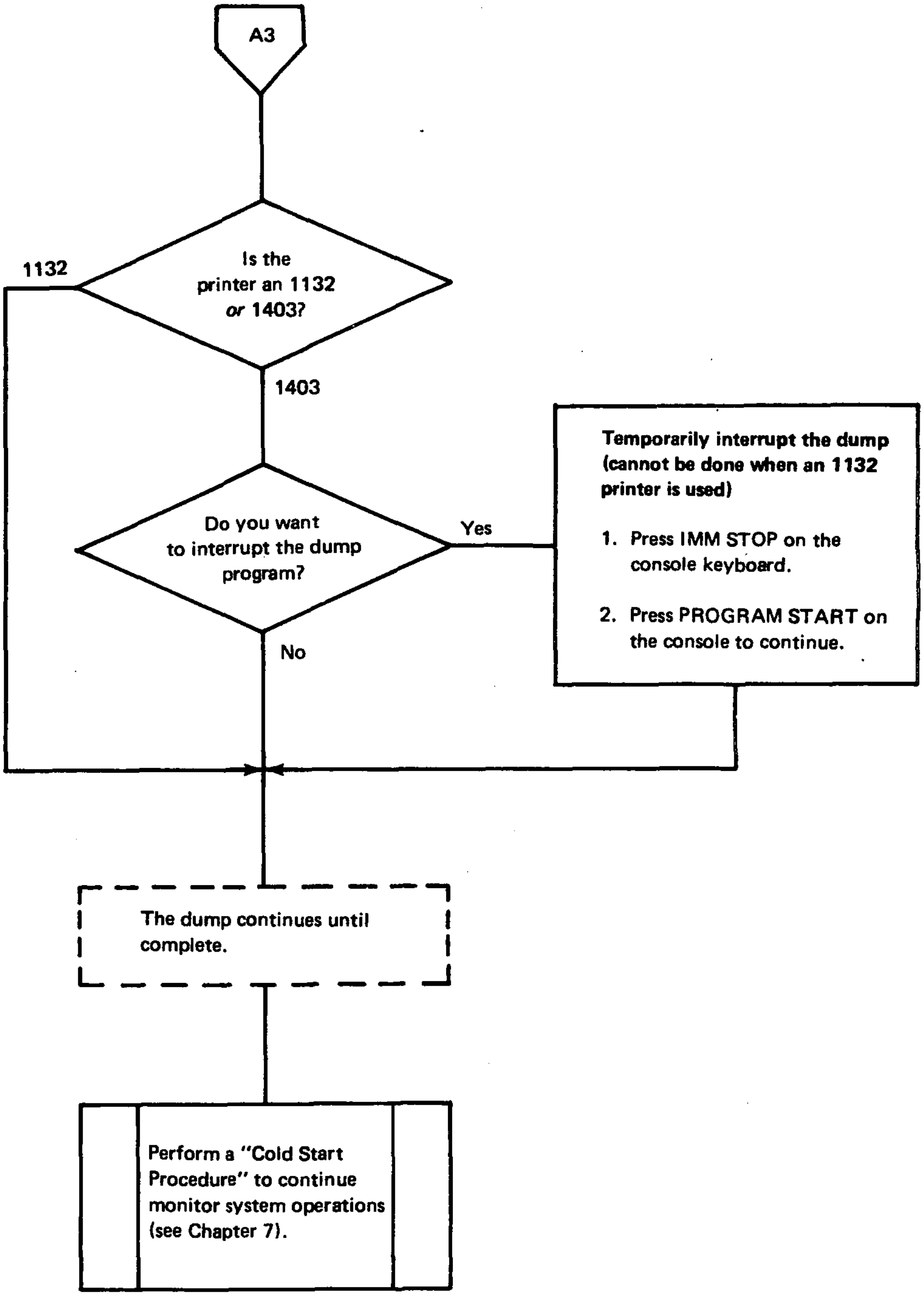

A3
Is the printer an 1132 *or* 1403?
1132
1403
Do you want to interrupt the dump program?
Yes
No
Temporarily interrupt the dump (cannot be done when an 1132 printer is used)
1. Press IMM STOP on the console keyboard.
2. Press PROGRAM START on the console to continue.
The dump continues until complete.
Perform a "Cold Start Procedure" to continue monitor system operations (see Chapter 7).

Figure 9-2 (Part 3 of 3). Printer Core Dump Program operating procedure

DISK CARTRIDGE INITIALIZATION PROGRAM (DCIP)

The Disk Cartridge Initialization Program (DCIP) is composed of:

- A disk initialization subroutine
- A disk copy subroutine
- A disk dump subroutine
- A disk patch subroutine
- A disk analysis subroutine
- A disk compare subroutine

Initialization of a cartridge is required before the monitor system can be loaded onto the cartridge. If sector @IDAD and/or sector @DCOM are destroyed on a disk, disk initialization is the only DCIP subroutine that can be performed on the disk.

The following text describes the functions of DCIP and provides sample operating procedures for using all of the functions of DCIP.

Disk Initialization Subroutine

This subroutine prepares a new disk cartridge for use and makes an old cartridge available to be used for other purposes. The initialization subroutine:

- Tests sectors to determine which, if any, are defective and fills in the defective cylinder table accordingly.
- Writes a sector address on every sector, including defective sectors.
- Establishes a file-protected area for the disk cartridge.
- Places an ID on the disk cartridge.
- Establishes a disk communications area (sector @DCOM), a location equivalence table (LET), and a core image buffer (CIB).

The monitor system disk I/O subroutines operate with up to 3 defective cylinders on a cartridge. That is, 3 cylinders that contain one or more defective sectors. A cartridge cannot be initialized if cylinder 0 is defective, or if a sector address cannot be written on every sector.

The contents of sectors @IDAD, @DCOM, and @RIAD in cylinder 0 are established during initialization (see Chapter 2 for a general description of the contents of these sectors). A message and the program that prints it are written in sector @IDAD. The message is:

THIS IS A NONSYSTEM CARTRIDGE

This message is printed when an attempt is made to cold start a nonsvstem cartridge that is initialized with DCIP.

Disk Copy Subroutine

This subroutine copies the contents from one cartridge (the source cartridge) onto another cartridge (the object cartridge). Before the copy is performed, the subroutine checks to ensure that the cartridge being copied and the object cartridge have been initialized. The cartridge ID, copy code, and defective cylinder data are not copied from the source cartridge.

Disk Dump Subroutine

This subroutine dumps sectors of a cartridge that you select on the principal printer.

Each sector is preceded by a 3-word header and is printed in 20 lines; sixteen 4-digit hexadecimal words per line. Two sectors are printed on each page.

The first digit of the first header word is the drive number; the remaining 3 digits are the physical sector address of the sector being dumped. The second header word is the actual address of the sector being dumped. The third word is the logical sector address, taking into account any defective cylinders. If you dump a sector that is in a defective cylinder, the third word of the header contains DEFC.

Disk Patch Subroutine

This subroutine allows you to change the contents, word-by-word, of selected disk sectors. The contents of the sector being modified are printed, on the principal printer, both before and after the changes are made.

A one-word buffer is used to store the contents of a specified word as you are modifying it. Six special characters are used to control the use of this buffer. These characters and their functions are listed in the disk patch operating procedure in Figure 9-7 under "DCIP Operating Procedures" in this chapter.

Disk Analysis Subroutine

This subroutine reads each sector of a selected cartridge 16 times.

If a read error occurs, the address of the sector being read is printed. You can then dump the contents of the sector in error if you wish.

If a sector address is incorrect, the incorrect address is printed, and the correct address is then written on the sector.

Disk Compare Subroutine

This subroutine of DCIP reads the corresponding sectors of 2 cartridges and compares the contents word by word. The addresses from both cartridges of any sectors that do not compare are printed.

DCIP Operating Procedures

The operating procedures in this section include a program load procedure (Figure 9-3) for DCIP and procedures (Figures 9-4 through 9-9) for performing the 6 functions of DCIP.

The following general comments should be kept in mind while using any of the DCIP functions:

1. If a disk drive is not ready, the system halts with /50X0 displayed in the ACCUMULATOR on the console display panel; X is the number of the physical drive that is not ready.
2. If your system has 2 card readers, ready only the reader that you use for cold start.
3. The messages printed during DCIP functions refer to the console entry switches as *bit* switches.
4. All console entry switch settings that you enter are printed on the console printer as 4-digit hexadecimal numbers.
5. If you turn on an invalid console entry switch during any of the DCIP functions, ENTRY ERR . . .RETRY is printed. To continue, turn off the incorrect switch, turn on the correct one, and press PROGRAM START.

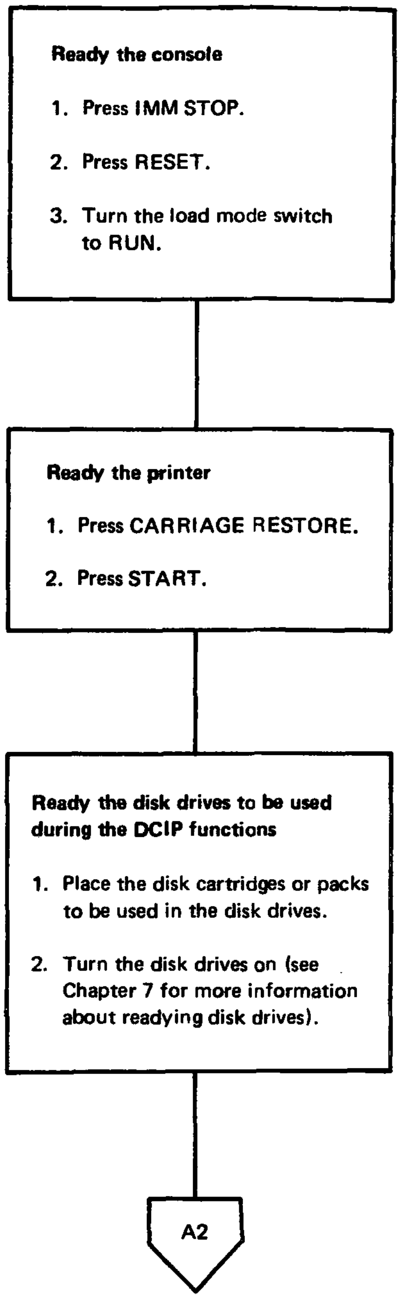
6. A DCIP function can be stopped at any time by pressing INT REQ on the console keyboard. The system prints the DCIP option message. This gives you the choice of repeating the current function or selecting a new one. Following the option message, you can change disk cartridges or packs, if necessary, before continuing. If you wish to discontinue using DCIP at this point, perform a cold start procedure (see Chapter 7) to make the monitor system operational.

   Note. If you press INT REQ while a disk is being copied or initialized, the results of the use of the object cartridge (in the copy operation) or the partially initialized cartridge are unpredictable.

The materials that you need to perform the function of DCIP are the IBM-supplied DCIP card deck (DCIP punched in columns 73 through 76) or paper tape (BP16) and any of the following depending on the function you are using:

- An uninitialized disk for disk initialization
- A system or nonsystem cartridge and an initialized disk for the copy function. The copy function is usable only if your system can contain more than one disk at a time.
- A system or nonsystem cartridge for the dump function
- A system or nonsystem cartridge for the disk patch function
- A system or nonsystem cartridge for disk analysis
- Two system or nonsystem cartridges whose contents are supposed to be the same for the disk compare function. The compare function is usable only if your system can contain more than one disk at a time.

Have all of the cartridges you are going to use ready before you load the DCIP program as follows.



Ready the console

1. Press IMM STOP.
2. Press RESET.
3. Turn the load mode switch to RUN.

Ready the printer

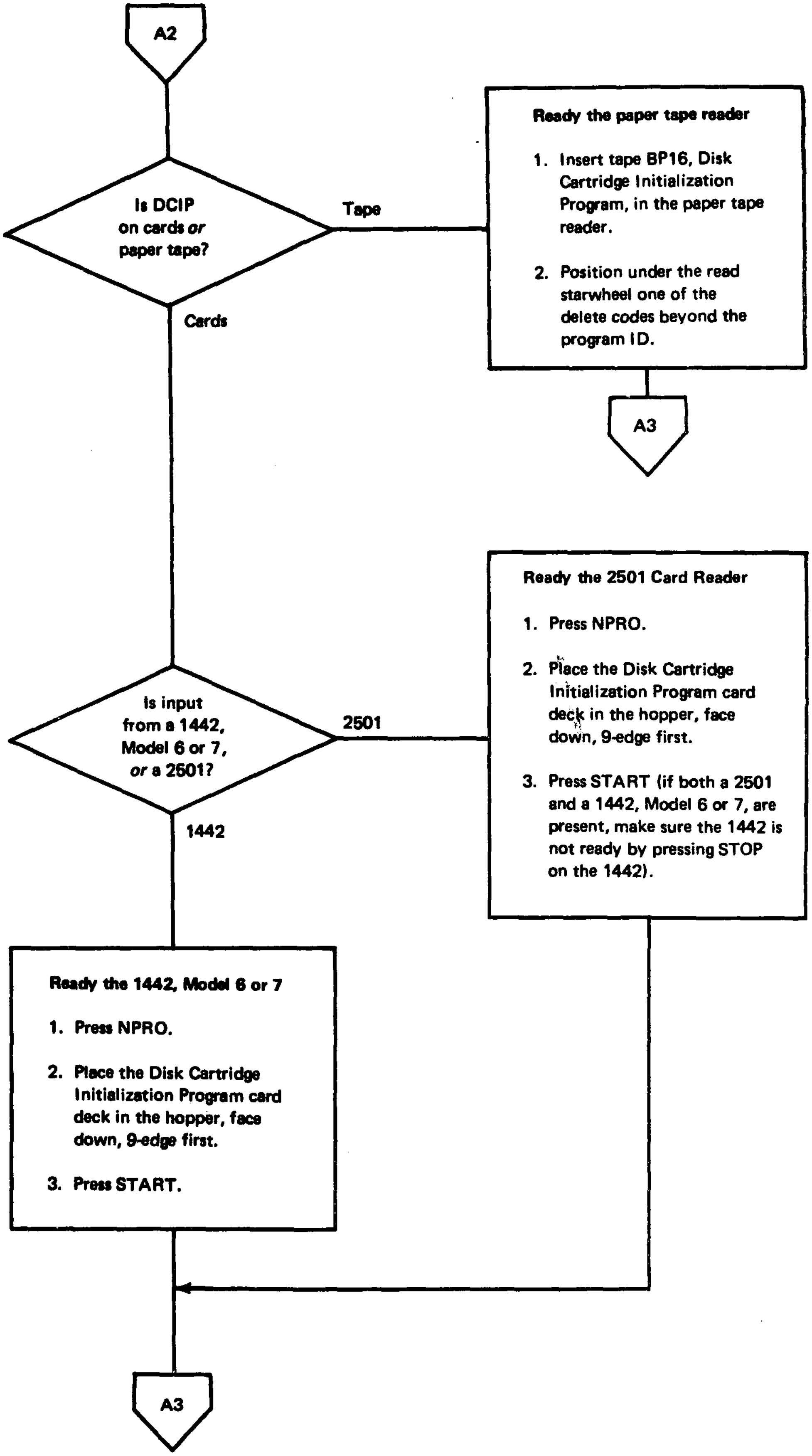
1. Press CARRIAGE RESTORE.
2. Press START.

Ready the disk drives to be used during the DCIP functions

1. Place the disk cartridges or packs to be used in the disk drives.
2. Turn the disk drives on (see Chapter 7 for more information about readying disk drives).

Note. If the 1403 or 1132 Printer is not ready when you load DCIP, or if your system does not have a 1403 or 1132, the console printer is the principal print device.

Figure 9-3 (Part 1 of 4). Load DCIP operating procedure


A2
Is DCIP on cards *or* paper tape?
Tape
Cards
A3
Is input from a 1442, Model 6 or 7, *or* a 2501?
2501
1442
A3

Ready the paper tape reader

1. Insert tape BP16, Disk Cartridge Initialization Program, in the paper tape reader.

2. Position under the read starwheel one of the delete codes beyond the program ID.

Ready the 2501 Card Reader

1. Press NPRO.

2. Place the Disk Cartridge Initialization Program card deck in the hopper, face down, 9-edge first.

3. Press START (if both a 2501 and a 1442, Model 6 or 7, are present, make sure the 1442 is not ready by pressing STOP on the 1442).

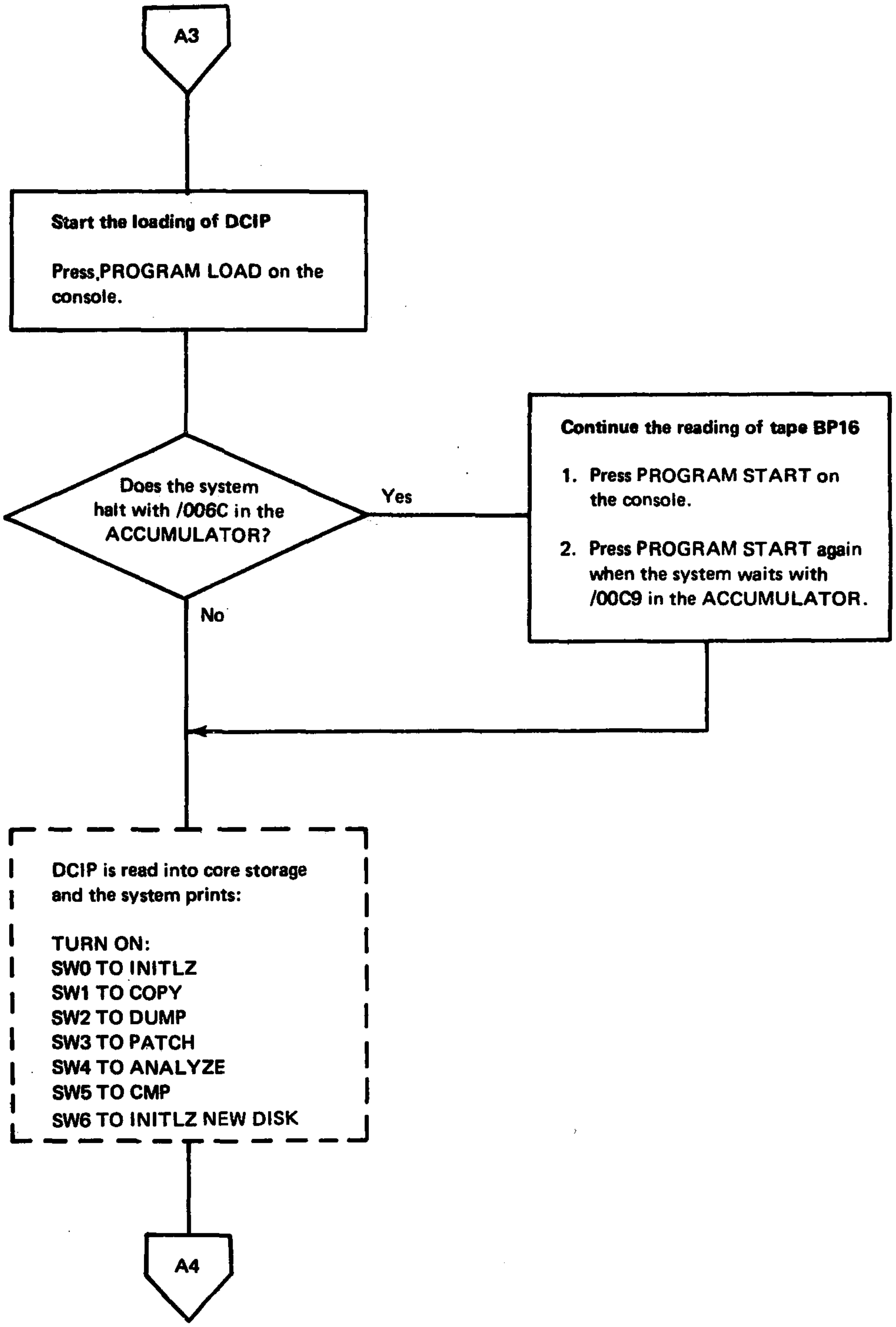
Ready the 1442, Model 6 or 7

1. Press NPRO.

2. Place the Disk Cartridge Initialization Program card deck in the hopper, face down, 9-edge first.

3. Press START.

Figure 9-3 (Part 2 of 4). Load DCIP operating procedure



Start the loading of DCIP

Press,PROGRAM LOAD on the console.

Does the system halt with /006C in the ACCUMULATOR?

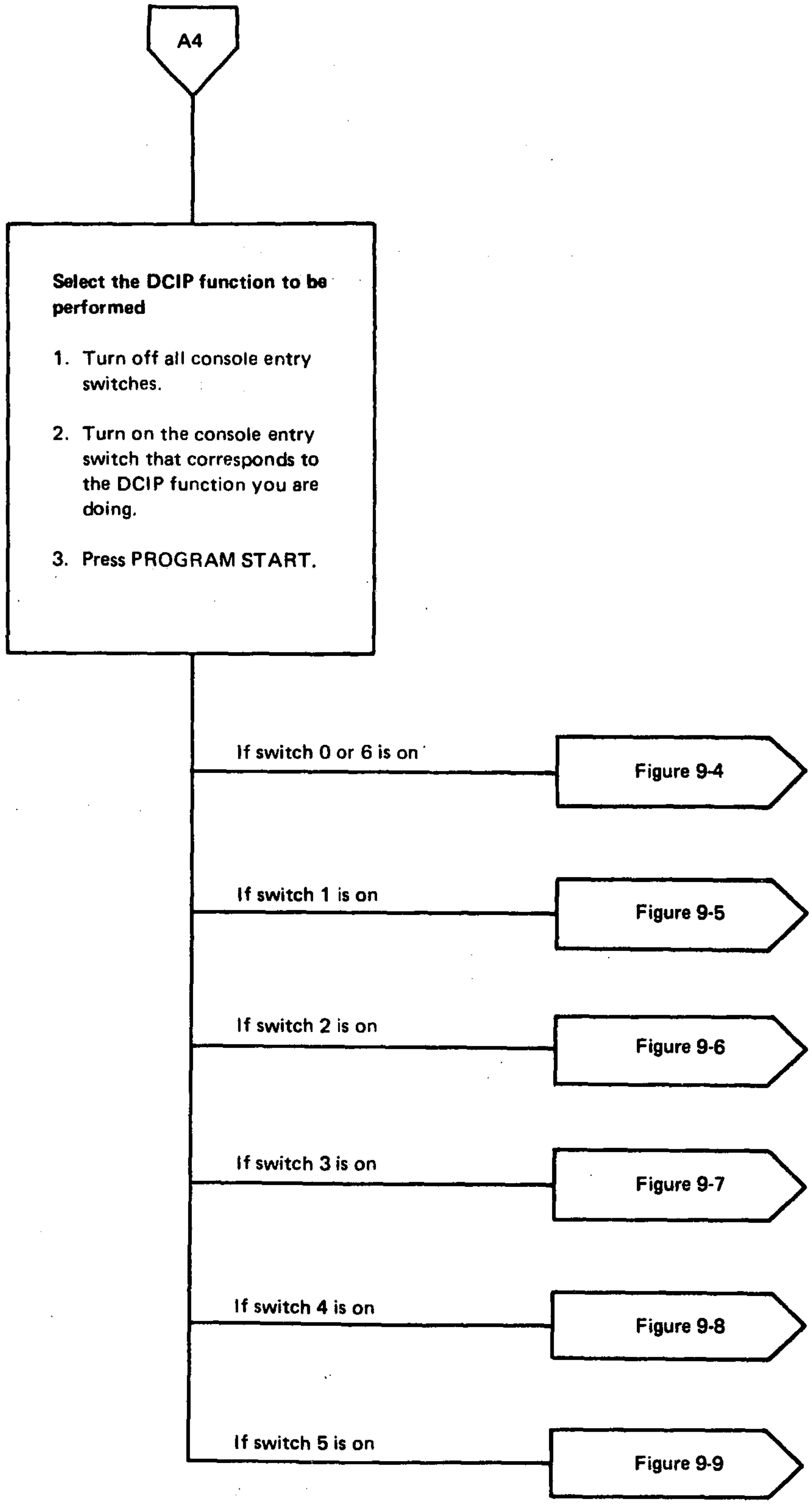
Continue the reading of tape BP16

1. Press PROGRAM START on the console.
2. Press PROGRAM START again when the system waits with /00C9 in the ACCUMULATOR.

DCIP is read into core storage and the system prints:

```
TURN ON:
SW0 TO INITLZ
SW1 TO COPY
SW2 TO DUMP
SW3 TO PATCH
SW4 TO ANALYZE
SW5 TO CMP
SW6 TO INITLZ NEW DISK
```

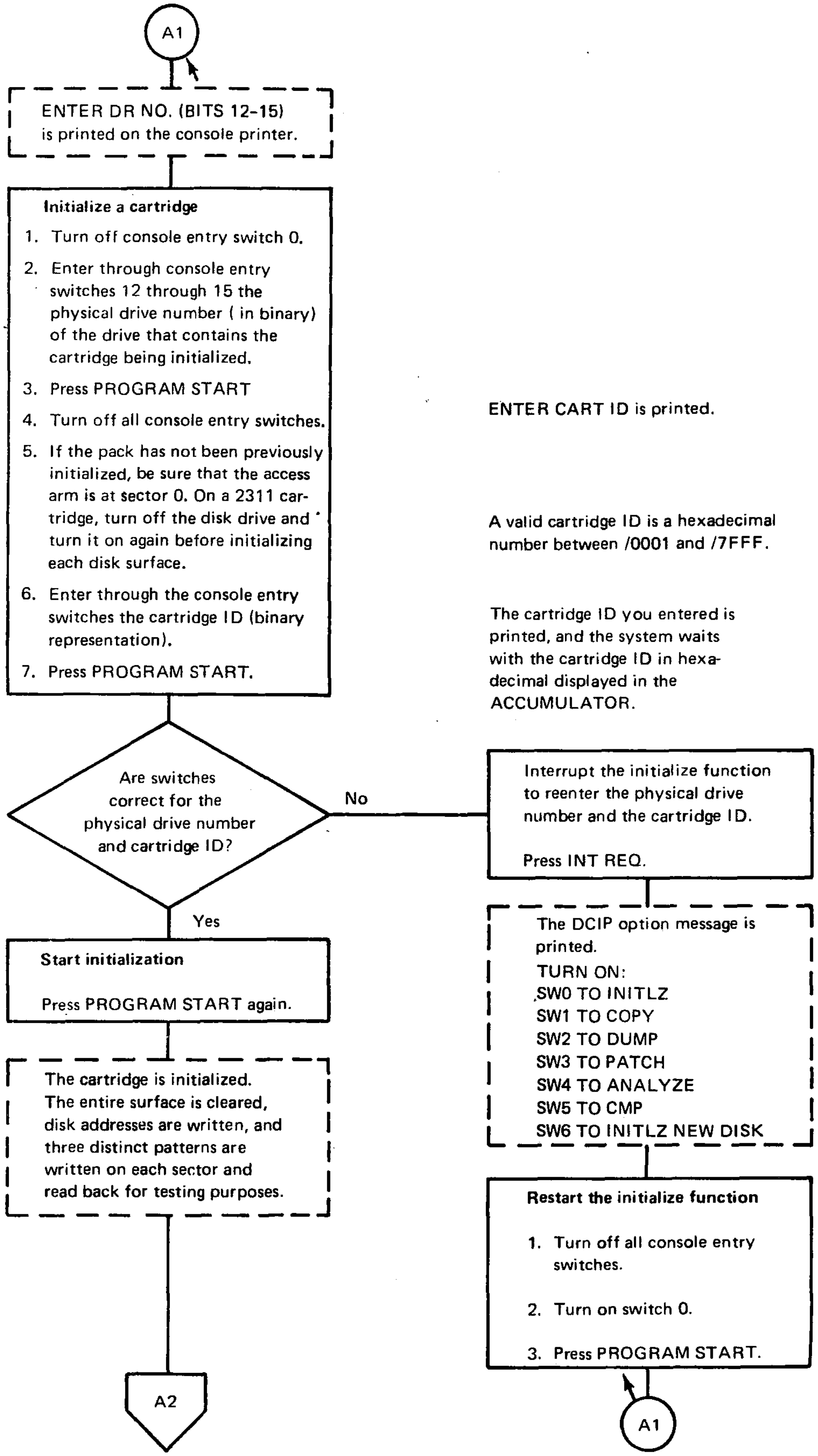
Figure 9-3 (Part 3 of 4). Load DCIP operating procedure



Select the DCIP function to be performed

1. Turn off all console entry switches.
2. Turn on the console entry switch that corresponds to the DCIP function you are doing.
3. Press PROGRAM START.

Figure 9-3 (Part 4 of 4). Load DCIP operating procedure



ENTER DR NO. (BITS 12-15) is printed on the console printer.

Initialize a cartridge

1. Turn off console entry switch 0.
2. Enter through console entry switches 12 through 15 the physical drive number (in binary) of the drive that contains the cartridge being initialized.
3. Press PROGRAM START
4. Turn off all console entry switches.
5. If the pack has not been previously initialized, be sure that the access arm is at sector 0. On a 2311 cartridge, turn off the disk drive and turn it on again before initializing each disk surface.
6. Enter through the console entry switches the cartridge ID (binary representation).
7. Press PROGRAM START.

ENTER CART ID is printed.

A valid cartridge ID is a hexadecimal number between /0001 and /7FFF.

The cartridge ID you entered is printed, and the system waits with the cartridge ID in hexadecimal displayed in the ACCUMULATOR.

Are switches correct for the physical drive number and cartridge ID?

Interrupt the initialize function to reenter the physical drive number and the cartridge ID.

Press INT REQ.

The DCIP option message is printed.

TURN ON:
SW0 TO INITLZ
SW1 TO COPY
SW2 TO DUMP
SW3 TO PATCH
SW4 TO ANALYZE
SW5 TO CMP
SW6 TO INITLZ NEW DISK

Restart the initialize function

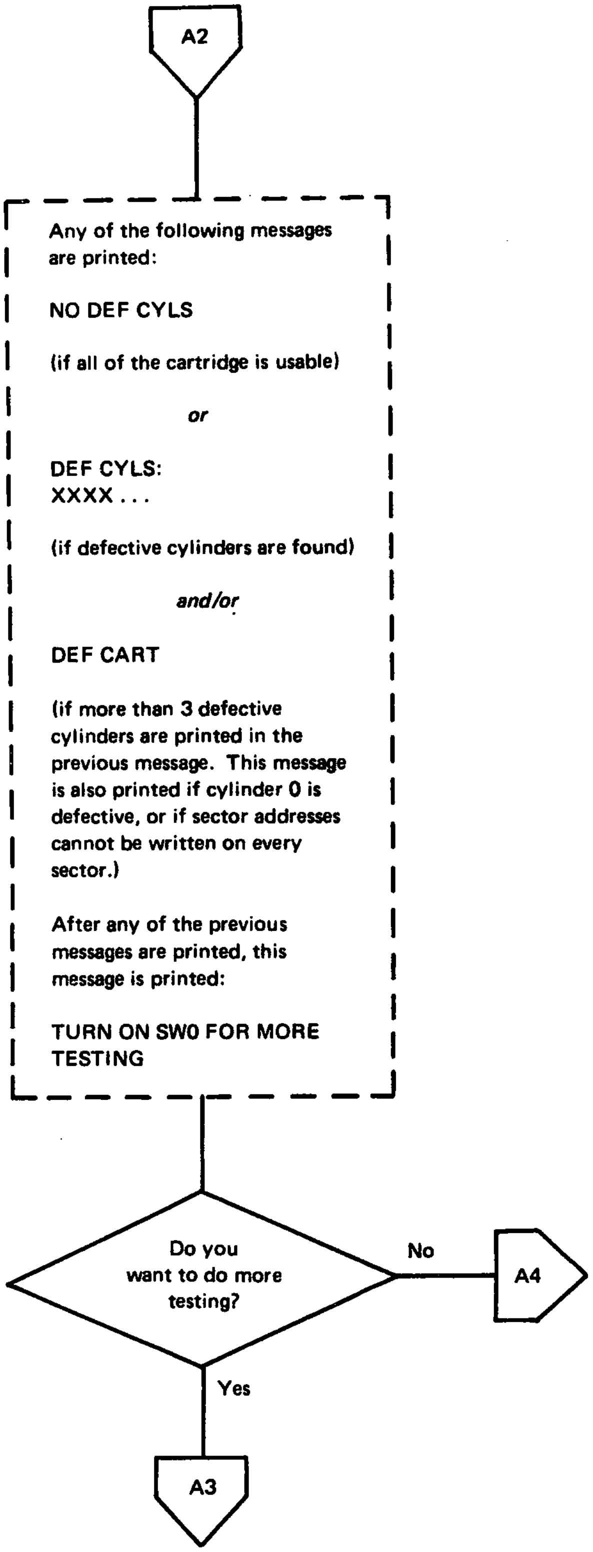
1. Turn off all console entry switches.
2. Turn on switch 0.
3. Press PROGRAM START.

Start initialization

Press PROGRAM START again.

The cartridge is initialized. The entire surface is cleared, disk addresses are written, and three distinct patterns are written on each sector and read back for testing purposes.

Figure 9-4 (Part 1 of 5). Operating procedure for DCIP initialize function



Any of the following messages are printed:

NO DEF CYLS

(if all of the cartridge is usable)

or

DEF CYLS:
XXXX . . .

(if defective cylinders are found)

and/or

DEF CART

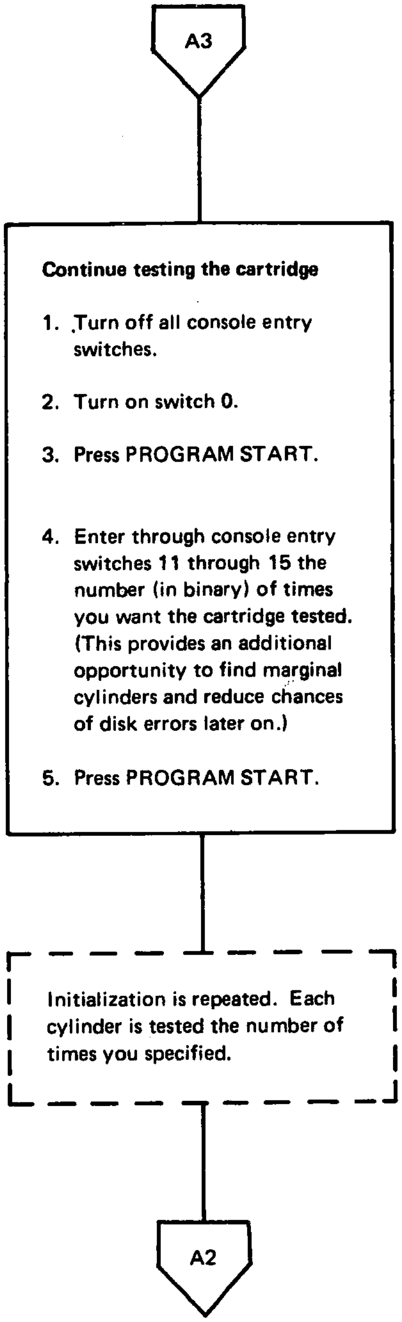
(if more than 3 defective cylinders are printed in the previous message. This message is also printed if cylinder 0 is defective, or if sector addresses cannot be written on every sector.)

After any of the previous messages are printed, this message is printed:

TURN ON SW0 FOR MORE TESTING

Do you want to do more testing?

Figure 9-4 (Part 2 of 5). Operating procedure for DCIP initialize function



Continue testing the cartridge

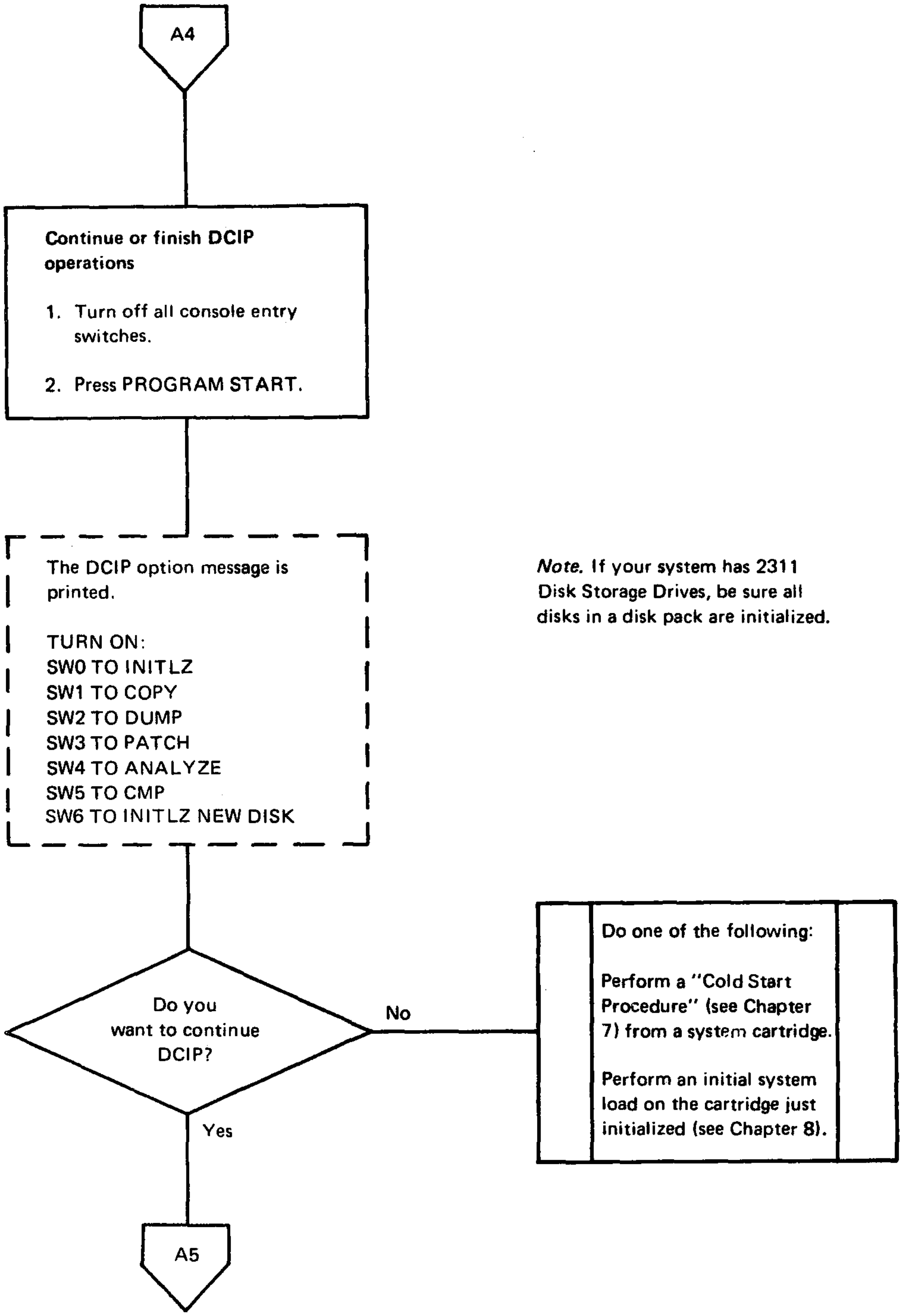
1. Turn off all console entry switches.
2. Turn on switch 0.
3. Press PROGRAM START.
4. Enter through console entry switches 11 through 15 the number (in binary) of times you want the cartridge tested. (This provides an additional opportunity to find marginal cylinders and reduce chances of disk errors later on.)
5. Press PROGRAM START.

Initialization is repeated. Each cylinder is tested the number of times you specified.

ENTER REPEAT CNT: (BITS 11-15) is printed.

A maximum of 31 (decimal) can be entered.

Figure 9-4 (Part 3 of 5). Operating procedure for DCIP initialize function



Continue or finish DCIP operations

1. Turn off all console entry switches.

2. Press PROGRAM START.

The DCIP option message is printed.

```
TURN ON:
SW0 TO INITLZ
SW1 TO COPY
SW2 TO DUMP
SW3 TO PATCH
SW4 TO ANALYZE
SW5 TO CMP
SW6 TO INITLZ NEW DISK
```

Do you want to continue DCIP?

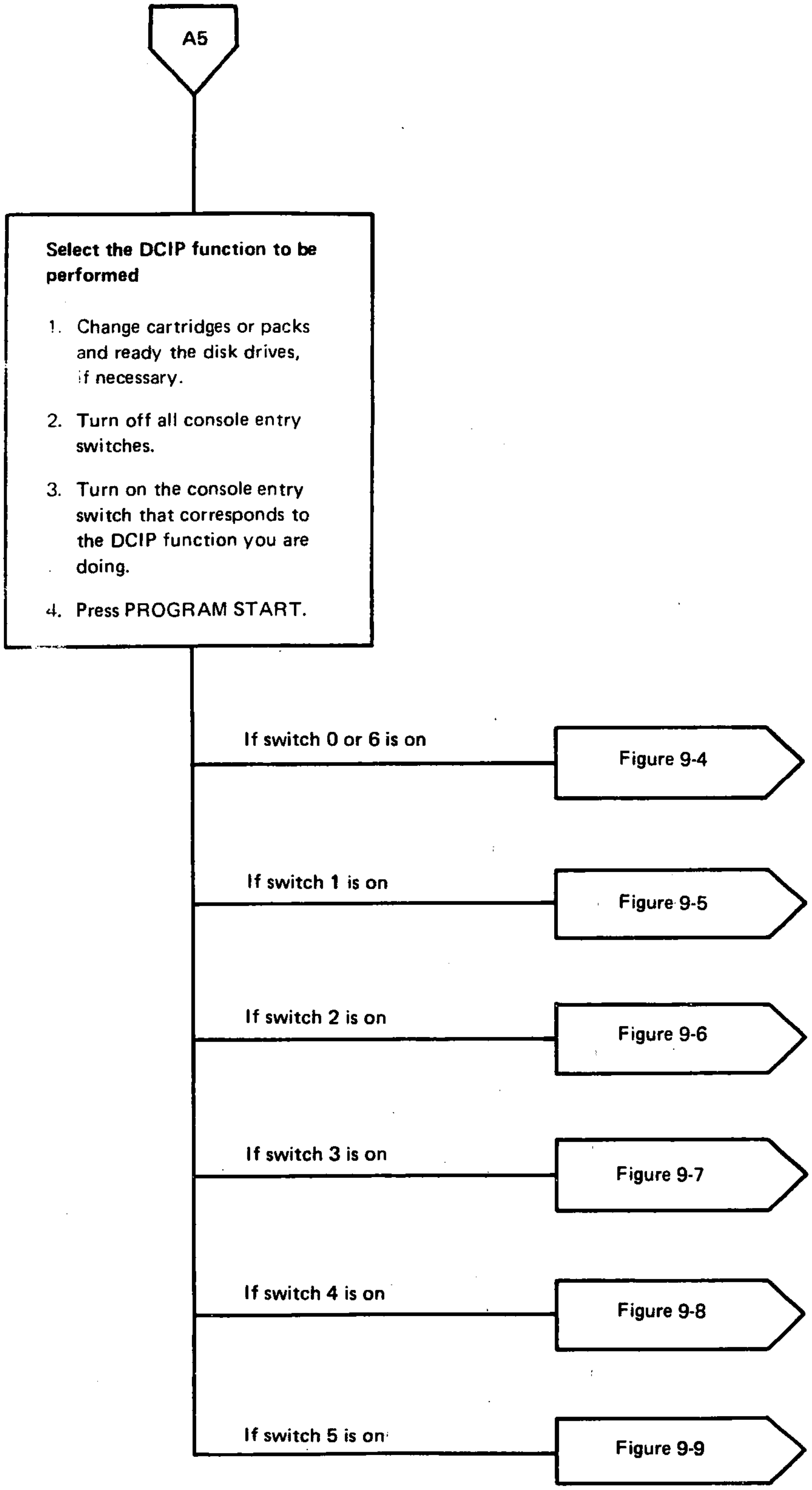
Do one of the following:

Perform a "Cold Start Procedure" (see Chapter 7) from a system cartridge.

Perform an initial system load on the cartridge just initialized (see Chapter 8).

Note. If your system has 2311 Disk Storage Drives, be sure all disks in a disk pack are initialized.

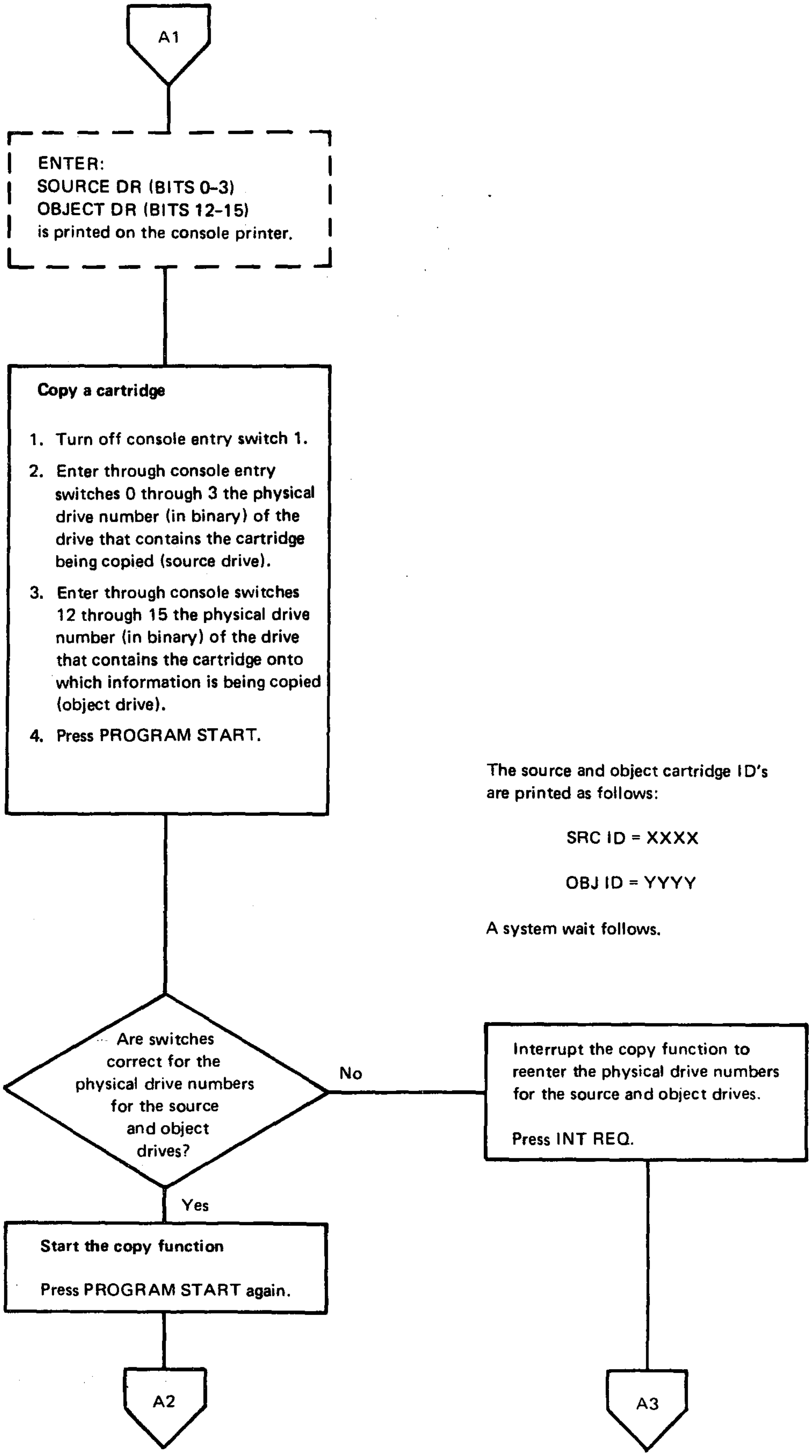
Figure 9-4 (Part 4 of 5). Operating procedure for DCIP initialize function



Select the DCIP function to be performed

1. Change cartridges or packs and ready the disk drives, if necessary.
2. Turn off all console entry switches.
3. Turn on the console entry switch that corresponds to the DCIP function you are doing.
4. Press PROGRAM START.

Figure 9-4 (Part 5 of 5). Operating procedure for DCIP initialize function



ENTER:
SOURCE DR (BITS 0-3)
OBJECT DR (BITS 12-15)
is printed on the console printer.

Copy a cartridge

1. Turn off console entry switch 1.
2. Enter through console entry switches 0 through 3 the physical drive number (in binary) of the drive that contains the cartridge being copied (source drive).
3. Enter through console switches 12 through 15 the physical drive number (in binary) of the drive that contains the cartridge onto which information is being copied (object drive).
4. Press PROGRAM START.

The source and object cartridge ID's are printed as follows:

SRC ID = XXXX

OBJ ID = YYYY

A system wait follows.

Are switches correct for the physical drive numbers for the source and object drives?

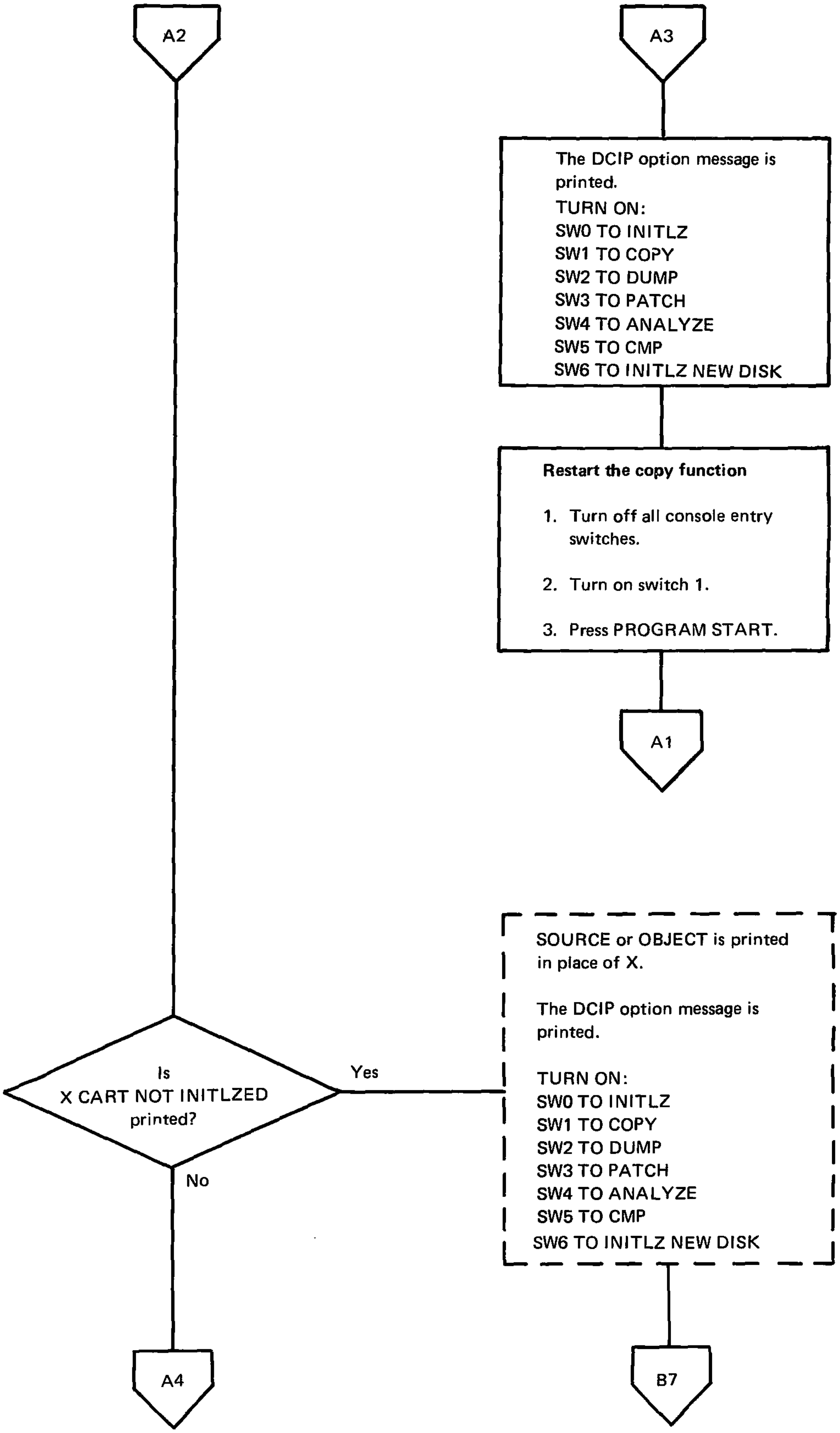
Interrupt the copy function to reenter the physical drive numbers for the source and object drives.

Press INT REQ.

Start the copy function

Press PROGRAM START again.

Figure 9-5 (Part 1 of 8). Operating procedure for DCIP copy function



The DCIP option message is printed.
TURN ON:
SW0 TO INITLZ
SW1 TO COPY
SW2 TO DUMP
SW3 TO PATCH
SW4 TO ANALYZE
SW5 TO CMP
SW6 TO INITLZ NEW DISK

Restart the copy function

1. Turn off all console entry switches.
2. Turn on switch 1.
3. Press PROGRAM START.

Is X CART NOT INITLZED printed?

SOURCE or OBJECT is printed in place of X.

The DCIP option message is printed.

TURN ON:
SW0 TO INITLZ
SW1 TO COPY
SW2 TO DUMP
SW3 TO PATCH
SW4 TO ANALYZE
SW5 TO CMP
SW6 TO INITLZ NEW DISK

Figure 9-5 (Part 2 of 8). Operating procedure for DCIP copy function

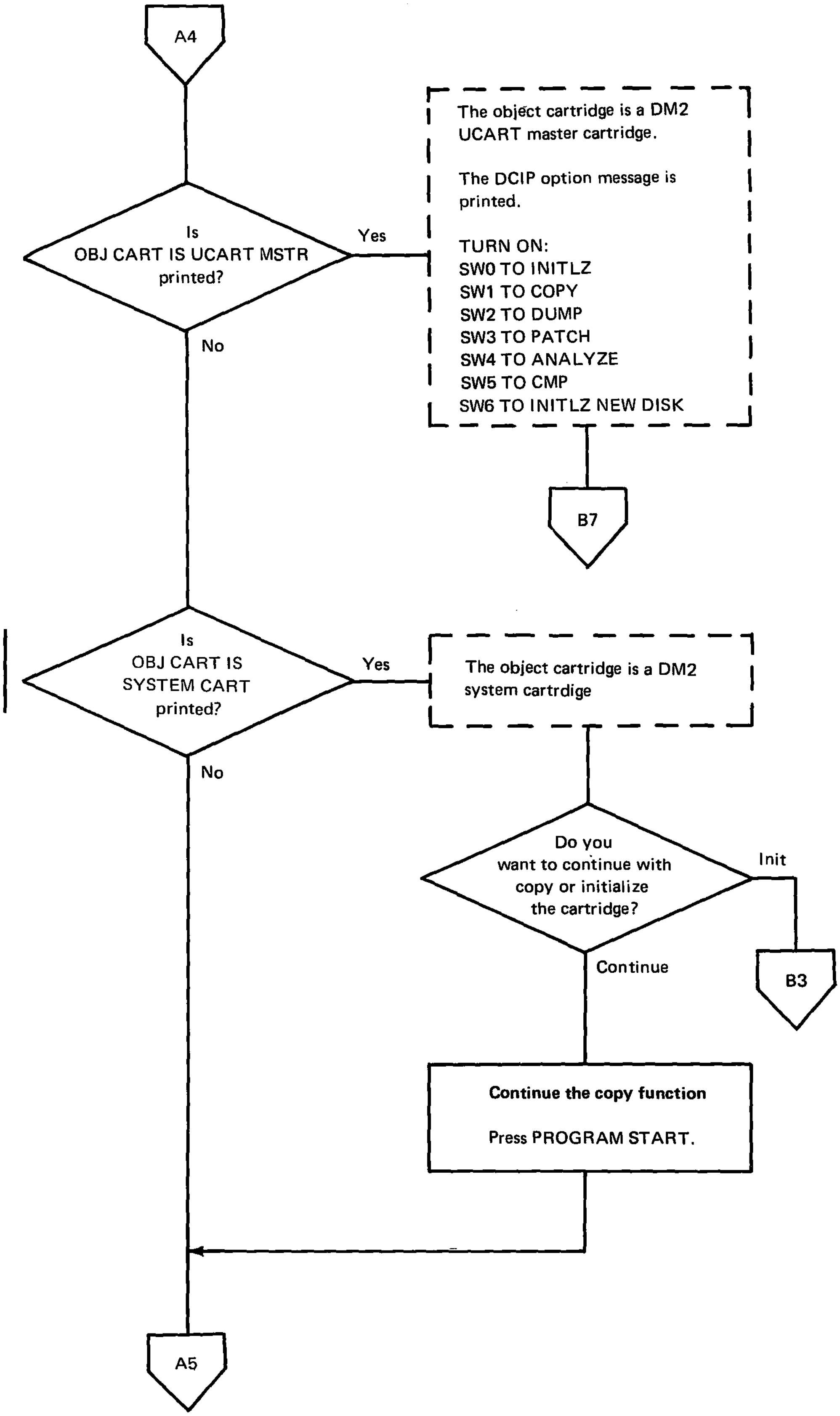
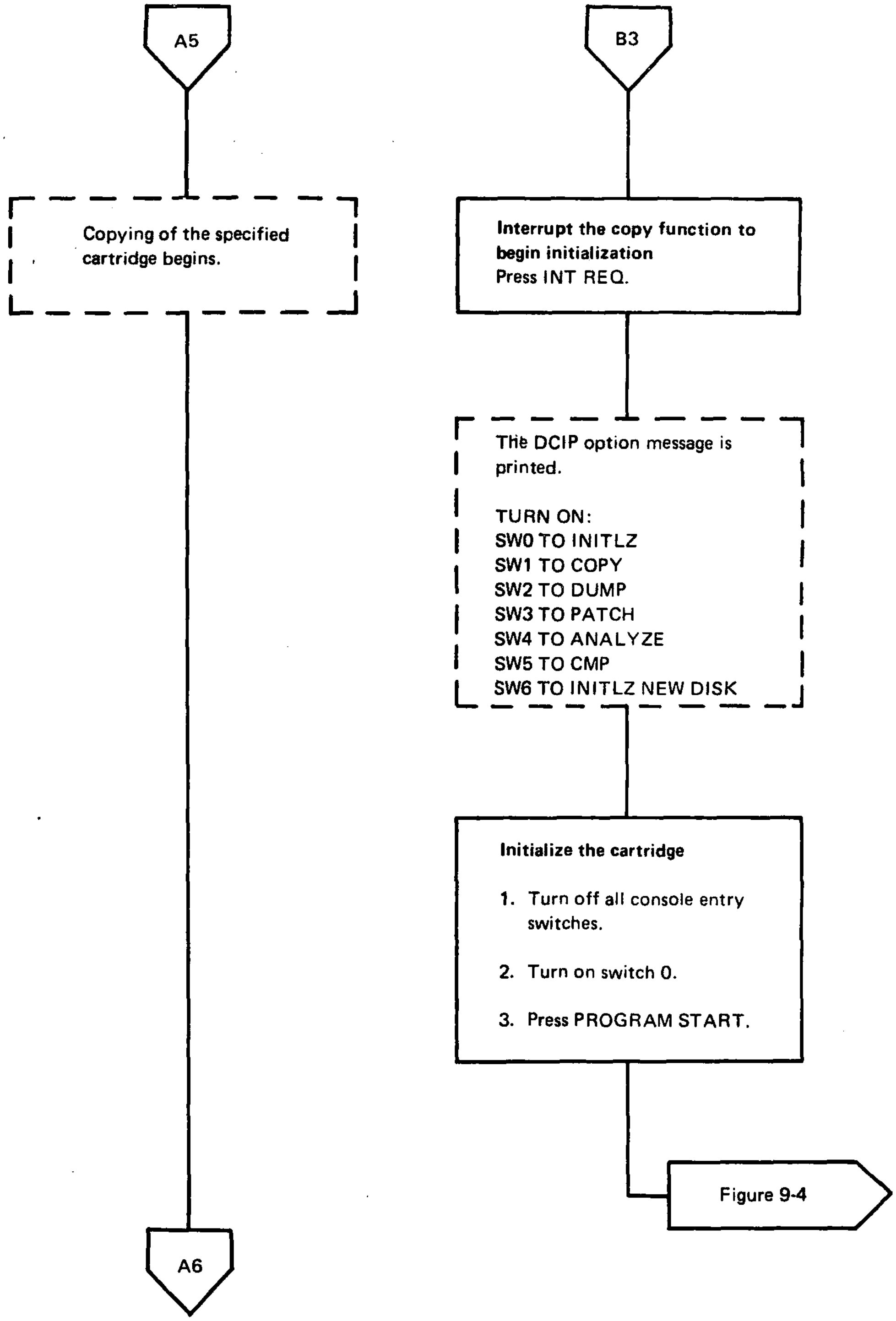


Figure 9-5 (Part 3 of 8). Operating procedure for DCIP copy function



Copying of the specified cartridge begins.

Interrupt the copy function to begin initialization
Press INT REQ.

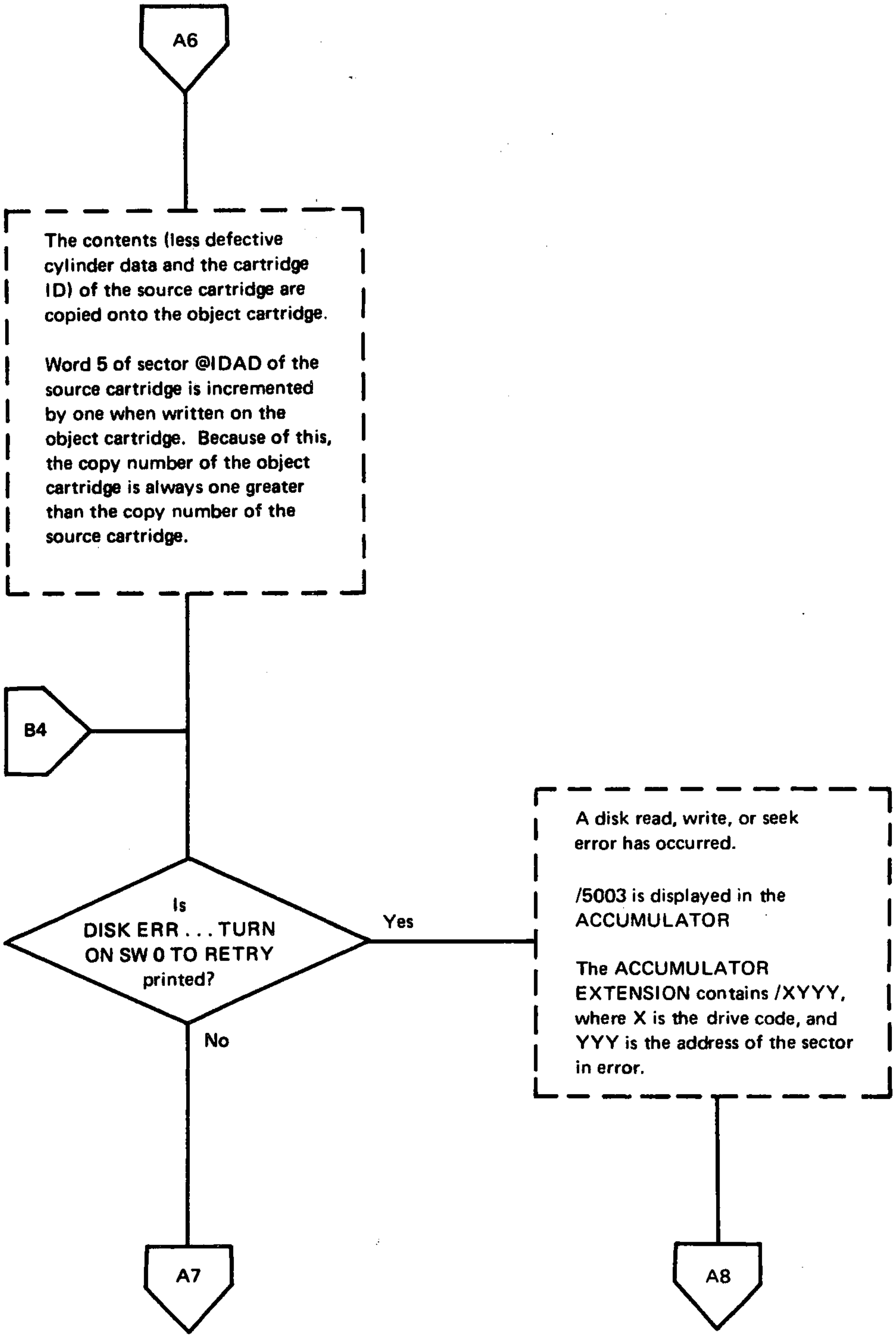
The DCIP option message is printed.

```
TURN ON:
SW0 TO INITLZ
SW1 TO COPY
SW2 TO DUMP
SW3 TO PATCH
SW4 TO ANALYZE
SW5 TO CMP
SW6 TO INITLZ NEW DISK
```

Initialize the cartridge

1. Turn off all console entry switches.
2. Turn on switch 0.
3. Press PROGRAM START.

Figure 9-5 (Part 4 of 8). Operating procedure for DCIP copy function



The contents (less defective cylinder data and the cartridge ID) of the source cartridge are copied onto the object cartridge.

Word 5 of sector @IDAD of the source cartridge is incremented by one when written on the object cartridge. Because of this, the copy number of the object cartridge is always one greater than the copy number of the source cartridge.

Is DISK ERR . . . TURN ON SW 0 TO RETRY printed?

A disk read, write, or seek error has occurred.

/5003 is displayed in the ACCUMULATOR

The ACCUMULATOR EXTENSION contains /XYYY, where X is the drive code, and YYY is the address of the sector in error.

Figure 9-5 (Part 5 of 8). Operating procedure for DCIP copy function

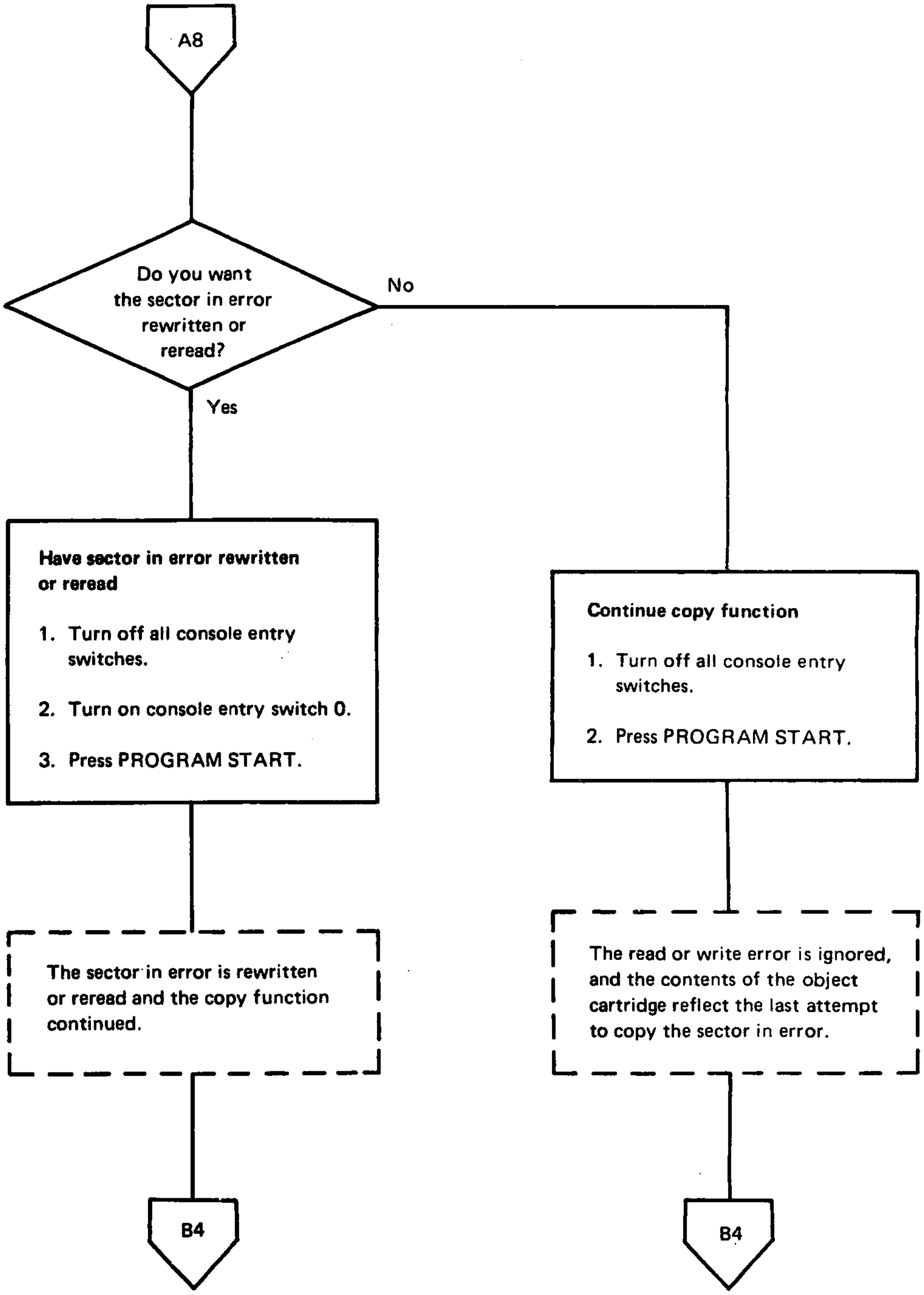

A8
Do you want the sector in error rewritten or reread?
No
Yes
Have sector in error rewritten or reread
1. Turn off all console entry switches.
2. Turn on console entry switch 0.
3. Press PROGRAM START.
Continue copy function
1. Turn off all console entry switches.
2. Press PROGRAM START.
The sector in error is rewritten or reread and the copy function continued.
The read or write error is ignored, and the contents of the object cartridge reflect the last attempt to copy the sector in error.
B4
B4

Figure 9-5 (Part 6 of 8). Operating procedure for DCIP copy function

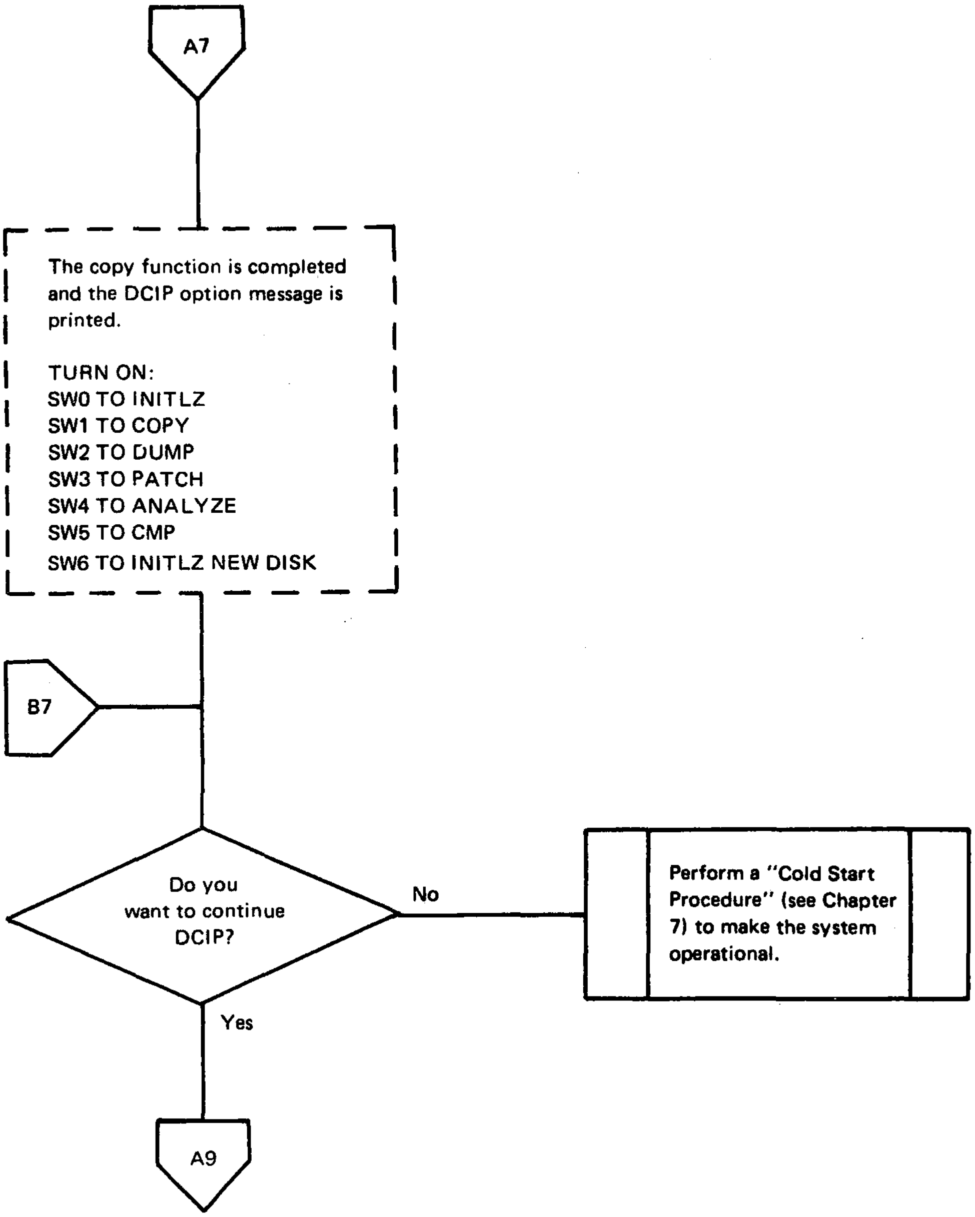
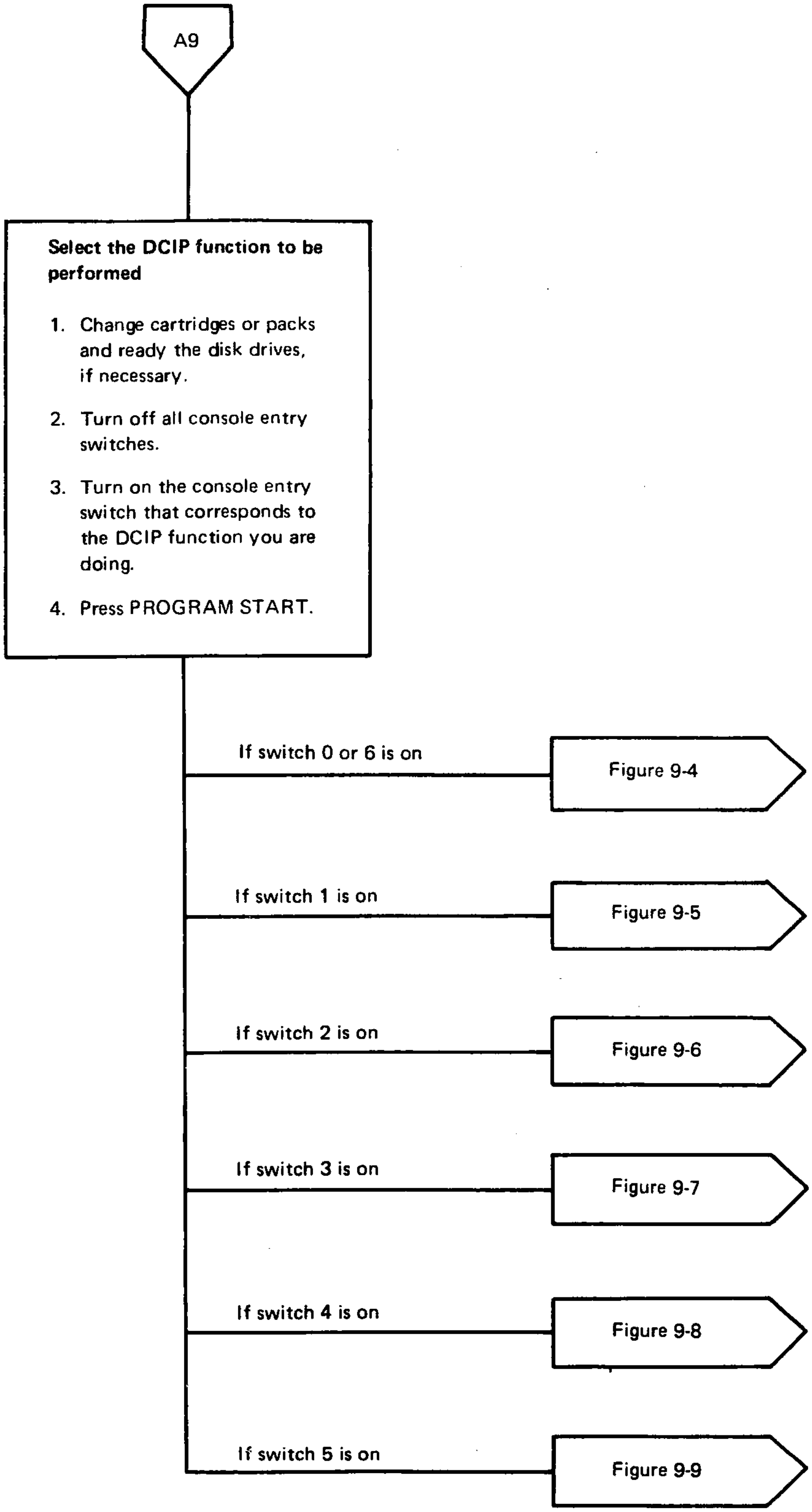

A7
The copy function is completed and the DCIP option message is printed.
TURN ON:
SW0 TO INITLZ
SW1 TO COPY
SW2 TO DUMP
SW3 TO PATCH
SW4 TO ANALYZE
SW5 TO CMP
SW6 TO INITLZ NEW DISK
B7
Do you want to continue DCIP?
No
Perform a "Cold Start Procedure" (see Chapter 7) to make the system operational.
Yes
A9

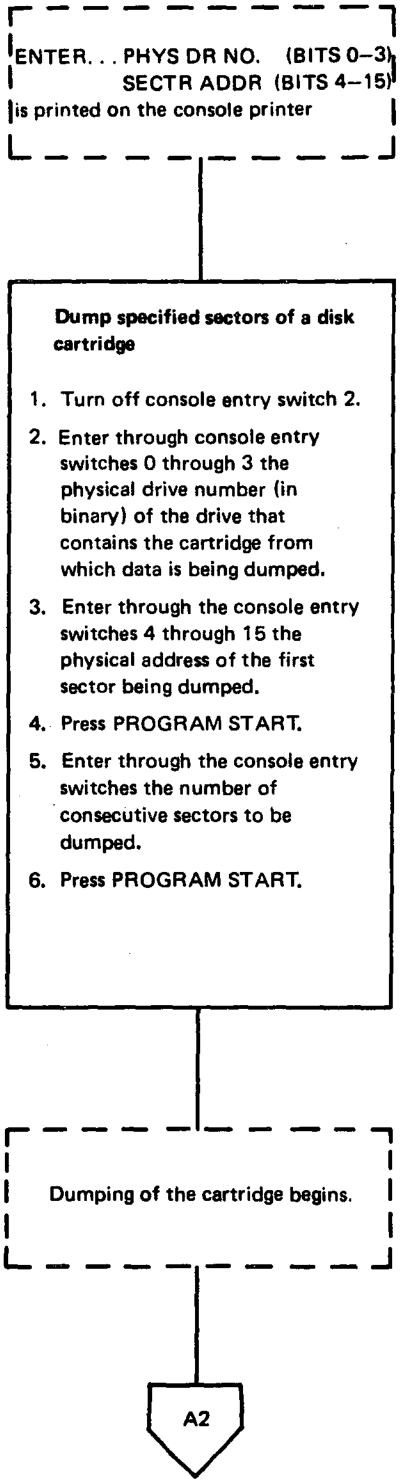
Figure 9-5 (Part 7 of 8). Operating procedure for DCIP copy function



Select the DCIP function to be performed

1. Change cartridges or packs and ready the disk drives, if necessary.
2. Turn off all console entry switches.
3. Turn on the console entry switch that corresponds to the DCIP function you are doing.
4. Press PROGRAM START.

Figure 9-5 (Part 8 of 8). Operating procedure for DCIP copy function



ENTER. . . PHYS DR NO. (BITS 0–3)
SECTR ADDR (BITS 4–15)
is printed on the console printer

Dump specified sectors of a disk cartridge

1. Turn off console entry switch 2.
2. Enter through console entry switches 0 through 3 the physical drive number (in binary) of the drive that contains the cartridge from which data is being dumped.
3. Enter through the console entry switches 4 through 15 the physical address of the first sector being dumped.
4. Press PROGRAM START.
5. Enter through the console entry switches the number of consecutive sectors to be dumped.
6. Press PROGRAM START.

Dumping of the cartridge begins.

The sector address is a right-adjusted hexadecimal number, maximum /0657. (A logical sector address, obtained from LET or FLET, must be adjusted for defective cylinders.)

ENTER NO. OF SCTRS TO DUMP is printed.

The number is a right-adjusted hexadecimal value; the maximum value depends on the starting address entered in Step 2.

Figure 9-6 (Part 1 of 4). Operating procedure for DCIP dump function

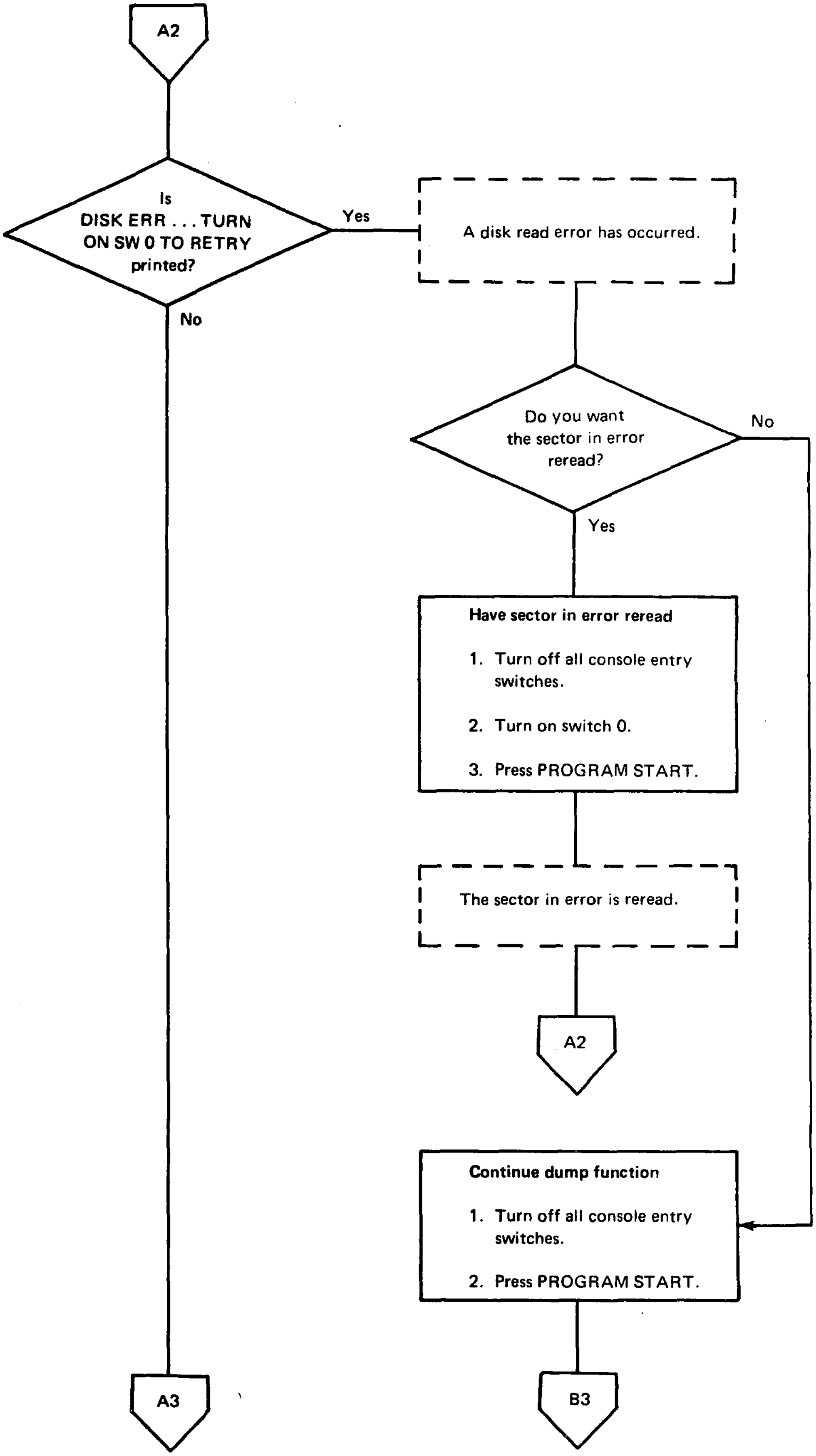

A2
Is DISK ERR . . . TURN ON SW 0 TO RETRY printed?
Yes
No
A disk read error has occurred.
Do you want the sector in error reread?
No
Yes
Have sector in error reread
1. Turn off all console entry switches.
2. Turn on switch 0.
3. Press PROGRAM START.
The sector in error is reread.
A2
Continue dump function
1. Turn off all console entry switches.
2. Press PROGRAM START.
A3
B3

Figure 9-6 (Part 2 of 4). Operating procedure for DCIP dump function

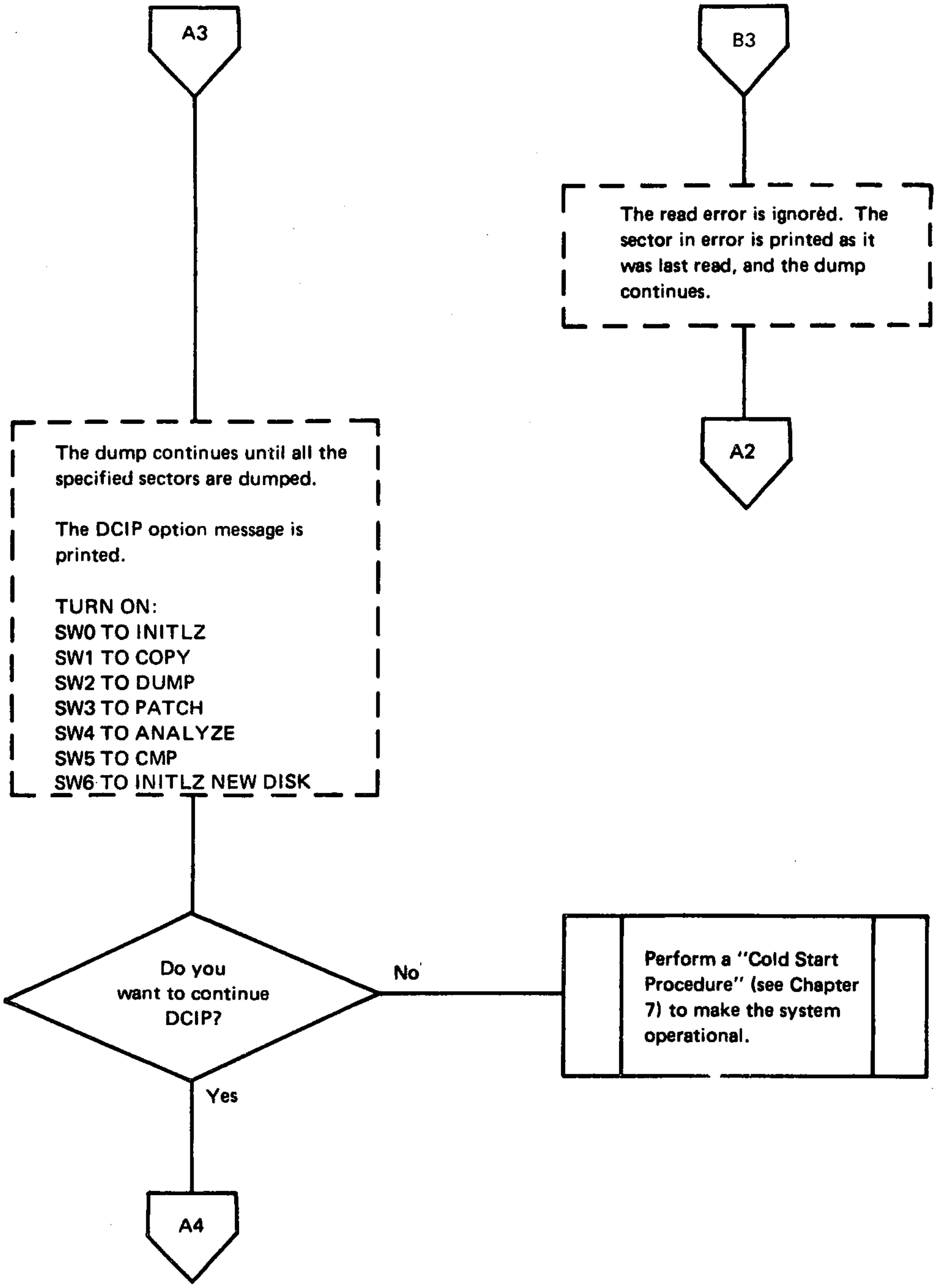
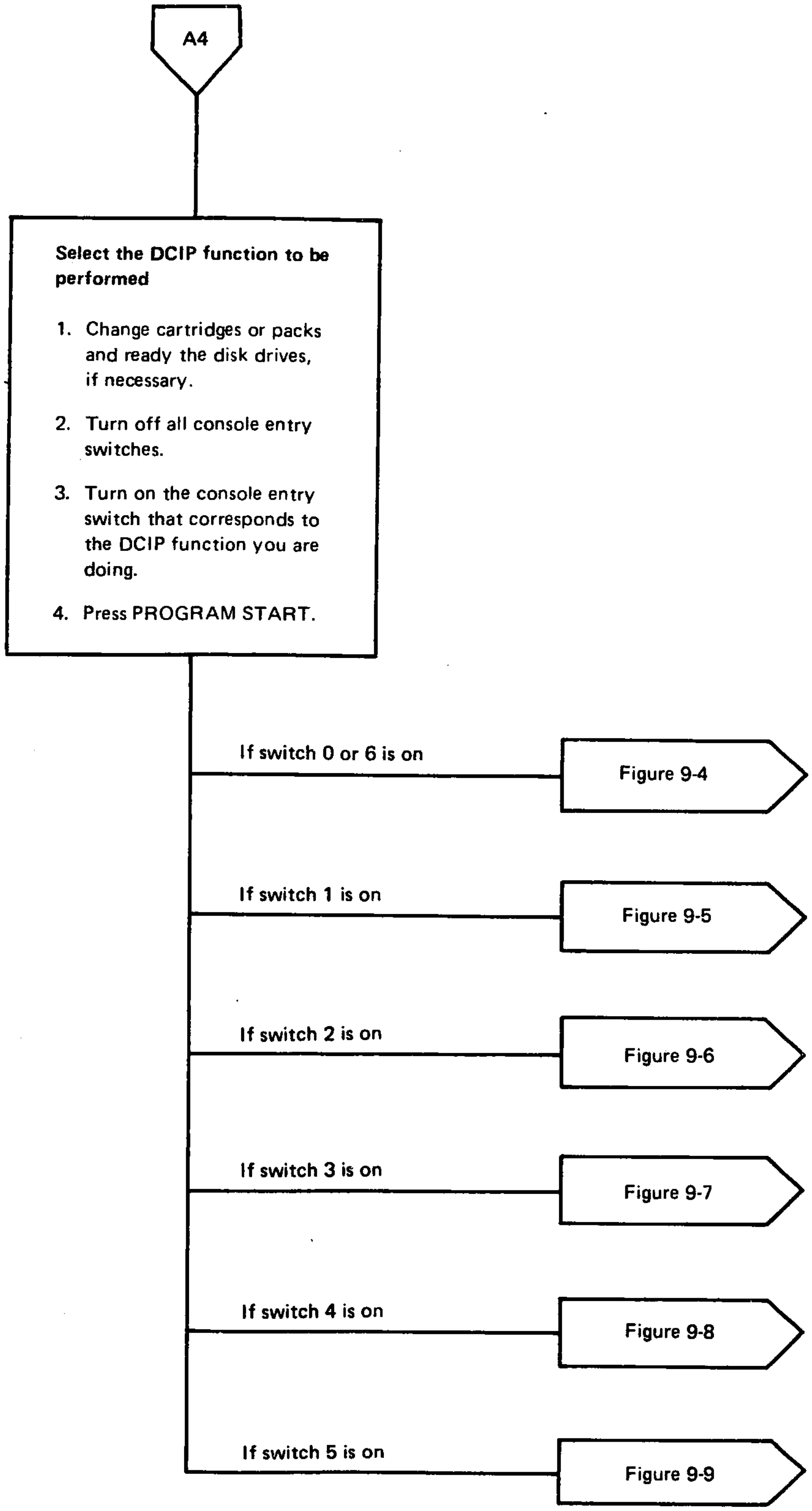

A3
B3
The read error is ignorèd. The sector in error is printed as it was last read, and the dump continues.
A2
The dump continues until all the specified sectors are dumped.
The DCIP option message is printed.
TURN ON:
SW0 TO INITLZ
SW1 TO COPY
SW2 TO DUMP
SW3 TO PATCH
SW4 TO ANALYZE
SW5 TO CMP
SW6 TO INITLZ NEW DISK
Do you want to continue DCIP?
No
Perform a "Cold Start Procedure" (see Chapter 7) to make the system operational.
Yes
A4

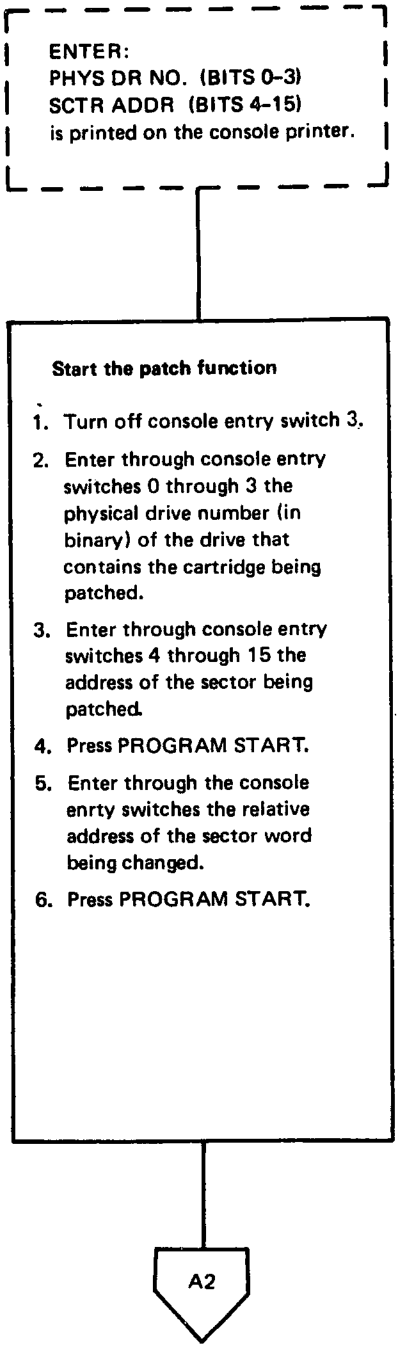
Figure 9-6 (Part 3 of 4). Operating procedure for DCIP dump function



Select the DCIP function to be performed

1. Change cartridges or packs and ready the disk drives, if necessary.
2. Turn off all console entry switches.
3. Turn on the console entry switch that corresponds to the DCIP function you are doing.
4. Press PROGRAM START.

Figure 9-6 (Part 4 of 4). Operating procedure for DCIP dump function



ENTER:
PHYS DR NO. (BITS 0–3)
SCTR ADDR (BITS 4–15)
is printed on the console printer.

Start the patch function

1. Turn off console entry switch 3.
2. Enter through console entry switches 0 through 3 the physical drive number (in binary) of the drive that contains the cartridge being patched.
3. Enter through console entry switches 4 through 15 the address of the sector being patched.
4. Press PROGRAM START.
5. Enter through the console enrty switches the relative address of the sector word being changed.
6. Press PROGRAM START.

The sector address is a right-adjusted hexadecimal number, maximum /0657.

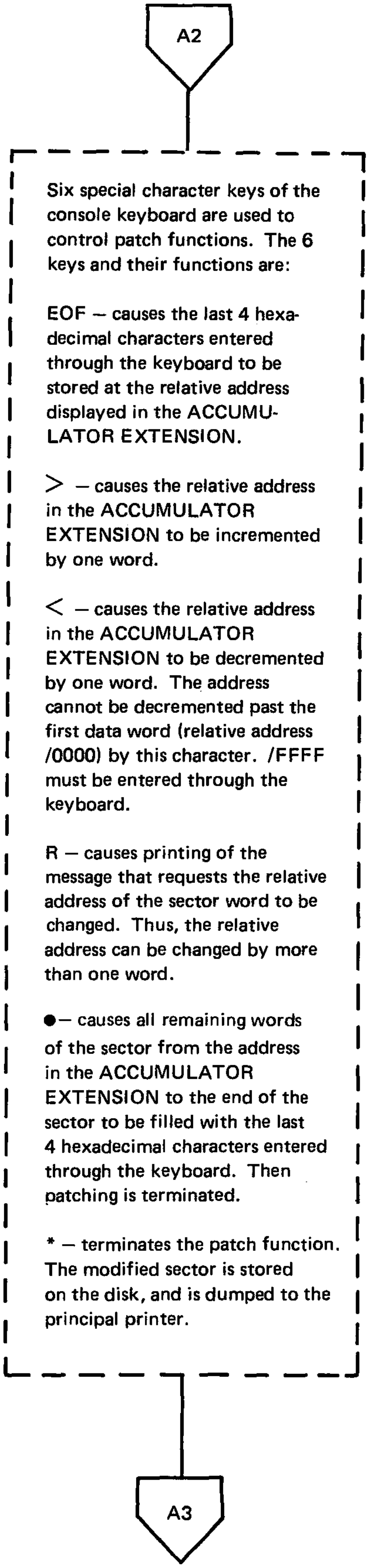
The specified sector is dumped, and the following message is printed:
ENTER RLTV ADDR OF SCTR WD TO CHANGE.

The relative address of the sector word is a right-adjusted hexadecimal number in the range /0000 through /013F.

Note: If the sector address is being changed, enter /FFFF (–1).

The KEYBOARD SELECT indicator on the console keyboard is turned on.

Figure 9-7 (Part 1 of 4). Operating procedure for DCIP patch function



Six special character keys of the console keyboard are used to control patch functions. The 6 keys and their functions are:

EOF – causes the last 4 hexadecimal characters entered through the keyboard to be stored at the relative address displayed in the ACCUMULATOR EXTENSION.

> – causes the relative address in the ACCUMULATOR EXTENSION to be incremented by one word.

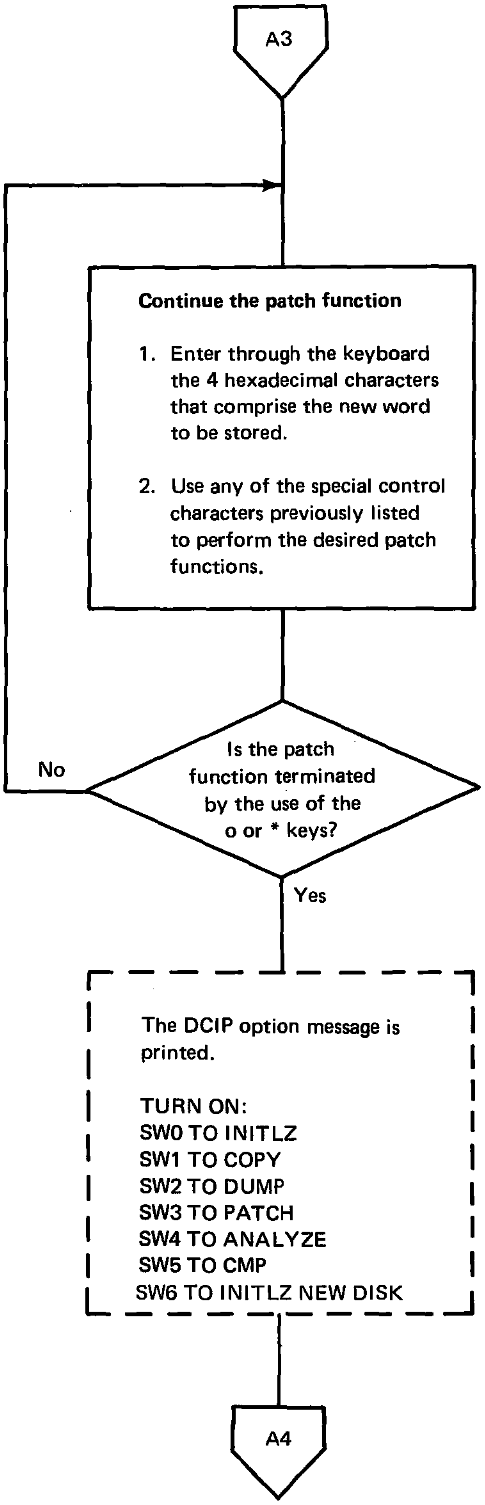
< – causes the relative address in the ACCUMULATOR EXTENSION to be decremented by one word. The address cannot be decremented past the first data word (relative address /0000) by this character. /FFFF must be entered through the keyboard.

R – causes printing of the message that requests the relative address of the sector word to be changed. Thus, the relative address can be changed by more than one word.

●– causes all remaining words of the sector from the address in the ACCUMULATOR EXTENSION to the end of the sector to be filled with the last 4 hexadecimal characters entered through the keyboard. Then patching is terminated.

* – terminates the patch function. The modified sector is stored on the disk, and is dumped to the principal printer.

Figure 9-7 (Part 2 of 4). Operating procedure for DCIP patch function



Continue the patch function

1. Enter through the keyboard the 4 hexadecimal characters that comprise the new word to be stored.
2. Use any of the special control characters previously listed to perform the desired patch functions.

The characters are printed on the console printer as you enter them.

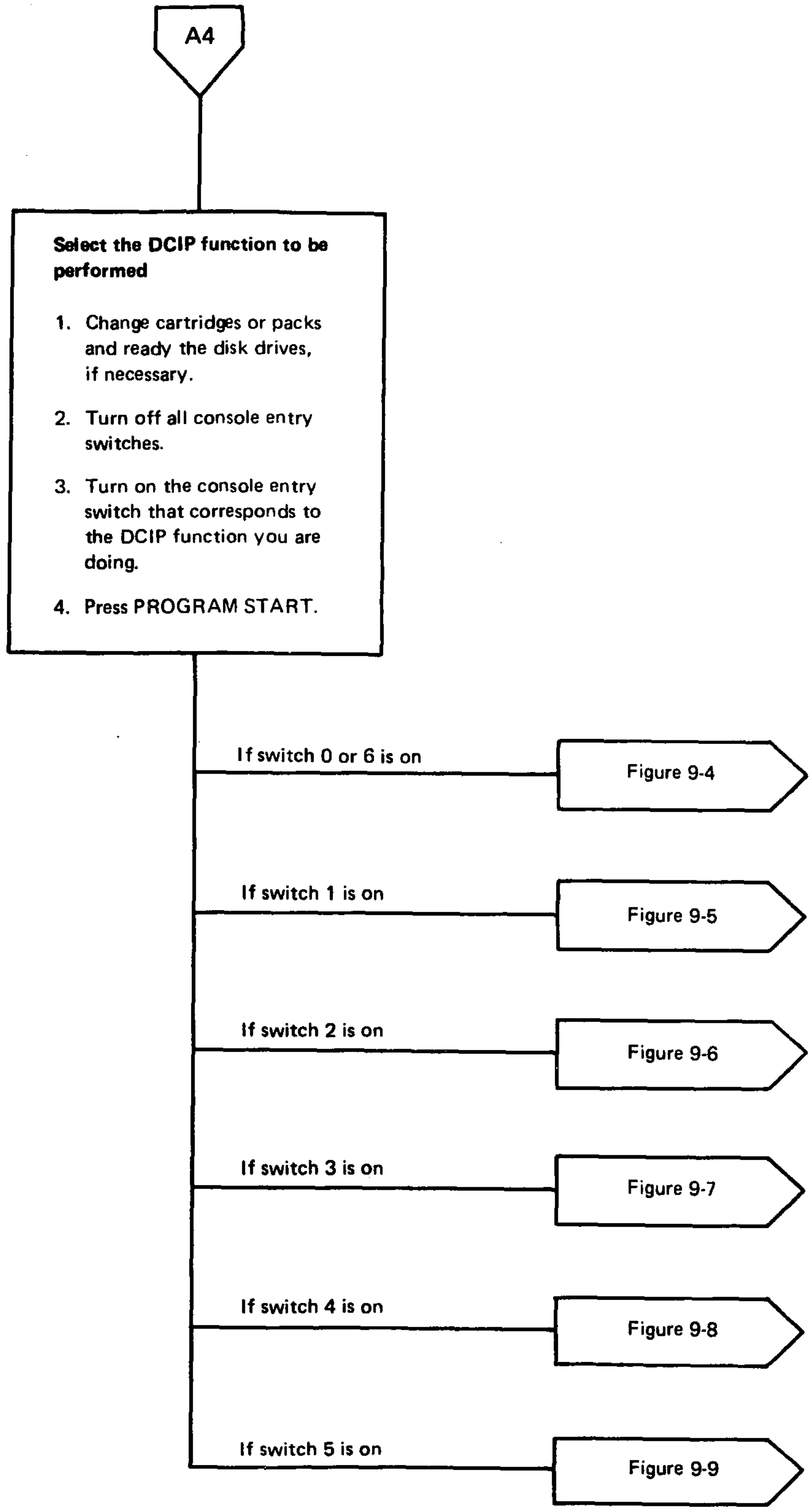
ENTRY ERR . . . RETRY is printed if you press an invalid key; use the correct key to continue.

Is the patch function terminated by the use of the o or * keys?

The DCIP option message is printed.

```
TURN ON:
SW0 TO INITLZ
SW1 TO COPY
SW2 TO DUMP
SW3 TO PATCH
SW4 TO ANALYZE
SW5 TO CMP
SW6 TO INITLZ NEW DISK
```

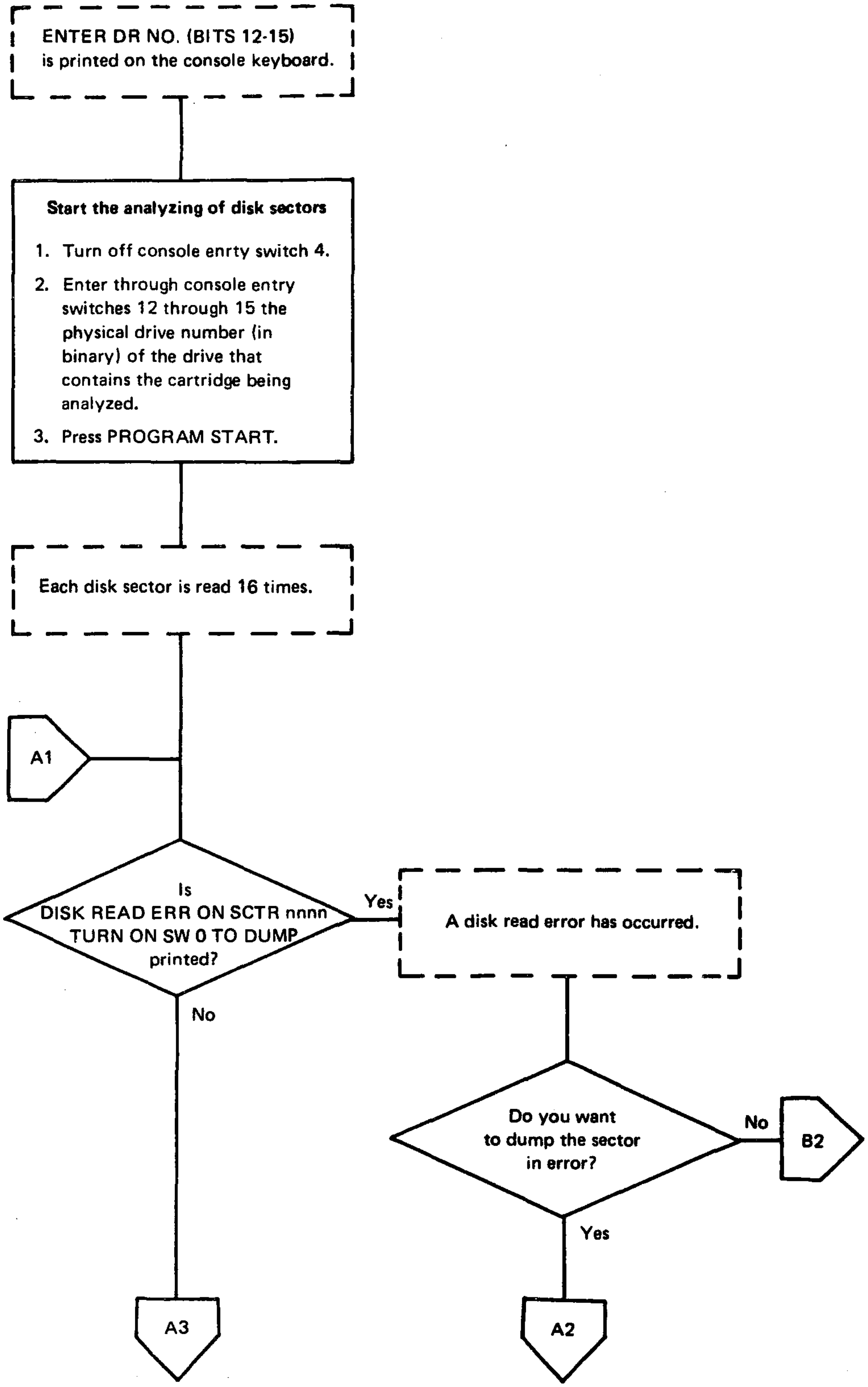
Figure 9-7 (Part 3 of 4). Operating procedure for DCIP patch function



Select the DCIP function to be performed

1. Change cartridges or packs and ready the disk drives, if necessary.
2. Turn off all console entry switches.
3. Turn on the console entry switch that corresponds to the DCIP function you are doing.
4. Press PROGRAM START.

Figure 9-7 (Part 4 of 4). Operating procedure for DCIP patch function



ENTER DR NO. (BITS 12-15) is printed on the console keyboard.

Start the analyzing of disk sectors

1. Turn off console enrty switch 4.
2. Enter through console entry switches 12 through 15 the physical drive number (in binary) of the drive that contains the cartridge being analyzed.
3. Press PROGRAM START.

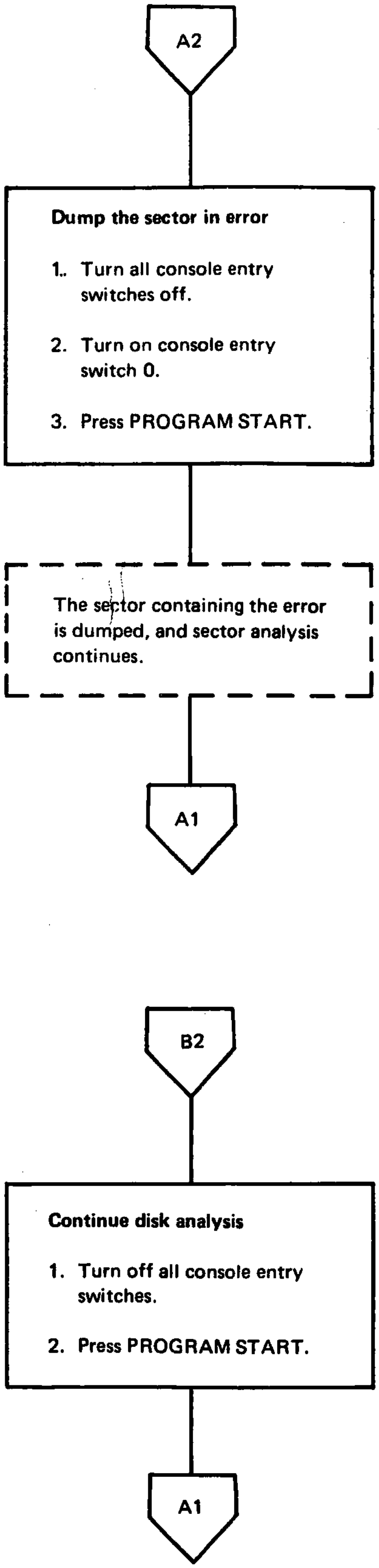
Each disk sector is read 16 times.

A1
Is DISK READ ERR ON SCTR nnnn TURN ON SW 0 TO DUMP printed?
Yes
No

A disk read error has occurred.

Do you want to dump the sector in error?
No
B2
Yes
A3
A2

Figure 9-8 (Part 1 of 4). Operating procedure for DCIP analysis function



Dump the sector in error

1.. Turn all console entry switches off.

2. Turn on console entry switch 0.

3. Press PROGRAM START.

The sector containing the error is dumped, and sector analysis continues.

Continue disk analysis

1. Turn off all console entry switches.

2. Press PROGRAM START.

Figure 9-8 (Part 2 of 4). Operating procedure for DCIP analysis function

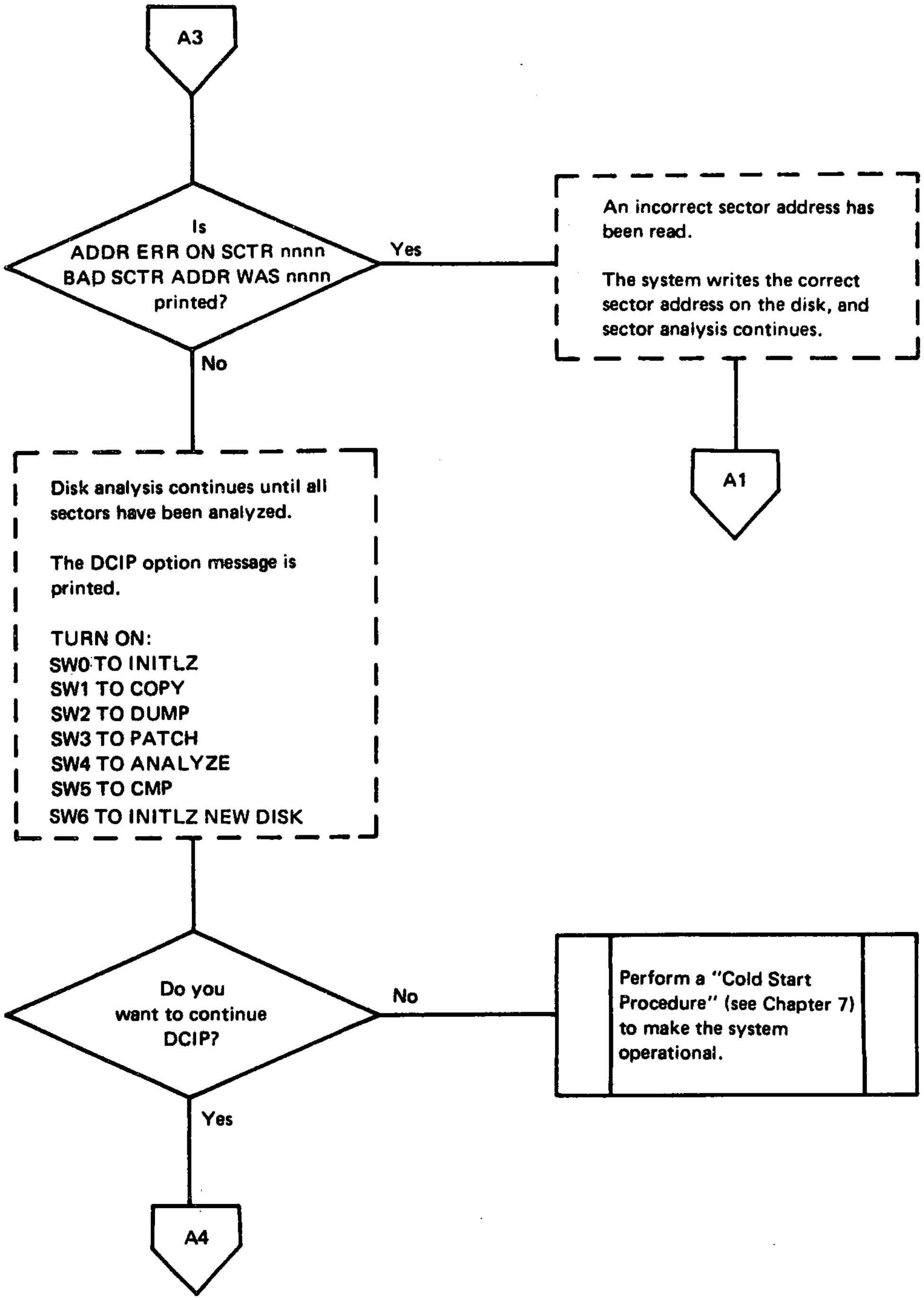
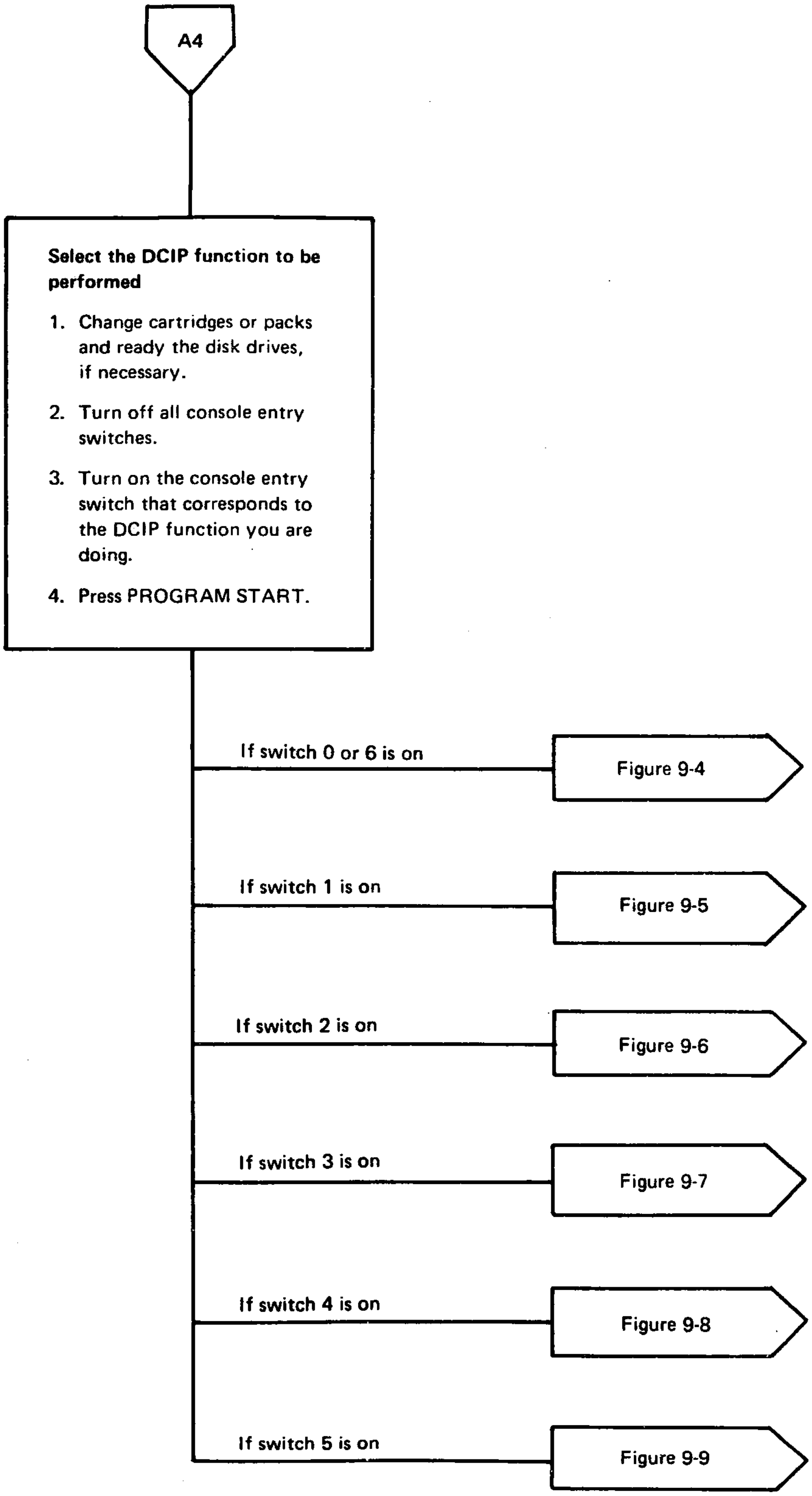

A3
Is
ADDR ERR ON SCTR nnnn
BAD SCTR ADDR WAS nnnn
printed?
Yes
An incorrect sector address has been read.
The system writes the correct sector address on the disk, and sector analysis continues.
A1
No
Disk analysis continues until all sectors have been analyzed.
The DCIP option message is printed.
TURN ON:
SW0 TO INITLZ
SW1 TO COPY
SW2 TO DUMP
SW3 TO PATCH
SW4 TO ANALYZE
SW5 TO CMP
SW6 TO INITLZ NEW DISK
Do you
want to continue
DCIP?
No
Perform a "Cold Start Procedure" (see Chapter 7) to make the system operational.
Yes
A4

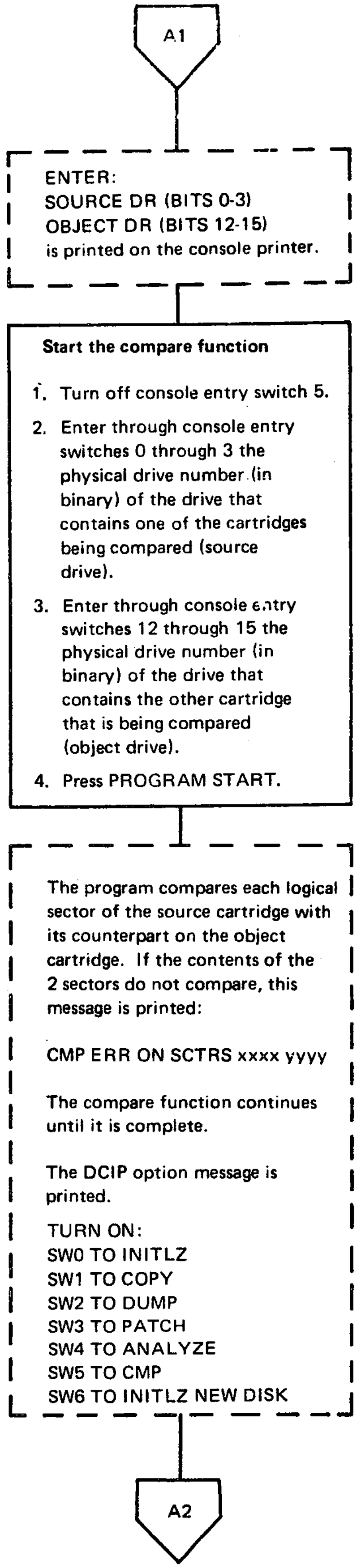
Figure 9-8 (Part 3 of 4). Operating procedure for DCIP analysis function



Select the DCIP function to be performed

1. Change cartridges or packs and ready the disk drives, if necessary.
2. Turn off all console entry switches.
3. Turn on the console entry switch that corresponds to the DCIP function you are doing.
4. Press PROGRAM START.

Figure 9-8 (Part 4 of 4). Operating procedure for DCIP analysis function



ENTER:
SOURCE DR (BITS 0-3)
OBJECT DR (BITS 12-15)
is printed on the console printer.

Start the compare function

1. Turn off console entry switch 5.
2. Enter through console entry switches 0 through 3 the physical drive number (in binary) of the drive that contains one of the cartridges being compared (source drive).
3. Enter through console entry switches 12 through 15 the physical drive number (in binary) of the drive that contains the other cartridge that is being compared (object drive).
4. Press PROGRAM START.

The program compares each logical sector of the source cartridge with its counterpart on the object cartridge. If the contents of the 2 sectors do not compare, this message is printed:

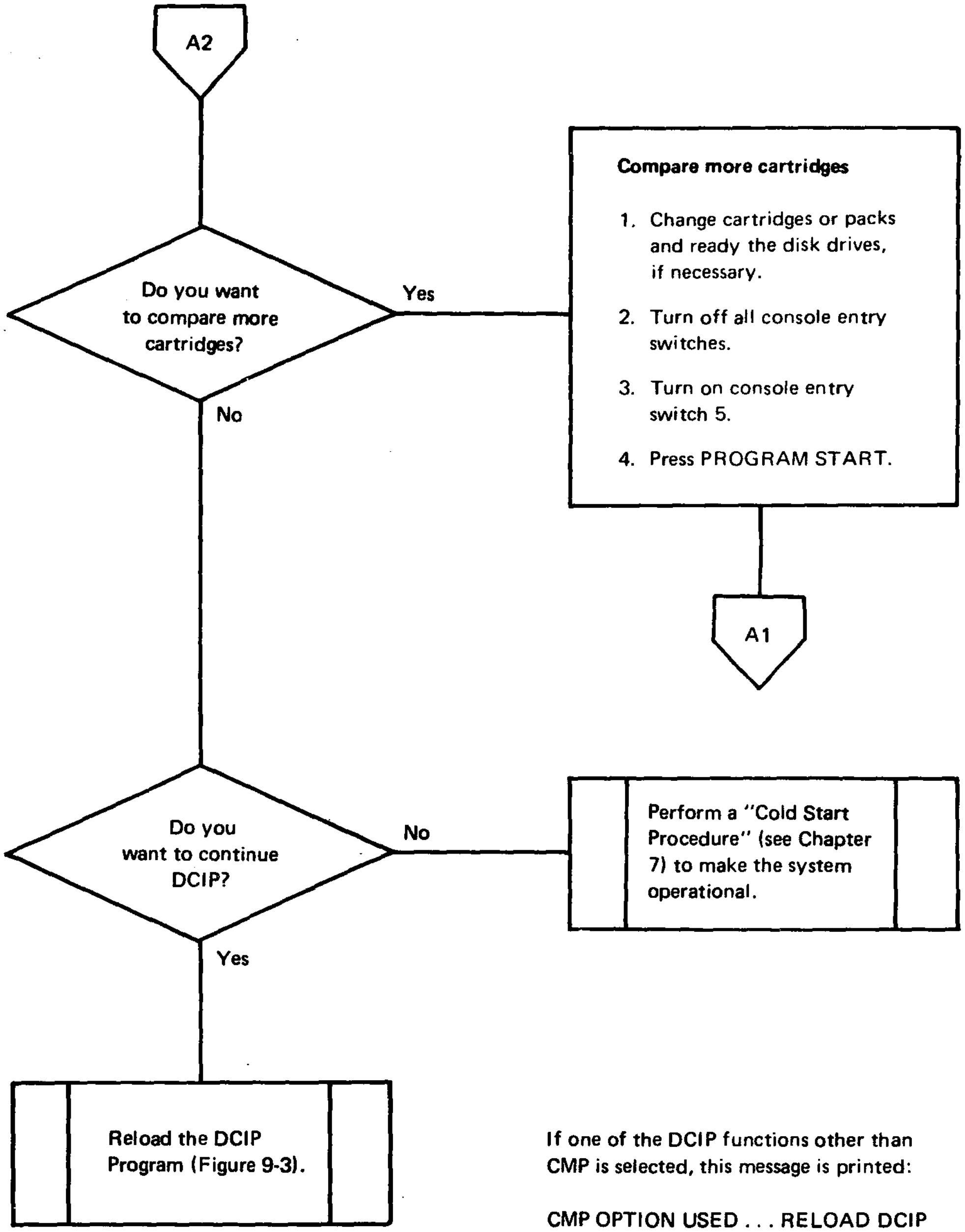
CMP ERR ON SCTRS xxxx yyyy

The compare function continues until it is complete.

The DCIP option message is printed.

TURN ON:
SW0 TO INITLZ
SW1 TO COPY
SW2 TO DUMP
SW3 TO PATCH
SW4 TO ANALYZE
SW5 TO CMP
SW6 TO INITLZ NEW DISK

Figure 9-9 (Part 1 of 2). Operating procedure for **DCIP compare function**


A2
Do you want to compare more cartridges?
Yes
No
Compare more cartridges
1. Change cartridges or packs and ready the disk drives, if necessary.
2. Turn off all console entry switches.
3. Turn on console entry switch 5.
4. Press PROGRAM START.
A1
Do you want to continue DCIP?
No
Perform a "Cold Start Procedure" (see Chapter 7) to make the system operational.
Yes
Reload the DCIP Program (Figure 9-3).

If one of the DCIP functions other than CMP is selected, this message is printed:

CMP OPTION USED . . . RELOAD DCIP

Figure 9-9 (Part 2 of 2). Operating procedure for DCIP compare function

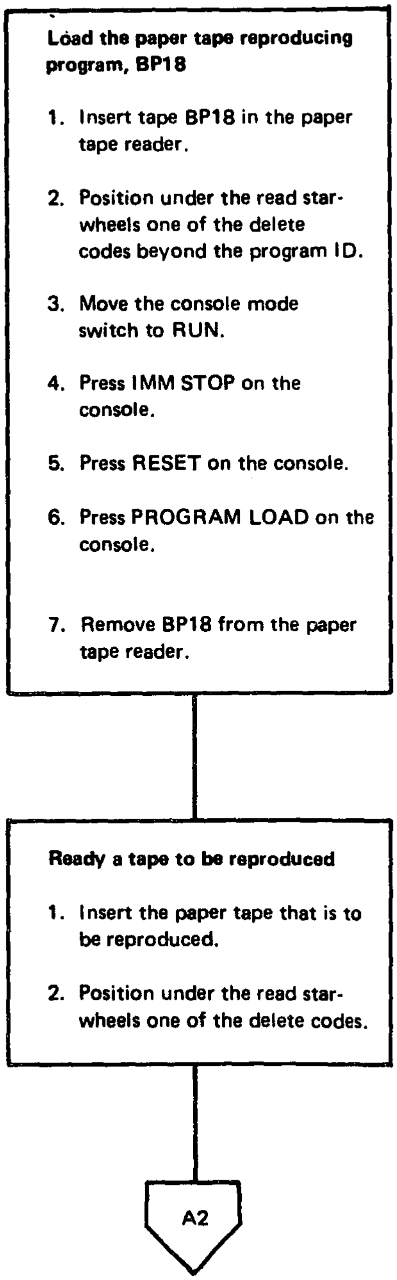
PAPER TAPE REPRODUCING PROGRAM

This program, available only with the paper tape system, copies information from one paper tape onto another. The program reads and punches characters with no intermediate conversion.

The materials that you need to reproduce paper tapes are:

- The Paper Tape Reproducing Program tape, BP18
- The tape being reproduced
- Blank tape

Figure 9-10 is the operating procedure for the stand-alone paper tape reproducing program.



Load the paper tape reproducing program, BP18

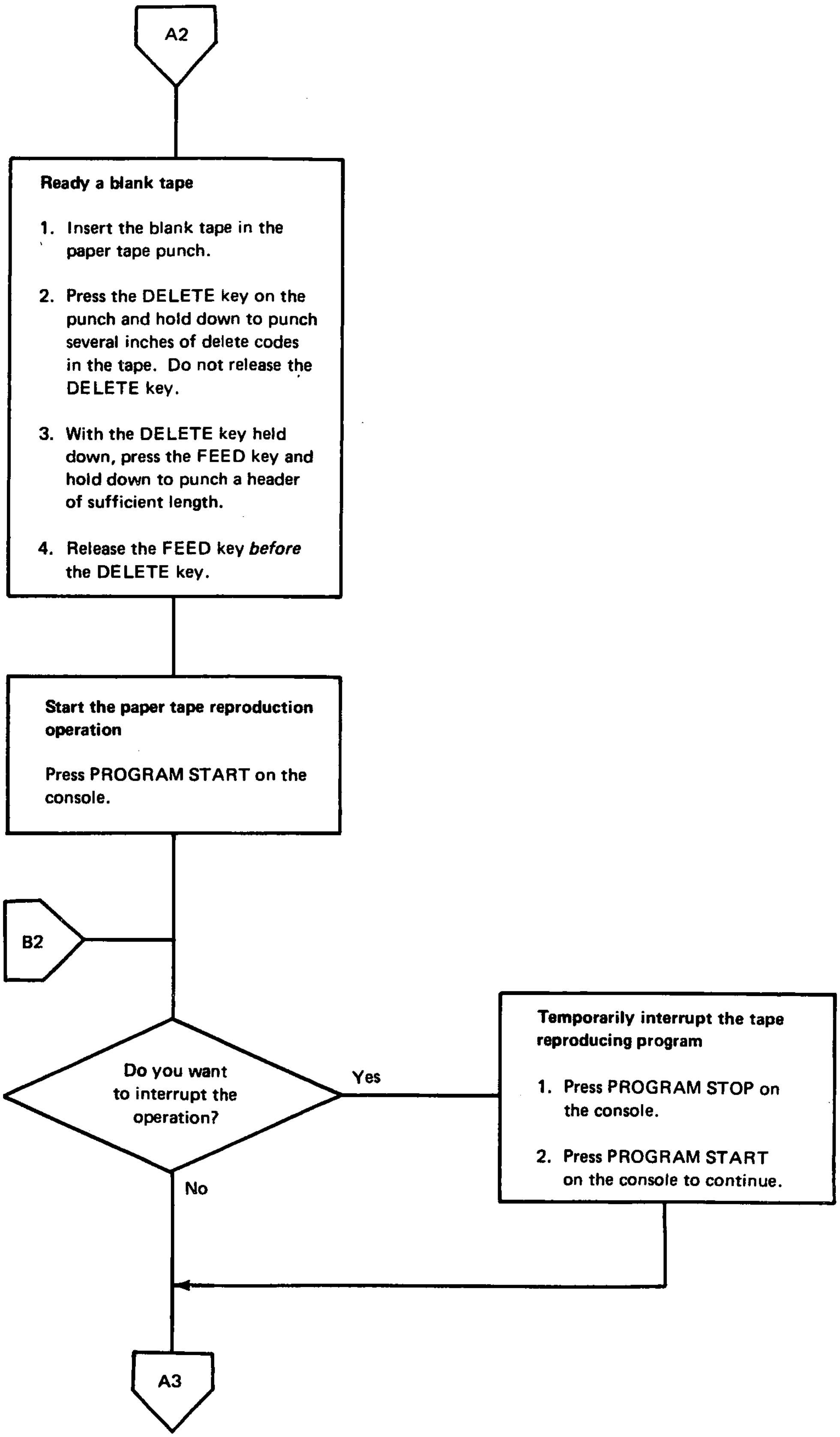
1. Insert tape BP18 in the paper tape reader.
2. Position under the read star-wheels one of the delete codes beyond the program ID.
3. Move the console mode switch to RUN.
4. Press IMM STOP on the console.
5. Press RESET on the console.
6. Press PROGRAM LOAD on the console.
7. Remove BP18 from the paper tape reader.

The program is read into core storage, and the system waits with /1111 displayed in the ACCUMULATOR.

Ready a tape to be reproduced

1. Insert the paper tape that is to be reproduced.
2. Position under the read star-wheels one of the delete codes.

Figure 9-10 (Part 1 of 4). Paper tape reproducing operating procedure



Ready a blank tape

1. Insert the blank tape in the paper tape punch.
2. Press the DELETE key on the punch and hold down to punch several inches of delete codes in the tape. Do not release the DELETE key.
3. With the DELETE key held down, press the FEED key and hold down to punch a header of sufficient length.
4. Release the FEED key *before* the DELETE key.

Start the paper tape reproduction operation

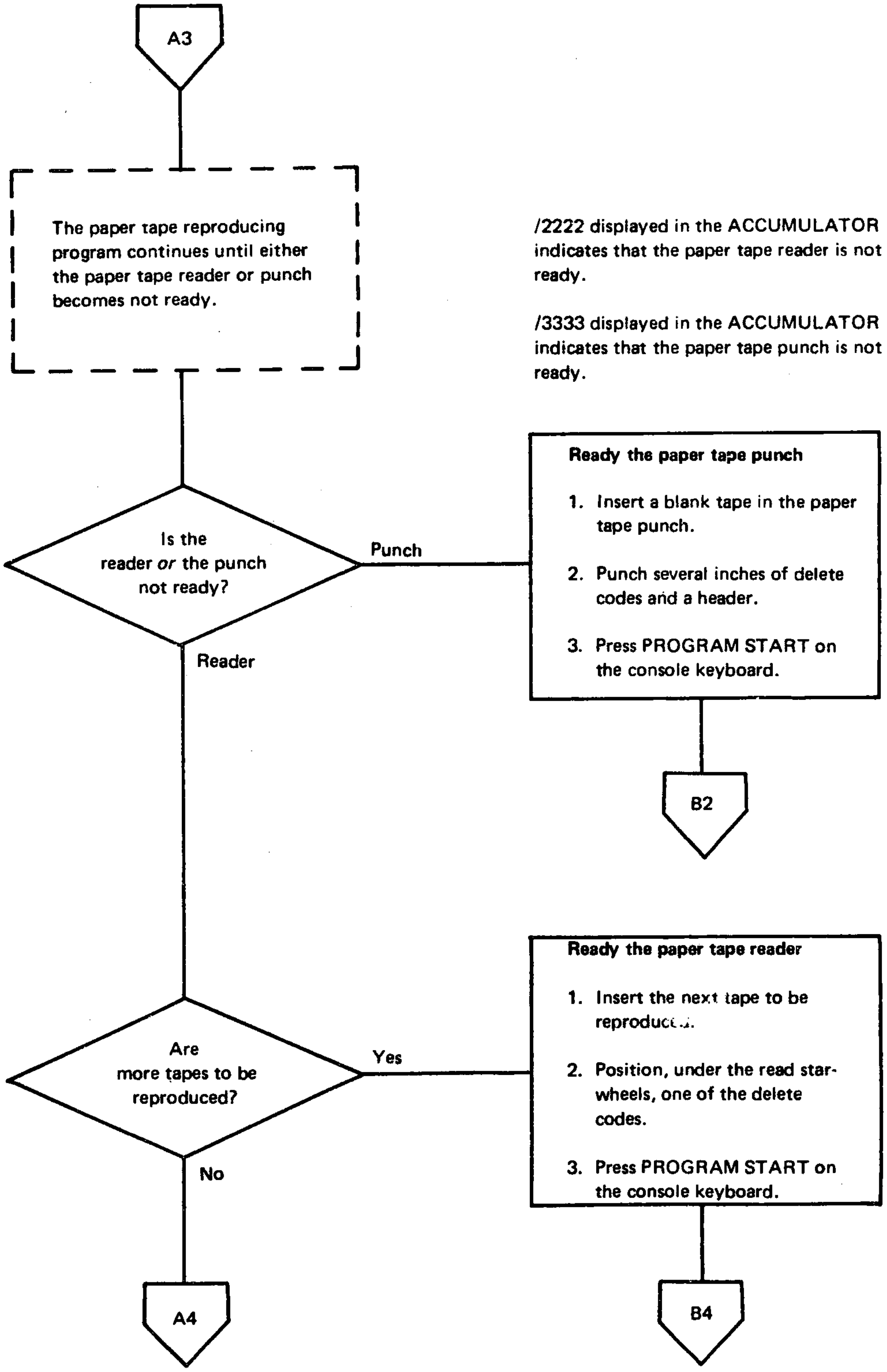
Press PROGRAM START on the console.

Do you want to interrupt the operation?

Temporarily interrupt the tape reproducing program

1. Press PROGRAM STOP on the console.
2. Press PROGRAM START on the console to continue.

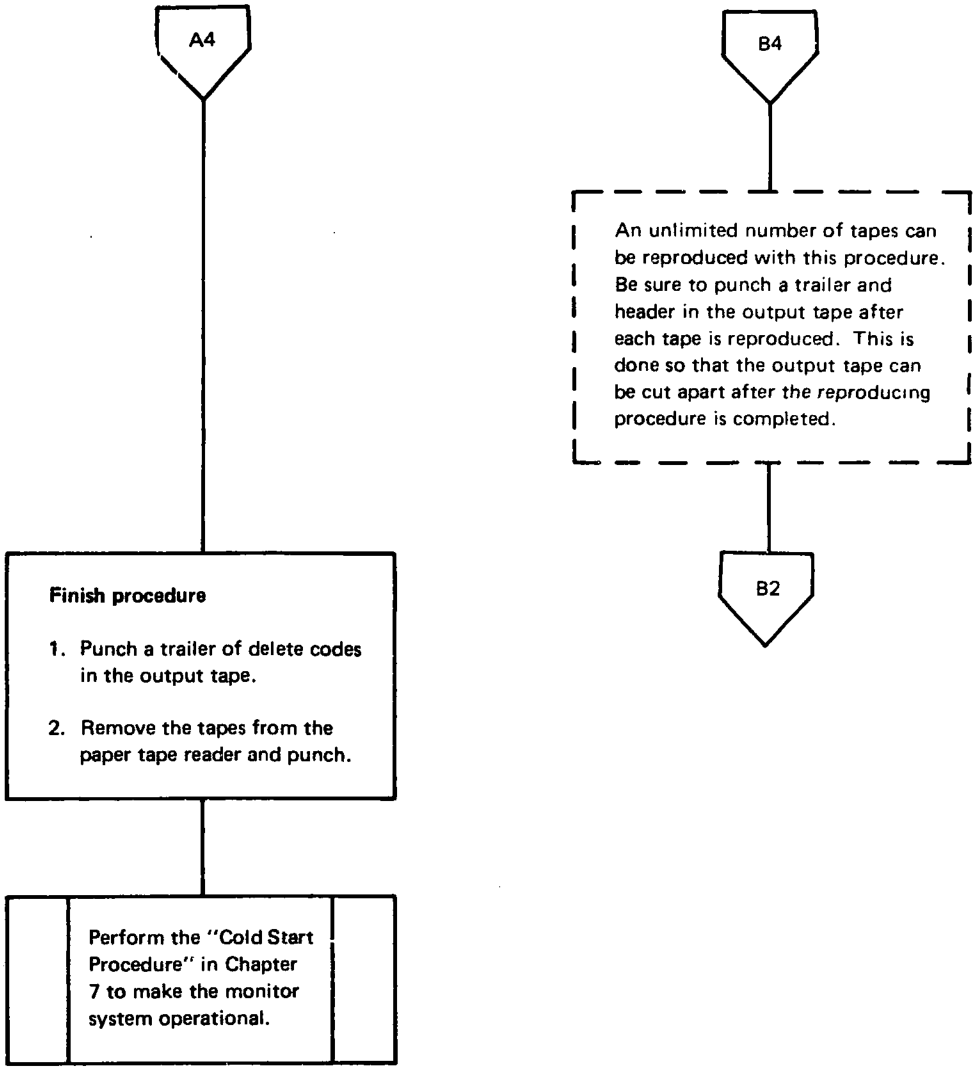
Figure 9-10 (Part 2 of 4). Paper tape reproducing operating procedure


A3
The paper tape reproducing program continues until either the paper tape reader or punch becomes not ready.
Is the reader *or* the punch not ready?
Punch
Reader
Ready the paper tape punch
1. Insert a blank tape in the paper tape punch.
2. Punch several inches of delete codes and a header.
3. Press PROGRAM START on the console keyboard.
B2
Are more tapes to be reproduced?
Yes
No
Ready the paper tape reader
1. Insert the next tape to be reproduced.
2. Position, under the read star-wheels, one of the delete codes.
3. Press PROGRAM START on the console keyboard.
A4
B4

/2222 displayed in the ACCUMULATOR indicates that the paper tape reader is not ready.

/3333 displayed in the ACCUMULATOR indicates that the paper tape punch is not ready.

Figure 9-10 (Part 3 of 4). Paper tape reproducing operating procedure



An unlimited number of tapes can be reproduced with this procedure. Be sure to punch a trailer and header in the output tape after each tape is reproduced. This is done so that the output tape can be cut apart after the reproducing procedure is completed.

Finish procedure

1. Punch a trailer of delete codes in the output tape.
2. Remove the tapes from the paper tape reader and punch.

Perform the "Cold Start Procedure" in Chapter 7 to make the monitor system operational.

Figure 9-10 (Part 4 of 4). Paper tape reproducing operating procedure

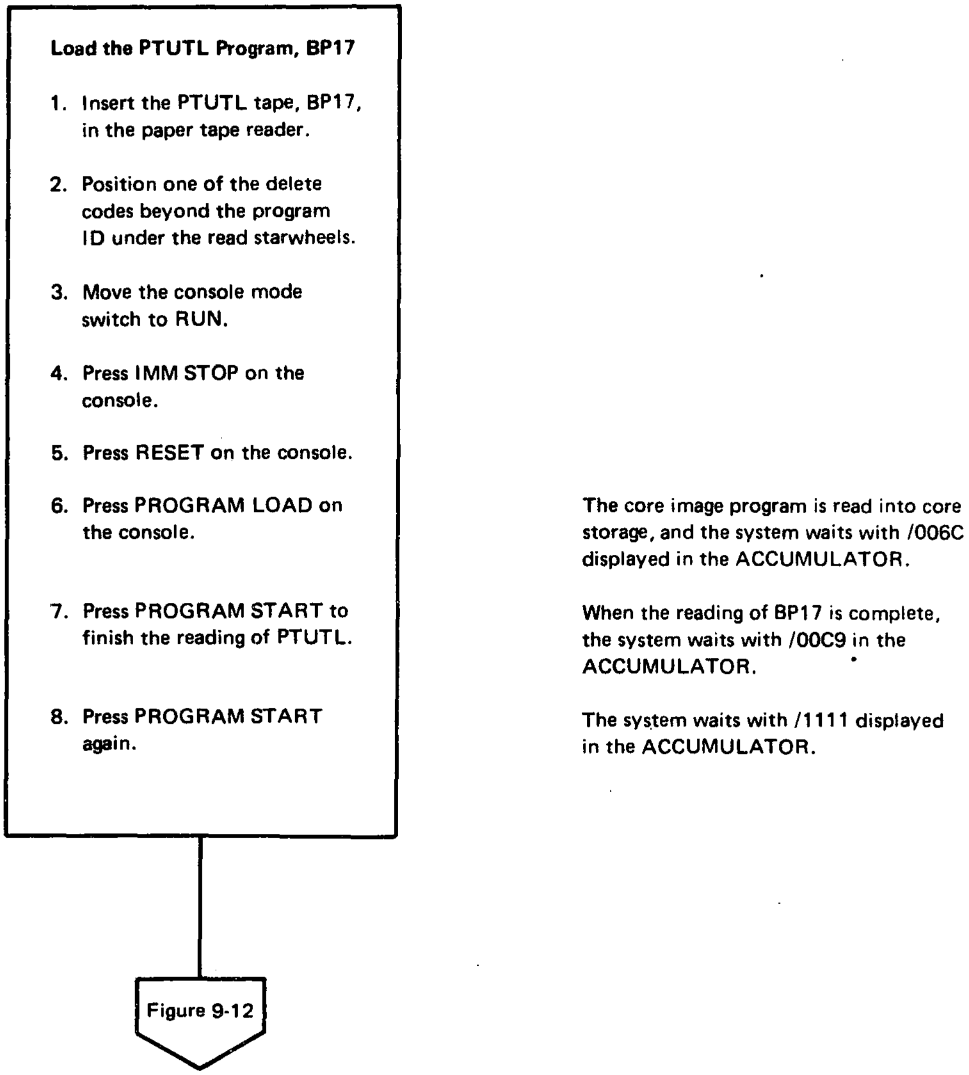
STAND-ALONE PAPER TAPE UTILITY PROGRAM (PTUTL)

This program, available only with the paper tape system allows you to enter records from the the 1134 Paper Tape Reader or the console keyboard. Program output is to the 1055 Paper Tape Punch and/or the console printer. This program is also included as an executable program in the Monitor System Library (see Chapter 4).

The materials that you need to use the PTUTL program are:

- The PTUTL (Paper Tape Utility Program) tape, BP17
- Blank tape if output from the PTUTL program is to be punched into tape
- Previously punched tape if they are being changed

Figure 9-11 is the operating procedure for loading the stand-alone PTUTL program, and Figure 9-12 is the operating procedure for using both the stand-alone PTUTL and the PTUTL mainline program from the system library.



Load the PTUTL Program, BP17

1. Insert the PTUTL tape, BP17, in the paper tape reader.
2. Position one of the delete codes beyond the program ID under the read starwheels.
3. Move the console mode switch to RUN.
4. Press IMM STOP on the console.
5. Press RESET on the console.
6. Press PROGRAM LOAD on the console.

   The core image program is read into core storage, and the system waits with /006C displayed in the ACCUMULATOR.

7. Press PROGRAM START to finish the reading of PTUTL.

   When the reading of BP17 is complete, the system waits with /00C9 in the ACCUMULATOR.

8. Press PROGRAM START again.

   The system waits with /1111 displayed in the ACCUMULATOR.

Figure 9-11. Loading the stand-alone PTUTL tape

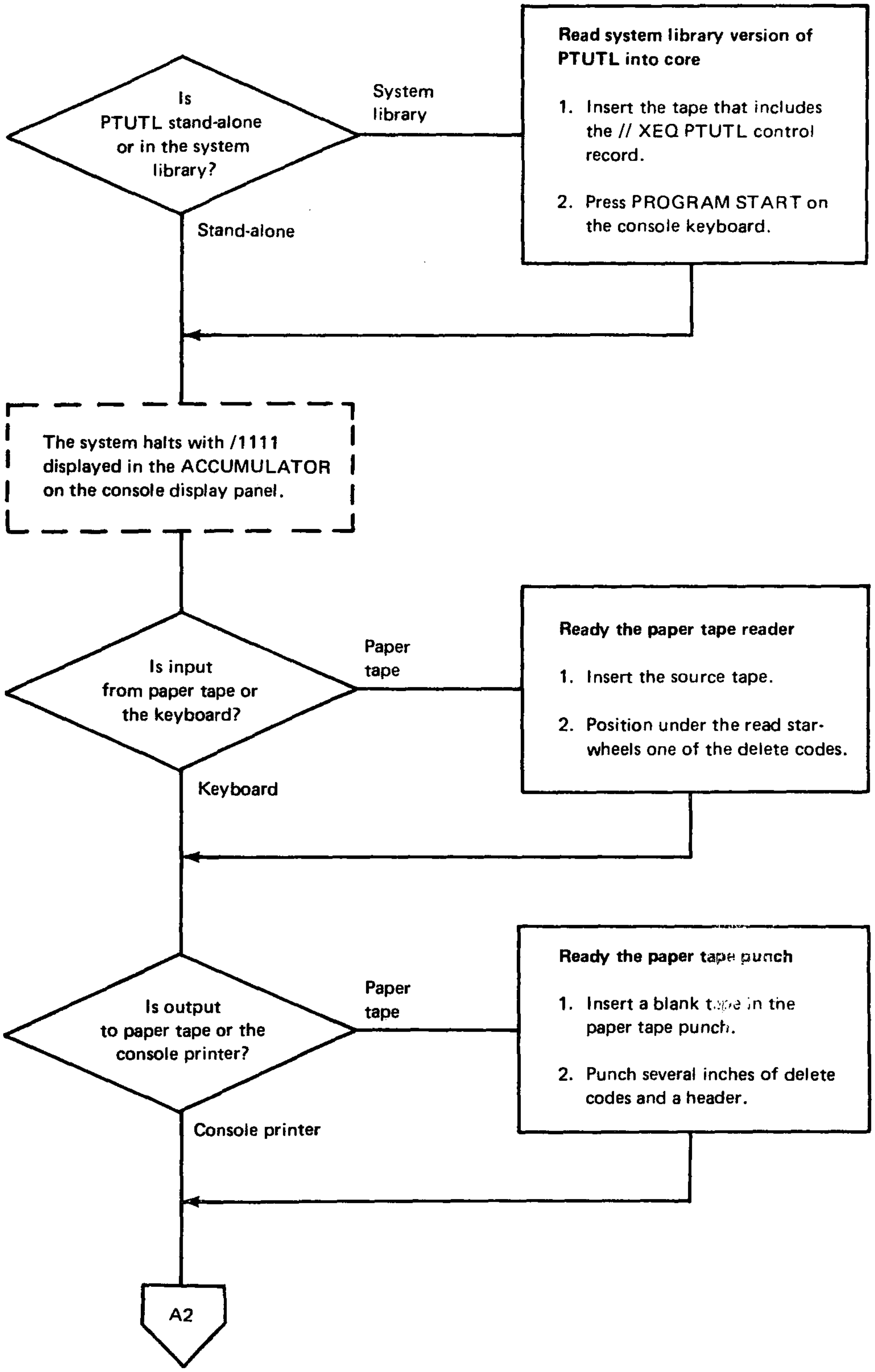
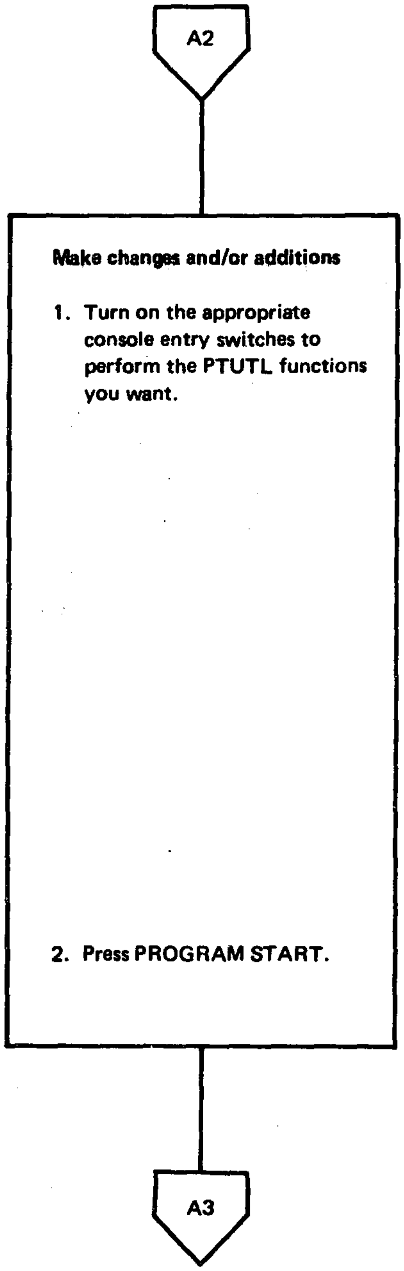

Is PTUTL stand-alone or in the system library?
System library
Read system library version of PTUTL into core
1. Insert the tape that includes the // XEQ PTUTL control record.
2. Press PROGRAM START on the console keyboard.
Stand-alone
The system halts with /1111 displayed in the ACCUMULATOR on the console display panel.
Is input from paper tape or the keyboard?
Paper tape
Ready the paper tape reader
1. Insert the source tape.
2. Position under the read star-wheels one of the delete codes.
Keyboard
Is output to paper tape or the console printer?
Paper tape
Ready the paper tape punch
1. Insert a blank tape in the paper tape punch.
2. Punch several inches of delete codes and a header.
Console printer
A2

Figure 9-12 (Part 1 of 4). PTUTL operating procedure



Make changes and/or additions

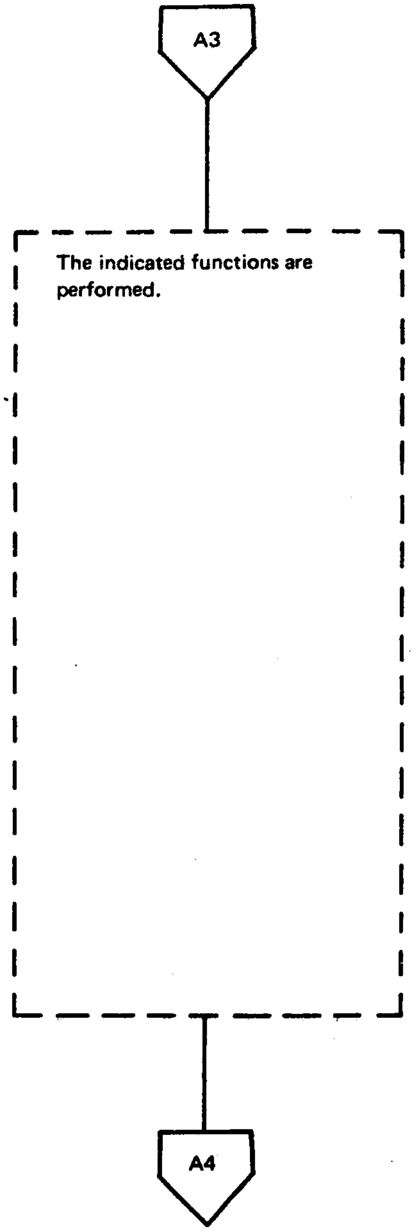
1. Turn on the appropriate console entry switches to perform the PTUTL functions you want.

2. Press PROGRAM START.

Console entry switch on	PTUTL function performed
0	Print record after reading
1	Read records from the paper tape reader
2	Accept keyboard input
3	Punch records on the paper tape punch
14	Wait after punching with /3333 in the ACCUMULATOR
15	Wait after printing with /2222 in the ACCUMULATOR

All other console entry switches must be off.

Figure 9-12 (Part 2 of 4). PTUTL operating procedure



If you want to omit a record just read and printed (switches 0, 1, and 15 on) from an output tape, do not change the switches and press PROGRAM START again.

A record just read and printed (switches 0, 1, and 15 on) is replaced by keyboard input if you turn on console entry switch 2 just before pressing PROGRAM START.

The system subroutine TYPE0 is used by PTUTL during keyboard input. These operating features of that subroutine apply:

1. An input record cannot exceed 80 characters.

2. Pressing the backspace key (←) cancels the last character entered.

3. Pressing ERASE FIELD cancels the entire record so you can reenter the record.

4. Pressing EOF indicates that input of a record is complete.

Figure 9-12 (Part 3 of 4). PTUTL operating procedure

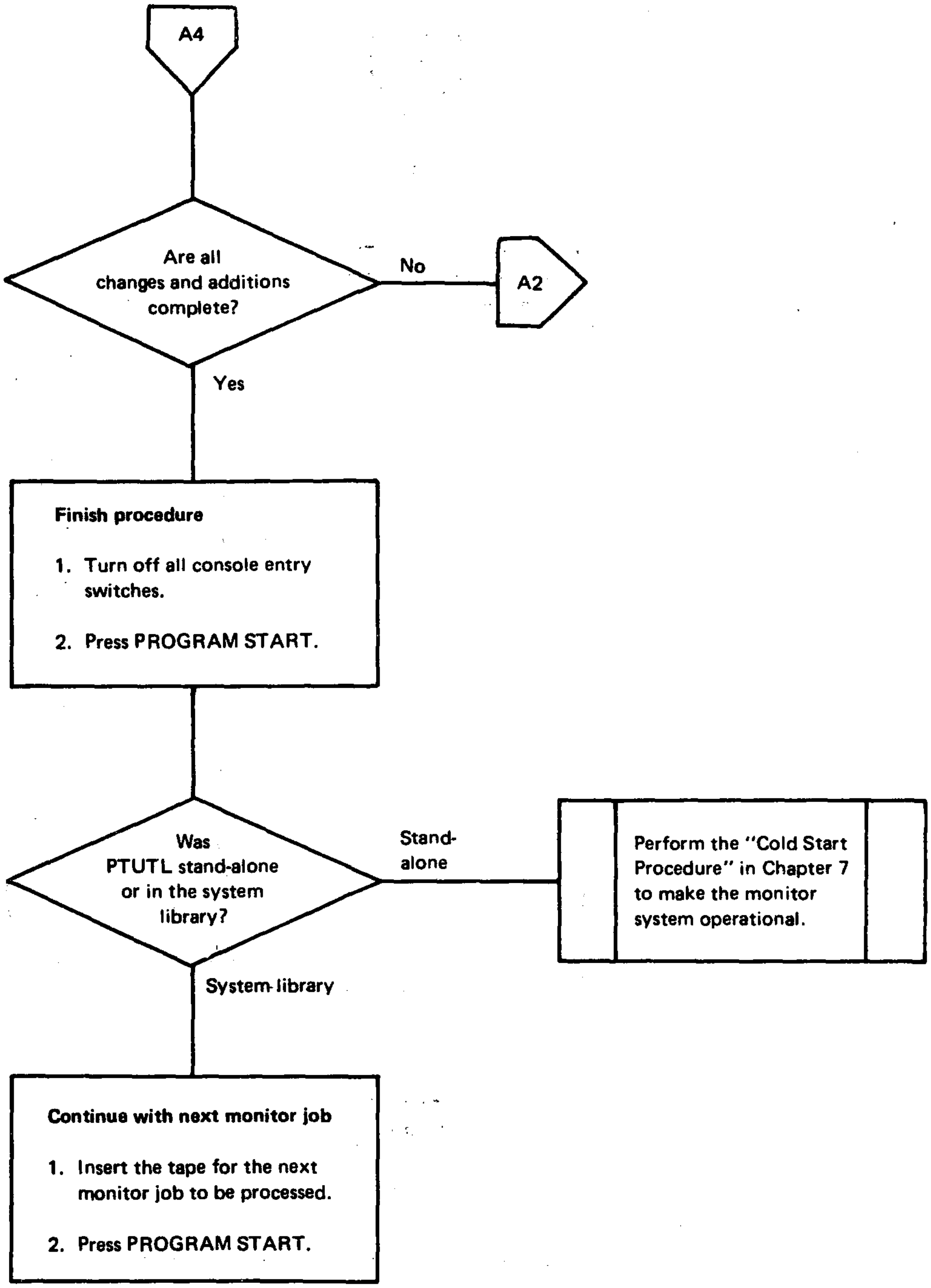

A4
Are all changes and additions complete?
No
A2
Yes
Finish procedure
1. Turn off all console entry switches.
2. Press PROGRAM START.
Was PTUTL stand-alone or in the system library?
Stand-alone
Perform the "Cold Start Procedure" in Chapter 7 to make the monitor system operational.
System library
Continue with next monitor job
1. Insert the tape for the next monitor job to be processed.
2. Press PROGRAM START.

Figure 9-12 (Part 4 of 4). PTUTL operating procedure

PTUTL Example

This example shows you how to change previously punched records. Assume that the following records are punched in a tape:

// JOB
// * (comments record)
// ASM
// DUP
ASM control records
Source program

You have decided to alter the comments record, insert a // PAUSE control record after the comments record, and delete the // DUP control record. The procedure you follow is:

	Your action	**System response**
1.	Load into core storage and start execution of PTUTL.	The system waits with /1111displayed in the ACCUMULATOR on the console display panel.
2.	Insert the source tape and ready the paper tape punch and the console printer. Punch a leader of delete codes in the output tape.	
3.	Turn on console entry switches 1, 3, and 14.	
4.	Press PROGRAM START.	The // JOB control record is read, punched in the output tape, and the system waits with /3333 in the ACCUMULATOR.
5.	In addition to the console entry switches already turned on, turn on 0, 2, and 15.	
6.	Press PROGRAM START.	The comments record is read and printed on the console printer. The system waits with /2222 in the ACCUMULATOR.
7.	Press PROGRAM START again.	The K.B. SELECT indicator on the console keyboard turns on and /3333 is displayed in the ACCUMULATOR.
8.	Enter the new comments record in the proper format.	
9.	Press EOF.	The new comments record is punched in the output tape; the system waits with /2222 in the ACCUMULATOR.
10.	Turn off console entry switch 1.	
11.	Press PROGRAM START.	The K.B. SELECT indicator turns on, and /3333 is displayed in the ACCUMULATOR.
12.	Enter the // PAUS control record.	
13.	Press EOF.	The // PAUS control record is punched in the output tape; the system waits with /2222 in the ACCUMULATOR.
14.	Turn off console entry switches 0, 2, and 15.	

Your action	System response
15. Turn on console entry switch 1. (Switches 3 and 14 should still be on.)	
16. Press PROGRAM START.	The // ASM control record is read and punched in the output tape; the system waits with /3333 in the ACCUMULATOR.
17. Turn off all console entry switches except 1.	
18. Turn on console entry switches 0 and 15.	
19. Press PROGRAM START.	The // DUP record is read and printed on the printer but is not punched in the output tape. The system waits with /2222 in the ACCUMULATOR.
20. Press PROGRAM START again.	The next input record is read into the I/O buffer, overlaying the // DUP control record. (The // DUP control record is deleted.)
21. Turn off console entry switches 0 and 15.	
22. Turn on console entry switch 3. (Switches 1 and 3 should be on.)	
23. Press PROGRAM START.	The remainder of the source tape is read in and reproduced in the output tape, record for record. The paper tape reader not-ready wait (/3005 in the ACCUMULATOR) occurs when all of the source tape has been reproduced.
24. Turn off all console entry switches.	
25. Press PROGRAM START.	A CALL EXIT is executed.

Chapter 10. Remote Job Entry Program

The remote job entry (RJE) feature of the IBM System/360 Operating System allows you to enter jobs into the operating system job stream via communication lines from terminals (work stations) at distant locations. RJE includes a unique job entry control language (JECL) that controls operations of the work station. For a general description of RJE, RJE terminology, and JECL, see the publication *IBM System/360 Operation System Remote Job Entry,* GC30-2006.

This chapter provides information for operators and programmers using an 1130 as a remote work station in an RJE environment, and describes machine and device requirements, input and output at the work station, communication considerations, operating procedures, user-exit subroutine, and generation and loading of the work station program.

Messages printed by the RJE program are included in Appendix A.

MACHINE AND DEVICE REQUIREMENTS

The RJE program for an 1130 work station requires at least an 1131 Central Processing Unit, Model 2B, a card reader, and a line printer (with a 120 character print line). The 1130 computing system must be connected to a 600–2400 bit-per-second line via a synchronous communications adapter in binary mode.

An optional compress-expand feature requires 16K words of core storage if the 1132 Printer is used, or 8K words if the 1403 Printer is used. The compress-expand feature eliminates blanks from data transmitted across the communication line.

An IBM-supplied RJE exit subroutine stores data from your IBM System/360 Operating System job on an 1130 disk. The data thus stored can be processed by other programs that you write. You can write an exit subroutine to replace the one supplied by IBM and direct the output from your System/360 job to any available 1130 I/O device. When you write an exit subroutine, an 1130 system with 16K words of core storage is required. Information about writing an exit subroutine is included under "User-Exit Subroutine" in this chapter.

COMMUNICATION CONSIDERATIONS

The 1130 RJE Work Station Program provides the standard RJE communications interface to the System/360 Operating System (the operating system) RJE communications network by using the SCAT2 and SCAT3 binary synchronous communications subroutines. These subroutines are stored in the monitor system library and provide the following capabilities:

- Point-to-point contention operation on leased lines
- Point-to-point operation on switched lines
- Multipoint operation with the 1130 system as slave station

All data transmissions between the operating system and an 1130 work station are in EBCDIC transparent mode, except headings, which are transmitted in normal mode. The 1130 RJE Work Station Program communicates with the operating system in 3 modes: monitor, receive, and transmit.

monitor mode

The work station program enters monitor mode from either transmit or receive mode. In this mode, the work station waits for output from the communication line or input from the card reader or console keyboard.

receive mode

The work station program enters receive mode when output is available for the work station. In this mode, the work station program reads output from the line until it receives an end-of-data indication from the operating system or until the operator discontinues the output (presses PROGRAM STOP on the console keyboard). The work station program then enters monitor mode.

transmit mode

This mode is entered at work station startup and when input is available at the work station. The work station program writes to the communication line in transmit mode. Transmission to the line continues until a logical end of file (the .. *null* command) or an RJEND command is encountered in the input stream. (RJE work station commands are described in the publication *IBM System/360 Operating System Remote Job Entry,* GC30-2006.)

If monitor mode is entered from transmit mode with a logical end-of-file indication caused by a .. *null* command, transmit mode is not entered again until operator intervention indicates that more input is available.

Communication Considerations for Switched Lines

The operating system disconnects the line if a switched communication line is inactive for a period of approximately 21 seconds. This occurs when:

- A work station output device error is not corrected within the specified time.
- A user-written exit subroutine fails to return control within the specified time (see "User-Exit Subroutine" in this chapter).
- An operator response to an RJE message is not entered within the specified time.

Note. Some RJE messages allow approximately 3 minutes for an operator response. The RJE Work Station Program operator messages are included in Appendix A.

INPUT AT THE WORK STATION

Input to the RJE program is accepted from the card reader, the keyboard, and from one or more disk storage units.

card input

System/360 jobs (with or without JED statements) and job entry control language (JECL) statements are accepted as input from the card reader. The first JECL statement at work station startup *must be* an RJSTART command submitted from the card reader. After that, JECL statements are not sequence checked.

keyboard input

The only valid input from the keyboard is work station commands and responses to RJE operator messages. Input is accepted from the keyboard between jobs being entered from the card reader when the operator indicates that he has input to submit (only in a point-to-point line configuration). The 1130 RJE Work Station Program checks this input only for the JECL identifier (. . . followed by at least one blank).

disk input

A special 1130 RJE control card is used to specify that input is from one or more disk storage units. This control card, .. DATA, is described under "JECL for the 1130 Work Station" in this chapter. A .. DATA control card can be placed in the card input stream or on disk. 1130 work station commands are placed on disk with the STOREDATAE operation of the Disk Utility Program (see "DUP Control Records" in Chapter 5).

The .. DATA control card contains information that allows the RJE program to read input alternately from the card reader and from the disk. Data to be read from disk must be stored there prior to RJE processing by you. This data must be stored in 80-character records in 8-bit packed code (EBCDIC) format (eight records per disk sector) in consecutive sectors. Data can be stored on disk by:

- Using the STOREDATAE function of the Disk Utility Program prior to executing the RJE Work Station Program
- Specifying that output from a job be placed on a disk

After the information on disk has been read to the end of file (see "JECL for the 1130 Work Station" in this chapter for a description of the end-of-file indications), the RJE program resumes reading from the card reader.

Note. Although work station commands can be submitted from disk, only System/360 jobs and input data sets are recommended to be placed on disk in order to simplify work station operation.

changed LOGON affect on input

If you are logged on because of a LOGON command entered from the card reader or disk, and you enter a new LOGON command from the keyboard, all pending input meant for the previous LOGON from the card reader and/or disk is submitted under the new LOGON ID entered from the keyboard. To prevent this, the LOGON that was entered from the card reader or disk must be resubmitted as the last command entered from the keyboard before card or disk input is continued.

Generation of the 1130 RJE Work Station Program

The 1130 RJE Work Station Program is supervised by the 1130 Disk Monitor System Version 2. You store the IBM-supplied RJE program in the user area by using the *STORE function of the Disk Utility Program (DUP). You then define your work station configuration by executing a program that is part of the RJE program and that is named RJE00. This program reads a data card that you code with the following optional parameters:

```
[LINE=P      ]  [,UEXIT=(address 1, address 2)]  [,COMPRESS=NO ]
[LINE=S      ]  [,UEXIT=USER                  ]  [,COMPRESS=YES]
[LINE=M (x,y)]
```

LINE=P specifies that the work station is connected over a point-to-point leased line.

LINE=S specifies that the work station is connected over a point-to-point switched line.

LINE=M (x,y) specifies that the work station is connected over a multipoint line, where
x is the polling character
y is the selection character.

UEXIT=(address 1, address 2) specifies the starting and ending addresses of the area on disk that has been reserved for storing data directed to the user exit, where
address 1 is the starting address
address 2 is the ending address.

The addresses must be in the form *xaaa*, where
x is the logical disk drive number from 0 to 4
aaa is the sector address.

This area must be reserved prior to executing the RJE Work Station Program.

UEXIT=USER specifies that the IBM-supplied user-exit subroutine is replaced by one that you have written.

COMPRESS=NO specifies that blanks are not to be eliminated from data transmitted across the communication line.

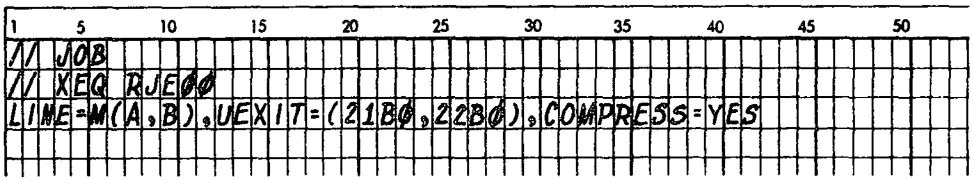
COMPRESS=YES specifies that blanks are to be eliminated from data transmitted across the communication line.

These optional parameters can be used in any order, and if more than one of them is specified, they must be separated by commas. The default options assumed when the RJE Work Station Program is first generated, are a leased point-to-point contention line, no reserved disk space for user-exit output, and no elimination of blanks. When this data card is used to redefine the RJE configuration and the LINE and/or COMPRESS parameters are omitted, the program assumes the last parameters specified as the current line configuration; however, if the UEXIT parameter is omitted, space is not reserved on disk for user-exit data.

The RJE00 program saves the information specified by these parameters in a disk data file reserved for common constants used by the RJE program.

work station RJE *generation*

The following example shows the coding for generating the 1130 Work Station Program:



```
1   5    10   15   20   25   30   35   40   45   50
// JOB
// XEQ RJEØØ
LINE=M(A,B),UEXIT=(21BØ,22BØ),COMPRESS=YES
```

The first 2 cards are the monitor control records needed to load the program that processes the information in the third card. The third card specifies that the RJE work station is on a multipoint line, that its polling character is A, and its selection character is B, and that it will compress input to the operating system program and expand output from the operating system program. For storing data that is directed to the user exit, an area is reserved on disk drive 2 starting at sector 1BO and ending with sector 2BO.

JECL FOR THE 1130 WORK STATION

The job entry control language (JECL) used with the 1130 work station is described under "Job Entry Control Language" in the publication *IBM System/360 Operating System Remote Job Entry,* GC30-2006, with one addition. The additional command allows you to alternate the source of input between disk and cards. The format of this command is:

ID	**Operation**	**Operand**
. .	DATA	DMS $\left\{\begin{array}{l}\text{, C}\\ \text{, D, xaaa [, bbbb]}\end{array}\right\}$

. . is the JECL identifier and must be in columns one and two.

DATA must be preceded and followed by at least one blank.

DMS identifies the card as an 1130 JECL command.

C indicates that input follows from cards.

D indicates that input follows from disk, where
x is the logical disk drive number,
aaa is the disk sector address (hexadecimal), and
bbbb is a hexadecimal number specifying the length of the disk data file in blocks, two blocks per 80-character record (16 blocks per sector).

If *D* is specified, the logical disk drive number and the sector address are required, but the block count is optional. When the block count is not specified, you must indicate the end of data on disk by using a . . DATA command to transfer reading data either to the card reader or to another disk area. The optional block count for disk data causes the RJE program to read data from disk until the specified number of blocks has been read, unless an end-of-file indicator (. . DATA command, . . *null* command, or . . RJEND command) is read first. When the specified number of disk blocks is read or an end-of-file indicator is read, reading from disk stops, and input continues from the card reader.

Data on disk must start at the beginning of a sector and continue on to consecutive sectors if necessary. Each sector must contain eight 80-character records in 8-bit code (EBCDIC), except the last sector, which can be less than 320 words.

The . . DATA command is not recognized between a // DD DATA statement and the corresponding /* in an IBM System/360 Operating System job.

Note 1. Restart problems may occur if jobs are chained on disk (that is, referenced by only one . . DATA command from the card reader), and a line error occurs that requires the work station to resubmit the RJSTART command and all unacknowledged input. To avoid these problems, reference each job with a . . DATA command from the card reader.

Note 2. You must specify the cartridges that are used during RJE on a monitor JOB control record. A logical drive number as specified on the JOB control record must be used in the . . DATA command.

End-of-File Indicators

The end-of-file indicator on disk is the . . DATA command. This command passes reading to another disk file or to the card reader. The end-of-file indicators for the card reader are the . . *null* command and the . . RJEND command.

Note. The . . *null* command and the . . RJEND command can be read from disk and have the same effect as if they were read from the card reader; that is, reading is stopped both from the card reader and from the disk.

OUTPUT TO THE WORK STATION

Output to the work station consists of job output and messages. Job output, consisting of SYSOUT data sets created by the job, is directed to the printer, the card punch, or a user-exit subroutine. Each job output data set is directed to the device associated with the SYSOUT class specified in the DD statement for that output data set. RJE system messages are directed to the console printer or the line printer.

You can specify carriage control for printer output with a special control character as the first byte of each data record; either System/360 machine code or ASA control characters are allowed. Output is single spaced with a skip to channel one when channel 12 is sensed in the carriage tape and control characters are not specified or are not recognized by the equipment.

You can specify stacker-select for punched output, if available, by specifying a special control character as the first byte of each data record; either System/360 machine code or ASA control characters are allowed. Stacker one is selected if control characters are not specified or are not recognized by the equipment.

The 1130 RJE Work Station Program includes a user-exit subroutine that accepts data sets directed to it and writes them on disk in an area that you reserve prior to executing the RJE program.

The IBM-supplied user-exit subroutine can be replaced by an exit subroutine that you write. Your subroutine can process data directed to the user-exit and write output to any available device (see "User-Exit Subroutine" in this chapter for more detailed information).

If you do not write a user-exit subroutine, the IBM RJE program user-exit subroutine writes data sets consecutively on disk, each data set beginning at a disk sector boundary. However, when the RJE program is reloaded at a later time, data sets previously written on disk are unprotected and may be destroyed since any user-exit data sets written after RJE is reloaded begin at the first sector of the reserved area. For each data set written, information is printed on the principal printer.

The primary output device for messages is the console printer. The secondary device is the line printer. You select the line printer as the message device by turning on console entry switch 0.

Note. Data directed to disk can be referenced later by a . . DATA command. To do this, you must define your data set as fixed blocked or unblocked with a logical record length of 80 bytes and no control characters.

Discontinuing and Continuing Output

Job output is discontinued by operator intervention. The operator presses the console keyboard PROGRAM STOP key, then the PROGRAM START key, and the system prints the J90 OCR=message. The operator then responds by typing D to discontinue output.

Output is also discontinued by the 1130 RJE Work Station Program when a user-exit subroutine is not present for output directed to the user-exit and one of the following errors occurs:

- An area is not reserved for user-exit output.
- The reserved output area is exhausted.
- An unrecoverable disk write error occurs.

These errors are indicated to the operator in error messages. To correct the first 2 problems, terminate the RJE program by submitting an RJEND command (after all pending input has been transmitted), and then specify a reserved area on disk by executing the RJE00 program (see "Generation of the 1130 RJE Work Station Program" in this chapter). Reload the RJE program (see "Work Station Startup" in this chapter), and discontinue output immediately by operator intervention. Then, enter a CONTINUE command with the BEGIN operand; otherwise, data is lost.

To correct the third error, enter a CONTINUE command with the BEGIN operand. The data set is then written again, starting at a new sector.

In general, once output is discontinued, no other output is transmitted to the work station until the disposition of the discontinued output is specified by a CONTINUE command.

Other conditions that cause output to be discontinued are:

- A change in form number is found at the operating system
- The work station program requests discontinuation
- An irrecoverable error occurs during an output operation

If either of the first 2 conditions occurs, you specify the disposition of the output with the CONTINUE command. The third condition requires error recovery procedures.

User-Exit Subroutine

The operating system RJE program passes physical records to the user-exit subroutine, either the one that is supplied with the RJE program or the one that you write to replace it. This section describes the programming requirements that must be included in your subroutine.

The subroutine entry point must be named UEXIT, and the subroutine must be stored in the user area (after deleting the resident module with the same name). You should save and restore the contents of registers 1 and 3 at the beginning and end of your subroutine. To specify that your subroutine be executed, use the UEXIT=USER parameter in the configuration data card used to generate the RJE program.

The user-exit subroutine gains control when output becomes available for it. Upon entry, the return address is stored in the first word of the subroutine, and index register 1 contains the address of a parameter list that describes the output being passed to the subroutine. This parameter list with the following format is aligned on an even word boundary.

+0	Starting address
+1	Ending address
+2	Logical record length
+3	Control character type
+4	Record format
+5	End of data

Data characters are packed 2 characters per 1130 word. The blocks start on a word boundary, but they end in the middle of a word if they contain an odd number of characters.

starting address The starting address is the 1130 core storage address of the block of data being received from the operating system. This address has the following format: the 15 leftmost bits are the core storage address, and the rightmost bit indicates whether the data starts in the first 8 bits or the second 8 bits of the first word at that location. Zero indicates that data begins in bit zero at the starting address; one indicates that data begins in bit 7 at the starting address.

ending address This is the ending address plus one of the data block being received from the operating system. The format of the ending address is the same as the starting address.

logical record length When fixed length records are being passed, this word contains the length of logical records. If variable or undefined records are being passed, this word is zero.

control character type This is a code that indicates the type of control characters being used.

0–No control characters
1–IBM System/360 machine code
2–ASA code

record format This word contains a code that indicates the type of data records being transmitted.

1–Fixed unblocked
2–Fixed blocked
3–Variable unblocked
4–Variable blocked
5–Undefined

end of data When this word is zero, the end of data is indicated.

The user-exit subroutine that you write must use the same I/O subroutines that the 1130 RJE program uses.

Device	*I/O Subroutine*
1132 Printer	PRNT2
1403 Printer	PRNT3
1442, Model 6 or 7, Card Read/Punch	CARD1
2501 Card Reader	READ1
1442, Model 5, Card Punch	PNCH1
Console Keyboard	TYPE0
Disk	DISKZ

Note. Your user-exit subroutine must return control to the RJE program within approximately 21 seconds in order to maintain communication with the operating system.

OPERATING PROCEDURES

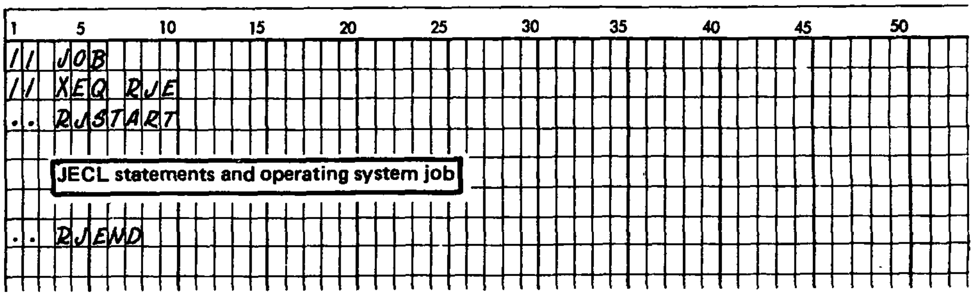
This section includes information about beginning and ending RJE jobs, as well as information about console keyboard operation during execution of the RJE program.

Work Station Startup

To start RJE operation, the 1130 RJE Work Station Program must be loaded into core storage. This program is loaded by specifying the program name RJE in a monitor XEQ control record. The work station program then loads into core the programs and subroutines from the system library that correspond to the configuration of your system. To load these programs and subroutines, the work station program uses information stored on disk by the RJE generation program and information in the disk monitor system that specifies the principal I/O devices.

Note. The console printer cannot be the principal print device.

The following example shows the coding to start and end the execution of the RJE program:



```
// JOB
// XEQ RJE
.. RJSTART

  JECL statements and operating system job

.. RJEND
```

The RJSTART command must be the first RJE command entered. An error message is printed when the RJSTART command is not the first entered. To continue, place an RJSTART command in the card reader, and press START on the card reader and PROGRAM START on the console keyboard. If the work station is connected to the operating system over a switched line, a message to call the central system is printed.

The RJSTART command is followed either by input to be sent to the operating system or by an end-of-file indicator (see the following section "The Null Command"). When contact is made with the operating system, the RJSTART command and all other commands, if any, before the first job entry (the System/360 job with or without the JED card) or before the end-of-file indicator, are transmitted.

The work station is logically attached to the RJE system when the RJSTART command is acknowledged. All pending messages and immediate job output is received at the work station. All pending input, if any, is transmitted, or the work station program waits for output from the operating system. The sequence of events is system dependent.

The Null Command

The *null* command is provided for the 1130 work station to indicate the end of file on the card reader. This command is coded with the identifying characters (. .) in columns 1 and 2. All other columns remain blank. The null command must be the last card in the input stream. When this command is read, the card reader is effectively closed even though communication is maintained with the operating system.

Operator intervention is required to resume input from the card reader after the null command has been read (see the following section "Console Keyboard Procedures" in this chapter).

Console Keyboard Procedures

Four RJE functions that you can start from the 1130 console keyboard are:

- Indicating card reader input
- Indicating keyboard input
- Discontinuing output
- Initiating an abnormal closedown of the RJE program

You start any of these by:

1. Pressing PROGRAM STOP on the console keyboard
2. Pressing PROGRAM START

The message J90 OCR= is printed on the console printer. Your response to this message indicates the function to be performed. The replies to this message are listed with other RJE messages in Appendix A.

If you type B when message J90 is printed, keyboard input is indicated. The system prints the message J93 PROCEED and the K.B. SELECT light on the console turns on when the RJE program can service keyboard input. You can then enter commands, each ended by pressing EOF. After entering the last command, press EOF an extra time to indicate the end of keyboard input; the last EOF must not be entered until the keyboard select (K.B. SELECT) light turns on.

You indicate abnormal closedown of the RJE program by typing T in response to the J90 message. This reply causes the work station program to be terminated and the contents of core storage to be printed.

The operating system notes an error condition and logically detaches and disconnects the work station if it is connected over a switched line. The work station is logically detached if connected with the central system over a leased or multipoint line and a line operation is in progress when you request termination through the keyboard. Also, if the RJE program is not reloaded, the work station is logically detached if the central system tries to contact the work station while the communication line is idle.

Note 1. If the console keyboard procedure is used when the console printer is already in use, the message is not printed. However, the PROGRAM START key must be pressed to continue processing.

Note 2. The INT REQ key *cannot* be used when the RJE program is being used. Pressing INT REQ prevents information in the skeleton supervisor that is modified by the RJE program from being restored. As a result, the disk monitor system may function improperly.

Error Recovery Procedures

Facilities are provided to recover from both communication errors and local device errors at the 1130 work station. Operator intervention may be necessary to correct the condition causing the error. Error messages are printed when errors occur, except for a forms check error on the console printer. In the latter case, when the FORMS CHECK light on the console keyboard turns on, you must turn on console entry switch 1 to retry the operation. Communications on the line are maintained only if the error is corrected within approximately 21 seconds. If errors cannot be corrected within the time allowed, the operating system logically detaches the work station from the RJE system. In addition, if the work station is connected over a switched line, the operating system breaks the connection.

RJE messages and error messages are described in Appendix A.

Unrecoverable communication errors result when communication is lost with the operating system because of either line errors or a failure at the central system. In either case, the work station is logically detached by the operating system and restart procedures are necessary. The response received when restart procedures are executed indicates whether the error is due to a line error or a failure at the central system.

Restart Procedures

Restart procedures must be used when the message J51 LINE ERROR OCR= is printed. These procedures involve regaining communication with the operating system and submitting an RJSTART command and are indicated when you type A in response to the J51 message. A complete description of this message is included in Appendix A.

The restart procedures cause output to automatically resume either where it was interrupted (after a line error) or at the beginning of the job (after a failure at the central system). If output is being written to disk at the time of a line error you should immediately discontinue the output and enter a CONTINUE command with the BEGIN operand.

If output is being punched in cards or printed at the time of a line error, a duplication of the last transmission block may occur when the program is restarted. The printer skips to a new page when RJE is restarted if the data set being printed is without control characters.

If a line error occurs during an input operation, all unacknowledged input must be resubmitted. Furthermore, a line error in the middle of a job implies that the whole job must be resubmitted from the beginning. Before the job can be transmitted again with the same job name, the old job that was partially sent to the central system must be deleted. Deletion is sometimes automatic, but if not, you must delete the job.

Note. The work station restart procedure after a central system failure is similar to the restart procedure after an unrecoverable line error. The primary difference is that after a system failure, an inprocess data set is rewritten from the *beginning* rather than from the last valid block.

Messages Sent to Work Stations

Detailed descriptions of all messages sent to an 1130 work station from the operating system RJE program are in "Messages Sent to Work Stations" in the publication *IBM System/360 Operating System Remote Job Entry*, GC30-2006.

RJE Program Console Entry Switches

Three console entry switches are used by the RJE Work Station Program

Console Entry Switch	*Console Entry Switch Function*
0 (off)	Indicates that RJE messages from the central system are printed on the console printer
0 (on)	Indicates that RJE messages from the central system are printed on the line printer
1	If on when the console printer becomes not ready, the operation is retried.
2	If on, the error statistics accumulated by the subroutines SCAT2 or SCAT3 are printed on the console printer at the end of the RJE run.

Error Statistics

Error statistics are accumulated during an RJE run by the subroutines SCAT2 and SCAT3. If you want these error statistics printed, turn on console entry switch 2 prior to the end of the RJE run.

The error statistics accumulated during the last RJE run can be printed if you execute a program called RJSTA that is a part of the RJE program package.

Appendix A. Monitor System Operational and Error Messages

This appendix includes all monitor system operational and error messages and codes, except for the messages for the stand-alone utility programs. The messages for these programs are included in Chapter 9 with the descriptions of the programs.

The messages in the appendix are ordered alphabetically by an error prefix letter. Unless otherwise noted, the messages are printed on the principal printer. All monitor system control records are also printed on the principal printer.

The messages, in sequential order, are:

Error code prefix	Figure number	Figure title including program name
–	A-1	Assembler error detection codes
A	A-2	Assembler error messages
C	A-3	FORTRAN error codes
C	A-4	FORTRAN error messages
D	A-5	DUP/MUP error messages
E	A-6	System loader error messages
G	A-7	SGJP error messages
J	A-8	RJE work station error messages
J	A-9	RJE work station messages
M	A-10	Phase 1. System control record program error messages
M	A-11	Phase 2. System control record program error messages
–	A-12	SYSUP - DCOM update error messages
Note	A-13	RPG compiler error notes
R	A-14	Core load builder error messages
S	A-15	Auxiliary supervisor error messages
–	–	Monitor system mainline programs messages

ASSEMBLER ERROR CODES AND MESSAGES

At the completion of an assembly, the following messages are printed on the principal printer:

XXX OVERFLOW SECTORS SPECIFIED
XXX OVERFLOW SECTORS REQUIRED
XXX SYMBOLS DEFINED
XXX ERROR(S) AND XXX WARNING(S) FLAGGED IN ABOVE ASSEMBLY

If LIST DECK or LIST DECK E control records are used, the error detection codes listed in Figure A-1 are punched in columns 18 and 19. These error detection codes are also printed if the program is listed. Figure A-1 includes the error flag (code), your coding violation that caused the error, and the assembler action.

For the first error detected in each statement, the assembler stores and then punches (or prints) the appropriate code; the code for a second error is stored, overlaid by any subsequent errors, and the code for the last error detected is punched (or printed). Thus, if more than 2 errors are detected in the same statement, only the first and last are indicated in columns 18 and 19 when LIST DECK or LIST DECK E is used, or are printed when the program is listed.

At the end of an assembly, a message is printed indicating the number of assembly errors detected in the source program (see the last of the assembly messages previously listed). Since no more than 2 errors are flagged per statement, the error count in the message may exceed the actual number of error flags.

Assembler error messages are listed in Figure A-2. These messages include the message number and message, the cause of the error, and the action you must take to correct the error.

Flag	Coding error	Assembler action
A	Address error	
	An attempt has been made to specify a displacement field, directly or indirectly, outside the range of -128 to +127.	The displacement is set to zero.
C	Condition code error	
	A character other than +, -, Z, E, C, or O is detected in the first operand of a short branch statement or the second operand of a long BSC, BOSC, or BSI statement.	The displacement is set to zero.
F	Format code error	
	A character other than L, I, X, or blank is detected in column 32; L or I format is specified for a statement that is valid only in short form, or I format is specified when not allowed.	The statement is processed as if L format were specified, unless the statement is valid only in short form. The statement is then processed as if X format were specified.
L	Label error	
	An invalid symbol is detected in the label field.	The label is ignored.
M	Multiply defined label error	
	A duplicate symbol is encountered in the label field.	The first occurrence of a symbol in the label field is used to define its value; subsequent occurrences of the symbol in the label field cause a multiply defined indicator to be inserted in the symbol table entry (bit 0 of the first word).
O	Operation code error	
	An operation code is not valid.	The statement is ignored and the address counter is incremented by 2. If the op code is punched beginning in column 26, the character punched in column 26 will not appear in the listing.
	An ISS, ILS, ENT, LIBR, SPR, EPR, or ABS is incorrectly placed.	The statement is ignored.
Q	Warning flag	A possible problem code is detected; that is, a modify memory statement with a displacement of zero.
R	Relocation error	
	An expression does not have a valid relocation.	The expression is set to zero.
	An absolute displacement is not specified.	The displacement is set to zero.
	An absolute origin is specified in a relocatable program.	The specified origin is ignored.
	An absolute operand is not specified in a BSS or BES statement.	The operand is assumed to be zero.
	A relocatable operand is not in an END statement of a relocatable mainline program.	Columns 9 through 12 are left blank; the entry is assumed to be relative zero.
	The operand of an ENT statement is not relocatable.	The statement is ignored.

Figure A-1 (Part 1 of 2). Assembler error detection codes

Flag	Coding error	Assembler action
S	Syntax error	
	An invalid expression (that is, an invalid symbol, adjacent operators, invalid constant) is used.	The expression is set to zero.
	An invalid character is used in a record.	If an invalid character is used in an expression, label, operation code, format, or tag field, additional errors may occur.
	The main program entry point is not specified as the operand in an END statement.	Columns 9 through 12 are left blank; the entry is assumed to be relative zero.
	The syntax of an EBC statement is incorrect (that is, a delimiter is not in column 35, a zero character count).	Columns 9 through 12 are left blank; the address counter is incremented by 17.
	An invalid label is used as an operand in an ENT or ISS statement.	The statement is ignored.
	An operand label occurs in more than one ENT statement.	All entries are built as usual.
T	Tag error	
	Column 33 contains a character other than blank, 0, 1, 2, or 3 instruction statement.	A tag of zero is assumed.
U	Undefined symbol	
	A symbol used in an expression is not defined.	The value of the expression is set to absolute zero.
W	An x- or y-coordinate, or both, is not within the specified range; or an operand is invalid.	The operand is set to zero.
X	A character other than R or I is in column 32; or a character other than D or N is in column 33.	The field is set to zero.
Z	An invalid condition is in a conditional branch or interrupt order.	The condition bits in the first word are set to zero.

Figure A-1 (Part 2 of 2). Assembler error detection codes

Error number and message	Cause of error	Your response
A01 MINIMUM W.S. NOT AVAILABLE . . . ASSEMBLY TERMINATED	The available working storage is less than the specified number of overflow sectors plus nine.	Do one of the following: 1. Reduce the specified number of overflow sectors (the number specified is zero if an *OVERFLOW SECTORS control record is not used). 2. If your system has more than one disk drive, use a monitor JOB control record to specify system working storage on the cartridge that has the most working storage available.
A02 SYMBOL TABLE OVERFLOW . . . ASSEMBLY TERMINATED	The number of sectors of symbol table overflow is greater than the number of overflow sectors available.	Use an *OVERFLOW SECTORS control record to increase the number of overflow sectors for this assembly (maximum 32 sectors).
A03 DISK OUTPUT EXCEEDS W.S.	Intermediate output (pass 1) or final DSF output (pass 2) exceeds the capacity of working storage less the specified number of overflow sectors.	If this error occurs during pass 1, restart the assembly using an *TWO PASS MODE control record. If this error occurs during pass 2, see the corrective actions for message A01.
A04 SAVE SYMBOL TABLE INHIBITED	One of the following occurs when an *SAVE SYMBOL TABLE control record is used:	
	1. The program is relocatable.	Add an ABS statement to your program and reassemble.
	2. The program contains assembly errors.	Correct the program errors and reassemble.
	3. The source program contains more than 100 symbols.	Reduce the number of symbols and reassemble.
A05 XXX ERRONEOUS ORG, BSS, OR EQU STATEMENTS	XXX is the number of ORG, BSS, BES, and/or EQU statements undefined in the first pass. At the end of pass 1, these statements are printed on the principal printer.	
	If the error is due to forward referencing, the error is not detected during pass 2.	When forward references are attempted, correct them and reassemble the program.
A06 LOAD BLANK CARDS	A card containing a punched column between 1 through 71 is read while a symbol table is being punched (*PUNCH SYMBOL TABLE specified for this assembly).	The system waits with /100F displayed in the console ACCUMULATOR. 1. Press NPRO on the card reader. 2. Place blank cards in front of the card just read 3. Press reader START. 4. Press console PROGRAM START. *Note:* If output is being punched on a 1442, Model 5, a punched card cannot be detected. In addition, the card punch may be damaged if an attempt is made to punch a hole where a hole already exists.

Figure A-2 (Part 1 of 2). Assembler error messages

Error number and message		Cause of error	Your response
A07	ABOVE CONTROL STATEMENT INVALID	The control record option does not agree, character for character, with its valid format. An invalid library name is detected on an *MACLIB control record, or multiple *MACLIB control records are detected.	The control record is ignored.
A08	MACLIB UNDEFINED	An attempt is made to define a stored macro when a macro library is not associated with this assembly.	Reassemble specifying a valid macro library.
A09	PARAMETER LIST OVERFLOW . . . ASSEMBLY TERMINATED	The disk parameter-list spill area is undefined or exceeded.	Reassemble specifying a larger parameter-list disk area (see "*OVERFLOW SECTORS" in Chapter 5).
A10	MACRO AREA OVERFLOW . . . ASSEMBLY TERMINATED	The disk area for macro definitions is undefined or exceeded.	Reassemble specifying a larger macro-definition disk area (see "*OVERFLOW SECTORS" in Chapter 5).
A12	NEST LEVEL EXCEEDS 20 . . . ASSEMBLY TERMINATED	An attempt is made to nest more than 20 macro calls.	Redefine the macro nest and reassemble.
A21	*LEVEL CONTROL STATEMENT MISSING	A program is assembled as an ISS subroutine without the required *LEVEL control record.	Reassemble using an *LEVEL control record.
A22	INVALID LIST DECK OPTION . . . ASSEMBLY TERMINATED	LIST DECK or LIST DECK E is specified when macros are called.	Reassemble and do not specify either LIST DECK or LIST DECK E options.

Figure A-2 (Part 2 of 2). Assembler error messages

FORTRAN MESSAGES AND ERROR CODES

compilation messages

Near the end of compilation, the FORTRAN compiler prints core usage information and the features supported as follows:

```
FEATURES SUPPORTED
      EXTENDED PRECISION
      ONE WORD INTEGERS
      TRANSFER TRACE
      ARITHMETIC TRACE
      ORIGIN
      IOCS
CORE REQUIREMENTS FOR XXXXX
COMMON YYYYY VARIABLES YYYYY PROGRAM YYYYY
```

where

XXXXX is the program name specified in the *NAME control record or in the SUBROUTINE or FUNCTION statement.
YYYYY is the number of words allocated for the specified parts of the program.

During a subprogram compilation, the compiler prints the following message:

```
RELATIVE ENTRY POINT ADDRESS IS XXXX (HEX)
```

where

XXXX is the address of the entry point relative to the address of the first word of the subprogram being compiled.

The compiler prints the following messages for successful and unsuccessful compilations, respectively:

```
END OF COMPILATION
COMPILATION DISCONTINUED
```

compilation error messages

During compilation, the compiler checks to determine if certain errors occur. If one or more of these errors are detected, the compiler prints the error messages at the conclusion of compilation, and the object program is not stored on disk. Only one error is detected for each statement. In addition, due to the interaction of error conditions, the occurrence of some errors may prevent the detection of others until the errors detected first are corrected. With the exception of the messages listed in Figure A-4, the error messages printed by the FORTRAN compiler have the following format:

```
C nn ERROK IN STATEMENT NUMBER xxxxx+yyy
```

where

C nn is the error code number in Figure A-3. xxxxx is all zeros until the first numbered statement is encountered in your program. When a valid statement number is encountered, xxxxx is replaced by that statement number. Statement numbers on specification statements and statement functions are ignored. When xxxxx is all zeros, yyy is the statement line in error (excluding comments and continuation lines). When xxxxx is a valid statement number, yyy is a count of statements from that numbered statement (counted as 0) to the statement in error. If the erroneous statement has a statement number, yyy is not printed.

For example:

```
      DIMENSION E(1,6,6)          (error C 08)
      DIMENSION F(4,4),G(2,7),
     1H(34,21),I(5,8)             (recall that the 1 in column 6
                                  indicates a continuation line)
      DIMENSION J(3,2,6))         (error C 16)
      FORMAT (I50,F5.2))          (error C 27)
   10 WRITE (1'C) ARRAY
      WRITE (1'C) ARRAYS          (error C 07)
```

This example causes the following error messages to be printed:

```
C 08 ERROR AT STATEMENT 00000+001
C 16 ERROR AT STATEMENT 00000+003
C 27 ERROR AT STATEMENT 00000+004
C 07 ERROR AT STATEMENT 10     +001
```

Look up the error numbers in Figure A-3 to determine the causes of the errors.

Note that a FORTRAN compiler error message can be caused by an invalid character in the source statement. In that case, the character in question is replaced with an ampersand in the listing. Errors in specification statements and any other obvious errors should be examined first. Since variables are not defined when a statement contains a compiler error, valid statements that reference the variables may also be flagged.

Error code	Cause of error
C01	Nonnumeric character in statement number
C02	More than 5 continuation cards, or continuation card out of sequence
C03	Syntax error in CALL LINK or CALL EXIT statement
C04	Unrecognizable, misspelled, or incorrectly formed statement
C05	Statement out of sequence
C06	A statement follows a STOP, RETURN, CALL LINK, CALL EXIT, or GO TO statement, or an IF statement does not have a statement number
C07	Name longer than 5 characters, or name not starting with an alphabetic character
C08	Incorrect or missing subscript within dimension information (DIMENSION, COMMON, REAL, or INTEGER)
C09	Duplicate statement number
C10	Syntax error in COMMON statement
C11	Duplicate name in COMMON statement
C12	Syntax error in FUNCTION or SUBROUTINE statement
C13	Parameter (dummy argument) appears in COMMON statement
C14	Name appears twice as a parameter in SUBROUTINE or FUNCTION statement
C15	*IOCS control record in a subprogram
C16	Syntax error in DIMENSION statement
C17	Subprogram name in DIMENSION statement
C18	Name dimensioned more than once, or not dimensioned on first appearance of name.
C19	Syntax error in REAL, INTEGER, or EXTERNAL statement
C20	Subprogram name in REAL or INTEGER statement, or a FUNCTION subprogram containing its own name in an EXTERNAL statement
C21	Name in EXTERNAL that is also in a COMMON or DIMENSION statement
C22	IFIX or FLOAT in EXTERNAL statement
C23	Invalid real constant
C24	Invalid integer constant
C25	More than 15 dummy arguments, or duplicate dummy argument in statement function argument list
C26	Right parenthesis missing from a subscript expression
C27	Syntax error in FORMAT statement
C28	FORMAT statement without statement number
C29	Field width specification greater than 145
C30	In a FORMAT statement specifying E or F conversion, w greater than 127, d greater than 31, or d greater than w, where w is an unsigned integer constant specifying the total field length of the data, and d is an unsigned integer constant specifying the number of decimal places to the right of the decimal point
C31	Subscript error in EQUIVALENCE statement
C32	Subscripted variable in a statement function
C33	Incorrectly formed subscript expression
C34	Undefined variable in subscript expression
C35	Number of subscripts in a subscript expression, and/or the range of the subscripts does not agree with the dimension information
C36	Invalid arithmetic statement or variable; or, in a FUNCTION subprogram the left side of an arithmetic statement is a dummy argument or in COMMON
C37	Syntax error in IF statement
C38	Invalid expression in IF statement

Figure A-3 (Part 1 of 3). FORTRAN error codes

Error code	Cause of error
C39	Syntax error or invalid simple argument in CALL statement
C40	Invalid expression in CALL statement
C41	Invalid expression to the left of an equal sign in a statement function
C42	Invalid expression to the right of an equal sign in a statement function
C43	In an IF, GO TO, or DO statement, a statement number is missing, invalid, incorrectly placed, or is the number of a FORMAT statement
C44	Syntax error in READ, WRITE or FIND statement
C45	*IOCS record missing with a READ or WRITE statement (mainline program only)
C46	FORMAT statement number missing or incorrect in a READ or WRITE statement
C47	Syntax error in input/output list; or an invalid list element; or, in a FUNCTION subprogram, the input list element is a dummy argument or in COMMON
C48	Syntax error in GO TO statement
C49	Index of a computed GO TO is missing, invalid, or not preceded by a comma
C50	*TRANSFER TRACE or *ARITHMETIC TRACE control record or CALL PDUMP statement present, with no *IOCS control record in a mainline program
C51	Incorrect nesting of DO statements; or the terminal statement of the associated DO statement is a GO TO, IF, RETURN, FORMAT, STOP, PAUSE, or DO statement
C52	More than 25 nested DO statements
C53	Syntax error in DO statement
C54	Initial value in DO statement is zero
C55	In a FUNCTION subprogram the index of DO is a dummy argument or in COMMON
C56	Syntax error in BACKSPACE statement
C57	Syntax error in REWIND statement
C58	Syntax error in END FILE statement
C59	Syntax error in STOP statement
C60	Syntax error in PAUSE statement
C61	Integer constant in STOP or PAUSE statement greater than 9999
C62	Last executable statement before END statement is not a STOP, GO TO, IF, CALL LINK, CALL EXIT, or RETURN statement
C63	Statement contains more than 15 different subscript expressions
C64	Statement too long to be scanned, because of compiler expansion of subscript expressions or compiler addition of generated temporary storage locations
C65*	All variables undefined in an EQUIVALENCE list
C66*	Variable made equivalent to an element of an array in such a manner as to cause the array to extend beyond the original of the COMMON area
C67*	Two variables of array elements in COMMON are equated, or the relative locations of two variables or array elements are assigned more than once (directly or indirectly). This error is also given if an attempt is made to allocate a standard precision real variable at an odd address by means of an EQUIVALENCE statement
C68	Syntax error in an EQUIVALENCE statement; or an illegal variable name in an EQUIVALENCE list
C69	Subprogram does not contain a RETURN statement, or a mainline program contains a RETURN statement
C70	No DEFINE FILE statement in a mainline program that has disk READ, WRITE, or FIND statements
C71	Syntax error in DEFINE FILE statement
C72	Duplicate DEFINE FILE statement, more than 75 DEFINE FILES, or DEFINE FILE statement in subprogram

Figure A-3 (Part 2 of 3). FORTRAN error codes

Error code	Cause of error
C73	Syntax error in record number of disk READ, WRITE, or FIND statement
C74	Defined file exceeds disk storage size
C75	Syntax error in DATA statement
C76	Names and constants in a DATA statement not in a one-to-one correspondence
C77	Mixed mode in DATA statement
C78	Invalid hollerith constant in a DATA statement (see "Length of FORTRAN DATA Statement" in Chapter 6)
C79	Invalid hexadecimal specification in a DATA statement
C80	Variable in a DATA statement not used elsewhere in the program or dummy variable in DATA statement
C81	COMMON variable loaded with a DATA specification
C82	DATA statement too long to compile, due to internal buffering. Refer to the section TIPS FOR FORTRAN PROGRAMMERS

* The detection of a code 65, 66, or 67 error prevents any subsequent detection of any of these three errors.

Figure A-3 (Part 3 of 3). FORTRAN error codes

Error number and message	Cause of error
C85 ORIGIN IN SUBPROGRAM	An ORIGIN control record was detected in a subprogram compilation.
C86 INVALID ORIGIN	An attempt has been made to relocate a word at an address exceeding 7FFF (hexadecimal).
C96 WORKING STORAGE EXCEEDED	The working storage area on disk is too small to accommodate the compiled program in disk system format.
C97 PROGRAM LENGTH EXCEEDS CAPACITY	The error occurs when the program in internal compiler format is too large to be contained in core working storage, and the program must be reduced in size in order to compile.
C98 SUBROUTINE INITIALIZE TOO LARGE	During compilation of subprograms a subroutine initialize statement (CALL SUBIN) is generated. The CALL SUBIN statement initializes all references to dummy variables contained within the subprogram to the appropriate core location in the calling program. The nature of the FORTRAN compiler limits the size of any statement in internal compiler format to 511 words. In the case of CALL SUBIN, the size is calculated by the following formula: S = 5 + ARG + N where ARG is the number of arguments in the subroutine parameter list and N is the total number of times the dummy arguments are used within the subprogram. S is the total size of the CALL SUBIN statement; if S ever exceeds 511, an error occurs and the above error message is printed.
C99 CORE REQUIREMENTS EXCESSIVE	The error occurs when the total core requirements exceed 32767 words.

Figure A-4. FORTRAN error messages

DUP AND MUP MESSAGES AND ERROR MESSAGES

DUP messages

When a Disk Utility Program (DUP) function is performed without errors, an informational message is printed on the principal printer. Information messages are described in the following text.

At the end of a DEFINE VOID, one of the following messages is printed:

ASSEMBLER VOIDED
FORTRAN VOIDED
RPG VOIDED
COBOL VOIDED

At the end of a DEFINE FIXED AREA function, the following message is printed:

CART ID XXXX CYLS FXA XXXX DBS AVAIL XXXX FLET SECTOR ADDR XXXX

where

CYLS FXA XXXX is the decimal number of cylinders minus one in the fixed area (the additional cylinder is used for FLET).
DBS AVAIL XXXX is the hexadecimal number of disk blocks remaining in the fixed area after the last program or data file stored there.
FLET SECTOR ADDR XXXX is the hexadecimal sector address of the first cylinder in the fixed area (the sector address of FLET).

At the end of a dump of LET or FLET, the following sign-off message is printed:

END OF DUMPLET/FLET

All other DUP operations, except MUP are followed by this message:

CART ID XXXX DB ADDR XXXX DB CNT XXXX

where

DB ADDR XXXX is the hexadecimal starting address of the program or data file.
DB CNT XXXX is the hexadecimal number of disk blocks being deleted, stored, or dumped.

The error messages printed by DUP are listed in Figure A-5. These messages include the message number and message, the causes of the error messages, and your corrective actions where appropriate.

MUP messages

The sign-off message of the Macro Update Program (MUP) is:

UPDATE COMPLETED

Informational messages that can be printed during a MUP run are:

ABOVE MACRO PURGED

that follows a PURGE control record, and

ABOVE MACRO RENAMED AS
SSSS DDDD MNAME

where

SSSS is the sector address in hexadecimal.
DDDD is the displacement in hexadecimal.
MNAME is the new macro name.

The error messages printed by MUP are listed in Figure A-5. These messages include the message number and message, the causes of the error messages, and your corrective actions where appropriate.

Error number and message		Cause of error	Your response
D01	NAME IS NOT PRIME ENTRY	The primary entry point name of the program in working storage does not match the name on the DUP control record.	
D02	INVALID HEADER RECORD TYPE	One of the following is detected: 1. A non-DSF program 2. A mispositioned header 3. Foreign data 4. An erroneous subtype	
D03	INVALID HEADER LENGTH	Word 6 of the DSF header is outside the range of 3 through 45. Other causes are similar to those of message D02, except for subtype.	
D05	SECONDARY ENTRY XXXXX IN LET	The specified secondary entry point name is already in LET.	Delete the specified entry point name before storing this subroutine.
D06	ENTRY POINT NAME ALREADY IN LET/FLET	The specified name is already in LET or or FLET.	Delete the specified name from LET or FLET before storing this program or data file.
D12	INVALID DISK I/O SPECIFIED	The disk I/O subroutine coded (column 9) on the STORECI control record is other than 0, 1, N, Z, or blank.	
D13	INVALID FUNCTION FIELD	An invalid DUP function is specified on the DUP control record.	
D14	INVALID FROM (CC 13-14)	One of the following: 1. Unacceptable characters are in columns 13 and 14 of the DUP control record. 2. The FROM field specified is not valid with this DUP function.	
D15	INVALID TO FIELD (CC 17-18)	One of the following: 1. Unacceptable characters are in columns 17 and 18 of the DUP control record. 2. The TO field specified is not valid with this DUP function.	
D16	INVALID NAME FIELD (CC 21-25)	One of the following: 1. A required name is not specified. 2. The specified name contains a syntax error.	

Figure A-5 (Part 1 of 8). DUP/MUP error messages

Error number and message		Cause of error	Your response
D17	INVALID COUNT FIELD (CC 27-30)	Columns 27 through 30 are blank or include alphabetic characters. The count field requires a decimal number.	
D18	INVALID FUNCTION DURING TEMPORARY JOB	This function is not allowed during the JOB T mode.	
D19	CARTRIDGE NOT ON SYSTEM	The cartridge specified as the TO or FROM cartridge is not specified on the JOB control record as being used for this job.	
D20	CARTRIDGE ID OUTSIDE VALID RANGE (0001-7FFF)		Correct the cartridge ID and retry.
D21	INVALID STOREMOD. SIZE OF REPLACEMENT EXCEEDS SIZE OF ORIGINAL	The replacement version of the program or data file is larger than the current stored version.	Delete the old version of the program or data file and retry.
D22	PROGRAM NOT IN WORKING STORAGE	One of the following: 1. The disk block count for the requested program in working storage is zero. 2. The program is not in working storage.	
D23	INVALID SYSTEM OVERLAY SUBTYPE SPECIFIED	The system overlay subtype indicator (column 11) on a STORE control record is not in the range 0 through 9.	
D24	COUNT FIELD TOO LARGE	One of the following: 1. The count field extends beyond column 30 of a DEFINE FIXED AREA control record. 2. Column 31 is not a minus sign.	
D25	REQUIRED FORMAT NOT IN W.S.	During a STOREMOD, the format of the LET or FLET entry does not agree with the format in working storage.	
D26	NAME NOT FOUND IN LET/FLET	The name specified on a DELETE or DUMP control record is not in LET or FLET.	
D27	SOURCE NOT IN DSF	The format indicator of the FROM cartridge indicates that working storage on this cartridge does not contain a DSF program.	
D30	INVALID RECORD TYPE	An invalid type binary record has been read when storing from cards or paper tape.	

Figure A-5 (Part 2 of 8). DUP/MUP error messages

Error number and message		Cause of error	Your response
D31	PROGRAM OR DATA EXCEEDS DESTINATION DISK AREA	The number of disk blocks required to store a program or data file exceeds the amount of space available in the specified TO field.	
D32	INVALID CORE IMAGE CONVERSION	The core load builder has inhibited the continuation of STORECI. The specific reason has been printed by the core load builder (see "Core Load Builder Error Messages" in this appendix).	
D33	LET/FLET OVERFLOW.	A ninth sector of LET/FLET is required (or a seventh sector of LET on a non-system cartridge) for the LET/FLET entry.	You must delete a program with a LET or FLET entry of similar size before this program can be stored.
D41	INVALID STORECI CONTROL RECORD	A control record read after a STORECI is not a LOCAL, NOCAL, FILES, or G2250 record, or a mainline name is not specified on a LOCAL or NOCAL record, or a mainline name is specified on a G2250 record, or the name specified on the LOCAL or NOCAL record does not match the name on the STORECI card.	
D42	STORECI CONTROL RECORDS INCORRECTLY ORDERED	LOCAL, NOCAL, FILES, and G2250 control records are intermixed.	All records of a given type must be loaded together.
D43	INCORRECT CONTINUATION	A comma at the end of a record indicates continuation to the next record; however, it is not continued.	
D44	ILLEGAL CHARACTER IN RECORD	An illegal character, probably a blank, is in the record.	
D45	ILLEGAL FILE NUMBER	One of the following: 1. A nonnumeric character is in a file number. 2. A file number is more than 5 characters long.	
D46	ILLEGAL NAME	One of the following: 1. A name is more than 5 characters long. 2. A name contains characters other than A through z, 0 through 9, or $. 3. A name contains embedded blanks.	

Figure A-5 (Part 3 of 8). DUP/MUP error messages

Error number and message		Cause of error	Your response
D47	ILLEGAL CARTRIDGE ID	One of the following: 1. The specified cartridge ID is not in the range /0001 through /7FFF. 2. The specified cartridge ID contains an invalid character.	
D48	SCRA BUFFER OVERFLOW	The supervisor control record area (SCRA) cannot contain all the LOCAL, NOCAL, FILES, or G2250 information.	
D70	LAST ENTRY IN LET/FLET NOT 1DUMY	A DELETE operation cannot find the end of LET or FLET. The header for this LET/FLET sector contains the count of unused words in this sector. This count should point to the last 1DUMY entry; however, the entry to which it now points is not a 1DUMY.	
D71	1DUMY ENTRY IN LET/FLET IS FOLLOWED BY A SECONDARY ENTRY POINT	The name on the DELETE control record points to a secondary entry point that follows a 1DUMY entry point. The primary entry is not in LET/FLET.	
D72	FIRST ENTRY IN LET/FLET SECTOR IS A SECONDARY ENTRY POINT	The LET/FLET table is improperly constructed; the first entry is not a primary entry.	
D80	FIXED AREA PRESENT	The FORTRAN compiler, RPG compiler, or assembler cannot be eliminated if a fixed area is defined on the disk.	
D81	ASSEMBLER NOT IN SYSTEM	The assembler has been previously deleted from the system.	
D82	FORTRAN NOT IN SYSTEM	The FORTRAN compiler has been previously deleted from the system.	
D83	INCREASE VALUE IN COUNT FIELD (CC 27-30)	The count field read is a value of zero or one; the first DEFINE FIXED AREA requires one cylinder for FLET plus one cylinder of fixed area. Thereafter, as little as one cylinder of additional fixed area can be defined.	
D84	DEFECTIVE SLET		The cartridge must be reloaded.
D85	FIXED AREA NOT PRESENT	The control record specifies a decrease in the fixed area, or specifies the fixed area as the TO field, and a fixed area is not on the cartridge.	

Figure A-5 (Part 4 of 8). DUP/MUP error messages

Error number and message		Cause of error	Your response
D86	DECREASE VALUE IN COUNT FIELD	One of the following: 1. Enough working storage is not available to allow the fixed area to be defined or expanded by the amount specified in the count field (cc 27 through 30). If a large program is in working storage this error may also occur. If you do not need the contents of working storage, precede the //DUP card with a //JOB card to reinitialize #WSCT in DCOM. If the contents of working storage are needed, save the required information, then run with the following cards: //JOB, //DUP, and *DEFINE FIXED AREA. 2. The number of unused cylinders in the fixed area is insufficient to decrease the fixed area the amount specified in the count field. This message is preceded by a count of the number of cylinders available: XXXX CYLS AVAILABLE. The count is a decimal number.	
D87	RPG NOT IN SYSTEM	The RPG compiler has been previously deleted from the system.	
D88	COBOL NOT IN SYSTEM	The COBOL compiler (a program product) has been previously deleted from the system.	
D90	CHECK SUM ERROR	One of the following: 1. A check sum error is detected in a binary card or paper tape record. 2. Binary cards are out of order.	
D92	INVALID DISKZ CALL.	While performing a DUP function, an attempt has been made to read or write sector 0, or to read or write with a negative word count. This is a system error.	
D93	CARTRIDGE OVERFLOW	While performing a DUP function, an attempt has been made to read or write a sector beyond 1599 decimal.	
D100	LIBRARY NOT FOUND	The library named on a LIB, BUILD, JOIN, or CONCAT statement cannot be found on drives currently in use. If the statement is a LIB, BUILD, or JOIN, all statements are ignored until the next LIB, BUILD, or ENDUP statement is encountered. If the statement is a CONCAT, processing continues with the next control statement.	Correct the name field in the statement in error, or change the // JOB control record to include the drive on which the named library resides, or define the macro library using a *DFILE or *STOREDATA control record.

Figure A-5 (Part 5 of 8). DUP/MUP error messages

Error number and message		Cause of error	Your response
D101	INVALID SUBFIELD COL XX	One of the following: 1. If on an INSERT or DELETE statement, the sequence number is incorrectly specified; that is, it is negative, nonnumeric, or the sequence numbers are reversed. 2. If on a SELECT statement, an incorrect parameter is specified. 3. If on a NAME statement, an invalid parameter was detected, and processing continues with the next LIB, BUILD, or ENDUP statement. 4. If on an INSERT or DELETE statement, processing continues with the next control statement. 5. If on a SELECT statement, processing continues with the remainder of the statement.	XX indicates the column in which the error was found. Correct the error and rerun the portion of the job that is affected.
D102	ILLEGAL REQUEST	One of the following: 1. An invalid statement was detected. 2. An INSERT or DELETE statement is not preceded by an UPDATE or RENAME statement. 3. An OUTPUT operation was requested using a cartridge configured for paper tape. Processing continues with the next control statement.	Correct the error and rerun the portion of the job that is affected.
D103	LIBRARY OVERFLOW	One of the following: 1. The library last specified by a LIB or BUILD statement does not have enough room to perform the operation. 2. If on a JOIN or an ADD statement, the operation is suppressed and the library is restored to its previous state. 3. If on an INSERT statement, the statements listed prior to the message are the only ones that can be included. Processing continues with the next LIB, BUILD, or ENDUP statement.	Do one of the following: 1. Purge unneeded macros or delete unneeded statements to obtain additional space in the current library. If this is not possible, define a larger library using an *DFILE or *STOREDATA control record, join the old library to a new one, and delete the old library. Once the additional space is obtained, rerun the portion of the job that is affected. 2. If on an INSERT statement, you may have to alter the INSERT statement as the statements in the macro library may have been resequenced.

Figure A-5 (Part 6 of 8). DUP/MUP error messages

Error number and message		Cause of error	Your response
D104	*MACRO NOT* FOUND	The macro name specified on an OUTPUT, PURGE, RENAME, or UPDATE statement cannot be found in the library being processed. Processing continues with the next control statement.	Do one of the following: 1. Correct the macro name on the statement in error. 2. Specify the correct macro library. Then, rerun the portion of the job that is affected.
D105	SEQUENCE NUMBER NOT FOUND	The sequence number on an INSERT or DELETE statement is out of the range of the macro and cannot be found, or the sequence numbers on multiple INSERT and/or DELETE statements for the same macro are out of order. Processing continues with the next control statement.	Place a correct sequence number on the statement in error, and rerun the portion of the job that is affected.
D106	LIBRARY NOT SPECIFIED	An attempt was made to operate on a macro without specifying a macro library. Processing continues with the next LIB, BUILD, or ENDUP statement.	Place a LIB or BUILD statement before the statement before the statement in error, and rerun the portion of the job that is affected.
D107	SPILL OVERFLOW	Macro text insertions have caused the capacity of working storage spill to be exceeded. Processing continues with the next LIB, BUILD, or ENDUP statement.	Correct the sequence numbers in the unprocessed INSERT statements, if necessary, and rerun these statements. Additional disk drives may have to be defined to provide adequate working storage.
D108	CONTROL STATEMENT READ	An * or // statement has been read, and the MUP run is terminated. Control is returned to the supervisor for a // statement or to DUP for an * statement.	
D109	NAME STATEMENT NOT FOUND	The operation attempted requires a NAME statement, and one has not been processed after the last LIB or BUILD statement. Processing continues with the next LIB, BUILD, or ENDUP statement.	Insert a NAME statement, and rerun the portion of the job that is affected.
D110	INVALID NAME	One of the following: 1. The name field on a LIB, BUILD, JOIN, CONCAT, UPDATE, ADD, PURGE, RENAME, or OUTPUT statement was left blank. 2. The name specified is invalid. 3. Apostrophes are improperly placed. If on a LIB, BUILD, or JOIN statement, processing continues with the next LIB, BUILD, or ENDUP statement. If on a CONCAT, UPDATE, ADD, PURGE, RENAME, or OUTPUT statement, processing continues with the next control statement.	

Figure A-5 (Part 7 of 8). DUP/MUP error messages

Error number and message	Cause of error	Your response
D112 NONBLANK CARD READ ENTER BLANK CARDS		1. Remove the stacked input from the card hopper. 2. Press NPRO to clear out nonblank cards. 3. Place blank cards followed by the NPRO nonblank cards and the stacked input in the hopper. 4. Press reader START and console keyboard PROGRAM START.
D116 LIBRARY NOT INITIALIZED	One of the following: 1. The library named on a LIB, JOIN, or CONCAT statement is not properly initialized. 2. The library specified on a BUILD statement is not a data file. If on a LIB, or JOIN statement, processing continues with the next LIB, BUILD, or ENDUP statement. If on a CONCAT statement, processing continues with the next control statement.	Do one of the following: 1. Initialize the library with a BUILD statement, and rerun the portion of the job that is affected. 2. Correct the BUILD statement and rerun the portion of the job that is affected.
D117 INVALID PARAMETER	One of the following: 1. A parameter has been detected that was not defined in the NAME statement. 2. More than 20 parameters are specified in a NAME statement. 3. A parameter greater than one character was used in the format or tag field. If the error occurs during an OUTPUT operation, the operation is terminated and processing continues with the next control statement. If the error occurs during a listing operation, this is a warning message, and the invalid parameter is printed as //N where N is 1 through 20. *Note:* N may be truncated if the field size is exceeded.	

Note. In addition to the DUP error messages just listed, the following message:

NO SUCH ERROR MESSAGE NUMBER

can be printed immediately followed by a 2-digit hexadecimal number. This message is an indication of a system error. The message is likely to be printed if DUP operations are performed while the physical core size and the configured core size do not agree. This situation is not supported by most system programs.

Figure A-5 (Part 8 of 8). DUP/MUP error messages

System Loader
messages and
error messages

SYSTEM LOADER MESSAGES AND ERROR MESSAGES

Informational messages are not printed during an initial load.

At the completion of a reload, the following message is printed:

```
END OF RELOAD
```

The error messages and the corrective action that you perform are listed in Figure A-6. Procedures A and B that are referenced under the column "Your response" are included at the end of the figure.

Error number and message	Your response
From phases 1 and 2	
E01 CHECKSUM ERROR	Follow procedure A or restart initial load. If the input is paper tape, this message can be caused by a paper tape read error. In such a case, follow procedure B.
E02 INVALID RECORD OR BLANK	Follow procedure A or restart initial load.
E03 SEQ ERROR OR MISSING RECORDS	Follow procedure A or restart initial load. The missing record may be end-of-program record.
E04 ORG BACKWARD	Inspect the deck for records missing or out of sequence. Correct the deck and restart from the record in error.
E05 INITIALIZE THE CARTRIDGE	The cartridge ID cannot be found in DCOM because DCOM is defective or an attempt is being made to initial load a cartridge that has not just been initialized or has been improperly initialized. Initialize and initial load the cartridge.
From phase 1 only	
E11 INVALID DRIVE NO.	Set all bit switches off. Set bit switches to select physical drive number and press PROGRAM START. Drive 0—All switches off Drive 1—Switch 15 on Drive 2—Switch 14 on Drive 3—Switches 14 and 15 on Drive 4—Switch 13 on Drive 5—Switches 13 and 15 on Drive 6—Switches 13 and 14 on Drive 7—Switches 13, 14, and 15 on Drive 8—Switch 12 on Drive 9—Switches 12 and 15 on Drive 10—Switches 12 and 14 on
E12 ID SECTOR DATA INVALID	Initialize using DCIP or DISC and follow with an initial load.
E13 CONFIG DECK ERROR	System configuration deck may be missing, out of place, or may contain an error in one or more records. Correct the deck and restart load.
E14 FILE PROTECT ADDR TOO HIGH	This error occurs on a reload only. The last program in the user area extends into the last two cylinders on the cartridge. These cylinders are required by the system loader during a reload operation. The file protect address must be lowered before a reload can be accomplished.
E15 PHID RECORD ERROR	Follow procedure A or reload and restart.
E16 INITIAL LOAD THE CARTRIDGE	The ID sector indicates that this cartridge has not been loaded since initialization by DCIP or DISC. Only an initial load may be performed.
E17 ERROR IN LOAD MODE RECORD	Follow procedure A or restart load.
E18 PAPER TAPE ERROR	The paper tape system loader has found a word count greater than 54. This is probably due to incorrect sequencing of tapes, a faulty tape, or a paper tape reader malfunction. Correct error and restart load.
E19 INVALID SLET/RELOAD TABLE CHECKSUM	System loader will ignore the checksum and continue if PROGRAM START is pressed. However, the cartridge should be initialized and an initial load performed.
From phase 2 only	
E20 FIXED AREA PRESENT	Programs may not be added to a cartridge with a fixed area defined. Press PROGRAM START to restore the resident image and DCOM.
E21 SYSTEM DECK ERROR	A defective record follows the sector break record. Correct the deck and restart the initial load or continue the reload from the preceding sector break record.

Figure A-6 (Part 1 of 3). System loader error messages

Error number and message	Your response
E22 SCRA OVERLAY – STOP	The cushion area used for allowing expanded or added phases has been used up. An initial load must be performed to store these phases on the cartridge. Press PROGRAM START to restore the resident image and DCOM.
E23 PHASE ID OUT OF SEQUENCE	The ACCUMULATOR displays the phase ID that is out of sequence (from last card read). Place the decks in proper order and continue from the sector break record of the correct phase.
E24 *PHASE MISSING*	Error occurred when phase ID (word 11) of last record read was processed. Inspect load mode record, PHID record and phase ID of previously loaded phase to determine which phase is now required. Locate missing phase, place deck in reader starting with sector break record of missing phase and continue.
E25 PHASE ID NOT IN PHID RECORD	The ACCUMULATOR displays the extraneous phase ID. To ignore the phase press PROGRAM START. To load the phase correct the PHID record and restart the load.
E26 PHASE ID NOT IN SLET	If the error occurred during processing of the reload table, the ACCUMULATOR displays the phase ID sought, and the extension displays the ID of the phase requesting the SLET search. Press PROGRAM START to place zeros in the entry and process the next. If the extension displays zeros, a phase is being added, and the phase which should precede it cannot be found. The ACCUMULATOR displays the phase ID searched for. Press PROGRAM START to restore the resident image and DCOM.
E27 DEFECTIVE SLET	SLET is defective. Initialize the cartridge and perform an initial load.
E28 SLET FULL	The ACCUMULATOR displays the ID of a phase that may not be added because the SLET table is full. Press PROGRAM START to ignore the phase and continue. An initial load should be performed as SLET is probably defective.
E29 PROGRAM NOT PRESENT	A program or phases of a program defined in the primary PHID record cannot be reloaded unless the program is currently on the cartridge. Press PROGRAM START to ignore the phases of this program.
E30 RELOAD TABLE FULL	If this error occurs before the '81' record is read the ACCUMULATOR displays the ID of a phase which may not be loaded because the reload table is full. Press PROGRAM START to ignore the phase and continue.
E31 MISSING PHASE ID DUE TO DEFECTIVE SLET OR RELOAD TABLE	The ACCUMULATOR displays the ID of a phase listed in the reload table as a phase requiring SLET information but the phase itself does not appear in SLET. Initialize the cartridge and perform an initial load.
E32 MISSING SYSTEM I/O PHASE	All system I/O subroutines must be on the cartridge and in SLET. Initialize the cartridge and perform an initial load.

Procedure A

If cards are being read from a 1442 Card Read Punch:

1. Lift the remaining cards from the hopper and press nonprocess run out (NPRO).
2. Correct the card in error (first card nonprocessed out) and place the two nonprocessed cards ahead of the cards removed from the hopper.
3. Place the deck back in the hopper.
4. Press reader START.
5. Press console PROGRAM START.

Figure A-6 (Part 2 of 3). System loader error messages

If cards are being read from a 2501 Card Reader:

1. Lift the remaining cards from the hopper and press NPRO.
2. a. Correct the card in error (last card in stacker prior to NPRO) and place this card followed by the single nonprocessed card ahead of the cards removed from the hopper or,
   b. If the error occurred after the PHID card was read and before the type 81 card was read the system loader is in double buffer mode. Correct the card in error (in this case the second from last card in the stacker when the error oc^urred) and place the last two cards from the stacker and the nonprocessed card ahead of the cards removed from the hopper. Note, however, that the last card in the stacker will be the next card processed since it is already in the double-buffer.
3. Place the deck back in the hopper.
4. Press reader START.
5. Press console PROGRAM START.

If the input is paper tape, procedure A is applicable only to errors E15 and E17.

Procedure B

1. Place a mark on the tape adjacent to the highest sprocket tooth under the read starwheels as a point of reference.
2. Count back (from that mark) the number of frames displayed in the ACCUMULATOR and mark the tape.
3. Reposition the tape in reader so that the last mark is at the point of reference.
4. Press console PROGRAM START.

Note: Corrective actions for error messages E04, E21, E23, and E24 are not applicable to paper tape since a faulty tape must normally be replaced in full.

Figure A-6 (Part 3 of 3). System loader error messages

SATELLITE GRAPHIC JOB PROCESSOR ERROR MESSAGES

Figure A-7 lists the error messages that are printed by the satellite graphic job processor (SGJP). The numbered messages are printed on the console printer; the messages preceded by IKyxxxz are displayed on the 2250 screen.

SGJP is described in detail in the publication *IBM System/360 Operating System and 1130 Disk Monitor System User's Guide for Job Control from an IBM 2250 Display Unit Attached to an IBM 1130 System*, GC27-6938.

Error number (if any) and message		Cause of error	Your response
G01	INITIALIZATION FAILURE	Contact has not been made with SGJP in the System/360 during an attempt to initialize the telecommunications line via the GTNIT data transmission subroutine.	Ensure that the System/360 operator has issued a VARY ON command for the 1130/2250 subsystem on which this error message is printed. Then, using the console keyboard, type either an R to retry the operation or a C to cancel SGJP.
G02	LINE ERROR	An attempt to transmit data to the System/360 is unsuccessful because of an I/O error; standard retries are unsuccessful.	Using the console keyboard, type either an R to retry the operation or a C to cancel SGJP.
G03	SYNCHRONIZATION ERROR	The operation is not completed, either because both the System/360 and the 1130/2250 subsystem are in read mode, or because the System/360 terminated communication.	Using the console keyboard, type either an R to retry the operation or a C to cancel SGJP.
IKyxxxz message text THE SATELLITE GRAPHIC JOB PROCESSOR MUST RESTART		SGJP is terminated because an internal error occurred. If the error recurs, refer to the publication, *IEM System/360 Operating System Messages and Codes*, GC28-6631, under the message code (IKyxxxz) for further explanation of the error condition.	Perform the END function, which causes the LOG ON frame to reappear. Perform the LOG ON operation again.
IKyxxxz message text THE SATELLITE GRAPHIC JOB PROCESSOR MUST TERMINATE		SGJP must be terminated because an internal error occurred. If the error recurs, refer to the publication, *IBM System/360 Operating System Messages and Codes*, GC28-6631, under the message code (IKyxxxz) for further explanation of the error condition.	Perform the END function. This returns SGJP to the state it was in before the initial (CANCEL key) attention.

Figure A-7. SGJP error messages

RJE MESSAGES AND ERROR MESSAGES

The error messages that are printed by the RJE program are listed in Figure A-8. The first digit of the messages has the following meaning:

0–Error in RJE00
1–Error in the initializing part of RJE
2–Error during the processing of the RJE program; does not require an operator reply through the console keyboard
5–Error during the processing of the RJE program; requires a reply through the console keyboard from the operator

Messages that are not caused by errors but are printed by the RJE program are listed in Figure A-9.

Error number and message	Cause of error	System action	Your response
J01 INVALID CARD	The control card that contains the work station generation information is invalid or contains invalid information (see "Generation of the 1130 RJE Work Station Program" in Chapter 10).	The work station prepares to read a new data card.	Enter a valid data card.
J10 INVALID PRINTER	Information from the disk monitor system indicates that the principal print device is not an 1132 Printer or a 1403 Printer.	The work station program exits to the disk monitor supervisor.	Reload the RJE Work Station Program after performing a system reload that specifies the 1132 or the 1403 as the principal print device (see Chapter 8 for information about system reload).
J11 INVALID READER	Information from the disk monitor system indicates that the principal I/O device for system is not a 1442 Card Reader or a 2501 Card Reader.	The work station program exits to the disk monitor supervisor.	Reload the RJE Work Station Program after performing a system reload that specifies the 1442 Card Reader or the 2501 Card Reader as the principal I/O device (see Chapter 8 for information about system reload).
J12 LOGICAL DRIVE X NOT IN SYSTEM	The area on disk reserved for your exit data is on a logical disk drive that is not present during this RJE run. The logical drive number replaces X in the message.	The work station program exits to the disk monitor supervisor.	Change your exit parameters or ready the requested logical drive, and reload the RJE Work Station Program.
J13 TOO MANY EQUATS	The number of subroutines equated by you and the RJE program in the current job is more than 25.	The work station program exits to the disk monitor supervisor.	Reload the RJE Work Station Program with a smaller number of subroutines specified in the *EQUAT control record. *Note:* The RJE program internally requires the following number of EQUATS. Compress/expand feature—2 pairs 2501 Card Reader—2 pairs 1132 Printer—1 pair
J14 DISK ERROR OCR=	A permanent error is encountered while attempting to read data from disk during the initialization part of the RJE program.	The program continues according to your response.	Enter one of the following codes: T — Indicates exit to the disk monitor supervisor requesting a terminating dump of the contents of core storage on the printer. X — Indicates exit to the disk monitor supervisor without printing the contents of core storage on the printer.

Figure A-8 (Part 1 of 5). RJE Work Station Program error messages

Error number and message		Cause of error	System action	Your response
J20	RJSTART MISSING	The requirement for an RJSTART command is not satisfied.	The program waits for your response.	Enter an RJSTART command through the card reader, and press PROGRAM START on the console to resume processing.
J21	. . DATA INVALID	A . . DATA command contains invalid parameter. *Note:* This message is also printed if the requested logical disk drive is not present.	The program waits for your response.	Use the operator communication request facility (see message J90 in Figure A-9).
J22	INVALID INPUT	The input entered from the console keyboard does not start with the JECL identifier (. .) followed by at least one blank.	The program waits for more input from the keyboard.	Enter a work station command or press EOF.
J23	INPUT ABORTED BY CENTRAL	The central system has terminated input from the work station and sends a message that explains why input was terminated (see "Messages Sent to Work Stations" in *IBM System/360 Operating System Remote Job Entry,* GC30-2006, for a list of the messages).	The program waits for input from the line.	When the message from the central system is printed, take the indicated action. To resume input, follow the procedures described under "Console Keyboard Procedures" in Chapter 10.
J51	LINE ERROR OCR=	An unrecoverable error is encountered while reading or writing on the communication line, or the line cannot be opened.	The RJE program closes the communication line, if it is open, and waits for your response.	Enter one of the following codes through the console keyboard: A — Indicates that input is available at the card reader. If you select this option, the first card in the card reader must be an RJSTART command. On a switched line, the line must be disconnected before the restart is tried. If this is not done automatically by the work station program, you must do it. Dial again when J91 ESTABLISH LINE CONNECTION is printed. T — Indicates exit to the disk monitor supervisor, requesting a terminating dump o: core storage to the printer. X — Indicates exit to the disk monitor supervisor, without printing the contents of core storage on the printer.

Figure A-8 (Part 2 of 5). RJE Work Station Program error messages

Error number and message	Cause of error	System action	Your response
J52 DISK ERROR INPUT OCR=	A permanent error is encountered while attempting to read input from disk. This message is printed only if your disk input is being read at the time the error occurs.	Reading of input data files and card reader input is discontinued. Any available output from the central system is accepted after you make your response. The system continues according to your response.	Enter one of the following codes (within approximately 3 minutes on a switched line): A – Indicates that input is available at the card reader. B – Indicates that commands are tc be read from the console keyboard. C – Indicates that available output is accepted. (Any pending keyboard input is processed first.) T – Indicates exit to the disk monitor supervisor, requesting a terminating dump of the contents of core storage on the printer. *Note:* You may have to resubmit a job that has been partially entered, but must precede this by either obtaining the output of, or deleting, the job in question.
J53 DISK ERROR OUTPUT OCR=	An unrecoverable error is encountered while attempting to write data on disk. This message is printed only if data is being written on disk by the IBM-supplied user-exit routine.	Output from the central system is discontinued. The disposition of the output is specified by the use of the CONTINUE command. The system continues as directed by your response.	Enter one of the following codes (within approximately 3 minutes on a switched line): A – Indicates input is available at the card reader. (Any pending keyboard and disk input is processed first.) B – Indicates that commands are to be read from the console keyboard. C – Indicates that any pending input (keyboard, disk or card) is processed. If input is not available, the system maintains the line operations. T – Indicates exit to the disk monitor supervisor, requesting a terminating dump of the contents of core storage on the printer.
J54 DISK ERROR OCR=	An unrecoverable error is encountered while attempting to read RJE constants or error messages from disk. If this message is printed, an RJE error message that indicates the original error may not be printed.	The program continues according to your response.	Enter one of the following codes: T – Indicates exit to the disk monitor supervisor, requesting a terminating dump of the contents of core storage on the printer. X – Indicates exit to the disk monitor supervisor without printing the contents of core storage on the printer.

Figure A-8 (Part 3 of 5). RJE Work Station Program error messages

Error number and message	Cause of error	System action	Your response
J55 END OF DISK AREA OCR=	You did not reserve space or reserved too little space on disk for user-exit output data sets.	Output from the central system is discontinued. The system continues as directed by your response.	Enter one of the following codes (within approximately 3 minutes on a switched line): A – Indicates that input is available at the card reader. (Any pending keyboard and disk input is processed first.) B – Indicates that commands are to be read from the console keyboard. C – Indicates that any pending input (keyboard, disk, or card) is processed. If pending input does not exist, the system maintains the line operations. T – Indicates exit to the disk monitor supervisor, requesting a terminating dump of the contents of core storage on the printer.
J56 CARD READER ERROR OCR=	An error has occurred on the card reader that requires your intervention.	The system waits for your response.	Enter one of the following codes (within approximately 3 minutes on a switched line): A – Indicates you have corrected the problem, and the program resumes card reader input. E – Indicates that you could not correct the problem. The program assumes an end-of-file (. . null card) indication closes the card reader.
J57 CARD PUNCH ERROR OCR=	An error has occurred on the card punch that requires your intervention.	The system waits for your response.	Enter one of the following codes (within approximately 3 minutes on a switched line): D – Indicates you could not correct the problem. Output from the central system is discontinued and a . . CONTINUE command has to be transmitted to resume output. P – Indicates that you have corrected the problem, and the program resumes card punch output.

Figure A-8 (Part 4 of 5). RJE Work Station Program error messages

Error number and message		Cause of error	System action	Your response
J58	PRINTER ERROR OCR=	An error has occurred on the printer that requires your intervention. This message is also printed if the length of the records received from the central system exceeds the size of a print line.	The system waits for your response.	Enter one of the following codes (within approximately 3 minutes on a switched line): D – Indicates you could not correct the problem. Output from the central system is discontinued, and a . . CONTINUE command must be transmitted to resume output. P – Indicates that you have corrected the problem, and the program resumes printer output.
J59	PREOPERATIVE ERROR CODE XXXX OCR=	A preoperative error has occurred in the user-exit subroutine, or a logical disk drive has been referenced that was present during the job processing preceding the loading of the work station program, but that has later become not ready. The preoperative error code that replaces XXXX is explained in Appendix B.	The system waits for your response.	Enter one of the following codes (within approximately 3 minutes on a switched line): C – Indicates that you have corrected the problem, and the program retries the operation. T – Indicates exit to the disk monitor supervisor, requesting a terminating dump of the contents of core storage on the printer. X – Indicates exit to the disk monitor supervisor without printing the contents of core storage on the printer.

Figure A-8 (Part 5 of 5). RJE Work Station Program error messages

Message number and message	Reason for message	System action	Your response
J90 OCR=	You have indicated that you want to communicate with the system by pressing PROGRAM STOP and PROGRAM START on the console keyboard.	The system waits for your response.	Enter one of the following codes (within approximately 21 seconds for switched lines and also within the same time limit on a leased or multipoint line, if a line operation is in progress): A – Indicates that input is available at the card reader. B – Indicates that commands are to be submitted from the console keyboard. D – Indicates that receiving output is to be discontinued. N – Indicates that the system ignore the request. T – Indicates exit to the disk monitor supervisor, requesting a terminating dump of the contents of core storage on the printer.
J91 ESTABLISH LINE CONNECTION	This message is printed only on a switched line 1130 work station. You must establish a connection with the central system.	The system waits for you to complete the connection.	Perform the dial-up procedure to establish the connection with the central system (see "Operating Procedures" in the *IBM 1130 Synchronous Communications Adapter Subroutines*, GC26-3706).
J92 DATA rrrr0c0f TO DISK AT xaaa,bbbb	This message is printed only when the IBM-supplied user-exit subroutine is used to write a data set to disk. The message codes have the following meanings. rrrr – The logical record length in hexadecimal for fixed blocked or unblocked records. c – The type of control characters used, where c may have the following values: 0 – No control characters used 1 – IBM System/360 machine code 2 – ASA control characters are used	The user-exit data set is written on disk. The disk block information part of the message is written when the data set is completed; therefore, if a line error or a disk error occurs before the whole data set is received, this portion of the message remains blank.	

Figure A-9 (Part 1 of 3). RJE Work Station Program messages

Message number and message	Reason for message	System action	Your response
J92 (Continued)	f – The IBM System/360 Operating System record format, where f may have the following values: 1 – Fixed unblocked records 2 – Fixed blocked records 3 – Variable unblocked records 4 – Variable blocked records 5 – Undefined records x – The logical disk drive number. aaa – The starting sector address of the data set in hexadecimal. bbbb – The length of the data set in disk blocks where there are 40 packed EBCDIC characters per block (16 disk blocks per sector). The last block may not be filled.		
J93 PROCEED	This message is printed as a result of a B reply to a J90 OCR= message. The work station is ready to receive commands from the keyboard.	The K.B. SELECT light on the console keyboard is turned on, and the program waits for input from the keyboard.	Enter the desired commands with an EOF after each command. After entering the last command, press EOF again to indicate the end of input. (On a switched line, you have approximately 3 minutes to enter each command.)
J94 PUNCHED OUTPUT	A SYSOUT data set is to be punched on a Model 6 or 7 card read punch that is also used to read card input, and a coded card is in the punch station.	The system waits for your action.	You may load blank cards in the punch and then press any character key or the space bar to resume processing. If you want the output to be punched in the prepunched cards, you press any character key or the space bar as just described. You must take action within approximately 3 minutes to maintain line communication. If this time limit is exceeded, a line error occurs. The RJE program is then restarted as described under message J51. You receive punched output if you place an RJSTART command, a null command, and the blank cards in the card reader, then reply A to the line error message.

Figure A-9 (Part 2 of 3). RJE Work Station Program messages

Message number and message	Reason for message	System action	Your response
J94 (Continued)			*Note:* If punched output is to be sent to a 1442 Card Read Punch that is also used for reading, all punched output should be specified as deferred.

Figure A-9 (Part 3 of 3). RJE Work Station Program messages

SUPERVISOR MESSAGES AND ERROR MESSAGES

The monitor supervisor causes all monitor system control records to be printed on the principal printer.

During a DCOM update operation (after each JOB control record or when your program calls SYSUP), the following information is printed:

```
LOG DRIVE CART SPEC CART AVAIL PHY DRIVE
   XXXX       XXXX       XXXX       XXXX
```

where

LOG DRIVE is the drive number specified on the JOB control record (or in the calling sequence of the SYSUP subroutine).
CART SPEC is the specified cartridge ID.
CART AVAIL is the available cartridge ID.
PHY DRIVE is the physical drive number starting with zero.

One line is printed for each physical drive that is ready on the system. The logical drive may be different from the physical drive; that is, physical drive zero may be defined as logical drive 2.

After the cartridge information is printed, the following is printed:

```
V2MXX  ACTUAL XXK  CONFIG XXK
```

where

V2MXX is the current version and modification level of the 1130 Disk Monitor System
ACTUAL XXK indicates the physical core size
CONFIG XXK indicates the configured core size specified by a system load or reload

Figures A-10 and A-11 list the error messages, and their causes, that are printed by Phases 1 and 2, respectively, of the System Control Record Program. Figure A-12 lists the error messages that are printed by the SYSUP DCOM update program.

SYSUP waits with zero displayed in the ACCUMULATOR if it fails to find the SLET entry for the principal printer subroutine. This error can be caused by your replacing the master cartridge with a nonsystem cartridge. Press INT REQ on the console keyboard to flush to the next job. An error printout during SYSUP results in termination of execution.

Error number and message		Cause of error
M11	INVALID MONITOR CONTROL RECORD	A // record was not recognized as a valid monitor control record.
M12	EXECUTION SUPPRESSED	$NXEQ was set upon detection of an error that would prevent successful execution by the system. Execution is bypassed.
M13	DUP SUPPRESSED	$NDUP was set upon detection of an error that would prevent successful DUP operation. DUP is bypassed.
M14	SYSTEM PROGRAM DETECTED MONITOR CONTROL RECORD	A system program has detected a monitor control record when none was expected. The control record is passed to the MCRA for processing. This situation often occurs as a result of a missing END statement in an assembler language program.
M15	ILLEGAL CARTRIDGE ID	A cartridge ID contains an illegal character or is a negative number. The job is terminated.
M16	PROGRAM VOIDED	ASM, FOR, or RPG required but the FORTRAN compiler and/or assembler and/or RPG compiler was either not loaded by the system loader or was voided by a DUP DEFINE.

Figure A-10. Phase 1. System Control Record Program error messages

Error number and message		**Cause of error**
M21	ABOVE RECORD NOT A SUPERVISOR CONTROL RECORD	The last record read is not a LOCAL, NOCAL, G2250, or FILES, record.
M22	SUPERVISOR CONTROL RECORDS INCORRECTLY ORDERED	LOCAL, NOCAL, FILES and G2250 records cannot be intermixed. All records of each type must be kept together.
M23	INCORRECT CONTINUATION	A comma at the end of the record indicated that the record would be continued; however, it was not.
M24	ILLEGAL CHARACTER IN RECORD	An illegal character, probably a blank, appeared in the record.
M25	ILLEGAL FILE NUMBER	A non-numeric character appears in a file number or the number is more than 5 characters long.
M26	ILLEGAL NAME	A name is more than 5 characters long, or contains characters other than A through Z, 0 through 9, or $, or a name contains embedded blanks.
M27	ILLEGAL CARTRIDGE ID	The cartridge ID specified is not in the range /0001 through /7FFF or contains an illegal character.
M28	SCRA BUFFER OVERFLOW	The supervisor control record area (SCRA) cannot contain all the LOCAL, NOCAL, FILES, EQUAT, or G2250 record information.
M29	ILLEGAL DISK SUBROUTINE REQUESTED	A character other than 0, 1, N, Z, or blank appeared in column 19 of the XEQ card.
M30	INVALID CHAR. IN G2250 OPTION COLUMN	A character other than U, N, or blank appeared in column 13, 15, 17, 19, or 21 of the *G2250 control record.
M31	REQUESTED W.S. DR NOT AVIL.	The requested cartridge has not been specified in the job record.

Figure A-11. Phase 2. System Control Record Program error messages (Phase 2 errors cause execution to be bypassed)

Cartridge ID and message	**Cause of error**
XXXX IS NOT AN AVAILABLE CARTRIDGE ID	A requested cartridge ID is not on any cartridge on the system, or the ID is not listed #CIDN of the DCOM on the cartridge.
XXXX IS A DUPLICATED SPECIFIED CARTRIDGE ID	The cartridge ID was listed as appearing on more than one drive on the JOB card.
XXXX IS A DUPLICATED AVAILABLE CARTRIDGE ID	A specified ID appears on more than one cartridge on the system.
XXXX IS NOT A SYSTEM CARTRIDGE	An attempt has been made to specify a non-system cartridge as the master cartridge (logical 0).

Figure A-12. SYSUP – DCOM update error messages

RPG COMPILER MESSAGES AND ERROR NOTES

compiler messages

Near the end of compilation, core usage information and literal parameters are printed in the following format:

```
INDICATORS
IND DISP . .  Indicators through H9 are printed for all programs (relative address)

FIELD NAMES
FIELD DISP            L              T              D...
(field name)    (field length)  (field type)   (number of
                                                decimal positions)

LITERALS
LITERAL     LENGTH TYPE DISP ...

KEY ADDRESS OF OBJECT PROGRAM
Name of routine     Hex DISP . . .

END OF COMPILATION
```

See "Sample Program 3" in Appendix H for an actual program listing.

The relative address that is printed can be used to compute the actual address of the indicator, field, literal, or routine the program is loading. The actual address is computed as follows: add the relative address to the execution address (as printed in the core map) and subtract hexadecimal 11 from the sum. The answer is the actual address.

compilation errors

If working storage is exceeded, compilation is terminated and the following message is printed:

```
WORKING STORAGE EXCEEDED
```

If terminating errors are detected during compilation, the following messages are printed:

```
ERROR(S) IN COMPILATION
END OF COMPILATION
```

The program is executed if any of the detected errors are in the correctable class; that is, an asterisk (*) preceeds the error note number (see Figure A-13 for an explanation of the asterisk).

Compiler error notes are printed as follows:

1. As each statement is processed, it is checked for invalid conditions. When an error is detected, the error note:

   ```
   NOTE xxx
   ```

   is printed on the line following the line in error in the columns reserved for program ID. (xxx is a 3-digit error note number.)
2. The source program is checked for invalid file references (modified, unreferenced, multidefined) and error notes are printed as required. These notes are printed within or below the source listing in the following format:

   ```
   NAME      NOTE xxx
   ```

   NAME is replaced with the name of the invalid file reference.

3. After the printout of indicators, field names, and literals at the end of compilation, any errors on extended diagnostics are printed in the following format:

	Seq. No.	*Error*
EXTENDED FILE DEF. EXT. AND/OR INPUT DIAGNOSTICS	xxxx	NOTE xxx
EXTENDED CALCULATION SPECIFICATION DIAGNOSTICS	xxxx	NOTE xxx
EXTENDED OUTPUT SPECIFICATION DIAGNOSTICS	xxxx	NOTE xxx

   The sequence number (xxxx) is a 4-digit number that is assigned to program statements. Comments cards are not assigned sequence numbers. Some error messages (such as, 227 and 228) are printed together with the number of the statement following the error because the error cannot be determined until then.

4. After the extended diagnostics, a summary of all error messages is printed as follows:

   DIAGNOSTIC MESSAGE EXPLANATIONS
   NOTE xxx y error message (y is the specification type)
   or
   NOTE *xxx y error message
   ***UNCORR ERR JOB TERM
   A message is printed for each error.

All RPG Compiler error notes are listed and explained in Figure A-13. The term *specification is dropped* means that a statement is no further processed by the compiler; the term *no immediate action taken* means that the compiler continues processing a statement by looking for additional errors. An * preceding an error note number indicates that the error cannot be corrected. The program is not executed, and the key addresses of the program are not printed.

Note	Spec type	Error message	Cause of error	System action
* 1	F	FILE TYPE COL 15 INVALID	File Type entry is not I, O, U, or C, or is blank.	I is assumed.
* 2	F	PROC MODE COL 28 INVALID	Mode of Processing entry is not L, R, or blank.	Blank is assumed.
* 3	F	REC ADDR COL 29-30 INVALID	Length of Record Address Field (or key length) entry is invalid or is blank.	08 is assumed.
4	F	REC ADDR TYPE COL 31 INVALID. CORRECT ENTRY ASSUM	Warning only. The correct value for the file type (column 32) is assumed.	Blank is assumed for sequential files. K is assumed for ISAM files.
5	F	TABLE FILE COL 16 REQ E COL 39. E ASSUM	Extension Code entry must be E if File Designation entry is T (table file).	E is assumed.
* 6	F	FILE DESIGN INVALID WITH INPUT FILE	File Designation entry column 16 is not P, S, R, C, or T with an input file (I in column 15).	P is assumed.
7	F	OF IND COL 33-34 INVALID BLK ASSUM	Overflow Indicator entry is invalid for the device type specified.	Blanks are assumed.
8	F	FILE TYPE COL 15 INVALID 0 ASSUM	File Type entry is invalid with a printer device in columns 40 through 46.	0 is assumed.
9	F	MULT PRI FILES DEF. SEC ASSUM	Only one primary file (P in column 16) is allowed. Other input files are designated as secondary (S in column 16).	Secondary is assumed for all but first input file.
* 11	F	FILE ORG COL 32 INVALID	File Organization entry is not I, numeric (1 through 9), or blank; or, two I/O areas are specified for a table file.	Blank is assumed.
12	F	EXT CODE COL 39 NOT BLK BLK ASSUM	Extension Code must be blank for output files.	Blank is assumed.
13	F	EOF COL 17 INVALID E ASSUM	End of File entry is not E or blank.	E is assumed.
14	F	SEQ COL 18 INVALID A ASSUM	Sequence entry not A, D, or blank.	A is assumed.
15	F	FILE DESIG COL 16 NOT BLK. BLK ASSUM	File Designation entry is not blank for an output file.	Blank is assumed.
* 16	F	C IN FILE TYPE COL 15 INVALID WITH DEVICE	File Type entry C requires card read punch in device columns 40 through 46.	READ 42 is assumed.
17	F	REC ADDR FILE REQ E COL 39. E ASSUM	File Designation entry R (record address file) requires an E in Extension Code column.	E is assumed.
18	F	FILE FMT INVALID. F ASSUM	File Format (column 19) is not F. 1130 RPG uses fixed length records only.	F is assumed.

Figure A-13 (Part 1 of 14). RPG compiler error notes

Note	Spec type	Error message	Cause of error	System action
19	F	BLOCK LNG COL 20-23 NOT BLK. BLK ASSUM	Block Length must be blank for 1130 RPG.	Blanks are assumed.
20	F	REC LNG COL 24-27 INVALID. 120 ASSUM PRINTER. ALL ELSE 80	Record Length is improperly specified or is blank.	120 is assumed for printer. 80 is assumed otherwise.
* 21	F	U IN FILE TYPE COL 15 INVALID WITH DEVICE	File Type entry U requires disk I/O in device columns 40 through 46.	DISK is assumed.
22	F	COL 17-18 INVALID WITH PRINTER. BLK ASSUM	End-of-File and Sequence entries are invalid with a printer.	Blanks are assumed.
23	F	COL 28 INVALID WITH CHAIN FILE, R ASSUME	Mode of processing must be random for chain file.	R is assumed.
* 24	F	MORE THAN 8 SEC FILES DEF	The number of secondary files (S1 in column 16) exceeds the maximum allowable 8.	8 is assumed.
25	F	OF IND COL 33-34 INVALID BLK ASSUM	Overflow indicator not OF on OV.	Blanks are assumed.
27	F	EOF COL 17 NOT BLK WITH OUTPUT. BLK ASSUM	End-of-File entry must be blank with output files.	Blank is assumed.
29	F	EXT CODE 39 INVALID. E ASSUM	Extension Code entry is not E or blank with input file.	E is assumed.
* 30	E	FROM FILENAME COL 11-18 INVALID	From Filename entry is missing or not left-justified.	Specification is dropped.
* 31	E	FROM FILENAME COL 11-18 INVALID	From Filename entry was not defined on a File Description Specification form.	Specification is dropped.
* 32	E	FROM FILENAME COL 11-18 INVALID	From Filename entry requires an E in Extension Code column on the File Description Specifications form.	Specification is dropped.
* 33	E	CHAINING FLD COL 9-10 INVALID	Chaining Field entry is not C1, C2, or C3 for chaining file (same entry as columns 61 and 62 of Input Specifications form).	Specification is dropped.
* 34	E	SEQ COL 7-8 INVALID	Record Sequence entry must be 2 alphabetic or 2 numeric characters for chaining file (same entry as columns 15 and 16 of Input Specifications form).	Specification is dropped.
* 35	E	TO FILENAME COL 19-26 INVALID	To Filename entry is missing or not left-justified on RAF or chaining type specifications.	Specification is dropped.
* 36	E	TO FILENAME COL 19-26 INVALID	To Filename entry was not defined on RAF or chaining type specifications on a File Description Specifications form.	Specification is dropped.

Figure A-13 (Part 2 of 14). RPG compiler error notes

Note	Spec type	Error message	Cause of error	System action
* 37	E	TO FILENAME COL 19-26 INVALID	To Filename entry is not the same as the filename defined as a RAF or chaining type specification on a File Description Specifications form.	Specification is dropped.
38	E	COL 33-57 NOT BLK. BLK ASSUM	Columns 33 through 57 of the Extension Specifications form must be blank for all chaining type specifications.	Blanks are assumed.
39	E	COL 7-10 NOT BLK. BLK ASSUM	Columns 7 through 10 of the Extension Specifications form must be blank for all RAF type specifications.	Blanks are assumed.
40	E	COL 33-57 NOT BLK. BLK ASSUM	Columns 33 through 57 of the Extension Specifications form must be blank for all RAF type specifications.	Blanks are assumed.
41	E	COL 7-10 NOT BLK. BLK ASSUM	Columns 7 through 10 of the Extension Specifications form must be blank for all table type specifications.	Blanks are assumed.
* 42	E	TO FILENAME COL 19-26 INVALID	To Filename entry is missing or not left-justified.	Specification is dropped.
* 43	E	TO FILENAME COL 19-26 INVALID	To Filename entry was not defined on a File Description Specifications form.	Specification is dropped.
* 44	E	TO FILENAME COL 19-26 INVALID	To Filename entry is not defined as an output file on a File Description Specifications form.	Blanks are assumed.
* 45	E	TBL NAME COL 27-32 OR 46-51 INVALID	Table Name entries missing or not left-justified. Columns 46-51 are required for alternating input formats only.	Specification is dropped.
* 46	E	COL 27-29 OR 46-48 NOT TAB	First 3 characters of table names must be TAB. Columns 46 through 48 are required for alternating input formats only.	TAB is assumed.
* 47	E	NO OF TBL ENTRIES COL 33-35 NOT NUMERIC	Number of table entries per record. These columns must contain a right-justified decimal number.	10 is assumed.
* 48	E	NO OF TBL ENTRIES COL 36-39 NOT NUMERIC	Number of table entries per table. These columns must contain a right-justified decimal number.	100 is assumed.
* 49	E	TBL ENTRY LNG COL 40-42 OR 52-54 NOT NUMERIC	Length of table entry. These columns must contain a right-justified decimal number. Columns 52 through 54 are required for alternating input formats only.	8 is assumed.
50	E	PACKED ENTRY COL 43 OR 55 INVALID. BLK ASSUM	Packed entry is not P or blank, or invalid for specified device.	Blank is assumed.

Figure A-13 (Part 3 of 14). RPG compiler error notes

Note	Spec type	Error message	Cause of error	System action
* 51	E	NUM DEC POS COL 44 OR 56 INVALID	Decimal positions is not blank or a number.	Zero is assumed.
52	E	TBL SEQ COL 45 OR 57 INVALID. BLK ASSUM	Sequence entry is not A, D, or blank.	Blank is assumed.
* 53	E	FORM TYPE COL 6 NOT VALID	The next specification should have been an E or I specification.	Specification is dropped.
56	F	COL 47-65, 67-70 MUST BE BLK FOR 1130 RPG	Specified columns are not used with 1130 RPG except for ISAM load files.	Blanks are assumed.
* 57	F	ISAM NUMBER OF RECORDS INVALID	The number of records specified for an ISAM load (columns 47 through 52) is not numeric or left-justified.	One is assumed.
60	H	NO RPG CONTROL CARD. BLK ASSUM	Warning only. A compilation and listing will be performed for this run.	Blanks are assumed for all entries.
61	H	COL 11 INVALID. BLK ASSUM	Type of run. This entry should be B, D, or blank.	Blank is assumed.
63	H	COL 17-20 INVALID. BLK ASSUM	Sterling entries are not blank, 0, 1, or 2, as required.	Blanks are assumed.
64	H	COL 21 INVALID. BLK ASSUM	Inverted print option entry is not I or blank.	Blank is assumed.
65	H	COL 26 INVALID. BLK ASSUM	Alternating collating sequence entry is not A or blank.	Blank is assumed.
67	H	PROG NAME COL 75-80 INV. RPGOBJ ASSUM	Program Name entry on RPG Control Card is invalid.	RPGOBJ is assumed.
* 71	C	RSLT FLD COL 43-48 REQUIRED	Result Field name is required but is missing.	Specification is dropped.
72	C	RSLT FLD COL 43-48 MUST BE BLK. BLK ASSUM	Result Field must be blank for COMP, GOTO, EXIT, TAG, SETOF, SETON, CHAIN, BEGSR, ENDSR, EXSR, and EXCPT.	Blanks are assumed.
* 73	C	FACT1, COL 18-27 INVALID	Factor 1 requires a fieldname, label, or literal with the specified operation.	Numeric literal 1 is assumed.
* 74	C	FACT2 COL 33-42 INVALID	Factor 2 requires a fieldname, label, or literal with the specified operation.	Numeric literal 1 is assumed.
75	C	RSLT IND COL 54-59 INVALID. 00 ASSUM	Resulting Indicator is not 01 through 99, H1 through H9, L1 through L9, OF, or OV.	00 is assumed for indicator in error.
76	C	FACT1 COL 18-27 MUST BE BLK. BLK ASSUM	Factor 1 entry must be blank for the operation being performed.	Blanks are assumed.
77	C	FACT2 COL 33-42 MUST BE BLK. BLK ASSUM	Factor 2 entry must be blank for the operation being performed.	Blanks are assumed.

Figure A-13 (Part 4 of 14). RPG compiler error notes

Note	Spec type	Error message	Cause of error	System action
* 78	C	CTRL LEVEL COL 7-8 INVALID	Control Level column 7 is not L or blank.	Blank is assumed.
* 79	C	DETAIL CALC DOES NOT PRECEDE TOTAL CALC	A detail calculation, columns 7 and 8 blank, follows a total calculation, columns 7 and 8 L0 through L9 or LR.	L0 is assumed.
* 80	C	FACT1 COL 18-27 INVALID	Factor 1 entry is not left-justified.	Numeric literal 1 is assumed.
* 81	C	FACT2 COL 33-42 INVALID	Factor 2 entry is not left-justified.	Numeric literal 1 is assumed.
* 82	C	FACT1 COL 18-27 INVALID	Factor 1 entry is an improperly stated literal or field name.	Numeric literal 1 is assumed.
* 83	C	FACT2 COL 33-42 INVALID	Factor 2 entry is an improperly stated literal or field name.	Numeric literal 1 is assumed.
* 84	C	FACT1 COL 18-27 INVALID	Factor 1 entry is a field name of more than 6 characters.	First six characters are assumed.
* 85	C	FACT2 COL 33-42 INVALID	Factor 2 entry is a field name of more than 6 characters.	First six characters are assumed.
* 86	C	OPER CODE COL 28-32 INVALID	Operation code is missing or unrecognizable.	MOVE operation code is assumed.
87	C	CTRL LEV COL 7-8 INVALID. L0 ASSUM	Column 7 is L but column 8 is not 0 through 9 or R.	L0 is assumed.
* 89	C	RSLT FLD COL 43-48 REQUIRED	Result Field entry is improperly defined.	Specification is dropped.
* 94	C	RSLT FLD LNG COL 49-51 INVALID	Field Length entry is blank, not numeric, or not right-justified; or, Field Length entry contains an embedded blank.	014 is assumed. 0 is assumed for blank.
* 95	C	DEC POS COL 52 INVALID	Decimal Position entry is not blank or numeric.	0 is assumed.
96	C	HLF ADJ COL 53 INVALID. H ASSUM	Half adjust entry is not H or blank.	H is assumed.
* 97	C	RSLT IND COL 54-59 REQUIRED	A resulting indicator is required for this operation.	Internal indicator is assigned.
* 98	C	IND COL 9-17 INVALID	Indicator entry improperly defined.	Indicator is dropped.
*100	I	STERL COL 71-74 INVALID	Sterling entry not numeric or sterling not defined on RPG Control Card. This note can be printed by input or output specifications.	Blanks are assumed.

Figure A-13 (Part 5 of 14). RPG compiler erroı notes

Note	Spec type	Error message	Cause of error	System action
*101	I	FLD REC RELATION IND COL 63-64 INVALID	Field Record Relation Indicator unrecognizable.	Blanks are assumed.
*102	I	PLUS, MINUS, ZERO/BLK IND COL 65-70 INVALID	Indicator columns 65 through 70 unrecognizable.	Blanks are assumed.
*103	I	OVER 60 REC TYPE SPEC'S	Input has more than 60 record identification columns 6 through 42.	Specification is dropped.
*109		INPUT OR OUTPUT SPECS MISSING OR INVALID	Input or output specifications are required.	Job is terminated.
110	I	FORM TYPE COL 6 INVALID	Form Type is not I, C, or O and column 7 does not contain an *.	Specification is dropped.
*111	I	FILENAME COL 7-14 INVALID	Filename entry is not defined.	Specification is dropped.
*112	I	FILENAME COL 7-14 INVALID	Filename entry is not correctly defined on the File Description form.	Specification is dropped.
*113	I	'AND' CD OUT OF SEQ	'AND' card is first card in deck, first specification after field name, or invalid file type.	Specification is dropped.
*114	I	NO RECORD ID IN CARD BEFORE 'AND' CARD	Record ID entry columns 21 through 41 of Input Specifications form required in card before 'AND' card.	Specification is dropped.
*115	I	'OR' CD OUT OF SEQ	'OR' card is first card in deck, first specification after field name, or invalid file type.	Specification is dropped.
*116	I	FILENAME COL 7-14 INVALID	Filename entry not left-justified.	Specification is dropped.
*117	I	FILENAME COL 7-14 INVALID	Filename entry begins with a numeric character.	Specification is dropped.
*118	I	FILE AND FLD NAME ARE BOTH ON SAME SPEC	File and field names cannot both appear on same specification.	Filename entry is assumed.
119	I	SEQ COL 15-16 BLK. AA ASSUM	Sequence entry must be 2 alpha or 2 numeric characters.	AA is assumed.
*120	I	SEQ COL 15-16 ALPHA SEQ AFTER NUM SEQ	Alpha sequence entries must appear before numeric sequence entries.	Numeric sequence last used is assumed.
*121	I	SEQ COL 15-16 IS INVALID	Ascending numeric sequence is required, or the first entries must begin with 01.	Numeric sequence last used is assumed.
122	I	NUMBER ENTRY COL 17 INVALID. N ASSUM	Sequence is numeric and the number entry column is not N or 1.	N is assumed.

Figure A-13 (Part 6 of 14). RPG compiler error notes

Note	Spec type	Error message	Cause of error	System action
123	I	OPTION ENTRY COL 18 INVALID. 0 ASSUM	Sequence is numeric, and the option entry column is not 0 or blank.	0 is assumed.
124	I	REC IDENTIFYING IND COL 19-20 INVALID. BLK ASSUM	Record Identifying Indicator entry is not 01 through 99.	Blanks are assumed.
125	I	STKR SEL COL 42 INVALID. BLK ASSUM	Stacker Select entry is one of the following: 1. Not 1, 2, or blank. 2. Specified with 2 I/O areas. 3. Invalid with the reader specified.	Blank is assumed.
*126	I	INVALID INPUT FILE	Input file has been specified as I, C, or U in column 15 of File Description Specifications form and no input specifications are found for that file. The file was not defined on an Extension Specifications form.	No immediate action taken.
*127	I	POSITION ENTRY COL 21-24, 28-31, 35-38 INVALID	Position entry contains a non-numeric character.	0 is assumed.
128	I	'NOT' ENTRY COL 25, 32 OR 39 INVALID. N ASSUM	'NOT' entry not N or blank.	N is assumed.
129	I	C/Z/D ENTRY COL 26, 33 OR 40 INVALID. C ASSUM	Combined/Zone/Digit entry is not C, Z, or D.	C is assumed.
130	I	FIELD NAME SPEC OUT OF SEQ	Field Name Type specification is first in deck, after invalid filename or invalid AND or OR specification.	Specification is dropped.
*131	I	FLD NAME COL 53-58 INVALID	Field Name entry is not left-justified.	Specification is dropped.
*132	I	FLD NAME COL 53-58 INVALID	Field Name entry does not begin with an alphabetic character.	Specification is dropped.
*133	I	FROM OR TO COL 44-51 INVALID	From or To columns are blank.	0001 is assumed.
*134	I	FROM OR TO COL 44-51 INVALID	From or To columns contain a non-numeric character.	0 is assumed.
*135	I	TO COL 48-51 LESS THAN FROM COL 44-47	Defined field length less than 1.	1 is assumed.
*136	I	PACKED INPUT FLD INVALID	Packed input field length defined by From and To fields is greater than 8, or packed field is invalid for input device.	8 is assumed.
137	I	PACKED ENTRY COL 43 INVALID. P ASSUM	Packed entry is not P or blank.	P is assumed.
*138	I	DEC POS COL 52 INVALID	Decimal Positions are not numeric.	0 is assumed.
*139	I	NUMERIC FLD GT 14	Numeric field length is greater than 14 characters.	Field length of 14 is assumed.

Figure A-13 (Part 7 of 14). RPG compiler error notes

Note	Spec type	Error message	Cause of error	System action
*140	I	CTRL LEV COL 59-60 INVALID	Column 59 not L.	L in column 59 is assumed.
*141	I	CTRL LEV COL 59-60 INVALID	Column 60 is not numeric.	1 in column 60 is assumed.
*142	I	MATCH OR CHAIN ENTRY COL 61-62 INVALID	Column 61 not M or C.	M in column 61 is assumed.
*143	I	MATCH OR CHAIN ENTRY COL 61-62 INVALID	Column 62 is not numeric.	1 in column 62 is assumed.
*144	I	MATCH ENTRY COL 61-62 NOT M1-M9	Match entry is invalid.	M9 is assumed.
145	I	RSLT IND COL 65-68 SPECIFIED FOR NON-NUM FLD. INDIGN	Plus and minus indicators cannot be used with an alphameric field.	Indicator is ignored.
*146		ALPHA FLD GT 256	Alphameric field length is more than 256 characters.	Field length of 256 is assumed.
*147	I	STERL FLD INVALID	Sterling field has more than 3 decimal positions specified.	3 is assumed.
*148	I	STERL FLD INVALID	Sterling field has no decimal positions specified.	0 is assumed.
149	I	REC ID SPEC OUT OF SEQ OR NO FIELDS FOR GIVEN REC	Warning only. Record ID specification is out of order, or no fields are indicated for a given record.	No immediate action is taken.
*150	I	PACKED FLD MUST BE NUMERIC	Decimal Position entry column 52 is blank.	0 is assumed.
*151	I	FROM TO OR RECORD ID ZERO	From, To, or Position entries are zero.	0001 is assumed.
*152	I	FLD REC POS BLK, BUT TEST CHAR PRESENT	Position entry 27, 34, or 41 contains a valid test character.	No immediate action is taken.
*155	F	KEY SIZE EXCEEDS REC LNG	Key length columns 29 and 30 (ISAM file) is greater than record length.	No immediate action is taken.
*158	F	KEY LNG EXCEEDS 50	Key length columns 29 and 30 (ISAM file) is more than 50 characters.	50 is assumed.
*159		FLD NAME BEGINS WITH 'TAB' BUT IS NOT TBL NAME	Field name beginning with TAB is not a table name. Tables are defined on Extension Specifications form columns 27 through 32.	Specification is dropped.
*160		FORM TYPE COL 6 INVALID	Next Form Type entry should have been 0.	Specification is dropped.

Figure A-13 (Part 8 of 14). RPG compiler error notes

Note	Spec type	Error message	Cause of error	System action
*161	O	INVALID OUTPUT SPEC	Column 6 of specification contains an O, but column 7 does not have * or start of filename. There is no H/D/T/E specified in column 15. The specification is not an AND or OR.	Specification is dropped.
*162	O	FILENAME COL 7-14 INVALID	Filename entry is missing, improperly defined, or undefined.	Specification is dropped.
*163	O	H/D/T/E ENTRY COL 15 OUT OF SEQ	Output lines must be sequenced as follows: H/D/T/E.	Specification is dropped.
*164	O	LINE TYPE COL 15 INVALID	Line Type entry must be H, D, T, or E.	H is assumed.
*165	O	IND COL 23-31 MISSING ON 'OR' SPEC. 00 ASSUM	'OR' specification requires conditioning indicators in columns 23 through 31.	Indicator 00 is assumed.
166	O	IND COL 23-31 MISSING ON 'AND' SPEC. SPEC DROPPED	'AND' specification requires conditioning indicators in columns 23 through 31.	Specification is dropped.
167	O	COL 32-70 MUST BE BLK ON LINE SPEC. BLK ASSUME	File ID and CONTROL specification requires columns 32 through 70 blank.	Blanks are assumed.
168	O	FIELD NAME COL 32-37 INVALID. SPEC DROPPED	Field Name entry is not left-justified.	Specification is dropped.
*169	O	IND COL 23-25, 26-28, OR 29-31, INVALID OR OF OR OV NOT IN 33-34 OF FDS. SPEC DROPPED	Output Indicator entry is incorrect.	Blanks are assumed.
*170	O	CARD OUT OF ORDER	'OR' or 'AND' card is out of sequence.	Specification is dropped.
*171	O	CARD OUT OF ORDER	Field type specification with column 15 blank is not preceded by a valid line type specification.	Specification is dropped
*172	O	OUTPUT FLD SPEC WITH ENTRIES IN COL 7-22	Output field specification requires columns 7 through 22 blank.	Entries in columns 7 through 22 are ignored.
173	O	LEAD OR CLOSE QUOTE COL 45-70 MISSING. NO EDIT	Edit word must be enclosed by apostrophes.	No editing is performed.
174	O	EDIT CODE COL 38 INVALID OR USED WITH ALPHA FLD. BLK ASSUM	Edit code used is invalid or an edit code has been specified with an alpha field.	Blank is assumed.
175	O	BLANK AFTER COL 39 INVALID. BLK ASSUM	Blank After entry not B or blank.	Blank is assumed.
176	O	PACKED ENTRY COL 44 INVALID. BLK ASSUM	Packed entry not P or blank, field is not numeric, or packed field is invalid.	Blank is assumed.
177	O	COL 17-22 NON-BLK ON 'AND' SPEC. BLK ASSUM	Columns 17 through 22 are not blank on 'AND' specification.	Blanks are assumed.

Figure A-13 (Part 9 of 14). RPG compiler error notes

Note	Spec type	Error message	Cause of error	System action
178	O	END POS COL 40-43 INVALID. SPEC DROPPED	End position in Output Record entry is blank, alphabetic, or is incompatible with constant or edit word.	Specification is dropped.
179	O	LEAD OR CLOSE QUOTE COL 45-70 MISSING. SPEC DROPPED	Constant must be enclosed by apostrophes.	Specification is dropped.
*180	C	FLD NAMED COL 43-48 GT 14	On an arithmetic operation, the field named in columns 43 through 48 is longer than 14 characters.	Specification is dropped.
*181	C	MOVE ZONE OPER INVALID	Incorrect alphameric or numeric fields have been specified for this Move Zone operation. Only the low zone of a numeric field can be referred to.	Specification is dropped.
*183	C	FIELD NAME UNDEF	The field name in Factor 1, Factor 2, or Result Field is undefined.	Specification is dropped.
184		FLD NAME UNREF	Warning only. Field Name entry is unreferenced field or table name.	No immediate action is taken.
*185		FLD NAME MULT-DEF	Field Name entry columns 53 through 58 Input Specification, columns 43 through 48 Calculation Specification, or columns 32 through 37 Output Specification contain a multidefined field name. The field name has defined as alpha and numeric or as same field type with different lengths or as numeric field with different decimal positions.	No immediate action is taken.
*186	C	ARITH OPER SPECIFIED WITH ALPHA FLD	Arithmetic operation specified in operation columns 28 through 32 with an alphameric field specified in Factor 1, Factor 2, or Result field.	Specification is dropped.
*187	C	COMP OPER SPECIFIED WITH ALPHA AND NUM FLD	Alphameric and numeric field being compared. Compare operations are valid only between like fields.	Specification is dropped.
188	C	RSLT FLD LNG COL 49-51 MAY NOT BE LARGE ENOUGH	Warning only. The Result Field may not be long enough to contain the true result.	No immediate action is taken.
*189	C	FACT2 OR RSLT FLD NOT TBL NAME	LOKUP requires table names in Factor 2 columns 33 through 42, and Result Field columns 43 through 48 (if specified).	Specification is dropped.
*190	C	EXSR OPER CALLS ITSELF	Name in Factor 2 is the name of the subroutine of which the EXSR operation is a part (a subroutine may not call itself).	Specification is dropped.
*191	C	TESTZ OPER INVALID	Result Field entry columns 43 through 48 is numeric. TESTZ tests for a high-order zone punch of an alpha field.	Specification is dropped.

Figure A-13 (Part 10 of 14). RPG compiler error notes

Note	Spec type	Error message	Cause of error	System action
192	C	GOTO AND TAG OPERS ARE NOT IN SAME CALC SECTION	Label of the TAG operation and the corresponding GOTO are not in Detail or Total calculations.	Specification is dropped.
193	C	HLF ADJ COL 53 IS INCOMPATIBLE. BLK ASSUM	The number of positions of the arithmetic result is less than or equal to the specified decimal position of the Result Field; therefore, half-adjust cannot be performed.	Blank is assumed.
*194	C	LOKUP OPER INVALID DUE TO UNEQUAL LNGS	Length of Factor 1 columns 18 through 27 and Factor 2 columns 33 through 42 are not equal.	Specification is dropped.
*196	C	MVR OPER NOT PRECEDED BY DIV	There is no remainder to move.	MVR operation is ignored.
*197	C	MVR OPER PRECEDED BY DIV WITH HLF ADJ	Half-adjust effectively removes any remainder.	MVR operation is ignored.
*198	C	LOKUP OPER SPECIFIED WITH ALPHA AND NUM FLD	Factor 1 columns 18 through 27 and Factor 2 columns 33 through 42 must both be alpha or numeric.	Specification is dropped.
*199	C	HIGH AND LOW RSLT IND SPEC FOR LOKUP OPER	High and Low Resulting indicators are both specified for LOKUP operation.	Low indicator is ignored.
*200	F	NO PRIMARY FILE SPECIFIED	No P in column 16 of File Description Specifications form. One file must be defined as primary.	Job is terminated.
*201		FORM TYPE COL 6 INVALID	Next Form Type entry should have been F, E or I.	Specification is dropped.
*202	F	FILENAME COL 7-14 INVALID	Filename incorrectly specified.	Specification is dropped.
*203	F	MORE THAN 10 FILENAMES SPEC	More than the maximum of 10 files are specified.	Only the first 10 are processed.
204	F	UNREF FILENAME	Warning only. A file defined on the File Description Specifications form has not been used in the program.	No immediate action is taken.
205	F	FILE TYPE COL 15 INVALID WITH READ01	Device entry READ01 requires an I in File Type column 15.	Specification is dropped.
*206	F	DEVICE COL 40-46 INVALID	Device name is unrecognizable.	Job is terminated.
207	F	FILENAME COL 7-14 MULT-REF	The filename is specified on the Input or Output Format Specifications form more than once.	No immediate action is taken.
*208	F	FILENAME COL 7-14 MULT-DEF	The same filename is defined on two File Description Specifications forms.	Second specification is dropped.

Figure A-13 (Part 11 of 14). RPG compiler error notes

Note	Spec type	Error message	Cause of error	System action
*210		NO IND OR ONLY PREDEF IND SPEC FOR INPUT REC	At least one indicator is required on input specifications.	Job is terminated.
*212		UNDEFINED RESULT IND	Result indicator used but not defined.	No immediate action is taken.
213		UNREFERENCED IND	Warning only. Indicator specified but not used.	No immediate action is taken.
215	F	FILE DESCR SPEC WITH E COL 39 NOT REF ON EXT SPEC	File description specification with E in column 39 is not used on an extension specification.	No immediate action is taken.
219	O	FLD NAME COL 32-37 UNDEFINED. SPEC DROPPED	Name must be defined on Input or Calculation Specifications form.	Specification is dropped.
*221	I	MATCH FLD LNGS INCOMPATIBLE	Sum of Matching Field lengths must be equal for all record types having matching records specified, or matching fields separated by fields conditioned on Field Record Relation indicators.	No immediate action is taken.
*222	E	TBL NAME MULT-DEF	Same name used for two tables, or the table has been defined as alpha and numeric or as same type with 2 lengths or decimal positions.	No immediate action is taken.
*223	I	FLD IS OUTSIDE THE REC	The input field specified in columns 44-51 is outside the physical record specified in columns 24-27 of the file description specification.	No immediate action is taken.
*224	I	SPLIT CHAIN FLDS IMPROPER	Split chain fields are improperly specified.	No immediate action is taken.
*225	I	SPLIT CTRL FLDS IMPROPER	Split control fields are improperly specified.	No immediate action is taken.
*226	I	SPLIT MATCH FLDS INVALID	Split matching fields are not allowed.	No immediate action is taken.
*227	I	MATCH FLD LNGS INCOMPATIBLE	All match fields of the same level must be the same length on all record types.	No immediate action is taken.
*228	I	CTRL FLD LNG INCOMPATIBLE	The control field on a given control level must be the same length for all record types.	No immediate action is taken.
*229	I	CHAIN FLD LNG INCOMPATIBLE	All fields using the same chaining indicator must be the same length on all record types.	No immediate action is taken.
*230	I	CTRL FLD LNG GT 247	The sum of the control fields on all levels used on a record type cannot exceed 247 characters.	No immediate action is taken.
*231	I	FLD AREA GT REC SIZE	Input field area size exceeds input record length.	No immediate action is taken.
232	O	PRINTER FILE BLK COL 17-22. SPACE 1 AFTER ASSUM	Entry required in columns 17 through 22 for printer carriage control.	Single space after is assumed.

Figure A-13 (Part 12 of 14). RPG compiler error notes

Note.	Spec type	Error message	Cause of error	System action
233	O	STKR SEL COL 16 INVALID. BLK ASSUM	Stacker select invalid for output device, or entry is incorrect (not 1 or 2).	Blank is assumed.
234	O	SPACE BEFORE, COL 17, INVALID. 1 ASSUM	There is an entry in column 17, but it is not 0, 1, 2, or 3.	Single space before is assumed.
235	O	SPACE AFTER, COL 18, INVALID. 1 ASSUM	There is an entry in column 18, but it is not 0, 1, 2, or 3.	Single space after is assumed.
236	O	SKIP BEFORE, COL 19-20 INVALID. BLK ASSUM	There is an entry columns 19 and 20, but it is not 01 through 12 or with an 1132 Printer the skip is to channel 7, 8, 10, or 11.	Blanks are assumed.
237	O	SKIP AFTER, COL 21-22, INVALID. BLK ASSUM	There is an entry in columns 21 through 22 but it is not 01 through 12 or with an 1132 Printer the skip is to channel 7, 8, 10, or 11.	Blanks are assumed.
238	O	PACKED FLD COL 44 NOT NUM. BLK ASSUM	Output field is alpha.	Blank is assumed.
239	O	EDIT CODE COL 38 SPECIFIED ON ALPHA FLD. BLK ASSUM	Alpha fields cannot be edited with an edit code.	Blank is assumed.
240	O	STERL SPECIFIED ON NON-NUM FLD, NO STERL ASSUM	Sterling option columns 71 through 74 requested for alpha field.	No sterling is assumed.
*241	O	EDIT WD TOO SMALL	Edit word is too small for field.	No immediate action is taken.
*242	O	EDIT FLD NOT NUM	Alpha fields not edited.	No immediate action is taken.
*243	O	DOLLAR SIGN INVALID	Both fixed and floating dollar sign have been specified.	No immediate action is taken.
*244	O	BOTH CR AND – USED	Both CR and minus are used for credit.	No immediate action is taken.
*245	O	OUTPUT SPEC INVALID	Output specifications are missing or are invalid for this program.	Job is terminated.
*246	O	PAGE FLD IS DEF AS ALPHA	PAGE defined on Input Specifications form with no decimal position in column 52.	No immediate action is taken.
*247	O	FLD LNG GT END POS COL 40-43	Output field length is greater than the indicated End Position in Output Record columns 40 through 43.	No immediate action is taken.
*248	F	INDEX SEQ FILE ADDITION COL 66 INVALID	Column 66 must contain an A for ISAM ADD functions.	No immediate action is taken.
*250	F	INDEX SEQ KEY LNG COL 29-30 INVALID	Key Length entry columns 29 and 30 is not numeric.	8 is assumed.

Figure A-13 (Part 13 of 14). RPG compiler error notes

Note	Spec type	Error message	Cause of error	System action
251	F	INDEX SEQ KEY START POS COL 35-38 INVALID. 1 ASSUM	Key field must start in position one of record.	0001 is assumed.
*252	O	END POS GT RCD LNG	Output field length is greater than Record length (columns 40 through 43).	No immediate action is taken.
*254	O	'ADD' COL 16-18 MUST BE SPEC	'ADD' must be specified if records are added to an ISAM file.	Specification is dropped.
*255	C	FACT2 COL 33-42 INVALID	Entry in Factor 2 must be filename described as a chained file on the File Description Specifications forms.	No immediate action is taken.
256	C	CTRL LEV COL 7-8 INVALID. SR ASSUM	Closed subroutine must follow total calculations.	SR is assumed.
*257	C	ERROR IN SEQ OF ENDSR-BEGSR	BEGSR operation must come first.	No immediate action is taken.
*258	C	BEGSR OR EXSR FACTORS INVALID	BEGSR—Subroutine name must appear in Factor 1 columns 18 through 27. EXSR—Subroutine name must appear in Factor 2 columns 33 through 42.	No immediate action is taken.
259	C	COL 49-59 MUST BE BLK WITH EXSR OR EXCPT. BLK ASSUM	EXSR or EXCPT operation codes require columns 49 through 59 blank.	Blanks are assumed.
260	C	COL 9-17 MUST BE BLK WITH BEGSR. BLK ASSUM	BEGSR operation code requires columns 9 through 17 blank.	Blanks are assumed.
262	C	COL 49-53 MUST BE BLK WITH CHAIN. BLK ASSUM	CHAIN operation code requires columns 49 through 53 blank.	Blanks are assumed.
263	C	IND COL 56-57 MUST BE THE SAME AS IND COL 54-55 HIGH ASSUM	The same indicator must be specified as high and low indicator.	High indicator is assumed for high and low.
264	O	CHAIN SPECIFIED WITH IND IN COL 58-59. BLK ASSUM	Equal indicator cannot be specified on chaining operation.	Blanks are assumed.
*265	C	PAGE FLD INVALID	Page field must be numeric. Field length must be 4 with zero decimal positions.	Field length of 4 and zero decimal positions are assumed.
270	O	SKIP INVALID FOR CONSOLE PRINTER. BLK ASSUM	Console printer has no provisions for forms skipping. Columns 19 through 22 must be blank.	Blanks are assumed.

Figure A-13 (Part 14 of 14). RPG compiler error notes

CORE LOAD BUILDER MESSAGES

Except for the core load map described in Chapter 6, "Programming Tips and Techniques," and messages R41–R45 listed in Figure A-14, the core load builder does not print informational messages. All core load builder messages are listed in Figure A-14. These messages include the message number and message, the causes of the error messages, and your corrective actions where appropriate.

Error number and message		Cause of error	Your response
R00	LOCALS/SOCALS OVERFLOW WORK STORAGE	Enough working storage is not available to accommodate the LOCAL and/or SOCAL overlays required by the core load.	Do one of the following: 1. Change the working storage ID on the JOB control record to the ID of the cartridge on the system that contains the most available working storage. 2. Create more working storage on the present cartridge by deleting subroutines, subprograms, and/or data that is no longer required.
R01	ORIGIN BELOW 1ST WORD OF MAINLINE	The core load builder has been instructed to load a word into an address lower than the first word of the mainline program.	Do one of the following: 1. Remove the ORG statement that is causing the problem. 2. Assign the mainline program origin at a lower address.
R02	DEFINE-FILE(S) OVERFLOW WORK STORAGE	Enough working storage is not available to accommodate any records of the defined file(s).	See the options for error message R00.
R03	NO DSF PROGRAM IN WORKING STORAGE	Working storage does not contain a program when the core load builder is called.	Load the desired program into working storage.
R05	INVALID LOADING ADDR FOR ILS02	ILS02 has been loaded into low COMMON. If error message R48 is also printed, see R48. If ILS02 (or ILSX2) can be relocated, this is a warning message only.	Make the mainline program longer so that ILS02 can be loaded in a higher address. If the mainline program is a system program, restore the system ILSs and store the program in core image format.
R06	FILE(S) TRUNCATED (SEE FILE MAP)	At least one defined file has been truncated, either because the previously defined storage area in the user area or fixed area is inadequate, or because enough working storage is not available to store the file.	Do one of the following: 1. Redefine the user area or fixed area file. 2. Change the record count specification in the DEFINE FILE statement.
R07	TOO MANY ENTRIES IN LOAD	More than approximately 375 different entry points are referenced in the core load by CALL and/or LIBF statements. If your system has a 4K core size, the number is approximately 125.	Divide the core load into 2 or more links.
R08	CORE LOAD EXCEEDS 32K	The core load builder has been instructed to load a word into a core address that exceeds 32767 (a negative number). The loading process is immediately terminated, since the core load builder cannot process negative addresses. This error is probably caused by bad data being read from the disk.	
R09	LIBF TV REQUIRES 84 OR MORE ENTRIES	At least 82 different entry points are referenced in the core load by LIBF statements.	Divide the core load into 2 or more links.
R16	XXXXX IS NOT IN LET OR FLET	The program name or data file name printed cannot be found in LET or FLET.	Store the program or data file. If the name cannot be explained, the program being loaded has probably been destroyed (bad data was read from the disk).

Figure A-14 (Part 1 of 4). Core load builder error messages

Error number and message		Cause of error	Your response
R17	XXXXX CANNOT BE A LOCAL/ NOCAL	The program named in this message is either a type that cannot appear on a *LOCAL control record, or is a LOCAL that has been referenced, directly or indirectly, by another LOCAL.	
R18	XXXXX LOADING HAS BEEN TERMINATED	The loading of the mainline program named in this message has been terminated as a result of the errors listed in the messages preceding this one.	
R19	XXXXX IS NOT A DATA FILE	The area named in this message does not begin at a sector boundary, which implies that it is not a data file but a DSF program, and thus a possible error.	Choose another area for the storage of this file.
R20	XXXXX COMMON EXCEEDS THAT OF ML	The length of COMMON for the subroutine named in this message is longer than that of the mainline program.	Define more COMMON for the mainline program.
R21	XXXXX PRECISION DIFFERENT FROM ML	The precision, both real and integer, for the subroutine named in this message is incompatible with that of the mainline program.	Make *EXTENDED PRECISION or *ONE WORD INTEGERS the same in the named subroutine and the mainline program.
R22	XXXXX AND ANOTHER VERSION REF'ENCED	At least 2 different versions of the same ISS have been referenced; that is, CARDZ and CARD0 (FORTRAN uses CARDZ). If a disk subroutine is named in the message, it is possible that the XEQ control record specifies one version (DISKZ) whereas the program references another (DISKN). (A blank in column 19 of the XEQ control record causes DISKZ to be used.)	Change the references so that the core load uses only one version of any given I/O subroutine.
R23	XXXXX SHOULD BE IN THE FIXED AREA	The area named in this message is in the user area.	References in DEFINE FILE and DSA statements for *STORECI functions must be to the fixed area.
R39	XXXX is not CURRENTLY MOUNTED	XXXX is a cartridge ID specified on an *FILES card, but not the ID of a cartridge currently mounted.	Change *FILES card to reference an available cartridge or mount the requested cartridge and restart the job.
R40	XXXX (HEX) = ADDITIONAL CORE REQUIRED	One of the following: 1. If the core load was executed, /XXXX is the number of words by which it exceeded core before the core load builder made it fit by creating special overlays (SOCALs). 2. If the core load was not executed, /XXXX is the number of words still required after the core load builder has attempted to make it fit by using SOCALs.	For the second case, create more links or LOCALs.
R41	XXXX (HEX) WORDS UNUSED BY CORE LOAD	*Not an error.* /XXXX is the number of words of core storage not used by this core load.	
R42	XXXX (HEX) IS THE EXECUTION ADDR	*Not an error.* This message follows every successful conversion from DSF to DCI when a core map is requested.	

Figure A-14 (Part 2 of 4). Core load builder error messages

Error number and message		Cause of error	Your response
R43	XXXX (HEX) = ARITH/FUNC SOCAL WD CNT	*Not an error.* Special overlays (SOCALs) are required. /XXXX is the length of the arithmetic/function overlay (see "Incorporating Subroutines" in Chapter 3).	
R44	XXXX (HEX) = FI/O, I/O SOCAL WD CNT	*Not an error.* Special overlays (SOCALs) are required. /XXXX is the length of the FORTRAN I/O, I/O, and conversion subroutine overlay (see "Incorporating Subroutines" in Chapter 3).	
R45	XXXX (HEX) = DISK FI/O SOCAL WD CNT	*Not an error.* Special overlays (SOCALs) are required. /XXXX is the length of the disk FORTRAN I/O overlay, including the 320 word buffer.	
R46	XXXX (HEX) = AN ILLEGAL ML ADDR	One of the following: 1. /XXXX is the address where the core load builder has been requested to start loading the mainline program. However, this address is lower than the highest address occupied by the version of disk I/O requested for this core load. 2. This error may also be caused by starting an absolute mainline program at an odd location. An ORG to an even location, followed by a BSS of an odd number of words, has the same effect as an ORG to an odd location.	Do one of the following: 1. Assign the mainline program origin at a higher address. 2. Request a shorter version of disk I/O. 3. Assign the mainline program origin at an even boundary.
R47	XXXX (HEX) TOO MANY WDS IN COMMON	The length of COMMON specified in the mainline program plus the length of the core load exceeds core storage by /XXXX words. Defined COMMON for this coreload overlaps low COMMON by /XXXX words.	Do one of the following: 1. Decrease the size of COMMON. 2. Request a shorter version of disk I/O.
R48	XXXX (HEX)	This message is printed with message R05.	The hex value is the number of words that must be added to your mainline program. The reason for this addition is that ILSX2 or a user-written ILS02 would have been loaded into an area where word count and sector address are temporarily placed by the disk routine as a result of an entry to the $DUMP entry point in the skeleton supervisor.
R64	XXXXX IS BOTH A LIBF AND A CALL	The subroutine named in this message is either improperly referenced; that is, a CALL instead of a LIBF or vice versa, or has been referenced in both CALL and LIBF statements.	
R65	XXXXX HAS MORE THAN 14 ENTRY POINTS	This message usually means that the subroutine has been destroyed since a subroutine is not stored if it contains more than 14 entry points.	

Figure A-14 (Part 3 of 4). Core load builder error messages

Error number and message		Cause of error	Your response
R66	XXXXX HAS AN INVALID TYPE	One of the following: 1. The subroutine named in this message: ● Has been designated on an XEQ control record and is not a mainline program, or ● Contains a type code other than 3 (LIBF subprogram, not an ISS), 4 (CALL subprogram, not an ISS), 5 (ISS referenced by LIBF), 6 (ISS referenced by CALL), or ● Has been stored with an appropriate subtype. 2. This error can also be caused by a DSA statement referencing a DSF program, or a CALL or LIBF referencing a program in DCI or DDF.	
R67	XXXX HAS AN INVALID GSB ADDRESS	The subroutine named has a Graphic Short Branch order address that is larger than 8191 after relocation.	
R68	XXXXX FILE NUMBER PREVIOUSLY USED	The data file named in this message appears on an *FILES control record equated to a file number that has been previously assigned to another data file.	Change the file numbers on the *FILES control record to point to unique data files.

Figure A-14 (Part 4 of 4). Core load builder error messages

AUXILIARY SUPERVISOR ERROR MESSAGES

The auxiliary supervisor does not print informational messages. Figure A-15 lists the auxiliary supervisor error messages.

Error number and message		Cause of error
S00	INVALID FUNCTION CODE	The auxiliary supervisor received an illegal parameter.
S01	XXXXX IS NOT IN LET/FLET	The core image loader is unable to find the name specified in this message in LET or FLET.
S02	XXXXX IS A DATA FILE	The specified name cannot be executed since it is a data file, not a program.

Figure A-15. Auxiliary supervisor error messages

MONITOR SYSTEM LIBRARY MAINLINE PROGRAMS MESSAGES AND ERROR MESSAGES

The following text describes the informational messages and error messages printed by the mainline programs that are a part of the monitor system library. These programs are described in Chapter 4.

IDENT Messages

At the end of execution of the IDENT program, the following message is printed:

```
PHYSICAL DRIVE          CART. ID
    YYYY                  XXXX
```

YYYY is replaced with the physical drive number, beginning with 0000, and XXXX is replaced with actual cartridge IDs. One line is printed for each ready drive.

DISC Messages and Error Messages

When DISC is executed, the contents of the *ID control record are printed on the principal print device. Then, if errors occur, any of the following messages may be printed, depending on the errors:

Error message	Cause of error
CARTRIDGE XXXX INVALID ... LOGICAL 0 ID	The ID of the master cartridge (logical drive 0) is specified as a current ID on the *ID control record. XXXX is the ID of the master cartridge.
CARTRIDGE XXXX NEW LABEL IS INVALID	The new label XXXX is outside the range /0001 through /7FFF.
CARTRIDGE XXXX IS NOT AVAILABLE	A selected cartridge with the ID XXXX is not on the system or the selection of XXXX results in the definition of more than 5 LOGICAL drives.
CARTRIDGE XXXX IS DEFECTIVE	Sector @IDAD, or more than 3 cylinders, on the identified cartridge are defective (to identify the defective cylinders, initialize the cartridge with the stand-alone program DCIP).

At the end of reinitialization, the following is printed:

XXXXYYYY NOT DONE
or
XXXXYYYY COMPLETE

where

XXXX is the old (FID1) cartridge ID.
YYYY is the new (TID1) cartridge ID.

One of these messages is printed for each satellite cartridge that is reinitialized. A NOT DONE message is printed only if an error message has been printed.

ID Messages and Error Messages

At completion of the execution of the ID program, the following is printed:

FFFF TTTT NOT DONE
or
FFFF TTTT COMPLETE

where

FFFF is the FROM cartridge ID.
TTTT is the TO cartridge ID.

One of these messages is printed for each cartridge ID that is changed (maximum of 4). The NOT DONE message is printed when a selected cartridge is not found on the system.

COPY Messages and Error Messages

At completion of the copy program, one of the following messages is printed for each copy requested on the *ID control record:

FFFF TTTT NOT DONE
FFFF TTTT NOT PRES
FFFF TTTT NO. ERROR
FFFF TTTT COMPLETE

where

FFFF is the source cartridge ID.
TTTT is the object cartridge ID.
NOT PRES indicates that the cartridge with the requested ID is not on the system.
NO. ERROR indicates that the requested ID is not within the range /0001–/7FFF.

When at least one COMPLETE message is printed, all of the cartridges on the system are listed.

DLCIB Messages and Error Messages

When the CIB is deleted from a cartridge, the following message is printed at the completion of the DLCIB program:

```
CART   UA/FX  FPAD
XXXX   YYYY   NNNN
```

where

XXXX is the cartridge ID.
YYYY is the sector address of the user area.
NNNN is the file protect address.

If the CIB cannot be deleted,

```
XXXX ERROR
```

is printed. XXXX is the cartridge ID.

This error message is printed if:

- The cartridge ID specified in the *ID control record is not on the system.
- The cartridge ID specified in the *ID control record is not specified on the current JOB monitor control record.
- The specified cartridge is a system cartridge.
- The CIB is already deleted from the specified cartridge.
- The CIB on the specified cartridge is specified as system CIB by the current JOB monitor control record.

MODIF Messages and Error Messages

When execution of MODIF is completed successfully, the following messages are printed on the principal printer:

```
MODIF EXECUTION 0WXX
MODIF COMPLETED 0YZZ
```

where

WXX is the old version and modification number.
YZZ is the new version and modification number.

If an error is detected during execution of MODIF, an error message is printed in the following format:

```
ERROR# XXXX XXXX
```

where

XXXX represents hexadecimal numbers.

The system waits for an operator response. All MODIF errors and operator recovery procedures are listed in Figure A-16.

Figure A-16 (Part 1 of 3). MODIF error numbers

Error number	Description	Operator's switch option	Operator recovery procedure (Note that the instruction PRESS START, if not stated, is implied in each of the following procedures.)	Remarks	First hexadecimal number printed	Second hexadecimal number printed
1	Invalid patch control record (*MON or *SUB)	No switches on	Correct error and reread from corrected patch control record. (If the error has occurred on the first patch control record, restart the modification.)			
		Switch 0 on	Press START to call EXIT	This terminates modification.		
2	Checksum error on binary patch data record	No switches on	Rechecksum and reread from preceding patch control record. (If the error has occurred on the first patch control record, restart the modification.)		Amount of checksum difference	Number of binary records read after patch header (including record in error)
		Switch 0 on	Press START to call EXIT	This terminates modification. If word 2 is blank, the test for a valid checksum is not made.		
		Switch 15 on	Reread card in error (cards may be out of order).			
3	Invalid hex data record	No switches on	Correct error and reread from preceding patch control record.			
		Switch 0 on	Press START to call EXIT	This terminates modification.		
		Switch 15 on	Reread card in error.			
4	Modification level error in system modification update	No switches on	Correct error and reread from corrected patch control record.		Present version and modification level (from DCOM on disk)	Level of version and modification (from patch control record)
		Switch 0 on	Press START to call EXIT	This terminates modification.		

Figure A-16 (Part 2 of 3). MODIF error numbers

Error number	Description	Operator's switch option	Operator recovery procedure	Remarks	First hexadecimal number printed	Second hexadecimal number printed
5	New modification level lower than current level in system modification update	No switches on	Correct error and reread from corrected patch control record.		Present version and modification level (from DCOM on disk)	Level of version and modification (from patch control record)
		Switch 0 on	Press START to call EXIT	This terminates modification.		
		Switch 15 on	Press START to continue	Level is reduced and program continues.		
6	Monitor control record or // DEND card read before required number of patches read	No switches on	Press START to continue	New patch control record is read.	Number of patches not installed	
		Switch 0 on	Press START to call EXIT	This terminates modification.		
7	DCOM configuration indicators do not agree with SLET or required system I/O routine missing	Switch 0 on	Press START to call EXIT	This terminates modification.	Contents of ACCUMULATOR when error was detected	Address +2 from which error branch was executed
8	DUP control record errors (DELETES or STORES)	No switches on	Press START to continue		XXYY where XX is the number of DUP errors detected (see DUP error printout) and YY is the number of DUP control records not processed.	Number of DUP control records specified on *SUB patch control record
9	SLET ID not found	No switches on	Press START to continue		SLET ID in question	
A	Patch exceeds space allotted on disk for this phase	No switches on	Press START to continue		High core patch address	High core SLET address
B	// DEND card not found (patches completed but version and modification level in DCOM not updated)	No switches on	Press START to call EXIT	This terminates modification.		

Error number	Description	Operator's switch option	Operator recovery procedure	Remarks	First hexadecimal number printed	Second hexadecimal number printed
C	Modification level error in general temporary fix	No switches on	Press START to call EXIT	This terminates modification. Preceding patches in this MODIF JOB have been installed.	Present version and modification level (from DCOM on disk)	Version and modification level (from patch control record)
D	Modification level error in restricted temporary fix	No switches on	Press START to call EXIT	This terminates modification. Preceding patches in this MODIF JOB have been installed.	Present version and modification level (from DCOM on disk)	Version and modification level (from patch control record)
E	System modification update mixed with temporary fixes	No switches on	Press START to call EXIT	This terminates modification. Preceding patches in this MODIF JOB have been installed.		

Figure A-16 (Part 3 of 3). MODIF error numbers

MODSF Messages and Error Messages

All update requests read by MODSF are listed on the principal printer, along with an indication of the results of the requests. Upon successful completion of an update that does not expand a program:

MODIFICATIONS MADE

is printed after the list of requests. When an *END control record is read and the program is not expanded:

SUCCESSFUL COMPLETION

is printed after the *END control record.

When an update that expands a program is successfully completed:

MODIFICATIONS MADE IN WORKING STORAGE

is printed after the list of requests. When an *END control record is read after a successful update that expands a program:

(*DELETE/*STORE RECORDS MUST FOLLOW)

is printed after the *END control record.

When an error is detected by MODSF:

ERROR nn
PROGRAM WAS NOT MODIFIED

is printed after the list of requests (nn represents the error number). Any previous program for which the message:

MODIFICATIONS MADE

has been printed, have been successfully updated; the current program is not updated, and any succeeding programs are bypassed. A program is never partially updated by MODSF. The MODSF error codes that are printed in the error message are listed in Figure A-17.

Error number	Cause of error
01	MODSF cannot be run in a temporary job mode.
02	MODSF cannot be run with DUP suppressed.
03	First card is not *PRO.
04	Last card was encountered before *END card.
05	Monitor control record was encountered.
06	*Card neither *PRO nor *END.
07	Column which must be blank was not blank in patch control record.
08	Version/modification (columns 6 through 8) invalidly specified or omitted.
09	Version/modification (columns 6 through 8) does not match system cartridge.
10	Program name (columns 10 through 14) is invalid or omitted.
11	Number of patch data records (columns 16 through 19) is not a valid positive hexadecimal value.
12	Cartridge ID (columns 23 through 26) is not validly specified.
13	Cartridge specified (columns 23 through 26) is not online.
14	Program specified (columns 10 through 14) cannot be found on requested cartridge.
15	Name specified in columns 10 through 14 is a secondary entry point.
16	Name specified in columns 10 through 14 is a core-image program.
17	Name specified in columns 10 through 14 is a data file.
18	Addressing mode (column 21) is neither D nor P.
19	Invalid address is specified for verification (columns 28 through 31, 38 through 41, 48 through 51, 58 through 61).
20	Invalid value is specified for verification (columns 33 through 36, 43 through 46, 53 through 56, 63 through 66).
21	During verification, a nonmatch was detected.
22	Number of patch data records does not match number specified.
23	Patch address is an invalid hexadecimal value.
24	Column in patch data record which must be blank was not blank.
25	In addressing mode P, relocation mode indicator is not A, R, L, or C.
26	Patch record contains an invalid hexadecimal value.
27	Patch address is within BSS or area skipped by ORG.

Figure A-17 (Part 1 of 2). MODSF error codes

Error number	Cause of error
28	Attempt was made to change relocation mode of an LIBF.
29	Relocation mode of second word of LIBF is not A.
30	Attempt to patch in an LIBF where non-LIBF appears in program.
31	Program requiring expansion is not followed by *END patch control record.
32	More than 31 words are to be updated.
33	Insufficient working storage for expansion.
34	Address specified for verification beyond end of program or in area skipped by BSS or ORG.

Figure A-17 (Part 2 of 2). MODSF error codes

DFCNV Messages and Error Messages

Each DFCNV control record is printed on the principal printer as it is read. At the end of successful processing of the DFCNV control records, the following message is printed:

DISK DATA FILE CONVERSION COMPLETED

As errors are detected in DFCNV control records, diagnostic messages are printed. All diagnostic errors, except the warning messages, cause program termination. If an error is detected on the file description card, program termination is immediate; all other errors are diagnosed before program termination. All messages, except F10, are printed before data conversion begins. All DFCNV diagnostic error messages are listed in Figure A-18.

Error number and message	Cause of error
F01 INVALID DESCRIPTION CARD FIELD–COL. XX	❶ 1. Numeric field at card column XX outside allowable field range ❶ 2. Unrecognizable character in field at card column XX

F02 FILE NAME NOT IN LET/FLET–Y	❶ 1. LET/FLET entry not found for file named on File Description card
	❶ 2. File name given on File Description card invalid
	Y = I, input file error
	Y = O,output file error

F03 FILE SIZE INVALID–Y	❶ File size calculated from File Description data exceeds actual file size
F04 INVALID FIELD SPECIFICATION SYNTAX–COL. XX	1. Numeric field of specification starting at card column XX outside allowable field range 2. Unrecognizable character in field of specification starting at card column XX ❸ 3. Embedded or intervening blanks on Field Specification card 4. J-field type specification detected starting at card column XX when extended precision was specified
F05 CSP A3 TABLE MISSING	No A (column 72) card precedes / * card when F-field specified.
F06 INVALID CARD SEQUENCE	❷ 1. Unrecognizable card precedes / * card (column 72 not D, S, or A). ❶ 2. Multiple File Description cards read ❶ 3. File Description card out of order ❶ 4. No Field Specification card precedes / * card
F07 TRUNCATION OCCURS AT COL. XXX	❷ High order truncation occurs in output field at column XXX.
F08 CARD INPUT INVALID	❶ Card input is specified when principal input device is console keyboard.
F09 OUTPUT RECORD LENGTH INVALID	Sum of individual field lengths exceeds specified record length for output.
F10 FIELD OUT OF RANGE AT COL. XXX OF RECORD YYYYY	❷ RPG real number field starting at column XXX has been set to zeros or nines in record YYYYY.

❶ Program termination immediate
❷ Warning only
❸ No columns indication

Figure A-18. DFCNV error messages

Appendix B. Monitor System Error Wait Codes

System loader, FORTRAN I/O and RPG object program errors cause the system to wait at $PRET. At the wait, bits 2 and 3 of the OPERATION REGISTER are on. FORTRAN I/O errors are identified by the Fxxx code in the ACCUMULATOR. RPG object program errors are identified by the Cxxx code in the ACCUMULATOR. A $PRET wait also occurs when a system I/O device is required but is not ready. The codes for all of these errors and the errors detected during the cold start program are described in this appendix.

COLD START PROGRAM ERROR WAITS

The following are the absolute addresses that are displayed in INSTRUCTION ADDRESS on the console when errors are detected during the cold start program:

INSTRUCTION ADDRESS register display	Explanation
/001F	–Invalid disk drive number in console entry switches
	–Indicated disk drive not ready
/0046	–Power is unsafe in the disk drive; turn drive off and on for a retry
	–Disk read error
	–Waiting for interrupt from seek operation
/0048	–Waiting for interrupt from reading sector @IDAD

Note. When any of these errors occur, perform another cold start.

ISS SUBROUTINE PREOPERATIVE ERROR WAITS

A preoperative error is an error condition that is detected before an I/O operation is started. The following preoperative error conditions cause the monitor system to wait at $PRET, $PST1, $PST2, $PST3, or $PST4:

- Device not ready
- Error check in device
- Illegal parameter or illegal specification in an I/O area

When a preoperative error condition is detected:

- The address of $PRET+2 is displayed in the INSTRUCTION ADDRESS on the console.
- An error code represented by 4 hexadecimal digits is displayed in the console ACCUMULATOR, where digit 1 identifies the ISS called:

  1–CARDx or PNCHx
  2–TYPEx or WRTYx
  3–PAPTx
  4–READx
  5–DISKx
  6–PRNT1, PRNT2 or PRNTZ
  7–PLOT1, PLOTx
  8–SCATx
  9–PRNT3 or PRNZ
  A–OMPR1

  Digits 2 and 3 are not used (zero).

  Digit 4 identifies the error, where

  0–Device not ready
  1–Illegal parameter or illegal specification in I/O area
- $PRET contains the address of the call in question. The ISS is set up to attempt initiation of the operation a second time if the call is reexecuted. Pressing console PROGRAM START returns control to the ISS for a reexecution of the call.

When a preoperative error wait occurs, you can do one of the following:

- Correct the error condition if possible and press PROGRAM START
- Note the contents of the ACCUMULATOR and location $PRET, dump core storage, and proceed with the next job

All ISS subroutine error waits are listed and described in Figure B-1.

ACCUMULATOR display	Device causing wait	Cause of wait
/1000	1442 Card Read/Punch or 1442 Card Punch	Device is not ready, or last card indicator is on or read.
/1001		Illegal device, device is not in system, illegal function, word count is over +80, or word count is zero or negative.
/100F		This wait occurs in a DUP operation after a D112 error message has been printed.
/2000	Keyboard/Console Printer	Device is not ready.
/2001		Device is not in system, illegal function, or word count is zero or negative.
/2002		Keyboard input is expected (TYPEZ only).
/3000	1134/1055 Paper Tape Reader/Punch	Device is not ready.
/3001		Illegal device, illegal function, word count is zero or negative, or illegal check digit.
/4000	2501 Card Reader	Device is not ready.
/4001		Illegal function, word count is over +80, or word count is zero or negative.
/5000	Disk	Device is not ready. Make device ready and press PROGRAM START.
/5001		Illegal device, device is not in system, invalid function, attempt to write in file protected area, word count is zero or negative or starting address is over +1599. Operation is retried if PROGRAM START is pressed (DISK1 and DISKN only).
/5002		Write select/power unsafe. Turn the cartridge off, then on again, to reset the error condition. DISKZ: If PROGRAM START is pressed, the operation is retried. DISKN or DISK1: If the program is waiting at $PRET and PROGRAM START is pressed, the operation is retried. If the program is waiting at $PST2 and PROGRAM START is pressed, the program goes to EXIT. *Note.* If an interrupt on level 0 or 1 occurs when the program is waiting at $PST2. the program will go to EXIT.
/5003		Read/write/seek failure remaining after 16 attempts, or disk overflow. Error occurred during the processing of a monitor control record (DISKZ only). If a code is also displayed in the ACCUMULATOR EXTENSION, bits 0 through 3 indicate the logical drive number, and bits 4 through 15 indicate the working-storage address, except for disk overflow. Press PROGRAM START; the program is retried 16 times.
/5004		Same as /5003 (DISK1 and DISKN only), or an attempt was made to cold start from a system cartridge when an uninitialized cartridge is on a ready drive. A cold start cannot be performed until the disk is initialized or is turned off. If a code is also displayed in the ACCUMULATOR EXTENSION, bits 0 through 3 indicate the logical drive number, and bits 4 through 15 indicate the working-storage sector address plus one.
/6000	1132 Printer	Device is not ready or end of forms.
/6001		Illegal function, word count is over +60, or word count is zero or negative.

Figure B-1 (Part 1 of 2). ISS subroutine WAITs

ACCUMULATOR display	Device causing wait	Cause of wait
/7000	1627 Plotter	Device is not ready. Ready the device and press PROGRAM START.
/7001		Illegal function, or word count is zero or negative. If PROGRAM START is pressed, the operation is retried (PLOT1 only).
/8001	SCA (STR mode) (SCAT1)	Invalid function code or invalid word count.
/8002		Receive or transmit operation is not completed.
/8003		Failure to establish synchronization before attempting to perform some transmit or receive operation, or attempting to receive before receiving INQ sequence.
/8001	SCA (BSC mode) (SCAT2 or SCAT3)	Invalid function code, word count, or subfunction code.
/8002		Invalid start characters in the I/O area for a transmit operation.
/8003		Invalid number of identification characters for an identification specification operation (SCAT2 only).
/9000	1403 Printer	Device is not ready or end of forms. Make device ready and press PROGRAM START.
/9001		Illegal function, word count is over +60, zero or negative. To retry operation, press PROGRAM START (PRNT3 only).
/9002		Parity check, scan check, or ring check. Reset check and press PROGRAM START. The operation is not retried (PRNZ only).
/A000	1231 Optical Mark Page Reader	Device is not ready.
/A001		Illegal function.
/A002		Feed check, last document is processed. Clear jam, make ready, do not refeed.
/A003		Feed check, last document is not processed. Clear jam, make ready, refeed last document. If error was caused by double feed, refeed both documents.

Figure B-1 (Part 2 of 2). ISS subroutine WAITs

I/O DEVICE SUBROUTINE ERRORS

The error parameters of the card read and punch, console printer, and paper tape I/O subroutines are discussed in the following text. (The special function keys of the console keyboard are discussed in Chapter 7.)

1442 Card Subroutine Errors

CARDZ, CARDO, PNCHZ, and PNCHO do not have an error parameter. If an error is detected during processing of an operation-complete interrupt, the subroutine traps to $PST4 with interrupt level 4 on. You can reinitiate the operation by readying the 1442, and pressing PROGRAM START on the console keyboard.

CARD1 and PNCH1 do have an error parameter. If an error is *detected* during processing of an operation-complete interrupt, your program can elect to terminate (clear the subroutine busy indicator, and turn off the interrupt level) or to retry the operation. A retry consists of waiting at $PST4 with interrupt level 4 on, and then reinitiating the function.

A read or feed function that is requested after the last card has been detected causes the last card to be ejected, and a trap to $PRET occurs. A punch function punches and then ejects the last card with a normal exit.

If a 1442 device error occurs, the 1442 becomes not ready until you intervene. Unless the wait is caused by a stacker full (none of the 1442 error indicators are on) or chip box indication, the 1442 card path must be cleared before proceeding. The 1442 error indicators and the position of the cards in the feed path are used to determine which cards must be placed back in the hopper.

For the card subroutines, a retry consists of positioning the cards (skipping the first card in the hopper, if necessary, on a read or feed operation) and reinitiating the function whenever the card reader is readied.

Card read error conditions are described in Figure B-2. Read errors do not apply to the 1442, Model 5.

1442 Card Read Error Waits

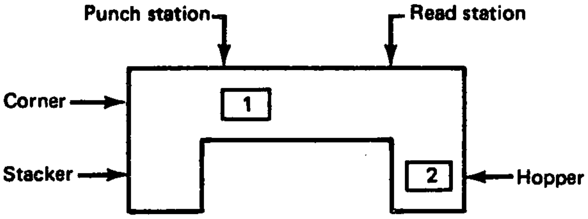
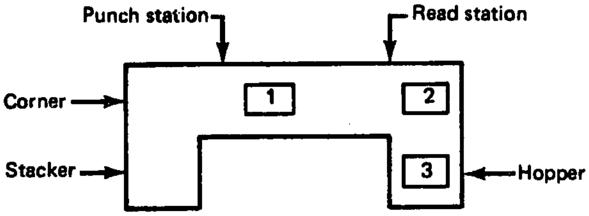
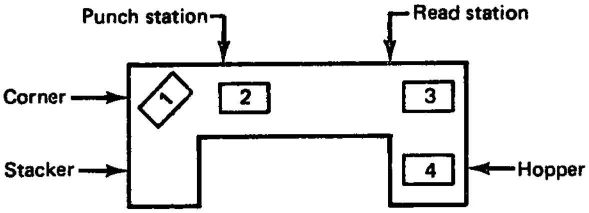
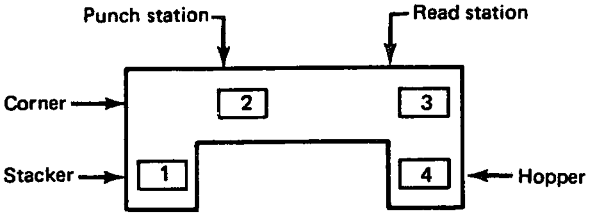
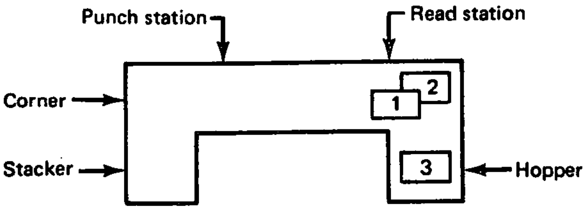
Error, indicator on	Error condition	Card positions after error	Your response
HOPR	*Hopper misfeed* indicates that card 2 failed to pass properly from the hopper to the read station during the card 1 feed cycle.	 Punch station Read station Corner Stacker Hopper 1 2	When the program halts, press reader NPRO to eject card 1, place card 1 in hopper before card 2, and ready the 1442.
PUNCH STA	*Feed check (punch station)* indicates that card 1 is improperly positioned in the punch station at the completion of its feed cycle.	 Punch station Read station Corner Stacker Hopper 1 2 3	When the program halts, empty the hopper and clear the 1442 card path. If reading, place card 2 in the hopper before card 3 and ready the 1442. If punching, place cards 1 and 2 in the hopper before card 3 and ready the 1442.
TRANS	*Transport* indicates that card 1 has jammed in the stacker during the feed cycle for card 2.	 Punch station Read station Corner Stacker Hopper 1 2 3 4	When the program halts, empty the hopper, clear the 1442 card path, place cards 2 and 3 in the hopper before card 4, and ready the 1442.
FEED CLU	*Feed cycle* indicates that the 1442 took an unrequested feed cycle and, therefore, cards 1, 2, and 3 are each one station ahead in the 1442 card path than they should be.	 Punch station Read station Corner Stacker Hopper 1 2 3 4	When the program halts, empty the hopper, press NPRO to eject cards 2 and 3, place cards 1, 2, and 3 in the hopper before card 4, and ready the 1442.
READ STA	*Feed check (read station)* indicates that card 1 failed to eject from the read station during its feed cycle.	 Punch station Read station Corner Stacker Hopper 1 2 3	When the program halts, empty the hopper, clear the 1442 card path, place cards 1 and 2 in the hopper before card 3, and ready the 1442.

Figure B-2 (Part 1 of 2). 1442 Card Read errors

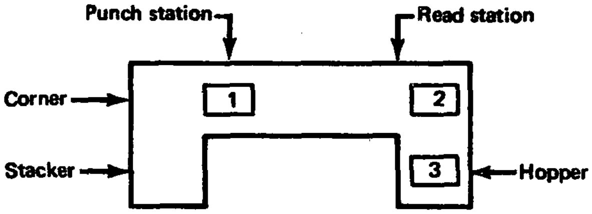
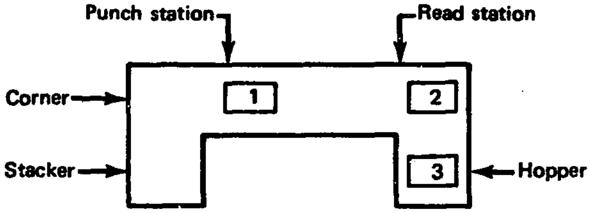
Error indicator on	Error condition	Card positions after error	Your response
READ REG	*Read registration* indicates incorrect card registration or a difference between the first and second reading of a column.	 Punch station Read station Corner Stacker Hopper 1 2 3	See error condition "Feed check (punch station)." Repeated failures of this type might indicate a machine malfunction.
PUNCH	*Punch check* indicates an error in output punching.	 Punch station Read station Corner Stacker Hopper 1 2 3	When the program halts, empty the hopper, check the card position, and press NPRO to clear the 1442 card path. If necessary, correct card 1 to prepunched state. Place card 1 and card 2 in the hopper before card 3 and ready the 1442.

Figure B-2 (Part 2 of 2). 1442 Card Read errors

2501 Card Subroutine Errors

READZ and READ0 do not have an error parameter. If an error is detected during processing of an operation-complete interrupt, the subroutine traps to $PST4, with interrupt level 4 on. You reinitiate the operation by making the 2501 ready and pressing PROGRAM START on the console keyboard.

READ1 does have an error parameter. If an error is detected during processing of an operation-complete interrupt, your program can elect to terminate (clear the subroutine busy indicator and turn off the interrupt level), or to retry the operation. A retry consists of waiting at $PST4 with interrupt level 4 on until the 2501 is readied, and then reinitiating the function.

A read function requested after the last card has been detected causes a trap to $PRET.

If a 2501 device error occurs, the 2501 becomes not ready until the operator intervenes. Unless the stop is caused by a stacker full or cover open (ATTENTION), the 2501 card path must be cleared before proceeding. The 2501 error indicators and the position of the cards in the feed path should be used to determine the cards to be placed back in the hopper.

For the card subroutines, a retry consists of positioning the cards (skipping the first card in the hopper, if necessary) and reinitiating the read function whenever the card reader is readied.

2501 feed check error

A 2501 feed check indicates that a card has failed to feed from the hopper or that a card is mispositioned in the feed path.

To correct this error, empty the hopper and press NPRO when the program waits at $PST4. If a card has failed to feed from the hopper, place the last card in the stacker ahead of the deck remaining to be read. Place this deck in the hopper, and ready the reader.

If a card has been mispositioned in the feed path, place the last 2 cards in the stacker ahead of the deck remaining to be read. Place this deck in the hopper, and ready the reader.

2501 read check error

A read check indicates incorrect card registration or a difference between the first and second reading of a column. To correct this error when the program traps to $PST4, empty the hopper, press NPRO, place the last 2 cards in the stacker ahead of the deck remaining to be read, place this deck back in the hopper, and ready the reader.

Console Printer Subroutine Errors

If the carrier attempts to print beyond the manually positioned margins, a carrier restore (independent of the program) occurs.

When TYPE0 and WRTY0 are being used, printing begins wherever the carrier is positioned as a result of a previous print operation. TYPEZ and WRTZ provide automatic carriage return before each operation.

If the console printer indicates a not-ready condition after printing begins, the subroutines trap to $PST4 with interrupt level 4 on. After you make the console printer ready, pressing PROGRAM START causes the operation to be reinitiated.

The special function keys of the console keyboard are discussed in Chapter 7.

Paper Tape Subroutine Errors

If the reader or punch becomes not ready during an I/O operation, the subroutines exit to your program via the error parameter. You can request the subroutine to terminate (clear device busy on the interrupt level) or to wait at $PST4 for operator intervention (interrupt level 4 on).

If the 1134/1055 indicates a not-ready condition after an operation has been initiated, the subroutines trap to $PST4 with interrupt level 4 on. The operation is reinitiated by making the device ready, and pressing PROGRAM START on the console.

Card Core Image Loader Wait Code

If any kind of card reader or checksum error occurs during the loading of a card image format program into core storage, the core image loader waits at location /0020 with the number of the card to be loaded displayed in the ACCUMULATOR on the console display panel.

To continue processing:

1. Press NPRO on the card reader.
2. Place all the cards, beginning with the one whose number is displayed in the ACCUMULATOR, in the card hopper, and press START on the card reader.
3. Press PROGRAM START on the console keyboard

PAPER TAPE UTILITY PROGRAM (PTUTL) ERROR WAIT CODES

When the paper tape reader or punch becomes not ready during processing, the system waits with an error code displayed in the console ACCUMULATOR. The PTUTL error wait codes are described in Figure B-3.

ACCUMULATOR display	Error condition	Your response
/3005	Paper tape reader not ready	Ready the reader if additional tape is to be read; set the console entry switches as desired, and press PROGRAM START on the console keyboard.
/3004	Paper tape punch not ready	Ready the paper tape punch and press console PROGRAM START. To repunch the record that was being processed when the not-ready condition occurrerl, set console entry switches 1 and 2 off (to prevent another record from being read), set switches 3 and 14 on (punch record and wait with /3333 in the ACCUMULATOR), and press PROGRAM START. After the record is punched, return the console entry switches to the original configuration, and press PROGRAM START.

Figure B-3. PTUTL error wait codes

FORTRAN I/O WAIT CODES

When a FORTRAN I/O error occurs, the system waits at $PRET with Fxxx displayed in the console ACCUMULATOR. The program should be corrected, and the execution restarted.

Figure B-4 describes the FORTRAN I/O error waits.

ACCUMULATOR display	Cause of error	Type of FORTRAN I/O	System action if you press PROGRAM START
F000	No *IOCS card appeared with the mainline program and I/O was attempted in a subroutine.	SFIO [1]	CALL EXIT
F001	Logical unit defined incorrectly, or no *IOCS control record for specified I/O device.	SFIO [1]	Execution continues with next FORTRAN statement.
F002	Requested record exceeds allocated buffer size.	SFIO [1]	All the variables in the I/O list, following the one which has the erroneous format specification, will also be treated as errors.
F003	Illegal character encountered in input record.	SFIO [1]	The variables connected with the erroneous data fields will contain zeros. Other variables in the I/O list connected to fields in the same data record will be handled as usual.
F004	Exponent too large or too small in input field.	SFIO [1]	The variables connected with the erroneous data fields will contain zeros. Other variables in the I/O list connected to fields in the same data record will be handled as usual.
F005	More than one exponent field encountered in input field.	SFIO [1]	The variables connected with the erroneous data fields will contain zeros. Other variables in the I/O list connected to fields in the same data record will be handled as usual.
F006	More than one sign encountered in input field.	SFIO [1]	The variables connected with the erroneous data fields will contain zeros. Other variables in the I/O list connected to fields in the same data record will be handled as usual.
F007	More than one decimal point encountered in input field.	SFIO [1]	The variables connected with the erroneous data fields will contain zeros. Other variables in the I/O list connected to fields in the same data record will be handled as usual.
F008	Read of output-only device, or write of input-only device.	SFIO [1]	Execution continues with next FORTRAN statement.
F009	Real variable transmitted with an I format specification or integer variable transmitted with an E or F format specification.	SFIO [1]	The actual format specifications will be effectuated.

Figure B-4 (Part 1 of 2). FORTRAN I/O errors

ACCUMULATOR display	Cause of error	Type of FORTRAN I/O	System action if you press PROGRAM START
F020	Illegal unit reference.	UFIO [2]	UFIO not updated.
F021	Read list exceeds length of write list.	UFIO [2]	UFIO updated.
F022	Record not existing for read list element.	UFIO [2]	UFIO updated.
F023	Maximum length of $$$$$ area on the disk has been exceeded. This error is unrecoverable and results in a call exit.	UFIO [2]	CALL EXIT
F024	UFIO has not been initialized: there is no *IOCS (UDISK) record in the mainline program.	UFIO [2]	CALL EXIT
F100	File not defined by DEFINE FILE statement.	SDFIO [3]	CALL EXIT
F101	File record number too large, equal to zero, or negative. This error may be caused by attempting to access the end of a working storage file that has been truncated by the core load builder.	SDFIO [3]	CALL EXIT
F103	Disk FIO has not been initialized; there is no *IOCS (DISK) record in the mainline program.	SDFIO [3]	CALL EXIT
F105	The length of a list element (2 or 3 words, depending on the precision) exceeds the record length (1 or 2 words) defined in a DEFINE FILE statement.	SDFIO [3]	CALL EXIT
F107	An attempt has been made to read or write at an invalid sector address. This error occurs if a core image program with working storage files is executed on a system with too small working storage.	SDFIO [3]	CALL EXIT
F10A	Subscripting has destroyed the define file table and/or core image header. This occurs when a subscript exceeds the specification in a DIMENSION.	SDFIO [3]	CALL EXIT

[1] Standard FORTRAN I/O

[2] Unformatted FORTRAN I/O

[3] Standard disk FORTRAN I/O

Figure B-4 (Part 2 of 2). FORTRAN I/O errors

RPG OBJECT PROGRAM WAIT CODES

RPG object program errors cause the system to wait with Cxxx displayed in the console ACCUMULATOR. All RPG object program wait codes are described in Figure B-5.

The object program errors can be divided into 2 categories, disk I/O and general. The wait codes for disk I/O errors are in the range C000 to C05F. All others are between C100 and CFFF. Some of the disk I/O errors should not occur during normal processing. However, if incorrect object code is generated or if the object program is erroneously modified at object time, these disk I/O errors may occur. These error codes are identified with an asterisk to the right of the Cxxx number in Figure B-5.

When an RPG object program error occurs, the operator must take specific action. Generally, this means terminating the job by turning all console entry switches off and pressing PROGRAM START on the console keyboard. Certain errors, however, allow the operator to ignore the error or retry the operation by setting console entry switch 15 on, all others off, and pressing console PROGRAM START. In the case of a retry, the card in error must be placed back in the hopper before continuing. An incorrect operator action causes the error wait to reoccur.

RPG Object Program wait codes

ACCUMULATOR display	Type of processing	Meaning	Your response	Console entry switch settings
C000	Sequential file: random processing	Record number is not within the assigned limits of the file.	One of the following:	
			Terminate the job.	All off. Press console START.
			Bypass the record and continue processing.	15 on, all others off. Press console START.
			If chaining, correct the card and reinsert it in the input stream, or bypass the chaining record and read the next card.	15 on, all others off. Press console START.
C001*	Sequential file: random processing	Record size is not within limits (maximum 640 characters).	Terminate the job.	All off. Press console START.
C002*	Sequential file: random processing	Records per sector is not maximum.	Terminate the job.	All off. Press console START.
C003	Sequential file: random processing	No record was found. The record number is not a positive number.	One of the following:	
			Terminate the job.	All off. Press console START.
			Bypass the record and continue processing.	15 on, all others off. Press console START.
			If chaining, correct the card and reinsert it in the input stream, or bypass the chaining record and read the next card.	15 on, all others off. Press console START.
C004	Sequential file: random processing	Write before read on an update file.	One of the following:	
			Terminate the job.	All off. Press console START.
			Bypass the record and continue processing.	15 on, all others off. Press console START.
C005*	Sequential file: random processing	File was accessed when not open.	Terminate the job.	All off. Press console START.
C006*	Sequential file: random processing	I/O buffer is not on even-word boundary.	Terminate the job.	All off. Press console START.
C010	Sequential file: sequential processing	Disk file is full.	Terminate the job.	All off. Press console START.
C011*	Sequential file: sequential processing	A write is requested on an input file.	Terminate the job.	All off. Press console START.
C012*	Sequential file: sequential processing	A read is requested on an output file.	Terminate the job.	All off. Press console START.

Figure B-5 (Part 1 of 5). RPG Object Program error messages

ACCUMULATOR display	Type of processing	Meaning	Your response	Console entry switch settings
C013*	Sequential file: sequential processing	Record size is not within limits (maximum 640 characters).	Terminate the job.	All off. Press console START.
C014*	Sequential file: sequential processing	Number of records per sector is not maximum.	Terminate the job.	All off. Press console START.
C015*	Sequential file: sequential processing	File was accessed when not open.	Terminate the job.	All off. Press console START.
C016*	Sequential file: sequential processing	I/O buffer is not on even-word boundary.	Terminate the job.	All off. Press console START.
C017	Sequential file: sequential processing	Write before read requested on an update file.	One of the following:	
			Terminate the job.	All off. Press console START.
			Bypass the record and continue processing.	15 on, all others off. Press console START.
C020	ISAM load processing	Invalid type of processing on load function.	Terminate the job.	All off. Press console START.
C021*	ISAM load processing	One of the following:		
		Record size not within limits (maximum 636 characters).	Terminate the job.	All off. Press console START.
		Number of records per sector is not maximum.		
C022*	ISAM load processing	Key length is greater than maximum.	Terminate the job.	All off. Press console START.
C023*	ISAM load processing	Index entry length is not same as length computed from key length.	Terminate the job.	All off. Press console START.
C024*	ISAM load processing	Number of index entries per sector does not permit maximum number of records per sector.	Terminate the job.	All off. Press console START.
C025	ISAM load processing	Prime data area is full.	Terminate the job.	All off. Press ɔonsole START.
C026	ISAM load processing	Index area is full.	Terminate the job.	All off. Press console START.
C027*	ISAM load processing	File was accessed when not open.	Terminate the job.	All off. Press console START.
C028*	ISAM load processing	Index buffer is not on even-word boundary.	Terminate the job.	All off. Press console START.

Figure B-5 (Part 2 of 5). RPG Object Program error messages

ACCUMULATOR display	Type of processing	Meaning	Your response	Console entry switch settings
C029*	ISAM load processing	Prime data buffer is not on even-word boundary.	Terminate the job.	All off. Press console START.
C02A	ISAM load processing	Input record is out of sequence.	One of the following:	
			Terminate the job.	All off. Press *console* START.
			Correct the card and reinsert it in the input stream, or bypass the record by reading another card.	15 on, all others off. Press console START.
C030*	ISAM add processing	Invalid type of processing on add function.	Terminate the job.	All off. Press console START.
C031*	ISAM add processing	File was accessed when not open.	Terminate the job.	All off. Press console START.
C032	ISAM add processing	Key length for this job is not same as key length in file.	Terminate the job.	All off. Press console START.
C033	ISAM add processing	Record length for this job is not same as record length in file.	Terminate the job.	All off. Press console START.
C034	ISAM add processing	Attempt was made to add record already on file.	One of the following:	
			Terminate the job.	All off. Press console START.
			Bypass the record and continue processing.	15 on, all others off. Press console START.
C035	ISAM add processing	Overflow area is full. The file must be resequenced, or the data area must be made larger before another add run can be made.	Terminate the job.	All off. Press console START.
C036*	ISAM add processing	Index buffer is not on even-word boundary.	Terminate the job.	All off. Press console START.
C040*	ISAM file: sequential processing	Invalid type of processing on retrieve or update function.	Terminate the job.	All off. Press console START.
C041*	ISAM file: sequential processing	Index buffer is not on even-word boundary.	Terminate the job.	All off. Press console START.
C042*	ISAM file: sequential processing	Prime data buffer is not on even-word boundary.	Terminate the job.	All off. Press console START.
C043	ISAM file: sequential processing	Key length for this job is not same as key length in file.	Terminate the job.	All off. Press console START.

Figure B-5 (Part 3 of 5). RPG Object Program error messages

ACCUMULATOR display	Type of processing	Meaning	Your response	Console entry switch settings
C044	ISAM file: sequential processing	Record length for this job is not same as record length in file.	Terminate the job.	All off. Press console START.
C045*	ISAM file: sequential processing	File accessed when not open.	Terminate the job.	All off. Press console START.
C046	ISAM file: sequential processing	Write before read requested on update file.	One of the following:	
			Terminate the job.	All off. Press console START.
			Bypass the record and continue processing.	15 on, all others off. Press console START.
C050*	ISAM file: random processing	Invalid type of processing on retrieve or update function.	Terminate the job.	All off. Press console START.
C051*	ISAM file: random processing	Index buffer is not on even-word boundary.	Terminate the job.	All off. Press console START.
C052*	ISAM file: random processing	Prime data buffer is not on even-word boundary.	Terminate the job.	All off. Press console START.
C053	ISAM file: random processing	Key length for this job is not same as key length in file.	Terminate the job.	All off. Press console START.
C054	ISAM file: random processing	Record length for this job is not same as record length in file.	Terminate the job.	All off. Press console START.
C055*	ISAM file: random processing	File accessed when not open.	Terminate the job.	All off. Press console START.
C056	ISAM file: random processing	Write before read requested on update.	One of the following:	
			Terminate the job.	All off. Press console START.
			Bypass the record and continue processing.	15 on, all others off. Press console START.
C057	ISAM file: random processing	Record not on file.	One of the following:	
			Terminate the job.	All off. Press console START.
			Bypass the record and continue processing.	15 on, all others off. Press console START.
C111		Numeric records or matching fields out of sequence, or record is an undefined type.	One of the following:	
			Terminate the job.	All off. Press console START.
			Bypass the record and continue processing.	15 on, all others off. Press console START.

Figure B-5 (Part 4 of 5). RPG Object Program error messages

ACCUMULATOR display	Type of processing	Meaning	Your response	Console entry switch settings
C12n		Halt switch set by object program (n = 1-9)	One of the following:	
			Terminate the job.	All off. Press console START.
			Set the halt switches off and continue processing.	15 on, all others off. Press console START.
C400		Write before read requested on combined file.	One of the following:	
			Terminate the job.	All off. Press console START.
			Bypass the record and continue processing.	15 on, all others off. Press console START.
C430		Attempt to divide by zero.	One of the following:	
			Terminate the job.	All off. Press console START.
			Continue processing. The quotient will be set to zero.	15 on, all others off. Press console START.
C450		Results of multiply over 14 positions.	One of the following:	
			Terminate the job.	All off. Press console START.
			Continue processing. The result is set to zero.	15 on, all others off. Press console START.
C500		Monitor control card is read while punching on the 1442 Reader/Punch.	One of the following:	
			Terminate the job.	All off. Press console START.
			Bypass the record and continue processing.	15 on, all others off. Press console START.
C998		Table fields are out of sequence.	Terminate the job.	All off. Press console START.

Figure B-5 (Part 5 of 5). RPG Object Program error messages

Appendix C. Monitor System Library Listing

System library programs	Names	Type and subtype	Subroutines required	ID field (73–75)
MAINLINES				
Disk Maintenance Programs				
Disk initialization	DISC	2, None	SYSUP, RDREC, DISKZ	U6C
Print cartridge ID	IDENT	2, None	CALPR, DISKZ	U6F
Change cartridge ID	ID	2, None	RDREC, CALPR, DISKZ	U6G
Disk copy	COPY	2, None	RDREC, DISKZ	U6B
Write sector addresses in WS	ADRWS (cannot be called)	2, None	Linked from DUP DWADR	U6A
Delete CIB	DLCIB	2, None	RDREC, DISKZ	U6D
Dump system location Equivalence table	DSLET	2, None	FSLEN, DISKZ	U6E
Library maintenance	MODSF	2, None	DISKZ	U6I
System maintenance	MODIF	2, None	DISKZ	U6H
Disk data file conversion [1]	DFCNV	2, None	DISK1, ELD, FLD, NORM	W1L
Paper Tape Utility				
Keyboard or 1134 input and/or console printer or 1055 output	PTUTL	2, None	PAPHL, PAPPR, PAPT1, TYPE0	U6J
SUBROUTINES				
Utility Calls				
Selective dump on console printer	DMTD0, DMTX0	4, 0	WRTY0	U5B
Selective dump on 1132 printer	DMPD1, DMPX1	4, 0	PRNT1	U5C
Dump 80	DMP80	4, 0	None	U5A
Update DCOM	SYSUP	4, 0	FSLEN, FSYSU	U5E
Call system print	CALPR	4, 0	FSLEN	U7A
Read *ID record	RDREC	4, 0	FSLEN	U7C
Fetch phase IDs or fetch system subroutine	FSLEN, FSYSU	4, 0	DISKZ	U7B
Dummy log subroutine for SCA subroutines	IOLOG/CPLOG	4, 0	None	
Common FORTRAN Calls				
Test data entry switches	DATSW	4, 8	None	T3A
Divide check test	DVCHK	4, 8	None	T3B
Functional error test	FCTST	4, 8	None	T3C
Overflow test	OVERF	4, 8	None	T3E
Selective dump	PDUMP	4, 0	SFIO, SIOAI, SIOAF, SWRT, SCOMP	T3F
Sense light control and test	SLITE, SLITT	4, 8	None	T3G
FORTRAN trace stop	TSTOP	4, 8	TSET	T3H
FORTRAN trace start	TSTRT	4, 8	TSET	T3I
Integer transfer of sign	ISIGN	4, 8	None	T3D

[1] Not distributed to papertape users.

System library programs	Names	Type and subtype	Subroutines required	ID field (73-75)
Extended Arithmetic/Function Calls				
Extended precision hyperbolic tangent	ETANH, ETNH	4, 8	EEXP, EADD, EDIV, EGETP, ELD/ESTO	S2I
Extended precision A**B function	EAXB, EAXBX	4, 8	EEXP, ELN, EMPY	S2C
Extended precision natural logarithm	ELN, EALOG	4, 8	XMD, EADD, EMPY, EDIV, NORM, EGETP	S2E
Extended precision exponential	EEXP, EXPN	4, 8	XMD, FARC, EGETP	S2D
Extended precision square root	ESQR, ESQRT	4, 8	EADD, EMPY, EDIV, EGETP, ELD/ESTO	S2H
Extended precision sine-cosine	ESIN, ESINE, ECOS, ECOSN	4, 8	EADD, EMPY, NORM, XMD, EGETP	S2G
Extended precision arctangent	EATN, EATAN	4, 8	EADD, EMPY, EDIV, XMD, EGETP, NORM	S2B
Extended precision absolute value function	EABS, EAVL	4, 8	EGETP	S2A
FORTRAN Sign Transfer Calls				
Extended precision transfer of sign	ESIGN	4, 8	ESUB, ELD	S2F
Standard precision transfer of sign	FSIGN	4, 8	FSUB, FLD	R2F
Standard Arithmetic/Function Calls				
Standard precision hyperbolic tangent	FTANH, FTNH	4, 8	FEXP, FADD, FDIV, FGETP, FLD/FSTO	R2I
Standard precision A**B function	FAXB, FAXBX	4, 8	FEXP, FLN, FMPY	R2C
Standard precision natural logarithm	FLN, FALOG	4, 8	FSTO, XMDS, FADD, FMPY, FDIV, NORM, FGETP	R2E
Standard precision exponential	FEXP, FXPN	4, 8	XMDS, FARC, FGETP	R2D
Standard precision square root	FSQR, FSQRT	4, 8	FADD, FMPY, FDIV, FGETP, FLD/FSTO	R2H
Standard precision sine-cosine	FSIN, FSINE, FCOS, FCOSN	4, 8	FADD, FMPY, NORM, XMDS, FSTO, FGETP	R2G
Standard precision arctangent	FATN, FATAN	4, 8	FADD, FMPY, FDIV, XMDS, FSTO, FGETP	R2B
Standard precision absolute value function	FABS, FAVL	4, 8	FGETP	R2A
Common Arithmetic/Function Calls				
Fixed point (fractional) square root	XSQR	4, 8	None	T1C
Integer absolute function	IABS	4, 8	None	T1B
Floating binary/EBC decimal conversions	FBTD (BIN. TO DEC.), FDTB (DEC. TO BIN.)	4, 0	None	T1A

System library programs	Names	Type and subtype	Subroutines required	ID field (73-75)
Flipper for LOCAL/SOCAL Subprograms				
	FLIPR	4, 0	DISKZ, DISK1, or DISKN	U5D
FORTRAN Trace Subroutines				
Extended floating variable trace	SEAR, SEARX	3, 0	ESTO, TTEST, SWRT, SIOF, SCOMP	S2J
Fixed variable trace	SIAR, SIARX	3, 0	TTEST, SWRT, SIOI, SCOMP	T6B
Standard floating IF trace	SFIF	3, 0	FSTO, TTEST, SWRT, SIOF, SCOMP	R2K
Extended floating IF trace	SEIF	3, 0	FSTO, TTEST, SWRT, SIOF, SCOMP	S2K
Fixed IF trace	SIIF	3, 0	TTEST, SWRT, SIOI, SCOMP	T6C
Standard floating variable trace	SFAR, SFARX	3, 0	FSTO, TTEST, SWRT, SIOF, SCOMP	R2J
GO TO trace	SGOTO	3, 0	TTEST, SWRT, SIOI, SCOMP	T6A
Nondisk FORTRAN Format I/O				
FORTRAN format subroutine	SFIO, SIOI, SIOAI, SIOF, SIOAF, SIOFX, SCOMP, SWRT, SRED, SIOIX	3, 3	FLOAT, IFIX, ELD/ESTO or FLD/FSTO, PAUSE	T4C
FORTRAN Find Subroutines				
	SDFND	3, 1	DISKZ, DISK1, or DISKN	T4B
Disk FORTRAN I/O				
	SDFIO, SDRED, SDWRT, SDCOM, SDAF, SDF, SDI, SDIX, SDFX, SDAI	3, 1	DISKZ, DISK1, or DISKN, PAUSE	T4A
Unformatted FORTRAN Disk I/O				
	UFIO, URED, UWRT, UIOI, UIOF, UIOAI, UIOAF, UIOFX, UIOIX, UCOMP, BCKSP, EOF, REWND	3, 1	DISKZ, DISK1, or DISKN, PAUSE	T4D
FORTRAN Common LIBFs				
FORTRAN pause	PAUSE	3, 0	None	T2A
FORTRAN stop	STOP	3, 2	None	T2B
FORTRAN subscript displacement calculation	SUBSC	3, 0	None	T2D
FORTRAN subroutine initialization	SUBIN	3, 0	None	T2C
FORTRAN trace test and set	TTEST, TSET	3, 0	None	T2E

System library programs	Names	Type and subtype	Subroutines required	ID field (73-75)
FORTRAN I/O and Conversion Subroutines				
FORTRAN 1442 input/output subroutine	CARDZ	5, 3	HOLEZ, GETAD, EBCTB, HOLTB, ILS00, ILS04	T5A
FORTRAN 1442 output subroutine	PNCHZ	5, 3	HOLEZ, GETAD, EBCTB, HOLTB, ILS00, ILS04	T5G
FORTRAN 2501 input subroutine	READZ	5, 3	HOLEZ, GETAD, EBCTB, HOLTB, ILS04	T5J
Disk I/O routine (part of supervisor)	DISKZ	–	ILS02	---
FORTRAN paper tape subroutine	PAPTZ	5, 3	ILS04	T5F
FORTRAN 1132 printer subroutine	PRNTZ	5, 3	ILS01	T5H
Call to PRNTZ to call to PRNT2 conversion	PRTZ2	5, 3	PRNT2, ILS01	WIK
FORTRAN 1403 printer subroutine	PRNZ	5, 3	ILS04	T5I
FORTRAN keyboard-typewriter subroutine	TYPEZ	5, 3	GETAD, EBCTB, HOLEZ, ILS04	T5K
FORTRAN typewriter subroutine	WRTYZ	5, 3	GETAD, EBCTB, ILS04	T5L
FORTRAN 1627 plotter subroutine	PLOTX	5, 0	ILS03	V1L
FORTRAN hollerith to EBCDIC conversion	HOLEZ	3, 3	GETAD, EBCTB, HOLTB, PAUSE	T5D
FORTRAN get address routine	GETAD	3, 3	None	T5C
FORTRAN EBCDIC table	EBCTB	3, 3	None	T5B
FORTRAN hollerith table	HOLTB	3, 3	None	T5E
FORTRAN multiple terminal communications adapter (MTCA) call interface	MTCAZ	4, 0	MTCA0	W5C
Extended Arithmetic/Function LIBFs				
Extended precision get parameter subroutine	EGETP	3, 2	ELD	S1E
Extended precision A**I function	EAXI, EAXIX	3, 2	ELD/ESTO, EMPY, EDVR	S1B
Extended precision divide reverse	EDVR, EDVRX	3, 2	ELD/ESTO, EDIV	S1D
Extended precision float divide	EDIV, EDIVX	3, 2	XDD, FARC	S1C
Extended precision float multiply	EMPY, EMPYX	3, 2	XMD, FARC	S1G
Extended precision subtract reverse	ESBR, EXBRX	3, 2	EADD	S1H
Extended add-subtract	EADD, ESUB, EADDX, ESUBX	3, 2	FARC, NORM	S1A
Extended load-store	ELD, ELDX, ESTO, ESTOX	3, 0	None	S1F
Standard Arithmetic/Function LIBFs				
Standard precision get parameter subroutine	FGETP	3, 2	FLD	R1E
Standard precision A**I function	FAXI, FAXIX	3, 2	FLD/FSTO, FMPY, FLVR	R1B
Standard precision divide reverse	FDVR, FDVRX	3, 2	FLD/FSTO, FDIV	R1D
Standard precision float divide	FDIV, FDIVX	3, 2	FARC	R1C
Standard precision float multiply	FMPY, FMPYX	3, 2	XMDS, FARC	R1G
Standard precision subtract reverse	FSBR, FSBRX	3, 2	FADD	R1H
Standard add-subtract	FADD, FSUB, FADDX, FSUBX	3, 2	NORM, FARC	R1A
Standard load-store	FLD, FLDX, FSTO, FSTOX	3, 0	None	R1F
Standard precision fractional multiply	XMDS	3, 2	None	S3I

System library programs	Names	Type and subtype	Subroutines required	ID field (73-75)
Common Arithmetic/Function LIBFs				
Fixed point (fractional) double divide	XDD	3, 2	XMD	S3G
Fixed point (fractional) double multiply	XMD	3, 2	None	S3H
Sign reversal function	SNR	3, 2	None	S3F
Integer to floating point function	FLOAT	3, 0	NORM	S3C
Floating point to integer function	IFIX	3, 0	None	S3D
I**J integer function	FIXI, FIXIX	3, 2	None	S3B
Normalize subroutine	NORM	3, 0	None	S3E
Floating accumulator range check subroutine	FARC	3, 2	None	S3A
Interrupt Service Subroutines				
1442 card read punch input/output (no error parameter)	CARD0	5, 0	ILS00, ILS04	U2A
1442 card read punch input/output (error parameter)	CARD1	5, 0	ILS00, ILS04	U2B
2501 card read input (no error parameter)	READ0	5, 0	ILS04	U2L
2501 card read input (error parameter)	READ1	5, 0	ILS04	U2M
1442 card punch output (no error parameter)	PNCH0	5, 0	ILS00, ILS04	U2H
1442 card punch output (error parameter)	PNCH1	5, 0	ILS00, ILS04	U2I
Multiple sector disk input/output (part of supervisor)	DISK1	None	ILS02	---
High speed multiple sector disk input/output (part of supervisor)	DISKN	None	ILS02	---
Synchronous communications adapter (SCA) STR mode	SCAT1	5, 0	IOLOG/CPLOG, ILS01	W1F
SCA (BSC, point-to-point mode)	SCAT2	5, 0	IOLOG/CPLOG, ILS01	W1H
SCA (BSC, multipoint mode)	SCAT3	5, 0	IOLOG/CPLOG, ILS01	W1I
Paper tape input/output	PAPT1	5, 0	ILS04	U2D
Simultaneous paper tape input/output	PAPTN	5, 0	ILS04	U2E
Character/word count paper tape input/output	PAPTX	5, 0	ILS04	U2F
Plotter output subroutine	PLOT1	5, 0	ILS03	U2G
Plotter output subroutine	PLOTX	5, 0	ILS03	V1L
1132 printer output subroutine	PRNT1	5, 0	ILS01	U2J
1132-SCA print with overlap	PRNT2	5, 0	ILS01	W1E
1403 printer output subroutine	PRNT3	5, 0	ILS04	U2K
Keyboard/console printer input/output	TYPE0	5, 0	HOLL, PRTY, ILS04	U2N
Console printer output subroutine	WRTY0	5, 0	ILS04	U2O
1231 optical mark page reader input subroutine	OMPR1	5, 0	ILS04	U2C
MTCA base section	MTCA0	5, 0	ILS03, TSM41, TSTTY	W5B
MTCA 2741 terminal select	TSM41	4, 0	None	W5D
MTCA teletype select	TSTTY	4, 0	None	W5E

System library programs	Names	Type and subtype	Subroutines required	ID field (73–75)
Conversion Subroutines				
Binary word to 6 decimal characters (card code)	BINDC	3, 0	None	U4B
Binary word to 4 hexadecimal characters (card code)	BINHX	3, 0	None	U4C
6 decimal characters (card code) to binary word	DCBIN	3, 0	None	U4G
EBCDIC to console printer output code	EBPRT	3, 0	EBPA, PRTY	U3A
Card code to EBCDIC-EBCDIC to card code	HOLEB	3, 0	EBPA, HOLL	U3B
Card code to console printer output code	HOLPR	3, 0	HOLL, PRTY	U3C
4 hexadecimal characters (card code) to binary word	HXBIN	3, 0	None	U3D
PTTC/8 to EBCDIC–EBCDIC to PTTC/8	PAPEB	3, 0	EBPA	U3E
PTTC/8 to card code–card code to PTTC/8	PAPHL	3, 0	EBPA, HOLL	U3F
PTTC/8 to console printer output code	PAPPR	3, 0	EBPA, PRTY	U3G
Card code to EBCDIC–EBCDIC to card code	SPEED	3, 0	None	U3H
4 of 8 code to EBCDIC–EBCDIC to 4 of 8 code	EBC48	3, 0	HXCV, STRTB	W1A
4 of 8 code to IBM card code–IBM card code to 4 of 8 code	HOL48	3, 0	HXCV, HOLCA, STRTB	W1B
4 of 8 code to table of displacements	HXCV	3, 0	None	W1D
32-bit binary value to IBM card code decimal value	BIDEC	3, 0	None	U4A
IBM card code decimal value to 32-bit binary value	DECBI	3, 0	None	U4H
Supplement to all standard conversions except those involving PTTC/8	ZIPCO	3, 0	Any ZIPCO Conversion Table	U3I
MTCA code conversion	FEB41, BEB41, F41EB, B41EB, QEB41, Q41EB	4, 0	None	W5A
Conversion Tables				
EBCDIC and PTTC/8	EBPA	3, 0	None	U4K
Card code table	HOLL	3, 0	None	U4P
Console printer output code table	PRTY	3, 0	None	U4Q
Table of IBM card codes	HOLCA	3, 0	None	W1C
Table of 4 of 8 and EBCDIC codes	STRTB	3, 0	None	W1G
ZIPCO Conversion Tables				
EBCDIC to console printer code	EBCCP	4, 0	None	U4I
EBCDIC to IBM card code	EBHOL	4, 0	None	U4J
EBCDIC to 1403 printer code	EBPT3	4, 0	None	U4L
Console printer code to EBCDIC	CPEBC	4, 0	None	U4D
Console printer code to IBM card code	CPHOL	4, 0	None	U4E
Console printer code to 1403 printer code	CPPT3	4, 0	None	U4F
IBM card code to EBCDIC	HLEBC	4, 0	None	U4M
IBM card code to console printer code	HOLCP	4, 0	None	U4O
IBM card code to 1403 printer code	HLPT3	4, 0	None	U4N
1403 printer code to EBCDIC	PT3EB	4, 0	None	U4S
1403 printer code to console printer code	PT3CP	4, 0	None	U4R
1403 printer code to IBM card code	PTHOL	4, 0	None	U4T
Log Subroutine				
Dummy log subroutine called by SCAT1, SCAT2, SCAT3	IOLOG, CPLOG	4, 0	None	W1J

System library programs	Names	Type and subtype	Subroutines required	ID field (73-75)
Interrupt Level Subroutines				
Interrupt level zero subroutine	ILS00	7, 0	None	U1A
Interrupt level one subroutine	ILS01	7, 0	None	U1B
Interrupt level two subroutine (part of supervisor)	ILS02	7, 1	None	U1C
Interrupt level three subroutine	ILS03	7, 0	None	U1D
Interrupt level four subroutine (part of supervisor)	ILS04	7, 1	None	U1E
Special Interrupt Level Subroutines (restores index register 3)				
Interrupt level zero subroutine	ILSX0	7, 0	None	U1F
Interrupt level one subroutine	ILSX1	7, 0	None	U1G
Interrupt level two subroutine	ILSX2	7, 0	None	U1H
Interrupt level three subroutine	ILSX3	7, 0	None	U1I
Interrupt level four subroutine	ILSX4	7, 0	None	U1J
Standard Plot Calls				
Standard precision character	FCHAR	4, 0	FSIN, FCOS, FPLOT, FCHRX, FLD, FSTOX, FSTO	V1F
Standard precision scale	SCALF	4, 0	FRULE	V1O
Standard precision grid	FGRID	4, 0	FPLOT, POINT, FADD, FLD, FSTO, SNR	V1H
Standard precision plot	FPLOT	4, 0	FMOVE, XYPLT, PLOTI	V1I
Extended Plot Calls				
Extended precision character	ECHAR	4, 0	ESIN, ECOS, EPLOT, ECHRX, ELD, ESTO, ESTOX	V1A
Extended precision scale	SCALE	4, 0	ERULE	V1N
Extended precision grid	EGRID	4, 0	EPLOT, POINT, EADD, ELD, ESTO, SNR	V1C
Extended precision plot	EPLOT	4, 0	EMOVE, XYPLT, PLOTI	V1D
Common Plot Call				
Point characters	POINT	4, 0	PLOTI	V1M
Standard Plot LIBFs				
Standard precision annotation	FCHRX, FCHRI, WCHRI	3, 0	FLOAT, FMPY IFIX, FADD, FLDX, FINC, XYPLT, PLOTI, FSTOX, FLD	V1G
Standard precision plot scaler	FRULE, FMOVE, FINC	3, 0	FLDX, FSUEX, FMPYX, FLD, FSTOX, FMPY, IFIX, FADD	V1J

System library programs	Names	Type and subtype	Subroutines required	ID field (73-75)
Extended Plot LIBFs				
Extended precision annotation	ECHRX, ECHRI, VCHRI	3, 0	FLOAT, FMPY, IFIX, EADD, ELDX, EINC, XYPLT, PLOTI, ESTOX, ELD	V1B
Extended precision plot scaler	ERULE, EMOVE, EINC	3, 0	ELDX, ESUEX, EMPYX, ELD, ESTOX, EMPY, IFIX, EADD, ESTO	V1E
Common Plot LIBFs				
Pen mover	XYPLT	3, 2	PLOTI	V1P
Interface	PLOTI	3, 2	PLOTX	V1K
Interrupt service	PLOTX	5, 0	ILS03	V1L
Disk I/O				
Sequential access	SEQOP, SEQIO, SEQCL	3, 0	DISKZ	W3F
Direct access	DAOPN, DAIO, DACLS	3, 0	DISKZ	W3E
ISAM load	ISLDO, ISLD, ISLDC	3, 0	DISKZ	W3D
ISAM add	ISADO, ISAD, ISADC	3, 0	DISKZ	W3C
ISAM sequential	ISEQO, ISETL, ISEQ, ISEQC	3, 0	DISKZ	W3B
ISAM random	ISRDO, ISRD, ISRDC	3, 0	DISKZ	W3A
RPG Decimal Arithmetic				
Add, subtract, and numeric compare [1]	RGADD, RGSUB, RGNCP	3, 0	None	W2T
Multiply [1]	RGMLT	3, 0	RGBTD, RGDTB, RGERR	W2S
Divide [1]	RGDIV	3, 0	RGERR	W2R
Move remainder [1]	RGMVR	3, 0	RGBTD	W2Q
Binary conversion [1]	RGBTD, RGDTB	3, 0	None	W2P
RPG Sterling and Edit				
Sterling input conversion [1]	RGSTI	3, 0	RGBTD, RGDTB, RGMV1	W4B
Sterling output conversion [1]	RGSTO	3, 0	RGBTD, RGDTB, RGMV2	W4A
Edit [1]	RGEDT	3, 0	RGMV2, RGSI5	W2O
RPG Move				
From I/O buffer to core [1]	RGMV1, RGMV5	3, 0	None	W2N
From core to I/O buffer [1]	RGMV2	3, 0	None	W2M
MOVE operation [1]	RGMV3	3, 0	None	W2L
MOVEL operation [1]	RGMV4	3, 0	None	W2K
RPG Compare				
Alphameric [1]	RGCMP	3, 0	None	W2J

[1] Not distributed to paper tape users.

System library programs	Names	Type and subtype	Subroutines required	ID field (73-75)
RPG Indicators				
Test [1]	RGSI1	3, 0	None	W2I
Set resulting on [1]	RGSI2	3, 0	None	W2H
Set on, set off [1]	RGSI3, RGSI4	3, 0	None	W2G
Test for 0 or blank [1]	RGSI5	3, 0	None	W2E
RPG Miscellaneous				
Test zone [1]	RGTSZ	4, 0	None	W2D
Convert to binary [1]	RGCVB	3, 0	None	W2C
Object time error [1]	RGERR	4, 0	None	W2B
Blank after [1]	RGBLK	3, 0	None	W2A
Alternating sequence [1]	ALTSE	None		

[1] Not distributed to paper tape users.

Appendix D. LET/FLET

The location equivalence table (LET) contains the name and disk block count of all programs, including those in the System Library, and data files stored in the user area (UA). The fixed location equivalence table (FLET) contains the names of all programs and data files stored in the fixed area (FA).

Each cartridge has a LET. FLET is optional and is defined when you use the DEFINE FIXED AREA function of the Disk Utility Program (DUP).

LET/FLET DISK FORMAT

Each sector of LET or FLET contains a 5 word sector header. All entries in LET or FLET are 3 words long and consist of a name and disk block count.

sector header format

Word	*Entry*
1	Relative sector address for this cartridge only. The first sector of LET is relative sector address 0000, the second 0001, etc. The first sector of FLET is relative sector address 0010, the second 0011, etc.
2	Sector address of the UA (or sector address of FX if FLET)
3	Reserved
4	Number of words available in this LET/FLET sector
5	Sector address of the next LET/FLET sector on this cartridge. If this is the last FLET sector on this cartridge, word 5 is zero. If this is the last LET sector on this cartridge, word 5 contains the address of the first FLET sector.

LET/FLET entry format

1, bits 0–1	00–if DSF format (LET only) 10–if DCI format 11–if data format
1, bits 2–15 and 2	Program or data file name in name code
3	Disk block (DB) count of program or data file

Sometimes unused disk space occurs because data files and programs in core image format are stored on sector boundaries. Such spaces are represented by a 1DUMY entry in LET/FLET.

A 1DUMY entry is always inserted to precede a DDF or DCI entry when the last entry is in DSF format, even when the preceding program ends on a sector boundary. In the latter case, a 1DUMY entry with a DB count of zero (blank) is generated. This 1DUMY entry is made because a DELETE operation may call for a 1DUMY padding in the future and because under certain circumstances, room for a 1DUMY entry may not be available.

1DUMY entry format

Word	*Entry*
1, bits 0–1	Reserved
1, bits 2–15 and word 2	Name code for 1DUMY
3	DB count of entry

The last entry of LET is a 1DUMY entry that reflects the current size of available working storage.

LET/FLET DUMP FORMAT

The DUP control records DUMPLET or DUMPFLET are used to dump LET and FLET, or FLET, respectively, to the principal printer. One sector of LET/FLET is printed per page. Each page is headed with the word LET or FLET, whichever is applicable. Each sector of LET/FLET dumped is preceded by 2 lines of header information. The first header line contains the contents of the following locations from COMMA/DCOM:

#CIDN–Cartridge ID, logical drive 0, 1, 2, 3, or 4
$FPAD–COMMA file protect address, logical drive 0, 1, 2, 3, or 4
#FPAD–DCOM file protect address, logical drive 0, 1, 2, 3, or 4
#CIBA–CIB address, logical drive 0, 1, 2, 3, or 4
#ULET–LET address, logical drive 0, 1, 2, 3, or 4
#FLET–FLET address, logical drive 0, 1, 2, 3, or 4

A second header line is printed that reflects information about the LET or FLET sector that is being dumped:

SCTR NO.–The relative sector number
UA/FXA–The actual sector address of the user area or fixed area
WORDS AVAIL–Available words in the sector
CHAIN ADR–Chain address to the next sector of LET or FLET

The LET/FLET entries for the sector are printed after the 2 header lines. Twenty-one lines of entries are printed, 5 entries per line, and sequenced by column. Each entry is formatted as follows:

PROG NAME–5 print positions plus a blank
FORMAT–DSF, DCI, or DDF: 3 print positions plus a blank, 4 blanks if 1DUMY or
secondary entry point
DB CNT–Disk block count, 4 print positions plus a blank
DB ADDR–Logical disk block address, 4 print positions plus 5 blanks

Only the name is printed for each secondary entry. Examples of DUMPLET and DUMPFLET follow:

```
// JOB

LOG DRIVE   CART SPEC   CART AVAIL   PHY DRIVE
  0000        4444        4444         0003
                          1124         0004

V2 M10   ACTUAL 32K  CONFIG 32K

// DUP

*DEFINE FIXED AREA           5
CART ID 4444  CYLS FXA  0004  DBS AVAIL 0200  FLET SECTOR ADDR  01E8

*STOREDATA  CD  FX  DATA    10
CART ID 4444   DB ADDR  1F00   DB CNT   0020

*STOREDATACICD  FX  CIMGE   18
CART ID 4444   DB ADDR  1F20   DB CNT   0030

*STOREDATA  CD  UA  DATA2   10
CART ID 4444   DB ADDR  2E30   DB CNT   0020

*DUMPLET
                                    LET




*CIDN   $FPAD   *FPAD   *CIBA   *ULET   *FLET
4444    02E5    02E5    0210    0220    01E8

SCTR NO.  UA/FXA.   WORDS AVAIL.  CHAIN ADDR.
0000      0228          0000         0221


PROG  FOR DB   DB       PROG  FOR DB   DB       PROG  FOR DB   DB       PROG  FOR DB   DB       PROG  FOR DB   DB
NAME  MAT CNT  ADDR     NAME  MAT CNT  ADDR     NAME  MAT CNT  ADDR     NAME  MAT CNT  ADDR     NAME  MAT CNT  ADDR

FADD  DSF 0008 2280     FATN  DSF 000A 22AA     ESUB                    EATAN                   FIXIX
FSUB                    FATAN                   EADDX                   EAXB  DSF 0005 231D     FLOAT DSF 0002 235E
FADDX                   FAXB  DSF 0005 22B4     ESUBX                   EAXBX                   IFIX  DSF 0004 2360
FSUBX                   FAXBX                   EAXI  DSF 0007 22F2     EEXP  DSF 000A 2322     NORM  DSF 0004 2364
FAXI  DSF 0006 2288     FEXP  DSF 0009 22B9     EAXIX                   EXPN                    SNR   DSF 0002 2368
FAXIX                   FXPN                    EDIV  DSF 0006 22F9     ELN   DSF 000B 232C     XDD   DSF 0006 236A
FDIV  DSF 0007 228E     FLN   DSF 000A 22C2     EDIVX                   EALOG                   XMD   DSF 0005 2370
FDIVX                   FALOG                   EDVR  DSF 0003 22FF     ESIGN DSF 0003 2337     XMDS  DSF 0003 2375
FDVR  DSF 0003 2295     FSIGN DSF 0003 22CC     EDVRX                   ESINE DSF 000B 233A     FBTD  DSF 001B 2378
FDVRX                   FSIN  DSF 0009 22CF     EGETP DSF 0003 2302     ESIN                    FDTB
FGETP DSF 0003 2298     FSINE                   ELD   DSF 0004 2305     ECOSN                   IABS  DSF 0002 2393
FLD   DSF 0005 229B     FCOS                    ELDX                    ECOS                    XSQR  DSF 0004 2395
FLDX                    FCOSN                   ESTO                    ESQR  DSF 0006 2345     PAUSE DSF 0003 2399
FSTO                    FSQR  DSF 0006 22D8     ESTOX                   ESQRT                   STOP  DSF 0002 239C
FSTOX                   FSQRT                   EMPY  DSF 0004 2309     ETANH DSF 0004 234B     SUBIN DSF 0003 239E
FMPY  DSF 0005 22A0     FTANH DSF 0005 22DE     EMPYX                   ETNH                    SUBSC DSF 0003 23A1
FMPYX                   FTNH                    ESBR  DSF 0003 230D     SEAR  DSF 0004 234F     TTEST DSF 0002 23A4
FSBR  DSF 0003 22A5     SFAR  DSF 0004 22E3     ESBRX                   SEARX                   TSET
FSBRX                   SFARX                   EABS  DSF 0002 2310     SEIF  DSF 0003 2353     DATSW DSF 0003 23A6
FABS  DSF 0002 22A8     SFIF  DSF 0003 22E7     EAVL                    FARC  DSF 0003 2356     DVCHK DSF 0002 23A9
FAVL                    EADD  DSF 0008 22EA     EATN  DSF 000B 2312     FIXI  DSF 0005 2359     FCTST DSF 0003 23AB
```

```
*CIDN   SFPAD   *FPAD   *CIBA   *ULET   *FLET
4444    02E5    02E5    0210    0220    01E8

SCTR NO.  UA/FXA.   WORDS AVAIL.  CHAIN ADDR.
0001      0228          0000          0222


PROG  FOR DB   DB      PROG  FOR DB   DB      PROG  FOR DB   DB      PROG  FOR DB   DB      PROG  FOR DB   DB
NAME  MAT CNT  ADDR    NAME  MAT CNT  ADDR    NAME  MAT CNT  ADDR    NAME  MAT CNT  ADDR    NAME  MAT CNT  ADDR

ISIGN DSF 0003 23AE    SIOF                   EBCTB DSF 0005 2450    ILSX1 DSF 0003 24BA    HOLPR DSF 0007 25C1
OVERF DSF 0002 23B1    SIOAF                  GETAD DSF 0002 2455    ILSX2 DSF 0003 24BD    HXBIN DSF 0005 25C8
PDUMP DSF 0009 23B3    SIOFX                  HOLEZ DSF 0005 2457    ILSX3 DSF 0004 24C0    PAPEB DSF 0010 25CD
SLITE DSF 0006 23BC    SCOMP                  HOLTB DSF 0004 245C    ILSX4 DSF 0004 24C4    PAPHL DSF 0010 25DD
SLITT                  SWRT                   PAPTZ DSF 000F 2460    CARD0 DSF 0010 24C8    PAPPR DSF 000D 25ED
TSTOP DSF 0002 23C2    SRED                   PNCHZ DSF 0006 246F    CARD1 DSF 0011 24D8    SPEED DSF 0015 25FA
TSTRT DSF 0002 23C4    SIOIX                  PRNTZ DSF 000E 2475    OMPR1 DSF 0015 24E9    ZIPCO DSF 0008 260F
SDFIO DSF 0019 23C6    UFIO  DSF 001D 2427    PRNZ  DSF 000C 2483    PAPT1 DSF 000F 24FE    BIDEC DSF 0006 261A
SDAF                   URED                   READZ DSF 0005 248F    PAPTN DSF 0013 250D    BINDC DSF 0005 2620
SDAI                   UWRT                   TYPEZ DSF 0008 2494    PAPTX DSF 0015 2520    BINHX DSF 0004 2625
SDCOM                  UIOI                   WRTYZ DSF 0005 249C    PLOT1 DSF 000C 2535    CPEBC DSF 0009 2629
SDF                    UIOF                   SGOTO DSF 0003 24A1    PNCH0 DSF 000E 2541    CPHOL DSF 0009 2632
SDFX                   UIOAI                  SIAR  DSF 0004 24A4    PNCH1 DSF 000E 254F    CPPT3 DSF 0009 263B
SDI                    UIOAF                  SIARX                  PRNT1 DSF 001A 255D    DCBIN DSF 0006 2644
SDIX                   UIOFX                  SIIF  DSF 0003 24A8    PRNT3 DSF 0010 2577    DECBI DSF 0009 264A
SDRED                  UIOIX                  ILS00 DSF 0003 24AB    READ0 DSF 0007 2587    EBCCP DSF 0009 2653
SDWRT                  UCOMP                  ILS01 DSF 0003 24AE    READ1 DSF 0008 258E    EBHOL DSF 0009 265C
SDFND DSF 0006 23DF    BCKSP                  ILS02 DSF 0001 24B1    TYPE0 DSF 0012 2596    EBPA  DSF 0006 2665
SFIO  DSF 0042 23E5    EOF                    ILS03 DSF 0003 24B2    WRTY0 DSF 0009 25A8    EBPT3 DSF 0009 266B
SIOI                   REWND                  ILS04 DSF 0002 24B5    EBPRT DSF 0007 25B1    HLEBC DSF 0009 2674
SIOAI                  CARDZ DSF 000C 2444    ILSX0 DSF 0003 24B7    HOLEB DSF 0009 25B8    HLPT3 DSF 0009 267D

*CIDN   SFPAD   *FPAD   *CIBA   *ULET   *FLET
4444    02E5    02E5    0210    0220    01E8

SCTR NO.  UA/FXA.   WORDS AVAIL.  CHAIN ADDR.
0002      0228          0000          0223


PROG  FOR DB   DB      PROG  FOR DB   DB      PROG  FOR DB   DB      PROG  FOR DB   DB      PROG  FOR DB   DB
NAME  MAT CNT  ADDR    NAME  MAT CNT  ADDR    NAME  MAT CNT  ADDR    NAME  MAT CNT  ADDR    NAME  MAT CNT  ADDR

HOLCP DSF 0009 2686    MODSF DSF 006C 288B    FRULE DSF 0009 29A5    PRTZ2 DSF 0006 2B25    RGDIV DSF 002E 2C3C
HOLL  DSF 0006 268F    PTUTL DSF 000A 28F7    FMOVE                  DFCNV DSF 009F 2B2B    RGMLT DSF 0010 2C6A
PRTY  DSF 0006 2695    CALPR DSF 0007 2901    FINC                   RGBLK DSF 0005 2BCA    RGADD DSF 001A 2C7A
PT3CP DSF 0009 269B    FSLEN DSF 0008 2908    PLOTI DSF 0003 29AE    RGERR DSF 0005 2BCF    RGSUB
PT3EB DSF 0009 26A4    FSYSU                  PLOTS                  RGCVB DSF 0006 2BD4    RGNCP
PTHOL DSF 0009 26AD    RDREC DSF 0015 2913    PLOTX DSF 0009 29B1    RGTSZ DSF 0005 2BDA    ISRD0 DSF 001C 2C94
DMP80 DSF 0007 26B6    ECHAR DSF 0005 2928    POINT DSF 0008 29BA    RGSI5 DSF 0006 2BDF    ISRD
DMTD0 DSF 001A 26BD    ECHRX DSF 0028 292D    SCALE DSF 0002 29C2    RGSI3 DSF 0004 2BE5    ISRDC
DMTX0                  ECHRI                  SCALF DSF 0002 29C4    RGSI4                  ISEQ0 DSF 002A 2CB0
DMPD1 DSF 001E 26D7    VCHRI                  XYPLT DSF 0007 29C6    RGSI2 DSF 0006 2BE9    ISETL
DMPX1                  EGRID DSF 0008 2955    EBC48 DSF 000B 29CD    RGSI1 DSF 0005 2BEF    ISEQ
FLIPR DSF 0007 26F5    EPLOT DSF 0005 295D    HOL48 DSF 0008 29D8    RGCMP DSF 0006 2BF4    ISEQC
SYSUP DSF 003A 26FC    ERULE DSF 000A 2962    HOLCA DSF 0006 29E0    RGMV4 DSF 0006 2BFA    ISAD0 DSF 003E 2CDA
ADRWS DSF 0010 2736    EMOVE                  HXCV  DSF 0004 29E6    RGMV3 DSF 0004 2C00    ISAD
COPY  DSF 0022 2746    EINC                   PRNT2 DSF 001F 29EA    RGMV2 DSF 000B 2C04    ISADC
DISC  DSF 0036 2768    FCHAR DSF 0005 296C    SCAT1 DSF 004A 2A09    RGMV1 DSF 000A 2C0F    ISLD0 DSF 0026 2D18
DLCIB DSF 001F 279E    FCHRX DSF 0028 2971    STRTB DSF 0006 2A53    RGMV5                  ISLD
DSLET DSF 0045 27BD    FCHRI                  SCAT2 DSF 0069 2A59    RGEDT DSF 0013 2C19    ISLDC
IDENT DSF 000C 2802    WCHRI                  SCAT3 DSF 0061 2AC2    RGDTB DSF 0008 2C2C    DAOPN DSF 000F 2D3E
ID    DSF 001A 280E    FGRID DSF 0008 2999    IOLOG DSF 0002 2B23    RGBTD                  DAIO
MODIF DSF 0063 2828    FPLOT DSF 0004 29A1    CPLOG                  RGMVR DSF 0008 2C34    DACLS
```

```
*CIDN   $FPAD   *FPAD   *CIBA   *ULET   *FLET
4444    02E5    02E5    0210    0220    01E8

SCTR NO.  UA/FXA.   WORDS AVAIL.  CHAIN ADDR.
0003       0228           0105          01E8


 PROG  FOR DB   DB         PROG  FOR DB   DB         PROG  FOR DB   DB         PROG  FOR DB   DB         PROG  FOR DB   DB
 NAME  MAT CNT  ADDR       NAME  MAT CNT  ADDR       NAME  MAT CNT  ADDR       NAME  MAT CNT  ADDR       NAME  MAT CNT  ADDR

 SEQOP DSF 001C 2D4D
 SEQIO
 SEQCL
 RGSTO DSF 001A 2D69
 RGSTI DSF 000F 2D83
 FEB41 DSF 0024 2D92
 BEB41
 F41EB
 B41EB
 QEB41
 Q41EB
 MTCA0 DSF 0023 2DB6
 MTCA2 DSF 000E 2DD9
 TSM41 DSF 003A 2DE7
 TSTTY DSF 0008 2E21
 1DUMY      0004 2E2C
 DATA2 DDF 0020 2E30
 1DUMY      3580 2E50
                                  FLET



*CIDN   $FPAD   *FPAD   *CIBA   *ULET   *FLET
4444    02E5    02E5    0210    0220    01E8

SCTR NO.  UA/FXA.   WORDS AVAIL.  CHAIN ADDR.
0010       01F0           0132          0000


 PROG  FOR DB   DB         PROG  FOR DB   DB         PROG  FOR DB   DB         PROG  FOR DB   DB         PROG  FOR DB   DB
 NAME  MAT CNT  ADDR       NAME  MAT CNT  ADDR       NAME  MAT CNT  ADDR       NAME  MAT CNT  ADDR       NAME  MAT CNT  ADDR

 DATA  DDF 0020 1F00
 CIMGE DCI 0030 1F20
 1DUMY     0180 1F50

 END OF DUMPLET/FLET
```

```
*DUMPFLET

                                        FLET



*CIDN   $FPAD   *FPAD   *CIBA   *ULET   *FLET
4444    02E5    02E5    0210    0220    01E8

SCTR NO.  UA/FXA.   WORDS AVAIL.  CHAIN ADDR.
0010      01F0          0132          0000


 PROG  FOR DB   DB         PROG  FOR DB   DB         PROG  FOR DB   DB         PROG  FOR DB   DB         PROG  FOR DB   DB
 NAME  MAT CNT  ADDR       NAME  MAT CNT  ADDR       NAME  MAT CNT  ADDR       NAME  MAT CNT  ADDR       NAME  MAT CNT  ADDR

 DATA  DDF 0020 1F00
 CIMGE DCI 0030 1F20
 1DUMY     0180 1F50

 END OF DUMPFLET
```

Appendix E. System Location Equivalence Table (SLET)

The addresses listed in the following SLET printout are subject to change. Only the symbols and phase IDs remain constant.

```
                                    SYSTEM LOCATION EQUIVALENCE TABLE (SLET)

SYMBOL  PH  CORE  WORD   SCTR     SYMBOL  PH  CORE  WORD   SCTR     SYMBOL  PH  CORE  WORD   SCTR     SYMBOL  PH  CORE  WORD   SCTR
        ID  ADDR  COUNT  ADDR             ID  ADDR  COUNT  ADDR             ID  ADDR  COUNT  ADDR             ID  ADDR  COUNT  ADDR
*****   **  ****  ****   ****     *****   **  ****  ****   ****     *****   **  ****  ****   ****     *****   **  ****  ****   ****

'DDUP   01  7C50  032F   0808     'DCTL   02  11DE  05A2   000B     'STOR   03  21DE  05A2   0010     'FILQ   04  01DE  03C0   0015
'DUMP   05  41DE  054B   0018     'DL/F   06  01DE  03C0   001D     'DLTE   07  01DE  05A2   0020     'DFNE   08  01DE  05A2   0025
'EXIT   09  01DE  0500   002A     'CFCE   0A  7A06  00DE   002E     'DU11   0B  7A06  0035   002F     'DU12   0C  7A06  00D8   0030
'DU13   0D  7782  087C   0031     'DU14   0E  7A06  0248   0038     'DU15   0F  7A06  0248   003A     'DU16   10  7A06  0248   003C
'PRCI   11  01DE  0280   003E     'DU18   12  0E6E  0140   0040     'FR01   1F  760C  09F1   0041     'FR02   20  7A34  0500   0049
'FR03   21  7A34  0280   004D     'FR04   22  7A34  03C0   004F     'FR05   23  7A34  0500   0052     'FR06   24  7A34  03C0   0056
'FR07   25  7A34  0280   0059     'FR08   26  7A34  0500   005B     'FR09   27  7A34  03F0   005F     'FR10   28  7A34  03C0   0063
'FR11   29  7A34  03C0   0066     'FR12   2A  7A34  03C0   0069     'FR13   2B  7A34  03C0   006C     'FR14   2C  7A34  0500   006F
'FR15   2D  7A34  0500   0073     'FR16   2E  7A34  0500   0077     'FR17   2F  7A34  0500   007B     'FR18   30  7A34  0500   007F
'FR19   31  7A34  0404   0083     'FR20   32  7A34  03C0   0087     'FR21   33  7A34  03C0   008A     'FR22   34  7A34  0280   008D
'FR23   35  7A34  03C0   008F     'FR24   36  7A34  03C0   0092     'FR25   37  7A34  0500   0095     'FR26   38  7B8E  03C0   0099
'FR27   39  766E  0140   009C     'SUP1   6E  04FE  02FE   009D     'SUP2   6F  07FE  052B   00A0     'SUP3   70  07FE  0280   00A5
'SUP4   71  07FE  0280   00A7     'SUP5   72  07FE  03EA   00A9     'SUP6   73  0506  04F8   00AD     'SUP7   74  0400  0189   00B1
'CLB1   78  01E0  0782   00B3     'CLB2   79  05BC  04E2   00BA     'CLB3   7A  08B6  01E8   00BE     'CLB4   7B  08B6  01E8   00C0
'CLB5   7C  08B6  01E8   00C2     'CLB6   7D  08B6  01E8   00C4     'CLB7   7E  0AA0  0140   00C6     'CLB8   7F  0AA0  0140   00C7
'CLB9   80  0AA0  0140   00C8     'CLBA   81  0AA0  0140   00C9     'CLBB   82  0BE2  0140   00CA     'CLBC   83  08B6  01E8   00CB
'CLBD   84  0AA0  0140   00CD     '1403   8C  0000  0132   80CE     '1132   8D  0000  0113   00CF     'CPTR   8E  0000  011B   00D0
'2501   8F  0000  009C   00D1     '1442   90  0000  00AB   00D2     '1134   91  0000  016C   00D3     'KBCP   92  0000  0174   00D5
'CDCV   93  0000  00B9   00D7     'PTCV   94  0000  0003   00D8     'KBCV   95  0000  0003   0CD9     'DZID   96  00F0  00EC   00DA
'D1ID   97  00F0  01A2   00DB     'DNID   98  00F0  02B0   00DD     'PPRT   99  0000  0113   00CF     'PIWK   9A  0000  009C   00D1
'PIXK   9B  0000  009C   00D1     'PCWK   9C  0000  00B9   00D7     'PCXK   9D  0000  00B9   00D7     'CIL1   A0  0000  0170   00E0
'CIL2   A1  0000  01C0   00E2     'RG00   B0  0212  094E   00E4     'RG02   B1  0906  0893   00EC     'RG04   B2  0906  07B3   00F3
'RG06   B3  0906  076B   00FA     'RG08   B4  0906  08C2   0100     'RG10   B5  04A6  0811   0108     'RG12   B6  073A  0867   010F
'RG14   B7  073A  06D4   0116     'RG16   B8  0762  048E   011C     'RG17   B9  0762  06E3   0120     'RG19   BA  073A  0932   0126
'RG20   BB  073A  05C8   012E     'RG21   BC  073A  06DF   0133     'RG22   BD  0782  02AE   0139     'RG24   BE  0782  06B9   013C
'RG26   BF  0782  022E   0142     'RG28   C0  0782  0491   0144     'RG32   C1  0782  06C7   0148     'RG34   C2  0782  046C   014E
'RG36   C3  0782  025F   0152     'RG38   C4  0782  050C   0154     'RG40   C5  0782  0576   0159     'RG42   C6  0782  03A5   015E
'RG44   C7  0782  05F3   0161     'RG46   C8  0782  04E9   0166     'RG52   C9  073A  03AC   016A     'RG54   CA  073A  0667   016D
'RG58   CB  073A  05FD   0173     'RG60   CC  073A  039D   0178     'DCL2   CD  11DE  0280   017B     'DMUP   CE  01DE  11DF   017D
'AS00   CF  01E0  026B   018C     'ACNV   D0  01E8  00BB   018E     'AS10   D1  01E8  0060   018F     'AS11   D2  01E8  0050   0190
'AS12   D3  027E  0189   0191     'AERM   D4  0AC8  013E   0193     'AS01   D5  027E  01D8   0194     'AS1A   D6  027E  0115   0196
'ASYM   D7  0000  0130   0197     'AS03   D8  07A6  0250   0198     'AS04   D9  027E  01D7   019A     'AS02   DA  027E  01A2   019C
'AS2A   DB  0280  00A6   019E     'AS09   DC  0456  059E   019F     'AS05   DD  027E  01C4   01A4     'AS06   DE  027E  01D8   01A6
'AS07   DF  027E  017E   01A8     'AS7A   E0  0280  0127   01AA     'AS08   E1  027E  0198   01AB     'AS8A   E2  027E  01B5   01AD
'APCV   E3  027E  0099   01AF     'AINT   E4  0980  0058   01B0     'ASAA   E5  0980  0063   01B1     'ASGR   E6  0EBC  03C1   01B2
'ADIV   E7  027E  00B8   01B6     'AMCC   E8  027E  018A   01B7     'AM01   E9  027E  01D6   01B9     'AM1A   EA  027E  01D8   01BB
'AM1B   EB  027E  01D8   01BD     'AM02   EC  027E  01D6   01BF     'AM2A   ED  027E  01D6   01C1     'AM2B   EE  05DA  015A   01C3
'AM03   EF  07AA  0051   01C5     'AM3A   F0  027E  01B3   01C6     'AM3B   F1  12E6  0285   01C8     'AX01   F2  027E  01C9   01CB
'AX2A   F3  07A6  0054   01CD     'AX2B   F4  091C  005B   01CE     'AX2C   F5  0882  003D   01CF     'AX03   F6  0EBC  03BE   01D0
```

Appendix F. Core Dump

The following is a partial printout of a core dump:

```
ACCUMULATOR  4000      EXTENSION 0FAF     XR1  0000    XR2 0260     XR3  007F       OVERFLOW OFF        CARRY OFF

ADDR ***0 ***1 ***2 ***3 ***4 ***5 ***6 ***7 ***8 ***9 ***A ***B ***C ***D ***E ***F

0000 70FF FFFB 0000 0949 0FFA 0238 0080 0000 0327 01E4 0083 0091 00C4 0091 4000 0000 *...................U.....D.. ...*
0010 0000 0000 FFFF 0000 70FF 0000 0001 0000 D900 70FF 4000 0FAF 4C00 0500 DC00 04FE *................R... ...........*
0020 C0FE 1890 4400 00F2 7400 00EE 70FD 70F4 038C 3000 4C80 0028 00E6 0248 0000 0000 *.......2.......4.........W......*
0030 0000 0000 0001 C000 0000 0000 0000 0002 7019 0000 1810 7017 0001 0004 FFFF 0000 *................................*
0040 D8D9 4023 282A 69D3 C480 003F D0D2 C8F4 4400 00F2 C0F1 7007 0000 0000 0000 0000 *QR ....LD....KH4...2.1..........*
0050 0000 C000 C0EB D0C2 6580 0039 C101 18D0 C100 6500 01DC D888 4008 C0FC 1890 4400 *.......B....A...A.....Q. .......*
0060 00F2 4003 4102 0000 0000 005D C0CB E8A9 4C20 0066 0803 4C80 0065 2000 0000 CC80 *.2 ........)..Y.................*
0070 0000 C000 0000 0000 0C00 0C00 FFFF 0000 006E 0001 0000 0000 0000 0000 0000 0000 *................................*
0080 0000 C000 3000 4C80 0081 0000 3000 4C80 0085 0000 3000 4C80 0089 0000 3000 4C80 *................................*
0090 008D 0000 3000 4CC0 0091 0530 0000 0000 0000 0000 0238 0000 0000 0000 0000 8800 *................................*
00A0 0CC0 C000 0000 C000 0658 0658 0658 0000 0000 0000 0000 0000 0000 0000 0000 0000 *................................*
00B0 0000 0000 0000 0066 6906 6A07 2807 D80A 4400 00F7 6500 01DC 6600 0260 2000 C802 *..............Q....7.......-..H.*
00C0 4CC0 C0B3 0001 0000 06CE D818 280E 690F 6A10 0816 1002 4C10 00DC 4480 002C FFFE *..........Q.....................*
00D0 6109 0810 1140 4580 054C 2000 6500 0003 6600 0000 C803 4CC0 00C4 4001 028C 0000 */.... ..............H....D .....*
00E0 020B 0F00 0000 0300 0C00 0F01 0000 08FC 4C40 00EA 4400 003F FFFE 0000 0011 0000 *................. ..............*
00F0 00EF FF6A 004A 7400 00EE 70FD 7002 0000 7018 690B 6A0C 1008 D03C 18D0 D05A 7054 *................................*
0100 4C00 01C5 690F 0822 6500 0000 6600 0260 C0EE 4C98 00F2 D003 1810 D0E9 4C00 00BA *...E...........-.....2.....Z....*
0110 1000 6500 0004 6600 00F2 0816 D0C6 4810 70E7 C80A D900 74FF 00EE 703A C80F C011 *.........2...F...XH.R.......H...*
0120 4293 7034 0001 0238 0FFA 0238 0C04 8D00 0004 8D00 0122 8E00 8C00 8F81 0E8A 0239 *................................*
0130 5002 5004 FEC0 0001 0080 0600 C008 5000 0FF8 0100 0701 0007 000A 009F FFFB 8E80 *&.&...........&..8..............*
0140 0400 0141 C000 FFFF 0C00 0C00 1810 D0A6 74FF 0032 1000 70B8 C8D7 D900 C0E1 70D0 *........................HPR.....*
0150 C0E6 4400 0028 7038 7401 0032 6211 6A96 6500 0004 C900 D8C8 D8D1 1810 1084 D00E *.W..................I.QHQJ......*
0160 80DC D01C 8008 D034 80D7 8C08 8007 D006 62FD 69BE C101 E0CC D101 940C 00A4 4828 *.........P..........A...J.......*
0170 7C07 C101 80C3 7401 016E 7201 70F5 D101 6600 00F2 C23D E249 D250 C400 009F EA4E *..A..C.......5J....2B.S.K&D....+*
0180 D23A EA43 D239 EA50 9247 D237 EA42 8247 D24D EA48 D23B CA3C 0A3A D2E8 4828 70BC *K...K..&..K.....K(..K.....K.....*
0190 1002 4828 708D 1002 4828 7010 C101 9400 009A 4818 701B 1893 180F 1002 EA3A 18D0 *............A...................*
01A0 4810 7002 F251 8230 DA34 420F CA38 DA34 420F C231 D480 0198 9101 4C18 01B6 74FF *....2.............B.M...........*
01B0 00EE 70E4 7401 00EE 4C00 0119 CA3C 4808 7011 8A40 DA3C 4830 1810 824F D100 CA36 *...U............... ........J...*
01C0 DA34 C101 EA50 D101 420F C24D D235 C247 4820 420F CA32 D900 C23C 4C08 0146 7500 *..A..&J...B(K.B.......R.B.......*
01D0 0140 C900 DA32 CA3C D900 7087 0000 0000 0000 0000 00A0 2222 0170 015C 0132 014A *. I.....R..................*....*
01E0 4C00 C000 7028 4C00 CC00 6232 081B D01A 1003 4810 7005 74FF 0032 1000 1810 D204 *..............................K.*
01F0 C011 1001 4810 7005 D204 0812 4804 7007 080D C008 100C 4810 70E6 D24E 70E4 C008 *........K................WK+.U..*
0200 425B 70F3 0000 AF01 0C00 AD00 0800 AC00 9000 AF00 FF00 D00A 694D 6A4E 684F 707E *.$.3.....................(.+,..=*
0210 18D0 C01F D05C D001 6780 0C00 1000 705D 7007 4063 6C00 0036 08E9 703B C0E9 42EC *.....*.........).. ......Z...Z..*
0220 623C 08E6 4804 70FA C2FA 4830 70FA C04A D600 0000 72FF 70FC 61C0 6600 0000 10A0 *...W....B.......O......./.......*
0230 C7C0 C000 1100 E0D6 4810 702B 1C02 4802 7001 7026 4808 720A 1002 180C D001 C600 *G......O......................F.*
0240 00C0 4802 1008 1808 1888 C0FA 9C2D 4810 7017 1090 1900 7100 7003 D0C8 7108 70DD *...........................H....*
0250 E8C5 D700 C000 73FF 70D7 4027 6C00 0036 08AB 6500 0C00 6600 0000 6700 0000 7080 *YEP......P .....................*
0260 C011 D01B 620D 10A0 C600 CC00 1888 1008 9014 4818 70DE 72FF 70F6 70D8 7001 C000 *........F................6......*
0270 0000 A900 7F7F 4040 000A 4C07 6204 D27C 6C00 0036 08F5 704C 4C00 0000 0889 4804 *......  .. ...K......5..........*
0280 7006 100D 4820 70FA 7401 0032 70F5 C080 44C0 0028 70F3 70CD D082 7082 6801 6600 *.............5.......3..........*
0290 0000 7600 FF77 6ADC 72FE 6A0B 7600 00EB 6A95 7213 6ACA 7600 FF89 6A8B 6AB3 7201 *................................*
02A0 6E00 C000 72A5 6A25 6A38 CC01 70E5 1000 0000 0000 C000 0000 0000 0000 0000 0000 *.............V..................*
02B0 0CC0 C000 C000 0000 0C00 0C00 0CC0 0000 C0C0 0000 0000 0000 00C0 0000 0000 0000 *................................*
02C0 0000 0000 0000 0000 0000 0000 0000 0000 6780 0000 C233 1890 A8A7 18D0 E81F D306 *....................B.......Y.L.*
02D0 1010 73FF 72FF 70F8 C307 F01B 4820 70C4 C09A D307 7301 70F8 6780 0000 C304 1888 *.......8C.0.......L....8....C...*
02E0 C303 1088 D303 C306 1888 C305 1088 C304 C88A DB05 7401 0037 C881 709D 00F0 7F7F *C...L.C...C...L.H.......H....0..*
02F0 6458 2519 261A 675B 681C 295D 2A5E 681F 2C20 7F49 7F40 0D01 0E02 4F43 1004 5145 *.......$...).,....... ..........*
0300 5246 13C7 5408 407F 7E4A 7C0B 614C 5015 6B16 4D57 6061 5B62 5C23 4E6C 486E 5D2F *...... .=.'./.&.,.(.-/$.*.+...).*
0310 1234 5678 D3F8 C2CD 4820 420D C201 1001 4828 701D 4802 7022 70C2 C2F9 009C 014D *....L8B.....B............BB9...(*
0320 4C00 06A9 7077 4C00 0C00 7C0C 4C40 0000 D835 2806 0835 C034 803B D032 0833 C82E *............. ..Q.............H.*
0330 2CC0 70F4 0829 1C02 4828 701B 10C1 4828 7036 1010 C400 0013 74FF 0032 1000 C022 *...4................M...........*
0340 DC01 6600 0000 C202 18D0 C201 9825 4818 18D0 4820 70D8 C203 4820 70D5 6C00 000F *......B...B..........QB....N....*
0350 70D2 C01C D00D D012 CC08 4804 7002 401E 7001 4028 080B 70C7 1401 1702 0000 0000 *.K............ ... ....G........*
0360 0CC0 11CC C000 1701 4E00 4F01 0000 0000 0001 1402 1000 1702 30CC 3000 4000 C0ED *........+................... ...*
0370 4804 70C7 D400 0033 70C4 4C00 0000 08F2 4804 7003 C0F0 D0E1 70F8 C0EC 4400 0028 *...GM....D.....2.....0...8......*
0380 70F6 4CC0 038E 08E0 4804 7C03 C0DE D0D5 70F8 C0E4 4400 0028 70F6 40F4 C0D5 D0D7 *.6.............N.8.U.....6 4.N.P*
0390 18D0 D0D4 D0CF 6CC0 0013 7401 0032 08CE 2000 7086 28FD D003 7400 0013 70FD 7002 *...M............................*
03A0 70EC 700C 70EA 40D2 C0C4 DCC1 C400 0033 4818 70E9 1010 D400 0033 70E9 40C7 C0AC *...... K.D.AD......Z..M....Z G..*
03B0 D086 18DC 8085 C0AC 70DD CCC0 C0C0 C000 0000 0000 0000 2542 0089 0153 4C00 C000 *................................*
03C0 282E 692A 6A28 D003 D023 6250 C600 0000 D028 1886 1807 1883 C024 610A E023 1140 *...........&F............./.... *
03D0 1C01 4818 7002 C020 7C12 691B C01A 1084 D008 D017 6808 C007 8016 D005 C012 1091 *................................*
03E0 6500 C000 C500 CC00 4802 1C08 1808 D600 0000 72FF 70DB 6500 0000 6600 0000 2000 *....E.........O.................*
03F0 70CD 0000 1FC0 001C 00EF 0C00 0000 40F9 F838 F0E9 E828 60D9 D818 D0A9 A868 50C9 *.............. 98.0ZY.-RQ.....&I*
0400 C808 C089 8848 6A99 9858 70B9 B878 F737 7F3F E727 6F2F D717 5F1F A767 AFEF C7C7 *H.............7...X...P.......G.*
0410 4F0F 8747 8FCF 9757 9FDF B777 BFFF F636 7E3E E626 6E2E D616 5E1E A666 AEEE C606 *..............6.=.W...O.......F.*
0420 4E0E 8646 8ECE 9656 9EDE B676 BEFE F535 7D3D E525 6D2D D515 5D1D A565 ADED C505 *+.............5.'.V...N.).....E.*
0430 4D0D 8545 8DCD 9555 9DCD B575 BDFD F434 7C3C E424 6C2C D414 5C1C A464 ACEC C404 *(.............4...U...M.*.....D.*
0440 4C0C 8444 8CCC 9454 9CDC B474 BCFC F333 7B3B E323 6B2B D313 5B1B A363 ABEB C303 *..............3...T.,.L.$.....C.*
0450 4B0B 8343 8BCB 9353 9BDB B373 BBFB F232 7A3A E222 E02A D212 5A1A A262 AAEA C202 *..............2...S...K.......B.*
0460 4A0A 8242 8ACA 9252 9ADA B272 BAFA F131 7939 6121 6929 D111 5919 A1E1 A020 C101 *..............1.../...J.......A.*
0470 4909 8141 8000 9151 9010 B171 B030 C0D8 0040 00D4 00D6 00C4 00C9 00C6 0000 0000 *...............Q. .M.O.D.I.F....*
0480 0CC0 C0C0 C000 C0C0 0000 CC00 00C0 0000 0000 720C 6A02 61F4 C5CC 0466 D500 0FBC *....................../4E...N...*
0490 7101 70FA 618C C014 D500 1000 7101 70FC 6580 0019 7101 70C7 61FC C50C 0451 D500 *..../...N.............../.E...N.*
04A0 0FBE 7101 70FA C005 D400 0C0F 4C00 0038 0040 FFFF 0C00 0000 00C0 000C 0000 C000 *........M........ ..............*
04B0 0C00 C000 0000 C0C0 0000 1000 C817 DC80 04D9 C01F 1890 4400 00F2 7400 00EE 70FD *............H....R.......2......*
04C0 C018 8400 054E D010 D012 D400 0009 6500 04CF 6D00 00D4 700F 0099 000C 0132 014A *.....+....P..........M..........*
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ADDR ***0 ***1 ***2 ***3 ***4 ***5 ***6 ***7 ***8 ***9 ***A ***B ***C ***D ***E ***F

04D0 0CC0 C000 C000 C000 CC00 0000 00C0 0000 0000 058A 058D 7200 7001 7038 C600 0550 *............................F..&*
04E0 D001 6500 0000 CCC0 0014 D828 1002 1802 1888 4018 0103 180A 1086 4014 1008 0020 *..........C....... .J..... .....*
04F0 1C02 1086 400F E81C 0104 C818 1084 1810 1086 4008 1008 D014 1002 1086 02FE 0119 *.... .Y.J.H........ ............*
0500 C4C0 C064 4C10 0508 4400 0039 221D 15C0 4C08 050E 4400 0039 0764 9540 616E 6000 *D.......................... /...*
0510 0078 1000 6500 054C 6000 CCD4 C841 6100 4022 C037 D400 0009 6500 057E C400 007C *..........MH./. ...M......=D...*
0520 4C20 C64C 6500 0582 4C00 064C C835 6101 4012 C029 801E D400 0008 4074 C01C 802C *............H./. .....M... .....*
0530 8018 1801 1001 C018 8014 D400 0688 C828 6102 4001 707E 053A 0D00 054A C500 054A *..........M...H./. ..=......E...*
0540 1890 4400 00F2 7400 00EE 7CFD 4C80 0538 0001 0003 01DE 031E 030C 000C 0000 C000 *.....2..........................*
0550 00C0 C1E4 0324 0324 0C00 0324 0099 0000 0132 014A 009A 0000 009C 014D 009C 0000 *...L......................(....*
0560 0089 C153 0070 07FE 0280 0121 0072 07FE 03EA 0125 0078 01E0 0782 012F 006F 07FE *................................*
0570 0528 C11C 0095 C000 CC03 0155 009D 0000 0089 0153 008E 0000 0118 014C 0092 0000 *................................*
0580 0174 0151 009B 0000 009C 014D 0071 07FE 0280 0123 0001 7C50 032F 0008 00CF 01E0 *...........(...........&........*
0590 0268 C171 001F 760C 09F1 0C41 0080 C000 0000 0000 0099 0000 0132 014A 0051 106A *.,........1.....................*
05A0 0CDF C09C 052E C0D9 9084 4C20 05AD C0D9 9084 4C20 0584 C09C 7008 C0D3 90AE 4C20 *.......R.......R...........L....*
05B0 0584 C400 0656 7001 1810 D400 007C 4C80 05A2 C400 000F 4C28 05C6 4C08 05C4 C400 *..D.......M.......D......F...DD.*
05C0 06DA 4400 06BA 7002 4400 069C 1010 D400 000F C03C D480 0685 6500 0F80 6208 C100 *..............M.....M........QA.*
05D0 1008 E901 D600 0FD8 7102 7201 70F8 C400 0FB2 1890 C400 0FB1 D827 9029 4C20 05E2 *..Z.O..Q......8D.....D...Q......S*
05E0 63F2 700E 6500 056E 62E5 63F3 C81D 9E00 0623 4C20 05F9 1090 4C20 05F9 721A 7007 *.2.......V.3H.........9.....9....*
05F0 7400 0071 7001 C400 0685 4400 068A 4F80 0630 7104 7202 7301 70E9 C400 0685 4400 *......JD....................ZD.....*
0600 06BA 6301 4400 06D1 0000 0C00 0028 405C 40D1 D6C2 40C5 D1C5 4007 C1E4 40C3 07D9 *.......J...... * JOB EJE PAU CPR*
0610 40E3 E8D7 40E3 C5D5 40E7 C5D8 40C4 E4D7 40C1 E2D4 40C6 D6D9 40D9 D7C7 40C3 C5D5 * TYP TEN XEQ DUP ASM FOR RPG CEN*
0620 40C3 D6C2 05C4 0666 063B 0644 0630 064C 064C 0657 065D 0663 0663 0663 0630 0663 * COB.D...............)..........*
0630 C902 DC00 0558 C820 4400 0CF2 7400 00EE 70FD 4C00 0516 4400 073D 7400 0036 70FD *I.....H....2.....................*
0640 1010 D480 0006 7080 7400 0032 70FD C00E 4400 0028 4C00 05C4 C902 DC00 055C C9F6 *..M.......................DI....*I6*
0650 0C00 0560 4C00 0526 0001 04FE FFFF C400 0035 4C18 0666 6302 4074 C400 0034 4C18 *...-..........D......... .D.....*
0660 0666 6303 406E 1810 D400 0034 C902 4C08 0686 D80E C101 D00E 6580 067A 62F2 C600 *.... ...M...I.....Q.A........2F.*
0670 0686 D600 0022 7201 70FA 4C00 0017 0000 0000 0000 0000 C8FC D900 C0FC 1890 4400 *..O.....................H.R......*
0680 00F2 7400 00EE 70FD 4000 0C02 C02D D400 0034 D400 0035 6306 4014 C0C8 D400 0018 *.2......(.....M...M...... ..HM...*
0690 7001 C000 4400 0039 0C00 0C00 6500 056A 70CD 0000 0000 0000 05C6 6100 1810 D500 *.........................F/...N.*
06A0 1000 7101 70FC C015 D480 0685 C80D 4400 0321 7400 0013 70FD C008 4480 0688 C400 *........M...H..................D.*
06B0 000F 4CA0 069C 70E9 7002 0FAF 7001 0000 03BF 0050 0000 D0F8 C400 057D 9400 0559 *........Z............&....D..'....*
06C0 4C18 C6C6 C480 0006 4420 073D C0ED 4400 01E1 C8EC 4400 01E1 7400 0036 70FD 4C80 *...FD..............H............*
06D0 06BA 0000 C700 06D6 40E5 4C00 05C4 06DD 06F0 06FE 0709 0724 0732 0012 D440 F1F1 *.....G..O V....D...0..........M 11*
06E0 40C9 D5E5 C1D3 C9C4 40D4 D6D5 C9E3 D6D9 40C3 D6D5 E3D9 D6D3 40D9 C5C3 D6D9 C440 * INVALID MONITOR CONTROL RECORD *
06F0 000D D440 F1F2 40C5 E7C5 C3E4 E3C9 D6D5 40E2 E4D7 D7D9 C5E2 E2C5 C440 000A D440 *..M 12 EXECUTION SUPPRESSED ..M *
0700 F1F3 40C4 E4D7 40E2 E4D7 D7D9 C5E2 E2C5 C440 001A D440 F1F4 40E2 E8E2 E3C5 D440 *13 DUP SUPPRESSED ..M 14 SYSTEM *
0710 D7D9 D6C7 D9C1 D440 C4C5 E3C5 C3E3 C5C4 40D4 D6D5 C9E3 D6D9 40C3 D6D5 E3D9 D6D3 *PROGRAM DETECTED MONITOR CONTROL*
0720 40D9 C5C3 D6D9 C440 000D D440 F1F5 40C9 D3D3 C5C7 C1D3 40C3 C1D9 E3D9 C9C4 C7C5 * RECORD ..M 15 ILLEGAL CARTRIDGE*
0730 40C9 C440 000A D440 F1F6 40D7 D9D6 C7D9 C1D4 40E5 D6C9 C4C5 C440 0000 C014 D015 * ID ..M 16 PROGRAM VOIDED ......*
0740 C011 1890 4400 00F2 7400 00EE 70FD C00C D00C C806 4400 01E1 4400 01E1 4C80 073D *.......2..........H.............*
0750 7C00 C755 0754 0007 000A 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 C000 *................................*
0760 0000 0E6C 0001 0E6C 0140 0001 0000 C0FE D005 C8FA DC00 0E6C C8F3 7002 0000 C8F2 *......... ........H.....H3....H2*
0770 4400 C0F2 7400 00EE 70FD 4C80 076E CC00 C200 902E 4C10 0795 693C 683C 63FB C200 *...2..............B.............B.*
0780 9C28 4C18 07CA 6500 079B C200 9022 4C18 07BE 9100 4C28 0795 9101 4C08 0791 7102 *...........B.......................*
0790 70F8 7201 7301 70EF 7016 6580 07B9 10A0 7401 0777 701D 001B 0000 002C 0001 0045 *.8...............................*
07A0 0008 C008 C008 0009 0007 CC07 C009 3F06 00F0 0040 003F 72F8 63F8 10A0 D821 C200 *................0. .........Q.B.*
07B0 E0F9 100A E81D 18DA 7201 7301 70F7 72FB 6500 0000 6700 0000 4C80 0777 C200 90E9 *.9..Y.........7..............B..Z*
07C0 4C20 C795 7201 7301 70F9 70E5 C200 90E1 4C20 0795 7201 7301 70F9 10AC 70E9 0000 *.........9.VB..............9...Z..*
07D0 0CC0 C000 C000 0000 0C00 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 C000 *................................*

07F0 0CC0 C000 C000 CCC0 0C00 CCC0 00C0 0000 0000 0000 C000 0000 00C0 000C 0280 0121 *................................*
0800 6170 6D00 0078 1000 61FB C500 0E96 9500 0E9B 4C18 0924 C500 0032 D400 0028 C400 */......./.E...........E...M...D.*
0810 08C9 1890 D400 08C6 4400 00F2 7400 00EE 70FD C400 002D 1004 D400 0889 9500 0E9B *.I..M..F...2......D.....M........*
0820 6600 FEC2 4C10 C843 6600 FEC5 C4C0 08B9 86C0 0E6E D400 08B9 9500 0E9B 4C10 0843 *...B.......ED.......M............*
0830 7203 70F4 C400 002B E400 0888 EC00 0D30 D400 002B C400 08C9 1890 440C 00F2 7400 *...4D...U.........M...D..I......2..*
0840 00EE 70FC 70E1 6301 C400 0C2B D700 088B 7203 701A C400 002B E400 08B8 EC00 0D30 *.........D...P.........D...U.......*
0850 D400 002B C400 08C9 1890 4400 00F2 7400 00EE 70FD 7301 C400 002B D700 08BB 6600 *M...D..I......2.........D...P......*
0860 FEC5 7400 08C6 700D CC54 8600 0E6E D051 9500 0E96 4C20 0848 7203 7003 C049 D056 *.E...F..........................*
0870 70D9 C4CC 0D30 C050 C600 0E6C 903F 4820 70F3 C600 0E6E D03E C5C0 0E96 D03C 7600 *.RD....&F..........3F.....E........*
0880 013E 1000 1810 D600 002E D600 002F D600 0D30 72FD 701D 62FB 1810 D600 0D31 7201 *.......O...O...O..............O.....*
0890 70FC CCC0 08C8 44C0 00F2 7400 00EE 70FD 73FF 1000 C700 08BB D4CC 002B C400 08C9 *......H...2...........G...M...D..I*
08A0 1890 4400 00F2 7400 00EE 70FD 6600 013B C011 8600 0D30 D00E C00E 9600 0D30 D008 *......2............................*
08B0 95C0 CE9B 4C18 08CB 70CD 0C00 7112 4528 F0C0 0000 0000 0000 0000 0000 0000 0000 *.................0...............*
08C0 0CC0 C0CC C000 CCC0 0C00 0C00 00C0 0140 0001 0D2A C002 6AF9 C0DA 90F7 D0F6 4C10 *............... ........9...7.6..*
08D0 08E0 C400 0D30 D400 002B CCF3 1890 4400 00F2 7400 00EE 70FD 6600 0139 6AE6 6203 *..D...M....3......2...........W..*
08E0 C0D9 D600 0D30 C0D2 D600 0C2F C0D0 D600 002F C0DA D400 0D30 C0D8 D400 002F C500 *.RO....KO.....C......M.....QM....E.*
08F0 CE9B D5C0 0E96 CCC0 08C8 4400 00F2 7400 00EE 70FD C500 0032 E088 4C08 0924 EC00 *..N.......H...2.......E...........*
0900 0E6D D4CC 002B C400 08C9 1890 4400 00F2 7400 00EE 70FD 62FB C5C0 0EAA 9600 0D68 *..M...D..I......2.........E........*
0910 4C18 C919 7201 70F8 D400 0C71 6305 4400 06D1 C600 0D59 D600 0D54 CC00 08C8 4400 *.......8M..........JF...O.......H..*
0920 00F2 7400 00EE 70FD 7101 7C01 7002 4C00 0805 4400 076E C400 0E8F 4C08 0038 61FD *.2......................D......../.*
0930 C400 C8CA D4C0 002B 7401 0C2B C400 08C9 1890 4400 00F2 7400 00EE 70FC 6600 FEC0 *D...M........D..I......2...........*
0940 C4C0 C566 9600 0E6C 4C18 094F 7204 70F8 7101 70EA D400 0071 6306 4400 06D1 6500 *D................8....M.........J..*
0950 0566 CEC0 0E6E C902 4C00 0666 0CC0 0000 00C0 0000 0C00 0000 0000 000C 0000 0000 *.......R...........................*
0960 0CC0 C0CC 0000 CCC0 CC00 CC00 0CC0 CCC0 C0C0 0000 C000 0000 00C0 0000 0000 C000 *................................*

0A80 C4C9 C9E5 C540 4040 C3C1 D9E3 40E2 D7C5 C340 4040 C3C1 D9E3 40C1 E5C1 C9D3 4040 *DRIVE    CART SPEC    CART AVAIL  *
0A90 D7C8 E840 C4D9 C9E5 C540 44C0 0C91 C0E4 1890 C600 0A2E 4400 0C03 C0AD 4C20 0AB5 *PHY DRIVE .....U..F..............*
0AA0 4400 0766 C400 0E76 4C20 0AA9 6204 4C00 0B87 D400 00E0 6600 FEC0 C600 0FAE D600 *.....D..............M........F....C.*
0AB0 0E6C 7201 70FA 44C0 0C45 62FB C6C0 0A33 D6C0 0EA5 7201 70FA 6680 0CF3 C500 0A28 *.............F....O...........3E...*
0AC0 72FC 7004 7204 1000 D600 0EA0 C400 0A46 1004 D400 0E8A 62FC 1810 D600 00A4 D600 *..........O....D......M........O....C.*
0AD0 009F D600 0E96 D600 0E9B D600 0EA0 D600 0EAA D600 0EAF D600 0E84 D600 0E89 D600 *..O....O....C....C....O....O....O....C.*
0AE0 0EBE C600 0EC3 C600 0EC8 D600 0ECD 7201 70E4 62F4 D600 00B3 7201 70FC 4400 096A *..O..CO..HC.......L.4O...........*
0AF0 4400 C73D 1010 C480 0006 C400 0685 4400 06BA 1010 D480 0006 C400 0A7C 4400 06BA *......M....C..........M....D.......*
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ACDR ***0 ***1 ***2 ***3 ***4 ***5 ***6 ***7 ***8 ***9 ***A ***B ***C ***D ***E ***F

0800 C400 CA7D 4400 0CAF 7101 1CC0 C500 0A28 4C18 0B3B 4001 7015 0A26 6600 0A5B 6E00 *D..'........E....... ........$..*
0810 0CAE 6200 C6C0 CA2E 4C28 0B80 4C08 0B1C 95C0 0A28 4C98 080C 7201 1C0C 7403 0CAE *....F...........................*
0820 70F1 4400 0C91 C001 1890 C6C0 0A2E 4400 0C03 C400 0CF2 100C 84C0 0E6C D4C0 0D2B *.1........F.......D..2......M...*
0830 C400 CA4A 1890 44C0 00F2 7400 00EE 70FD 44C0 0C45 70C5 61F5 C5CC 0A39 4C18 0B4A *D........2...........E/5E.......*
0840 6CC0 CCF3 7408 0CF3 1C00 D4C0 0CF4 1810 44C0 0CAF 7101 70F0 61FB C500 0EC3 D500 *...3...3..M..4.........0/.E..CN.*
0850 0032 C500 0EA0 D5C0 009A 7101 70F6 C400 0EAA D400 0005 C400 0A3B D400 0D2B C400 *..E...N......6D...M...D...M...D.*
0860 0A4A 189C 4400 C0F2 7400 0CEF 70FD CC00 0E36 DC00 C1DC 4009 74C1 09AC 4C80 09A0 *.......2.............. .........*
0870 00C0 CC00 0BFE 4CC0 00D5 0E6C C4C0 0BFC D400 002C C0F5 4C98 0875 440C 003F FFFE *.........N..D...M....5..........*
0880 807D 4C18 0886 907A D500 0A28 6201 C600 0BA2 8074 D40C 0D19 C5C0 0A28 4400 0CF5 *.'......N.....F.....M...E......5*
0890 C6C0 CBA2 4400 C6BA C068 D4C0 009F D400 0071 C866 DC00 00A4 C065 D400 00A6 40D5 *F.........M...M...H.......M... N*
08A0 6038 C0CC 7001 CBA7 0BBB 0BD3 0BEB 0013 E7E7 E7E7 40C9 E240 D5D6 E34C C1D5 40C1 *-..........L....XXXX IS NOT AN A*
08B0 E5C1 C9D3 C1C2 D3C5 40C3 C1D9 E3D9 C9C4 C7C5 40C9 C440 0017 E7E7 E7E7 40C9 E240 *VAILABLE CARTRIDGE ID ..XXXX IS *
08C0 C140 C4E4 D7D3 C9C3 C1E3 C5C4 40E2 D7C5 C3C9 C6C9 C5C4 40C3 C1D9 E3D9 C9C4 C7C5 *A DUPLICATED SPECIFIED CARTRIDGE*
08D0 40C9 C440 4040 0017 E7E7 E7E7 40C9 E240 C140 C4E4 D7D3 C9C3 C1E3 C5C4 40C1 E5C1 * ID   ..XXXX IS A DUPLICATED AVA*
08E0 C9D3 C1C2 D3C5 40C3 C1D9 E3D9 C9C4 C7C5 40C9 C440 4040 000F E7E7 E7E7 40C9 E240 *ILABLE CARTRIDGE ID   ..XXXX IS *
08F0 D5D6 E340 C140 E2E8 E2E3 C5D4 40C3 C1D9 E3D9 C9C4 C7C5 0870 00E6 8800 0001 CF01 *NOT A SYSTEM CARTRIDGE...W......*
0C00 0658 0658 0658 0A9D D83B 693C 6A3C C039 4C20 0C15 6205 C600 0A27 4C18 0C12 9030 *........Q.............F.........*
0C10 4418 CC2C 72FF 70F7 7021 620B C6C0 0A2D 4C18 0C1D 9025 4418 0C2C 72FF 70F7 7016 *.......7....F................7..*
0C20 0C1D 6A22 74FF 0C44 1000 C01D 901D 4C98 0C20 C017 4C20 0C31 6580 0C43 6202 4C00 *................................*
0C30 0887 6580 0C42 6203 4C00 0887 6580 0C42 6680 0C43 1810 D600 0A2E C802 4C80 0C03 *......................O...H.....*
0C40 2222 CA7D C000 C001 CC01 CC00 62FB C500 0A28 9600 0D68 4C18 0C51 7201 70F8 4C00 *...'..........E..............8..*
0C50 0886 7205 1000 693C C03B 1C0C D039 C600 0D4F D500 0E91 C600 0D54 D500 0E96 C600 *..............F...N...F...N...F.*
0C60 0D59 402E D500 0E9B C6C0 CC63 D5C0 0EA5 C6C0 0068 401F D500 0EAA C600 0D6D 401A *.. .N...F...N...F... .N...F... .*
0C70 D5C0 CEAF C600 CD72 D500 0EB4 C600 0D77 4011 D500 0EB9 C600 0D7C 400C D500 0EBE *N...F...N...F... .N...F... .N...*
0C80 C600 CD81 D500 0EC3 C600 0C86 D500 0EC8 4C80 0C45 C000 1004 1804 E802 4C80 0C8A *F...N..CF...N..H..........Y.....*
0C90 0CC0 CA97 695F 6A5F C6C0 CA2E D4C0 CCF4 C6C0 0A50 D500 009F 6580 0CAE 6600 C0A7 *........F...M..4F..&N...........*
0CA0 C100 C200 C101 C201 C102 D20? 7403 0C9F 6580 0CF2 6680 0CF3 4C80 0C91 0A5E 084A *A.K.A.K.A.K........2...3........*
0CB0 1890 C027 D066 62EA CC3C D6C0 0CF1 7201 70FC 1090 4C18 0CC6 7402 0D19 C033 4035 *..........C..1.........F...... .*
0CC0 7404 C019 C500 CA28 4030 7C0? 74CA 0D19 7404 0019 C029 4029 7404 0D19 C024 4025 *....E... ............. ....... .*
0CD0 C807 4400 01E1 7400 0036 7CFD 4C80 0CAF 7001 0CDA 0016 4040 4040 4040 4040 4040 *H.....................          *
0CE0 4040 4040 4040 4C40 4040 4C40 4040 4040 F0F0 F1F1 4040 4040 4040 4040 F0F0 F0F2 *                0011        0002*
0CF0 4040 4040 0000 0002 0011 0CD0 1890 6918 6A19 61FE 62FE D01C 1810 1084 9016 4808 *    ............../.............*
0D00 8015 8015 1008 7201 70F6 180B E811 D480 0D19 7401 0D19 1810 D00B 7101 70EB 65C0 *.........6..Y.M.................*
0D10 FFF7 6600 C000 4C80 0CF5 0009 0039 00C0 00C0 0CF0 0000 0000 0000 0000 0000 C000 *.7.......5.........C............*
0D20 0000 C0CC 0000 0000 0C00 0000 0000 0000 0000 0000 0140 0003 0001 7C5C 032F 0008 *..................... .....&....*
0D30 0C02 11DE 05A2 000B 0C03 21DF 05A2 0010 0004 01DE 03C0 0015 00C5 41DE 054B C018 *................................*
0D40 0006 C1DE 03C0 001D 0007 01DE 05A2 0020 0008 01DE 05A2 0025 0009 01DE 0500 002A *................................*
0D50 000A 7A06 00DE 002E 0C08 7A06 0035 002F 000C 7A06 00D8 0030 000D 7782 087C 0031 *........................Q.......*
0D60 0C0E 7A06 0248 0038 000F 7A06 0248 003A 0010 7A06 0248 003C 0011 01DE 0280 003E *................................*
0D70 0012 CE6E 0140 0040 001F 760C 09F1 0041 0020 7A34 0500 0049 0021 7A34 0280 004D *..... . .....1.................(*
0D80 0022 7A34 03C0 C04F 0023 7A34 05C0 0052 0024 7A34 03C0 0056 0025 7A34 0280 0059 *................................*
0D90 0026 7A34 0500 005B 0027 7A34 03F0 005F 0028 7A34 03C0 0063 0029 7A34 03C0 0066 *.......$.....0..................*
0DA0 002A 7A34 03C0 0069 002B 7A34 03C0 006C 002C 7A34 0500 006F 002D 7A34 0500 0073 *................................*
0DB0 002E 7A34 0500 0077 002F 7A34 0500 007B 0030 7A34 0500 007F 0031 7A34 0404 0083 *................................*
0DC0 0032 7A34 03C0 0087 C033 7A34 03C0 008A 0034 7A34 0280 008D 0035 7A34 03C0 008F *................................*
0DD0 0036 7A34 03C0 0092 0C37 7A34 05C0 0095 0038 788E 03C0 0099 0039 766E 0140 009C *............................. ..*
0DE0 0051 106A 0CDF 009D 0052 01DE 0CCA 00A8 0053 0282 04AC 0083 0054 0282 154B 0087 *................................*
0DF0 0055 0282 0E3B 00C9 0056 0282 13E9 00D5 0057 0282 0A68 00E5 0058 0282 19FD C0EE *.......I.....Z.N.......V........*
0E00 0059 C284 0525 0103 005A 0280 05C0 0108 005B 0282 06D4 010D 005C 0282 06F6 0113 *.................$...M...*...6..*
0E10 006E 04FE 02FE 0119 006F 07FE 052B 011C 0070 07FE 0280 0121 0071 07FE 0280 0123 *................................*
0E20 0072 07FE 03EA 0125 0073 0506 04F8 0129 0074 0400 0189 012D 0078 01E0 0782 012F *.............8..................*
0E30 0079 C58C 0403 0136 007A 0886 01E8 013A 007B 0886 01E8 013C 007C 0886 01E8 013E *.....L.......Y.......Y.......Y..*
0E40 007D 0886 01E8 0140 007E 0AA0 0140 0142 007F 0AA0 0140 0143 0080 0AA0 0140 0144 *.'...Y. .=... ....... ....... ..*
0E50 0081 0AA0 0140 0145 0082 08E2 0140 0146 0083 08B6 01E8 0147 0084 0AA0 0140 0149 *..... .....S. .......Y....... ..*
0E60 008C C000 0132 014A 008D 0000 0113 014B 008E 0000 011B 014C 0140 0001 0000 0000 *......................... ......*
0E70 0000 C000 0000 C0C0 0C00 CCC0 020B C000 00C0 0000 0C00 0000 0000 0000 0000 0001 *................................*
0E80 C000 C000 0000 C000 0C00 CC00 0000 0001 0001 010A 6C00 C000 C0C0 0000 0000 0000 *....................-...........*
0E90 0000 5300 0000 C000 0C00 CC00 5300 0000 00C0 0000 0C00 0530 00C0 0C0C 0000 0000 *................................*
0EA0 0000 2222 0011 C0C0 0C00 2222 0000 0000 00C0 0000 0238 0000 C0C0 0C0C 0000 01C8 *...............................H*
0EB0 0000 0000 0000 C000 0000 0000 0000 0000 0000 01D0 0000 0000 C000 0000 0248 0000 *................................*
0EC0 0000 0000 0000 C000 0C00 0C00 0000 0000 000F 0000 C000 0000 00C0 0000 0000 0000 *................................*
0ED0 0CC0 C000 0000 C000 0C00 0C00 0000 0000 0000 0000 C000 0000 0000 0000 0000 0000 *................................*

0FA0 0CC0 C000 0000 C0C0 0C00 CCC0 00C0 C000 00C0 0000 CC00 0000 00CC 0C0C 0000 0050 *...............................&*
0FB0 C000 C000 0000 C000 0C00 CC00 0000 0000 0000 0000 0000 0000 00C0 0000 0000 0000 *................................*

1FF0 0CC0 C0CC 0000 0000 0C00 0C00 0000 0000 0000 0000 CC00 0000 0000 000C 0000 2000 *................................*
2000 0CC0 C000 0000 00C0 0C00 0C00 0CC0 0000 0000 0000 C000 0000 00C0 0000 0000 C000 *................................*

3FF0 CCC0 C000 0000 C0C0 0C00 0C00 00C0 0C00 C0C0 0000 CC00 0000 00CC 0C0C C0C0 4000 *.............................. .*
```

Appendix G. Resident Monitor (Including Table of Equivalences)

The contents of this appendix are not to be construed as an external specification; that is, the locations in this listing may be changed. $PRET, $IREQ, $EXIT, $LINK, and $DUMP are the only locations that are guaranteed.

Note. In the following listing of the resident monitor, = is equivalent to #, and ' (apostrophe) is equivalent to @. The items noted in this listing identify locations discussed throughout the text of this publication.

```
// ASM
*LIST
*XREF

* RLTV ADDR* SYMBOL* DESCRIPTION                     PMN00010
*           *       *                               PMN00020
* 0-3       *       * RESERVED FOR EVEN BOUNDARIES  PMN00030
* 4-5       * =NAME * NAME OF PROGRAM/CORE LOAD     PMN00040
* 6         * =DBCT * BLOCK COUNT OF PROG/CORE LOAD PMN00050
* 7         * =FCNT * *FILES SWITCH--ZERO MEANS NO  PMN00060
*           *       * FILES HAVE BEEN EQUATED       PMN00070
* 8         * =SYSC * SYS/NON-SYS CARTRIDGE INDR    PMN00080
* 9         * =JBSW * JOBT SWITCH-- NON-ZERO MEANS  PMN00090
*           *       * TEMPORARY MODE                PMN00100
* 10        * =CBSW * CLB-RETURN-TO-DUP SWITCH--    PMN00110
*           *       * ZERO=CLB RETURN TO SUPV       PMN00120
* 11        * =LCNT * NO. OF LOCALS                 PMN00130
* 12        * =MPSW * CORE MAP SWITCH--ZERO MEANS   PMN00140
*           *       * DO NOT PRINT A CORE MAP       PMN00150
* 13        * =MDF1 * NO. DUP CTRL RECDS (MODIF)    PMN00160
* 14        * =MDF2 * ADDR OF MODIF BUFFER          PMN00170
* 15        * =NCNT * NO. OF NOCALS                 PMN00180
* 16        * =ENTY * RLTV ENTRY ADDR OF PROGRAM    PMN00190
* 17        * =RP67 * 1442-5 SW (0=1442-5 ON SYSTEM PMN00200
* 18        * =TODR * 'TO' WORKING STG DRIVE CODE   PMN00210
* 19        * =FRDR * 'FROM' WORKING STG DRIVE CODE PMN00220
* 20        * =FHOL * ADDR OF LARGEST HOLE IN FXA   PMN00230
* 21        * =FSZE * BLK CNT OF LARGEST HOLE IN FXA PMN00240
* 22        * =UHOL * ADDR OF LAST HOLE IN UA   2-10 PMN00250
* 23        * =USZE * BLK CNT OF LAST HOLE IN UA2-10 PMN00260
* 24        * =DCSW * DUP CALL SW--NON-ZERO=DUP CALL PMN00270
* 25        * =PIOD * PRINCIPAL I/O DEVICE INDICATOR PMN00280
* 26        * =PPTR * PRINC. PRINT DEVICE INDICATOR PMN00290
* 27        * =CIAD * RLTV ADDR IN 'STRT OF CIL ADDR PMN00300
* 2r        * =ACIN * AVAILABLE CARTRIDGE INDICAT2-2 PMN00310
* 29        * =GRPH * 2250 INDICATOR             2G2 PMN00320
* 30        * =GCNT * NO. G2250 RECORDS          2G2 PMN00330
* 31        * =LOSW * LOCAL-CANNOT-CALL-LOCAL SW 2-2 PMN00340
* 32        * =X3SW * SPECIAL ILS SWITCH         2-2 PMN00350
* 33        * =ECNT * NO. OF *EQUAT RCDS         2-4 PMN00360
* 33-34     *       * RESERVED FOR FUTURE USE    2-2 PMN00370
* 35        * =ANDU * 1+BLOCK ADDR OF END OF USER   PMN00380
*           *       * AREA (ADJUSTED) LOGICAL DR 0  PMN00390
* 36        *       * 1+BLOCK ADDR OF END OF USER   PMN00400
*           *       * AREA (ADJUSTED) LOGICAL DR 1  PMN00410
* 37        *       * 1+BLOCK ADDR OF END OF USER   PMN00420
*           *       * AREA (ADJUSTED) LOGICAL DR 2  PMN00430
* 38        *       * 1+BLOCK ADDR OF END OF USER   PMN00440
*           *       * AREA (ADJUSTED) LOGICAL DR 3  PMN00450
* 39        *       * 1+BLOCK ADDR OF END OF USER   PMN00460
*           *       * AREA (ADJUSTED) LOGICAL DR 4  PMN00470
* 40        * =BNDU * 1+BLOCK ADDR OF END OF USER   PMN00480
*           *       * AREA (BASE) LOGICAL DRIVE  0  PMN00490
* 41        *       * 1+BLOCK ADDR OF END OF USER   PMN00500
*           *       * AREA (BASE) LOGICAL DRIVE  1  PMN00510
* 42        *       * 1+BLOCK ADDR OF END OF USER   PMN00520
*           *       * AREA (BASE) LOGICAL DRIVE  2  PMN00530
* 43        *       * 1+BLOCK ADDR OF END OF USER   PMN00540
*           *       * AREA (BASE) LOGICAL DRIVE  3  PMN00550
* 44        *       * 1+BLOCK ADDR OF END OF USER   PMN00560
*           *       * AREA (BASE) LOGICAL DRIVE  4  PMN00570
* 45        * =FPAD * FILE PROTECT ADDR, LOGICAL    PMN00580
*           *       * DRIVE 0 (BASE)                PMN00590
* 46        *       * FILE PROTECT ADDR, LOGICAL    PMN00600
*           *       * DRIVE 1 (BASE)                PMN00610
* 47        *       * FILE PROTECT ADDR, LOGICAL    PMN00620
*           *       * DRIVE 2 (BASE)                PMN00630
```

DCOM
monitor
system
parameters

DCOM
cartridge
parameters

```
* 48        *        * FILE PROTECT ADDR, LOGICAL      PMN00640
*           *        * DRIVE 3 (BASE)                  PMN00650
* 49        *        * FILE PROTECT ADDR,LOGICAL       PMN00660
*           *        * DRIVE 4 (BASE)                  PMN00670
* 50        * =PCID  * CARTRIDGE ID, PHYSICAL DRIVE 0  PMN00680
* 51        *        * CARTRIDGE ID, PHYSICAL DRIVE 1  PMN00690
* 52        *        * CARTRIDGE ID, PHYSICAL DRIVE 2  PMN00700
* 53        *        * CARTRIDGE ID, PHYSICAL DRIVE 3  PMN00710
* 54        *        * CARTRIDGE ID, PHYSICAL DRIVE 4  PMN00720
* 55        * =CIDN  * CARTRIDGE ID, LOGICAL DRIVE 0   PMN00730
* 56        *        * CARTRIDGE ID, LOGICAL DRIVE 1   PMN00740
* 57        *        * CARTRIDGE ID, LOGICAL DRIVE 2   PMN00750
* 58        *        * CARTRIDGE ID, LOGICAL DRIVE 3   PMN00760
* 59        *        * CARTRIDGE ID, LOGICAL DRIVE 4   PMN00770
* 60        * =CIBA  * SCTR ADDR OF CIB, LOGICAL DR 0  PMN00780
* 61        *        * SCTR ADDR OF CIB, LOGICAL DR 1  PMN00790
* 62        *        * SCTR ADDR OF CIB, LOGICAL DR 2  PMN00800
* 63        *        * SCTR ADDR OF CIB, LOGICAL DR 3  PMN00810
* 64        *        * SCTR ADDR OF CIB, LOGICAL DR 4  PMN00820
* 65        * =SCRA  * SCRA, LOGICAL DRIVE 0           PMN00830
* 66        *        * SCRA, LOGICAL DRIVE 1           PMN00840
* 67        *        * SCRA, LOGICAL DRIVE 2           PMN00850
* 68        *        * SCRA, LOGICAL DRIVE 3           PMN00860
* 69        *        * SCRA, LOGICAL DRIVE 4           PMN00870
* 70        * =FMAT  * FORMAT OF PROG IN WS, DRIVE 0   PMN00880
* 71        *        * FORMAT OF PROG IN WS, DRIVE 1   PMN00890
* 72        *        * FORMAT OF PROG IN WS, DRIVE 2   PMN00900
* 73        *        * FORMAT OF PROG IN WS, DRIVE 3   PMN00910
* 74        *        * FORMAT OF PROG IN WS, DRIVE 4   PMN00920
* 75        * =FLET  * FLET SCTR ADDR, LOGICAL DR 0    PMN00930
* 76        *        * FLET SCTR ADDR, LOGICAL DR 1    PMN00940
* 77        *        * FLET SCTR ADDR, LOGICAL DR 2    PMN00950
* 78        *        * FLET SCTR ADDR, LOGICAL DR 3    PMN00960
* 79        *        * FLET SCTR ADDR, LOGICAL DR 4    PMN00970
* 80        * =ULET  * LET SCTR ADDR, LOGICAL DR 0     PMN00980
* 81        *        * LET SCTR ADDR, LOGICAL DR 1     PMN00990
* 82        *        * LET SCTR ADDR, LOGICAL DR 2     PMN01000
* 83        *        * LET SCTR ADDR, LOGICAL DR 3     PMN01010
* 84        *        * LET SCTR ADDR, LOGICAL DR 4     PMN01020
* 85        * =WSCT  * BLK CNT OF PROG IN WS, DRIVE 0  PMN01030
* 86        *        * BLK CNT OF PROG IN WS, DRIVE 1  PMN01040
* 87        *        * BLK CNT OF PROG IN WS, DRIVE 2  PMN01050
* 88        *        * BLK CNT OF PROG IN WS, DRIVE 3  PMN01060
* 89        *        * BLK CNT OF PROG IN WS, DRIVE 4  PMN01070
* 90        * =CSHN  * SCTR CNT CUSHION,LOGICAL DR 0   PMN01080
* 91        *        * SCTR CNT CUSHION,LOGICAL DR 1   PMN01090
* 92        *        * SCTR CNT CUSHION,LOGICAL DR 2   PMN01100
* 93        *        * SCTR CNT CUSHION,LOGICAL DR 3   PMN01110
* 94        *        * SCTR CNT CUSHION,LOGICAL DR 4   PMN01120
* 95-319    *        * RESERVED FOR FUTURE USE         PMN01130
```

DCOM
cartridge
parameters

```
          RESIDENT MONITOR

*****************************************************  PMN01150
*                                                   *  PMN01160
*STATUS -- VERSION   2, MODIFICATION  13            *  PMN01170
*                                                   *  PMN01180
*FUNCTION/OPERATION-                                *  PMN01190
*   THIS SECTION ALWAYS REMAINS IN CORE. IT         *  PMN01200
*   IS COMPRISED OF THE COMMUNICATIONS              *  PMN01210
*   AREA (COMMA), THE SKELETON SUPERVISOR, AND      *  PMN01220
*   A DISK I/O SUBROUTINE, NOMINALLY DISKZ. (THE    *  PMN01230
*   FIRST TWO OF THESE SECTIONS ARE INTERMIXED.)    *  PMN01240
*   COMMA CONTAINS THE SYSTEM PARAMETERS REQUIR-    *  PMN01250
*   ED TO FETCH A CORE LOAD IN CORE IMAGE FOR-      *  PMN01260
*   MAT. THE SKELETON SUPERVISOR PROVIDES IN-       *  PMN01270
*   STRUCTIONS FOR INITIATING A CALL EXIT, A        *  PMN01280
*   CALL LINK, A DUMP-TO-PRINTER OR A CALL TO THE   *  PMN01290
*   AUXILIARY SUPERVISOR.  IN ADDITION, THE SKELE-  *  PMN01300
*   TON SUPERVISOR CONTAINS SEVERAL TRAPS FOR CER-  *  PMN01310
*   TAIN I/O FUNCTIONS/CONDITIONS. THE DISK I/O     *  PMN01320
*   SECTION CONSISTS OF A SUBROUTINE FOR READING    *  PMN01330
*   FROM OR WRITING ON A DISK CARTRIDGE ON A        *  PMN01340
*   GIVEN LOGICAL DISK DRIVE.                       *  PMN01350
*                                                   *  PMN01360
*ENTRY POINTS-                                      *  PMN01370
*   * $PRET-A TRAP FOR PREOPERATIVE I/O ERRORS.     *  PMN01380
*            THE CALLING SEQUENCE IS                *  PMN01390
*                 BSI   L  $PRET                    *  PMN01400
*   * $PSTX-A POSTOPERATIVE ERROR TRAP FOR I/O      *  PMN01410
*            DEVICES ON LEVEL X (X=1,2,3,OR 4).     *  PMN01420
*            THE CALLING SEQUENCE IS                *  PMN01430
*                 BSI   L  $PSTX                    *  PMN01440
*   * $STOP-THE PROGRAM STOP KEY TRAP.              *  PMN01450
*   * $EXIT-THE ENTRY POINT FOR THE EXIT/CALL       *  PMN01460
*          EXIT STATEMENT. THE CALLING SEQUENCE IS*  PMN01470
*                LDX    0 $EXIT                     *  PMN01480
*   * $LINK-THE ENTRY POINT FOR THE LINK/CALL       *  PMN01490
*          LINK STATEMENT. THE CALLING SEQUENCE IS*  PMN01500
*                BSI  L  $LINK                      *  PMN01510
*   * $DUMP-THE ENTRY POINT FOR THE DUMP/PDMP       *  PMN01520
*          STATEMENT. THE CALLING SEQUENCE IS       *  PMN01530
*                BSI  L  $DUMP                      *  PMN01540
*             DC      FORMAT                             * PMN01550
*             DC      LIMIT1                             * PMN01560
*             DC      LIMIT2                             * PMN01570
*          WHERE LIMIT1 AND LIMIT2 ARE THE LIMITS * PMN01580
*          BETWEEN WHICH THE DUMP IS TO OCCUR, AND* PMN01590
*          FORMAT IS A CODE INDICATING THE FORMAT * PMN01600
*          OF THE DUMP. IF FORMAT IS NEGATIVE,    * PMN01610
*          THE AUXILIARY SUPERVISOR IS FETCHED    * PMN01620
*          AND CONTROL PASSED TO IT.              * PMN01630
*   * DZ000-ENTERED WHEN THE CALLER WISHES TO    * PMN01640
*           PERFORM A DISK I/O OPERATION. THE    * PMN01650
*           CALLING SEQUENCE VARIES WITH THE     * PMN01660
*           VERSION OF THE DISK I/O SUBROUTINE.  * PMN01670
*   * $I200/$I400-ENTERED WHEN THE OPERATION-    * PMNC1680
*                  COMPLETE INTERRUPT OCCURS ON  * PMN01690
*                  LEVEL 2/4.                    * PMN01700
*                                                * PMN01710
*INPUT-N/A                                       * PMN01720
*                                                * PMN01730
*OUTPUT-WORDS 6-4090 SAVED ON THE CIB ON A CALL  * PMN01740
*       DUMP                                     * PMN01750
*                                                * PMN01760
*EXTERNAL REFERENCES-N/A                         * PMN01770
*                                                * PMN01780
*EXITS-                                          * PMN01790
*   * NORMAL                                     * PMN01800
*       *THE EXITS FROM THE SUBROUTINES AT $PRET * PMN01810
*        $PST1, $PST2, $PST3, $PST4, AND $STOP   * PMN01820
*        ARE BRANCH INSTRUCTIONS FOLLOWING A     * PMNC1830
*        WAIT INSTRUCTION. $STOP TURNS OFF IN-   * PMN01840
*        TERRUPT LEVEL 5 AFTER THE START KEY IS  * PMN01850
*        DEPRESSED.                              * PMN01860
*       *THE EXITS FROM $EXIT,$LINK,AND $DUMP ARE * PMN01870
*        TO THE CORE IMAGE LOADER, PHASE 1,      * PMN01880
*        AFTER THAT PHASE HAS BEEN FETCHED.      * PMN01890
*       *THE EXIT FROM DZ000 IS BACK TO THE      * PMN01900
*        CALLER AFTER THE REQUESTED DISK OPERA-  * PMN01910
*        TION HAS BEEN INITIATED.                * PMN01920
*       *THE EXITS FROM $I200/$I400 ARE BACK TO  * PMN01930
*        THE ADDRESSES FROM WHICH THE DISK OP-   * PMN01940
*        ERATION COMPLETE INTERRUPT OCCURED      * PMN01950
*        AFTER THE INTERRUPT HAS BEEN SERVICED   * PMN01960
*        BY THE APPROPRIATE ISS.                 * PMN01970
*   * ERROR-N/A                                  * PMN01980
*                                                * PMN01990
*TABLES/WORK AREAS-                              * PMN02000
*   * $ACDE                                      * PMN02010
*   * $CH12                                      * PMN02020
*   * $CILA                                      * PMN02030
*   * $CLSW                                      * PMN02040
*   * $COMN                                      * PMN02050
*   * $CORE                                      * PMN02060
*   * $CTSW                                      * PMN02070
*   * $CXR1                                      * PMN02080
*   * $CYLN                                      * PMN02090
*   * $DADR                                      * PMN02100
*   * $DBSY                                      * PMN02110
*   * $DCYL                                      * PMN02120
*   * $DMPF                                      * PMN02130
*   * $DREQ                                      * PMN02140
*   * $FPAD                                      * PMN02150
*   * $GCOM                                  2G2 * PMN02160
*   * $GRIN                                  2G2 * PMN02170
*   * $HASH                                      * PMN02180
*   * $IBT2                                      * PMN02190
*   * $IBT4                                      * PMN02200
*   * $IBSY                                      * PMN02210
*   * $IOCT                                      * PMN02220
*   * $KCSW                                      * PMN02230
*   * $LAST                                      * PMN02240
*   * $LNXQ                                  2-9 * PMN02250
*   * $NDUP                                      * PMN02260
*   * $NXEQ                                      * PMN02270
*   * $PBSY                                      * PMN02280
*   * $PGCT                                      * PMNC2290
*   * $PHSE                                      * PMN02300
*   * $RMSW                                      * PMN02310
*   * $SCAT                                  2-4 * PMN02320
*   * $SNLT                                      * PMN02330
*   * $UFIO                                      * PMN02340
*   * $ULET                                      * PMN02350
*   * $WRD1                                      * PMN02360
*   * $WSDR                                      * PMN02370
*   * $XR3X                                  2-2 * PMN02380
* $XCWS                                     2-13 PMN02385
*                                                * PMN02390
*ATTRIBUTES-REUSABLE                             * PMN02400
*                                                * PMN02410
*NOTES-                                          * PMN02420
*    THERE ARE WAIT INSTRUCTIONS AT $PRET+1,     * PMN02430
*    $STOP+1, AND $PSTX+1. DEPRESSING THE START  * PMN02440
*    KEY WILL RETURN CONTROL TO THE CALLER IN ALL * PMN02450
*    CASES.                                      * PMN02460
```

```
                   00248   ****************************************************** PMN02470
                   00250   * PROVIDE PARAMETERS FOR SYSTEM LOADER                 PMN02490
                   00251   *                                                      PMN02500
                   00252         ABS                                              PMN02510
03C0               00253         ORG     4                                        PMN02520
0004 0  0FFA       00254         DC      4095-* WD CNT FOR WRITING CORE ON CIB    PMN02530
0005 0  0000       00255   $CIBA DC      *-*  SCTR ADDR OF THE CIB                PMN02540
0006 0  0000       00256   $CH12 DC      *-*  ADDR OF CHANNEL 12 INDICATOR        PMN02550
0007 0  0000       00257   $COMN DC      *-*  LENGTH OF COMMON (IN WORDS)         PMN02560
                   00258   *                                                      PMN02570
                   00259   * ULTIMATE RESIDENCE OF THE INTERRUPT TV               PMN02580
                   00260   *                                                      PMN02590
0008 0  0000       00261   $LEV0 DC      *-*   LEVEL 0 BRANCH ADDRESS             PMN02600
0009 0  0000       00262   $LEV1 DC      *-*   LEVEL 1 BRANCH ADDRESS             PMN02610
000A 0  00B3       00263   $LEV2 DC      $I200 LEVEL 2 BRANCH ADDR                PMN02620
000B 0  0000       00264   $LEV3 DC      *-*   LEVEL 3 BRANCH ADDRESS             PMN02630
000C 0  00C4       00265   $LEV4 DC      $I400 LEVEL 4 BRANCH ADDR                PMN02640
000D 0  0091       00266   $LEV5 DC      $STOP LEVEL 5 BRANCH ADDR                PMN02650
                   00267   *                                                      PMN02660
                   00268   *                                                      PMN02670
000E 0  0000       00269   $CORE DC      *-*  SIZE OF CORE, E.G., /1000=4K        PMN02680
000F 0  0000       00270   $CTSW DC      *-*  CONTROL RECORD TRAP SWITCH          PMN02690
0010 0  0000       00271   $DADR DC      *-*  SCTR ADDR OF PROG TO BE LOADED      PMN02700
0011 0  0000       00272   $SCAT DC      *-*  NON ZERO=SCA INTRPT PNDNG      2-4  PMN02710 ——$SCAT
0012 0  0000       00273   $DREQ DC      *-*  IND. FOR REQUESTED VERSION DKI/O    PMN02720
0013 0  0000       00274   $IBSY DC      *-*  NON-ZERO IF CD/PAP TP DEV. BUSY     PMN02730
0014    000C       00275   $HASH BSS  E  12   WORK AREA                           PMN02740
                   00276   *                                                      PMN02750
                   00277   *                                                      PMN02760
0020    0008       00278   $SCAN BSS     8    1132 SCAN AREA                   32 PMN02770
                   00279   *                                                      PMN02780
                   00280   *                                                      PMN02790
                   00281   *                                                      PMN02800
                   00282   * TRAP FOR PREOPERATIVE I/O ERRORS                     PMN02810
                   00283   *                                                      PMN02820
0028 0  0000       00284   $PRET DC      *-*       ENTRY POINT                    PMN02830 ——$PRET
0029 0  3000       00285         WAIT               WAIT TIL START KEY PUSHED      PMN02840
002A 00 4C800028   00286         BSC  I  $PRET      RETURN TO CALLER               PMN02850
                   00287   *                                                      PMN02860
                   00288   *                                                      PMN02870
002C 0  0000       00289   $IREQ DC      *-*  ADDR OF INT REQUEST SUBROUTINE      PMN02880
002D 0  0000       00290   $ULET DC      *-*  ADDR OF LET, LOGICAL DR 0           PMN02890 ⎫
002E 0  0000       00291         DC      *-*  ADDR OF LET, LOGICAL DR 1           PMN02900 ⎪
002F 0  0000       00292         DC      *-*  ADDR OF LET, LOGICAL DR 2           PMN02910 ⎬LET addresses
0030 0  0000       00293         DC      *-*  ADDR OF LET, LOGICAL DR 3           PMN02920 ⎪
0031 0  0000       00294         DC      *-*  ADDR OF LET, LOGICAL DR 4           PMN02930 ⎭
0032 0  0000       00295   $IOCT DC      *-*  ZERO IF NO I/O IN PROGRESS      50  PMN02940 ——$IOCT
0033 0  0000       00296   $LAST DC      *-*  NON-ZERO WHEN LAST CARD SENSED      PMN02950
0034 0  0000       00297   $NDUP DC      *-*  DO NOT DUP IF NON-ZERO              PMN02960
0035 0  0000       00298   $NXEQ DC      *-*  DO NOT EXECUTE IF NON-ZERO          PMN02970
0036 0  0000       00299   $PBSY DC      *-*  NON-ZERO WHEN PRINTER BUSY          PMN02980
0037 0  0000       00300   $PGCT DC      *-*  PAGE NO. FOR HEADINGS               PMN02990
                   00301   *                                                      PMN03000
                   00302   * CALL EXIT ENTRY POINT TO SKELETON SUPERVISOR         PMN03010
                   00303   *                                                      PMN03020
0038 0  7019       00304   $EXIT MDX     $S000      BR TO FETCH CIL, PHASE 1 56    PMN03030 ——$EXIT
                   00305   *                                                      PMN03040
                   00306   *** CALL LINK ENTRY POINT                              PMN03050
                   00307   *                                                      PMN03060
0039 0  0000       00308   $LINK DC      *-*        ENTRY POINT                57 PMN03070 ——$LINK
003A 0  1810       00309         SRA     16                                       PMN03080
003B 0  7017       00310         MDX     $S100      BR TO FETCH CIL, PHASE 1       PMN03090
003C    0000       00311         BSS  E  0                                        PMN03100
003C 0  0001       00312   $S900 DC      1    DISK PARAMETERS FOR SAVING CORE     PMN03110
                   00313   *$S900 ALSO USED AS CONSTANT 1 BY CIL PH2         2-10 PMN03111
003D 0  0004       00314         DC      $CIBA-1 *IN CONNECTION WITH DUMP         PMN03120
003E 0  FFFF       00315   $S910 DC      -1   CALL EXIT INDICATOR                 PMN03130
                   00316   *$S910 ALSO USED AS CONSTANT-1 BY CIL PH2         2-10 PMN03131
                   00317   *                                                      PMN03140
                   00318   *** SAVE 1ST 4K OF CORE ON THE CIB                     PMN03150
                   00319   *                                                      PMN03160
003F 0  0000       00320   $DUMP DC      *-*        ENTRY POINT               63  PMN03170 ——$DUMP
0040 0  D8D9       00321         STD     $ACEX      SAVE ACCUMULATOR, EXTENSION    PMN03180
0041 0  4023       00322         BSI     $S250      CHK PNDNG INTRPT          2-4  PMN03190
0042 0  282A       00323         STS     $SSTS      SAVE STATUS               2-6  PMN03200
0043 0  69D3       00324         STX   1 $CXR1      SAVE XR1                       PMN03210
0044 00 C480003F   00325         LD   I  $DUMP                                    PMN03220
0046 0  D0D2       00326         STO     $DMPF      SAVE DUMP FORMAT CODE          PMN03230
0047 0  C8F4       00327         LDD     $S900                                    PMN03240
0048 00 440000F2   00328         BSI  L  DZC00      SAVE WDS 6-4095 ON CIB         PMN03250
004A 0  C0F1       00329         LD      $S900                                    PMN03260
004B 0  7007       00330         MDX     $S100      BR TO FETCH CIL, PHASE 1       PMN03270
                   00331   *                                              2-6     PMN03280
004C    0006       00332         BSS     6          PATCH AREA                2-7  PMN03290
                   00334   *                                                      PMN03310
                   00335   *** FETCH CORE IMAGE LOADER, PHASE 1                   PMN03320
                   00336   *                                                      PMN03330
0052 0  C0EB       00337   $S000 LD      $S910                                    PMN03340
0053 0  D0C2       00338   $S100 STO     $RMSW      SAVE EXIT-LINK-DUMP SWITCH     PMN03350
0054 00 65800039   00339         LDX  I1 $LINK      LINK ADDR TO XR1               PMN03360
0056 0  C101       00340         LD    1 1          FETCH 2ND WD OF LINK NAME      PMN03370
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0057 0  18D0     00341         RTE      16                                PMN03380
0058 0  C100     00342         LD     1 0         FETCH 1ST WD OF LINK NAME   PMN03390
                 00343   * $S150+1 CONTAINS ADDR LAST WD OF DISK I/O MINUS 3 PMN03400
0059 00 65000000 00344   $S150 LDX  L1 *-*        ADDR END OF DKI/O-1 TO XR1  PMN03410
005B 0  D8B8     00345         STD      $LKNM     SAVE LINK NAME              PMN03420
005C 0  4008     00346         BSI      $S250     CHK ANY PNDNG INTRPT    2-4 PMN03430
005D 0  C0FC     00347         LD       $CILA                                 PMN03440
005E 0  1890     00348   $S200 SRT      16                                    PMN03450
005F 00 440000F2 00349         BSI   L  DZ000     FETCH CI LOADER, PHASE 1    PMN03460
0061 0  4003     00350         BSI      $S250     CHK DISK OP FINISHED    2-4 PMN03470
0062 0  4102     00351         BSI    1 2         BR TO CI LOADER, PHASE 1    PMN03480
                 00352   *                                                    PMN03490
0063 0  0000     00353   $GCOM DC       *-*  GRAPHIC SUBR PACKAGE INDR    2G2 PMN03500
0064 0  0000     00354   $GRIN DC       *-*  GRAPHIC INITLZN PROGRAM INDR 2G2 PMN03510
                 00355   *                                                    PMN03520
                 00356   *** SUBR TO CHECK IF ANY INTRPT IS PENDING           PMN03530
                 00357   *                                                    PMN03540
0065 0  0000     00358   $S250 DC       *-*       ENTRY POINT                 PMN03550
0066 0  C0CB     00359   $S300 LD       $IOCT     IS THERE INTRPT PNDNG       PMN03560
0067 0  E8A9     00360         OR       $SCAT     *OR SCA INTRPT PNDNG        PMN03570
0068 00 4C200066 00361         BSC   L  $S300,Z   *THEN BR,IF ALL INTRPT      PMN03580
006A 0  0803     00362         XIO      $I499     RESET 2250              2-7 PMN03590
006B 00 4C800065 00363         BSC   I  $S250     *IS SERVICED-RETURN         PMN03600
                 00364   *                                                2-6 PMN03610
006D 0  2000     00365   $SSTS LCS      *-*       STATUS SAVED FOR DUMP  .2-7 PMN03620
006E 0  0000     00366   $I499 DC       0         IOCC FOR RESET          2-7 PMN03630
006F 0  CC80     00367         DC       /CC80     *OF 2250                2-7 PMN03640
0070 0  0000     00368   $LNXQ DC       *-*  LINK/XEQ SW, -1 LINK,+1 XEQ  2-9 PMN03650
                 00369   *                                                    PMN03660
0071 0  0000     00370   $FLSH DC       *-*  FLUSH-TO-NEXT-JOB SWITCH 1=FLUSH PMN03670
0072    0000     00371         BSS   E  0                                     PMN03680
0072 0  0000     00372   $CWCT DC       *-*  WORD COUNT AND SECTOR ADDRESS    PMN03690
0073 0  0000     00373         DC       *-*  *FOR SAVING/RESTORING COMMON     PMN03700
0074 0  0000     00374   $CCAD DC       *-*  ADDR FOR SAVING/RESTORING COMMON PMN03710
0075 0  0000     00375   $LSAD DC       *-*  SCTR ADDR OF 1ST LOCAL/SOCAL     PMNC3720
0076 0  0000     00376   $DZIN DC       *-*  DISKZ/1/N INDICATOR (-1,0,+1)    PMN03730
0077 0  0000     00377   $DCDE DC       *-*  LOGICAL DRIVE CODE FOR PROGRAM   PMN03740
0078 0  0000     00378   $PHSE DC       *-*  NO. OF PHASE NOW IN CORE         PMN03750
0079 0  0000     00379   $UFIO DC       *-*  UNFORMATTED I/O RECORD NO.       PMN03760
007A 0  0000     00380   $WSDR DC       *-*  WORKING STORAGE DRIVE CODE       PMN03770
007B 0  0000     00381   $WRD1 DC       *-*  LOADING ADDR OF THE CORE LOAD    PMN03780
007C 0  0000     00382   $KCSW DC       *-*  1 IF KB,CP BOTH UTILIZED         PMN03790
007D 0  0000     00383   $UFDR DC       *-*  UNFORMATTED I/O DRIVE CODE       PMN03800
007E 0  0000     00384   $CPTR DC       *-*  CHANNEL 12 INDICATOR FOR CP      PMN03810
007F 0  0000     00385   $1132 DC       *-*  CHANNEL 12 INDICATOR FOR 1132    PMN03820
0080 0  0000     00386   $1403 DC       *-*  CHANNEL 12 INDICATOR FOR 1403    PMN03830
                 00388   * TRAP FOR POSTOPERATIVE I/O ERRORS ON LEVEL 1       PMN03850
                 00389   *                                                    PMN03860
0081 0  C000     00390   $PST1 DC       *-*       ENTRY POINT                 PMNC3870 ——$PST1
0082 0  3000     00391         WAIT                                           PMN03880
0083 00 4C800081 00392         BSC   I  $PST1     PETURN TO DEVICE SUBROUTINE PMN03890
                 00393   *                                                    PMN03900
                 00394   * TRAP FOR POSTOPERATIVE I/O ERRORS ON LEVEL 2       PMN03910
                 00395   *                                                    PMN03920
0085 0  0000     00396   $PST2 DC       *-*       ENTRY POINT                 PMN03930 ——$PST2
0086 0  3000     00397         WAIT                                           PMN03940
0087 00 4C800085 00398         BSC   I  $PST2     RETURN TO DEVICE SUBROUTINE PMN03950
                 00399   *                                                    PMN03960
                 00400   * TRAP FOR POSTOPERATIVE I/O ERRORS ON LEVEL 3       PMN03970
                 00401   *                                                    PMN03980
C089 0  0000     00402   $PST3 DC       *-*       ENTRY POINT                 PMN03990 ——$PST3
008A 0  3000     00403         WAIT                                           PMN04000
C08B 00 4C800089 00404         BSC   I  $PST3     RETURN TO DEVICE SUBROUTINE PMN04010
                 00405   *                                                    PMN04020
                 00406   * TRAP FOR POSTOPERATIVE I/O ERRORS ON LEVEL 4       PMNC4030
                 00407   *                                                    PMN04040
008C 0  0000     00408   $PST4 DC       *-*       ENTRY PCINT                 PMN04050 ——$PST4
008E 0  3000     00409         WAIT                                           PMN04060
008F 00 4C80008D 00410         BSC   I  $PST4     RETURN TO DEVICE SUBROUTINE PMN04070
                 00411   *                                                    PMN04080
                 00412   *                                                    PMN04090
                 00413   * PROGRAM STOP KEY TRAP                              PMN04100
                 00414   *                                                    PMN04110
0091 0  0000     00415   $STOP DC       *-*       ENTRY POINT                 PMN04120 ——$STOP
0092 0  3000     00416         WAIT               WAIT TIL START KEY PUSHED   PMN04130
0093 00 4CC00091 00417         BOSC I   $STOP     RETURN TO CALLER            PMN04140
                 00419   *                                                    PMN04160
                 00420   * PARAMETERS USED BY THE DISK I/O SUBROUTINES. THE   PMN04170
                 00421   * LOGICAL DRIVE CODE IS FOUND IN BITS 1-3 FOR ALL    PMN04180
                 00422   * BUT THE AREA CODE. BIT 0 WILL ALWAYS BE ZERO.      PMN04190
                 00423   *                                                    PMN04200
                 00424   *                                                    PMN04210
                 00425   *** DISKI AND DISKN WILL NOT WRITE BELOW THE         PMN04220
                 00426   *** FOLLOWING SCTR ADDRESSES (EXCEPT WRITE IMMED).   PMN04230
                 00427   *                                                    PMN04240
0095 0  0000     00428   $FPAD DC       *-*  FILE PROTECT ADDR, LOGICAL DR 0  PMN04250
0096 0  0000     00429         DC       *-*  FILE PROTECT ADDR, LOGICAL DR 1  PMN04260
0097 0  0000     00430         DC       *-*  FILE PROTECT ADDR, LOGICAL DR 2  PMN04270
0098 0  0000     00431         DC       *-*  FILE PROTECT ADDR, LOGICAL DR 3  PMN04280
0099 0  0000     00432         DC       *-*  FILE PROTECT ADDR, LOGICAL DR 4  PMN04290
                 00433   *                                                    PMN04300
                 *** THE ARM POSITION IS UPDATED WHENEVER A SEEK      PMN04310
                 *** OCCURS.                                          PMN04320
                 *                                                    PMN04330
009A 0  0000     $CYLN DC       0     ARM POSITION FOR LOGICAL DRIVE 0 PMN04340
009B 0  0000           DC       0     ARM POSITION FOR LOGICAL DRIVE 1 PMN04350
009C 0  0000           DC       0     ARM POSITION FOR LOGICAL DRIVE 2 PMN04360
009D 0  0000           DC       0     ARM POSITION FOR LOGICAL DRIVE 3 PMN04370
009E 0  0000           DC       0     ARM POSITION FOR LOGICAL DRIVE 4 PMN04380
                 *                                                    PMN04390
                 *** BELOW ARE THE DISK AREA CODES. A ZERO            PMN04400
                 *** INDICATES THE CORRESPONDING DRIVE IS NOT         PMN04410
                 *** ON THE SYSTEM                                    PMN04420
                 *                                                    PMN04430
009F 0  0000     $ACDE DC       *-*   AREA  CODE FOR LOGICAL DRIVE 0   PMN04440
00A0 0  0000           DC       *-*   AREA  CODE FOR LOGICAL DRIVE 1   PMN04450
00A1 0  0000           DC       *-*   AREA  CODE FOR LOGICAL DRIVE 2   PMN04460
00A2 0  0000           DC       *-*   AREA  CODE FOR LOGICAL DRIVE 3   PMN04470
00A3 0  0000           DC       *-*   AREA  CODE FOR LOGICAL DRIVE 4   PMN04480
                 *                                                    PMN04490
                 *** THE ADR OF THE CYLINDER IN WHICH A DEFECT OC-    PMN04500
                 *** CURS, IF ANY, IS STORED IN THE 1ST, 2ND, OR 3RD PMN04510
                 *** WORD BELOW, DEPENDING ON WHETHER IT IS THE 1ST, PMN04520
                 *** 2ND, OR 3RD DEFECT ON THE CARTRIDGE.             PMN04530
                 *                                                    PMN04540
00A4 0  0000     $DCYL DC       *-*   DEFECTIVE CYLINDER ADDRESSES   1 PMN04550
00A5 0  0000           DC       *-*   *FOR LOGICAL DRIVE 0           2 PMN04560
00A6 0  0000           DC       *-*                                  3 PMN04570
00A7 0  0000           DC       *-*   DEFECTIVE CYLINDER ADDRESSES   1 PMN04580
00A8 0  0000           DC       *-*   *FOR LOGICAL DRIVE 1           2 PMN04590
00A9 0  0000           DC       *-*                                  3 PMN04600
00AA 0  0000           DC       *-*   DEFECTIVE CYLINDER ADDRESSES   1 PMN04610
00AB 0  0000           DC       *-*   *FOR LOGICAL DRIVE 2           2 PMN04620
00AC 0  0000           DC       *-*                                  3 PMN04630
00AD 0  0000           DC       *-*   DEFECTIVE CYLINDER ADDRESSES   1 PMN04640
00AE 0  0000           DC       *-*   *FOR LOGICAL DRIVE 3           2 PMN04650
00AF 0  0000           DC       *-*                                  3 PMN04660
00B0 0  0000           DC       *-*   DEFECTIVE CYLINDER ADDRESSES   1 PMN04670
00B1 0  0000           DC       *-*   *FOR LOGICAL DRIVE 4           2 PMN04680
00B2 0  0000           DC       *-*                                  3 PMN04690
                 *                                                    PMN04710
                 * ILS02--THIS SUBROUTINE SAVES XR1, XR2, STATUS,     PMN04720
                 *         AND THE ACCUMULATOR AND ITS EXTENSION.     PMN04730
                 *         THE ADDRESS OF THE INTERRUPT SERVICE ROU-  PMN04740
                 *         TINE IS STORED IN $I205 BY PHASE 2 OF      PMN04750
                 *         THE CORE IMAGE LOADER. WORD 10 ALWAYS      PMN04760
                 *         CONTAINS THE ACDRESS OF $I200.             PMN04770
                 *                                                    PMN04780
                 *                                                    PMN04790
                 *                                                    PMN04800
00B3 0  0000     $I200 DC       *-*        ENTRY PT (LEVEL 2 INTRUPT) PMN04810
00B4 0  6906           STX    1 $I210+1    SAVE XR1                   PMN04820
00B5 0  6A07           STX    2 $I210+3    SAVE XR2                   PMN04830
00B6 0  2807           STS      $I210+4    STORE STATUS               PMN04840
00B7 0  D80A           STD      $I290      SAVE ACCUMULATOR,EXTENSION PMN04850
                 * $I205+1 CONTAINS ADDR INTERRUPT ENTRY PT TO DKI/O PMN04860
00B8 00 44000000 $I205 BSI  L   *-*        BR TO SERVICE THE INTERRUPT PMN04870
00BA 00 65000000 $I210 LCX  L1  *-*        RESTORE XR1                PMN04880
00BC 00 66000000       LDX  L2  *-*        RESTORE XR2                PMN04890
00BE 0  2000           LDS      0          RESTORE STATUS             PMN04900
00BF 0  C802           LDD      $I290      RESTORE ACCUMULATOR,EXT    PMN04910
00C0 00 4CC000B3       BOSC I   $I200      RFTURN FROM INTERRUPT      PMN04920
00C2    0000     $I290 BSS  E   0                                     PMN04930
00C2 0  0000           DC       *-*        CONTENTS OF ACCUMULATOR AND PMN04940
00C3 0  0000           DC       *-*        *EXTENTION                 PMN04950
                 *                                                    PMN04970
                 * ILS04--THIS SUBROUTINE SAVES XR1, XR2, STATUS,     PMN04980
                 *         AND THE ACCUMULATOR AND ITS EXTENSION.     PMN04990
                 *         IF THE INTERRUPT IS FOR A KEYBOARD REQ-  * PMN05000
                 *         UEST,AND IF A MONITOR PROGRAM IS IN CON- * PMN05010
                 *         TROL, CONTROL IS PASSED TO DUMP. OTHER-  * PMN05020
                 *         WISE, CONTROL IS PASSED TO THE KEYBOARD/ * PMN05030
                 *         CONSOLE PRINTER SUBROUTINE. WORD 12 AL-  * PMN05040
                 *         WAYS CONTAINS THE ADDRESS OF $I400.      * PMN05050
                 *                                                    PMN05060
                 * THE TABLE BELOW CONTAINS THE ADDRESSES OF THE      PMN05070
                 * INTERRUPT SERVICE ROUTINES FOR ALL THE DEVICES     PMN05080
                 * ON LEVEL 4.                                        PMN05090
                 *                                                    PMN05100
                 *                                                    PMN05110
                 *                                                    PMN05120
00C4 0  0000     $I400 DC       *-*        ENTRY POINT                PMN05130
00C5 0  D818           STD      $I490      SAVE ACCUMULATOR, EXTENSION PMN05140
00C6 0  280E           STS      $I410      SAVE STATUS                PMN05150
00C7 0  690F           STX    1 $I410+2    SAVE XR1                   PMN05160
00C8 0  6A10           STX    2 $I410+4    SAVE XR2                   PMN05170
00C9 0  0816           XIO      $I492      SENSE DSW                  PMN05180
00CA 0  1002           SLA      2          IS THIS INTERRUPT REQUEST  PMN05190
00CB 00 4C100000       BSC  L   $I403,-    BR IF NOT INTERRUPT REQUEST PMN05200
00CD 00 4480002C       BSI  I   $IREQ      BR IF INTERRUPT REQUEST    PMN05210
00CF 0  FFFE           DC       -2         ERROR CODE                 PMN05220
00D0 0  6109     $I403 LDX    1 9          NO. DEVICES ON LEVEL TO XR1 PMN05230
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0001 0  0810     00527         XIO     $I494      SENSE ILSW                 PMN05240
0002 0  1140     00528         SLCA  1            FIND CAUSE OF INTERRUPT    PMN05250
                 00529    * $I405+1 CONTAINS ADDR OF LEVEL 4 IBT MINUS 1     PMN05260
0003 00 45800000 00530    $I405 BSI  I1 *-*       BR TO SERVICE THE INTERRUPT PMN05270
0005 0  2000     00531    $I410 LDS      0        RESTORE STATUS             PMN05280
0006 00 65000000 00532         LDX  L1 *-*        RESTORE XR1                PMN05290
0008 00 66000000 00533         LDX  L2 *-*        RESTORE XR2                PMN05300
000A 0  C803     00534         LDD     $I490      RESTORE ACCUMULATOR, EXT.  PMN05310
000B 00 4CC000C4 00535         BOSC I  $I400      RETURN                     PMN05320
                 00536    *                                                  PMN05330
                 00537    * CONSTANTS AND WORK AREAS                         PMN05340
                 00538    * EVEN-NUMBERED LABELS ARE ON EVEN BOUNDARIES      PMN05350
                 00539    *                                                  PMN05360
000D 0  0000     00540    $DDSW DC      *-*       DSW FOR THE DISK           PMN05370
000E    0002     00541    $I490 BSS  E  2    CONTENTS OF ACCUMULATOR, EXT.   PMN05380
00E0 0  0000     00542    $I492 DC      *-*                                  PMN05390
00E0             00543    $SYSC EQU     *-1  VERSION AND MOD NO.             PMN05400
00E1 0  0F00     00544          DC      /0F00 IOCC FOR SENSE IOCC FOR KB/CP  PMN05410
00E2    0001     00545    $I494 BSS     1    PATCH AREA                      PMN05420
00E3 0  0300     00546          DC      /0300 IOCC FOR SENSING ILSW04        PMN05430
                 00548    *                                              2-2 PMN05450
                 00549    *                                              2-2 PMN05460
00E4 0  0000     00550    $I496 DC      *-*        XR3 SETTING DURING XEQ 2-2 PMN05470
00E5 0  0F01     00551          DC      /0F01      SENSE KEY BOARD W RESET2-2 PMN05480
                 00552    *                                              2-2 PMN05490
00E6 0  0000     00553    $I420 DC      *-*        ENTRY POINT FLUSH JOB  2-2 PMN05500
00E7 0  08FC     00554          XIO     $I496      SENSE KEY BOARD W RESET2-2 PMN05510
00E8 00 4C4000EA 00555          BOSC L  $I425      TURN OF INTERRUPT      2-2 PMN05520
00EA 00 4400003F 00556    $I425 BSI  L  $DUMP     BR TO $DUMP             2-7 PMN05530
00EC 0  FFFE     00557          DC      -2        CALLING AUX SUP         2-7 PMN05540
                 00558    *                                              2-2 PMN05550
00ED 0  0000     00559    $XQWS DC      *-*       XEQ WS SW              2-13 PMN05560
00EE 0  0000     00560    $DBSY DC      *-*  NON-ZERO WHEN DISK I/O BUSY     PMN05570 ——$DBSY


                            DISKZ

                 00562    ********************************************* PMN05590
                 00563    *                                           * PMN05600
                 00564    *STATUS -- VERSION   2, MODIFICATION  13    * PMN05610
                 00565    *                                           * PMN05620
                 00566    *PROGRAM NAME-                              * PMN05630
                 00567    *    *FULL NAME-FORTRAN/SYSTEM DISK I/O SUBROUTINE * PMN05640
                 00568    *    *CALLING SEQUENCE-                     * PMN05650
                 00569    *       LDD     PARAM                       * PMN05660
                 00570    *       BSI  L  DZ000                       * PMN05670
                 00571    *     WHERE PARAM IS THE LABEL OF A DOUBLE-WORD   * PMN05680
                 00572    *     CELL CONTAINING THE FUNCTION CODE AND THE   * PMN05690
                 00573    *     ADDR OF THE I/O BUFFER,I.E., ADDR OF WD CNT. * PMN05700
                 00574    *     SEE 'CAPABILITIES' FOR DISCUSSION OF PARAM-  * PMN05710
                 00575    *     ETERS.                                * PMN05720
                 00576    *                                             PMN05730
                 00577    *PURPOSE-                                   * PMN05740
                 00578    *    TO PROVIDE A SUBROUTINE TO PERFORM DISK OPERA-* PMN05750
                 00579    *    TIONS. THIS SUBROUTINE IS INTENDED FOR USE BY * PMN05760
                 00580    *    MONITOR PROGRAMS AND USER PROGRAMS WRITTEN IN * PMN05770
                 00581    *    FORTRAN. THUS,IT IS INTENDED FOR USE IN AN    * PMN05780
                 00582    *    ERROR-FREE ENVIRONMENT.                * PMN05790
                 00583    *                                           * PMN05800
                 00584    *METHOD-                                    * PMN05810
                 00585    *    DISKZ REQUIRES A BUFFER,THE LENGTH OF WHICH IS* PMN05820
                 00586    *    2 GREATER THAN THE NO. WORDS TO BE READ/WRIT- * PMN05830
                 00587    *    TEN.                                   * PMN05840
                 00588    *                                           * PMN05850
                 00589    *CAPABILITIES AND LIMITATIONS-              * PMN05860
                 00590    *    THE WD CNT,AS WELL AS DZ000,MUST BE ON AN EVEN* PMN05870
                 00591    *    BOUNDARY,MUST BE IN THE RANGE 0-32767. THE    * PMN05880
                 00592    *    DRIVE CODE MUST BE IN BITS 1-3 OF THE SECTOR  * PMN05890
                 00593    *    ADDR,WHICH FOLLOWS THE WD CNT. THE FUNCTION   * PMN05900
                 00594    *    INDICATOR MUST BE XX00 FOR A READ OR XX01 FOR * PMN05910
                 00595    *    A WRITE,WHERE 'XX' MEANS ANY 2 HEXADECIMAL    * PMN05920
                 00596    *    CHARACTERS. A WD CNT OF ZERO INDICATES A SEEK.* PMN05930
                 00597    *    (READ OR WRITE MAY BE INDICATED.) AUTOMATIC   * PMN05940
                 00598    *    SEEKING IS PROVIDED AS A PART OF READ/WRITE.  * PMN05950
                 00599    *    A WRITE IS ALWAYS WITH A READ-BACK-CHECK.     * PMN05960
                 00600    *    DISKZ MAKES NO PREOPERATIVE PARAMETER CHECKS. * PMN05970
                 00601    *                                           * PMN05980
                 00602    *SPECIAL FEATURES-                          * PMN05990
                 00603    *    DISKZ PROVIDES ONLY THOSE FUNCTIONS MENTIONED * PMN06000
                 00604    *    ABOVE. DISK1 AND DISKN OFFER THIS BASIC SET OF* PMN06010
                 00605    *    FUNCTIONS PLUS OTHERS.                 * PMN06020
                 00606    *                                           * PMN06030
                 00607    ********************************************* PMN06040
                 00609    * PROVIDE PARAMETERS FOR SYSTEM LOADER        PMN06060
                 00610    *                                             PMN06070
00F0    0000     00611         BSS   E  0                             PMN06080
00F0 0  00EF     00612         DC       $ZEND-*   DISKZ WORD COUNT    PMN06090
00F1 0  FF6A     00613         DC       -'DZID    PHASE ID            PMN06100
00F2 0  00E8     00614         DC       $ZEND-6-*+1 ADDR OF SLET EXTRACT PMN06110
00F3 0  0001     00615         DC       1         NO. ENTRIES IN SLET EXTRACT PMN06120
00F4             00616         ORG      *-2                           PMN06130
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00F2 0  0000     00618    DZ000 DC       *-*       ENTRY POINT                 PMN06150
00F3 00 740000EE 00619 Q        MDX  L   $DBSY,0   LOOP UNTIL OPERATION IN     PMN06160
00F5 0  70FD     00620          MDX      *-3       *PROGRESS IS COMPLETE       PMN06170
00F6 0  7002     00621          MDX      DZ020     BR AROUND INT ENTRY POINT   PMN06180
                 00622    *                                                    PMN06190
                 00623    * INTERRUPT ENTRY POINT                              PMN06200
                 00624    *                                                    PMN06210
00F7 0  0000     00625    DZ010 DC       *-*       INTERRUPT ADDRESS           PMN06220
00F8 0  7018     00626          MDX      DZ180     BR TO SERVICE INTERRUPT     PMN06230
COF9 0  690B     00627    DZ020 STX    1 DZ100+1   SAVE XR1                    PMN06240
00FA 0  6A0C     00628          STX    2 DZ100+3   SAVE XR2                    PMN06250
COFB 0  1008     00629          SLA      8         SHIFT INDICATOR 8 BITS      PMN06260
00FC 0  D03C     00630          STO      DZ945     SAVE FUNCTION INDICATOR     PMN06270
00FD 0  18D0     00631          RTE      16                                    PMN06280
00FE 0  D05A     00632          STO      DZ235+1   SAVE ADDR OF THE I/O AREA   PMN06290
00FF 0  7054     00633          MDX      DZ230     BR TO CONTINUE              PMN06300
0100 00 4C000000 00634    DZ060 BSC  L   *-*       PR TO SERVICE THE INTERRUPT PMN06310
                 00635    *                                                    PMN06320
                 00636    * START ALL DISK OPERATIONS                          PMN06330
                 00637    *                                                    PMN06340
0102 0  690F     00638    DZ070 STX    1 DZ180+1   SAVE ADDR OF THE I/O AREA   PMN06350
0103 0  0822     00639          XIO      DZ904     START AN OPERATION          PMN06360
                 00640    *                                                    PMN06370
                 00641    * RETURN TO USER                                     PMN06380
                 00642    *                                                    PMN06390
0104 00 65000000 00643    DZ100 LDX  L1 *-*        RESTORE XR1                 PMN06400
0106 00 66000000 00644          LDX  L2 *-*        RESTORE XR2                 PMN06410
0108 0  COEE     00645          LD       DZ010     INTERRUPT ENTRY         2-6 PMN06420
0109 00 4C9800F2 00646          BSC  I   DZ000,+-  NO,MONITOR ENTRY        2-6 PMN06430
010B 0  D003     00647          STO      DZ110+1   YES,INT ENTRY           2-6 PMN06440
010C 0  1810     00648          SRA      16        RESET                   2-6 PMN06450
010D 0  D0E9     00649          STO      DZ010     *INT ENTRY              2-6 PMN06460
010E 00 4C000000 00650    DZ110 BSC  L   *-*                               2-6 PMN06470
0110 0  1000     00651          NOP                DUMMY OP                2-6 PMN06480
                 00652    *                                                    PMN06490
                 00653    * SERVICE ALL INTERRUPTS                             PMN06500
                 00654    *                                                    PMN06510
0111 00 65000000 00655    DZ180 LDX  L1 *-*        ADDR OF I/O AREA TO XR1     PMN06520
0113 00 660000F2 00656          LDX  L2 DZ000      ADDR OF DZ000 TO XR2        PMN06530
0115 0  0816     00657          XIO      DZ910     SENSE THE DSW               PMN06540
0116 0  D0C6     00658          STO      $DDSW     SAVE THE DSW                PMN06550
0117 0  4810     00659          BSC      -         SKIP IF ERROR BIT SET   2-6 PMN06560
0118 0  70E7     00660          MDX      DZ060     BRANCH IF ERROR BIT NOT SET PMN06570
0119 0  C80A     00661    DZ185 LDD      DZ902     RESTORE WORD COUNT          PMN06580
011A 0  D900     00662          STD    1 0         *AND SECTOR ADDRESS         PMN06590
011B 00 74FF00EE 00663          MDX  L   $DBSY,-1  SKIP IF 16 RETRIES DONE     PMN06600
011D 0  703A     00664          MDX      DZ235     BRANCH IF LESS THAN 16      PMN06610
                 00665    *                                                    PMN06620
                 00666    * TRAP OUT TO POSTOPERATIVE TRAP                     PMN06630
                 00667    *                                                    PMN06640
011E 0  C80F     00668          LDD      DZ912     1+SCTR ADDR TO EXTENSION    PMN06650
011F 0  C011     00669          LD       DZ915                                 PMN06660
0120 0  4293     00670    DZ190 BSI    2 $PST2-X2  BR TO POSTOPERATIVE ER TRAP PMN06670
0121 0  7034     00671          MDX      DZ232     RETRY OPERATION         2-6 PMN06680
                 00672    *                                                    PMN06690
                 00673    * CONSTANTS AND WORK AREAS                           PMN06700
                 00674    *                                                    PMN06710
0122    0000     00675          BSS  E   0                                     PMN06720
                 00676    * EVEN-NUMBERED LABELS ARE ON EVEN BOUNDARIES        PMN06730
0122 0  0001     00677    DZ900 DC       1    CONSTANT,READ-AFTER-SEEK WD CNT  PMN06740
0123 0  0000     00678    DZ901 DC       0    CURRENT ARM POSITION             PMN06750
0124 0  0000     00679    DZ902 DC       *-*  LAST TWO WORDS OF SECTOR         PMN06760
0125 0  0000     00680          DC       *-*  *PREVIOUSLY READ                 PMN06770
0126 0  0000     00681    DZ904 DC       *-*  IOCC FOR OPERATION CURRENTLY     PMN06780
0127 0  0000     00682    DZ905 DC       *-*  *BEING PERFORMED                 PMN06790
0128 0  0000     00683    DZ906 DC       *-*  SAVE AREA FOR IOCC FOR           PMN06800
0129 0  0000     00684    DZ907 DC       *-*  *USFR-REQUESTED OPERATION        PMN06810
012A 0  0122     00685    DZ908 DC       DZ900 IOCC FOR READ                   PMN06820
012B 0  0000     00686    DZ909 DC       *-*  *AFTER SEEK                      PMN06830
012C 0  0000     00687    DZ910 DC       *-*  2ND WORD OF SEEK IOCC            PMN06840
012D 0  0000     00688    DZ911 DC       *-*  SENSE IOCC                       PMN06850
012E 0  0000     00689    DZ912 DC       *-*  INTERMEDIATE WORD COUNT          PMN06860
012F 0  0000     00690    DZ913 DC       *-*  ADDR OF NEXT SEQUENTIAL SECTOR   PMN06870
0130 0  5002     00691    DZ914 DC       /5002 WRITE SELECT/POWER UNSAFE INDR  PMN06880
0131 0  5004     00692    DZ915 DC       /5004 READ/WRITE/SEEK ERROR INDICATOR PMN06890
0132 0  FEC0     00693    DZ916 DC       -320 TO BE USED TO SIMULTANEOUSLY     PMN06900
0133 0  0001     00694          DC       1    *DECR WD CNT, INCR SCTR ADDR     PMN06910
0134 0  0080     00695    DZ920 DC       /0080 READ CHECK BIT FOR IOCC         PMN06920
0135 0  0600     00696    DZ925 DC       /0600 2ND WD OF READ IOCC W/O AREA CD PMN06930
0136 0  0008     00697    DZ930 DC       8    NO. SECTORS PER CYLINDER         PMN06940
0137 0  5000     00698    DZ935 DC       /5000 NOT READY DISPLAY CODE          PMN06950
0138 0  0FF8     00699    DZ940 DC       /0FF8 'AND' OUT DR CODE, SCTR ADDR    PMN06960
0139 0  0000     00700    DZ945 DC       *-*  FUNC INDICATOR (0=READ,1=WRITE)  PMN06970
013A 0  0701     00701    DZ950 DC       /0701 SENSE IOCC W/O AREA CODE        PMN06980
013B 0  0007     00702    DZ955 DC       /CC07 'AND' OUT ALL BUT SCTR NO.      PMN06990
013C 0  000A     00703    DZ960 DC       $DCYL-$CYLN BASE DEFECTIVE CYL ADDR   PMN07000
013D 0  009F     00704    DZ965 DC       $ACDE BASE AREA CODE ADDR             PMN07010
013E 0  FFFB     00705    DZ970 DC       $CYLN-$ACDE BASE ARM POSITION ADDR    PMN07020
013F 0  0000     00706    DZ975 DC       *-*  2ND WORD OF READ CHECK IOCC      PMN07030
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0140 0  0400     00707  DZ980 DC      /0400 2ND WD OF SEEK IOCC W/O AREA CD PMN07040
0141 0  0141     00708  DZ985 DC      321  NO. WORDS PER SECTOR (W/ ADDR)   PMN07050
0142 0  0000     00709  DZ990 DC      *-*  CURRENT SECTOR NO.               PMN07060
0143 0  FFFF     00710  DZ995 DC      -1   MASK FOR COMPLEMENTING           PMN07070
                 00711  *                                                   PMN07080
                 00712  * RESERVED FOR SAVING CORE ON A DUMP ENTRY TO SKEL  PMN07090
                 00713  *                                                   PMN07100
0144    0002     00714        BSS     2    THIS AREA MUST BE AT $CIBA+319   PMN07110
00F2             00715  X2    EQU     DZ000                                 PMN07120
                 00716  *                                                   PMN07130
                 00717  *                                                   PMN07140
                 00718  *                                                   PMN07150
0146 0  1810     00719  DZ210 SRA     16                                    PMN07160
0147 0  D0A6     00720        STO     $DBSY     CLEAR BUSY INDICATOR        PMN07170
0148 00 74FF0032 00721        MDX   L $IOCT,-1  DECREMENT IOCS COUNTER      PMN07180
014A 0  1000     00722        NOP                                           PMN07190
014B 0  7088     00723        MDX     DZ100     TO EXIT                     PMN07200
                 00724  *                                                   PMN07210
                 00725  * PREPARE TO TRAP OUT ON 'POWER UNSAFE' CONDITION   PMN07220
                 00726  *                                                   PMN07230
014C 0  C8D7     00727  DZ215 LDD     DZ902     RESTORE WORD COUNT      2-6 PMN07240
014D 0  D900     00728        STD    1 0        *AND SECTOR ADDRES      2-6 PMN07250
014E 0  C0E1     00729        LD      DZ914                                 PMN07260
014F 0  70D0     00730        MDX     DZ190     BR TO TPAP OUT              PMN07270
                 00731  *                                                   PMN07280
                 00732  * PREPARE TO TRAP OUT ON 'NOT READY' CONDITION      PMN07290
                 00733  *                                                   PMN07300
0150 0  C0E6     00734  DZ220 LD      DZ935     FETCH ERROR CODE            PMN07310
0151 00 44000028 00735        BSI   L $PRET     BR TO PREOPERATIVE ERR TRAP PMN07320
0153 0  7038     00736        MDX     DZ340     RETRY THE OPERATION         PMN07330
                 00737  *                                                   PMN07340
                 00738  *                       STATEMENTS MOVED        2-1 PMN07350
                 00739  *                                                   PMN07360
0154 00 74010032 00740  DZ230 MDX   L $IOCT,1   INCREMENT IOCS COUNTER      PMN07370
0156 0  6211     00741  DZ232 LDX    2 'TCNT    TURN BUSY INDICATOR ON 2-10 PMN07380
0157 0  6A96     00742        STX    2 $DBSY    *                       2-6 PMN07390
0158 00 65000000 00743  DZ235 LDX   L1 *-*      ADDR I/O AREA TO XR1        PMN07400
015A 0  C900     00744        LDD    1 0                                    PMN07410
015B 0  D8C8     00745        STD     DZ902     SAVE WORD COUNT, SCTR ADDR  PMN07420
015C 0  D8D1     00746        STD     DZ912                                 PMN07430
015D 0  1810     00747  DZ240 SRA     16                                    PMN07440
015E 0  1084     00748        SLT     4         DRIVE CODE IN BITS 12-15    PMN07450
015F 0  D00E     00749        STO     DZ280+1                               PMN07460
0160 0  80DC     00750        A       DZ965     COMPUTE AND STORE THE       PMN07470
0161 0  D01C     00751        STO     DZ330+1   *ADDR OF THE AREA CODE      PMN07480
0162 0  80DB     00752        A       DZ970     COMPUTE AND STORE THE       PMN07490
0163 0  D034     00753        STO     DZ350+1   *ADDR OF THE ARM POSITION   PMN07500
0164 0  80D7     00754        A       DZ960     ADD IN BASE DT ADDR         PMN07510
0165 0  8008     00755        A       DZ280+1   ADD IN THE DRIVE            PMN07520
0166 0  8007     00756        A       DZ280+1   *CODE TWICE MORE            PMN07530
0167 0  D006     00757        STO     DZ280+1                               PMN07540
0168 0  62FD     00758        LDX    2 -3       INITIALIZE COUNTER FOR LOOP PMN07550
0169 0  69BE     00759        STX    1 DZ906                                PMN07560
016A 0  C101     00760        LD     1 1        FETCH DESIRED SECTOR ADDR   PMN07570
016B 0  E0CC     00761        AND     DZ940     'AND' OUT SECTOR NO.        PMN07580
016C 0  D101     00762  DZ250 STO    1 1        *AND DRIVE CODE             PMN07590
016D 00 94000000 00763  DZ280 S     L *-*       SUB DEFECTIVE CYLINDER ADDR PMN07600
016F 0  4828     00764        BSC     Z+        SKIP IF BAD CYLINDER        PMN07610
0170 0  7007     00765        MDX     DZ300     BR TO CONTINUE PROCESSING   PMN07620
0171 0  C101     00766        LD     1 1                                    PMN07630
0172 0  80C3     00767        A       DZ930     INCREMENT SCTR ADDR BY 8    PMN07640
0173 00 7401016E 00768        MDX   L DZ280+1,1 POINT TO NEXT DEFECTIVE CYL PMN07650
0175 0  7201     00769        MDX    2 1        SKIP AFTER 3RD PASS         PMN07660
0176 0  70F5     00770        MDX     DZ250     COMPARE W/ NEXT DEF CYL ADR PMN07670
0177 0  D101     00771        STO    1 1        SCTR ADDR WITH 3 DEF CYL2-4 PMN07680
                 00772  *                                                   PMN07690
                 00773  * CONSTRUCT THE 2ND WORD OF ALL IOCC'S              PMN07700
                 00774  *                                                   PMN07710
0178 00 660000F2 00775  DZ300 LDX   L2 DZ000    ADDR OF DZ000 TO XR2        PMN07720
017A 0  C23D     00776        LD     2 DZ913-X2 FETCH SECTOR ADDRESS        PMN07730
017B 0  E249     00777        AND    2 DZ955-X2 'AND' OUT ALL BUT SECTOR NO PMN07740
017C 0  D250     00778        STO    2 DZ990-X2 SAVE SECTOR NO.             PMN07750
017D 00 C4000000 00779  DZ330 LD    L *-*       FETCH AREA CODE             PMN07760
017F 0  EA4E     00780        OR     2 DZ980-X2 'OR' IN SEEK FUNCTION CODE  PMN07770
0180 0  D23A     00781        STO    2 DZ910-X2 SEEK IOCC MINUS DIRECTION   PMN07780
0181 0  EA43     00782        OR     2 DZ925-X2 'OR' IN READ FUNCTION CODE  PMN07790
0182 0  D239     00783        STO    2 DZ909-X2 IOCC FOR READ-AFTER-SEEK    PMN07800
0183 0  EA50     00784        OR     2 DZ990-X2 'OR' IN SECTOR NO.          PMN07810
0184 0  9247     00785        S      2 DZ945-X2 COMPLETE READ/WRITE CODE    PMN07820
0185 0  D237     00786        STO    2 DZ907-X2 2ND WD OF READ/WRITE IOCC   PMN07830
0186 0  EA42     00787        OR     2 DZ920-X2 'OR' IN READ CHECK BIT      PMN07840
0187 0  8247     00788        A      2 DZ945-X2                             PMN07850
0188 0  D24D     00789        STO    2 DZ975-X2 2ND WD OF READ CHECK IOCC   PMN07860
0189 0  EA48     00790        OR     2 DZ950-X2 'OR' IN SENSE IOCC BITS     PMN07870
018A 0  D23B     00791        STO    2 DZ911-X2 COMPLETED SENSE IOCC        PMN07880
018B 0  CA3C     00792        LDD    2 DZ912-X2 1+SCTR ADDR TO EXTENSION    PMN07890
018C 0  0A3A     00793  DZ340 XIO    2 DZ910-X2 SENSE FOR DISK READY        PMN07900
018D 0  D2EB     00794        STO    2 $DDSW-X2 SAVE THE DSW                PMN07910
018E 0  4828     00795        BSC     Z+        SKIP UNLESS POWER UNSAFE OR PMN07920
018F 0  70BC     00796        MDX     DZ215     *WRITE SELECT, BR OTHERWISE PMN07930
0190 0  1002     00797        SLA     2         BR TO PREOPERATIVE ERR TRAP PMN07940
0191 0  4828     00798        BSC     Z+        *IF DISK NOT READY, SKIP    PMN07950
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      * EQUIVALENCES FOR ABSOLUTE SECTOR ADDRESSES          PMN09660
      *                                                     PMN09670
0000  $IDAD EQU    0    ADDR OF SCTR WITH ID,DEF CYL ADR    PMN09680
0001  $DCOM EQU    1    ADDR OF SCTR CONTAINING DCOM        PMN09690
0002  $RIAD EQU    2    ADDROOF SCTR CONTAINING RES IMGE    PMN09700
0003  $SLET EQU    3    ADDR OF SCTR CONTAINING SLET        PMN09710
0006  $RTBL EQU    6    ADDR OF SCTR CONTAINING RELD TBL    PMN09720
0007  $HDNG EQU    7    ADDR OF SCTR CONTAINING PAGE HDR    PMN09730
0000  $STRT EQU    0    ADDR OF SCTR W/ COLD START PROG     PMN09740
      *                                                     PMN0975C
      * EQUIVALENCES FOR THE CORE IMAGE HEADER              PMN09760
      *                                                     PMN09770
0000  $XEQA EQU    0    RLTV ADDR OF CORE LOAD EXEC ADDR    PMN09780
0001  $CMON EQU    1    RLTV ADDR OF WD CNT OF COMMON       PMN09790
0002  $DREQ EQU    2    RLTV ADDR OF DISK I/O INDICATOR     PMN09800
0003  $FILE EQU    3    RLTV ADDR OF NO. FILES DEFINED      PMN09810
0004  $HWCT EQU    4    RLTV ADDR OF WD CNT OF CI HEADER    PMN09820
0005  $LSCT EQU    5    SCTR CNT OF FILES IN WK STORAGE     PMN09830
0006  $LCAD EQU    6    RLTV ADDR OF LOAD ADDR CORE LOAD    PMN09840
0007  $XCTL EQU    7    RLTV ADDR DISK1/DISKN EXIT CTRL     PMN09850
0008  $TVWC EQU    8    RLTV ADDR OF WD CNT OF TV           PMN09860
0009  $WCNT EQU    9    RLTV ADDR OF WD CNT OF CORE LOAD    PMN09870
000A  $XR3X EQU    10   RLTV ADDR OF EXEC SETTING OF XR3    PMN09880
000B  $ITVX EQU    11   RLTV ADDR OF 1ST WD OF ITV          PMN09890
0011  $ILS4 EQU    17   RLTV ADDR OF 1ST WD OF IBT4         PMN09900
001A  $OVSW EQU    26   RLTV ADDR OF LOCAL/SOCAL SWITCH     PMN09910
C01B  $CORE EQU    27   CORE SIZE OF BUILDING SYST   2-10   PMN09920
001D  $HEND EQU    29   RLTV ADDR OF LAST WD OF CI HDR      PMN09930
      *                                                     PMN09940
      * EQUIVALENCES FOR LET/FLET                           PMN09950
      *                                                     PMN09960
0005  $LFHD EQU    5    WORD COUNT OF LET/FLET HEADER       PMN09970
0003  $LFEN EQU    3    NO OF WDS PER LET/FLET ENTRY        PMN09980
0000  $SCTN EQU    0    RLTY ADDR OF LET/FLET SCTR NO.      PMN09990
0001  $UAFX EQU    1    RLTV ADDR OF SCTR ADDR OF UA/FXA    PMN10000
0003  $WDSA EQU    3    RLTV ADDR OF WDS AVAIL IN SCTR      PMN10010
0004  $NEXT EQU    4    RLTV ADDR OF ADDR NEXT SCTR         PMN10020
0000  $LFNM EQU    0    RLTV ADDR OF LET/FLET ENTRY NAME    PMN10030
0002  $BLCT EQU    2    RLTV ADDR OF LET/FLET ENTRY DBCT    PMN10040
      *                                                     PMN10050
      * MISCELLANEOUS EQUIVALENCES                          PMN10060
      *                                                     PMN10070
0033  $ISTV EQU    51   ISS NO. ADJUSTMENT FACTOR    2-1    PMN10080
0005  $MXDR EQU    5    MAX NO. DRIVES SUPPORTED            PMN10090
0380  $COMZ EQU    896  LOW COMMON LIMIT FOR DISKZ          PMN10100
04C0  $COM1 EQU    1216 LOW COMMON LIMIT FOR DISK1          PMN10110
0600  $COM2 EQU    1536 LOW COMMON LIMIT OF DISKN           PMN10120
0011  $TCNT EQU    17   NO. TRIES BEFORE DISK ERROR         PMN10130
C0F9  $DKEP EQU    DZ000+7 LIBF ENTRY TO DISK1/N            PMN10140
00F7  $DKIP EQU    DZ000+5 DISK I/O INTERRUPT ENTRY PT      PMN10150
0010  $SCIB EQU    16   CIB SECTOR COUNT             2-2    PMN10160
C003  $HCIB EQU    3    HIGH COMMON SECTOR COUNT     2-2    PMN10170
1000  $MCOR EQU    4096        SIZE OF MINIMUM CORE  2-2    PMN10180
007F  Y     EQU    127                                      PMN10190
      *                                                     PMN10200
C004  $CIDN EQU    4    RLTV ADDR CARTRIDGE ID       2-2    PMN10210
0005  $COPY EQU    5    RLTV ADDR COPY INDICATOR     2-2    PMN10220
0001  $DCTB EQU    1    RLTV ADDR DEFECTIV CYL TBL   2-2    PMN10230
0008  $DTYP EQU    8    RLTV ADDR DISK TYPE INDR     2-2    PMN10240
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COLD START PROGRAM

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      **************************************************** PMN10260
      *                                                  * PMN10270
      *STATUS -- VERSION   2, MODIFICATION  13           * PMN10280
      *                                                  * PMN10290
      *FUNCTION/OPERATION -                              * PMN10300
      *   THIS PROGRAM IS READ INTO CORE FROM SECTOR 0   * PMN10310
      *   OF THE SYSTEM CARTRIDGE AND TRANSFERRED TO BY  * PMN10320
      *   THE COLD START CARD.  DEFECTIVE CYLINDER       * PMN10330
      *   ADDRESSES, CARTRIDGE ID AND DISKZ ARE ALSO ON  * PMN10340
      *   SECTOR 0 AND ARE READ IN AT THE SAME TIME.     * PMN10350
      *   ALL THAT REMAINS FOR THE COLD START PROGRAM IS* PMN10360
      *   TO READ IN THE RESIDENT IMAGE, SAVE THE        * PMN10370
      *   CARTRIDGE ID AND TRANSFER TO THE AUXILIARY     * PMN10380
      *   SUPERVISOR THROUGH $DUMP IN THE RESIDENT       * PMN10390
      *   MONITOR.                                       * PMN10400
      *                                                  * PMN1041C
      *ENTRY - CR010-2                                   * PMN10420
      *   ENTER PROGRAM BY TRANSFER FROM COLD START CARD* PMN10430
      *                                                  * PMN10440
      *INPUT -                                           * PMN10450
      *   THE CARTRIDGE ID OF LOGICAL DRIVE ZERO (THE    * PMN10460
      *   SYSTEM CARTRIDGE) IS READ IN FROM SECTOR 0     * PMN10470
      *   WITH THE COLD START PROGRAM.                   * PMN10480
      *                                                  * PMN10490
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```
                       01059    *OUTPUT -                                         * PMN10500
                       01060    *   * THE RESIDENT IMAGE IS READ INTO CORE FROM   * PMN10510
                       01061    *     THE DISK.                                   * PMN10520
                       01062    *   * IN COMMA-                                   * PMN10530
                       01063    *     $ACDE                                       * PMN10540
                       01064    *     $CIBA-1                                     * PMN10550
                       01065    *     $CIDN                                       * PMN10560
                       01066    *     $CYLN                                       * PMN10570
                       01067    *     $DBSY                                       * PMN10580
                       01068    *     $IOCT                                       * PMN10590
                       01069    *                                                 * PMN10600
                       01070    *EXTERNAL REFERENCES -                            * PMN10610
                       01071    *   DZ000  SUBROUTINE TO PERFORM DISK I/O.        * PMN10620
                       01072    *                                                 * PMN10630
                       01073    *EXITS -                                          * PMN10640
                       01074    *   THE ONLY EXIT IS TO THE AUXILIARY SUPERVISOR  * PMN10650
                       01075    *   AS FOLLOWS-                                   * PMN10660
                       01076    *     BSI     $DUMP                               * PMN10670
                       01077    *     DC      -1                                  * PMN10680
                       01078    *                                                 * PMN10690
                       01079    *TABLES/WORK AREAS - N/A                          * PMN10700
                       01080    *                                                 * PMN10710
                       01081    *ATTRIBUTES -                                     * PMN10720
                       01082    *   THIS PROGRAM IS NOT NATURALLY RELOCATABLE.    * PMN10730
                       01083    *                                                 * PMN10740
                       01084    *NOTES -                                          * PMN10750
                       01085    *   DISK ERRORS RESULT IN A WAIT AT $PST2.        * PMN10760
                       01086    *************************************************** PMN10770
                       01088    *                                                   PMN10790
                       01089    * READ THE RESIDENT IMAGE INTO CORE                 PMN10800
                       01090    *                                                   PMN10810
01E0 0  617F           01091          LDX   1 Y                                     PMN10820
01E1 0  C824           01092          LDD     CR920      SET UP WORD COUNT AND SCTR PMN10830
01E2 00 DC000004       01093    CR010 STD  L  $CIBA-1    *ADDR OF RESIDENT IMAGE    PMN10840
01E4 0  D125           01094          STO   1 $CCYL-Y    *INITIALIZE DEF CYL NO. 1  PMN10850
01E5 0  C184           01095          LD    1 3-Y        FETCH LOG DRIVE 0 AREA CODE PMN10860
01E6 0  D120           01096          STO   1 $ACDE-Y    *AND STORE IT IN COMMA     PMN10870
01E7 0  D01F           01097          STO     CR920+1    SAVE THE AREA CODE         PMN10880
01E8 0  C156           01098          LD    1 DZ000-2-27-Y FETCH AND SAVE THE       PMN10890
01E9 0  D0F1           01099          STO     $CIDN      *CARTRIDGE ID              PMN10900
01EA 00 660001FE       01100          LDX  L2 CR020      SET UP TEMPORARY      2-11 PMN10902
01EC 00 6E00000A       01101          STX  L2 $LEV2      *ILS02                2-11 PMN10904
01EE 0  C0F4           01102          LD      CR010+1    FETCH CORE ADDR OF RESIDENT PMN10910
01EF 0  1890           01103          SRT     16         *IMAGE AND PUT IN EXTENSION PMN10920
01F0 0  D16F           01104          STO   1 $DBSY-Y    CLEAR DISK BUSY INDICATOR  PMN10930
01F1 0  D118           01105          STO   1 $CYLN-Y    INITIALIZE ARM POSITION    PMN10940
01F2 0  4173           01106          BSI   1 DZ000-Y    FETCH RESIDENT IMAGE       PMN10950
01F3 0  3000           01107          WAIT               WAIT OUT THE INTERRUPT     PMN10960
                       01108    *                                                   PMN10970
                       01109    * INITIALIZE ITEMS IN COMMA                         PMN10980
                       01110    *                                                   PMN10990
01F4 0  1810           01111          SRA     16                                    PMN11000
01F5 0  D183           01112          STO   1 $IOCT-Y    CLEAR IOCS COUNTER         PMN11010
01F6 0  C80D           01113          LDD     CR910                                 PMN11020
01F7 0  D985           01114          STD   1 $CIBA-1-Y *FOR SAVING CORE ON THE CIB PMN11030
01F8 0  C00E           01115          LD      CR920+1    FETCH AREA CODE            PMN11040
01F9 0  D120           01116          STO   1 $ACDE-Y    RESET AREA CODE            PMN11050
01FA 0  C00D           01117          LD      CR905      INITIALIZE WD ZERC TO      PMN11060
01F8 0  D181           01118          STO   1 0-Y        *AN 'MDX   *-1' LOOP       PMN11070
                       01119    *                                                   PMN11080
                       01120    * TRANSFER TO THE AUXILIARY SUPERVISOR              PMN11090
                       01121    * TO COMPLETE INITIALIZATION                        PMN11100
                       01122    *                                                   PMN11110
01FC 0  41C0           01123          BSI   1 $DUMP-Y    BR TO AUXILLIARY SUPERVISOR PMN11120
01FD 0  FFFF           01124          DC      -1         *FOR JOB PROCESSING        PMN11130
                       01125    *                                                   PMN11140
01FE 0  0000           01126    CR020 DC      *-*                              2-11 PMN11142
01FF 0  4178           01127          BSI   1 DZ010-Y    BR TO SERVICE INTERRUPT2-11 PMN11144
0200 00 74FF01FE       01128          MDX  L  CR020,-1                         2-11 PMN11146
0202 00 4CC001FE       01129          BOSC I  CR020      RETURN                2-11 PMN11148
                       01130    *                                                   PMN11160
                       01131    * CONSTANTS AND WORK AREAS                          PMN11170
                       01132    *                                                   PMN11180
0204    0000           01133          BSS  E  0          ASSURE EVEN BOUNDARY  2-11 PMN11190
0204 0  0000           01134    CR910 DC      0          WD CNT,SCTR ADDR OF    2-5 PMN11200
0205 0  0007           01135          DC      'HDNG      *HARMLESS WRITE TO DISK    PMN11210
0206 0  00E8           01136    CR920 DC      $DBSY-$CH12 WD CNT AND SCTR           PMN11220
0207 0  0002           01137          DC      'RIAD      *ADDR OF RESIDENT IMAGE    PMN11230
0208 0  70FF           01138    CR905 MDX     *-1        TO BE PUT AT ADDR 0000 2-11 PMN11231
0209    0009           01139          BSS     /0212-*    PATCH AREA            2-11 PMN11232
0212    0212           01140          END     *                                     99999999
```

```
                          CROSS-REFERENCE

SYMBOL     VALUE  REL DEFN     REFERENCES

CR010      01E2   0   01093    01102,R
CR020      01FE   0   01126    01100,R 01128,M 01129,B
CR905      0208   0   01138    01117,R
CR910      0204   0   01134    01113,R
CR920      0206   0   01136    01092,R 01097,M 01115,R
DZ000      00F2   0   00618    00328,B 00349,B 00646,B 00656,R 00715,R 00775,R 00971,R 00972,R 01023,R 01024,R 01098,R
                               01106,B
DZ010      00F7   0   00625    00645,R 00649,M 01127,B
DZ020      00F9   0   00627    00621,B
DZ060      0100   0   00634    00660,B
DZ070      0102   0   00638    00824,B 00830,B 00860,B 00868,B
DZ100      0104   0   00643    00627,M 00628,M 00723,B
DZ110      010E   0   00650    00647,M
DZ180      0111   0   00655    00626,B 00638,M
DZ185      0119   0   00661    00841,B
DZ190      0120   0   00670    00730,B
DZ210      0146   0   00719    00873,B
DZ215      014C   0   00727    00796,B
DZ220      0150   0   00734    00799,B
DZ230      0154   0   00740    00633,B
DZ232      0156   0   00741    00671,B
DZ235      0158   0   00743    00632,M 00664,B
DZ240      015D   0   00747    00879,B
DZ250      016C   0   00762    00770,B
DZ280      016D   0   00763    00749,M 00755,R 00756,R 00757,M 00768,M
DZ300      0178   0   00775    00765,B
DZ330      017D   0   00779    00751,M
DZ340      018C   0   00793    00736,B
DZ350      0197   0   00808    00753,M 00835,M 00839,B
DZ380      01A4   0   00823    00820,B
DZ390      01A5   0   00824    00803,B
DZ400      01B6   0   00846    00810,B 00837,B
DZ410      01CA   0   00869    00848,B
DZ900      0122   0   00677    00685,R 00822,R
DZ901      0123   0   00678    00834,R
DZ902      0124   0   00679    00661,R 00727,R 00745,M 00869,R 00876,M
DZ904      0126   0   00681    00639,R 00823,M 00829,M 00856,M
DZ905      0127   0   00682    00865,M
DZ906      0128   0   00683    00759,M 00855,R
DZ907      0129   0   00684    00786,M
DZ908      012A   0   00685    00828,R
DZ909      012B   0   00686    00783,M
DZ910      012C   0   00687    00657,R 00781,M 00793,R 00817,R
DZ911      012D   0   00688    00791,M
DZ912      012E   0   00689    00668,R 00746,M 00792,R 00846,R 00850,M 00871,R 00877,R
DZ913      012F   0   00690    00776,R
DZ914      0130   0   00691    00729,R
DZ915      0131   0   00692    00669,R
DZ916      0132   0   00693    00849,R
DZ920      0134   0   00695    00787,R
DZ925      0135   0   00696    00782,R
DZ930      0136   0   00697    00767,R
DZ935      0137   0   00698    00734,R
DZ940      0138   0   00699    00761,R
DZ945      0139   0   00700    00630,M 00785,R 00788,R 00866,R
DZ950      013A   0   00701    00790,R
DZ955      013B   0   00702    00777,R
DZ960      013C   0   00703    00754,R
DZ965      013D   0   00704    00750,R
DZ970      013E   0   00705    00752,R
DZ975      013F   0   00706    00789,M 00864,R
DZ980      0140   0   00707    00780,R
DZ985      0141   0   00708    00853,R
DZ990      0142   0   00709    00778,M 00784,R 00858,R
DZ995      0143   0   00710    00821,R
$ACDE      009F   0   00447    00704,R 00705,R 01096,M 01116,M
$ACEX      001A   0   00966    00321,M
$CCAD      0074   0   00374
$CH12      0006   0   00256    01136,R
$CIBA      0005   0   00255    00314,R 01093,M 01114,M
$CIDN      01DB   0   00887    01099,M
$CILA      005A   0   00967    00347,R
$CLSW      0018   0   00964
$COMN      0007   0   00257
$CORE      000E   0   00269
$CPTR      007E   0   00384
$CTSW      000F   0   00270
$CWCT      0072   0   00372
$CXR1      0017   0   00963    00324,M
$CYLN      009A   0   00437    00703,R 00705,R 011C5,M
$DADR      0010   0   00271
$DBSY      00EE   0   00560    00619,M 00663,M 00720,M 00742,M 00838,M 00840,M 00970,R 01104,M 01136,R
$DCDE      0077   0   00377
$DCYL      00A4   0   00458    00703,R 01094,M
$DDSW      00DD   0   00540    00658,M 00794,M
$DMPF      0019   0   00965    00326,M
$DREQ      0012   0   00273
$DUMP      003F   0   00320    00325,R 00556,B 01123,B
```

```
                         CROSS-REFERENCE

SYMBOL      VALUE  REL DEFN      REFERENCES

$DZ1N       0076    0   00376
$EXIT       0038    0   00304
$FLSH       0071    0   00370
$FPAD       0095    0   00428
$GCOM       0063    0   00353
$GRIN       0064    0   00354
$HASH       0014    0   00275     00961,R 00962,R 00963,R 00964,R 00965,R 00966,R
$IBSY       0013    0   00274
$IBT2       00B9    0   00968
$IBT4       00D4    0   00969
$IOCT       0032    0   00295     00359,R 00721,M 00740,M 01112,M
$IREQ       002C    0   00289     00524,B
$I200       00B3    0   00484     00263,R 00495,B
$I205       00B8    0   00490     00968,R
$I210       00BA    0   00491     00485,M 00486,M 00487,M
$I290       00C2    0   00496     00488,M 00494,R
$I400       00C4    0   00516     00265,R 00535,B
$I403       00D0    0   00526     00523,B
$I405       00D3    0   00530     00969,R
$I410       00D5    0   00531     00518,M 00519,M 00520,M
$I420       00E6    0   00553
$I425       00EA    0   00556     00555,B
$I490       00DE    0   00541     00517,M 00534,R
$I492       00E0    0   00542     00521,R
$I494       00E2    0   00545     C0527,R
$I496       00E4    0   00550     00554,R 00973,R
$I499       006E    0   00366     00362,R
$KCSW       007C    0   00382
$LAST       0033    0   00296
$LEV0       0008    0   00261
$LEV1       0009    0   00262
$LEV2       000A    0   00263     01101,M
$LEV3       000B    0   00264
$LEV4       000C    0   00265
$LEV5       000D    0   00266
$LINK       0039    0   00308     00339,R
$LKNM       0014    0   00961     00345,M
$LNXQ       0070    0   00368
$LSAD       0075    0   00375
$NDUP       0034    0   00297
$NXEQ       0035    0   00298
$PAUS       00F0    0   00971
$PBSY       0036    0   00299
$PGCT       0037    0   00300
$PHSE       0078    0   00378
$PRET       0028    0   00284     C0286,B 00735,B
$PST1       0081    0   00390     00392,B
$PST2       0085    0   00396     00398,B 00670,B
$PST3       0089    0   00402     00404,B
$PST4       008D    0   00408     00410,B
$RMSW       0016    0   00962     00338,M
$RWCZ       00F1    0   00972
$SCAN       0020    0   00278
$SCAT       0011    0   00272     00360,R
$SNLT       00EF    0   00970
$SSTS       006D    0   00365     00323,M
$STCP       0091    0   00415     00266,R 00417,B
$SYSC       00E0    0   00543
$S000       0052    0   00337     00304,B
$S100       0053    0   00338     00310,B 00330,B
$S150       0059    0   00344     00967,R
$S200       005E    0   00348
$S250       0065    0   00358     00322,B 00346,B 0035C,B 00363,8
$S300       0066    0   00359     00361,B
$S900       003C    0   00312     00327,R 00329,R
$S910       003E    0   00315     00337,R
$UFDR       007D    0   00383
$UFIO       0079    0   00379
$ULET       002D    0   00290
$WRD1       007B    0   00381
$WSDR       007A    0   00380
$XQWS       00ED    0   00559
$XR3X       00E4    0   00973
$ZEND       01E0    0   00882     00612,R 00614,R 00883,R
$1132       007F    0   00385
$1403       0080    0   00386
X2          00F2    0   00715     00670,B 00776,R 00777,R 00778,M 00780,R 00781,M 00782,R 00783,M 00784,R 00785,R 00786,M
                                  00787,R 00788,R 00789,M 00790,R 00791,M 00792,R 00793,R 00794,M 00817,R 00821,R 00822,R
                                  00823,M 00824,B 00828,R 00829,M 00830,B 00834,R 00846,R 00849,R 00850,M 00853,R 00855,R
                                  00856,M 00858,R 00860,B 00864,R 00865,M 00866,R 00868,B 00869,R 00871,R 00876,M 00877,R
Y           007F    0   01028     01091,R 01094,M 01095,R 01096,M 01098,R 01104,M 01105,M 01106,B 01112,M 01114,M 01116,M
                                  01118,M 01123,B 01127,B
=ACIN       001C    0   00918
=ANDU       0023    0   00924
=BNDU       0028    0   00925
=CBSW       000A    0   00901
=CIAD       001B    0   00917
=CIBA       003C    0   00929
=CIDN       0037    0   00928
=CSHN       005A    0   00935
```

```
                         CROSS-REFERENCE

SYMBOL       VALUE  REL  DEFN       REFERENCES

=DBCT        0006   0    00897
=DCSW        0018   0    00914
=ECNT        0021   0    00923
=ENTY        0010   0    00907
=FCNT        0007   0    00898
=FHOL        0014   0    00910
=FLET        004B   0    00932
=FMAT        0046   0    00931
=FPAD        002D   0    00926
=FSZE        0015   0    00911
=GCNT        001E   0    00920
=GRPH        001D   0    00919
=JBSW        0009   0    00900
=LCNT        000B   0    00902
=LOSW        001F   0    00921
=MDF1        000D   0    00904
=MDF2        000E   0    00905
=MPSW        000C   0    00903
=NAME        0004   0    00896
=NCNT        000F   0    00906
=PCID        0032   0    00927
=PIOD        0019   0    00915
=PPTR        001A   0    00916
=RP67        0011   0    00908
=SCRA        0041   0    00930
=SYSC        0008   0    00899
=TODR        0012   0    00909
=UHOL        0016   0    00912
=ULET        0050   0    00933
=USZE        0017   0    00913
=WSCT        0055   0    00934
=X3SW        0020   0    00922
'BLCT        0002   0    01013
'CDCV        0093   0    00950
'CIDN        0004   0    01030
'CIL1        00A0   0    00956      00886,R
'CIL2        00A1   0    00957
'CLBO        0078   0    00942
'CMON        0001   0    00988
'COMZ        0380   0    01019
'COM1        04C0   0    01020
'COM2        0600   0    01021
'COPY        0005   0    01031
'CORE        001B   0    01001
'CPTR        008E   0    00945
'DCOM        0001   0    00978
'DCTB        0001   0    01032
'DKEP        00F9   0    01023
'DKIP        00F7   0    01024
'DNID        0098   0    00955
'DREG        0002   0    00989
'DTYP        0008   0    01033
'DZID        0096   0    00953      00613,R
'D1ID        0097   0    00954
'FILE        0003   0    00990
'HCIB        0003   0    01026
'HDNG        0007   0    00982      01135,R
'HEND        001D   0    01002
'HWCT        0004   0    00991
'IDAD        0000   0    00977
'ILS4        0011   0    00999
'ISTV        0033   0    01017
'ITVX        000B   0    00998
'KBCP        0092   0    00949
'KBCV        0095   0    00952
'LDAD        0006   0    00993
'LFEN        0003   0    01007
'LFHD        0005   0    01006
'LFNM        0000   0    01012
'LSCT        0005   0    00992
'MCOR        1000   0    01027
'MCRA        006E   0    00939
'MXDR        0005   0    01018
'NEXT        0004   0    01011
'CVSW        001A   0    01000
'PTCV        0094   0    00951
'RIAD        0002   0    00979      01137,R
'RTBL        0006   0    00981
'SCIB        0010   0    01025
'SCTN        0000   0    01008
'SLET        0003   0    00980
'STRT        0000   0    00983
'SUP6        0073   0    00940
'SUP7        0074   0    00941
'TCNT        0011   0    01022      00741,R
'TVWC        0008   0    00995
'UAFX        0001   0    01009
```

```
                              CROSS-REFERENCE

SYMBOL      VALUE   REL  DEFN       REFERENCES

'WCNT       0009    0    00996
'WDSA       0003    0    01010
'XCTL       0007    0    00994
'XEQA       0000    0    00987
'XR3X       000A    0    00997
'1132       008D    0    00944
'1134       0091    0    00948
'1403       008C    0    00943
'1442       0090    0    00947
'2501       008F    0    00946

ERROR STATEMENT LINE NUMBERS

00619
   000.OVERFLOW SECTORS SPECIFIED
   000 OVERFLOW SECTORS REQUIRED
   270 SYMBOLS DEFINED
    NO ERROR(S) AND  001 WARNING(S)  FLAGGED IN ABOVE ASSEMBLY
```

Appendix H. Monitor System Sample Programs

Sample programs 1, 2, and 3 are provided with the monitor system. The first is a FORTRAN compilation, the second is an assembly, and the third is an RPG compilation (RPG is available on the Disk Monitor System, Version 2, card system only). All 3 programs are loaded, listed on the principal printer, and processed as monitor jobs.

The output of the FORTRAN program is printed on the printer specified on the IOCS control record. The output of the assembler program is printed on the console printer. The output of the RPG program is printed on the printer specified as the output device on a file description coding sheet.

Sample programs 4, 5, 6, and 7 are not provided with the monitor system. These programs illustrate techniques described in Chapter 6. "Programming Tips and Techniques."

1. FORTRAN SAMPLE PROGRAM

The FORTRAN sample program is listed as it runs on a 4K and an 8K system (the LIST ALL control record is removed for the 8K run). This program reads data cards supplied with the program and builds 3 files on disk; one in the user area, and 2 in working storage. The core and file maps for the program are described in Chapter 6.

The FORTRAN card sample program as supplied uses a 1442-6, or -7, and 1132 Printer, and disk. The paper tape sample program uses an 1134 Paper Tape Reader, a console printer, and disk. If your system does not have the required configuration, you must make the following changes to the program:

card SMFOR006 If printed output is to a 1403 Printer, change the IOCS entry from 1132 PRINTER to 1403 PRINTER.

If printed output is to the console printer, change the IOCS entry from 1132 PRINTER to TYPEWRITER.

card SMFOR007 If card input is from a 2501 Reader, change the IOCS entry from CARD to 2501 READER.

card SMFOR023 If card input is from a 2501 Reader, change M=2 to M=8.

card SMFOR024 If printer output is to a 1403 Printer, change L=3 to L=5.

If the printer output is on a console printer, change L=3 to L=1.

FORTRAN Sample Program Run on 4K

```
// JOB T                                                 SAMPLE               SMFOR000

LCG DRIVE   CART SPEC   CART AVAIL  PHY DRIVE
  CCOO        0EDO         0EDO        CCOO

// DUP                                                                        SMFOR001

*STCREDATA  WS  UA  FILEA    2                                                SMFOR002
CART IC 0EDO   DB ADCR  2EA0   DB CNT   0C20

// * IBM 1130 FCRTRAN SAMPLE PROGRAM                                          SMFOR003

// FOR                                                                        SMFOR004
*CNE WCRD INTEGERS                                                            SMFOR005
*ICCS(DISK,1132 PRINTER)                                                      SMFOR006
*ICCS(CARD)                                                                   SMFOR007
*LIST ALL                                                                     SMFOR008
C      IBM 1130 FCRTRAN SAMPLE PROGRAM                                        SMFOR009
C      SIMLLTANECUS EQUATICN PROGRAM                                          SMFOR010
C                                                                             SMFOR011
       INTEGER V1,V2,V3                                                       SMFOR012
       DIMENSICN A(10,10),X(10),B(126)                                        SMFOR013
       CEFINE FILE 101(1,1C0,U,V1),102(1,10,U,V2),103(1,100,U,V3)             SMFOR014
  301 FORMAT (1H1,20X15HINCOMPATIBILITY)                                      SMFOR015
  302 FORMAT (1H 20X41HMORE EQUATICNS THAN UNKNOWNS-NC SOLUTICNS)             SMFOR016
  3C3 FORMAT (1H 2CX46HMORE UNKNCWNS THAN EQUATIONS-SEVERAL SCLUTIONS)        SMFOR017
  304 FORMAT (1H 20X15HSCLUTICN MATRIX)                                       SMFOR018
  305 FORMAT (1H 20X8HMATRIX A)                                               SMFOR019
  3C6 FORMAT (1H 20X8HMATRIX B)                                               SMFOR020
  3C7 FORMAT (1H 20X10H A-INVERSE)                                            SMFOR021
  308 FORMAT (1H 20X24HDIAGONAL ELEMENT IS ZERO)                              SMFOR022
      M=2                                                                     SMFOR023
      L=3                                                                     SMFOR024
      READ (M,10)                                                             SMFOR025
   10 FORMAT(80H            SPACE FOR TITLE                                   SMFOR026
     1                             )                                          SMFOR027
      WRITE (L,10)                                                            SMFOR028
   12 FORMAT (6I10,20X)                                                       SMFOR029
      REAC (M,12) M1,M2,L1,L2,N1,N2                                           SMFOR030
C                                                                             SMFOR031
C     M1 = NO. OF ROWS OF A                                                   SMFOR032
C     M2 = NC. OF COLS OF A                                                   SMFOR033
C     L1 = NC. OF ROWS OF X                                                   SMFOR034
C     L2 = NC. OF COLS OF X                                                   SMFOR035
C     N1 = NC. OF ROWS OF B                                                   SMFOR036
C     N2 = NO. OF COLS OF B                                                   SMFOR037
C                                                                             SMFOR038
   13 FCRMAT (7F10.4,10X)                                                     SMFOR039
   17 FORMAT (10F10.4)                                                        SMFOR040
      IF (N2-1)63,64,63                                                       SMFOR041
   64 IF (L2-1)63,65,63                                                       SMFOR042
   65 IF (L1-M2)63,66,63                                                      SMFOR043
   66 IF (M1-N1)63,11,63                                                      SMFOR044
   63 WRITE (L,301)                                                           SMFOR045
      GO TC 2                                                                 SMFOR046
   11 N=M1                                                                    SMFOR047
      N=M2                                                                    SMFOR048
      IF (M1-M2) 91,14,93                                                     SMFOR049
   91 WRITE (L,302)                                                           SMFOR050
      GC TO 2                                                                 SMFOR051
   93 WRITE (L,303)                                                           SMFOR052
      GC TO 2                                                                 SMFOR053
   14 WRITE (L,305)                                                           SMFOR054
      DO 70 I=1,N                                                             SMFOR055
      REAC  (M,13) (A(I,J), J=1,N)                                            SMFOR056
      WRITE (L,17) (A(I,J), J=1,N)                                            SMFOR057
      WRITE (101'1)(A(I,J), J=1,N)                                            SMFOR058
   70 CONTINUE                                                                SMFOR059
   89 FORMAT (F10.4,70X)                                                      SMFOR060
      WRITE (L,306)                                                           SMFOR061
      REAC  (M,89) (B(I), I=1,N)                                              SMFOR062
      WRITE (L,89) (B(I), I=1,N)                                              SMFOR063
      WRITE (102'1)(B(I), I=1,N)                                              SMFOR064
C                                                                             SMFOR065
C     INVERSICN CF A                                                          SMFOR066
C                                                                             SMFOR067
      DO 12C K=1,N                                                            SMFOR068
      D=A(K,K)                                                                SMFOR069
      IF(D)40,200,40                                                          SMFOR070
   40 A(K,K)=1.0                                                              SMFOR071
      DO 60 J=1,N                                                             SMFOR072
   60 A(K,J)=A(K,J)/D                                                         SMFOR073
      IF(K-N)80,130,130                                                       SMFOR074
   80 IK=K+1                                                                  SMFOR075
      DO 120 I=IK,N                                                           SMFOR076
      D=A(I,K)                                                                SMFOR077
      A(I,K)=0.0                                                              SMFOR078
      DO 120 J=1,N                                                            SMFOR079
  120 A(I,J)=A(I,J)-(D*A(K,J))                                                SMFOR080
```

```
C                                                                       SMFOR081
C .     BACK SCLUTICN                                                   SMFOR082
C                                                                       SMFOR083
  130 IK=N-1                                                            SMFOR084
      DO 180 K=1,IK                                                     SMFOR085
      I1=K+1                                                            SMFOR086
      CC 180 I=I1,N                                                     SMFOR087
      D=A(K,I)                                                          SMFOR088
      A(K,I)=0.0                                                        SMFOR089
      DC 180 J=1,N.                                                     SMFOR090
  180 A(K,J)=A(K,J)-(C*A(I,J))                                          SMFOR091
      GC TC 202                                                         SMFOR092
  200 WRITE (L,308)                                                     SMFOR093
      GC TC 2                                                           SMFOR094
  202 WRITE (L,307)                                                     SMFOR095
      DC 201 I=1,N                                                      SMFOR096
      WRITE (L,17)  (A(I,J), J=1,N)                                     SMFOR097
      WRITE (103'1) (A(I,J), J=1,N)                                     SMFOR098
  201 CONTINUE                                                          SMFOR099
      DO 21 I=1,N                                                       SMFOR100
      X(I)=0.0                                                          SMFOR101
      DO 21 K=1,N                                                       SMFOR102
   21 X(I)=X(I)+A(I,K)*B(K)                                             SMFOR103
      WRITE (L,304)                                                     SMFOR104
      WRITE (L,89) (X(I), I=1,N)                                        SMFOR105
    2 CALL EXIT                                                         SMFOR106
      END                                                               SMFOR107

VARIABLE ALLOCATICNS
     A(R )=00CC-0016      X(R )=00F0-000E      B(R )=01EC-00F2      D(R )=01EE          V1(I )=01F0          V2(I )=01F1
    V3(I )=01F2            M(I )=01F3           L(I )=01F4         M1(I )=01F5          M2(I )=01F6          L1(I )=01F7
    L2(I )=01F8           N1(I )=01F9          N2(I )=01FA          N(I )=01FB           I(I )=01FC           J(I )=01FD
     K(I )=01FE           IK(I )=01FF          I1(I )=02C0

STATEMENT ALLCCATICNS
 301  =020E  302  =0218  303  =0235  304  =0251  305  =025E  306  =0267  307  =0270  308  =027A  10   =028B  12   =0285
 13   =0289  17   =028D  89   =02C0  64   =0300  65   =0306  66   =03CC  63   =0312  11   =0318  91   =0328  93   =032E
 14   =0334  70   =0386  40   =03EB  60   =03FA  80   =0416  120  =0435  130  =0468  180  =0491  200  =04C6  202  =04CC
 201  =05C6  21   =0520  2    =056C

FEATURES SUPPCRTED
 CNE WCRD INTEGERS
 ICCS

CALLEC SUBPRCGRAMS
 FACDX   FMPYX   FDIV    FLD     FLDX    FSTO    FSTOX   FSBRX   CARDZ   PRNTZ   SRED    SWRT    SCOMP   SFIO    SIOFX
 SIOI    SUBSC   SDFIC   SDWRT   SDCOM   SDFX

REAL CCNSTANTS
  .100000E 01=0204     .00C000E 00=0206

INTEGER CCNSTANTS
     2=0208        3=0209        1=020A      101=02C8      102=020C      103=020D

CCRE REQUIREMENTS FOR
 COMMCN       0  VARIABLES     516  PROGRAM     874

ENC OF CCMPILATICN
```

```
// XEC        L  2                                                    SMFOR108

*LCCAL,FLCAT,PARC,IFIX,PAUSE,HOLEZ                                    SMFOR109

*FILES(103,FILEA)                                                     SMFOR110
FILES ALLCCATICN
  1C3 02EA  0C01  0EDC FILEA
  101 C00C  0C01  0ED0  02EC
  102 C001  CC01  0ECO  02EC
STCRAGE ALLCCATICN
R 4C  038F (HEX) ACDITICNAL CCRE REQUIRD
R 43  0124 (HEX) ARITH/FUNC SCCAL WD CNT
R 44  06B2 (HEX) FI/C, I/C SOCAL WD CNT
R 45  07B6 (HEX) CISK FI/C SCCAL WD CNT
R 41  C004 (HEX) WCS UNUSEC BY CCRE LCAC
LIBF TRANSFER VECTCR
 XMCS   09AA SCCAL 1
 EBCTB  0F51 SCCAL 2
 HCLTB  0F15 SCCAL 2
 GETAC  0ED2 SCCAL 2
 NORM   07C0
 FACDX  0955 SCCAL 1
 FSBRX  092C SCCAL 1
 FMPYX  08F8 SCCAL 1
 FCIV   08A6 SCCAL 1
 FSTCX  076C
 FLCX   0788
 SCCOM  0978 SCCAL 3
 SDFX   08E3 SCCAL 3
 SDWRT  0901 SCCAL 3
 SICFX  09A6 SOCAL 2
 SUBSC  07A2
 SICI   09AA SCCAL 2
 SCCMP  0983 SCCAL 2
 SWRT   08A2 SCCAL 2
 SRED   08A7 SCCAL 2
 FSTO   0770
 FLD    078C
 PRNTZ  0CF8 SOCAL 2
 CARDZ  0C48 SCCAL 2
 SFIO   098F SCCAL 2
 SCFIC  0960 SCCAL 3
 HCLEZ  086A LOCAL
 PAUSE  086A LOCAL
 IFIX   086A LOCAL
 FARC   086A LOCAL
 FLCAT  086A LOCAL
SYSTEM SUBROUTINES
 ILS04  0CC4
 ILS02  00B3
 ILS01  0F56
 ILS00  0F6F
 FLIPR  0804
      04C1 (HEX) IS THE EXECUTION ADDR

     IBM 1130 FORTRAN          SAMPLE PROGRAM                        SMFOR111
                         MATRIX A
   4.2150   -1.2120    1.1050
  -2.1200    3.5050   -1.6320
   1.1220   -1.3130    3.9860
                         MATRIX B
   3.2160
   1.2470
   2.3456
                          A-INVERSE
   0.2915    0.0833   -0.0467
   0.1631    0.3836    0.1118
  -0.0283    0.1029    0.3008
                         SOLUTION MATRIX
   0.9321
   1.2654
   0.7429
```

FORTRAN Sample Program Run on 8K

```
// JOB T                                                SAMPLE              SMFOR000

LOG DRIVE   CART SPEC   CART AVAIL   PHY DRIVE
  0000        2222        2222         0002

V2 M11   ACTUAL  8K  CONFIG  8K

// DUP                                                                      SMFOR001

*STOREDATA  WS  UA  FILEA    2                                              SMFOR002
CART ID 2222   DB ADDR  5380   DB CNT   0020

// * IBM 1130 FORTRAN SAMPLE PRCGRAM                                        SMFOR003

// FOR                                                                      SMFOR004
*ONE WORD INTEGERS                                                          SMFOR005
*IOCS(DISK,1132 PRINTER)                                                    SMFOR006
*IOCS(CARD)                                                                 SMFOR007
*LIST ALL                                                                   SMFOR008
C     IBM 1130 FORTRAN SAMPLE PROGRAM                                       SMFOR009
C     SIMULTANEOUS ECUATICN PROGRAM                                         SMFOR010
C                                                                           SMFOR011
      INTEGER V1,V2,V3                                                      SMFOR012
      DIMENSICN A(10,10),X(10),B(126)                                       SMFOR013
      DEFINE FILE 101(1,1CC,U,V1),102(1,10,U,V2),103(1,100,U,V3)            SMFOR014
  301 FCRMAT (1H1,20X15HINCOMPATIPILITY)                                    SMFOR015
  302 FORMAT (1H 20X41HMORE EQUATICNS THAN UNKNCWNS-NO SOLUTIONS)           SMFOR016
  303 FORMAT (1H 20X46HMORE UNKNCWNS THAN EQUATIONS-SEVERAL SOLUTIONS)      SMFOR017
  304 FCRMAT (1H 20X15HSOLUTION MATRIX)                                     SMFOR018
  305 FORMAT (1H 20X8HMATRIX A)                                             SMFOR019
  306 FORMAT (1H 20X8HMATRIX B)                                             SMFOR020
  307 FORMAT (1H 20X10H A-INVERSE)                                          SMFOR021
  308 FORMAT (1H 20X24HDIAGONAL ELEMENT IS ZERO)                            SMFOR022
      M=2                                                                   SMFOR023
      L=3                                                                   SMFOR024
      READ (M,10)                                                           SMFOR025
   10 FCRMAT(80H             SPACE FOR TITLE                                SMFOR026
     1                                 )                                    SMFOR027
      WRITF (L,10)                                                          SMFOR028
   12 FCRMAT (6I10,2CX)                                                     SMFOR029
      READ (M,12) M1,M2,L1,L2,N1,N2                                         SMFOR030
C                                                                           SMFOR031
C     M1 = NC. CF RCWS CF A                                                 SMFOR032
C     M2 = NC. CF CCLS CF A                                                 SMFOR033
C     L1 = NO. OF RCWS OF X                                                 SMFOR034
C     L2 = NC. CF COLS OF X                                                 SMFOR035
C     N1 = NC. CF ROWS CF B                                                 SMFOR036
C     N2 = NC. CF CCLS OF B                                                 SMFOR037
C                                                                           SMFOR038
   13 FCRMAT (7F10.4,10X)                                                   SMFOR039
   17 FCRMAT (10F10.4)                                                      SMFOR040
      IF (N2-1)63,64,63                                                     SMFOR041
   64 IF (L2-1)63,65,63                                                     SMFOR042
   65 IF (L1-M2)63,66,63                                                    SMFOR043
   66 IF (M1-N1)63,11,63                                                    SMFOR044
   63 WRITE (L,301)                                                         SMFOR045
      GC TC 2                                                               SMFOR046
   11 N=M1                                                                  SMFORC47
      N=M2                                                                  SMFOR048
      IF (M1-M2) 91,14,93                                                   SMFOR049
   91 WRITE (L,302)                                                         SMFOR050
      GC TC 2                                                               SMFOR051
   93 WRITE (L,303)                                                         SMFCR052
      GC TC 2                                                               SMFOR053
   14 WRITE (L,305)                                                         SMFOR054
      DC 7C I=1,N                                                           SMFOR055
      READ  (M,13) (A(I,J), J=1,N)                                          SMFOR056
      WRITE (L,17) (A(I,J), J=1,N)                                          SMFOR057
      WRITE (1C1'1)(A(I,J), J=1,N)                                          SMFOR058
   70 CCNTINUE                                                              SMFOR059
   89 FCRMAT (F10.4,70X)                                                    SMFOR060
      WRITE (L,306)                                                         SMFOR061
      READ  (M,89) (B(I), I=1,N)                                            SMFOR062
      WRITE (L,89) (B(I), I=1,N)                                            SMFOR063
      WRITE (102'1)(B(I), I=1,N)                                            SMFOR064
C                                                                           SMFOR065
C     INVERSICN UF A                                                        SMFOR066
C                                                                           SMFOR067
      CC 120 K=1,N                                                          SMFOR068
      D=A(K,K)                                                              SMFOR069
      IF(C)40,200,4C                                                        SMFOR070
   40 A(K,K)=1.0                                                            SMFOR071
      CO 6C J=1,N                                                           SMFOR072
   60 A(K,J)=A(K,J)/C                                                       SMFOR073
      IF(K-N)80,130,130                                                     SMFOR074
   80 IK=K+1                                                                SMFOR075
      DC 120 I=IK,N                                                         SMFGR076
      C=A(I,K)                                                              SMFOR077
      A(I,K)=0.0                                                            SMFOR078
      CO 120 J=1,N                                                          SMFOR079
  120 A(I,J)=A(I,J)-(D*A(K,J))                                              SMFOR080
```

```
C                                                                                SMFOR081
C      BACK SCLUTION                                                             SMFOR082
C                                                                                SMFOR083
   130 IK=N-1                                                                    SMFOR084
       DC 180 K=1,IK                                                             SMFOR085
       I1=K+1                                                                    SMFOR086
       DO 180 I=I1,N                                                             SMFOR087
       C=A(K,I)                                                                  SMFOR088
       A(K,I)=0.0                                                                SMFOR089
       DO 180 J=1,N                                                              SMFOR090
   180 A(K,J)=A(K,J)-(D*A(I,J))                                                  SMFOR091
       GO TC 202                                                                 SMFOR092
   200 WRITE (L,308)                                                             SMFOR093
       GO TO 2                                                                   SMFOR094
   202 WRITE (L,307)                                                             SMFOR095
       DC 201 I=1,N                                                              SMFOR096
       WRITE (L,17)  (A(I,J), J=1,N)                                             SMFOR097
       WRITE (103'1) (A(I,J), J=1,N)                                             SMFOR098
   201 CONTINUE                                                                  SMFOR099
       DO 21 I=1,N                                                               SMFOR100
       X(I)=0.0                                                                  SMFOR101
       DO 21 K=1,N                                                               SMFOR102
    21 X(I)=X(I)+A(I,K)*B(K)                                                     SMFOR103
       WRITE (L,304)                                                             SMFCR104
       WRITE (L,89) (X(I), I=1,N)                                                SMFOR105
     2 CALL EXIT                                                                 SMFOR106
       END                                                                       SMFOR107
VARIABLE ALLOCATIONS
     A(R )=000C-0016      X(R )=COF0-000E       B(R )=01EC-00F2     D(R )=01EE           V1(I )=01F0           V2(I )=01F1
    V3(I )=01F2           M(I )=C1F3            L(I )=01F4         M1(I )=01F5           M2(I )=01F6           L1(I )=01F7
    L2(I )=01F8          N1(I )=01F9           N2(I )=01FA          N(I )=01FB            I(I )=01FC            J(I )=01FD
     K(I )=01FE          IK(I )=01FF           I1(I )=0200

STATEMENT ALLOCATIONS
 301  =020E  302  =0218  303  =C235  304  =0251  305  =025E  306  =0267  307  =0270  308  =027A  10   =0288  12   =0288
 13   =0289  17   =028D  89   =C2C0  64   =0300  65   =0306  66   =030C  63   =0312  11   =0318  91   =0328  93   =032E
 14   =0334  70   =0386  4C   =03E8  60   =03FA  80   =0416  120  =0435  130  =0468  180  =0491  200  =04C6  202  =04CC
 201  =0506  21   =0520  2    =C56C

FEATURES SUPPCRTED
 ONE WCRD INTEGERS
 IOCS

CALLED SUBPROGRAMS
 FADDX   FMPYX   FDIV    FLD     FLDX    FSTO    FSTOX   FSBRX   CARCZ   PRNTZ   SRED    SWRT    SCOMP   SFIO    SIOFX
 SIOI    SUBSC   SOFIO   SOWRT   SCCOM   SOFX

REAL CONSTANTS
  .100000E 01=0204    .0C0C00E C0=C206

INTEGER CONSTANTS
     2=C208      3=0209      1=C20A    101=020B    102=020C    1C3=020D

CORE RECUIREMENTS FOR
 COMMON       0  VARIABLES    516  PROGRAM    874

END OF COMPILATION
```

```
// XEQ        L  2                                                   SPFCR108

*LOCAL,FLOAT,FARC,IFIX,PAUSE,HCLE7,FLD                               SPFOR109

*FILES(103,FILEA)                                                    SPFCR110
FILES ALLOCATION
  103 C538  0C01  2222 FILEA
  101 C000  0001  2222  053D
  102 C001  CC01  2222  053D
STORAGE ALLOCATION
R 41  0C42 (HEX) WDS UNUSEC BY CORE LCAD
LIBF TRANSFER VECTOR
 XMDS   1244
 EBCTB  1241
 HOLTB  12C5
 GETAD  11C2
 NORM   1198
 FADDX  1143
 FSBRX  111A
 FMPYX  1CE6
 FDIV   1086
 FSTOX  12F4 LCCAL
 FLOX   1310 LOCAL
 SDCOM  0842
 SDFX   07AD
 SDWRT  07CB
 SIOFX  0B2A
 SUBSC  1064
 SIOI   0B2E
 SCOMP  0B06
 SWRT   0A22
 SRED   0A27
 FSTO   12F8 LCCAL
 PRNTZ  0F7C
 CARDZ  0ECC
 SFIO   0B43
 SDFIO  082A
 FLD    1314 LOCAL
 HOLEZ  12F4 LOCAL
 PAUSE  12F4 LOCAL
 IFIX   12F4 LOCAL
 FARC   12F4 LOCAL
 FLCAT  12F4 LOCAL
SYSTEM SUBROUTINES
 ILS04  C0C4
 ILS02  00B3
 ILS01  132C
 ILS00  1345
 FLIPR  128E
      04C1 (HEX) IS THE EXECUTICN ADDR
```

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2. ASSEMBLER SAMPLE PROGRAM

The core map printed with the assembler sample program is described in Chapter 6. "Programing Tips and Techniques."

output on
the principal
printer

```
// JOB                                                                                SMASM101

LCG DRIVE    CART SPEC    CART AVAIL   PHY DRIVE
  0000         0ED0          0ED0         0000

V2 M09    ACTUAL 32K   CONFIG 32K

// ASM                                                                                SMASM102
*LIST                                                                                 SMASM103
*PRINT SYMBOL TABLE                                                                   SMASM104

                                  CCMPUTE TFE SQUARE ROOT OF 64

                    C0001    **************************************************** SMASM106
                    CC002    *                                                  * SMASM107
                    CC003    *   THIS PROGRAM COMPUTES TFE SQUARE RCOT OF 64   * SMASM108
                    00004    *   *ANC PRINTS THE RESLLT IN THE CCNSOLE PRINTER.* SMASM109
                    0C005    *                                                  * SMASM110
                    C0006    **************************************************** SMASM111
0CC0 0  C030        CC007    BEGIN LC      D64        INPUT TO THE SQUARE ROOT      SMASM112
0C01 20 064D6063 C0008          LIBF    FLOAT      INTEGER TO FLOATING PT.       SMASM113
0002 30 06898640 00009          CALL    FSQR       FLOATING PT. SQRT.            SMASM114
CC04 20 0918S9CC C0010          LIBF    IFIX       FLOATING PT. TO INTEGER       SMASM115
0C05 0  1008        CC011          SLA     8                                        SMASM116
                    CC012    *             MASK TC BUILD EBCDIC INTEGER             SMASM117
                    CC013    *             RESULT ANC EBCDIC BLANK IN WORD1.        SMASM118
CC06 0  E829        CC014          OR      MASK                                     SMASM119
0C07 0  DC1B        CC015          STO     WCRD1      CONVERSION INPUT AREA         SMASM120
                    00016    *             CCNVERT MESSAGE FROM EBCDIC              SMASM121
                    CC017    *             TC ROTATE/TILT CODE.                     SMASM122
0008 20 05097663 CC018          LIBF    EBPRT      CALL CCNVERSION SUBROUTINE    SMASM123
0C09 0  0C00        CC019          DC      0          CONTROL PARAMETER             SMASM124
0C0A 1  0C23        CC02C          DC      WORD1      INPUT AREA                    SMASM125
0CCB 1  0015        CC021          DC      TYPE+1     OUTPUT AREA                   SMASM126
0CCC 0  001A        C0022          DC      26         CHARACTER COUNT               SMASM127
0CCD 20 23A17170 C0023          LIBF    TYPE0      TYPE MESSAGE                  SMASM128
0C0E 0  2C00        CC024          DC      /2C00      CONTROL PARAMETER             SMASM129
0CCF 1  0C14        CC025          DC      TYPE       I/O AREA                      SMASM130
0010 20 23A17170 C0026    BUSY  LIBF    TYPE0      WAIT FOR TYPING COMPLETE      SMASM131
0011 0  CC00        C0027          DC                                               SMASM132
0012 C  7CFD        CC028          MDX     BUSY       BR TO WAIT FOR COMPLETION     SMASM133
0013 0  6038        CC029          EXIT               RETURN TO MCNITCR CCNTROL     SMASM134
0014 0  0C0E        CC030    TYPE  DC      14         I/O AREA WORD COUNT           SMASM135
0015    CC0D        C0031          BSS     13         RESERVE AS PRINT BUFFER       SMASM136
0022 0  8181        CC032          DC      /8181      TWO CARRIAGE RETURNS          SMASM137
0023 0  CC00        CC033    WORC1 DC      *-*        CONVERSION INPUT AREA         SMASM138
0024    0C18        C0034          EBC     .IS TFE SQUARE RCOT OF 64.               SMASM139
C030 0  FC40        CC035    MASK  DC      /F040      EBCCIC INTEGER MASK           SMASM140
0031 0  0040        00036    D64   DC      64         CCNSTANT FOR SQUARE RCOT      SMASM141
0032    0CC0        C0037          END     BEGIN                                    SMASM142
```

```
                                        *SYMBOL TABLE*

          BEGIN  0000      BUSY    001C      D64    0031      MASK   0030      TYPE   0014
          WORD1  0023

          C00 OVERFLCW SECTCRS SPECIFIED
          C00 OVERFLCW SECTCRS REQUIRED
          C06 SYMBCLS DEFINEC
           NC ERRCR(S) ANC   NO WARNING(S)  FLAGGED IN ABOVE ASSEMBLY

       // XEC        L                                                          SMASM143
       R 41   7908 (HEX) WCS UNUSED BY CORE LOAC
       CALL TRANSFER VECTCR
        FSQR    0248
       LIBF TRANSFER VECTCR
        FARC    069A
        XMCS    067E
        HCLL    062E
        PRTY    05DE
        EBPA    058E
        FACD    04CD
        FCIV    053C
        FLD     0488
        FACDX   04E3
        FMPYX   049E
        FSTO    046C
        FGETP   0452
        NORM    0428
        TYPEO   0312
        EBPRT   02AC
        IFIX    0280
        FLCAT   0230
       SYSTEM SUBROUTINES
        ILS04   0CC4
        ILS02   00B3
            01FE (HEX) IS THE EXECUTION ADDR
```

output on the console printer

```
8 IS THE SQUARE ROOT OF 64
```

3. RPG SAMPLE PROGRAM

The RPG program as supplied, uses 1442 input and 1132 output. If your system does not have the required configuration, you must make the following changes to the program:

card RGS009 — If card input is from a 2501 Card Reader, change READ42 to READ01.

card RGS010 — If printed output is to a 1403 Printer, change PRINTER to PRINT03. If printer output is on the console printer, change PRINTER to CONSOLE.

output on principal printer

```
// JOB

LOG DRIVE   CART SPEC   CART AVAIL  PHY DRIVE
  0000        0EDO        0EDO        0000
                          0ED4        0001

V2 M09   ACTUAL 32K  CONFIG 32K

// RPG

                                V1-3  1130  RPG   RGSPL


SEQ NO  PG LIN    SPECIFICATIONS COL 6 - 74                                             ERRORS

                  H                                                                    RGSPL
                  F*  1130 RPG SAMPLE PROGRAM.                                         RGS001
                  F*  THIS PROGRAM PRINTS AN ACCOUNTS RECEIVABLE REGISTER WITH         RGS002
                  F*  INVOICE TOTALS . CUSTOMER TOTALS PRINT AS A RESULT OF A CONTROL  RGS003
                  F*  BREAK IN COLUMNS 39-43 OF THE INPUT CARD. CORRECT OUTPUT         RGS004
                  F*  APPEARS IN ACCOMPANYING DOCUMENTATION. CARDS ARE SORTED ON       RGS005
                  F*  COLUMNS 39-43 AND ARE IDENTIFIED BY AN ELEVEN PUNCH IN CARD      RGS006
                  F*  COLUMN 1.                                                        RGS007
                  F*                                                                   RGS008
 0001   01 010    FINPUT   IPE F      80            READ42                             RGS009
 0002   01 020    FOUTPUT  O   F     120     OF     PRINTER                            RGS010
 0003   02 010    IINPUT   AA  01   1 Z-                                               RGS011
 0004   02 020    I                                        8  29 NAME                  RGS012
 0005   02 030    I                                       30  310MONTH                 RGS013
 0006   02 040    I                                       32  330DAY                   RGS014
 0007   02 050    I                                       34  380INVNO                 RGS015
 0008   02 060    I                                       39  430CUSTNOL1              RGS016
 0009   02 070    I                                       44  450STATE                 RGS017
 0010   02 080    I                                       46  480CITY                  RGS018
 0011   02 090    I                                       74  802INVAMT                RGS019
 0012   03 010    C   01      INVAMT    ADD  TOTAL     TOTAL   82                      RGS020
 0013   03 020    C   01      INVAMT    ADD  GRPTOT    GRPTOT  82                      RGS021
 0014   04 010    OOUTPUT  H  201   1P                                                 RGS022
 0015   04 020    O       OR        OF                                                 RGS023
 0016   04 030    O                                   53 '     A C C O U N T S  R'     RGS024
 0017   04 040    O                                   77 ' E C E I V A B L E  R E '    RGS025
 0018   04 050    O                                   88 'R E G I S T E R'             RGS026
 0019   04 060    O        H  1     1P                                                 RGS027
 0020   04 070    O       OR        OF                                                 RGS028
 0021   04 080    O                                   25 'CUSTOMER'                    RGS029
 0022   04 090    O                                   80 'LOCATION        INVOICE'     RGS030
 0023   04 100    O                                  109 'INVOICE DATE     INVOICE'    RGS031
 0024   04 110    O        H  2     1P                                                 RGS032
 0025   04 120    O       OR        OF                                                 RGS033
 0026   04 130    O                                   42 'NUMBER         CUSTOMER '    RGS034
 0027   04 140    O                                   45 'NAME'                        RGS035
 0028   04 150    O                                   79 'STATE   CITY      NUMBER'    RGS036
 0029   04 160    O                                  108 'MO      DAY     AMOUNT'      RGS037
 0030   05 010    O        D  2     01                                                 RGS038
 0031   05 020    O                          CUSTNOZ  22                               RGS039
 0032   05 030    O                          NAME     53                               RGS040
 0033   05 040    O                          STATE Z  59                               RGS041
 0034   05 050    O                          CITY  Z  67                               RGS042
 0035   05 060    O                          INVNO Z  79                               RGS043
 0036   05 070    O                          MONTH Z  89                               RGS044
 0037   05 080    O                          DAY   Z  97                               RGS045
 0038   05 090    O                          INVAMT  109 '$    ,  0.  '                RGS046
 0039   05 100    O        T  2     L1                                                 RGS047
 0040   05 110    O                          GRPTOT B 109 '$    ,  0.  '               RGS048
 0041   05 120    O                                  110 '*'                           RGS049
 0042   05 130    O        T  2     LR                                                 RGS050
 0043   05 140    O                          TOTAL   109 '$    ,  0.  '                RGS051
 0044   05 150    O                                  111 '**'                          RGS052
```

```
                                INDICATORS

IND  DISP     IND  DISP     IND  DISP     IND  DISP     IND  DISP     IND  DISP

MR   0150     00   0151     OF   0152     OV   0153     1P   0154     L0   0155
L1   0156     L2   0157     L3   0158     L4   0159     L5   015A     L6   015B
L7   015C     L8   015D     L9   015E     LR   015F     H1   0160     H2   0161
H3   0162     H4   0163     H5   0164     H6   0165     H7   0166     H8   0167
H9   0168     01   0169

                                FIELD NAMES

FIELD  DISP  L  T D   FIELD  DISP  L  T D   FIELD  DISP  L  T D   FIELD  DISP  L  T D

NAME   016A 022 A     MONTH  0181 002 N 0   DAY    0184 002 N 0   INVNO  0187 005 N 0
CUSTNO 018D 005 N 0   STATE  0193 002 N 0   CITY   0196 003 N 0   INVAMT 019A 007 N 2
TOTAL  01A2 008 N 2   GRPTOT 01AB 008 N 2

                                     LITERALS

       LITERAL          LENGTH  TYPE  DISP           LITERAL          LENGTH  TYPE  DISP
     A C C O U N T S  R   24      A   0184   E C E I V A B L E  R E    24      A    01CD
R E G I S T E R           15      A   01E6  CUSTOMER                    8      A    01F6
LOCATION      INVOICE     22      A   01FF  INVOICE DATE   INVOICE     23      A    0216
NUMBER        CUSTOMER    24      A   022E  NAME                        4      A    0247
STATE  CITY     NUMBER    24      A   024C  MO     DAY     AMOUNT      21      A    0265
    ,  .                  11      E   027B  *                           1      A    0287
**                         2      A   0289
                                KEY ADDRESSES OF OBJECT PROGRAM

  NAME OF ROUTINE            HEX DISP             NAME OF ROUTINE           HEX DISP

    H + D LINES               04DE                  TOTAL LINES               04EC
    DETAIL CALCS              046E                  TOTAL CALCS               047D
    CHAIN ROUT 1              03D2                  CONTROL FLD               03F5
    LOW FIELD                 042E                  EXCPT LINES               04FA
    CLOSE FILES               067B                  FILE SEQ 1                02EC
    FILE SEQ 2                0377

END OF COMPILATION

// XEQ      L            R
R 41  6D16 (HEX) WDS UNUSED BY CORE LOAD
CALL TRANSFER VECTOR
 RGERR  0C24
 HLEBC  0A1A
LIBF TRANSFER VECTOR
 RGSI5  11E4
 RGBLK  11AA
 RGEDT  105A
 RGMV2  0FA6
 RGADD  0DDD
 RGSI1  0D80
 RGMV5  0C72
 RGMV3  0D50
 RGCMP  0CFE
 RGMV1  0C6A
 PRNT1  0A9A
 ZIPCO  097A
 CARD0  087C
SYSTEM SUBROUTINES
 ILSX4  1249
 ILSX2  126D
 ILSX1  1286
 ILSX0  12A3
     020F (HEX) IS THE EXECUTION ADDR
```

output on specified output device

```
                     A C C O U N T S   R E C E I V A B L E   R E G I S T E R
CUSTOMER                                  LOCATION       INVOICE      INVOICE DATE       INVOICE
 NUMBER          CUSTOMER NAME          STATE   CITY     NUMBER         MO     DAY        AMOUNT
10712        AMALGAMATED CORP             33      61      11603         11      10 $      389.25
                                                                                   $      389.25*

11315        BROWN WHOLESALE              30     231      12324         12      28 $      802.08
11315        BROWN WHOLESALE              30     231      99588         12      14 $      261.17
                                                                                   $    1,063.25*

11897        FARM IMPLEMENTS              47      77      10901         10      18 $       27.63
                                                                                   $       27.63*

18530        BLACK OIL                    16      67      11509         11       8 $      592.95
18530        BLACK OIL                    16      67      12292         12      22 $      950.97
                                                                                   $    1,543.92*

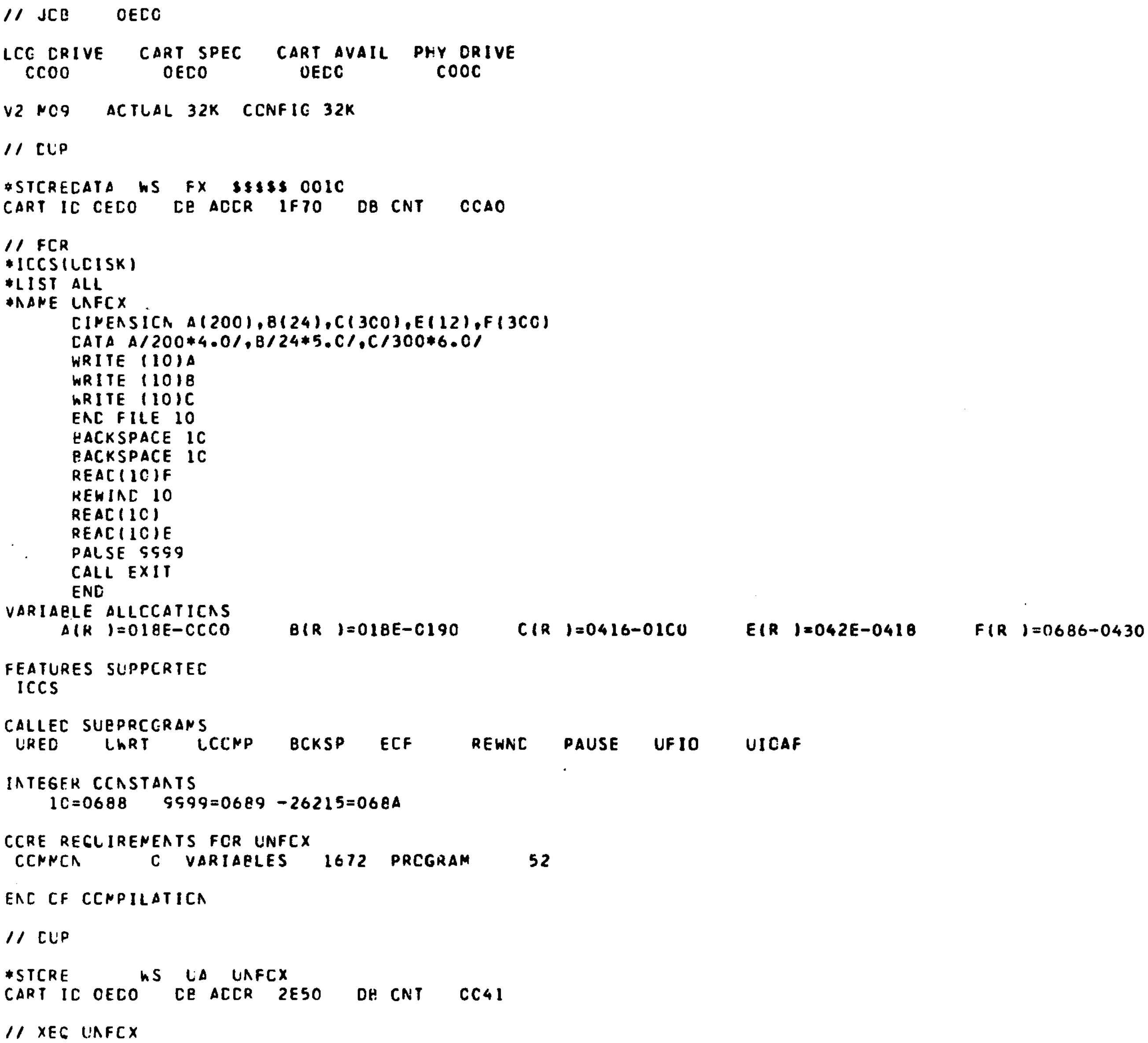
20716        LEATHER BELT CO              36     471      11511         11       8 $      335.63
20716        LEATHER BELT CO              36     471      12263         12      17 $      121.75
                                                                                   $      457.38*

29017        GENERAL MFG CO                6      63      11615         11      14 $      440.12
29017        GENERAL MFG CO                6      63      11676         11      23 $      722.22
                                                                                   $    1,162.34*

29054        A-B-C DIST CO                25      39       9689          9      11 $      645.40
29054        A-B-C DIST CO                25      39      11605         11      11 $      271.69
29054        A-B-C DIST CO                25      39      12234         12      14 $      559.33
                                                                                   $    1,476.42*
                                                                                   $    6,120.19**
```

4. USING FORTRAN UNFORMATTED I/O

This program is referred to under "Initializing $$$$$ Data Files for Use with FORTRAN Unformatted I/O" in Chapter 6.



```
// JCB    OECO

LCG CRIVE   CART SPEC   CART AVAIL  PHY DRIVE
  CCOO        OECO        OECC        COOC

V2 M09   ACTUAL 32K  CCNFIG 32K

// CUP

*STCREDATA  WS   FX  $$$$$ 001C
CART IC CEDO   CB ACCR  1F70   DB CNT   CCAO

// FCR
*ICCS(LCISK)
*LIST ALL
*NAME LNFCX .
      CIMENSICN A(200),B(24),C(3CO),E(12),F(3CO)
      CATA A/200*4.0/,B/24*5.C/,C/300*6.0/
      WRITE (10)A
      WRITE (10)B
      WRITE (10)C
      ENC FILE 10
      BACKSPACE 1C
      BACKSPACE 1C
      REAC(1C)F
      REWINC 10
      REAC(1C)
      REAC(1C)E
      PALSE 9999
      CALL EXIT
      END
VARIABLE ALLCCATICNS
     A(R )=018E-CCCO     B(R )=018E-C190     C(R )=0416-01CU     E(R )=042E-0418     F(R )=0686-0430

FEATURES SUPPCRTEC
 ICCS

CALLEC SUBPRCGRAMS
 URED    LWRT    LCCMP   BCKSP   ECF     REWNC   PAUSE   UFIO    UICAF

INTEGER CCNSTANTS
    1C=0688   9999=0689 -26215=068A

CCRE RECLIREMENTS FCR UNFCX
 CCMMCN       C  VARIABLES   1672  PRCGRAM     52

ENC CF CCMPILATICN

// CUP

*STCRE       WS  UA  UNFCX
CART IC OECO   CB ACCR  2E50   DB CNT   CC41

// XEC UNFCX
```

5. PROCESSING ON ONE DISK DRIVE A FILE THAT EXTENDS OVER TWO CARTRIDGES

This program is referred to under "Reeling" in the section "SYSUP" in Chapter 6.

```
// JOB    0ED0

LOG DRIVE   CART SPEC   CART AVAIL  PHY DRIVE
  0000        0ED0        0ED0        0000

V2 M09   ACTUAL 32K  CONFIG 32K

// FOR
*NAME LINK2
*IOCS(1132 PRINTER)
*IOCS(DISK)
*ONE WORD INTEGERS
*LIST SOURCE PROGRAM
      DIMENSION J(320)
      DEFINE FILE 2(200,320,U,K)
      K = 1
      L = 0
      DO 5 I = 1, 199
      L = L + 1
      DO 4 N = 1, 320
    4 J(N) = L
    5 WRITE (2'K) J
      L = 999
      DO 6 N = 1, 320
    6 J(N) = L
      WRITE (2'K) J
      WRITE (3,10)
   10 FORMAT(/' LINK NO. 2 EXECUTED.'/)
      CALL EXIT
      END

FEATURES SUPPORTED
 ONE WORD INTEGERS
 IOCS

CORE REQUIREMENTS FOR LINK2
 COMMON      0  VARIABLES    334  PROGRAM    142

END OF COMPILATION

// DUP

*DUMP       WS  CD  LINK2
CART ID 0ED0  DB ADDR 4530   DB CNT 0008

// FOR
*NAME LINK1
*IOCS(DISK,1132 PRINTER)
*ONE WORD INTEGERS
*LIST SOURCE PROGRAM
      DIMENSION J(320)
      DIMENSION L(2)
      DEFINE FILE 1(210,320,U,K)
      K = 1
      L(2) = 3796
      L(1) = 0
      M = 0
      DO 5 I = 1, 209
      M = M + 1
      DO 4 N = 1, 320
    4 J(N) = M
    5 WRITE (1'K) J
      M = 999
      DO 6 N = 1, 320
    6 J(N) = M
   WRITE (1'K) J
   WRITE (3,40)
40 FORMAT (40HOLINK NO. 1 EXECUTED. CHANGE CARTRIDGES.///)
   PAUSE 1111
   CALL SYSUP (L(2))
   CALL LINK (LINK2)
   END

FEATURES SUPPORTED
 ONE WORD INTEGERS
 IOCS

CORE REQUIREMENTS FOR LINK1
 COMMON       0  VARIABLES     336   PROGRAM     180

END OF COMPILATION

// DUP

*STORECI     WS  UA  LINK1 0001
*FILES(1,DATA,0ED0)
FILES ALLOCATION
    1 0206  00D2  0ED0 DATA
STORAGE ALLOCATION
R 41  6B6C (HEX) WDS UNUSED BY CORE LOAD
CALL TRANSFER VECTOR
 FSYSU  13F1
 FSLEN  1205
 SYSUP  0CA2
LIBF TRANSFER VECTOR
 NORM   1418
 FLOAT  11FA
 IFIX   11CE
 PAUSE  0C8C
 SCOMP  0799
 SWRT   06B8
 SDCOM  04D8
 SDAI   043A
 SDWRT  0461
 SUBSC  0C6E
 FSTO   0C3C
 FLD    0C58
 PRNTZ  0B5E
 SFIO   07D5
 SDFIO  04C0
SYSTEM SUBROUTINES
 ILS04  00C4
 ILS02  00B3
 ILS01  1444
      0370 (HEX) IS THE EXECUTION ADDR
CART ID 0ED0    DB ADDR  4530    DB CNT    00F0

// PAUS                      CHANGE TO CARTRIDGE 0ED4

// JOB     0ED4

LOG DRIVE    CART SPEC    CART AVAIL   PHY DRIVE
  0000         0ED4         0ED4         0000

V2 M09   ACTUAL 32K  CONFIG 32K

// DUP

*STORECI     CD  FX  LINK2 0001
*FILES(2,DATA2,0ED4)
FILES ALLOCATION
    2 01F7  00C8  0ED4 DATA2
STORAGE ALLOCATION
R 41  72D8 (HEX) WDS UNUSED BY CORE LOAD
```

```
LIBF TRANSFER VECTOR
 NORM   0CB0
 FLOAT  0CA6
 IFIX   0C7A
 PAUSE  0C64
 SCOMP  0771
 SWRT   0690
 SDCOM  04B0
 SDAI   0412
 SDWRT  0439
 SUBSC  0C46
 FSTO   0C14
 FLD    0C30
 PRNTZ  0B36
 SFIO   07AD
 SDFIO  0498
SYSTEM SUBROUTINES
 ILS04  00C4
 ILS02  00B3
 ILS01  0CDC
      0362 (HEX) IS THE EXECUTION ADDR
CART ID 0ED4   DB ADDR  3230   DB CNT   00A0

// PAUS                      CHANGE TO CARTRIDGE 0ED0

// JOB    0ED0

LOG DRIVE   CART SPEC   CART AVAIL  PHY DRIVE
  0000        0ED0        0ED0        0000

V2 M09   ACTUAL 32K  CONFIG 32K

// XEQ LINK1


LINK NO. 1 EXECUTED. CHANGE CARTRIDGES.


LOG DRIVE   CART SPEC   CART AVAIL  PHY DRIVE
  0000        0ED4        0ED4        0000


LINK NO. 2 EXECUTED.
```

6. PROCESSING ON TWO DISK DRIVES A FILE THAT EXTENDS OVER TWO CARTRIDGES

This program is referred to under "Reeling" in the section "SYSUP" in Chapter 6.

```
// JOB    0ED0 0ED4

LOG DRIVE   CART SPEC   CART AVAIL  PHY DRIVE
  0000        0ED0        0ED0        0000
  0001        0ED4        0ED4        0001

V2 M09   ACTUAL 32K  CONFIG 32K

// FOR
*NAME MDEX1
*IOCS (DISK)
*ONE WORD INTEGERS
*LIST SOURCE PROGRAM
      DIMENSION J(320)
      DEFINE FILE 1(210,320,U,K)
      DEFINE FILE 2(200,320,U,KK)
      M = 111
      K = 1
      KK = 1
      DO 2 N = 1, 320
    2 J(N) = M
      DO 3 I = 1, 209
    3 WRITE (1'K) J
      M = 999
      DO 5 N = 1, 320
    5 J(N) = M
      WRITE (1'K) J
      M = 222
      DO 7 N = 1, 320
    7 J(N) = M
      DO 8 I = 1, 199
    8 WRITE (2'KK) J
      M = 999
      DO 9 N = 1,320
    9 J(N) = M
      WRITE (2'KK) J
      CALL EXIT
      END

FEATURES SUPPORTED
 ONE WORD INTEGERS
 IOCS

CORE REQUIREMENTS FOR MDEX1
 COMMON       0  VARIABLES    340  PROGRAM    178

END OF COMPILATION

// DUP

*STORE       WS  UA  MDEX1
CART ID 0ED0   DB ADDR  4515   DB CNT   000D

// XEQ MDEX1 L  2

*FILES(1,DATA,0ED0)

*FILES(2,DATA2,0ED4)
FILES ALLOCATION
    1 0206  00D2  0ED0 DATA
    2 01F7  00C8  0ED4 DATA2
STORAGE ALLOCATION
R 41  78FA (HEX) WDS UNUSED BY CORE LOAD
LIBF TRANSFER VECTOR
 PAUSE  06D8
 SDCOM  04DA
 SDAI   043C
 SDWRT  0463
 SUBSC  06BA
 SDFIO  04C2
SYSTEM SUBROUTINES
 ILS04  00C4
 ILS02  00B3
      035A (HEX) IS THE EXECUTION ADDR
```

7. CALCULATING ISAM FILE PARAMETERS

This program is referred to under "Indexed Sequential Access Method" in the section "Calculating Sequentially Organized and ISAM File Sizes" in Chapter 6. This program does no error checking.

For this program, you are requested to enter the first 4 values. The input fields are 5 characters long; enter right-justified decimal numbers (leading zeros are required). Press EOF on the console keyboard after each entry. The requests for your entries are as follows:

```
           ISAM FILE LOAD CALCULATIONS


 INDEX ENTRY LENGTH IN WORDS =
RECORD LENGTH IN WORDS =
NUMBER OF RECORDS TO BE LOADED =
NUMBER OF OVERFLOW SECTORS =
NUMBER OF INDEXES PER SECTOR =
NUMBER OF RECORDS PER SECTOR =
NUMBER OF PRIME DATA CYLINDERS =
NUMBER OF PRIME DATA SECTORS =
NUMBER OF INDEX SECTORS =

TOTAL NUMBER OF SECTORS =
```

After you enter the number of overflow sectors, the program calculates the file size. The following is a sample of the program output:

```
          ISAM FILE LOAD CALCULATIONS


 INDEX ENTRY LENGTH IN WORDS = 00010
RECORD LENGTH IN WORDS = 00100
NUMBER OF RECORDS TO BE LOADED = 00250
NUMBER OF OVERFLOW SECTORS = 00009
NUMBER OF INDEXES PER SECTOR = 00032
NUMBER OF RECORDS PER SECTOR = 00003
NUMBER OF PRIME DATA CYLINDERS = 00011
NUMBER OF PRIME DATA SECTORS = 00084
NUMBER OF INDEX SECTORS =00001 .

TOTAL NUMBER OF SECTORS =00095 .
```

The program that computes file size is listed as follows:

```
// JOB

LOG DRIVE   CART SPEC   CART AVAIL   PHY DRIVE
  0000        0ED1        0ED1         0000

// ASM
*XREF

0000 20 23A17170 00001    START LIBF    TYPE0                                  ISM00010
0001 0  2C00     00002          DC      /2C00      TYPE HEADING LINE           ISM00020
0002 1  001B     00003          DC      HEAD                                   ISM00030
0003 20 23A17170 00004    WAIT4 LIBF    TYPE0                                  ISM00040
0004 0  0000     00005          DC      /0000      WAIT FOR CONSOLE            ISM00050
0005 0  70FD     00006          B       WAIT4                                  ISM00060
0006 00 65000004 00007          LDX  L1 4          SET COUNT                   ISM00070
0008 01 C5000016 00008    IN    LD   L1 BTAB1      LOAD ADDR OF MESSAGE        ISM00080
000A 0  D002     00009          STO     MESS       STORE FOR SUBROUTINE        ISM00090
000B 20 23A17170 00010          LIBF    TYPE0                                  ISM00100
000C 0  2C00     00011          DC      /2C00      TYPE MESSAGE                ISM00110
000D 0  0000     00012    MESS  DC      *-*                                    ISM00120
000E 20 23A17170 00013    WAIT1 LIBF    TYPE0                                  ISM00130
000F 0  0000     00014          DC      /0000      WAIT FOR CONSOLE            ISM00140
0010 0  70FD     00015          B       WAIT1                                  ISM00150
0011 00 66000005 00016          LDX  L2 5          SET CHARACTER               ISM00160
0013 01 6E000080 00017          STX  L2 IO         *COUNT FOR TYPE0            ISM00170
0015 0  705B     00018          B       CONV                                   ISM00180
0016 0  1000     00019    BTAB1 NOP                TABLE OF ADDRESSES          ISM00190
0017 1  0061     00020          DC      MESS4      *FOR MESSAGES               ISM00200
0018 1  004F     00021          DC      MESS3      *FOR INPUT                  ISM00210
0019 1  0041     00022          DC      MESS2                                  ISM00220
001A 1  0030     00023          DC      MESS1                                  ISM00230
001B 0  0014     00024    HEAD  DC      20         WORD COUNT FOR HEADING      ISM00240
001C    0028     00025          DMES    'R'10SISAM FILE LOAD CALCULATIONS'R'E ISM00250
0030 0  0010     00026    MESS1 DC      16                                     ISM00260
0031    0020     00027          DMES    '2RINDEX ENTRY LENGTH IN WORDS = 'E    ISM00270
0041 0  000D     00028    MESS2 DC      13                                     ISM00280
0042    001A     00029          DMES    'RRECORD LENGTH IN WORDS = 'E          ISM00290
004F 0  0011     00030    MESS3 DC      17                                     ISM00300
0050    0022     00031          DMES    'RNUMBER OF RECORDS TO BE LOADED = 'E ISM00310
0061 0  000F     00032    MESS4 DC      15                                     ISM00320
0062    001E     00033          DMES    'RNUMBER OF OVERFLOW SECTORS = 'E      ISM00330
0071 20 23A17170 00034    CONV  LIBF    TYPE0                                  ISM00340
0072 0  1C00     00035          DC      /1C00      READ IN VALUE               ISM00350
0073 1  0080     00036          DC      IO                                     ISM00360
0074 20 23A17170 00037    WAIT  LIBF    TYPE0                                  ISM00370
0075 0  0000     00038          DC      /0000      WAIT ON KEYBOARD            ISM00380
0076 0  70FD     00039          B       WAIT                                   ISM00390
0077 0  C00E     00040          LD      OUT1       MOVE PLUS SIGN TO           ISM00400
0078 0  D007     00041          STO     IO         *IO AREA FOR DCBIN          ISM00410
0079 20 040C2255 00042          LIBF    DCBIN      CONVERT FROM IBM CARD CODE  ISM00420
007A 1  0080     00043          DC      IO         *TO BINARY VALUE IN ACC     ISM00430
007B 01 D500008C 00044          STO  L1 VTAB1      STORE IN VALUE TABLE        ISM00440
007D 0  71FF     00045          MDX   1 -1         DECREMENT COUNT             ISM00450
007E 0  7089     00046          B       IN         BRANCH IF COUNT NON-ZERO    ISM00460
007F 0  7011     00047          B       CAL        OTHERWISE TAKE THIS BRANCH  ISM00470
0080 0  0005     00048    IO    DC      5          INPUT AREA FOR KEYBOARD     ISM00480
0081    0005     00049          BSS     5                                      ISM00490
0086 0  80A0     00050    OUT1  DC      /80A0      CONVERSION AREA             ISM00500
0087    0005     00051    OUT   BSS     5                                      ISM00510
008C 0  1000     00052    VTAB1 NOP                TABLE OF INPUT VALUES       ISM00520
008D 0  0000     00053    OVRSC DC      *-*        NO. OF OVERFLOW SECTORS     ISM00530
008E 0  0000     00054    RECRD DC      *-*        NO. OF RECORDS              ISM00540
008F 0  0000     00055    LENGR DC      *-*        RECORD LENGTH               ISM00550
0090 0  0000     00056    LENGI DC      *-*        INDEX ENTRY LENGTH          ISM00560
0091 0  C022     00057    CAL   LD      SCTLG      DIVID SECTOR LENGTH BY      ISM00570
0092 0  1890     00058          SRT     16         *INDEX ENTRY LENGTH TO      ISM00580
0093 0  A8FC     00059          D       LENGI      *CALCULATE THE NUMBER OF    ISM00590
```

```
0094 0  D027      00060          STO      IEPS      *INDEX ENTRIES PER SECTOR  ISM00600
0095 0  C0F9      00061          LD       LENGR     CREATE DIVISOR BY ADDING   ISM00610
0096 0  801B      00062          A        TWO       *TWO TO THE RECORD SIZE AN ISM00620
0097 0  D01D      00063          STO      WORK      *STORING IN HOLD AREA      ISM00630
0098 0  C01B      00064          LD       SCTLG     DIVIDE RECORD LENGTH+2     ISM00640
0099 0  1890      00065          SRT      16        *INTO THE SECTOR LENGTH    ISM00650
009A 0  A81A      00066          D        WORK      *TO CALCULATE THE NUMBER   ISM00660
009B 0  D01F      00067          STO      RCDPS     *OF RECORDS PER SECTOR     ISM00670
009C 0  C0F1      00068          LD       RECRD     DIVIDE THE TOTAL NUMBER OF ISM00680
009D 0  801D      00069          A        RCDPS     *RECORDS PLUS NO. OF REC.  ISM00690
009E 0  9012      00070          S        ONE       *PER SECTOR MINUS ONE      ISM00700
009F 0  1890      00071          SRT      16        *BY THE NUMBER OF          ISM00710
00A0 0  A81A      00072          D        RCDPS     *REC. PER SECTOR TO FIND   ISM00720
00A1 0  D017      00073          STO      NOPDS     *NO. OF PRIME DATA SECTORS ISM00730
00A2 0  8010      00074          A        SEVEN     ADD CONSTANT OF SEVEN      ISM00740
00A3 0  1803      00075          SRA      3         DIVIDE BY 8 TO DETERMINE   ISM00750
00A4 0  D015      00076          STO      NOPDC     *NO. OF PRIME DATA CYLNDRS ISM00760
00A5 0  8016      00077          A        IEPS      ADD INDEX ENTRIES/SECTOR   ISM00770
00A6 0  900A      00078          S        ONE       MINUS ONE                  ISM00780
00A7 0  1890      00079          SRT      16        DIVIDE BY NO. OF INDEX     ISM00790
00A8 0  A813      00080          D        IEPS      *ENTRIES/SECTOR TO FIND NO ISM00800
00A9 0  D00E      00081          STO      NOISC     *OF INDEX SECTORS          ISM00810
00AA 0  800E      00082          A        NOPDS     ADD NO OF INDEX SECTORS+   ISM00820
00AB 0  80E1      00083          A        OVRSC     *NO. OF PRIME DATA SECTORS ISM00830
00AC 0  8004      00084          A        ONE       * + NO OF OVERFLOW SECTORS ISM00840
00AD 0  D009      00085          STO      TOTSC     * + 1 FOR LABEL            ISM00850
00AE 00 65000006  00086          LDX   L1 6         SET COUNT                  ISM00860
00B0 0  7013      00087          B        ROUT                                 ISM00870
00B1 0  0001      00088    ONE   DC       1         CONSTANT OF ONE            ISM00880
00B2 0  0002      00089    TWO   DC       2         CONSTANT OF TWO            ISM00890
00B3 0  0007      00090    SEVEN DC       7         CONSTANT OF SEVEN          ISM00900
00B4 0  0140      00091    SCTLG DC       320       NO. WORDS PER SECTOR       ISM00910
00B5 0  0000      00092    WORK  DC       *-*       TEMPORARY HOLD AREA        ISM00920
00B6 0  1000      00093    VTAB2 NOP                TABLE OF OUTPUT VALUES     ISM00930
00B7 0  0000      00094    TOTSC DC       *-*       TOTAL NO. OF SECTORS       ISM00940
00B8 0  0000      00095    NOISC DC       *-*       NO. OF INDEX SECTORS       ISM00950
00B9 0  0000      00096    NOPDS DC       *-*       TOT NO. OF PRIME DATA SCTR ISM00960
00BA 0  0000      00097    NOPDC DC       *-*       NO. OF PRIME DATA CYLINDRS ISM00970
00BB 0  0000      00098    RCDPS DC       *-*       NO. OF RECORDS PER SECTOR  ISM00980
00BC 0  0000      00099    IEPS  DC       *-*       NO. OF INDEX ENTRIES/SECTR ISM00990
00BD 0  1000      00100    MTAB  NOP                MESSAGE TABLE CONTAINS     ISM01000
00BE 1  00F4      00101          DC       MS5P      *ADDRESS IN MESSAGES       ISM01010
00BF 1  0105      00102          DC       MS6P      *WHERE THE VALUES ARE TO   ISM01020
00C0 1  0119      00103          DC       MS7P      *BE INSERTED               ISM01030
00C1 1  012E      00104          DC       MS8P                                 ISM01040
00C2 1  0142      00105          DC       MS9P                                 ISM01050
00C3 1  0156      00106          DC       MS10P                                ISM01060
00C4 01 C50000BD  00107    ROUT  LD    L1 MTAB      MOVE ADDR OF CORRECT       ISM01070
00C6 01 D40000CF  00108          STO   L  ADDR      *MSG TO CONVERT ROUTINE    ISM01080
00C8 01 C50000B6  00109          LD    L1 VTAB2     LOAD A VALUE TO CONVERT    ISM01090
00CA 20 02255103  00110          LIBF     BINDC     GO CONVERT FROM BINARY TO  ISM01100
00CB 1  0086      00111          DC       OUT1      *IBM CARD CODE             ISM01110
00CC 20 29257006  00112          LIBF     ZIPCO     CONVERT FROM IBM CARD CODE ISM01120
00CD 0  1100      00113          DC       /1100     *TO CONSOLE CODE AND       ISM01130
00CE 1  0087      00114          DC       OUT       *PLACE VALUE IN            ISM01140
00CF 0  0000      00115    ADDR  DC       *-*       *MESSAGE                   ISM01150
00D0 0  0005      00116          DC       5                                    ISM01160
00D1 30 085930C7  00117          CALL     HOLDP                                ISM01170
00D3 01 C50000CF  00118          LD    L1 BTAB2     LOAD ADDR OF MESSAGE       ISM01180
00D5 0  D002      00119          STO      MESSP     STORE ADDR FOR SUBROUTINE  ISM01190
00D6 20 23A17170  00120          LIBF     TYPE0                                ISM01200
00D7 0  2000      00121          DC       /2000     TYPE OUTPUT MESSAGE        ISM01210
00D8 0  0000      00122    MESSP DC       *-*                                  ISM01220
00D9 20 23A17170  00123    WAIT3 LIBF     TYPE0                                ISM01230
00DA 0  0000      00124          DC       /0000     WAIT FOR CONSOLE           ISM01240
00DB 0  70FD      00125          B        WAIT3                                ISM01250
```

```
00DC 0  71FF     00126          MDX   1 -1         DECREMENT COUNT          ISM01260
00DD 0  70E6     00127          B       ROUT       IF COUNT NON-ZERO BRANCH ISM01270
00DE 0  6C38     00128          EXIT               OTHERWISE, CALL EXIT     ISM01280
00DF 0  1000     00129    BTAB2 NOP                TABLE OF ADDRESSES       ISM01290
00E0 1  00E6     00130          DC      MS5                                 ISM01300
00E1 1  00F7     00131          DC      MS6                                 ISM01310
00E2 1  0108     00132          DC      MS7                                 ISM01320
00E3 1  011C     00133          DC      MS8                                 ISM01330
00E4 1  0131     00134          DC      MS9                                 ISM01340
00E5 1  0145     00135          DC      MS10                                ISM01350
00E6 0  0011     00136    MS5   DC      17                                  ISM01360
00E7    001B     00137          DMES    'RTOTAL NUMBER OF SECTORS = '       ISM01370
00F4    0005     00138    MS5P  DMES        'E                              ISM01380
00F7 0  0011     00139    MS6   DC      17                                  ISM01390
00F8    001B     00140          DMES    'RNUMBER OF INDEX SECTORS = '       ISM01400
0105    0005     00141    MS6P  DMES        'E                              ISM01410
0108 0  0013     00142    MS7   DC      19                                  ISM01420
0109    0020     00143          DMES    'RNUMBER OF PRIME DATA SECTORS = '  ISM01430
0119    0006     00144    MS7P  DMES        'E                              ISM01440
011C 0  0014     00145    MS8   DC      20                                  ISM01450
011D    0022     00146          DMES    'RNUMBER OF PRIME DATA CYLINDERS = ' ISM01460
012E    0006     00147    MS8P  DMES        'E                              ISM01470
0131 0  0013     00148    MS9   DC      19                                  ISM01480
0132    0020     00149          DMES    'RNUMBER OF RECORDS PER SECTOR = '  ISM01490
0142    0006     00150    MS9P  DMES        'E                              ISM01500
0145 0  0013     00151    MS10  DC      19                                  ISM01510
0146    0020     00152          DMES    'RNUMBER OF INDEXES PER SECTOR = '  ISM01520
0156    0006     00153    MS10P DMES        'E                              ISM01530
015A    0000     00154          END     START                               ISM01540
```

```
                         CROSS-REFERENCE

SYMBOL      VALUE  REL DEFN      REFERENCES

ADDR        00CF   1   00115     00108,M
BTAB1       0016   1   00019     00008,R
BTAB2       00DF   1   00129     00118,R
CAL         0091   1   00057     00047,B
CONV        0071   1   00034     00018,B
HEAD        001B   1   00024     00003,R
IEPS        00BC   1   00099     00060,M 00077,R 00080,R
IN          0008   1   00008     00046,B
IO          0080   1   00048     00017,M 00036,R 00041,M 00043,R
LENGI       0090   1   00056     00059,R
LENGR       008F   1   00055     00061,R
MESS        000D   1   00012     00009,M
MESSP       00D8   1   00122     00119,M
MESS1       003C   1   00026     00023,R
MESS2       0041   1   00028     00022,R
MESS3       004F   1   00030     00021,R
MESS4       0061   1   00032     00020,R
MS10        0145   1   00151     00135,R
MS10P       0156   1   00153     00106,R
MS5         00E6   1   00136     00130,R
MS5P        00F4   1   00138     00101,R
MS6         00F7   1   00139     00131,R
MS6P        0105   1   00141     00102,R
MS7         0108   1   00142     00132,R
MS7P        0119   1   00144     00103,R
MS8         011C   1   00145     00133,R
MS8P        012E   1   00147     00104,R
MS9         0131   1   00148     00134,R
MS9P        0142   1   00150     00105,R
MTAB        00BD   1   00100     00107,R
NOISC       00B8   1   00095     00081,M
NOPDC       00BA   1   00097     00076,M
NOPDS       00B9   1   00096     00073,M 00082,R
```

```
ONE         00B1    1    00088    00070,R 00078,R 00084,R
OUT         0087    1    00051    00114,R
OUT1        0086    1    00050    00040,R 00111,R
OVRSC       008D    1    00053    00083,R
RCDPS       00BB    1    00098    00067,M 00069,R 00072,R
RECRD       008E    1    00054    00068,R
ROUT        00C4    1    00107    00087,B 00127,B
SCTLG       00B4    1    00091    00057,R 00064,R
SEVEN       00B3    1    00090    00074,R
START       0000    1    00001    00154,R
TOTSC       00B7    1    00094    00085,M
TWO         00B2    1    00089    00062,R
VTAB1       008C    1    00052    00044,M
VTAB2       00B6    1    00093    00109,R
WAIT        0074    1    00037    00039,B
WAIT1       000E    1    00013    00015,B
WAIT3       00C9    1    00123    00125,B
WAIT4       0003    1    00004    00006,B
WORK        00B5    1    00092    00063,M 00066,R

   000 OVERFLOW SECTORS SPECIFIED
   000 OVERFLOW SECTORS REQUIRED
   052 SYMBOLS DEFINED

NO ERROR(S) AND   NO WARNING(S)  FLAGGED IN ABOVE ASSEMBLY
```

Appendix I. Formats

The general formats in which information is stored and dumped by the monitor system are:

- Disk
- Card
- Paper tape
- Data

Programs and subroutines are assigned type and subtype numbers that are placed in the program or subroutine header. The program types are defined as follows:

Type	Type of program
1	Mainline (absolute)
2	Mainline (relocatable)
3	Subprogram, not an ISS, referenced by an LIBF statement
4	Subprogram, not an ISS, referenced by a CALL statement
5	Interrupt service subroutine (ISS), referenced by an LIBF statement
6	Interrupt service subroutine (ISS), referenced by a CALL statement
7	Interrupt level subroutine (ILS)

Subtypes are defined for program types 3, 4, 5, and 7 only. When not used, the subtype indicator in a program header contains a zero. Program subtypes are defined as follows:

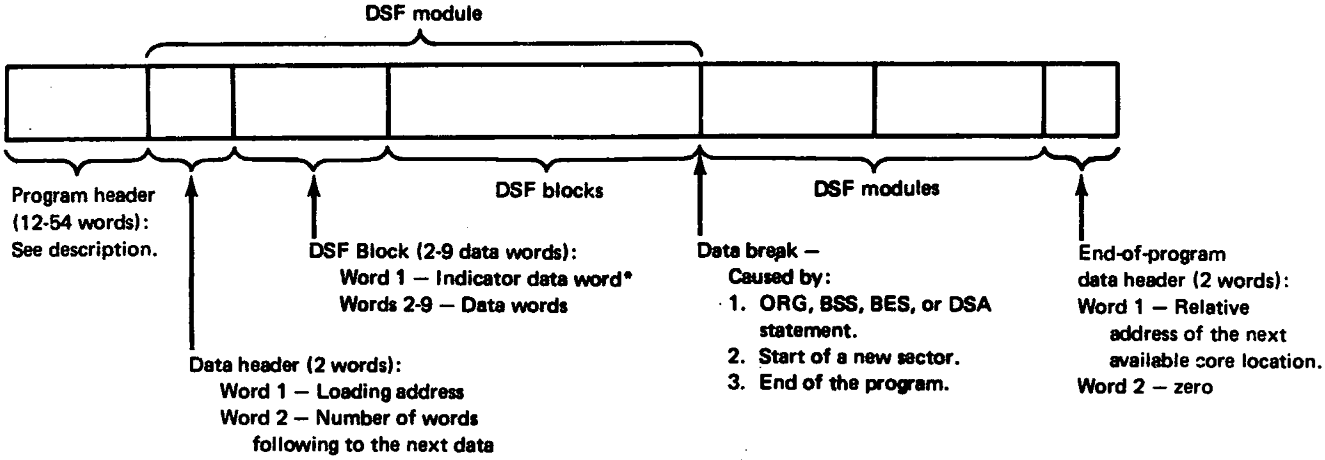
Subtype	Type	Description
0	3, 4	In-core subprograms
1	3	Disk FORTRAN I/O subroutines
2	3	Arithmetic subroutines
3	3	Nondisk FORTRAN I/O and "Z" conversion subroutines
3	5	"Z" device subroutines
8	4	Function subprogram
1	7	Dummy ILS02, ILS04

Monitor system formats are described in the following text.

DISK FORMATS

DSF format

Disk system format is the format in which absolute and relocatable programs (mainlines and subroutines) are stored on disk. The layout of a program stored in DSF format is shown in Figure I-1.



*The bits of the indicator data word describe the corresponding data word as follows:

00	Absolute
01	Relocatable
1000	LIBF
1100	CALL
1101	DSA

Figure I-1. Disk system format

The format of words 1 through 12 of the program header is the same for all program types. The following shows the contents of words 1 through 12 of a program header:

Word	Contents	
1	Zero	
2	Checksum, if the source was cards; otherwise, a zero.	
3	Subtype (bits 0 through 3)	
	Program type (bits 4 through 7)	
	Precision bits:	
	Integer Precision [1] [2]	3RD HEX DIGIT
	unspecified	0
	matches real	8
	one word	9
	Real Precision [1]	4TH HEX DIGIT
	unspecified	0
	standard	1
	extended	2
4	Effective program length, the terminal address in the program	
5	Length of COMMON (in words)	
6	Length of the program header (in words) minus 9	
7	Zero	
8	Length of the program, including the program header (in disk blocks)	
9	FORTRAN indicator (bits 0 through 7), number of files defined (bits 8 through 15)	
10 and 11	Name of entry point 1 (in name code)	
12	Address of entry point 1 (absolute for type 1 programs, relative for all others)	

[1] All FORTRAN programs specify precision of both real and integers. Real precision in assembler is unspecified unless an EPR or SPR card is used.

[2] Two words for standard precision, 3 for extended.

The format of words 13 through 54 of the program header varies according to the program type. For program types 1 and 2, the program header consists of words 1 through 12 only. For program types 3 and 4, the program header, in addition to words 1 through 12, includes:

Word	Contents
13 and 14	Name of entry point 2 (in name code)
15	Relative address of entry point 2
16 and 17	Name of entry point 3 (in name code)
18	Relative address of entry point 3
19 through 51	Name and relative addresses of entry points 4 through 14, as required, in the format shown above. The program header ends following the relative address of the last entry point defined; hence, it is of variable length.

For program types 5 and 6, the program header, in addition to words 1 through 12, contains the following information:

Word	Contents
13	ISS number plus 50
14	ISS number
15	Number of interrupt levels required ❶
16	Interrupt level number associated with the primary interrupt ❶
17	Interrupt level number associated with the secondary interrupt ❶

❶ The 1442 Card Read/Punch is the only device requiring more than one interrupt level.

For type 7 programs, the program header, in addition to words 1 through 12, contains the associated interrupt level number in word 13.

DDF format

Disk data format (DDF) is the format in which data files are stored on disk. DDF consists of 320 binary words per sector. Information such as headers, trailers, and indicator words is not included in DDF format.

DCI format

Disk core image (DCI) format is the format in which a core image program is stored on disk. A core image program consists of the core image header, the mainline program, all subroutines referenced in the mainline program or other subroutines (except the disk I/O subroutine), the transfer vector, and any LOCALs or SOCALs that are required. A layout of a stored DCI program is shown under "Construction of a Core Load" in Chapter 3. The contents of the core image header are:

Word		Contents	
Symbol	Relative address		
@XEQA	0	Execution address of the core load	
@CMON	1	Length of COMMON (in words)	
@DREQ	2	Disk I/O subroutine indicator – /FFFF for DISKZ, /0000 for DISK1, /0001 for DISKN	
@FILE	3	Number of files defined	
@HWCT	4	Length of the core image header (in words)	
@LSCT	5	Sector count of files in system WS	
@LDAD	6	Loading address of the core load	
@XCTL	7	Exit control address for DISK1/N	
@TVWC	8	Length of the transfer vector (in words)	
@WCNT	9	Length, in words, of the core load, core image header, and the transfer vector	
@XR3X	10	Setting for the index register 3 during execution of the core load	
@ITVX	11	Contents of word 8 during execution	ITV
	12	Contents of word 9 during execution	
	13	Contents of word 10 during execution	
	14	Contents of word 11 during execution	
	15	Contents of word 12 during execution	
	16	Contents of word 13 during execution	
	17	Reserved	IBT for ILS04
	18 through 20	Interrupt entry to 1231 ISS	
	21	Interrupt entry to 1403 ISS	
	22	Interrupt entry to 2501 ISS	
	23	Interrupt entry to 1442 ISS	
	24	Interrupt entry to keyboard/ console printer ISS	
	25	Interrupt entry to 1134/1055 ISS	
@OVSW	26	Sector count of LOCALs/SOCALs	
@CORE	27	Core size of system on which core load built	
	28 and 29	Define file table checksum work area	
@HEND	29	Last word of core image header	

CARD FORMATS

card sequencing and ID field

In card formats, the file name and card sequence number are punched in columns 73 through 80. The file name is in columns 73 through 77, and 3-column sequence number in columns 78 through 80. Names of less than 5 characters use columns 73 through 76 and 4-column sequence number in columns 77 through 80. The only exception to this convention is that card decks punched by DUMPDATA E do not contain the ID field and sequence number.

CDS format

Card system format (CDS) is the format in which absolute and relocatable programs (mainlines and subroutines) are punched into cards. Each deck in card system format consists of (1) a header card, (2) data cards, and (3) an end-of-program card.

mainline header card

The mainline header card is the first card of every type 1 or 2 program in CDS format. This card contains:

Word	Contents	
1	Reserved	
2	Checksum	
3	Type code (first 8 bits): 0000 0001 absolute 0000 0010 relocatable	
	Precision bits:	
	Integer Precision [1] [2]	3RD HEX DIGIT
	unspecified	0
	matches real	8
	one word	9
	Real Precision [1]	4TH HEX DIGIT
	unspecified	0
	standard	1
	extended	2
4	Reserved	
5	Length of COMMON, in words (FORTRAN mainline program only)	
6	0000 0000 0000 0011	
7	Length of the work area required, in words (FORTRAN only)	
8	Reserved	
9	Define file count	
10 and 11	Name	
12	Relative entry point	
13 through 54	Reserved	

[1] All FORTRAN programs specify precision of both real and integers. Real precision in assembler is unspecified, unless an EPR or SPR card is used.

[2] Two words for standard precision, three for extended.

subprogram header card

The subprogram header card is the first card of every type 3 or 4 program in card system format. This card contains:

Word	Contents	
1	Reserved	
2	Checksum	
3	Type code (first 8 bits): 0000 0011 to be called by an LIBF statement only 0000 0100 to be called by a CALL statement only	
	Precision bits:	
	Integer Precision [1] [2]	3RD HEX DIGIT
	unspecified	0
	matches real	8
	one word	9
	Real Precision [1]	4TH HEX DIGIT
	unspecified	0
	standard	1
	extended	2
4 and 5	Reserved	
6	Number of entry points times three	
7 through 9	Reserved	
10 and 11	Name of entry point 1 (in name code)	
12	Relative address of entry point 1	
13 through 51	Names and relative addresses of entry point 2 through 14, as required	
52 through 54	Reserved	

[1] All FORTRAN programs specify precision of both real and integers. Real precision in assembler is unspecified unless an EPR or SPR card is used.

[2] Two words for standard precision, three for extended.

ISS header card

The ISS header card is the first card of every type 5 or 6 program in CDS format, and contains:

Word	Contents	
1	Reserved	
2	Checksum	
3	Type code (first 8 bits): 0000 0101 to be called by an LIBF statement only 0000 0110 to be called by a CALL statement only	
	Precision bits:	
	Integer Precision ❶ ❷	3RD HEX DIGIT
	unspecified	0
	matches real	8
	one word	9
	Real Precision ❶	4TH HEX DIGIT
	unspecified	0
	standard	1
	extended	2
4 and 5	Reserved	
6	Number of interrupt levels required plus 6	
7 through 9	Reserved	
10 and 11	Subroutine name (in name code)	
12	Relative entry point address	
13 and 14	Reserved for parameters used by the 1130 Card/Paper Tape System	
15	Number of interrupt levels required ❸	
16	Interrupt level number associated with the primary interrupt ❸	
17	Interrupt level associated with the secondary interrupt level ❸	
18 through 29	Reserved	
30	One	
31 through 54	Reserved	

❶ All FORTRAN programs specify precision of both real and integers. Real precision in assembler is unspecified unless an EPR or SPR card is used.

❷ Two words for standard precision, three for extended.

❸ The 1442 Card Read Punch is the only device requiring more than one interrupt level.

ILS header card

The ILS header card is the first card of every type 7 program in CDS format, and contains:

Word	Contents
1	Reserved
2	Checksum
3	Type code (first 8 bits): 0000 0111 Reserved (last 8 bits)
4 and 5	Reserved
6	0000 0000 0000 0100
7 through 9	Reserved
10 through 12	Reserved
13	Interrupt level number
14 through 54	Reserved

format of data cards

In all types of programs, data cards contain the instructions and data that comprise the machine language program. The format of each data card is:

Word	Contents
1	The loading address of the first data word in the card. Succeeding words go into higher numbered core locations. The relocation factor must be added to this address to obtain the actual load address. For an absolute program the relocation factor is zero.
2	Checksum
3	Type code (first 8 bits): 0000 1010 Count of data words, excluding indicator data words, in these cards (last 8 bits)
4 through 9	Relocation indicator data words (2 bits for each following data word): 00 absolute 01 relocatable 10 LIBF (next two bits 00) 11 CALL (next two bits 00) 11 DSA (next two bits 01)
10 through 54	Data words 1 through 45

end-of-program card

The end-of-program card is the last card of all programs in CDS format, and contains:

Word	Contents
1	Effective length of the program. This number is always even and is assigned by the assembler, FORTRAN compiler, or RPG compiler.
2	Checksum
3	Type code (first 8 bits): 0000 1111 Last 8 bits: 0000 0000
4	Execution address (mainline program only)
5 through 54	Reserved

sector break cards

Sector break cards are binary cards used by the system loader to cause programs or phases of programs to start loading at the beginning of a sector. The monitor system uses type 1 header cards as sector break cards. The sector break cards are not checksummed. Columns 5 through 72 of the sector break cards may contain information identifying the program phase being loaded. The card sequence number appears in columns 73 through 80. Columns 5 through 80 are punched in IBM Card Code.

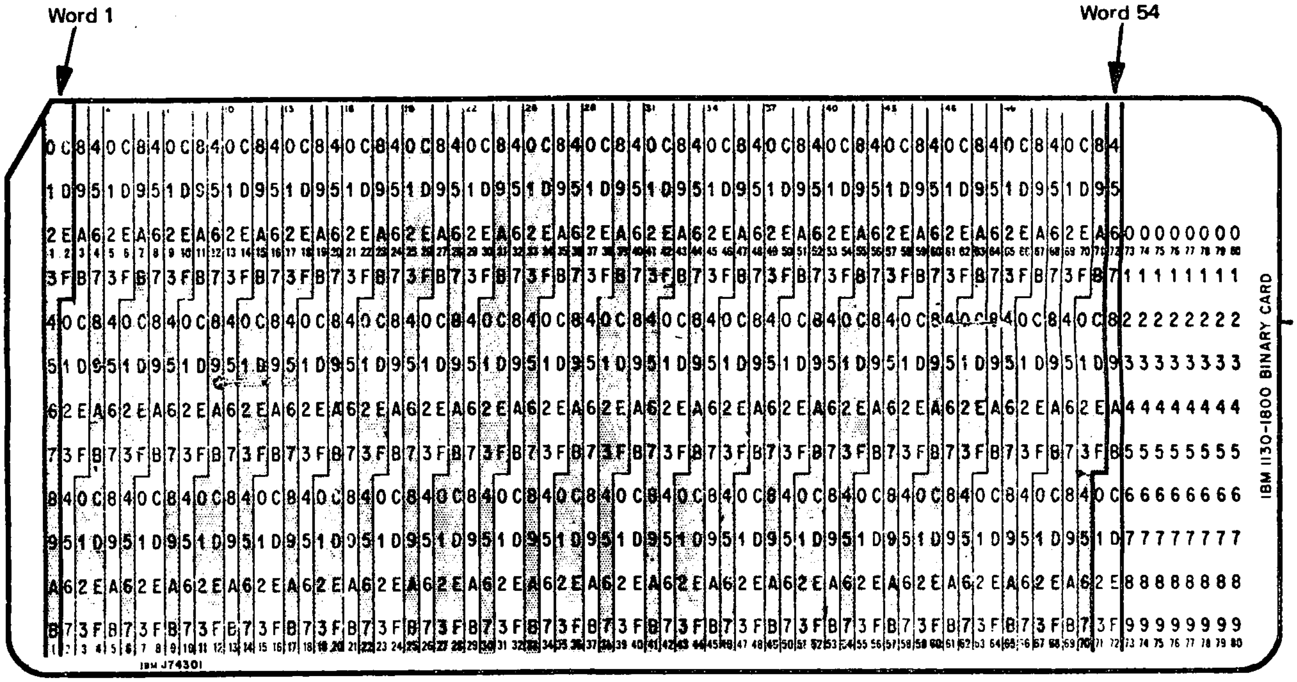
Type 1 cards are identified by a 1 punch in column 4 (binary word 3). A type 1 card indicates to the system loader that it should check word 11 of the first data card that follows. For the resident image, Cold Start Program, and phase 1 of the system loader, word 11 contains the absolute starting sector address. For all other monitor programs or phases, word 11 contains the phase ID. Recognition of a phase ID during initial load causes the system loader to load the program or phase starting at the next sequential sector. During a reload, the phase ID is matched with the ID in SLET and the phase is loaded to the sector address indicated in SLET.

On an initial load, phase 1 of DUP starts loading at sector 8.

A type 2 (relocatable starting sector address) sector break card is processed by the monitor system as a type 1 sector break card.

CDD format

Card data format (CDD) is the format in which data files are punched into cards. CDD format consists of 54 binary words per card. Each binary word occupies 1-1/3 columns. Information such as headers, trailers, and indicator words is not included in CDD format. CDD format is illustrated by the following:



CDC format

Card core image (CDC) format is the format in which core image programs are punched into cards. CDC format is identical to card data format (CDD), that is, one binary word occupies 1-1/3 columns and 54 binary words can be punched per card.

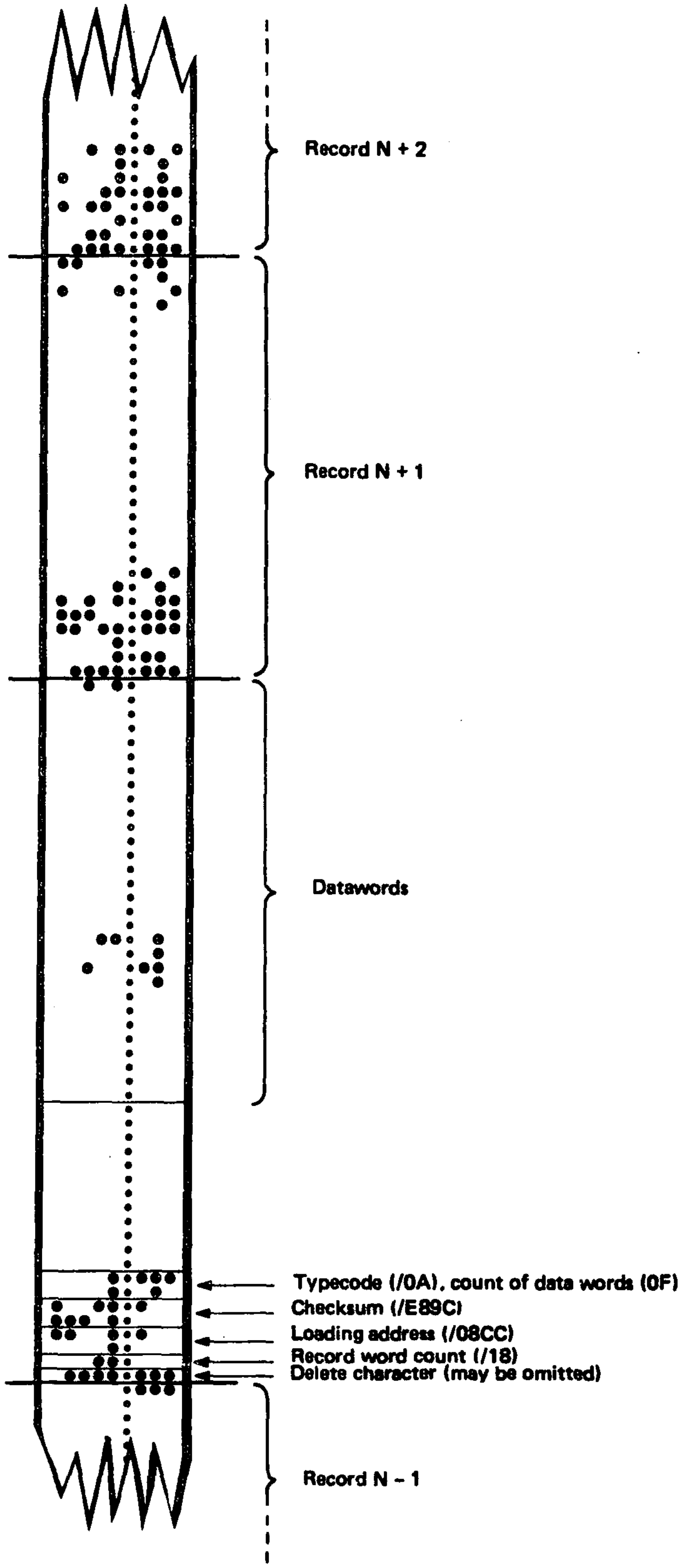
PAPER TAPE FORMATS

The paper tape formats—paper tape system format (PTS), paper tape data format (PTD), and paper tape core image format (PTC)—are analogous to the corresponding card formats (see preceding).

Two frames in paper tape (data or core image) format contain one binary word and are equivalent to 1-1/3 columns in card (data or core image) format. A data record in paper tape (data or core image) format differs from a data record in card (data or core image) format in that the record is preceded by any number (normally zero) of delete characters (/7F) and a frame containing the word count, one-half the number of frames in this data record. A data record in paper tape (data or core image) format contains a maximum of 108 frames (54 binary words) plus the 2 special frames.

Information that would appear in columns 73 through 80 in card format must not appear in paper tape format.

The following is an example of paper tape data (PTD) format:



PRINT FORMATS

PRD format

Print data format (PRD) is the format in which DUP prints a DSF program, core image program, or data file on a print device (1403, 1132, or console printer). The following are printouts of dumps of a DSF program and a DCI program:

DSF Program

```
*CUMP           UA    PR    SAMPL
ADCR     ***0  ***1  ***2  ***3    ***4  ***5  ***6  ***7    ***8  ***9  ***A  ***B    ***C  ***D  ***E  ***F

00CC     CCC0  0000  0100  0372    0000  CC03  CCOC  0015    0C00  2205  45D3  0218    0218  0098  8080  23A1
0C1C     717C  2C0C  0233  23A1    717C  CC00  70FC  CC20    6500  0004  C5C0  022E    D002  23A1  7170  2000
002C     2C00  CC00  23A1  7170    CC0C  7CFD  660C  0C05    6E0C  CCCC  0298  7058    1000  0279  0267  0259
0C30     0248  0C14  CC00  8121    2121  2121  2121  2121    2120  983C  7021  0000    1020  5C34  215C  503C
0C4C     3021  1C3C  5C1C  B05C    CC00  3C9C  2C5C  7498    8121  0010  8181  2074    3034  0000  9421  3474
CC5C     9C60  A421  5C34  7414    9C24  2120  CC0C  7421    9C5C  6030  9821  C221    C00D  8160  341C  0000
0060     5C60  3021  5C34  7414    9C24  2120  7421  9C50    CCCC  6030  9821  C221    0011  8174  8070  1834
CC70     6021  C00C  5010  216C    341C  5C6C  3098  219C    5C21  1834  C000  215C    503C  3034  3021  C221
0080     CCOF  8174  B070  C00C    1834  6021  5010  2150    B434  6010  5C50  9021    0020  9834  1C9C  5060
0C9C     9821  C221  23A1  717C    1000  2C02  0298  23A1    7170  CC00  70FD  C00E    D007  040C  0000  2255
CCA0     0298  C5CC  C2A4  71FF    7089  7C1I  CC05  029E    0C04  0000  80A0  02A4    0096  0000  1000  0000
0CBC     CC00  CCCC  CCC0  C022    1890  A8FC  C000  D027    COF9  801B  D01D  C01B    1890  A81A  D01F  0000
CCC0     CCF1  801C  9012  189C    A81A  DC17  8C1C  1803    CC00  D015  8016  900A    1890  A813  D00E  800E
0CCC     80E1  CC0C  8C04  D009    65CC  0C06  7013  CC01    0C02  0007  C000  0140    0000  1000  0000  0000
0CEC     CCC0  CCC0  CCC0  0000    CC00  1CC0  030C  031D    0331  0346  035A  036E    0008  C500  02D5  D400
0CFC     02E7  C5CC  C2CE  0225    5103  2C03  029E  2925    70D6  1100  029F  0000    0005  0859  0080  30D7
0100     C5C0  02F7  D002  23A1    717C  2CC0  CCCC  8CC0    23A1  717C  0000  70FD    71FF  70E6  6038  1000
C11C     CCC0  02FE  030F  032C    C334  0349  035C  0011    819C  C000  509C  3C5C    2174  B070  1834  6021
C12C     5C10  2198  CCC0  341C    9C5C  6098  21C2  2121    2121  2121  0011  C000    8174  8070  1834  6021
C130     5C10  2120  7430  3494    C000  2198  341C  9C50    6C98  21C2  2121  2121    2121  0000  0013  8174

C14C     8C7C  0323  005A  C00C    1834  6C21  5C1C  2154    6020  7034  2130  3C9C    0000  3C21  9834  1C9C
C15C     5C60  9821  C221  2121    2121  CC00  2121  0014    8174  807C  1834  6021    5010  2154  0000  6020
0160     7034  2130  3C9C  3C21    1CA4  5C20  7430  0000    3460  9821  C221  2121    2121  2121  0013  8174
0170     0CC0  807C  1834  6021    5010  2160  341C  5C60    3098  00CC  2154  3460    2198  341C  9C50  6021
018C     C221  2121  CCC0  2121    2121  CC13  8174  8070    1834  6021  5010  C000    2120  7430  3494  3498
C19C     2154  346C  2198  341C    C000  9C50  6021  C221    2121  2121  2121  0372    0000  8160  341C  0000
01A0     5C60  3021  5C34  7414
CART  IC 0EC1   CB ACDR 2EAD   CB CNT CC15
```

Disk block on sector. For Data Files, this position will always be 0 (Data Files must start on sector boundary).

Sector

Core Image Program (note that the actual starting address is /01FA)

```
*CLMP           FX    PR    CISAM
ACCR     ***0  ***1  ***2  ***3    ***4  ***5  ***6  ***7    ***8  ***9  ***A  ***B    ***C  ***D  ***E  ***F

C1FC                                                                     0218  0000    FFFF  0000  001E  0000
02CC     C1FA  CC0C  CC1A  C508    7F7E  0C91  0091  0C83    0091  00C4  0091  0091    0091  0091  0091  0091
C21C     CC91  CC91  0376  0091    C000  8C00  CC0C  0C00    4377  200C  0233  4377    0000  70FD  6500  0004
0220     C5C0  022E  C002  4377    2C00  CCC0  4377  CCC0    7CFD  660C  0005  6E00    0298  705B  1000  0279
C230     0267  0259  024B  CC14    8121  2121  2121  2121    2121  212C  983C  7021    1020  5C34  215C  503C
C240     3C21  1C3C  5C1C  B05C    3C9C  2C50  7498  8121    C01C  8181  2074  3034    9421  3474  9C60  A421
C25C     5C34  7414  9C24  212C    7421  9C50  6C3C  9821    C221  000C  8160  341C    5060  3021  5C34  7414
C260     9C24  2120  7421  905C    6030  9821  C221  0011    8174  B07C  1834  6021    5010  2160  341C  5060
C27C     3C98  219C  5021  1834    215C  5C3C  3C34  3021    C221  C00F  8174  B070    1834  6021  5010  2150
C28C     B434  6C1C  5C50  9021    9834  1C9C  5060  9821    C221  4377  10C0  0298    4377  0000  70FD  C00E
C29C     DC07  4374  0298  D50C    C2A4  71FF  7C89  7C11    CCC5  0658  0658  0000    0000  0000  80A0  0000
C2A0     CC00  000C  0000  C00C    1000  0C00  0C00  0C00    0000  C022  1890  A8FC    D027  COF9  801B  D01D
C2B0     CC1B  189C  A81A  C01F    COF1  801D  9012  1890    A81A  D017  8010  1803    D015  8016  900A  1890
C2CC     A813  DC0E  8C0E  80E1    8004  DC09  650C  0CC6    7013  C001  0002  0007    0140  0000  1000  0000
C2CC     CCC0  0CC0  CC00  0C0C    CC00  1CC0  C30C  031D    0331  0346  035A  036E    C500  02D5  D400  02E7
C2E0     C5C0  02CE  4371  029E    436E  11C0  029F  0C00    00C5  448C  7FFF  C500    02F7  D002  4377  2000

C2F0     CCC0  4377  C00C  70FC    71FF  7CE6  6C38  1CC0    02FE  030F  0320  0334    0349  035D  0011  819C
03CC     5C9C  3C5C  2174  B07C    1834  6021  5C1C  2198    341C  9C5C  6098  21C2    2121  2121  2121  0011
031C     8174  B07C  1834  6021    5010  212C  743C  3494    2198  341C  9C50  6098    21C2  2121  2121  2121
032C     CC13  8174  BC70  1834    6021  5010  2154  6020    7C34  213C  3C9C  3C21    9834  1C9C  5060  9821
C33C     C221  2121  2121  2121    C014  8174  B07C  1834    6021  501C  2154  602C    7034  2130  3C9C  3C21
C340     1CA4  5C2C  7430  346C    9821  C221  2121  2121    2171  0013  8174  8070    1834  6021  5010  2160
C350     341C  5060  3098  2154    3460  2198  341C  9C50    6021  C221  2121  2121    2121  0013  8174  8070
C360     1834  6021  5C10  212C    7430  3494  3498  2154    3460  2198  341C  9C50    6021  C221  2121  2121
C37C     2121  C400  6914  658C    7FF5  7C03  CC0C  4C00    03D5  6A0F  280F  D83A    C100  180C  4C20  038D
C380     CC34  4818  7101  C832    7101  6906  650C  0C00    6600  C000  2000  4C00    0000  C027  4C20  038D
0390     C1C0  180C  906C  4C30    03AB  8C45  C011  082C    1C05  4C28  03AD  1810    C05D  D058  D05E  D059
C3AC     C1C1  805C  C051  D057    C580  CC01  4C08  03AB    7C00  7012  701F  C00E    7003  4C02  0397  C008
C3BC     71FF  6C0C  C028  6128    70CF  CCC0  D235  C247    2C00  0F00  2001  0F01    D03A  D03E  08F9  1006
C3CC     4C28  C3AF  4C00  047C    D0FC  7401  C032  1000    0827  70B8  1001  C02B    D0E8  7401  0032  1000
C3CC     C480  03F4  D01D  C81E    70AC  08E4  C021  1C01    4C28  0423  4802  7001    7011  C01C  4C20  0462
C3EC     CC15  4C2C  0455  CCC4    4804  7C1A  740C  C3F7    7CC5  181C  D0CA  74FF    0032  1000  4C80  0376
```

```
ACCR      ***0  ***1  ***2  ***3    ***4  ***5  ***6  ***7    ***8  ***9  ***A  ***B    ***C  ***D  ***E  ***F

C3FC      7CE6  0CCC  C3F0  09CC    CC0C  CA00  CCCC  CC00    CC00  C00C  0000  C000    0000  0000  0001  0002
C400      74FF  03F7  7001  70E5    C0F4  4C18  C40E  1810    D0F0  7401  03F4  C48C    03F4  7005  C0EF  D0E9
C41C      C480  C3F4  1C08  D0DC    08A3  1CC5  4C28  C41E    089F  1005  4C28  C41E    08D5  70D0  C400  03B8
C420      4400  0C8C  70F1  08CC    C480  03F4  1C0C  4C02    043F  4C3C  0443  4C2C    044A  614B  C480  03F4
C430      F5C0  CCCC  4C18  0436    71FF  7CF8  C50C  0C00    DCB7  7401  03F4  74FF    03F7  08B2  70D5  C02E
C440      C480  03F4  70A6  D0B6    C0B6  DCAE  C0B5  DCAF    C027  70C9  D0AB  C0B0    90AA  4C08  0453  74FF
C450      C3F4  7401  03F7  C019    70BE  CCA7  4C2C  045C    C0A5  D0A3  C015  70B7    1810  D098  D09E  D09A
C460      088F  7CBB  C09A  4C18    C458  CC90  4C2C  045C    CC95  D08C  C004  70A7    0003  1100  4110  8100
C470      BCC0  1C00  1008  1888    6804  8C03  8088  D001    C400  000C  80F1  4C80    0471  C007  40F2  D0B1
C480      CC05  4CEF  DCB4  4C0C    03C4  436B  4368  6ADC    6936  6580  7FF2  6A35    282F  D850  C100  D003
C49C      7101  6931  6500  C001    C040  DC3E  181C  DC46    C101  4C18  04A7  E03F    4C20  04BA  C101  620C
C4AC      1240  9C38  4C20  04BA    6A37  CC30  9C35  8C36    74FF  04D4  701C  D032    4C01  04CE  C1FC  4C18
C4B0      04BC  9C27  4C18  04C4    9024  4C18  C4BC  9020    4C18  04BC  2001  7001    2000  C820  6500  0000
C4C0      6600  CC00  4C00  C00C    9019  DC18  70F5  AC0F    4C20  04BA  108F  D012    7101  70CA  F00B  4C20
C4D0      04BA  C1FC  FC06  7CE4    CC00  CC05  CC0A  0C14    0CA0  400C  8000  CC0F    0000  DB05  7401  0037
04EC      6926  658C  7FEF  2824    C83C  DC40  C10C  D01B    7101  6921  6105  C03A    4C28  050C  C02F  D480

04F0      0503  CC34  A027  C031    A028  1C90  4801  8020    802D  802A  D006  901C    4C10  0513  C026  D026
050C      CC1A  1800  D500  CC0C    71FF  7CEB  650C  0000    2CC0  C818  4C00  CC00    1810  9018  4808  C00D
051C      D015  CC0A  70DC  801C    C0EC  7401  0525  7CE6    0C01  180A  1999  2000    4000  7FFF  80A0  A000
052C      FFF6  D032  0833  C82E    18C0  0C0C  CC0C  1002    695D  6580  7FEC  6A58    10A0  D02F  C100  18D0
0530      1084  C027  1C84  C026    1010  1C84  C024  1084    D023  C101  D00B  C102    D040  C103  D07E  C580
C540      CC05  C011  7106  6944    10AC  C400  CC0C  18D0    1081  D076  1010  7400    0559  7045  1087  D06E
C55C      6580  05BE  C5C0  C00C    7400  05C0  7C07  1C08    7006  0000  0000  0000    0000  0000  E062  D05E
C56C      C061  740C  055D  101C    C0F8  C058  7400  055C    7C10  740C  055D  7001    700A  D051  74FF  05BD
057C      7C18  C480  057C  E052    E84A  7C06  7C09  1808    E846  740C  055B  7028    D400  0000  7401  057D
0580      74FF  05BC  7C06  6600    CC00  65C0  CC0C  4C00    0C00  1010  7400  055A    7003  7400  055D  70B8
C59C      7401  0546  7CB1  1082    1C05  DC2D  1010  1087    4C18  05A1  620F  1240    72F9  1C00  6A1F  1010
C5AC      9C1D  1082  E820  70AB    18D0  D01F  1010  1083    100C  D019  1083  4C18    05B6  9016  D00F  1010
05B0      9C0D  C00C  668C  05BE    C00D  12C0  E80C  1806    1086  18DC  C00A  18D0    70BF  0000  0000  0000
05C0      0CC0  FFC0  C001  000C    0C0D  CCC0  C0FF  CC20    4421  20E0  24E4  2121    3CFC  2121  2!21  2121
C5DC      1808  2121  0282  2121    1CDC  2121  00C0  2121    30F0  2121  DE04  2121    34F4  4109  FEE6  2121
C5EC      1CD0  2121  DAC2  2121    14D4  2121  C6E2  2121    21C4  21A0  21A4  2121    218C  2121  2121  2121

C5F0      2198  2121  2121  2121    219C  2121  218C  2121    2180  2121  2106  2121    21B4  2103  218E  2121
06CC      2190  2121  2146  2121    2194  2121  2186  2121    2184  2160  2164  2121    217C  2121  2121  2121
0610      2158  2121  2142  2121    215C  2121  2140  2121    2170  2105  2106  2121    2174  2181  21F6  2121
0620      2150  2111  2102  2121    2154  2121  21F2  2121    2121  2121  2121  2121    2121  2121  2121  2121
0630      2121  2121  2121  2121    2121  2121  2121  2121    2121  2121  2121  2121    2121  2121  2121  2121
064C      2121  2121  2121  2121    2121  2121  2121  2121    0000  0000  7FE9  0000    0000  0000  8110  8090
0650      8C50  4210  4110  409C    2110  2090  0110  0090    8820  8220  8060  4820    40A0  4060  2220  2120
0660      20A0  2060  0820  0420    0120  0060  842C  8120    4420  422C  4120  3000    2420  0220  00A0  2010
C670      2C20  2040  2080  2100    2200  2400  280C  4C10    4020  404C  4080  4100    4200  4400  4800  5000
0680      8C10  8020  8040  808C    8100  8200  8400  8800    9C00  0010  0020  0040    0080  0100  0200  0400
0690      0800  1C00  2000  4000    8000  80A0  C00C  0282    0000  0000  7FE6  217F    217F  217F  417F  217F
06A0      217F  057F  817F  117F    037F  217F  097F  217F    027F  DE7F  C67F  427F    D27F  F27F  067F  BE7F
06B0      467F  867F  827F  C07F    E60B  E27F  C06E  FE57    4062  D623  F62F  BC4C    8016  047F  C24A  A054
06CC      A413  9452  9051  B41C    B04F  9C0E  980C  6020    641F  545E  505D  741C    705B  5C1A  5819  7C58
06D0      202C  2468  142A  1029    3468  3067  1C26  1825    3C64  E008  E407  D446    D045  F404  F043  DC02
06E0      D801  FC40  C449  8461    4415  DA6D  217F  C1C0    0C00  4C00  0698  0000    4C00  0648  0000  4C00

06FC      0528  0C00  4C00  04E0    0000  4C00  0488  0C00    4C00  0372  0000  0C00    0000  0000  0000  0000
0700      0C00  05C8
CART  ID 0ED1   DB ACDR 1F00    CB CNT CC50
```

The address that precedes each printed line is the core address of word 1 on that line when a core image program is being printed. If a DSF program or data file is being printed, the address is the address of word 1 on that line relative to the start of the DSF program or data file. Each word printed is 4 hexadecimal characters long, and represents one binary word.

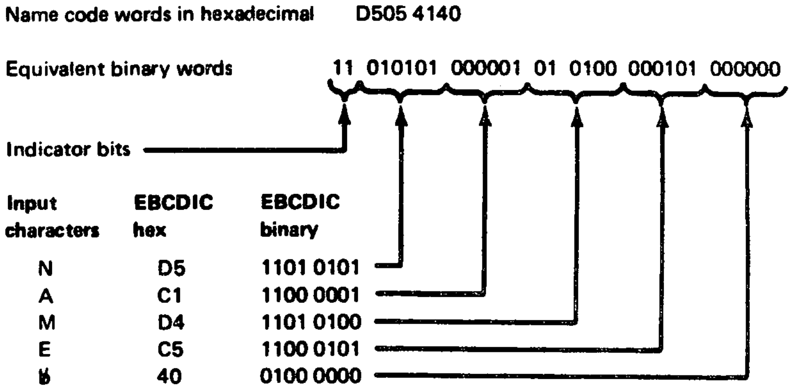
DATA FORMATS

NCF format

Name code format is the format in which names of subprograms, entry points, labels, etc., are stored into 2 binary words for use by monitor programs. The name consists of 5 characters, with the terminal characters possibly being blanks. Each EBCDIC character has the 2 leftmost bits dropped, and the remaining 6-bit blocks are packed to fill the following 30 bits of the 2 words. The 2 left bits of the 2-word name code representation are used for various purposes by different parts of the monitor system. For example, in the LET/FLET entry, these bits specify the format of the file (see Appendix D "LET/FLET").

The name-data words, used internally by the FORTRAN compiler, are similarly packed but the leftmost bit of each word is used as the indicator bit. This bit is set to zero if the word contains a constant; otherwise, it is set to one.

The following is an example of name code format:



Name code words in hexadecimal D505 4140

Equivalent binary words 11 010101 000001 01 0100 000101 000000

Indicator bits

Input characters	EBCDIC hex	EBCDIC binary
N	D5	1101 0101
A	C1	1100 0001
M	D4	1101 0100
E	C5	1100 0101
b̸	40	0100 0000

Appendix J. Field Type Examples for DFCNV

The following is a description of each field type supported by the program. In each of these specification descriptions, the column and field length indicators may vary from 1 to 3 digits in length; all other numeric indicators must be one digit in length.

I-FIELD TYPE

This field type describes FORTRAN integer conversion; input is an integer field. The specification is:

m-Iw.t (P)

where

m is the column of the RPG record in which the converted field begins (1 through 640).
I identifies the field type.
w is the field length of the converted field (maximum of 14).
t is the number of positions to the right of the decimal point reserved in the RPG field (maximum of 9).
(P) is optional and is present only if the RPG field is to be packed.

Note. Since the FORTRAN integer field is regarded as a whole number with no decimal places, up to 5 positions to the left of the decimal should be reserved in the converted field to hold the largest possible integer value. Alignment is at the decimal point; if 5 positions are not reserved, high-order truncation occurs (see "DFCNV Messages and Error Messages" in Appendix A).

Example 1: The integer field /3A7E (14974 decimal) is converted using the field specification 15-I8.2 to the following RPG field.

Record word	8	9	10	11
Content	F0F1	F4F9	F7F4	F0F0

Example 2 (truncation): The integer field of Example 1 is converted using the field specification 15-I6.2 to the following RPG field.

Record word	8	9	10
Content	F4F9	F7F4	F0F0

Example 3 (packed format): The integer field of example 1 is converted using the field specification 15-I8.2(P) to the following RPG field. The number is converted as in Example 1. The zone portions of each character are then removed and the digit portions are packed 2 per byte. The sign is added as a trailing hexadecimal digit (F=positive; D=negative).

Record word	8	9	10
Content	0014	9740	0F40

Note. Since field length does not account for sign, incorrect alignment exists if packed mode is specified and field length is an even number. In order to align the data correctly, a leading zero is added to the field. This is true in all field types that accept packed mode conversion.

Example 4: The integer field /C582 (−14974 decimal) is converted using the field specification 15-I8.2 to the following RPG field.

Record word	8	9	10	11
Content	F0F1	F4F9	F7F4	F0D0

J-FIELD TYPE

This field type describes 2-word integer conversion; input is a 2-word integer. The specification is:

m-Jw.t (P)

where

m is the column of the RPG record in which the converted field begins (1 through 640).
J identifies the field type.
w is the field length of the converted field (maximum of 14).
t is the number of positions to the right of the decimal point reserved in the RPG field (maximum of 9).
(P) is optional and is present only if the RPG field is to be packed.

Note. Since a 2-word integer is regarded as a whole number with no decimal places, up to 10 positions to the left of the decimal point should be reserved in the converted field to hold the largest possible integer value. Alignment is at the decimal point; if 10 positions are not reserved, high-order truncation occurs (see "DFCNV Messages and Error Messages" in Appendix A). If a file contains 2-word integers, standard precision must be specified on the file description card. If extended precision is specified, any J-field type specification is invalid.

Example: The 2-word integer field /7FFF/FFFF is converted using the field specification 7-J13.(P) to the following RPG field.

Record word	4	5	6	7
Content	0021	4748	3647	0F40

R-FIELD TYPE

This field type describes FORTRAN real-variable conversion. The specification is:

m-Rw.t (P)

where

m is the column of the RPG record in which the converted field begins (1 through 640).
R identifies the field type.
w is the field length of the converted field (maximum of 14).
t is the number of positions to the right of the decimal point reserved in the RPG field (maximum of 9).
(P) is optional and is present only if the RPG field is to be packed.

Note. If the real number of the input field is too small to yield any significant digits in the RPG field, the RPG field is set to zeros. If the real number is too large to yield any significant digits in the RPG field, the RPG field is set to nines (see "DFCNV Messages and Error Messages" in Appendix A).

Example 1: The standard precision real field /BC00/0080 (−0.53125 decimal) is converted using the field specification 25-R7.5 (P) to the following RPG field.

Record word	13	14
Content	0053	125D

Example 2: The real field of Example 1 is converted using the field specification 25-R7.5 to the following RPG field.

Record word	13	14	15	16
Content	F0F0	F5F3	F1F2	D540

Example 3: The standard precision real field /7A12/0097 (eight million decimal) is converted using the field specification 39-R7.0 (P) to the following RPG field.

Record word	20	21
Content	8000	000F

Example 4: If the field specification in Example 3 were 39-R7.2 (P) then the resulting RPG field would be set to nines since the input field is too large to yield any significant digits in the RPG field.

Record word	20	21
Content	9999	999F

If column 33 of the file description card contained a W, a warning message would be printed when the preceding conversion took place.

Example 5: The extended precision real field /0047/6250/0000 (10^{-12} decimal) is converted using the field specification 17-R9.9 to the following RPG field.

Record word	9	10	11	12	13
Content	F0F0	F0F0	F0F0	F0F0	F040

The RPG field is set to zeros since the input field is too small to yield any significant digits in the RPG field. A number whose first significant digit is more than 9 decimal places to the right of the decimal point cannot be expressed in RPG. If column 33 of the file description card contained a W, a warning message would be printed when above conversion took place.

B-FIELD TYPE

This field type describes FORTRAN A-conversion for integer data and CSP A1 and A2 conversion. The specification is:

m-Bw.n

where

m is the column of the RPG record in which the converted field begins (1 through 640).
B identifies the field type.
w is the number of characters in the field (maximum of 255).
n is the number of characters in each unit of the input field (n=1 or 2).

Note. If CSP A1 or A2 format is converted, one word integers must be specified on the file description card; however, no diagnostic check is made for this condition.

Example: The CSP field POSITIVE appears on a disk record in A2 format as follows:

Record word	n	n+ 1	n+ 2	n+ 3
Content	E5C5	E3C9	E2C9	D7D6
	VE	TI	SI	PO

This fieid is converted using the field specification 21-B8.2 to the following RPG field.

Record word	11	12	13	14
Content	D7D6	E2C9	E3C9	E5C5
	PO	SI	TI	VE

C-FIELD TYPE

This field type describes FORTRAN A-conversion for real data. The specification is:

m-Cw.n

where

m is the column of the RPG record in which the converted field begins (1 through 640).
C identifies the field type.
w is the number of characters in the field (maximum of 255).
n is the number of characters in each unit (2 or 3 words) of the input field. For standard precision, n may range from 1 through 4; for extended precision, from 1 through 6.

Example: The FORTRAN field WASHINGTON, D. C. appears on a disk record in A4 format, extended precision, beginning at word 221 as follows:

Record word	210	211	212	213	214	215
Content	4BC3	4B40	4040	D6D5	6BC4	4040
	.C	.		ON	,D	

Record word	216	217	218	219	220	221
Content	C9D5	C7E3	4040	E6C1	E2C8	4040
	IN	GT		WA	SH	

D-FIELD TYPE

This field type describes CSP D1 conversion. The specification is

m-D1.j=l_2.K(P)

where

m is the column of the RPG record in which the converted field begins (1 through 640).

D identifies the field type.

l_1 is the length of the CSP field (maximum of 255).

j is the number of positions to the right of the decimal point in the CSP field.

l_2 is the length of the RPG field (maximum of 14).

k is the number of positions to the right of the decimal point in the RPG field (maximum of 9).

(P) is optional and is present only if the RPG field is to be packed.

Note. Alignment is at the decimal point. If, for example, l_1= l_2 and k>j, then k–j high order positions of the CSP field are truncated in the RPG field (see "DFCNV Messages and Error Messages" in Appendix A).

Example: The CSP D1 format field +00946.88 appears on a disk record beginning at word 78 as shown.

Record word	72	73	74	75	76	77	78
Content	0008	0008	0006	0004	0009	0000	0000

This field is converted using the field specification 35-C15.4 to the following RPG field.

Record word	18	19	20	21	22	23
Content	E6C1	E2C8	C9D5	C7E3	D6D5	6BC4
	WA	SH	IN	GT	ON	, D

Record word	24	25
Content	4BC3	4B40
	.C.	

This field is converted using the field specification 25-D7.2=6.3 to the following RPG field.

Record word	13	14	15
Content	F9F4	F6F8	F8F0

E-FIELD TYPE

This field describes CSP D4 conversion. The specification is:

m–El_1.j=l_2.k(P)

where

m is the column of the RPG record in which the converted field begins (1 through 640).
E identifies the field type.
l_1 is the length of the CSP field (maximum of 255).
j is the number of positions to the right of the decimal point in the CSP field.
l_2 is the length of the RPG field (maximum of 14).
k is the number of positions to the right of the decimal point in the RPG field (maximum of 9).
(P) is optional and is present only if the RPG field is to be packed.

Note. For E-field type conversion, alignment is also performed at the decimal point; high order truncation is possible (see "DFCNV Messages and Error Messages" in Appendix A).

Example: The CSP D4 format field –00946.88 appears on a disk record beginning at word 103 as follows:

Record word	101	102	103
Content	FFF7	68FF	0094

This field is converted using the field specification 25-E7.2=7.2 (P) to the following RPG field.

Record word	13	14
Content	0094	688D

F-FIELD TYPE

This field type describes CSP A3 conversion, and requires a 40 character translation table. The specification is:

m-Fw

where

m is the column of the RPG record in which the converted field begins (1 through 640).
F identifies the field type.
w is the number of characters in the field (not to exceed the input record size in characters).

Example: Suppose that a 40 character translation table with W as the 23rd position relative to the last position (card column 40) of the A3 table, H as the eighth relative position, and Y as the 25th relative position, is used to form the CSP field WHY in A3 format. This field is represented on a disk record by the integer /1419 that is derived using the following formula.

$$I=1600\,(N_1-20)+40N_2+N_3$$

where

N_1, N_2 *and* N_3 represent the positions relative to card column 40 in the table of the 1st, 2nd and 3rd characters, respectively.

/1419 is converted using the field specification 21-F4 to the following RPG field.

Record word	11	12
Content	E6C8	E840
	WH	Y

X-FIELD TYPE

This field type allows fields on the input record to be bypassed. The specification is:

Xw

where

X identifies the field type.
w is the number of words to be bypassed (not to exceed input record size).

Example: The field specification used to bypass an array of 10 real numbers when standard precision (each real number is 2 words in length) is specified as X20.

Appendix K. Decimal and Hexadecimal Disk Addresses

SECTOR ADDRESS BASE 10	SECTOR ADDRESS BASE 16	CYLINDER ADDRESS BASE 10	CYLINDER ADDRESS BASE 16	SECTOR ADDRESS BASE 10	SECTOR ADDRESS BASE 16	CYLINDER ADDRESS BASE 10	CYLINDER ADDRESS BASE 16	SECTOR ADDRESS BASE 10	SECTOR ADDRESS BASE 16	CYLINDER ADDRESS BASE 10	CYLINDER ADDRESS BASE 16
+00000	0000	+00000	0000	+00536	0218	+00067	0043	+01072	0430	+00134	0086
+00008	0008	+00001	0001	+00544	0220	+00068	0044	+01080	0438	+00135	0087
+00016	0010	+00002	0002	+00552	0228	+00069	0045	+01088	0440	+00136	0088
+00024	0018	+00003	0003	+00560	0230	+00070	0046	+01096	0448	+00137	0089
+00032	0020	+00004	0004	+00568	0238	+00071	0047	+01104	0450	+00138	008A
+00040	0028	+00005	0005	+00576	0240	+00072	0048	+01112	0458	+00139	008B
+00048	0030	+00006	0006	+00584	0248	+00073	0049	+01120	0460	+00140	008C
+00056	0038	+00007	0007	+00592	0250	+00074	004A	+01128	0468	+00141	008D
+00064	0040	+00008	0008	+00600	0258	+00075	004B	+01136	0470	+00142	008E
+00072	0048	+00009	0009	+00608	0260	+00076	004C	+01144	0478	+00143	008F
+00080	0050	+00010	000A	+00616	0268	+00077	004D	+01152	0480	+00144	0090
+00088	0058	+00011	000B	+00624	0270	+00078	004E	+01160	0488	+00145	0091
+00096	0060	+00012	000C	+00632	0278	+00079	004F	+01168	0490	+00146	0092
+00104	0068	+00013	000D	+00640	0280	+00080	0050	+01176	0498	+00147	0093
+00112	0070	+00014	000E	+00648	0288	+00081	0051	+01184	04A0	+00148	0094
+00120	0078	+00015	000F	+00656	0290	+00082	0052	+01192	04A8	+00149	0095
+00128	0080	+00016	0010	+00664	0298	+00083	0053	+01200	04B0	+00150	0096
+00136	0088	+00017	0011	+00672	02A0	+00084	0054	+01208	04B8	+00151	0097
+00144	0090	+00018	0012	+00680	02A8	+00085	0055	+01216	04C0	+00152	0098
+00152	0098	+00019	0013	+00688	02B0	+00086	0056	+01224	04C8	+00153	0099
+00160	00A0	+00020	0014	+00696	02B8	+00087	0057	+01232	04D0	+00154	009A
+00168	00A8	+00021	0015	+00704	02C0	+00088	0058	+01240	04D8	+00155	009B
+00176	00B0	+00022	0016	+00712	02C8	+00089	0059	+01248	04E0	+00156	009C
+00184	00B8	+00023	0017	+00720	02D0	+00090	005A	+01256	04E8	+00157	009D
+00192	00C0	+00024	0018	+00728	02D8	+00091	005B	+01264	04F0	+00158	009E
+00200	00C8	+00025	0019	+00736	02E0	+00092	005C	01272	04F8	+00159	009F
+00208	00D0	+00026	001A	+00744	02E8	+00093	005D	01280	0500	+00160	00A0
+00216	00D8	+00027	001B	+00752	02F0	+00094	005E	+01288	0508	+00161	00A1
+00224	00E0	+00028	001C	+00760	02F8	+00095	005F	+01296	0510	+00162	00A2
+00232	00E8	+00029	001D	+00768	0300	+00096	0060	+01304	0518	+00163	00A3
+00240	00F0	+00030	001E	+00776	0308	+00097	0061	+01312	0520	+00164	00A4
+00248	00F8	+00031	001F	+00784	0310	+00098	0062	+01320	0528	+00165	00A5
+00256	0100	+00032	0020	+00792	0318	+00099	0063	+01328	0530	+00166	00A6
+00264	0108	+00033	0021	+00800	0320	+00100	0064	+01336	0538	+00167	00A7
+00272	0110	+00034	0022	+00808	0328	+00101	0065	+01344	0540	+00168	00A8
+00280	0118	+00035	0023	+00816	0330	+00102	0066	+01352	0548	+00169	00A9
+00288	0120	+00036	0024	+00824	0338	+00103	0067	+01360	0550	+00170	00AA
+00296	0128	+00037	0025	+00832	0340	+00104	0068	+01368	0558	+00171	00AB
+00304	0130	+00038	0026	+00840	0348	+00105	0069	+01376	0560	+00172	00AC
+00312	0138	+00039	0027	+00848	0350	+00106	006A	+01384	0568	+00173	00AD
+00320	0140	+00040	0028	+00856	0358	+00107	006B	+01392	0570	+00174	00AE
+00328	0148	+00041	0029	+00864	0360	+00108	006C	+01400	0578	+00175	00AF
+00336	0150	+00042	002A	+00872	0368	+00109	006D	+01408	0580	+00176	00B0
+00344	0158	+00043	002B	+00880	0370	+00110	006E	+01416	0588	+00177	00B1
+00352	0160	+00044	002C	+00888	0378	+00111	006F	+01424	0590	+00178	00B2
+00360	0168	+00045	002D	+00896	0380	+00112	0070	+01432	0598	+00179	00B3
+00368	0170	+00046	002E	+00904	0388	+00113	0071	+01440	05A0	+00180	00B4
+00376	0178	+00047	002F	+00912	0390	+00114	0072	+01448	05A8	+00181	00B5
+00384	0180	+00048	0030	+00920	0398	+00115	0073	+01456	05B0	+00182	00B6
+00392	0188	+00049	0031	+00928	03A0	+00116	0074	+01464	05B8	+00183	00B7
+00400	0190	+00050	0032	+00936	03A8	+00117	0075	+01472	05C0	+00184	00B8
+00408	0198	+00051	0033	+00944	03B0	+00118	0076	+01480	05C8	+00185	00B9
+00416	01A0	+00052	0034	+00952	03B8	+00119	0077	+01488	05D0	+00186	00BA
+00424	01A8	+00053	0035	+00960	03C0	+00120	0078	+01496	05D8	+00187	00BB
+00432	01B0	+00054	0036	+00968	03C8	+00121	0079	+01504	05E0	+00188	00BC
+00440	01B8	+00055	0037	+00976	03D0	+00122	007A	+01512	05E8	+00189	00BD
+00448	01C0	+00056	0038	+00984	03D8	+00123	007B	+01520	05F0	+00190	00BE
+00456	01C8	+00057	0039	+00992	03E0	+00124	007C	+01528	05F8	+00191	00BF
+00464	01D0	+00058	003A	+01000	03E8	+00125	007D	+01536	0600	+00192	00C0
+00472	01D8	+00059	003B	+01008	03F0	+00126	007E	+01544	0608	+00193	00C1
+00480	01E0	+00060	003C	+01016	03F8	+00127	007F	+01552	0610	+00194	00C2
+00488	01E8	+00061	003D	+01024	0400	+00128	0080	+01560	0618	+00195	00C3
+00496	01F0	+00062	003E	+01032	0408	+00129	0081	+01568	0620	+00196	00C4
+00504	01F8	+00063	003F	+01040	0410	+00130	0082	+01576	0628	+00197	00C5
+00512	0200	+00064	0040	+01048	0418	+00131	0083	+01584	0630	+00198	00C6
+00520	0208	+00065	0041	+01056	0420	+00132	0084	+01592	0638	+00199	00C7
+00528	0210	+00066	0042	+01064	0428	+00133	0085				

Appendix L. Disk Storage Unit Conversion Factors

No. of ↓ Per →	Word	Disk block	Sector	Track	Cylinder	Disk
Bits	16	320	5,112	20,480	40,960	8,192,000
Data words		20	320 [1]	1,280	2,560	512,000
Disk blocks			16	64	128	25,600
Sectors				4	8	1,600
Tracks					2	400
Cylinders						200

[1] These follow the first actual word of each sector, which is used for the address.

Appendix M. Character Code Set

Ref no.	EBCDIC			IBM card code							Graphics and control names		1132 Printer EBCDIC subset hex	PTTC/8 hex U-uppercase L-lowercase	Console printer hex	notes	1403 Printer hex
	Binary		Hex	Rows						Hex							
	0123	4567		12	11	0	9	8	7-1								
0	0000	0000	00	12		0	9	8	1	B030	NUL						
1		0001	01	12			9		1	9010							
2		0010	02	12			9		2	8810							
3		0011	03	12			9		3	8410							
4		0100	04	12			9		4	8210	PF	Punch Off					
5*		0101	05	12			9		5	8110	HT	Horiz.Tab		6D (U/L)	41	①	
6		0110	06	12			9		6	8090	LC	Lower Case		6E (U/L)			
7*		0111	07	12			9		7	8050	DEL	Delete		7F (U/L)			
8		1000	08	12			9	8		8030							
9		1001	09	12			9	8	1	9030							
10		1010	0A	12			9	8	2	8830							
11		1010	0B	12			9	8	3	8430							
12		1100	0C	12			9	8	4	8230							
13		1101	0D	12			9	8	5	8130							
14		1110	0E	12			9	8	6	8080							
15	↓	1111	0F	12			9	8	7	8070							
16	0001	0000	10	12	11		9	8	1	D030							
17		0001	11		11		9		1	5010							
18		0010	12		11		9		2	4810							
19		0011	13		11		9		3	4410							
20*		0100	14		11		9		4	4210	RES	Restore		4C (U/L)	05	②	
21*		0101	15		11		9		5	4110	NL	New Line		DD (U/L)	81	③	
22*		0110	16		11		9		6	4090	BS	Backspace		5E (U/L)	11		
23		0111	17		11		9		7	4050	IDL	Idle					
24		1000	18		11		9	8		4030							
25		1001	19		11		9	8	1	5030							
26		1010	1A		11		9	8	2	4830							
27		1011	1B		11		9	8	3	4430							
28		1100	1C		11		9	8	4	4230							
29		1101	1D		11		9	8	5	4130							
30		1110	1E		11		9	8	6	4080							
31	↓	1111	1F		11		9	8	7	4070							
32	0010	0000	20		11	0	9	8	1	7030							
33		0001	21			0	9		1	3010							
34		0010	22			0	9		2	2810							
35		0011	23			0	9		3	2410							
36		0100	24			0	9		4	2210	BYP	Bypass					
37*		0101	25			0	9		5	2110	LF	Line Feed		3D (U/L)	03		
38*		0110	26			0	9		6	2090	EOB	End of Block		3E (U/L)			
39		0111	27			0	9		7	2050	PRE	Prefix					
40		1000	28			0	9	8		2030							
41		1001	29			0	9	8	1	3030							
42		1010	2A			0	9	8	2	2830							
43		1011	2B			0	9	8	3	2430							
44		1100	2C			0	9	8	4	2230							
45		1101	2D			0	9	8	5	2130							
46		1110	2E			0	9	8	6	2080							
47	↓	1111	2F			0	9	8	7	2070							
48	0011	0000	30	12	11	0	9	8	1	F030							
49		0001	31				9		1	1010							
50		0010	32				9		2	0810							
51		0011	33				9		3	0410							
52		0100	34				9		4	0210	PN	Punch On					
53*		0101	35				9		5	0110	RS	Reader Stop		0D (U/L)	09	④	
54*		0110	36				9		6	0090	UC	Upper Case		0E (U/L)			
55		0111	37				9		7	0050	EOT	End of Trans.					
56		1000	38				9	8		0030							
57		1001	39				9	8	1	1030							
58		1010	3A				9	8	2	0830							
59		1011	3B				9	8	3	0430							
60		1100	3C				9	8	4	0230							
61		1101	3D				9	8	5	0130							
62		1110	3E				9	8	6	0080							
63	↓	1111	3F				9	8	7	0070							

Notes. Typewriter output

① Tabulate ③ Carrier return

② Shift to black ④ Shift to red

* Recognized by all conversion subroutines
Codes that are not asterisked are recognized by the SPEED subroutine. The ZIPCO subroutine also recognizes these codes in conjunction with the appropriate code tables, notably EBHOL and HLEBC.

Ref no.	EBCDIC			IBM card code							Graphics and control names	1132 Printer EBCDIC subset hex	PTTC/8 hex U-upper case L-lower case	Console printer hex	1403 Printer hex
	Binary		Hex	Rows						Hex					
	0123	4567		12	11	0	9	8	7-1						
64*	0100	0000	40	no punches						0000	blank	40 **	10 (U/L)	21	7F
65		0001	41	12		0	9		1	B010					
66		0010	42	12		0	9		2	A810					
67		0011	43	12		0	9		3	A410					
68		0100	44	12		0	9		4	A210					
69		0101	45	12		0	9		5	A110					
70		0110	46	12		0	9		6	A090					
71		0111	47	12		0	9		7	A050					
72		1000	48	12		0	9	8		A030					
73		1001	49	12				8	1	9020					
74*		1010	4A	12				8	2	8820	¢		20 (U)	02	
75*		1011	4B	12				8	3	8420	. (period)	4B	6B (L)	00	6E
76*		1100	4C	12				8	4	8220	<		02 (U)	DE	
77*		1101	4D	12				8	5	8120	(	4D	19 (U)	FE	57
78*		1110	4E	12				8	6	80A0	+	4E	70 (U)	DA	6D
79*		1111	4F	12				8	7	8060	| (logical OR)		3B (U)	C6	
80*	0101	0000	50	12						8000	&	50	70 (L)	44	15
81		0001	51	12	11		9		1	D010					
82		0010	52	12	11		9		2	C810					
83		0011	53	12	11		9		3	C410					
84		0100	54	12	11		9		4	C210					
85		0101	55	12	11		9		5	C110					
86		0110	56	12	11		9		6	C090					
87		0111	57	12	11		9		7	C050					
88		1000	58	12	11		9	8		C030					
89		1001	59		11			8	1	5020					
90*		1010	5A		11			8	2	4820	!		5B (U)	42	
91*		1011	5B		11			8	3	4420	$	5B	5B (L)	40	62
92*		1100	5C		11			8	4	4220	*	5C	08 (U)	D6	23
93*		1101	5D		11			8	5	4120	)	5D	1A (U)	F6	2F
94*		1110	5E		11			8	6	40A0	;		13 (U)	D2	
95*		1111	5F		11			8	7	4060	¬ (logical NOT)		6B (U)	F2	
96*	0110	0000	60		11					4000	- (dash)	60	40 (L)	84	61
97*		0001	61			0			1	3000	/	61	31 (L)	BC	4C
98		0010	62		11	0	9		2	6810					
99		0011	63		11	0	9		3	6410					
100		0100	64		11	0	9		4	6210					
101		0101	65		11	0	9		5	6110					
102		0110	66		11	0	9		6	6090					
103		0111	67		11	0	9		7	6050					
104		1000	68		11	0	9	8		6030					
105		1001	69			0		8	1	3020					
106		1010	6A	12	11					C000					
107*		1011	6B			0		8	3	2420	, (comma)	6B	3B (L)	80	16
108*		1100	6C			0		8	4	2220	%		15 (U)	06	
109*		1101	6D			0		8	5	2120	_ (underscore)		40 (U)	BE	
110*		1110	6E			0		8	6	20A0	>		07 (U)	46	
111*		1111	6F			0		8	7	2060	?		31 (U)	86	
112	0111	0000	70	12	11	0				E000					
113		0001	71	12	11	0	9		1	F010					
114		0010	72	12	11	0	9		2	E810					
115		0011	73	12	11	0	9		3	E410					
116		0100	74	12	11	0	9		4	E210					
117		0101	75	12	11	0	9		5	E110					
118		0110	76	12	11	0	9		6	E090					
119		0111	77	12	11	0	9		7	E050					
120		1000	78	12	11	0	9	8		E030					
121		1001	79					8	1	1020					
122*		1010	7A					8	2	0820	:		04 (U)	82	
123*		1011	7B					8	3	0420	#		0B (L)	C0	
124*		1100	7C					8	4	0220	@		20 (L)	04	
125*		1101	7D					8	5	0120	' (apostrophe)	7D	16 (U)	E6	0B
126*		1110	7E					8	6	00A0	=	7E	01 (U)	C2	4A
127*		1111	7F					8	7	0060	"		0B (U)	E2	

** Any code other than those defined for 1132 is interpreted by the PRNT1 subroutine as a blank.

Ref no.	EBCDIC			IBM card code							Graphics and control names	1132 Printer EBCDIC subset hex	PTTC/8 hex U-upper case L-lower case	Console printer hex	1403 Printer hex
	Binary		Hex	Rows						Hex					
	0123	4567		12	11	0	9	8	7-1						
128	1000	0000	80	12		0		8	1	B020					
129		0001	81	12		0			1	B000	a				
130		0010	82	12		0			2	A800	b				
131		0011	83	12		0			3	A400	c				
132		0100	84	12		0			4	A200	d				
133		0101	85	12		0			5	A100	e				
134		0110	86	12		0			6	A080	f				
135		0111	87	12		0			7	A040	g				
136		1000	88	12		0		8		A020	h				
137		1001	89	12		0	9			A010	i				
138		1010	8A	12		0		8	2	A820					
139		1011	8B	12		0		8	3	A420					
140		1100	8C	12		0		8	4	A220					
141		1101	8D	12		0		8	5	A120					
142		1110	8E	12		0		8	6	A0A0					
143		1111	8F	12		0		8	7	A060					
144	1001	0000	90	12	11			8	1	D020					
145		0001	91	12	11				1	D000	j				
146		0010	92	12	11				2	C800	k				
147		0011	93	12	11				3	C400	l				
148		0100	94	12	11				4	C200	m				
149		0101	95	12	11				5	C100	n				
150		0110	96	12	11				6	C080	o				
151		0111	97	12	11				7	C040	p				
152		1000	78	12	11			8		C020	q				
153		1001	99	12	11		9			C010	r				
154		1010	9A	12	11			8	2	C820					
155		1011	9B	12	11			8	3	C420					
156		1100	9C	12	11			8	4	C220					
157		1101	9D	12	11			8	5	C120					
158		1110	9E	12	11			8	6	C0A0					
159		1111	9F	12	11			8	7	C060					
160	1010	0000	A0		11	0		8	1	7020					
161		0001	A1		11	0			1	7000					
162		0010	A2		11	0			2	6800	s				
163		0011	A3		11	0			3	6400	t				
164		0100	A4		11	0			4	6200	u				
165		0101	A5		11	0			5	6100	v				
166		0110	A6		11	0			6	6080	w				
167		0111	A7		11	0			7	6040	x				
168		1000	A8		11	0		8		6020	y				
169		1001	A9		11	0	9			6010	z				
170		1010	AA		11	0		8	2	6820					
171		1011	AB		11	0		8	3	6420					
172		1100	AC		11	0		8	4	6220					
173		1101	AD		11	0		8	5	6120					
174		1110	AE		11	0		8	6	60A0					
175		1111	AF		11	0		8	7	6060					
176	1011	0000	B0	12	11	0		8	1	F020					
177		0001	B1	12	11	0			1	F000					
178		0010	B2	12	11	0			2	E800					
179		0011	B3	12	11	0			3	E400					
180		0100	B4	12	11	0			4	E200					
181		0101	B5	12	11	0			5	E100					
182		0110	B6	12	11	0			6	E080					
183		0111	B7	12	11	0			7	E040					
184		1000	B8	12	11	0		8		E020					
185		1001	B9	12	11	0	9			E010					
186		1010	BA	12	11	0		8	2	E820					
187		1011	BB	12	11	0		8	3	E420					
188		1100	BC	12	11	0		8	4	E220					
189		1101	BD	12	11	0		8	5	E120					
190		1110	BE	12	11	0		8	6	E0A0					
191		1111	BF	12	11	0		8	7	E060					

Ref no.	EBCDIC			IBM card code							Graphics and control names	1132 Printer EBCDIC subset hex	PTTC/8 hex U-uppercase L-lower case	Console printer hex	1403 Printer hex
	Binary		Hex	Rows						Hex					
	0123	4567		12	11	0	9	8	7-1						
192	1100	0000	C0	12		0				A000	(+ zero)				
193*		0001	C1	12					1	9000	A	C1	61 (U)	3C or 3E	64
194*		0010	C2	12					2	8800	B	C2	62 (U)	18 or 1A	25
195*		0011	C3	12					3	8400	C	C3	73 (U)	1C or 1E	26
196*		0100	C4	12					4	8200	D	C4	64 (U)	30 or 32	67
197*		0101	C5	12					5	8100	E	C5	75 (U)	34 or 36	68
198*		0110	C6	12					6	8080	F	C6	76 (U)	10 or 12	29
199*		0111	C7	12					7	8040	G	C7	67 (U)	14 or 16	2A
200*		1000	C8	12				8		8020	H	C8	68 (U)	24 or 26	6B
201*		1001	C9	12			9			8010	I	C9	79 (U)	20 or 22	2C
202		1010	CA	12		0	9	8	2	A830					
203		1011	CB	12		0	9	8	3	A430					
204		1100	CC	12		0	9	8	4	A230					
205		1101	CD	12		0	9	8	5	A130					
206		1110	CE	12		0	9	8	6	A0B0					
207		1111	CF	12		0	9	8	7	A070					
208	1101	0000	D0		11	0				6000	(- zero)				
209*		0001	D1		11				1	5000	J	D1	51 (U)	7C or 7 E	58
210*		0010	D2		11				2	4800	K	D2	52 (U)	58 or 5A	19
211*		0011	D3		11				3	4400	L	D3	43 (U)	5C or 5E	1A
212*		0100	D4		11				4	4200	M	D4	54 (U)	70 or 72	5B
213*		0101	D5		11				5	4100	N	D5	45 (U)	74 or 76	1C
214*		0110	D6		11				6	4080	O	D6	46 (U)	50 or 52	5D
215*		0111	D7		11				7	4040	P	D7	57 (U)	54 or 56	5E
216*		1000	D8		11			8		4020	Q	D8	58 (U)	64 or 66	1F
217*		1001	D9		11		9			4010	R	D9	49 (U)	60 or 62	20
218		1010	DA	12	11		9	8	2	C830					
219		1011	DB	12	11		9	8	3	C430					
220		1100	DC	12	11		9	8	4	C230					
221		1101	DD	12	11		9	8	5	C130					
222		1110	DE	12	11		9	8	6	C0B0					
223		1111	DF	12	11		9	8	7	C070					
224	1110	0000	E0			0		8	2	2820					
225		0001	E1		11	0	9		1	7010					
226*		0010	E2			0			2	2800	S	E2	32 (U)	98 or 9A	0D
227*		0011	E3			0			3	2400	T	E3	23 (U)	9C or 9E	0E
228*		0100	E4			0			4	2200	U	E4	34 (U)	B0 or B2	4F
229*		0101	E5			0			5	2100	V	E5	25 (U)	B4 or B6	10
230*		0110	E6			0			6	2080	W	E6	26 (U)	90 or 92	51
231*		0111	E7			0			7	2040	X	E7	37 (U)	94 or 96	52
232*		1000	E8			0		8		2020	Y	E8	38 (U)	A4 or A6	13
233*		1001	E9			0	9			2010	Z	E9	29 (U)	A0 or A2	54
234		1010	EA		11	0	9	8	2	6830					
235		1011	EB		11	0	9	8	3	6430					
236		1100	EC		11	0	9	8	4	6230					
237		1101	ED		11	0	9	8	5	6130					
238		1110	EE		11	0	9	8	6	60B0					
239		1111	EF		11	0	9	8	7	6070					
240*	1111	0000	F0			0				2000	0	F0	1A (L)	C4	49
241*		0001	F1						1	1000	1	F1	01 (L)	FC	40
242*		0010	F2						2	0800	2	F2	02 (L)	D8	01
243*		0011	F3						3	0400	3	F3	13 (L)	DC	02
244*		0100	F4						4	0200	4	F4	04 (L)	F0	43
245*		0101	F5						5	0100	5	F5	15 (L)	F4	04
246*		0110	F6						6	0080	6	F6	16 (L)	D0	45
247*		0111	F7						7	0040	7	F7	07 (L)	D4	46
248*		1000	F8					8		0020	8	F8	08 (L)	E4	07
249*		1001	F9				9			0010	9	F9	19 (L)	E0	08
250		1010	FA	12	11	0	9	8	2	E830					
251		1011	FB	12	11	0	9	8	3	E430					
252		1100	FC	12	11	0	9	8	4	E230					
253		1101	FD	12	11	0	9	8	5	E130					
254		1110	FE	12	11	0	9	8	6	E0B0					
255		1111	FF	12	11	0	9	8	7	E070					

Glossary-Index

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This Technical Newsletter, a part of Version 2, Modification 12, of the IBM 1130 Disk Monitor System provides replacement pages for the subject publication. These replacement pages remain in effect for subsequent versions and modifications unless specifically altered. Pages to be inserted and/or removed are:

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A technical change to the text or to an illustration is indicated by a vertical line to the left of the change.

Summary Of Amendments

Minor technical changes have been made.

Note. Please file this cover letter at the back of the manual to provide a record of changes.

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