File Number 1130-36
Form C26-3717-1

Systems Reference Library

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

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

This manual contains the operating and maintenance procedures for the IBM 1130 Disk Monitor System, Version 2. An introductory section acquaints the user with the IBM 1130 System. A section on programming tips and techniques assists the user in utilizing the Monitor system.

Monitor system control records are described in detail. An appendix contains all error messages generated by the system.

PREFACE

This publication provides the IBM 1130 System user with the information required to operate and maintain the IBM 1130 Disk Monitor programming system. It is recommended that the user familiarize himself with the terms contained in the Glossary at the back of this manual. It is important that these terms be understood in the context of the Monitor system.

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

Symbolic addresses rather than absolute addresses are used throughout this manual. A table of equivalences is provided in Appendix H, Resident Monitor.

$XXXX	All symbolic labels whose first character is a dollar sign are found in the Resident Communications Area (COMMA)
#XXXX	All symbolic labels whose first character is a pound 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, i. e:, @HDNG refers to the page heading sector (sector 7) and thus has a value of 7.

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

MINIMUM SYSTEM CONFIGURATION

The minimum system configuration required to operate the 1130 Disk Monitor system is as follows:

- IBM 1131 Central Processing Unit, Model 2, with 4096 words of core storage,and one of the following input/output devices
- IBM 1442 Card Read Punch, Model 6 or 7
- IBM 2501 Card Reader, in combination with an IBM 1442 Card Punch, Model 5, or an IBM 1442 Card Read Punch, Model 6 or 7
- IBM 1134 Paper Tape Reader in combination with an IBM 1055 Paper Tape Punch.

PUBLICATIONS

The following publications will assist the user in utilizing the Monitor system.

IBM 1130 Functional Characteristics (Form A26-5881)

IBM 1130 Computing System Input/Output Units (Form A26-5890)

IBM 1130 Assembler Language (Form C26-5927)

IBM 1130/1800 Basic FORTRAN IV Language (Form C26-3715)

IBM 1130 Subroutine Library (Form C26-5929)

Second Edition

This publication, C26-3717-1, is a major revision of C26-3717-0, which is now obsolete. The manual has been updated to correspond with modification 1 of the IBM 1130 Disk Monitor System, Version 2. A large number of changes and additions have been made to text and tabular material throughout the manual.

Specifications contained herein are subject to change from time to time. Any such change will be reported in subsequent revisions or Technical Newsletter.

Requests for copies of IBM publications should be made to your IBM representative or to the IBM branch office serving your locality.

A form is provided at the back of this publication for reader's comments. If the form has been removed, comments may be addressed to IBM Nordic Laboratory, Technical Communications, Box 962, Lidingö 9, Sweden.

CONTENTS

The 1130 Disk Monitor System provides for the continuous operation of the 1130 Computing System, with minimal set-up time and operator intervention, in a stacked job environment. The Monitor system consists of seven distinct but interdependent elements -- Supervisor, Disk Utility Program, Assembler, FORTRAN Compiler, Core Load Builder, Core Image Loader, and System Library.

The Supervisor performs control functions for the Monitor system and provides the linkage between user programs and Monitor programs.

The Disk Utility Program (DUP) is a group of IBM-supplied programs that performs operations involving the disk such as storing, moving, deleting, and dumping data and/or programs.

The Assembler converts source programs written in Assembler language into machine-language object programs.

The FORTRAN Compiler translates source programs written in 1130 Basic FORTRAN IV language into machine-language object programs.

The Core Load Builder constructs core image programs from mainline object programs. The mainline programs and all necessary subprograms are converted into Disk Core Image format from Disk System format, and the resultant core load is built for immediate execution or for storing for future execution.

The Core Image Loader serves as both a loader for core loads and as an interface for the Monitor programs.

The System Library is a group of disk-resident programs that perform I/O, data conversion, arithmetic, disk initialization, and maintenance functions.

The operating procedures for readying the system I/O units are described below. Following these procedures are instructions to the operator on the various ways of actually getting data in and out of the system and how these methods are utilized by the 1130 Disk Monitor Programming System.

READYING THE IBM 1130 COMPUTING SYSTEM

This section describes the basic operator actions required to ready the IBM 1130 Computing System for operation. The paragraphs on readying the I/O units should be sufficient to allow the operator to prepare the units for selection by the system. Where necessary, illustrations have been provided to supplement the text.

Additional information regarding 1130 system and unit displays and operator functions can be found in the following publications.

IBM 1130 Functional Characteristics (Form A26-5881)
IBM 1130 Input/Output Units (Form A26-5890)
IBM 2501 Card Reader, Models A1 and A2 - Component Description and Operating Procedures (Form A26-5892)
IBM Disk Pack Handling and Operator Procedures (Form A26-5756)

1131 Central Processing Unit

Most operator action will occur at the console of the 1130 system. This console, as well as three I/O devices -- the Keyboard/Console Printer, the console entry switches, and a single disk storage drive -- are all located in or on the 1131 CPU.

System Power On. When the 1131 POWER switch is turned on, the following console operator panel lights will be on: DISK UNLOCK (no cartridge in single disk storage drive) and FORMS CHECK (if there is no paper in the Console Printer). If any other operator panel lights are on, press the RESET key.

To ready the Console Printer, perform the following steps:

1. Open the Console Printer top cover.
2. Pull the paper pressure rod forward (the rod with three rubber rollers that leans against the platen). If the paper is to be pin fed, this rod should remain in this position.
3. Lift up on the left and right platen pin feed pressure plates.
4. Set the paper release lever in the forward position. This lever is located on the top right rear corner of the Console Printer. If the paper is to be pin fed, this lever should remain in this position.
5. Feed the paper in from the rear and guide it under the platen. Make sure that the paper lies over and closes the forms check microswitch. This will turn off the FORMS CHECK light on the console operator panel.
6. Lay the paper back across the top of the Console Printer and guide the paper so that the holes line up with the pin feeds.
7. Close the pin feed pressure plates.
8. Looking directly down into the Console Printer, set the left and right margins. The margin settings can be read on the scale across the front of the unit.
9. Close the top cover.
10. Press CARRIER RETURN.

The Console Printer is now ready to be selected.

To ready the single disk storage drive, perform the following steps.

1. Open the single disk storage access cover located at the front of the 1131 (to the right of the console). The cover swings open to the right.
2. Grasp the handle of the access release mechanism and pull out and down.
3. Pick up the cartridge and, holding the cartridge with the IBM name towards you and on the left, insert the cartridge into the slot.
4. When the cartridge is seated, raise the access release handle to lock the cartridge into place.
5. Turn the DISK switch (leftmost switch on the panel beneath the cartridge enclosure) to the ON position. As the disk starts to turn, the DISK UNLOCK light on the console operator panel will go out.
6. Close the access cover.

When the drive comes up to speed (approximately 90 seconds), the DISK READY indicator on the console operator panel will turn on. The single disk storage drive is now ready to be selected.

1442 Model 6 and 7 Card Read Punch Ready Procedure

Pre-conditions. POWER ON light on, CHECK light off, CHIP BOX light off, stacker not full, and covers closed.

When the system is first powered up, it is good practice to press the NPRO key to ensure that no cards are in the feed path.

Readying the Card Read Punch. When all pre-conditions are met, place the cards to be processed in the hopper, face down, 9-edge first, and press reader START. When the first card is positioned at the read station, the READY light will turn on. The card read punch is now ready to be selected.

1442 Model 5 Card Punch Ready Procedure

Pre-conditions. POWER ON light on, CHECK light off, and ATTENTION light off.

When the system is first powered up, the HOPPER check light is lit. Press NPRO to turn this light off. This action ensures the card path is clear.

Readying the Card Punch. When all pre-conditions are met, place blank cards in the hopper, face down, 9-edge first, and press punch START. Two card feed cycles are taken and the first card is registered at the punch station. When the punch READY light turns on, the card punch is ready to be selected.

2501 Card Reader Ready Procedure

Pre-conditions. POWER ON light on, READ CHECK light off, FEED CHECK light off, and ATTENTION light off.

When the system is first powered up, the FEED CHECK light is lit. Press NPRO to turn this light off. This action ensures that the card path is clear.

Readying the Card Reader. When all pre-conditions are met, place the cards to be processed in the hopper, face down, 9-edge first, and press reader START. When the first card is positioned at the pre-read station, the READY light will turn on. The card reader is now ready to be selected.

1134 Paper Tape Reader Ready Procedure

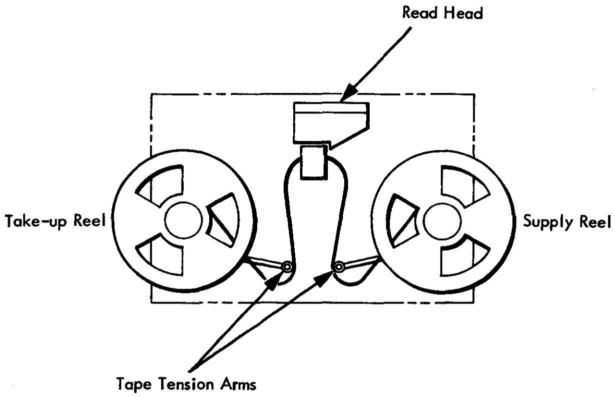
Pre-conditions. System power on.

Readying the Paper Tape Reader. Raise the lever located at the top right side of the read head (see illustration below). Load the reel containing the program tape on the right hand drive and lock the reel in place. The tape must be loaded so that the three-hole side is nearest the operator. With both tension arms in the up position, feed the tape across the read head and position the tape on the drive sprocket.

Position a program tape so that a delete code (all punches) beyond the program ID punched in the leader is under the read starwheels.

Position a tape without a leader (or when starting in the middle of a tape) so that the first character position to be read is one position to the right of the read starwheels.

Lower the lever on the read head, thus bringing the read starwheels in contact with the tape. Wind the leader on the take-up reel and let down the tape tension arms.



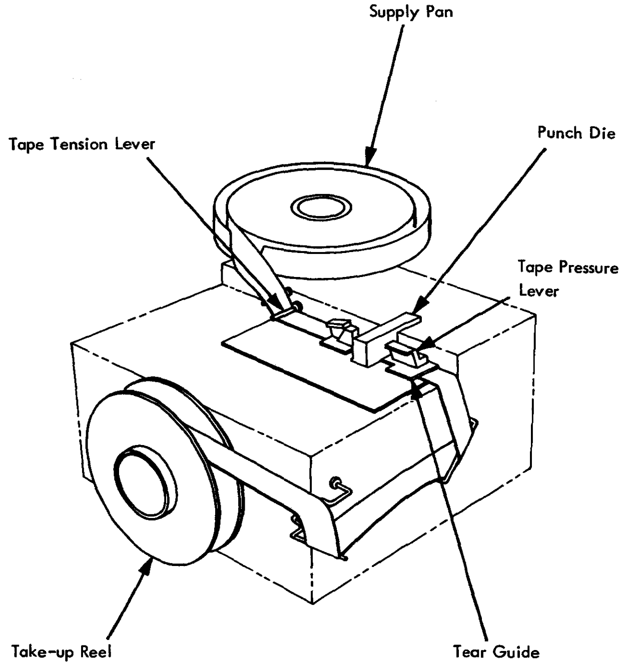
The paper tape reader is now ready to be selected.

1055 Paper Tape Punch Ready Procedure

Pre-conditions. System power on.

Readying the Paper Tape Punch.

1. Place a reel of tape in the supply pan so that the tape feeds out toward the punch die (see illustration below).
2. With the punch die facing forward (unit name plate at the front), pivot the tape pressure lever (right side of die) up and to the right.
3. Feed the tape from the supply pan over the first tape guide, under the tape tension lever, and slide the tape in under the punch die, tear guide, and tape pressure lever.
4. If the punch has a take-up reel, guide the tape over the side of the unit, over the outside of the side guide, and back up towards the front of the unit.
5. The tape now makes a half turn towards the outside and comes up and over the end guide.
6. The tape is then brought up and over to the left and wound over the top of the take-up reel.



After the tape is loaded, a leader (all delete codes) may be made by first pressing and holding the DELETE key. Now press the FEED key and hold until a leader of sufficient length has been punched. Release the FEED key before releasing the DELETE key. The paper tape punch is now ready to be selected.

1132 Printer Ready Procedure

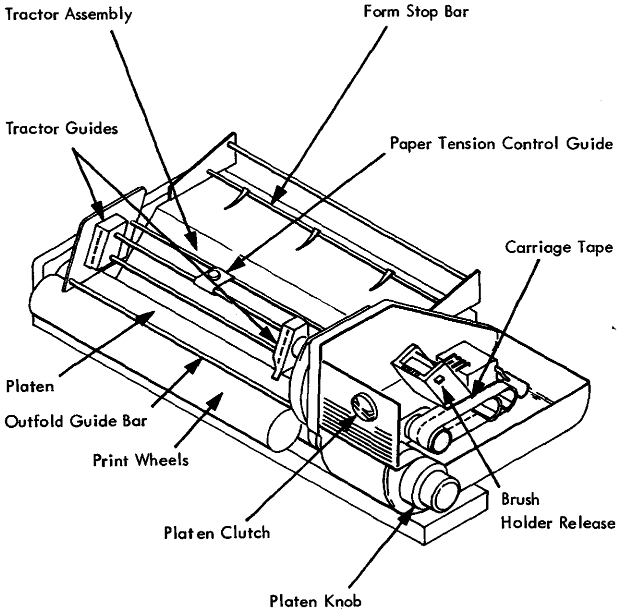
Pre-conditions. POWER ON light on and MOTOR switch on. The FORMS CHECK light will be on if there are no forms in the printer.

Readying the 1132 printer. To load the forms into the printer:

1. Raise the top cover and disengage the PLATEN CLUTCH (set it to OUT). This knob is located on the right side of the print carriage (see illustration below).
2. Turn the outside knob on the right end of the carriage to ensure that the carriage is free.
3. Remove the spring loaded outfold guide bar (the bar across the bottom front of the forms tractor, directly behind the print wheels).
4. Open the left and right tractor pressure plates.
5. Now feed the forms from the rear of the printer under the form stop bar (three levers) and down under the tractor.
6. Use a rocking motion to feed the paper under the platen (if necessary raise the paper tension control guide located in the center of the tractor).
7. When the paper appears in front of the platen, grasp it firmly and pull it up so that it lies evenly across the tractor.
8. Place the holes in the paper on the left and right tractor pins and close the tractor pressure plates.
9. Reinsert the outfold guide bar.
10. Using the knob at the right end of the carriage, feed the paper until a crease between two sheets appears just above the print wheels.

To load the carriage control tape into the printer:

1. Raise the carriage cover directly above the platen clutch knob.
2. Raise the brush holder by pulling the lever on the right side towards you.
3. Insert a carriage control tape (channel one to the left) and close the brush holder.
4. Close the carriage cover.



1132 Carriage Familiarization

Press the CARRIAGE RESTORE key on the 1132 operator's panel. Engage the platen clutch (set to IN) and close the printer top cover. Press printer START. When the READY light comes on, the 1132 printer is ready to be selected.

1403 Printer Ready Procedure

Pre-conditions. System power on. The END OF FORMS light will be on if there are no forms in the printer.

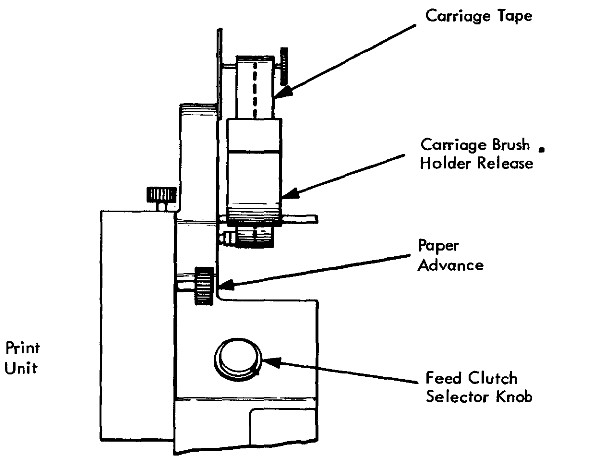
Readying the 1403 Printer. To load the forms into the printer:

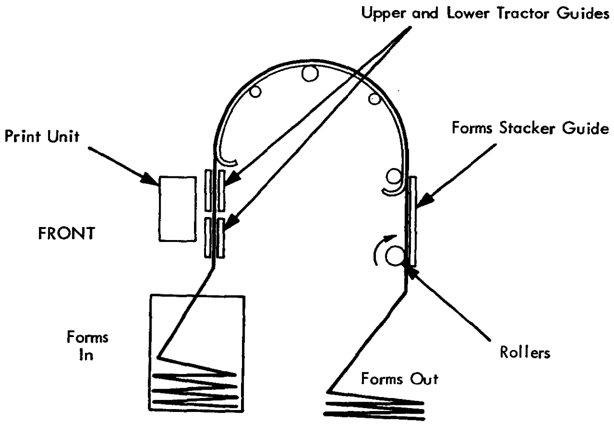
1. Raise the printer cover and set the feed clutch selector knob to neutral. This knob is located on the right side of the print unit (see illustration below).
2. Unlock the print unit by pulling back on the release lever located on the left side of the unit. The print unit will swing out to the right.
3. Open the upper and lower left and right tractor guides.
4. Lift the forms up from their position below the front of the printer and lay them back across the arched rack at the top of the printer.
5. Line up the holes in the paper with the tractor pins and close all four tractor guides.
6. Close the print unit and lock the print unit release level. The ribbon drive will activate when the print unit is closed.
7. Using the PAPER ADVANCE knob located at the right end of the print unit, advance the paper until a crease between two forms is about 1/2 inch above the print position indicator bar on the print unit.

To load the carriage control tape in the printer:

1. Raise the carriage brush holder by pulling down on the lever on the right side. The carriage brush holder is located to the right and slightly above the print unit (see illustration).
2. Insert the carriage tape (channel one to the left) and close the brush holder.
3. Set the feed clutch selector knob to 6 or 8 lines per inch, whichever is desired.
4. Close the printer cover.

Press the CARRIAGE RESTORE key on the 1403 operator's panel. Continue to restore until sufficient paper has fed over the top arch to extend down the back of the printer. Open the rear cover of the printer and ensure that this paper has fed down between the forms stacker guide and the printer. If the paper has fed properly, the rollers on the forms stacker guide will keep a constant downward pull on the paper. Close the back cover.





Press CHECK RESET and printer START on the operator panel. When the PRINT READY light comes on, the 1403 printer is ready. Set the ENABLE/DISABLE switch on the 1133 to the ENABLE position (READY light on). The 1403 Printer is now ready to be selected.

2310 Disk Storage Ready Procedures

Pre-condition. System power on, CARTRIDGE UNLOCKED lights on the 2310 operator's panel on.

Readying the 2310 Disk Storage Drive.

1. Open the front door of the disk drive.
2. Grasp the handle of the access release mechanism of the drive to be loaded (drive 1 or 3 on top, 2 or 4 on the bottom) and pull out and down.

3. Pick up the cartridge and, holding the cartridge with the IBM name towards you and on the left, insert the cartridge into the slot.
4. When the cartridge is seated, raise the access release handle to lock the cartridge into place. If desired, load the other drive on the 2310 disk storage unit.

Close the front door of the disk storage unit. Turn on the START/STOP switch for the desired drives. The CARTRIDGE UNLOCKED lights will go out when the drives start to turn. When the drives come up to speed (approximately 90 seconds), the indicators showing the drive numbers will light, thus showing that the heads are loaded and the drives are ready.

When the drives are required by the system, set the ENABLE/DISABLE switches on the 2310 disk storage drives and on the 1133 to the ENABLE position (1133 READY light on). The 2310 disk storage drives are now ready to be selected.

1627 Plotter Ready Procedure

Pre-conditions. System power on.

Readying the 1627 Plotter. Load the chart paper using the following procedure.

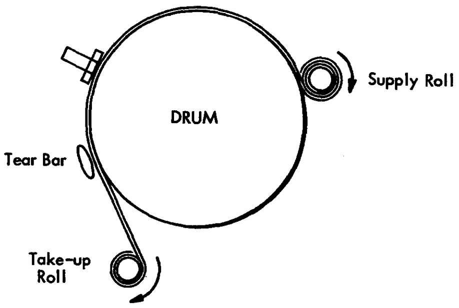
1. Ensure the 1627 Power switch is OFF (1627 power on indicator lamp out).
2. Remove the pen assembly, if installed, by loosening the knurled knob at the bottom of the pen holder and lifting the assembly out of the carriage.

Caution

Use care when handling the pen assembly. This assembly is manufactured to close tolerances for optimum performance.

3. Rotate the right rear chart spool by hand until the drive key is pointing upward.
4. Hold the new roll of chart paper so that the key slot in the core is pointing upward. Place the roll against the spring-loaded left rear idler spool and force the spool to the left.
5. Lower the paper roll into the paper well and slide the right end onto the drive spool. Make certain the drive key engages the key slot in the core. The paper should feed out from under the roll and over the drum (see illustration).
6. Install a paper roll core on the front spool below the drum, in the same manner as with the paper roll.
7. Pull a short length of paper off the roll, slide the end under the carriage rods, under the tear bar, behind the core, and fasten it to the front side of the core with two or three short pieces of cellophane tape. Wind one or two turns of paper onto the core. Make certain the drum sprockets are properly meshed with the sprocket holes on both sides of the paper.
8. Reinstall the pen assembly in the carriage.
9. Turn the 1627 power switch to ON. The 1627 power on indicator will come on.

NOTE: The pen is down when the power is off; therefore, the pen assembly should be installed with the carriage over an area outside the "recording area". If the pen does not raise when power is turned on, turn the pen switch to DOWN, then to UP.



With the pen in the UP position, use the drum (x axis) and carriage (Y axis) controls to position the pen for the first plot. The 1627 plotter is now ready to be selected.

1231 Optical Mark Page Reader Ready Procedure

Pre-conditions. System power on, RESET light on, and READ light off. SYSTEM STOP light on if the CPU is stopped.

Readying the Optical Mark Page Reader. Place the data sheets in the hopper with the side to be read facing up and the top edge positioned to feed first. Set the FEED MODE switch to ON-DEMAND. The settings of the other selector switches on the operator console are dependent on the data being read.

Press PROGRAM LOAD on the 1231 operator's console. This action clears the delay line and conditions the machine for program loading. The PROGRAM LOAD light turns on. Press 1231 RESET. This causes the hopper to raise to the ready position. The RESET light turns off and the 1231 START light turns on. Press

1231 START. The first data sheet in the hopper is fed through the 1231, loading the delay line. The first data sheet is now in the stacker. The PROGRAM LOAD light turns off. Press 1231 START. The 1231 START light turns off.

With all lights off on the 1231 operator's console (the SYSTEM STOP light may be on), the 1231 optical mark page reader is ready to be selected.

USING THE IBM 1130 WITH THE MONITOR SYSTEM

When all I/O units required for a job are on-line and in a ready condition, the user may proceed as follows.

Loading a Program from Card or Paper Tape

On the console:

1. Press IMM STOP (press PROGRAM STOP if the Monitor system is running).
2. Press RESET.
3. Check that the console Mode switch is set to RUN mode.
4. With the reader wired for IPL in a ready state, press PROGRAM LOAD (if the system has a 2501 and a 1442-6 or -7, ensure that the 1442 is not ready). The first record (usually a loader) is read into core starting at location zero. Instructions on this record tell the system what operation is to be performed next, usually the loading of more records from the input device.
5. When a card reader goes not ready, press reader START to read in the last card and pass control to the loaded program. This action is not required with paper tape input.

Altering or Displaying the Contents of a Selected Core Location Using the Console Entry Switches

1. With the system stopped, set the console Mode switch to LOAD.
2. Set the console entry switches to the desired four-character hexadecimal core addr:ss. Switches 0-3 constitute the first hexadecimal character, 4-7 the second, etc.
3. Press LOAD IAR (the selected address is displayed in the IAR).

To display the contents of the address:

1. Set the console Mode switch to DISPLAY.
2. Press PROGRAM START.

The contents of the selected location is displayed in the Storage Buffer Register. Successive pressing of the PROGRAM START key will display consecutive core locations.

To alter the contents of the address:

1. Set the new data word in the console entry switches.
2. Press PROGRAM START.

To return to system operation:

1. Set the console Mode switch to RUN.
2. Press PROGRAM START.

NOTE: At a Monitor system WAIT, the address of instruction causing the WAIT is at the address displayed in the IAR minus 1.

Reading the Console Entry Switches Under User Program Control

The setting of the console entry switches can be read by an XIO read instruction at any time during the execution of a user-written stored program. The device code of the instruction is set to 00111.

Entering Programs from the Keyboard Under Monitor System Control

A single Monitor control record or an entire program including all required control records and data records can be entered from the 1130 Keyboard using the Monitor System. Control is passed 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 or // JOB record is entered from the keyboard.

Keyboard Operation

When the // TYP Monitor control record is read, the Console Printer performs a carrier return and the KB SELECT light on the Keyboard operator's panel turns on. The system is now ready to accept input from the Keyboard.

Enter all control records in the correct format. Use the space bar for blanks. The records are printed on the Console Printer as they are entered. Press EOF to end each record. An NL (new line) character is entered, the carrier is restored to a new line, and the keyboard is reselected. This sequence of events continues until a // TEND or // JOB record is entered. Pressing EOF then returns control to the principal input device.

Up to 80 characters can be entered in each record. If an error is made when entering a record from the Keyboard, the user can elect to backspace and correct the entry or re-enter the entire record.

Backspace. When the backspace key (←) is pressed, the last graphic character entered is slashed and the address of the next character to be read is decremented by +1. If the backspace key is pressed twice consecutively, the character address is decremented by +2, but only the last graphic character is slashed. For example, assume that *DELET has been entered and the backspace key is pressed three times. The next graphic character replaces the L, but only the T is slashed. If the characters FINE are used for replacement, the paper would show *DELET̸FINE, but *DEFINE would be stored in the buffer.

Re-entry. When the ERASE FIELD key is pressed, a character interrupt signals the interrupt response subroutine that the previously-entered Keyboard record is in error and is to be re-entered. The subroutine prints two slashes on the Console Printer, restores the carrier to a new line, and prepares to replace the old record in the I/O area with the new record. The new record overlays the previous record, character by character. Blanks are placed in the buffer following the NL character which terminated the new record.

Console Functions While Under Monitor System Control

PROGRAM STOP Key. Pressing this key causes a level 5 interrupt and an entry to the PROGRAM STOP key trap providing there are no user-written device subroutines associated with level 5 currently in core. The trap consists of a WAIT and a branch. When the PROGRAM START key is pressed, the interrupt level is turned off and execution resumes following the point of the level 5 interrupt.

The PROGRAM STOP key trap allows the user to stop the entire 1130 system with the ability to continue execution without disturbing the system status or the contents of core storage.

If a higher interrupt level is being serviced when the PROGRAM STOP key is pressed, the PROGRAM STOP key interrupt is masked until the current operation is completed.

INT REQ. Pressing the Interrupt Request key causes the current job to be aborted. Control is returned to the Supervisor, which then searches for the next JOB record in the input stream.

IMM STOP. Do not press IMM STOP when running under Monitor system control. The contents of a system cartridge can be destroyed, necessitating a regeneration of the system.

Manual Dump of the Monitor System

If a problem occurs during the execution of a core load and the user desires to dump core storage, the dump entry point in the Skeleton Supervisor can be entered by a manually executed transfer to the dump entry entry point plus one (location $DUMP+1). A dump of the entire contents of core storage is given in hexadecimal and the dump program (see Supervisor Core Dump Program) executes a CALL EXIT thereby terminating the execution of the core load in progress.

If the dump was necessitated by the introduction of bad data in a Monitor system program, the system may loop rather than perform the dump. If this occurs when DISKZ is in use, the user must manually clear $IOCT and $DBSY before reinitiating the dump.

Before describing the contents of a Monitor system and non-system cartridge, it is necessary to briefly describe the steps to initialize the cartridges for use on the system.

- When the Monitor system is loaded by the System Loader onto a disk cartridge that has been initialized by the Disk Cartridge Initialization Program (DCIP), that cartridge becomes a system cartridge.

- Placement of a system cartridge on any physical drive readies the system for the user-initiated cold start procedure. The cold start establishes the physical drive on which the system cartridge has been placed as logical drive 0, which is, by definition, the system drive. The system cartridge on logical drive 0 is then called the master cartridge.

- The other cartridges on the system (also initialized by DCIP) are called non-system cartridges. If desired, the IBM system can then be loaded on any of these cartridges, thus making them system cartridges. However, once a cold start has been performed and a master cartridge established, all other cartridges, system or non-system, are called satellite cartridges.

The organization of programs and areas on system and non-system cartridges is described and illustrated below.

Sector @IDAD of any Cartridge

This sector, illustrated in Figure 1, contains the defective cylinder table, the cartridge ID, the cartridge copy code, a reserved area, and an Error Message program.

The defective cylinder table contains the addresses of the first sector on any cylinders on the cartridge that are not capable of accurately storing data. The Monitor system can be operated from a cartridge with up to 3 defective cylinders.

The cartridge ID is a hexadecimal number in the range /0001 - /7FFF that uniquely identifies the cartridge.

The copy ID (updated by DCIP or COPY) gives the user the ability to identify any given copy of a system or non-system cartridge. Each time a copy is made, word 5 (initially 1) is incremented by one, i.e., word 5 of the copy is always one greater than the source.

The reserved area of sector @IDAD is used by the System Loader when the IBM System is loaded on the cartridge (see Figure 2).

Following initialization by DCIP (or DISC), an error message and the program that causes it to print are stored in sector @IDAD. The error message -- NON-SYST. CART. ERROR -- is printed if an attempt is made to cold start a cartridge that is not a system cartridge. This message and the program that prints it are overlaid by the Cold Start program when the Monitor system is loaded on the cartridge.

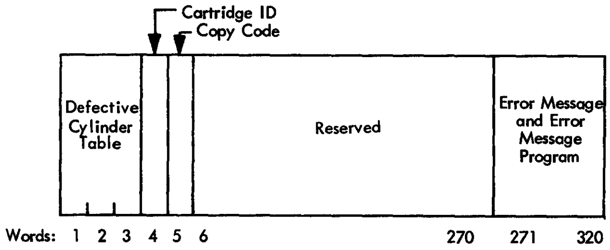

Cartridge ID
Copy Code
Defective Cylinder Table
Reserved
Error Message and Error Message Program
Words: 1 2 3 4 5 6 270 271 320

Figure 1. Contents of Sector @IDAD after Initialization by DCIP or DISC

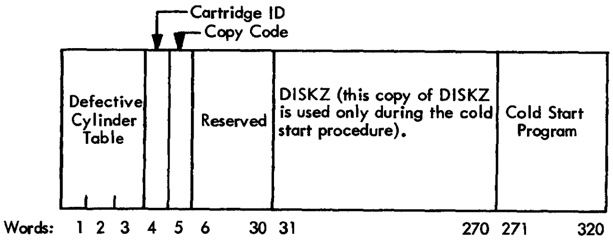

Cartridge ID
Copy Code
Defective Cylinder Table
Reserved
DISKZ (this copy of DISKZ is used only during the cold start procedure).
Cold Start Program
Words: 1 2 3 4 5 6 30 31 270 271 320

Figure 2. Contents of Sector @IDAD after the IBM System is on Disk

SYSTEM CARTRIDGE

The system cartridge is divided into three logical areas, which are illustrated in Figure 3. These areas are the IBM System Area, the User Area, and the Working Storage. In addition, the user may define a Fixed Area on disk for the purpose of storing programs and/or data files into permanent locations so they may be referenced by sector address.

IBM SYSTEM AREA

During system generation, the IBM system decks are loaded on disk by the System Loader. The disk areas occupied by the IBM-supplied Monitor programs, and the disk areas reserved for the use of these programs, are collectively known as the IBM System Area.

The contents of the IBM System Area are listed below.

Cylinder 0

The contents of sector @IDAD have already been described (see Figure 2). Sector @DCOM contains the Disk Communications Area, which is described below (see DCOM).

Sector @RIAD contains the Resident Image. The Resident Image is a copy of the Resident Monitor without a disk I/O subroutine, that is, it is a reflection of COMMA and the Skeleton Supervisor (see Resident Monitor in the section Supervisor). The Resident Image is used to initialize the Resident Monitor during a cold start.

The System Location Equivalence Table (SLET) resides on sectors @SLET and @SLET+1. SLET is composed of an identification number, core loading address, word count, and sector address for every phase of every Monitor program.

Sector 5 is reserved.

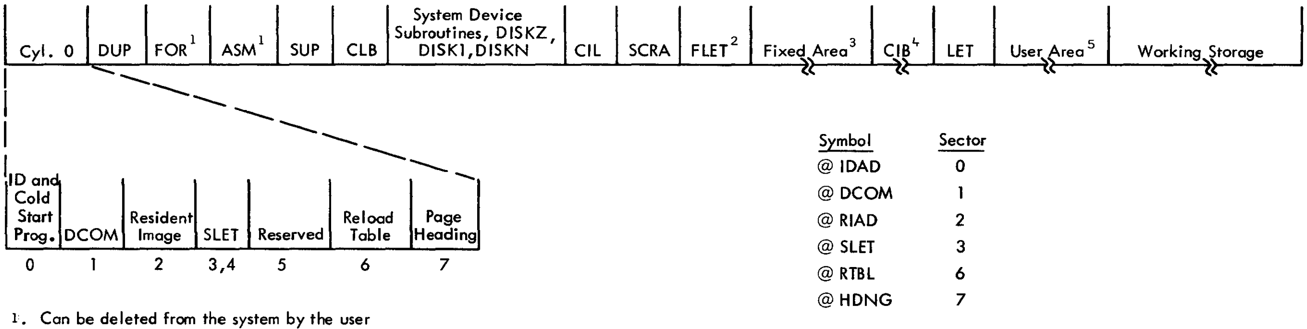
Sector @RTBL contains the Reload Table, which is used by the System Loader during a program reload and by the Disk Utility Program (DUP) when deleting the Assembler or FORTRAN Compiler. The Reload Table is established during system generation when the System Loader reads the Type 81 System Loader control card.

Sector @HDNG is used to store the page heading that appears at the top of each page printed by a Monitor program.

DCOM

The Disk Communications area, located in sector @DCOM of a system cartridge, contains the parameters that must be passed from one Monitor program to another and that must be accessed through disk storage (as opposed to core storage). Generally speaking, parameters that are not required when fetching a link stored in Disk Core Image format are found in DCOM. A listing of DCOM is provided in Appendix H, Resident Monitor.

DCOM is divided into two parts. The first part of DCOM contains the parameters that are not related to all the disk cartridges, for example, the core map switch. The second part of DCOM contains the cartridge-related parameters: cartridge ID, LET address, file protect address, etc. Each of the



Symbol	Sector
@ IDAD	0
@ DCOM	1
@ RIAD	2
@ SLET	3
@ RTBL	6
@ HDNG	7

1. Can be deleted from the system by the user
2. Present only if a Fixed Area is defined for this cartridge by the user
3. Optionally defined by the user
4. May not be deleted by the user from a system cartridge.
5. Initially contains only the System Library; user-written programs may be added

Figure 3. Layout of a System Cartridge

parameters in the second part is in the form of a five-word table, one word for the corresponding value for each of the five possible cartridges. The five words of each table, known as a quintuple, are arranged in the order of logical drive numbers; that is, the first is for logical drive 0, the second for logical drive 1, etc.

The parameters for the non-system cartridges are obtained from the DCOM areas of those cartridges and stored in the DCOM on the system cartridge through the use of a merge operation. For example, the file protect address quintuple on the master DCOM is composed of the file protect address from each of the other four logical drives, plus its own file protect address.

The subroutine for performing the DCOM merge operation is called SYSUP and must be called by the user for the purpose of updating the DCOM parameters if cartridges are changed during a job (see SYSUP in the section System Utility Subroutines). A similar subroutine is an integral part of the Monitor Control Record Analyzer and is executed during JOB processing.

During the processing of a JOB record, the DCOMs of only those cartridges listed on the JOB record are merged into the master DCOM. The parameter tables for the other drives are cleared to zero.

DCOM Indicator Words

In the following paragraphs, "set" means that a value is stored in the word in question; "reset" means that it is cleared to zero.

Working Storage Indicator Word. DCOM contains a Working Storage Indicator word for each cartridge on the system. The Working Storage Indicator word for a cartridge contains the disk block count of any DSF program, DCI program, or Data File currently in Working Storage on that cartridge.

The Working Storage Indicator word for a cartridge is set (1) at the completion of a DUP operation in which information is transferred to Working Storage and (2) at the completion of any assembly or successful compilation, at which time the Assembler or FORTRAN Compiler places the assembled/compiled object program in Working Storage.

The Working Storage Indicator word for a specific cartridge is reset 1) following any STORE operation to the User Area on that cartridge and 2) following the building of a core load that requires LOCALs and/or SOCALs. Because the User Area is increased at the expense of Working Storage, it is assumed that any STORE operation to the User Area overlays a part of the Working Storage area with that which was stored. Therefore, the Working Storage Indicator word is reset.

Format Indicator Word. DCOM contains a Format Indicator word for each cartridge on the system. The Format Indicator word for a cartridge indicates the format of any DSF program, DCI program, or Data File currently in Working Storage on that cartridge.

The Format Indicator word for a cartridge is set and reset under the same conditions as the Working Storage Indicator word for the same cartridge.

Temporary Mode Indicator Word. The Temporary Mode Indicator word in DCOM is set by the Supervisor when temporary mode is indicated by the user in the JOB record (see // JOB under Monitor Control Records). Table 1 lists DUP operations and any restrictions that apply when in temporary mode. The temporary mode indicator is set/reset during JOB processing.

Monitor System Disk Areas

Following cylinder 0, the IBM System is loaded onto disk in the order shown in Figure 3. The individual programs are described in the section of this manual entitled Monitor Programs; the disk areas are described below.

System Device Subroutine Area. The System Device Subroutine Area contains the following components.

- The subroutines used by the Monitor programs to operate the following print devices.
  1403 Printer
  1132 Printer
  Console Printer

Table 1. Restrictions on DUP Operations in Temporary Mode

DUP Operations	Restrictions
DUMP	None
DUMPDATA	None
STORE	None
STORECI	To UA only
STOREDATA	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

- The subroutines used by the Monitor programs to operate the following I/O devices.
  2501 Card Reader/1442 Card Punch, model 5, 6, or 7
  1442 Card Read Punch, model 6 or 7
  1134/1055 Paper Tape Reader/Punch
  Keyboard/Console Printer

- The I/O character code conversion subroutines used in conjunction with the I/O subroutine for the following devices.
  2501 Card Reader/1442 Card Punch
  1134/1055 Paper Tape Reader/Punch
  Keyboard/Console 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 System Library because they are processed by the Core Load Builder differently than those stored in the System Library.

DISKZ is stored twice on the disk, once in sector @IDAD with the Cold Start program, and once in the System Device Subroutine Area with DISK1 and DISKN. Cold Start initializes with the DISKZ in sector @IDAD, in all other cases, DISKZ is fetched from the System Device Subroutine Area.

Supervisor Control Record Area. The Supervisor Control Record Area (SCRA) is the area in which Supervisor control records (LOCAL, NOCAL, and FILES) are saved. These records 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.

Fixed Location Equivalence Table (FLET). This table 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 format

- Each Data File stored in Disk Data format

- The padding required to permit a DCI program or Data File to be stored on a sector boundary.

Each FLET entry specifies the name of the DCI program or Data File, its format, and its size in disk blocks.

Each cartridge on the system having a Fixed Area has a FLET. Regardless of the size of the Fixed Area (one cylinder is the minimum requirement), the FLET for a cartridge occupies the cylinder preceding the fixed Area (a minimum of 2 cylinders of Fixed Area may be initially defined. The first cylinder becomes FLET).

The sector address of the first sector of FLET on a given cartridge may be obtained from the LET on the same cartridge. The last LET header contains this sector address.

A FLET dump is illustrated in Appendix G.

Core Image Buffer (CIB). The CIB is the area on disk in which the Core Load Builder builds any portion of a core load that is to reside below location 4096. It is also used by the Core Image Loader to save any COMMON defined below location 4096 during the transfer of control from one link to the next.

Location Equivalence Table (LET). The LET on a cartridge is a directory to the contents of the User Area on that cartridge. There is one LET entry for:

- Each entry point for each program stored in Disk System format

- Each program stored in Disk Core Image format

- Each Data File stored in Disk Data format

- The padding required to permit a DCI program or Data File to be stored on a sector boundary.

Each LET entry specifies the name of an entry point, DCI program, or Data File; its format; and its size in disk blocks.

Each cartridge on the system has a LET. However, a cartridge has a User Area only if there is an entry in the LET on that cartridge other than a dummy entry (1DUMY). On a system cartridge, LET occupies the cylinder preceding the User Area.

COMMA contains the sector address of the first sector of LET for each cartridge being used in a given job.

A LET dump is illustrated in Appendix G.

USER AREA

The User Area (UA) is the area in which the user can store programs in Disk System format or Disk Core Image format and/or Data Files in Disk Data format. The User Area is defined on any cartridge when the cartridge is initialized. However, its size is 0 sectors until the first DSF program, DCI program, or Data

File is stored in the User Area on that cartridge. The User Area occupies as many sectors as are required to contain the DSF programs, DCI programs, and Data Files stored on that cartridge.

When a DSF program, DCI program, or Data File is to be added to the User Area, it is stored at the start of Working Storage, that is, immediately following the end of the User Area. The area occupied by the new DSF program, DCI program, or Data File is then incorporated into the User Area, and Working Storage is decreased by the size of that area.

DSF programs are stored in the User Area starting at the beginning 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 DSF program, DCI program, or Data File is deleted from the User Area; that is, the DSF programs, DCI programs, and/or Data Files in the User Area are moved so as to occupy the vacancy (the area formerly occupied by the deleted DSF program, DCI program, or Data File). In 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 in the vacancy. All following DSF programs, DCI programs, and Data Files are similarly packed.

The area gained by packing the User Area is returned to Working Storage.

WORKING STORAGE AREA

Working Storage (WS) is that area on all cartridges that is not defined as the User/Fixed Area and, on a system cartridge, as the IBM System Area. Working Storage is available to Monitor and user programs alike as temporary disk storage. It extends from the sector boundary immediately following the User Area to the end of the cartridge (cylinder 199).

FIXED AREA

The Fixed Area (FX) is the area in which the user may store programs in Disk Core Image format and/or Data Files in Disk Data format if it is desired that these programs and Data Files always occupy the same sectors. The Fixed Area is optionally defined on any cartridge by the use of the DUP operation, DEFINE FIXED AREA. This operation is also used to increase or decrease the size of the Fixed Area.

When a DCI program or Data File is stored in the Fixed Area, it is stored starting at the beginning of a sector. When a DCI program or Data File is deleted from the Fixed Area, no packing of the Fixed Area occurs. Hence, DCI programs and Data Files in this area reside at fixed sector addresses and can be referenced as such by the user.

NON-SYSTEM CARTRIDGE

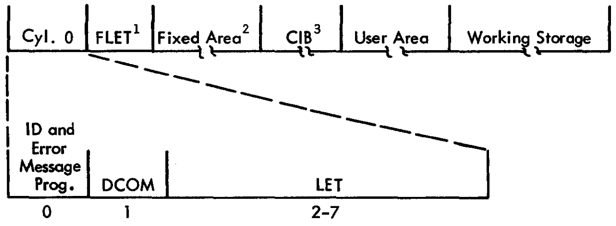
Figure 4 shows the layout of a non-system cartridge, a cartridge that contains no Monitor programs. Such a cartridge on multi-drive 1130 systems can be used exclusively for the storage of data and/or programs and is called a satellite cartridge.

Except for cylinder 0, which is described below, the definitions of the areas present on a non-system cartridge are the same as those previously described for a system cartridge.

Cylinder 0

Sector @IDAD of cylinder 0 on a non-system cartridge contains the parameters established by DCIP or DISC (see Sector @IDAD of any Cartridge). Note however that the Error Message program has not been overlaid since this is not a system cartridge. An attempt to cold start a non-system cartridge will cause the error message to be printed on the Console Printer. Sector @DCOM of cylinder 0 contains only that information from DCOM applicable to this non-system cartridge (see DCOM).

The location equivalence table (LET) for the cartridge (see Location Equivalence Table), occupies the remaining six sectors of cylinder 0.



1. Present only if a Fixed Area is defined for this cartridge by the user
2. Optionally defined by the user
3. May be deleted by the user. However, a CIB must be present on at least one of the cartridges on the system at any given time.

Figure 4. Layout of a Non-System Cartridge

The Monitor programs: Supervisor, DUP, Assembler, FORTRAN Compiler, Core Load Builder, and Core Image Loader reside in the IBM System Area on the master cartridge. The following paragraphs briefly describe these programs and the subprograms within them that are of most interest to the user.

SUPERVISOR

The Supervisor is actually a group of programs and areas which are responsible for the control functions of the Monitor system. The Supervisor reads control records included in the stacked job input, decodes them, and calls the appropriate Monitor program to perform the specified operation. The Supervisor initially achieves control of the Monitor system through the user-initiated cold start procedure (see Cold Start).

A portion of the Supervisor is located in core storage. This portion is called the Resident Monitor.

RESIDENT MONITOR

The resident portion of the Monitor system consists of (1) a data area used for system parameters and for communication between Monitor programs (COMMA), (2) the Skeleton Supervisor, and (3) a disk I/O subroutine (either DISKZ, DISK1, or DISKN).

Core Communications Area (COMMA)

In general, COMMA consists of the parameters required by the Core Image Loader to process a CALL LINK to a DCI program without referring to the Disk Communications area (DCOM). This information is interspersed with parts of the Skeleton Supervisor (see Appendix H, Resident Monitor).

Skeleton Supervisor

On any entry to the Resident Monitor (EXIT, LINK, or DUMP), the Skeleton Supervisor calls the Core Image Loader, which determines where the Skeleton Supervisor was entered and either calls the Supervisor if the entry was at EXIT or DUMP or fetches and transfers control to the core load specified in the CALL LINK statement if the entry was at LINK. (If the link to be executed is in Disk System format, it will be necessary to call the Core Load Builder before transferring control to the core load itself.)

The use of the Core Image Loader as an intermediate supervisor allows the Monitor system to achieve efficient link-to-link transfer of control.

The Skeleton Supervisor, which is interspersed with COMMA, consists of the entry points and subroutines described below.

LINK Entry Point. LINK is the entry point in the Skeleton Supervisor that accomplishes link-to-link transfer of control.

EXIT Entry Point. EXIT is the entry point in the Skeleton Supervisor that accomplishes link-to-Supervisor transfer of control.

DUMP Entry Point. DUMP is the entry point in the Skeleton Supervisor that prints out the contents of core storage between specified limits. Dynamic dumps are obtained through the DUMP entry point; terminal dumps are obtained through the DUMP entry point plus 1.

ILS02 Subroutine. The ILS02 subroutine handles the servicing of interrupts on level 2. Only the disk devices on the system interrupt on level 2. Since the Skeleton Supervisor requires the disk, the ILS02 subroutine is a part of the Resident Monitor.

ILS04 Subroutine. The ILS04 subroutine handles the servicing of interrupts on level 4. One of the devices that interrupt on level 4 is the Keyboard. Since the user may perform a console interrupt request at any time, the ILS04 subroutine is a part of the Resident Monitor.

Preoperative Error Trap. The preoperative error trap is entered by all ISS subroutines when an error is detected before an operation has been initiated. The trap consists of a WAIT and a branch. When the PROGRAM START key is pressed, execution resumes at the location following the branch to this trap. Under certain conditions, this trap is entered when no error has occurred, e.g., FORTRAN PAUSE.

Postoperative Error Traps. One of the postoperative error traps (there is one for each interrupt level) is entered by all ISS subroutines when an error is detected after an operation has been initiated. Each trap consists of a WAIT and a branch. When the PROGRAM

START key is pressed, control is returned to the ISS subroutine, which may then retry the operation in error.

PROGRAM STOP Key Trap. The PROGRAM STOP key trap is entered if a level 5 interrupt occurs and there is no user-written device subroutine associated with level 5 currently in core. The trap consists of a WAIT and a branch. When the PROGRAM START key is pressed, the interrupt level is turned off and execution resumes following the point of the level 5 interrupt.

This trap allows the user to stop the entire 1130 system with the ability to continue execution without disturbing the system status or the contents of core storage.

If a higher interrupt level is being serviced when the PROGRAM STOP key is pressed, the PROGRAM STOP key interrupt is masked until the current operation is completed.

Interrupt Request Key

When the INT REQ key is pressed, all busy indicators are turned off and a switch in COMMA is set to instruct the Supervisor to pass input records until a JOB record is encountered. Parts of the Monitor which should not be interrupted before completion, e.g., SYSUP, delay the interrupt request until they have completed their operation.

Disk I/O Subroutine

The disk I/O subroutine required by the program in control resides in core storage following the Skeleton Supervisor. The following table lists the disk I/O subroutines, their approximate sizes, and the corresponding addresses of the end of the Resident Monitor plus 1.

Subroutine (in Core)	End of Resident Monitor +1 (Core Location) Decimal	Hexadecimal
DISKZ	480	/01E0
DISK1	660	/0294
DISKN	930	/03A2

DISKZ is the disk I/O subroutine used by all system programs. DISKZ is initially loaded with the Resident Monitor.

Prior to the execution of a core load requiring 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. User programs, including those written in FORTRAN language, may use any of the three disk I/O subroutines; however, only one disk I/O subroutine may be referenced in a given core load. In this context "core load" includes column 19 of the XEQ record (the entry in column 19 of the XEQ record specifies the version of the disk I/O subroutine to be used by the core load during execution).

DISK-RESIDENT SUPERVISOR PROGRAMS

The programs described below are the disk-resident programs that constitute the Supervisor. One of these programs is fetched and given control by the Core Image Loader, depending upon the entry made in the Skeleton Supervisor; the Monitor Control Record Analyzer is called following an EXIT entry, the DUMP program following a DUMP entry.

Monitor Control Record Analyzer

The Monitor Control Record Analyzer (1) reads a Monitor control record or Supervisor control record from the input stream, (2) prints the control record on the principal print device, and (3) fetches the required Monitor program and transfers control to it. Supervisor control records are stored on disk in the Supervisor Control Record Area.

Supervisor Control Record Area. The Supervisor Control Record Area is the area on disk, within the IBM System Area, on which the FILES, LOCAL, and NOCAL control records are stored from the input stream. The Core Load Builder reads these records from this area on disk for analysis during the building of the core image program.

MONITOR CONTROL RECORDS

Monitor control records perform the load and control functions of the Monitor system. The individual control records are described in the paragraphs that follow.

Where shown in the control record format, the character "b" indicates that the column must be blank. Remarks may be punched in the card columns listed as "not used" in the control record formats.

// JOB

The JOB control record defines the start of a new job. It causes the Supervisor to perform the job initialization procedure, which includes:

- The initialization of COMMA

- The initialization of the parameters in DCOM

- The setting of the Temporary Mode Indicator if a T is present in column 8 of the JOB control record (reset if no T in column 8). If set, the temporary mode indicator causes all DSF programs, DCI programs, or Data files stored in the User Area by DUP during the current job to be deleted automatically from that area at the end of the job (that is, at the beginning of the next job). See DCOM for DUP restrictions while in the temporary mode.
- The definition of the cartridges to be used during the current job. IDs 1 through 5 on the JOB control record specify the cartridges to be used. These cartridges may be mounted on the physical drives in any order. The order of the IDs in the JOB control record specifies the logical assignments for the cartridges. IDs 1 through 5 correspond to logical drives 0 through 4, and they must be specified consecutively. If only three drives are to be used IDs 1-3 only are specified. The cartridge-related entries of COMMA and DCOM (quintuples) are filled in according to the logical order specified by the user. The first ID may be left blank, in which case the master cartridge for the last JOB will also be the master for this JOB.
- The definition of the cartridge on which the Core Image Buffer for the current job is to be found. The ID of the cartridge containing the CIB must follow the field of the fifth cartridge ID. If the CIB ID is omitted, the CIB on the master cartridge is used. Core image programs can be built faster if the CIB is assigned to a cartridge other than the master cartridge.
- The definition of the cartridge containing the Working Storage to be used by the Monitor programs (System Working Storage). The ID of the cartridge to be used for Working Storage by the Monitor System must follow the CIB ID. If the Working Storage ID is omitted, all Monitor programs use the Working Storage on the master cartridge (except when otherwise specified, see DUP Control Records). Core Image programs can be built faster if the System Working Storage is on a cartridge other than the master cartridge. They can be built even faster if the CIB, the system Working Storage, and the Monitor system itself are all on separate cartridges. Assemblies are also faster if System Working Storage is on a separate cartridge.
- The definition of the cartridge containing the unformatted I/O ($$$$$) disk buffer area to be used with this job.
- The starting of a new page on the principal print device. A skip to channel 1 is executed on the 1132 or 1403 Printer; or five consecutive carriage returns are made on the Console Printer. The page count is reset to 1, and the current page heading is replaced with whatever appears in columns 51-58 of the JOB control record. HDNG (assembler language) statements and **(FORTRAN control record) records will cause additional information to be printed.

The format of the JOB control record is as follows.

Card Column	Contents	Notes
1-6	//bJOB	
7	Reserved	
8	Temporary mode indicator	T or blank. A T indicates that temporary mode is desired for this job.
9-10	Reserved	
11-14	First ID	This is the ID of the master cartridge (logical drive 0).
15	Reserved	
16-19	Second ID	This is the ID of the cartridge on logical drive 1.
20	Reserved	
21-24	Third ID	This is the ID of the cartridge on logical drive 2.
25	Reserved	
26-29	Fourth ID	This is the ID of the cartridge on logical drive 3.
30	Reserved	
31-34	Fifth ID	This is the ID of the cartridge on logical drive 4.
35	Reserved	
36-39	CIB ID	This is the ID of the cartridge containing the CIB to be used during this job.
40	Reserved	
41-44	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, p. 23, for details on Working Storage for user programs.
45	Reserved	
46-49	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	
51-58	Date, Name, etc.	This information is printed at the top of every page of the listing on the principal print device during this job.
59-80	Not used	

// ASM

This control record causes the Supervisor to read the Assembler into core storage and transfer control to it. Any Assembler control records and the source statements to be assembled must follow this control record. Comments control records (// *) may not follow this control record.

The format of the ASM control record is as follows.

Card Column	Contents	Notes
1-6 7-80	//bASM Not used	

(See *FILES, p. 23 for working storage for user programs.)

// FOR

This control record causes the Supervisor to read the FORTRAN Compiler into core storage and transfer control to it. Any FORTRAN control records and the source statements to be compiled must follow this control record. Comments control records (// *) may not follow this control record.

The format of the FOR control record is as follows.

Card Column	Contents	Notes
1-6	//bFOR	
7-80	Not used	

// DUP

This control record causes the Supervisor to read the control portion of the Disk Utility Program into core storage and transfer control to it. A DUP control record must follow this control record. Only one // DUP control record is required to process a stack of DUP control records, provided no Monitor control record other than the Comments control record (// *) is encountered.

The format of the DUP Monitor control record is as follows.

Card Column	Contents	Notes
1-6	//bDUP	
7-80	Not used	

// XEQ

This control record causes the Supervisor to initialize for core load execution. If the name specified in this control record (columns 8 through 12) is that of a mainline program stored in Disk System format, the Supervisor reads the Supervisor control records (LOCAL, NOCAL, or FILES), if any, from the input stream and writes them in the Supervisor Control Record Area (SCRA). The Core Load Builder is then called to build a core image program from the mainline program.

If no name is specified on this control record, a mainline program in Disk System format is assumed to be stored in the Working Storage of the cartridge specified in columns 21-24. The Supervisor then processes the Supervisor control records and calls the Core Load Builder via the LINK entry point in the Resident Monitor.

After the Core Image program has been built, or if the name in the control record is that of a program already stored on disk in DCI format, the Core Image Loader is called to read the core load into core storage and transfer control to it.

If an L is punched in column 14 of this control record, a core map is printed by the Core Load Builder during the building of the core image program. In addition, a core map is printed for all DSF links during the execution (see Reading a Core Map and a File Map for an example of a core map). These core maps include:

- The execution address of the mainline program
- The names and execution addresses of all subprograms in the core load
- All file allocations, with the file number, sector address (relative to first sector of Working Storage for files in Working Storage, absolute otherwise), sector count, and either cartridge ID or the address of Working Storage. (If the file is in Working Storage, the address of Working Storage will be included; otherwise, the name of the file is printed.)

Columns 16 and 17 of this control record contain the right-justified decimal count of Supervisor control records to be read by the Supervisor before calling the Core Load Builder.

Column 19 contains a character that identifies the disk I/O subroutine to be used by the core load during execution. If column 19 contains zero or one, DISK1 is fetched by the Core Image Loader along with the core load. If Column 19 contains an N, DISKN is fetched. If column 19 contains a blank or a Z, no disk I/O subroutine is fetched (that is, DISKZ, which is in core storage for use by the Monitor programs, is used by the core load). Any other character is illegal and will cause the execution to be bypassed. All links in Disk System format that are called during a given execution must utilize the same disk I/O subroutine as the link that precedes them in execution.

Comments control records (// *) may not follow an XEQ control record.

The format of the XEQ control record is as follows.

Card Column	Contents	Notes
1-6	//bXEQ	
7	Reserved	
8-12	Name	This is the name (left-justified) of the DSF program or DCI program to be executed.

(continued)

Card Column	Contents	Notes
13	Reserved	
14	Core Map Indicator	L or blank. An L indicates that a core map is to be printed for this and all following DSF links during this execution.
15	Reserved	
16-17	Count	This is the right justified decimal number of Supervisor control records (LOCAL, NOCAL, and FILES) that follow.
18	Reserved	
19	Disk I/O subroutine indicator	This column specifies the disk I/O subroutine to be loaded into core by the Core Image Loader for use by the core load during execution.
21-24	Cartridge ID	The ID of the cartridge that contains the mainline program in its Working Storage (valid only if no name is specified in columns 8-12; blanks in this field indicate the System Working Storage).
25-80	Not used	

// PAUS

This control record causes the Supervisor to WAIT. When PROGRAM START is pressed, the Supervisor continues processing Monitor control records from the input stream.

The format of the PAUS control record is as follows.

Card Column	Contents	Notes
1-7 8-80	//bPAUS Not used	

// TYP

This control record causes the Supervisor to temporarily assign the Keyboard as the principal input device. The Keyboard replaces the card or paper tape reader as the principal input device until a TEND or JOB control record is entered from the Keyboard.

The format of the TYP control record is as follows.

Card Column	Contents	Notes
1-6 7-80	//bTYP Not used	

With the Keyboard as the principal input device, the keyboard functions are identical to those discussed for TYPEZ and TYPE0 (System Library Subroutines) with one exception. The END-OF-MESSAGE character causes the rest of the buffer to be filled with blanks. Therefore, at the completion of a new message, nothing will remain of any previously-entered message.

// TEND

This control record causes the Supervisor to reassign the card or paper tape reader as the principal input device. The reassignment is to whichever unit was the principal device prior to the detection of a TYP control record.

The TEND control record must be entered from the Keyboard. The format of the TEND control record is as follows.

Card Column	Contents	Notes
1-7 8-80	//bTEND Not used	

// EJECT

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. Control is then returned to the Supervisor, which reads the next record in the input stream. The EJECT control record itself is printed.

The format of the EJECT control record is as follows.

Card Column	Contents	Notes
1-8 9-80	//bEJECT Not used	

// *(comments)

This control record allows the user to print alphameric text on the listing printed on the principal print device by the Supervisor and DUP. The Supervisor and DUP simply print the control record and continue reading control records from the input stream. The Comments control record may not immediately follow an XEQ, ASM, or FOR control record.

The format of the Comments control record is as follows.

Card Column	Contents	Notes
1-4 5-80	//b* User comments	 Any alphameric characters may be used.

// CPRNT

This control record causes the Supervisor to print all Monitor and Supervisor control records that it reads on the Console Printer. Printing by all other Monitor programs will be on the principal print device.

Once the CPRNT control record has taken effect, all Monitor and Supervisor control records will be printed as described above. To return the printing of Monitor and Supervisor control records to the principal print device, a reload function must be performed by the System Loader to redefine the principal print device.

The format of the CPRNT control record is as follows.

Card Column	Contents	Notes
1-8 9-80	//bCPRNT Not used	

SUPERVISOR CONTROL RECORDS

The control records described below (LOCAL, NOCAL, and FILES) are used by the Core Load Builder to:

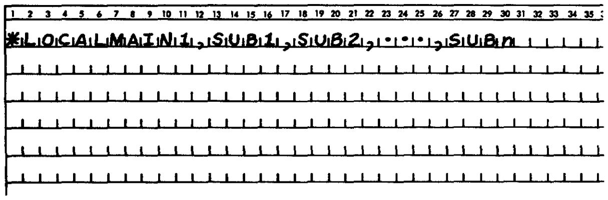
- Provide for subprogram overlays during execution (LOCAL)
- Include subprograms not called in the core load (NOCAL)
- Equate disk storage files defined in the mainline program during compilation or assembly to specific files stored on the disk (FILES)

These control records are placed in the input stream following an XEQ Monitor control record that names a mainline program stored in Disk System format or following a STORECI 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.

Up to 99 Supervisor control records may follow the XEQ or STORECI control record. There is no specified order (by type) to be followed; however, the types may not be intermixed.

*LOCAL

LOCAL (load-on-call) subprograms are subprograms specified by the user to be read, one at a time, as they are called during the execution, into a LOCAL overlay area. The LOCAL subprograms are specified on the LOCAL control record as follows:

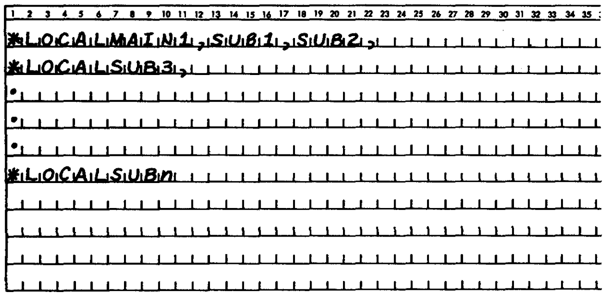


```
*LOCALMAIN1,SUB1,SUB2,...,SUBn
```

where

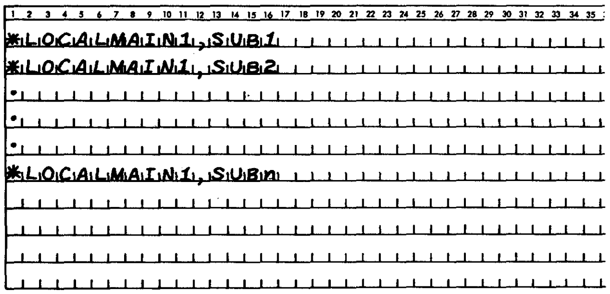
MAIN1 is the name of the mainline program already stored on disk. SUB1 through SUBn are the names of the LOCAL subprograms used with that mainline program.

In the case illustrated below, all the LOCAL control records except the last end with a comma (continuation character) and the mainline program name appears on the first LOCAL control record only.



```
*LOCALMAIN1,SUB1,SUB2,
*LOCALSUB3,
.
.
.
*LOCALSUBn
```

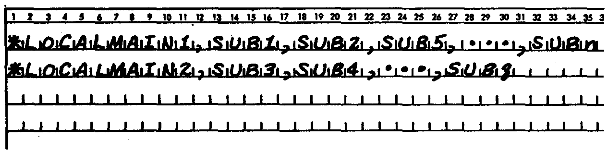
The same results would have been obtained if the records had been:



```
*LOCALMAIN1,SUB1
*LOCALMAIN1,SUB2
.
.
.
*LOCALMAIN1,SUBn
```

All the LOCAL subprograms for each mainline program in an execution must be specified on the LOCAL control records that follow the XEQ Monitor control record initiating the execution.

Separate LOCAL control records must be used for each mainline program in the execution that calls LOCAL subprograms. For example,

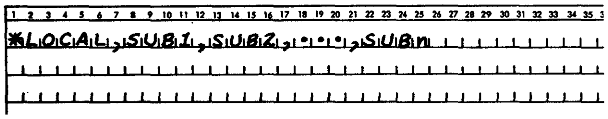


```
*LOCALMAIN1,SUB1,SUB2,SUB5,...,SUBn
*LOCALMAIN2,SUB3,SUB4,...,SUBj
```

where

MAIN2 is a link called by MAIN1.

If the mainline program is to be executed from Working Storage, the mainline program name must be omitted from the LOCAL control record. For example,



```
*LOCAL,SUB1,SUB2,...,SUBn
```

This LOCAL control record format must be used if LOCALs are to be specified with the DUP operation STORECI.

No embedded blanks are allowed in the LOCAL control record.

*NOCAL

NOCAL (load-although-not-called) subprograms are subprograms specified by the user to be included in the core load, even though they are not called. They are specified on NOCAL control records using the same format that applies to LOCAL control records except that *NOCAL is used in place of *LOCAL.

Rules for LOCAL and NOCAL Usage

The user must observe the following rules in the usage of LOCAL and NOCAL control records:

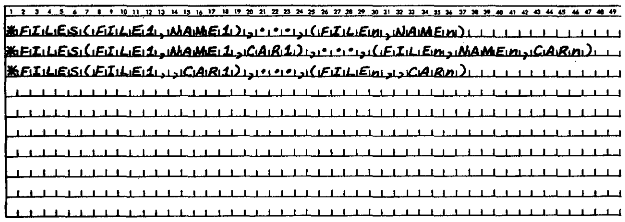
- A subprogram cannot be specified as a LOCAL subprogram if it causes another subprogram, also specified as a LOCAL subprogram in the same mainline program, to be called. For example, if A calls B and B calls C, and A is a LOCAL subprogram, neither B nor C can be specified as a LOCAL subprogram for the same mainline program.
- If a subprogram is specified as a LOCAL subprogram and system overlays (SOCALs) are employed, the subprogram is made a LOCAL subprogram, even if it would otherwise have been included in one of the SOCALs.
- If a subprogram is specified as a LOCAL subprogram, it is included as a LOCAL subprogram in the core image program even if it is not otherwise called.
- The information on all the LOCAL control records for an execution may not exceed M+2(C+1), where M is the number of mainlines and C is the number of commas. This restriction also applies to NOCAL control records.
- Only subprogram types 3, 4, 5, and 6 can be named on LOCAL and NOCAL control records. Subprogram types 3 and 5 are referenced by LIBF statements, types 4 and 6 with CALL statements. Types 5 and 6 are ISSs; types 3 and 4 are subprograms. See Appendix C for a description of subprogram types.
- Conversion tables, e.g., EBPA, HOLTB, may not be used as LOCALs.

*FILES

By means of FILES control records the file numbers specified in FORTRAN DEFINE FILE statements or in Assembler FILE statements are equated to the names of Data Files stored in the User and Fixed areas. FILES control records may also be used to define Data Files in Working Storage other than the master cartridge. All the User/Fixed Area files to be used by all the core loads in an execution must be defined in the FILES control records following the XEQ Monitor control record initiating the execution. All the files thus defined are available to each core load in the execution.

When Data Files are equated in a program stored in DCI, successful execution of this program requires that all cartridges on which these files are stored must be in the same condition and on the same logical drives as when the STORECI occurred. This is necessary since the Core Load Builder places an absolute sector address, including the drive code, into the file table for each equated file.

The format of the FILES control record is as follows.



```
*FILES(FILE1,NAME1),...,(FILEn,NAMEn)
*FILES(FILE1,NAME1,CAR1),...,(FILEn,NAMEn,CARn)
*FILES(FILE1,,CAR1),...,(FILEn,,CARn)
```

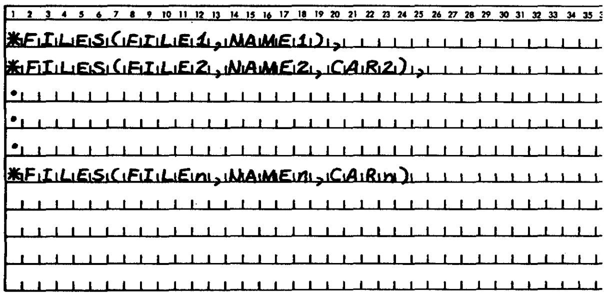
where

FILE1 through FILEn are the file numbers specified in the FORTRAN DEFINE FILE statements or Assembler FILE statements.

NAME1 through NAMEn are the names of Data Files already stored on disk. If the name is omitted (2 commas are required in the control record format), the file is placed in Working Storage on the specified cartridge.

CAR1 through CARn are the IDs of the cartridges on which the respective Data Files are found. If the cartridge ID is omitted, it is assumed that the corresponding Data File has been defined on the master cartridge.

Continuation of FILES control records may be indicated by a comma following the last file definition on the control record, as follows:



```
*FILES(FILE1,NAME1),
*FILES(FILE2,NAME2,CAR2),
.
.
.
*FILES(FILEn,NAMEn,CARn)
```

The continuation comma may appear only immediately after a right parenthesis.

No more than 159 files may be equated during an execution.

No embedded blanks are allowed in the FILES control record.

SUPERVISOR CORE DUMP PROGRAM

The DUMP program provides the user with a hexadecimal printout of the contents of core storage. The calling sequences for the DUMP and PDMP statements are contained in the Assembler language manual (Form C26-5927). FORTRAN programs access the DUMP Program through the FORTRAN statement CALL PDUMP (See FORTRAN language manual, Form C26-3715).

Terminal and Dynamic Dumps

The DUMP entry point ($DUMP) in the Skeleton Supervisor (and thus the DUMP program in the Supervisor) can be entered (1) by a BSI to the DUMP entry point, (2) by a manually executed transfer to the DUMP entry point plus 1, or (3) by a branch to location zero. which contains an MDX to $DUMP+1.

When the DUMP entry point is entered, a dump of the area of core storage bounded by the limit parameters is given in hexadecimal format. Execution of the core load in progress then resumes at the location following the last parameter of the call to the DUMP entry point.

When $DUMP+1 is entered, a dump of the entire contents of core storage is given in hexadecimal format. The DUMP program then executes a CALL EXIT, thereby terminating the execution of the core load in progress.

A portion of a core dump is printed below.

```
ACCUMULATOR 4000      EXTENSION 78D3     XR1 7FA0     XR2 78D3     XR3 0000       OVERFLOW OFF        CARRY OFF

ADDR     ***0  ***1  ***2  ***3    ***4  ***5  ***6  ***7    ***8  ***9  ***A  ***B    ***C  ***D  ***E  ***F

0000     703F  FFFB  0000  0000    0FFA  0140  0080  0000    7AED  7C56  0083  0000    00C4  0091  8000  0000
0010     0000  5540  FFFF  C0C0    0327  0008  CC01  7FA0    D900  703F  4000  78D3    00F2  7400  00EE  70FD
0020     4DC0  C002  4400  00F2    740C  C0EE  70FD  70F4    783F  3000  4C80  0028    003F  0150  0CC0  0000
0030     0000  0000  C001  0000    0000  CC00  0000  000C    7014  CCC0  1810  7012    0001  0004  FFFF  0000
0040     7400  0032  70FD  D8D6    69D2  C480  003F  D0D1    C8F3  4400  00F2  C0F0    7001  C0F0  D0C7  7400
0050     0032  70FD  08BD  6580    0039  C101  18D0  C100    D8BB  6500  01DC  C0FE    1890  4400  00F2  7400
0060     00EE  70FD  4102  0000    C000  0000  0000  0000    0000  0000  C000  0000    CC00  0000  C000  C000
0070     C000  0000  0000  0000    0000  0000  FFFF  0000    0802  0C01  0000  0000    0000  0000  0000  0000
0080     0000  0000  3000  4C80    0081  0000  3000  4C80    0085  CC00  3000  4C80    0089  0000  3000  4C80
0090     008D  C000  3000  4CC0    C091  01D6  CC00  0000    0000  0000  0140  0000    0000  0000  0000  9000
00A0     0000  C000  0000  CCC0    0658  0658  0658  0000    0000  0000  C000  0000    C000  0000  0CC0  0000
00B0     0000  C000  C000  0051    6906  6A07  2807  D80A    4400  0CF7  6500  7FA0    6600  78D3  2000  C802
00C0     4CC0  0083  0001  9400    002A  D818  280E  690F    6A10  0816  1002  4C10    00D0  4480  002C  FFFE
00D0     6109  0810  1149  4580    7FE8  2C00  6500  7FA0    6600  78D3  C803  4CC0    00C4  4001  4000  78D3
00E0     0200  CFC0  0000  0300    0000  C000  C000  0000    C000  0C00  C000  0000    0C00  0C00  0011  0000
00F0     00EF  FF6A  004B  7400    00EE  70FD  7002  00BA    7015  690F  6A10  1008    D03C  18D0  D05B  6211
0100     6AED  C0F0  D0F4  7053    4C00  01BE  6908  081E    6500  7FA0  6600  78D3    4C80  00F7  6500  0004
0110     6600  00F2  0819  D0C9    485C  70EE  C80D  D900    74FF  00EE  703E  C812    C014  4293  1810  D480
0120     0198  70DD  0001  0140    0FFA  0140  C004  95C0    0004  95C0  0122  9600    9400  9781  0EBA  0141
0130     5002  5004  FEC0  0001    0080  C600  0008  5000    0FF8  01CC  0701  0007    000A  009F  FFFB  9680
0140     0400  0141  0000  FFFF    CC00  0000  1810  D0A6    74FF  0032  1000  70BC    C0E3  70CF  C0E8  4400
0150     0028  703A  C0D9  18D0    C101  1803  704D  7401    0032  6500  C004  C900    D8C7  D8D0  1810  1084
0160     DC0E  80DB  D01B  80DA    D033  80D6  8008  80C7    D006  62FD  69BD  C101    E0CB  D101  9400  00A4
0170     4828  7006  C101  80C2    7401  016F  7201  70F5    6600  00F2  C23D  E249    D250  C400  009F  EA4E
0180     D23A  EA43  D239  EA50    9247  D237  EA42  8247    D24D  EA48  D23B  CA3C    0A3A  D2EB  4828  70BC
0190     1002  4828  70BB  100B    4828  70BC  C101  9400    009A  4818  7014  1893    180F  1002  EA3A  18D0
01A0     4810  7002  F251  8230    CA34  4213  CA38  DA34    4213  C231  D480  0198    9101  4C20  0116  CA3C
01B0     4808  7094  8A40  DA3C    4830  1810  824F  D100    CA36  DA34  C101  EA50    D101  4213  C24D  D235
01C0     C247  4820  4213  CA32    D900  C23C  4808  70E9    7500  0140  C900  DA32    CA3C  D900  708F  0000
01D0     0C00  0000  0000  C000    0000  0000  C000  0000    0000  0000  C0A0  3333    016E  0100  03C0  001C
01E0     4480  7DB9  0006  6780    7FFC  18A0  DF00  0142    633C  6FCC  7925  6300    C193  4C28  01F1  6780
01F0     7F33  6F00  045A  6F00    02C0  C120  4C20  0307    C11D  4C28  0283  C700    7F70  4C18  02E7  D400
0200     0395  4400  02A9  C302    1804  4C20  020C  CC00    0342  DC00  7DA4  7004    CC00  033E  DC00  7DA4
0210     4480  7DB8  4480  7DB5    4480  7DB5  4480  7DB5    4480  7DB5  4480  7DB5    C400  0386  4418  03E7
0220     4400  044C  6600  035A    6317  4079  4480  7DBB    7925  405A  6600  7925    6780  7FFC  C302  4480
0230     7DB0  C928  DA01  C303    4480  7DB0  C928  D206    18D0  D207  C305  4480    7DB0  C928  DA0D  C306
0240     4480  7DB0  C928  DA13    4480  7DBB  7925  4480    7DB5  4480  7DB5  4480    7DB5  4036  6600  0371
0250     4C3F  6600  037B  403C    4480  7DB5  6215  6E00    039F  C400  039B  D400    039C  6680  7FFC  7206
0260     6A5D  7201  6A13  1810    D400  C39D  4400  03A7    1000  CC00  0390  D916    4480  7DB7  C4C0  039D
0270     4C18  02BD  4480  7DBB    7925  6600  7792  C202    8400  039C  D400  039C    7203  74FF  039F  7001
0280     703C  D400  039B  70DE    02EC  613C  C008  D500    7925  71FF  70FC  6500    7FA0  4C80  0284  4040
0290     0254  6105  630A  400B    740C  02A4  71FF  70FA    C003  D00A  4480  7DBB    7925  4C80  0290  02F7
02A0     6A01  C700  032F  D700    7925  73FF  70FA  4C80    029F  0203  6780  7FFC    CC00  0394  DB00  4480
02B0     7DB3  4C80  02A9  C700    7F6B  1004  1804  4C18    02D9  C700  7F6B  4C00    01FF  C400  7788  6700
02C0     0004  4C18  02D9  C700    7F6B  1004  1804  9480    02BE  D400  0386  C600    00FB  8400  039B  D400
02D0     039B  C7C0  7F70  180C    100C  EC80  02BE  4C00    01FF  C193  4C10  02E7    7301  6F00  0336  74FC
02E0     0336  7005  1810  D400    0386  4C00  01F1  4480    7DB5  4480  7DB5  4098    C11D  4C28  02FF  C84A
02F0     D845  C84A  D845  6600    032F  630A  40A8  4480    7DBB  7925  C845  DC00    7DA4  4480  7D8D  C83E
0300     D835  C83E  D835  66C0    032F  630A  70EF  6827    4400  044C  6700  7925    6680  7FB4  7201  C202
0310     4C20  0315  D01C  72FD    70FA  C019  4C20  0318    C112  9202  D112  1810    D400  039D  C112  D400
0320     039B  4400  03A7  C400    039D  4C18  02E7  4480    7DBB  7925  7203  C202    4C20  02E7  70F2  0000
0330     40C5  D5C4  40D6  C640    C4E4  D4D7  C6D3  C5E3    4040  4040  D3C5  E361    C6D3  C5E3  C6D3  C5E3
0340     4040  4040  D3C5  E340    7BC3  C9C4  D540  4040    5BC6  D7C1  C440  4040    7BC6  D7C1  C440  4040
0350     78C3  C9C2  C140  4C40    7BE4  D3C5  E340  4040    7BC6  D3C5  E340  E2C3    E3D9  40D5  D64B  4040
≈                                                                                                         ≈

7EB0     4480  7DB3  7A14  D8C8    280F  690C  6A09  6B06    6500  7FA0  4C80  7EB2    7E4F  6700  0000  6600
7EC0     7926  6500  7FA0  C8B8    2001  4C80  7EBC  435E    4480  7DBA  0100  C0FB    D002  C089  7005  435E
7ED0     4480  7DBA  0200  C0B4    D0AD  6BAD  C301  E0B3    D115  4820  C300  4C30    7EE0  4480  7DB4  005C
7EE0     80AC  18D0  1010  A8AA    8115  90A9  4C08  7EEB    4480  7DB4  005D  C896    4400  00F2  7400  00EE
7EF0     70FD  C091  D116  8300    D117  4480  7DB7  C12E    4C98  7ECF  1010  D12E    4F00  0002  70FD  C08D
7F00     D116  8300  D117  4480    7DB7  C12E  4C98  7EDD    1010  D12E  4F00  0002    0000  0000  0000  0000
7F10     0000  0000  0000  C000    0000  0000  0000  0000    0000  0000  0000  0000    0000  0000  0070  0001
7F20     0000  0000  0000  0000    C406  3040  0020  0000    0200  0000  C000  0000    0C00  FFF6  0C00  0000
7F30     0000  0000  0000  0000    0000  0000  0000  C000    0000  0C01  0001  010A    7800  0C00  0000  0000
7F40     0000  C0C0  0000  1D52    0000  0000  0000  0000    1D52  0C00  0000  0000    0000  01D6  0C00  0000
7F50     0000  C000  C000  2222    3333  000F  0ABB  3333    0000  0000  0000  0000    0140  0000  0000  0000
7F60     0000  0110  1110  0000    C000  C000  FFFE  0000    0000  0C00  C000  0118    0000  0000  0000  C000
7F70     0150  0000  0000  0000    0000  0020  CC00  0000    0000  0000  000C  0009    0C00  0000  0C00  0000
7F80     0000  C000  C000  0000    C000  CC00  0000  0000    0000  0C00  0000  0000    0000  0000  0C00  0000
7F90     05A3  C00B  C56B  0010    03C0  0015  0461  0018    03C0  001C  05A3  001F    05A3  0024  0500  0029
7FA0     05F8  0030  023D  0035    023D  0037  C248  0039    0000  CC00  0000  0000    0000  0000  0000  0000
7FB0     0000  0000  0000  0000    0000  CC00  78D3  7DBB    0000  0000  CC00  0000    0000  0000  0CC0  0000
7FC0     0000  0000  C000  0000    0000  0000  0000  0000    0000  0CC0  C000  0000    0000  0000  0000  0000
7FD0     C000  0000  0000  0000    0000  0000  0000  0000    0000  0C00  0004  056B    0461  7DFD  003F  0000
7FE0     7C64  0000  0000  0000    C000  0000  0000  0000    008D  008D  008D  008D    008D  7C56  7AEA  7AEA
7FF0     0000  0000  00A0  C0F2    78D3  7DBB  0802  78D3    11DE  7D91  7A06  0640    7782  7925  79B5  7963
```

DISK UTILITY PROGRAM (DUP)

The Disk Utility Program (DUP) provides the user with the ability to perform the following operations through the use of control records.

- Store Disk System Format (DSF) programs, Disk Core Image (DCI) programs, and Data Files on the disk
- Make the DSF programs, DCI programs, and Data Files on the disk available in printed, punched card, or punched paper tape output
- Remove DSF programs, DCI programs, and Data Files from the disk
- Determine the status of disk storage through a printed copy of LET/FLET
- Modify the system
- Perform other disk maintenance functions

DUP control records are described in the section of this manual entitled DUP Control Records. DUP error messages are listed in Appendix A.

GENERAL FLOW

DUP is called into operation when the Supervisor recognizes a DUP Monitor control record (// DUP). The control portion of DUP is brought into core to read the next record from the input stream, which should be a DUP control record (*...). The DUP control record is printed and analyzed. LET is searched for the program specified, and switches and indicators are set in accordance with the information obtained from the control record. The DUP program required to perform the requested operation is then read into core from the disk and given control.

The DUP program performs its assigned tasks, directed by the switches and indicators that were set according to the information on the DUP control record. Upon completion of its tasks, the DUP program prints a message and returns control to the control portion of DUP. The control portion indicates the completion of the DUP operation with a printed message and reads the next record from the input stream.

If the record read is a Monitor control record other than comments, control is returned to the Supervisor to process the record. If the record read is a DUP control record, DUP maintains control and reads the next record. Comments Monitor control records are simply printed; blank records are passed.

INFORMATION TRANSFER AND FORMAT CONVERSION

Table 2 summarizes the DUP operations that transfer information from one area or medium to another area or medium. In addition, the format conversions made during the transfers of information are shown. The acronyms for the various formats are described below. The formats are described in Appendix C.

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

ALTERING LET/FLET

The two tables LET and FLET constitute a directory to the contents of the User and Fixed areas on disk. The allocation of disk storage and, correspondingly, the contents of LET/FLET can be altered by the user only through the use of DUP.

Before storing any DSF program, DCI program, or Data File, DUP searches LET/FLET to ensure that the name of the DSF program, DCI program, or Data File does not already appear in LET/FLET on the cartridge specified on the DUP control record. (If no cartridge is specified, the LET/FLET of every cartridge specified on the last JOB record is searched.) Disk storage is allocated to the DSF program, DCI program, or Data File and a corresponding entry is made in LET/FLET only if the name is not found.

When dumping or deleting a DSF program, DCI program, or Data File from the User/Fixed Area, the DSF program, DCI program, or Data File is located through LET/FLET using the name specified by the user in the DUP control record.

A LET/FLET printout and description is contained in Appendix G.

DUP CONTROL RECORDS

DUP control records call IBM-supplied programs that perform operations involving the disk such as storing, moving, deleting, and dumping data and/or programs.

DUP control records generally follow the format described below. Note that all fields in the control

Table 2. Summary of DUP Data Transfer Operations

"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							

record except the count field are always left-justified and that unless otherwise stated, all fields are required.

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

Operation Field. Columns 2 through 12 (21 in the case of the DEFINE operation) contain the name of the desired DUP operation. Columns 2 through 6 identify the basic operation (STOREDATACI); columns 7 through 12 (or 21) identify the extended operation (STOREDATACI). Where shown in the control record format, a blank character (b) is required within or following the operation name.

FROM and TO Fields. Columns 13 and 14 contain the "FROM" symbol, that is, the symbol specifying the disk area or I/O device from which information is to be obtained (the source). Columns 17 and 18 contain the "TO" symbol, that is, the symbol specifying the disk area or I/O device to which information is to be transferred (the destination). The symbols that must be used as the "FROM" and "TO" symbols are shown below.

Symbol	Disk Area or I/O Device
UA	User Area, Disk
FX	Fixed Area, Disk
WS	Working Storage, Disk
CD	Card I/O device. If the 1134 has been defined as the principal input device, CD is equivalent to PT.
PT	Paper Tape
PR	Principal print device

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

Name Field. Columns 21 through 25 contain the name of the DSF program, DCI program, or Data File involved in the specified DUP operation. The name may consist of up to five alphameric characters, and must be left-justified within the field. The first character must be alphabetic (A-Z, $), and no embedded blank characters are allowed.

When referencing a DSF program, DCI program, or Data File already stored on disk, the name must be an exact duplicate of the LET/FLET entry.

Count Field. Columns 27 through 30 contain the count. The count is always a right-justified decimal integer. The count field is defined in the individual control record formats for those operations that require it.

FROM and TO Cartridge ID Fields. Columns 31 through 34 contain the cartridge ID of the cartridge containing the disk area from which information is to be obtained, that is, the "FROM" (source) cartridge ID. Columns 37 through 40 contain the cartridge ID of the cartridge containing the disk area to which information is to be transferred, that is, the "TO" (destination) cartridge ID.

Either or both of these cartridge IDs may be omitted. If a cartridge ID is omitted, and the corresponding FROM or TO field is the User or Fixed Area, a search is made of the LET/FLET on each cartridge specified on the JOB record, starting with the cartridge on logical drive zero (the master cartridge) and continuing through logical drive four. If the corresponding FROM or TO field is Working Storage, then a default to System Working Storage is made. If a cartridge ID is specified, the LET/FLET on the specified cartridge only is searched, or System Working Storage is used.

Use of the "FROM" and "TO" cartridge IDs makes it possible for DUP (1) to transfer DSF programs, DCI programs, and Data Files from one cartridge to another without deleting them from the source cartridge, and (2) to operate on a DSF program, DCI program, or Data File even though the same name appears in the LET/FLET on more than one cartridge.

Unused Columns. All unused columns between columns 2 and 40 must be left blank. Columns 41 through 80 are ignored by DUP and are available for user's remarks.

DUP Operations and Control Record Formats

The following are descriptions of the various DUP operations. Each description consists of (1) a brief description of the processing performed, (2) a breakdown of the control record for the operation, and (3) a table of the transfers and format conversions possible in the operation.

*DUMP

The DUMP operation moves information from the User/Fixed Area on disk to Working Storage or makes information from the User/Fixed Area and Working Storage available as card, paper tape, or printed output. The print format is illustrated in Appendix C.

The movement of DSF programs from the User/Fixed Area to the output devices is accomplished in two phases; that is, the information is first moved to System Working Storage and then to the output device. Hence, information residing in Working Storage on the cartridge defined in the JOB Monitor control record by the Working Storage ID (see // JOB under Monitor Control Records) is destroyed during the DUMP operation. Data Files and DCI programs are moved directly from the User/Fixed Area to the output devices.

The number of disk blocks to be dumped is obtained from the LET/FLET entry, or, if the dump is from Working Storage, from the appropriate Working Storage Indicator in DCOM.

The format of the DUMP control record is as follows.

Card Column	Contents	Notes
1-6	*DUMPb	
7-12	Reserved	
13-14	"FROM" symbol	See chart below. If the dump is from Working Storage and the corresponding Working Storage Indicator is zero, an error message is printed (see DUP error messages, Appendix A).
15-16	Reserved	
17-18	"TO" symbol	See chart below. If the dump is to cards and if a 1442-6 or 1442-7 is utilized, each card is checked to see that it is blank before it is punched. If a non-blank card is read, the System will WAIT at $PRET with /100F displayed in the Accumulator after the appropriate error message has been printed (see DUP Error Messages, Appendix A).
19-20	Reserved	
21-25	Program name	The name is required except when the dump is from Working Storage to the printer.
26-30	Reserved	
31-34	"FROM" cartridge ID	
35-36	Reserved	
37-40	"TO" cartridge ID	
41-80	Not used	

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

Possible Sources, Including Formats	Possible Destinations, 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)

*DUMPDATA

The DUMPDATA operation moves information from the User/Fixed Area on disk to Working Storage or makes information from the User/Fixed Area and Working Storage available in card, paper tape, or printed output. The print format is similar to that of DUMP (see Appendix C). The DUMPDATA operation differs from the DUMP operation in that the information, after transfer, is always in data format, and the amount of information transferred is dependent upon the count field of the DUMPDATA control record rather than the actual length of the program or data.

Information is moved directly from the User/Fixed Area or Working Storage to the output devices. The contents of Working Storage are not changed.

The count field (columns 27-30) in the DUMPDATA control record specifies the number of sectors to be dumped. This number of sectors is dumped regardless of the length of the DSF program, DCI program, or Data File, as indicated in the LET/FLET entry or in the Working Storage Indicator.

The format of the DUMPDATA control record is as follows.

Card Column	Contents	Notes
1-10	*DUMPDATAb	
11-12	Reserved	
13-14	"FROM" symbol	See chart below.
15-16	Reserved	
17-18	"TO" symbol	See chart below. If the dump is to cards, and if a 1442-6 or 1442-7 is utilized, each card is checked to see that it is blank before it is punched.
19-20	Reserved	
21-25	Program name	The name is required except when the dump is from Working Storage to the printer.
26	Reserved	
27-30	Count	The count (right justified, decimal) specifies the number of sectors to be dumped. The count overrides the contents of the Working Storage Indicator and the disk block count in the LET/FLET entry.
31-34	"FROM" cartridge ID	
35-36	Reserved	
37-40	"TO" cartridge ID	
41-80	Not used	

(continued)

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

Possible Sources, Including Formats	Possible Destinations, 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)

*DUMPLET

The DUMPLET operation prints the contents of LET on the principal print device. In addition, the contents of FLET are also printed on the principal print device if a Fixed Area has been defined by the user.

If the name of a DSF program, DCI program, or Data File is specified in the DUMPLET control record, only the LET/FLET entry corresponding to that name is printed. If a cartridge ID is specified in the control record, the LET/FLET on only that cartridge is printed. If neither name nor cartridge ID are specified, the entire contents of both LET and FLET on each cartridge specified on the JOB record are printed. A sample LET/FLET dump and description appears in Appendix G.

The format of the DUMPLET control record is as follows.

Card Column	Contents	Notes
1-8	*DUMPLET	
9-20	Reserved	
21-25	Program name	Use of the name specifies that the LET/FLET entry for that name only is to be printed.
26-30	Reserved	
31-34	"FROM" cartridge ID	If an ID is specified, the LET/FLET on that cartridge only is printed.
35-80	Not used	

*DUMPFLET

The DUMPFLET operation prints the contents of FLET on the principal print device.

If the name of a DCI program or Data File is specified in the DUMPFLET control record, only the FLET entry corresponding to that name is printed. If a cartridge ID is specified in the control record, the FLET on that cartridge only is printed. If neither name nor cartridge ID are specified, the entire contents of the FLET on each cartridge defined on the JOB record are printed. A sample LET/FLET dump and description appears in Appendix G.

The format of the DUMPFLET control record is as follows.

Card Column	Contents	Notes
1-10	*DUMPFLETb	
11-20	Reserved	
21-25	Program name	Use of the name specifies that the FLET entry for that name only is to be printed.
26-30	Reserved	
31-34	"FROM" cartridge ID	If an ID is specified, the FLET on that cartridge only is printed.
35-80	Not used	

*STORE

The STORE operation moves information from Working Storage to the User Area or accepts information from the input devices and moves it to Working Storage or the User Area.

All movement of information from the input devices to the User Area is accomplished in two phases; that is, the information is first moved to the System Working Storage and then to the User Area. Hence, information residing in Working Storage on the cartridge defined in the JOB Monitor control record by the Working Storage ID (see // JOB under Monitor Control Records) is destroyed during the STORE operation.

Since the User Area and Working Storage are adjacent areas, and since the User Area expands as needed into what had been Working Storage, DUP assumes that on any STORE operation to the User Area, the contents of that Working Storage are destroyed. Therefore, the appropriate Working Storage Indicator is reset to zero following the STORE operation to the User Area.

DUP makes the required LET entry (or entries) for each program stored. A LET entry is made for each entry point in the program. DUP supplies the disk block count required in the LET entry for the primary entry point.

The format of the STORE control record is as follows.

Card Column	Contents	Notes
1-6	*STORE	
7-10	Reserved	
11-12	Subtype (for type 3,4, 5 and 7 subprograms only)	See "System Overlays" under Core Load Builder.
13-14	"FROM" symbol	If the STORE operation is from Working Storage and the corresponding Working Storage Indicator is zero, an error message is printed (see DUP Error Messages, Appendix A).
15-16	Reserved	
17-18	"TO" symbol	See chart below.
19-20	Reserved	
21-25	Program name	The name is required except when the STORE operation is to Working Storage.
26-30	Reserved	
31-34	"FROM" cartridge ID	
35-36	Reserved	
37-40	"TO" cartridge ID	
41-80	Not used	

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

Possible Sources, Including Formats	Possible Destinations, Including Formats
WS(DSF)	UA(DSF)

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

*STOREDATA

The STOREDATA operation moves information from Working Storage to the User/Fixed Area or accepts information from the input devices and moves it to Working Storage or the User/Fixed Area. DUP assumes that the input to the STOREDATA operation is in data format; the output from the STOREDATA operation is always in data format.

Information is moved directly from the input devices to the User/Fixed Area. The contents of Working Storage are not changed except that when storing to the User Area, the contents of Working Storage on that drive are destroyed since the User Area and Working Storage are adjacent areas.

DUP makes the required LET/FLET entry. The name specified on the STOREDATA control record is the name used to generate the LET/FLET entry and is the name that must be used in all subsequent references to the Data File. DUP supplies the disk block count required in the LET/FLET entry if the source is cards or paper tape. If the source is Working Storage, the sector count specified in the STOREDATA control record is used.

The format of the STOREDATA control record is as follows.

Card Column	Contents	Notes
1-10	*STOREDATA	
11-12	Reserved	
13-14	"FROM" symbol	See chart below.
15-16	Reserved	
17-18	"TO" symbol	See chart below.
19-20	Reserved	
21-25	Program name	The name is not required when the STORE operation is from cards or paper tape to Working Storage.
26	Reserved	
27-30	Count	If the source is Working Storage, the count is the number (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 (decimal) of cards to be read. If the source is paper tape, the count is the number (decimal) of paper tape records to be read.
31-34	"FROM" cartridge ID	
35-36	Reserved	
37-40	"TO" cartridge ID	
41-80	Not used	

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

Possible Sources, Including Formats	Possible Destinations, 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)

*STOREDATACI

The STOREDATACI operation moves information from Working Storage to the User/Fixed Area on disk or accepts information from the input devices and moves it to Working Storage or to the User/Fixed Area. If the input is from cards or paper tape, the STOREDATACI operation assumes the input format to be 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 Format Indicator must indicate Disk Core Image format (DCI); otherwise, no STORE operation is performed. The output from the STOREDATACI operation is always in Disk Core Image format.

All movement of information from the input devices to the User/Fixed Area is done directly; that is, the transfer is not made via Working Storage. Hence, the contents of Working Storage are not changed by the STOREDATACI operation when storing information from an input device to the Fixed Area. Note, however, that when storing to the User Area, the contents of Working Storage on that drive are destroyed.

DUP makes the required LET/FLET entry. The name specified on the STOREDATACI control record is the name used to generate the LET/FLET entry and is the name that must be used in all subsequent references to the core image program. DUP computes the disk block count required in the LET/FLET entry from the count specified in the STOREDATACI control record.

The format of the STOREDATACI control record is as follows.

Card Column	Contents	Notes
1-12	*STOREDATACI	
13-14	"FROM" symbol	See chart below.
15-16	Reserved	
17-18	"TO" symbol	See chart below.
19-20	Reserved	
21-25	Program name	If the STORE operation is to Working Storage, the name is not required.
26	Reserved	
27-30	Count	The count (right justified, decimal) is the number of records in the core image input. The count is not required if the source is Working Storage.
31-34	"FROM" cartridge ID	
35-36	Reserved	
37-40	"TO" cartridge ID	
41-80	Not used	

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

Possible Sources Including Formats	Possible Destinations, Including Formats
WS(DCI)	UA or FX(DCI)
CD(CDC, CDD)	UA, FX, or WS(DCI)
PT(PTC, PTD)	UA, FX, or WS(DCI)

*STORECI

The STORECI operation obtains an object program from Working Storage or from an input device, converts it into a core image program using the Core Load Builder,

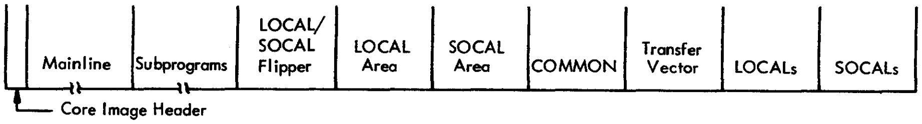


Figure 5. Layout of a Core Image Program Stored in the User/Fixed Area

and stores the core image program into the User/ Fixed Area.

The Core Load Builder is fetched 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 above core location 4096 is placed in the System CIB, and LOCALs and/or SOCALs are placed in System Working Storage. The STORECI operation stores all these portions of the core image program into the "TO" (destination) area.

The DCI program stored in the User/Fixed Area includes the Transfer Vector built by the Core Load Builder; however, neither the disk I/O subroutine nor any COMMON area is included. Figure 5 shows the layout of a DCI program as it is stored in the User/ Fixed Area. No scale is intended in this illustration.

DUP makes the required LET/FLET entry for the core image program as it is stored. The name specified on the STORECI control record is the name used to generate the LET/FLET entry and is the name that must be used in all subsequent references to the DCI program. DUP obtains the disk block count required in the LET/FLET entry from the Core Load Builder.

The format of the STORECI control record is as follows.

Card Column	Contents	Notes
1-8	*STORECI	
9	Disk I/O subroutine indicator	This column specifies the disk I/O subroutine to be loaded into core by the Core Image Loader for use by the core load during execution. Indicator — Disk Subroutine 0,1 — DISK1 N — DISKN blank or Z — DISKZ all others — An error message is printed (see DUP Error Messages, Appendix A.)
10-12	Reserved	
13-14	"FROM" symbol	See chart below. If the STORE operation is from Working Storage and the corresponding Working Storage Indicator is zero, an error message is printed (see DUP Error Messages, Appendix A).
15-16	Reserved	
17-18	"TO" symbol	See chart below.
19-20	Reserved	
21-25	Program name	
26	Reserved	
27-30	Count	The count is the number (decimal) of FILES, NOCAL, and LOCAL control records that follow the STORECI control record. These records are read by DUP for use by the Core Load Builder before the STORE operation is performed. Note that the mainline program name must not be used on the LOCAL or NOCAL control records. Data files named in FILES record must be in Fixed Area.
31-34	"FROM" cartridge ID	
35-36	Reserved	
37-40	"TO" cartridge ID	
41-80	Not used	

(continued)

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

Possible Sources, Including Formats	Possible Destinations, Including Formats
WS(DSF)	UA or FX(DCI)
CD(CDS)	UA or FX(DCI)
PT(PTS)	UA or FX(DCI)

*STOREMOD

The STOREMOD operation moves information from Working Storage into the User/Fixed Area. If the name of the DSF program, DCI program, or Data File specified on the STOREMOD control record is identical to an entry in LET/FLET (that is, a DSF program, DCI program, or Data File of the same name already resides in the User/Fixed Area), the information in Working Storage overlays (replaces) that DSF program, DCI program, or Data File in the User/Fixed Area. The format of Working Storage must match the format of the LET/FLET entry which is to be replaced.

If the name on the STOREMOD control record does not match an entry in LET/FLET, a simple STORE operation is performed (see *STORE).

The STOREMOD operation permits the user to modify a DSF program, DCI program, or Data File in the User/Fixed Area without changing its name or relative position within the area. However, the length of the DSF program, DCI program, or Data File in Working Storage cannot be greater than the length of the DSF program, DCI program, or Data File that it replaces in the User/Fixed Area. No change is made to the LET/FLET entry as a result of this operation.

The format of the STOREMOD control record is as follows.

Card Column	Contents	Notes
1-10	*STOREMODb	
11-12	Reserved	
13-14	"FROM" symbol	The source is always Working Storage.
15-16	Reserved	
17-18	"TO" symbol	See chart below.
19-20	Reserved	
21-25	Program name	
26-30	Reserved	
31-34	"FROM" cartridge ID	
35-36	Reserved	
37-40	"TO" cartridge ID	
41-80	Not used	

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

Possible Sources, Including Formats	Possible Destinations, Including Formats
WS(DSF)	UA(DSF)
WS(DDF)	UA or FX(DDF)
WS(DCI)	UA or FX(DCI)

*DELETE

The DELETE operation removes a specified DSF program, DCI program, or Data File from the User/Fixed Area. The deletion is accomplished by the removal of the LET/FLET entry (or entries) for the DSF program, DCI program, or Data File, including the dummy entry for associated padding, if any.

If a DSF program, DCI program, or Data File is deleted from the User Area, that area is packed so that (1) the areas represented by LET entries are contiguous, and (2) Working Storage can be increased by the amount of disk storage formerly occupied by the deleted DSF program, DCI program, or Data File.

If a DCI program or Data File is deleted from the Fixed Area, no packing of that area occurs. 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) representing the area formerly occupied by the deleted DCI program or Data File and its padding. DUP store operations may be used to place new entries in the Fixed Area.

The contents of Working Storage are not destroyed by the DELETE operation.

The format of the DELETE control record is as follows.

Card Column	Contents	Notes
1-8	*DELETEb	
9-20	Reserved	
21-25	Program name	
26-30	Reserved	
31-34	"FROM" cartridge ID	The deletion is performed on the specified cartridge only. If no cartridge ID is specified, and the program or data file name (21-25) is present in LET/FLET of more than one cartridge specified for this JOB, the deletion will be from the first logical drive on which the name is found.
35-80	Not used	

*DEFINE

The DEFINE operation (1) initially establishes the size of the Fixed Area, (2) increases or decreases the size of the Fixed Area, (3) deletes the Assembler or FORTRAN Compiler, or both, from the System Area. If the Assembler and/or FORTRAN Compiler is to be deleted, this deletion must be performed prior to defining the Fixed Area on the master cartridge (or after completely removing a defined Fixed Area).

Definition of a Fixed Area on disk allows the user to store DCI programs and Data Files in fixed locations, which can subsequently be referred to by sector address. The Fixed Area is defined in cylinder increments (one cylinder minimum). When a FIXED AREA is defined, one cylinder is always reserved for FLET, i.e., the initial definition of the Fixed Area must be two cylinders.

Increases and decreases in the size of the Fixed Area must also be made in cylinder units; however, the Fixed Area cannot be decreased by a number greater than the number of unused cylinders at the end of the last program or data file in the Fixed Area. If all DCI programs and Data Files have been deleted from the Fixed Area (1DUMY entries) and the Fixed Area is decreased to less than two cylinders by a DEFINE FIXED AREA control record, the remaining Fixed Area, as well as FLET, is deleted. The Fixed Area and FLET will likewise be deleted if the DEFINE FIXED AREA control record specifies a decrease that exceeds the number of cylinders of Fixed Area on the cartridge.

The control record format for definition of the Fixed Area is described below.

Card Column	Contents	Notes
1-8	*DEFINEb	
9-18	FIXEDbAREA	
19-26	Reserved	

(continued)

Card Column	Contents	Notes
27-30	Count	In initial definition of the Fixed Area, the count is the number (decimal) of cylinders to be allocated as the Fixed Area which must INCLUDE one cylinder for FLET, thus a minimum of two cylinders 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	If the Fixed Area is being decreased, this column contains a minus sign; otherwise, it is blank.
32-36	Reserved	
37-40	Cartridge ID	This ID specifies the cartridge which is to be altered.
41-80	Not used	

Deletion of the Assembler and/or FORTRAN Compiler causes the specified Monitor programs to be removed from the IBM System Area on the master cartridge. The IBM System Area is then packed so that following programs and areas occupy the areas formerly occupied by the deleted Monitor programs. SLET entries are updated to reflect the new disk storage allocation for the Monitor programs. The reload table is used to make adjustments in the programs which use disk storage addresses from SLET. If the Assembler and/or FORTRAN Compiler is to be deleted, the user must perform this deletion before defining the Fixed Area on the master cartridge, or after completely removing the Fixed Area. After the Assembler and/or FORTRAN Compiler have been deleted, neither can be restored without performing an initial load.

The control record format for deletion of the Assembler and/or FORTRAN Compiler is described below.

Card Column	Contents	Notes
1-8	*DEFINEb	
9-13	VOIDb	
14-22	ASSEMBLER or FORTRANbb	
23-80	Not used	

*DWADR

The DWADR control record causes a sector address to be written on every sector of Working Storage on the cartridge specified by the DWADR control record, or if no ID is specified, on the System Working Storage. The operation restores correct disk sector addresses in Working Storage if they have been modified during execution of a user's program.

The contents of Working Storage prior to the operation are destroyed.

Following the sector address word (word 0), the first 240 words of each sector contain the sector address of that sector, including the drive code. The remaining 80 words of each sector contain zeros.

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

The format of DWADR control record is as follows.

Card Column	Contents	Notes
1-6	*DWADR	
7-36	Reserved	
37-40	Cartridge ID	This ID specifies the cartridge on which the Working Storage sector addresses are to be rewritten.
41-80	Not used	

ASSEMBLER

The basic language for the Assembler in the Monitor system is described in the publication IBM 1130 Assembler Language (Form C26-5927). Therefore, this section contains only a general description of the Assembler program and its operation. Assembler control records are described in the section Assembler Control Records; Assembler messages, error messages, and error detection codes are listed in Appendix A.

The 1130 Monitor Assembler cannot be operated independently of the Monitor system; however, the Assembler can be deleted from the Monitor system if desired (see *DEFINE under DUP Control Records).

An ASM Monitor control record is used to call the Assembler into operation. The Assembler reads the source program, including control records, from the principal input device. After assembly, the object program resides in System Working Storage. The object program can now be (1) called for execution with an XEQ Monitor control record, (2) stored in the User/Fixed Area with a STORE or STORECI operation (see DUP Control Records), or (3) punched as a binary deck or tape with a DUMP operation (see DUP Control Records).

If symbol table overflow exceeds the number of sectors allocated for overflow by the OVERFLOW SECTORS control record (a maximum of 32 sectors is allowed), an Assembler error message is printed. The approximate maximum size of the symbol table (including overflow) and, hence, the maximum number of symbols that can be defined in a program, is determined by the size of core storage as indicated below:

Size of Core Storage (Words)	4096	8192	16384	32768
Symbol Table Size	3500	4865	7595	13055

CARD OPERATION

The source deck (including Assembler control cards) can be assembled either as part of a job or as a separate job. In either case, the source deck must be preceded by an ASM Monitor control record.

One-Pass Mode

In most cases, the source deck is passed through the 1442 Card Read Punch or 2501 Card Reader only once. If the assembly is part of a stacked job, the assembly proceeds without operator intervention. If the END card of the source deck is the last card in the hopper, press reader START when the reader goes not-ready.

The assembly of a program may start in one-pass mode and then change to two-pass mode. This condition occurs when the intermediate output of pass 1 exceeds the capacity of Working Storage less the number of overflow sectors specified. The system WAITs at the preoperative error trap ($PRET).with /100E (1442 input) or /400E (2501 input) displayed in the Accumulator (see Assembler error messages, Appendix A). If this assembly is part of a stacked job, operator intervention is necessary to prevent the Assembler from reading the Monitor control card following the END card of the source deck. Remove the stacked input behind the END card and press PROGRAM START. The assembly will continue in two-pass mode.

Two-Pass Mode

In some cases it may be known in advance that it is necessary to assemble in two-pass mode, that is, pass the source deck through the 1442 Card Read Punch or the 2501 Card Reader twice. If a copy of the source deck, including all Assembler control records, is placed behind the original, the source deck will be read twice, and a stacked job is again possible even when in two-pass mode. Two-pass mode is not allowed with 1134 or Keyboard input.

It is important to note that when a deck is being assembled in two-pass mode, the Assembler is ready to read another card as soon as pass 1 processing of the END card is completed. Therefore, a Monitor control record must not follow the END card the first time (or the first END card if the deck has been copied), or the Assembler will trap this record and execute a CALL EXIT.

If the deck has not been copied, the END card should be the last card in the hopper. Press reader START to process the last card and complete pass 1. The Assembler will then try to read cards for pass 2; therefore, the source deck (with its control cards) should be removed from the stacker and placed in the hopper. Press reader START to begin pass 2 of the assembly. Operation is continuous if the source deck is taken from the stacker during pass 1 and placed in the hopper behind the END card. If the END card is the last card in the hopper, press reader START to complete the assembly.

Punch Symbol Table Option

If the *PUNCH SYMBOL TABLE Assembler control card is used and the principal input device is the 1442 Card Read Punch, sufficient blank cards must be placed after the END card and before the next Monitor control record in the stacked job input. (If a non-blank card is read when punching on the 1442-6, 7 the

Assembler will WAIT at the preoperative error trap ($PRET) with /100F displayed in the accumulator). In estimating the number of blank cards required, allow one card for each symbol used in the source deck. Unnecessary blank cards will be passed until the next Monitor control record is read.

If the system configuration is 2501/1442, place blank cards in the 1442 hopper and press 1442 START before beginning the assembly.

Note: Do not place non-blank cards in the 1442-5. The punch may be damaged if an attempt is made to punch a hole where a hole exists. No error is detected.

KEYBOARD/PAPER TAPE OPERATION

Most of the procedures for card input are also applicable to keyboard/paper tape input. The LIST DECK, LIST DECK E, PUNCH SYMBOL TABLE, and TWO PASS MODE options are not allowed with keyboard/paper tape input.

Note: The paper tape input to the Assembler is punched in PTTC/8 code, one frame per character. The format of the keyboard/paper tape control records is the same as the card format. The format of the symbolic program keyboard/paper tape records is the same as card format except for the following:

- The record does not contain leading blanks corresponding to card columns 1-20.
- The record does not contain blanks or data corresponding to card columns 72-80.
- Trailing blanks need not be used. Therefore, up to 51 characters (corresponding to card columns 21-71) can appear in the record.

The assembly is continuous, and at the end of the assembly control is returned to the Supervisor, which will then pass any delete codes between the Assembler and the next Monitor control record. The assembler will also pass any codes that may occur between paper tape records of the source program.

The first record processed by the Assembler is checked for an asterisk in column one. If an asterisk is present in column one, this record is treated as an Assembler control record. This procedure continues until the first non-asterisk character is detected in column one. For this record, and all records following (up to and including the END statement), column one is treated as if it were column twenty-one; therefore, the first non-control record should not be an * comments record.

ORIGIN OF MAINLINES

The origin of a relocatable program is always set at zero unless otherwise specified in the source program.

The origin of an absolute mainline program, if not otherwise specified in an ORG statement, is set to the end of DISKN plus 30 (the core image header record is 30 words long).

If the program requires DISKZ, DISK1, or DISKN, the origin may be set to the end of the requested disk I/O subroutine plus 30.

If no disk I/O subroutine is used by the program, the origin may be set as low as the end of DISKZ plus 30.

Note that if DISKZ is in core during execution (required or not), the ORG statement for the program being executed must specify an even core address greater than or equal to the end of DISKZ plus 30. An ORG to the end of DISKZ plus 30, followed by a BSS or a BES of an odd number of locations is not allowed. This sequence has the same effect as an ORG to an odd location.

ASSEMBLER CONTROL RECORDS

Assembler control records are used to specify options affecting an assembly and its output. These control records must precede the source program and can be in any order (see Figure 6). Assembler control records

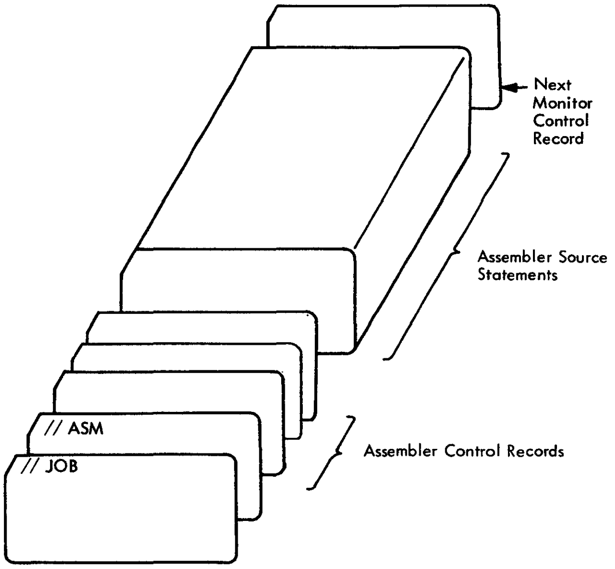

Next Monitor Control Record
Assembler Source Statements
// ASM
// JOB
Assembler Control Records

Figure 6. Layout of an Assembler Input Deck

can be entered in card or paper tape form along with the source program deck or tape or, unless otherwise noted, may be entered from the Keyboard along with the source statements (see // TYP under Monitor Control Records).

All Assembler control records have the following format:

Column 1: * (asterisk)
2-71: Option

If an Assembler control record contains an asterisk in column 1, but the option does not agree, character for character, with its valid format, as described below, the asterisk is replaced by a minus sign on the control record listing. The erroneous control record is ignored and no other error occurs.

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

*TWO PASS MODE

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

- The user desires a list deck to be punched on the 1442 Card Read Punch, model 6 or 7 (see LIST DECK and LIST DECK E).
- 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 from the Keyboard or the 1134 Paper Tape Reader.

The format of the TWO PASS MODE control record is as follows.

Card Column	Contents	Notes
1	*	Asterisk
2-71	TWO PASS MODE	
72-80	Not used	

*LIST

This control record causes the Assembler to provide a printed listing on the principal print device (1403 Printer, 1132 Printer, or Console Printer). The format of the printed listing corresponds to that of the list deck (see Figure 7). If the LIST control record is not used, only those statements in which assembly errors are detected will be listed. All BSS, BES, ORG, and EQU statements in which errors are detected will be unconditionally listed in Pass 1 of the assembly.

A sample program listing appears in Appendix J.

The format of the LIST control record is as follows.

Card Column	Contents	Notes
1	*	Asterisk
2-71	LIST	
72-80	Not used	

*LIST DECK

This control record causes the Assembler to punch a list deck if the principal I/O device is a 1442 model 6 or 7 Card Read Punch. This option requires two passes of the source deck (TWO PASS MODE). The list deck format is shown in Figure 7. Object information is punched into columns 1-19 of the source deck during pass 2.

This control record is ignored if entered from the 2501 Card Reader, the 1134 Paper Tape Reader, or the Keyboard.

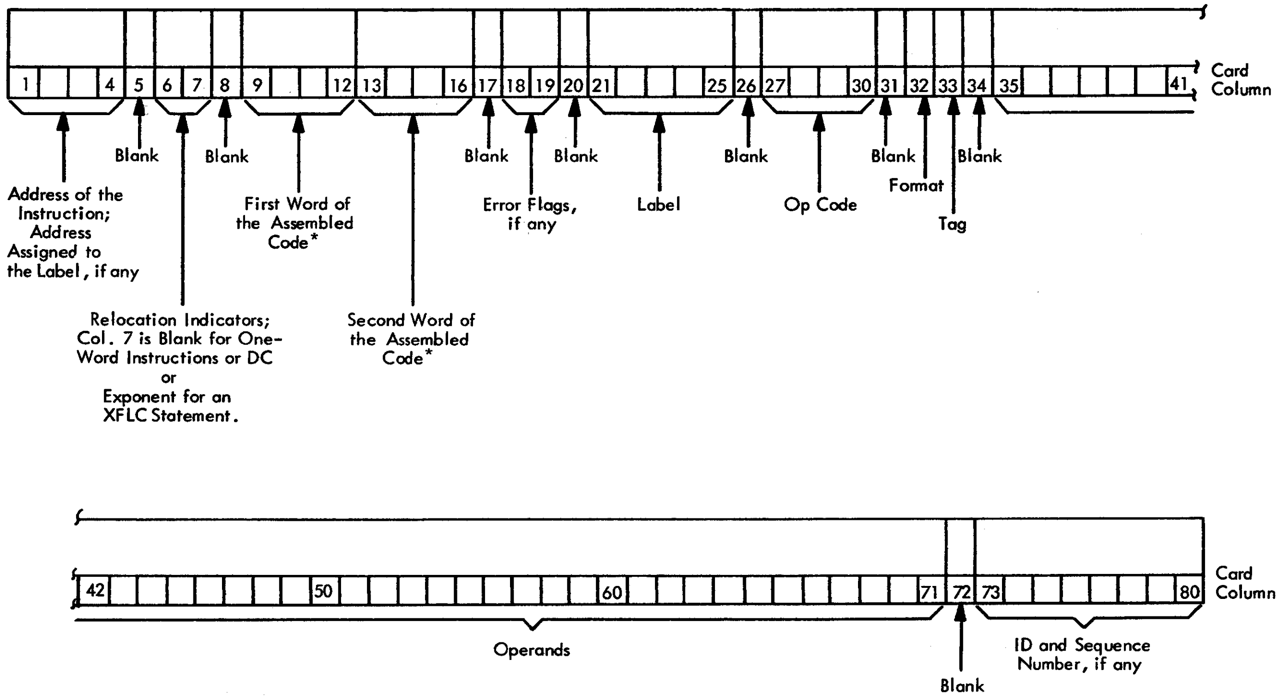
The format of the LIST DECK control record is as follows.

Card Column	Contents	Notes
1	*	Asterisk
2-71	LIST DECK	
72-80	Not used	

*LIST DECK E

This control record causes the Assembler to punch assembly error codes only (columns 18-19) in the list deck output (see LIST DECK). The principal I/O device must be a 1442 model 6 or 7 Card Read Punch. The Assembler error detection codes are listed in Appendix A.

This control record is ignored if entered from the 2501 Card Reader, the 1134 Paper Tape Reader, or the Keyboard.


Card Column
1
4
5
6
7
8
9
12
13
16
17
18
19
20
21
25
26
27
30
31
32
33
34
35
41
Blank
Blank
Blank
Blank
Blank
Blank
Blank
Address of the Instruction; Address Assigned to the Label, if any
First Word of the Assembled Code*
Error Flags, if any
Label
Op Code
Format
Tag
Relocation Indicators; Col. 7 is Blank for One-Word Instructions or DC or Exponent for an XFLC Statement.
Second Word of the Assembled Code*
Card Column
42
50
60
71
72
73
80
Operands
ID and Sequence Number, if any
Blank

*For EBC statements, columns 9-12 contain the number of EBC characters.
For BSS and BES statements, columns 9-12 contain the number of words reserved for the block.
For ENT, ILS, and ISS statements, columns 9-16 contain the entry label in packed EBCDIC code.

Figure 7. List Deck Format

The format of the LIST DECK E control record is as follows:

Card Column	Contents	Notes
1 2-71 72-80	* LIST DECK E Not used	Asterisk

*PRINT SYMBOL TABLE

This control record causes the Assembler to provide a printed listing of the symbol table on the principal print device. Symbols are grouped five 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. The M and A flags, however, are not counted as assembly errors.

The format of the PRINT SYMBOL TABLE control record is as follows.

Card Column	Contents	Notes
1 2-71 72-80	* PRINT SYMBOL TABLE Not used	Asterisk

*PUNCH SYMBOL TABLE

This control record causes the Assembler to punch the symbol table 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 1134 Paper Tape Reader or the Keyboard.

The format of the PUNCH SYMBOL TABLE control record is as follows.

Card Column	Contents	Notes
1 2-71 72-80	* PUNCH SYMBOL TABLE Not used	Asterisk

*SAVE SYMBOL TABLE

This control record causes the Assembler to save the symbol table generated in this assembly on the disk as a System Symbol Table. This System Symbol Table is saved until the next assembly containing a SAVE SYMBOL TABLE control record causes a new assembly-generated symbol table to replace it. This control record is also used with the SYSTEM SYMBOL TABLE control record to add symbols to the System Symbol Table. The SAVE SYMBOL TABLE option requires that this assembly be absolute. If any assembly errors are detected, or if the symbol table exceeds 100 symbols, the symbol table is not saved as a System Symbol Table, and an assembly error message is printed (see Assembler Error Messages, Appendix A).

The format of the SAVE SYMBOL TABLE control record is as follows.

Card Column	Contents	Notes
1	*	Asterisk
2-71	SAVE SYMBOL TABLE	
72-80	Not used	

*SYSTEM SYMBOL TABLE

This control record causes the Assembler to add the System Symbol Table (previously built by a SAVE SYMBOL TABLE assembly) to the symbol table for this assembly as the assembly begins. This control record is used when it is desired to refer to symbols in the System Symbol Table without redefining those symbols in the source program, or it is used together with the SAVE SYMBOL TABLE control record when it is desired to add symbols to the System Symbol Table. All symbols in the System Symbol Table have absolute values.

The format of the SYSTEM SYMBOL TABLE control record is as follows.

Card Column	Contents	Notes
1	*	Asterisk
2-71	SYSTEM SYMBOL TABLE	
72-80	Not used	

*LEVEL

This control record specifies the interrupt levels serviced by an ISS and, hence, the associated ILS subroutines. It is required for the assembly of an ISS subroutine. The interrupt level number is a decimal number in the range 0-5. If the device operates on more than one interrupt level (for example, the 1442 Card Read Punch), one LEVEL control record is required for each interrupt level on which the device operates. 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 (see Assembler Error Messages, Appendix A).

The format of the LEVEL control record is as follows.

Card Column	Contents	Notes
1	*	Asterisk
2-71	LEVELbn	n is an interrupt level number
72-80	Not used	

*OVERFLOW SECTORS

This control record specifies the number of sectors of Working Storage to be used by the Assembler for symbol table overflow. The number of overflow sectors (nn) is a decimal number between 1 and 32. If the entry is zero or blank, no overflow sectors are allowed. If the entry is greater than 32, only 32 overflow sectors are allowed. If this control record is not used, no overflow sectors are allowed; if it is used, the Assembler actually allocates one more sector than the number specified. This additional sector is used as a working sector when the Assembler is handling symbol table overflow.

The format of the OVERFLOW SECTORS control record is as follows.

Card Column	Contents	Notes
1	*	Asterisk
2-71	OVERFLOW SECTORSbnn	nn is the number of sectors assigned to symbol table overflow.
72-80	Not used	

*COMMON

This control record specifies the length (in words) of COMMON as defined by a FORTRAN core load that is to be executed prior to the execution of the program being assembled. Use of this control record provides for a COMMON area to be saved in linking between FORTRAN mainlines and Assembler mainlines. At least one blank must separate the word COMMON and the decimal number.

The format of the COMMON control record is as follows.

Card Column	Contents	Notes
1	*	Asterisk
2-71	COMMONbnnnnn	nnnnn is the number of words of COMMON (decimal) to be saved between links.
72-80	Not used	

FORTRAN COMPILER

The basic language for the FORTRAN Compiler in the Monitor system is described in the publication IBM 1130/1800 Basic FORTRAN IV Language (Form C26-3715); therefore, this section contains only a general description of the Compiler and its operation. The FORTRAN Compiler control records are described in the section FORTRAN Control Records; FORTRAN messages and error messages are listed in Appendix A.

The FORTRAN Compiler cannot be operated independently of the Monitor system; however, it can be deleted from the Monitor system if desired (see *DEFINE under DUP Control Records).

A FOR Monitor control record is used to call the FORTRAN Compiler into operation. The Compiler reads the source program, including control records, from the principal input device. After compilation, the object program resides in System Working Storage and can be (1) called for execution with an XEQ Monitor control record, (2) stored in the User/Fixed Area with a STORE or STORECI operation (see DUP Control Records), or (3) punched as a binary deck or tape with a DUMP operation (see DUP Control Records).

The 1130 FORTRAN I/O logical unit numbers and record sizes are listed in Table 3.

//b RECORDS READ DURING THE EXECUTION OF A FORTRAN PROGRAM

During the execution of a FORTRAN program, any //b record encountered by CARDZ, READZ, or PAPTZ will cause an immediate CALL EXIT. The Supervisor will then search for the next valid Monitor control record entered from the reader. Only the //b characters on the record trapped by CARDZ, READZ, or PAPTZ are recognized. Any other data entered in this record is not available to programs in the Monitor system. The record is not listed. For off-line listing purposes, however, this record can contain comments (e.g., // END OF DATA).

FORTRAN CONTROL RECORDS

Before a FORTRAN program is compiled, the user can specify certain options affecting both the compilation and execution of the program by means of control records. These control records must precede the source program and can be in any order (see Figure 8).

FORTRAN control records can be entered in card or paper tape form along with the source program deck or tape, or they may be entered from the Keyboard along with the source statements (see // TYP under Monitor Control Records). The IOCS and NAME control records can be used only in mainline programs; the others can be used in both mainline programs and subprograms.

All FORTRAN control records have the following format:

Column 1: *(asterisk)
2-72: Option

Table 3. FORTRAN I/O Logical Unit Designations and Record Sizes

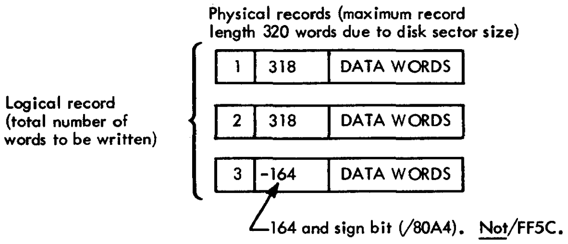
Logical Unit Number	Device	Kind of Transmission	Record Size Allowed
1	Console Printer	Output only	120
2	1442 Card Read Punch	Input/output	80
3	1132 Printer	Output only	1 carriage control + 120
4	1134/1055 Paper Tape Reader Punch	Input/output	80, plus max. of 80 case shifts for PTTC/8 code, plus NL code.
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 two-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 effective 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).

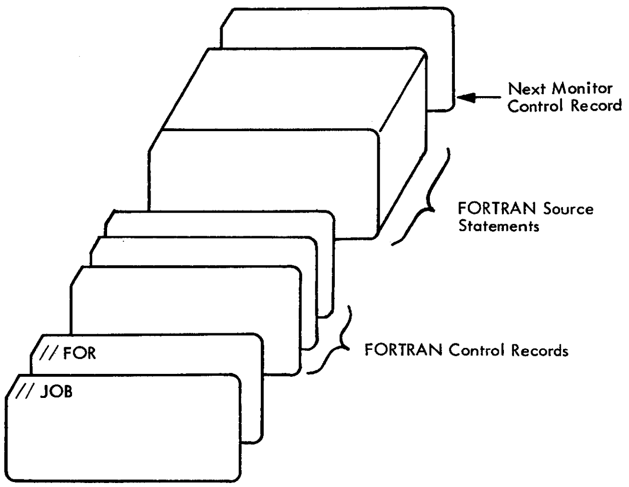


Figure 8. Layout of a FORTRAN Compiler Input Deck

If a FORTRAN control record contains an asterisk in column 1, but the option does not agree, character for character, with its valid format, as described below, the asterisk is replaced by a minus sign on the control record listing. The erroneous control record is ignored in the compilation and the option is not performed; however, no error results.

FORTRAN control records can be written in free form; that is, any number of blanks may occur between the characters of the option. No remarks are allowed.

*IOCS(. . .)

This control record is required to specify any I/O device that is to be used during execution of the program; however, only the devices required should be included. Because the IOCS control record may appear only in the mainline program, it must include all the I/O devices used by all FORTRAN subprograms that are called. The device names must be in parentheses with a comma between each name. The valid names and the devices to which they correspond are listed below:

Name	Device
CARD	1442 Card Read Punch, Model 6 or 7
2501 READER	2501 Card Reader
1442 PUNCH	1442 Card Punch, Model 5 (1442 Model 6 or 7 if used as a punch only)
TYPEWRITER	Console Printer
KEYBOARD	Keyboard
1132 PRINTER	1132 Printer
1403 PRINTER	1403 Printer
PAPER TAPE	1134/1055 Paper Tape Reader/Punch
PLOTTER	1627 Plotter
DISK	Disk
UDISK	Disk (unformatted disk I/O)

Note that CARD is used for the 1442 Card Read Punch, Model 6 or 7 and that 1442 PUNCH is used for the 1442 Card Punch, Model 5 (1442 PUNCH may be used with a 1442 Model 6 or 7 if the function is punch only; 1442 PUNCH uses less core). These two names are mutually exclusive; therefore, the use of both the CARD and 1442 PUNCH IOCS Control Records in the same compilation is not allowed.

Subprograms that are a part of a FORTRAN core load but are written in Assembler language can use any I/O subroutines for any device that is not specified on the IOCS control record. Otherwise they must use the same I/O subroutine as the FORTRAN subprogram.

Any number of IOCS control records can be used to specify the required device names.

The format of the IOCS control record is as follows.

Card Column	Contents	Notes
1	*	Asterisk
2-72	IOCS (d, d, . . . , d)	d is a valid device name selected from the above list.
73-80	Not used	

*LIST SOURCE PROGRAM

This control record causes the Compiler to list the source program on the principal print device as it is read in.

The format of the LIST SOURCE PROGRAM control record is as follows:

Card Column	Contents	Notes
1	*	Asterisk
2-72	LIST SOURCE PROGRAM	
73-80	Not used	

*LIST SUBPROGRAM NAMES

This control record causes the Compiler to list on the principal print device the names of all subprograms (including EXTERNAL subprograms) called directly by the compiled program.

The format of the LIST SUBPROGRAM NAMES control record is as follows.

Card Column	Contents	Notes
1	*	Asterisk
2-72	LIST SUBPROGRAM NAMES	
73-80	Not used	

*LIST SYMBOL TABLE

This control record causes the Compiler to list the following items on the principal print device:

- Variable names and their relative addresses
- Statement numbers and their relative addresses
- Statement function names and their relative addresses
- Constants and their relative addresses

The format of the LIST SYMBOL TABLE control record is as follows.

Card Column	Contents	Notes
1	*	Asterisk
2-72	LIST SYMBOL TABLE	
73-80	Not used	

*LIST ALL

This control record causes the Compiler to list the source program, subprogram names, and the symbol table on the principal print device. If this control record is used, the other LIST control records are not required.

The format of the LIST ALL control record is as follows.

Card Column	Contents	Notes
1	*	Asterisk
2-72	LIST ALL	
73-80	Not used	

*EXTENDED PRECISION

This control record causes the Compiler to store variables and real constants in three words instead of two and to generate linkage to extended precision subprograms.

The format of the EXTENDED PRECISION control record is as follows.

Card Column	Contents	Notes
1	*	Asterisk
2-72	EXTENDED PRECISION	
73-80	Not used	

*ONE WORD INTEGERS

This control record causes the Compiler to allocate one word of storage for integer variables rather than the same allocation (two or three words) used for real variables. Whether this control record is used or not, integer constants are always contained in one word. When this control record is used, the program does not conform to the USASI Basic FORTRAN standard for data storage and may require modification in order to be used with other FORTRAN systems.

The format of the ONE WORD INTEGERS control record is as follows.

Card Column	Contents	Notes
1	*	Asterisk
2-72	ONE WORD INTEGERS	
73-80	Not used	

*NAME

This control record causes the Compiler to print the specified program name at the end of the listing. The name is five consecutive characters (including blanks) starting at the first non-blank column following NAME. At least one blank must separate the word NAME and the mainline program name.

The format of the NAME control record is as follows.

Card Column	Contents	Notes
1	*	Asterisk
2-72	NAMEbxxxxx	xxxxx is the name of the mainline object program.
73-80	Not used	

**(Header Information)

This column record causes the Compiler to print the information in columns 3-72 at the top of each page of compilation printout when a 1403 Printer or 1132 Printer is the principal print device. It initially causes a skip to channel 1 when the first statement of the program is read.

The format of the header control record is as follows.

Card Column	Contents	Notes
1	*	Asterisk
2	*	Asterisk
3-72	Any string of characters	
73-80	Not used	

*ARITHMETIC TRACE

This control record causes the Compiler to generate linkage to the trace subprograms, which are executed whenever a value is assigned to a variable on the left of an equal sign. If console entry switch 15 is on during execution and program logic (see Optional Tracing) does not prevent tracing, the value of the assigned variable is printed as it is calculated.

If tracing is requested, an IOCS control record must also be present to indicate that either the typewriter (that is, the Console Printer), 1132 Printer, or 1403 Printer is needed. If more than one print device is specified in the IOCS control record, the fastest device is used for tracing.

The traced value for a variable to the left of an equal sign of an arithmetic statement is printed with one leading asterisk.

The format of the ARITHMETIC TRACE control record is as follows.

Card Column	Contents	Notes
1	*	Asterisk
2-72	ARITHMETIC TRACE	
73-80	Not used	

*TRANSFER TRACE

This control record causes the Compiler to generate linkage to the trace subprograms, which are executed whenever an IF statement or computed GO TO statement is encountered. If console entry switch 15 is on during execution and program logic (see Optional Tracing) does not prevent tracing, the value of the IF expression or the value of the computed GO TO index is printed.

If tracing is requested, an IOCS control record must also be present to indicate that either the typewriter (that is, the Console Printer), 1132 Printer, or 1403 Printer is needed. If more than one print device is specified in the IOCS control record, the fastest device is used for tracing.

The traced value for the expression in an IF statement is printed with two leading asterisks. The traced value for the index of a computed GO TO statement is printed with three leading asterisks.

The format of the TRANSFER TRACE control records is as follows.

Card Column	Contents	Notes
1	*	Asterisk
2-72	TRANSFER TRACE	
73-80	Not used	

Optional Tracing

The user can elect to trace only selected parts of the program by placing statements in the source program logic flow to start and stop tracing. This is done by executing a CALL TSTOP to stop tracing or a CALL TSTRT to start tracing. Thus, tracing occurs only if:

- Console entry switch 15 is on (can be turned off at any time)
- The trace control records were compiled with the source program
- A CALL TSTOP has not been executed, or a CALL TSTRT has been executed since the last CALL TSTOP.

Operating Notes

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 also displayed in the accumulator when the system waits at $PRET during the execution of the PAUSE or STOP statement.

Variables and constants that require more than one word of storage have the address of the word nearest the zero address of the machine. In the case of arrays, the given address refers to the addressed word of the first element. In the case of a two- or three-word integer, the integer value is contained in the addressed word. The first variable listed might not be addressed at 0000 because space may be required for generated temporary storage locations.

The relative address for variables not in COMMON would be the actual address if the program started at storage location zero. The relative address for variables in COMMON would be the actual address if the machine had 32K storage. Variables in COMMON reside in the high-order core location of the machine being used (e.g., first COMMON variable will be loaded to /1FFF on an 8K machine).

Any of the three versions of the disk I/O subroutines may be used with a FORTRAN core load. However, under normal circumstances no advantage in speed may be gained, because the FORTRAN disk formatting subroutine operates with one sector at a time. SOCALs may operate faster if DISKN is used.

KEYBOARD INPUT OF DATA RECORDS

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 it is desirable to key in less than 80 characters, the EOF key can be pressed to stop transmittal. Also, the ERASE FIELD or BACKSPACE key can be pressed to restart the record transmittal if an error is detected while entering data. If the keyboard appears to be locked up, press REST KB to restore the keyboard. The correct case shift must be selected before data is entered.

Buffer Status After Keyboard Input

When the END FLD key is pressed prior to completing a full buffer load of 80 characters, blanks are inserted in the remainder of the buffer. If more data is necessary to satisfay the list items, the remaining numeric fields (I, E, or F) are stored in core as zeros and remaining alphameric fields (A or H) are stored as blanks. Processing is continuous and no errors result from the above condition.

OBJECT PROGRAM PAPER TAPE DATA RECORD FORMAT

Data records of up to 80 EBCDIC characters in PTTC/8 code can be read or written by the FORTRAN object programs. The delete and new-line codes are recognized. Delete codes and case shifts are not included in the count of characters. If a new-line code is enountered before the 80th character is read, the record is terminated. If the 80th character is not a new-line code, the 81st character is read and assumed to be a new-line code. A new-line code is punched at the end of each output record.

FORTRAN I/O ERRORS

If input/output errors are detected during execution, the program stops and cannot be contined. The error is indicated by a display in the accumulator. The error displays and meanings are listed in Appendix A, Table 12.

When the output field is too small to contain the number, the field is filled with asterisks and execution is continued.

The input/output routines 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. When the devices are ready, press PROGRAM START to execute the I/O operation.

Error detection in functional and arithmetic subroutines is possible by the use of source program statements. Refer to "FORTRAN Machine and Program Indicator Tests" in the manual, IBM 1130/1800 Basic FORTRAN IV Language (Form C26-3715).

CORE LOAD BUILDER

The Core Load Builder builds a specified mainline program into a core image program. The mainline program, with its required programs (LOCALs and SOCALs included), is converted from Disk System format to Disk Core Image format. During the conversion, the Core Load Builder also builds the Core Image Header record and the Transfer Vector. The resultant core image program is suitable for immediate execution or for storing on the disk in Disk Core Image format for future execution. The Core Load Builder can build a core load that references up to approximately 150 different LIBF and CALL entry points, e.g., 80 LIBFs plus 70 CALLs (the maximum number of LIBFs allowable is 83 due to the size of the LIBF Transfer Vector).

The Core Load Builder is called by:

- The Supervisor. After the Supervisor has detected the XEQ Monitor control record in the input stream and has read the Supervisor control records, if any, and written them in the Supervisor Control Record Area (SCRA) on disk, the Supervisor dummys up a CALL LINK to the program specified on the XEQ record unless the program resides in Working Storage, in which case the Supervisor calls the Core Load Builder directly. The Core Load Builder then builds the core load and returns control to the Core Image Loader to fetch the core load and transfer control to it.

- DUP. After DUP has detected the STORECI control record, it reads the Supervisor control records, if any, and writes them in the Supervisor Control Record Area (SCRA) on disk. Unless the program is already in Working Storage, DUP fetches the program, converts it to Disk System format, if necessary, and stores it in Working Storage. Next, the Core Load Builder is fetched to construct the core image program (see Core Load Construction). After the core image program has been built, the Core Load Builder returns control to DUP to store the core image program in the User or Fixed Area.

- The Core Image Loader. When the Resident Monitor is entered at the LINK entry point, the Core Image Loader is called to transfer control to the next link. The Core Image Loader determines the format of the link from the LET/FLET entry and, if the program to be executed is in Disk System format, calls the Core Load Builder to construct the core image program (see Core Load Construction). After the core image program has been built, the Core Load Builder returns control to the Core Image Loader to fetch the core load and transfer control to it.

CORE LOAD CONSTRUCTION

The following paragraphs describe the functions of the Core Load Builder during the construction of a core image program. These functions are not necessarily performed in the order in which they appear.

Figure 9 shows a core image program being built. Figure 5 (see *STORECI under DUP Control Records) shows a core image program stored on disk. Figure 11 (see Fetching a Link under Core Image Loader) shows a core load ready for execution.

Processing the Contents of the SCRA

The LOCAL, NOCAL, and FILES control records are read from the Supervisor Control Record Area (SCRA) on disk and analyzed. Tables are built from the information obtained from the respective control record types. These tables are used in later phases of the construction of the core image program.

Conversion of the Mainline Program

The mainline program is converted from Disk System format to Disk Core Image format. The mainline is always converted before any other part of the core load.

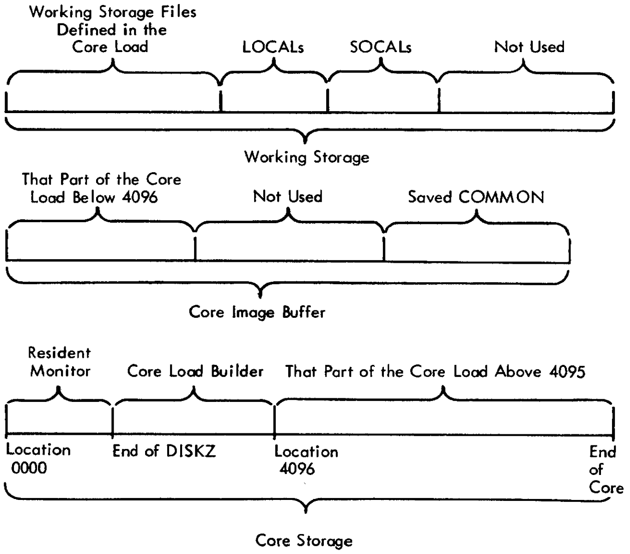


Figure 9. Distribution of a Core Image Program being Built

Incorporation of Subprograms

All the subprograms called by the mainline program and by other subprograms are included in the core load, except for (1) the disk I/O subroutine, (2) any LOCAL subprograms specified, and (3) SOCALs (see System Overlays).

If LOCALs have been specified or if SOCALs are employed by the Core Load Builder, the LOCAL/SOCAL flipper (FLIPR) is included in the core load. The order of conversion is generally NOCALs, followed by the subprograms in the order they are called. The order of processing when either LOCALs or SOCALs are included is more complicated and will not be discussed here.

Provision for LOCALs and SOCALs

If LOCALs have been specified, a LOCAL Area as large as the largest LOCAL is reserved in the core load, into which the LOCAL subprograms are read by the LOCAL/SOCAL flipper. In addition, the subprograms specified on the LOCAL control records are written in Working Storage following any files defined in Working Storage. If the core load is executed immediately, each LOCAL is read, as it is called, from Working Storage into the LOCAL Area by the LOCAL/SOCAL flipper. If the core load is stored in Disk Core Image format before it is executed, the LOCALs are stored following the core load. During execution, the LOCAL/SOCAL flipper fetches them from the User/Fixed Area.

If SOCALs are employed by the Core Load Builder, a SOCAL Area as large as the largest SOCAL (usually SOCAL 2) is reserved in the core load, into which the SOCALs are read by the LOCAL/SOCAL flipper. In addition, the subprograms comprising the SOCALs are written in Working Storage following any files defined in Working Storage and any LOCALs stored there. If the core load is executed immediately, each SOCAL is read from Working Storage into the SOCAL Area by the LOCAL/SOCAL flipper as it is called. If the core load is stored in Disk Core Image format before it is executed, the SOCALs are stored following the core load and the LOCALs, if any. During execution, the LOCAL/SOCAL flipper fetches the SOCALs from the User/Fixed Area.

Construction of the Core Image Header

During the construction of the Core Image program, the Core Load Builder also constructs the Core Image Header, which contains the information required by the Core Image Loader to initialize the core load for execution. This header becomes a part of the core image program and resides in core along with the rest of the core load during execution. Since FORTRAN subroutines access this information during execution, the header is not to be considered a work area.

Processing Defined Files

The Core Load Builder uses the information in the FILES control record to equate files defined in the mainline program (by the FORTRAN DEFINE FILE statement or by the Assembler FILE statement) to Data Files on disk. The processing consists of comparing the file number in a 7-word DEFINE FILE table entry with each of the file numbers from the FILES control records, which have been stored in the SCRA by the Supervisor or DUP. If a match occurs, the name of the disk area associated with the file number on the FILES control record is found in LET/FLET, and the sector address of that disk area (including the logical drive code) is placed in word 5 of the DEFINE FILE table entry. If none of the file numbers from the FILES control records match the number in the DEFINE FILE table entry or if no name is 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 word 5 of the DEFINE FILE table entry. This procedure is repeated for each 7-word DEFINE FILE table entry in the mainline program.

Use of the Core Image Buffer (CIB) and Working Storage

The Core Load Builder places in the CIB any parts of the core load which, when loaded, are to reside below location 4096. Any parts of the core load that are to reside above location 4095 are placed directly into core storage.

Enough Working Storage is reserved by the Core Load Builder to contain any Data Files assigned by the Core Load Builder to Working Storage. All the LOCAL subprograms and SOCALs, respectively, are stored in Working Storage following any files defined there. Figure 9 shows the distribution of a core image program between core storage, the CIB, and Working Storage. These diagrams depict a core image program just after it has been built but before it has been stored (STORECI).

Assignment of the Core Load Origin

The Core Load Builder origins core loads built from relocatable mainline programs at the next higher-addressed word above the end of the disk I/O subroutine to be used by the core load plus 30.

Disk I/O	Core Load Origin	
Subroutine in Core	Decimal	Hexadecimal
DISKZ	510	/01FE
DISK1	690	/02B2
DISKN	960	/03C0

The origins for core loads built from absolute mainline programs are not controlled by the Core Load Builder. Therefore, the user must origin absolute mainline programs at 30 or more words above the end of the disk I/O subroutine to be used by the core load (these 30 words are required for the Core Image Header).

TRANSFER VECTOR

The Transfer Vector is a table included in each core load that provides the linkage to the subprograms. It is composed of the LIBF TV, the Transfer Vector for subprograms referenced by LIBF statements, and the CALL TV, the Transfer Vector for subprograms referenced by CALL statements.

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

Each LIBF TV entry consists of three words. Word 1 is the link word in which the return address is stored. Words 2 and 3 contain a branch to the subprogram entry point. In the case of a subprogram referenced by a LIBF statement but specified as a LOCAL, the LIBF TV entry for its entry point contains a branch to the special LOCAL linkage instead of to the subprogram entry point address. If SOCALs are required, the LIBF TV entry for a SOCAL subprogram contains a branch to a special entry in the LIBF TV for the SOCAL of which the subprogram is a part. This special entry provides the linkage to the desired SOCAL subprogram.

SYSTEM OVERLAYS

SOCALs (system-overlays-to-be-loaded-on-call) are subprogram groups (by type and subtype) that are made into overlays by the Core Load Builder. They make it possible for many FORTRAN core loads that would otherwise not fit into core to be loaded and executed.

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 by the Core Load Builder for the core load. In addition, the LOCAL/SOCAL flipper, which fetches the SOCALs when they are required during execution, is included in the core load along with the area into which the SOCALs are loaded (the SOCAL Area).

The SOCALs are created by subprogram type and subtype (see the description of program type and subtype under Disk System Format in Appendix C). The following table describes the SOCALs.

Subprogram Class	Type	Subtype	Overlay (SOCAL Number)
Arithmetic	3	2	1
Function	4	8	1
Non-disk FORTRAN I/O and "Z" conversion subroutines	3	3	2
"Z" device subroutines	5	3	2
Disk FORTRAN I/O	3	1	3

There are two SOCAL options. The Core Load Builder first attempts to make the core load fit into core by using SOCALs 1 and 2 only (option 1). If the core load still will not fit into core, SOCALs 1, 2, and 3 are used (option 2). If the use of option 2 still does not make it possible for the core load to fit into core, an error message is printed (see Core Load Builder Error Messages, Appendix A).

Option 1 reduces the core requirement of the core load by an amount equal to the size of the smaller of the two SOCALs used, minus approximately 15 additional words required for the special SOCAL linkage. Option 2 reduces the core requirement by an amount equal to the sum of the sizes of the two smallest SOCALs minus approximately 20 additional words required for the special SOCAL linkage. SOCAL 2 is usually the largest SOCAL.

Each SOCAL does not contain all the available subprograms of the specified types and subtypes; only those subprograms of the specified types and subtypes required by the core load are contained in the SOCAL.

If a subprogram that would otherwise be included in a SOCAL is specified as a LOCAL subprogram, that subprogram is made a LOCAL and is not included in the SOCAL in which it would ordinarily be found.

SOCALs are never built for core loads in which the mainline program is written in Assembler language.

LOCAL/SOCAL FLIPPER (FLIPR)

The LOCAL/SOCAL flipper is included in each core load in which LOCAL subprograms have been specified and/or in which SOCALs have been employed. If execution of the core load immediately follows the building of the core image program, this subroutine reads a LOCAL/SOCAL from Working Storage into the LOCAL/SOCAL Area as it is called during execution. If the core image program was stored in the User or Fixed Area in Disk Core Image format prior to execution, the flipper reads each LOCAL/SOCAL as it is called during execution from the User or Fixed Area (where it was stored following the core load) into the LOCAL/SOCAL Area.

The flipper is entered via the special LOCAL/SOCAL linkage. A check is made to determine if the required LOCAL/SOCAL is already in core. If it is not in core, the flipper reads the required LOCAL/SOCAL into the LOCAL/SOCAL Area, and transfers the LOCAL/SOCAL subprogram via the special linkage.

CORE IMAGE LOADER

The Core Image Loader serves both as a loader for core loads and as an interface for some parts of the Monitor system.

On any entry to the Skeleton Supervisor, the Core Image Loader is fetched and control is transferred to it. The Core Image Loader determines where the Skeleton Supervisor was entered, i.e., at $EXIT, $DUMP, or $LINK.

FETCHING THE SUPERVISOR

If an entry was made to the Skeleton Supervisor at the $EXIT entry point, the Core Image Loader first fetches the disk I/O subroutine used by the Monitor programs (DISKZ), if it is not already in core. It then fetches and transfers control to the Monitor Control Record Analyzer to read Monitor control records from the input stream.

If an entry was made to the Skeleton Supervisor at the $DUMP entry point, the Core Image Loader first saves words 6-4095 on the CIB and then fetches and transfers control to the DUMP program to perform the core dump according to the parameters specified. At the completion of the dump, the DUMP program either restores core from the CIB and transfers control back to the core load, or it terminates the execution with a CALL EXIT (see Terminal and Dynamic Dumps under Supervisor).

FETCHING A LINK

If an entry was made to the Skeleton Supervisor at the $LINK entry point, the Core Image Loader first saves low COMMON (locations 1536-1855 if DISKN is in core, locations 1216-1535 if DISK1 is in core, or locations 896-1215 if DISKZ is in core). It then determines from COMMA the lowest-addressed word of COMMON, if any, defined by the core load just executed. Any COMMON below location 4096 is saved in the CIB by the Core Image Loader.

Figure 10 illustrates the scheme used in saving COMMON between links.

The LET/FLET entry for the link to be fetched is then located, and the Core Image Loader determines from it whether the link is in Disk Core Image format or Disk System format. If the link is in Disk Core Image format, the Core Image Loader fetches the disk I/O subroutine required by the core load, if it is not already in core. It next restores low COMMON if it lies within the COMMON defined by the core load just executed. The core load is then fetched and control is transferred to it.

If the link is in Disk System format, the Core Image Loader calls the Core Load Builder to construct a core image program from the mainline program. After the core image program has been built, the Core Load Builder returns control to the Core Image Loader, which then fetches the core load, as described above, and transfers control to it.

Figure 11 shows the layout of a core load loaded into core, ready for execution.

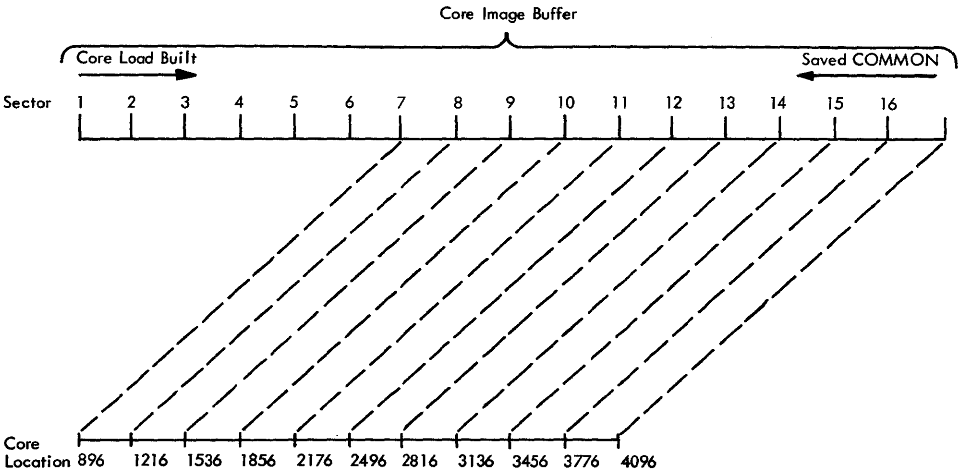


Figure 10. Scheme for Saving COMMON between Links

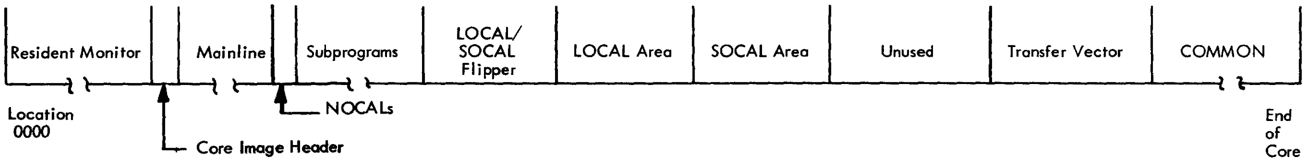


Figure 11. Layout of a Core Load Loaded for Execution

The information presented in this section should assist the user in achieving maximum utilization of the Monitor system.

USING THE DISK I/O SUBROUTINES

All core loads, whether they use disk I/O or not, require one of the three disk I/O subroutines. As a minimum, this disk subroutine is used to read the core load into core and execute CALL EXIT, CALL LINK, CALL DUMP, and/or CALL PDUMP. Generally, DISKZ is used by FORTRAN core loads and DISK1 or DISKN by Assembler-Language core loads. DISKN provides faster operation than DISK1 for operations involving more than 320 words, as well as the simultaneous operation of disk drives. DISKZ is intended for use only in an error-free environment, because it does no preoperative parameter checking, whereas DISK1 and DISKN do. DISKZ also has a special calling sequence; DISK1 and DISKN have the LIBF calling sequence. Bear in mind that all three disk subroutines are assembled as mainlines and are thus not the same as programs stored in the System Library, even though DISK1 and DISKN (but not DISKZ) may be referenced with the LIBF statement. They are described with library subroutines because they are similar in some respects to library subroutines. Actually, they are neither incorporated into the core load like library subroutines nor are they stored in the System Library.

A switch is set in COMMA to indicate which version of disk I/O is requested on the XEQ record. The setting of this switch is not altered until 1) a Monitor control record is read or 2) a link that is stored in DCI is called. In the first case the switch is set to indicate DISKZ, unless the record was XEQ, in which case the switch is set to indicate whatever version is requested. In the second case the switch is set to indicate the version of disk I/O required by the link. In short, each DSF link except the first in an execution must utilize the same version of disk I/O as the preceding link. The first link must, of course, utilize the disk I/O specified on the XEQ record.

In order to save core in Monitor programs, all of which utilize DISKZ, DISKZ has been pared to a minimum. The following is a list of functions that are not available in DISKZ but are available in DISK1 and/or DISKN.

- No validity checking of the word count and sector address
- No file protection
- No LIBF type calling sequence
- No validity checking of the function indicator
- No write without readback check option
- No write immediate function
- Word count may not be on an odd boundary
- No simultaneous disk operations
- Does not "make" the sector gap when reading or writing more than 320 words

THE USE OF SOCALs

Restrictions on Subroutines in SOCALs

A rule of prime importance regarding subroutines in the SOCAL scheme is that none must cut across SOCALs. That is, a given subroutine that is in one SOCAL may not call a subroutine that is in another SOCAL or cause another SOCAL to be brought into core before the execution of the given subroutine is completed. This is due to the fact that the IBM-supplied 1130 subroutines that go into the SOCAL scheme are not re-enterable. It should also be noted that disk I/O is used every time a SOCAL is brought into core. This means that disk I/O will sometimes be entered without the user's direct knowledge.

Decreasing Program Execution Time

When writing or modifying a program that is known to require SOCALs, planning is required to minimize the flipping of the various SOCALs in and out of core during execution. Ideally the program should be written in sections, each of which employs a single SOCAL, e.g., input, computation, and output. Even input and output should be carefully planned so as to separate disk and non-disk operations whenever possible.

TIPS ON MONITOR CONTROL

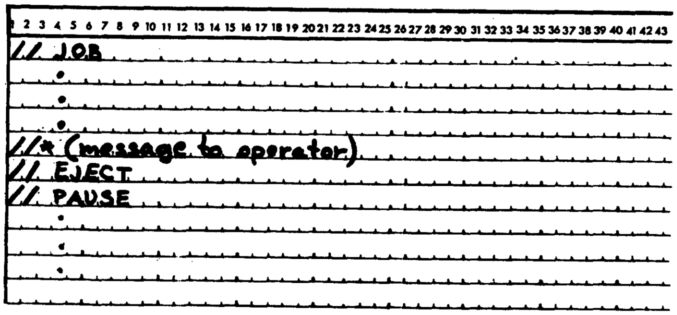
Temporary JOB Mode

In many cases DUP delete functions must be performed to clear the User Area of old programs before newly assembled or compiled programs may be stored. The necessity for such deletions is avoided by using the temporary mode when running jobs that contain programs that are likely to be replaced at a later time. In the Temporary mode all programs stored to the User Area are automatically deleted when the next JOB record is processed. This assures the user that his new program is the one stored in the User Area and is particularly useful while debugging.

EJECT Monitor Control Record

The EJECT record is used to control the beginning of a new page on the principal print device during a job. For example, messages to the operator of the Monitor Comments control record type may be placed in a more readable position if followed by an EJECT record.

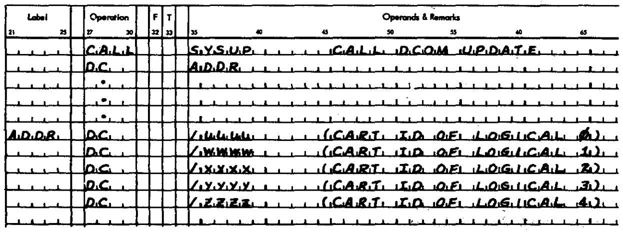
Example:



```
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43
// JOB
    .
    .
    .
//* (message to operator)
// EJECT
// PAUSE
    .
    .
    .
```

SYSUP

Changing cartridges in the middle of a job is permissible; however, great care must be exercised. A system update operation must always be performed. This function is provided by the System Library subroutine SYSUP. The subroutine should be called immediately following the loading of the new cartridge or cartridges as follows:



```
Label   Operation  F T  Operands & Remarks
21   25 27   30   32 33 35

        CALL            SYSUP        (CALL DCOM UPDATE
        DC              ADDR
         .
         .
         .
ADDR    DC              /WWWW        (CART ID OF LOGICAL 0)
        DC              /WWWW        (CART ID OF LOGICAL 1)
        DC              /XXXX        (CART ID OF LOGICAL 2)
        DC              /YYYY        (CART ID OF LOGICAL 3)
        DC              /ZZZZ        (CART ID OF LOGICAL 4)
```

The IDs of cartridges to be used must be specified, even those that were previously specified except the master (logical 0), which if unspecified will be the previous master. Continuation of the job must be delayed until all the newly loaded cartridges are ready. Rules governing the specification of cartridges are the same as those for the JOB Monitor control record.

It is also permissible to provide no system cartridge on the system at this time if no further system operations are required, e.g., CALL EXIT, CALL DUMP, or CALL LINK. This is particularly useful to the one drive user.

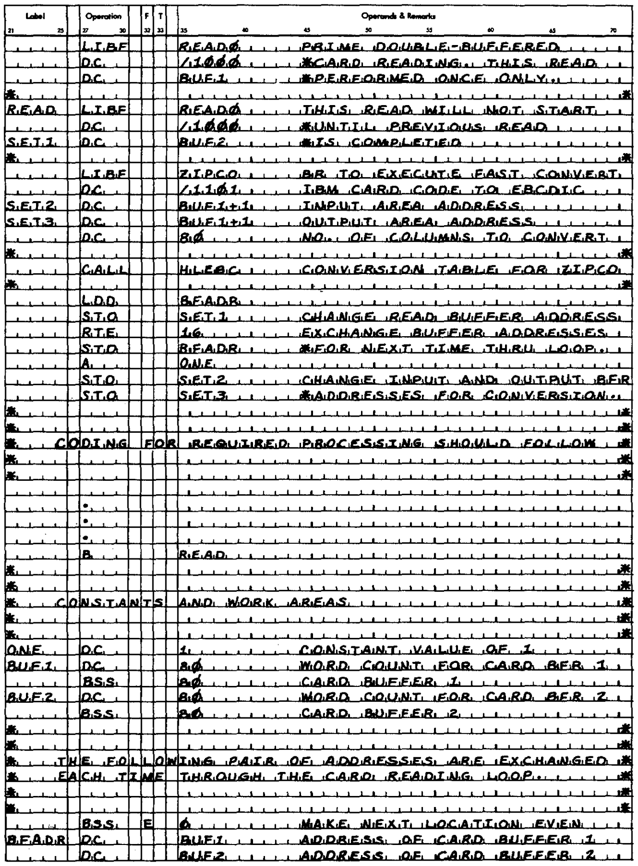
The FORTRAN calling sequence for SYSUP is described in the section of this manual entitled System Library Utility Subroutines.

MAXIMUM PERFORMANCE OF HIGH SPEED DEVICES

Double Buffering

The 2501 Card Reader model A2, rated at 1000 cards per minute presents a special problem to the programmer who desires maximum performance from his card I/O operations. If any conversion of the card data is required, the reading speed is likely to drop to 500 cards per minute, unless double-buffering is used.

The principle involved, is to read into one buffer while converting and processing the data from another buffer. This scheme does cost core for the extra buffer and additional programming involved, but in most cases it should allow the card throughput for the 2501 to remain at 1000 cards per minute. The coding illustrated below shows 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            READ0     PRIME DOUBLE-BUFFERED
        DC              /1000     *CARD READING. THIS READ
        DC              BUF1      *PERFORMED ONCE ONLY.
*                                                            *
READ    LIBF            READ0     THIS READ WILL NOT START
        DC              /1000     *UNTIL PREVIOUS READ
SET1    DC              BUF2      *IS COMPLETED
*                                                            *
        LIBF            ZIPCO     BR TO EXECUTE FAST CONVERT
        DC              /1101     IBM CARD CODE TO EBCDIC
SET2    DC              BUF1+1    INPUT AREA ADDRESS
SET3    DC              BUF1+1    OUTPUT AREA ADDRESS
        DC              80        NO. OF COLUMNS TO CONVERT
*                                                            *
        CALL            HLEBC     CONVERSION TABLE FOR ZIPCO
*                                                            *
        LDD             BFADR
        STO             SET1      CHANGE READ BUFFER ADDRESS
        RTE             16        EXCHANGE BUFFER ADDRESSES
        STO             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              80        WORD COUNT FOR CARD BFR 1
        BSS             80        CARD BUFFER 1
BUF2    DC              80        WORD COUNT FOR CARD BFR 2
        BSS             80        CARD BUFFER 2
*                                                            *
*                                                            *
*     THE FOLLOWING PAIR OF ADDRESSES ARE EXCHANGED          *
*     EACH TIME THROUGH THE CARD READING LOOP.               *
*                                                            *
*                                                            *
        BSS        E    0         MAKE NEXT LOCATION EVEN
BFADR   DC              BUF1      ADDRESS OF CARD BUFFER 1
        DC              BUF2      ADDRESS OF CARD BUFFER 2
```

1403 Conversion Subroutines

Two subroutines are provided with the Monitor system that may be used by Assembler object programs to convert EBCDIC to 1403 Printer Code. These subroutines are EBPRT and ZIPCO.

Using the execution times listed in the Subroutine Library manual, the average time EBPRT requires to convert a 120 character line is 156 ms. This compares with an estimate of 72 ms per line for ZIPCO.

Considering that the available times on the 1403 Printer are

Model 6 (340 LPM): 176 ms/line
Model 7 (600 LPM): 100 ms/line

it would be difficult or impossible to run the printer at rated speed, depending on the model, using EBPRT. If overlapped I/O were attempted, it would be impossible to run either model at rated speed.

The assembly language programmer is therefore advised to use ZIPCO for all EBCDIC to 1403 Printer code conversions.

TIPS FOR ASSEMBLER LANGUAGE USERS

Grouping of Mnemonics

Assembler language programs can often be organized in such a manner as to improve the assembly time. The Assembler Program is divided into overlay phases, each phase processing a certain group of mnemonics. By grouping mnemonics of a common type in the source program, fewer disk reads of overlay phases will be required by the Assembler. The following is a list of the mnemonics as they are grouped within the Assembler program:

A. ABS, FILE, ENT, ISS, ILS, SPR, EPR
B. DCs and imperative instructions (A, LD, EOR, BSC, etc.)
C. DEC and XFLC
D. DMES
E. HDNG, ORG, EQU, BSS, BES, LIST, SPACE, EJCT, DUMP, PDMP
F. LIBF, CALL, DSA, LINK, EXIT, EBC, DN

Each time a mnemonic is encountered during the assembly process, the overlay phase required to process it will be read into core, unless it is already residing in core.

Intermediate I/O

As the source records are read and processed by the Assembler in Pass 1, each statement is packed and saved on the disk in Working Storage. The part of the record that is saved is from column 21 to the last nonblank column. If no listing is specified, comments records are not saved on the disk.

Each record saved on the disk is preceded by a prefix word that contains the length of the associated record plus one. Up to sixteen 38-column records are saved on one sector.

WRITING ISS AND ILS

Interrupt Service Subroutines

The following rules must be adhered to when writing an ISS:

- Precede the ISS statement with an LIBR statement if the subroutine is to be called by LIBF rather than CALL.

- Precede the subroutine with an EPR (extended) or an SPR (standard) statement if precision specification is necessary.

- Precede the subroutine with one ISS statement defining the entry point (one only), the ISS number, and the ILS subroutines required. The device interrupt level assignments, and the ISS numbers used in the IBM-provided ISS and ILS routines, are shown in Table 4. See the 1130 Assembler Language Manual (Form C26-5927), for a description of the ISS statement. Note that the ISS numbers assigned by the IBM-supplied subroutine range from 1-11. ISS numbers 12-20 are assignable by the user. (They should be assigned from 20 downwards.)

- When assembling the ISS, an *LEVEL n control card must be included for each interrupt level associated with the device.

- The entry points of an ISS are defined by the related ILS. This must be taken into consideration when a user-written ISS is used with an IBM supplied ILS. The ILS executes a Branch and Store I instruction to the ISS at the ISS entry point plus n (see Table 4). The ISS must return to the ILS via a BSC instruction (not a BOSC).

Table 4. ISS/ILS Correspondence

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	Disk Storage	2	+4
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

Interrupt Level Subroutines

An ILS is included in a core load only if requested by an ISS that is a part of the same core load. ILS02 and ILS04 are a part of the Resident Monitor unless they are deleted from the System Library and replaced with user-written subroutines. The following rules must be adhered to when writing an ILS.

- Precede the subroutine with an ILS statement to identify the interrupt level involved.

- Precede all instructions by an ISS branch table and include one word per ILSW bit used. If the ILSW is not to be scanned, (i.e., a single ISS handles all interrupts on the level), then a one word table is sufficient. The minimum table size is one word. Table words must be non-zero. A zero must follow the branch table.

Word Corresponding To

$$\left.\begin{array}{l}\text{ILSW Bit 15}\\ \text{ILSW Bit 14}\\ \quad\cdot\\ \quad\cdot\\ \quad\cdot\\ \text{ILSW Bit 0}\end{array}\right\}\quad\text{ISS Branch Table}$$

The ISS branch table identifies both the ISS subroutine and the point within the ISS which should be entered for each bit used in the ILSW. The actual linkage is generated by the Core Load Builder. Basic to this generation is the ISS number implied by bits 8-15 of the branch table word and specified in the ISS statement. This number identifies a core location in which the Core Load Builder has stored the address of the called entry point in the ISS. This entry point address is incremented by the value in bits 0-7 of the branch table word, producing the interrupt entry point address. The Core Load Builder replaces the ISS branch table word with the interrupt entry point address.

During execution, each address in the branch table may be used with an indirect branch and store I (BSI) instruction to reach the ISS corresponding to that ILSW bit position. The ILSW bit that is ON can be determined by the execution of a SLCA instruction. At the completion of this instruction, the index register specified contains a relative value equivalent to the bit position in the ISS branch table. An indirect, indexed BSI may then be used to reach the appropriate ILS.

Before processing by the Core Load Builder, each word in the ISS branch table has the following format:

Bits 0-7 -- Increment added to the entry point named in the ISS statement to obtain the interrupt entry point in the ISS for this ILSW bit. (In IBM-written ISS subroutines, this increment is +4 for the primary interrupt level and +7 for the second interrupt level.)

Bits 8-15 -- @ISTV+ the ISS number for the ISS subroutine for this ILSW bit.

- The ILS entry point must immediately follow the ISS branch address 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. (The table must contain at least one entry.) The interrupt results in a BSI to the ILS entry point.

- To clear the level, a user-written ILS, used with an IBM-supplied ISS, should exit via the return linkage with a BOSC instruction.

- User-written ILS must replace the equivalent IBM-supplied ILS. The user written ILS must be stored as ILS0x, where x = 0, 1, 2, 3, 4, or 5.

- The IBM-supplied ILS02 and ILS04 subroutines are stored as subtype 1. User-written replacements must be stored as subtype zero.

- The branch table for ILS04 may have no more than 9 entries.

READING A CORE MAP AND A FILE MAP

The core maps described below are taken from the sample programs supplied with the Monitor system. (The sample program listings and operating instructions are printed in Appendix J.)

The core map for the Assembler-language sample program indicates that there were /7904 words of core storage not occupied by the core load (R41 is an informational message, not an error message). There was only one CALL (FSQR), but there were several LIBFs, e.g., FARC. 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 proper. The entry point to the mainline program is /01FE.

The principal difference in the core map printed for the FORTRAN-language sample program is that it includes a file map. The file defined as file number 103 has been equated to a data file named FILEA, which begins at sector /01AE, is one sector in length, and is stored on a cartridge labeled 000F.

If file 103 had required more than the two sectors available in FILEA, the record count would have been reduced to make the file fit in FILEA, and the file map entry would have been

```
103 01AE 0002 000F FILEA TRUNCATED
```

The files defined as 101 and 102 are files in Working Storage because they do not appear in the *FILES record. This can be determined by looking at the rightmost entry in the file map. For files defined in the User/Fixed Area, for example, FILEA, this entry is the name of the file; otherwise, it is the address of Working Storage.

The second entry for a User/Fixed Area file is the absolute sector address of the first sector of the file. For files in Working Storage, this address is relative to the first sector of Working Storage. Thus, the absolute sector address of the first sector of file 101 is /0000 + /01B0; for file 102 it is /0001 + /01B0.

Note that the 4K example requires both LOCALs and SOCALs. The LOCALs were, of course, requested by the user, and the core map entries for the LOCAL subroutines (FLOAT, FARC, and IFIX) have been flagged. The presence of SOCALs, which were selected and constructed by the Core Load Builder, are also indicated by flags on the core map entries for the subroutines included in the various SOCALs. The number following the word "SOCAL" indicates in which of the SOCALs a particular subroutine is to be found. In this case SOCAL Option 2 was employed. This can be deduced from the fact that there are three SOCALs. Option 1 consists of only two.

Several other facts about the 4K core load can be extracted from the core map. For one thing, the core load exceeds the capacity of core storage (before SOCALizing) by /03AB words (message R40). Furthermore messages R43, R44, and R45 indicate that SOCALs 1, 2, and 3 require /0124, /06AC, and /02A2 words of core, respectively. This information indicates that, for example, since SOCAL 2 is much larger than SOCAL 1, more arithmetic and function subprograms may be called at little extra cost in core. (It would be necessary to reduce the dimension of the variable B to realize this.) Message R41 says that, after SOCALizing, there are only /0004 words of core that are not used by this core load.

Assembler Core Map

```
// XEQ       L
R 41  7904 (HEX) WDS UNUSED BY CORE LOAD
CALL TRANSFER VECTOR
 FSQR   0248
LIBF TRANSFER VECTOR
 FARC   069E
 XMDS   0682
 HOLL   0632
 PRTY   05E2
 EBPA   0592
 FADD   04E1
 FDIV   0540
 FLD    048C
 FADDX  04E7
 FMPYX  04A2
 FSTO   0470
 FGETP  0456
 NORM   042C
 TYPEO  0312
 EBPRT  02AC
 IFIX   0280
 FLOAT  0230
SYSTEM SUBROUTINES
 ILS04  00C4
 ILS02  00B3
     01FE (HEX) IS THE EXECUTION ADDR
```

FORTRAN Sample 4K Core and File Map

```
// XEQ       L  2
*LOCAL,FLOAT,FARC,IFIX
*FILES(103,FILEA)
FILES ALLOCATION
  103 01AE  0001  000F FILEA
  101 0000  0001  000F  01B0
  102 0001  0001  000F  01B0
STORAGE ALLOCATION
R 40  03AB (HEX) ADDITIONAL CORE REQUIRD
R 43  0124 (HEX) ARITH/FUNC SOCAL WD CNT
R 44  06AC (HEX) FI/O, I/O SOCAL WD CNT
R 45  02A2 (HEX) DISK FI/O SOCAL WD CNT
R 41  0004 (HEX) WDS UNUSED BY CORE LOAD
LIBF TRANSFER VECTOR
 EBCTB  0F53 SOCAL 2
 HOLTB  0F17 SOCAL 2
 GETAD  0ED4 SOCAL 2
 XMDS   09B2 SOCAL 1
 HOLEZ  0E9E SOCAL 2
 NORM   07DC
 FADDX  095D SOCAL 1
 FSBRX  0934 SOCAL 1
 FMPYX  0900 SOCAL 1
 FDIV   08AE SOCAL 1
 FSTOX  0788
 FLDX   07A4
 SDCOM  0920 SOCAL 3
 SDFX   08E6 SOCAL 3
```

```
  SDWRT  0954 SOCAL 3
  SIOFX  099A SOCAL 2
  SUBSC  07BE
  SIOI   099E SOCAL 2
  SCOMP  0982 SOCAL 2
  SWRT   08AB SOCAL 2
  SRED   08B0 SOCAL 2
  FSTO   078C
  FLD    07A8
  PRNTZ  0DE0 SOCAL 2
  CARDZ  0D36 SOCAL 2
  SFIO   09AD SOCAL 2
  SDFIO  0959 SOCAL 3
  IFIX   087C LOCAL
  FARC   087C LOCAL
  FLOAT  087C LOCAL
 SYSTEM SUBROUTINES
  ILS04  00C4
  ILS02  00B3
  ILS01  0F5A
  ILS00  0F75
  FLIPR  0816
       04DD (HEX) IS THE EXECUTION ADDR
```

FORTRAN Sample 8K Core and File Map

```
// XEQ        L  1
*FILES(103,FILEA)
FILES ALLOCATION
  103 01AE  0001  000F FILEA
  101 0000  0001  000F  01B0
  102 0001  0001  000F  01B0
STORAGE ALLOCATION
R 41  0C9C (HEX) WDS UNUSED BY CORE LOAD
LIBF TRANSFER VECTOR
 EBCTB  12CD
 HOLTB  1291
 GETAD  124E
 NORM   1224
 XMDS   1208
 FARC   11E6
 HOLEZ  11B0
 FLOAT  11A6
 IFIX   117A
 FADDX  1125
 FSBRX  10FC
 FMPYX  10C8
 FDIV   1076
 FSTOX  101E
 FLDX   103A
 SDCOM  07FE
 SDFX   07C4
 SDWRT  0832
 SIOFX  0B1A
 SUBSC  1054
 SIOI   0B1E
 SCOMP  0B02
 SWRT   0A2B
 SRED   0A30
 FSTO   1022
 FLD    103E
 PRNTZ  0F60
 CARDZ  0EB6
 SFIO   0B2D
 SDFIO  0837
SYSTEM SUBROUTINES
 ILS04  00C4
 ILS02  00B3
 ILS01  12D2
 ILS00  12ED
      04DD (HEX) IS THE EXECUTION ADDR
```

LOCATING FORTRAN ALLOCATION ADDRESSES

The variable allocations listed below are taken from the FORTRAN sample program in Appendix J.

```
VARIABLE ALLOCATIONS
    A(R )=00DC-0016      X(R )=00F0-00DE     B(R )=0208-00F2
   V3(I )=020E           M(I )=020F          L(I )=0210
   L2(I )=0214          N1(I )=0215         N2(I )=0216
    K(I )=021A          IK(I )=021B         I1(I )=021C



    D(R )=020A          V1(I )=020C         V2(I )=020D
   M1(I )=0211          M2(I )=0212         L1(I )=0213
    N(I )=0217           I(I )=0218          J(I )=0219
```

The variable array A is to be found between core locations /00DC + /001E + $ZEND and /0016 + /001E + $ZEND, inclusive. That is, A_1 is at /00DC + /001E + $ZEND, A_2 at /00DB + /001E + $ZEND, etc. The /001E term is the length of the Core Image Header and $ZEND is the address of the first core location following DISKZ.

The other allocation addresses, e.g., statement allocation, may be calculated in a similar manner.

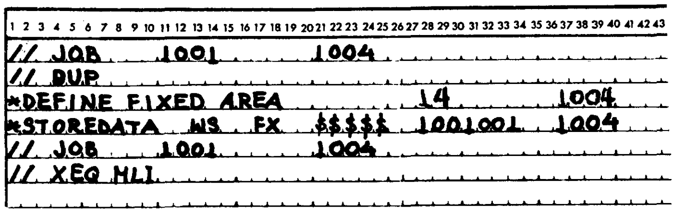
INITIALIZING $$$$$ DATA FILES FOR USE WITH FORTRAN UNFORMATTED I/O

The user must define a Data File with the name $$$$$ prior to executing a FORTRAN mainline program or subroutine that uses unformatted I/O. This Data File must be located in the Fixed Area. One file may be defined in the Fixed Area of each cartridge on the system; however, only one $$$$$ file may be referenced in any one job.

The following example shows a $$$$$ file being defined on a satellite cartridge.

The satellite cartridge ID is 1004
The system cartridge ID is 1001
A file of 100 sectors is desired

After the file is defined, program ML1 which uses unformatted I/O can be executed. Note that no *FILES card is required at execution time to define the $$$$$ file.



```
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43
// JOB    1001      1004
// DUP
*DEFINE FIXED AREA          14       1004
*STOREDATA  WS  FX  $$$$$ 1001001  1004
// JOB    1001      1004
// XEQ ML1
```

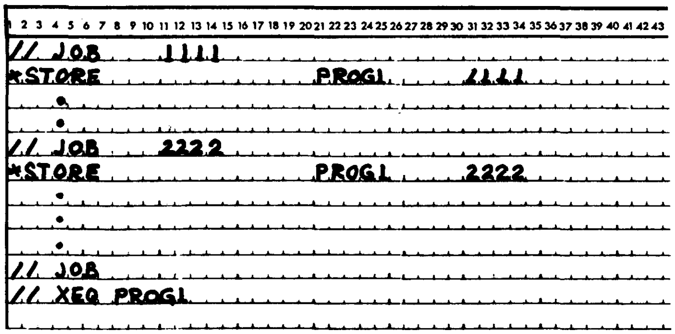
USE OF DEFINED FILES

When an *FILES Supervisor control record is used following a // XEQ Monitor control record, or a *STORECI control record, the Core Load Builder attempts to locate the file name by searching LET or FLET. If the name is found, the sector address of this Data File is inserted in the file table (created as a result of the FORTRAN DEFINE FILE statement or the Assembler FILE mnemonic) identified by the file number specified on the *FILES record. If the file name is not found in LET or FLET, the Core Load Builder causes this file to be a Working Storage file. A suggested way of initially allocating a disk area for a Data File is to perform a *STOREDATA DUP operation from Working Storage to the User or Fixed Area. The number of sectors stored should be determined on the basis of the number of records the file is to contain, and the size of each record. Note that records do not continue across sector boundaries. Once the number of sectors required has been determined, this number of sectors should be specified on the *STOREDATA control record, provided the User Area or Fixed Area is large enough to contain this file.

DUPLICATE PROGRAM AND DATA FILE NAMES

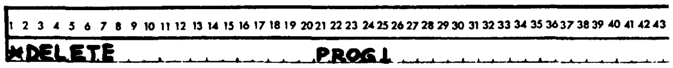
On a multi-drive system, it is possible to have more than one program or data file with the same name. This can cause problems when attempting to execute or delete the named program.

Example:



```
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43
// JOB    1111
*STORE              PROG1     1111
   .
   .
// JOB    2222
*STORE              PROG1     2222
   .
   .
   .
// JOB
// XEQ PROG1
```

This sequence of instructions will cause PROG1 on the cartridge labeled 1111 to be executed when PROG1 on 2222 may have been desired. A similar problem can occur on a DELETE operation.



```
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43
*DELETE             PROG1
```

would delete the program on 1111, not the one on 2222.

The answer to this problem is to avoid having two programs or data files with the same name. If a strange cartridge is on line and it is not needed for the job, disable it.

NAME CONFLICTS

In STORE and DELETE operations, care should be taken to avoid name conflict with IBM-supplied programs. If the program to be stored or deleted carries the same name as an IBM program, the system may execute the operation on the wrong program.

RESTORING DESTROYED CHARACTERS

Cartridges that contain data and/or programs in the User Area or Fixed Area, and which may be difficult to replace, can sometimes be restored to use after being rendered unusable. If only sector addresses are affected, DCIP may be used to initialize sector addresses only. (See p. 87 for operating procedure.)

If some part of the Monitor System has been destroyed (including LET, FLET, User Area and Fixed Area) a reload function may be performed with the System Loader. In this case, the entire Monitor System deck, except the System Library, should be processed by the System Loader.

MAINLINE PROGRAMS THAT USE ALL OF CORE

Before writing a program that occupies all or nearly all of core, the user should weigh the advantage gained against the possible later rewriting required if IBM-supplied subroutines used by the core load are expanded due to modification.

TIPS FOR FORTRAN LANGUAGE USERS

It is strongly recommended that the use of the 1130 device code be avoided in READ and WRITE statements, the use of integer variables in such cases allows for easier modification.

CONNECTING FROM VERSION 1 TO VERSION 2

- Data files and DSF programs must be dumped from the Version 1 cartridge to cards or paper tape and stored on the Version 2 cartridge under DUP control,

- The five-character alphameric disk cartridge labels used in Version 1 must be changed to four-character hexadecimal labels.

- DCI programs on a Version 1 cartridge cannot be dumped and stored on a DM2 cartridge. They must be stored in DSF on the DM2 cartridge and then converted to DCI under DUP control, which implies that the original DSF mainlines must be available.

- Since the FORTRAN I/O device numbers are fixed, some reprogramming is necessary whenever programs that use a given I/O device are required to employ a different device. For example, if a program that uses an 1132 Printer is to use a 1403 Printer, the device numbers must be changed in all READ and WRITE statements that reference the printer.

MONITOR SYSTEM LIBRARY

The System Library is a group of disk-resident subprograms and mainline programs that perform I/O, conversion, arithmetic, and disk initialization and disk maintenance functions. A paper tape utility program (PTUTL) is also included in the System Library. Appendix F is a listing of the Monitor System Library.

ADDING AND REMOVING SUBROUTINES

Subroutines can be added to or deleted from the Monitor System Library as desired by the user. The DUP control record STORE is used to add a subroutine and the DUP control record DELETE is used to remove a program (see DUP Control Records). Each program in the IBM-supplied system deck is preceded by a DUP STORE control record.

The user should not remove subroutines that are called by other subroutines left in the System Library (refer to Appendix F for a list of subroutines called by other subroutines). Neither should he delete any of the mainline programs, since they may be required by Monitor programs.

SYSTEM LIBRARY SUBROUTINES

The 1130 Monitor System Library contains a group of programs that aid the programmer in making efficient use of the 1130 Computing System. Descriptions of the programs and methods for programming them are contained in the publication, IBM 1130 Subroutine Library (Form C26-5929). From an operational standpoint, the programs of particular interest are the ISSs, which manipulate the I/O devices attached to the 1130 Computing System and handle all programming details peculiar to each device. Table 5 lists the ISSs supplied with the 1130 Monitor system.

NOTE: User-written ISSs should be numbered from 20 down to avoid conflict with IBM-assigned ISS numbers (see Digit 1 under Preoperative Errors).

NOTE: Although the disk subroutines are technically not ISSs, they have most of the characteristics of an ISS.

The following paragraphs describe the use of some of the IBM-supplied ISS subroutines and discuss preoperative errors and I/O error restarts in which special handling is required. All addresses are given in symbolic form. See the table of equivalence in the listing of the Resident Monitor (Appendix H) to equate the symbolic to the absolute addresses. ISS preoperative error WAITs are listed in Appendix A.

PREOPERATIVE ERRORS

A preoperative error is an error condition detected before an I/O operation is started. It denotes either an illegal parameter, an illegal specification in the I/O area, or a device not-ready condition. This error causes a trap to $PRET and the following conditions:

- The Instruction Address Register displays the address $PRET+1.
- The Accumulator displays an error code represented by four hexadecimal digits.

  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
  8 - SCATx
  9 - PRNT3 or PRNZ
  A - OMPR1

  Digits 2 and 3 are not used.
  Digit 4 identifies the error:

  0 - Device not ready
  1 - Illegal parameter or illegal specification in I/O area

Table 5. 1130 Disk Monitor System ISS Names

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, or PRNT2
1403 Printer	PRNZ, or PRNT3
Keyboard/Console Printer	TYPEZ, or TYPE0
Console Printer	WRTYZ, or WRTY0
1134/1055 Paper Tape Reader Punch	PAPTZ, PAPT1, PAPTN, OR PAPTX
1627 Plotter	PLOT1
1231 Optical Mark Page Reader	OMPR1
Synchr. Comm. Adapter	SCAT1, SCAT2, or SCAT3

- $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 re-executed. Pressing the PROGRAM START key will return control to the ISS for a re-execution of the call.

When a preoperative error is encountered the operator can:

- Correct the error condition if possible and press PROGRAM START, or

- Note the contents of the Accumulator and location $PRET, dump core storage, and proceed with the next job.

1442 CARD SUBROUTINE ERRORS (CARDx AND PNCHx)

Error Parameters

CARDZ, CARD0, PNCHZ, or PNCH0. There is no error parameter. If an error is detected during processing of an operation-complete interrupt, the subroutine traps to $PST4, with interrupt level 4 on. After the 1442 is made ready, pressing the PROGRAM START key will cause the operation to be reinitiated.

CARD1 or PNCH1. There is an error parameter. If an error is detected during processing of an operation-complete interrupt, the user program can elect to terminate (clear "subroutine busy indicator" and turn off the interrupt level) or to retry. A retry consists of waiting at $PST4 with interrupt level 4 on and then reinitiating the function.

Last Card. A read or feed function requested after the last card has been detected causes the last card to be ejected, and a trap to $PRET occurs. A punch function will punch and then eject the last card with a normal exit.

1442 Errors and Operator Procedures

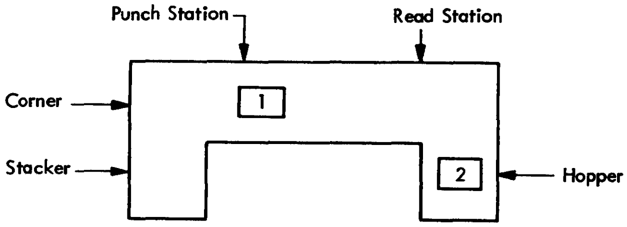
If a 1442 error occurs, the 1442 becomes not-ready until the operator has intervened. Unless the stop is caused by a stacker full (no indicator) or chip box indication, the 1442 card path must be cleared before proceeding. The 1442 error indicators and the position of the cards in the feed path should be used to determine which cards must be placed back in the hopper.

For the card subroutines, a retry consists of positioning the cards (i.e., skipping the first card in the hopper, if necessary, on a read or feed operation) and reinitiating the function whenever the card reader becomes ready.

Read errors do not apply to the 1442-5.

Hopper Misfeed. Indicates that card 2 failed to pass properly from the hopper to the read station during the card 1 feed cycle.

Card positions after error:

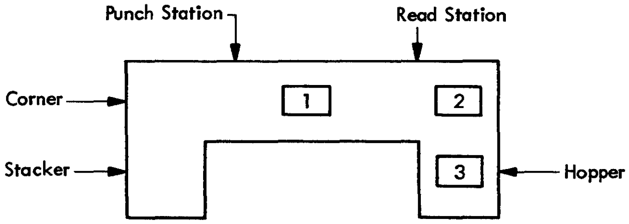


Error indicator: HOPR

Operator procedure: When program halts, press NPRO to eject card 1, place card 1 in hopper before card 2, and ready the 1442.

Feed Check (punch station). Indicates that card 1 is improperly positioned in the punch station at the completion of its feed cycle.

Card positions after error:

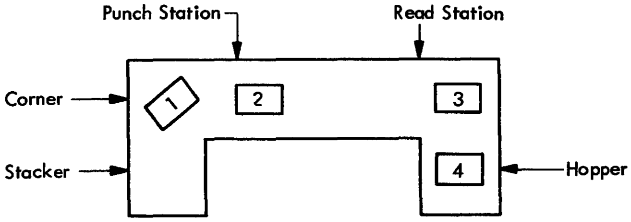


Error indicator: PUNCH STA

Operator procedure: When program halts, empty hopper, clear 1442 card path, place cards 1 and 2 in hopper before card 3 and ready the 1442.

Transport. Indicates that card 1 has jammed in the stacker during the feed cycle for card 2.

Card positions after error:

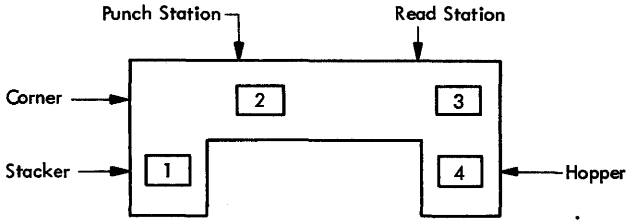


Error indicator: TRANS

Operator procedure: When program halts, empty hopper, clear 1442 card path, place cards 2 and 3 in hopper before card 4, and ready the 1442.

Feed Cycle. Indicates that the 1442 took an unrequested feed cycle and, therefore, cards 1, 2, and 3 are each one station farther ahead in the 1442 card path than they should be.

Card positions after error:

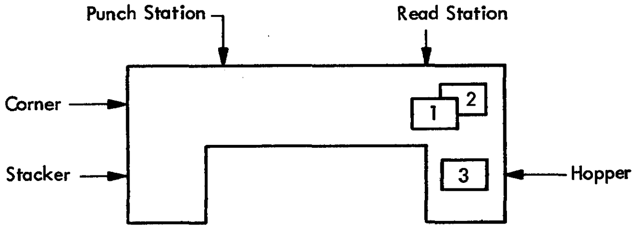


Error indicator: FEED CLU

Operator procedure: When program halts, empty hopper, press NPRO to eject cards 2 and 3, place cards 1, 2, and 3 in hopper before card 4, and ready the 1442.

Feed Check (read station). Indicates that card 1 failed to eject from the read station during its feed cycle.

Card positions after error:

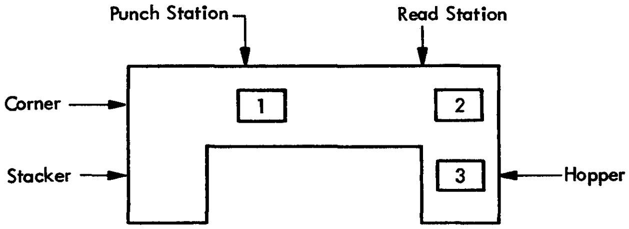


Error indicator: READ STA

Operator procedure: When program halts, empty hopper, clear 1442 card path, place cards 1 and 2 in hopper before card 3, and ready the 1442.

Read Registration. Indicates incorrect card registration or a difference between the first and second reading of a column.

Card positions after error:

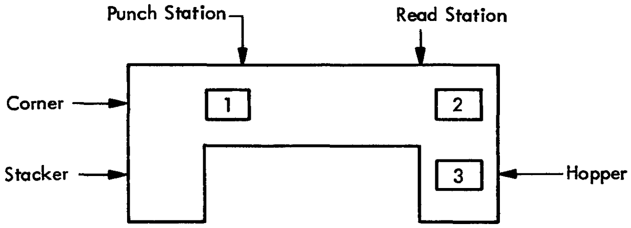


Error indicator: READ REG

Operator procedure: See Feed check (punch station). Repeated failures of this type might indicate a machine malfunction.

Punch Check. Indicates an error in output punching.

Card positions after error:



Error indicator: PUNCH

Operator procedure: When program halts, empty hopper, check card position and press NPRO to clear 1442 card path. If necessary, correct card 1 to prepunched state. Place (corrected) card 1 and card 2 in hopper before card 3 and ready the 1442.

2501 CARD SUBROUTINE ERRORS (READx)

Error Parameters

READZ or READ0. There is no error parameter. If an error is detected during processing of an operation-complete interrupt, the subroutine traps to $PST4, with interrupt level 4 on. After the 2501 is made ready, pressing the PROGRAM START key will cause the operation to be reinitiated.

READ1. There is an error parameter. If an error is detected during processing of an operation-complete interrupt, the user program can elect to terminate (clear "subroutine busy indicator" and turn off the interrupt level) or to retry. A retry consists of waiting at $PST4 with interrupt level 4 on until the 2501 becomes ready, and then reinitiating the function.

Last Card. A read function requested after the last card has been detected causes a trap to $PRET.

2501 Errors and Operator Procedures

If a 2501 error occurs, the 2501 becomes not-ready until the operator has intervened. 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 which cards must be placed back in the hopper.

For the card subroutines, a retry consists of positioning the cards (i.e., skipping the first card in the hopper, if necessary) and reinitiating the read function whenever the card reader becomes ready.

FEED CHECK. A feed check indicates that a card is mispositioned in the feed path or a card has failed to feed from the hopper.

When the program traps to $PST4, empty the hopper and clear the 2501 card path. If a card is improperly positioned at the pre-read station (it has not been read), place this card ahead of the cards remaining to be read, place the deck back in the hopper, and ready the 2501.

READ CHECK. A read check indicates incorrect card registration or a difference between the first and second reading of a column.

When the program traps to $PST4, empty the hopper, NPRO, place the last two 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 (TYPEZ, TYPE0, WRTYZ, and WRTY0)

If the carrier attempts to print beyond the manually positioned margins, a carrier restore (independent of the program) occurs.

Subroutine printing begins wherever the carrier is positioned as a result of the previous print operation. There is no automatic carrier return as a result of a call to the subroutine.

If the Console Printer indicates a not-ready condition after printing has begun, the subroutine traps to $PST4 with interrupt level 4 on. After the Console Printer is made ready, pressing the PROGRAM START key will cause the operation to be reinitiated.

KEYBOARD SUBROUTINE FUNCTIONS (TYPEZ and TYPE0)

Re-entry

When the ERASE FIELD key is pressed, a character interrupt signals the interrupt response subroutine that the previously-entered Keyboard message is in error and will be re-entered. The subroutine prints two slashes on the Console Printer, restores the carrier to a new line, and prepares to replace the old message in the I/O area with the new message. The operator then enters the new message. The old message in the I/O area is not cleared. The new message overlays the previous message, character by character. If the previous message was longer than the new message, characters from the previous message remain (following the NL character which terminated the new message).

When the interrupt response subroutine recognizes the end-of-message control character, it assumes the message has been completed, stores an NL character in the I/O area, and terminates the operation.

Backspace

When the backspace key is pressed, the last graphic character entered is slashed and the address of the next character to be read is decremented by +1. If the backspace key is pressed twice consecutively, the character address is decremented by +2, but only the last graphic character is slashed. For example, assume that ABCDE has been entered and the backspace key pressed three times. The next graphic character replaces the C, but only the E is slashed. If the character F had been used for replacement, the paper would show ABCDEFFF, but ABFFF would be stored in the buffer.

TYPEZ treats the backspace key as if it were the erase field key.

PAPER TAPE SUBROUTINES (PAPTx)

If the reader or punch becomes not ready during an I/O operation, the subroutines exit to the user via the error parameter. The user can request the subroutine to terminate (clear device busy on the interrupt level) or to wait at $PST4 (postoperative error trap) waiting 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. After the device has been made ready, pressing the PROGRAM START key will cause the operation to be reinitiated.

SYSTEM LIBRARY MAINLINE PROGRAMS

The 1130 System Library mainline programs provide the user with the ability to perform disk maintenance and paper tape utility functions by requesting execution of the appropriate program directly through the job stream.

DISK MAINTENANCE PROGRAMS

The disk maintenance programs are mainline programs that are a part of the System Library and that initialize and modify disk cartridge IDs, addresses, and tables required by the Monitor system. Normally, they should never be deleted from the System Library.

The disk maintenance mainline programs are:

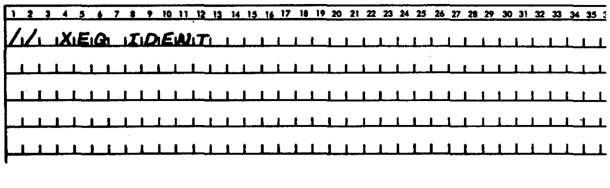
IDENT	-	Print Cartridge ID
DISC	-	Satellite Disk Initialization*
DSLET	-	Dump System Location Equivalence Table
ID	-	Change Cartridge ID
COPY	-	Disk Copy
ADRWS	-	Write Sector Addresses in Working Storage
DLCIB	-	Delete CIB
MODIF	-	Monitor System Update

The disk maintenance programs (except ADRWS) are called by an XEQ monitor control record. Some disk maintenance programs also require an ID control record. The format and use of the ID control record is described under the program descriptions which follow.

IDENT (Print Cartridge ID)

This program prints the ID and physical drive number of each cartridge mounted on the system. The program overrides any cartridge IDs specified on the JOB card and operates with all ready drives. IDENT will read and print illegal IDs including negative numbers.

The calling sequence for IDENT is:



```
// XEQ IDENT
```

Printout

```
PHYSICAL DRIVE      CART.ID

      00             XXXX
      01             XXXX
      02             XXXX
      03             XXXX
      04             XXXX
```

where

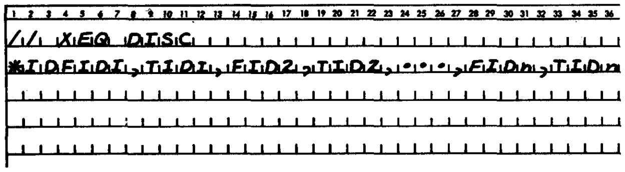
XXXX is the cardridge ID. Only the IDs on ready drives are printed.

DISC (Satellite Disk Initialization)

This program re-initializes up to four satellite cartridges -- all but the master cartridge (see DCIP). DISC gives the user the ability to re-initialize a disk cartridge on line. It writes the sector addresses, defective cylinder addresses, a cartridge ID, a LET, a DCOM, an error message program, and a CIB on each cartridge initialized.

DISC overrides all cartridge IDs specified on the JOB card except the master cartridge ID.

The calling sequence for DISC is:



```
// XEQ DISC
*IDFID1,TID1,FID2,TID2,...,FIDn,TIDn
```

where

FID1 through FIDn are the IDs currently on the satellite cartridges to be re-initialized (identified by IDENT or a JOB record).

TID1 through TIDn are the IDs to be written on the satellite cartridges by this program. A valid cartridge ID is a number between /0001 and /7FFF.

DISC Operation

DISC causes all selected satellite drives to seek home. The program then writes sector addresses and three distinct bit patterns (/AAAA, /5555, and /0000) on all sectors on the first cylinder of the first disk cartridge being reinitialized. The program reads back each pattern after it is written. If no error occurs on any of the patterns, DISC continues to the next cylinder. This procedure is repeated until all 203 cylinders have been checked. The program then starts reinitialization on the next cartridge selected. If a read error occurs, the cylinder on which the error occurred is rewritten

*All new cartridges must be initialized with DCIP before any operation is performed under Monitor control. DCIP also provides a disk copy function similar to the COPY program in the System Library.

and reread 50 times using the same pattern that caused the error to appear. If a second error occurs, the first sector address of the cylinder is placed in the defective cylinder table in word 1 of sector @IDAD. If a second and third defective cylinder are found, their cylinder addresses are written in words 2 and 3 of sector @IDAD. If there are no defective cylinders on the cartridge, words 1, 2, and 3 contain /0658. The cartridge ID is written in word 4 and the copy ID is written in word 5 of sector @IDAD. An error message (NON-SYST. CART. ERROR) and the program to print it on the Console Printer is also stored in sector @IDAD. The error message is printed if a cold start is attempted on this non-system cartridge.

Printout

When DISC is executed, the user punched *ID record is printed on the principal print device. Following this printout one or more of the following error messages may be printed.

CARTRIDGE XXXX INVALID...LOG0 CARD ID

The ID of the master cartridge (logical drive 0) has been specified as a current ID on the *ID card.

CARTRIDGE XXXX NEW LABEL IS INVALID

A new ID is outside of the range /0001 - /7FFF.

CARTRIDGE XXXX IS NOT AVAILABLE

A selected cartridge is not on the system

CARTRIDGE XXXX IS DEFECTIVE

Sector @IDAD or more than 3 cylinders are defective on a satellite cartridge being reinitialized (to identify the defective cylinders, initialize the cartridge using DCIP).

Following the reinitialization of the selected cartridges, the following message is printed.

XXXXYYYY NOT DONE

or

COMPLETE

XXXX is the old (FID1) cartridge ID

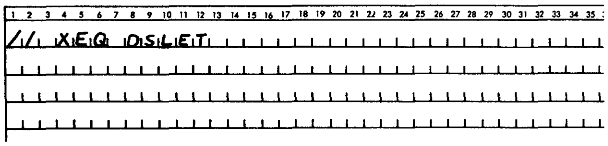
YYYY is the new (TID1) cartridge ID

One line is printed for each satellite cartridge that is reinitialized. A NOT DONE message should appear only if an error message has previously been printed.

DSLET (Dump System Location Equivalence Table)

This program dumps the contents of SLET to the principal print device. Each entry printed consists of a symbolic name, phase ID, core address, word count, and disk sector address. A SLET dump is shown in Appendix I.

The calling sequence for DSLET is:

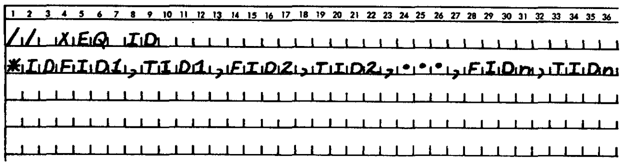


```
// XEQ DSLET
```

ID (Change Cartridge ID)

This program changes the ID on up to four satellite cartridges.

The calling sequence for ID is:



```
// XEQ ID
*IDFID1,TID1,FID2,TID2,...,FIDn,TIDn
```

where

FID1 through FIDn are the IDs currently on the satellite cartridges being changed (these IDs must be in the same logical order as the entries on the JOB card),

TID1 through TIDn are the new IDs to be written on the selected satellite cartridges. A valid cartridge ID is a number between /0001 and /7FFF.

Printout

FFFF TTTT NOT DONE

or

COMPLETE

where

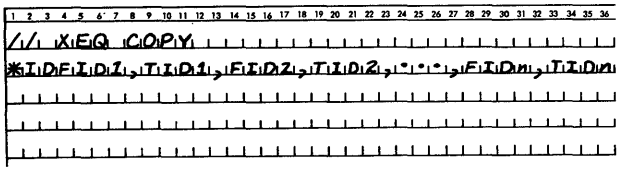
FFFF is the FROM ID
TTTT is the TO ID
NOT DONE is printed if a selected cartridge is not found on the system.

One line is printed for each cartridge ID that is changed (maximum 4).

COPY (Disk Copy)

This program copies the contents (except the defective cylinder table and the cartridge ID) of one cartridge onto another. The copy ID (word 5 of sector @IDAD) is incremented by one on the destination cartridge. The cartridge to be copied onto must have previously been initialized (see DISC or DCIP).

The calling sequence for COPY is:



```
// XEQ COPY
*IDFID1,TID1,FID2,TID2,...,FIDn,TIDn
```

where

FID1 through FIDn are the IDs of the cartridges to be copied,

TID1 through TIDn are the IDs of the cartridges onto which the copies are to be made.

If multiple copies are to be made from a single master, FID1 through FIDn will all contain the same ID.

If a system cartridge from a system with a different configuration is copied, it will be necessary to reconfigure the cartridge before a Cold Start can be performed (see System Reload).

Printout

```
FFFF TTTT NOT DONE
          or
          COMPLETE
          or
          NOT PRES
          or
          NO. ERROR
```

where

FFFF is the FROM ID
TTTT is the TO ID
NOT PRES indicates that the ID requested was not found.
NO. ERROR indicates that the ID requested exceeded /7FFF.

One line is printed for each copy requested on the *ID record. The printout occurs at the end of the job.

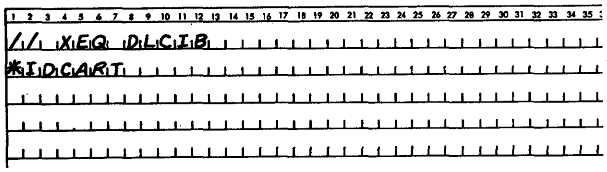
ADRWS (Write Sector Addresses in Working Storage)

This program, linked to from DUP on detection of the DUP control record, DWADR, writes the sector address on each sector of Working Storage of the disk cartridge specified in the DWADR control record (see *DWADR in DUP Control Records). ADRWS is intended for system use only.

DLCIB (Delete Core Image Buffer)

This program deletes the CIB from a non-system cartridge. If a User Area is defined, it is moved two cylinders closer to cylinder 0. The new addresses of disk areas moved as the result of the deletion of the CIB are reflected in DCOM on the master cartridge, on the non-system cartridge from which the CIB is deleted, and in COMMA.

The calling sequence for DLCIB is:



```
// XEQ DLCIB
*IDCART
```

where

CART is the ID of the non-system cartridge from which the CIB is to be deleted.

Printout

```
CART    UA/FX    FPAD
XXXX    YYYY     NNNN
```

or

```
XXXX ERROR
```

where

XXXX is the cartridge ID
YYYY is the User Area sector address
NNNN is the File Protect Address
ERROR is printed if the CIB was not deleted (cartridge not found on system or cartridge not specified on JOB card)

MODIF--SYSTEM MAINTENANCE PROGRAM

Included in the System Library is a system maintenance program, MODIF, that provides the user with the ability to update the Monitor system on the master cartridge. This program makes changes to the version and modification level word in DCOM, and can be used to update both System Programs and/or the System Library. A card deck or paper tape containing corrections to update the Monitor system to the latest version and modification level is supplied by IBM. Every modification must be run to update the version and modification level, even if the affected program has been deleted from the system.

NOTE: The replacement of a system program phase that contains reload entries (references to SLET generated by the System Loader during an initial or reload operation) cannot be performed by MODIF. MODIF does not update the System Reload Table. The replacement phase must be loaded by a system reload.

The calling sequence for MODIF is:

```
// XEQ MODIF
```

System Program Maintenance

Typical input for System Program update is shown in Figure 12.

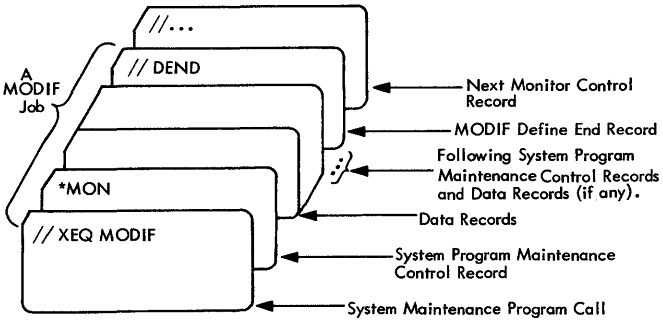

A MODIF Job
//...
// DEND
*MON
// XEQ MODIF
Next Monitor Control Record
MODIF Define End Record
Following System Program Maintenance Control Records and Data Records (if any).
Data Records
System Program Maintenance Control Record
System Maintenance Program Call

Figure 12. Layout of an Input Deck for a System Program Update

System Program Maintenance (Patch) Control Record

Each Monitor program phase to be changed requires a patch control record. If MODIF determines in analyzing SLET that the FORTRAN Compiler or the Assembler has been voided from the disk, modifications to these programs are not made; however, the version and modification levels for these programs are updated in DCOM.

The format of the patch control record is as follows.

Card Column	Contents	Notes
1-5	*MON	These characters identify a system patch to the FORTRAN Compiler, Assembler, DUP, Supervisor, Core Load Builder, System Device Subroutines[1], or Core Image Loader
5	blank	
6-8	vmm	The version (v) and modification level level (mm) are specified in hexadecimal.
9	0	Reserved
10	blank	
11-14	xxxx	The SLET ID of the Monitor program phase to which the patch is to be made is specified in hexadecimal. 0000 indicates an absolute patch (see columns 28-31, 33-36).
15	blank	
16-19	nnnn	"nnnn" specifies (in hex) the number of patch data records following this patch control record.
20	blank	
21	B or H	This character identifies the format of the patch data records (binary system format or hex patch format)
22	blank	
23-26	pppp	"pppp" specifies (in hex) the total number of patch control records to be processed. This parameter is required on the first patch control record only. [2]
27	blank	
28-31	dsss	The drive code (d) and sector address (sss) of the program to be patched are specified in hexadecimal. This field is used only when the SLET ID (columns 11-14) is 0.
32	blank	
33-36	cccc	"cccc" specifies (in hex) the core address of the first word of this sector. This field is used only when the SLET-ID (columns 11-14) is 0. [3]
37-80	Not used	

Notes:
1. Modifications to subroutines in the System Device Subroutine Area must be made with a *MON patch, not a *SUB DELETE and STORE.
2. A MODIF job may perform both System Program and System Library maintenance (see System Library Maintenance). In such a case the number in columns 23-26 must include the *SUB card in the count. Only one subroutine control record is allowed in any MODIF job, and it must be the last MODIF control record (not counting // DEND) in the stacked input.
3. Core addresses can be obtained from the microfiche listing.

Patch Data Record Formats

Patch Data Records may not contain CALLs or LIBFs, nor will the relocation indicators be used.

Binary System Format.

Word	Contents
1	Location
2	Checksum
3	Type Code (first 8 bits) 00001010
4-9	Relocation Indicators
10-54	Data words 1 through 45
55-60	ID and sequence number or may be blank

Hex Patch Format.

Card Column	Contents	Notes
1-4	aaaa	"aaaa" specifies (in hex) the core address (origin) of the patch. Each patch record must have a core address.
5	blank	
6-9, 11-14, 16-19, etc.		Each 4-column field contains one word of patch data (in hex). Up to 13 words of patch data can be specified per record. A blank column follows each word.
66-68, 73-80	Not used	

Hex patch cards may contain ID/sequence numbers. Zeros must be punched as leading blanks will not be assumed.

System Library Maintenance

Changes to the System Library require the deletion of the old program and the storing of the new one. MODIF updates the version and modification level word; the actual operation is performed by a DUP DELETE operation, followed by a DUP STORE operation.

Typical input for System Library maintenance is shown in Figure 13.

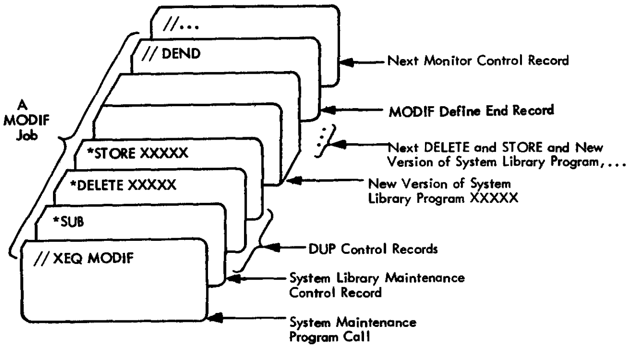

//...
// DEND
A MODIF Job
*STORE XXXXX
*DELETE XXXXX
*SUB
// XEQ MODIF
Next Monitor Control Record
MODIF Define End Record
Next DELETE and STORE and New Version of System Library Program,...
New Version of System Library Program XXXXX
DUP Control Records
System Library Maintenance Control Record
System Maintenance Program Call

Figure 13. Layout of an Input Deck for a System Library Update

System Library Maintenance (Subroutine) Control Record

Only one subroutine control record may appear in a MODIF job; however, any number of DELETEs and STOREs may be performed with that control record. System Library maintenance may also be performed concurrently with System Program maintenance (see note 2, columns 23-26 of *MON card).

The format of a subroutine control record is as follows

Card Column	Contents	Notes
1-4	*SUB	These characters identify a system patch to the System Library.
5	blank	
6-8	vmm	The version (v) and modification level (mm) are specified in hexadecimal.
9	0	Reserved
10-15	blank	
16-19	nnnn	"nnnn" specifies (in hex) the number of deletes and stores to be processed.
20-80	Not used	

All Maintenance

Define End Record

All MODIF jobs must end with a card punched as follows.

Card Column	Contents	Notes
1-7	//bDEND	
8-80	Not used	

This card terminates MODIF execution and passes control to the Supervisor.

Operating Procedures

The card deck or paper tape supplied by IBM is to be run as a Monitor job.

When a modification is completed successfully, the following messages are printed on the principal printer.

```
MODIF EXECUTION 0WXX
MODIF TERMINATION 0YZZ
```

where

WXX is the old version and modification number, and YZZ is the new version and modification number.

MODIF Error Messages

If an error occurs during MODIF execution, an error message is printed on the principal printer. The format of the error message is as follows.

ERROR# XXXX XXXX

Following the printing of the error message, the system will WAIT. All MODIF errors and their recovery procedures are listed in table 6.

MODIF Example

The purpose of the following example is to change one instruction in the 1134/1055 System Subroutine. The SLET ID of this subroutine is /0091.

Address (from assembly listing)	Change From	Change To
/0023	/0000	/7002

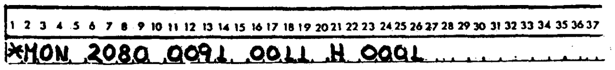
If the new modification level is 8, the following control and data cards must be punched by the user.

Table 6. MODIF Errors and Recovery Procedures

Error Number	Description	Recovery Options*	First Hex Number Printed	Second Hex Number Printed
1	Invalid patch control record (*MON or *SUB)	A. Correct error and reread from corrected patch control record. (If the error has occurred on the first patch control record, restart the modification.) B. Terminate modification, CALL EXIT.		
2	Checksum error on binary patch data record.	A. Recheck sum and reread from preceding patch control record. (If the error has occurred on the first patch control record, restart the modification.) B. Terminate modification, CALL EXIT. C. Reread card in error (cards may be out of order).	Amount of checksum difference.	Number of binary records read after patch header (including record in error).
3	Invalid hex data record.	A. Correct error and reread from preceding patch control record. B. Terminate modification, CALL EXIT. C. Reread card in error.		
4	Change level error.	A. Correct error and reread from corrected patch control record. B. Terminate modification, CALL EXIT.	Present version and modification level (from DCOM on disk).	Change level of version and modification (from patch control record).
5	New change level lower than current level.	A. Correct error and reread from corrected patch control record. B. Terminate modification, CALL EXIT. C. Reduce level and continue.	Present version and modification level (from DCOM on disk).	Change level of version and modification (from patch control record).
6	Monitor control record or // DEND card read before required number of patches read.	A. Read new patch header. B. Terminate modification, CALL EXIT.	Number of patches not installed.	
7	DCOM configuration indicators do not agree with SLET or, Required system I/O routine missing.	A. Restart MODIF execution. B. Terminate modification, CALL EXIT.	Contents of Accumulator when error was detected.	Address +2 from which error branch was executed.
8	DUP control record errors (DELETES or STORES).	Print error indicators and WAIT. Press START to continue.	XXYY where XX is the number of DUP errors detected and YY is the number of DUP control records processed (see DUP error printout).	Number of DUP control records specified on *SUB patch control record.
9	SLET ID not found.	Print error indicators and WAIT. Press START to read patch data cards without processing and read new control record.	SLET ID in question.	
A	Patch exceeds space allotted on disk for this phase.	Print error indicators and WAIT. Press start to read patch data cards without processing and read new control record.	High core patch address.	High core SLET address.
B	// DEND card not found (patches completed but version and modification level in DCOM not updated.	Press START to CALL EXIT or, Rerun modification with // DEND card.		

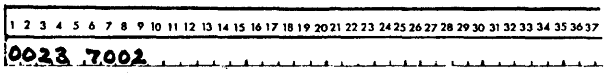
* Set console entry switches as desired for errors 1-7 and press START.
No switches on - recovery A
Switch 0 on - recovery B
Switch 15 on - recovery C

System Program Maintenance Control Record



```
*MON 2080 0091 0011 H 0001
```

Patch Data Record: Hex Patch Format



```
0023 7002
```

These two cards together with the Monitor control cards shown in Figure 12 will perform the required modification.

At completion of execution, the following messages will print on the principal printer.

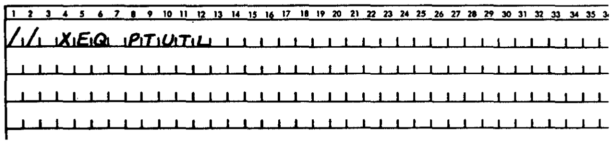
MODIF EXECUTION	0207	The execution of MODIF has been initialized on version 2 level 7
MODIF TERMINATION	0208	The patch has been installed and the new level is 8.

PAPER TAPE UTILITY (PTUTL)

This 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.

PTUTL allows changes and/or additions to FORTRAN and Assembler language source records as well as Monitor control records.

The calling sequence for PTUTL is:



```
// XEQ PTUTL
```

Operating Procedure

If paper tape is the principal input, select the appropriate initializing procedure listed below and continue.

If the Resident Monitor is in core:

- Place the PTUTL execute tape in the paper tape reader.
- Press PROGRAM START.

If the Resident Monitor is not in core:

- Place the cold start paper tape record in the paper tape reader.
- Press IMM STOP, RESET, and PROGRAM LOAD on the console.
- Place the PTUTL execute tape in the paper tape reader.
- Press PROGRAM START.

The paper tape utility program is loaded into core and then comes to a WAIT with /1111 displayed in the Accumulator. This WAIT allows the operator to ready the Console Printer, paper tape reader, and paper tape punch. The user should punch a leader of delete codes on the paper tape punch.

At this time, the user can select the desired program options by turning on the appropriate console entry switches. Figure 14 shows the PTUTL console entry switch logic in flowchart form.

Console Entry Switch On	Option
0	Print record after reading
1	Read paper tape records from 1134
2	Accept Keyboard input[1]
3	Punch paper tape records on 1055
14	WAIT after punching with /3333 in the Accumulator[3]
15	WAIT after printing with /2222 in the Accumulator[2]
All switches off	CALL EXIT[3]

NOTES:

1. The keyboard input option uses TYPE0; therefore all features of that subroutine apply to PTUTL.
   - The input record cannot exceed 80 characters.
   - Pressing the backspace key cancels the last character entered.
   - Pressing the ERASE FIELD key cancels the entire record and allows the user to restart.
   - Pressing the EOF key indicates that the record is complete. The Keyboard is released and the program continues.
2. Keyboard input will replace the last paper tape record read if console entry switch 2 is turned on prior to pressing PROGRAM START.
3. The test for exit is made just before an input record is read; therefore, a convenient way to branch out of PTUTL is to perform a WAIT after punching the last record desired (console entry switch 14 on). Turn off all console entry switches and press PROGRAM START. A CALL EXIT will be executed.

Paper Tape Not-Ready WAITs

Condition	Indication	Recovery Procedures
Paper tape reader not ready	Program WAITs with /3005 in the Accumulator	Ready reader if additional tape is to be read. Set the console entry switches as desired and press PROGRAM START.
Paper tape punch not ready	Program WAITs with /3004 in the Accumulator	Ready the paper tape punch and press PROGRAM START. To repunch the record that was being processed when the not-ready occurred, set console entry switches 1 and 2 off (to prevent another record from being read), set switches 3 and 14 on (punch a 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.

Example

Assume that the following records appear on a tape.

// JOB
// *(comments)
// ASM
// DUP
ASM Control Records
Source Program

The user now desires to alter the comments record, insert a // PAUS record after the comments record, and delete the // DUP record. The procedure is as follows.

1. Load and execute PTUTL. The program will WAIT with /1111 in the Accumulator.
2. Load the source tape in the paper tape reader and ready the paper tape punch and Console Printer. Make a leader of delete codes on the punch.
3. Turn on console entry switches 1, 3, and 14.
4. Press PROGRAM START.
5. The // JOB record will be read, reproduced, and the program will WAIT with /3333 in the Accumulator.
6. Turn on console entry switches 0, 1, 2, 3, 14, and 15.
7. Press PROGRAM START.
8. The comments record in the source tape will be read and printed on the Console Printer. The program will WAIT with /2222 in the Accumulator.
9. Press PROGRAM START. The Keyboard will be selected (PROCEED light on) and the program will WAIT with /3333 in the Accumulator.
10. Enter the new comments record in the proper format.
11. Press the EOF key on the Keyboard.
12. The new comments record will be punched on the tape, replacing the old record. The program will WAIT.
13. Turn off console entry switch 1. Press PROGRAM START. The Keyboard will be reselected.
14. Enter the // PAUS record from the Keyboard and press EOF.
15. Turn off the console entry switches 0, 2, and 15. Turn on switch 1. Leave switches 3 and 14 on.
16. Press PROGRAM START.
17. The // ASM record will be read and reproduced on the punch. The program will WAIT with /3333 in the Accumulator.
18. The next record // DUP, is to be deleted; therefore, switches 0, 1, and 15 should be set on, all other console entry switches should be set off.
19. Press PROGRAM START.
20. The // DUP record will be read and printed but not punched. The program will WAIT with /2222 in the Accumulator.
21. Leave the sense switches at the present setting and press PROGRAM START. The next record on the input tape will be read into the I/O buffer, overlaying the // DUP record.
22. Turn on console entry switches 1 and 3, all others off.
23. Press PROGRAM START.
24. The remainder of the source tape will be read in and reproduced, record for record.
25. When the paper tape reader goes not-ready at the end of the source tape, the program will again WAIT with /3005 in the Accumulator. Set all console entry switches off and press PROGRAM START. A CALL EXIT will be executed.

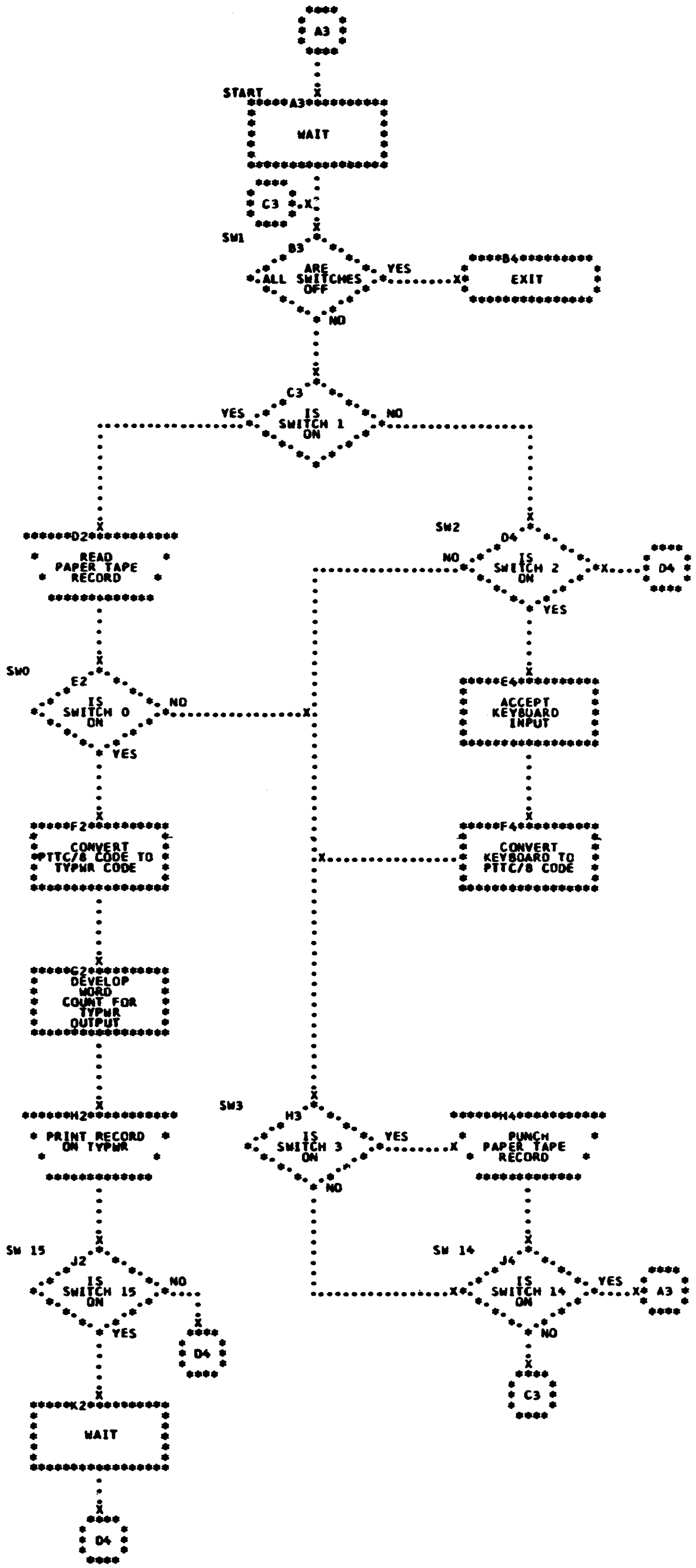


Figure 14. PTUTL Console Entry Switch Options

SYSTEM LIBRARY UTILITY SUBROUTINES

Also included in the System Library are a group of subroutines that perform utility functions for the Monitor system.

The utility subroutines are:

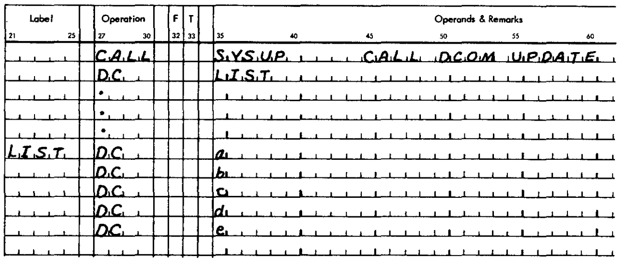
SYSUP	-	DCOM Updating Subroutine
RDREC	-	Read *ID Record Subroutine
CALPR	-	Call System Print Subroutines
FSLEN	-	Fetch Phase ID (FSLEN) or Fetch System Subroutine (FSYSU)
FLIPR	-	LOCAL/SOCAL Overlay Subroutine

SYSUP can be called by the user. The other utility subroutines are for system use only.

SYSUP (DCOM Update)

Whenever a core load requires changing disk cartridges during the job, SYSUP must be called to update DCOM on the master cartridge (logical drive 0) with the IDs and DCOM information from all satellite cartridges mounted on the system that are specified in the list or array in the calling sequence.

The Assembler language calling sequence for SYSUP is:


Label
21
25
Operation
27
30
F
T
32
33
Operands & Remarks
35
40
45
50
55
60

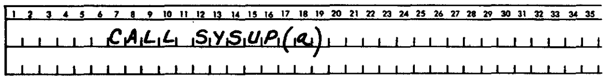
```
      CALL  SYSUP        CALL DCOM UPDATE
      DC    LIST
      .
      .
      .
LIST  DC    a
      DC    b
      DC    c
      DC    d
      DC    e
```

where

a is the ID of the master cartridge on the system,
b is the ID of the first satellite cartridge on the system,
c is the ID of the second satellite cartridge on the system,
d is the ID of the third satellite cartridge on the system,
e is the ID of the fourth satellite on the system.

a may be zero, in which case the master cartridge is the same as that defined for the previous job.

The FORTRAN calling sequence for SYSUP is:


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35

```
      CALL SYSUP(a)
```

where

a is the name of the last item in an array containing the IDs of the satellite cartridges on the system.

The last item in the array may be zero, in which case the master cartridge is the same as that defined for the previous job. For example:

CALL SYSUP (A(5))

The array is stored in reverse order

A(5) DC
A(4) DC
A(3) DC
A(2) DC
A(1) DC

Thus A(5) is the entry for logical 0, the master cartridge. A is a one-word integer.

NOTE: The list or array must be no longer than five words. It may be shorter. If a list or array shorter than five words is specified, the Assembler array must be terminated with an ID of all zeros (all zeros in the first entry will not terminate the array).

The FORTRAN array must be started with an ID of all zeros (all zeros in the last entry will not terminate the array). For example, a three-cartridge FORTRAN array would be specified as (A(4)) with A(1) having a DC of all zeros.

Printout

The following error messages may be printed by SYSUP (SYSUP error messages are also listed with the Supervisor Errors in Appendix A).

XXXX IS NOT AN AVAILABLE CARTRIDGE ID

A specified cartridge is not in the system.

XXXX IS A DUPLICATED SPECIFIED CARTRIDGE ID

The same ID appears more than once in the list or array in the calling sequence.

XXXX IS A DUPLICATED AVAILABLE CARTRIDGE ID

Two or more disks (specified in the calling sequence) have the same cartridge ID.

An error printout is followed by termination of execution.

CALPR (Call System Print Subroutine)

This subroutine calls FSLEN to bring the system print subroutines into core storage for the purpose of printing one or more lines on the principal printer. This subroutine is intended for system use only.

RDREC (Read *ID Record)

This subroutine is called by the Disk Maintenance Programs to read the *ID record. The *ID record is printed on the principal print device. This subroutine is intended for system use only.

FSLEN (Fetch Phase IDs and Fetch System Subroutine)

This subroutine has two entry points: FSLEN and FSYSU.

- FSLEN -- Fetch Phase IDs from SLET

  This entry point obtains the requested phase ID headers from SLET.

- FSYSU -- Fetch System Subroutines

  Fetches the requested system subroutine into core storage. This subroutine is intended for system use only.

FLIPR (LOCAL/SOCAL Overlay)

The Monitor system library contains a flipper subroutine (FLIPR), which is used to call LOCAL (load-on-call) and SOCAL (system-load-on-call) subroutines into core storage. FLIPR is used with DISKZ, DISK1, or DISKN.

FLIPR passes the total word count to DISKZ, DISK1, or DISKN to fetch the LOCAL. When a LOCAL subroutine is called, control is passed to the flipper, which reads the LOCAL into core storage if it is not already in core and transfers control to it. All LOCALs in a given core load are executed from the same core storage locations; each LOCAL overlays the previous one. FLIPR fetches SOCALs in the same manner as LOCALs.

The steps required to generate a complete multi-drive Monitor system are as follows.

- Initialize all disk cartridgės using the stand-alone program DCIP.
- Punch an initial load MODE control record and system configuration deck (or tape) and insert these cards in the System Loader deck. (These records are prepared using the stand-alone utility PTUTL in the paper tape system).
- Use the System Loader to load the Monitor system to disk.
- Perform a cold start.

The complete Monitor system is now on-line and operational.

Detailed instructions for initial load and reload of the card and paper tape Monitor system are listed below. All loading and reloading is performed by the System Loader. System Loader error messages are listed in Appendix A.

CARD SYSTEM PRE-LOAD

The Monitor system for the card user is supplied on a disk cartridge and must be dumped to cards before the Initial Load procedure can be started. The dump is accomplished by loading the Monitor 2 cold start card supplied with the cartridge.

Operating Procedure

- Place the pre-load cartridge on any drive on the system and ready the drive
- Set the physical drive number of the drive containing the pre-load cartridge in console entry switches 12-15

Switches 12-15 off,	drive 0
Switch 15 on,	drive 1
Switch 14 on,	drive 2
Switch 15, 14 on,	drive 3
Switch 13 on,	drive 4

- Place the cold start card in the reader wired for IPL and ready the reader.

  -- If the IPL device is a 1442-6 or 7, place the blank cards directly behind the cold start card.

  -- If the IPL device is a 2501 and the system has a 1442, place the blank cards in the 1442 but do not ready the 1442. Make the 1442 ready when the the system WAITs after the cold start program is loaded.

- With the console Mode switch set to RUN, press IMM STOP, RESET, and PROGRAM LOAD

The cold start card is read in and punching begins. If the punch is a 1442-5, the first card will be blank. Throw the blank card away. If the punch runs out of cards or is not-ready as in the latter case listed above, the system executes a standard pre-operative WAIT at $PRET. Ready the punch unit and press PROGRAM START to continue. If a punch or feed error occurs, refer to the writeup on 1442 Errors and Operator Procedures in the System Library section of this manual.

The dump of the Monitor system requires approximately 3000 cards.

INITIAL LOAD (CARD SYSTEM)

The user must prepare an initial load mode control card and system configuration cards (REQ) and insert these cards into the System Loader deck. These System Loader control cards must be present before the Monitor system can be loaded. An optional CORE card may also be used. See Figure 15 for the placement of these cards. The card formats are listed below.

User-Punched System Loader Control Cards

The following System Loader control cards are punched by the user (see Figure 15).

Load Mode Control Card. The load mode control card informs the system whether the operation is an initial load or a reload. In addition, the Assembler and/or FORTRAN Compiler can be deleted from the system through the use of the load mode control card. The load mode control card is placed behind the last card of the first part of the System Loader.

The format of the user-punched load mode control card is as follows.

Card Column	User Entry
1-4	MODE
8	I (initial load) or R (reload)
12	A (do not load Assembler) or blank (load Assembler)
13	F (do not load FORTRAN) or blank (load FORTRAN)

Note: If FORTRAN and/or the Assembler are deleted they cannot be reloaded using the reload procedure. They must be loaded by an initial load.

System Configuration Cards (REQ). The system configuration cards are user-punched REQ cards that identify

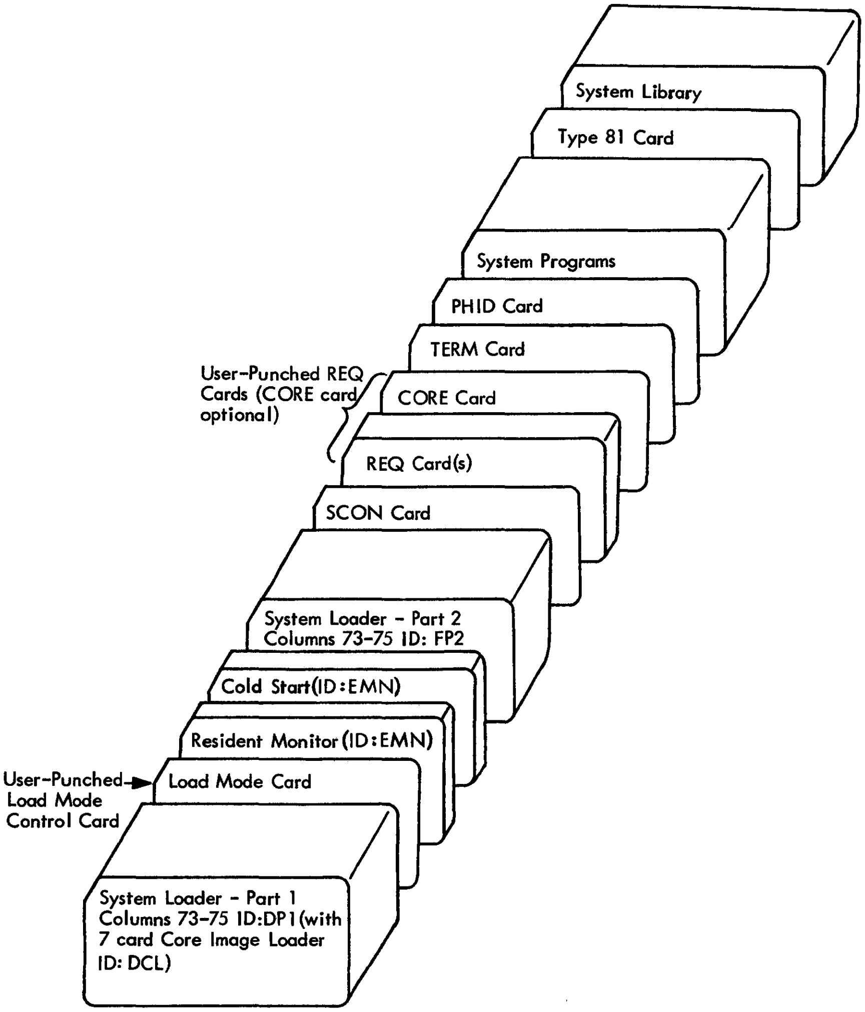

System Library
Type 81 Card
System Programs
PHID Card
TERM Card
User-Punched REQ Cards (CORE card optional)
CORE Card
REQ Card(s)
SCON Card
System Loader - Part 2 Columns 73-75 ID: FP2
Cold Start(ID:EMN)
Resident Monitor (ID:EMN)
User-Punched Load Mode Control Card
Load Mode Card
System Loader - Part 1 Columns 73-75 ID:DP1 (with 7 card Core Image Loader ID: DCL)

Figure 15. IBM System Load

the system I/O devices that are a part of the user's system. If an REQ card specifies the 1442, columns 15-20 of that card must contain the model number, as indicated on the REQ card format chart.

The format of the REQ cards required by the System Loader are listed below. The user should punch only those cards that identify units on the system currently being generated. Punch one card for each device. Missing or extraneous REQ cards may cause initial load operations to fail. The REQ cards must be placed between the SCON card and the TERM card in the IBM system deck.

NOTES:
1. Those I/O devices not listed on the following chart are initialized as part of the system. REQ cards are not required.
2. The principal printer is defined as the fastest printer entered on an REQ card.

	Card Columns			
Device	1-3	9-10*	15-20	
1442 Card Read Punch or 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	

*ISS numbers, right justified. Maximum entry number ISS 20.

CORE Card (Optional). An optional user-punched control card CORE may be placed anywhere between the SCON and TERM cards in the IBM system deck. If this card is used, the calculated (actual) core size of the system is replaced by the core size defined in the CORE card.

The format of the CORE card is as follows.

	Card Columns	
User-Defined Core Size	1-4	6-8
4K	CORE	04K
8K	CORE	08K
16K	CORE	16K
32K	CORE	32K

IBM-Supplied System Loader Control Cards

The following System Loader control cards are supplied with the IBM system (see Figure 15) and must be present in the IBM system deck on any system load.

SCON and TERM Card. These cards (supplied with the card system), together with the user-punched REQ cards, make up the system configuration deck. The system configuration deck must be included in the System Loader for any system load or reload. The format of the SCON and TERM cards are listed below.

SCON card, columns 1-4: SCON
TERM card, columns 1-4: TERM

Phase Identification Card (PHID). The PHID card contains the beginning and ending phase numbers of the various programs in the IBM system deck. All numbers in the phase ID field of the PHID card are in ascending sequence and in the order in which the system decks occur. The Resident Monitor and Cold Start Program have no phase IDs and are included in part 2 of the System Loader. The entries in the PHID card are loaded into the System Location Equivalence Table (SLET) and SLET is then used by the system as an internal directory to the Monitor programs.

The format of the PHID card is as follows.

Card Columns	Entry
1-4	PHID
6-8 10-12	Phase IDs of first and last DUP phases
14-16 18-20	Phase IDs of first and last FORTRAN Compiler phases
22-24 26-28	Phase IDs of first and last Assembler phases
30-32 34-36	Phase IDs of first and last Supervisor phases
38-40 42-44	Phase IDs of first and last Core Load Builder phases
46-48 50-52	Phase IDs of first and last System Device Subroutine phases
54-56 58-60	Phase IDs of first and last Core Image Loader phases
66-68	Vxx (xx is the version number)
70-72	Mxx (xx is the modification number)
73-80	Card identification and sequence number

TYPE 81 Card. During an initial load, the type 81 card causes the principal print device and the principal I/O device entries to be placed in SLET. The Disk Communications Area (DCOM) and Location Equivalence Table (LET) are initialized and the Reload Table is established during an initial load. The IBM System Library is loaded following the reading of the type 81 card. The format of the type 81 card is as follows.

Column 3: 6 punch
Column 4: 1 punch

Operating Procedures

- Initialize a cartridge using DCIP (see Disk Cartridge Initialization Program)
- Prepare the required user-punched control records (see User-Punched System Loader Control Cards)
- Remove the Cold Start card, the stand-alone utilities, and the sample programs from behind the System Library.

After the disk cartridge has been initialized by DCIP and the user-punched System Loader control cards inserted in the IBM system deck, the Monitor system is ready to load. The complete system, ready for loading, is illustrated in Figure 15.

The steps necessary to perform a system load are as follows.

- Ready the selected disk drive
- Ready the Console Printer and the principal printer
- Set the physical drive number of the drive containing the initialized cartridge in console entry switches 12-15.

  Switches 12-15 off, drive 0
  Switch 15 on, drive 1
  Switch 14 on, drive 2
  Switch 14, 15 on, drive 3
  Switch 13 on, drive 4

- With the console Mode switch set to RUN, press IMM STOP and RESET.
- Place the IBM system deck in the hopper of the reader wired for initial program load (IPL).
- Press reader START. If both a 2501 and a 1442 model 6 or 7 are present, place the 1442 in a not-ready status.
- Press PROGRAM LOAD on the console.

After the type 81 card has been read, the Auxiliary Supervisor calls DUP directly to store the System Library. After the last program of the System Library has been stored, the Monitor system is on disk and can be made operational by a user-initiated cold start.

SYSTEM RELOAD (CARD SYSTEM)

The Monitor programs are divided into phases so that if changes are made within a program, only the affected phase needs to be reloaded. As in initial load, the user-punched load mode control card and REQ cards are required with the System Loader. The only difference is that the load mode control card for a reload must have an R in column 8. The programs or program phases being loaded by the reload procedure must be placed directly behind the IBM-supplied phase identification (PHID) card.

When using a 2501 Card Reader, the double-buffering procedure in the System Loader requires a blank card following the type 81 control card. The message END RELOAD will be printed by the Console Printer when the reload is completed.

If the Assembler or FORTRAN Compiler were deleted on initial load or deleted by a DUP DEFINE VOID operation, they cannot be reloaded using the reload procedure. They must be loaded by an initial load.

A useful option provided by the reload function is the ability to reconfigure a system cartridge with different I/O devices. Reconfiguration will be necessary if a system cartridge is copied from a system with a different configuration. The reload deck listed below will perform this function. (To reconfigure only, place the Type 81 card directly after the PHID card.)

- System Loader deck, part 1, with Core Image Loader
- Load mode control card (R in column 8)
- Resident Monitor/cold start deck
- System Loader deck, part 2
- System configuration deck:
  SCON card
  REQ cards } System reconfigured
  CORE card (optional) } if desired
  TERM card
- PHID card
- (Revised programs or program phases)*
- Type 81 control card
- Blank card

*All decks must have phase ID numbers within the limits of the IDs listed on the PHID card.

During a reload operation, loading terminates with the reading of the type 81 card, and the printing of END RELOAD.

Operating Procedures

With the console Mode switch set to RUN, press PROGRAM STOP on the console.

- Ready the selected disk drive.
- Ready the Console Printer
- Set the physical drive number of the drive containing the cartridge to be reloaded in console entry switches 12-15.
  Switches 12-15 off, drive 0
  Switch 15 on, drive 1
  Switch 14 on, drive 2
  Switch 14, 15 on, drive 3
  Switch 13 on, drive 4
- Press RESET on the console
- Place the reload deck (see listing above) in the reader wired for IPL.
- Press reader START. If both a 2501 and a 1442 model 6 or 7 are present, place the 1442 in a not-ready status.
- Press PROGRAM LOAD on the console.
- Perform a cold start to make the revised Monitor system operational.

System Program Phase Sector Break Cards

In order to allow the user to load only a portion of a Monitor program, the programs are divided into phases, each identified by a sector break card. The user can load the revised phase using the reload procedure and then place the revised phase in the IBM system deck in place of the phase it replaces.

The sector break cards identifying the phases of the IBM system programs are listed below. Sector break cards (see Appendix C) have a 1 punch in column 4. The version and modification level are punched in the cards starting at column 67 (VxMxx).

Phase Number	Program or Program Phase Name		ID Starting in Column 73
XX	RESIDENT IMAGE	Part of	ERI
	COLD START PROGRAM	System Loader	EST
	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 INPUT W/O KEYBOARD		J17
10	DUP PAPER TAPE I/O		J17
11	DUP STORE CI		J17

Phase Number	Program or Program Phase Name	ID Starting in Column 73
12	DUP MODIF DUMMY PHASE	J17
	FORTRAN Compiler	
1F	FOR INPUT PHASE	K01
20	FOR CLASSIFIER PHASE	K02
21	FOR CHECK ORDER/STMNT NO. PH	K03
22	FOR COMMON SUBR OR FUNCTION PH	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 PH	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
	ASSEMBLER	
51	ASM INITIALIZATION PHASE	M01
52	ASM CARD CONVERSION PHASE	M02
53	ASM DSF OUTPUT PHASE	M03
54	ASM INTERMEDIATE INPUT PHASE	M04
55	ASM END STATEMENT PHASE	M05
56	ASM ASSEMBLY ERROR PHASE	M06
57	ASM CONTROL CARDS 1	M07
58	ASM CONTROL CARDS 2	M08
59	ASM DUMMY PH (SYST SYMBOL TBL)	M09
5A	ASM SYMBOL TABLE OPTIONS PHASE	M10
5B	ASM EXIT PHASE	M11
5C	ASM PROG HEADER MNEMONICS PH	M12
5D	ASM FILE STATEMENT PHASE	M13
5E	ASM COMMON SUBROUTINES, ASCOM	M14
5F	ASM PROG CONTROL MNEMONICS PH	M15
60	ASM IMPERATIVE STATEMENTS PH	M16
61	ASM DECML XFLC PROCESSING PH	M17
62	ASM DECIMAL CONVERSION PHASE	M18
63	ASM PROG LINKING PHASE	M19
64	ASM DMES PROCESSING PHASE	M20
65	ASM PUNCH CONVERSION PHASE	M21
66	ASM INTERMEDIATE DISK OUTPUT	M22
67	ASM SYMBOL TABLE OVERFLOW	M23
	SUPERVISOR	
6E	SUP PHASE 1 - MONITOR CONTROL RECORD ANALYZER	N01
6F	SUP PHASE 2 - XEQ CONTROL AND PROCESSOR SUPERVISOR CONTROL RECORD PROCESSOR	N01
70	SYSTEM DUMP-CORE-TO-PRINTER	N02
71	AUXILIARY SUPERVISOR	N03
	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
	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

INITIAL LOAD (PAPER TAPE SYSTEM)

The tapes constituting the complete Paper Tape Monitor System, including the user-punched control record tapes are'listed below.

Tape Number	Description
1	System Loader, Part 1
-	Load Mode Control Record (User-punched)
2	System Loader, Part 2, with Resident Monitor and Cold Start
-	System Configuration Records (User-punched)
3	Phase Id. (PHID) Control Record
4	Disk Utility Program
5	FORTRAN Compiler
6	Assembler
7	Supervisor, Core Load Builder, System I/O Subroutines, Core Image Loader
8	End of System Tapes Control Record (Type 81 record)
9	Standard LIBFs and CALLs
10	Extended Precision LIBFs and CALLS
11	Common LIBFs and CALLs
12	ILS, ISS, Conversion and Utility Subroutines
13	Plotter Subroutines
14	SCA Subroutines
15	Cold Start Paper Tape Record
16	DCIP Disk Cartridge Initialization Program
17	PTUTL Paper Tape Utility Program
18	Paper Tape Reproducing Program
19	1132/1403 Printer Core Dump from /01E0
20	Console Printer Core Dump

Tape 15 is used to initialize the Monitor system after it is loaded. Tapes 16-20 are stand-alone utilities and are not loaded as part of the Monitor System; however, PTUTL and DCIP are used during the loading process. Tapes 21 and 22 are the Monitor system sample programs

NOTE: If the FORTRAN Compiler and/or the Assembler are not be be loaded during an initial load, the corresponding tapes (7 and/or 8) need not be read. If the FORTRAN Compiler and/or the Assembler are not loaded, they cannot be loaded using the reload procedure. They must be loaded by an initial load.

System Loader Control Records

With the exception of the Load Mode Control Record and the System Configuration Records, all of the paper tape control records needed to load the Paper Tape Monitor System to disk storage are supplied to the user by IBM. These control records have the same functions as the corresponding IBM-supplied and user-punched control cards (see Initial Load (Card System)). The Load Mode Control record and System Configuration records must be prepared by the user. If these tapes are not prepared correctly, the System Loader will print an error message during system load (see Appendix A). A user-punched CORE record is optional.

Preparation of Load Mode and System Configuration Control Tapes

Paper tape control records must be punched in PTTC/8 (Perforated Tape Transmission Code). The formats are the same as the previously-described card formats. Paper tape control records must be separated by one NL (new line) control character. A control record that immediately follows paper tape data not followed by an NL code must be preceded by one NL code. Delete codes may precede or follow this NL code.

To initially generate a system cartridge the necessary control records can be punched using a stand-alone paper tape utility program (PTUTL).

To load the PTUTL program tape, perform the following steps:

- Place the PTUTL tape in the Paper Tape Reader, positioning the tape so that one of the delete codes beyond the program ID in the tape leader is under the read starwheels.

- With the console Mode switch set to RUN, press IMM STOP, RESET, and PROGRAM LOAD.

- PTUTL is read in and the program WAITs with /1111 in the Accumulator.

- Set console entry switches 2 and 3 on. Functions requested by these switches are:

  Switch 2-accept Keyboard input
  Switch 3-punch records on the 1055 Paper Tape Punch

  NOTE: Complete operating procedures for PTUTL are contained in the writeup for the System Library version of the Paper Tape Utility Program (see Paper Tape Utility (PTUTL).

- Ready the Paper Tape Punch. Be sure to punch a leader of delete codes.

- Use the Keyboard to prepare the user-punched System Loader control records.

Paper Tape Load Mode Record

Steps in preparation are:

- Write MODE using Keyboard input.
- Space 3 times.
- Write I or R for initial load or reload operation.
- Space 3 times.
- If the Assembler is not to be loaded write A, otherwise space 1.
- If the FORTRAN Compiler is not to be loaded write F, otherwise space 1.
- Press EOF on the Keyboard if no mistakes were made, otherwise press ERASE FIELD and repeat the above procedure.
- Create a trailer (and new leader) of delete codes on the paper tape punch.

Paper Tape System Configuration Tape

Steps in preparation are:

- Write SCON using keyboard input.
- Press EOF to end the SCON record.
- Write REQ
- Space 6 (or 5 in cases of a 2 digit ISS number)
- Write the ISS number for an I/O device to be configured into the system (see System Configuration Cards (REQ) for the required ISS numbers).
- Press EOF. Repeat the preceding three steps until all necessary REQ records have been punched.
- A CORE record may be added if desired. Its format is identical to the card system description.
- Write TERM
- Press EOF to end the TERM record and Configuration tape.
- Create a trailer of delete codes on the Paper Tape Punch.

Operating Procedure

- Initialize a cartridge using DCIP (see Disk Cartridge Initialization Program)
- Prepare the required user-punched control records (see Preparation of Load Mode and System Configuration Control Tapes)

After the disk cartridge has been initialized by DCIP and the user-punched System Loader control record tapes generated, the Monitor system is ready to load.

The steps necessary to perform a system load are as follows.

- Ready the selected disk drive
- Ready the Console Printer and principal printer
- Set the physical drive number of the drive containing the initialized cartridge in console entry switches 12-15.
  Switches 12-15 off, drive 0
  Switch 15 on, drive 1
  Switch 14 on, drive 2
  Switch 14, 15 on, drive 3
  Switch 13 on, drive 4
- Place the System Loader Part 1 (Tape 1) in the Paper Tape Reader.

  When loading tapes, position any of the delete codes following the program ID in the tape leader under the read starwheels.
- With the console Mode switch set to RUN, press IMM STOP, RESET, and PROGRAM LOAD

  Tape 1 is read in and the system WAITs at $PST4 or $PRET.
- Place the user-punched Load Mode control record tape in the reader and press PROGRAM START.

  This tape is read in and the system again waits at $PST4 or $PRET.
- Place the System Loader Part 2 (Tape 2) in the reader and press PROGRAM START. The system will WAIT after loading.
- Place the user-punched System Configuration Tape in the reader and press PROGRAM START. The system will WAIT.
- Load tapes 3 through 14 as required using the same procedure.

NOTE: If the FORTRAN Compiler and/or Assembler are to be deleted, tapes 5 and/or 6 need not be loaded. Load only those System Library Tapes (9 through 14) that are required for your system.

After the last required System Library Tape has been loaded, the Monitor system is on disk and can be made operational by a user-initiated cold start.

SYSTEM RELOAD (PAPER TAPE SYSTEM)

During a reload of system programs or a system reconfiguration, all System Loader Control record tapes must be used. A typical paper tape reload would include:

Tape 1
User-punched Load Mode Control record
(R for reload)

Tape 2
User-punched System Configuration tape (revised if system is being reconfigured)

Tape 3
(Revised programs or program phases)*

Tape 8

*All programs must have phase ID numbers within the limits of the IDs listed on the PHID tape.

If the Assembler or FORTRAN Compiler were deleted on initial load or deleted by a DUP DEFINE VOID operation, they cannot be reloaded using the reload procedure. They must be loaded by an initial load.

For further information regarding reload, see System Reload (Card System).

The Supervisor initially achieves control over the 1130 Monitor System through the user-initiated Cold Start procedure. The Cold Start procedure begins with the IPL (Initial Program Load) of the Cold Start record, which causes the Cold Start program to be read into core storage from the system cartridge and control to be transferred to it.

The Cold Start program, in turn, loads the Resident Monitor into its location in lower core storage. The Cold Start procedure ends when control is given to the job initialization program in the Supervisor.

NOTE: Do not perform a cold start with an uninitialized cartridge on line.

Cold Start Procedure

To perform a cold start:

- Ready the principal print device.
- Set the physical drive number of the drive containing the system cartridge in console entry switches 12-15.
  Switches 12-15 off, drive 0
  Switch 15 on, drive 1
  Switch 14 on, drive 2
  Switch 15, 14 on, drive 3
  Switch 13 on, drive 4
- Ready the selected disk drive.
- Press IMM STOP and RESET on the console.
- Ready the Console Printer.
- Place the cold start record in the reader wired for IPL (Tape 15, paper tape system).
- Press reader START. If both a 2501 and 1442 model 6 or 7 are present, place the 1442 in a not-ready status.
- Press PROGRAM LOAD on the console.

When the Cold Start record is read, a dummy // JOB record is printed on the principal printer and the Supervisor prints cartridge status information as follows.

```
LOG DRIVE   CART SPEC   CART AVAIL   PHY DRIVE

  XXXX        XXXX         XXXX        XXXX
```

where

LOG DRIVE is always zero

CART SPEC is the cartridge ID written on the cartridge by DCIP.

CART AVAIL is the same as CART SPEC.

PHY DRIVE is the physical drive number selected in the console entry switches. This physical drive is now logical zero.

The Monitor system is now operational and is ready to receive the first JOB record from the reader. If an attempt is made to cold start a non-system cartridge, an error message -- NON-SYST. CART ERROR -- is printed on the Console Printer.

The table below lists the error stops contained in the Cold Start Loader (i.e., card or paper tape).

Absolute Address	Explanation
/0014	-Invalid disk drive number in Console Entry Switches -Indicated disk drive not ready
/0044	-Disk read error -Waiting for interrupt from seek operation
/0046	-Waiting for interrupt from reading sector @IDAD

These utility programs -- each self-loading and complete with subroutines -- are separate from the System Library and enable the user to perform operations without Monitor system control. The first three programs are available in card and paper tape, the last two in paper tape only. The utility programs are:

- Console Printer Core Dump
- Printer Core Dump
- Disk Cartridge Initialization Program (DCIP)
- Paper Tape Utility (PTUTL)
- Paper Tape Reproducing

CONSOLE PRINTER CORE DUMP

This program aids the user in debugging programs by dumping selected portions of core on the Console Printer.

Format

Each core location is dumped as a four-digit hexadecimal word with a space separating each word. The first word dumped is the starting address of the dump (as specified in the console entry switches).

Operating Procedures

- With the console Mode switch set to RUN, press IMM STOP and RESET on the console.
- Place the Console Printer Core Dump program in the reader wired for IPL and ready the reader (if the system configuration is 2501, 1442-6 or -7, make the 1442 not-ready).
- Set the margin on the Console Printer. To print the same format on each line set the number of print positions to a multiple of 5.
- Set the starting address (in hexadecimal) in the console entry switches.
- Press PROGRAM LOAD.

Dumping continues until IMM STOP is pressed. To continue, press PROGRAM START.

PRINTER CORE DUMP

This program dumps core in hexadecimal format on either the 1403 Printer or the 1132 Printer, whichever is in a ready status. If both are ready, the dump will be on the 1403.

NOTE: "Not present" is equivalent to "not ready".

Format

Dumping starts at location $ZEND. Each line contains a four-digit hexadecimal address, followed by 16 four-digit hexadecimal words. A space separates the address and each word in the printed line. An additional space is inserted between each group of four words.

To decrease dump time, the program does not print consecutive duplicate lines. Before printing a line, it compares the next 16 words with the 16 words just printed. If they are identical, the program goes on to the next 16 words in core. If they are not identical, the printer spaces one line and prints. The address printed is that of the first word on the line.

Operating Procedures

- With the console Mode switch set to RUN, press IMM STOP and RESET.
- Place the Printer Core Dump program in the reader wired for IPL and ready the reader. (If the system configuration is 2501, 1442-6 or -7, make the 1442 not-ready.)
- Ready the printer.
- Press PROGRAM LOAD.

Dumping starts at location $ZEND and continues to the end of core. The user may halt the dump at any time by pressing IMM STOP. Press PROGRAM START to continue on the 1403. The 1132 has no restart capabilities.

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

Initialization

- Writes a sector address on every sector, including defective sectors.
- Determines which, if any, sectors are defective and fills in the defective cylinder table accordingly.
- Establishes a file-protected area for the disk cartridge.
- Puts an ID on the disk cartridge.
- Establishes a DCOM, LET, and CIB.

Initialization of a cartridge is required before the Monitor system can be loaded.

The disk I/O subroutines operate with up to three defective cylinders, i.e., three cylinders that contain one or more defective sectors.

Cylinder zero must not be a defective cylinder; otherwise, the cartridge cannot be initialized.

At the completion of disk initialization, a four-word table is written on sector@IDAD. Words 1, 2, and 3 contain the address of sector zero of any defective cylinders found (maximum of three). When there are no defective cylinders, these words contain /0658, e.g., the table for a cartridge with a defect only in sector 9 (cylinder 1) would contain:

/0008
/0658
/0658

Word 4 contains the cartridge ID. The copy code (word 5) through word 270 is cleared to zero, and the Cold Start Error Message (including the program to type the message) is stored on sector @IDAD starting at word 271.

After sector @DCOM has been cleared to zeros, certain parameters are initialized to indicate that this is a non-system cartridge. The parameter set, including their initial values, are listed below:

#ANDU	/0180 (disk block address)	End of User Area, adjusted (update during JOB T)
#BNDU	/0180 (disk block address)	End of User Area, base
#FPAD	/0018 (sector address)	File protect address on this cartridge
#CIDN	XXXX	Cartridge ID of this cartridge
#CIBA	/0008 (sector address)	First sector of CIB on this cartridge
#ULET	/0002 (sector address)	First sector of LET on this cartridge

An initial LET is also created on sector @RIAD. Its contents are as follows:

Word 1	LET sector number	/0000	
Word 2	Sector address of UA	/0018	
Word 3	Reserved	/0000	
Word 4	Words available in this sector	/0138	
Word 5	LET/FLET chain address	/0000	(Last LET/FLET sector)
Word 6	1st Word of 1DUMY entry	/7112	1DUMY in packed
Word 7	2nd Word of 1DUMY entry	/4568	truncated EBCDIC
Word 8	Size of 1DUMY	/6280	(Size of WS available in disk blocks)

Words 9-320 of @RIAD all contain zero.

Copy

The disk copy subroutine of DCIP

- Checks to ensure that both the cartridge to be copied and the cartridge onto which the copy is to be made have been correctly initialized.
- Copies a cartridge from any drive onto a cartridge on any other drive, making allowances for defective cylinders. The cartridge ID, copy code, and defective cylinder table are not copied from the source cartridge. Both Version 1 and Version 2 cartridges may be copied.

Dump

The disk dump subroutine of DCIP

- Dumps any disk sectors from any drive.
- Prints the dump on the fastest printer on the system (in the order of speed -- 1403, 1132, or Console Printer).

The address of the first sector to be dumped and the number of consecutive sectors to be dumped are specified in the console entry switches.

Each sector printout is 20 lines -- 16 four-digit hexadecimal words per line. Two sectors are printed on each page and each sector is preceded by a 3-word header. The first digit of the first header word is the drive number. The remaining three digits of the first header word show the physical sector address of the sector being dumped. The second header word is the sector address that actually appears on the sector being dumped. The third word is the logical sector address, taking into account any defective cylinders. If the user dumps a sector that is in a defective cylinder, the third word will contain the letters DEFC.

Operating Procedures

- With the console Mode switch set to RUN, press IMM STOP and RESET on the console.

- Place the Disk Cartridge Initialization Program in the reader wired for IPL and ready the reader.

  If the system configuration is 2501-1442, make the 1442 not-ready. (On the paper tape system, place the DCIP tape in the reader, positioning the tape so that one of the delete codes following the program name in the leader is under the read starwheels.)

- Press PROGRAM LOAD.

- After the program is loaded, the following message is printed on the Console Printer.

```
TURN ON SW0 TO INITIALIZE
  SW1 TO COPY
  SW2 to DUMP
```

- Turn on console entry switch 0, 1, or 2 and press PROGRAM START.

NOTES:

1. At any point in this program, an invalid entry in the console entry switches will cause the following message to be printed.

   ```
   ENTRY ERROR ... RETRY
   ```

   Correct the error and press PROGRAM START to continue.
2. If a drive is not ready, the standard preoperative trap to $PRET is made. The Accumulator contains /50X0 where X is the number of the physical drive that is not ready.
3. All console entry switch settings are printed on the Console Printer as 4-digit hexadecimal numbers.
4. DCIP messages refer to console entry switches as "bit" switches.
5. If the system has two card readers, only the reader wired for IPL should be in the ready state.
6. A DCIP function can be aborted at any time by pressing keyboard INT REQ. The user is then given the option of repeating the current function or selecting a new function.

Initialization (Console Entry Switch 0 On)

- If console entry switch 0 is on, the following message is printed.

```
ENTER DR. NO. IN BITS 12-15
  TURN ON BIT 0 FOR ADDRESSES ONLY
```

Enter the physical drive number of the cartridge being initialized (in binary) in console entry switches 12-15.

- Turn console entry switch 0 off if the cartridge is being initialized. (The entire disk surface is cleared, disk addresses are written, and three distinct bit patterns are written and read back for checking purposes. In addition, the following message and a program for printing it is written on sector @IDAD, starting at word 271.

```
NON-SYST. CART ERROR
```

When the Monitor system is loaded to disk, this message is overlaid by the Cold Start program; therefore, an attempt to cold start a <u>non-system</u> cartridge will result in the above message being printed.

- Leave console entry switch 0 on if addresses only are being written (any data on the cartridge is retained).

- Press PROGRAM START.

- If console entry switch 0 is on, addresses are written on the disk and the following message is then printed.

```
ADDRESSING COMPLETE
```

The program now returns to accept the next DCIP function and the option messages are reprinted.

- If console entry switch 0 is off, the following message is printed.

```
ENTER CARTRIDGE ID
```

Turn off all console entry switches and enter the cartridge ID in console entry switches 1-15 (four hexadecimal characters). A valid cartridge ID is a number between /0001 and /7FFF.

- Press PROGRAM START. The cartridge ID is printed.

```
XXXX
```

- The cartridge is initialized and the following message is printed.

```
INITIALIZATION COMPLETE
```

In addition, one of the following messages is printed.

```
NO DEFECTIVE CYLS
```

or

```
DEFECTIVE CYLS FOLLOW
XXXX. . .
```

If more than 3 defective sectors are printed, or if cylinder zero is defective, or if the sector address cannot be written on every sector, the cartridge cannot be used with the Monitor system and the following message is printed:

CARTRIDGE DEFECTIVE

The last message printed is:

TURN ON SW 0 FOR ADDITIONAL TESTING

- Set console entry switch 0 as desired and press PROGRAM START.
- If console entry switch 0 is off, the program returns to accept the next DCIP function.

  If console entry switch 0 is on, the following message is printed.

  ENTER REPETITION COUNT IN BITS 11-15

  Enter the repetition count (max. 31) in binary in console entry switches 11-15. This will give additional opportunity to find marginal cylinders and reduce chances of disk errors later on.
- Press PROGRAM START.

  Initialization is repeated with each cylinder being checked with each pattern the number of times specified in the repetition count. When the pass is completed, the initialization complete messages are repeated, including any new defective cylinders found and the user is again given the option to repeat the initialization, or select the next DCIP function. All new cartridges must be initialized by DCIP.

Copy (Console Entry Switch 1 On)

- If console entry switch 1 is on, the following message is printed.

  ```
  ENTER. . . SOURCE DR.  (BITS 0-3)
             OBJECT DR.  (BITS 12-15)
  ```

  Enter the physical drive number of the source drive (in binary) in console entry switches 0-3. Enter the drive code of the object drive (in binary) in console entry switches 12-15.
- Press PROGRAM START.

  If the cartridge on either the source or object drive has not been initialized, the following message is printed.

  X DR. NOT INITIALIZED

  The program now returns to accept the next DCIP function and the option messages are printed.

  If both drives have been initialized, the contents of the source cartridge (less defective sector data and cartridge ID) is copied on the object cartridge.

  Word 5 of sector @IDAD of the source cartridge (zero when the cartridge is initialized) is incremented by 1 when writter on the object cartridge. The copy number of the object cartridge will thus always be one more than the copy number of the source cartridge.

NOTE: When copying is complete, the program returns to select the next DCIP function and the option messages are printed. If a disk read/write error occurs, the following message is printed.

DISK ERROR. . . TURN ON SW 0 TO RETRY

At the WAIT, the Accumulator contents will be /0001 for a read error or /0002 for a write error. The Extension will contain /XYYY where X is the drive code and YYY is the address of the sector in error.

Turn console entry switch 0 on and press PROGRAM START to rewrite or reread the sector in error.

Leave console entry switch 0 off and press PROGRAM START to ignore the error and continue. If the error is ignored, the contents of the object cartridge will reflect the last attempt to copy the sector in error.

Dump (Console Entry Switch 2 On)

- If console entry switch 2 is on, the following message is printed.

  ```
  ENTER. . . PHYS. DR. NO.  (BITS 0-3)
             FIRST SECTOR (BITS 4-15)
  ```

  Enter the physical drive number of the drive containing the cartridge to be dumped in console entry switches 0-3. Enter the address of the first sector to be dumped in console entry switches 4-15 (hexadecimal, maximum /0657).
- Press PROGRAM START.

  The following message is printed.

  ENTER NO. OF SCTRS. TO DUMP

  Enter the number of consecutive sectors to be dumped as a right-justified hexadecimal number in the console entry switches. The maximum amount will depend on the starting sector address.
- Press PROGRAM START.

  The requested number of sectors will be dumped. When the dump is complete, the program returns to accept the next DCIP function and the option messages are printed.

  NOTE: If a disk read error occurs, the following message is printed.

  DISK ERROR. . . TURN ON SW 0 TO RETRY

  Turn console entry switch 0 on and press PROGRAM START to read the sector in error. If the reread is successful, the sector is printed and the dump continues.

Leave console entry switches 0 off and press PROGRAM START to ignore the error and continue. The sector in error is printed as it was last read from the disk.

PAPER TAPE REPRODUCING PROGRAM

This program, available only with the paper tape system, is a self-loading paper tape strip that reproduces paper tapes. The program reads a character and punches it with no intermediate conversion.

Operating Procedure

- Place the paper tape reproducing program tape in the paper tape reader, positioning the tape so that one of the delete codes beyond the ID in the leader is beneath the read starwheels.
- With the console Mode switch set to RUN, press IMM STOP, RESET, and PROGRAM LOAD on the console. The reproducing program is read in and WAITs with /1111 in the Accumulator.
- Remove the reproducing program tape and place the tape to be reproduced in the reader. Place blank tape in the tape punch unit and produce several inches of delete code leader by first pressing down and holding the DELETE key. Then press the FEED key and hold until a leader of sufficient length has been punched. Release the FEED key before releasing the DELETE key.
- Press PROGRAM START to begin the tape reproducing operation. The program continues to operate until the paper tape reader goes not-ready, indicating that there is no more tape to be read. The tape reproducing routine then WAITs with /2222 in the Accumulator. If the paper tape punch is not-ready, the tape reproducing program WAITs with /3333 in the Accumulator. To restart, ready the paper tape punch, and press PROGRAM START. An unlimited number of tapes can be reproduced by this program. Be sure to create a trailer (and leader) of delete codes between the output tapes if the tapes are to be separated.

NOTE: If the PROGRAM STOP key is pressed while the program is in operation, the program WAITs with /4444 in the Accumulator. Press PROGRAM START to continue.

STAND-ALONE PAPER TAPE UTILITY PROGRAM (PTUTL)

This program, also included as an executable program in the System Library, is a self-loading paper tape utility program that allows the user to enter records from the 1134 Paper Tape Reader or the Keyboard. Program output is to the 1055 Paper Tape Punch and/or the Console Printer.

Operating Procedures

- Place the PTUTL tape in the paper tape reader so that one of the delete codes beyond the program ID is under the read starwheels.
- With the console mode switch set to RUN, press IMM STOP, RESET, and PROGRAM LOAD on the console.
- PTUTL is read in and the system WAITs with/1111 in the Accumulator.
- For complete operating instructions for PTUTL, see Paper Tape Utility (PTUTL) in the System Library.

APPENDIX A. MONITOR SYSTEM ERROR AND OPERATIONAL MESSAGES

With the exception of the System Library Mainline Programs, this appendix lists all Monitor System WAITs and messages. SYSUP, the DCOM update subroutine, is also available in the System Library. The errors for the user callable version of SYSUP are listed in the System Library Utility Subroutines section of the manual. All messages for stand-alone utilities are included in the writeups of the individual programs.

System Loader and FORTRAN I/O 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 can be identified by the Fxxx code in the accumulator. A $PRET WAIT also occurs when a system I/O device is required but is not ready (see Table 18).

All error tables in this appendix are listed alphabetically by prefix letter. Unless otherwise noted, the operational and error messages are printed on the principal printer. All Monitor system control records are printed on the principal printer.

The error tables in order of appearance are as follows.

Table Number	Error Code Prefix	Program Name	
8	A	Assembler	
9	C	FORTRAN Compiler	
10	D	Disk Utility Program (DUP)	
11	E	System Loader	
12	F	FORTRAN I/O	
13	M	Monitor Control Record Analyzer (MCRA)	Supervisor
14	M	Supervisor Control Record Program	
15	-	SYSUP	
16	R	Core Load Builder	
17	S	Auxiliary Supervisor	
18	-	ISS Subroutine	

ASSEMBLER MESSAGES AND ERROR CODES

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
XX ERROR(S) FLAGGED IN ABOVE ASSEMBLY

Table 7. Assembler Error Detection Codes

Flag	Cause	Assembler Action
A	Address Error Attempt made to specify displacement field, directly or indirectly, outside range of -128 to +127.	Displacement set to zero
C	Condition Code Error Character other than +, -, Z, E, C, or O detected in first operand of short branch or second operand of long BSC, BOSC, or BSI statement.	Displacement set to zero
F	Format Code Error Character other than L, I, X, or blank detected in col. 32, or L or I format specified for instruction valid only in short form.	Instruction processed as if L format were specified, unless that instruction is valid only in short form, in which case it is processed as if the X format were specified
L	Label Error Invalid symbol detected in label field.	Label ignored
M	Multiply Defined Label Error Duplicate symbol encountered in label field.	First occurrence of symbol in label field defines its value; subsequent occurrences of symbol in label field cause a multiply defined indicator to be inserted in symbol table entry (Bit 0 of first word).
O	Op Code Error Unrecognized op code ISS, ILS, ENT, LIBR, SPR, EPR, or ABS incorrectly placed.	Statement ignored and address counter incremented by 2. Statement ignored
R	Relocation Error Expression does not have valid relocation. Non-absolute displacement specified. Absolute origin specified in relocatable program. Non-absolute operand specified in BSS or BES. Non-relocatable operand in END statement of relocatable mainline program. ENT operand non-relocatable.	Expression set to zero Displacement set to zero Origin ignored Operand assumed to be zero Card columns 9-12 left blank; entry assumed to be relative zero Statement ignored
S	Syntax Error Invalid expression (e.g., invalid symbol, adjacent operators, illegal constant) Illegal character in record. Main program entry point not specified in END operand. Incorrect syntax in EBC statement (e.g., no delimiter in card column 35, zero character count). Invalid label in ENT or ISS operand.	Expression set to zero If illegal character appears in expression, label, op code, format, or tag field, additional errors may be caused. Card columns 9-12 left blank; entry assumed to be relative zero Card columns 9-12 not punched; address counter incremented by 17. Statement ignored
T	Tag Error Card column 33 contains character other than blank, 0, 1, 2, or 3 in instruction statement.	Tag of zero assumed
U	Undefined Symbol Undefined symbol in expression	Expression set to absolute zero

If LIST DECK or LIST DECKE is specified, the error detection codes shown in Table 7 are punched in columns 18 and 19. For the first error detected in each statement the Assembler stores and then punches the code in column 18; the code for a second error is stored, overlaid by any subsequent errors, and punched in column 19. Thus, if more than two errors are detected in the same statement, only the first and last are indicated. These error detection codes will appear on the printout if the deck is listed.

At the end of the assembly, a message is printed indicating the number of assembly errors detected in the source program (see above). Since no more than two errors are flagged per statement, the error count may exceed the actual number of flags.

Assembler error messages are listed in Table 8.

FORTRAN MESSAGES AND ERROR CODES

Compilation Messages

Near the end of the compilation, core usage information and the features supported (control records used) are printed out as follows:

```
FEATURES SUPPORTED
   EXTENDED PRECISION
   ONE WORD INTEGERS
   TRANSFER TRACE
   ARITHMETIC TRACE
   IOCS
CORE REQUIREMENTS FOR XXXXX
COMMON YYYYY VARIABLES YYYYY PROGRAM YYYYY
```

where XXXXX is the name of the program designated in the *NAME control record or in the SUBROUTINE or FUNCTION statement, and YYYYY is the number of words allocated for the specified parts of the program.

The following message is printed for a normal end of compilation (with or without errors):

```
END OF COMPILATION
```

Compilation Error Messages

During compilation, a check is made to determine if certain errors have occurred. If one or more of these

Table 8. Assembler Error Messages

Error Number and Message	Cause of Error	Corrective Action
A01 MINIMUM W.S. NOT AVAILABLE... ASSEMBLY TERMINATED	Available Working Storage is less than the number of overflow sectors specified plus one sector.	Reduce the number of overflow sectors specified (number specified is zero if no *OVERFLOW SECTORS control record is used) or, If more than one drive is available on the system, use the //JOB record to specify System Working Storage on the cartridge with 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 number of overflow sectors specified.	If this error occurs during pass 1, the system will WAIT at location $PRET with /400E (2501) or /100E (1442) in the accumulator. Press PROGRAM START to continue the assembly in TWO PASS MODE. For pass 2, see options on A01.
A04 SAVE SYMBOL TABLE INHIBITED	With SAVE SYMBOL TABLE option specified: 1. Program is relocatable. 2. Program contains assembly errors. 3. Source program contains more than 100 symbols.	1. Use ABS card and reassembly. 2. Correct source program errors and reassemble. 3. Reduce the number of symbols and reassemble.
A05 XXX ERRONEOUS ORG, BSS, OR EQU STATEMENTS IN ABOVE ASSEMBLY	XXX is the number of ORG, BSS, BES, and/or EQU statements that were undefined in pass 1. At the end of pass 1, these erroneous statements are printed on the principal printer. If the error was due to forward referencing, it will not be detected during pass 2.	Where forward references have been attempted, they must be corrected before the program is reassembled.
A06 LOAD BLANK CARDS	A card containing a non-blank column between 1-71 has been read while punching a symbol table (*PUNCH SYMBOL TABLE specified for this assembly).	The system will WAIT with /100F in the accumulator. Nonprocess run out (NPRO) the card just read. Place blank cards ahead of this card in the hopper. Press reader START and console PROGRAM START. NOTE: If the output is being punched on a 1442-5, a non-blank card cannot be detected. In addition, the punch may be damaged if an attempt is made to punch a hole where a hole already exists.
A07 *LEVEL CONTROL RECORD MISSING	The program listed above was assembled as an ISS subroutine without the required *LEVEL control record.	Reassemble using *LEVEL control record.

errors have been detected the error indications are printed at the conclusion of compilation, and no object program is stored on the 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 those which have been detected are corrected. With the exception of the C00 error message and those noted below, the error message appears in the following format:

```
CNN ERROR IN STATEMENT NUMBER XXXXX+YY
```

NN is the error code number listed in Table 9. With the exception of specification statement errors, XXXXX is the last valid statement number preceding the erroneous statement and YYY is the count of statements from XXXXX to the statement that is in error. If the erroneous statement has a valid statement number, XXXXX will be the statement in error and YYY will not be printed.

For example:

```
105   FORMAT (I5, F8.4)
110   IF (A-B) 10,30,20
      A = A+1.0
ABC   B = B-2.0          (error C01)
135   GO TO 105          (error C43)
```

This example will cause the following error messages to be printed.

```
C01 ERROR IN STATEMENT NUMBER 110 + 002
C43 ERROR IN STATEMENT NUMBER 135
```

For specification statements, XXXXX is always 00000 and YYY is the count of the number of specification statements in error. YYY is never 000, i.e., for the first error YYY is 001. Specification statements are not counted unless they contain an error. Statement numbers on specification statements and statement functions are ignored. NN is the error code.

For example:

```
1   DIMENSION       C(10,10)
2   DIMENSION       D(5,5)
3   DIMENSION       E(I,6,6)    (error C08)
4   DIMENSION       F(4,4)
5   DIMENSION       G(2,2))     (error C16)
```

This example will cause the following error messages to be printed.

```
C08 ERROR AT STATEMENT 00000 + 001
C16 ERROR AT STATEMENT 00000 + 002
```

In addition to the CNN type of error the following error messages may be encountered:

```
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.

```
SUBROUTINE INITIALIZE TOO LARGE
```

During compilation of Sub-programs 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.

If any of these errors are detected during compilation, the message:

```
OUTPUT HAS BEEN SUPPRESSED
```

is also printed.

If a monitor control record is encountered prior to an END card, the message

```
MONITOR CONTROL RECORD ENCOUNTERED
```

is printed, and control is returned to the monitor supervisor.

The above error and the C00 error will interrupt the compilation. In this case the message

```
COMPILATION DISCONTINUED
```

will be printed.

Table 9. FORTRAN Error Codes

Error Number	Cause of Error
C00	WORKING STORAGE EXCEEDED The working storage area on disk is too small to accommodate the compiled program in disk system format.
C01	Non-numeric character in statement number.
C02	More than five continuation cards, or continuation card out of sequence.
C03	Syntax error in CALL LINK or CALL EXIT statement.
C04	Undeterminable, misspelled, or incorrectly formed statement.
C05	Statement out of sequence.
C06	Statement following STOP, RETURN, CALL LINK, CALL EXIT, GO TO, or IF statement does not have statement number.
C07	Name longer than five 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.
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 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.
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 or WRITE 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 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 is 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 are undefined in an EQUIVALENCE list.

Table 9. FORTRAN Error Codes (continued)

Error Number	Cause of Error
C66*	Variable made equivalent to an element of an array in such a manner as to cause the array to extend beyond the origin of the COMMON area.
C67*	Two variables or array elements in COMMON are equated, or the relative locations of two variables or array elements are assigned more than once (directly or indirectly).
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.
C73	Syntax error in record number of disk READ, WRITE, or FIND statement.
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.
C79	Invalid hexadecimal specification in a DATA statement.
C80	Variable in a DATA statement not used elsewhere in the program.
C81	COMMON variable loaded with a DATA specification.
C82	DATA statement too long.

* The detection of a code 65, 66, or 67 error prevents any subsequent detection of any of these three errors.

DUP MESSAGES AND ERROR CODES

When a DUP function is performed without error, an informational message is printed on the principal printer.

On a DEFINE VOID, one of the following messages is printed.

```
ASSEMBLER VOIDED
FORTRAN VOIDED
```

On a DEFINE FIXED AREA, the message is as follows,

```
CART ID XXXX CYLS FXA XXXX DBS AVAIL XXXX
  FLET SECTOR ADDR XXXX
```

where

CYLS FXA XXXX is the decimal number of cylinders -1 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 following the last program or data file.

FLET SECTOR ADDR XXXX is the hexadecimal sector address of the first cylinder in the Fixed Area, i.e., the sector address of FLET.

On a dump of LET or FLET, the printout is followed by a sign-off message.

```
END OF DUMPLET/FLET
```

All other DUP operations are followed by the following 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.

DUP error messages are listed in Table 10.

Table 10. DUP Error Messages

Error Number and Message	Cause of Error
D01 NAME IS NOT PRIME ENTRY	The primary 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: a non-DSF program, a mispositioned header, foreign data, or an erroneous subtype.
D03 INVALID HEADER LENGTH	Word six of the DSF header is outside the range of 3-45. The causes are similar to D02, except for subtype.
D05 SECONDARY ENTRY POINT OR NAME ALREADY IN LET	The specified secondary entry point name is already in LET. The name must be deleted before this subprogram can be stored.
D06 ENTRY POINT NAME ALREADY IN LET/FLET	The specified name is already in LET/FLET. The name must be deleted before this program or data file can be stored.
D12 INVALID DISK I/O SPECIFIED	Disk routine code on STORECI control record (column 9) was other than 0, 1, N, Z, or blank.
D13 INVALID FUNCTION FIELD (CC 1-12)	An invalid DUP function is specified in columns 1-12 of the DUP control record.
D14 INVALID FROM FIELD (CC 13-14)	Unacceptable characters are in columns 13 and 14 of the DUP control record. The FROM field specified is not valid with this DUP function.
D15 INVALID TO FIELD (CC 17-18)	Unacceptable characters are in columns 17 and 18 of the DUP control record. The TO field specified is not valid with this DUP function.
D16 INVALID NAME FIELD (CC 21-25)	No name specified and one required, or syntax error in construction of name.
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	Cartridge specified as TO or FROM cartridge was not specified on JOB record as being used in this job.
D20 CARTRIDGE ID OUTSIDE VALID RANGE (0001-7FFF)	Correct 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 version. The old version must be deleted before the replacement can be stored.
D22 PROGRAM NOT IN WORKING STORAGE	The disk block count for the requested program in Working Storage is zero. 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 0-9.
D24 COUNT FIELD TOO LARGE	The count field extends beyond column 30 of a DEFINE FIXED AREA control record or column 31 is not a minus sign.
D25 REQUIRED FORMAT NOT IN W.S.	During a STOREMOD, the format of the LET/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/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.
D31 PROGRAM OR DATA EXCEEDS DESTINATION DISK AREA	The number of disk blocks required to store a program or data 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.
D33 LET/FLET OVERFLOW. A CORE DUMP FOLLOWS	A ninth sector of LET/FLET is required (or a seventh sector of LET on a non-system cartridge) for the LET/FLET entry. A deletion of a program with a LET/FLET entry of similar size is required before this program can be stored. A core dump follows this message since the affected cartridge may have to be reloaded. The dump allows the user to locate the condition that caused the error. Use of the affected cartridge is not recommended until the problem has been investigated.
D41 INVALID STORECI CONTROL RECORD	The STORECI control record read was not a LOCAL, NOCAL, or FILES record, or a mainline name was specified on a LOCAL or NOCAL record.
D42 STORECI CONTROL RECORDS INCORRECTLY ORDERED	LOCAL, NOCAL, and FILES records were intermixed. All records of a given type must be loaded together.
D43 INCORRECT CONTINUATION	A comma at the end of the record indicated that it would be continued; however, it was not.
D44 ILLEGAL CHARACTER IN RECORD	An illegal character, probably a blank, appeared in the record.
D45 ILLEGAL FILE NUMBER	A non-numeric character appears in a file number, or the number is more than five characters long.

Table 10. DUP Error Messages (continued)

Error Number and Message		Cause of Error
D46	ILLEGAL NAME	A name is more than five characters long, or contains characters other than A-Z, 0-9, or $, or a name contains embedded blanks.
D47	ILLEGAL CARTRIDGE ID	The cartridge ID specified is not in the range/0001-/7FFF, or contains an illegal character.
D48	SCRA BUFFER OVERFLOW	The Supervisor Control Record Area (SCRA) cannot contain all the LOCAL, NOCAL, or FILES information.
D50	NON-BLANK CARD READ ENTER BLANK CARDS	A non-blank card has been read during a dump to a 1442-6 or -7. Place blank cards in the hopper and ready the card read punch. Press PROGRAM START.
D70	LAST ENTRY IN LET/FLET NOT 1DUMY	DELETE 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. The first entry in LET/FLET with a non-zero disk block count that precedes the secondary entry is a 1DUMY. 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 and/or Assembler cannot be eliminated if a Fixed Area has been previously defined.
D81	ASSEMBLER NOT IN SYSTEM	The Assembler has previously been eliminated from the system.
D82	FORTRAN NOT IN SYSTEM	The FORTRAN Compiler has previously been eliminated from the system.
D83	INCREASE VALUE IN COUNT FIELD (CC 27-30)	The count field was read as a value of zero or one. The first DEFINE 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	Cartridge must be reloaded.
D85	FIXED AREA NOT PRESENT	The control record specifies a decrease in the Fixed Area and there is no Fixed Area on the cartridge.
D86	DECREASE VALUE IN COUNT FIELD	There is insufficient Working Storage area available to allow the Fixed Area to be defined or expanded by the amount specified in the count field (cc 27-30). This message is preceded by a count of the number of cylinders available XXXX CYLS AVAILABLE. The count is in decimal.
D90	CHECK SUM ERROR	Checksum error in binary card or paper tape record, or binary cards are out of order.
D92	INVALID DISKZ CALL. A CORE DUMP FOLLOWS	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. A core dump follows this message since the affected cartridge may have to be reloaded. The dump allows the user to locate the condition that caused the error. Use of the affected cartridge is not recommended until the problem has been investigated.
D93	CARTRIDGE OVERFLOW	While performing a DUP function, an attempt has been made to read or write a sector beyond 1599 decimal.

SYSTEM LOADER MESSAGES AND ERROR CODES

No informational messages are printed during an initial load. At the completion of a reload, the following message is printed,

END RELOAD

Table 11 lists the System Loader Errors.

Table 11. System Loader Errors

Error Number and Message		Corrective Action
E01	CHECKSUM ERROR	Follow procedure A or restart initial load.
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.
E04	ORG BACKWARDS	Inspect deck for cards missing or out of sequence. Correct deck and restart from card in error.
E05	ERROR IN LOAD MODE RECORD	Follow procedure A or restart initial load.
E06	INVALID DRIVE NUMBER	Set all bit switches off. Set bit switches to select physical drive number and press PROGRAM START. All switches off - Drive 0 Switch 14, 15 on - Drive 3 Switch 15 on - Drive 1 Switch 13 on - Drive 4 Switch 14 on - Drive 2
E07	ID SCTR DATA INVALID	Use DCIP or DISC and follow with initial load.
E08	CONFIG DECK ERROR	System configuration deck may be missing, out of place, or may contain errors in one or more cards. Correct the deck and restart initial load.
E09	FILE PROTECT ADDRESS TOO HIGH	This error will occur 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.
E10	SYST DECK ERROR	A card containing a negative phase ID has less than four data words. Correct the deck in error and restart initial load, or reload the phase in error, starting with the sector break card which precedes the last card read.
E11	SCRA OVERLAY STOP	Abort. An initial load must be performed to shift the location of the Supervisor Control Record Area (SCRA) address. An attempt to perform a reload on a non-system cartridge will cause this message to be printed.
E12	PHASE NO. OUT OF SEQ	The Accumulator contains the phase ID of the phase that is out of sequence (from last card read). Place the decks in proper order and continue from sector break card of correct phase.
E13	PHID RECD ERROR	Follow procedure A or reload and restart.
E14	PHASE MISSING	Error occurred when phase ID (binary word 11) of last card read was processed. Inspect Load Mode card, PHID card, and phase ID of previously loaded phase to determine what phase is now required. Locate missing phase, place deck in reader starting with sector break card of missing phase, and continue.
E15	PH. ID NOT IN PHID CARD	The Accumulator contains the extraneous phase ID. To ignore this phase, press PROGRAM START. To load this phase, correct the PHID card and perform an initial load.
E16	PHASE ID NOT IN SLET	If this error occurs during a reload, and the system decks have not all been loaded, the error was caused by an attempt to reload a phase not presently in the System Location Equivalence Table (SLET). The Accumulator contains the ID of the phase that cannot be found. The Extension contains 0. Press PROGRAM START to bypass this phase. If this error occurs during reload table processing, the Accumulator contains the phase ID that is being searched for and the Extension contains the ID of the phase requesting a SLET lookup. Press PROGRAM START to go on to the next phase requested or to the next requesting phase in SLET.
E17	DEFECTIVE SLET	Processing cannot be completed. An initial load of the system is required.
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 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.

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 occurred) and place the last two cards from the stacker and the nonprocessed card 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.

FORTRAN I/O ERRORS

When a FORTRAN I/O error occurs, the system WAITs at $PRET with an Fxxx error code displayed in the accumulator. Table 12 lists the FORTRAN I /O errors.

Table 12. FORTRAN I/O Errors

Accumulator Display	Cause of Error
F000	No *IOCS card appeared with the mainline program and I/O was attempted in a subroutine.
F001	Logical unit defined incorrectly, or No *IOCS control record for specified I/O device.
F002	Requested record exceeds allocated buffer size.
F003	Illegal character encountered in input record.
F004	Exponent too large or too small in input field.
F005	More than one E encountered in input field.
F006	More than one sign encountered in input field.
F007	More than one decimal point encountered in input field.
F008	Read of output-only device, or Write of input-only device.
F009	Real variable transmitted with an I format specification or integer variable transmitted with an E or F format specification.
F020	Illegal unit reference.*
F021	Read list exceeds length of write list.*
F022	Record does not exist for read list element.*
F023	Maximum length of $$$$$ area on the disk has been exceeded. This error is unrecoverable and results in a call exit.*
F100	File not defined by DEFINE FILE statement.
F101	File record too large, equal to zero, or negative.
F103	Disk FIO (SDFIO) has not been initialized.
F10A	Subscripting has destroyed the Define File Table. This occurs when a subscript exceeds the specification in a DIMENSION statement.
	*) Can occur in unformatted I/O operations.

SUPERVISOR MESSAGES AND ERROR CODES

The monitor Supervisor causes all Monitor system control records to be printed on the principal printer.

During a DCOM update operation (i. e. , following each JOB record or user call to SYSUP) the following message 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 card (in the calling sequence of the SYSUP subroutine)

CART SPEC is specified cartridge ID

CART AVAIL is the available cartridge ID

PHY DRIVE is the physical drive number starting with 0.

The logical drive may be different from the physical drive, e. g. , physical drive 0 may be defined as logical drive 2.

One line is printed for each physical drive on the system.

Tables 13,14, and 15 list Supervisor errors.

Table 13. Phase 1, Monitor Control Record Analyzer Errors

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.
M15	ILLEGAL CARTRIDGE ID	A cartridge ID contains an illegal character or is a negative number. The job is aborted.
M16	ASM AND/OR FOR VOIDED	ASM or FOR requested but the FORTRAN Compiler and/or Assembler was either not loaded by the System Loader or was voided by a DUP DEFINE.

Table 14. Phase 2. System Control Record Program Errors (Phase 2 errors cause execution to be bypassed).

Error Number and Message		Cause of Error
M21	ABOVE RECORD NOT A SUPERVISOR CONTROL RECORD	The last record read is not a LOCAL, NOCAL, or FILES record.
M22	SUPERVISOR CONTROL RECORDS INCORRECTLY ORDERED	LOCAL, NOCAL, and FILES records cannot be intermixed.
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 five characters long.
M26	ILLEGAL NAME	A name is more than five characters long, or contains characters other than A-Z, 0-9, or $, or a name contains embedded blanks.
M27	ILLEGAL CARTRIDGE ID	The cartridge ID specified is not in the range /0001-/7FFF, or contains an illegal character.
M28	SCRA BUFFER OVERFLOW	The Supervisor Control Record Area (SCRA) cannot contain all the LOCAL, NOCAL, or FILES 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.

Table 15. SYSUP - DCOM Update Errors (SYSUP errors are also listed with the System Library Utility Subroutine SYSUP).

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 in #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).

CORE LOAD BUILDER ERRORS

Except for the core load map described in the Programming Tips and Techniques section and messages R41-R45, the Core Load Builder prints no informational messages. Table 16 lists Core Load Builder Error Messages.

Table 16. Core Load Builder Error Messages

Error Number and Message		Cause and Corrective Action
R00	LOCALS/SOCALS OVERFLOW WORK STORAGE	There is insufficient Working Storage remaining to accommodate the LOCAL and/or SOCAL overlays required by the core load. Remedy Change the Working Storage ID on the JOB card to the drive with the most available Working Storage or Create more Working Storage on the present drive by deleting subroutines, subprograms, and/or data 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. Remedy Remove the ORG statement that is causing the problem or, Origin the mainline program at a lower address.
R02	DEFINE FILE(S) OVERFLOW WORK STORAGE	There is insufficient Working Storage remaining to accommodate even one record of the defined file(s). Remedy See R00.
R03	NO DSF PROGRAM IN WORKING STORAGE	No program in Working Storage. Remedy Place the desired program in Working Storage before calling the Core Load Builder.
R05	INVALID LOADING ADDR FOR ILS02	ILS02 has been loaded into low COMMON. Remedy The mainline should be made longer so that ILS02 will be loaded in a higher address.
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 or Fixed Area was inadequate, or because there is inadequate Working Storage available to store the file. Remedy Redefine the User/Fixed Area file, or change the record count specification in the DEFINE FILE statement.
R07	TOO MANY ENTRIES IN LOAD TABLE	There are references to more than (approximately) 150 different entry points in the core load by CALL and/or LIBF statements. Remedy Divide the core load into two 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. The error was probably caused by bad data being read from the disk.
R09	LIBF TV REQUIRES 82 OR MORE ENTRIES	There are at least 82 different entry points referenced in the core load by LIBF statements. Remedy Divide the core load into two or more links.
R16	XXXXX IS NOT IN LET OR FLET	The program or data file name printed in the message cannot be found in LET or FLET. Remedy 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).
R17	XXXXX CANNOT BE A LOCAL/NOCAL	The program named in this message is either a type which cannot appear on a *LOCAL control card, 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. Remedy 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. Remedy Define more COMMON for the mainline program.
R21	XXXXX PRECISION DIFFERENT FROM ML	The precision for the subroutine named in this message is incompatible with that of the mainline program. Remedy Make the precisions compatible.

Table 16. Core Load Builder Error Messages (continued)

Error Number and Message	Cause and Corrective Action
R22 XXXXX AND ANOTHER VERSION REF'ENCED	At least two different versions of the same ISS have been referenced, e.g., CARDZ and CARD0 (FORTRAN uses CARDZ). If a disk subroutine is named in the message, it is possible that the XEQ record specifies one version (e.g., DISKZ) whereas the program references another (e.g., DISKN). (A blank in column 19 of the XEQ control record causes DISKZ to be used.) Remedy 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 ON SYSTEM	XXXX is a cartridge ID appearing on an *FILES record. The cartridge was not on-line when the core load was built.
R40 XXXX(HEX) = ADDITIONAL CORE REQUIRED	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). If the core load was not executed, /XXXX equals the number of words still required after the Core Load Builder has attempted to make it fit by using SOCALs. Remedy In the latter 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 has been requested.
R43 XXXX(HEX) = ARITH/FUNC SOCAL WD CNT	NOT AN ERROR. It has been necessary to use special overlays (SOCALs) and /XXXX is the length of the arithmetic/function overlay (see System Overlays).
R44 XXXX(HEX) = FI/O, I/O SOCAL WD CNT	NOT AN ERROR. It has been necessary to use special overlays (SOCALs), and /XXXX is the length of the FORTRAN I/O, I/O, and conversion subroutine overlay (see System Overlays).
R45 XXXX(HEX) = DISK FI/O SOCAL WD CNT	NOT AN ERROR. It has been necessary to use special overlays (SOCALs), and /XXXX is the length of the disk FORTRAN I/O overlay, including the 320 word buffer.
R46 XXXX(HEX) = AN ILLEGAL ML LOAD ADDR	/XXXX is the address at which 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. 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. Remedy Origin the mainline at a higher address, or Request a shorter version of disk I/O, or Origin the mainline 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.
R64 XXXXX IS BOTH A LIBF AND A CALL	The subroutine named in this message either been improperly referenced, i.e., CALL instead of 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.
R66 XXXXX HAS AN INVALID TYPE CODE	The subroutine named in this message has either 1) Been designated on an XEQ record and is not a mainline program or, 2) Contains a type code other than 3 (subroutine), 4 (function), 5 (ISS), or 6 ILS), in which case, the subroutine has probably been destroyed. 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.

AUXILIARY SUPERVISOR ERRORS

The Auxiliary Supervisor prints no informational messages. Table 17 lists Auxiliary Supervisor Error messages.

Table 17. Auxiliary Supervisor Errors

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 specified name 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.

ISS SUBROUTINE WAITS

A device not ready or illegal function parameter causes a pre-operative WAIT at $PRET. The ISS subroutine WAITs are listed in Table 18.

Table 18. ISS Subroutine WAITs

Device Causing WAIT	Contents of Accumulator	Cause of WAIT
1442 Card Read Punch or 1442 Card Punch	/1000	Device not ready or last card indicator on for read.
	/1001	Illegal device, device not in system, illegal function, word count over +80, or word count zero or negative.
Keyboard/Console Printer	/2000	Device not ready.
	/2001	Device not in system, illegal function, or word count zero or negative.
1134/1055 Paper Tape Reader/Punch	/3000	Device not ready.
	/3001	Illegal device, illegal function, word count zero or negative, or illegal check digit.
2501 Card Reader	/4000	Device not ready.
	/4001	Illegal function, word count over +80, or word count zero or negative.
Disk	/5000	Device not ready.
	/5001	Illegal device, device not in system, illegal function, attempt to write in file protected area, word count zero or negative, or starting sector identification over +1599.
	/5002	Write select/power unsafe.
	/5003	Same as /5001 except error caused by a Monitor program (DISK1, DISKN only).
	/5004	Disk error (DISKZ only)
1132 Printer	/6000	Device not ready or end of forms.
	/6001	Illegal function, word count over +60, or word count zero or negative.
1627 Plotter	/7000	Device not ready.
	/7001	Illegal device, device not in system, illegal function, or word count zero or negative.
SCAT	/8001	Invalid function code or invalid word count (all SCAT subroutines).
		Invalid sub-function code for some transmit or receive operation (SCAT2 or SCAT3 only).
	/8002	Receive operation not completed or transmit operation not completed (SCAT1 only).
	/8003	Failure to establish synchronization before attempting to perform some transmit or receive operation,or attempting to receive before receiving INQ sequence (SCAT1 only).
1403 Printer	/9000	Device not ready or end of forms.
	/9001	Illegal function, word count over +60, or word count zero or negative.
1231 Optical Mark Page Reader	/A000	Device not ready.
	/A001	Illegal function.

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	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		1011	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	80B0							
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	40B0							
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	20B0							
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	00B0							
63		1111	3F				9	8	7	0070							

NOTES: Typewriter Output

① Tabulate
② Shift to black
③ Carrier Return
④ Shift to red

* Recognized by all Conversion subroutines
Codes that are not asterisked are recognized only by the SPEED subroutine

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	

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	98	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-Upper Case 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					

DISK FORMATS

DISK SYSTEM FORMAT (DSF)

Disk system format is the format in which absolute and relocatable programs (mainlines and subprograms) are stored on disk. Disk system format is shown in Figure 16.

Program Header

The format of words 1-12 of the program header is the same for all program types (see Program Types below). These words contain the following information:

Word	Contents
1	Zero
2	Checksum, if the source was cards; otherwise, zero.
3	Program type (bits 4-7), subtype (bits 0-3), and precision (bits 8-15)
4	Effective program length, i.e., 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 0-7), number of files defined (bits 8-15).
10-11	Name of entry point 1 (in name code)
12	Address of entry point 1 (absolute for type 1 programs, relative for all others)

The format of words 13-54 of the program header varies according to the program type. For program types 1 and 2, the program header consists of words 1-12 only.

For program types 3 and 4, the program header, in addition to words 1-12, contains the following information:

Word	Contents
13-14	Name of entry point 2 (in name code)
15	Relative address of entry point 2
16-17	Name of entry point 3 (in name code)
18	Relative address of entry point 3
19-51	Names 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 1-12, contains the following information:

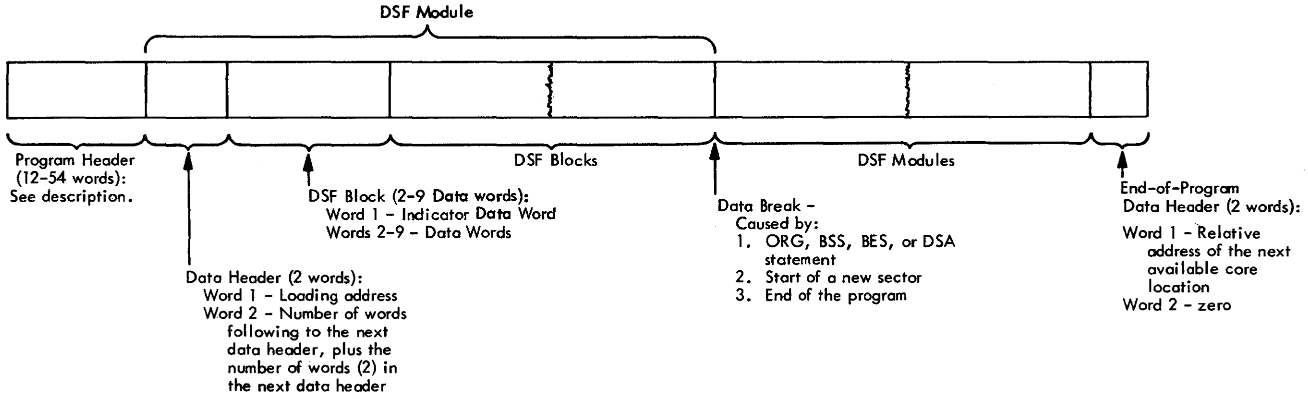

DSF Module
Program Header (12-54 words): See description.
DSF Blocks
DSF Block (2-9 Data words):
Word 1 - Indicator Data Word
Words 2-9 - Data Words
Data Header (2 words):
Word 1 - Loading address
Word 2 - Number of words following to the next data header, plus the number of words (2) in the next data header
DSF Modules
Data Break -
Caused by:
1. ORG, BSS, BES, or DSA statement
2. Start of a new sector
3. End of the program
End-of-Program Data Header (2 words):
Word 1 - Relative address of the next available core location
Word 2 - zero

Figure 16. Disk System Format

Word	Contents
13	ISS number plus 50
14	ISS number
15	Number of interrupt levels required*
16	Interrupt level number associated with the primary interrupt*
17	Interrupt level number associated with the secondary interrupt*

*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 1-12, contains the associated interrupt level number in word 13.

Program Types

The program types are defined as follows:

Type	Type of Program
1	Mainline (absolute)
2	Mainline (relocatable)
3	Subprogram, not an ISS, referenced by a LIBF statement
4	Subprogram, not an ISS, referenced by a CALL statement
5	Interrupt service subroutine (ISS) referenced by a LIBF statement
6	Interrupt service subroutine (ISS) referenced by a CALL statement
7	Interrupt level subroutine (ILS)

Program Subtypes

Subtypes are defined for program types 3, 4, 5, and 7 only. When not used, the subtype indicator in the program header contains a zero.

The 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	Non-disk FORTRAN I/O and "Z" conversion subroutines
3	5	"Z" device subroutines
8	4	Function subprogram
1	7	Dummy ILS02, ILS04

DISK DATA FORMAT (DDF)

Disk data format is the format in which data files are stored on the disk. Disk data format consists of 320 binary words per sector. There are no headers, trailers, indicator words, etc.

DISK CORE IMAGE FORMAT (DCI)

Disk core image 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 subprograms referenced in the mainline program or other subprograms (except the disk I/O subroutine), the Transfer Vector, and any LOCALs and SOCALs required. Figure 5 (see STORECI under Disk Utility Programs) shows the layout of a core image program stored on disk.

Core Image Header

The Core Image Header contains the following information:

Word		Contents	
Symbol	Relative Address		
@XEQ1	1	Execution address of the core load	
@CMON	2	Length of COMMON (in words)	
@DREQ	3	Disk I/O subroutine indicator — /FFFF for DISKZ, /0000 for DISK1, /0001 for DISKN	
@FILE	4	Number of files defined	
@HWET	5	Length of the Core Image Header (in words)	
@LSCT	6	Sector count of files in System WS	
@LDAD	7	Loading address of the core load	
@XCTL	8	Exit control address for DISK1/N	
@TVWC	9	Length of the transfer vector (in words)	
@WCNT	10	Length of the core load (in words)	
@XR3X	11	Setting for index register 3 during execution of the core load	
@ITVX	12	Contents of word 8 during execution	ITV
	13	Contents of word 9 during execution	
	14	Contents of word 10 during execution	
	15	Contents of word 11 during execution	
	16	Contents of word 12 during execution	
	17	Contents of word 13 during execution	
	18-20	Reserved	IBT for ILS04
	21	Interrupt entry to 1231 ISS	
	22	Interrupt entry to 1403 ISS	
	23	Interrupt entry to 2501 ISS	
	24	Interrupt entry to 1442 ISS	
	25	Interrupt entry to Keyboard/Console Printer ISS	
	26	Interrupt entry to 1134/1055 ISS	
@OVSW	27	Sector count of LOCALs/SOCALs	
@CORE	28	Core size of system on which core load built	
	29-30	Define File Table checksum work area.	

CARD FORMATS

CARD SYSTEM FORMAT (CDS)

Card system format is the format in which absolute and relocatable programs (mainlines and subprograms) 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 card system format. It contains the following information:

Word	Contents
1	Reserved
2	Checksum
3	Type code (first 8 bits):
	0000 0001 -- absolute
	0000 0010 -- relocatable
	Precision code (last 8 bits):
	0000 0001 -- standard
	0000 0010 -- extended
	0000 0000 -- undefined
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
10-11	Name
12	Relative Entry Point
13-54	Reserved

Subprogram Header Card

The subprogram header card is the first card of every type 3 or 4 program in card system format. It contains the following information:

Word	Contents
1	Reserved
2	Checksum
3	Type code (first 8 bits):
	0000 0011 -- to be called by a LIBF statement only
	0000 0100 -- to be called by a CALL statement only
	Precision code (last 8 bits):
	0000 0001 -- standard
	0000 0010 -- extended
	0000 0000 -- undefined
4-5	Reserved
6	Number of entry points times three
7-9	Reserved
10-11	Name of entry point 1 (in name code)
12	Relative address of entry point 1
13-51	Names and relative addresses of entry points 2 through 14, as required
52-54	Reserved

ISS Header Card

The ISS header card is the first card of every type 5 or 6 program in card system format. It contains the following information:

Word	Contents
1	Reserved
2	Checksum
3	Type code (first 8 bits):
	0000 0101 -- to be called by a LIBF statement only
	0000 0110 -- to be called by a CALL statement only
	Precision code (last 8 bits):
	0000 0001 -- standard
	0000 0010 -- extended
	0000 0000 -- undefined
4-5	Reserved
6	Number of interrupt levels required plus 6
7-9	Reserved
10-11	Subroutine name (in name code)
12	Relative entry point address
13-14	Reserved for parameters used by the 1130 Card/Paper Tape System
15	Number of interrupt levels required*
16	Interrupt level number associated with the primary interrupt*
17	Interrupt level associated with the secondary interrupt level*
18-29	Reserved
30	One
31-54	Reserved

*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 card system format. It contains the following information:

Word	Contents
1	Reserved
2	Checksum
3	Type code (first 8 bits): 0000 0111 Reserved (last 8 bits)
4-5	Reserved
6	0000 0000 0000 0100
7-9	Reserved
10-12	Reserved
13	Interrupt level number
14-54	Reserved

Data Cards

In all types of programs, data cards contain the instructions and data that constitute the machine language program. The format of each data card is as follows:

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 this card (last 8 bits)
4-9	Relocation indicator data words (2 bits for each following data word): 00 -- absolute 01 -- relocatable 10 -- LIBF 11 -- CALL
10	Data word 7
11-54	Data words 8 through 51

End-of-Program (EOP) Card

The end-of-program card is the last card of all programs in card system format. It contains the following information:

Word	Contents
1	Effective length of the program. This number is always even and is assigned by the Assembler, or FORTRAN Compiler.
2	Checksum
3	Type code (first 8 bits): 0000 1111 Last 8 bits: 0000 0000
4	Execution address (mainline program only)
5-54	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 loader cards as sector break cards. The sector break cards are not checksummed. Columns 5-72 of the sector break cards may contain information identifying the program phase being loaded. The card sequence number appears in columns 73-80. Columns 5-80 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 or the System Loader, word 11 contains an 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.

CARD DATA FORMAT (CDD)

Card data format is the format in which data files are punched into cards. Card Data format consists of 54 binary words per card. Each binary word occupies 1-1/3 columns. There are no headers, trailers, indicator words, etc.

Card Data format is illustrated in Figure 17.

CARD CORE IMAGE FORMAT (CDC)

Card core image format is the format in which core image programs are punched into cards. Card core image format is identical to card data format; 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 above).

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 2 special frames precede the data record; the first contains $7F_{16}$, and the second contains 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 73-80 in card format must not appear in paper tape format.

PRINT FORMAT

PRINT DATA FORMAT (PRD)

Print data format 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 Address which precedes each printed line is the core address of Word 1 on that line if 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 consists of four hexadecimal characters and represents one binary word. Figure 18 illustrates the DSF and core image print format.

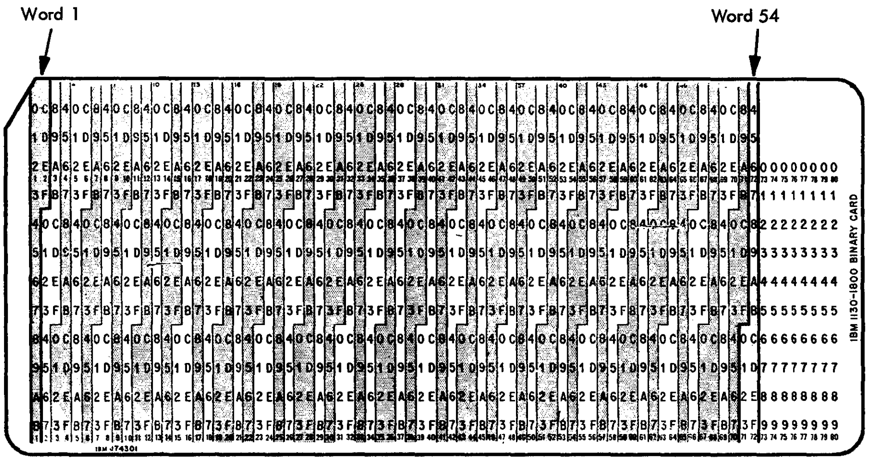
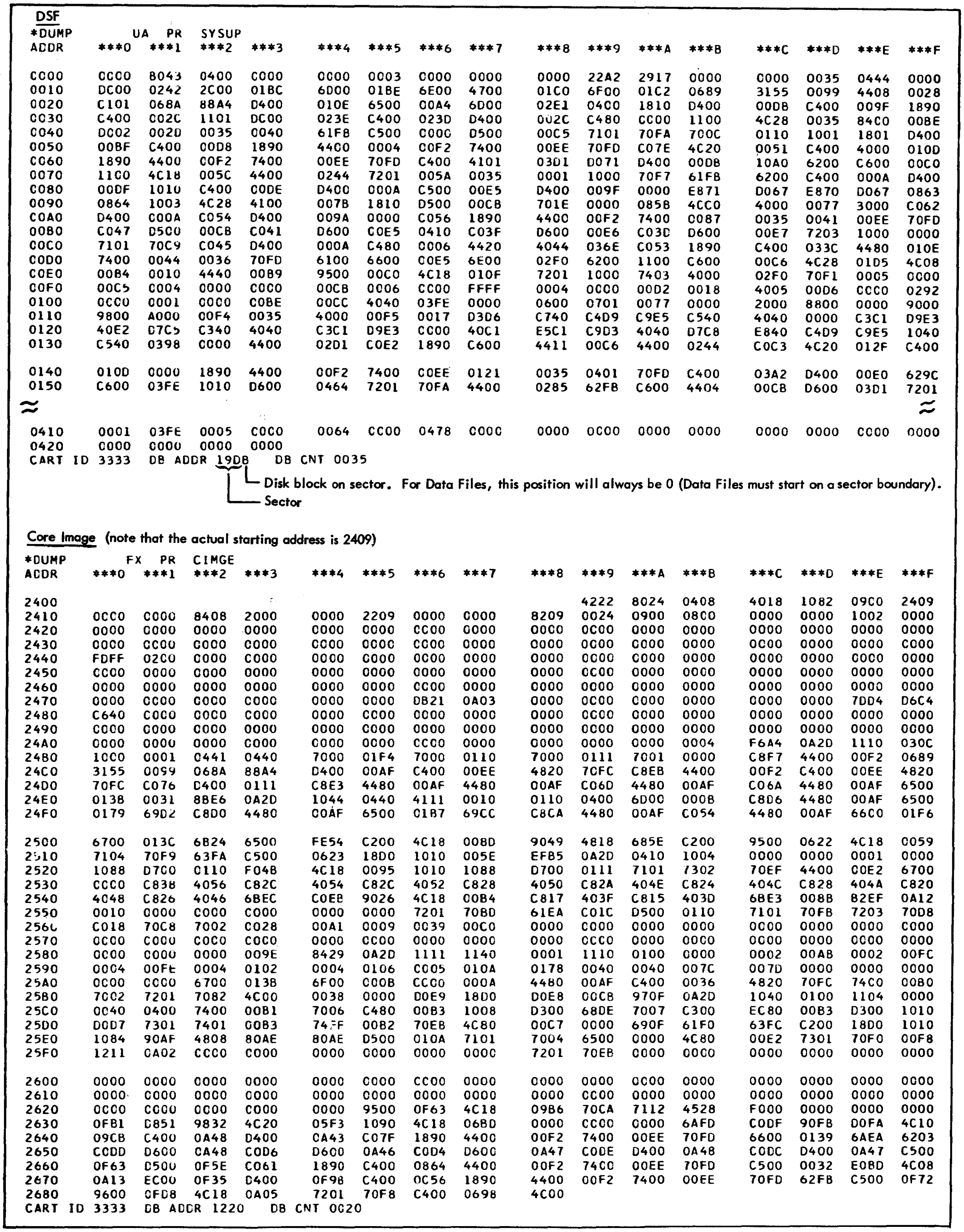


Figure 17. Card Data Format



```
DSF
*DUMP        UA   PR   SYSUP
ADDR    ***0 ***1 ***2 ***3   ***4 ***5 ***6 ***7   ***8 ***9 ***A ***B   ***C ***D ***E ***F

C000    0CC0 8043 0400 C000   0000 0003 C000 0000   0000 22A2 2917 0000   0000 0035 0444 0000
0010    DC00 0242 2C00 01BC   6D00 01BE 6E00 4700   01C0 6F00 01C2 0689   3155 0099 4408 0028
0020    C101 068A 88A4 D400   010E 6500 00A4 6D00   02E1 0400 1810 D400   00DB C400 009F 1890
C030    C400 002C 1101 DC00   023E C400 023D D400   002C C480 CC00 1100   4C28 0035 84C0 008E
C040    D002 002D 0035 0040   61FB C500 C000 D500   00C5 7101 70FA 700C   0110 1001 1801 D400
0050    00BF C400 00D8 1890   4400 0004 C0F2 7400   00EE 70FD C07E 4C20   0051 C400 4000 010D
C060    1890 4400 C0F2 7400   00EE 70FD C400 4101   03D1 D071 D400 00DB   10A0 6200 C600 00C0
0070    1100 4C18 005C 4400   0244 7201 005A 0035   0001 1000 70F7 61FB   6200 C400 000A D400
C080    000F 1010 C400 C0DE   D400 000A C500 00E5   D400 009F 0000 E871   D067 E870 D067 0863
0090    0864 1003 4C28 4100   007B 1810 D500 00CB   701E 0000 085B 4CC0   4000 0077 3000 C062
C0A0    D400 C00A C054 D400   009A 0000 C056 1890   4400 00F2 7400 0087   0035 0041 00EE 70FD
00B0    C047 D500 00CB C041   D600 C0E5 0410 C03F   D600 00E6 C03D D600   00E7 7203 1000 0000
00C0    7101 70C9 C045 D400   000A C480 0006 4420   4044 036E C053 1890   C400 033C 4480 010E
C0D0    7400 0044 0036 70FD   6100 6600 C0E5 6E00   02F0 6200 1100 C600   00C6 4C28 01D5 4C08
C0E0    0084 0010 4440 0089   9500 00C0 4C18 010F   7201 1000 7403 4000   02F0 70F1 0005 0000
C0F0    00C5 0004 0000 C0C0   00CB 0006 CC00 FFFF   0004 0000 00D2 0018   4005 00D6 CCC0 0292
0100    0CC0 0001 0000 C0BE   00CC 4040 03FE 0000   0600 0701 0077 0000   2000 8800 0000 9000
0110    9800 A000 00F4 0035   4000 00F5 0017 D3D6   C740 C4D9 C9E5 C540   4040 0000 C3C1 D9E3
0120    40E2 D7C5 C340 4040   C3C1 D9E3 C000 40C1   E5C1 C9D3 4040 D7C8   E840 C4D9 C9E5 1040
0130    C540 0398 C000 4400   02D1 C0E2 1890 C600   4411 00C6 4400 0244   C0C3 4C20 012F C400

0140    010D 0000 1890 4400   00F2 7400 C0EE 0121   0035 0401 70FD C400   03A2 D400 00E0 629C
0150    C600 03FE 1010 D600   0464 7201 70FA 4400   0285 62FB C600 4404   00CB D600 03D1 7201
≈                                                                                            ≈

0410    0001 03FE 0005 C0C0   0064 CC00 0478 C00C   0000 0C00 0000 0000   0000 0000 C000 0000
0420    C000 C000 0000 0000
CART ID 3333  DB ADDR 19DB   DB CNT 0035
```

└─ Disk block on sector. For Data Files, this position will always be 0 (Data Files must start on a sector boundary).

└── Sector

Core Image (note that the actual starting address is 2409)

```
*DUMP        FX   PR   CIMGE
ADDR    ***0 ***1 ***2 ***3   ***4 ***5 ***6 ***7   ***8 ***9 ***A ***B   ***C ***D ***E ***F

2400                                                     4222 8024 0408   4018 1082 09C0 2409
2410    0CC0 C000 8408 2000   0000 2209 0000 C000   8209 0024 0900 08C0   0000 0000 1002 0000
2420    0000 0000 0000 0000   C000 0000 CC00 0000   0000 0C00 0000 0000   0000 0000 0000 0000
2430    0000 CC00 C000 C000   CC00 000C CC00 0000   0000 0C00 C000 0000   0C00 0000 0000 C000
2440    FDFF 02C0 C000 C000   0000 C000 0C00 0000   0000 0000 C000 0000   0000 0000 C000 0000
2450    CC00 0000 0000 0000   0000 0000 0000 0000   0000 CC00 0000 0000   0000 0000 0000 0000
2460    0000 0000 0000 0000   0000 0000 CC00 0000   0000 0000 0000 0000   0000 0000 0000 0000
2470    0000 0C00 C0C0 C00C   0000 0000 DB21 0A03   0000 0C00 C000 0000   0000 0000 7DD4 D6C4
2480    C640 C0C0 00C0 C000   0000 CC00 0000 0000   0000 0C00 0000 0000   0000 0000 0000 0000
2490    C000 0000 C000 0000   0000 C000 0000 0000   0000 0C00 0000 0000   0000 0000 0000 0000
24A0    0000 0000 0000 C000   C000 0000 CCC0 0000   0000 0000 0000 0004   F6A4 0A2D 1110 030C
24B0    1CC0 0001 0441 0440   7000 01F4 7000 0110   7000 0111 7001 0000   C8F7 4400 00F2 0689
24C0    3155 0099 068A 88A4   D400 00AF C400 00EE   4820 70FC C8EB 4400   00F2 C400 00EE 4820
24D0    70FC C076 C400 0111   C8E3 4480 00AF 4480   00AF C06D 4480 00AF   C06A 4480 00AF 6500
24E0    0138 0031 8BE6 0A2D   1044 0440 4111 0010   0110 0400 6D00 000B   C8D6 4480 00AF 6500
24F0    0179 69D2 C8D0 4480   C0AF 6500 01B7 69CC   C8CA 4480 00AF C054   4480 00AF 66C0 01F6

2500    6700 013C 6B24 6500   FE54 C200 4C18 008D   9049 4818 685E C200   9500 0622 4C18 0059
2510    7104 70F9 63FA C500   0623 18D0 1010 005E   EFB5 0A2D 0410 1004   0000 0000 0001 0000
2520    1088 D7C0 C110 F04B   4C18 0095 1010 1088   D700 0111 7101 7302   70EF 4400 C0E2 6700
2530    CCC0 C838 4056 C82C   4054 C82C 4052 C828   4050 C82A 404E C824   404C C828 404A C820
2540    4048 C826 4046 6BEC   C0EB 9026 4C18 00B4   C817 403F C815 403D   6BE3 008B 82EF 0A12
2550    0010 0000 C0C0 C000   0000 0000 7201 70BD   61EA C01C D500 0110   7101 70FB 7203 70D8
2560    C018 70C8 7002 C028   00A1 0009 0039 00C0   0000 C000 0000 0000   0C00 0000 0000 C000
2570    0C00 C000 C0C0 C0C0   0000 CC00 0000 0000   0000 CCC0 0000 0000   0000 0000 C000 0000
2580    0000 0000 0000 009E   8429 0A2D 1111 1140   0001 1110 0100 0000   0002 00AB 0002 00FC
2590    0004 00FE 0004 0102   0004 0106 C005 010A   0178 0040 0040 007C   007D 0000 0000 0000
25A0    0C00 C000 6700 013B   6F00 C00B CC00 000A   4480 00AF C400 0036   4820 70FC 74C0 0080
25B0    7002 7201 7082 4C00   0038 0000 D0E9 18D0   D0E8 00CB 970F 0A2D   1040 0100 1104 0000
25C0    0040 0400 7400 00B1   7006 C480 00B3 1008   D300 68DE 7007 C300   EC80 00B3 D300 1010
25D0    D0D7 7301 7401 00B3   74FF 00B2 70EB 4C80   00C7 0000 690F 61F0   63FC C200 18D0 1010
25E0    1084 90AF 4808 80AE   80AE D500 010A 7101   7004 6500 0000 4C80   00E2 7301 70F0 00F8
25F0    1211 0A02 CCC0 C000   0000 0000 0000 000C   7201 70EB 0000 0000   0000 0000 0000 0000

2600    0000 0000 0000 0000   0000 C000 CC00 0000   0000 0000 0C00 0000   0000 0000 0000 0000
2610    0000 C000 0000 C000   0000 0000 0000 0000   0000 CC00 0000 0000   0000 0000 0000 0000
2620    0C00 C000 0000 C000   0000 9500 0F63 4C18   09B6 70CA 7112 4528   F000 0000 0000 0000
2630    0FB1 D851 9832 4C20   05F3 1090 4C18 06BD   0000 CC00 0000 6AFD   C0DF 90FB D0FA 4C10
2640    09CB C400 0A48 D400   0A43 C07F 1890 4400   00F2 7400 00EE 70FD   6600 0139 6AEA 6203
2650    C0DD D600 0A48 C0D6   D600 0A46 C0D4 D600   0A47 C0DE D400 0A48   C0DC D400 0A47 C500
2660    0F63 D500 0F5E C061   1890 C400 0864 4400   00F2 74C0 00EE 70FD   C500 0032 E08D 4C08
2670    0A13 EC00 0F35 D400   0F98 C400 0C56 1890   4400 00F2 7400 00EE   70FD 62FB C500 0F72
2680    9600 0FD8 4C18 0A05   7201 70F8 C400 0698   4C00
CART ID 3333  DB ADDR 1220   DB CNT 0020
```

Figure 18. Dump of DSF and Core Image Program

APPENDIX D. 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*	1,280	2,560	512,000
Disk Block			16	64	128	25,600
Sectors				4	8	1,600
Tracks					2	400
Cylinders						200

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

APPENDIX E. DECIMAL AND HEXADECIMAL DISK ADDRESSES

SECTOR ADDRESS BASE 10	SECTOR ADDRESS BASE 16	CYLINDER ADDRESS BASE 10	CYLINDER ADDRESS BASE 16
+00000	0000	+00000	0000
+00008	0008	+00001	0001
+00016	0010	+00002	0002
+00024	0018	+00003	0003
+00032	0020	+00004	0004
+00040	0028	+00005	0005
+00048	0030	+00006	0006
+00056	0038	+00007	0007
+00064	0040	+00008	0008
+00072	0048	+00009	0009
+00080	0050	+00010	000A
+00088	0058	+00011	000B
+00096	0060	+00012	000C
+00104	0068	+00013	000D
+00112	0070	+00014	000E
+00120	0078	+00015	000F
+00128	0080	+00016	0010
+00136	0088	+00017	0011
+00144	0090	+00018	0012
+00152	0098	+00019	0013
+00160	00A0	+00020	0014
+00168	00A8	+00021	0015
+00176	00B0	+00022	0016
+00184	00B8	+00023	0017
+00192	00C0	+00024	0018
+00200	00C8	+00025	0019
+00208	00D0	+00026	001A
+00216	00D8	+00027	001B
+00224	00E0	+00028	001C
+00232	00E8	+00029	001D
+00240	00F0	+00030	001E
+00248	00F8	+00031	001F
+00256	0100	+00032	0020
+00264	0108	+00033	0021
+00272	0110	+00034	0022
+00280	0118	+00035	0023
+00288	0120	+00036	0024
+00296	0128	+00037	0025
+00304	0130	+00038	0026
+00312	0138	+00039	0027
+00320	0140	+00040	0028
+00328	0148	+00041	0029
+00336	0150	+00042	002A
+00344	0158	+00043	002B
+00352	0160	+00044	002C
+00360	0168	+00045	002D
+00368	0170	+00046	002E
+00376	0178	+00047	002F
+00384	0180	+00048	0030
+00392	0188	+00049	0031
+00400	0190	+00050	0032
+00408	0198	+00051	0033
+00416	01A0	+00052	0034
+00424	01A8	+00053	0035
+00432	01B0	+00054	0036
+00440	01B8	+00055	0037
+00448	01C0	+00056	0038
+00456	01C8	+00057	0039
+00464	01D0	+00058	003A
+00472	01D8	+00059	003B
+00480	01E0	+00060	003C
+00488	01E8	+00061	003D
+00496	01F0	+00062	003E
+00504	01F8	+00063	003F
+00512	0200	+00064	0040
+00520	0208	+00065	0041
+00528	0210	+00066	0042
+00536	0218	+00067	0043
+00544	0220	+00068	0044
+00552	0228	+00069	0045
+00560	0230	+00070	0046
+00568	0238	+00071	0047
+00576	0240	+00072	0048
+00584	0248	+00073	0049
+00592	0250	+00074	004A
+00600	0258	+00075	004B
+00608	0260	+00076	004C
+00616	0268	+00077	004D
+00624	0270	+00078	004E
+00632	0278	+00079	004F
+00640	0280	+00080	0050
+00648	0288	+00081	0051
+00656	0290	+00082	0052
+00664	0298	+00083	0053
+00672	02A0	+00084	0054
+00680	02A8	+00085	0055
+00688	02B0	+00086	0056
+00696	02B8	+00087	0057
+00704	02C0	+00088	0058
+00712	02C8	+00089	0059
+00720	02D0	+00090	005A
+00728	02D8	+00091	005B
+00736	02E0	+00092	005C
+00744	02E8	+00093	005D
+00752	02F0	+00094	005E
+00760	02F8	+00095	005F
+00768	0300	+00096	0060
+00776	0308	+00097	0061
+00784	0310	+00098	0062
+00792	0318	+00099	0063

SECTOR ADDRESS BASE 10	SECTOR ADDRESS BASE 16	CYLINDER ADDRESS BASE 10	CYLINDER ADDRESS BASE 16
+00800	0320	+00100	0064
+00808	0328	+00101	0065
+00816	0330	+00102	0066
+00824	0338	+00103	0067
+00832	0340	+00104	0068
+00840	0348	+00105	0069
+00848	0350	+00106	006A
+00856	0358	+00107	006B
+00864	0360	+00108	006C
+00872	0368	+00109	006D
+00880	0370	+00110	006E
+00888	0378	+00111	006F
+00896	0380	+00112	0070
+00904	0388	+00113	0071
+00912	0390	+00114	0072
+00920	0398	+00115	0073
+00928	03A0	+00116	0074
+00936	03A8	+00117	0075
+00944	03B0	+00118	0076
+00952	03B8	+00119	0077
+00960	03C0	+00120	0078
+00968	03C8	+00121	0079
+00976	03D0	+00122	007A
+00984	03D8	+00123	007B
+00992	03E0	+00124	007C
+01000	03E8	+00125	007D
+01008	03F0	+00126	007E
+01016	03F8	+00127	007F
+01024	0400	+00128	0080
+01032	0408	+00129	0081
+01040	0410	+00130	0082
+01048	0418	+00131	0083
+01056	0420	+00132	0084
+01064	0428	+00133	0085
+01072	0430	+00134	0086
+01080	0438	+00135	0087
+01088	0440	+00136	0088
+01096	0448	+00137	0089
+01104	0450	+00138	008A
+01112	0458	+00139	008B
+01120	0460	+00140	008C
+01128	0468	+00141	008D
+01136	0470	+00142	008E
+01144	0478	+00143	008F
+01152	0480	+00144	0090
+01160	0488	+00145	0091
+01168	0490	+00146	0092
+01176	0498	+00147	0093
+01184	04A0	+00148	0094
+01192	04A8	+00149	0095
+01200	04B0	+00150	0096
+01208	04B8	+00151	0097
+01216	04C0	+00152	0098
+01224	04C8	+00153	0099
+01232	04D0	+00154	009A
+01240	04D8	+00155	009B
+01248	04E0	+00156	009C
+01256	04E8	+00157	009D
+01264	04F0	+00158	009E
+01272	04F8	+00159	009F
+01280	0500	+00160	00A0
+01288	0508	+00161	00A1
+01296	0510	+00162	00A2
+01304	0518	+00163	00A3
+01312	0520	+00164	00A4
+01320	0528	+00165	00A5
+01328	0530	+00166	00A6
+01336	0538	+00167	00A7
+01344	0540	+00168	00A8
+01352	0548	+00169	00A9
+01360	0550	+00170	00AA
+01368	0558	+00171	00AB
+01376	0560	+00172	00AC
+01384	0568	+00173	00AD
+01392	0570	+00174	00AE
+01400	0578	+00175	00AF
+01408	0580	+00176	00B0
+01416	0588	+00177	00B1
+01424	0590	+00178	00B2
+01432	0598	+00179	00B3
+01440	05A0	+00180	00B4
+01448	05A8	+00181	00B5
+01456	05B0	+00182	00B6
+01464	05B8	+00183	00B7
+01472	05C0	+00184	00B8
+01480	05C8	+00185	00B9
+01488	05D0	+00186	00BA
+01496	05D8	+00187	00BB
+01504	05E0	+00188	00BC
+01512	05E8	+00189	00BD
+01520	05F0	+00190	00BE
+01528	05F8	+00191	00BF
+01536	0600	+00192	00C0
+01544	0608	+00193	00C1
+01552	0610	+00194	00C2
+01560	0618	+00195	00C3
+01568	0620	+00196	00C4
+01576	0628	+00197	00C5
+01584	0630	+00198	00C6
+01592	0638	+00199	00C7

Type and sub-type are defined in Appendix C.

System Library Programs	Names	Type and Sub-type	Subroutines Required	ID Field (cc 73 - 75)
MAINLINES				
Disk Maintenance Programs				
Disk Initialization	DISC	2,0	SYSUP, RDREC, DISKZ	U6C
Print Cartridge ID	IDENT	2,0	CALPR, DISKZ	U6F
Change Cartridge ID	ID	2,0	RDREC, CALPR, DISKZ	U6G
Disk Copy	COPY	2,0	RDREC, DISKZ	U6B
Writer Sector Addresses in WS	ADRWS (cannot be called)	2	Linked From DUP DWADR	U6A
Delete CIB	DLCIB	2,0	RDREC, DISKZ	U6D
Dump System Location Equivalence Table	DSLET	2,0	FSLEN, DISKZ	U6E
System Maintenance	MODIF	-	DISKZ	U6H
Paper Tape Utility				
Keyboard or 1134 Input/Console Printer or 1055 Output	PTUTL	--		U6I
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 Subroutine	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
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
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
Extended Arith/Funct Calls				
Extended Precision Hyperbolic Tangent	ETANH, ETNH	4,8	EEXP, ELD/ESTO, EADD, EDIV,EGETP	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	ELD/ESTO, EADD, EMPY, EDIV, EGETP	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 Arith/Funct Calls				
Standard Precision Hyperbolic Tangent	FTANH, FTNH	4,8	FEXP, FLD/FSTO, FADD, FDIV,FGETP	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	FLD/FSTO, FADD, FMPY, FDIV, FGETP	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 Arith/Funct 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 T1A
Flipper for LOCAL SOCAL Subprograms	FLIPP	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

System Library Programs	Names	Type and Sub-type	Subroutines Required	ID Field (cc 73 - 75)
Non-Disk FORTRAN Format I/O				
FORTRAN Format Subroutine	SFIO, SIOI, SIOAI, SIOF, SIOAF, SIOFX, SCOMP, SWRT, SRED, SIOIX	3,3	FLOAT, ELD/ESTO or FLD/FSTO, IFIX	T4C
FORTRAN Find Subroutine	SDFND	3,1	DISKZ, DISK1 or DISK2	T4B
Disk FORTRAN I/O	SDFIO, SDRED, SDWRT, SDCOM, SDAF, SDF, SDI, SDIX, SDFX, SDAI	3,1	DISKZ, DISK1 or DISK2	T4A
FORTRAN Unformatted Disk I/O	UFIO	3,1	DISKZ, DISK1 or DISK2	T4D
FORTRAN Common LIBFs				
FORTRAN Pause	PAUSE	3,2	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
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
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	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
Extended Arith/Funct LIBFs				
Extended Precision Get Parameter Subroutine	EGETP	3,2	ELD	S1I
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 Arith/Funct LIBFs				
Standard Precision Get Parameter Subroutine	FGETP	3,2	FLD	R1E
Standard Precision A**I Function	FAXI, FAXIX	3,2	FLD/FSTO, FMPY, FDVR	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
Common Arith/Funct 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	U2T
Multiple Sector Disk Input/Output (Part of Supervisor)	DISK1	-	ILS02	--
High Speed Multiple Sector Disk Input/Output (Part of Supervisor)	DISKN	-	ILS02	--
Synchronous Communications Adaptor (SCA) STR Mode	SCAT1	5,0	ILS01	W1F

System Library Programs	Names	Type and Sub-type	Subroutines Required	ID Field (cc 73 - 75)
Interrupt Service Subroutines (Cont'd)				
SCA(BSC, Point-to-Point Mode)	SCAT2	5,0	ILS01	
SCA(BSC, Multi-Point Mode)	SCAT3	5,0	ILS01	
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
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	HOL, PRTY, ILS04	U2N
Console Printer Output Subroutine	WRTY0	5,0	ILS04	U2O
1231 Optical Mark Page Reader Input Subroutine	OMPR1	5,0	ILS04	U2C
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
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	3,0	None	U4I
EBCDIC to IBM Card Code	EBHOL	3,0	None	U4J
EBCDIC to 1403 Printer Code	EBPT3	3,0	None	U4L
Console Printer Code to EBCDIC	CPEBC	3,0	None	U4D
Console Printer Code to IBM Card Code	CPHOL	3,0	None	U4E
Console Printer Code to 1403 Printer Code	CPPT3	3,0	None	U4F
IBM Card Code to EBCDIC	HLEBC	3,0	None	U4M
IBM Card Code to Console Printer Code	HOLCP	3,0	None	U4O
IBM Card Code to 1403 Printer Code	HLPT3	3,0	None	U4N
1403 Printer Code to EBCDIC	PT3EB	3,0	None	U4S
1403 Printer Code to Console Printer Code	PT3CP	3,0	None	U4R
1403 Printer Code to IBM Card Code	PTHOL	3,0	None	U4T
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
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, PLOT1	V1I

System Library Programs	Names	Type and Sub-type	Subroutines Required	ID Field (cc 73 - 75)
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	3,2	FLOAT, FMPY, IFIX, FADD, FLDX, FINC, XYPLT, PLOTI, FSTOX, FLD	V1G
Standard Precision Plot Scaler	FRULE, FMOVE, FINC	3,2	FLDX, FSUBX, FMPYX, FLD, FSTOX, FMPY, IFIX, FADD	V1J
Extended Plot LIBFs				
Extended Precision Annotation	ECHRX, ECHRI, YCHRI	3,2	FLOAT, EMPY, IFIX, EADD, ELDX, EINC, XYPLT, PLOTI, ESTOX, ELD	V1B
Extended Precision Plot Scaler	ERULE, EMOVE, EINC	3,2	ELDX, ESUBX, 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

The Location Equivalence Table (LET) contains the name and disk block count of all programs and data files stored in the User Area, including the System Library. The Fixed Location Equivalence Table (FLET) contains the names of all programs and data files stored in the Fixed Area.

Each cartridge must have a LET. FLET is optionally defined on each cartridge by the DUP control record DEFINE FIXED AREA.

LET/FLET DISK FORMAT

All entries are three words long and consist of a name and disk block count. In addition, each sector of LET/FLET contains a five word sector header.

LET/FLET Entries

Entries	DSF (LET only)	CI	Data
Word 1, bits 0-1	00	10	11
Word 1, bits 2-15 plus Word 2	Program or data file name in name code		
Word 3	DB count of program or data file		

Sometimes unused disk space occurs because programs and data files are stored on sector boundaries.

Such spaces are represented by a 1DUMY entry:

Word 1, bits 0-1	Reserved
Word 1, bits 2-15 plus Word 2	Name code for 1DUMY
Word 3	DB count of entry

The last entry of LET is a 1DUMY entry reflecting the current size of WS available.

LET/FLET Sector Header

Word	Entry
1	Relative sector number for this cartridge only
2	Sector address of the UA (sector address of FX if FLET)
3	Reserved
4	Number of words available in this LET/FLET sector.
5	Sector address for the next LET/FLET sector of this cartridge. This entry is zero if this is the last LET/FLET sector on this cartridge.

LET/FLET DUMP FORMAT

The DUP control records DUMPLET or DUMPFLET are used to dump LET/FLET on the principal printer. One sector of LET/FLET is printed per page. The page is headed with the word LET or FLET, whichever is applicable. Each sector of LET/FLET dumped is preceded by two 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

Following this line will be a second header line which reflects information concerning the LET/FLET sector being dumped:

Relative Sector Number (SCTR NO.)
User Area/Fixed Area (UA/FXA)
Word Available (WORDS AVAIL)
Chain Address (CHAIN ADR)

Following these two header lines are the LET/FLET entries. Twenty one lines of entries are printed, five entries per line and sequenced by column. Each entry is formatted as follows:

Name -- 5 print positions + blank
Type code -- DSF, DCI, or DDF -- 3 print positions + blank, 4 blanks if 1DUMY or secondary entry point
DB Count -- 4 print positions + blank
DB Addr -- 4 print positions + 5 blanks

Only the name is printed for each secondary entry.

Examples of DUMPLET and DUMPFLET follow.

```
// JOB    3333

LOG DRIVE   CART SPEC   CART AVAIL  PHY DRIVE
  0000         3333        3333        C002
                           2222        0C01
                           COOF        0003
                           0ABB        0004

// DUP

*DEFINE FIXED AREA          5
CART ID 3333  CYLS FXA  0004  DBS AVAIL 0200  FLET SECTOR ADDR  0118

*STOREDATA  CD  FX  DATA    10
CART ID 3333   DB ADDR  1200   DB CNT   0020

*STOREDATACICC  FX  CIMGE   10
CART ID 3333   DB ACCR  1220   CB CNT   C020



*STOREDATA  CC  UA  CATA2   10
CART ID 3333   DB ACCR  1C40   CB CNT   CC20

*CUMPLET


                                 LET


=CIDN   $FPAC   =FPAC   =CIBA   =ULET   =FLET
3333    01D6    01D6    0140    C150    C118

SCTR NO.  UA/FXA.   WORDS AVAIL.  CHAIN ADDR.
CC00       0158          0000         0151


 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  CSF 0008 1580      FATN  DSF 000A 15AA      ESUB                     EATAN                    FIXIX
 FSUB                     FATAN                    EADDX                    EAXB  DSF 0005 161D      FLOAT DSF 0002 165E
 FADDX                    FAXB  DSF 0005 1584      ESUBX                    EAXBX                    IFIX  DSF 0004 1660
 FSUBX                    FAXBX                    EAXI  DSF 0007 15F2      EEXP  DSF 000A 1622      NORM  DSF 0004 1664
 FAXI  DSF 0006 1588      FEXP  DSF C009 15B9      EAXIX                    EXPN                     SNR   DSF 0002 1668
 FAXIX                    FXPN                     EDIV  DSF 0006 15F9      ELN   DSF 000B 162C      XDD   DSF 0006 166A
 FDIV  DSF 0007 158E      FLN   DSF 000A 15C2      EDIVX                    EALOG                    XMD   DSF 0005 1670
 FDIVX                    FALOG                    EDVR  DSF 0003 15FF      ESIGN DSF 0003 1637      XMDS  DSF 0003 1675
 FDVR  CSF 0003 1595      FSIGN DSF C003 15CC      EDVRX                    ESIN  DSF 000B 163A      FBTD  DSF 0019 1678
 FDVRX                    FSIN  DSF 0009 15CF      EGETP DSF 0003 1602      ESINE                    FDTB
 FGETP DSF 0003 1598      FSINE                    ELD   DSF 0004 1605      ECOSN                    IABS  DSF 0002 1691
 FLD   CSF 0005 159B      FCOS                     ELDX                     ECOS                     XSQR  DSF 0004 1693
 FLDX                     FCOSN                    ESTO                     ESQR  DSF 0006 1645      PAUSE DSF 0003 1697
 FSTO                     FSQR  DSF 0006 15D8      ESTOX                    ESQRT                    STOP  DSF 0002 169A
 FSTOX                    FSQRT                    EMPY  DSF 0004 1609      ETANH DSF 0004 164B      SUBIN DSF 0003 169C
 FMPY  CSF 0005 15A0      FTANH DSF C005 15DE      EMPYX                    ETNH                     SUBSC DSF 0003 169F
 FMPYX                    FTNH                     ESBR  DSF 0003 160D      SEAR  DSF 0004 164F      TTEST DSF 0002 16A2
 FSBR  CSF 0003 15A5      SFAR  DSF 0004 15E3      ESBRX                    SEARX                    TSET
 FSBRX                    SFARX                    EABS  DSF 0002 1610      SEIF  DSF C003 1653      DATSW DSF 0003 16A4
 FABS  DSF 0C02 15A8      SFIF  DSF 0003 15E7      EAVL                     FARC  DSF 0003 1656      DVCHK DSF 0002 16A7
 FAVL                     EADD  DSF 0008 15EA      EATN  DSF 000B 1612      FIXI  DSF 0005 1659      FCTST DSF 0003 16A9


=CIDN   $FPAC   =FPAD   =CIBA   =ULET   =FLET
3333    01C6    01D6    0140    0150    0118

SCTR NO.  UA/FXA.   WORDS AVAIL.  CHAIN ADDR.
CC01       0158          0000         0152


 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  ACDR      NAME  MAT CNT  ADDR      NAME  MAT CNT  ADDR      NAME  MAT CNT  ACDR

 ISIGN DSF 0003 16AC      SIOF                     PAPTZ DSF 000F 1748      CARD1 DSF 0010 17BE      SPEED DSF 0015 180A
 OVERF DSF 0C02 16AF      SICAF                    PNCHZ CSF 0006 1757      OMPR1 DSF C011 17CE      ZIPCO DSF 000A 18EF
 SLITE CSF 0005 16B1      SIOFX                    PRNTZ DSF 000D 175D      PAPT1 DSF 0011 17DF      BIDEC DSF 0006 18F9
 SLITT                    SCOMP                    PRNZ  DSF 000D 176A      PAPTN DSF 0013 17F0      BINDC DSF 0005 18FF
 PDUMP DSF 0009 16B6      SWRT                     READZ DSF 0005 1777      PAPTX DSF 0015 1803      BINHX DSF 0004 1904
 TSTOP DSF 0002 16BF      SRED                     TYPEZ DSF 0007 177C      PLOT1 DSF 000E 1818      CPEBC DSF 0009 1908
 TSTRT DSF 0002 16C1      SIOIX                    WRTYZ DSF 0005 1783      PNCH0 DSF 000E 1826      CPHOL DSF 0009 1911
 SDFIO DSF 0017 16C3      UFIO  DSF 001C 1720      EBCTB DSF 0005 1788      PNCH1 DSF 000E 1834      CPPT3 DSF C009 191A
 SDAF                     URED                     GETAD DSF 0002 178D      PRNT1 DSF 0018 1842      DCBIN DSF 0006 1923
 SDAI                     UWRT                     HOLEZ DSF 0005 178F      PRNT3 DSF 000D 185A      DECBI DSF 0009 1929
 SDCOM                    UIOI                     HOLTB DSF 0004 1794      READ0 DSF 0007 1867      EBCCP DSF 0009 1932
 SDF                      UIOF                     SGOTO DSF 0003 1798      READ1 DSF 0008 186E      EBHOL DSF 0009 193B
 SDFX                     UIOAI                    SIAR  DSF 0004 179B      TYPE0 DSF 0012 1876      EBPA  DSF 0006 1944
 SDI                      UIOAF                    SIARX                    WRTY0 DSF 0009 1888      EBPT3 DSF 0009 194A
 SDIX                     UIOFX                    SIIF  DSF 0003 179F      EBPRT DSF 0007 1891      HLEBC DSF 0009 1953
 SDRED                    UIOIX                    ILS00 DSF 0003 17A2      HOLEB DSF 0009 1898      HLPT3 DSF 0009 195C
 SDWRT                    UCOMP                    ILS01 DSF 0003 17A5      HOLPR DSF 0007 18A1      HOLCP DSF 0009 1965
 SDFND DSF 0006 16DA      BCKSP                    ILS02 DSF 0001 17A8      HXBIN DSF 0005 18A8      HOLL  DSF 0006 196E
 SFIO  DSF 0040 16E0      EOF                      ILS03 DSF 0003 17A9      PAPEB DSF 0010 18AD      PRTY  DSF 0006 1974
 SIOI                     REWND                    ILS04 DSF 0002 17AC      PAPHL DSF 0010 188D      PTHOL DSF 0009 197A
 SIOAI                    CARDZ DSF 000C 173C      CARD0 DSF 0010 17AE      PAPPR DSF 000D 18CD      PT3CP DSF 0009 1983


=CIDN   $FPAD   =FPAD   =CIBA   =ULET   =FLET
3333    01D6    01D6    0140    0150    0118

SCTR NO.  UA/FXA.   WORDS AVAIL.  CHAIN ADDR.
0002       0158          0087         0118


 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

 PT3EB DSF 0009 198C       ECHAR DSF 0005 1B75       POINT DSF 0008 1C05
 DMTD0 DSF 001A 1995       ECHRX DSF 0026 1B7A       SCALE DSF 0002 1C0D
 DMTX0                     ECHRI                     SCALF DSF 0002 1C0F
 DMPD1 DSF 001E 19AF       VCHRI                     XYPLT DSF 0007 1C11
 DMPX1                     EGRID DSF 0008 1BA0       EBC48 DSF 0009 1C18
 DMP80 DSF 0007 19CD       ERULE DSF 000A 1BA8       HOLCA DSF 0006 1C21
 FLIPR DSF 0007 19D4       EMOVE                     HOL48 DSF 0008 1C27
 SYSUP DSF 0035 19DB       EINC                      HXCV  DSF 0004 1C2F
 ADRWS DSF 0010 1A10       EPLOT DSF 0005 1BB2       PRNT2 DSF 001E 1C33
 COPY  DSF 001D 1A20       FCHAR DSF 0005 1BB7       SCAT1 DSF 0041 1C51
 DISC  DSF 0036 1A3D       FCHRX DSF 0025 1BBC       STRTB DSF 0006 1C92
 DLCIB DSF 001D 1A73       FCHRI                     SCAT3 DSF 004B 1C98
 DSLET DSF 0036 1A90       WCHRI                     KG3   DSF 0006 1CE3
 ID    DSF 001A 1AC6       FGRID DSF 0008 1BE1       KG4   DSF 0009 1CE9
 IDENT DSF 000C 1AE0       FRULE DSF 0009 1BE9       SCAT2 DSF 0040 1CF2
 MODIF DSF 0059 1AEC       FMOVE                     1DUMY      000E 1D32
 PTUTL DSF 0009 1B45       FINC                      DATA2 DDF 0020 1D40
 CALPR DSF 0007 1B4E       FPLOT DSF 0004 1BF2       1DUMY      46A0 1D60
 FSLEN DSF 000B 1B55       PLOTI DSF 0003 1BF6
 FSYSU                     PLOTS
 RDREC DSF 0015 1B60       PLOTX DSF 000C 1BF9


                                                FLET


=CIDN   $FPAD   =FPAD   =CIBA   =ULET   =FLET
3333    01D6    01D6    0140    0150    0118

SCTR NO.  UA/FXA.   WORDS AVAIL.  CHAIN ADDR.
0010       0120          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 1200
 CIMGE DCI 0020 1220
 1DUMY      01C0 1240

 END OF DUMPLET/FLET

*DUMPFLET


=CIDN   $FPAD   =FPAD   =CIBA   =ULET   =FLET
3333    01D6    01D6    0140    0150    0118

SCTR NO.  UA/FXA.   WORDS AVAIL.  CHAIN ADDR.
0010       0120          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 1200
 CIMGE DCI 0020 1220
 1DUMY      01C0 1240
```

The contents of this appendix are not to be construed as an external specification, i. e., the location in this listing may be changed. $PRET, $IREQ, $EXIT, $LINK, and $DUMP are the only locations that are guaranteed.

Note that = is equivalent to # and ' (apostrophe) is equivalent to @.

```
DCOM
ADDR REL OBJECT    ST.NO.   LABEL OPCD FT OPERANDS                               ID/SEQNO

                   0001     * RLTV ADDR* SYMBOL* DESCRIPTION                    SYS00010
                   0002     *          *       *                                SYS00020
                   0003     * 0-3      *       * RESERVED FOR EVEN BOUNDARIES   SYS00030
                   0004     * 4-5      * =NAME * NAME OF PROGRAM/CORE LOAD      SYS00040
                   0005     * 6        * =DBCT * BLOCK COUNT OF PROG/CORE LOAD  SYS00050
                   0006     * 7        * =FCNT * *FILES SWITCH--ZERO MEANS NO   SYS00060
                   0007     *          *       * FILES HAVE BEEN EQUATED        SYS00070
                   0008     * 8        * =SYSC * SYS/NON-SYS CARTRIDGE INDR     SYS00080
                   0009     * 9        * =JBSW * JOBT SWITCH-- NON-ZERO MEANS   SYS00090
                   0010     *          *       * TEMPORARY MODE                 SYS00100
                   0011     * 10       * =CBSW * CLB-RETURN-TO-DUP SWITCH--     SYS00110
                   0012     *          *       * ZERO=CLB RETURN TO SUPV        SYS00120
                   0013     * 11       * =LCNT * NO. OF LOCALS                  SYS00130
                   0014     * 12       * =MPSW * CORE MAP SWITCH--ZERO MEANS    SYS00140
                   0015     *          *       * DO NOT PRINT A CORE MAP        SYS00150
                   0016     * 13       * =MDF1 * NO. DUP CTRL RECDS (MODIF)     SYS00160
                   0017     * 14       * =MDF2 * ADDR OF MODIF BUFFER           SYS00170
                   0018     * 15       * =NCNT * NO. OF NOCALS                  SYS00180
                   0019     * 16       * =ENTY * RLTV ENTRY ADDR OF PROGRAM     SYS00190
                   0020     * 17       * =RP67 * 1442-5 SW (0=1442-5 ON SYSTEM  SYS00200
                   0021     * 18       * =TODR * 'TO' WORKING STG DRIVE CODE    SYS00210
                   0022     * 19       * =FRDR * 'FROM' WORKING STG DRIVE CODE  SYS00220
                   0023     * 20       * =FHOL * ADDR OF LARGEST HOLE IN FXA    SYS00230
                   0024     * 21       * =FSZE * BLK CNT OF LARGEST HOLE IN FXA SYS00240
                   0025     * 22       * =UHOL * ADDR OF LARGEST HOLE IN UA     SYS00250
                   0026     * 23       * =USZE * BLK CNT OF LARGEST HOLE IN UA  SYS00260
                   0027     * 24       * =DCSW * DUP CALL SW--NON-ZERO=DUP CALL SYS00270
                   0028     * 25       * =PIOD * PRINCIPAL I/O DEVICE INDICATOR SYS00280
                   0029     * 26       * =PPTR * PRINC. PRINT DEVICE INDICATOR  SYS00290
                   0030     * 27       * =CIAD * RLTV ADDR IN 'STRT OF CIL ADDR SYS00300
                   0031     * 28-34    *       * RESERVED FOR FUTURE USE        SYS00310
                   0032     * 35       * =ANDU * 1+BLOCK ADDR OF END OF USER    SYS00320
                   0033     *          *       * AREA (ADJUSTED) LOGICAL DR 0   SYS00330
                   0034     * 36       *       * 1+BLOCK ADDR OF END OF USER    SYS00340
                   0035     *          *       * AREA (ADJUSTED) LOGICAL DR 1   SYS00350
                   0036     * 37       *       * 1+BLOCK ADDR OF END OF USER    SYS00360
                   0037     *          *       * AREA (ADJUSTED) LOGICAL DR 2   SYS00370
                   0038     * 38       *       * 1+BLOCK ADDR OF END OF USER    SYS00380
                   0039     *          *       * AREA (ADJUSTED) LOGICAL DR 3   SYS00390
                   0040     * 39       *       * 1+BLOCK ADDR OF END OF USER    SYS00400
                   0041     *          *       * AREA (ADJUSTED) LOGICAL DR 4   SYS00410
                   0042     * 40       * =BNDU * 1+BLOCK ADDR OF END OF USER    SYS00420
                   0043     *          *       * AREA (BASE) LOGICAL DRIVE  0   SYS00430
                   0044     * 41       *       * 1+BLOCK ADDR OF END OF USER    SYS00440
                   0045     *          *       * AREA (BASE) LOGICAL DRIVE  1   SYS00450
                   0046     * 42       *       * 1+BLOCK ADDR OF END OF USER    SYS00460
                   0047     *          *       * AREA (BASE) LOGICAL DRIVE  2   SYS00470
                   0048     * 43       *       * 1+BLOCK ADDR OF END OF USER    SYS00480
                   0049     *          *       * AREA (BASE) LOGICAL DRIVE  3   SYS00490
                   0050     * 44       *       * 1+BLOCK ADDR OF END OF USER    SYS00500
                   0051     *          *       * AREA (BASE) LOGICAL DRIVE  4   SYS00510
                   0052     * 45       * =FPAD * FILE PROTECT ADDR, LOGICAL     SYS00520
                   0053     *          *       * DRIVE 0 (BASE)                 SYS00530
                   0054     * 46       *       * FILE PROTECT ADDR, LOGICAL     SYS00540
                   0055     *          *       * DRIVE 1 (BASE)                 SYS00550
                   0056     * 47       *       * FILE PROTECT ADDR, LOGICAL     SYS00560
                   0057     *          *       * DRIVE 2 (BASE)                 SYS00570
                   0058     * 48       *       * FILE PROTECT ADDR, LOGICAL     SYS00580
                   0059     *          *       * DRIVE 3 (BASE)                 SYS00590
                   0060     * 49       *       * FILE PROTECT ADDR,LOGICAL      SYS00600
                   0061     *          *       * DRIVE 4 (BASE)                 SYS00610
                   0062     * 50       * =PCID * CARTRIDGE ID, PHYSICAL DRIVE 0 SYS00620
                   0063     * 51       *       * CARTRIDGE ID, PHYSICAL DRIVE 1 SYS00630
                   0064     * 52       *       * CARTRIDGE ID, PHYSICAL DRIVE 2 SYS00640
                   0065     * 53       *       * CARTRIDGE ID, PHYSICAL DRIVE 3 SYS00650
                   0066     * 54       *       * CARTRIDGE ID, PHYSICAL DRIVE 4 SYS00660
                   0067     * 55       * =CIDN * CARTRIDGE ID, LOGICAL DRIVE 0  SYS00670
                   0068     * 56       *       * CARTRIDGE ID, LOGICAL DRIVE 1  SYS00680
                   0069     * 57       *       * CARTRIDGE ID, LOGICAL DRIVE 2  SYS00690
                   0070     * 58       *       * CARTRIDGE ID, LOGICAL DRIVE 3  SYS00700
                   0071     * 59       *       * CARTRIDGE ID, LOGICAL DRIVE 4  SYS00710
                   0072     * 60       * =CIBA * SCTR ADDR OF CIB, LOGICAL DR 0 SYS00720
                   0073     * 61       *       * SCTR ADDR OF CIB, LOGICAL DR 1 SYS00730
                   0074     * 62       *       * SCTR ADDR OF CIB, LOGICAL DR 2 SYS00740
                   0075     * 63       *       * SCTR ADDR OF CIB, LOGICAL DR 3 SYS00750
                   0076     * 64       *       * SCTR ADDR OF CIB, LOGICAL DR 4 SYS00760
                   0077     * 65       * =SCRA * SCRA, LOGICAL DRIVE 0          SYS00770
                   0078     * 66       *       * SCRA, LOGICAL DRIVE 1          SYS00780
                   0079     * 67       *       * SCRA, LOGICAL DRIVE 2          SYS00790
                   0080     * 68       *       * SCRA, LOGICAL DRIVE 3          SYS00800
                   0081     * 69       *       * SCRA, LOGICAL DRIVE 4          SYS00810
                   0082     * 70       * =FMAT * FORMAT OF PROG IN WS, DRIVE 0  SYS00820
                   0083     * 71       *       * FORMAT OF PROG IN WS, DRIVE 1  SYS00830
                   0084     * 72       *       * FORMAT OF PROG IN WS, DRIVE 2  SYS00840
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DCOM
ADDR REL OBJECT    ST.NO.    LABEL OPCD FT OPERANDS                           ID/SEQNO

                   0085      * 73          *        * FORMAT OF PROG IN WS, DRIVE 3  SYS00850
                   0086      * 74          *        * FORMAT OF PROG IN WS, DRIVE 4  SYS00860
                   0087      * 75          * =FLET  * FLET SCTR ADDR, LOGICAL DR 0   SYS00870
                   0088      * 76          *        * FLET SCTR ADDR, LOGICAL DR 1   SYS00880
                   0089      * 77          *        * FLET SCTR ADDR, LOGICAL DR 2   SYS00890
                   0090      * 78          *        * FLET SCTR ADDR, LOGICAL DR 3   SYS00900
                   0091      * 79          *        * FLET SCTR ADDR, LOGICAL DR 4   SYS00910
                   0092      * 80          * =ULET  * LET SCTR ADDR, LOGICAL DR 0    SYS00920
                   0093      * 81          *        * LET SCTR ADDR, LOGICAL DR 1    SYS00930
                   0094      * 82          *        * LET SCTR ADDR, LOGICAL DR 2    SYS00940
                   0095      * 83          *        * LET SCTR ADDR, LOGICAL DR 3    SYS00950
                   0096      * 84          *        * LET SCTR ADDR, LOGICAL DR 4    SYS00960
                   0097      * 85          * =WSCT  * BLK CNT OF PROG IN WS, DRIVE 0 SYS00970
                   0098      * 86          *        * BLK CNT OF PROG IN WS, DRIVE 1 SYS00980
                   0099      * 87          *        * BLK CNT OF PROG IN WS, DRIVE 2 SYS00990
                   0100      * 88          *        * BLK CNT OF PROG IN WS, DRIVE 3 SYS01000
                   0101      * 89          *        * BLK CNT OF PROG IN WS, DRIVE 4 SYS01010
                   0102      * 90          * =CSHN  * SCTR CNT CUSHION,LOGICAL DR 0  SYS01020
                   0103      * 91          *        * SCTR CNT CUSHION,LOGICAL DR 1  SYS01030
                   0104      * 92          *        * SCTR CNT CUSHION,LOGICAL DR 2  SYS01040
                   0105      * 93          *        * SCTR CNT CUSHION,LOGICAL DR 3  SYS01050
                   0106      * 94          *        * SCTR CNT CUSHION,LOGICAL DR 4  SYS01060
                   0107      * 95-319      *        * RESERVED FOR FUTURE USE        SYS01070
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RESIDENT IMAGE

ADDR REL OBJECT    ST.NO.    LABEL OPCD FT OPERANDS                           ID/SEQNO

                   0109      *                                                SYS01090
                   0110      * RLTV ADDR* SYMBOL* DESCRIPTION                 SYS01100
                   0111      *           *       *                            SYS01110
                   0112      * 0-209     *       * INITIAL VALUES FOR WORDS 4-213 SYS01120
                   0113      *           *       * OF THE RESIDENT MONITOR    SYS01130
                   0114      * 210-319   *       * RESERVED FOR FUTURE USE    SYS01140
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RESIDENT MONITOR

ADDR REL OBJECT    ST.NO.    LABEL OPCD FT OPERANDS                           ID/SEQNO

                   0116      ************************************************ SYS01160
                   0117      *                                              * SYS01170
                   0118      *STATUS-VERSION 2, MODIFICATION 0              * SYS01180
                   0119      *                                              * SYS01190
                   0120      *FUNCTION/OPERATION-                           * SYS01200
                   0121      *   THIS SECTION ALWAYS REMAINS IN CORE. IT    * SYS01210
                   0122      *   IS COMPRISED OF THE COMMUNICATIONS         * SYS01220
                   0123      *   AREA (COMMA), THE SKELETON SUPERVISOR, AND * SYS01230
                   0124      *   A DISK I/O SUBROUTINE, NOMINALLY DISKZ. (THE * SYS01240
                   0125      *   FIRST TWO OF THESE SECTIONS ARE INTERMIXED.) * SYS01250
                   0126      *   COMMA CONTAINS THE SYSTEM PARAMETERS REQUIR- * SYS01260
                   0127      *   ED TO FETCH A CORE LOAD IN CORE IMAGE FOR- * SYS01270
                   0128      *   MAT. THE SKELETON SUPERVISOR PROVIDES IN-  * SYS01280
                   0129      *   STRUCTIONS FOR INITIATING A CALL EXIT, A   * SYS01290
                   0130      *   CALL LINK, A DUMP-TO-PRINTER OR A CALL TO THE * SYS01300
                   0131      *   AUXILIARY SUPERVISOR.  IN ADDITION, THE SKELE-* SYS01310
                   0132      *   TON SUPERVISOR CONTAINS SEVERAL TRAPS FOR CER-* SYS01320
                   0133      *   TAIN I/O FUNCTIONS/CONDITIONS. THE DISK I/O  * SYS01330
                   0134      *   SECTION CONSISTS OF A SUBROUTINE FOR READING * SYS01340
                   0135      *   FROM OR WRITING ON A DISK CARTRIDGE ON A   * SYS01350
                   0136      *   GIVEN LOGICAL DISK DRIVE.                  * SYS01360
                   0137      *                                              * SYS01370
                   0138      *ENTRY POINTS-                                 * SYS01380
                   0139      *   * $PRET-A TRAP FOR PREOPERATIVE I/O ERRORS. * SYS01390
                   0140      *          THE CALLING SEQUENCE IS             * SYS01400
                   0141      *             BSI   L  $PRET                   * SYS01410
                   0142      *   * $PSTX-A POSTOPERATIVE ERROR TRAP FOR I/O * SYS01420
                   0143      *          DEVICES ON LEVEL X (X=1,2,3,OR 4).  * SYS01430
                   0144      *          THE CALLING SEQUENCE IS             * SYS01440
                   0145      *             BSI   L  $PSTX                   * SYS01450
                   0146      *   * $STOP-THE PROGRAM STOP KEY TRAP.         * SYS01460
                   0147      *   * $EXIT-THE ENTRY POINT FOR THE EXIT/CALL  * SYS01470
                   0148      *         EXIT STATEMENT. THE CALLING SEQUENCE IS* SYS01480
                   0149      *            LDX    0 $EXIT                    * SYS01490
                   0150      *   * $LINK-THE ENTRY POINT FOR THE LINK/CALL  * SYS01500
                   0151      *         LINK STATEMENT. THE CALLING SEQUENCE IS* SYS01510
                   0152      *            BSI   L  $LINK                    * SYS01520
                   0153      *   * $DUMP-THE ENTRY POINT FOR THE DUMP/PDMP  * SYS01530
                   0154      *         STATEMENT. THE CALLING SEQUENCE IS   * SYS01540
                   0155      *            BSI   L  $DUMP                    * SYS01550
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ADDR REL OBJECT    ST.NO.   LABEL OPCD FT OPERANDS                                ID/SEQNO
                    0156    *              DC      FORMAT                      * SYS01560
                    0157    *              DC      LIMIT1                      * SYS01570
                    0158    *              DC      LIMIT2                      * SYS01580
                    0159    *           WHERE LIMIT1 AND LIMIT2 ARE THE LIMITS * SYS01590
                    0160    *           BETWEEN WHICH THE DUMP IS TO OCCUR, AND* SYS01600
                    0161    *           FORMAT IS A CODE INDICATING THE FORMAT * SYS01610
                    0162    *           OF THE DUMP. IF FORMAT IS NEGATIVE,    * SYS01620
                    0163    *           THE AUXILIARY SUPERVISOR IS FETCHED    * SYS01630
                    0164    *           AND CONTROL PASSED TO IT.              * SYS01640
                    0165    *   * DZ000-ENTERED WHEN THE CALLER WISHES TO      * SYS01650
                    0166    *            PERFORM A DISK I/O OPERATION. THE     * SYS01660
                    0167    *            CALLING SEQUENCE VARIES WITH THE      * SYS01670
                    0168    *            VERSION OF THE DISK I/O SUBROUTINE.   * SYS01680
                    0169    *   * $I200/$I400-ENTERED WHEN THE OPERATION-      * SYS01690
                    0170    *                  COMPLETE INTERRUPT OCCURS ON    * SYS01700
                    0171    *                  LEVEL 2/4.                      * SYS01710
                    0172    *                                                  * SYS01720
                    0173    *INPUT-N/A                                         * SYS01730
                    0174    *                                                  * SYS01740
                    0175    *OUTPUT-WORDS 6-4090 SAVED ON THE CIB ON A CALL    * SYS01750
                    0176    *       DUMP                                       * SYS01760
                    0177    *                                                  * SYS01770
                    0178    *EXTERNAL REFERENCES-N/A                           * SYS01780
                    0179    *                                                  * SYS01790
                    0180    *EXITS-                                            * SYS01800
                    0181    *   * NORMAL                                       * SYS01810
                    0182    *      *THE EXITS FROM THE SUBROUTINES AT $PRET    * SYS01820
                    0183    *        $PST1, $PST2, $PST3, $PST4, AND $STOP     * SYS01830
                    0184    *        ARE BRANCH INSTRUCTIONS FOLLOWING A       * SYS01840
                    0185    *        WAIT INSTRUCTION. $STOP TURNS OFF IN-     * SYS01850
                    0186    *        TERRUPT LEVEL 5 AFTER THE START KEY IS    * SYS01860
                    0187    *        DEPRESSED.                                * SYS01870
                    0188    *      *THE EXITS FROM $EXIT,$LINK,AND $DUMP ARE   * SYS01880
                    0189    *        TO THE CORE IMAGE LOADER, PHASE 1,        * SYS01890
                    0190    *        AFTER THAT PHASE HAS BEEN FETCHED.        * SYS01900
                    0191    *      *THE EXIT FROM DZ000 IS BACK TO THE         * SYS01910
                    0192    *        CALLER AFTER THE REQUESTED DISK OPERA-    * SYS01920
                    0193    *        TION HAS BEEN INITIATED.                  * SYS01930
                    0194    *      *THE EXITS FROM $I200/$I400 ARE BACK TO     * SYS01940
                    0195    *        THE ADDRESSES FROM WHICH THE DISK OP-     * SYS01950
                    0196    *        ERATION COMPLETE INTERRUPT OCCURED        * SYS01960
                    0197    *        AFTER THE INTERRUPT HAS BEEN SERVICED     * SYS01970
                    0198    *        BY THE APPROPRIATE ISS.                   * SYS01980
                    0199    *   * ERROR-N/A                                    * SYS01990
                    0200    *                                                  * SYS02000
                    0201    *TABLES/WORK AREAS-                                * SYS02010
                    0202    *   * $ACDE                                        * SYS02020
                    0203    *   * $CH12                                        * SYS02030
                    0204    *   * $CILA                                        * SYS02040
                    0205    *   * $CLSW                                        * SYS02050
                    0206    *   * $COMN                                        * SYS02060
                    0207    *   * $CORE                                        * SYS02070
                    0208    *   * $CTSW                                        * SYS02080
                    0209    *   * $CXR1                                        * SYS02090
                    0210    *   * $CYLN                                        * SYS02100
                    0211    *   * $DABL                                        * SYS02110
                    0212    *   * $DADR                                        * SYS02120
                    0213    *   * $DBSY                                        * SYS02130
                    0214    *   * $DCYL                                        * SYS02140
                    0215    *   * $DMPF                                        * SYS02150
                    0216    *   * $DREQ                                        * SYS02160
                    0217    *   * $FPAD                                        * SYS02170
                    0218    *   * $HASH                                        * SYS02180
                    0219    *   * $IBT2                                        * SYS02190
                    0220    *   * $IBT4                                        * SYS02200
                    0221    *   * $IBSY                                        * SYS02210
                    0222    *   * $IOCT                                        * SYS02220
                    0223    *   * $KCSW                                        * SYS02230
                    0224    *   * $LAST                                        * SYS02240
                    0225    *   * $NDUP                                        * SYS02250
                    0226    *   * $NXEQ                                        * SYS02260
                    0227    *   * $PBSY                                        * SYS02270
                    0228    *   * $PGCT                                        * SYS02280
                    0229    *   * $PHSE                                        * SYS02290
                    0230    *   * $RMSW                                        * SYS02300
                    0231    *   * $SNLT                                        * SYS02310
                    0232    *   * $UFIO                                        * SYS02320
                    0233    *   * $ULET                                        * SYS02330
                    0234    *   * $WRD1                                        * SYS02340
                    0235    *   * $WSDR                                        * SYS02350
                    0236    *                                                  * SYS02360
                    0237    *ATTRIBUTES-REUSABLE                               * SYS02370
                    0238    *                                                  * SYS02380
                    0239    *NOTES-                                            * SYS02390
                    0240    *   THERE ARE WAIT INSTRUCTIONS AT $PRET+1,        * SYS02400
                    0241    *   $STOP+1, AND $PSTX+1. DEPRESSING THE START     * SYS02410
                    0242    *   KEY WILL RETURN CONTROL TO THE CALLER IN ALL   * SYS02420
                    0243    *   CASES.                                         * SYS02430
                    0244    **************************************************** SYS02440
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ADDR REL OBJECT   ST.NO.   LABEL OPCD FT OPERANDS                              ID/SEQNO

                  0246     * PROVIDE PARAMETERS FOR SYSTEM LOADER              SYS02460
                  0247     *                                                   SYS02470
                  0248           ABS                                           SYS02480
0280              0249           ORG     4                                     SYS02490
0004 0  0FFA      0250           DC      4095-* WD CNT FOR WRITING CORE ON CIB SYS02500
0005 0  0000      0251     $CIBA DC      *-*  SCTR ADDR OF THE CIB             SYS02510
0006 0  0000      0252     $CH12 DC      *-*  ADDR OF CHANNEL 12 INDICATOR     SYS02520
0007 0  0000      0253     $CCMN DC      *-*  LENGTH OF COMMON (IN WORDS)      SYS02530
                  0254     *                                                   SYS02540
                  0255     * ULTIMATE RESIDENCE OF THE INTERRUPT TV            SYS02550
                  0256     *                                                   SYS02560
0008 0  0000      0257     $LEV0 DC      *-*   LEVEL 0 BRANCH ADDRESS          SYS02570
0009 C  0000      0258     $LEV1 DC      *-*   LEVEL 1 BRANCH ADDRESS          SYS02580
000A 0  00B3      0259     $LEV2 DC      $I200 LEVEL 2 BRANCH ADDR             SYS02590
0008 0  0000      0260     $LEV3 DC      *-*   LEVEL 3 BRANCH ADDRESS          SYS02600
000C 0  00C4      0261     $LEV4 DC      $I400 LEVEL 4 BRANCH ADDR             SYS02610
000D 0  0091      0262     $LEV5 DC      $STOP LEVEL 5 BRANCH ADDR             SYS02620
                  0263     *                                                   SYS02630
                  0264     *                                                   SYS02640
000E C  0000      0265     $CORE DC      *-*  SIZE OF CORE, E.G., 4096=4K      SYS02650
000F 0  0000      0266     $CTSW DC      *-*  CONTROL RECORD TRAP SWITCH       SYS02660
0010 C  0000      0267     $DADR DC      *-*  SCTR ADDR OF PROG TO BE LOADED   SYS02670
0011 0  5540      0268     $DABL DC      /5540 IOCC FOR SCA RESET (ODD ADDR)   SYS02680
CC12 0  0000      0269     $DREQ DC      *-*  IND. FOR REQUESTED VERSION DKI/O SYS02690
0013 C  0000      0270     $IBSY DC      *-*  NON-ZERO IF CD/PAP TP DEV. BUSY  SYS02700
0014    000C      0271     $HASH BSS   E  12   WORK AREA                       SYS02710
                  0272     *                                                   SYS02720
                  0273     *                                                   SYS02730
0020    0008      0274     $SCAN BSS      8    1132 SCAN AREA                32 SYS02740
                  0275     *                                                   SYS02750
                  0276     *                                                   SYS02760
                  0277     *                                                   SYS02770
                  0278     * TRAP FOR PREOPERATIVE I/O ERRORS                  SYS02780
                  0279     *                                                   SYS02790
0028 C  0000      028C     $PRET DC      *-*       ENTRY POINT                 SYS02800
0029 C  3000      0281           WAIT              WAIT TIL START KEY PUSHED   SYS02810
002A 00 4C800028  0282           BSC   I  $PRET     RETURN TO CALLER            SYS02820
                  0283     *                                                   SYSC2830
                  0284     *                                                   SYS02840
002C 0  0000      0285     $IREQ DC      *-*  ADDR OF INT REQUEST SUBROUTINE   SYS02850
002D 0  0000      0286     $ULET DC      *-*  ADDR OF LET, LOGICAL DR 0        SYS02860
002E C  0000      0287           DC      *-*  ADDR OF LET, LOGICAL DR 1        SYS02870
002F C  0000      0288           DC      *-*  ADDR OF LET, LOGICAL DR 2        SYS02880
0030 0  0000      0289           DC      *-*  ADDR OF LET, LOGICAL DR 3        SYS02890
0031 C  0000      0290           DC      *-*  ADDR OF LET, LOGICAL DR 4        SYS02900
0032 0  0000      0291     $IOCT DC      *-*  ZERO IF NO I/O IN PROGRESS    50 SYS02910
0033 0  0000      0292     $LAST DC      *-*  NON-ZERO WHEN LAST CARD SENSED   SYS02920
0034 0  0000      0293     $NDUP DC      *-*  DO NOT DUP IF NON-ZERO           SYS02930
0035 0  0000      0294     $NXEQ DC      *-*  DO NOT EXECUTE IF NON-ZERO       SYS02940
0036 0  0000      0295     $PBSY CC      *-*  NON-ZERO WHEN PRINTER BUSY       SYS02950
0037 0  0000      0296     $PGCT DC      *-*  PAGE NO. FOR HEADINGS            SYS02960
                  0297     *                                                   SYS02970
                  0298     * CALL EXIT ENTRY POINT TO SKELETON SUPERVISOR      SYS02980
                  0299     *                                                   SYS02990
0038 0  7014      0300     $EXIT MDX     $S000     BR TO FETCH CIL, PHASE 1 56 SYS03000
                  0301     *                                                   SYS03010
                  0302     *** CALL LINK ENTRY POINT                           SYS03020
                  0303     *                                                   SYS03030
0039 0  0000      0304     $LINK DC      *-*       ENTRY POINT               57 SYS03040
003A C  1810      0305           SRA     16                                    SYS03050
003B 0  7012      0306           MDX     $S100     BR TO FETCH CIL, PHASE 1    SYS03060
003C    0000      0307           BSS   E  0                                    SYS03070
003C 0  0001      0308     $S900 DC      1    DISK PARAMETERS FOR SAVING CORE  SYS03080
003D C  C004      0309           DC      $CIBA-1 *IN CONNECTION WITH DUMP      SYS03090
C03E 0  FFFF      0310     $S910 DC      -1   CALL EXIT INDICATOR              SYS03100
                  0311     *                                                   SYS03110
                  0312     *** SAVE 1ST 4K OF CORE ON THE CIB                  SYS03120
                  0313     *                                                   SYS03130
003F 0  0000      0314     $DUMP DC      *-*       ENTRY POINT             63   SYS03140
0040 00 74C00032  0315           MDX   L  $IOCT,0   SKIP IF NO INTERRUPT        SYS03150
0042 C  70FD      0316           MDX      *-3       *PENDING, BR OTHERWISE      SYS03160
0043 0  D8D6      0317           STD     $ACEX     SAVE ACCUMULATOR, EXTENSION SYS03170
0044 0  69D2      0318           STX    1 $CXR1     SAVE XR1                    SYS03180
0045 C0 C480003F  0319           LD    I  $DUMP                                 SYS03190
0047 0  D0D1      0320           STO     $DMPF     SAVE DUMP FORMAT CODE       SYS03200
0048 0  C8F3      0321           LDD     $S900                                 SYS03210
0049 C0 440000F2  0322           BSI   L  DZ000     SAVE WDS 6-4095 ON CIB      SYS03220
0048 0  C0F0      0323           LD      $S900                                 SYS03230
004C 0  7001      0324           MDX     $S100     BR TO FETCH CIL, PHASE 1    SYS03240
                  0326     *                                                   SYS03260
                  0327     *** FETCH CORE IMAGE LOADER, PHASE 1                SYS03270
                  0328     *                                                   SYS03280
004D 0  C0F0      0329     $S000 LD      $S910                                 SYS03290
004E 0  D0C7      0330     $S100 STO     $RMSW     SAVE EXIT-LINK-DUMP SWITCH  SYS03300
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ADDR REL OBJECT    ST.NO.  LABEL OPCD FT OPERANDS                               ID/SEQNO

004F 00 74C00032   0331          MDX  L  $IOCT,0    SKIP IF NO INTERRUPT LEFT   SYS03310
0051 0  70FD       0332          MDX     *-3        BR IF INTERRUPT(S) PENDING  SYS03320
0052 0  08BD       0333          XIO     $DABL-1    TURN OFF THE SCA            SYS03330
0053 00 65800039   0334          LDX  I1 $LINK      LINK ADDR TO XR1            SYS03340
0055 0  C101       0335          LD    1 1          FETCH 2ND WD OF LINK NAME   SYS03350
0056 0  18D0       0336          RTE     16                                     SYS03360
0057 0  C100       0337          LD    1 0          FETCH 1ST WD OF LINK NAME   SYS03370
0058 0  D8BB       0338          STD     $LKNM      SAVE TEMPORARILY            SYS03380
                   0339    * $S150+1 CONTAINS ADDR LAST WD OF DISK I/O MINUS 3 SYS03390
0059 00 65000000   0340    $S150 LDX  L1 *-*        ADDR END OF DKI/O-1 TO XR1  SYS03400
005B C  C0FE       0341          LD      $CILA                                  SYS03410
005C 0  1890       0342          SRT     16                                     SYS03420
005D 00 440000F2   0343          BSI  L  DZ000      FETCH CI LOADER, PHASE 1    SYS03430
005F CC 740000EE   0344          MDX  L  $DBSY,0    SKIP IF READ OP DONE        SYS03440
0061 0  70FD       0345          MDX     *-3        BR UNTIL READ FINISHED      SYS03450
0062 0  4102       0346          BSI   1 2          BR TO CI LOADER, PHASE 1    SYS03460
                   0347    *                                                    SYS03470
0063    0005       0348          BSS     5          RESERVED FOR THE 2250       SYS03480
0068    0009       0349          BSS     9          PATCH AREA                  SYS03490
                   0350    *                                                    SYS03500
0071 0  0000       0351    $FLSH DC      *-*  FLUSH-TO-NEXT-JOB SWITCH 1=FLUSH SYS03510
0072    0000       0352          BSS  E  0                                      SYS03520
0072 0  0000       0353    $CWCT DC      *-*  WORD COUNT AND SECTOR ADDRESS     SYS03530
0073 0  0000       0354          DC      *-*  *FOR SAVING/RESTORING COMMON      SYS03540
0074 C  0000       0355    $CCAD DC      *-*  ADDR FOR SAVING/RESTORING COMMON  SYS03550
0075 0  0000       0356    $LSAD DC      *-* SCTR ADDR OF 1ST LOCAL/SOCAL       SYS03560
0076 C  0000       0357    $DZ1N DC      *-*  DISKZ/1/N INDICATOR (-1,0,+1)     SYS03570
0077 C  0000       0358    $DCDE DC      *-*  LOGICAL DRIVE CODE FOR PROGRAM    SYS03580
0078 0  0000       0359    $PHSE DC      *-*  NO. OF PHASE NOW IN CORE          SYS03590
0079 0  0000       0360    $UFIO DC      *-*  UNFORMATTED I/O RECORD NO.        SYS03600
007A C  0000       0361    $WSDR DC      *-*  WORKING STORAGE DRIVE CODE        SYS03610
007B 0  0000       0362    $WRD1 DC      *-*  LOADING ADDR OF THE CORE LOAD     SYS03620
007C 0  000C       0363    $KCSW DC      *-*  1 IF KB,CP BOTH UTILIZED          SYS03630
007D C  0000       0364    $UFDR DC      *-*  UNFORMATTED I/O DRIVE CODE        SYS03640
007E 0  0000       0365    $CPTR DC      *-*  CHANNEL 12 INDICATOR FOR CP       SYS03650
007F 0  0000       0366    $1132 DC      *-*  CHANNEL 12 INDICATOR FOR 1132     SYS03660
0080 6  0000       0367    $1403 DC      *-*  CHANNEL 12 INDICATOR FOR 1403     SYS03670
                   0369    * TRAP FOR POSTOPERATIVE I/O ERRORS ON LEVEL 1       SYS03690
                   0370    *                                                    SYS03700
0081 0  0000       0371    $PST1 DC      *-*        ENTRY POINT                 SYS03710
0082 0  3000       0372          WAIT                                           SYS03720
0083 00 4C800081   0373          BSC  I  $PST1      RETURN TO DEVICE SUBROUTINE SYS03730
                   0374    *                                                    SYS03740
                   0375    * TRAP FOR POSTOPERATIVE I/O ERRORS ON LEVEL 2       SYS03750
                   0376    *                                                    SYS03760
0085 0  0000       0377    $PST2 DC      *-*        ENTRY POINT                 SYS03770
0086 0  3000       0378          WAIT                                           SYS03780
0087 00 4C800085   0379          BSC  I  $PST2      RETURN TO DEVICE SUBROUTINE SYS03790
                   0380    *                                                    SYS03800
                   0381    * TRAP FOR POSTOPERATIVE I/O ERRORS ON LEVEL 3       SYS03810
                   0382    *                                                    SYS03820
0089 C  0000       0383    $PST3 DC      *-*        ENTRY POINT                 SYS03830
008A 0  3000       0384          WAIT                                           SYS03840
008B 00 4C800089   0385          BSC  I  $PST3      RETURN TO DEVICE SUBROUTINE SYS03850
                   0386    *                                                    SYS03860
                   0387    * TRAP FOR POSTOPERATIVE I/O ERRORS ON LEVEL 4       SYS03870
                   0388    *                                                    SYS03880
008D C  0000       0389    $PST4 DC      *-*        ENTRY POINT                 SYS03890
008E 0  3000       0390          WAIT                                           SYS03900
008F 00 4C80008D   0391          BSC  I  $PST4      RETURN TO DEVICE SUBROUTINE SYS03910
                   0392    *                                                    SYS03920
                   0393    *                                                    SYS03930
                   0394    * PROGRAM STOP KEY TRAP                              SYS03940
                   0395    *                                                    SYS03950
0091 0  0000       0396    $STOP DC      *-*        ENTRY POINT                 SYS03960
0092 0  3000       0397          WAIT               WAIT TIL START KEY PUSHED   SYS03970
0093 00 4CC00091   0398          BOSC I  $STOP      RETURN TO CALLER            SYS03980
                   0400    *                                                    SYS04000
                   0401    * PARAMETERS USED BY THE DISK I/O SUBROUTINES. THE   SYS04010
                   0402    * LOGICAL DRIVE CODE IS FOUND IN BITS 1-3 FOR ALL    SYS04020
                   0403    * BUT THE AREA CODE. BIT 0 WILL ALWAYS BE ZERO.      SYS04030
                   0404    *                                                    SYS04040
                   0405    *                                                    SYS04050
                   0406    *** DISK1 AND DISKN WILL NOT WRITE BELOW THE         SYS04060
                   0407    *** FOLLOWING SCTR ADDRESSES (EXCEPT WRITE IMMED).   SYS04070
                   0408    *                                                    SYS04080
0095 0  0000       0409    $FPAD DC      *-*  FILE PROTECT ADDR, LOGICAL DR 0   SYS04090
0096 C  0000       0410          DC      *-*  FILE PROTECT ADDR, LOGICAL DR 1   SYS04100
0097 C  0000       0411          DC      *-*  FILE PROTECT ADDR, LOGICAL DR 2   SYS04110
0098 C  0000       0412          DC      *-*  FILE PROTECT ADDR, LOGICAL DR 3   SYS04120
0099 C  0000       0413          DC      *-*  FILE PROTECT ADDR, LOGICAL DR 4   SYS04130
                   0414    *                                                    SYS04140
                   0415    *** THE ARM POSITION IS UPDATED WHENEVER A SEEK      SYS04150
                   0416    *** OCCURS.                                          SYS04160
                   0417    *                                                    SYS04170
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ADDR REL OBJECT     ST.NO.   LABEL OPCD FT OPERANDS                       ID/SEQNO

009A 0  0000        0418     $CYLN DC       0    ARM POSITION FOR LOGICAL DRIVE 0 SYS04180
009B 0  0000        0419           DC       0    ARM POSITION FOR LOGICAL DRIVE 1 SYS04190
009C 0  0000        0420           DC       0    ARM POSITION FOR LOGICAL DRIVE 2 SYS04200
009D 0  0000        0421           DC       0    ARM POSITION FOR LOGICAL DRIVE 3 SYS04210
009E 0  0000        0422           DC       0    ARM POSITION FOR LOGICAL DRIVE 4 SYS04220
                    0423     *                                                 SYS04230
                    0424     *** BELOW ARE THE DISK AREA CODES. A ZERO         SYS04240
                    0425     *** INDICATES THE CORRESPONDING DRIVE IS NOT      SYS04250
                    0426     *** ON THE SYSTEM                                 SYS04260
                    0427     *                                                 SYS04270
009F 0  0000        0428     $ACDE DC       *-*  AREA  CODE FOR LOGICAL DRIVE 0  SYS04280
00A0 0  0000        0429           DC       *-*  AREA  CODE FOR LOGICAL DRIVE 1  SYS04290
00A1 0  0000        0430           DC       *-*  AREA  CODE FOR LOGICAL DRIVE 2  SYS04300
00A2 0  0000        0431           DC       *-*  AREA  CODE FOR LOGICAL DRIVE 3  SYS04310
00A3 0  0000        0432           DC       *-*  AREA  CODE FOR LOGICAL DRIVE 4  SYS04320
                    0433     *                                                 SYS04330
                    0434     *** THE ADR OF THE CYLINDER IN WHICH A DEFECT OC-   SYS04340
                    0435     *** CURS, IF ANY, IS STORED IN THE 1ST, 2ND, OR 3RD SYS04350
                    0436     *** WORD BELOW, DEPENDING ON WHETHER IT IS THE 1ST, SYS04360
                    0437     *** 2ND, OR 3RD DEFECT ON THE CARTRIDGE.            SYS04370
                    0438     *                                                 SYS04380
00A4 0  0000        0439     $DCYL DC       *-*  DEFECTIVE CYLINDER ADDRESSES   1 SYS04390
00A5 0  0000        0440           DC       *-*  *FOR LOGICAL DRIVE 0           2 SYS04400
00A6 C  0000        0441           DC       *-*                                 3 SYS04410
00A7 0  0000        0442           DC       *-*  DEFECTIVE CYLINDER ADDRESSES   1 SYS04420
00A8 0  0000        0443           DC       *-*  *FOR LOGICAL DRIVE 1           2 SYS04430
00A9 0  0000        0444           DC       *-*                                 3 SYS04440
00AA C  0000        0445           DC       *-*  DEFECTIVE CYLINDER ADDRESSES   1 SYS04450
00AB 0  0000        0446           DC       *-*  *FOR LOGICAL DRIVE 2           2 SYS04460
00AC 0  0000        0447           DC       *-*                                 3 SYS04470
00AD 0  0000        0448           DC       *-*  DEFECTIVE CYLINDER ADDRESSES   1 SYS04480
00AE 0  0000        0449           DC       *-*  *FOR LOGICAL DRIVE 3           2 SYS04490
00AF 0  0000        0450           DC       *-*                                 3 SYS04500
00B0 C  0000        0451           DC       *-*  DEFECTIVE CYLINDER ADDRESSES   1 SYS04510
00B1 0  0000        0452           DC       *-*  *FOR LOGICAL DRIVE 4           2 SYS04520
00B2 0  0000        0453           DC       *-*                                 3 SYS04530
                    0455     *                                                 SYS04550
                    0456     * ILS02--THIS SUBROUTINE SAVES XR1, XR2, STATUS,   SYS04560
                    0457     *        AND THE ACCUMULATOR AND ITS EXTENSION.    SYS04570
                    0458     *        THE ADDRESS OF THE INTERRUPT SERVICE ROU- SYS04580
                    0459     *        TINE IS STORED IN $I205 BY PHASE 2 OF     SYS04590
                    0460     *        THE CORE IMAGE LOADER. WORD 10 ALWAYS     SYS04600
                    0461     *        CONTAINS THE ADDRESS OF $I200.            SYS04610
                    0462     *                                                 SYS04620
                    0463     *                                                 SYS04630
                    0464     *                                                 SYS04640
00B3 0  0000        0465     $I200 DC       *-*       ENTRY PT (LEVEL 2 INTRUPT)  SYS04650
00B4 0  6906        0466           STX    1 $I210+1   SAVE XR1                    SYS04660
00B5 0  6A07        0467           STX    2 $I210+3   SAVE XR2                    SYS04670
00B6 0  2807        0468           STS      $I210+4   STORE STATUS                SYS04680
00B7 0  D80A        0469           STD      $I290     SAVE ACCUMULATOR,EXTENSION  SYS04690
                    0470     * $I205+1 CONTAINS ADDR INTERRUPT ENTRY PT TO DKI/O SYS04700
00B8 00 44000000    0471     $I205 BSI  L   *-*       BR TO SERVICE THE INTERRUPT SYS04710
00BA 00 65000000    0472     $I210 LDX  L1  *-*       RESTORE XR1                 SYS04720
00BC 00 66000000    0473           LDX  L2  *-*       RESTORE XR2                 SYS04730
00BE 0  2000        0474           LDS      0         RESTORE STATUS              SYS04740
00BF 0  C802        0475           LDD      $I290     RESTORE ACCUMULATOR,EXT     SYS04750
00C0 00 4CC000B3    0476           BOSC I   $I200     RETURN FROM INTERRUPT       SYS04760
00C2    0000        0477     $I290 BSS  E   0                                     SYS04770
00C2 0  0000        0478           DC       *-*       CONTENTS OF ACCUMULATOR AND SYS04780
00C3 0  0000        0479           DC       *-*       *EXTENTION                  SYS04790
                    0481     *                                                 SYS04810
                    0482     * ILS04--THIS SUBROUTINE SAVES XR1, XR2, STATUS,   SYS04820
                    0483     *        AND THE ACCUMULATOR AND ITS EXTENSION.    SYS04830
                    0484     *        IF THE INTERRUPT IS FOR A KEYBOARD REQ-  * SYS04840
                    0485     *        UEST,AND IF A MONITOR PROGRAM IS IN CON- * SYS04850
                    0486     *        TROL, CONTROL IS PASSED TO DUMP. OTHER-  * SYS04860
                    0487     *        WISE, CONTROL IS PASSED TO THE KEYBOARD/ * SYS04870
                    0488     *        CONSOLE PRINTER SUBROUTINE. WORD 12 AL-  * SYS04880
                    0489     *        WAYS CONTAINS THE ADDRESS OF $I400.      * SYS04890
                    0490     *                                                 SYS04900
                    0491     * THE TABLE BELOW CONTAINS THE ADDRESSES OF THE    SYS04910
                    0492     * INTERRUPT SERVICE ROUTINES FOR ALL THE DEVICES   SYS04920
                    0493     * ON LEVEL 4.                                      SYS04930
                    0494     *                                                 SYS04940
                    0495     *                                                 SYS04950
                    0496     *                                                 SYS04960
00C4 0  0000        0497     $I400 DC       *-*       ENTRY POINT                 SYS04970
00C5 0  D818        0498           STD      $I490     SAVE ACCUMULATOR, EXTENSION SYS04980
00C6 0  280E        0499           STS      $I410     SAVE STATUS                 SYS04990
00C7 0  690F        0500           STX    1 $I410+2   SAVE XR1                    SYS05000
00C8 0  6A10        0501           STX    2 $I410+4   SAVE XR2                    SYS05010
00C9 0  0816        0502           XIO      $I492     SENSE DSW                   SYS05020
00CA 0  1002        0503           SLA      2         IS THIS INTERRUPT REQUEST   SYS05030
00CB 00 4C1000D0    0504           BSC  L   $I403,-   BR IF NOT INTERRUPT REQUEST SYS05040
00CD 00 4480002C    0505           BSI  I   $IREQ     BR IF INTERRUPT REQUEST     SYS05050
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ADDR REL OBJECT    ST.NO.  LABEL OPCD FT OPERANDS                              ID/SEQNO

00CF 0  FFFE       0506          DC      -2        ERROR CODE                  SYS05060
00D0 0  6109       0507    $I403 LDX    1 9        NO. DEVICES ON LEVEL TO XR1 SYS05070
00D1 0  0810       0508          XIO     $I494     SENSE ILSW                  SYS05080
00D2 0  1140       0509          SLCA   1          FIND CAUSE OF INTERRUPT     SYS05090
                   0510    * $I405+1 CONTAINS ADDR OF LEVEL 4 IBT MINUS 1      SYS05100
00D3 00 45800000   0511    $I405 BSI  I1 *-*       BR TO SERVICE THE INTERRUPT SYS05110
00D5 0  2000       0512    $I410 LDS     0         RESTORE STATUS              SYS05120
00D6 00 65000000   0513          LDX  L1 *-*       RESTORE XR1                 SYS05130
00D8 00 66000000   0514          LDX  L2 *-*       RESTORE XR2                 SYS05140
00DA 0  C803       0515          LDD     $I490     RESTORE ACCUMULATOR, EXT.   SYS05150
00DB 00 4CC000C4   0516          BOSC I  $I400     RETURN                      SYS05160
                   0517    *                                                   SYS05170
                   0518    * CONSTANTS AND WORK AREAS                          SYS05180
                   0519    * EVEN-NUMBERED LABELS ARE ON EVEN BOUNDARIES       SYS05190
                   0520    *                                                   SYS05200
00DD 0  0000       0521    $DDSW DC      *-*       DSW FOR THE DISK            SYS05210
00DE    0002       0522    $I490 BSS  E  2    CONTENTS OF ACCUMULATOR, EXT.    SYS05220
00E0 0  0000       0523    $I492 DC      *-*                                   SYS05230
00E0 0             0524    $SYSC EQU     *-1  VERSION AND MOD NO.              SYS05240
00E1 0  0F00       0525          DC      /0F00 IOCC FOR SENSE IOCC FOR KB/CP   SYS05250
00E2    0001       0526    $I494 BSS     1    PATCH AREA                       SYS05260
00E3 0  0300       0527          DC      /0300 IOCC FOR SENSING ILSW04         SYS05270
00E4    000A       0529          BSS     10   PATCH AREA                       SYS05290
00EE 0  0000       0530    $DBSY DC      *-*  NON-ZERO WHEN DISK I/O BUSY      SYS05300
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DISKZ

ADDR REL OBJECT    ST.NO.  LABEL OPCD FT OPERANDS                              ID/SEQNO

                   0532    *************************************************** SYS05320
                   0533    *                                                 * SYS05330
                   0534    *PROGRAM NAME-                                    * SYS05340
                   0535    *   *FULL NAME-FORTRAN/SYSTEM DISK I/O SUBROUTINE * SYS05350
                   0536    *   *CALLING SEQUENCE-                            * SYS05360
                   0537    *      LDD     PARAM                              * SYS05370
                   0538    *      BSI  L  DISKZ                              * SYS05380
                   0539    *    WHERE PARAM IS THE LABEL OF A DOUBLE-WORD    * SYS05390
                   0540    *    CELL CONTAINING THE FUNCTION CODE AND THE    * SYS05400
                   0541    *    ADDR OF THE I/O BUFFER,I.E., ADDR OF WD CNT. * SYS05410
                   0542    *    SEE 'CAPABILITIES' FOR DISCUSSION OF PARAM-  * SYS05420
                   0543    *    ETERS.                                       * SYS05430
                   0544    *                                                   SYS05440
                   0545    *PURPOSE-                                         * SYS05450
                   0546    *   TO PROVIDE A SUBROUTINE TO PERFORM DISK OPERA-* SYS05460
                   0547    *   TIONS. THIS SUBROUTINE IS INTENDED FOR USE BY * SYS05470
                   0548    *   MONITOR PROGRAMS AND USER PROGRAMS WRITTEN IN * SYS05480
                   0549    *   FORTRAN. THUS,IT IS INTENDED FOR USE IN AN    * SYS05490
                   0550    *   ERROR-FREE ENVIRONMENT.                       * SYS05500
                   0551    *                                                 * SYS05510
                   0552    *METHOD-                                          * SYS05520
                   0553    *   DISKZ REQUIRES A BUFFER,THE LENGTH OF WHICH IS* SYS05530
                   0554    *   2 GREATER THAN THE NO. WORDS TO BE READ/WRIT- * SYS05540
                   0555    *   TEN.                                          * SYS05550
                   0556    *                                                 * SYS05560
                   0557    *CAPABILITIES AND LIMITATIONS-                    * SYS05570
                   0558    *   THE WD CNT,AS WELL AS DZ000,MUST BE ON AN EVEN* SYS05580
                   0559    *   BOUNDARY,MUST BE IN THE RANGE 0-32767. THE    * SYS05590
                   0560    *   DRIVE CODE MUST BE IN BITS 1-3 OF THE SECTOR  * SYS05600
                   0561    *   ADDR,WHICH FOLLOWS THE WD CNT. THE FUNCTION   * SYS05610
                   0562    *   INDICATOR MUST BE XX00 FOR A READ OR XX01 FOR * SYS05620
                   0563    *   A WRITE,WHERE 'XX' MEANS ANY 2 HEXADECIMAL    * SYS05630
                   0564    *   CHARACTERS. A WD CNT OF ZERO INDICATES A SEEK.* SYS05640
                   0565    *   (READ OR WRITE MAY BE INDICATED.) AUTOMATIC   * SYS05650
                   0566    *   SEEKING IS PROVIDED AS A PART OF READ/WRITE.  * SYS05660
                   0567    *   A WRITE IS ALWAYS WITH A READ-BACK-CHECK.     * SYS05670
                   0568    *   DISKZ MAKES NO PREOPERATIVE PARAMETER CHECKS. * SYS05680
                   0569    *                                                 * SYS05690
                   0570    *SPECIAL FEATURES-                                * SYS05700
                   0571    *   DISKZ PROVIDES ONLY THOSE FUNCTIONS MENTIONED * SYS05710
                   0572    *   ABOVE. DISK1 AND DISKN OFFER THIS BASIC SET OF* SYS05720
                   0573    *   FUNCTIONS PLUS OTHERS.                        * SYS05730
                   0574    *                                                 * SYS05740
                   0575    *************************************************** SYS05750

                   0577    * PROVIDE PARAMETERS FOR SYSTEM LOADER              SYS05770
                   0578    *                                                   SYS05780
00F0    0000       0579          BSS  E  0                                     SYS05790
00F0 0  00EF       0580          DC      $ZEND-*   DISKZ WORD COUNT            SYS05800
00F1 0  FF6A       0581          DC      -'DZID    PHASE ID                    SYS05810
00F2 0  00E8       0582          DC      $ZEND-6-*+1 ADDR OF SLET EXTRACT      SYS05820
00F3 0  0001       0583          DC      1         NO. ENTRIES IN SLET EXTRACT SYS05830
00F4               0584          ORG     *-2                                   SYS05840
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ADDR REL OBJECT   ST.NO.  LABEL OPCD FT OPERANDS                                  ID/SEQNO

00F2 0  0000        0586    DZ000 DC        *-*         ENTRY POINT                 SYS05860
00F3 00 740000EE    0587          MDX   L   $DBSY,0     LOOP UNTIL OPERATION IN     SYS05870
00F5 0  70FD        0588          MDX       *-3         *PROGRESS IS COMPLETE       SYS05880
00F6 0  7002        0589          MDX       DZ020       BR AROUND INT ENTRY POINT   SYS05890
                    0590    *                                                       SYS05900
                    0591    * INTERRUPT ENTRY POINT                                 SYS05910
                    0592    *                                                       SYS05920
00F7 0  0000        0593    DZ010 DC        *-*         INTERRUPT ADDRESS           SYS05930
00F8 0  7015        0594          MDX       DZ180       BR TO SERVICE INTERRUPT     SYS05940
00F9 0  690F        0595    DZ020 STX     1 DZ100+1     SAVE XR1                    SYS05950
00FA 0  6A10        0596          STX     2 DZ100+3     SAVE XR2                    SYS05960
00FB 0  1008        0597          SLA       8           SHIFT INDICATOR 8 BITS      SYS05970
00FC 0  D03C        0598          STO       DZ945       SAVE FUNCTION INDICATOR     SYS05980
00FD 0  18D0        0599          RTE       16                                      SYS05990
00FE 0  D05B        0600          STO       DZ235+1     SAVE ADDR OF THE I/O AREA   SYS06000
00FF 0  6211        0601    DZ030 LDX     2 'TCNT       TURN BUSY INDICATOR ON AND  SYS06010
0100 0  6AED        0602          STX     2 $DBSY       *SET RETRY COUNT            SYS06020
0101 0  C0F0        0603          LD        DZ000                                   SYS06030
0102 0  D0F4        0604          STO       DZ010                                   SYS06040
0103 0  7053        0605          MDX       DZ230       BR TO CONTINUE              SYS06050
0104 00 4C000000    0606    DZ060 BSC   L   *-*         BR TO SERVICE THE INTERRUPT SYS06060
                    0607    *                                                       SYS06070
                    0608    * START ALL DISK OPERATIONS                             SYS06080
                    0609    *                                                       SYS06090
0106 0  6908        0610    DZ070 STX     1 DZ180+1     SAVE ADDR OF THE I/O AREA   SYS06100
0107 0  081E        0611          XIO       DZ904       START AN OPERATION          SYS06110
                    0612    *                                                       SYS06120
                    0613    * RETURN TO USER                                        SYS06130
                    0614    *                                                       SYS06140
0108 00 65000000    0615    DZ100 LDX   L1  *-*         RESTORE XR1                 SYS06150
010A 00 66000000    0616          LDX   L2  *-*         RESTORE XR2                 SYS06160
010C 00 4C8000F7    0617          BSC   I   DZ010       RETURN                      SYS06170
                    0618    *                                                       SYS06180
                    0619    * SERVICE ALL INTERRUPTS                                SYS06190
                    0620    *                                                       SYS06200
010E 00 65000000    0621    DZ180 LDX   L1  *-*         ADDR OF I/O AREA TO XR1     SYS06210
0110 00 660000F2    0622          LDX   L2  DZ000       ADDR OF DZ000 TO XR2        SYS06220
0112 0  0819        0623          XIO       DZ910       SENSE THE DSW               SYS06230
0113 0  D0C9        0624          STO       $DDSW       SAVE THE DSW                SYS06240
0114 0  4850        0625          BOSC      -           SKIP IF ERROR BIT SET       SYS06250
0115 0  70EE        0626          MDX       DZ060       BRANCH IF ERROR BIT NOT SET SYS06260
0116 0  C80D        0627    DZ185 LDD       DZ902       RESTORE WORD COUNT          SYS06270
0117 0  D900        0628          STD     1 0           *AND SECTOR ADDRESS         SYS06280
0118 00 74FF00EE    0629          MDX   L   $DBSY,-1    SKIP IF 16 RETRIES DONE     SYS06290
011A 0  703E        0630          MDX       DZ235       BRANCH IF LESS THAN 16      SYS06300
                    0631    *                                                       SYS06310
                    0632    * TRAP OUT TO POSTOPERATIVE TRAP                        SYS06320
                    0633    *                                                       SYS06330
011B 0  C812        0634          LDD       DZ912       1+SCTR ADDR TO EXTENSION    SYS06340
011C 0  C014        0635          LD        DZ915                                   SYS06350
011D 0  4293        0636    DZ190 BSI     2 $PST2-X2    BR TO POSTOPERATIVE ER TRAP SYS06360
011E 0  1810        0637          SRA       16          CLEAR                       SYS06370
011F 00 D4800198    0638          STO   I   DZ350+1     *ARM POSITION               SYS06380
0121 0  70DD        0639          MDX       DZ030       RETRY OPERATION             SYS06390
                    0640    *                                                       SYS06400
                    0641    * CONSTANTS AND WORK AREAS                              SYS06410
                    0642    *                                                       SYS06420
0122    0000        0643          BSS   E   0                                       SYS06430
                    0644    * EVEN-NUMBERED LABELS ARE ON EVEN BOUNDARIES           SYS06440
0122 0  0001        0645    DZ900 DC        1    CONSTANT,READ-AFTER-SEEK WD CNT    SYS06450
0123 0  0000        0646    DZ901 DC        0    CURRENT ARM POSITION               SYS06460
0124 0  0000        0647    DZ902 DC        *-*  LAST TWO WORDS OF SECTOR           SYS06470
0125 0  0000        0648          DC        *-*  *PREVIOUSLY READ                   SYS06480
0126 0  0000        0649    DZ904 DC        *-*  IOCC FOR OPERATION CURRENTLY       SYS06490
0127 0  0000        0650    DZ905 DC        *-*  *BEING PERFORMED                   SYS06500
0128 0  0000        0651    DZ906 DC        *-*  SAVE AREA FOR IOCC FOR             SYS06510
0129 0  0000        0652    DZ907 DC        *-*  *USER-REQUESTED OPERATION          SYS06520
012A 0  0122        0653    DZ908 DC        DZ900 IOCC FOR READ                     SYS06530
012B 0  0000        0654    DZ909 DC        *-*  *AFTER SEEK                        SYS06540
012C 0  0000        0655    DZ910 DC        *-*  2ND WORD OF SEEK IOCC              SYS06550
012D 0  0000        0656    DZ911 DC        *-*  SENSE IOCC                         SYS06560
012E 0  0000        0657    DZ912 DC        *-*  INTERMEDIATE WORD COUNT            SYS06570
012F 0  0000        0658    DZ913 DC        *-*  ADDR OF NEXT SEQUENTIAL SECTOR     SYSC6580
0130 0  5002        0659    DZ914 DC        /5002 WRITE SELECT/POWER UNSAFE INDR    SYS06590
0131 0  5004        0660    DZ915 DC        /5004 READ/WRITE/SEEK ERROR INDICATOR   SYS06600
0132 0  FEC0        0661    DZ916 DC        -320 TO BE USED TO SIMULTANEOUSLY       SYS06610
0133 0  0001        0662          DC        1    *DECR WD CNT, INCR SCTR ADDR       SYS06620
0134 0  0080        0663    DZ920 DC        /0080 READ CHECK BIT FOR IOCC           SYS06630
0135 0  0600        0664    DZ925 DC        /0600 2ND WD OF READ IOCC W/O AREA CD   SYS06640
0136 0  0008        0665    DZ930 DC        8    NO. SECTORS PER CYLINDER           SYS06650
0137 0  5000        0666    DZ935 DC        /5000 NOT READY DISPLAY CODE            SYS06660
0138 0  0FF8        0667    DZ940 DC        /0FF8 'AND' OUT DR CODE, SCTR ADDR      SYS06670
0139 0  0000        0668    DZ945 DC        *-*  FUNC INDICATOR (0=READ,1=WRITE)    SYS06680
013A 0  0701        0669    DZ950 DC        /0701 SENSE IOCC W/O AREA CODE          SYS06690
013B 0  0007        0670    DZ955 DC        /0007 'AND' OUT ALL BUT SCTR NO.        SYS06700
013C 0  000A        0671    DZ960 DC        $DCYL-$CYLN BASE DEFECTIVE CYL ADDR     SYS06710
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ADDR REL OBJECT    ST.NO.   LABEL OPCD FT OPERANDS                       ID/SEQNO

013D 0  009F       0672     DZ965 DC       $ACDE BASE AREA CODE ADDR       SYS06720
013E 0  FFF8       0673     DZ970 DC       $CYLN-$ACDE BASE ARM POSITION ADDR SYS06730
013F 0  0000       0674     DZ975 DC       *-*  2ND WORD OF READ CHECK IOCC   SYS06740
0140 0  0400       0675     DZ980 DC       /0400 2ND WD OF SEEK IOCC W/O AREA CD SYS06750
0141 0  0141       0676     DZ985 DC       321  NO. WORDS PER SECTOR (W/ ADDR) SYS06760
0142 0  0000       0677     DZ990 DC       *-*  CURRENT SECTOR NO.            SYS06770
0143 0  FFFF       0678     DZ995 DC       -1   MASK FOR COMPLEMENTING        SYS06780
                   0679     *                                             SYS06790
                   0680     * RESERVED FOR SAVING CORE ON A DUMP ENTRY TO SKEL SYS06800
                   0681     *                                             SYS06810
0144    0002       0682           BSS      2    THIS AREA MUST BE AT $CIBA+319 SYS06820
00F2 0             0683     X2    EQU      DZ000                          SYS06830
                   0684     *                                             SYS06840
                   0685     *                                             SYS06850
                   0686     *                                             SYS06860
0146 0  1810       0687     DZ210 SRA      16                             SYS06870
0147 0  D0A6       0688           STO      $DBSY      CLEAR BUSY INDICATOR SYS06880
0148 00 74FF0032   0689           MDX   L  $IOCT,-1   DECREMENT IOCS COUNTER SYS06890
014A 0  1000       0690           NOP                                     SYS06900
014B 0  70BC       0691           MDX      DZ100      TO EXIT             SYS06910
                   0692     *                                             SYS06920
                   0693     * PREPARE TO TRAP OUT ON 'POWER UNSAFE' CONDITION SYS06930
                   0694     *                                             SYS06940
014C 0  C0E3       0695     DZ215 LD       DZ914                          SYS06950
014D 0  70CF       0696           MDX      DZ190      BR TO TPAP OUT      SYS06960
                   0697     *                                             SYS06970
                   0698     * PREPARE TO TRAP OUT ON 'NOT READY' CONDITION SYS06980
                   0699     *                                             SYS06990
014E 0  C0E8       0700     DZ220 LD       DZ935      FETCH ERROR CODE    SYS07000
014F 00 44000028   0701           BSI   L  $PRET      BR TO PREOPERATIVE ERR TRAP SYS07010
0151 0  703A       0702           MDX      DZ340      RETRY THE OPERATION SYS07020
                   0703     *                                             SYS07030
                   0704     *                                             SYS07040
                   0705     *                                             SYS07050
0152 0  C0D9       0706     DZ225 LD       DZ910      FETCH 1ST WD SEEK IOCC SYS07060
0153 0  18D0       0707           RTE      16                             SYS07070
0154 0  C101       0708           LD     1 1          FETCH DESIRED CYLINDER ADDR SYS07080
0155 0  1803       0709           SRA      3                              SYS07090
0156 0  704D       0710           MDX      DZ380      BR TO PERFORM THE SEEK SYS07100
                   0711     *                                             SYS07110
                   0712     *                                             SYS07120
                   0713     *                                             SYS07130
0157 00 74010032   0714     DZ230 MDX   L  $IOCT,1    INCREMENT IOCS COUNTER SYS07140
0159 00 65000000   0715     DZ235 LDX   L1 *-*        ADDR I/O AREA TO XR1 SYS07150
015B 0  C900       0716           LDD    1 0                              SYS07160
015C 0  D8C7       0717           STD      DZ902      SAVE WORD COUNT, SCTR ADDR SYS07170
015D 0  D8D0       0718           STD      DZ912                          SYS07180
015E 0  1810       0719     DZ240 SRA      16                             SYS07190
015F 0  1084       0720           SLT      4          DRIVE CODE IN BITS 12-15 SYS07200
0160 0  D00E       0721           STO      DZ280+1                        SYS07210
0161 0  80D8       0722           A        DZ965      COMPUTE AND STORE THE SYS07220
0162 0  D01B       0723           STO      DZ330+1    *ADDR OF THE AREA CODE SYS07230
0163 0  80DA       0724           A        DZ970      COMPUTE AND STORE THE SYS07240
0164 0  D033       0725           STO      DZ350+1    *ADDR OF THE ARM POSITION SYS07250
0165 0  80D6       0726           A        DZ960      ADD IN BASE DT ADDR SYS07260
0166 0  8008       0727           A        DZ280+1    ADD IN THE DRIVE    SYS07270
0167 0  8007       0728           A        DZ280+1    *CODE TWICE MORE    SYS07280
0168 0  D006       0729           STO      DZ280+1                        SYS07290
0169 0  62FD       0730           LDX    2 -3         INITIALIZE COUNTER FOR LOOP SYS07300
016A 0  698D       0731           STX    1 DZ906                          SYS07310
016B 0  C101       0732           LD     1 1          FETCH DESIRED SECTOR ADDR SYS07320
016C 0  E0C8       0733           AND      DZ940      'AND' OUT SECTOR NO. SYS07330
016D 0  D101       0734     DZ250 STO    1 1          *AND DRIVE CODE     SYS07340
016E 00 94000000   0735     DZ280 S     L  *-*        SUB DEFECTIVE CYLINDER ADDR SYS07350
0170 0  4828       0736           BSC      Z+         SKIP IF BAD CYLINDER SYS07360
0171 0  7006       0737           MDX      DZ300      BR TO CONTINUE PROCESSING SYS07370
0172 0  C101       0738           LD     1 1                              SYS07380
0173 0  80C2       0739           A        DZ930      INCREMENT SCTR ADDR BY 8 SYS07390
0174 00 7401016F   0740           MDX   L  DZ280+1,1  POINT TO NEXT DEFECTIVE CYL SYS07400
0176 0  7201       0741           MDX    2 1          SKIP AFTER 3RD PASS SYS07410
0177 0  70F5       0742           MDX      DZ250      COMPARE W/ NEXT DEF CYL ADR SYS07420
                   0743     *                                             SYS07430
                   0744     * CONSTRUCT THE 2ND WORD OF ALL IOCC'S        SYS07440
                   0745     *                                             SYS07450
0178 00 660000F2   0746     DZ300 LDX   L2 DZ000      ADDR OF DZ000 TO XR2 SYS07460
017A 0  C23D       0747           LD     2 DZ913-X2   FETCH SECTOR ADDRESS SYS07470
017B 0  E249       0748           AND    2 DZ955-X2   'AND' OUT ALL BUT SECTOR NO SYS07480
017C 0  D250       0749           STO    2 DZ990-X2   SAVE SECTOR NO.     SYS07490
017D 00 C4000000   0750     DZ330 LD    L  *-*        FETCH AREA CODE     SYS07500
017F 0  EA4E       0751           OR     2 DZ980-X2   'OR' IN SEEK FUNCTION CODE SYS07510
0180 0  D23A       0752           STO    2 DZ910-X2   SEEK IOCC MINUS DIRECTION SYS07520
0181 0  EA43       0753           OR     2 DZ925-X2   'OR' IN READ FUNCTION CODE SYS07530
0182 0  D239       0754           STO    2 DZ909-X2   IOCC FOR READ-AFTER-SEEK SYS07540
0183 0  EA50       0755           OR     2 DZ990-X2   'OR' IN SECTOR NO.  SYS07550
0184 0  9247       0756           S      2 DZ945-X2   COMPLETE READ/WRITE CODE SYS07560
0185 0  D237       0757           STO    2 DZ907-X2   2ND WD OF READ/WRITE IOCC SYS07570
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ADDR REL OBJECT   ST.NO.   LABEL OPCD FT OPERANDS                              ID/SEQNO

0186 0  EA42       0758          OR   2 DZ920-X2  'OR' IN READ CHECK BIT      SYS07580
0187 0  8247       0759          A    2 DZ945-X2                              SYS07590
0188 0  D24D       0760          STO  2 DZ975-X2  2ND WD OF READ CHECK IOCC   SYS07600
0189 C  EA48       0761          OR   2 DZ950-X2  'OR' IN SENSE IOCC BITS     SYS07610
018A 0  D23B       0762          STO  2 DZ911-X2  COMPLETED SENSE IOCC        SYS07620
018B 0  CA3C       0763          LDD  2 DZ912-X2  1+SCTR ADDR TO EXTENSION    SYS07630
018C 0  0A3A       0764    DZ340 XIO  2 DZ910-X2  SENSE FOR DISK READY        SYS07640
018D 0  D2EB       0765          STO  2 $DDSW-X2  SAVE THE DSW                SYS07650
018E 0  4828       0766          BSC      Z+        SKIP UNLESS POWER UNSAFE OR SYS07660
018F 0  70BC       0767          MDX      DZ215     *WRITE SELECT, BR OTHERWISE SYS07670
0190 0  1002       0768          SLA      2         BR TO PREOPERATIVE ERR TRAP SYS07680
0191 0  4828       0769          BSC      Z+        *IF DISK NOT READY, SKIP    SYS07690
0192 0  70BB       0770          MDX      DZ220     *OTHERWISE                  SYS07700
0193 0  100B       0771          SLA      11                                    SYS07710
0194 0  4828       0772          BSC      Z+                                    SYS07720
0195 0  70BC       0773          MDX      DZ225                                 SYS07730
0196 0  C101       0774          LD     1 1         FETCH DESIRED CYLINDER ADDR SYS07740
0197 00 94000000   0775    DZ350 S    L   *-*       SUBTRACT ARM POSITION       SYS07750
0199 0  4818       0776          BSC      +-        SKIP IF SEEK NECESSARY      SYS07760
019A 0  7014       0777          MDX      DZ400     BRANCH TO PERFORM OPERATION SYS07770
                   0778    *                                                    SYS07780
                   0779    * SEEK                                               SYS07790
                   0780    *                                                    SYS07800
019B 0  1893       0781          SRT      19        PUT NO. CYLINDERS IN EXT    SYS07810
019C 0  180F       0782          SRA      15        + OR - SIGN TO BIT 15       SYS07820
019D 0  1002       0783          SLA      2         SHIFT SIGN TO BIT 13        SYS07830
019E 0  EA3A       0784          OR   2 DZ910-X2   OR  IN REMAINDER OF IOCC   SYS07840
019F 0  18D0       0785          RTE      16                                    SYS07850
01A0 0  4810       0786          BSC      -         SKIP IF SEEK TOWARD HOME    SYS07860
01A1 0  7002       0787          MDX      DZ380     BRANCH IF SEEK TOWARD CENTR SYS07870
01A2 0  F251       0788          EOR  2 DZ995-X2  COMPLEMENT NO. CYLS TO BE   SYS07880
01A3 0  8230       0789          A    2 DZ900-X2  *SOUGHT TO GET POSITIVE NO. SYS07890
01A4 0  DA34       0790    DZ380 STD  2 DZ904-X2                              SYS07900
01A5 0  4213       0791          BSI  2 DZ070-1-X2     START SEEK             SYS07910
                   0792    *                                                    SYS07920
                   0793    * SEEK COMPLETE INTERRUPT PROCESSING                 SYS07930
                   0794    *                                                    SYS07940
01A6 0  CA38       0795          LDD  2 DZ908-X2  SET UP IOCC FOR             SYS07950
01A7 0  DA34       0796          STD  2 DZ904-X2  *READ AFTER SEEK            SYS07960
01A8 0  4213       0797          BSI  2 DZ070-1-X2 START READ-AFTER-SEEK      SYS07970
                   0798    *                                                    SYS07980
                   0799    * READ-AFTER-SEEK COMPLETE INTERRUPT PROCESSING      SYS07990
                   0800    *                                                    SYS08000
01A9 0  C231       0801          LD   2 DZ901-X2  FETCH ADR OF SCTR JUST READ SYS08010
01AA 00 D4800198   0802          STO  I  DZ350+1    UPDATE ARM POSITION         SYS08020
01AC 0  9101       0803          S      1 1         SUB DESIRED SCTR ADDR       SYS08030
01AD 00 4C200116   0804          BSC  L  DZ185,Z    BR IF SEEK UNSUCCESSFUL     SYS08040
                   0805    *                                                    SYS08050
                   0806    *                                                    SYS08060
                   0807    * READ/WRITE                                         SYS08070
                   0808    *                                                    SYS08080
01AF 0  CA3C       0809    DZ400 LDD  2 DZ912-X2  FETCH INTERMEDIATE WD CNT   SYS08090
01B0 0  4808       0810          BSC      +         SKIP, WD CNT NOT EXHAUSTED  SYS08100
01B1 0  7094       0811    DZ410 MDX      DZ210     BRANCH IF READ/WRITE DONE   SYS08110
01B2 0  8A40       0812          AD   2 DZ916-X2  DECREMENT WORD COUNT AND    SYS08120
01B3 0  DA3C       0813          STD  2 DZ912-X2  *INCREMENT SECTOR ADDRESS   SYS08130
01B4 0  4830       0814          BSC      Z-        SKIP IF THIS IS LAST SECTOR SYS08140
01B5 0  1810       0815          SRA      16        CLEAR ACCUMULATOR           SYS08150
01B6 0  824F       0816          A    2 DZ985-X2  ADD BACK 321 TO WD CNT      SYS08160
01B7 0  D100       0817          STO    1 0         STORE RESULT IN I/O AREA    SYS08170
01B8 0  CA36       0818          LDD  2 DZ906-X2  RESTORE IOCC FOR ORIGINALLY SYS08180
01B9 0  DA34       0819          STD  2 DZ904-X2  *REQUESTED OPERATION        SYS08190
01BA 0  C101       0820          LD     1 1         ADD SECTOR NO. TO SECTOR    SYS08200
01BB 0  EA50       0821          OR   2 DZ990-X2  *ADDRESS                    SYS08210
01BC 0  D101       0822          STO    1 1                                     SYS08220
01BD 0  4213       0823          BSI  2 DZ070-1-X2 START READ/WRITE OPERATION SYS08230
                   0824    *                                                    SYS08240
                   0825    * READ/WRITE COMPLETE INTERRUPT PROCESSING           SYS08250
                   0826    *                                                    SYS08260
01BE 0  C24D       0827          LD   2 DZ975-X2  SET UP FOR READ CHECK       SYS08270
01BF 0  D235       0828          STO  2 DZ905-X2                              SYS08280
01C0 0  C247       0829          LD   2 DZ945-X2  FETCH FUNCTION INDICATOR    SYS08290
01C1 0  4820       0830          BSC      Z         SKIP IF READ REQUESTED      SYS08300
01C2 0  4213       0831          BSI  2 DZ070-1-X2 START READ CHECK OPERATION SYS08310
01C3 0  CA32       0832          LDD  2 DZ902-X2  RESTORE LAST 2 WDS OF SEC-  SYS08320
01C4 0  D900       0833          STD    1 0         *TOR PREVIOUSLY READ        SYS08330
01C5 0  C23C       0834          LD   2 DZ912-X2  FETCH INTERMEDIATE WD CNT   SYS08340
01C6 0  4808       0835          BSC      +         SKIP IF MORE READING/WRTING SYS08350
01C7 0  70E9       0836          MDX      DZ410     BRANCH IF FINISHED          SYS08360
01C8 00 75000140   0837          MDX  L1 320        POINT XR1 TO NEW I/O AREA   SYS08370
01CA 0  C900       0838          LDD    1 0         SAVE LAST 2 WDS OF SECTOR   SYS08380
01CB 0  DA32       0839          STD  2 DZ902-X2  *JUST READ/WRITTEN          SYS08390
01CC 0  CA3C       0840          LDD  2 DZ912-X2  WD CNT, SCTR ADDR NEXT OP   SYS08400
01CD 0  D900       0841          STD    1 0         STORE BOTH IN NEW I/O AREA  SYS08410
01CE 0  708F       0842          MDX      DZ240     BACK TO SET UP NEXT OPERATN SYS08420
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ADDR REL OBJECT   ST.NO.   LABEL OPCD FT OPERANDS                             ID/SEQNO

                  0843     *                                                  SYS08430
                  0844     *                                                  SYS08440
01CF     000B     0845           BSS     11       PATCH AREA                  SYS08450
                  0846     *                                                  SYS08460
                  0847     *                                                  SYS08470
01DA 0   00A0     0848           DC      'CIL1    ID NO. OF CORE IMAGE LDR,P1 SYS08480
01DB 0   0000     0849     $CIDN DC      *-*      CORE ADDR/CID NO.           SYS08490
01DC 0   0000     0850           DC      *-*      WORD COUNT                  SYS08500
01DD 0   0000     0851           DC      *-*      SCTR ADDR                   SYS08510
01DE     0002     0852           BSS     2        WD CNT, SCTR ADDR CORE LDS  SYS08520
01E0 0            0853     $ZEND EQU     *        1 + END OF DISKZ            SYS08530
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EQUIVALENCES

ADDR REL OBJECT   ST.NO.   LABEL OPCD FT OPERANDS                             ID/SEQNO

                  0855     *                                                  SYS08550
                  0856     * EQUIVALENCES FOR PHASE ID NUMBERS                SYS08560
                  0857     *                                                  SYS08570
006E 0            0858     'SUP1 EQU     110      PHASE ID FOR MCRA           SYS08580
0070 0            0859     'SUP3 EQU     112      PHASE ID FOR DUMP PROGRAM   SYS08590
0071 0            0860     'SUP4 EQU     113      OHASE ID FOR ERR ANAL PROG  SYS08600
0078 0            0861     'CLBO EQU     120      PHASE ID FOR CLB, PHASE 0/1 SYS08610
008C 0            0862     '1403 EQU     140      PHASE ID FOR SYS 1403 SUBR  SYS08620
008D 0            0863     '1132 EQU     141      PHASE ID FOR SYS 1132 SUBR  SYS08630
008E 0            0864     'CPTR EQU     142      PHASE ID FOR SYS CP SUBR    SYS08640
008F 0            0865     '2501 EQU     143      PHASE ID FOR SYS 2501 SUBR  SYS08650
0090 0            0866     '1442 EQU     144      PHASE ID FOR SYS 1442 SUBR  SYS08660
0091 0            0867     '1134 EQU     145      PHASE ID FOR SYS 1134 SUBR  SYS08670
0092 0            0868     'KBCP EQU     146      PHASE ID FOR SYS KB/CP SUBR SYS08680
0093 0            0869     'CDCV EQU     147      PHASE ID FOR SYS CD   CONV  SYS08690
0094 0            0870     'PTCV EQU     148      PHASE ID FOR SYS 1134 CONV  SYS08700
0095 0            0871     'KBCV EQU     149      PHASE ID FOR SYS KB   CONV  SYS08710
0096 0            0872     'DZID EQU     150      PHASE ID FOR DISKZ          SYS08720
0097 0            0873     'D1ID EQU     151      PHASE ID FOR DISKI          SYS08730
0098 0            0874     'DNID EQU     152      PHASE ID FOR DISKN          SYS08740
00A0 0            0875     'CIL1 EQU     160      PHASE ID FOR CI LOADER,PH 1 SYS08750
00A1 0            0876     'CIL2 EQU     161      PHASE ID FOR CI LOADER,PH 2 SYS08760
                  0877     *                                                  SYS08770
                  0878     * EQUIVALENCES FOR RESIDENT MONITOR                SYS08780
                  0879     *                                                  SYS08790
0014 0            0880     $LKNM EQU     $HASH    SAVE AREA FOR NAME OF LINK  SYS08800
0016 0            0881     $RMSW EQU     $HASH+2  EXIT-LINK-DUMP SW(-1,0,+1)  SYS08810
0017 0            0882     $CXR1 EQU     $HASH+3  SAVE AREA FOR XR1           SYS08820
0018 0            0883     $CLSW EQU     $HASH+4  SW FOR CORE IMAGE LDR,PH 2  SYS08830
0019 0            0884     $DMPF EQU     $HASH+5  DUMP FORMAT CODE            SYS08840
001A 0            0885     $ACEX EQU     $HASH+6  ACC AND EXT WHEN ENTER DUMP SYS08850
005A 0            0886     $CILA EQU     $S150+1  ADDR OF END OF DK I/O - 3   SYS08860
00B9 0            0887     $IBT2 EQU     $I205+1  ADR OF SERVICE PART OF DKIO SYS08870
00D4 0            0888     $IBT4 EQU     $I405+1  ADDR OF THE IBT             SYS08880
00EF 0            0889     $SNLT EQU     $DBSY+1  SENSE LIGHT INDICATOR       SYS08890
00F0 0            0890     $PAUS EQU     DZ000-2  PAUSE,INTERRUPT INDICATOR   SYS08900
00F1 0            0891     $RWCZ EQU     DZ000-1  READ/WRITE SWITCH (CARDZ)   SYS08910
                  0892     *                                                  SYS08920
                  0893     * EQUIVALENCES FOR ABSOLUTE SECTOR ADDRESSES       SYS08930
                  0894     *                                                  SYS08940
0000 0            0895     'IDAD EQU     0   ADDR OF SCTR WITH ID,DEF CYL ADR SYS08950
0001 0            0896     'DCOM EQU     1   ADDR OF SCTR CONTAINING DCOM     SYS08960
0002 0            0897     'RIAD EQU     2   ADDROOF SCTR CONTAINING RES IMGE SYS08970
0003 0            0898     'SLET EQU     3   ADDR OF SCTR CONTAINING SLET     SYS08980
0006 0            0899     'RTBL EQU     6   ADDR OF SCTR CONTAINING RELD TBL SYS08990
0007 0            0900     'HDNG EQU     7   ADDR OF SCTR CONTAINING PAGE HDR SYS09000
0000 0            0901     'STRT EQU     0   ADDR OF SCTR W/ COLD START PROG  SYS09010
                  0902     *                                                  SYS09020
                  0903     * EQUIVALENCES FOR THE CORE IMAGE HEADER           SYS09030
                  0904     *                                                  SYS09040
0000 0            0905     'XEQA EQU     0   RLTV ADDR OF CORE LOAD EXEC ADDR SYS09050
0001 0            0906     'CMON EQU     1   RLTV ADDR OF WD CNT OF COMMON    SYS09060
0002 0            0907     'DREQ EQU     2   RLTV ADDR OF DISK I/O INDICATOR  SYS09070
0003 0            0908     'FILE EQU     3   RLTV ADDR OF NO. FILES DEFINED   SYS09080
0004 0            0909     'HWCT EQU     4   RLTV ADDR OF WD CNT OF CI HEADER SYS09090
0005 0            0910     'LSCT EQU     5   SCTR CNT OF FILES IN WK STORAGE  SYS09100
0006 0            0911     'LDAD EQU     6   RLTV ADDR OF LOAD ADDR CORE LOAD SYS09110
0007 0            0912     'XCTL EQU     7   RLTV ADDR DISK1/DISKN EXIT CTRL  SYS09120
0008 0            0913     'TVWC EQU     8   RLTV ADDR OF WD CNT OF TV        SYS09130
0009 0            0914     'WCNT EQU     9   RLTV ADDR OF WD CNT OF CORE LOAD SYS09140
000A 0            0915     'XR3X EQU     10  RLTV ADDR OF EXEC SETTING OF XR3 SYS09150
000B 0            0916     'ITVX EQU     11  RLTV ADDR OF 1ST WD OF ITV       SYS09160
0011 0            0917     'ILS4 EQU     17  RLTV ADDR OF 1ST WD OF IBT4      SYS09170
001A 0            0918     'OVSW EQU     26  RLTV ADDR OF LOCAL/SOCAL SWITCH  SYS09180
001C 0            0919     'CCRE EQU     28  CORE SIZE OF BUILDING SYSTEM     SYS09190
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ADDR REL OBJECT    ST.NO.  LABEL OPCD FT OPERANDS                              ID/SEQNO

001D 0             0920   'HEND EQU      29   RLTV ADDR OF LAST WD OF CI HDR     SYS09200
                   0921   *                                                      SYS09210
                   0922   * EQUIVALENCES FOR LET/FLET                            SYS09220
                   0923   *                                                      SYS09230
0005 0             0924   'LFHD EQU      5    WORD COUNT OF LET/FLET HEADER      SYS09240
0003 0             0925   'LFEN EQU      3    NO OF WDS PER LET/FLET ENTRY       SYS09250
0000 0             0926   'SCTN EQU      0    RLTV ADDR OF LET/FLET SCTR NO.     SYS09260
0001 0             0927   'UAFX EQU      1    RLTV ADDR OF SCTR ADDR OF UA/FXA   SYS09270
0003 0             0928   'WDSA EQU      3    RLTV ADDR OF WDS AVAIL IN SCTR     SYS09280
0004 0             0929   'NEXT EQU      4    RLTV ADDR OF ADDR NEXT SCTR        SYS09290
0000 0             0930   'LFNM EQU      0    RLTV ADDR OF LET/FLET ENTRY NAME   SYS09300
0002 0             0931   'BLCT EQU      2    RLTV ADDR OF LET/FLET ENTRY DBCT   SYS09310
                   0932   *                                                      SYS09320
                   0933   * MISCELLANEOUS EQUIVALENCES                           SYS09330
                   0934   *                                                      SYS09340
0033 0             0935   'ISTV EQU      51   ISS NO. ADJUSTMENT FACTOR      2-1 PMN09345
0005 0             0936   'MXDR EQU      5    MAX NO. DRIVES SUPPORTED           PMN09350
0380 0             0937   'COMZ EQU      896  LOW COMMON LIMIT FOR DISKZ         PMN09360
04C0 0             0938   'COM1 EQU      1216 LOW COMMON LIMIT FOR DISK1         PMN09370
0600 0             0939   'COM2 EQU      1536 LOW COMMON LIMIT OF DISKN          PMN09380
0011 0             0940   'TCNT EQU      17   NO. TRIES BEFORE DISK ERROR        PMN09390
00F9 0             0941   'DKEP EQU      DZ000+7 LIBF ENTRY TO DISK1/N           PMN09400
00F7 0             0942   'DKIP EQU      DZ000+5 DISK I/O INTERRUPT ENTRY PT     PMN09410
1000 0             0943   'MCOR EQU      4096 SIZE OF MINIMUM CORE           2-1 PMN09417
007F 0             0944   Y      EQU     127                                     PMN09420
                   0946   ******************************************************* PMN09440
                   0947   *                                                     * PMN09450
                   0948   *STATUS - VERSION 2, MODIFICATION LEVEL 0.            * PMN09460
                   0949   *                                                     * PMN09470
                   0950   *FUNCTION/OPERATION -                                 * PMN09480
                   0951   *   THIS PROGRAM IS READ INTO CORE FROM SECTOR 0      * PMN09490
                   0952   *   OF THE SYSTEM CARTRIDGE AND TRANSFERRED TO BY     * PMN09500
                   0953   *   THE COLD START CARD.  DEFECTIVE CYLINDER          * PMN09510
                   0954   *   ADDRESSES, CARTRIDGE ID AND DISKZ ARE ALSO ON     * PMN09520
                   0955   *   SECTOR 0 AND ARE READ IN AT THE SAME TIME.        * PMN09530
                   0956   *   ALL THAT REMAINS FOR THE COLD START PROGRAM IS    * PMN09540
                   0957   *   TO READ IN THE RESIDENT IMAGE, SAVE THE           * PMN09550
                   0958   *   CARTRIDGE ID AND TRANSFER TO THE AUXILIARY        * PMN09560
                   0959   *   SUPERVISOR THROUGH $DUMP IN THE RESIDENT          * PMN09570
                   0960   *   MONITOR.                                          * PMN09580
                   0961   *                                                     * PMN09590
                   0962   *ENTRY - CR010-2                                      * PMN09600
                   0963   *   ENTER PROGRAM BY TRANSFER FROM COLD START CARD    * PMN09610
                   0964   *                                                     * PMN09620
                   0965   *INPUT -                                              * PMN09630
                   0966   *   THE CARTRIDGE ID OF LOGICAL DRIVE ZERO (THE       * PMN09640
                   0967   *   SYSTEM CARTRIDGE) IS READ IN FROM SECTOR 0        * PMN09650
                   0968   *   WITH THE COLD START PROGRAM.                      * PMN09660
                   0969   *                                                     * PMN09670
                   0970   *OUTPUT -                                             * PMN09680
                   0971   *   * THE RESIDENT IMAGE IS READ INTO CORE FROM       * PMN09690
                   0972   *     THE DISK.                                       * PMN09700
                   0973   *   * IN COMMA-                                       * PMN09710
                   0974   *     $ACDE                                           * PMN09720
                   0975   *     $CIBA-1                                         * PMN09730
                   0976   *     $CIDN                                           * PMN09740
                   0977   *     $CYLN                                           * PMN09750
                   0978   *     $DBSY                                           * PMN09760
                   0979   *     $IOCT                                           * PMN09770
                   0980   *                                                     * PMN09780
                   0981   *EXTERNAL REFERENCES -                                * PMN09790
                   0982   *   DZ000  SUBROUTINE TO PERFORM DISK I/O.            * PMN09800
                   0983   *                                                     * PMN09810
                   0984   *EXITS -                                              * PMN09820
                   0985   *   THE ONLY EXIT IS TO THE AUXILIARY SUPERVISOR      * PMN09830
                   0986   *   AS FOLLOWS-                                       * PMN09840
                   0987   *     BSI      $DUMP                                  * PMN09850
                   0988   *     DC       -1                                     * PMN09860
                   0989   *                                                     * PMN09870
                   0990   *TABLES/WORK AREAS - N/A                              * PMN09880
                   0991   *                                                     * PMN09890
                   0992   *ATTRIBUTES -                                         * PMN09900
                   0993   *   THIS PROGRAM IS NOT NATURALLY RELOCATABLE.        * PMN09910
                   0994   *                                                     * PMN09920
                   0995   *NOTES -                                              * PMN09930
                   0996   *   DISK ERRORS RESULT IN A WAIT AT $PST2.            * PMN09940
                   0997   ******************************************************* PMN09950

                   0999   *                                                      PMN09970
                   1000   * READ THE RESIDENT IMAGE INTO CORE                    PMN09980
                   1001   *                                                      PMN09990
01E0 0  617F       1002         LDX   1 Y                                        PMN10000
01F1 0  C82F       1003         LDD     CR920      SET UP WORD COUNT AND SCTR    PMN10010
01E2 00 DC000004   1004   CR010 STD   L $CIBA-1    *ADDR OF RESIDENT IMAGE       PMN10020
01E4 0  D125       1005         STO   1 $DCYL-Y    *INITIALIZE DEF CYL NO. 1     PMN10030
01E5 0  C184       1006         LD    1 3-Y        FETCH LOG DRIVE 0 AREA CODE   PMN10040
01E6 0  D12C       1007         STO   1 $ACDE-Y    *AND STORE IT IN COMMA        PMN10050
01E7 0  D029       1008         STO     CR920+1    SAVE THE AREA CODE            PMN10060
01E8 0  C156       1009         LD    1 DZ000-2-27-Y FETCH AND SAVE THE          PMN10070
01E9 0  D0F1       1010         STO     $CIDN      *CARTRIDGE ID                 PMN10080
01EA 0  C0F8       1011         LD      CR010+1    FETCH CORE ADDR OF RESIDENT   PMN10090
01EB 0  1890       1012         SRT     16         *IMAGE AND PJT IN EXTENSION   PMN10100
01FC 0  D16F       1013         STO   1 $DBSY-Y    CLEAR DISK BUSY INDICATOR     PMN10110
01ED 0  D11B       1014         STO   1 $CYLN-Y    INITIALIZE ARM POSITION       PMN10120
```

```
ADDR REL OBJECT   ST.NO.   LABEL OPCD FT OPERANDS                               ID/SEQNO

01EE 0  4173      1015           BSI   1 DZ000-Y   FETCH RESIDENT IMAGE        PMN10130
01EF 0  3000      1016           WAIT              WAIT OUT THE INTERRUPT      PMN10140
                  1017     *                                                   PMN10150
                  1018     * INITIALIZE ITEMS IN COMMA                         PMN10160
                  1019     *                                                   PMN10170
01F0 0  1810      1020           SRA      16                                   PMN10180
01F1 0  D183      1021           STO   1 $IOCT-Y   CLEAR IOCS COUNTER          PMN10190
01F2 0  C818      1022           LDD      CR910                                PMN10200
01F3 0  D985      1023           STD   1 $CIBA-1-Y *FOR SAVING CORE ON THE CIB PMN10210
01F4 0  C01C      1024           LD       CR920+1   FETCH AREA CODE             PMN10220
01F5 0  D120      1025           STO   1 $ACDE-Y   RESET AREA CODE             PMN10230
01F6 0  C016      1026           LD       CR905     INITIALIZE WD ZERO TO BR TO PMN10240
01F7 0  D181      1027           STO   1 0-Y       *DUMP ENTRY POINT PLUS 1    PMN10250
                  1028     *                                                   PMN10260
                  1029     * TRANSFER TO THE AUXILIARY SUPERVISOR              PMN10270
                  1030     * TO COMPLETE INITIALIZATION                        PMN10280
                  1031     *                                                   PMN10290
01F8 0  41C0      1032           BSI   1 $DUMP-Y   BR TO AUXILLIARY SUPERVISOR PMN10300
01F9 0  FFFF      1033           DC       -1        *FOR JOB PROCESSING         PMN10310
                  1034     *                                                   PMN10320
01FA    0013      1035           BSS      19        PATCH AREA                  PMN10330
                  1036     *                                                   PMN10340
                  1037     * CONSTANTS AND WORK AREAS                          PMN10350
                  1038     *                                                   PMN10360
020D 0  703F      1039     CR905 MDX  X  $DUMP+1-1 TO BE STORED IN LOCN ZERO   PMN10370
020E 0  0001      1040     CR910 DC       1         WD CNT,SCTR ADDR OF CAUSE   PMN10380
020F 0  0007      1041           DC       'HDNG     *HARMLESS WRITE TO DISK     PMN10390
0210 0  00E8      1042     CR920 DC       $DBSY-$CH12 WD CNT AND SCTR          PMN10400
0211 0  0002      1043           DC       'RIAD     *ADDR OF RESIDENT IMAGE     PMN10410
0212    0000      1044           END                                           PMN10420
```

CROSS-REFERENCE

```
SYMBOL    VALUE  REL   DEFN     REFERENCES

CR010      01E2   0    1004     1011
CR905      020D   0    1039     1026
CR910      020E   0    1040     1022
CR920      0210   0    1042     1003  1008  1024
DZ000      00F2   0    0586     0322  0343  0603  0622  0683  0746  0890  0891  0941  0942  1009  1015
DZ010      00F7   0    0593     0604  0617
DZ020      00F9   0    0595     0589
DZ030      00FF   0    0601     0639
DZ060      0104   0    0606     0626
DZ070      0106   0    0610     0791  0797  0823  0831
DZ100      0108   0    0615     0595  0596  0591
DZ180      010E   0    0621     0594  0610
DZ185      0116   0    0627     0804
DZ190      011D   0    0636     0696
DZ210      0146   0    0687     0811
DZ215      014C   0    0695     0767
DZ220      014E   0    0700     0770
DZ225      0152   0    0706     0773
DZ230      0157   0    0714     0605
DZ235      0159   0    0715     0600  0630
DZ240      015E   0    0719     0842
DZ250      016D   0    0734     0742
DZ280      016E   0    0735     0721  0727  0728  0729  0740
DZ300      0178   0    0746     0737
DZ330      017D   0    0750     0723
DZ340      018C   0    0764     0702
DZ350      0197   0    0775     0638  0725  0802
DZ380      01A4   0    0790     0710  0787
DZ400      01AF   0    0809     0777
DZ410      01B1   0    0811     0836
DZ900      0122   0    0645     0653  0789
DZ901      0123   0    0646     0801
DZ902      0124   0    0647     0627  0717  0832  0839
DZ904      0126   0    0649     0611  0790  0796  0819
DZ905      0127   0    0650     0828
DZ906      0128   0    0651     0731  0818
DZ907      0129   0    0652     0757
DZ908      012A   0    0653     0795
DZ909      012B   0    0654     0754
DZ910      012C   0    0655     0623  0706  0752  0764  0784
DZ911      012D   0    0656     0762
DZ912      012E   0    0657     0634  0718  0763  0809  0813  0834  0840
DZ913      012F   0    0658     0747
DZ914      0130   0    0659     0695
DZ915      0131   0    0660     0635
```

```
SYMBOL     VALUE  REL   DEFN      REFERENCES

DZ916      0132    0    0661      0812
DZ920      0134    0    0663      0758
DZ925      0135    0    0664      0753
DZ930      0136    0    0665      0739

DZ935      0137    0    0666      0700
DZ940      0138    0    0667      0733
DZ945      0139    0    0668      0598   0756   0759   0829
DZ950      013A    0    0669      0761
DZ955      013B    0    0670      0748
DZ960      013C    0    0671      0726
DZ965      013D    0    0672      0722
DZ970      013E    0    0673      0724
DZ975      013F    0    0674      0760   0827
DZ980      0140    0    0675      0751
DZ985      0141    0    0676      0816
DZ990      0142    0    0677      0749   0755   0821
DZ995      0143    0    0678      0788
$ACDE      009F    0    0428      0672   0673   1007   1025
$ACEX      001A    0    0885      0317
$CCAD      0074    0    0355
$CH12      0006    0    0252      1042
 CIBA      0005    0    0251      0309   1004   1023
$CIDN      01DB    0    0849      1010
$CILA      005A    0    0886      0341
$CLSW      0018    0    0883
$COMN      0007    0    0253
$CORE      000E    0    0265
$CPTR      007E    0    0365
$CTSW      000F    0    0266
$CWCT      0072    0    0353
$CXR1      0017    0    0882      0318
$CYLN      009A    0    0418      0671   0673   1014
$DABL      0011    0    0268      0333
$DADR      0010    0    0267
$DBSY      00EE    0    0530      0344   0587   0602   0629   0688   0889   1013   1042
$DCDE      0077    0    0358
$DCYL      00A4    0    0439      0671   1005
$DDSW      000D    0    0521      0624   0765
$DMPF      0019    0    0884      0320
$DREQ      0012    0    0269
$DUMP      003F    0    0314      0319   1032   1039
$DZIN      0076    0    0357
$EXIT      0038    0    0300
$FLSH      0071    0    0351
$FPAD      0095    0    0409
$HASH      0014    0    0271      0880   0881   0882   0883   0884   0885
$IBSY      0013    0    0270
$IBT2      00B9    0    0887
$IBT4      00D4    0    0888
$IOCT      0032    0    0291      0315   0331   0689   0714   1021
$IREQ      002C    0    0285      0505
$I200      00B3    0    0465      0259   0476
$I205      00B8    0    0471      0887
$I210      00BA    0    0472      0466   0467   0468
$I290      00C2    0    0477      0469   0475
$I400      00C4    0    0497      0261   0516
$I403      00D0    0    0507      0504
$I405      00D3    0    0511      0888
$I410      00D5    0    0512      0499   0500   0501
$I490      00DE    0    0522      0498   0515
$I492      00E0    0    0523      0502
$I494      00E2    0    0526      0508
$KCSW      007C    0    0363
$LAST      0033    0    0292
$LEV0      0008    0    0257
$LEV1      0009    0    0258
$LEV2      000A    0    0259
$LEV3      000B    0    0260
$LEV4      000C    0    0261
$LEV5      000D    0    0262
$LINK      0039    0    0304      0334
$LKNM      0014    0    0880      0338
$LSAD      0075    0    0356
$NDUP      0034    0    0293
$NXEQ      0035    0    0294
$PAUS      00F0    0    0890
$PBSY      0036    0    0295
$PGCT      0037    0    0296
$PHSE      0078    0    0359
$PRET      0028    0    0280      0282   0701
$PST1      0081    0    0371      0373
$PST2      0085    0    0377      0379   0636
$PST3      0089    0    0383      0385
$PST4      008D    0    0389      0391
$RMSW      0016    0    0881      0330
$RWCZ      00F1    0    0891
$SCAN      0020    0    0274
$SNLT      00EF    0    0889
$STOP      0091    0    0396      0262   0398
$SYSC      00F0    0    0524
```

```
SYMBOL   VALUE  REL   DEFN     REFERENCES

$S000    004D   0     0329     0300
$S100    004E   0     0330     0306  0324
$S150    0059   0     0340     0886
$S900    003C   0     0308     0321  0323
$S910    003E   0     0310     0329
$UFDR    007D   0     0364
$UFIO    0079   0     0360
$ULET    002D   0     0286
$WRD1    007B   0     0362
$WSDR    007A   0     0361
$ZEND    01E0   0     0853     0580  0582
$1132    007F   0     0366
$1403    0080   0     0367
X2       00F2   0     0683     0636  0747  0748  0749  0751  0752  0753  0754  0755  0756  0757  0758  0759  0760  0761
                               0762  0763  0764  0765  0784  0788  0789  0790  0791  0795  0796  0797  0801  0809  0812
                               0813  0816  0818  0819  0821  0823  0827  0828  0829  0831  0832  0834  0839  0840
Y        007F   0     0944     1002  1005  1006  1007  1009  1013  1014  1015  1021  1023  1025  1027  1032
'BLCT    0002   0     0931
'CDCV    0093   0     0869
'CIL1    00A0   0     0875     0848
'CIL2    00A1   0     0876
'CLBO    0078   0     0861
'CMON    0001   0     0906
'COMZ    0380   0     0937
'COM1    04C0   0     0938
'COM2    0600   0     0939
'CORE    001C   0     0919
'CPTR    008E   0     0864
'DCOM    0001   0     0896
'DKEP    00F9   0     0941
'DKIP    00F7   0     0942
'DNID    0098   0     0874
'DREQ    0002   0     0907
'DZID    0096   0     0872     0581
'D1ID    0097   0     0873
'FILE    0003   0     0908
'HDNG    0007   0     0900     1041
'HEND    001D   0     0920
'HWCT    0004   0     0909
'IDAD    0000   0     0895
'ILS4    0011   0     0917
'ISTV    0033   0     0935
'ITVX    0008   0     0916
'KBCP    0092   0     0868
'KBCV    0095   0     0871
'LDAD    0006   0     0911
'LFEN    0003   0     0925
'LFHD    0005   0     0924
'LFNM    0000   0     0930
'LSCT    0005   0     0910
'MCOR    1000   0     0943
'MXDR    0005   0     0936
'NEXT    0004   0     0929
'OVSW    001A   0     0918
'PTCV    0094   0     0870
'RIAD    0002   0     0897     1043
'RTBL    0006   0     0899
'SCTN    0000   0     0926
'SLET    0003   0     0898
'STRT    0000   0     0901
'SUP1    006E   0     0858
'SUP3    0070   0     0859
'SUP4    0071   0     0860
'TCNT    0011   0     0940     0601
'TVWC    0008   0     0913
'UAFX    0001   0     0927
'WCNT    0009   0     0914
'WDSA    0003   0     0928
'XCTL    0007   0     0912
'XEQA    0000   0     0905
'XR3X    000A   0     0915
'1132    0080   0     0863
'1134    0091   0     0867
'1403    008C   0     0862
'1442    0090   0     0866
'2501    008F   0     0865
```

APPENDIX I. SYSTEM LOCATION EQUIVALENCE TABLE (SLET)

The addresses listed on the SLET printout are subject to change. Only the symbols and phase IDs will remain constant.

```
// DUP
// XEQ DSLET L
R 41  75F2 (HEX) WDS UNUSED BY CORE LOAD
CALL TRANSFER VECTOR
 FSYSU  09DD
 FSLEN  0825
SYSTEM SUBROUTINES
 ILS04  00C4
 FLS02  00B3
      020A (HEX) IS THE EXECUTION ADDR


                                   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 0327  0008    @DCTL  02  11DE 05A3  0008    @STOR  03  21DE 056B  0010    @FILQ  04  01DE 03C0  0015
@DUMP  05  41DE 0461  0018    @DL/F  06  01DE 03C0  001C    @DLTE  07  01DE 05A3  001F    @DFNE  08  01DE 05A3  0024
@EXIT  09  01DE 0500  0029    @CFCE  0A  7A06 00D8  002D    @DU11  0B  7A06 0035  002E    @DU12  0C  7A06 00D1  002F
@DU13  0D  7782 087C  0030    @DU14  0E  7A06 0248  0037    @DU15  0F  7A06 0248  0039    @DU16  10  7A06 0248  003B
@PRCI  11  01DE 0280  003D    @DU18  12  0E6E 0140  003F    @FR01  1F  766E 098F  0040    @FR02  20  7A34 0500  0048
@FR03  21  7A34 0280  004C    @FR04  22  7A34 03C0  004E    @FR05  23  7A34 0500  0051    @FR06  24  7A34 03C0  0055
@FR07  25  7A34 0280  0058    @FR08  26  7A34 0500  005A    @FR09  27  7A34 03F0  005E    @FR10  28  7A34 03C0  0062
@FR11  29  7A34 03C0  0065    @FR12  2A  7A34 03C0  0068    @FR13  2B  7A34 03C0  006B    @FR14  2C  7A34 0500  006E
@FR15  2D  7A34 0500  0072    @FR16  2E  7A34 0500  0076    @FR17  2F  7A34 0500  007A    @FR18  30  7A34 0500  007E
@FR19  31  7A34 0404  0082    @FR20  32  7A34 03C0  0086    @FR21  33  7A34 03C0  0089    @FR22  34  7A34 0280  008C
@FR23  35  7A34 03C0  008E    @FR24  36  7A34 03C0  0091    @FR25  37  7A34 0500  0094    @FR26  38  788E 03C0  0098
@FR27  39  766E 013F  009B    @AS00  51  01E0 021E  009C    @ACNV  52  01E8 00BB  009E    @AS10  53  01E8 0067  009F
@AS11  54  01E8 0050  00A0    @AS12  55  026A 0185  00A1    @AERM  56  0AC4 00C1  00A3    @AS01  57  026A 019A  00A4
@AS1A  58  026A 00B5  00A6    @ASYM  59  0000 0130  00A7    @AS03  5A  076E 01EC  00A8    @AS04  5B  025A 01AF  00AA
@AS02  5C  026A 015B  00AC    @AS2A  5D  026C 00A6  00AE    @AS09  5E  0408 05ED  00AF    @AS05  5F  025A 017C  00B4
@AS06  60  026A 0196  00B6    @AS07  61  026A 0166  00B8    @AS7A  62  026C 0127  00BA    @AS08  63  026A 0191  00BB
@AS8A  64  026A 0199  00BD    @APCV  65  026A 0097  00BF    @AINT  66  094E 0057  00C0    @ASAA  67  094E 005E  00C1
@SUP1  6E  051A 0A80  00C2    @SUP2  6F  07FE 0734  00CB    @SUP3  70  0506 04F9  00D1    @SUP4  71  01DE 0167  00D5
@CLB1  78  01E0 0555  00D7    @CLB2  79  0542 0498  00DC    @CLB3  7A  0802 01E4  00E0    @CLB4  7B  0802 01BA  00E2
@CLB5  7C  0802 0164  00E4    @CLB6  7D  0802 01CF  00E6    @CLB7  7E  09E8 013A  00E8    @CLB8  7F  09E8 012B  00E9
@CLB9  80  09E8 0131  00EA    @CLBA  81  09E8 00EA  00EB    @CLBB  82  0B2A 013A  00EC    @CLBC  83  0802 0141  00ED
@1403  8C  0000 0131  00EF    @1132  8D  0000 0126  00F0    @CPTR  8E  0000 011B  00F1    @2501  8F  0000 009C  80F2
@1442  90  0000 00A0  00F3    @1134  91  0000 016C  00F4    @KBCP  92  0000 0174  00F6    @CDCV  93  0000 00BB  00F8
@PTCV  94  0000 0003  00F9    @KBCV  95  0000 0003  00FA    @DZID  96  00F0 00EC  00FB    @D1ID  97  00F0 01A2  00FC
@DNID  98  00F0 0280  00FE    @PPRT  99  0000 0131  00EF    @PIWK  9A  0000 00A0  00F3    @PIXK  9B  0000 00A0  00F3
@PCWK  9C  0000 00BB  00F8    @PCXK  9D  0000 00BB  00F8    @CIL1  A0  0000 0170  0101    @CIL2  A1  0000 01C6  0103
```

Two sample programs are provided with the Monitor system. One is a FORTRAN compilation, the other is an assembly. Both programs are loaded and processed as Monitor jobs. Both programs are listed on the principal printer, which in FORTRAN is specified on the IOCS card. The answer to the FORTRAN problem is printed on the principal printer. The answer to the Assembler problem is printed on the Console Printer.

FORTRAN SAMPLE PROGRAM

The FORTRAN sample program is listed below as it runs on a 4K and 8K system (the LIST ALL card is removed for the 8K run). This program reads data cards supplied with the program and builds three files on disk, one in the User Area and two in Working Storage. The core and file maps for the program are described in the Programming Tips and Techniques section of this manual.

The FORTRAN card sample program as supplied uses a 1442-6, or -7, an 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, it will be necessary to make changes to the program. These changes are listed below.

Card CHK13030

- If printed output is on a 1403 Printer, change the IOCS entry from 1132 PRINTER to 1403 PRINTER.
- If printed output is on the Console Printer, change the IOCS entry from 1132 PRINTER to TYPEWRITER.

Card CHK13040

- If card input is from a 2501 Reader, change the IOCS entry from CARD to 2501 READER.

Card CHK13180

- If card input is from a 2501 Reader, change M = 2 to M = 8.

Card CHK13190

- If printer output is on a 1403 Printer, change L = 3 to L = 5.
- If printed output is on a Console Printer, change L = 3 to L = 1.

FORTRAN Sample Program Run on 4K

```
// JOB                                          09/27/67                CHK12970

LOG DRIVE   CART SPEC   CART AVAIL  PHY DRIVE
  0000        000F        000F        0000

// DUP                                                                  CHK12980

*STOREDATA  WS  UA  FILEA    2                                          CHK12990
CART ID 000F   DB ADDR  1AE0   DB CNT   0020

// * IBM 1130 FORTRAN SAMPLE PROGRAM                                    CHK13000

// FOR                                                                  CHK13010
*ONE WORD INTEGERS                                                      CHK13020
*IOCS(DISK,1132 PRINTER)                                                CHK13030
*IOCS(CARD)                                                             CHK13040
*LIST ALL                                                               CHK13060
C     IBM 1130 FORTRAN SAMPLE PROGRAM                                   CHK13070
C     SIMULTANEOUS EQUATION PROGRAM                                     CHK13080
C                                                                       CHK13084
      INTEGER V1,V2,V3                                                  CHK13086
      DIMENSION A(10,10),X(10),B(140)                                   CHK13090
      DEFINE FILE 101(1,100,U,V1),102(1,10,U,V2),103(1,100,U,V3)        CHK13095
  301 FORMAT (1H1,20X15HINCOMPATIBILITY)                                CHK13100
  302 FORMAT (1H 20X41HMORE EQUATIONS THAN UNKNOWNS-NO SOLUTIONS)       CHK13110
  303 FORMAT (1H 20X46HMORE UNKNOWNS THAN EQUATIONS-SEVERAL SOLUTIONS)  CHK13120
  304 FORMAT (1H 20X15HSOLUTION MATRIX)                                 CHK13130
  305 FORMAT (1H 20X8HMATRIX A)                                         CHK13140
  306 FORMAT (1H 20X8HMATRIX B)                                         CHK13150
  307 FORMAT (1H 20X10H A-INVERSE)                                      CHK13160
  308 FORMAT (1H 20X24HDIAGONAL ELEMENT IS ZERO)                        CHK13170
      M=2                                                               CHK13180
      L=3                                                               CHK13190
      READ (M,10)                                                       CHK13200
   10 FORMAT(80H          SPACE FOR TITLE                               CHK13210
     1                        )                                         CHK13220
      WRITE (L,10)                                                      CHK13230
   12 FORMAT (6I10,20X)                                                 CHK13240
      READ (M,12) M1,M2,L1,L2,N1,N2                                     CHK13250
C                                                                       CHK13255
C     M1 = NO. OF ROWS OF A                                             CHK13260
C     M2 = NO. OF COLS OF A                                             CHK13270
C     L1 = NO. OF ROWS OF X                                             CHK13280
C     L2 = NO. OF COLS OF X                                             CHK13290
C     N1 = NO. OF ROWS OF B                                             CHK13300
C     N2 = NO. OF COLS OF B                                             CHK13310
C                                                                       CHK13315
   13 FORMAT (7F10.4,10X)                                               CHK13320
   17 FORMAT (10F10.4)                                                  CHK13330
      IF (N2-1)63,64,63                                                 CHK13340
   64 IF (L2-1)63,65,63                                                 CHK13350
   65 IF (L1-M2)63,66,63                                                CHK13360
   66 IF (M1-N1)63,11,63                                                CHK13370
   63 WRITE (L,301)                                                     CHK13380
      GO TO 2                                                           CHK13390
   11 N=M1                                                              CHK13400
      N=M2                                                              CHK13410
      IF (M1-M2) 91,14,93                                               CHK13420
   91 WRITE (L,302)                                                     CHK13430
      GO TO 2                                                           CHK13440
   93 WRITE (L,303)                                                     CHK13450
      GO TO 2                                                           CHK13460
   14 WRITE (L,305)                                                     CHK13470
      DO 70 I=1,N                                                       CHK13480
      READ  (M,13) (A(I,J), J=1,N)                                      CHK13490
      WRITE (L,17) (A(I,J), J=1,N)                                      CHK13500
      WRITE (101'1)(A(I,J), J=1,N)                                      CHK13505
   70 CONTINUE                                                          CHK13510
   89 FORMAT (F10.4,70X)                                                CHK13520
      WRITE (L,306)                                                     CHK13530
      READ  (M,89) (B(I), I=1,N)                                        CHK13540
      WRITE (L,89) (B(I), I=1,N)                                        CHK13550
      WRITE (102'1)(B(I), I=1,N)                                        CHK13554
C                                                                       CHK13556
C     INVERSION QF A                                                    CHK13560
C                                                                       CHK13565
      DO 120 K=1,N                                                      CHK13570
      D=A(K,K)                                                          CHK13580
      IF(D)40,200,40                                                    CHK13590
   40 A(K,K)=1.0                                                        CHK13600
      DO 60 J=1,N                                                       CHK13610
   60 A(K,J)=A(K,J)/D                                                   CHK13620
      IF(K-N)80,130,130                                                 CHK13630
   80 IK=K+1                                                            CHK13640
      DO 120 I=IK,N                                                     CHK13650
      D=A(I,K)                                                          CHK13660
      A(I,K)=0.0                                                        CHK13670
      DO 120 J=1,N                                                      CHK13680
  120 A(I,J)=A(I,J)-(D*A(K,J))                                          CHK13690
C                                                                       CHK13695
C     BACK SOLUTION                                                     CHK13700
C                                                                       CHK13705
  130 IK=N-1                                                            CHK13710
      DO 180 K=1,IK                                                     CHK13720
      I1=K+1                                                            CHK13730
      DO 180 I=I1,N                                                     CHK13740
      D=A(K,I)                                                          CHK13750
      A(K,I)=0.0                                                        CHK13760
      DO 180 J=1,N                                                      CHK13770
  180 A(K,J)=A(K,J)-(D*A(I,J))                                          CHK13780
      GO TO 202                                                         CHK13790
  200 WRITE (L,308)                                                     CHK13800
      GO TO 2                                                           CHK13810
  202 WRITE (L,307)                                                     CHK13820
      DO 201 I=1,N                                                      CHK13830
      WRITE (L,17)  (A(I,J), J=1,N)                                     CHK13840
      WRITE (103'1) (A(I,J), J=1,N)                                     CHK13845
  201 CONTINUE                                                          CHK13850
      DO 21 I=1,N                                                       CHK13860
      X(I)=0.0                                                          CHK13870
      DO 21 K=1,N                                                       CHK13880
   21 X(I)=X(I)+A(I,K)*B(K)                                             CHK13890
      WRITE (L,304)                                                     CHK13900
      WRITE (L,89) (X(I), I=1,N)                                        CHK13910
    2 CALL EXIT                                                         CHK13940
      END                                                               CHK13950
VARIABLE ALLOCATIONS
    A(R )=00DC-0016      X(R )=00F0-00DE      B(R )=0208-00F2      D(R )=020A           V1(I )=020C          V2(I )=020D
   V3(I )=020E           M(I )=020F           L(I )=0210          M1(I )=0211           M2(I )=0212          L1(I )=0213
   L2(I )=0214          N1(I )=0215          N2(I )=0216           N(I )=0217            I(I )=0218           J(I )=0219
    K(I )=021A          IK(I )=021B          I1(I )=021C

STATEMENT ALLOCATIONS
 301  =022A  302  =0237  303  =0251  304  =026D  305  =027A  306  =0283  307  =028C  308  =0296  10   =02A7  12   =09D1
 13   =02D5  17   =02D9  89   =02DC  64   =031C  65   =0322  66   =0328  63   =032E  11   =0334  91   =0344  93   =004A
 14   =0350  70   =03A2  40   =0407  60   =0416  80   =0432  120  =0451  130  =0484  180  =04AD  200  =04E2  202  =0=E8
 201  =0522  21   =053C  2    =0588

FEATURES SUPPORTED
 ONE WORD INTEGERS
 IOCS

CALLED SUBPROGRAMS
 FADDX    FMPYX    FDIV     FLD      FLDX     FSTO     FSTOX    FSBRX    CARDZ    PRNTZ    SRED     SWRT     SCOMP    SFIO     SIOlx
 SIOI     SUBSC    SDFIO    SDWRT    SDCOM    SDFX

REAL CONSTANTS
  .100000E 01=0220    .000000E 00=0222

INTEGER CONSTANTS
     2=0224       3=0225       1=Q226     101=0227     102=0228     103=0229

CORE REQUIREMENTS FOR
 COMMON       0  VARIABLES    544  PROGRAM    874

 END OF COMPILATION

// XEQ        L  2                                                      CHK13960
*LOCAL,FLOAT,FARC,IFIX                                                  CHK13963
*FILES(103,FILEA)                                                       CHK13965
FILES ALLOCATION
  103 01AE  0001  000F FILEA
  101 0000  0001  000F  01B0
  102 0001  0001  000F  01B0
STORAGE ALLOCATION
R 40  03AB (HEX) ADDITIONAL CORE REQUIRD
R 43  0124 (HEX) ARITH/FUNC SOCAL WD CNT
R 44  06AC (HEX) FI/O, I/O SOCAL WD CNT
R 45  02A2 (HEX) DISK FI/O SOCAL WD CNT
R 41  0004 (HEX) WDS UNUSED BY CORE LOAD
LIBF TRANSFER VECTOR
 EBCTB  0F53 SOCAL 2
 HOLTB  0F17 SOCAL 2
 GETAD  0ED4 SOCAL 2
 XMDS   09B2 SOCAL 1
 HOLEZ  0E9E SOCAL 2
 NORM   07DC
 FADDX  095D SOCAL 1
 FSBRX  0934 SOCAL 1
 FMPYX  0900 SOCAL 1
 FDIV   08AE SOCAL 1
 FSTOX  0788
 FLDX   07A4
 SDCOM  0920 SOCAL 3
 SDFX   08E6 SOCAL 3
```

```
  SDWRT  0954 SOCAL 3
  SIOFX  099A SOCAL 2
  SUBSC  07BE
  SIOI   099E SOCAL 2
  SCOMP  0982 SOCAL 2
  SWRT   08AB SOCAL 2
  SRED   08B0 SOCAL 2
  FSTO   078C
  FLD    07A8
  PRNTZ  0DE0 SOCAL 2
  CARDZ  0D36 SOCAL 2
  SFIO   09AD SOCAL 2
  SDFIO  0959 SOCAL 3
  IFIX   087C LOCAL
  FARC   087C LOCAL
  FLOAT  087C LOCAL
 SYSTEM SUBROUTINES
  ILS04  00C4
  ILS02  00B3
  ILS01  0F5A
  ILS00  0F75
  FLIPR  0816
       04DD (HEX) IS THE EXECUTION ADDR

      IBM 1130 FORTRAN          SAMPLE PROGRAM                        CHK1397
                      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                                             09/27/67           CHK12970

LOG DRIVE   CART SPEC   CART AVAIL   PHY DRIVE
  0000        000F        000F         0000

// * IBM 1130 FORTRAN SAMPLE PROGRAM                                  CHK13000

// FOR                                                                CHK13010
*ONE WORD INTEGERS                                                    CHK13020
*IOCS(DISK,1132 PRINTER)                                              CHK13030
*IOCS(CARD)                                                           CHK13040

FEATURES SUPPORTED
 ONE WORD INTEGERS
 IOCS

CORE REQUIREMENTS FOR
 COMMON       0  VARIABLES    544  PROGRAM    874

 END OF COMPILATION

// XEQ        L  1                                                    CHK13960
*FILES(103,FILEA)                                                     CHK13965
FILES ALLOCATION
  103 01AE  0001  000F FILEA
  101 0000  0001  000F  0180
  102 0001  0001  000F  0180
STORAGE ALLOCATION
R 41  0C9C (HEX) WDS UNUSED BY CORE LOAD
LIBF TRANSFER VECTOR
 EBCTB  12CD
 HOLTB  1291
 GETAD  124E
 NORM   1224
 XMDS   1208
 FARC   11E6
 HOLEZ  11B0
 FLOAT  11A6
 IFIX   117A
 FADDX  1125
 FSBRX  10FC
 FMPYX  10C8
 FDIV   1076
 FSTOX  101E
 FLDX   103A
 SDCOM  07FE
 SDFX   07C4
 SDWRT  0832
 SIOFX  081A
 SUBSC  1054
 SIOI   081E
 SCOMP  0802
 SWRT   0A2B
 SRED   0A30
 FSTO   1022
 FLD    103E
 PRNTZ  0F60
 CARDZ  0EB6
 SFIO   082D
 SDFIO  0837
SYSTEM SUBROUTINES
 ILS04  00C4
 ILS02  0083
 ILS01  12D2
 ILS00  12ED
      04DD (HEX) IS THE EXECUTION ADDR

     IBM 1130 FORTRAN         SAMPLE PROGRAM                          CHK1397
                    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
```

ASSEMBLER SAMPLE PROGRAM

The core map for the Assembler sample program is described in the Programming Tips and Techniques section of this manual.

Output on Principal Printer

```
// JOB                                                                  SMASM001

LOG DRIVE   CART SPEC   CART AVAIL  PHY DRIVE
  0000         2027        2027        0002

// ASM                                                                  SMASM002
*LIST                                                                   SMASM003
*PRINT SYMBOL TABLE                                                     SMASM004


                           COMPUTE THE SQUARE ROOT OF 64

                    *************************************************** SMASM006
                    *                                                 * SMASM007
                    *   THIS PROGRAM COMPUTES THE SQUARE ROOT OF 64   * SMASM008
                    *   *AND PRINTS THE RESULT ON THE CONSOLE PRINTER.* SMASM009
                    *                                                 * SMASM010
                    *************************************************** SMASM011
0000 0  C030        BEGIN LD      D64       INPUT TO THE SQUARE ROOT    SMASM012
0001 20 064D6063          LIBF    FLOAT     INTEGER TO FLOATING PT.     SMASM013
0002 30 06898640          CALL    FSQR      FLOATING PT. SQRT.          SMASM014
0004 20 091899C0          LIBF    IFIX      FLOATING PT. TO INTEGER     SMASM015
0005 0  1008              SLA     8                                     SMASM016
                    *             MASK TO BUILD EBCDIC INTEGER          SMASM017
                    *             RESULT AND EBCDIC BLANK IN WORD1.     SMASM018
0006 0  E829              OR      MASK                                  SMASM019
0007 0  D01B              STO     WORD1     CONVERSION INPUT AREA       SMASM020
                    *             CONVERT MESSAGE FROM EBCDIC           SMASM021
                    *             TO ROTATE/TILT CODE.                  SMASM022
```

```
0008 20 05097663          LIBF   EBPRT      CALL CONVERSION SUBROUTINE  SMASM023
0009 0  0000              DC     0          CONTROL PARAMETER           SMASM024
000A 1  0023              DC     WORD1      INPUT AREA                  SMASM025
000B 1  0015              DC     TYPE+1     OUTPUT AREA                 SMASM026
000C 0  001A              DC     26         CHARACTER COUNT             SMASM027
000D 20 23A17170          LIBF   TYPE0      TYPE MESSAGE                SMASM028
000E 0  2000              DC     /2000      CONTROL PARAMETER           SMASM029
000F 1  0014              DC     TYPE       I/O AREA                    SMASM030
0010 20 23A17170    BUSY  LIBF   TYPE0      WAIT FOR TYPING COMPLETE    SMASM031
0011 0  0000              DC                                            SMASM032
0012 0  70FD              MDX    BUSY       BR TO WAIT FOR COMPLETION   SMASM033
0013 0  6038              EXIT              RETURN TO MONITOR CONTROL   SMASM034
0014 0  000E        TYPE  DC     14         I/O AREA WORD COUNT         SMASM035
0015    000D              BSS    13         RESERVE AS PRINT BUFFER     SMASM036
0022 0  8181              DC     /8181      TWO CARRIAGE RETURNS        SMASM037
0023 0  0000        WORD1 DC     *-*        CONVERSION INPUT AREA       SMASM038
0024    0018              EBC    .IS THE SQUARE ROOT OF 64.             SMASM039
0030 0  F040        MASK  DC     /F040      EBCDIC INTEGER MASK         SMASM040
0031 0  0040        D64   DC     64         CONSTANT FOR SQUARE ROOT    SMASM041
0032    0000              END    BEGIN                                  SMASM042


                          *SYMBOL TABLE*

   BEGIN  0000     BUSY   0010     D64    0031     MASK   0030     TYPE   0014
   WORD1  0023

   000 OVERFLOW SECTORS SPECIFIED
   000 OVERFLOW SECTORS REQUIRED
   006 SYMBOLS DEFINED
    NO ERROR(S)  FLAGGED IN ABOVE ASSEMBLY

// XEQ       L                                                          SMASM043
R 41  7904 (HEX) WDS UNUSED BY CORE LOAD
CALL TRANSFER VECTOR
 FSQR    0248
LIBF TRANSFER VECTOR
 FARC    069E
 XMDS    0682
 HOLL    0632
 PRTY    05E2
 EBPA    0592
 FADD    04E1
 FDIV    0540
 FLD     048C
 FADDX   04E7
 FMPYX   04A2
 FSTO    0470
 FGETP   0456
 NORM    042C
 TYPE0   0312
 EBPRT   02AC
 IFIX    0280
 FLOAT   0230
SYSTEM SUBROUTINES
 ILS04   00C4
 ILS02   00B3
      01FE (HEX) IS THE EXECUTION ADDR
```

Output on Console Printer

```
8 IS THE SQUARE ROOT OF 64
```

Many of the differences between Monitor 1 and Monitor 2 are listed below.

- Lowest allowable origin with:

	Version 1		Version 2	
	Dec.	Hex.	Dec.	Hex.
DISKZ	450	/01C2	510	/01FE
DISK0	610	/0262	690	/02B2
DISK1	880	/0370	690	/02B2
DISKN	1080	/0438	960	/03C0

NOTE: All version 2 disk subroutines provide multiple disk support and accommodate word counts exceeding 320. There is no DISK0 subroutine in version 2; a LIBF to DISK0 is interpreted as a LIBF to DISK1.

- Version 2 does not allow an initial ORG to an odd location in mainlines that require DISKZ. An ORG to an even location followed by a BSS or BES of an odd number of words is equivalent to an ORG to an odd location.

- Version 2 may require more core than Version 1, especially FORTRAN core loads.

- Defective cylinders are taken into account in the Version 2 incremental seek and write immediate functions. In other words, it is not possible to seek to or write immediate on a defective cylinder.

- The object code produced by the FORTRAN compiler is slightly longer in Version 2 than Version 1.

- The calling sequence for DISKZ in Version 2 is different from Version 1.

- The LIST DECK, LIST DECK E, and PUNCH SYMBOL TABLE Assembler Options are not allowed with 1134 input.

- ILS02 and ILS04 are part of the Resident Monitor. (The user may write his own and store them in the User Area for use with user programs.)

- The entire Resident Monitor, with the exception of $LINK, $EXIT, $IOCT, $PRET, and $IREQ, has been relocated. Certain parameters that were formerly in COMMA in Version 1 are in DCOM in Version 2.

- The Core Image header for Disk Core Image format (DCI) has been revised and relocated.

- The *FILE Assembler Control Record has been replaced by the pseudo-operation FILE. *FILE (not to be confused with the Supervisor Control Record *FILES) is not recognized in Version 2.

- On a DUP DUMP using the 1442-6 or -7, blank cards following the punched cards are not selected to stacker 2.

- Version 2 requires that all cartridges have a 4-character ID.

- There are certain diagnostics in Version 2 that are not in Version 1. Thus, some conditions are detected as errors in Version 2 that are not in Version 1.

- The Version 2 System Loader does not bypass the loading of ISSs for devices not defined on the REQ records. Such subroutines may, however, be deleted if desirable.

- Disk organization is different in the two versions.

- Version 2 requires 14 sectors more disk storage than Version 1, i.e., the address of Working Storage in Version 2 is 14 greater than in Version 1.

Absolute Address. An address that either should not be incremented or has already been incremented by a relocation factor.

Absolute Program. A program which, although stored in disk system format, has been written in such a way that it can be executed from only one core location.

Assembler Core Load. A core load that was built from a mainline written in Assembler language.

CALL Subprogram. A subprogram that must be referenced with a CALL statement. The type codes for subroutines in this category are 4 and 6.

CALL TV. The transfer vector through which CALL subroutines are entered during execution. See the section on the Core Load Builder for a description of this transfer vector.

Card Core Image Format (abbr. CDC). The format in which a program stored in disk core image format is dumped to cards.

Card Data Format (abbr. CDD). The format in which a data file is dumped to cards.

Card System Format (abbr. CDS). The format in which absolute and relocatable programs are punched into cards. In this format, columns 73-80 are used only to contain the card ID and sequence number.

CDC. (See Card Core Image Format.)

CDD. (See Card Data Format.)

CDS. (See Card System Format.)

Checksum. The two's complement of the logical sum of the record count (the position of the record within the program) and the data word(s). The logical sum is obtained by summing the data word(s) and the record number arithmetically, with the addition of one each time a carry occurs out of the high-order position of the Accumulator. The first record is record 1, not record 0.

This term (record number) should not be confused with the sequence number that appears in columns 73-80 in card formats.

CIB. (See Core Image Buffer.)

Cold Start Card. The card that contains the coding necessary for initial program loading (IPL), that is, fetching the Cord Start Program.

Cold Start Program. The disk-resident program that initializes the Monitor system by reading the Resident Monitor into core from the disk.

COMMA. (See Core Communications Area.)

Comment. The text contained on a Monitor control record with an asterisk in column 4, an Assembler language source record with an asterisk in column 21, or a FORTRAN source record with a C in column 1.

Control Record. One of the records (card or paper tape) that direct the activities of the Monitor system. For example, the DUP Monitor control record directs the Monitor to initialize DUP, the DUMPLET DUP control record directs DUP to initialize the DUMPLET program; the EXTENDED PRECISION FORTRAN control record directs the Compiler to allot three words instead of two for the storage of variables.

Core Communications Area (abbr. COMMA). The part of core which is reserved for work areas and parameters that are required by the Monitor programs. In general a parameter is found in COMMA if it is required by two or more Monitor programs and is required to load a program stored in disk core image format. Otherwise the parameter is found in DCOM. COMMA is initialized by the Supervisor during the processing of a JOB record.

Core Image Buffer (abbr. CIB). The buffer on which most of the first 4K of core are saved while a core load is being built. It is also used to save any part of COMMON defined below location 4096 during a link-to-link transfer of control. See the section on the Core Load Builder for a description of the CIB and its use.

Core Image Header Record. A part of a core image program including such parameters as the word count of the core load, the ITV, and the setting for index register 3.

Core Image Program. A mainline that has been converted, along with all of its required subroutines, to disk core image format. Included in the core image program are any LOCALs and/or SOCALs that are required. This term should not be confused with "core load", which refers to only that part of a core image program that is read into core just prior to execution.

Core Load. A mainline, its required subroutines, and its interrupt, CALL, and LIBF transfer vectors. This term should not be confused with "core image program".

CSF Block. A group of not more than 51 data words of a program in card system format. In this format, the first six data words of every CSF block are indicator words. These six words are always present, even though all six are not needed. A CSF block is equivalent to words 4-54 of the CSF module (Data card) of which it is a part.

CSF Module. A group of words consisting of a data header and CSF blocks for a program in card system format. A CSF module is equivalent to a Data card in card system format. A new CSF module is created for every data break. A data break occurs (1) whenever there is an ORG, BSS, BES, or DSA statement, (2) whenever a new Data card is required to store the words comprising a program, and (3) at the end of the program.

Data Break. (See DSF Module.)

Data File. An area in either the User Area or the Fixed Area in which data is stored. "Data file" may also refer to the data itself.

Data Header. The first pair of words in a module for a program in disk system format. The first word contains the loading address of the module; the second the total number of words contained in the module. The data header for the last module contains the effective program length, followed by a word count of zero.

DCI. (See Disk Core Image Format.)

DCOM. (See Disk Communications Area.)

DDF. (See Disk Data Format.)

DEFINE FILE Table. The table which appears at the beginning of every mainline that refers to defined files. There is one 7-word entry for each file that has been defined.

Disk Block. One sixteenth of a disk sector, that is, 20 disk words. The disk block is the smallest distinguishable increment for programs stored in disk system format. Thus, the Monitor system permits packing of disk system format programs at smaller intervals than the hardware would otherwise allow.

Disk Communications Area (abbr. DCOM). The disk sector that contains the work areas and parameters for the Monitor programs.

Disk Core Image Format (abbr. DCI). The format in which core image programs are stored on the disk prior to execution.

Disk Data Format (abbr. DDF). The format in which a data file is stored in either the User Area or the Fixed Area.

Disk System Format (abbr. DSF). The format in which mainlines and subprograms are stored on the disk as separate entities. It is not possible to execute a program in disk system format; it must first be converted to disk core image format as a result of either an XEQ Monitor control record or a STORECI DUP control record.

Disk System Format Program. A program that is stored in disk system format. It is sometimes called a DSF program.

DSF. (See Disk System Format.)

DSF Block. A group of not more than nine data words of a program in disk system format. In this format, the first data word of every DSF block is an indicator word. Normally every DSF block in a DSF module consists of nine data words, including an indicator word; but if the DSF module contains a number of data words that is not a multiple of nine, then the next-to-last DSF block contains less than nine data words.

DSF Module. A group of words consisting of a data header and DSF blocks for a program in disk system format. A new DSF module is created for every data break. A data break occurs (1) whenever there is an ORG, BSS, BES, or DSA statement, (2) whenever a new sector is required to store the words comprising a program, and (3) at the end of the program.

Effective Program Length. The terminal address appearing in a relocatable program. For example, in Assembler language programs, this address is the last value taken on by the Location Assignment Counter and appears as the address assigned to the END statement.

Entry Point. Either (1) the symbolic address (name) of a place at which a program is entered, (2) the absolute core address at which a program is to be entered, or (3) the address, relative to the address of the first word of the subprogram, at which it is to be entered.

Execution. The execution of the program specified on an XEQ Monitor control record and any subsequent links executed via CALL LINK statements. The execution is complete when a CALL EXIT is executed.

Fetching. The process of reading something into core storage, usually from disk.

Fixed Area (abbr. FX). The area on disk in which core image programs and data files are stored if it is desired that they always occupy the same sectors. No programs in disk system format may be stored in this area. No packing ever occurs in the Fixed Area.

FLET. (See LET/FLET.)

FORTRAN Core Load. A core load that was built from a mainline written in the FORTRAN language.

Function. A subprogram that evaluates a mathematical relationship between a number of variables. In FORTRAN, a FUNCTION is a subprogram that is restricted to a single value for the result. This type of subprogram is called by direct reference.

FX. (See Fixed Area.)

IBM Area. That part of disk storage that is occupied by DCOM, the CIB, and the Monitor programs. This area is also known as the System Area.

IBT. (See ILS Branch Table.)

ILS. (See Interrupt Level Subroutine.)

ILS Branch Table (abbr. IBT.) A table consisting of the addresses of the interrupt entry points for each ISS used for an interrupt level. An IBT is required by the ILS for an interrupt level with which more than one device is associated.

In-core Subprogram. A subprogram that remains in core storage during the entire execution of the core load, of which it is a part. ILSs are always in-core subprograms, whereas LOCALs and SOCALs never are.

Indicator Word. The first word of a DSF block indicating which of the following data words should be incremented (relocated) when relocating a program in disk system format. This word also indicates which words are LIBF, CALL, and DSA names. Programs in disk system format all contain indicator words. Each pair of bits in the indicator word is associated with one of the following data words -- the first pair with the first data word following the indicator word, etc.

Initial Program Load. The action that occurs when the PROGRAM LOAD key is pressed. One record is read into core, starting at location zero, from the input hardware device that is physically wired to perform this function. The record read, usually a loader, then instructs the system as to the next action to be performed, e.g., load more records.

Interrupt Level Subroutine (abbr. ILS). A subroutine that analyzes all interrupts on a given level; that is, it determines which device on a given level caused the interrupt and branches to a servicing subroutine (ISS) for the processing of that interrupt.

Interrupt Service Subroutine (abbr. ISS). A subroutine that 1) manipulates a given I/O device and 2) services all interrupts for that devicer after they have been detected by an ILS.

Interrupt Transfer Vector (abbr. ITV). The contents of words 8-13, which are the second words of the automatic BSI instructions which occur with each interrupt. In other words, if an interrupt occurs on level zero and if core location eight contains 500, an automatic BSI to core location 500 occurs. Similarly, interrupts on levels 1-5 cause BSIs to the contents of core locations 9-13, respectively.

IOAR Header. The word(s) required by an I/O device subroutine (ISS). They must be the first or the first and second words of the I/O buffer.

IPL. (See Initial Program Load.)

ISS. (See Interrupt Service Subroutine.)

ISS Counter. A counter in COMMA (word $IOCT) that is incremented by 1 upon the initiation of every I/O operation and decremented by 1 upon receipt of an I/O operation complete interrupt.

ITV. (See Interrupt Transfer Vector.)

Job. A group of tasks (subjobs) that are to be performed by the Monitor system and which are interdependent; that is, the successful execution of any given subjob (following the first) depends upon the successful execution of at least one of those that precede it.

LAC. (See Location Assignment Counter.)

LET/FLET (the Location Equivalence Table for the User Area/ the Location Equivalence Table for the Fixed Area). The disk-resident table through which the disk addresses of programs and data files stored in the User/Fixed Area may be found. On a system cartridge, LET occupies the cylinder preceding the User Area. If a Fixed Area has been defined, FLET occupies the cylinder preceding it; otherwise, there is no FLET.

LIBF Subroutine. A subprogram that must be referenced with an LIBF statement. The type codes for subroutines in this category are 3 and 5.

LIBF TV. The transfer vector through which LIBF subprograms are entered at execution time. See the section on the Core Load Builder for a description of this transfer vector.

Link. A link is a core image program that is read into core for execution as a result of the execution of a CALL LINK statement.

Loading Address. The address at which a mainline, subprogram, core load, or DSF module is to begin. For mainlines and DSF modules, the loading address is either absolute or relative. For subprograms, it is always relative, whereas, for core loads, it is always absolute.

Load-On-Call (abbr. LOCAL) Subroutine. A subprogram in a core image program that is not an in-core subprogram. It is read from the disk into a special overlay area in core only when it is called during execution time. LOCALs, which are specified for any given execution by the user, are a means of gaining core storage at the expense of execution time. The Core Load Builder constructs the LOCALs and all linkages to and from them.

Load-Although-Not-Called (abbr. NOCAL) Subprogram. A subprogram that is to be included in a core image program although it is never referenced in that core image program by an LIBF or CALL statement. Debugging aids such as a trace or a dump fall into this category.

LOCAL. (See Load-On-Call Subroutine.)

Location Assignment Counter. A counter maintained in the Assembler for assigning addresses to the instructions it assembles. A similar counter is maintained in the Core Load Builder for loading purposes.

Long Instruction. An instruction that occupies two core storage locations.

Low COMMON. Words 896 - 1215 if DISKZ is in core, words 1216 - 1535 if DISK1 is in core, or words 1536 - 1855 is DISKN is in core. This area exists even if there is no COMMON.

Mainline. The program about which a core image program is built. The mainline is normally the program in control. It calls subprograms to perform various functions.

Master Cartridge. The cartridge residing on logical drive zero. The master cartridge must be a system cartridge.

Modified EBCDIC Code. A six-bit code used internally by the Monitor programs. In converting from EBCDIC to Modified EBCDIC, the leftmost two-bits are dropped. (See Name Code.)

Monitor. A synonym for the entire 1130 Disk Monitor System, Version 2, which is also known as the Monitor system or the Disk Monitor.

Monitor Control Record. (See Control Record.)

Monitor Program. One of the following parts of the Monitor system: Supervisor (SUP), Core Image Loader (CIL), Core Load Builder (CLB), Disk Utility Program (DUP), Assembler (ASM), or FORTRAN Compiler (FOR).

Name Code. The format in which the names of subprograms, entry points, labels, etc., are stored for use in the Monitor programs. The name consists of five characters, terminal blanks being added if necessary to make five characters. Each character is in Modified EBCDIC code, and the entire 30-bit representation is right-justified in two 16-bit words. The leftmost two bits are used for various purposes by the Monitor.

Naturally Relocatable Program. A program that may be executed from any core storage location without first being relocated. The only absolute addresses in such a program refer to parts of the Resident Monitor, which, of course, are fixed.

NOCAL. (See Load-Although-Not-Called Subprogram.)

Non-system Cartridge. A cartridge that does not contain the Monitor programs, although it does contain DCOM, LET, etc. A non-system cartridge may be used only as a satellite cartridge.

NOP. An acronym used to denote the instruction, No operation.

Object Program. The output from either the Assembler, or the FORTRAN Compiler.

Packing. The process of storing programs in the User Area to the nearest disk block, thus reducing the average wasted disk space from 160 disk words/program to 10 disk words/program.

Padding. Areas in the User/Fixed Area required to permit core image programs and data files to start on a sector boundary. The length of the padding, which is reflected in LET/FLET with a dummy entry, is from 1 to 15 disk blocks.

Principal I/O Device. The device used for stacked job input to the Monitor system. The 2501/1442, 1442/1442, or 1134/1055 may be assigned as the principal I/O device. The Keyboard may be assigned temporarily as the principal input device (see // TYP under Monitor Control Records). The System Loader considers the fastest device defined on the REQ records to be the principal I/O device.

Principal Print Device. The device used by the Monitor system for printing system messages. Either the 1403, 1132, or Console Printer may be assigned as the principal print device. The System Loader considers the fastest print device defined on the REQ records to be the principal print device.

Program. The highest level in the hierarchy describing various types of code. Subprograms and mainlines are subsets of this set.

Program Header Record. The part of a program stored in disk system format that precedes the first DSF module. Its contents vary with the type of program with which it is associated. It contains the information necessary to identify the program, to describe its properties, and to convert it from disk system format to disk core image format.

Quintuples. Five-word tables in DCOM that contain cartridge-related parameters. There is one table for each parameter and an entry in the table for each cartridge on the system. These tables are updated by SYSUP during JOB processing or by a user callable subprogram SYSUP if cartridges are changed during a job.

Relocatable Program. A program that can be executed from any core location. Such a program is stored on the disk in disk system format. It is relocated by the Core Load Builder.

Relocation. The process of adding a relocation factor to address constants and to those long instructions whose second words are not (1) invariant quantities, (2) absolute core addresses, or (3) symbols defined as absolute core addresses. The relocation factor for any program is the absolute core address at which the first word of that program is found.

Relocation Indicator. The second bit in a pair of bits in an indicator word. If the data word with which this bit is associated is not an LIBF, CALL, or DSA name, then it indicates whether or not to relocate the data word. If the relocation indicator is set to 1, the word is to be relocated. Pairs of relocation indicators indicate LIBF, CALL, or DSA names. The combinations are 1000, 1100, and 1101, respectively.

Remark. An explanation of the use or function of a statement or statements. A remark is a part of a statement, whereas a comment is a separate statement.

Resident Image. The mirror-image of the Resident Monitor minus the disk I/O subroutine. It resides on disk and is read into core by the Cold Start Program.

Resident Monitor. The area required in core by the Monitor system for its operation. This area is generally unavailable to the user for his own use. The Resident Monitor consists of COMMA, the Skeleton Supervisor, and one of the disk I/O subroutines, nominally DISKZ.

Satellite Cartridge. A cartridge residing on a drive other than logical drive zero. A satellite cartridge can be either a system or a non-system cartridge.

Short Instruction. An instruction that occupies only one core storage location.

Skeleton Supervisor. The part of the Supervisor that is always in core and that is, essentially, the logic necessary to process CALL DUMP, CALL EXIT, and CALL LINK statements. Certain traps are also considered to be part of the Skeleton Supervisor.

SOCAL. (See System Overlay to be Loaded-On-Call.)

Subjob. A Monitor operation to be performed during a job. Each subjob is initiated by a Monitor control record such as ASM or XEQ. It may also be initiated by a CALL LINK.

Subprogram. A synonym used mainly in FORTRAN for both FUNCTIONs and SUBROUTINEs. This term is equivalent to subroutine when subroutine is used in its broadest sense.

Subroutine. A subset of the set "program". In FORTRAN, a SUBROUTINE is a type of subprogram that is not restricted to a single value for the result and that is called with a CALL statement.

Supervisor Control Record Area (abbr. SCRA). The cylinder in which the Supervisor control records are written. The first two sectors are reserved for LOCAL control records, the next two for NOCAL control records and the next two for FILES control records. See the Supervisor section for the formats of these records.

System Area. (See IBM Area.)

System Cartridge. A cartridge that contains the Monitor programs. A system cartridge may be used as either a master or a satellite cartridge.

System Overlay to be Loaded-On-Call (abbr. SOCAL). One of two or three overlays automatically prepared by the Core Load Builder under certain conditions when a core load is too large to fit into core storage. See the section on the Core Load Builder for an explanation.

System Working Storage. The Working Storage area to be used during a job by the Monitor programs. The cartridge to be used for System Working Storage is defined on the JOB record. System Working Storage need not be on the system cartridge.

Transfer Vector (abbr. TV). A collection of both the LIBF TV and the CALL TV.

TV. (See Transfer Vector.)

UA. (See User Area.)

User Area (abbr. UA). The area on the disk in which all programs in disk system format are found. Core image programs and data files may also be stored in this area. All IBM-supplied programs are found here. This area occupies as many sectors as are required to store the programs and files residing there.

User Programs. Mainlines, subprograms, or core loads that have been written by the user and stored in the User/Fixed Area.

Working Storage (abbr. WS). The area on disk immediately following the last sector occupied by the User Area. This is the only one of the three major divisions of disk storage (IBM Area, User/Fixed Area, Working Storage) that does not begin at a cylinder boundary.

WS. (See Working Storage.)

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