

The IBM logo, consisting of the letters "IBM" in a bold, sans-serif font, is positioned on the left side of the page. It is set against a dark, textured rectangular background.

Systems Reference Library

IBM 7090/7094 IBSYS Operating System

Version 13

Utilities

This publication provides descriptions of the IBM 7090/7094 Operating System Utilities, program number 7090-UT-927, available to users of Version 13 of the 7090/7094 IBSYS Operating System equipped with IBM 1301/2302 Disk Storage, IBM 7320 Drum Storage, IBM 729 Magnetic Tape, or IBM 7340 Hypertape Units.

Descriptions are included of the following routines:

- Format-Track Generation
- Home-Address and Record-Address Generation
- Load Disk/Drum
- Dump Disk/Drum
- Restore Disk/Drum
- Dump 2302 Disk Platter
- Clear Disk/Drum
- Tape Dump

There is also a section in which the Utility Monitor is described.

Preface

This manual provides programmers with complete instructions for using the Utility Monitor and all utility routines provided by IBM for use with Version 13 of the 7090/7094 IBSYS Operating System. Disk, Drum, and Tape Dump routines comprise the entire set of utility routines.

It is assumed that the reader has a basic understanding of the 7090/7094 and is familiar with the contents of the following IBM publications:

IBM 7090/7094 IBSYS Operating System, Version

13: System Monitor (IBSYS), Form C28-6248

IBM 7340 Hypertape Drive, Form A22-6616

IBM 1301, 1302 Disk Storage, Form A22-6785

IBM 7340 Hypertape Drive, Form A22-6746

IBM 7320 Drum Storage, Form A22-6747

These routines require an IBM 7090/7094 Data Processing System equipped with the following:

1. An IBM 711 Card Reader; an IBM 729 II, IV, V, or VI Magnetic Tape Unit; or an IBM 7340 Hypertape Drive.
2. An IBM 716 Printer.
3. An IBM 7909 Data Channel, an IBM 7631 File Control, and at least one module of 1301/2302 Disk Storage or 7320 Drum Storage.
4. Either an IBM 729 II, IV, V, or VI Magnetic Tape Unit or an IBM Hypertape Drive is required for the System Library Unit, unless the library unit is IBM 1301/2302 Disk Storage or IBM 7320 Drum Storage.
5. An additional magnetic tape unit (either an IBM 729 II, IV, V, or VI Magnetic Tape Unit or an IBM 7340 Hypertape Drive) is required by some utility routines.
6. An IBM 7909 Data Channel and an IBM 7640 Hypertape Control are required, if any IBM 7340 Hypertape Drives are used.

MINOR REVISION (July 1965)

This edition, Form C28-6364-5, is a reprint of Form C28-6364-4, incorporating changes released in the following Technical Newsletter:

FORM NO.	PAGES	DATED
N28-0151-0	3, 20, 21	May 5, 1965

Form C28-6364-4 and the Technical Newsletter are not obsoleted.

Copies of this and other IBM publications can be obtained through IBM Branch Offices.

Address comments concerning the contents of this publication to:

IBM, Programming Systems Publications, Dept. D39, 1271 Avenue of the Americas, New York, N. Y., 10020

Contents

Introduction and Utility Monitor	5	Description	14
Utility Monitor	5	Output Tape	14
Disk/Drum Utility Routines	7	Control Cards	14
Disk/Drum Utility Routines Usage	7	General Operating Instructions	14
Format-Track Generation Routine	7	Restoring a Dumped Platter	14
Standard Field Lengths	8	Restore Disk/Drum Routine	14
Generated Fields	8	Input Tape	14
Record Areas	8	Control Cards	14
Record Area Length	8	General Operating Instructions	15
Home-Address and Record-Address Generation Routine	8	Clear Disk/Drum Routine	15
Control Cards	9	Methods of Clearing	15
Control Card Errors	10	Control Cards	16
Load Disk/Drum Routine	10	Control Card Errors	16
Loading Methods	10	Input/Output Errors	16
Address Modification	11	Tape Utility Routines	17
Input Files	11	Tape Dump Routine	17
Control Cards	11	Operations	17
Control Card Errors	12	Control Cards	18
Dump Disk/Drum Routine	12	Operating Procedure	19
Output Tape	12	Off-Line Messages	20
Control Cards	13	Index	
General Operating Instructions	13		
Dump 2302 Disk Platter Routine	14		

Introduction and Utility Monitor

The first section of this publication contains a description of the utility routines that were written to facilitate use of direct access storage units. (Throughout this text the term "direct access storage units" refers to IBM 1301/2302 Disk Storage Units and to IBM 7320 Drum Storage Units.)

The direct access storage utility routines are intended to be used in both test and production runs. An example of the use of the utility routines with each type of run is discussed briefly in the following paragraphs.

At the beginning of a test run, it is frequently necessary to generate format tracks, home addresses, and record addresses for the cylinders that are to be used for the test. Then, it may be necessary to load the data (that is to be used during the test) into the storage unit. At the end of the test, it may be desirable to dump data from certain portions of storage onto tape so that the data can be printed by a tape print program for visual checking. The utility operations required for this test run are provided by the Format-Track Generation, Home-Address and Record-Address Generation, Load Disk/Drum, and Dump Disk/Drum routines, respectively.

At the end of a production run, it may be necessary to dump the contents of certain areas of the cylinder onto magnetic tape in order to make these areas available to another program. When the data written on tape is required for another production run, the data must be restored to its original storage locations. The utility operations for this production run are provided by the Dump Disk/Drum and Restore Disk/Drum routines, respectively.

The horizontal surface of each platter in an IBM 2302 Disk Storage Unit is divided into two groups of 250 tracks. Each group of 250 tracks is served by a separate access arm. A Dump 2302 Disk Platter routine is available to dump such a group or part of such a group of 250 tracks onto magnetic tape or onto the on-line printer. The data dumped by this routine is restored by the Restore Disk/Drum routine. Information dumped onto SYSOU1 or onto the on-line printer cannot be restored.

The utility routines are written to use a standard home-address identifier and a standard record address format. If these standards are not desired, the user may modify the routines to satisfy a particular need.

All of the utility routines allow the use of either the 6-bit mode or the 8-bit mode of operation. All utility

routines read and write disk, drum, and tape in the binary mode, except for SYSOU1 which is always written in the BCD mode. None of the utility routines uses the cylinder mode of operation; therefore, the IBM 7631 File Control need not be equipped with that optional feature.

The second section of this publication describes the tape utility routines which consist of a tape dump routine for IBM 729 Magnetic Tape and IBM 7340 Hypertape.

Utility Monitor

The Utility Monitor operating under the System Monitor (IBSYS), controls and loads the various utility routines. The Utility Monitor processes the control cards which direct the processing of different jobs.

The Utility Monitor has its origin at location 2500₁₀. The first locations contain the following common table and routines:

- Decimal-to-binary conversion table
- Decimal-to-binary conversion routine
- Binary-to-decimal conversion routine
- On-line print routine
- Buffered card read routine
- General tape IOEX read/write routine
- General disk IOEX subroutines

When the System Monitor recognizes a \$EXECUTE DK9OUT card, it releases control to the Utility Monitor. The Utility Monitor can reside on disk, drum, or tape, and can, therefore, load utility programs from disk, drum, or tape. The monitor determines the unit on which the program is residing by interrogating unit control block word 1, associated with the library-tape entry in the System Unit Function Table. The utility routines cannot be the first subsystem on a library tape. Control cards are read from the unit assigned as the System Input Unit (SYSIN1).

If the System Input Unit is the card reader and an end-of-file condition occurs before control is returned to the System Monitor, a message is printed indicating this condition and the machine halts. At this time, more cards can be placed in the card reader and START may be pressed to continue with the job. If a card reader error or redundant input tape error is found, a message is printed on-line to indicate the condition. The operator may press START to ignore the error. If an end-of-file condition occurs when the System Input Unit (SYSIN1)

is tape, the Utility Monitor prints a message and returns control to the System Monitor.

The routine `TNORM` within the Utility Monitor reads the control cards and transfers control to the various utility routines. `TNORM` may be entered by an appropriate bit in location `SWITCH` by using a specific type of utility control card. If the card read is not the type requested, an out-of-sequence message and the card contents are printed off-line and control is transferred to the routine associated with the control card just read.

If location `SWITCH` is zero upon entry to `TNORM`, the name of the routine needed to process this card is determined. If this routine is already in core storage, control is transferred to it immediately. Otherwise, this routine is loaded from tape to disk/drum using `SYSLDR`, and control is transferred to it.

If a control card with an invalid identification is detected during control card processing, the utility program in control writes a message off-line and then returns control to the Utility Monitor, which writes, both on-line and off-line, a message indicating that an error has occurred in the job segment. Control is then returned to the System Monitor, which proceeds with

the next job segment or job. The following identification codes are valid:

DK90FA	DK90C
DK90F	DK90D
DK90A1	DK90D*
DK90A2	DK90R
DK90L	HT90D

Upon detection of a `$IBSYS` card, control is returned to the System Monitor. A subsequent `$EXECUTE DK90UT` card will call the Utility Monitor back into control.

The Utility Monitor and the utility routines comprise one file on the library tape. This file contains eight records in the following order:

RECORD IDENTIFICATION	ROUTINE NAME
DK90UT	Utility Monitor
DK90FA	Format-Track and Address Generation routine
DK90D	Dump Disk/Drum routine
DK90D*	Dump 2302 Disk Platter routine
DK90C	Clear Disk/Drum routine
DK90R	Restore Disk/Drum routine
DK90L	Load Disk/Drum routine
HT90D	Tape Dump routines

No change in this order is permissible. Each of the routines, when loaded, has its origin at location 4000₁₀. However, the Utility Monitor is not located here.

Disk/Drum Utility Routines Usage

Utility Monitor control cards must be punched according to the specifications stated in the individual utility routines.

Every input/output reference must have been defined by System Monitor control cards using the System Unit Function (SYSUNI) names appearing in the Utility Monitor section of this publication. Input/output units are logically attached to the system by means of \$ATTACH and \$AS cards, which define symbolically the individual units as follows:

RDA	System Card Reader
PRA	System Printer
PUA	System Peripheral Punch
A1-A0, B1-B0	Tape Units
x $\left\{ \begin{array}{l} D \\ N \end{array} \right\}$ am/s	Direct Access Storage Units

where

x = Channel (A through H)
 D = Disk
 N = Drum
 a = Access
 m = Module

Control cards are read, input/output units assigned, and control is transferred from the System Monitor to the Utility Monitor, which then reads the utility control cards and transfers control to the desired programs. When execution of the program has been completed, the \$IBSYS card transfers control back to the System Monitor, and another \$EXECUTE DK90UT card must be used to restore control to the Utility Monitor.

Format-Track Generation Routine

The Format-Track Generation routine generates and writes one or more format tracks, as specified by control cards. The 7320 Drum Storage has only one format track per module. The Address Generation routine generates home-address identifiers and record addresses for one or more data tracks, as specified by control cards. All addresses and data areas on a specified track will be changed in the process. Both of these routines can be used independently as well as in conjunction with each other.

The arrangement of home addresses, record addresses, and record areas within a cylinder must be indicated by the format track for that cylinder. The Format-Track Generation routine generates the characters that describe the arrangement of the information to be stored on the cylinder and writes them onto the specified format tracks.

Upon the first entrance to this routine, after it has been loaded into core storage by the Utility Monitor (DK90UT), a message is printed on-line advising the operator to verify that the Format Key-Lock switch is set in WRITE position, and a halt occurs. The operator may press START to continue (an on-line message indicating this is also printed) after the action has been completed.

The routine then generates a format track in core storage based on the control card information. Particular areas of the format track have standard character configurations. Each area, A through Q, is represented by a constant in the routine except for M, which is the data area. These constants have symbolic addresses corresponding to the areas they represent (i.e., AREA A contains the character-count constant for area A; AREA B contains the character-count constant for area B, etc.). Any character-count constant may be easily modified and will have no effect on the internal coding of the routine other than to produce a non-standard format track. The user should note that increasing the size of the character-count constants will require a change in the data-area length.

The format-track length cannot (without modifying the routine) be longer than the following:

	6-BIT MODE	8-BIT MODE
1301 Disk – Words	479	374
Characters	2,874	2,244
2302 Disk – Words	983	764
Characters	5,902	4,585
7320 Drum – Words	544	409
Characters	3,264	2,454

These figures include all character-count constants and data areas. If any of these maximums are exceeded, a message will be printed off-line indicating that too many characters have appeared in the format track. The program will then print the message:

JOB DISCONTINUED

and return control to the Utility Monitor. Any other control cards pertinent to this particular job (home-address or record-address cards) will be skipped, and the Utility Monitor will proceed to the next job.

The write-check operation is performed on all format tracks that are written; there is no option regarding the write-check operation.

The write format, which operates under control of the System Monitor, uses the Input/Output Executor (IOEX) to monitor input and output. If an error occurs during format-track generation, a message is printed,

the job is skipped, and control is returned to the Utility Monitor.

Standard Field Lengths

The utility routines use a standard home-address identifier and a standard record-address format, as explained under "Home-Address and Record-Address Generation Routine." To provide for these standards, the Format-Track Generation routine generates the necessary characters to describe the following fields on the format track:

FIELD NAME	STANDARD FIELD LENGTH
Home-Address Identifier	6 characters
Record Address	6 characters

If the standard field lengths are not desired, the user may modify the Format-Track Generation routine so that it generates fields of the desired length.

Generated Fields

The number of fields generated for, and written on, the format track depends on the way the data is to be arranged in the storage unit. The following table shows the fields that will be generated for each format track. The number of characters used to generate each field, except the field that defines the record area, is contained as constants (assembly parameters) within the Format-Track Generation routine. By changing these constants, the user can cause the routine to generate nonstandard fields without affecting the internal coding of the routine. The number of characters generated for the fields that define the record areas is determined from control cards. The table also shows the BCD character that is generated for each field. When either of two characters can be generated, the proper one will be selected by the routine, depending upon the mode of operation specified in the control cards.

FIELD TYPE	NUMBER OF CHARACTERS GENERATED	BCD CHARACTER GENERATED	ADDITIONAL CONSIDERATIONS OR USES OF THE FIELD
1	3	4	
2	9	3	This field defines the 4-character physical home address.
3	1	4	
4	10	3	
5	1	4	
6	4+HA2	1 or 3*	This field defines the home-address identifier.
7	12	2 or 4*	
8	4+RA	1 or 3*	This field defines the record address.
9	1	2 or 4*	
10	10	1 or 3*	
11	1	2 or 4*	
12	4+L	1 or 3*	This field defines the record area.
13	Fields 7 through 12 will be repeated for each additional record area that is required.		

14 1 2 or 4* This field will follow only the last record area on a track.

*BCD 1 or 2 will be generated if the 6-bit mode of operation is specified; BCD 3 or 4 will be generated if the 8-bit mode of operation is specified.

HA2 is the number of characters in the home-address identifier.
RA is the number of characters in the record address.
L is the number of characters in the record area.

Before the format track is generated, the utility routine verifies that the amount of data to be recorded on the track does not exceed the maximum allowable value. After each format track is written, the utility routine performs a write-check operation to make sure the track was written correctly.

Record Areas

One or more record areas may be specified for one track. The number of record areas desired is specified in the control card. When there is more than one record area on a track, the record areas need not be the same length. The lengths of the record areas are specified in the control cards.

Record Area Length

The length of record areas depends both on the mode of operation that is to be used when placing data into the record area and on the number of record areas on the track. The maximum record area is obtained when there is one record on each track. The following table indicates the maximum number of characters allowable when the format track specifies one record area per track. Because the 7090 and 7094 handle data in the form of words, this table indicates the maximum length of a record area in terms of the number of words as well as the number of characters. The maximum record size when the format track specifies one record per track is as follows:

	6-BIT MODE	8-BIT MODE
1301 Disk – Words	466	360
Characters	2,796	2,100
2302 Disk – Words	973	754
Characters	5,838	4,524
7320 Drum – Words	530	395
Characters	3,180	2,370

Home-Address and Record-Address Generation Routine

When the Utility Monitor (DK90UT) first enters this routine after the routine has been loaded into core storage, a message is printed on-line advising the operator to verify that the HAO switch on the file control is ON and a halt is executed. The operator may press START to continue after this action has been completed. The first card of each job (DK90A2) for this routine is printed

off-line, and a message is printed indicating the start of a job.

The number of words used to generate home-address identifiers and record addresses are assembly parameters and are contained as constants in core storage. This program generates a one-word home-address identifier containing zeros (octal 12s) and a one-word record address of the form TTTTYY, where TTTT is the BCD head-track number of the track (0000-9999 for Disk and 0000-0399 for Drum) and YY is the BCD record arranged so that the first record number on each track is 01, the second 02, etc., for as many record areas as exist on the track. All zeros used in addresses are octal 12s.

If a variation is desired from this standard, either in length or content, the following procedure must be followed. Location LRA contains the record address word-length parameter and location LHA2 contains the home-address identifier word-length parameter. (Both parameters originally contain 1.) These parameters must be changed accordingly. Before generating an image of the track to be written on the direct access module, the following two lists are generated. Beginning at location RA, a list of m groups of n words is generated, where m is the number of record areas on the track (constant stored in location AREAS) and n is the word length of record addresses contained in location LRA. The first word of each group of n words contains the standard record address for this track. The succeeding n-1 words contain six BCD zeros (octal 12s). Beginning at location HA2, there are n words of six BCD zeros, where n is the word length of the home-address identifier contained in location LHA2.

These two lists will be taken in their entirety and placed into the track image at the appropriate places when the track image is generated. Prior to this, however, a program exit has been made available to transfer to a subroutine, which is to be inserted by the user and which can change the contents of these lists. The lengths of the addresses are changed by changing the contents of LHA2 and LRA at assembly time. Location EXIT contains zero, which must be retained unless either of these lists is to be changed. If a change is desired, transfer instruction TSX SUBR,4 must be inserted at this location to transfer control to the change routine. The change routine may return with standard transfer instruction TRA 1,1. The index registers must be saved and restored at this point. By interrogating the first word in the RA list, the track being generated can easily be determined.

Upon returning from the change routine, the Home-Address and Record-Address Generation routine uses these lists in their changed or unchanged form (one, none, or both of the lists may have been changed).

Space has been reserved to enlarge the RA list to 300 words and to enlarge the HA2 list to 3 words. If more space is desired, the storage allocated by BSS to these locations at assembly time can be increased.

The data areas of the tracks written in the full-track home-address mode are filled with words containing the filler character specified in the first DK90A2 control card.

Another assembly parameter exists for the write-check operation performed on these tracks. To perform a write check on these tracks as a standard procedure after the track with new addresses has been written, location WRCK must be set to nonzero during assembly time. Location WRCK contains zero. Write checking is not performed by this program, since it doubles running time of the program. Location EXIT will be provided for a subroutine in which the user may specify the use of the WRCK operation. It will be the user's responsibility to set location WRCK to nonzero if write checking is desired, and to reset location WRCK to zero if no write checking is desired.

This program, under control of the System Monitor (IBSYS), uses the Input/Output Executor (IOEX) to monitor its input and output. If an error occurs during address generation, a message is printed off-line to indicate this condition and the job is discontinued.

Control Cards

There are two types of control cards required to use this routine. Type 1 and Type 2 control cards are required in all cases except when the Format-Track Generation routine is used by itself. In this case, Type 2 cards are not required.

Since no format track is written, it is assumed that the format tracks associated with the specified tracks will correspond to those specified in the control cards. The cylinder-specification area in the control card is not used but must contain *valid information*. The rest of the information on the card is pertinent to the Address-Generation routine.

TYPE 1 CONTROL CARDS

Columns 1 through 6 of Type 1 control cards contain DK90F if only format-track generation is desired, DK90A1 if only address generation is desired, or DK90FA if both are desired.

Column 8 contains a C if this card specification is to be continued on the next card; otherwise, it is blank. All cards of an identification sequence, except the last card, contain C. The five ordered fields, as described below, are written beginning in column 13 of the first card; if these fields extend past column 72, they are to be continued starting in column 13 on all succeeding cards.

1. A System Unit Function Table (SYSUNI) designation consisting of six alphanumeric characters, specifying the Disk/Drum access and the module to be written on. Only the following System Unit Functions are recognized:

SYSOU1	SYSCK2	SYSUT5
SYSOU2	SYSUT1	SYSUT6
SYSIN1	SYSUT2	SYSUT7
SYSIN2	SYSUT3	SYSUT8
SYSCK1	SYSUT4	SYSUT9

2. A 6 or an 8 to specify 6-bit or 8-bit mode.

3. The cylinders which are to be set up to conform to the information contained in this sequence of Type 1 control cards, as follows: three digits (000-249 for Disk, 000-009 for Drum) followed by a comma to specify a single cylinder, and two sets of three digits separated by a dash and followed by a comma to designate sequential inclusive cylinders. Any number of cylinder designations are allowed.

4. A two-digit number followed by a comma to specify the number of data areas to be contained on any track within the above cylinders.

5. A three-digit number to specify the word length of each data area for the tracks that are to be set up. If the data areas have uniform length, only one length is specified; otherwise, a three-digit length must be listed for each area.

TYPE 2 CONTROL CARD

Columns 1-6 of Type 2 control cards contain the identification code DK90A2. Column 8 may contain a C if card contents are continued on another card; otherwise, this column should be left blank.

Card columns 13-72 should contain the following information:

1. A one-character field followed by a comma, containing any valid BCD character with which the data areas of the tracks whose addresses are being generated are to be filled.

2. The tracks which are to be set up to conform to the preceding Type 1 card sequence are specified as follows: four digits (0000-9999 for Disk, 0000-0399 for Drum), followed by a comma to specify a single track; and two sets of four digits separated by a dash and followed by a comma to indicate sequential inclusive tracks. Any number of track designations are allowable.

Only 72 columns may be used on a card. On all C cards the last nonblank character must be a comma. The last card of a Type 1 or 2 sequence, i.e., not containing a C, should have a blank following the last field. A sequence of DK90FA or DK90A1 cards must be followed by a sequence of DK90A2 cards, since address generation is implied.

On all cards, columns 1-6 contain the identification, column 8 is for continuation, and columns 13-72 are for

information. No embedded blanks are allowed in any fields.

Example for Disk:

COLUMN 1	COLUMN 8	COLUMN 13-72
DK90FA	C	SYSCK1, 6, 003-010, 020, 030-035, 070, 03, 100, 200, 050
DK90FA		0, 0080-0400, 9760
DK90A2		SYSOU2, 8, 083, 05, 075
DK90F		SYSIN2, 6, 001, 10, 14
DK90A1		0, 0010-0100, 0250,
DK90A2	C	0500-0699
DK90A2		

Example for Drum:

COLUMN 1	COLUMN 8	COLUMN 13-72
DK90FA	C	SYSCK1, 6, 003,
DK90FA		03, 100
DK90A2		0, 0398-0399
DK90F		SYSOU2, 8, 003, 05, 075
DK90A1		SYSIN2, 6, 001, 10, 14
DK90A2	C	0, 0010-0100, 0250,
DK90A2		0251-0350

Control Card Errors

If a control card error is detected during control card processing or if a permanent input/output error occurs on disk, drum, or tape, the utility routine in control writes a message off-line and the Utility Monitor writes, both on-line and off-line (utilizing the Input/Output Executor off-line printing routine - SPOUT), a message indicating that an error has occurred in the job segment. Control is then returned to the System Monitor, which proceeds with the next job segment or job.

Load Disk/Drum Routine

The Load Disk/Drum routine loads tape data onto designated areas of the storage unit by one of two types of operation. These tape records may be written in binary mode or BCD mode and must be prepared so that the length of each tape record fulfills the requirements outlined under the appropriate method.

Loading Methods

Two methods of loading data from tape records into the designated area of storage are provided by the Load Disk/Drum routine. The Load Disk/Drum routine normally does not check the record it has written. However, an option is provided so that the user can specify that a write-check operation follow each write operation; the use of the write-check option *doubles* the time needed to load the records into storage.

The Load Disk/Drum routine assumes that each of the tracks to be loaded has standard record addresses. To allow loading of tracks that do not have standard record addresses, the user may modify the Load Disk/Drum routine.

METHOD 1

In Method 1, *n* records from tape will be written on all designated single tracks and/or sequences of tracks beginning at record area number *m*. Thus, *n* tape records are written in the single-record mode of operation of each track, and *n* records are written in sequential record areas on every specified track. As soon as *n* tape records have been written in *n* data areas of a track, the program switches to the next (not necessarily sequential) track and writes the next *n* records. One physical tape record must be less than or equal to the length of its corresponding data record area on the cylinder, since any excess data will be lost.

METHOD 2

Method 2 provides for loading one tape record into each record area on a track; one or more tracks may be loaded in this manner. The length of each tape record to be loaded using Method 2 must be *equal* to the length of the total record area on the track into which the tape record is to be loaded. An advantage of this method is that record addresses need not be verified, decreasing the time needed to load the storage unit. One tape record for this method contains one whole track of data. This method is most directly applicable to tapes previously generated from the direct access storage unit by the full track mode of operation. If the tape record is shorter than the capacity of the corresponding track, the excess portion of the track will be filled with zeros. If the tape record exceeds the capacity of the track, the excess will be lost.

Address Modification

The Load Disk/Drum routine assumes that record addresses for Method 1 and the first two characters of the home-address identifier for Method 2 are the standard type generated by the Address-Generation routine. However, exits have been included so that the user may write routines, which can be incorporated to change the addresses after their insertion in the prepare-to-verify orders. Locations REXIT and HEXIT, at present, contain zero. If record addresses or home-address identifiers are to be changed, a `TSX SUBR,4` instruction must be inserted at REXIT or HEXIT, respectively, at assembly time. The user's subroutines would either change the list of *N* standard record addresses, starting at location RA, or change the two low-order characters of location HA, which contains HA1 plus two low-order zeros (octal 12s). The HA1 portion of location HA must be left intact. Thus, it will be easy for the user's routine to determine which track he is dealing with. The first record address in the RE list is the standard record address for area *m*. The user's routine should save and restore all index registers and return with a `TRA 1, 4` instruction.

Input Files

A maximum of three input reels is acceptable. Each reel may contain from 1 to 9 files. There is only one input tape unit assigned. Therefore, when all the files on a tape have been loaded but more reels are to be loaded, the present reel is rewound and unloaded, and a message is printed on-line indicating this condition. The computer halts so that the next reel can be loaded on this unit or on a waiting unit. The next reel should be dialed to this tape unit number and `START` pushed to continue.

NOTE: The program does not utilize the write-check feature, since this option doubles running time of the direct access write operations. The write check feature may be selected by altering the symbolic deck and reassembling. Location `WRCK` should be assembled as nonzero if write checking is desired.

Control Cards

A sequence of at least *two* control cards is needed to load the Disk or Drum from tape.

The first card in the sequence contains the code `DK90L` in columns 1-5. If the contents of this card are continued on another card, a `C` is placed in column 8. Columns 13-72 contain a maximum of eight ordered fields separated by commas. These fields are listed below:

1. This field contains two System Unit Function (`SYFUN`) designations consisting of six alphanumeric characters each, the first specifying the storage unit to be loaded and the second specifying the tape unit containing the data to be loaded. Only the following System Unit Functions are allowed:

<code>YSOU1</code>	<code>YSCK2</code>	<code>YSUT5</code>
<code>YSOU2</code>	<code>YSUT1</code>	<code>YSUT6</code>
<code>YSIN1</code>	<code>YSUT2</code>	<code>YSUT7</code>
<code>YSIN2</code>	<code>YSUT3</code>	<code>YSUT8</code>
<code>YSCK1</code>	<code>YSUT4</code>	<code>YSUT9</code>

2. This field contains a 6 or an 8 to designate 6-bit or 8-bit mode.

3. This field contains digit 1, 2, or 3, to designate the number of tape reels to be loaded.

4. This field contains a three-digit number; each digit, starting with the high-order digit, specifies the number of files to be loaded from tape reels 1-3. If fewer than three tape reels are to be loaded, low-order zeros should be inserted in the appropriate positions.

5. This field contains a 0 if the tape is binary or a 1 if the tape is BCD.

6. This field contains either a 1 or a 2, to specify which method is to be used during loading.

7. This field contains a two-digit number, specifying the beginning record area, *m*, at which loading is to begin on each track.

8. This field contains a two-digit number, specifying the number of records, n, to be loaded on each track, beginning at record area m.

Fields 7 and 8 are omitted if Method 2 is specified.

The remaining cards of the sequence contain:

Columns 1-5 contain DK90L.
 Column 8 contains a C if this is not the last card of the job sequence. If it is the last card, this column is blank.
 Columns 13-72 specify the tracks that are to be loaded in the order in which they are listed. Four digits (0000-9999 for Disk, 0000-0399 for Drum), followed by a comma specify a single track; two sets of four digits, separated by a dash and followed by a comma, indicate sequential inclusive tracks. Any number of such track designations are allowed. Only 72 columns may be used on a card. When continuing on an additional card, start in column 13. The last nonblank character on every card must be a comma except for the last card of a sequence.

Disk Example:

COLUMN 1	COLUMN 8	COLUMNS 13-72
DK90L	C	SYSCK1SYSUT3,6,2,120,1,1, 02,05,
DK90L		0100-0500,0700,0702-0750

Drum Example:

COLUMN 1	COLUMN 8	COLUMNS 13-72
DK90L	C	SYSCK1SYSUT3,6,2,120,1,1, 02,05,
DK90L		0100-0200,0210,0212-0300

Control Card Errors

If a control card error is detected during control card processing or if a permanent input/output error occurs on a direct access or tape unit, the utility routine in control writes a message off-line and the Utility Monitor writes, both off-line and on-line (utilizing the Input/Output Executor off-line printing routine – SPOUT), a message indicating that an error has occurred in the job segment. Control is then returned to the System Monitor, which proceeds with the next job segment or job.

If all tape files are loaded onto the storage unit before all of the tracks have been filled (i.e., the data on tape does not fill the designated area of a direct access storage unit), a message is printed at the time of job completion indicating this condition and identifying the next track which was to be loaded. The Utility Monitor then proceeds to the next job. If all the designated tracks are filled before all the tape records have been loaded onto the storage unit, this routine prints an off-line message indicating this condition.

Dump Disk/Drum Routine

Description

The Dump Disk/Drum routine writes the data contained on one or more full tracks onto tape or prints it on-line. When the tape option is used, its format permits it to be used as input to the Restore Disk/Drum routine. The on-line printer option allows the user to display the contents of one or more tracks for quick visual scanning.

The information on the track(s), specified by the control card(s), is read by means of the prepare-to-verify track (with addresses) order. For this operation, the Dump Disk/Drum routine assumes that the home-address identifier consists of zeros. To allow dumping of tracks without the standard home-address identifier, the Dump Disk/Drum routine has a one-instruction modification to permit the user to insert the nonstandard identifiers.

Output Tape

There are three types of records on the output tape:

1. *Control Card Records:* The control card information is written on the output tape as a separate record, preceding the data from the tracks called for by that control card.

2. *Track Data Records:* The information contained on three 1301 tracks is blocked to form one physical tape record. The physical tape record is 1,407 words long and is constructed as follows: the 1st, 470th, and 939th words are a six-character name or number given to the dump by the user. The 2nd, 471st, and 940th words are the four-digit track numbers and the first two characters of the home-address identifiers of the three 1301 tracks in the block. The remaining words in the block contain the 1301 track data and record addresses, 467 words for each track. If fewer than three tracks are in the block, either the last 469 words or the last 938 words will consist of blanks, so that a standard record length can be maintained.

The information contained on three 2302 tracks is blocked to form one physical tape record. The physical tape record is 2,928 words long and is constructed as follows: the 1st, 977th, and 1,953rd words are a six-character name or number given to the dump by the user. The 2nd, 978th, and 1,954th words are the four-digit track numbers and the first two characters of the home-address identifiers of the three 2302 tracks in the block. The remaining words in the block contain the 2302 track data record addresses, 974 words for each track. If fewer than three tracks are in the block, either the last 976 words or the last 1,952 words will consist of blanks, so that a standard record length can be maintained.

The information contained on three 7320 tracks is blocked to form one physical tape record. The physical tape record is 1,599 words long and is constructed as follows: the 1st, 534th, and 1,067th words are a six-character name or number given to the dump by the user. The 2nd, 535th, and the 1,068th are the four-digit track numbers and the first two characters of the home-address identifiers of the three 7320 tracks in the block. The remaining words in the block contain the 7320 track data and record addresses, 530 words for each track. If fewer than three tracks are in the block, either the last 533 words or the last 1,066 words will consist of blanks, so that a standard record length can be maintained.

3. *Trailer Records:* At the end of each full reel of tape and following the last track-data record of a completed dump, there will be an end of file, a six-word trailer record, and another end of file. At this point, the tape will be rewound and unloaded. The trailer record is used by the Restore Disk/Drum routine to determine if more input follows when it reaches an end-of-file mark. If the dump is complete, the first word of the trailer record will be "Termination." If the dump is not complete, the first word will be "Continuation."

Control Cards

There are two types of control cards used in the Dump Disk/Drum routine: "prime" cards and "continuation" cards. A prime card is always the first card for a given dump operation. This card contains the basic information for each dump (see below). Continuation cards may be used when the series of requested tracks extends beyond column 72 of a previous control card. The control card format is as follows:

PRIME CONTROL CARDS

Columns 1-5	Identification field: it is always DK90D.
Column 8	Continuation field: this field contains a C if a continuation card follows; otherwise, it is blank.
Column 10	EOT field: this field contains an L that causes an EOT trailer record, preceded and followed by a tape mark, to be written following the last track on that card, and causes the tape to be rewound. If this field is blank, the output tape is not rewound and output from the next control card is continued on the same reel if the System Unit Function name is the same.
Column 12	Mode field: this field contains a 6 or 8, depending on the bit mode desired.
Columns 13-18	Set name field: this field must contain a six-character alphameric name given to the dump by the user. This name is used by the Restore Disk/Drum routine so that partial restoration may be used.
Columns 19-24	Primary output unit field: this field supplies the name of the desired output unit (printer or tape).

Columns 25-30	Alternate output unit field: this field contains a System Unit Function name of the alternate output tape unit to be used if a reflective spot is reached on the primary output tape unit. Even though less than one reel of output is expected, a System Unit Function name must be given as an alternate. In the case of printer output, the System Printer name (SYSPRT) must be punched in both primary and alternate fields. If SYSOU1 is specified, the output will be written on SYSOU1 using SPOUT.
Columns 31-36	System Unit Function name, specifying the disk to be dumped.
Columns 39-72	Track number field: this field contains a series of tracks and/or sequences of tracks to be dumped. The sequences are to be designated by the lowest numbered tracks in the sequence, followed by a dash, and then by the highest track. Individual tracks and sequences of tracks are to be separated by a comma. All tracks on a control card must be in ascending order.

CONTINUATION CONTROL CARDS

Columns 1-5	are the same as those of the prime control card.
Column 8	is the same as that of the prime control card.
Columns 13-72	are used to extend columns 39-72 of the prime control card.

NOTE: Any columns not specified for either control card must be left blank.

General Operating Instructions

The Dump Disk/Drum routine must be run under the control of the 7090 Utility Monitor (DK90UT), which in turn must be monitored by the IBM System Monitor (IBSYS). The System Monitor will load the Utility Monitor and relinquish control to it upon recognition of a `SEXPETE DK90UT` card. The Utility Monitor will load and relinquish control to the Dump Disk/Drum routine upon recognition of a `DK90D` card. An off-line message is printed at the completion of the execution of each `DK90D` control card.

The first two characters of the home-address identifier are assumed to be zero by the program. However, the NOP instruction at symbolic location `IDSW` may be altered to `TSX` by the user if he desires to use nonstandard identifiers. The user's routine should update symbolic location `HAIID` with the actual identifier (right-justified). The user must return to the main program with a `TRA 1,4` instruction. In addition, all index registers should be saved and restored. The pertinent track number can be found at this time in BCD form in symbolic location `HALOC`. However, the bit configuration in this location must not be changed. The Dump Disk/Drum routine returns control to `DK90UT` at the completion of the execution of each control card or series of control cards. A series is defined as one prime control card followed by one or more continuation control cards.

Dump 2302 Disk Platter Routine

Description

The Dump 2302 Disk Platter routine writes the data from one group of 250 tracks on a 2302 disk surface onto magnetic tape or onto the on-line printer. This routine permits partial dumping of a group of 250 tracks by allowing the user to specify on the control card the track at which dumping is to begin.

The dumped data may be restored to the disk surface by using the output tape as input to the Restore Disk/Drum routine. Data dumped onto `sysout` or onto the on-line printer cannot be restored.

Output Tape

The output tape format for the Dump 2302 Disk Platter routine is the same as that described above under "Dump Disk/Drum Routine."

Control Cards

Only one control card is required for the Dump 2302 Disk Platter routine. The control card format is as follows:

CONTROL CARD FORMAT

Columns 1-6	Identification field: DK90D*.
Columns 7-10	Track specification field: This field contains a four-digit number (0000-9999) that specifies the first track of the platter to be dumped (normally 0000-0039).
Columns 13-18	Set name field: If complete restoration is desired, this field is left blank. If only partial restoration is desired, a six-character alphanumeric name must be given to the dump. This name is used by the Restore Disk/Drum routine in providing partial restoration.
Columns 19-24	Primary output unit field: This field provides the name of the system unit (SYSUNI) of the desired output unit.
Columns 25-30	Alternate output unit field: This field contains a system unit function name of an alternate output unit to be used if an end-of-tape condition is detected on the primary output unit. This unit specification is necessary even though less than one reel of output is expected.
Columns 31-36	System unit function name field: This field specifies where the platter to be dumped is located.

General Operating Instructions

The operating instructions for the Dump 2302 Disk Platter routine are the same as for the Dump Disk/Drum routine described above except that the `DK90D*` control card is used instead of the `DK90D` control card.

Restoring a Dumped Platter

The Restore Disk/Drum routine is used to restore data dumped by the Dump 2302 Disk Platter routine. When

using the `ALL` option, all the tracks that were dumped are restored. The Restore routine uses the home-address identifiers to provide proper restoration. The home-address identifiers must correspond in both the Dump and Restore phases. The Home-Address Generation routine can be used prior to restoring to maintain this correspondence. If partial restoration is desired, the user must specify the set names of the tracks to be restored (see the subsection "Control Cards" under the heading "Restore Disk/Drum Routine" in this publication).

Restore Disk/Drum Routine

The Restore Disk/Drum routine reads either all or selected portions (sets) of the data placed on tape by the Dump Disk/Drum routine and returns the data to its original area in disk storage. If more than one set of tracks has been loaded onto the tape, the Restore Disk/Drum routine restores only the sets which are specified in the control cards. The Restore Disk/Drum routine searches the tape for the identification (set names) of the specified groups and restores only those sets for which restoration is requested.

The Restore Disk/Drum routine uses the prepare-to-verify order. This order verifies the first two characters of the home-address identifier (`HA2`). Therefore, at the time of restoration, `HA2` on the track to be restored must be the same as it was when the track was dumped.

An option is provided for the user to use the write-check operation. A control card field is provided to indicate whether or not the write-check option is to be used.

Input Tape

Input to the Restore Disk/Drum routine is the tape output from the Dump Disk/Drum routine. See the "Output Tape" section for a description of the types of records and their formats.

Control Cards

Two types of control cards are used by the Restore Disk/Drum routine: "prime" cards and "continuation" cards. A prime control card is always the first control card for a given restore operation. Continuation cards may be used when the series of requested sets extends beyond column 72 of a previous control card. The control card format is as follows:

PRIME CONTROL CARDS

Columns 1-5	Identification field: this field always contains DK90R.
Column 8	Continuation field: this field contains a C if a continuation card follows; otherwise, it is blank.

Column 9	Verification field: this column contains a V if the write-check option is to be used; otherwise, it is blank.
Columns 10-12	All option field: if the letters ALL appear in these columns, every track on the input tape will be restored. If anything else appears in these columns, the program will restore only those sets listed in columns 25-72 and those on continuation cards immediately following.
Columns 13-18	Primary input tape field: this field contains the System Unit Function name of the desired input tape unit.
Columns 19-24	Alternate input tape field: this field contains the System Unit Function name of the alternate input tape. Should there be more than one reel of input tape, the first will be loaded on the primary unit and the second will be loaded on the alternate unit. When the restore program has finished with the primary unit, an on-line message will be printed asking the operator to load a third reel (if one exists) on the primary unit. Meanwhile, the program will continue processing the second reel on the secondary input unit. This operation will be repeated as often as necessary. Should there be only one input reel, a System Unit Function name must still be given as an alternate.
Columns 25-72	Set name field: this field contains one or more six-character set names, or blanks. If the ALL option is not to be used, one or more six-character alphanumeric names or numbers must appear in this field. The set names must be identical to those given the series of tracks at the time of the dump. Only the set names given to the tracks that the user wishes to restore should appear. If the ALL option is used, the field should be blank.

CONTINUATION CONTROL CARDS

Columns 1-5	are the same as those in the prime control card.
Column 8	is the same as that in the prime control card.
Columns 13-72	are used to extend columns 25-72 of the prime control card.

NOTE: Any columns not mentioned in either control card must be left blank.

General Operating Instructions

The Restore Disk/Drum routine must be run under control of the 7090 Utility Monitor (DK90UT), which in turn must be monitored by the IBM System Monitor (IBSYS). The System Monitor will load the Utility Monitor and relinquish control to the Utility Monitor upon recognition of a `SEXPETE DK90UT` card. The Utility Monitor will load and relinquish control to the Restore Disk/Drum routine upon recognition of a `DK90R` card. There are no stops in the program. An on-line message is printed after each control card has been executed.

When the Restore Disk/Drum routine detects an end-of-file condition, it will read the following trailer record. If the first word is "Termination," it will print an off-line comment that restoration is complete. If the first word is "Continuation," it will begin processing the alternate input tape and print an on-line comment

for the operator to load the next input reel (if one exists).

Clear Disk/Drum Routine

The Clear Disk/Drum routine will clear, i.e., fill the record area(s) of one or more tracks with one specific character. The character that will be used to fill the record areas must be specified in a control card.

The first time this routine is entered, a message is printed off-line indicating the start of the job. The message is printed after the Clear Disk/Drum routine has been loaded into core storage by the Utility Monitor (DK90UT).

The routine is set up to use the standard record address, `TTTTRR`, and the standard track address, `TTTTHH`, in searching for record areas. `TTTT` is the standard BCD head-track number, `RR` is the standard BCD record number (01, etc.), and `HH` is the standard home-address identifier (00).

If a variation is desired from these standard addresses, the user must place a transfer instruction in the Clear Disk/Drum routine to give himself control so that modification may be made. For record address modification, a transfer instruction should be inserted in location `MODRA`, at which time the record address is in the accumulator as `TTTTRR` in BCD. Return to the Clear Disk/Drum routine must be made at "`MODRA+1`." For home-address identifier modification, a transfer instruction should be inserted in location `MODHA`, at which time the track address is in the accumulator as `TTTTHH` in BCD. It is important to remember that in home-address identifier modification, *only* the home-address identifier (`HH`) may be modified. Return to the Clear Disk/Drum routine must be made at `MODHA+1`.

NOTE: Included within the Clear Disk/Drum routine is the option for performing the write-check operation on each track or record area after clearing. This option may be exercised by setting location `WRCHK` to one.

Methods of Clearing

Two methods of clearing the designated area of storage are provided by the Clear Disk/Drum routine. This routine normally does not check the data it has written. However, an option is provided so that the user may specify that a write-check operation is to follow each write operation; the use of the write-check option will double the time needed to clear an area of storage.

The Clear Disk/Drum routine assumes that each track that is to be cleared has a standard record address(es) and a standard home-address identifier. To allow for the clearing of tracks that do not have standard record addresses or home-address identifiers, the Clear Disk/Drum routine is designed to permit the

user to modify the routine so that the nonstandard address can be processed.

METHOD 1

Method 1 provides for clearing one or more record areas on a track; one or more tracks may be cleared in this manner. The user specifies both the number of record areas *n* to be cleared on each track and the number of the record area *m* at which clearing is to begin. For example, if there are eight record areas on each track and the user wants to clear the third and fourth record areas, the user must indicate that *n* equals 2 and *m* equals 3. By proper selection of the values for *n* and *m*, one record area or consecutive record areas may be cleared by using Method 1. However, if all record areas on a track are to be cleared, the use of Method 2 will clear the tracks more efficiently than the use of Method 1.

Method 1 will use the write-single-record order for clearing the record areas.

METHOD 2

Method 2 provides for the clearance of all the record areas on a track; one or more tracks may be cleared in this manner. An advantage of this method is that record addresses need not be verified.

Method 2 will use the write-full-track-without-addresses order for clearing all of the record areas on a track.

Control Cards

Columns 1-6	contain DK90C.
Column 8	contains a C if this card is to be continued on the next card; otherwise, it is blank. All but the last card of an identification sequence contain C.
Columns 13-72	contain ordered fields.

Each field in columns 13-72 is ordered as follows:

1. A System Unit Function designation consisting of six alphameric characters, specifying the storage access and module to be written on. Only the following System Unit Functions are allowed:

SYSOU1	SYSCK2	SYSUT5
SYSOU2	SYSUT1	SYSUT6
SYSIN1	SYSUT2	SYSUT7
SYSIN2	SYSUT3	SYSUT8
SYSCK1	SYSUT4	SYSUT9

2. Contains a 6 or 8 to specify 6-bit or 8-bit mode.

3. Contains a character which will be used to fill the record areas to be cleared.

4. Contains a 1 or 2, to specify which method of clearing is desired. If Method 1 is indicated to clear one or more record areas on a track, two additional fields, 5 and 6, are required.

5. A two-digit number, indicating the number of records to be cleared on one track (this field is required only when Method 1 is used).

6. A two-digit number, indicating the beginning record address to be cleared (this field is required only when Method 1 is used).

7. The tracks to be cleared are set up as follows: four digits (0000-9999 for Disk, 0000-0399 for Drum), followed by a comma specify a single track, and two sets of four digits, separated by a dash and followed by a comma, designate sequential inclusive tracks. Any number of track designations are permitted.

Only 72 columns may be used on a card. On all C cards, the last nonblank character must be a comma, and the last card of a sequence, i.e., not containing a C, must have a blank following the last field.

On all cards, columns 1-6 contain the identification DK90C, column 8 is for the continuation symbol C, and columns 13 through 72 are for information; no embedded blanks are allowed in any fields.

Disk Example:

COLUMNS 1-6	COLUMN 8	COLUMNS 13-72
DK90C		SYSUT1,6,A,1,06,03, 0001-0500
DK90C		SYSUT2,8,Z,2,0001-0500
DK90C	C	SYSCK1,6,X,1,03,01,001,002,
DK90C	C	0006,0100,1500,1700-1710,1800,
DK90C		2100, 6500-6550

Drum Example:

COLUMNS 1-6	COLUMN 8	COLUMNS 13-72
DK90C		SYSUT1,6,A,1,06,03, 0001-0020
DK90C		SYSUT2,8,Z,2,0001-0020
DK90C	C	SYSCK1,6,X,1,03,01,001,002,
DK90C	C	0006,0100,0150,0175-0200,0220,
DK90C		0250,0275-0350

Control Card Errors

If a control card error is detected during control card processing or if a permanent input/output error occurs on disk, drum, or tape, the utility program in control writes a message off-line and the Utility Monitor writes, both on-line and off-line (utilizing the Input/Output Executor off-line printing routine — SPOUT), a message indicating that an error has occurred in the job segment. Control is then returned to the System Monitor, which proceeds with the next job segment or job.

Input/Output Errors

The Clear Disk/Drum routine, which runs under control of the System Monitor, uses IOEX to monitor its input and output. If an error return is given to it by IOEX during operation, a message is printed off-line to indicate this condition, the job is discontinued, and control is returned to the Utility Monitor.

Tape Utility Routines

Tape Dump Routine

The Tape Dump routine operates under the Utility Monitor, which is a subsystem operating under the System Monitor (IBSYS). The System Monitor contains routines which control the assignment of all input/output units.

The contents of tapes written in either the BCD or binary mode and mounted on a 729 Magnetic Tape Unit or a 7340 Hypertape Drive are written as output by this routine. The output is written either on-line by the printer, on tape, or on both.

All necessary information is entered through control cards. When the program is loaded, any number of tape dumps can be produced without reloading the program. Each binary tape or BCD tape can be dumped entirely or in part. The routine accepts tape records up to 10,000 words in length. If a tape record to be dumped is longer than this, the record is truncated (i.e., the excess words are deleted).

Output tape records are blocked for efficient printing on an off-line printer. Each tape record contains five 120-character logical records. The first four logical records are terminated by a record mark. The first character of each logical record is a standard carriage control character. The output tape can then be printed off-line under program control. A tape mark and a standard trailer label follow the last record.

Tape Dump routine error messages are written on the on-line printer only when operator intervention to correct error conditions is possible. In case of an irrecoverable error, a message is written off-line and control is returned to the System Monitor.

Operations

ASSEMBLY OF THE SYMBOLIC DECK

The routine, as distributed, is assembled for a non-labeled installation; the BCD conversion feature for Hypertape is required for the system; and the printer output is single-spaced. If these assembly parameters are to be changed, the following cards in the symbolic deck must be changed:

HYPCVT	OPSYN	BRA	Designates that the system has the BCD conversion feature for Hypertape.
HYPCVT	OPSYN	BRN	Designates that the system does not have the BCD conversion features for Hypertape. A request to dump a BCD tape when the conversion feature is not designated causes an internal conversion.

IOCS	OPSYN	BRN	Designates a labeled installation. The routine checks the retention cycle on the output tape if the tape is at load point.
IOCS	OPSYN	BRA	Designates a nonlabeled installation. The routine writes on the output tape without checking labels.
DBLSPC	BOOL	0 or 1	Designates whether output on the printer is single-spaced or double-spaced. A zero specifies single-spacing, and a 1 specifies double-spacing.

REWIND/LABEL OPTION

In column 7 of all three types of control cards essential for this routine, the following options are available:

CARD COLUMNS	CONTENTS	EXPLANATION
7	R	R specifies an unlabeled tape skip, backspace, or dump operation. No search is made for labels, and any labels on the tape are counted as files. A count is kept of files and records within the files. If record control (R) is specified in column 21, the operation is terminated when either the number of records specified are skipped or dumped, or when a file mark is encountered. The presence of tape marks is indicated during dumping. Before the operation is initiated, the specified tape is rewound.
7	N	N specifies an unlabeled tape dump without a rewind. Operations are subject to record count control. File marks are counted as records under N control. The record count is initially set at 1,000 and the file count is set at zero. Backspacing is limited to 1,000 records; therefore, the presence of negative record numbers listed in a dump is impossible. If an operation has just been completed on the specified input unit, the file count and the record count that were a result of that operation are retained, rather than the initial values of 1,000 records and zero file counts. When under file-count control, the no-rewind option is not available unless the system unit is the same as the last system unit used. In this case, a blank in column 7 will simulate a no-rewind.
7	L	L specifies a labeled tape operation. However, files on the tape need not be labeled. If a file has a label, the checkpoint character in the label is examined. If this character is greater than zero, records that follow the

CARD
COLUMNS CONTENTS

EXPLANATION
header label are spaced over until a tape mark is detected. If this character is equal to zero, spacing does not take place. Labels are not counted as files and, when dumping, are written without modification. If a trailer label is not encountered following a labeled file, this is indicated in the output listing by the message END FILE. NO TRAILER. Unlabeled files are dumped as they would be under R control. Before any operation, the specified tape is rewound unless an operation has just been completed on the specified input unit.

Control Cards

Information is supplied to the Tape Dump routine by using any of the following control cards:

1. The first type HT90D Dump control card specifies the input unit, the type of dump to be taken, and two output units. One output unit must be the printer, and the other output unit must be a magnetic tape unit.

CARD COLUMNS	CONTENTS	EXPLANATION
1-6	HT90Db	Card identifier.
7	R, N, or L	Rewind/Label Option.
8	,	Field separator.
9-14	SYSxxx	Designates the input unit. It must be an available System Unit Function Table (SYSUNI) unit. If the SYSUNI unit has not been previously attached as a system unit, it must be attached, using a \$ATTACH card, before the tape can be dumped.
15	,	Field separator.
16-19	DUMP	Designates that a dump is to be taken.
20	,	Field separator.
21	F or R	Designates whether files (F) or records (R) are to be dumped.
22	,	Field separator.
23-25	BCD or BIN	Designates the mode in which the tape is written: BCD—If a 729 Magnetic Tape Unit is specified, the files or records to be dumped are in the BCD mode. If a 7340 Hypertape Drive is specified, the files or records to be dumped are in the converted (i.e., BCD) mode. BIN—If a 729 Magnetic Tape Unit is specified, the files or records to be dumped are in the binary mode. If a 7340 Hypertape Drive is specified, the files or records to be dumped are in the nonconverted (i.e., binary) mode.
26	,	Field separator.
27	A-F	Designates the format of the dump: Format A—Octal, 8 words per line. Format B—BCD, 16 words per line.

CARD
COLUMNS CONTENTS

EXPLANATION
Format C—SQUEZY, mnemonics with address and tag fields. If the Tape Dump routine cannot interpret the operation code, the octal representation is given.

Format D—Octal and SQUEZY. If the SQUEZY word would have normally appeared as octal, it is not listed twice, but is suppressed. Otherwise, both the octal word and the SQUEZY word are listed in this format.

Format E—Octal and mnemonics.

Format F—Octal, mnemonics, and BCD. A BCD interpretation of the word is listed to the right of the mnemonic.

28	,	Field separator.
29-34	SYSxxx	Designates one of the output units. It must be a SYSUNI unit. If the SYSUNI unit has not been previously attached as a system unit, it must be attached, using a \$ATTACH card, before the dump is initiated.
35	,	Field separator.
36-41	SYSxxx	Designates one of the output units. It must be a SYSUNI unit. If the SYSUNI unit has not been previously attached as a system unit, it must be attached, using a \$ATTACH card, before the dump is initiated.
42	,	Field separator.
43-47	x-xxxxx	Designates the number of files or records to be dumped. The number can be from one to five digits long. It is written in decimal notation, and is left-justified within the field. Example: 42bbb

2. The second type HT90D Dump control card contains the same information as the first type except that only one output unit is specified.

CARD COLUMNS	CONTENTS	EXPLANATION
1-6	HT90Db	Card identifier.
7	R, N, or L	Rewind/Label Option.
8	,	Field separator.
9-14	SYSxxx	Same as the type 1 Dump control card.
15	,	Field separator.
16-19	DUMP	Same as the type 1 Dump control card.
20	,	Field separator.
21	F or R	Same as the type 1 Dump control card.
22	,	Field separator.
23-25	BCD or BIN	Same as the type 1 Dump control card.
26	,	Field separator.
27	A-F	Same as the type 1 Dump control card.
28	,	Field separator.
29-34	SYSxxx	Designates the output unit. It must be a System Unit Function Table (SYSUNI) unit. If the SYSUNI unit has not been previously attached as a system unit, it must be attached,

CARD COLUMNS	CONTENTS	EXPLANATION
35	,	using a \$ATTACH card, before the dump is initiated. Field separator.
36-40	x-xxxxx	Designates the number of files or records to be dumped. The number can be from one to five digits long. It is written in decimal notation, and is left-justified within the field. Example: 42bbb

3. The HT90D Backspace or Skip control card, the third type, is used to position a tape before or after a dump. This control card is used in conjunction with either of the HT90D control cards.

CARD COLUMNS	CONTENTS	EXPLANATION
1-6	HT90Db	Same as the Dump control cards.
7	R, N, L, or blank	Rewind/Label Option.
8	,	Field separator.
9-14	SYSxxx	Same as the Dump control cards.
15	,	Field separator.
16-19	BACK or SKIP	Designates whether the tape is to be backspaced or skipped.
20	,	Field separator.
21	F or R	Designates whether files (F) or records (R) are to be backspaced or skipped.
22	,	Field separator.
23-27	x-xxxxx	Designates the number of files or records to be backspaced or skipped. The number can be from one to five digits long. It is written in decimal notation, and is left-justified within the field. Example: 42bbb

Operating Procedure

The Tape Dump routine is called into core storage by using control cards. The Utility Monitor is first called into core storage by the System Monitor when it encounters a \$EXECUTE DK90UT card. The Utility Monitor, in turn, calls the Tape Dump routine when it encounters any HT90D card. When the dump has been completed, control is returned to the Utility Monitor. If another utility run follows, the utility routine is called, if necessary, and control is given to the utility routine. If another utility run is not pending, the Utility Monitor returns control to the System Monitor.

If a System Unit Function Table (SYSUNI) unit must be attached to execute the Tape Dump routine, the appropriate system control cards must precede the Tape Dump control cards.

Sample Control Deck Format:

COLUMN 1	COLUMN 16	
\$ATTACH	A4	ATTACH SYSOU2, TO BE USED AS THE OUTPUT UNIT.
\$AS	SYSOU2	
\$ATTACH	B2	ATTACH SYSCK1, TO BE USED AS THE INPUT UNIT.
\$AS	SYSCK1	
\$ATTACH	CH1/1	ATTACH A HYPERTAPE AS SYSUT1, TO BE USED AS THE INPUT UNIT.
\$AS	SYSUT1	
\$EXECUTE	DK90UT	CALL AND LOAD THE UTILITY MONITOR
HT90D	R,SYSCK1,DUMP,F,BCD,F,SYSOU2,1	
HT90D	R,SYSUT1,DUMP,F,BCD,F,SYSOU2,7	
\$IBSYS		
\$STOP		

Off-Line Messages

This section lists, in alphabetical order, the messages included in the off-line listing produced by the IBSYS Utilities. These messages appear only off-line and provide the programmer with a detailed account of the processing of the job by the utility routines. Other messages may appear both off-line and on-line. These are primarily operator messages and are documented in *IBM 7090/7094 IBSYS Operating System, Operator's Guide*, Form C28-6355.

ALL FILES LOADED

NEXT TRACK TO BE LOADED WAS xxxxxx

Program: Load Disk/Drum Routine

Explanation: This loading operation has been completed using all tape files specified but not all the tracks specified. The Utility Monitor assumes control to process the next control card.

ALL TRACKS LOADED BUT ALL
TAPE RECORDS NOT USED

Program: Load Disk/Drum Routine

Explanation: Not enough disk or drum tracks have been specified to hold all the specified tape records. The Utility Monitor assumes control to process the next control card.

BELOW CARD OUT OF SEQUENCE
WILL TRY TO EXECUTE

card image

Program: Utility Monitor

Explanation: The card shown has been encountered in place of an expected control card. The Utility Monitor will attempt to process the listed card. This may result in skipping the job requested by previous control cards.

CONTROL CARD ERROR

JOB TERMINATED

Program: Tape Dump Routine

Explanation: There is an error in a field of the current control card.

CONTROL CARD ERROR

error comment (see below)

card image

JOB DISCONTINUED

Program: Format Track and Address Generation Routine or Clear Disk/Drum Routine

Explanation: The error comment explains the error in the control card. It may be:

INCORRECT ACCESS UNIT

INCORRECT CHARACTER

INCORRECT CONTROL CARD FORMAT

INCORRECT FIELD LENGTH

INCORRECT METHOD

INCORRECT MODE

INCORRECT MODULE UNIT

INCORRECT SYSUNI DESIGNATION

INCORRECT TRACK NUMBER

TRACK OR CYLINDER TOO HIGH FOR DRUM

FILE

CONTROL CARD ERROR IN FOLLOWING CARD

card image

JOB DISCONTINUED

Program: Load Disk/Drum Routine

Explanation: The control card has an error in one or more of its fields.

CONTROL CARD ERROR IN FOLLOWING CARD

card image

JOB DISCONTINUED

Program: Home-Address and Record-Address Generation Routine

Explanation: The Type 2 control card shown either has an error in one of its fields, or is meant to be a continuation of a previous Type 2 control card which had no continue punch.

CONTROL CARD SKIPPED

ILLEGAL SYSUNI GIVEN AS OUTPUT UNIT

Program: Dump Disk/Drum Routine

Explanation: One or both of the output unit fields in a control card is in error. The Utility Monitor assumes control and reads the next control card.

DISK HARDWARE ERROR INDICATED BY IOEX
DURING PRESENT ADDRESS GENERATION

JOB DISCONTINUED

Program: Home-Address and Record-Address Generation Routine

Self-explanatory.

DISK HARDWARE ERROR INDICATED BY IOEX
DURING PRESENT DISK LOAD FROM TAPE

Program: Load Disk/Drum Routine

Self-explanatory.

DISK RESTORATION COMPLETE
RETURNING TO UTILITY MONITOR

Program: Restore Disk/Drum Routine

Self-explanatory.

DUMP COMPLETED, RETURNING CONTROL
TO UTILITY MONITOR

Program: Dump Disk/Drum Routine

Self-explanatory.

END OF FILE ON CONTROL CARD TAPE
NOW RETURNING TO IBSYS

Program: Utility Monitor

Self-explanatory.

EOT

JOB TERMINATED

Program: Tape Dump Routine

Explanation: The program has dumped or skipped the input Hypertape to the end-of-tape mark.

FILE COMMENT

FORMAT TRACK ERROR—TOO MANY

CHARACTERS IN FORMAT TRACK

JOB DISCONTINUED

Program: Format—Track and Address Generation Routine

Self-explanatory.

FILE COMMENT

REPETITIVE DISK FILE ERROR

JOB DISCONTINUED

Program: Format-Track and Address Generation or Clear Disk Routines.

Self-explanatory.

ILLEGAL ID ON FOLLOWING CARD

SKIPPING TO NEXT CARD

card image

Program: Utility Monitor

Explanation: An unrecognizable control card has been encountered. The next card is read.

ILLEGAL SYSUNI GIVEN AS INPUT TAPE
Program: Restore Disk/Drum Routine
Self-explanatory.

JOB ABORTED,
 ILLEGAL SYSNUNI GIVEN AS DISK UNIT
Program: Restore Disk/Drum Routine
Explanation: A control card has specified an illegal input tape. The Utility Monitor assumes control and reads the next control card.

LOADING DISK FROM TAPE FOR JOB
 STARTING WITH BELOW CARD
 card image
Program: Load Disk/Drum Routine
Self-explanatory.

NOW LOADING CLEAR DISK ROUTINE (DK90C)
Program: Utility Monitor
Self-explanatory.

NOW LOADING DUMP DISK ROUTINE (DK90D)
Program: Utility Monitor
Self-explanatory.

NOW LOADING FORMAT TRACK AND
 ADDRESS GENERATION ROUTINE
Program: Utility Monitor
Self-explanatory.

NOW LOADING LOAD DISK ROUTINE (DK90L)
Program: Utility Monitor
Self-explanatory.

NOW LOADING PLATTER MODE DUMP
Program: Utility Monitor
Explanation: The 2302 Disk Platter Routine has been called by a control card.

NOW LOADING RESTORE DISK ROUTINE (DK90R)
Program: Utility Monitor
Self-explanatory.

NOW LOADING TAPE DUMP (HT90D)
Program: Utility Monitor
Self-explanatory.

OUTPUT TAPE ERROR
 JOB TERMINATED
Program: Tape Dump Routine
Explanation: A write redundancy has occurred on the output tape.

PERFORMING ADDRESS GENERATION
 FOR JOB INDICATED BY BELOW CARD
 card image
Program: Home-Address and Record-Address Generation Routine
Self-explanatory.

PERFORMING CLEAR DISK FOR JOB
 INDICATED BY BELOW CARD
 card image
Program: Clear Disk/Drum Routine
Self-explanatory.

PERFORMING FORMAT TRACK GENERATION
 FOR JOB INDICATED BY BELOW CARD
 card image
Program: Format-Track Generation Routine
Self-explanatory.

PERMANENT ERROR ON DISK OPERATION,
 RETURNING TO UTILITY MON.
Program: Restore Disk/Drum Routine
Explanation: The job is discontinued.

PERMANENT ERROR OCCURRED DURING
 PRESENT LOAD DISK OPERATION
 JOB DISCONTINUED
Program: Load Disk/Drum Routine
Self-explanatory.

REMAINDER OF CONTROL CARD SKIPPED
 ILLEGAL TRACK CHARACTER
Program: Dump Disk/Drum Routine
Explanation: A track address specified in a control card contains non-numeric characters. The job is discontinued.

REMAINDER OF CONTROL CARD SKIPPED
 ILLEGAL TRACK SEPARATOR
Program: Dump Disk/Drum Routine
Explanation: A character other than comma or dash has been used to separate two track addresses on a control card. The job is discontinued.

REMAINDER OF DUMP ABORTED
 PERMANENT ERROR OCCURRING ON DISK
 RETURNING CONTROL TO UTILITY MONITOR
Program: Dump Disk/Drum Routine
Self-explanatory.

REMAINDER OF TRACKS SKIPPED
 TRACKS NOT IN ASCENDING ORDER
Program: Dump Disk/Drum Routine
Explanation: Track addresses in a control card must be specified in ascending order. The job is discontinued.

RESTORATION INCOMPLETE, UNABLE TO
 FIND FOLLOWING SET, xxxxxx
Program: Restore Disk/Drum Routine
Explanation: The input tape does not contain a set corresponding to the set shown. The job is discontinued.

SPECIFIED TRACK TOO HIGH FOR DRUM
 FILE-JOB ABORTED
Program: Dump Disk/Drum Routine
Explanation: A track address greater than 0399 has been specified for a drum file.

TAPE DATA LOADED ON DISK SUCCESSFULLY
Program: Load Disk/Drum Routine
Self-explanatory.

THIS DK90D CARD COMPLETED,
 RETURNING CONTROL TO UTIL. MONITOR
Program: Dump Disk/Drum Routine
Self-explanatory.

THIS DK90R CARD COMPLETED
 RETURNING CONTROL TO UTIL. MONITOR
Program: Restore Disk/Drum Routine
Self-explanatory.

TRACK TOO HIGH FOR DRUM
 CONTROL CARD ERROR FOUND IN FOLLOWING
 CARD
 card image
 JOB DISCONTINUED
Program: Load Disk/Drum Routine
Explanation: The control card specifies a track address greater than 0399 for a drum file.

TRACK TOO HIGH FOR DRUM FILE
 JOB DISCONT.
Program: Restore Disk/Drum Routine
Explanation: The input specifies a track address greater than 0399 for a drum file. This is most likely the result of trying to restore a disk dump onto a drum.

TRACKS OUT OF SEQUENCE
 REMAINDER OF CONTROL CARD SKIPPED
Program: Restore Disk/Drum Routine
Explanation: The tracks in the set being restored are out of sequence. The job is discontinued.

UNIT NOT ATTACHED xxxxxx
 JOB TERMINATED
Program: Tape Dummy Routine
Explanation: A unit that is specified in a control card has not been logically attached, or the name specified in the control card is misspelled. The name of the unit is printed to the right of the message.

Index

(Where more than one page reference is given, major reference appears first.)

Address modifications	11	Prepare-to-verify order	14
Assembly of symbolic deck	17	Prime control cards	13
Binary-to-decimal conversion routine	5	Redundant input tape error	5
Buffered card read routine	5	Restore Disk/Drum routine	14
Card reader error	5	Rewind/Label option	17
Character-count constants	7	Six-bit mode	5
Clear Disk/Drum routine	15	SPOUT	12, 13
Continuation control cards	13	Standard character configurations	7
Control card records	12	Standard home-address identifier	5, 8
Cylinder mode of operation	5	Standard record-address format	5
Decimal-to-binary conversion routine	5	Symbolic input/output units	7
Decimal-to-binary conversion table	5	Symbolic locations	
DK90A1 card	9	EXIT	9
DK90A2 card	9	HAID	13
DK90FA card	9	HALOC	13
\$AS card	7	HEXIT	11
\$ATTACH card	7	IDSW	13
\$EXECUTE DK90UT	2	MODHA	15
\$IBSYS card	6	MODRA	15
Dump Disk/Drum routine	12	REXIT	11
Dump 2302 Disk Platter routine	14	SWITCH	5
Eight-bit mode	5	TNORM	5
End-of-file condition	5	WRCHK	9, 11, 15
Format Key-Lock switch	7	System Unit Function Table (SYSUNI) designation	10, 11
Format-Track Generation routine	7	Tape Dump control cards	18
General disk/drum IOEX subroutines	5	Backspace card	19
General tape IOEX read/write routine	5	Skip card	19
Home-Address and Record-Address Generation routine	9	Tape Dump routine	17
Home-address identifier	11	control deck format	19
Home-address (HAO) switch	9	operating procedure	19
Identification codes	6	Track data records	12
Input files	11	Trailer records	13
Input/Output Executor (IOEX)	9, 12	Utility Monitor	5, 7
Invalid identification	6	origin	5
Load Disk/Drum routine	10	Utility routines	
Off-line messages	20	example	5
On-line print routine	5	file order	6
		origin	6
		Write-check feature	11
		Write-check operation	8, 10, 16
		Write format	8
		Write-full-track-without address order	16
		Write-single-record order	16



**International Business Machines Corporation
Data Processing Division
112 East Post Road, White Plains, New York**