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IBM 7090-7040 Direct Couple Operating System Programmer's Guide

This publication contains information the programmer needs to prepare jobs for the IBM 7090-7040 Direct Couple Operating System (DCOS), #7090-PR-161. Included are discussions of basic system concepts, control cards, the Core Storage Dump Program, the Direct Couple Input/Output Executor, and a discussion of 7090 octal dump interpretation.

PREFACE

This publication describes the Direct Couple Operating System (DCOS) and the components of it that are of primary interest to the applications programmer. The first section contains a general introduction to DCOS that is intended to acquaint the reader with system concepts, modes of operation, and job flow. Subsequent sections include discussions of control cards, the Core Storage Dump Program, the Direct Couple Input/Output Executor, and 7090 octal dump interpretation.

More detailed information about DCOS, including initial creation and system maintenance procedures, is contained in the publication, IBM 7090-7040 Direct Couple Operating System: Systems Programmer's Guide, Form C28-6383.

All information required by machine operators is provided in the publication IBM 7090-7040 Direct Couple Operating System: Operator's Guide, Form C28-6384.

Specifications for the Direct Couple feature, and descriptions of additional machine instructions that facilitate its use, are contained in the publication Directly Coupled Processing Units--7040 to 7090/7094; 7044 to 7094/7094 II, Form A22-6803.

For information on the IBJOB Processor, the major subsystem of DCOS, the reader is referred to the following IBM publications:

IBM 7090/7094 IBSYS Operating System: IBJOB Processor, Form C28-6389
IBM 7090/7094 Programming Systems: FORTRAN IV Language, Form C28-6390
IBM 7090/7094 Programming Systems: Macro Assembly Program (MAP) Language,

Major Revision (March 1965)

This edition, Form C28-6382-3, is a major revision of Form C28-6382-2. This publication amplifies material previously presented, and, in some cases, provides additional material. Major changes and additions are concerned with: system messages, utility routines, and direct- and compatibility-mode systems.

Additions or changes are indicated by a vertical line to the left of the text; new or revised illustrations are denoted by the symbol • to the left of the caption.

The following publications are made obsolete by this revision: C28-6382-2, C28-6382-1, C28-6382-0, and the Technical Newsletters N28-0145-0 and N28-0148-0.

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Form C28-6392
IBM 7090/7094 Programming Systems: COBOL Language, Form C28-6391
IBM 7090/7094 IBSYS Operating System: IBJOB Processor Debugging Package, Form C28-6393

Instructions for using the IBJOB Processor should be interpreted by the reader of the above publications in light of the DCOS configuration and other characteristics of DCOS. The most significant considerations are the unit assignment specifications for the \$FILE control card. These are described in Appendix A of this publication.

References to the Input/Output Control System also appear in this publication. The Input/Output Control System is described in the publication IBM 7090/7094 IBSYS Operating System: Input/Output Control System, Form C28-6345.

The Direct Couple Operating System is designed for five major machine configurations.

1. 7090-DC-7040
2. 7094-DC-7040
3. 7094-DC-7044
4. 7094 II-DC-7044
5. 7094 II-DC-7040

Throughout this publication, the term 7090 refers to the 7090, 7094, or 7094 II and the term 7040 refers to the 7040 or 7044.

The minimum machine configuration required by the distributed version of DCOS is given in Appendix F.

CONTENTS

INTRODUCTION	7	Transfer To Dump Instructions	24
DIRECT COUPLE OPERATING SYSTEM CONCEPTS	8	Dump Parameters	24
IBM 7090 Data Processing System . .	8	Machine Status at the End of a Dump . .	25
IBM 7040 Data Processing System . .	8	DIRECT COUPLE INPUT/OUTPUT EXECUTOR . .	27
IBM 1402 Card Read Punch	8	DC-IOEX Communication Region Table . .	27
IBM 1403 Printer	8	Unit Control Block	29
IBM 1014 Remote Inquiry Unit	8	Word 1	29
IBM 729 Magnetic Tape Units	8	Word 2	30
IBM 1301 Disk Storage	8	Word 3	30
IBM 7320 Drum Storage	9	Word 4	30
Job Processing	9	Maintenance of Unit Control Block	
DCOS Multiprocessor	9	Fields	30
IBM 7090 Operating System with DC		Using The DC-IOEX Trap Supervisor . . .	30
Capability	10	Determining the Availability of a	
7040/7044 IBJOB Tape Blocking		Unit	30
Utility Routines	11	Call to DC-IOEX	30
Operating Modes	11	Select Routines	31
Direct Mode	11	Select Routine Exits	31
Compatibility Mode	11	Location MODSW	31
Job Flow	12	Design of Select Routines, Select	
Input Stage	12	Plus Entry	31
Setup Stage	12	Design of Select Routines, Select	
Execution Stage	12	Minus Entry	32
Breakdown Stage	13	Sense Indicators	32
Punch Stage	13	Suppression of the IOEX Redundancy	
Print Stage	13	Message	32
Purge Stage	13	Location .COMM	32
Example of Typical Job Flow	13	General Considerations in the Design	
Functional 7090 System Unit (IOBASE)		of Select Routines	33
Configurations	14	Nondata Selects	33
CONTROL CARDS	15	DC-IOEX Utility Routines	34
General Control Card Format	15	Message Writer	34
\$JOB Card	15	Message Length	35
\$EXECUTE Card	15	Alphameric Punch	35
\$ROW Card	16	Post-Mortem Dump	35
\$ENDROW Card	16	Binary-to-Decimal Conversion--AC	
\$IOBASE Card	17	Decrement	35
\$SETUP Card	17	Binary-to-Decimal Conversion--AC	
\$SETUP Card Option Specifications .	18	Address	35
\$ASSIGN Card	19	Binary-to-BCD Octal Conversion--MQ	
\$ATEND Card	20	Decrement	35
\$DATA, \$EOF, $\frac{7}{8}$ EOF, and $\frac{7}{8}$ Cards . .	20	Binary-to-BCD Octal	
\$ID Card	20	Conversion--S,1-14 of MQ	35
\$* Card	21	Pause Routines	35
\$PAUSE Card	21	Symbolic Unit Conversion	36
Utility Routines Specified on		Convert and Add Unit Designation to	
\$UTILITY Cards	21	Message	36
Examples of Deck Setups	22		
SYSTEM CORE STORAGE DUMP PROGRAM . . .	24		

GENERAL PROGRAMMING CONSIDERATIONS . . .	37
Direct- and Compatibility-Mode Systems	37
Direct-Mode Systems	38
Compatibility-Mode Systems	38
GUIDE TO 7090 OCTAL DUMP INTERPRETATION	40
Non-DC-IBSYS Jobs	40
Data Channel-Trap Simulation	40
DC-IBSYS Locations	41
communication region locations	42
Examining Unit Control Blocks	44
APPENDIX A: IBJOB UNIT ASSIGNMENT-DCOS	46
Unit Assignment Options	46
General Unit Assignment Considerations	47
APPENDIX B: MESSAGES	48
APPENDIX C: CONTROL CARD FORMAT INDEX .	58
DC-IBSYS/DCMUP Control Cards	58
System Editor Control Cards	59
7040/7044 IBJOB Tape Blocking Utility Control Cards	60
APPENDIX D: CONTROL CARD CHECK LIST .	61
DC-IBSYS/DCMUP Control Cards	61
System Editor Control Cards	62
APPENDIX E. SPECIAL CONSIDERATIONS;	
COMPATIBILITY MODE OPERATION	64
FORTRAN II Monitor System	64
7090/7094 Sort	64
APPENDIX F: MACHINE CONFIGURATION . . .	66

ILLUSTRATIONS

Figure 1. Direct Couple Operating System--General Machine Configuration . . .	8
Figure 2. Phases of Processing	9
Figure 3. DC-IBSYS Monitor Organization	10
Figure 4. IBM 7090 Operating System with DC Capability (DC-IBSYS)	11
Figure 5. Stages of Processing for Non-Utility Jobs	12
Figure 6. Direct-Mode System Unit Functions (IOBASE 0)	14
Figure 7. IOBASE 1	14
Figure 8. IOBASE 2	14
Figure 9. Sample \$ROW-\$ENDROW Application	16
Figure 10. Sample Deck Setup--FORTRAN Compilation and IBCMAP Assembly	22
Figure 11. Sample Deck Setup--One-Segment FORTRAN Compilation and Execution	23
Figure 12. Sample Deck Setup--Two-Segment Job	23
Figure 13. Sample Deck Setup--Object Program on Cards	23
Figure 14. Sample Deck Setup--System on Tape	23
Figure 15. Core Storage Dump Formats	26
Figure 16. DC-IOEX Communication Table	28
Figure 17. Unit Control Block	30
Figure 18. DC-IBSYS Locations	42
Figure 19. Communication Region Locations	43
Figure 20. Contents of Sample Unit Control Block	45

INTRODUCTION

The Direct Couple Operating System (DCOS) is a set of supervisory routines that coordinate job processing on systems having the Direct Couple feature. DCOS provides a framework within which other 7090/7094 programming systems may function.

The most significant advantages of DCOS are more efficient use of 7090 processing capabilities and improved job turnaround time. Several operating characteristics contribute to this improved performance.

The need for operator handling of tapes is reduced. Normally a job is never handled in an intermediate form. For example, most output tapes that must be printed or punched off-line are eliminated.

Less system search time is needed because programming systems reside on 1301 Disk Storage.

The workload of the 7090 is maintained by 7040 routines that prepare and supply the input flow to the 7090 and handle all 7090 output.

All 7090 input/output requirements are handled by 7040 routines. The 7607 Data Channel and its associated input/output devices are simulated by 7040 routines. The 7909 Data Channel is not simulated.

Jobs are scheduled by 7040 routines based on their individual priorities and queued for 7090 processing. Any setup required, such as mounting and blocking tapes on the 7040, is performed before the job is loaded into the 7090, so that the 7090 is not delayed for these operations.

The functions of the 7090 operator in controlling job processing are performed by 7040 routines. The operator communicates with the system through a 1014 Remote Inquiry Unit or the 7040 console keys. Facilities are included for job status inquiry, change of job priority, system restart, setup communication, and automatic notification of excessive 7090 execution time or output.

DIRECT COUPLE OPERATING SYSTEM CONCEPTS

This section serves to acquaint the reader with the Direct Couple Operating System (DCOS). The general organization, function, and relationship of each system component is discussed. A brief description of the basic machine configuration and of the functions performed by each device is included. Familiarity with these basic DCOS concepts is necessary for a better understanding of the material presented throughout the remainder of this publication.

Figure 1 illustrates the machine configuration for DCOS in general terms for purposes of the discussions that follow.

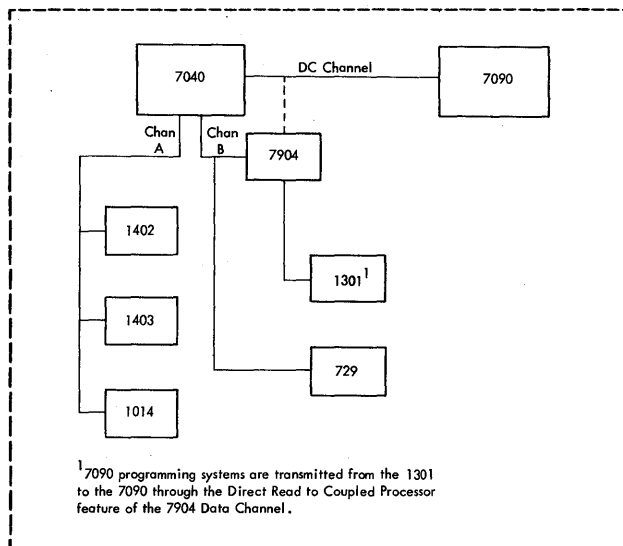


Figure 1. Direct Couple Operating System--
General Machine Configuration

IBM 7090 DATA PROCESSING SYSTEM

The IBM 7090 Data Processing System performs one major function: actual job processing. It has no input/output facilities other than the Direct Couple feature. In normal operation, a component of DCOS, the 7090 IBSYS Operating System with DC Capability (DC-IBSYS), resides in the 7090 and exercises control over job execution. DC-IBSYS does not initiate input/output activity, but requests the activity, which is performed by the 7040.

IBM 7040 DATA PROCESSING SYSTEM

The primary function of the IBM 7040 Data Processing System is to service the input/output requirements of the 7090. This includes preparing input files, performing pre-job setup, interpreting the 7090 input/output requests and initiating the activity, and performing all printing, punching, and post-job breakdown.

IBM 1402 CARD READ PUNCH

The IBM 1402 Card Read Punch is used by the system for all punched card input and output.

IBM 1403 PRINTER

The IBM 1403 Printer is used by the system for all printed output.

IBM 1014 REMOTE INQUIRY UNIT

The IBM 1014 Remote Inquiry Unit is used by the operator to communicate with the system and to control operations executed by the system. Messages to the operator may appear on the 1014.

IBM 729 MAGNETIC TAPE UNITS

IBM 729 Magnetic Tape Units are used for all jobs requiring tape input or output.

IBM 1301 DISK STORAGE

One module of IBM 1301 Disk Storage (channel B, module 0) is required. It is used for 7090 programming systems residence; for 7040 supervisory routine residence; and for intermediate storage of system input and output data. Any additional channel B modules are used for system residence (systems are shared between all modules). All modules are used

for intermediate storage of system input and output data.

IBM 7320 DRUM STORAGE

IBM 7320 Drum Storage may be substituted for any even numbered module but the one required module of disk storage. Functions of drum storage are identical to those of the additional disk storage modules that are allowed.

Throughout the remainder of this publication, the terms disk, 1301, or 1301 Disk Storage may refer to either IBM 1301 Disk Storage or IBM 7320 Drum Storage.

JOB PROCESSING

A fundamental concept of DCOS is that many jobs are handled by the system simultaneously. To facilitate control over the many jobs being processed concurrently, each job is divided into three phases: preprocessing, processing, and postprocessing. Control of the system is exercised by two supervisory programs (Figure 2): the IBM 7090/7094 IBSYS Operating System with DC Capability (DC-IBSYS) and the DCOS Multiprocessor (DCMUP).

DC-IBSYS resides in the 7090 and exercises control over the processing phase. DCMUP resides in the 7040 and exercises control over both the preprocessing and postprocessing phases. DC-IBSYS and DCMUP perform their functions asynchronously. The overlap of job processing with the preprocessing and postprocessing of other jobs significantly reduces turnaround time, which is the time from the introduction of a job to the system to the time the job is complete.

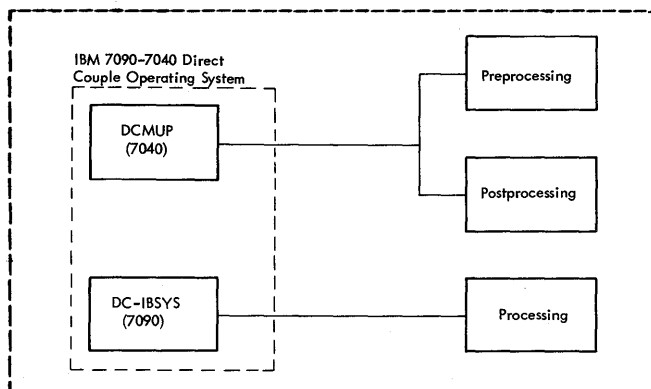


Figure 2. Phases of Processing

All files to be processed by DCOS must be in the standard DCOS record format. This format consists of 460-word physical records, each record containing a two-word identifier and a 458-word area into which the logical records, separated by record control words, are placed. More detailed information about the DCOS record format is contained in the publication Direct Couple Operating System: Systems Programmer's Guide, Form C28-6383.

DCOS MULTIPROCESSOR

The DCOS Multiprocessor (DCMUP) contains subroutines that perform all preprocessing and postprocessing functions and service all input/output requirements of the 7090. DCMUP subroutines are entered from a master control program called the commutator. Upon entry into a subroutine, one unit of its work (e.g., printing one line) is performed, control is returned to the commutator, and another subroutine is entered. Thus, preprocessing, postprocessing, and input/output servicing appear to occur simultaneously.

DCMUP includes five utility routines that are available during the preprocessing and postprocessing phases of a job. These background utilities are specified on the \$SETUP control card (described under "Control Cards"). DCMUP utility routines block or deblock records of 3 to 457 words per block. Other utility routines are described in the section "7040/7044 IBJOB Tape Blocking Utility Routines."

Preprocessing Utilities

TAPE-TO-TAPE BLOCKING: The Tape-to-Tape Blocking Utility blocks tape records written with a blocking factor of 3 to 457 words to the standard DCOS record format, and writes them on another tape. (All tape input to the processing phase of DCOS must be in the standard DCOS record format.)

TAPE-TO-DISK BLOCKING: The Tape-to-Disk Blocking Utility blocks tape records written with a blocking factor of 3 to 457 words to the standard DCOS record format, and writes them on the disk.

Postprocessing Utilities

TAPE-TO-TAPE DEBLOCKING: The Tape-to-Tape Deblocking Utility returns tapes that have been written in the standard DCOS record format to the format (3 to 457 words per block) specified within the user's program.

DISK-TO-TAPE DEBLOCKING: The Disk-to-Tape Deblocking Utility writes information from the disk onto a tape unit. Records are written in a format (3 to 457 words per block) specified within the user's program.

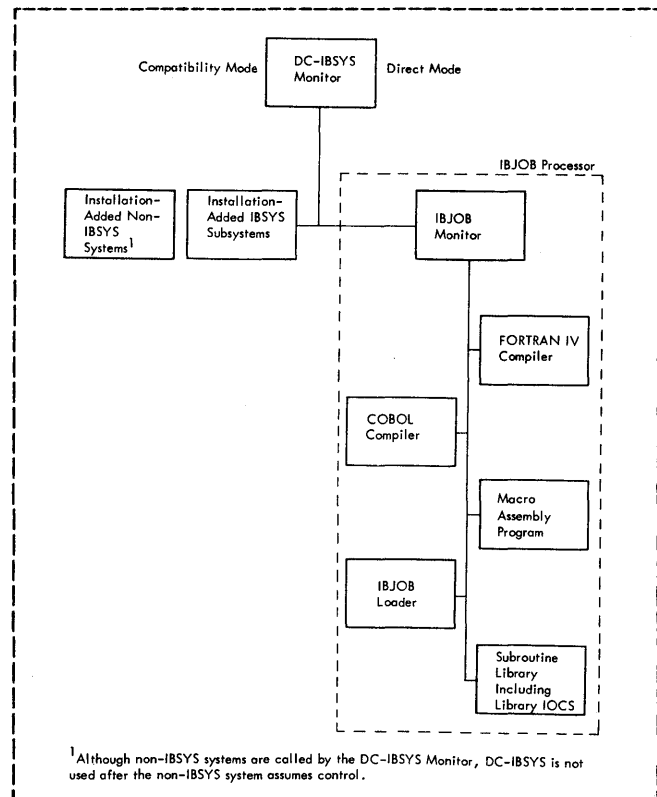


Figure 3. IBM 7090 Operating System with DC Capability (DC-IBSYS)

IBM 7090 OPERATING SYSTEM WITH DC CAPABILITY

The IBM 7090 Operating System with DC Capability (DC-IBSYS) supervises the execution of jobs. As shown in Figure 4, it consists of the DC-IBSYS Monitor, the system editor (IBEDT), and the IJOB Processor. IBSYS subsystems, other than the IJOB Processor, and non-IBSYS systems may be executed under control of the DC-IBSYS

Monitor, but must reside in the system library (1301). Procedures for editing the system library to include IBSYS subsystems, other than IJOB, and non-IBSYS systems are included in the publication IBM 7090-7040 Direct Couple Operating System: Systems Programmer's Guide, Form C28-6383. Non-IBSYS systems need not be on the system library and may be introduced to DCOS on cards or tape.

The DC-IBSYS Monitor

The general organization of the DC-IBSYS Monitor is illustrated in Figure 3. The DC-IBSYS Monitor consists of:

1. The DC-IBSYS Nucleus (DC-IBNUC), which remains in core storage during processing and provides common facilities for communication and control among the subsystems and between the DC-IBSYS Monitor and the subsystems.
2. The DC Input/Output Executor (DC-IOEX), which normally remains in core storage to coordinate and control input/output and other trapping operations.
3. The DC-IBSYS Supervisor (DC-IBSUP), whose primary function is to control and coordinate the processing of jobs by passing control from one subsystem to another.
4. The DC-IBSYS Core Storage Dump Program (DC-SYSDMP), which may be used to facilitate the testing and analysis of programs executed by the system.
5. The System Editor (IBEDT), which provides the systems programmer with a means of modifying and maintaining the DCOS monitors and the subsystems operating under their control.

The DC-IBSYS Monitor may also contain an installation accounting routine tailored to the specific requirements of the installation.

Subsystems operating under control of the DC-IBSYS Monitor provide the programmer with a variety of programming aids, which he may use singly or in combination to process a particular job.

The IJOB Processor

The IJOB Processor is an integrated processor that can be used to compile, assemble, load, and execute programs writ-

ten in FORTRAN IV or COBOL language. It can also be used to assemble, load, and execute programs written in the Macro Assembly Program (MAP) language or to load and execute previously assembled object programs. Facilities are provided for overlay, debugging, and combining program segments written in different languages with previously assembled segments to form a single executable object program.

The IBJOB Processor contains a complete library of relocatable subroutines, including a complete Input/Output Control System (library IOCS).

The IBJOB Processor and its use are described in detail in the publication IBM 7090/7094 IBSYS Operating System: IBJOB Processor, Form C28-6275.

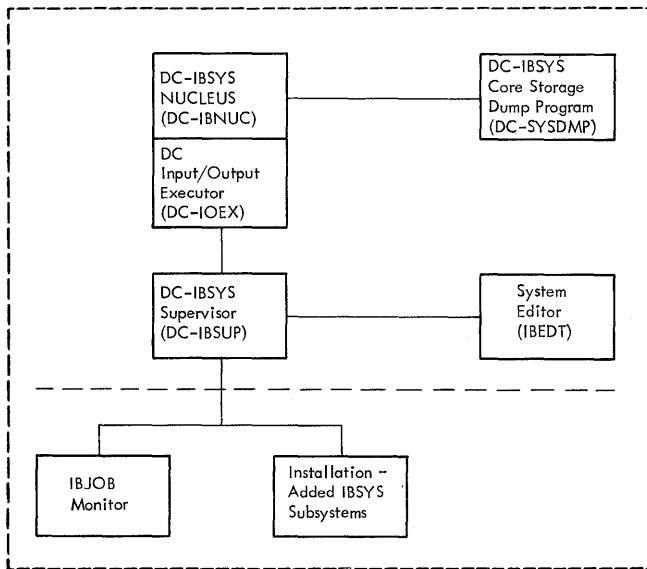


Figure 4. IBM 7090 Operating System with DC Capability (DC-IBSYS)

7040/7044 IBJOB TAPE BLOCKING UTILITY ROUTINES

The 7040/7044 IBJOB Tape Blocking Utility routines are three programs that run under control of the IBM 7040/7044 Operating System (16/32K). The programs are described in detail in the publication IBM 7090-7040 Direct Couple Operating System: Operator's Guide, Form C28-6384. They may be used to (1) block tape records of three to 16,000 words to the standard DCOS record format, (2) deblock tape records written in the standard DCOS record format to a format specified by the user, that is, 16,000 words maximum and 3 words minimum, or (3) block either IBSYS or non-IBSYS system tapes into the standard DCOS record format.

OPERATING MODES

In the DCOS machine configuration the absence of data channels attached to the 7090 does not limit applications to those written especially for DCOS. Two modes of operation are provided in DCOS--the direct mode and the compatibility mode. Basically, the difference between the two modes is the manner in which input/output activity is handled. Input/output conventions for the direct mode are tailored especially for DCOS and the direct-couple channel, whereas, in the compatibility mode, input/output conventions are adapted to programs written for a standard 7090 Data Processing System (with data channels).

DIRECT MODE

The IBM 7090/7094 IBJOB Processor has been modified to operate in the direct mode. Programs written in the FORTRAN IV, COBOL, or MAP (with library IOCS) languages are automatically provided with input/output routines tailored to the direct-couple channel.

When a request for input/output activity is encountered in the direct mode, DC-IOEX places a description of the desired input/output function in a predetermined area of 7090 core storage; the 7090 traps the 7040 (7090 processing continues); and DCMUP interprets the function description and initiates the input/output activity via the DC channel. Data transmission and 7090 execution occur simultaneously. When the activity is finished, DCMUP issues an instruction that traps the 7090 and indicates that transmission has been completed.

COMPATIBILITY MODE

The compatibility mode is provided for execution of programs or programming systems that do not utilize direct mode input/output conventions. In the compatibility mode, each 7090 input/output instruction and each instruction that tests input/output status causes the 7090 to stop and traps the 7040; DCMUP interprets each instruction, restarts the 7090, and initiates the input/output activity. Data transmission and 7090 execution occur simultaneously. If trapping is enabled by the 7090 program, the 7040 traps the 7090 when transmission is complete.

IBSYS subsystems other than IBJOB and all non-IBSYS systems are processed in the compatibility mode.

JOB FLOW

The three processing phases described earlier (preprocessing, processing, postprocessing) are each subdivided into stages (Figure 5). The preprocessing phase includes the input and setup stages, the processing phase includes the execution stage; and the postprocessing phase includes the breakdown, print, punch, and purge stages. A job containing \$UTILITY cards will not go through the processing phase, but will go through preprocessing and postprocessing.

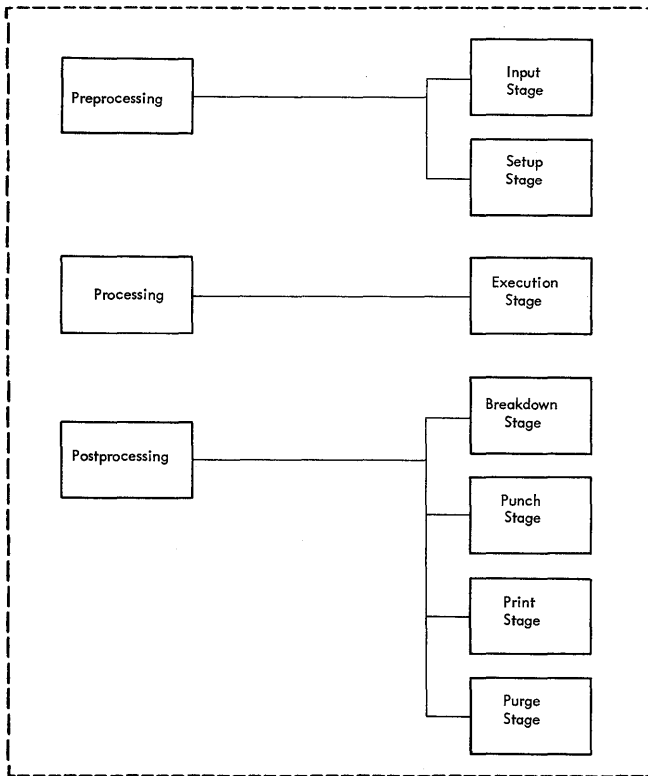


Figure 5. Stages of Processing for Non-Utility Jobs

INPUT STAGE

A job first enters the input stage, during which the control cards are analyzed by DCMUP and the following actions are performed:

1. The input deck is blocked into the

standard DCOS record format and written on the disk.

2. A job description is prepared by DCMUP and written on the disk. The job description includes a job number and the disk location that was assigned to the job.
3. A one-word job identifier is formed. The identifier contains the disk location assigned to the job description, the priority code of the job, and a stage number. The priority code is obtained from the \$JOB control card, described under "Control Cards." The stage number is maintained by DCMUP and always reflects either the current stage of processing or, if the previous stage has been completed, the next stage.
4. Job identifiers are placed into a table called a job queue table. DCMUP selects jobs from this table by first examining the priorities assigned to the jobs.

SETUP STAGE

If the job requires setup, DCMUP selects an available 7040 tape unit and types a message directing the operator to mount a tape on the selected unit. An effort is made to balance the assignment of setup tapes to provide the most efficient input/output activity. \$SETUP cards specifying 7090 channels A or C result in assignments to 7040 channel B. \$SETUP cards specifying 7090 channels B or D result in assignments to 7040 channel C. However, if there are no units available on the desired 7040 channel at the time of setup, no attempt will be made to wait until one is available. Instead, any available unit is assigned.

If control card specifications indicate that the tape is to be converted into the standard DCOS record format, the tape records are read into the system, converted, and stored on the disk (or, at the programmer's option, on another tape). Tapes in standard DCOS record format are not read into the system during the setup stage.

EXECUTION STAGE

During the execution stage, DCMUP selects jobs from the job queue table, interprets the job description, and loads DC-IBSYS into the 7090. Control is then transferred to the programming system, which processes the job.

Program processing on the 7090 is essentially the same as it would be on a standard 7090 Data Processing System without the DC feature except that all input/output requests are handled by the 7040. When the 7090 requests input, the blocked records which have been read from

the disk (or tape) into 7040 buffers are deblocked by DCMUP and transmitted to the 7090. Output from the 7090 is transmitted to the 7040, blocked into 7040 buffers, and written onto the disk (or tape). Punch and print files are written onto the disk in

preparation for the punch and print stages, or onto tape in DCOS format for subsequent processing.

BREAKDOWN STAGE

During the breakdown stage, 7090 output may be deblocked and written on tape. Any intermediate tapes are rewound; other tapes used by the job are rewound and unloaded, and the respective 7040 tape units are returned to availability status.

PUNCH STAGE

If the job requires punched output, the job is scheduled for the punch stage and punched on the 1402. (A job will go through this stage even if no deck options have been selected, so that the job separator card may be punched.)

PRINT STAGE

If the job requires printed output, it is scheduled for the print stage and printed on the 1403 (720 carriage control is simulated). The print routine can also simulate the IBM 720A Printer on the 1403. In the case of a printer check, the first character of the line (carriage control character if under program control) is replaced by an asterisk.

The print routines will simulate the FORTRAN carriage control characters for single space, double space, and eject. All other carriage control characters will be treated as single space.

Incorporated in the print routines is a record mark scanning routine that allows (within the print stage) for the deblocking of 720A type output without going through the breakdown stage first. The use of

```
$SETUP          DISK,PRINT,720
```

to specify 720A type output is unnecessary.

PURGE STAGE

When all other postprocessing of a job is complete, the job is scheduled for the purge stage, during which the data files pertaining to the job, the job description, and the job identifier are purged from the disk.

EXAMPLE OF TYPICAL JOB FLOW

As an example of job flow, consider the following case. The job is a FORTRAN IV compilation and execution. One input tape

in nonstandard format is required, and printer and punch output are desired. The job deck, which includes control cards specifying the nonstandard tape, is placed in the 1402 Card Reader. The 7040 reads in the deck, and DCMUP blocks the input, prepares the job description, and stores the records on the disk. While the deck is being read in, a message is written on the 7040 console typewriter informing the operator that the job has entered the system.

When the job is selected for setup, DCMUP locates an available tape unit and prints a message instructing the operator to mount the nonstandard tape. When the tape has been mounted, DCMUP reads the input tape into the 7040 core storage buffers, converts the records to the standard DCOS record format, and stores the records on the disk (or, at the user's option, on another tape).

When the job is selected for 7090 processing, the job description is read from the disk into 7040 core storage. DCMUP then loads IBSYS into the 7090, which in turn calls the IBJOB Processor. The job is processed in direct mode. Input files for the job are read from disk into buffers in 7040 core storage, when each file is first used. Thus, DCMUP can respond immediately when the 7090 issues a request for input from one of these files. DCMUP can then deblock and transmit the desired number of words from a core storage buffer at the transmission rate of the Direct Couple facility.

Output is handled similarly, since DCMUP establishes buffers in the 7040 to receive all output files. Messages that would appear on an on-line 716 Printer in a non-DC configuration may be printed on the 1014 or the console typewriter. DCMUP also maintains a file of these messages for later printing on a 1403 as part of the job's output. As the output buffers become filled, the records are stored on the disk.

When the job is selected for punching, the punch files are read from the disk into 7040 buffers and punched on the 1402. The print files are read from the disk into 7040 core storage buffers and printed on the 1403 Printer. The operator is notified when punching and/or printing for the job is initiated.

When all the output of the job has been processed and the job is selected for purging, DCMUP purges the disk of all remaining data files pertaining to the job, returns disk areas to availability status, and discards the job description and the job identifier. The operator is then notified that the job has been completed.

FUNCTIONAL 7090 SYSTEM UNIT (IOBASE)
CONFIGURATIONS

System unit functions assigned by DCOS for direct-mode operation are shown in Figure 6. In compatibility mode, the programmer may specify one of three functional system unit configurations. Each is defined in an IOBASE table. The use of a particular IOBASE table for a job is specified on a \$IOBASE control card (described under "Control Cards"). IOBASE 0 is the same functional system unit configuration as that for direct-mode operation (Figure 6). IOBASE 1 is provided for general usage (Figure 7). IOBASE 2 (Figure 8) is the functional system unit configuration for the FORTRAN Monitor System (FMS).

7090 Unit	Function
A1	LB1 (disk)
A2	IN1 (1402), IN2
A3	OU1 (1403), OU2
A4	PP1 (1402), PP2
A5	CK1
A6-A0	No function assigned
B1	UT1
B2	UT2
B3	UT3
B4	UT4
B5	CK2
B6-B0	No function assigned
C1-C6	No function assigned
D1-D6	No function assigned
PRA	PRT
PUA	PCH
RDA	CRD

Figure 6. Direct-Mode System Unit Functions (IOBASE 0)

The programmer should not deviate from the functional use of system units as defined in the IOBASE used. For example, if IOBASE 0 is used, 7090 unit A3 should not be used for any function except the system output unit. Procedures for assigning functions to IOBASE 1 and for defining additional IOBASE tables are contained in the publication IBM 7090-7040 Direct Couple Operating System: Systems Programmer's Guide, Form C28-6383.

7090 Unit	Function
A1-A0	No function assigned
B1-B0	
C1-C4	
D1-D4	
PRA	
PUA	
RDA	

Figure 7. IOBASE 1

7090 Unit	Function
A1	System
A2	Input
A3	Print output
A4-A0	No function assigned
B1-B3	No function assigned
B4	Punch output
B5-B0	No function assigned
C1-C6	No function assigned
D1-D6	No function assigned
PRA	
PUA	
RDA	

Figure 8. IOBASE 2

The control cards that the programmer normally uses to run jobs are discussed in this section. One control card, the \$JOB card, is required and must be present in every job. The other cards are optional. Most applications will need only five control cards (\$JOB, \$EXECUTE, \$SETUP, \$ATEND, and \$EOF).

Control cards of interest to the systems programmer are discussed in the publication IBM 7090-7040 Direct Couple Operating System: Systems Programmer's Guide, Form C28-6383.

GENERAL CONTROL CARD FORMAT

The general format of the control cards discussed here is:

<u>1</u>	<u>2-8</u>	<u>16-72</u>	<u>73-80</u> ,
\$	Control card name left-justified	Variable field information (parameter 1, parameter 2, ..., parameter n)	Ignored

All parameters must appear in the order shown and must be separated by commas. Embedded blanks are not allowed within the variable field. A blank must separate the last parameter from the comments. Embedded parameters that are omitted must be indicated with a comma.

The following conventions are used in describing variable field information:

1. Lower-case letters indicate that a substitution must be made.
2. Upper-case letters must be punched exactly as shown.
3. Brackets [] contain a parameter that may be omitted or included at the user's choice.
4. Braces { } indicate that a choice of the contents is to be made.
5. A number over the first character of a parameter indicates the first card column of the field.

\$JOB CARD

The \$JOB card is required for each job. It defines the beginning of a job. A job

consists of all of the cards beginning with a \$JOB card and ending with, but not including, the next \$JOB card. A job may consist of any logical combination of job segments to be performed by the subsystems and the DC-IBSYS Monitor. The \$JOB card transfers control to the installation accounting routine (if one exists at the installation).

The format of the \$JOB card is:

```

1           16
$JOB         [priority],[time estimate],
                                     31           60
                                     [line estimate] [job identification]

```

The parameters are:

priority

This is the priority assigned to the job. The digits 0 through 9 may be specified. A priority of 0 is the lowest priority that can be assigned. When this parameter is omitted, a priority of 0 is assumed.

time estimate

This is the estimated total 7090 processing time, in minutes. A maximum specification of 32,767 minutes is allowed.

line estimate

This is the estimated line count of the printed (1403) output from the job. A maximum specification of 262,143 lines is allowed.

job identification

Columns 31 through 60 are normally used to identify a job and may contain any combination of characters and blanks.

If either the time estimate or the line-count estimate is exceeded, the operator is notified and DCMUP initiates termination procedures. If either or both estimates are omitted, the above values are assigned.

\$EXECUTE CARD

The \$EXECUTE card defines the beginning of each segment of a job. A \$EXECUTE card is required for each non-utility job.

The format of the \$EXECUTE card is:

```
1           16  
$EXECUTE    {system name}  
             {CARDS  
             {TAPE }
```

The parameters are:

system name

The name of a subsystem (six or fewer characters) that resides on the disk. In the distributed DCOS, IBJOB is the only subsystem that may be so specified. Procedures for adding other systems to the disk are described in the publication IBM 7090-7040 Direct Couple Operating System: Systems Programmer's Guide, Form C28-6383. Those systems not residing on the disk should be specified with the parameters CARDS or TAPE, described below.

CARDS

CARDS should be specified when a row binary program (self-loading card deck) is to be processed by the system. The deck must be preceded by a \$ROW control card and followed by a \$ENDROW control card (described below). When a \$EXECUTE card with CARDS specified is recognized by the 7090, pressing of the 7090 LOAD CARD button is simulated. Therefore, the first card of the deck must be a self-loading type card.

TAPE

TAPE should be specified when the program or system to be loaded resides on magnetic tape. The program or system must have been previously prepared in the standard DCOS record format using the standalone Tape Blocking Routine. When a \$EXECUTE card with TAPE specified is recognized, pressing of the 7090 LOAD TAPE button is simulated, and the 7040 unit functioning as 7090 tape unit A1 is selected.

\$ROW CARD

The \$ROW card is normally used in conjunction with a \$EXECUTE card with CARDS specified. The \$ROW card indicates that the cards following, up to but not including a \$ENDROW control card are row binary cards to be converted to 24-word image format (as though read through a 711 Card Reader) and placed into a separate input file for the 7090. An end-of-file condition is sent from the card reader file when the \$ENDROW card is encountered. Any num-

ber of \$ROW-\$ENDROW card groups may be included within the range of one \$EXECUTE CARDS control card.

All \$ROW-\$ENDROW groups used in a given job should be grouped together and placed as the last cards in the job deck.

Note: All control cards except the \$JOB card are ignored if they appear between \$ROW and \$ENDROW control cards.

The format of the \$ROW card is:

```
1  
$ROW
```

Certain 7090 programs may rely on cards that were read from the 711 Card Reader (on a 7090 Data Processing System without the Direct Couple feature). In DCOS, these cards may be included with the job input, which is read from the 1402 Card Reader during the preprocessing phase. However, the cards must be included within a \$ROW-\$ENDROW card group (Figure 9). A \$ROW card in the DCOS input stream causes a file mark to be written on the system input unit.

\$ENDROW CARD

The \$ENDROW control card is used in conjunction with the \$ROW card. It specifies the end of a row binary card file and causes an end-of-file indication to be sent from the card reader file.

The format of the \$ENDROW card is:

```
1  
$ENDROW
```

```
1      8      16-72
-----
$JOB
$EXECUTE      IBJOB
      .
      . Source Program
      .
$DATA
      .
      . Input Data
      .
$ROW
      .
      . IBM 711 Card Reader File
      .
$ENDROW
$EOF
```

Figure 9. Sample \$ROW-\$ENDROW Application

\$IOBASE CARD

The \$IOBASE card is used to specify the IOBASE to be used for a job. Only one IOBASE card is allowed for each job. If a job does not contain a \$IOBASE card, the standard DC-IBSYS IOBASE (IOBASE 0) is used.

The format of the \$IOBASE card is:

```

1           16
$IOBASE      n

```

where n is number (0, 1, or 2) of the IOBASE required for the job.

\$SETUP CARD

The \$SETUP card must be used when a program requires that tape reels be mounted on 7040 tape units.

The primary functions of the \$SETUP card are:

1. Inform DCMUP that a specific reel of tape is to be processed by the 7090 program, so that messages to the operator can be constructed and the tape reel mounted in preparation for the execution stage.
2. Provide DCMUP with information concerning the 7090 tape units referenced, so that the 7090 units can be related to the 7040 units on which the reels are mounted.
3. Allow the programmer to specify desired preprocessing and postprocessing utilities on the \$SETUP card.

Any number of \$SETUP cards are allowed for a job. All \$SETUP cards for a job must be grouped together.

The format of the \$SETUP card is:

```

1      8      16
$SETUP unit  option 1, [option 2],
              [(LABITS)], [REELS], [file count]
              [{720  }]

```

The parameters are:

unit

This is the designation assigned to the unit by the programmer. Allowable unit designations for direct mode (IBJOB subsystems) are:

True channel designations A (0) -A (9) , B (0) -B (9) , . . . ,
D (0) -D (9)

Intersystem reserve units J (0) -J (9) , K (0) -K (9) , . . . ,
Q (0) -Q (9)

Symbolic channel designations S (0) -S (9) , T (0) -T (9) , . . . ,
Z (0) -Z (9)

System unit functions CRD, PRT, PCH, LB2, LB3,
LB4, CK1, CK2, UT1, UT2,
UT3, UT4, UT5, UT6, UT7,
UT8, UT9, IN1, IN2, OU1,
OU2, PP1, PP2

Note that LB1 is not valid.

FORTRAN logical units 1-8

True channel designations (above) are treated as symbolic assignment requests, because there are no data channels attached to the 7090.

Allowable unit designations for compatibility mode are:

True machine units^a A1-A0, B1-B0, C1-C6,
D1-D6, RDA, PRA, PUA

Intersystem reserve units (IBSYS subsystems only) J (1) -J (0) , K (1) -K (0) , . . . ,
Q (1) -Q (0)

System unit functions (IBSYS subsystems only, \$ASSIGN card required) CRD, PRT, PCH, LB2, LB3,
LB4, CK1, CK2, UT1, UT2,
UT3, UT4, UT5, UT6, UT7,
UT8, UT9, IN1, IN2, OU1,
OU2, PP1, PP2

Note that LB1 is not valid.

option 1, option 2

Option 1 and option 2: (a) specify the type of input/output device (tape, disk, printer, punch) that will be assigned to functions normally performed by "unit"; (b) provide DCMUP with the blocking and/or deblocking requirements of the job; and (c) provide information to DCMUP to be used in messages that instruct the operator to mount desired reels at the appropriate time.

The two options are detailed in the section "\$SETUP Card Option Specifications."

LABITS

The LABITS option identifies a file as having mixed-mode records with stand-

^aTrue machine unit designations are related to actual machine addresses of the units, e.g., 1201 for unit A1.

ard look-ahead bits. It is applicable only when the file is to be blocked to the standard DCOS record format with either of the following specifications:

option 1 option 2

ident₁ ident₂
 ident₁ TAPE
 ident₁ DISK

720

When the 720 option is used, the IBM 720A Printer is simulated on the 1403. This simulation is compatible with 720A simulation on the 1401 (the last line of a record may end with a record mark). This option allows programs in which output for the 720A Printer is created to be run on DCOS, because each record that is written is examined for record marks to separate print lines. IBM 720 carriage control is always simulated, even if the 720 option is not specified.

REELS

REELS should be specified only when a multireel file is to be blocked into standard DCOS record format with the following specification:

option 1 option 2

ident₁ DISK

A separate \$SETUP card is required for each reel, and each \$SETUP card but the last should have REELS specified. The ident field does not have to be the same for all reels.

file count

When a multi-file input tape is to be blocked into standard DCOS record format, a file count must be specified to indicate the number of files to be blocked from that tape. File count indicates the number of physical files on the tape. If file count is omitted, only the first file will be blocked.

If tape-to-tape deblocking is requested for more than one file, a file count is required.

\$SETUP CARD OPTION SPECIFICATIONS

The options are:

option 1	{	ident ₁ TAPE DISK	}	option 2	[ident ₂ TAPE DISK PRINT PUNCH NORING INPUT]
----------	---	------------------------------------	---	----------	---	---	---

The term ident is the installation reel identification, i.e., the identification usually written on a label affixed to the tape reel. A maximum of six characters is allowed for ident. Any characters except blanks or commas may be used.

MOUNTING OF INPUT FILES: When the \$SETUP card is used to specify mounting of input files, option 1 must be the reel identification (ident₁). Option 2 may be any of the permissible options discussed below.

<u>option 1</u>	<u>option 2</u>	<u>Explanation</u>
ident ₁	(omitted)	File labeled "ident ₁ " contains records in standard DCOS record format.
ident ₁	NORING	Same as above except that the operator is instructed to remove the file-protect ring from "ident ₁ " before mounting.
ident ₁	ident ₂	Reel "ident ₁ " is mounted on an available unit, blocked to the standard DCOS record format, and written on "ident ₂ ." The reel "ident ₂ " is assigned to "unit."
ident ₁	TAPE	Reel "ident ₁ " is mounted on an available unit, blocked to the standard DCOS record format, and written on a work tape assigned to "unit."
ident ₁	DISK	Reel "ident ₁ " is mounted on an available unit, blocked to the standard DCOS record format, and written on the disk.

Thereafter, whenever "unit" is referred to in a program, the desired data is read from the disk.

ASSIGNING A TAPE UNIT TO AN INTERMEDIATE FILE: Option 1 must be TAPE to write an intermediate file on tape.

<u>option 1</u>	<u>option 2</u>	<u>Explanation</u>
TAPE	(omitted)	"unit" is assigned as an intermediate file.

REQUESTING A TAPE OUTPUT FILE: An output file is written on tape (standard DCOS record format) when the following options are specified.

<u>option 1</u>	<u>option 2</u>	<u>Explanation</u>
ident ₁	(omitted)	Output is written on "ident ₁ " during the processing phase.

REQUESTING A DEBLOCKED TAPE OUTPUT FILE: An output file is written on tape in deblocked format when the following options are specified.

<u>option 1</u>	<u>option 2</u>	<u>Explanation</u>
DISK	ident ₂	Output intended for "unit" is written on the disk during the processing phase. During the postprocessing phase, the records are deblocked and written on "ident ₂ ." (See note below.)
TAPE	ident ₂	Output is written on a tape mounted on "unit" during the processing phase. During the postprocessing phase, the records are deblocked and written on "ident ₂ ."

Note: When "unit" represents the system unit functions SYSPRT, SYSPCH, SYSOU1, or SYSP1, the symbolic designations PRT, PCH, OUI, or PP1 must be used instead of the physical unit designations PRA, PUA, B1, etc.

PRINTING AN OUTPUT FILE: An output file is written on the system printer (1403) when the following options are specified.

<u>option 1</u>	<u>option 2</u>	<u>Explanation</u>
DISK	PRINT	Output intended for "unit" is written on the disk during the processing phase and printed on the 1403 during the postprocessing phase.

Normally, all data directed to the DC-IBSYS system output unit by IBJOB will be printed on the 1403. Therefore, a \$SETUP

card with OU1 DISK,PRINT specified is unnecessary. The use of

\$SETUP OU1 DISK,PRINT,720

is optional and has no effect on DCMUP. For best performance it should not be used.

PUNCHING AN OUTPUT FILE: An output file is punched on the 1402 Card Read Punch when the following options are specified.

<u>option 1</u>	<u>option 2</u>	<u>Explanation</u>
DISK	PUNCH	Output intended for "unit" is written on the disk during the processing phase and punched on the 1402 during the postprocessing phase.

The records to be punched may be column-binary card images or BCD card images. Row-binary card images can be punched by a program reference to the 7090 punch (PCH).

Normally, all data directed by IBJOB to the DC-IBSYS system peripheral punch unit or to an on-line 7090 punch unit is punched on the 1402. Therefore, a \$SETUP card requesting these functions is unnecessary.

DEFINING AN INPUT UNIT FOR NON-DC-IBSYS SYSTEMS: The following specifications assign "unit" as the system input unit for systems other than DC-IBSYS.

<u>option 1</u>	<u>option 2</u>	<u>Explanation</u>
DISK	INPUT	"unit" is treated as the 7090 system input unit. Cards supplied through the 1402 (normal input) that follow \$EXECUTE cards with system name or TAPE specified are passed to the system when "unit" is read.

\$ASSIGN CARD

The \$ASSIGN card causes the specified system unit function to be assigned to a unit. The format of the \$ASSIGN card is:

1 16
\$ASSIGN SYSxxx

Selection of the unit is governed by whether a \$SETUP card referring to the same system function was included among the 7040 control cards for that job.

If a \$SETUP card was not used and if the specified system unit function has already been assigned, the \$ASSIGN card has no effect. Otherwise, a unit is selected from one of the unit availability chains in the DC-IBSYS nucleus and is assigned to the specified system unit function.

If a \$SETUP card was used, the unit control block that was assigned a unit symbol corresponding to the symbol on the

\$ASSIGN card is selected and assigned to the specified system unit function.

\$ATEND CARD

The \$ATEND card allows the programmer to specify action to be taken when a job is terminated. On all successful runs, the programmer will be given a dump of the 7090 panel and the location at which execution was terminated, regardless of the options he specifies. In addition, if the operator terminated the job because it appeared to be in a loop, a message indicating this fact will be printed. The status of the 7090 panel, and the location at which the program was terminated, is the only information provided for the programmer if the \$ATEND card is not included in the job deck.

Since a segment of a multiple segment job can be terminated by one of the actions described in the following text without termination of the entire job, more than one dump can result from the presence of a \$ATEND card.

A job may be terminated due to:

1. Operator action
2. An STR in the 7090
3. Invalid input/output commands
4. Any conditions encountered in a subsystem that cause termination of a job
5. Normal termination after execution has been successfully completed

The format of the \$ATEND card is:

```
1           16
$ATEND      [limit 1], [limit 2],
            [format], [DUMP], [POST]
```

The parameters are:

limit 1, limit 2

These are the limits of the area to be dumped in octal (00000-77777). If limits are not specified, a dump will not be taken.

format

This is the format of the dump. Valid entries are the digits 1-6, which will result in the dump formats described in "The System Core Storage Dump Program." If this parameter is omitted, a digit 3 is assumed.

DUMP

When DUMP is specified, the dump will be taken even if the job has been successfully completed. If this par-

ameter is omitted, a dump will be taken only at abnormal termination.

POST

When POST is specified, the IBJOB Debugging Postprocessor will be called if execution is terminated prior to completion. This will permit printing of any IBJOB debugging output that may have been produced before the job was terminated.

\$DATA, \$EOF, %EOF, AND % CARDS

The \$DATA, \$EOF, %EOF, and % cards perform the same function and may be used interchangeably. Each, when it appears in a deck being read from the card reader, causes an end-of-file condition to be simulated in the input buffer.

These cards are not recognized when they appear within the bounds of a \$ROW-\$ENDROW card group.

The format of the \$DATA, \$EOF, %EOF, and % cards is:

```
1
$DATA
$EOF
%EOF
%
```

\$ID CARD

The \$ID card is used for intrajob accounting purposes at installations that employ a 7090 installation accounting routine. It causes a transfer of control to the installation accounting routine. Upon exit from the accounting routine, the next card in the input file is read. The \$ID card is written on the system printer.

The format of the \$ID card is:

```
1       7-72
$ID    any text
```

The \$ID card may appear after a \$EXECUTE card with IBJOB specified. However, it should appear before a \$EXECUTE card that refers to a non-IBSYS subsystem, because it may not be recognized by that subsystem.

Columns 7 through 72 may contain any combination of alphameric characters and blanks.

tape ident

The tape ident parameter is the installation reel identification; that is, the identification written on a label affixed to the tape reel. It may be a maximum of six alphameric

characters. Any characters except blanks or commas may be used.

option 1, option 2, option 3
As shown below, these options depend upon the utility specified.

<u>utility name</u>	<u>option 1</u>	<u>option 2</u>	<u>option 3</u>
TPPR	form control	form ident	file count
TPPU	form ident	file count	
CDTP			

The form control parameter specifies the desired format and spacing of printed output. It may be any of the following.

PROGRAM
SINGLE
DOUBLE
720

If PROGRAM is specified, desired spacing must be provided in the program. If 720 is specified, the 720A printer will be simulated on a 1403 printer. If form control is not specified, PROGRAM will be assumed.

The form ident parameter defines the type of paper or cards to be used for output. Any available type, for example, 2PART or VELLUM, may be specified. A maximum of six characters is allowed. Any characters except blanks or commas may be used.

When DCMUP selects the job for processing, the \$UTILITY card is analyzed. If the form ident is not included, cards or paper currently ready will be used. If the form ident has been specified, the following message will be typed:

```
4 hmmmss JOB xxx READY xxxxxx
FORM ON { PRINTER n
          PUNCH }
```

The operator should take the printer or punch out of ready status, provide the proper paper or cards, and then return the unit to ready status. When these procedures have been performed, processing of the job will resume.

The file count is the number of files to be processed. If this option is omitted, a file count of 1 is assumed.

EXAMPLES OF DECK SETUPS

The following examples illustrate the use of control cards by showing some of the basic applications.

Figure 10 illustrates a deck setup for a FORTRAN compilation and an IBCMAP assembly. The job is given a priority of zero, is expected to run no more than three minutes, and should produce no more than 2,000 lines of printing.

```
1      8      16
-----
$JOB           ,3,2000
$EXECUTE       IBCJOB
$IBJOB
$IBFTC PROG1
.
. FORTRAN Source Program
.
$IBMAP PROG2
.
. MAP Source Program
.
$EOF
```

Figure 10. Sample Deck Setup--FORTRAN Compilation and IBCMAP Assembly

Figure 11 illustrates a deck setup for a one-segment FORTRAN compilation and execution with two IBLDR subroutines. The output, written on FORTRAN logical unit 8, will be in standard DCOS format and assigned the installation reel identification R365.

Figure 12 illustrates a deck setup for a two-segment job. The job will use an intersystem reserve unit, whose designation, in this case, is J(1). Data created by the first segment will be written on J(1). It will then be read by the second segment. Unit J(1) will be simulated on the disk, eliminating all setup that the operator would normally perform with the intersystem reserve tape. Unit SYSUT3 will be listed on the 1403 printer; unit SYSUT4 will be deblocked onto a reel given the installation reel identification R67748.

Figure 13 shows how an object program that was prepared for execution on a 7090 Data Processing System without the Direct Couple feature may be adapted for DCOS. The program, in the form of row-binary cards, was previously loaded into the 7090 through the 711 Card Reader when the LOAD CARD button was pressed. Input data consisted of cards following the program and tape reel R600 on 7090 unit A8. Output was written on 7090 unit B6. Since the program did not use 7090 units A1, A2, A3, or A4, a

```

1      8      16
-----
$JOB          3,6,1700
$SETUP 8      R365
$ATEND        03000,77777,1
$EXECUTE      IBJOB
$IJOB         MAP,GO
$IBFTC DECK1
.
.   FORTRAN Source Program
.
$IBLDR SUBR1
.
.   IBLDR Binary Object Program
.
$IBLDR SUBR2
.
.   IBLDR Binary Object Program
.
$DATA
.
.   Input Data
.
$EOF

```

Figure 11. Sample Deck Setup--One-Segment
FORTRAN Compilation and Execution

```

1      8      16
-----
$JOB          ,8,4000
$ID   PROJ. CHARGE NO. 87263A
$ATEND        00000,77777,1
|$*   OPERATOR MESSAGE-SET 7090 SSW1 ON
$PAUSE
$SETUP UT3    DISK,PRINT
$SETUP UT4    DISK,R67748
$ASSIGN       SYSUT3
$ASSIGN       SYSUT4
$EXECUTE      IBJOB
$IJOB         MAP,GO
$IJOBMAP SEG1
.
.   MAP Source Program
.
$DATA
.
.   Data for Segment 1
.
$EOF
$EXECUTE      IBJOB
$IJOB         MAP,GO
$IJOBMAP SEG2
.
.   IBLDR Binary Program
.
$DATA
.
.   Data for Segment 2
.
$EOF

```

• Figure 12. Sample Deck Setup--Two-Segment
Job

\$IOBASE control card is unnecessary; system unit function assignments made by DCOS in the absence of a \$IOBASE card have not been violated.

Figure 14 illustrates a deck setup for a program to be processed by a system on tape reel R200. The input unit for the system is A3, and both system listing and program listing output (B2 and B6) are under control of the system. IOBASE 1 is required, since 7090 unit A3 does not correspond in function with either IOBASE 0 or IOBASE 2. Also, 7090 unit A1 is referred to by a \$SETUP card, and, although its function (system library) corresponds with both IOBASE 0 and IOBASE 2, the system has not been edited onto the disk. Reel R200 has been blocked to the standard DCOS format by a 7040/7044 Operating System (16/32K) IBJOB Processor Tape Blocking utility routine.

```

1      8      16
-----
$JOB
$SETUP A8      R600,DISK
$SETUP B6      DISK,PRINT
$EXECUTE      CARDS
$ROW
.
.   Row-binary Card Loader
.
.
.   Row-binary Card Object Program
.
.
.   Input Data
.
$ENDROW
$EOF

```

Figure 13. Sample Deck Setup--Object Program on Cards

```

1      8      16
-----
$JOB
$IOBASE        1
$SETUP A1      R200
$SETUP A3      DISK,INPUT
$SETUP B2      DISK,PRINT,720
$SETUP B6      DISK,PRINT,720
$EXECUTE      TAPE
.
.   Source Program
.
$DATA
.
.   Input Data
.
$EOF

```

Figure 14. Sample Deck Setup--System on Tape

SYSTEM CORE STORAGE DUMP PROGRAM

The System Core Storage Dump Program is designed to (1) provide a core storage dump when difficulty is encountered and (2) facilitate the testing of programs. To perform these functions, post-mortem and snap dump options are provided.

The snap dump option (available only while operating under DC-IBSYS Monitor control) can dump one or more sequential locations of core storage during execution of an object program. After the snap dump is complete, core storage is restored and control is returned to that point in the object program from which the dump was called.

The post-mortem dump option (available to all programs) dumps core storage in the same manner as the snap dump option, but the limits of the dump are those specified in the \$ATEND control card.

When a dump is requested, a portion of core storage is saved. The dump program is then read into 7090 core storage, and control is transferred to it. Logical unit 13 is always used as the intermediate dump unit. The Core Storage Dump Program then writes the edited output onto the system output unit.

TRANSFER TO DUMP INSTRUCTIONS

To obtain a dump of core storage during execution of an object program, insert one of the following instructions in the body of the source program at the point at which the dump is required.

The instruction

```
TRA    SYSDMP  or
TSX    SYSDMP,4,1,
```

initiates the post-mortem processes specified on the \$ATEND card.

The instruction

```
TSX    SYSDMP,4
```

followed by a parameter control word results in a snap dump, in accordance with the information from the parameter control

word. Dumps are always taken from the low to the high location specified. For example, the following instruction and control word would result in an octal snap dump on the system output unit of storage locations beginning at STDMP and ending at ENDMP:

```
TSX    SYSDMP,4
PON    STDMP,,ENDMP
```

DUMP PARAMETERS

The dump parameters for a snap dump are entered by a parameter control word. Any one of six dump formats (Figure 15) can be specified. In the distributed version of the System Core Storage Dump Program, output is singled spaced. An asterisk (*) is inserted by the program when the following octal integers are printed in BCD: 15, 16, 17, 35, 36, 37, 55, 56, 57, 75, and 77. Record marks (72*) are replaced with blanks. The various parts of the parameter control word are interpreted as follows:

Prefix	PON	FORMAT 1--Octal, eight words per line.
	PTW	FORMAT 2--BCD, sixteen words per line.
	PZE,PTH	FORMAT 3--SQUEZY, mnemonics with address and tag field. If the dump program cannot interpret the operation code, an octal representation is given.
	MZE	FORMAT 4--Octal and SQUEZY. If the dump program cannot interpret the operation code, only the octal representation is given. Otherwise, both the octal word and the SQUEZY word are listed.
	MON	FORMAT 5--Octal and mnemonics
	MTW	FORMAT 6--octal, mnemonics, and BCD. BCD interpretation of the word is listed to the right of the mnemonic.

Address Starting or ending location of the dump.

Decrement Starting or ending location of the dump.

Notes: The limits of the requested dump may be stated in any order, i.e., the starting parameter in the address field and the ending parameter in the decrement field, or vice versa.

In the distributed version of the Core Storage Dump Program, the dump is always made onto the system output unit (SYSOU1) only.

A parameter control word of all zeros will provide a panel dump, and the contents of 7090 location zero.

MACHINE STATUS AT THE END OF A DUMP

At the completion of a Snap dump, all of core storage and all registers are restored. Although it is necessary to delay until all channel traps are inactive when taking Snap dumps under 7090/7094 IBSYS, it is unnecessary to do this under DC-IBSYS.

Format 1 -- Octal

AC	MQ	SENSE IND	KEYS	XR1	XR2	XR4
000000000000	000000000000	001321000000	000000000000	00001	00006	74320
						-03460
INDICATORS						
Q-BIT	P-BIT	TRAP	DCT	IOT	OFL	SENSE LIGHTS
OFF	OFF	OFF	OFF	OFF	ON	1 2 3 4
00000	100000000000	100000000000	042000000377	002000005557	002100003626	000000000000
00010	002100003632	000000000000	000000000000	002100000751	000000000000	002100000751
00020	000000000000	002100000751	000000000000	002100000751	000000000025	000060000024
00030	000000000031	000060000030	000000000033	000060000032	001321000000	000060000034

Format 2 -- BCD

AC	MQ	SENSE IND	KEYS	XR1	XR2	XR4
-300000005176	000000000000	101201300475	000000000000	00001	77323	71371
						-06407
INDICATORS						
Q-BIT	P-BIT	TRAP	DCT	IOT	OFL	SENSE LIGHTS
OFF	OFF	OFF	OFF	ON	ON	1 2 3 4
00000	DK90UT	800000	4+003* 0+00**	0A00*F	000000	000000
00020	000000	0A007R	000000	0A007R	00000E	00 00D
00040	000000	000000	000000	80008U	000000	80208U

Format 3 -- SQUEZY

AC	MQ	SENSE IND	KEYS	XR1	XR2	XR4
-300000005176	000000000000	101201300475	000000000700	00001	77323	71371
						-06407
INDICATORS						
Q-BIT	P-BIT	TRAP	DCT	IOT	OFL	SENSE LIGHTS
OFF	OFF	OFF	OFF	ON	ON	1 2 3 4
00000	244211006463	100000000000	HPR	377	TRA	5557
00010	002100003632	000000000000	HTR	TTR	751	HTR
00020	HTR	TTR	751	HTR	TTR	751

Format 4 -- Octal and SQUEZY

AC	MQ	SENSE IND	KEYS	XR1	XR2	XR4
-300000005176	000000000000	101201300475	000000000000	00001	77323	71371
						-06407
INDICATORS						
Q-BIT	P-BIT	TRAP	DCT	IOT	OFL	SENSE LIGHTS
OFF	OFF	OFF	OFF	ON	ON	1 2 3 4
00000	244211006463	100000000000	042000000377	002000005557	002100003626	000000000000
00010	002100003632	000000000000	HPR	377	TRA	5557
00020	000000000000	002100000751	000000000000	002100000751	000000000025	000060000024

Format 5 -- Octal and Mnemonics

AC	MQ	SENSE IND	KEYS	XR1	XR2	XR4
-300000005176	000000000000	101201300475	000000000000	00001	77323	71371
						-06407
INDICATORS						
Q-BIT	P-BIT	TRAP	DCT	IOT	OFL	SENSE LIGHTS
OFF	OFF	OFF	OFF	ON	ON	1 2 3 4
00000	244211006463	100000000000	042000000377	002000005557	002100003626	000000000000
00010	002100003632	000000000000	HPR	377	TRA	5557
00020	000000000000	002100000751	000000000000	002100000751	000000000025	000060000024
00030	000000000031	000060000030	000000000033	000060000032	101201300475	000060000034

Format 6 -- Octal, Mnemonics, and BCD

AC	MQ	SENSE IND	KEYS	XR1	XR2	XR4
-300000005176	000000000000	101201300475	000000000000	00001	77323	71371
						-06407
INDICATORS						
Q-BIT	P-BIT	TRAP	DCT	IOT	OFL	SENSE LIGHTS
OFF	OFF	OFF	OFF	ON	ON	1 2 3 4
00000	244211006463	100000000000	042000000377	002000005557	002100003626	000000000000
00010	002100003632	000000000000	HPR	4+003*	TRA	0+00**
00020	000000000000	002100000751	000000000000	002100000751	000000000025	000060000024
00030	000000000031	000060000030	000000000033	000060000032	101201300475	000060000034

Figure 15. Core Storage Dump Formats

The Direct Couple Input/Output Executor (DC-IOEX) is used by DC-IBSYS subsystems for supervision of input/output activity. The programmer need not be familiar with DC-IOEX and the manner in which it functions if he uses the FORTRAN, COBOL, or IBCMAP (with Library IOCS) languages. Although each of these languages relies on DC-IOEX, the programmer need only be familiar with the languages, not with the detailed coding they generate to handle input/output activity.

The programmer may, however, communicate directly with DC-IOEX if he writes his programs in the MAP language. In this way he may reduce the number of core storage locations used and may also decrease execution time.

DC-IOEX consists of a direct couple channel trap supervisor and a number of utility routines. The primary functions of DC-IOEX are (1) to construct a description of the desired input/output request in a location within 7090 core storage and (2) to schedule the processing of requests for input/output operations. Both the trap supervisor and the utility routines may be used by the programmer. Basically, use of the trap supervisor minimizes input/output coding and ensures proper coordination of

trapping. The utility routines include a message writer and several conversion routines.

DC-IOEX COMMUNICATION REGION TABLE

The DC-IOEX communication region table (shown in Figure 16) is a series of locations starting at 702, most of which, when addressed, cause a transfer of control to a specific DC-IOEX routine. In the discussions that follow, references are made to symbolic addresses of entries in the table. The reader should keep in mind that all communication with DC-IOEX is made through the DC-IOEX communication region table.

Two symbolic addresses are shown in Figure 16 for each entry. The user of the FORTRAN Assembly Program (IBSFAP) should refer to the entries by using the FAP symbolic addresses. The user of the Macro Assembly Program (IBMAP), in relocatable mode, should refer to the entries by using the MAP symbolic addresses. In the discussions that follow, MAP symbolic addresses of DC-IOEX communication table entries are used. Corresponding FAP addresses may be obtained from Figure 16.

Octal Address	MAP Symbolic Address	FAP Symbolic Address	IOEX Entry	Function
702	.ACTV	(ACTIV	TTR TEST	Activate Routine and Test
703	.ACTV+1	(ACTVX	TTR ACTIV	Activate Routine Without Test
704	.NDSEL	(NDATA	TTR TEST	Non-Data Select and Test
705	.NDSEL+1	(NDSLX	TTR NDATA	Non-Data Select Without Test
706	.MWR	(PROUT	TTR PROUT	Message Writer
707	.PUNCH	(PUNCH	TTR PUNCH	Alphameric Punch
710	.ENBSW	(ENBSW	PZE **	Enable Switch
711	.PAWS	(PAWSX	TTR PAWS	Error Pause
712	.PAUSE	(PAUSE	TTR PAUSE	Operator Action Pause
713	.STOP	(STOPX	TTR STOP	Termination Procedures
714	.SYMUN	(SYMUN	TTR SYUNCV	Symbolic Unit Conversion
715	.DECVD	(DECVD	TTR BCVDEC-1	Binary to Decimal - AC Decrement
716	.DECVA	(DECVA	TTR BCVDEC	Binary to Decimal - AC Address
717	.CKWAT	(CKWAT	TTR CKWAIT	Checkpoint Wait (not used in DCOS)
720	.BCD5R	(BCD5R	TTR BCD5-1	Binary to BCD Octal, bits 3-17 of MQ
721	.BCD5X	(BCD5X	TTR BCD5	Binary to BCD Octal, Bits 1-14 and S of MQ
722	.CVPRT	(CVPRT	TTR CVPRT	Convert and Append Unit Designation to Message
723	.STOPD	(STOPD	TTR STOPD	Job Termination Procedures
724	.CHXAC	(CHXAC	PZE CHXAC	Channel Activity (Indirect Reference)
725	.URRX	(URRXI	PZE URRX,1	Redundancy Count (Indirect Reference)
726	.RCTX	(RCTXI	PZE RCTX,1	Redundancy Control (Indirect Reference)
727	.RCHX	(RCHXI	PZE RCHX,1	Reset Load Channel (Indirect Reference)
730	.TCOX	(TCOXI	PZE TCOX,1	Channel Delay (Indirect Reference)
731	.TRCX	(TRCXI	PZE TRCX,1	Tape Redundancy Test (Indirect Reference)

• Figure 16. DC-IOEX Communication Table

Octal Address	MAP Symbolic Address	FAP Symbolic Address	IOEX Entry	Function
732	.ETTX	(ETTXI	PZE ETTX,1	End-Tape Test (Indirect Reference)
733	.TEFX	(TEFXI	PZE TEFX,1	End-File Test (Indirect Reference)
734	.TRAPX	(TRAPX	PZE (TRAPS	Current Traps Enabled (Indirect Reference)
735	.TRAPS	(TRAPS	OCT 377	Current Traps Enabled
736	.COMM	(COMMM	PZE **,,**	Store Channel Results at Trap
737	.LTPOS	(LTPOS	PZE **,,**	Tape Position before Last EOF Trap
740	.IOXSI	(IOXSI	PZE **,,**	Sense Indicators at Trap
741	.CHPSW	(CHPSW	PZE **	Checkpoint Switch
742	.TRPSW	(TRPSW	PZE **	Trap Switch
743	.FDAMT	(FDAMT	TTR STOP	Termination Procedure
744	.SDCXI	(SDCXI	PZE SDCX	SDCX Table (not used in DCOS)
745	.STCXI	(STCXI	PZE STCX	STCX Table (not used in DCOS)
746	.COMMD	(COMMD	PZE **	(not used in DCOS)
747	.IBCDZ	(IBCDZ	TSX STOP,4	(not used in DCOS)
750	.CHXSP	(CHXSP	PZE CHXSP	Priority Switch Table (Indirect Reference)

• Figure 16. DC-IOEX Communication Table (continued)

UNIT CONTROL BLOCK

WORD 1

A four-word block of information, called a unit control block (UCB), is generated at job initialization time for each 7090 input/output device that may be simulated by the 7040. Each UCB is used for storing information pertaining to a specific input/output unit being simulated and for activity on that unit. The format of a unit control block is shown in Figure 17.

R is the reserve status flag (intersystem use only). When R=0, the unit is not reserved. When R=1, the unit is reserved and the address portion of word 1 contains data for intersystem pickup.

The unit address is the BCD mode address of the unit, e.g., 1201 for tape unit A1.

Each unit control block contains the following fields:

EOT is the end-of-tape flag. When EOT=1, end of tape has been assigned to the unit. When EOT=0, end of tape has not been assigned to the unit.

USING THE DC-IOEX TRAP SUPERVISOR

The following steps describe the manner in which the programmer may use DC-IOEX to schedule his input/output requests.

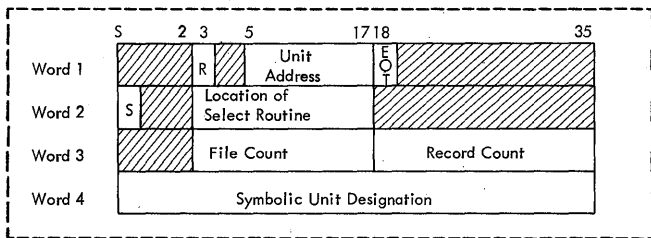


Figure 17. Unit Control Block

WORD 2

S is the select type. When S=0, a read operation is indicated. When S=1, a write operation is indicated.

The location of user's select routine is placed in bits 3 through 17.

WORD 3

The file count reflects the number of file marks written on or read from the unit.

The record count reflects the number of records that have been written on or read from the current file.

The file count and the record count are affected by all tape movement instructions.

WORD 4

The symbolic unit designation (BCD with leading zeros) obtained from the \$SETUP card is placed in word 4. For example, if the \$SETUP card contained A(1), the following would be placed in word 4:

0021740134

Word 4 is also used by IOCS labeling routines for storing the tape reel serial number for multifile reels.

MAINTENANCE OF UNIT CONTROL BLOCK FIELDS

The unit address and symbolic unit designation are placed in each UCB at job initialization time. The end-of-tape flag and the file and record counts are maintained by DC-IOEX. The programmer must maintain word 2 (select type and location of select routine).

DETERMINING THE AVAILABILITY OF A UNIT

Before the user can request input/output activity for a unit, he must establish its availability. A unit is available for new input/output activity when word 2 of its UCB contains zeros. The following routine is an example of the manner in which the availability of a unit may be determined.

```
AXC **,2    LOCATION OF UCB
            (COMP.) TO IR2
ZET 1,2    IS WORD 2 CLEAR?
TRA *-1    NO, TRY AGAIN
```

When the unit becomes available, the user should place the select type and the location of his select routine in word 2 of the UCB, as shown in the following example.

```
AXC **,2    LOCATION OF UCB
            (COMP.) TO IR2
CAL SELRTN STORE SELECT TYPE
            AND LOC. OF SELECT
            ROUTINE IN WORD 2
.
.
SELRTN pfx 0,,location of select
```

Select type is indicated by pfx, which should be PZE for read; MZE for write.

CALL TO DC-IOEX

The user indicates to DC-IOEX that activity on a unit is desired, and that UCB contains the address of a select routine, by using the following calling sequence:

```
TSX .ACTV,4
pfx a,t
return
```

When pfx = MZE, the unit is given a priority, that is, the select routine is entered when the current input/output operation is complete, regardless of any non-priority requests that are waiting. When pfx = PZE, the select routine is entered when the activity is scheduled for the unit and any priority request has been completed.

The parameter a,t is the location whose address contains the location of the UCB for the unit. If the unit is a system unit, parameter a,t may be the address of its system unit function table entry.

SELECT ROUTINES

DC-IOEX transfers control to a user-written select routine twice. The first entry, called the select plus entry, is made when the unit is scheduled for input/output activity on the DC channel. The second entry to the user's select routine, called the select minus entry, is made when the activity has been completed. The user may distinguish between the entries by testing the sign of the accumulator.

Upon entry to the select routine, DC-IOEX disables trapping and provides:

- C (IR1) In compatibility mode, IR1 contains the 2's complement of the channel identifier (0=A, 1=B, etc.). In direct mode, IR1 contains a +1.
- S (AC) Sign of the accumulator is plus for the select plus entry, minus for the select minus entry.
- A (AC) The address portion (bits 21-35) of the accumulator contains the location of the UCB.

SELECT ROUTINE EXITS

Three exits from the select routine are available.

- Return 1 TRA 1,4 Normal exit (Select plus)
- Return 2 TRA 2,4 Not to be used in DCOS. Provided only for compatibility with programs written for a standard 7090 Data Processing System.
- Return 3 TRA 3,4 The select plus entry for the record will be entered again after a back-space for the record.

LOCATION MODSW

An entry in the DC-IBSYS Nucleus communication region, MODSW, indicates to DC-IOEX the mode (BCD or binary) of the next record to be transmitted from the 7040. MODSW should only be used in direct-mode operation, and its contents should only be changed during the select plus entry to the select routine.

MODSW is equal to 0 The next record to be transmitted is a BCD record.

MODSW is not equal to 0 The next record to be transmitted is a binary record.

DC-IOEX sets MODSW to nonzero when entering the select routine (select plus entry); therefore, a binary record is normally expected.

DESIGN OF SELECT ROUTINES, SELECT PLUS ENTRY

During the first, or select plus, entry to the select routine, the user should provide DC-IOEX with the location of his input/output commands. This is done through the DC-IOEX communication table entry, .RCHX, which contains the address of the location in DC-IOEX reserved for the input/output commands.

The following is an example of a select routine for the select plus entry in direct-mode operation.

```

TMI SELMIN TEST FOR SELECT
                                MINUS
CLA IOPTR LOCATION OF INPUT/
                                OUTPUT
STA* .RCHX COMMAND TO DC-IOEX
TRA 1,4 RETURN TO DC-IOEX
IOPTR PZE location of input/output
                                command

```

Note: An input/output instruction (RDS, WRS, etc.) is not used. Input/output instructions are not to be used in direct-mode operation. However, in the compatibility mode, the user must specify an input/output instruction within his select routine.

The following is an example of a select routine for the select plus entry in compatibility mode.

```

TMI  SELMIN  TEST FOR SELECT
      MINUS
STA  **1     PLACE UNIT
CLA  **      ADDRESS
ARS  18      IN
STA  SELCT   SELCT
CLA  IOPTR   LOCATION OF
      INPUT/OUTPUT
      COMMAND TO DC-IOEX
SELCT STA* .RCHX
      RDS   **
      XEC* .RCHX  EXECUTE RCHX
      INSTRUCTION
      TRA  1,4  RETURN TO DC-IOEX
IOPTR PZE   location of input/output
      command

```

An entry in the DC-IBSYS Nucleus communication region, CHEXI, contains the address of a location that may be tested indirectly to determine whether a program is being executed in direct or compatibility mode. The location contains zeros when a job is being processed in the direct mode.

The following is an example of a select routine for the select plus entry in which the mode of operation may be either direct or compatibility, and the record is to be in BCD mode.

```

TMI  SELMIN  TEST FOR SELECT
      MINUS
STA  **1     PLACE UNIT
CLA  **      ADDRESS
ARS  18      IN
STA  SELCT   SELCT
NZT* CHEXI   SET BCD MODE
STZ  MODSW   FOR DC-IOEX
CLA  IOPTR   LOCATION OF
      INPUT/OUTPUT
      COMMAND TO DC-IOEX
SELCT STA* .RCHX
      ZET* CHEXI  DIRECT MODE ?
      RDS   **
      NO, EXECUTE RDS
      (MODE IN ADDRESS)
      XEC* .RCHX  YES, EXECUTE RCHX
      INSTRUCTION
      TRA  1,4  RETURN TO
      DC-IOEX
IOPTR PZE   location of input/output
      command

```

When in direct mode, the XEC* instruction results in the execution of a NOP instruction. The facility is provided solely for compatibility with programs written for a standard 7090 Data Processing System.

DESIGN OF SELECT ROUTINES, SELECT MINUS ENTRY

If the sign of the accumulator is minus when the select routine is entered, the activity on the unit has been completed.

If no further activity is desired, the user may relinquish control of the unit by clearing word 2 of the UCB.

The following is an example of a select routine for the select minus entry in which control of the unit is relinquished.

```

SEL   TMI  SELMIN
      .
      .
      .
SELMIN PAC  0,2  LOCATION OF UCB
              (COMP.) TO IR2
              CLEAR WORD 2
              OF UCB
      STZ  1,2
      TRA  1,4  RETURN TO DC-IOEX

```

SENSE INDICATORS

When the select minus entry to the select routine is made, the sense indicators will contain the following:

```

Bit 5      Always 1.

Bit 1      End-of-file (read) or end-of-tape (write) indicator. If bit 1 is 0, either an end-of-file (or end-of-tape) condition was not sent from the 7040 or the end-of-tape bit in the 7090 unit control block is 0.

Bit 2      Read redundancy indicator. If bit 2 is a 1, the record was read in a mode other than the mode in which it was written.

```

SUPPRESSION OF THE IOEX REDUNDANCY MESSAGE

Printing of the message

```

9 hhmms  UNIT xx FILE xxxxx REC
          xxxxx PERMANENT READ
          REDUNDANCY

```

is suppressed if a 1 is placed in bit 1 of the second word in the unit control block when the location of the select routine is inserted in word.2.

LOCATION .COMM

When the select minus entry to the select routine is made, location .COMM of the DC-IOEX communication table contains the following:

Bits 5,1-2 Prefix of last input/output command simulated by the 7040.

Bits 3-17 Location+1 (in 7090 core storage) of last input/output command simulated by the 7040.

Bits 18-20 Bits 18 and 20 are set to zero. Bit 19 is set equal to bit 19 of the command in the channel register.

Bits 21-35 Location+1 (in 7090 core storage) of last word transmitted.

TSX .NDSEL,⁴
PZE a,t,oper
return

The parameter a,t is the location whose address contains the location of the UCB for the unit. If the unit is a system unit, parameter a,t may be the address of its entry in the system unit function table. The parameter oper is interpreted as follows:

oper	Operation
0	NOP
1	SDNL ¹
2	SDNH ¹
3	REW
4	RUN
5	BSR
6	BSF
7	WEF ²

GENERAL CONSIDERATIONS IN THE DESIGN OF SELECT ROUTINES

If the sign of the accumulator is plus when the select routine is entered, the routine must provide DC-IOEX with location of a data select command sequence. The last command in the sequence must be a trap-type command (IOxT). Trapping should not be enabled within the select routine.

Select routines must not destroy the contents of index register 1 or change the unit address in the decrement portion of word 1 in the unit control block.

Redundancy checking and error-recovery procedures are performed by DCMUP. No error-recovery procedures are initiated by DC-IOEX.

NONDATA SELECTS

Nondata selects are executed by the routine .NDSEL. The calling sequence is:

Non-data selects are executed as soon as present activity on the unit is complete. Return is made to the user's program only after the non-data select has been executed. Location .NDSEL may not be entered from the user's select plus routine.

¹Not recognized by DCOS. Provided solely for compatibility of programs written for a 7090 Data Processing System without the DC feature. Each of these operations is interpreted as a NOP.

²Normal return for WEF is 3,4. The 2,4 return is the end-of-tape exit.

DC-IOEX UTILITY ROUTINES

Several DC-IOEX routines that are available to subsystems operating under control of the DC-IBSYS Monitor may be used to advantage by the programmer. Entry into these routines is made through the DC-IOEX communication table (Figure 16). The routines described here are:

.MWR	Message Writer ³
.PUNCH	Alphameric Punch ³
.STOPX	Post-Mortem Dump
.DECVD	Binary-to-Decimal Conversion--AC Decrement
.DECVA	Binary-to-Decimal Conversion--AC Address
.BCD5R	Binary-to-BCD Octal Conversion--MQ Decrement ³
.BCD5X	Binary-to-BCD Octal Conversion--S,1-14 of MQ ³
.PAUSE}	Pause Routines
.PAWS }	
.SYMUN	Symbolic Unit Conversion
.CVPRT	Convert and Add Unit Designation to Message

MESSAGE WRITER

The routine .MWR may be used to write a message either off-line only or off-line and on-line. Off-line messages are written on the 1403 Printer during the postprocessing phase. On-line messages are written on either the 1014 Remote Inquiry Unit or the console typewriter, depending on specifications in the user's calling sequence.

The calling sequence for .MWR is:

```
TSX      .MWR,4
pfx      no,,class
p        loc1,t1,m1+512*sp
p        loc2,t2,m2+512*sp
.
.
.
p        locn,tn,mn+512*sp
```

The parameters have the following meanings:

³Trapping is enabled prior to exit from these routines. If trap mode is not desired after exit, set the address portion of the DC-IOEX communication table entry .ENBSW to nonzero before entering these routines. Then reset the address portion of .ENBSW to zero after exit from the routines unless calling them from a select routine.

pfx

If bit position 1 of pfx is 0, the message is written off-line only; if bit position 1 of pfx is 1, the message is written off-line and on-line. Therefore, the following choice is given:

PZE}	
MZE}	The message is written
PON}	off-line
MON}	
PTW}	
MTW}	The message is written
PTH}	off-line and on-line
MTH}	

no

no is the number of entries in the calling sequence following the entry in which it appears.

class

If class is 0, the message is written on the 1014 Remote Inquiry Unit. If class is 1, the message is written on the 7040 console typewriter. The parameter class is not checked if the message is to be written off-line (1403 Printer) only.

loc,t,m

m words (six characters each), beginning in location loc,t, are placed in the message.

p

If p=PZE, the message is considered complete.

If p=MZE, the message is considered incomplete and loc,t,m of the next entry are used to continue the line.

sp

This parameter is used to effect spacing on the 1403 Printer.

If sp=0, a single space will occur after the message is written.

If sp=1, the printer will skip to a new page after the message is written.

If sp=4, a double space will occur after the message is written.

The parameter sp need not be specified if the line is incomplete. Spacing before a line is printed may be caused by:

```
PZE      **,512*sp
```

which will write a blank line followed by the spacing indicated by sp.

MESSAGE LENGTH

The maximum length of one line of a message is 72 characters. If more than 72 characters are specified, the message is truncated. Each message is preceded by a 12-character identifier of the form

b9*hhmssbcb

where b represents a blank, * signifies that the message is pertinent to the operator, 9 identifies the message as having been originated by DC-IOEX, c identifies the class assigned, and hhmss indicates the time of day (hour, minute, second) that the message is written.

ALPHAMERIC PUNCH

The entry

TSX .PUNCH,4

with a calling sequence similar to that for .MWR causes BCD cards to be punched on the 1402 Card Read Punch. However the parameters pfx and 512*sp are ignored in this case. Each card is limited to 72 BCD characters. Cards are punched during the postprocessing phase.

POST-MORTEM DUMP

The instruction

TSX .STOPX,4

causes a post-mortem dump of 7090 core storage in accordance with limits specified on the \$ATEND control card.

The dump will be taken only if the DUMP option is specified on the \$ATEND card. The job is terminated when the above instruction is encountered. The POST option of the \$ATEND card is ignored.

BINARY-TO-DECIMAL CONVERSION--AC DECREMENT

The instruction

TSX .DECVD,4

converts the binary number in the decrement of the AC to its BCD equivalent. The results are located in the low-order positions of the MQ. The high-order character

in the MQ is a BCD blank. The previous contents of both the AC and the MQ are destroyed. Control is returned to 1,4.

BINARY-TO-DECIMAL CONVERSION--AC ADDRESS

The instruction

TSX .DECVA,4

has the same function as .DECVD except that the address portion of the AC is converted.

BINARY-TO-BCD OCTAL CONVERSION--MQ DECREMENT

The instruction

TSX .BCD5R,4

converts the binary number in the decrement of the MQ to its octal equivalent in BCD octal. The results are located in the low-order position of the AC. The high-order character in the AC is a BCD blank. Control is returned to 1,4. The previous contents of both the AC and MQ are destroyed.

BINARY-TO-BCD OCTAL CONVERSION--S,1-14 OF MQ

The instruction

TSX .BCD5X,4

has the same function as .BCD5R except that bit positions S and 1-14 of the MQ are converted.

PAUSE ROUTINES

The instruction

TSX .PAUSE,4,1

causes the 7090 to stop and the message

9*hhmss 0 PAUSE

to be written on-line (1014 or console typewriter) and off-line (1403). The operator may restart the 7090 through the 7040 console, in which case the message

9*hhmss 0 PROCEEDING

is generated.

The instruction

```
TSX .PAUSE,4
```

causes the message

```
9*hhmmss PAUSE IGNORED.  
PROCEEDING
```

to be written off-line (1403).

The instruction

```
TSX .PAWS,4,1
```

causes the 7090 to stop and the message

```
9*hhmmss 0 PAWS
```

to be written on-line (1403 or console typewriter) and off-line (1403). The operator may restart the 7090 through the 7040 console. This message should only be used when a choice of actions is given the operator, since the message is recognized by the operator as requiring a decision. If the 7090 is restarted, the message

```
9 hhmmss 0 PROCEEDING
```

is generated.

The instruction

```
TSX .PAWS,4
```

causes the message

```
9 hhmmss 0 PAWS IGNORED. PROCEEDING
```

to be written on-line (1014 or console typewriter) and off-line (1403).

SYMBOLIC UNIT CONVERSION

The instruction

```
TSX .SYMUN,4
```

converts the unit address located in the decrement of the MQ to its BCD equivalent (e.g., 1203=A3). The results, straddled by any necessary BCD blanks, are located in the AC upon return to 1,4.

CONVERT AND ADD UNIT DESIGNATION TO MESSAGE

The words "UNITxxxxxx", where xxxxxx is the 7090 unit address, can be added to a message by the calling sequence below, after placing the unit address, in binary, in the decrement of the MQ.

```
TSX .CVPRT,4  
pfx loc,t,m+512*sp
```

where pfx is interpreted in the same way as the pfx immediately after the TSX .MWR,4 in the calling sequence for the Message Writer. The remainder of the control word (loc,t,m+512*sp) is interpreted the same way as in the control words in .MWR. The unit address, xxxxxx is converted to BCD before printing.

GENERAL PROGRAMMING CONSIDERATIONS

This section contains a summary of the rules and considerations to be followed by the programmer in planning existing 7090 jobs for DCOS processing and writing programs to be run on the Direct Couple Operating System.

DIRECT- AND COMPATIBILITY-MODE SYSTEMS

1. The system output unit (SYSOU) should only be used as the system print file, since all files written on it are normally printed on the system printer (1403).
2. The system peripheral punch unit (SYSPP) should be used only as a system punch file, since all files written on it are normally punched on the system punch (1402) and must be in the form of unblocked card-image records. BCD card images longer than 14 words and binary card images longer than 28 words will cause the job to be terminated and the message

```
4 hhhmss  JOB xxx ON PUNCH DISCON-  
          TINUED
```

to be typed.

3. DCMUP causes a tape mark to be written when an output file is rewound. Therefore, the user may not read a file beyond the last record written on that file, since all data beyond the area written is lost. An output operation on a file currently in use as an input file causes the remainder of the input data to be lost.
4. The 7040 console and the 1014 Remote Inquiry Unit are the primary means of communication between the operator and DCOS. The programmer should minimize his use of 7090 console switches and keys.
5. All set-density instructions issued from the 7090 are ignored since the 7040 does not have a set-density instruction.
6. When the instructions

```
HTR      0  
HTR      *
```

are encountered, or the sequence

```
HPR  
TRA      *-1
```

is encountered, the 7090 stops and the job is terminated. Therefore, the above coding should not be used for intermediate halts.

7. Labeled files should not be written on units simulated on the disk, unless a label has been previously written on the disk; any attempt by IOCS to check the content of the label (e.g., retention date) will result in termination of the job and printing of the message:

```
4*hhmmss  UNIT xx READING BEYOND  
          VALID INPUT
```

Labels may be written on disk storage at the start of a job by using \$SETUP cards in the following form:

```
$SETUP unit IDENT,DISK
```

where: IDENT refers to a tape reel that has a blank label.

8. A record mark is printed by the 7040 whenever octal combination 12 is encountered during a print operation.
9. All symbolic unit assignments are made on a first available unit control block basis, without regard to 7090 channels; real channel specifications are treated as symbolic unit requests.
10. Programs which rely on an end-of-tape condition must assign the file to a tape. By the time the 7090 receives an end-of-tape indication, the 7040 may have a queue of output activity pending for the tape which is at end. Except where the 7040 tape drive is operated at 200 bpi, there will be sufficient tape beyond the reflective marker to accommodate the maximum number of output requests still in the 7040 queue for that unit. However, if the 7090 continues to write on that file after it receives an end-of-tape indication, it could, under some circumstances, exceed the capacity of the reel. Programs that read multi-reel tape files produced by the tape-to-tape blocking or card-to-tape utility routines must be able to recognize an end-of-tape condition. The utility routines write an end-of-file mark on the output tape whenever the end-of-tape condition is detected.
11. Receipt by the 7090 of a redundancy indication means that either (a) the 7090 tried to read a binary record in BCD mode or a BCD record in binary mode; or (b) the record was truly

redundant. In the design of redundancy-handling subroutines, it must be kept in mind that the 7090 input/output instructions do not control input/output devices directly. Therefore, the only meaningful redundancy handling is for the routine to try one backspace with a reread in the opposite mode. If a redundancy is again indicated, it is treated by the 7090 as a permanent redundancy. Tape records which are unreadable during execution of the tape-to-tape or tape-to-disk deblocking utility routines

will not cause termination of the job during setup. Upon reading such records the 7090 will receive a simulated redundancy signal. The record will be transmitted to the 7090 as read during the blocking operation.

12. All 7090 tape units referred to within a program that require a tape to be mounted must be determined and must be specified on the \$SETUP card. Therefore, difficulty may be encountered with programs that employ variable or symbolic unit assignment procedures

other than those allowed by IBJOB on the \$FILE control card.

13. Except for those halts described in item 6 of the section "Direct- and Compatibility-Mode Systems," DCOS performs one of the following actions on programmed intermediate 7090 halts: (a) If 7040 sense switch 2 is off and the stop is the second successive stop at the same location, the job is terminated. (b) If 7040 sense switch 2 is off and the stop is not at the same location as the previous halt, the 7090 is restarted automatically. (c) If 7040 sense switch 2 is on, the 7090 remains stopped; 7090 processing of the job should be resumed by the operator.
14. In addition to causing the 7090 to halt on programmed intermediate halts, 7040 sense switch 2 controls the printing of messages. If it is off (normal mode), only the messages that are considered operator-pertinent appear on-line on the 1014. If sense switch 2 is on, all 7090 messages intended for the 716 Printer are printed on-line as well as off-line.

This provides the programmer with the facility to instruct the operator to set 7090 sense switches and 7090 entry keys in the course of 7090 execution. This should only be done when it is not practical to reprogram to eliminate the need for sense switch and entry key settings.

In order to set the switch initially, the programmer should precede his \$EXECUTE card with a \$PAUSE card instructing the operator to set sense switch 2 on.

The programmer should assume the responsibility for instructing the operator, via a programmed halt and message, to set sense switch 2 off when it is no longer needed.

DIRECT-MODE SYSTEMS

1. System messages written to the operator by the DC-IOEX Message Writer are classified as being either operator pertinent or non-operator pertinent. However, if an existing 7090 program uses the Message Writer directly, the message will be classified as being non-operator pertinent.
2. The 7090 is restarted automatically for all halts except those caused by sense switch 2 (item 13 above), those caused by a \$PAUSE card preceding a \$EXECUTE card, those caused by direct calls to the .PAUSE or .PAWS routines of DC-IOEX, and those caused by the

instructions described in item 6 of the section "Direct- and Compatibility-Mode Systems." The halts described in item 6 are considered as the end of the job, and a new job will be brought in.

COMPATIBILITY-MODE SYSTEMS

1. A job to be processed in the compatibility mode by a non-DC-IBSYS system may not consist of more than one segment unless all preceding segments are DC-IBSYS subsystems. A non-DC-IBSYS segment is always considered to be the last segment of a job.
2. An RDS instruction for the 716 Printer is treated as a NOP; therefore, echo checking and routines relying on echo checking should not be used.
3. The following instructions are treated as NOPS, and routines relying on their execution should not be used.

WPBA Write Printer Binary

SPR Sense Printer
(716 Printer)

SPU Sense Punch
(721 Card Punch)

RDCx Reset Data Channel x

4. Any references to the 7909 Data Channel will cause an input/output check condition. The 7909 Data Channel is not simulated by DCOS.
5. Only standard devices that may be attached through a 7607 Data Channel are simulated by DCMUP.
6. Programs that are dependent upon the physical speed of input/output devices may not execute properly.
7. Because of the existence of a single DC channel, simultaneous operation of separate channels is not performed. An operation is not performed until the previous one is complete. Programs dependent on this type of operation will not work. For example:

RDS (channel A)
RCHA Y (Y = IOxT a, b)
RDS (channel B)
RCHB Z (Z = IOxy 1, n)
LCHA

will not work in compatibility mode when the 7090 is enabled for data channel trapping, because the 7090 CPU cannot execute an HPR instruction upon decoding the RDS for channel B until the IOxT has been completed. Completion

tion of the first IOxT for channel A (since no LCHA is waiting) will cause a data channel trap at the location of the RDS for channel B. The compatibility simulation assumes that this type of sequence is not attempted; in the above sequence, the LCHA would be treated by DCOS as an LCHB. DCOS extends this philosophy to all RCHx instructions. A select instruction followed by a RCHx for a different channel will be interpreted as if the RCHx were for the selected channel. Hence, the sequences

RTDA 3
RCHB ALPHA

and

RTDA 3
RCHA ALPHA

are equivalent in DCOS simulation.

8. Since a channel always appears to be inactive in response to channel test operations on the 7090, a channel test procedure that is used to alter the course of 7090 activity when the channel is busy requires reprogramming.
9. Programs that control their own 7090 channel interrupts should observe two conditions of DCOS simulation:
 - a. To simulate a 7090 channel trap while the 7090 is held on an ENB, DCMUP issues an SRC (Start Remote Computer) instruction followed immediately by an MPT (Multiprocess Trap) instruction. In the interim between these two 7040 instruc-

tions, the 7090 will execute at least five instructions, all of which are effectively exempt from interrupt. Therefore, programs should not assume that a trap will occur on the second instruction following an ENB.

- b. A stand-alone 7090 processes a channel interrupt by performing a remote execution of the contents of the channel trap location; this location need not necessarily contain a transfer instruction. However, DCOS simulates the trap by an actual transfer to the trap location; therefore, it must contain a true transfer instruction.

10. If any of the following commands appear between an RCHx and a subsequent LCHx, the input/output command specified by the LCHx will process data in the record following that record processed by the last command in the RCHx sequence.

TRCx
TCNx
TCOx
TEFx
ENB

11. An RCHx following an RCHx may sometimes work on a standalone 7090, but in DCOS this sequence, if attempted, will cause job termination with the message

ILLEGAL OP CODE 04.

GUIDE TO 7090 OCTAL DUMP INTERPRETATION

The following information is provided to assist the programmer in interpreting a 7090 core storage dump to determine the status of the system at the time the dump was taken. The material is presented in tabular form. It identifies key locations that appear in a dump and that could be considered starting points for debugging. The programmer should refer to a listing of the output from a core storage dump while reading this section.

Two types of locations are discussed: those that are permanently assigned functions because of the nature of the machine, and those that are assigned functions by DC-IBSYS.

NON-DC-IBSYS JOBS

The DC-IBSYS Core Storage Dump Program is used for all 7090 core storage dumps, whether or not a DC-IBSYS subsystem is in control. DC-IBSYS, however, does not reside in 7090 core storage while non-DC-IBSYS jobs are being processed.

If a system other than DC-IBSYS is in control when a dump is taken, the contents of the panel, which appear at the beginning of each dump, show the value of the 7090 location counter plus one. All locations except those assigned machine functions will reflect the functions assigned to them by the system in control.

Key Machine Locations

<u>Location (octal)</u>	<u>Comment</u>
00000	Bits 21-35 contain the value in the location counter plus one when the last transfer trap of floating-point trap or STR occurred.
00001	Contains the address of the location to which control was transferred when the last transfer trap occurred.
00002	Contains the instruction to be executed when an STR (Store Location and Trap) instruction is encountered during processing.
00003	Bits 21-35 contain the value in the location counter plus one when

the 7040 last trapped the 7090 while it was in direct mode.

00004 Contains the instruction to which control was transferred when the 7040 last trapped the 7090. This is always a transfer to a location in the DC-IOEX Trap Supervisor.

00010 Contains the address of the location to which control was transferred when the last floating-point trap occurred.

Location (Octal) Comment

00012,00013 (A)	Channel trap locations.
00014,00015 (B)	Data channel trapping
00016,00017 (C)	is simulated for channels A-D when in compatibility mode.
00020,00021 (D)	
00024,00025 (F)	
00026,00027 (G)	
00030,00031 (H)	

40000 Contains the value in the location counter plus one when the last select trap occurred.

40001 Contains the address of the location to which control was transferred when the last select trap occurred.

The user is not responsible for maintaining these locations. DC-IBNUC and DC-IOEX maintain them for DC-IBSYS subsystems. These locations are cleared to zero prior to loading of non-DC-IBSYS systems.

DATA CHANNEL-TRAP SIMULATION

DCOS, when simulating a data channel trap, places the value of the 7090 location counter plus one into bits 21-35 of the even-numbered channel-trap location of the appropriate channel. In addition, bits 15-17 are set as follows:

bit 15=1	An EOF or EOT was encountered.
16=1	A redundancy was detected.

17=1 An IOCT, IOST, or
 IORT was completed
 with no LCH (load
 channel) instruc-
 tion waiting.

A simulated data channel trap causes the 7090 to transfer control to the associated odd-numbered data channel-trap location.

DCOS does not allow channel E to be simulated because of the conflict with the beginning-of-tape test on channel E (BTTE), which is assigned the same 7090 operation code as the instruction used for trapping the 7040 when in direct mode.

DC-IBSYS LOCATIONS

As in non-DC-IBSYS systems, the DC-IBSYS Core Storage Dump Program is used for all post-mortem dumps. The value of the location counter plus one at the time the dump was taken is included in the panel listing.

Key DC-IBNUC and DC-IOEX locations and initial values are shown in Figure 18. Wherever specific values are given in Figure 18, they are the values that will appear in the dump listing.

Location	Content	Initial value	Comments
00002	TTR	0 02100 0 xxxxx	Varied settings for STR handling
00004	TTR SAVE,,15	0 02117 0 01055	DC-IOEX Entry from 7040
00010	TTR FPTRP	0 02100 0 00206	Transfer to SYSDMP
00012	PZE **,,**	0 0000x 0 xxxxx	Channel A trap location
00013	TTR	0 02100 0 01055	Transfer to DC-IOEX trap supervisor
00014	PZE **,,**	0 0000x 0 xxxxx	Channel B trap location
00015	TTR	0 02100 0 01055	Transfer to DC-IOEX trap supervisor
00016	PZE **,,**	0 0000x 0 xxxxx	Channel C trap location
00017	TTR	0 02100 0 01055	Transfer to DC-IOEX trap supervisor
00020	PZE **,,**	0 0000x 0 xxxxx	Channel D trap location
00021	TTR	0 02100 0 01055	Transfer to DC-IOEX trap supervisor
00022	px **,,**		DC communication locations (THIS and THIS+1)
00023	px **,,**		
00024	PZE **,,**	0 0000x 0 xxxxx	Channel F trap location
00025	HTR *	0 00000 0 00025	Channel F not simulated by DCOS
00026	PZE **,,**	0 0000x 0 xxxxx	Channel G trap location
00027	HTR *	0 00000 0 00027	Channel G not simulated by DCOS
00030	PZE **,,**	0 0000x 0 xxxxx	Channel H trap location
00031	HTR *	0 00000 0 00031	Channel H not simulated by DCOS

Figure 18. DC-IBSYS Locations

COMMUNICATION REGION LOCATIONS

The locations in Figure 19 have been selected from either the DC-IBNUC or DC-IOEX communication regions. They contain information pertaining to a subsystem in control and to the status of input/output units prior to the dump. These locations

are all unique to DC-IBSYS systems. Similar locations are maintained by non-DC-IBSYS systems. Wherever specific values are given in Figure 19, they are the values that will appear in the dump listing.

Location	Symbolic Name	Contents	Comments
100	SYSTRA	TRA **	Contains transfer instruction to last subsystem in control.
102	SYSCUR	BCI 1,xxxxxx	Contains name of last subsystem in control.
107	SYSUNI	0 00023 0 00140	Contains location and length of system unit function table in address and decrement positions, respectively.
112	SYSUCW	0 00214 0 00260	Contains location and length of unit control blocks in address and decrement positions, respectively.
115	SYSDMP	0 02100 0 00206	Contains transfer instruction to Core Storage Dump Program.
116	SYSIOX	0 00047 0 00702	Contains location and length of IOEX communication table in address and decrement positions, respectively.
120	SYSCOR	0 02652 0 77777	Contains upper and lower limits of usable core storage in address and decrement positions, respectively.
122	SYSACC	0 00000 0 00000	Contains the location and length of group of location in which accounting information is stored (job ident, etc.).
134	.CHEXI	0 00000 0 00062	Location 00062 is equal to 0: Last job segment was being processed in direct mode. Location 62 is not equal to 0: Last job segment was being processed in compatibility mode.
724	.CHXAC	0 00000 0 00205	Contains the address of a location that contains the address of the last UCB being serviced by IOEX.

• Figure 19. Communication Region Locations

Location	Symbolic Name	Contents	Comments
727	.RCHX	0 00000 1 01001	Contains the location and length of a table (one entry for each channel, including the DC channel) in which each entry contains the location of the last input/output commands specified for each channel. The table is in the following form: DC channel NOP ** Channel A RCHA ** : : Channel H RCHH **
735	.TRAPS	0 00000 0 00377	Contains trapping signal control bits effective when the last enable instruction was executed.
737	.LTPOS	x xxxxx x xxxxx	Reflects tape position of last unit on which an EOF was recognized (position prior to EOF trap).
720	.IOXSI	x xxxxx x xxxxx	Contains the contents of the sense indicators when the last trap occurred.
742	TRAPSW	x xxxxx x xxxxx	TRAPSW is equal to 0 at nontrap time. TRAPSW is not equal to 0 at trap time.

Figure 19. Communication Region Locations (continued)

EXAMINING UNIT CONTROL BLOCKS

A unit control block is shown in Figure 20 as it might appear in a core storage dump. It illustrates how the programmer can obtain information concerning a particular input/output unit and the status of that unit when the dump was taken. Refer to the section "Direct Couple Input/Output Executor" for a more detailed discussion.

Unit Address: The unit address is 01205, the address (BCD mode) of tape unit A5.

Select Type: A bit in the sign position of word 2 indicates that the last operation

performed on the unit was a write operation (S=0: read S=1: write).

Location of Select Routine: The select routine may be found at location 6251.

File Count: The fourth file on the tape was the last file written.

Record Count: The first record of file 5 was the last record written.

Symbolic Unit Designation: This BCD unit designation is A(1), the unit being referred to in the program. Unit designation is taken from the "unit" field of the \$SETUP card. Note that although A(1) is specified, the actual unit on which the

operation is performed may differ, as it does in this example.

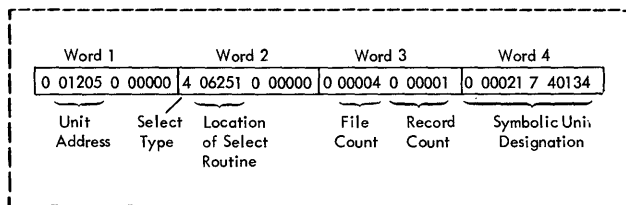


Figure 20. Contents of Sample Unit Control Block

APPENDIX A: IBJOB UNIT ASSIGNMENT-DCOS

This appendix contains a discussion of the unit assignment specifications for the \$FILE control card. The \$FILE control card is described in the publication IBM 7090/7094 IBSYS Operating System: IBJOB Processor, Form C28-6275. Several characteristics of DCOS, however, require changes to the unit assignment specifications as described in the above publication. The following considerations should be made before executing existing IBJOB programs that have unit assignment options specified on a \$FILE control card.

1. Devices other than IBM 729 Magnetic Tape Units, IBM 711 Card Reader, 716 Printer, and 721 Card Punch are not simulated by DCOS. Unit assignment requests for any other units (e.g., disk or hypertape) are invalid and result in job termination.
2. Specifications of 729 model numbers are ignored in the assignment process.
3. All unit assignments are made on a first-available-unit-control block basis, without regard to 7090 channels. Real channel specifications are treated as symbolic assignment requests. If intersystem reserve units are specified for the same symbolic channel, IBJOB may assign them to more than one channel even if there are enough available units on one channel.

UNIT ASSIGNMENT OPTIONS

Basically, the IBLDR unit assignment process consists of either finding a 7090 unit control block whose fourth word matches the symbolic unit requested (a unit control block will be found if a \$SETUP card for the unit is included with the job), or of assigning any available 7090 unit control block from the availability chains. The programmer need not know which unit control block is selected. He should consider his request for a unit in terms of its symbolic unit reference symbol.

Allowable DCOS unit assignment options for the \$FILE card are shown with the following notation:

- P denotes a symbolic channel (A through H and S through Z)
- I denotes an intersystem channel (J through Q)

k denotes a unit number (0 through 9)

The DCOS assignment options for the \$FILE card and the assignment processes are:

{blank}
{P } Use any available unit and assign a unique reference symbol.

P(k) Examine 7090 unit control blocks for one whose fourth word contains P(k). If one is not found, select any available 7090 unit control block and place P(k) in the fourth word.

I(k) Determine whether a unit control block for an intersystem reserve unit has been assigned. If one has not been assigned, select any available 7090 unit control block and insert the intersystem reserve bits. After the program has been executed, the assigned unit control block will remain reserved.

I(k) R Similar to above except that the assigned unit control block will be released from reserve status after the program has been executed.

IN, IN1, IN2 Use system input unit.

OU, OU1, OU2 Use system output unit.

PP, PP1, PP2 Use system peripheral punch unit.

LB2 - LB4 Use system library unit.

CK1 - CK2 Use system checkpoint unit.

UTk Use system utility unit, number k.

CRD,RDA Use card reader.

PRT,PRA Use printer.

PCH,PUA Use card punch.

INT This is an internal file.

NONE No units are assigned.
 A file control block is
 generated but does not
 refer to a unit control
 block.

unit, or a unique symbolic unit and if the
required secondary unit is also one of
these, the secondary unit is assigned in
the same manner as the primary unit. If
the above conditions are not met, the
request for a secondary unit is ignored.

GENERAL UNIT ASSIGNMENT CONSIDERATIONS

 If the unit assigned as the primary unit
is a system unit, an intersystem reserve

 If a real channel or a symbolic channel
is specified without a unit number or if a
unit is not specified, any available unit
will be assigned. Intersystem reserve
units (J through R) should not be specified
without unit number.

APPENDIX B: MESSAGES

This appendix contains all DCOS messages in alphabetical order. Explanations of each message are provided, and, for those messages directed to the operator, any actions to be taken by the operator are given.

In addition to the messages in this section, any label handling or label error messages given by IBJOB-IOCS will be typed on-line.

Most messages from the system are preceded by a twelve-character prefix of the form

bo [*] hmmmssb [c] b

where:

- b Signifies a blank.
- o Identifies the originator of the message (4 = 7040, 9 = 7090).
- * (asterisk) Indicates that the message may require operator action.
- hmmmss Is the time (hour, minute, second) at which the message was typed.
- c Is a 0 for messages originated by the 7090.

All disk and tape error messages are indicated by the sign < preceding the body of the message.

Messages always appear where indicated. In addition, messages originated by the 7090 also appear on the 1014 when operating with 7040 sense switch 2 on.

ALL CARDS PUNCHED, PUT UP SW2, PUSH START

Message Written on: The console typewriter.

Explanation: The DCOS card decks contained on the DCOS Distribution Tape have been punched.

Action: Self-explanatory.

ALL 7090 JOBS AND 7040 SUPPORT FUNCTIONS ARE COMPLETE

Message Written on: The console typewriter or 1014.

Explanation: The system has halted after having completed all 7040 and 7090 tasks.

Action: No operator action is required.

9 hmmmss 0 CARD IGNORED

Message Written on: System output unit.

Explanation: This message always appears when a DC-IBSYS control card is ignored. The message is preceded by (1) another message that indicates the reason that the card was ignored and (2) a listing of the contents of the card.

9 hmmmss 0 CONTROL CARDS INACCESSIBLE

Message Written on: System output unit.

Explanation: The system input unit (SYSIN1) is not defined. Therefore, control cards cannot be read. The job is terminated.

9 hmmmss DCMUP NOT FIRST RECORD OF PRESYS POSTEDIT TERMINATED

Message Written on: The system output unit.

Explanation: When checking the first word of the PRESYS library, the posteditor found that the first record was not DCMUP. The job is terminated.

DELETE JOB xxx

Message Written on: 1014.

Explanation: The operator has requested that job xxx be deleted from the system.

Action: No operator action is required.

4 hmmmss <DISK ERROR CHANNEL x - disk command

- INVALID SEQUENCE
- INVALID CODE
- FORMAT CHECK
- NO RECORD FOUND
- INVALID ADDRESS
- RESPONSE CHECK
- DATA COMPARE CHECK
- PARITY CHECK
- ACCESS INOPERATIVE
- ACCESS NOT READY
- 7631 CIRCUIT CHECK
- 7631 ADAPTER CHECK

Message Written on: Console typewriter.

Explanation: The specified disk error has occurred on channel x after the disk command was given. The error has been corrected, and processing will proceed normally.

The disk command is of the form

```
8x      0      x      xxxx
  ↑      ↑      ↑      ↑
opera- access module track
tion  arm
code
```

where the operation is one of the following.

80 = seek
84 = write command
85 = read command

Action: No operator action is required. However, a customer engineer should be notified of the condition.

DO JOB xxx

Message Written on: 1014.

Explanation: The operator has requested that job xxx be given highest priority.

Action: No operator action is required.

END OF TAPE ON UNIT xx. REMOVE, MOUNT
BLANK REEL TO CONTINUE

Message Written on: Typewriter.

Explanation: An end of tape was reached before the end of the job.

Action: Self-explanatory.

ENTER BCD TIME OF DAY IN KEYS, HHMMSS, TURN
ON CLOCK, PUSH START

Message Written on: Console typewriter.

Explanation: The system has halted after DCMUP was loaded from the disk into 7040 core storage. This halt allows the operator to enter the time of day and turn on the clock.

Action: Place time of day, in BCD (hhmmss - hour, minute, second), in entry keys, turn on 7040 console storage clock, and press 7040 START button.

4*hhmmss FCB NOT FOUND FOR PRIMARY BUFFER.
DUMP, NOTIFY SE, AND USE DISK
RESTART PROCEDURE.

or possibly

4*hhmmss FCB NOT FOUND FOR SECONDARY BUFFER.
DUMP, NOTIFY SE, AND USE DISK
RESTART PROCEDURE.

Message Written on: Console typewriter.

Explanation: A stop at 7040 octal location 270 has occurred because a file control block has not been found that corresponds to a primary or secondary buffer.

Action: Self-explanatory.

9 hhmmss 0 ILLEGAL SYSUNI DEFINITION

Message Written on: System output unit.

Explanation: A DC-IBSYS control card containing a reference to an invalid system unit has been encountered. Only those system units that appear in the system units (SYSUNI) function table are valid.

The contents of the card are printed above the message. The card is being ignored.

9 hhmmss 0 ILLEGAL UNIT REQUEST AT xxxxx

Message Written on: System output unit.

Explanation: The parameter a,t used in the calling sequence to either .ACTV or .NDSEL refers to a unit control block location that is not in the area allocated for unit control blocks. The job is terminated.

9 hhmmss IN THE RECORD SEQUENCE - name 1
name 2 name 3 LAST RECORD TOO LARGE FOR
POSTEDIT POSTEDIT TERMINATED

Message Written on: The system output unit.

Explanation: The posteditor has encountered a record greater than 16,000 words in length. The job is terminated.

9 hhmmss 0 I/O CHECK

Message Written on: System output unit.

Explanation: An input/output check condition has been detected. The job has been terminated.

(contents of cols. 31-60 of \$JOB card)

JOB xxx ACCOUNTING

```
TOTAL 7040 TIME      { hh mm ss }
                    { INFINAL }
TOTAL 7090 TIME      hh mm ss
TOTAL CARDS READ     xxxxxx
```

TOTAL CARDS PUNCHED . xxxxxx
TOTAL LINES PRINTED . xxxxxx
TOTAL TAPES USED . xxxxxx

Explanation: This message appears at the
end of each job's printed output. The
same information is printed twice for

Message Written on: System output unit.

each job. It is preceded by and followed by four rows of x's. If a repeat of the printed output of a job is requested, the word INFIMAL will be printed in place of the total 7040 time. The repeated output will include the previous accounting information and the final accounting information.

Action: No operator action is required.

4*hhmmss JOB xxx ALTERNATE INPUT TAPE CHECK

Message Written on: Console typewriter.

Explanation: A tape record error has been detected while job xxx was being read into the system. The job has been deleted.

Action: No operator action is required.

4 hhmmss JOB xxx BEING DELETED FROM QUEUE

Message Written on: Unit on which the request was made.

Explanation: Upon operator request, job xxx has been deleted from the system.

Action: No operator action is required.

4 hhmmss JOB xxx CANNOT BE SETUP - TOO MANY TAPES REQUESTED

Message Written on: System output unit.

Explanation: The number of tape units requested exceeds the number of tape units available on the 7040. The job has been terminated.

SETUP
ATEND

4 hhmmss JOB xxx IOBASE CARD IN ERROR UTIL

Message Written on: System output unit.

Explanation: The specified control card contains an error. Job xxx has been deleted.

Action: No operator action is required.

4*hhmmss JOB xxx CARD READER CHECK

Message Written on: Console typewriter.

Explanation: An error has been detected while a card was being read into the system. Job xxx has been deleted. (This message can occur only in systems assembled with parameter RDRCK set to 0.)

Action: The operator may take one of the following actions:

1. If card is correctly punched, restack job in 1402.
2. If card is mispunched or if it was jammed, repunch card if possible and restack job in 1402.

4*hhmmss JOB xxx CARD READER CHECK, RE-READ CARD

Message Written on: Console typewriter.

Explanation: An error was detected while a card was being read into the system. Job xxx has not been deleted and the card may be reread. (This message can occur only in systems assembled with parameter RDRCK set to 1.)

Action: Clear reader, insert unread cards, ready the card reader, reread card.

4 hhmmss JOB xxx DISCONTINUE PRINTER x

Message Written on: 1014.

Explanation: The system has responded to the operator's entry key setting to restart or discontinue printer x.

Action: No operator action is required.

4 hhmmss JOB xxx ERROR - IOCY SPANS RECORD GAP

Message Written on: System output unit.

Explanation: A 7090 read operation was given and an IOCY command with a word count greater than one 7090 record was specified. The job is terminated.

4 hhmmss JOB xxx ERROR - xxxxxx NOT IN RECORD NAME TABLE

Message Written on: System output unit.

Explanation: 7090 system record xxxxxx was requested from the 1301/7320, but there was no entry for the record in the 7040 system record name table. The job is terminated.

4 hhmmss JOB xxx ERROR - READ GIVEN FOR AN OUTPUT FILE

Message Written on: System output unit.

Explanation: A read operation was attempted on a file that was in write status. The job is terminated.

4 hhmmss JOB xxx ERROR - WRITE GIVEN ON SYSTEM LIBRARY

Message Written on: System output unit.

Explanation: A write operation was attempted on SYSLB1. The job is terminated.

4 hhmms JOB xxx HAS BEEN GIVEN
HIGHEST PRIORITY

Message Written on: Unit on which the request was made.

Explanation: Upon operator request, job xxx has been given highest priority. No operator action is required.

4 hhmms JOB xxx HAS EXCEEDED THE JOB
DESCRIPTION BLOCK

Message Written on: Console typewriter.

Explanation: Too many task descriptions have been created for job xxx. The job is terminated.

A task description entry is inserted into the Job Description Block for every file written on the disk. 443 words are available in the Job Description Block for task description entries, so that the maximum number of tasks that a job may have is 147. Certain entries, such as the setup task description and the IOBASE task description, will always be present.

4 hhmms JOB xxx ILLEGAL OP CODE xx (90
OP xxxxxxxxxxxxxx)

Message Written on: System output unit.

Explanation: An invalid 7090 operation has trapped the 7040. The contents of the 7090 location counter (when the trap occurred) appear in the dump of the 7090 panel. CODE xx notations have the following meanings

- 01 An MPT (multiprocessor trap) instruction was encountered by the 7040 before the previous one was honored (Machine malfunction.)
- 02 An MPT (Multiprocessor Trap) instruction from the 7090 did not cause valid condition bits to be stored in 7090 location 34. (Machine malfunction.)

03 A non-input/output 7090 instruction caused a trap in the 7040. (Machine malfunction.) Also, 03 may mean that an HPR or an HTR has occurred during the time interval between a 7090 HEY and the 7040 MPT response.

04 A multiple level (nested) HIP (Halt on Input/Output Primary) trap was encountered by the 7040. (Machine malfunction.)

05 An attempt was made to read SYSLB1 from DC-IBSYS into the non-standard systems area of SYSLB1. (Source program error.)

06 DCOS buffer synchronization failure. (Possible system failure.)

07 A read (IOCT command) of a scatter load record was attempted from SYSLB1 but SYSLDR was not used. SYSLDR is an entry in the DC-IBSYS nucleus communication region which, when addressed, causes a transfer to the scatter load routine. (Object program error.)

10 A write with a word count greater than 458 words was issued on peripheral units. (Object program error.)

11 An IOCD command was issued while operating in direct mode. (Object program error.)

12 An invalid unit number (unit greater than 34) was issued in a HEY call from the 7090. (Possible modification of system core storage locations by an object program.)

13 An invalid HEY call (code greater than 18) was issued by the 7090. (Possible modification of system core storage locations by an object program.)

14 The Loader has an undefined Library subroutine on its first call to the 7040. (Machine malfunction or Loader error.)

4 hhmss JOB xxx IN

}	INPUT	}
	SETUP	
	EXECUTION	
	BREAKDOWN	
	PUNCH	
	PRINT	
	PURGE	
UTILITY		

}	QUEUE
}	PROCESS

Explanation: The estimated line count for printed output, specified on the \$JOB control card, has been exceeded. 7090 processing of job xxx has been automatically terminated.

This message is always followed by

Message Written on: Unit on which the inquiry was made.

Explanation: This message is a response to a job-status inquiry. It indicates the current stage of job xxx or specifies that the job requires record transmission only (UTILITY). It also indicates whether the job is waiting to enter (QUEUE) or has entered (PROCESS) the specified stage.

An inquiry about a job that is in the process of being purged will normally result in the message

4 hhmss JOB xxx NOT IN QUEUE
rather than the message

4 hhmss JOB xxx IN PURGE PROCESS

Action: No operator action is required.

4 hhmss JOB xxx IN QUEUE. \$JOB contents of columns 31-60 of \$JOB card

Message Written on: Console typewriter.

Explanation: JOB xxx is being read into the system.

Action: No operator action is required.

4 hhmss JOB xxx IS NOT IN THE QUEUE

Message Written on: Unit on which the inquiry was made.

Explanation: This message is a response to a job-status inquiry made by the operator. It indicates that job xxx is not in any processing stage.

Action: No operator action is required.

4 hhmss JOB xxx IS PRINTING ON x

Message Written on: 1014.

Explanation: The system is printing the output of job xxx on printer x.

Action: No operator action is required.

4 hhmss JOB xxx LIST ESTIMATE EXCEEDED

Message Written on: System output unit.

4 hhmss JOB xxx TERMINATED POSSIBLE LOOP

Action: No operator action is required. (If system assembly parameters have specified that job not be terminated, operator action will be that desired at the installation.)

4*hhmss JOB xxx 90 IS STOPPED AT xxxxx

Message Written on: 1014.

Explanation: A valid 7090 intermediate or terminal stop has occurred at location xxxxx. This message is typed only if sense switch 2 is on.

Action: To continue 7090 processing after an intermediate stop, enter code 50 in the entry keys and set sense switch 6 on. Terminal stops do not require operator action.

4*hhmss JOB xxx 90 WAS STOPPED AT xxxxx

Message Written on: 1014.

Explanation: A valid 7090 intermediate stop has occurred at location xxxxx. Processing of job xxx is automatically resumed. This message is typed only if sense switch 2 is off.

Action: No operator action is required.

4 hhmss <JOB xxx NOISE RECORD ON XX

Message Written on: Console typewriter.

Explanation: A noise record has been detected while the tape mounted on 7040 tape unit xx was being read. The record is being ignored.

Action: No operator action is required.

4 hhmss JOB xxx ON 90

Message Written on: Console typewriter.

Explanation: Job xxx is being loaded into the 7090 for processing.

Action: No operator action is required.

4 hhmss JOB xxx ON PUNCH

}	REPEAT
	DISCONTINUED
	RESTART

Message Written on: 1014.

Explanation: The system has responded to the operator's entry-key setting for job xxx.

The DISCONTINUED message will also be printed if the file contains a BCD record greater than 14 words or a binary record greater than 28 words.

Action: No operator action is required.

4*hhmmss JOB xxx PUNCH ERROR - CLEAR PUNCH

Message Written on: 1014.

Explanation: A punch error has occurred while output for job xxx was being punched.

Action: Clear punch, enter code 34 in entry keys, set sense switch 6 on, and then ready punch. If punch is cleared and readied without key 34 set, punching of this deck will continue, with the possible duplication of cards within this deck.

4*hhmmss JOB xxx PUNCH TRANSFER ERROR - CARD DROPPED

Message Written on: 1014.

Explanation: A card has dropped into the 1402 Punch error hopper.

Action: No operator action is required.

4 hhhmmss JOB xxx PURGED

Message Written on: Console typewriter.

Explanation: Job xxx has been purged from the system.

Action: No operator action is required.

4 hhhmmss <JOB xxx READ ERROR ON xx

Message Written on: Console typewriter.

Explanation: A permanent read error has occurred on 7040 tape unit xx. Job xxx has been deleted.

Action: No operator action is required.

4*hhmmss JOB xxx READY xxxxxx FORM ON PRINTER x

Message Written on: 1014.

Explanation: A special form xxxxxx has been requested for printer x.

Action: Remove printer x from ready

status, mount the requested form, and ready printer x.

4*hhmmss JOB xxx READY xxxxxx FORM ON PUNCH

Message Written on: 1014.

Explanation: A special form xxxxxx has been requested for the punch.

Action: Remove the punch from ready status, insert the requested form, and ready the punch.

4*hhmmss JOB xxx READY BLANK ON IDENT

UNIT xx [WITH NO RING]

Message Written on: 1014.

Explanation: The operator is requested to mount and ready a tape on 7040 tape unit xx.

Action: Mount and ready tape according to specifications provided in message.

4 hhhmmss JOB xxx SINGLE RECORD EXCEEDS BUFFER SPACE RESTRUCTURE I/O

Message Written on: System output unit.

Explanation: An attempt has been made to write a record with a multiple 7090 input/output command sequence in which the word counts indicated that available 7040 buffer space would be exceeded. The job has been terminated.

4*hhmmss JOB xxx SYSTEM NOT ASSEMBLED FOR COMPATIBILITY MODE

Message Written on: Console typewriter.

Explanation: The system has been requested to run in compatibility mode, but has not been assembled to do so. Job xxx is deleted. This message occurs only when DCMUP is assembled with CMPKG set to 0.

Action: No operator action is required.

4 hhhmmss JOB xxx<TAPE xx - xxx READ ERRS yyy WRITE ERRS

Message Written on: Console typewriter.

Explanation: After 7040 tape unit xx has been rewound and unloaded, a summary of permanent read errors (xxx) and write errors (yyy), if any occurred, is written out for use at the installation.

Action: No operator action is required.

4 hhmss JOB xxx TERMINATED

Message Written on: Both the system output unit and console typewriter.

Explanation: 7090 processing of job xxx has been terminated prior to successful completion, possibly upon operator request for termination or restart.

Action: No operator action is required.

4 hhmss JOB xxx TERMINATED POSSIBLE LOOP

Message Written on: Both the system output unit and console typewriter.

Explanation: The operator has terminated 7090 processing of job xxx by entering code 10 in the entry keys. This message will also appear when list or time estimate has been exceeded.

Action: No operator action is required.

4 hhmss JOB xxx TIME ESTIMATE EXCEEDED

Message Written on: System output unit.

Explanation: The estimated 7090 job processing time specified on the \$JOB control card has been exceeded. 7090 processing of job xxx has been automatically terminated.

This message is always followed by

4 hhmss JOB xxx TERMINATED POSSIBLE LOOP

Action: No operator action is required. (If system assembly parameters have specified that job not be terminated, operator action depends on that desired at installation.)

4 hhmss JOB xxx UNABLE TO BLOCK INPUT

Message Written on: System output unit.

Explanation: A permanent read redundancy has occurred on the tape being read during a setup blocking operation or a record greater than 457 words was read. The job is deleted.

4 hhmss JOB xxx UNABLE TO DEBLOCK OUTPUT

Message Written on: System output unit.

Explanation: A 7090 record longer than 457 words has been written, the record to be deblocked has a permanent read error, or there was no output to deblock. The utility has been terminated.

4 hhmss JOB xxx UNIT xx READING BEYOND

VALID INPUT

Message Written on: System output unit.

Explanation: An attempt was made to read the file beyond recorded data. The job has been terminated. Unit xx notations reflect the following 7090 units:

7090 Unit			
Unit xx	IOBASE 0	IOBASE 1	IOBASE 2
32	1321 (RDA)	1321 (RDA)	1321 (RDA)
33	1341 (PUA)	1341 (PUA)	1341 (PUA)
34	1361 (PRA)	1361 (PRA)	1361 (PRA)
0	A1	none	A1
1	A2	none	A2
2	A3	none	A3
3	A4	none	B4
4	A5	A1	A5
5	A6	A2	A6
6	A7	A3	A7
7	A8	A4	A8
8	A9	A5	A9
9	A0	A6	A0
10	B1	A7	B1
11	B2	A8	B2
12	B3	A9	B3
13	B4	A0	A4
14	B5	B1	B5
15	B6	B2	B6
16	B7	B3	B7
17	B8	B4	B8
18	B9	B5	B9
19	B0	B6	B0
20	C1	B7	C1
21	C2	B8	C2
22	C3	B9	C3
23	C4	B0	C4
24	C5	C1	C5
25	C6	C2	C6
26	D1	C3	D1
27	D2	C4	D2
28	D3	D1	D3
29	D4	D2	D4
30	D5	D3	D5
31	D6	D4	D6

4 hhmss JOB xxx <UNIT xx - 25 ERASES ON WRITE

Message Written on: Console typewriter.

Explanation: Twenty-five consecutive attempts to write on unit xx have failed due to write redundancy. The system will continue attempting to write successfully on this unit.

Action: No operator action is necessary. If the error persists, the job may be deleted.

4 hhhmss JOB xxx UTILITY xxxxxx NOT AVAILABLE

Message Written on: System output unit.

Explanation: Utility xxxxxx has been requested from the 1301/7320, but there is no entry for the utility in the 7040 utility name table. The job has been terminated.

KEY kk

Message Written on: 1014.

Explanation: The operator has made a request on the 1014 by duplicating the 7040 entry-key setting kk.

Action: No operator action is required.

4*hhmss KEYS OUT OF RANGE, TRY AGAIN

Message Written on: Unit on which the setting was made.

Explanation: An invalid entry-key setting has been encountered by the system.

Action: Place correct entry in keys and set sense switch 6 on.

LOCATE JOB xxx

Message Written on: 1014.

Explanation: The operator has made this request to determine the stage of job xxx. The system will type a response to this request.

Action: No operator action is required.

4 hhhmss MULTI-PROCESSOR SKIPPING FOR \$JOB CARD

Message Written on: Console typewriter.

Explanation: A job that was being read into the system from cards or tape has been deleted. The system is ignoring all input for this job.

Action: No operator action is required.

9 hhhmss 0 xxxxxx NO ASSIGNMENT MADE

Message Written on: System output unit.

Explanation: This message appears when one of the following conditions has been encountered:

1. A unit was requested on a \$ASSIGN control card for the system unit function xxxxxx, but the function had a unit assigned to it and no \$SETUP card specifying that func-

tion was provided.

2. A unit was requested on a \$ASSIGN control card for the system unit function xxxxxx, but the function did not have a unit assigned to it and DC-IBSYS could not find an available unit.

3. A DC-IBSYS tape-manipulation control card specified a system function, but a unit was not assigned to that function. The card is being ignored.

9 hhhmss 0 NOT A BASIC MONITOR CONTROL CARD

Message Written on: System output unit.

Explanation: A control card that DC-IBSYS could not identify has been encountered. The contents of the card are printed above the message. The card is being ignored.

4 hhhmss OCTAL KEYS xx SET

Message Written on: Unit on which the setting was made.

Explanation: Entry-key setting xx has been recognized by the 7040.

Action: No operator action is required.

9*hhmss 0 columns 7-72 of \$PAUSE card

9*hhmss 0 PAUSE

Message Written on: Both the system output unit and the 1014.

Explanation: The 7090 has read a \$PAUSE card included to allow time for some programmer-specified operator action(s). The contents of columns 7 through 72 of the \$PAUSE card may contain instructions to the operator.

Action: Perform tasks(s) specified in 7090 message(s) preceding the message

9*hhmss 0 PAUSE

To continue 7090 processing, enter code 50 in entry keys, and set sense switch 6 on. The message

9*hhmss 0 PROCEEDING

will then be typed.

9*hhmss 0 PAUSE

Message Written on: Both the system output unit and 1014.

Explanation: The 7090 .PAUSE routine has been called by the program to allow time for the operator to perform the

action specified in the 7090 message(s) preceding this one.

Action: Perform task(s) specified in preceding 7090 message(s). To continue 7090 processing, enter code 50 in entry keys and set sense switch 6 on. The message

9*hhmmss 0 PROCEEDING

will then be typed.

9 hhhmmss 0 PAUSE IGNORED. PROCEEDING

Message Written on: System output unit.

Explanation: This message appears when the DC-IOEX .PAUSE routine has been entered with the instruction

TSX .PAUSE,4

9*hhmmss 0 PAWS

Message Written on: Both the system output unit and 1014.

Explanation: An object program has transferred control to the .PAWS routine, which has printed the above message and caused the 7090 to halt. This stop allows time for the operator to perform action specified in the 7090 message(s) preceding this one.

Action: Perform task(s) specified in preceding message(s). To continue 7090 processing, enter code 50 in entry keys and set sense switch 6 on. The message

9*hhmmss 0 PROCEEDING

will then be typed.

4*hhmmss <PERMANENT DISK ERROR - disk command

Message Written on: Both the console typewriter and 1014.

Explanation: A permanent disk error has occurred after the specified disk command was given.

The disk command is of the form

8x o x xxxx
↑ ↑ ↑ ↑
opera- access module track
tion arm code

where the operation is one of the following.

80 = seek

84 = write command
85 = read command

Action: Contact a customer engineer.

4*hhmmss <PERMANENT DISK ERROR - READY FILE CONTROL

Message Written on: Both the console typewriter and 1014.

Explanation: The disk is inoperative either because one or more of the switches has been set incorrectly or because a disk malfunction has occurred.

Action: Correct switch setting(s) if in error. If disk remains inoperative, contact a Customer Engineer.

9 hhhmmss PERMANENT REDUNDANCY ON POSTED INTER POSTEDIT TERMINATED

Message Written on: The system output unit.

Explanation: The posteditor has detected a permanent redundancy while reading the intermediate input/output unit (SYSUT2). The job is terminated.

9 hhhmmss PERMANENT REDUNDANCY ON PRESYS FILE POSTEDIT TERMINATED

Message Written on: The system output unit.

Explanation: The posteditor has detected a permanent redundancy while reading its input unit (SYSCK1). The job is terminated.

4*PERMANENT REDUNDANCY ON SYSTEM TAPE. PUSH START TO BEGIN AGAIN

Message Written on: 1014.

Explanation: The system has halted because a permanent read error on the DCOS Distribution Tape occurred during system initialization.

Action: To restart system initialization, press 7040 START button. If the error persists, use another DCOS Distribution Tape.

9*hhmmss 0 PROCEEDING

Message Written on: Both the system output unit and 1014.

Explanation: 7090 processing has been resumed by the operator after a valid intermediate stop.

Action: No operator action is required.

4*hhmmss PUSH START TO BEGIN AGAIN
SEQUENCE ERROR RECORD xxx

Message Written on: Console typewriter.

Explanation: This message appears during the loading of DCSYS if the record sequence is out of order.

Action: Push start and try again. If error persists, re-edit or use another system tape.

4*hhmmss <READY DRIVE xx

Message Written on: 1014.

Explanation: 7040 tape unit xx has been made ready, and is no longer ready.

Action: Ready 7040 tape unit xx. Processing of job xxx will then be resumed.

4*hhmmss REPEAT LAST REQUEST

Message Written on: Unit on which the request was made.

Explanation: The latest request cannot be serviced because the system has not completed processing of the previous request. A job in the utility stage will cause this message in response to keys 27.

Action: Re-enter the request.

4*hhmmss REPEAT REQUEST, INCLUDE VALID
JOB NUMBER

Message Written on: Unit on which the request was made.

Explanation: The operator has specified the number of a job not currently being processed by the system.

Action: Enter request with correct job number in octal.

4*hhmmss REPEAT REQUEST, 1014 ERROR

Message Written on: 1014.

Explanation: An error has occurred during transmission of an operator request from the 1014 to 7040 core storage.

Action: Repeat request. If message occurs several times, notify customer engineer of condition.

4*hhmmss REPEAT REQUEST WITH VALID VERB

Message Written on: 1014.

Explanation: The operator has entered on the 1014 a job-status inquiry or a

change-of-status request containing a verb that the system cannot recognize. (The verbs LOCATE, DO, and DELETE are the only ones recognized.) The request is being ignored.

Action: Enter valid request.

4 hhmmss 7090 IS IDLE

Message Written on: Console typewriter.

Explanation: No job is currently being processed by the 7090.

Action: No operator action is required.

4*hhmmss 7090 IS IDLE, SETUP PENDING

Message Written on: Console typewriter.

Explanation: No job is currently being processed on the 7090. One or more jobs requiring the mounting of tapes is waiting in the SETUP queue.

Action: Mount and ready any tapes for which mounting has been requested but not yet performed.

4 hhmmss SPILL TAPE READ ERROR

Message Written on: System output unit.

Explanation: The system core storage dump program has detected an apparent read redundancy on the overflow tape. The dump will proceed without a halt to ensure at least a partial recovery of the contents of core storage and to allow the system to continue. If this procedure is not satisfactory for an application, the job should be rerun.

Action: No operator action is required.

4*hhmmss STORAGE PARITY CHECK AT LOC
xxxxxx, NOTIFY CE.

Message Written on: Console typewriter.

Explanation: A stop has occurred at 7040 octal location 270 because of a storage parity check indicating that stored data is unreliable. Notify a customer engineer at once.

Action: Self-explanatory.

4*hhmmss STR AT LOC xxxxxx
DUMP, NOTIFY SE, AND USE DISK
RESTART PROCEDURE.

Message Written on: Console typewriter.

Explanation: A stop has occurred at 7040 octal location 270 because an STR (Store

and Trap) instruction has been encountered during DCOS processing.

Action: Self-explanatory.

9 hhhmss SYSLB1 SPECIFICATION
CATASTROPHE

Message Written on: System output unit.

Explanation: A DC-IBSYS control card containing a reference to SYSLB1 has been encountered. The contents of the card are printed above the message. The job has been terminated.

4*hhmss SYSTEM OUT OF TRACKS, PROCEEDING
WITH OUTPUT ONLY.

Message Written on: Both the console typewriter and 1014.

Explanation: All tracks on all modules of disk are currently in use by previous jobs. The job currently on the 7090 is terminated and returned to the execution queue.

Action: When the message

ALL 7090 JOBS AND 7040 SUPPORT FUNCTIONS ARE COMPLETE

is typed, use the disk restart procedure with sense switch 3 out.

9 hhhmss 0 SYSTEMS CORE DUMP TAKEN AT THIS
POINT

Message Written on: System output unit.

Explanation: This message is printed before a post-mortem dump is taken. The job has been terminated.

4 hhhmss 1014 NO LONGER USED DUE TO PARITY
ERRORS

Message Written on: Both the console typewriter and 1014.

Explanation: Because an excessive number of parity errors have occurred on the 1014, all messages will be typed on the 7040 typewriter and none will appear on the 1014.

Action: Contact a customer engineer.

4 hhhmss THE DISK HAS BEEN DUMPED

Message Written on: Console typewriter.

Explanation: The specified contents of disk and/or drum have been saved on tape during a Save procedure.

Action: No operator action is required. (Non-DCOS jobs may be processed.)

4 hhhmss THE DISK HAS BEEN LOADED

Message Written on: Console typewriter.

Explanation: The specified contents of disk and/or drum storage have been restored during a Restore procedure.

Action: No operator action is required.

9 hhhmss TOO MANY I/O COMMANDS IN REC.
xxxxx POSTEDIT TERMINATED.

Message Written on: The system output unit.

Explanation: This message is printed by the Posteditor when more than 250 memory loading sequences (before overlays are eliminated) are encountered in one record. The job is terminated.

9 hhhmss TOO MANY SYSTEM RECORDS OR DATA
FILES POSTEDIT TERMINATED

Message Written on: The system output unit.

Explanation: This message is printed by the Posteditor when more than 233 system records, data files, and end-of-file marks are contained on the PRESYS library tape.

4 hhhmss TSL FROM LOC xxxxxx-PROBABLE
LOGIC OR MACHINE ERROR.
DUMP, NOTIFY SE, AND USE DISK
RESTART PROCEDURE.

Message Written on: Console typewriter.

Explanation: A general trap stop has occurred at 7040 octal location 270.

Action: Self-explanatory.

9 hhhmss 0 UNIT xx FILE xxxxxx REC. xxxxx
PERMANENT READ REDUNDANCY

Message Written on: System output unit.

Explanation: The 7090 has attempted to read a record from the specified unit in the wrong mode.

4 hhhmss UNIT xx PERMANENT READ ERROR

Message Written on: System output unit.

Explanation: A permanent read redundancy has occurred on the specified unit. The job has been terminated.

9*hhmss columns 7-72 of \$* card

Message Written on: Both the system
output unit and 1014.

Explanation: The contents of columns 7
through 72 of a \$* card are typed in
this message. These columns frequently
contain instructions to the operator
that should be followed when the message

9*hhmmss 0 PAUSE

is typed.

Action: Perform specified task during
7090 halt.

APPENDIX C: CONTROL CARD FORMAT INDEX

This Appendix contains the formats of all DCOS control cards. Refer to the specified DCOS publication for a complete description of each card. Notations used are:

- PG = Programmer's Guide, Form C28-6382
- SPG = Systems Programmer's Guide, Form C28-6383
- OG = Operator's Guide, Form C28-6384

DC-IBSYS/DCMUP CONTROL CARDS

<u>Card Format</u>	<u>Publication</u>
1 \$ASSIGN 16 SYSxxx	SPG
1 7-72 \$* any text	PG
1 \$ATEND 16 [limit 1], [limit 2], [format], [DUMP], [POST]	PG
1 \$CARDS	SPG
1 \$DATA	PG
1 16 \$DATE mmdyy	OG
1 16 \$ENDFILE SYSxxx	SPG
1 \$ENDROW	PG
1 \$ENDREEL	OG
1 \$EOF	PG
1 16 \$EXECUTE { system name } { CARDS } { TAPE }	PG PG PG
1 \$IBEDT	SPG
1 \$IBSYS	SPG
1 7-72 \$ID any text	PG
1 16 \$IOBASE n	PG

1		16	31	60	
\$JOB		[priority] , [time estimate] , [line estimate]	[job identification]		PG
1	7-72				
\$PAUSE	any text				PG
1		16			
\$RELEASE		SYSxxx			SPG
1		16			
\$REMOVE		SYSxxx			SPG
1					
\$RESET					SPG
1					
\$RESTORE					SPG
1		16			
\$REWIND		SYSxxx			SPG
1					
\$ROW					PG
1	8	16			
\$SETUP	unit	{ ident ₁ } , { ident ₂ } , [LABITS] , [REELS] , [file count]			
		{ TAPE } , { DISK } , { PRINT } , { PUNCH } , { NORING } , { INPUT }			
1					
\$STOP					SPG
1		16			
\$SWITCH		SYSxxx, SYSyyy			SPG
1					
\$TAPE					SPG
1		16			
\$UNLOAD		SYSxxx			
1		16			
\$UTILITY		utility name, tape ident, [option 1] , [option 2] , [option 3]			
1					
⌘ EOF					PG

SYSTEM EDITOR CONTROL CARDS

1	7	16			
[FILE] *AFTER		{ recnam } { sysnam } { FILEMK }			SPG
1	7	16			
*CHECK		[count] [, oldnam] [, newnam]			SPG
1	7	16			
*DUP		SYSxxx, SYSyyy, n			SPG
1	7	16			
*EDIT		SYSLB2 [, MAP] [, MODS]			

1	7	16		
[TAPE]	*INSERT	FILEMK		
1	7	16		
[TAPE]	*MODIFY	recnam		
1	7 8	16	72	
octloc*	{OCT } {OCTAL }	word 1,word 2,...,word n		SPG
1	7	16		
	*PLACE	sysnam[,tfiles,1,order]		
1	7	16		
	*REMARK	any remark		SPG
1	7	16		
[FILE]	*REMOVE	{recnam } {sysnam } {FILEMK }		SPG
1	7	16		
[TAPE] [FILE]	*REPLACE	{recnam } [,SYSxxx] {sysnam }		SPG
1	7	16		
	*REWIND	SYSxxx		SPG

7040/7044 IBJOB TAPE BLOCKING UTILITY CONTROL CARDS

| Tape Blocker and Tape Deblocker

1	job description	31	37-42	
		output	number of files	OG
		reel	to be processed	
		number		

| System Tape Blocker

1	job description	31	37-42	
		system	number of files	
		name	to be processed	

APPENDIX D: CONTROL CARD CHECK LIST

This Appendix contains a summary of the functions of all DCOS control cards.

DC-IBSYS/DCMUP CONTROL CARDS

<u>Control Card</u>	<u>Processed By</u>		<u>Comments</u>
	<u>DC-IBSYS</u>	<u>DCMUP</u>	
\$ASSIGN	x		Assigns a 7090 unit control block to a system unit function.
\$*	x		Comments card.
\$ATEND		x	Specifies action to be taken when 7090 processing is terminated.
\$CARDS	x		Causes control cards to be read from system card reader (SYSCRD) file.
\$DATA	x	x	Causes end-of-file condition to be set in input stream.
\$DATE		x	Initializes date on printed output.
\$ENDFILE	x		Causes end of file to be written on simulated 7090 output unit.
\$ENDROW		x	Specifies end of 711 card file; used in conjunction with \$ROW card.
\$ENDREEL		x	Indicates end of the job input tape.
\$EOF	x	x	Causes end-of-file condition to be set in input stream.
\$EXECUTE	x		Defines beginning of job segment; transfers control to specified subsystem.
\$IBEDT	x		Transfers control to system editor.
\$IBSYS	x		Transfers control to DC-IBSYS Supervisor.
\$ID	x		Transfers control to 7090 installation accounting routine, if one exists.
\$IOBASE		x	Specifies simulated 7090 input/output configuration to be used.
\$JOB	x	x	Defines beginning of job; one is required for each job.
\$PAUSE	x		Causes 7090 processing to stop for operator action.
\$RELEASE	x		Releases 7090 unit control block from system unit function.

\$REMOVE	x		Effectively causes the 7040 device simulating the specified 7090 system unit function to be rewound and unloaded.
\$RESET	x		Causes input/output units to be assigned to or released from system unit functions.
\$RESTORE	x		Causes DC-IBSYS Nucleus to be restored to original status as defined by system assembly parameters.
\$REWIND	x		Effectively causes the 7040 device simulating the specified 7090 system unit function to be rewound.
\$ROW		x	Specifies beginning of 711 card file; used in conjunction with \$ENDROW card.
\$SETUP		x	Causes tape-mounting message to be typed for operator, and specifies any required blocking or deblocking.
\$STOP	x		Causes 7090 processing to halt, and transfers control to 7040.
\$SWITCH	x		Interchanges simulated units of two 7090 input/output system functions.
\$TAPE	x		Causes control cards to be read from system input unit (SYSIN1).
\$UNLOAD	x		Effectively causes the 7040 device simulating the specified 7090 system unit function to be rewound and unloaded.
\$UTILITY		x	Specifies a task for a DCMUP utility routine.
⌘ EOF	x	x	Causes end-of-file condition to be set in input stream.

SYSTEM EDITOR CONTROL CARDS

Control Card

Comments

*AFTER	Causes information to be transferred from SYSLB2 to SYSUT1.
*CHECK	Causes a test to be made to ensure that correct number of editing cards were read and that correct PRESYS library tape was processed.
*DUP	Causes files to be transferred from one system unit to another (neither may be SYSLB1).
*EDIT	Causes control information to be transmitted to system editor. One

*EDIT card is required for every edit run.

*INSERT Causes a new record, formed from alteration cards, to be written on SYSUT1.

*MODIFY Causes a specified record to be consolidated with alteration cards.

*{OCT }
 {OCTAL } Octal words in this card are written on new PRESYS library.

*PLACE Used to modify DC-IBSYS system name table.

*REMARK Causes characters in columns 7-72 to be written on system output unit.

*REMOVE Causes a specified record or file to be skipped on SYSLB2.

*REPLACE Causes a record or file in old PRESYS library to be replaced by a new record formed by alteration cards.

*REWIND Rewinds the unit assigned to the specified system unit function.

APPENDIX E. SPECIAL CONSIDERATIONS; COMPATIBILITY MODE OPERATION

In preparing jobs for operation in compatibility mode, the programmer should review his program or programming system for any procedures or techniques used that require special handling in DCOS. This applies to programs that depend on channel balance for efficiency (e.g., a sort program), programs that require operator action at intermediate points, etc. Below are examples of specific points that must be considered in using the FORTRAN II Monitor System and 7090/7094 Sort.

FORTRAN II MONITOR SYSTEM

The material in this section is intended for the user of the IBM 7090/7094 FORTRAN II Monitor System operating under DCOS, and supplements the material in the publication IBM 7090/7094 Programming Systems: FORTRAN II Operations, Form C28-6066.

DCOS is distributed with IOBASE number 2 set up for use by the FORTRAN II Monitor System, which runs independently of IBSYS. Thus, jobs using this system may be run under DCOS control by using the following sequence of DCOS control cards:

<u>1</u>	<u>8</u>	<u>16-72</u>
\$JOB		normal DCOS parameters
\$IOBASE		2
\$SETUP A3		DISK,PRINT,720
\$EXECUTE		system name

The \$SETUP card provides for the printing of the output listing file on a 1403 in 720A Printer format.

When user source program errors occur that cause the calling of the FORTRAN II Monitor System error diagnostic record, DCOS will terminate compiler operation due to the attempted writing of a record larger than 458 words on SYSOU.

7090/7094 SORT

The material in this section is intended for the user of the IBM 7090/7094 Generalized Sorting System (7090 Sort) operating under DCOS, and supplements the material in the publication IBM 7090/7094 IBSYS Operat-

ing System: Generalized Sorting System, Form C28-6365.

Order of Merge

The capacity of the 7040 buffering system is such that if no DCMUP peripheral operations (setup, breakdown, printing, etc.) are being performed in addition to 7090 execution, the maximum order of merge that can be handled is five. However, since the peripheral operations of DCMUP share the same buffers as the 7090, a sort that uses an order of merge that is greater than three may be terminated automatically with the message

```
4 hhmms JOB xxx SINGLE RECORD EXCEEDS
  BUFFER SPACE RESTRUCTURE I/O
```

Simultaneous operation of all DCMUP functions may possibly reduce the order of merge capacity even further.

Preparation of CHANNELS Card

If the sorted output is to be written on tape, the OUTPUT channel parameter must be specified on the Sort CHANNELS card and a \$SETUP card must be used to prepare the output tape unit.

Unit Assignment

For maximum efficiency, the programmer should assign the units on one of his merge channels to tape, and the units on the other merge channel to the disk.

Since Sort assigns units directly from the unit availability chain, it uses the notation xn to denote the nth available unit on 7090 channel x. In preparing his \$SETUP cards, where the actual 7090 unit is specified, the programmer must allow for the fact that, in IOBASE 0, units A1-A5 and B1-B5 are unavailable and A6 and B6 are the first available units on channels A and B. Thus, where the SORT CHANNELS card specifies a unit such as A1, the \$SETUP card to prepare that unit should specify A6, etc.

Checkpoints

Since the checkpoint and restart facilities of Sort are not available with DCOS, the Sort OPTION card should specify NOCKPT.

Additional Merge Input

To use the Sort facility for merging previously sorted data files during the final sort phase, the programmer must assign all merge channel units to tape and Sort must be run with sense switch 2 on, so that the merge input mounting message will be printed on-line and cause a pause for operator action.

The operator should be provided with a list of the original \$SETUP cards. When Sort issues the message for him to mount the additional merge input tape, he can correlate the 7090 unit designation and the 7040 tape unit assignment, using the 7040-issued mounting messages.

For example, suppose that the merge unit designated by the 7090 as A8 becomes the

unit on which the additional merge input tape is to be mounted. If the original \$SETUP card for A8 specified the mounting of reel number 1234, and the 7040 message instructed the operator to mount reel 1234 on 7040 unit C4, the operator knows that the 7040 has assigned C4 as A8 and the later Sort-issued message to mount a reel on A8 means the reel should be mounted on C4.

Unreadable Records

In its normal operation, SORT writes unreadable records on SYSOU1 in a format of 120 characters per line. Since DCOS output on SYSOU1 is limited to 72 characters per line, users wanting a complete listing of unreadable records should specify the NOF option on the Sort OPTION card. This option directs unreadable records and all off-line information generated by the MAP, CARDS, TAPES, and HISTORY options to SYSCK2, which should be set up by the user as a print file.

APPENDIX F: MACHINE CONFIGURATION

As distributed, the Direct Couple Operating System requires at least the following equipment:

1. An IBM 7090, 7094, or 7094 II Data Processing System. (Data channels are neither required nor used.)
2. The Direct Couple Feature.
3. A IBM 7040 or 7044 Data Processing System with 32,768 words of core storage, the Extended Performance Instruction Set, the Storage Clock and Interval Timer, and the following input/output units:
 - a. An IBM 1014 Remote Inquiry Unit.
 - b. An IBM 1402-2 Card Read Punch, attached through an IBM 1414-4 Input/Output Synchronizer with the Read and Punch Column Binary feature and the Read Card Image feature.
 - c. An IBM 1403 Model 2 or 3 Printer.
 - d. An IBM 1301 Model 1 Disk Storage Unit and an IBM 7631 File Control with the Cylinder Mode feature, attached through an IBM 7904 Data Channel with the Direct Read to Couple Processor feature.

- e. Five IBM 729 Model II, IV, V, or VI Magnetic Tape Units.¹

Additional input/output units may be attached to the 7040 or 7044 to achieve the following configuration:

1. Four IBM 7904 Data Channels.
2. Three IBM 1403 Model 2 or 3 Printers.
3. As many as ten modules of IBM 1301 Model 1 or 2 Disk Storage Units (a maximum of four modules on any one channel). Except for the one module of 1301 Disk Storage required, IBM 7320 Drum Storage Units may be substituted for any of the even numbered modules of disk storage. A maximum of 5 drum modules is allowed.
4. Forty IBM 729 Model II, IV, V, or VI Magnetic Tape Units.

¹Certain applications may be performed satisfactorily with two IBM 729 Magnetic Tape Units. The five required tape units ensure satisfactory performance for system operation.

INDEX

This is a master index for all three Direct Couple Operating System guides. References are keyed to the individual publications by the following codes:

PG = Programmer's Guide, Form C28-6382

SPG = Systems Programmer's Guide, Form C28-6383

OG = Operator's Guide, Form C28-6384

Accounting routines			
for installations	61	SPG	
under DC-IBSYS	61	SPG	
Add Unit Designation to Message Routine			
calling sequence	36	PG	
Alphameric Punch Routine			
calling sequence	35	PG	
Alteration cards			
absolute column binary	50	SPG	
octal	52	SPG	
Backspace printer			
request to	20	OG	
Basic Supervisor			
\$EXECUTE	22	SPG	
\$ID	22	SPG	
Binary-to-BCD Conversion Routine			
MQ decrement	35	PG	
s,1-14 of MQ	35	PG	
Binary-to-Decimal Conversion Routine			
AC address	35	PG	
AC decrement	35	PG	
Bit maps			
master	83	SPG	
peripheral	82,83	SPG	
scratch	83	SPG	
Blocking records			
\$SETUP card	9,17,18	PG	
\$SETUP card	13,25	OG	
setup stage	10	OG	
stand-alone 7040/44 utility			
routines	26	OG	
utility routine	16	PG	
Breakdown stage			
description of	10	OG	
description of	13	PG	
Card input			
using	8,13	OG	
Card Read Punch			
function of	5	OG	
function of	8	PG	
Card-to-Tape Routine			
description and use of	26	OG	
Change-of-job-status request			
means of making	20,21,22	OG	
Channel			
activating a	34	SPG	
balancing at setup stage	12	PG	
indicators	10	SPG	
information block	10	SPG	
priority location	33	SPG	
registers	10	SPG	
trap	7	SPG	
unit priority on a	33	SPG	
Checkpoint of disk/drum			
control card for	23	OG	
procedures for taking	22,23	OG	
Codes			
system control	19	OG	
Comments card			
description of	14	OG	
function of \$* card	21	PG	
Communication region			
DC-IBSYS Nucleus	27,31,87	SPG	
SYSACC	61	SPG	
SYSCOR	62	SPG	
SYSCUR	63	SPG	
SYSGET	29	SPG	
SYSIDR	30,61	SPG	
SYSIOX	31	SPG	
SYSJOB	29,30	SPG	
SYSPID	62	SPG	
SYSRET	29	SPG	
SYSTRA	50,63	SPG	
symbolic and octal addresses	28	SPG	
Communication region table (DC-IOEX)			
description of	27	PG	
symbolic addresses of entries	27	PG	
Communication system			
THIS and THIS+1	8,37	SPG	
Commutator			
main DCOS commutator	10	SPG	
SETUP commutator gate	14	SPG	
Compatibility mode			
description of	14	PG	
description of	8	OG	
example of select plus entry	31	PG	
input/output activity	11,12	PG	
programming considerations	37-39	PG	
programs operating in	8	OG	
programs operating under	11	PG	
Console controls, 7040			
entry keys	19	OG	
sense switches	18	OG	
Control cards			
\$* card	21	PG	
\$* card	14	OG	
\$ASSIGN card	23	SPG	
\$ATEND card	20	PG	
\$ATEND card	14	OG	
\$CARDS card	24	SPG	
\$DATA card	13	OG	
\$DATA card	20	PG	
\$DATE card	15	OG	
\$DATE card	42	SPG	
\$ENDFILE card	24	SPG	
\$ENDREEL card	15	OG	

\$ENDROW card	13	OG	pool control word	13	SPG
\$ENDROW card	16	PG	Data processing system		
\$ENDROW card	25	SPG	7040, function of	5	OG
\$EOF card	13	OG	7090, function of	5	OG
\$EOF card	20	PG	DC Operating System		
\$EXECUTE card	13	OG	Core Storage Dump Program	21,27	SPG
\$EXECUTE card	15	PG	DC-IBSUP	7	SPG
\$EXECUTE card	7,8,22,30	SPG	DC-IBSYS	7	SPG
\$FILE card	33,75	SPG	DC-IBSYS Loader	27	SPG
\$IBEDT card	26,48	SPG	DC-IBSYS Monitor	21	SPG
\$IBSYS card	25,30	SPG	DC-IBSYS Nucleus	21,27,33,87	SPG
\$ID card	13	OG	DC-IBSYS Supervisor	22	SPG
\$ID card	20	PG	DC-IOEX	8,21,31-36	SPG
\$ID card	23,30	SPG	distribution tape	41	SPG
\$IOBASE card	17	PG	DC-IBSYS		
\$IOBASE card	13,14	SPG	components of	7	OG
\$JOB card	22	SPG	components of	10	PG
\$JOB card	12	OG	DC-IBSYS Monitor	10	PG
\$JOB card	15	PG	description of	7	OG
\$PAUSE card	21	PG	diagram of	7	OG
\$PAUSE card	14	OG	diagram of	11	PG
\$RELEASE card	24	SPG	execution stage	12	PG
\$REMOVE card	25	SPG	dump interpretation	40	PG
\$RESET card	24	SPG	execution stage	10	OG
\$RESTORE card	25	SPG	function of	10	PG
\$REWIND card	24	SPG	IBJOB processor	10	PG
\$ROW card	16	PG	phase controlled by	9	PG
\$ROW card	23,25	SPG	processing phase	9	PG
\$SETUP card	17	PG	subsystems operating under	7	OG
\$SETUP card	13,25	OG	DC-IBSYS Core Storage Dump Program		
\$SETUP card	13	SPG	(see also "dump")	10,24	PG
\$STOP card	25	SPG	DC-IBSYS Monitor		
\$SWITCH card	24	SPG	DC-IBSYS core storage dump		
\$TAPE card	24	SPG	program	10,24	PG
\$UNITS card	26	SPG	DC-IBSYS Nucleus	10	PG
\$UNLOAD card	25	SPG	DC-IBSYS patch routine	91	SPG
\$UTILITY card	25	OG	DC-IBSYS Supervisor	10	PG
\$UTILITY card	21	PG	DC-Input/Output Executor	10,27	PG
*AFTER card	53	SPG	diagram of	10	PG
*CHECK card	54	SPG	System Editor	10	PG
*DUP card	53	SPG	DC-IBSYS Nucleus		
*EDIT card	48	SPG	function of	10	PG
*INSERT card	52	SPG	DC-IBSYS Supervisor		
*MODIFY card	51	SPG	function of	10	PG
*PLACE card	48	SPG	DC-Input/Output Executor		
*REMARK card	54	SPG	(see also "DC-IOEX")		
*REMOVE card	53	SPG	description of	27	PG
*REPLACE card	51	SPG	function of	10	PG
*REWIND card	54	SPG	DC-IOEX		
checklist	61	PG	calling sequence for	30	PG
format index	58	PG	communication region table	28,29	PG
general format of	15	PG	functions of	27	PG
general format of	12	OG	location .COMM	32	PG
sample job deck	15	OG	location MODSW	31	PG
7/8EOF card	13	OG	maintenance of UCB fields	30	PG
7/8EOF card	20	PG	non-data selects	33	PG
Control words			redundancy message, suppression of	32	PG
buffer	13	SPG	select routine exits	31	PG
buffer pool	13	SPG	select routines	31	PG
logical record	13	SPG	sense indicators, contents of	32	PG
physical records	13	SPG	trap supervisor, description of	27	PG
Core storage, saving	92	SPG	trap supervisor, use of	27,30	PG
Data buffer			unit control blocks	29	PG
control words	13	SPG	use of	27	PG
format	13	SPG	DC-IOEX utility routines		
			Alphameric Punch	35	PG

Binary-to-BCD Octal Conversion ...	35	PG	input/output activity in	11	PG
Binary-to-Decimal Conversion	35	PG	program languages operating in ...	11	PG
Convert and Add Unit Designation to Message	36	PG	programming considerations	37-38	PG
Message Writer	34	PG	Discontinue		
Pause Routines	35	PG	job	19	OG
Post-Mortem Dump	35	PG	printed output	20	OG
Symbolic Unit Conversion	36	PG	punched output	20	OG
DCMUP			1014 typewriter	20	OG
description of	6	OG	7040 console typewriter	20	OG
function of	9	PG	7090 job processing	19	OG
patches to	91	SPG	Disk		
phases controlled by	9	PG	checkpoint of	23	OG
stages controlled by	12	PG	function of	8	PG
track allocation maps	82,83	SPG	function of	6	OG
utilities controlled by	9,10	PG	writing format tracks on	16	OG
DCOS concepts			Disk (drum)		
presentation of	8	PG	direct-read-to-processor bit	67	SPG
DCOS debugging aids program	90	SPG	existence and availability of modules	70	SPG
DCOS failures			format track generator	41	SPG
handling	24	OG	respecification of	67	SPG
DCOS Multiprocessor			track allocation for utilities ...	67	SPG
(see also "DCMUP")	9	PG	track allocation/module definition	70	SPG
DCOS Posteditor			Disk-to-Tape Deblocking Routine		
output	69,71	SPG	description of	25	OG
phase I	67	SPG	Disk-to-Tape Deblocking Utility Routine		
phase II	67	SPG	function of	10	PG
restrictions and error messages	71.1	SPG	Distribution		
role of	67	SPG	DCOS tape	41	SPG
DCOS PRESYS library			DCSYS	41	SPG
arrangement of	43,50	SPG	Drum		
location on tape	43	SPG	checkpoint of	23	OG
preparation and maintenance	57-61,67	SPG	function of	6	OG
preparation of DCSYS from	68	SPG	Dump		
preparing a backup	57	SPG	format of	24	PG
DCOS record format			\$ATEND card	20	PG
control words	91	SPG	in DCOS	14,20	OG
description of	9	PG	instructions for	20	PG
description of	8	OG	interpretation of	40	PG
DCOS-controlled utility routines			limits of	25	PG
use of	25	OG	machine status after	25	PG
Deblocking records			panel dump	20,25	PG
breakdown stage	10	OG	parameter control word	24	PG
\$SETUP card	13,25	OG	post-mortem dump	24,35	PG
\$SETUP card specifications	17-19	PG	snap dump	24	PG
stand-alone 7040/44 utility			specifications for	20,24	PG
routines	26	OG	System Core Storage Dump Program .	24	PG
utility routines	21	PG	7040	27	OG
Deck setups			7040 core storage snapshot	91	SPG
examples of	22-23	PG	Echo checking		
Deleting a job			routines relying on	38	PG
methods of	20	OG	Editing		
Direct Couple Input/Output Executor			examples	54,59-60	SPG
activating a channel	34	SPG	relocatable records	54	SPG
assigning priority	34	SPG	System Editor	20,24,43-56	SPG
communication table	32	SPG	termination of	54	SPG
DC-IOEX	8,21,31-36	SPG	End-of-tape		
non-data selects	35	SPG	condition	29,32,37	PG
organization	31	SPG	condition	19,19.1	SPG
RDUN	35	SPG	flag	29	PG
structuring input/output requests	35	SPG	procedure	37	PG
unit control blocks	28,31,37,73	SPG	Entry keys		
Direct mode			use of	19	OG
description of	11	PG	Execution stage		
description of	7	OG			
example of select plus entry	33	PG			

description of	10	OG	Input/output requests		
description of	12	PG	backspace file	39	SPG
Failures			backspace record	38	SPG
handling 7040	24	OG	channel indicator tests	40	SPG
File control block			compatibility mode	40	SPG
availability	16,74	SPG	data transmission	40	SPG
relationship to 7090 UCBS	73	SPG	direct mode	31,37,38	SPG
selection of	73	SPG	enable traps	40	SPG
7040	10,16,73	SPG	load and enter compatibility mode	39	SPG
7090	33	SPG	non-data selects	40	SPG
GETBUF			processing	7,37	SPG
as system macro or subroutine	92	SPG	read--compatibility mode	40	SPG
IBJOB Processor			read--direct mode	37	SPG
description of	7	OG	restore traps	40	SPG
description of	10	PG	rewind and unload	38	SPG
program languages operating under	10	PG	rewind input files	38	SPG
IBJOB unit assignment			rewind output files	38	SPG
considerations for using	46	PG	scatter-load DC-IBSYS	39	SPG
IBLDR unit assignment			sense instructions	40	SPG
considerations for using	46	PG	store channel	40	SPG
Immediate stop			time request	39	SPG
procedure for	24	OG	write--compatibility mode	40	SPG
Incorporating systems/programs under			write--direct mode	38	SPG
DCOS			write end of file	39	SPG
accounting routine into a			Input/output trapping		
subsystem	61	SPG	direct mode	11	PG
DCMUP utilities	63	SPG	Input/output units		
IBSYS systems in compatibility			compatibility mode	11	PG
mode	62	SPG	determining availability of	30	PG
IBSYS systems in direct mode	62	SPG	Installation accounting routine		
non-IBSYS systems	64	SPG	designing an	61	SPG
Initial start procedures			incorporating into a system	61	SPG
initiating job processing	16	OG	incorporating under DC-IBSYS	61	SPG
system initialization	16	OG	transfer to	23	SPG
Initiating job processing			Intermediate halts		
DCMUP in 7040	17	OG	restrictions for using	37,38,39	PG
DCMUP not in 7040	17	OG	Interpretation of dumps		
Input			communication region locations ...	42	PG
card	8,13	OG	DC-IBSYS 1obs	41	PG
data file requirements	8,25	OG	examining unit control blocks	44	PG
job file requirements	8,25	OG	key machine locations	40	PG
tape	8,18,25	OG	non-DC-IBSYS jobs	40	PG
Input stage			Interrupting 7090 processing		
description of	12	PG	by operator	20,22	OG
description of	9	OG	by programmer	15	OG
Input/output			Intersystem communication cells		
(see also "input" and "output") ...	8	OG	IBSNXT	29	SPG
compatibility mode	11	PG	IBSxec	29	SPG
DC-IOEX, supervision of	27	PG	IBSYST	29	SPG
direct mode	11	PG	STOP	29	SPG
printing output file	19	PG	IOBASE tables		
punching output file	19	PG	description of	14	PG
servicing of	11	PG	Job		
tape	16,18	PG	breakdown	17	SPG
trapping	11	PG	definition of	12	OG
unit availability	30	PG	definition of	15	PG
utility routines	9,10	PG	description block	10,14,82	SPG
Input/output file control block base			number	13,16	SPG
DC-IBSYS (IOBASE 0)	13,78	SPG	number of	9	OG
IOBASE	12	SPG	priority of	12	OG
IOBASE table	12	SPG	queue table	7,8,10,11,14	SPG
IOBASE1	78	SPG	sample job deck	15	OG
number	12	SPG	separator card	16	SPG
			setup	14	SPG
			Job description		

preparation of	12	PG	messages	48	PG
use of	13	PG	DCOS	28	OG
Job execution			Message Writer Utility Routine ...	34	PG
execution stage	12	PG	prefix	9,28	OG
Job flow			tape mounting	13,18	PG
description of	10	OG	Modes of operation		
example of typical job flow	13	PG	compatibility	11	PG
description of stages	12	PG	compatibility mode	8	SPG
Job identifier			description of	7	OG
contents of	12	PG	difference between	11	PG
use of	12	PG	difference between	8	SPG
Job number			direct	11	PG
assignment of	9	OG	direct mode	8	SPG
Job processing			mode switch (MODSW)	35	SPG
description of	9	PG	MODSW		
description of	10	OG	use of	31	PG
example of	13	PG	Multiprocessor control program (DCMUP)		
initiating	16	OG	arrangement of	48	SPG
interrupting	15,20,22	OG	background utilities	16	SPG
restarting	21	OG	commutator	8	SPG
stages of	12,13	PG	control	21	SPG
stages of	9	OG	input service routine	14	SPG
supervision of	9	PG	introduction	7	SPG
terminating	20	OG	job breakdown	17	SPG
Job segment			job setup	14	SPG
definition of	13	OG	logic flow	8	SPG
occurrence within a job	15	PG	post-execution utilities	18	SPG
Job-status change			pre-execution utilities	17	SPG
means of making	22	OG	print routine	18	SPG
Job-status inquiry			punch routine	17	SPG
means of making	22	OG	Non-data selects		
Line estimate			calling sequence for	33	PG
description of	12	OG	NOPs		
Load from disk and start procedures			instructions treated as	38	PG
description of	17	OG	Operator's log		
Locating a job			description of	9	OG
via operator's log	9	OG	sample	9	OG
via 1014	22	OG	Output		
via 7040	19	OG	printed	8	OG
Machine configuration			punched	8	OG
description of	5	OG	tape	8,13,25	OG
function of each unit	8,9	PG	Panel dump		
minimum	66	PG	obtaining a	26-27	PG
Magnetic tape units			Pause Routines		
function of	8	PG	.PAUSE Routine	35	PG
Magnetic tapes			.PAWS Routine	36	PG
function of	6	OG	Phases of processing		
Maintenance control cards			description of	9	PG
*AFTER	53	SPG	description of	6,9	OG
*CHECK	54	SPG	diagram of	6	OG
*DUP	53	SPG	diagram of	9	PG
*INSERT	52	SPG	postprocessing	6,9	OG
*MODIFY	51	SPG	preprocessing	6,9	OG
*REMARK	54	SPG	processing	6,9	OG
*REMOVE	53	SPG	Posteditor (see DCOS Posteditor)		
*REPLACE	51	SPG	Post-Mortem dump		
*REWIND	54	SPG	DC-IOEX utility routine	34	PG
Message Writer Utility Routine			description of	24	PG
calling sequences for	34	PG	initiating	24	PG
classification of operator			specifications for	24	PG
messages	34	PG	Postprocessing phase		
message length	35	PG	breakdown stage	10	OG
Messages			breakdown stage	13	PG
classification of operator					

description of	6,9	OG	description of	8	OG
diagram of	12	PG	Punching output file		
print stage	10	OG	\$SETUP card specifications for	17-19	PG
print stage	13	PG	Purge stage		
punch stage	10	OG	description of	11	OG
punch stage	13	PG	description of	13	PG
purge stage	11	OG	PUTBUF		
purge stage	13	PG	as system macro or subroutine 92	SPG
utilities	9	PG	Queue table		
utility stage	25	OG	contents of	13	PG
Preprocessing phase			Record format		
description of	6,9	OG	description of	8	OG
diagram of	12	PG	Record formats		
input stage	9	OG	data buffer	13	SPG
input stage	12	PG	library records	50,54	SPG
setup stage	10	OG	Records		
setup stage	12	PG	blocking	10,25	OG
utilities	9	PG	deblocking	10,25	OG
utility routines	25	OG	standard DCOS format	8	OG
PRESYS library (see DCOS PRESYS library)			transmission to and from tape 25	OG
Print			Redundancy indication		
IBM 720A simulation	19	SPG	meaning of	37	PG
routine	18	SPG	Remarks card		
Print stage			description of	14	OG
description of	10	OG	Remote inquiry unit		
description of	13	PG	discontinuing typewriter	20	OG
Printed output			function of	6	OG
description of	8	OG	function of	8	PG
Printer			restarting typewriter	20	OG
backspace	20	OG	use of	6,19,21	OG
discontinue job output on	20	OG	Repeat requests		
function of	5	OG	means of making	20	OG
function of	8	PG	Restart		
repeat job output on	20	OG	description of	21	OG
restart job output on	20	OG	printing of output	20	OG
simulation of 720A printer	13,25	OG	punching of output	20	OG
single space	20	OG	system	24	OG
Priority			1014 typewriter	20	OG
assignment of	10,12	OG	7040 console typewriter	20	OG
giving highest priority to job ...	20	OG	7090 job	19	OG
Priority code			Restore disk (drum) procedures		
in job identifier	13	PG	description of	23	OG
on job card	15	PG	Resume 7090 processing		
Processing phase			methods used to	21	OG
description of	12	PG	Save disk (drum) procedures		
description of	6,9	OG	description of	23	OG
diagram of	12	PG	Save-restore card		
execution stage	12	PG	description of	23	OG
Programming considerations			Save-Restore Disk/Drum Routine		
compatibility mode systems	38	PG	description of	23	OG
direct and compatibility mode			restore procedures	23	OG
systems	37	PG	save procedures	23	OG
direct mode systems	38	PG	save-restore card	23	OG
Punch			Select minus entry		
activity routine	18	SPG	relinquishing control of a unit ..	32	PG
discontinue job output on	20	OG	Select plus entry		
errors	18	SPG	compatibility mode	31	PG
function of	5	OG	direct mode example	31	PG
hole-count error	18	SPG	general entry	32	PG
repeat job output on	20	OG	Select routines		
restart job output on	20	OG	design of	31,32	PG
routine	17	SPG	distinguishing between	31	PG
Punch stage			error recovery procedures	33	PG
description of	10	OG			
description of	13	PG			
Punched output					

exits	31	PG	(see also "dump")	24	PG
general considerations	33	PG	System Editor		
redundancy checking	33	PG	function of	10	PG
select minus entry	32	PG	System initialization		
select plus entry	31	PG	procedure used for	16	OG
Sense indicators			System Output Unit		
contents of	32	PG	use of	37	PG
Sense switches			System Peripheral Punch (SYSPP)		
use of	18	OG	use of	37	PG
Set-density instructions			System units		
issued form 7090 program	37	PG	SYSCK1	23	SPG
Setup stage			SYSCK2	23	SPG
description of	10	OG	SYSCRD	24	SPG
description of	12	PG	SYSIN1	24,51,52	SPG
Simulation			SYSLB1	23,24,39	SPG
data channel trap	40	PG	SYSLB2	51,52,53	SPG
devices simulated	7,46	PG	SYSUT1	51,52,53	SPG
of 7090 units	73	SPG	SYSUT2	51,52	SPG
7090 LOAD CARD button	21	SPG	UNISYM table	16,75	SPG
7090 LOAD CARD button, pressing of,	16	PG	unit availability table	29	SPG
7090 LOAD TAPE button, pressing of,	16	PG	unit function table	28	SPG
7090 tape load routine	22	SPG			
720A printer	10	PG	Tables		
720A printer	25	OG	DC-IBSYS system name	48,51,53	SPG
Single-space printer			DC-IOEX communication	32	SPG
request to	20	OG	direct mode name	21	SPG
limits of	25	PG	IOBASE	12,14,16	SPG
machine status after	25	PG	system unit function (SYSUNI) .	27,28	SPG
parameter control word	24	PG	track allocation/module		
Snap dump			definition	67,70	SPG
formats of	24-25	PG	unit availability	27,29	SPG
Snapshot routine	91	SPG	unit control block	27,31	SPG
Stage number			unit symbol (UNISYM)	16,75	SPG
assignment of	10	OG	utility name	67,71	SPG
use of	12	PG	7040 system name	39,67,69	SPG
Stages of processing			Tape		
breakdown	10	OG	blocking	10,25-27	OG
description of	9	OG	deblocking	10,25-27	OG
diagram of	10	OG	discontinuing tape input	18,20	OG
execution	11	OG	initiating tape input	18,20	OG
execution	12	PG	input	18	OG
input	12	PG	output	8	OG
input	9	OG	preparation of	18,25-27	OG
print	10	OG	procedure for input to DCOS	18,25-27	OG
print	13	PG	specified on \$SETUP card	13,25	OG
punch	10	OG	subsystem on tape	13	OG
punch	13	PG	Tape Blocking Routine (7040/44)		
purge	11	OG	description and use of	25-27	OG
purge	13	PG	Tape Deblocking Routine (7040/44)		
setup	10	OG	description and use of	25-27	OG
setup	12	PG	Tape input/output		
Stand-alone 7040/44 utility routines			assigning units	19	PG
description of	26	OG	blocking	9,11,19	PG
Standard DCOS record format			deblocking	10,19	PG
description of	9	PG	mounting input files	18	PG
description of	8	OG	requesting output files	19	PG
Starting the system			specifying on \$SETUP card	18	PG
procedure for	16	OG	Tape manipulation control cards		
Stopping the system			\$ENDFILE	24	SPG
procedure for	24	OG	\$REMOVE	25	SPG
Storage units			\$REWIND	25	SPG
disk	6	OG	\$UNLOAD	25	SPG
drum	6	OG	Tape mounting messages		
Symbolic Unit Conversion Routine			appearance of	13	PG
instructions for using	36	PG	with \$SETUP card	19	PG
System Core Storage Dump Program			Tape-to-Disk Blocking Routine		

description and use of	25	OG	Unit control block	
Tape-to-Disk Blocking Utility Routine			(see also "UCB")	29 PG
description of	10	PG	table	27 SPG
Tape-to-Printer Routine			7040 tape units	10,16,74 SPG
description and use of	25	OG	7090 simulated units	38,74 SPG
Tape-to-Punch Routine			Utility	
description and use of	26	OG	arrangement of	63 SPG
Tape-to-Tape Blocking Routine			background utilities	16,19 SPG
description and use of	25	OG	breakdown utilities	19 SPG
Tape-to-Tape Blocking Utility Routine			communication region	64 SPG
description of	9	PG	design of	64 SPG
Tape-to-Tape Deblocking Routine			incorporating DCMUP utilities	63 SPG
description and use of	25	OG	monitored utilities	19 SPG
Tape-to-Tape Deblocking Utility Routine			name table	67,71 SPG
description of	10	PG	post-execution utilities	18 SPG
Termination			pre-execution utilities	17 SPG
job	20	OG	setup utilities	19 SPG
printed output	20	OG	tape blocking routine	65 SPG
punched output	20	OG	track allocation for	67 SPG
0004 typewriter	21	OG	720A printer utility	19 SPG
7040 console typewriter	20	OG	Utility routines	
7090 processing	19	OG	Add Unit Designation to Message ..	36 PG
Time estimate			Alphameric Punch	35 PG
description of	12	OG	Binary-to-BCD Octal Conversion ...	35 PG
Trap supervisor			Binary-to-Decimal Conversion	35 PG
description of	27	PG	blocking	9,11,19 PG
use of	30	PG	Card-to-Tape Routine	26 OG
UCB			DC-IOEX	10,27 PG
end-of-tape flag	29	PG	DCOS-controlled	25 OG
examining in dump	44	PG	deblocking	10,19 PG
file count	30,44	PG	Disk-to-Tape Deblocking	10 PG
format of	29-30	PG	Disk-to-Tape Deblocking Routine ..	25 OG
location of select routine	30,44	PG	Message Writer	34 PG
maintenance of fields	30	PG	Pause Routines	35 PG
record count	30,44	PG	Post-Mortem Dump	35 PG
reserve status flag	29	PG	print	9 PG
select type	30,44	PG	punch	9 PG
symbolic unit designation	30,44	PG	specified on \$SETUP card	25 OG
unit address	29,44	PG	specified on \$UTILITY card	25 OG
Unit assignment control cards			specified on \$UTILITY card	21 PG
\$ASSIGN	23	SPG	specifying on \$SETUP card	17 PG
\$CARDS	24	SPG	Symbolic Unit Conversion	36 PG
\$RELEASE	24	SPG	Tape Blocking Routine	26 OG
\$RESET	24	SPG	Tape Deblocking Routine	27 OG
\$SWITCH	24	SPG	Tape-to-Disk Blocking	10 PG
\$TAPE	24	SPG	Tape-to-Disk Blocking Routine	25 OG
Unit assignment under DCOS			Tape-to-Printer Routine	25 OG
basic precepts	73	SPG	Tape-to-Punch Routine	26 OG
control cards	22	SPG	Tape-to-Tape Blocking	9 PG
IBJOB	75	SPG	Tape-to-Tape Blocking Routine	25 OG
IBLDR	75	SPG	Tape-to-Tape Deblocking	10 PG
non-IBSYS systems	78	SPG	Tape-to-Tape Deblocking Routine ..	25 OG
operational inconsistencies	79	SPG	6040/44 Utility Routines	27 OG
other IBSYS subsystems	76	SPG	720A simulation	10 PG
special considerations	78	SPG	720A Simulation Routine	25 OG



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IBM 7090-7040 Direct Couple Operating System:
Programmer's Guide

This Technical Newsletter amends the publication IBM 7090-7040 Direct Couple Operating System: Programmer's Guide, Form C28-6382-3. The pages attached to this newsletter document the use of the IBJOB Processor and the System Editor of the Version 13 IBSYS Operating System under the Direct Couple System.

In the referenced publication, replace the pages listed below with the corresponding pages attached to this newsletter.

Cover and Preface
Pages 9 and 10
Pages 13 and 14
Pages 17 through 22
Pages 35 through 40
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Pages 11, 12 and 12.1	Pages 43 and 44
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<u>Pages</u>	<u>Subject of Amendment</u>
15 and 16	Use of \$ROW-\$ENDROW card groups in a job deck
19 and 20	Unit designations on \$SETUP cards when requesting a deblocked tape output file
33 and 34	Bit settings in location .COMM of the DC-IOEX communication table

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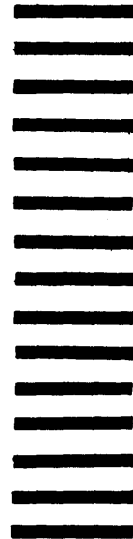
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