IBM Field Engineering Programming Handbook

System/360

ACKNOWLEDGEMENT

This Handbook has been prepared by the Plant CE Department, World Trade Corporation, Japan, and is intended to be a Service Aid for the Program Support Customer Engineer.

IBM Programming Handbook

DOS Version 3

IBM / FE Supplement

System/Unit Programming Handbook

Re: Form No. 229-2129-0

This Supplement No. S29-0028

Date: September 1, 1968

This *Supplement* is issued to release information on DOS Version 3 differences. File the attached in the Field Engineering Programming Handbook, Form Number 229-2129-0.

File this cover letter at the back of the publication. It will then serve as a record of the changes received and incorporated.

DOS VERSION 3

TABLE OF CONTENTS

Op	Operand
TPLAB	'label fields 3-10' 'label fields 3-13'

'label fields 3-10'
This is a 49-byte character string, included within apostrophes (8-5 punch), identical to positions 5-53 of the tape file label. These fields can be included in one line.

'label fields 3-13'
This is a 69-byte character string, included within apostrophes (8-5 punch), identical to positions 5-73 of the tape file label. These fields are too to be included on a single line. The character string must extend into column 71, a continuation character (any character) is present in column 72, and the character string is completed on the next line. The continuation line starts in column 16.

DLBL -- DASD Label Information Command

The DLBL command replaces the VOL and DLAB combination used in earlier systems. It contains file label information for DASD label checking and creation. The DLBL command must not be followed by the XTENT command. The current system will, however, continue to accept the VOL, DLAB and XTENT combination. The DLBL command has the following format:

Op	Operand
DLBL	filename,['file-ID'],[date],[codes]

filename
From one to seven characters and identical to the symbolic name of the program DTF, which identifies the file.

'file-ID'
The name associated with the file on the volume. From 1 to 44 bytes of alphameric data, contained within apostrophes, including file-ID and, if used, generation number and version number of generation. If fewer than 44 characters are used, the field is left justified and padded with blanks. If this operand is omitted, "filename" is used.

date
From 1 to 6 characters indicating either the retention period of the file (in the format d through dddd) or the absolute expiration date of the file (in the format yy/ddd). ddd cannot exceed 366. If this operand is omitted for an output file, a 7-day retention period is assumed and the current date is the creation date. If present, this operand is ignored for an input file.

codes
A 2-3 character field indicating the type of file label as follows:

SD for sequential disk or for DTFPH with MOUNTED=SINGLE.

DA for direct access or for DTFPH with MOUNTED=ALL.

IS C for indexed sequential using Load Create.

IS E for indexed sequential using Load Extension, Add, or retrieve.

If this operand is omitted, SD is assumed.

Additional fields in the standard disk file label are filled with default options for output files and "DOS/360 VER 3" is used as the system code.

Op	Operand
EXTENT	[symbolic-unit], [serial-number], [type], [sequence-number], [relative-track], [number-of-tracks], [split-cylinder-track], [B=bins]

symbolic unit — A six-character field indicating the symbolic unit (SYSxxx) of the volume for this extent. If this operand is omitted, the symblic unit of the preceding EXTENT command is used. This operand is not required for a single volume, IJSYSxxx filename or for a file defined with the DTF DEVADDR=SYSnnn.

serial number — From 1 to 6 characters indicating the volume serial number for this extent. If fewer than six characters are used, the field is right-justified and padded with zeros. If this operand is omitted the volume serial number of the preceding EXTENT is used. If no serial number was provided in the EXTENT command, the serial number is not checked, and the files may be destroyed if the wrong volume is mounted.

type — One of the following characters to indicate the extent type:

1 - data area (no split cylinder)

2 - overflow area (for indexed sequential file)

4 - index area (for indexed sequential file)

8 - data area (split cylinder)

If this operand is omitted, type 1 is assumed.

sequence number — One to three characters containing a decimal number from 0 to 255, indicating the sequence number of this extent within a multiextent file. Extent sequence 0 is used for the master index of an indexed sequential file. If a master index is not used, the first extent of an indexed sequential file has the sequence number 1. The extent sequence number for all other types of files begins with 0. If this operand is omitted for the first extent of an ISFMS file, the extent is not accepted. This operand is not required for SD or DA files.

relative track — One to five characters indicating the sequential number of the track (relative to zero) where the data extent is to begin. For example, track 0, cylinder 150 on a 2311 equals 1500 in relative track. If this field is omitted on an ISFMS file, the extent is not accepted. This operand is not required for SD or DA input files because the extents from the file labels on a disk are used.

number of tracks — One to five characters indicating the number of tracks to be allotted to the file. For SD or DA input files, this operand may be omitted. For split cylinders, the number of tracks must be an even mutiple of the number of tracks per cylinder specified for the file.

split cylinder track — One or two characters, from 0 to 19, indicating the upper track number for the split cylinder in SD files.

bins — One or two characters identifying the 2321 bin for which the extent was created or on which the extent is currently located. If this field is one character, the creating bin is assumed to be zero. There is no need to specify a creating bin number for SD or ISFMS files. If this operand is omitted, bin zero is assumed for both characters. If this operand is included and positional operands are omitted, only one comma is required preceding the key-word operand (bins). (One comma for each omitted positional operand is acceptable, but not necessary.)

```
// JOB BUILD  STANDARD LABELS        VERSION III
// OPTION STDLABEL
// DLBL IJSYSLN,'SYSTEM WORK FILE N 0.   ',99/365,SD
// EXTENT SYSLNK,111111,8,0,0010,198,0
// DLBL IJSYS01,'SYSTEM WORK FILE N 1   ',99/365,SD
// EXTENT SYS001,111111,8,0,0011,594,3
// DLBL IJSYS02,'SYSTEM WORK FILE N 2.   '99/365,SD
// EXTENT SYS002,111111,8,0,0014,594,6
// DLBL IJSYS03,'SYSTEM WORK FILE N 3.   ',99/365,SD
// EXTENT SYS003,111111,8,0,0017,594,9
// DLBL IJSYSRS,'DOS SYSTEM RESIDENCE   F',99/365,SD
// EXTENT SYSRES,111111,1,0,0001,1980
// DLBL IJSYSRL,'DOS PVT REL LIB',99/365,SD
// EXTENT SYSRLB,111111,1,1,0380,1000
// DLBL IJSYSSL,'DOS PVT SRS LIB',99/365,SD
// EXTENT SYSSLB,111111,1,1,1390,600
/*
/&
// PAUSE END OF BUILD
```

Track	
0	Background program temporary (USRLABEL) label information
1	Background program standard (PARSTD) label information
2	Foreground-two temporary (USRLABEL) label information
3	Foreground-two standard (PARSTD) label information

4	Foreground-one temporary (USRLABEL) label information
5	Foreground-one standard (PARSTD) label information
6-n	Standard (STDLABEL) label information for any partition. n is 9 for 2311; 19 for 2314.

Sample of Control Cards to Build Standard Labels for Work Files and Private Libraries.

Definition of a Private Relocatable Library

```
// JOB jobname
// ASSGN SYSRLD, X'cuu'
// DLBL IJSYSRL, 'user identification
   of private library',date, code
// EXTENT extent information
// EXEC CORGZ
   NEWVOL RL-cylin (tracks)
/*
/&
```

A MAINT function will be required to catalog modules into the private library.

Definition of a Private Source Statement Library

```
// JOB jobname
// ASSGN SYSSLB, X 'cuu'
// DLBL IJSYSSL, 'user identification of
   private library', date, code
// EXTENT extent information
// EXEC CORGZ
   NEWVOL SL-cylin (tracks)
/*
/&
```

A MAINT function will be required to catalog modules into the private library.

Definition and Creation of a Private Relocatable Library

```
// JOB jobname
// ASSGN SYSRLB,X'cuu'
// DLBL IJSYSRL, 'user identification
   of private library', date, code
// EXTENT extent information
// EXEC CORGZ
   NEWVOL RL-cylin (tracks)
   COPYR operands
/*
/&
```

COPY function is effective for private libraries only during their creation.

Definition and Creation of a Private Source Statement Library

```
// JOB jobname
// ASSGN SYSSLB,X'cuu'
// DLBL IJSYSSL, 'user identification
   of private library', date, code
// EXTENT extent information
// EXEC CORGZ
   NEWVOL SL-cylin (tracks)
   COPYS operands
/*
/&
```

COPY function is effective for private libraries only during their creation

COMMAND	MEANING	IPL	JC	AR	SPI	WHEN ACCEPTED
ADD	Add a device to the PUB table.	X				
DEL	Delete a device from the PUB table	X				During IPL SET date and clock only
SET	Set values in the communication area.	X	X			
CLOSE	Close magnetic tape input or output file or 2311.		X			
DVCDN	Device down (not available to system		X			
DVCUP	Device up (now available to system		X			
MTC	Magnetic tape control		X			Between Jobs and Job Steps
RESET	Reset temporary I/O device assignments to system standard					
STOP	Stop execution of background job.		X			
UNBATCH	Terminate batch processing		X			
UCS	Load universal character set buffer		X			
ALLOC	Allocate core storage.		X	X		Between Jobs and Job Steps and after pressing the request key on 1052
MAP	List core storage allocations.		X	X	X	
PAUSE	Suppress processing (enter WAIT state).		X	X	X	
LOG	Log (print) job control statements		X	X	X	Between Jobs and Job Steps after pressing the request key on 1052, and as response to system message, and during single program initiation.

NOLOG	Suppress logging control statements.		X	X	X	
CANCEL	Cancel execution of current job.		X	X	X	
B	End-of-block or communications	X	X	X	X	During IPL between Jobs and Job Steps after pressing the request key on 1052, and as response to system message, and during single program initiation.
C	Cancel terminal response (1052).	X	X	X	X	
ASSGN	Assign Logical name.		X		X	
HOLD	Hold current foreground assignments		X		X	
LISTIO	List current I/O assignments.		X		X	
RELSE	Release current foreground assignments and unassign them at the end of any job initiated for that area.		X		X	Between Jobs and Job Steps and during single program initiation.
UNA	Set all assignments for foreground area to unassigned. The specified area must be inactive.		X		X	
MSG	Give control to a a foreground communication routine.			X	X	
TIMER	Transfers timer support to indicated program.			X	X	After pressing the requestkey on the 1052 and during single program initiation
START	Initiates a foreground program or resumes batch processing.			X		After pressing request key on 1052
BATCH	Initiate batch processing.			X		
DLAB	Disk label information.				X	
DLBL	Disk label information.				X	

EXEC	Initiate single program execution				X	
EXTENT	Disk extent information.				X	
LBLTYP	Label information				X	During Single Program Initiation
READ	Specifies a card reader from which further single program initiation commands are read.				X	
TLBL	Tape label information.				X	
TPLAB	Tape label information.				X	
VOL	Disk volume information.				X	
XTENT	Disk extent information.				X	

1. Initial Program Loader (IPL).
2. Job Control (JC).
3. ATTN Routine (AR).
4. Single Program Initiation for F1 or F2.
5. Date and clock only.
6. Valid only if batch job joreground option was specified at system generation.
7. Valid only in a multiprogramming system.

LIBRARY MAINTENANCE FUNCTIONS
V3 DIFFERENCES

Function	Unit	Element	Control Statements Required
Catalog	Core Image Library	Phase	Same as V2

	Relocatable Library	Module	// JOB jobname
			// EXEC MAINT
			CATALR modulename [,V.M[,C]]
			(module to be cataloged)
			/*
			/&

	Source Statement Library	Book	// JOB jobname
			// EXEC MAINT
			CATALS sublib.bookname [,V.M]
			(book to be cataloged)

			/* /&
Delete	Core Image Library	Phase	Same as V2
		Program	Same as V2
	Relocatable Library	Module	Same as V2
		Program	Same as V2
		Library	Same as V2
	Source Statement Library	Book	Same as V2
		Sub-Library	Same as V2

		Library	// JOB jobname
			// EXEC MAINT
			DELETS ALL
			/*
			/&

Rename	Core Image Library	Phase	// JOB jobname
			// EXEC MAINT
			RENAMC oldname, newname(,oldname, newname,...)
			/*
			/&

	Relocatable Library	Module	// JOB jobname
			// EXEC MAINT
			RENAMR oldname, newname(,oldname, newname,...)
			/*
			/&

	Source Statement Library	Book	// JOB jobname
			// EXEC MAINT
			RENAMS sublib. oldname,sublib. newname(,sublib. oldname,sublib. newname,...)
			/*
			/&

Update	Source Statement Library	Book	// JOB jobname
			// EXEC MAINT
			UPDATE sublib. bookname,[s.book1], [v.m],[nn]
			) ADD,) DEL, or) REP statements as required with source statements to be changed
			) END [v.m[,C]]
			/*
			/&

Condense	Core Image Library	Library	// JOB jobname
			// EXEC MAINT
			CONDS CL
			/*
			/&

	Relocatable Library	Library	// JOB jobname
			// EXEC MAINT
			CONDS RL
			/*
			/&

	Source Statement Library	Library	// JOB jobname
			// EXEC MAINT
			CONDS SL
			/*
			/&

	Libraries	All	// JOB jobname
			// EXEC MAINT
			CONDS CL,RL,SL
			/*
			/&

Set Parameter for Automatic Condense	Libraries	Any or All	// JOB jobname
			// EXEC MAINT
			CONDL lib=nnnnn
			[,lib=nnnnn[,
			lib=nnnnn]]
			/*
			/&
			
			Notes: Values to be substituted for lib:
			CL--Core Image library
			RL--Relocatable library
			SL--Source Statement Library
			Values to be substituted for nnnnn:
			One to five decimal digits, with a maximum value of 65536.

Reallocation	System	Library	// JOB jobname
			// DLBL IJSYSRS,
			'DOS SYSTEM
			RESIDENCE FILE',
			date,code
			// EXTENT extent information
			// EXEC MAINT
			ALLOC id=cylin
			(tracks) (,id=
			cylin(tracks),...)
			/*
			/&

			Notes: Values to be substituted for id: CL--Core Image Library RL--Relocatable Library SL--Source statement library Values to be substituted for cylin and tracks: Any integer

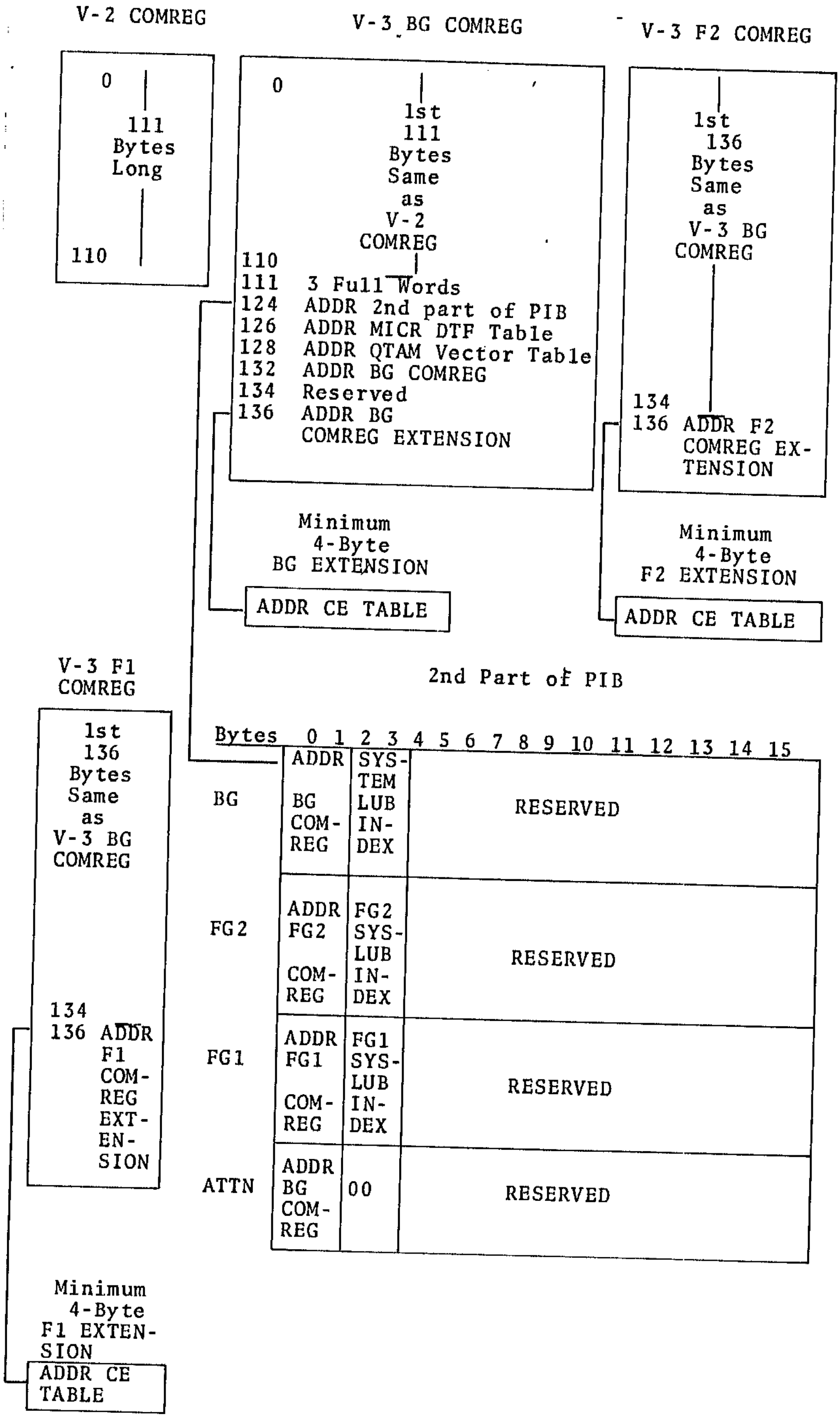
Copy	source Statement Library	Book	// JOB jobname
			// ASSGN SYS002,X'cuu'
			// DLBL IJSYSRS,' DOS SYSTEM RESIDENCE FILE', date,code
			// EXTENT extent information
			// EXEC CORGZ
			ALLOC id=cylin (tracks) [,id= cylin(tracks),...)
			* PRECEDING ALLOC
			* STATEMENT REQUIRED
			* IF NEW LIMITS TO BE
			* ESTABLISHED
			COPYS sublib.book1 [,sublib.book2,...]
			/*
			/&

		Sub-library	// JOB jobname
			// ASSGN SYS002,X'cuu'
			// DLBL IJSYSRS,'DOS SYSTEM RESIDENCE FILE',date,code
			// EXTENT extent information
			// EXEC CORGZ
			ALLOC id=cylin (tracks) [,id= cylin(tracks),...]
			* PRECEDING ALLOC
			* STATEMENT REQUIRED
			* IF NEW LIMITS TO BE
			* ESTABLISHED
			COPYS sublib1.ALL [,sublib2.ALL,...]
			/*
			/&

		Library	// JOB jobname
			// ASSGN SYS002,X'cuu'
			// DLBL IJSYSRS,'DOS SYSTEM RESIDENCE FILE',date,code
			// EXTENT extent information
			// EXEC CORGZ
			ALLOC id=cylin (tracks) [,id= cylin(tracks),...]
			* PRECEDING ALLOC
			* STATEMENT REQUIRED
			* IF NEW LIMITS TO BE

			* ESTABLISHED COPYS ALL /* /&

	Libraries	All	// JOB jobname
			// ASSGN SYS002,X'cuu'
			// DLBL IJSYSRS,'DOS SYSTEM RESIDENCE FILE',date,code
			// EXTENT extent information
			// EXEC CORGZ
			ALLOC id=cylin (tracks) [,id=cylin(tracks),...]
			* PRECEDING ALLOC
			* STATEMENT REQUIRED
			* IF NEW LIMITS TO BE
			* ESTABLISHED
			COPY ALL
			/*
			/&


V-2 COMREG
0
111 Bytes Long
110
V-3 BG COMREG
0
1st 111 Bytes Same as V-2 COMREG
110
111 3 Full Words
124 ADDR 2nd part of PIB
126 ADDR MICR DTF Table
128 ADDR QTAM Vector Table
132 ADDR BG COMREG
134 Reserved
136 ADDR BG COMREG EXTENSION
V-3 F2 COMREG
1st 136 Bytes Same as V-3 BG COMREG
134
136 ADDR F2 COMREG EXTENSION
Minimum 4-Byte BG EXTENSION
ADDR CE TABLE
Minimum 4-Byte F2 EXTENSION
ADDR CE TABLE
V-3 F1 COMREG
1st 136 Bytes Same as V-3 BG COMREG
134
136 ADDR F1 COMREG EXTENSION
Minimum 4-Byte F1 EXTENSION
ADDR CE TABLE

2nd Part of PIB

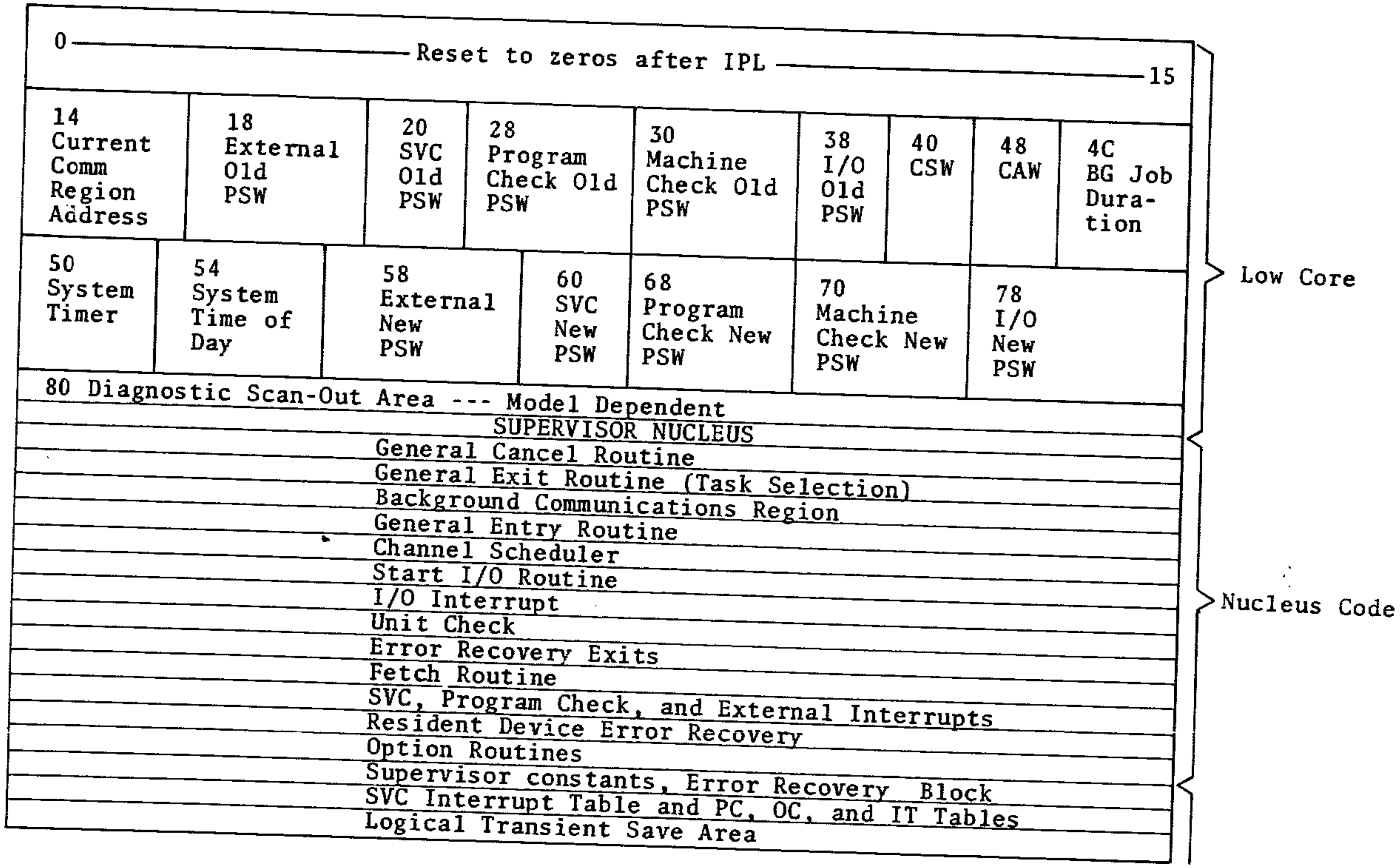
Bytes	0 1	2 3	4 5 6 7 8 9 10 11 12 13 14 15
BG	ADDR BG COMREG	SYSTEM LUB INDEX	RESERVED
FG2	ADDR FG2 COMREG	FG2 SYSLUB INDEX	RESERVED
FG1	ADDR FG1 COMREG	FG1 SYSLUB INDEX	RESERVED
ATTN	ADDR BG COMREG	00	RESERVED

Comparison of Communication Regions

PARTITION SAVE AREA

0	JOB NAME*		PSW		REG 9	REG A	23
24	REG B	REG C	REG D	REG E	REG F	REG 0	47
48	REG 1	REG 2	REG 3	REG 4	REG 5	REG 6	71
72	REG 7	REG8	LENGTH RESER- LABEL VED AREA	PARTITION START TIME	FLTPT R0		95
96	FLTPT R2		FLTPT R4		FLTPT R6		119

* NOT USED FOR BG



0 —— Reset to zeros after IPL —— 15

14 Current Comm Region Address	18 External Old PSW	20 SVC Old PSW	28 Program Check Old PSW	30 Machine Check Old PSW	38 I/O Old PSW	40 CSW	48 CAW	4C BG Job Duration

50 System Timer	54 System Time of Day	58 External New PSW	60 SVC New PSW	68 Program Check New PSW	70 Machine Check New PSW	78 I/O New PSW	

80 Diagnostic Scan-Out Area --- Model Dependent

Low Core

SUPERVISOR NUCLEUS

General Cancel Routine

General Exit Routine (Task Selection)

Background Communications Region

General Entry Routine

Channel Scheduler

Start I/O Routine

I/O Interrupt

Unit Check

Error Recovery Exits

Fetch Routine

SVC, Program Check, and External Interrupts

Resident Device Error Recovery

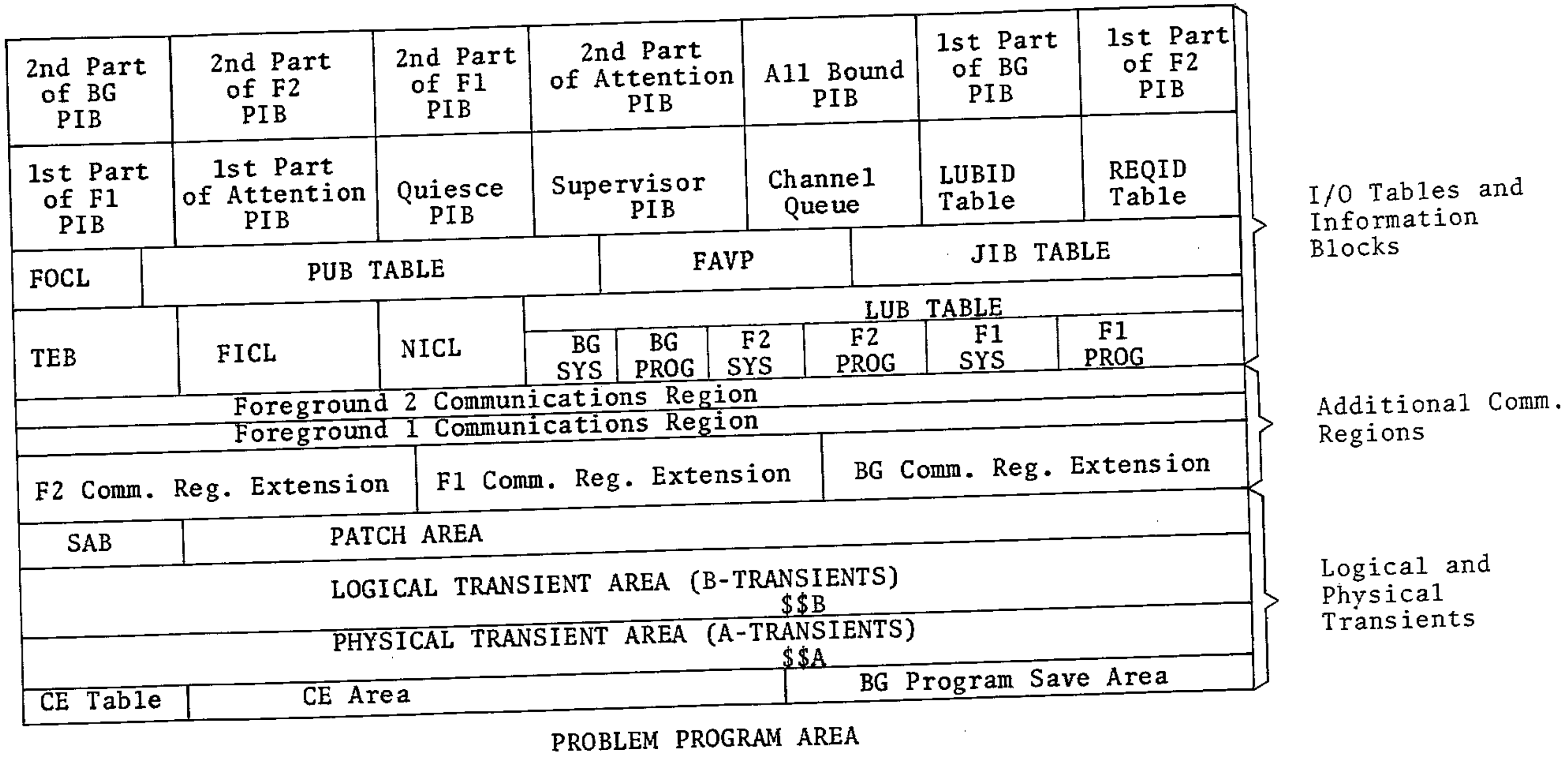
Option Routines

Nucleus Code

Supervisor constants, Error Recovery Block

SVC Interrupt Table and PC, OC, and IT Tables

Logical Transient Save Area


2nd Part of BG PIB
2nd Part of F2 PIB
2nd Part of F1 PIB
2nd Part of Attention PIB
All Bound PIB
1st Part of BG PIB
1st Part of F2 PIB
1st Part of F1 PIB
1st Part of Attention PIB
Quiesce PIB
Supervisor PIB
Channel Queue
LUBID Table
REQID Table
FOCL
PUB TABLE
FAVP
JIB TABLE
TEB
FICL
NICL
LUB TABLE
BG SYS
BG PROG
F2 SYS
F2 PROG
F1 SYS
F1 PROG
Foreground 2 Communications Region
Foreground 1 Communications Region
F2 Comm. Reg. Extension
F1 Comm. Reg. Extension
BG Comm. Reg. Extension
SAB
PATCH AREA
LOGICAL TRANSIENT AREA (B-TRANSIENTS)
$$B
PHYSICAL TRANSIENT AREA (A-TRANSIENTS)
$$A
CE Table
CE Area
BG Program Save Area
PROBLEM PROGRAM AREA
I/O Tables and Information Blocks
Additional Comm. Regions
Logical and Physical Transients

Core Map

IBM / **FE Supplement**

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IBM Programming Handbook

DOS

CE Serviceability Programs

FES S29-0029

CE SERVICEABILITY PROGRAMS

DOS CE SERVICEABILITY PROGRAMS GENERAL INFORMATION:

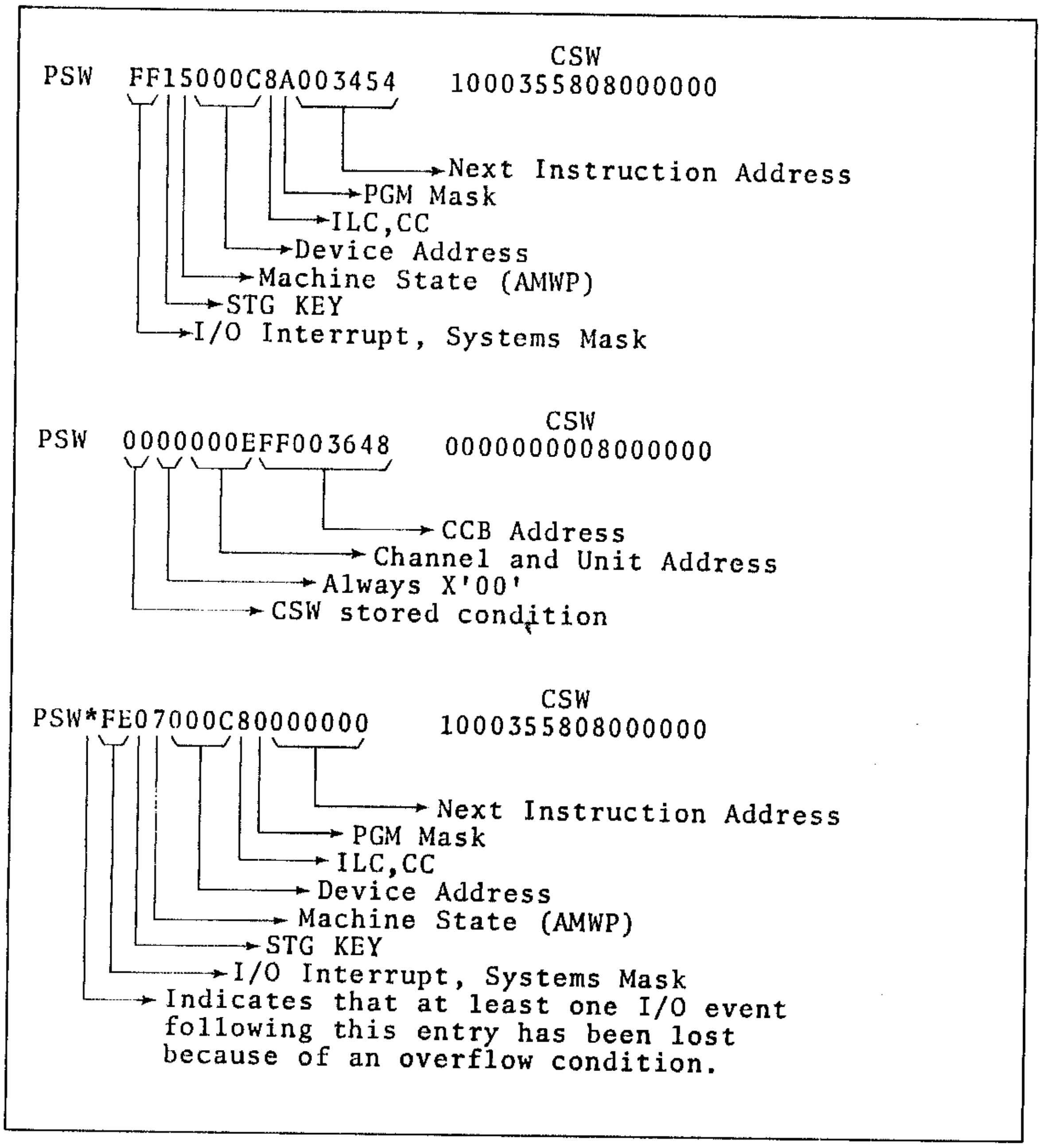
The SERVICEABILITY PROGRAMS can now be included in DOS by using the FOPT parameter CE=YES, in the Supervisor. These programs can be used by Customer Engineers, System Engineers and programmers as a troubleshooting tool simply by requesting them on SYSLOG. A complete outline on how to use these programs can be found in the PLM IBM System/360 DISK OPERATING SYSTEM (Version 3) CE SERVICEABILITY PROGRAMS (Z24-5091).

The Serviceability Program available in Release 16 is the I/O TRACE FUNCTION. In Release 17, FETCH/LOAD TRACE and TRANSIENT DUMP were added.

Release 19 will have two additional Serviceability Programs. They are DYNAMIC DISPLAY FUNCTION and DYNAMIC PATCH FUNCTION.

The fcllowing is a brief description of the Serviceability Programs and a summary on how to use them.

I/O TRACE FUNCTION - Provides a trace table for input/output devices. It records the I/O old PSW and CSW when an I/O interruption occurs. It records the device address, the CCB address and the CSW when the CSW is stored, in response to a SIO instruction issued by the DOS supervisor.



```
                              CSW
PSW  FF15000C8A003454    1000355808000000

                             CSW
PSW  0000000EFF003648    0000000008000000

                             CSW
PSW*FE07000C80000000    1000355808000000
```

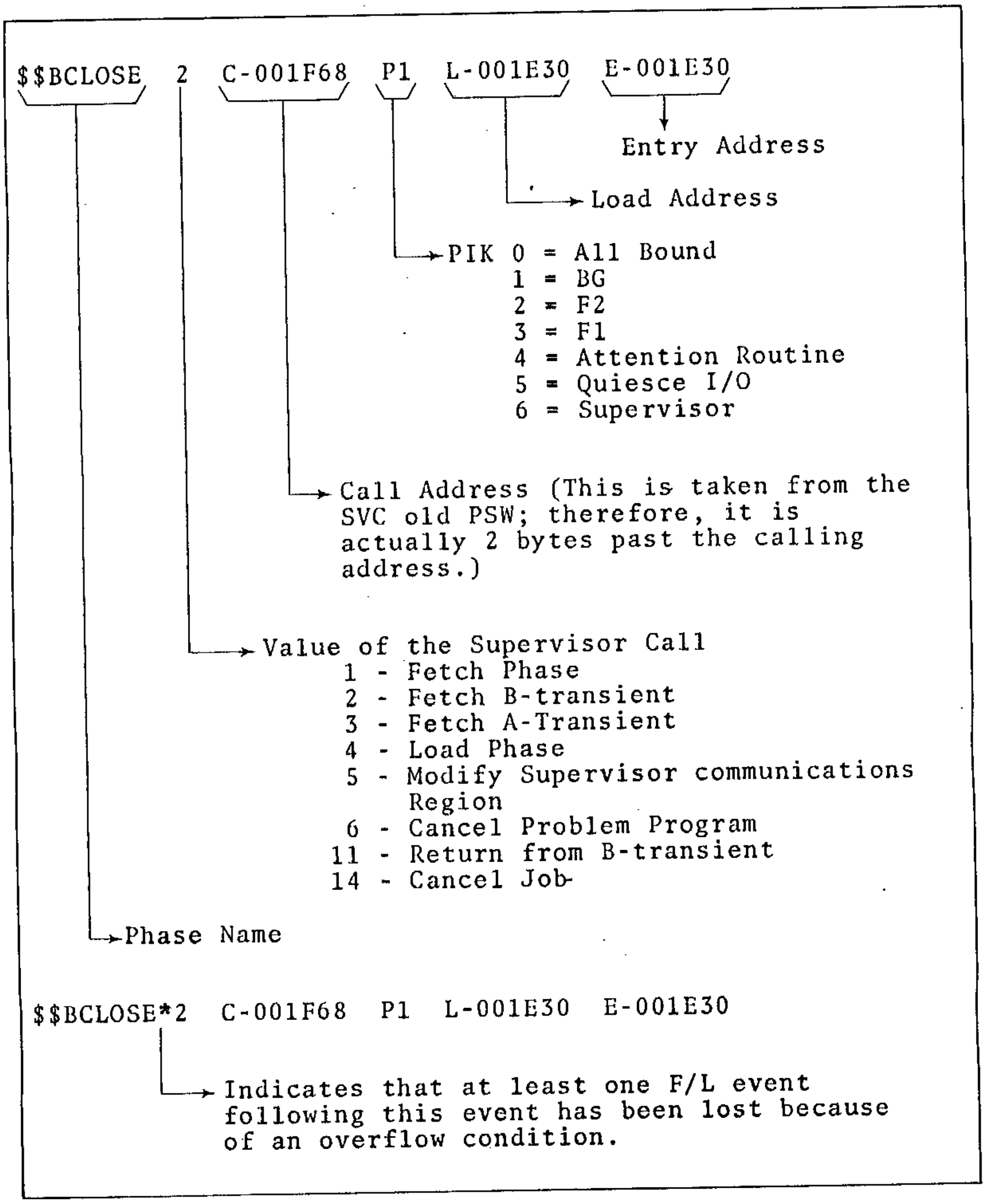
Sample Output for I/O Trace

FETCH/LOAD TRACE FUNCTION - allows tracing the order in which phases and transients are executed under control of DOS. Traceing consists of recording (for SVC1, SVC2, SVC3, SVC4):

- The location of the supervisor call
- The program interrupt key
- The supervisor call number
- The name of the phase or transient being called.
- The load address of the phase
- The entry address of the phase.

NOTE: At times, SVC5, 6, 11 and 14 branch directly into the supervisor fetch or load routine. These are traced whenever they occur, and appear in the output of the trace. (For multiprogramming systems, the calling address and SVC value cannot be guaranteed accurate in such cases.)

Each collection of data is referred to as a F/L event. The events may be preserved in a rotating buffer (first entry overwritten when the area is full), or may be outputed on a printer, punch, tape unit or console printer. When punch or tape is used, the cards or tape must be processed by the CEAIDLST utility program to provide readable output data.



```
$$BCLOSE 2 C-001F68 P1 L-001E30 E-001E30
```

Entry Address

Load Address

PIK 0 = All Bound
1 = BG
2 = F2
3 = F1
4 = Attention Routine
5 = Quiesce I/O
6 = Supervisor

Call Address (This is taken from the SVC old PSW; therefore, it is actually 2 bytes past the calling address.)

Value of the Supervisor Call
1 - Fetch Phase
2 - Fetch B-transient
3 - Fetch A-Transient
4 - Load Phase
5 - Modify Supervisor communications Region
6 - Cancel Problem Program
11 - Return from B-transient
14 - Cancel Job

Phase Name

```
$$BCLOSE*2 C-001F68 P1 L-001E30 E-001E30
```

Indicates that at least one F/L event following this event has been lost because of an overflow condition.

Sample Output for F/L Trace

TRANSIENT DUMP FUNTION provides a dump of the supervisor, before it is altered, on a program check interruption. The dump provides:

- The 16 general registers.
- The first 144 bytes of low core.
- The logical transient area (with the label LTA).
- The physical transient area (with the label PTA).

This information may be outputed on either a printer or tape unit. When tape is used, the tape must be processed by the CEAIDLST utility program to provide readable output data.

Both the printer and tape modules are reusable. That is, a dump is given on each program check interruption until the function is reset.

DYNAMIC DISPLAY FUNCTION - will allow the general registers and a specified area of core storage to be displayed each time a designated location (trigger address) is reached in the execution of the program.

The User specifies the parameters to determine the display. Required:

- The location of the instruction that triggers the display (trigger address).
- The op-code expected at the trigger address (trigger instruction).
- An output device address (to be used for the displaying).
- The name of the phase to trigger the display.

Optional:

- The partition, in which the monitored phase is to be loaded in a multiprogramming system.
- The area of core storage to be displayed (in addition to the general registers).

NOTE: AVAILABLE IN RELEASE 19 AND LATER.

DYNAMIC PATCH FUNCTION - will allow the user to dynamically patch desired areas of core. To perform this, the user specifies:

- The name of the phase that is to trigger the patch.
- The partition (optional) into which the phase is to be loaded.
- Start address where the patch is to be inserted.
- The data (patch) to be inserted.

The patch information cannot exceed 64K bytes.

NOTE: AVAILABLE IN RELEASE 19 AND LATER.

OPERATING REQUIREMENTS AND PROCEDURES

EQUIPMENT REQUIREMENTS

The CEAID option requires at least 24K bytes of main storage. When tape, printer, or punch output is used, it is recommended that the output device be dedicated to the CEAID function being executed and not share a selector channel or a control unit with other programs being executed. Although it is possible to share devices, this may result in lost events, and should be avoided.

When 7-track tape is used, the data conversion feature is required, and the unit must be in system reset mode while the module (IOTRTAPE, FLTRTAPE, and TDMPTAPE) is operating.

The CEAID functions support existing DOS hardware and require no new hardware; however, the console feature must be present. The modules using a punch for output do not support the 1442 unless the 1442 is used as a punch only.

PROGRAM REQUIREMENTS

The CEAID option require a DOS supervisor (Version 3) in which the FOPT macro option CE=YES, or CE=nnnnn (nnnnn is between 600 and 10,240) has been specified. The SYSGEN option associated with the DOS supervisor provides:

- A CE area (600 bytes minimum) in the supervisor.
- Exit points from certain supervisor routines
- A table of addresses (CE area address, exit point addresses, etc)
- A pointer to the CE table in the communication region extension
- A low core pointer to the CETABLE (used by exit points).

The core image and relocatable libraries must contain the following phases.

Core Image	Relocatable
CEAID	ILCEAID1
CEAID001	
CEAID002	
CEAID003	
CEAID004	
CEAID005*	
CEAID006*	
CEAIDLST	ILCEAID2
$$BZCE01	

* Release 19

CATALOGING CEAID AND CEAIDLST

All CEAID modules are written as self-relocating code to allow initialization in any partition of a multiprogramming system. Some differences exist in job control programs between batch-only and multiprogramming systems. These differences affect self-relocating code.

For multiprogramming systems, self-relocating programs must be assigned an origin of location zero when they are linkage edited. The zero address allows the supervisor to recognize self-relocating program, and the program can be loaded into the appropriate location for the partition being initialized.

Batch-only systems cannot recognize self-relocating programs, and they require all programs to be linkage edited to a valid location beyond the end of the supervisor.

The root-phases CEAID and CEAIDLST (modules ILCEAID1 and ILCEAID2, respectively) are provided in the relocatable library so they can be linkage edited for the system in which they are to be used. All other phases associated with the CEAID functions are loaded by the root-phase CEAID, and because they do not require linkage editing, they are provided only in the core image library.

Before using the functions, perform a linkage editor run and catalog CEAID and CEAIDLST into the core image library. Cataloging may be performed by entering one of the following sets of cards into the DOS job stream:

1. For operation in a batch-job system:

```
// JOB CE1
// OPTION CATAL
   PHASE CEAID,S
   INCLUDE ILCEAID1
/*
// EXEC LNKEDT
/*
/&
// JOB CE2
// OPTION CATAL
   PHASE CEAIDLST,S
   INCLUDE ILCEAID2
/*
// EXEC LNKEDT
/*
/&
```

2. For operation in a multiprogramming system:

```
// JOB CE1
// OPTION CATAL
   PHASE CEAID,+0
   INCLUDE ILCEAID1
/*
// EXEC LNKEDT
/*
/&
// JOB CE2
// OPTION CATAL
   PHASE CEAIDLST,+0
   INCLUDE ILCEAID2
/*
// EXEC LNKEDT
/*
/&
```

INITIALIZATION

After linkage editing into the core image library, the initializer program is loaded with standard DOS job control statements. The statement:

```
    // EXEC CEAID
```

causes the initializer to be loaded. The initializer types out the first keyword, CEAID= and opens the keyboard for a response. A choice can be made at this point to enter the parameters from the console typewriter or from SYSRDR via cards. The following is a description of each of these methods.

INITIALIZATION VIA CARD

1. Punch desired keywords and paramters into cards. Entries may be punched one-per-card, or multiple entries (separated by commas) can be made in a single card. An entry may not be split between two cards. All 80 columns of a card may be used, but a card is terminated by the first blank following an entry, or a GO entry. The last entry of the last card must be GO and the last card must be followed by a /* card.

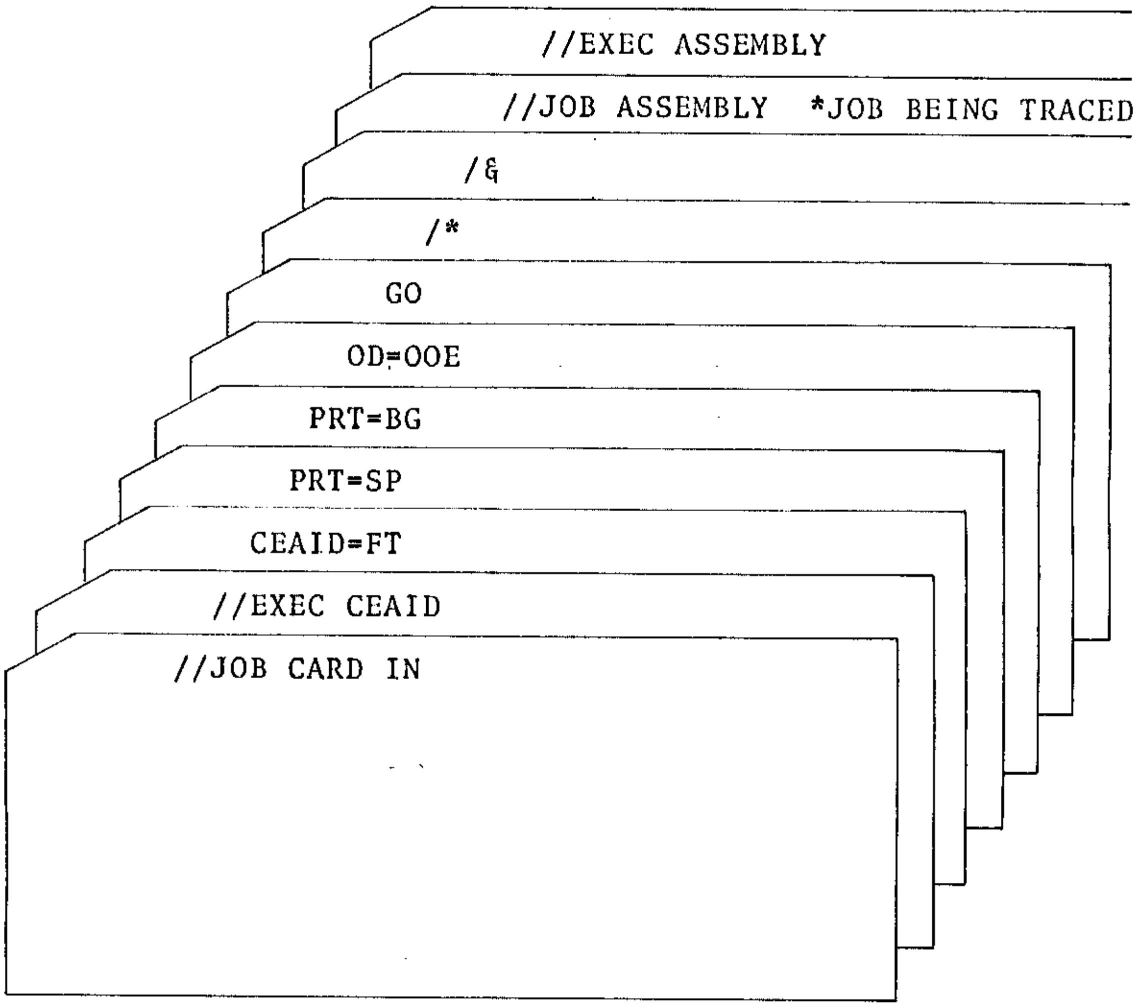
2. Place keyword entry card(s) in SYSRDR.

3. Respond to the console message CEAID= by entering only an end-of-block Ⓑ character (alternate code 5).

4. The initializer reads from cards until the GO entry is encountered.

NOTE: If a bad parameter occurs on a card, corrections are request on SYSLOG.

SAMPLE
CEAID CARD INPUT STREAM FOR FETCH/LOAD TRACE



```
//EXEC ASSEMBLY
//JOB ASSEMBLY  *JOB BEING TRACED
/&
/*
GO
OD=OOE
PRT=BG
PRT=SP
CEAID=FT
//EXEC CEAID
//JOB CARD IN
```

INITIALIZATION VIA CONSOLE TYPEWRITER

1. Respond to the console message CEAID=-- by entering IT Ⓑ, FT Ⓑ, TD Ⓑ, DD Ⓑ, or DP Ⓑ.

2. The initializer responds with the next keyword OD=CUU.

   NOTE: This keyword is not issued for dynamic patch.

   a. Respond with the Ⓑ character to select core-wrap mode.

   NOTE: This response is invalid for transient dump and dynamic display.

   b. Respond with a channel and unit address (CUU or X'CUU') Ⓑ, to select an output device.

   c. Respond with GO Ⓑ. This automatically terminates input, and selects defaults for all remaining options.

   NOTE: This response is invalid for transient dump, dynamic display and dynamic patch.

3. The initializer continues to "prompt" with appropriate keywords until all options have been satisfied, or a GO Ⓑ response is received, whereupon defaults are selected for any remaining options. Ⓑ character, in response to any keyword "prompt", causes selection of the default option, and causes the initializer to respond with the next option available. Response to IGN= or TRC= with a valid CUU causes the keyword to be repeated until:

   a. Three entries have been made, or
   b. Ⓑ response alone is given, or
   c. GO Ⓑ is entered.

4. The sequence in which keywords are prompted depends on previous responses. Because AAA is valid only in core-wrap mode, it does not occur unless the response to OD is Ⓑ (which selects core-wrape mode by default). Because IGN and TRC are mutually exclusive TRC is prompted only after a default response to IGN.

SAMPLE
CONSOLE TYPEWRITER INPUT
FOR FETCH/LOAD TRACE

```
//JOB TYPINPT3
//EXEC CEAID            (Calls for Initializer)
  CEAID =--             (Console Requests Function)
  FT Ⓑ                  (CE Response: F/L Trace Function)
  OD = CUU              (Console Requests Output Device)
  Ⓑ                     (CE Response: Core Wrap)
  AAA=X'hhhh',X'hhhh'   (Console Request Alternate Area)
  Ⓑ                     (CE Response: No AAA)
  PRT =--               (Console Requests Partition to be
                        Traced)
  BG Ⓑ                  (CE Response: Background)
  PRT =--               (Console Requests Second Partition)
  GO Ⓑ                  (CE Response: End of Input)
```

Keywords for IT, FT, and TD.

The CEAID program uses keywords to initialize the program and provide parameters. When initializing by card, the keywords may be placed in any column, and need not be in any specific order. When initiating by console, requests are made as needed. The following charts explain the keywords and their meanings.

Keyword	Parameter	Meaning	Default
CEAID=	IT FT TD XX	Initiate I/O trace. Initiate F/L trace. Initiate transient dump. Terminate function. (Turn off all hooks.)	-- -- -- Function continues.
OD= (Note 4)	CUU or X'CUU'	Use specified output device for output of trace function.	Core-wrap mode.
AAA=	x'hhhh',x'hhhh' or x'hhhhhh',x'hhhhhh'	Use specified (lower limit address, upper limit address) alternate area addresses for core-wrap trace tables. (The addresses specified cannot be in the supervisor or beyond the machine core limits and must contain either 4 6 numerals.)	Keep trace table in CE area.
PRT= (Note 1)	SP BG F2 F1	Trace supervisor. Trace background partition. Trace foreground 2 partition. Trace foreground 1 partition.	Trace all partitions.

Keyword	Parameter	Meaning	Default
IGN= (Note 2)	CUU or X'CUU'	Ignore I/O activity of specified device. A maximum of three IGN=CUU entries are allowed.	Trace all I/O.
TRC= (Note 2)	CUU or X'CUU'	Trace only device specified. A maximum of three TRC=CUU entries are allowed.	Trace all I/O.
GO (Note 3)		End of initializer keyword entries	--

Note 1 : This keyword is valid only for multiprogramming systems. It applies only to F/L trace.

Note 2 : These keywords apply only to I/O trace.

Note 3 : GO is an invalid response to a request for a console correction to card input.

Note 4 : An output device must be specified for transient dump.

Keywords for IT, FT, and TD.

Keywords for Dynamic Display.

KEYWORD	PARAMETER	MEANING	DEFAULT
CEAID=	DD	Initiate dynamic display.	--
	XX	Terminate function. (Turn off all hooks. If present, replace trigger with the trigger instruction.)	Function continues
OD= (Note 2)	CUU or X'CUU'	Use specified output device for output of display function.	--
PHASE= (Note 2)	NNNNNNNN (1-8) byte name field	Insert the display trigger when the specified phase is loaded.	--
	*	Instert the display trigger at the trigger address regardless of which phase is in core.	--
PRT= (Note 3)	SP	Display the trigger when the phase is loaded into the supervisor.	Display the trigger whenever phase is loaded, regardless of partition.
	BG	Display the trigger when the phase is loaded into the background partition.	
	F2	Display the trigger when the phase is loaded into the foreground 2 partition.	
	F1	Display the trigger when the phase is loaded into the foreground 1 partition.	

Keywords for Dynamic Display

KEYWORD	PARAMETER	MEANING	DEFAULT
DISPLIMS=	X'HHHHHH',X'HHHHHH' or X'HHHHHH',LDDDDDDD or RDD,LDDDDDDD	Display the general registers and the specified area of core (lower limit address, upper limit address; lower limit address, length of display area; register containing lower limit address, length of display area). The addresses cannot be beyond the machine core limits. The display area must be a fullword multiple of bytes. The address parameter must contain 1-6 hex numerals; the length parameter must contain 1-7 decimal numerals; the register parameter must contain one of two decimal numerals, (registers 9,10,11,12 are invalid because they are used by the function at display time.)	Display only the general registers.
OP-CODE= (Note 2)	HH	Op code of the instruction at the trigger address (must be in hex).	--
TRIGADDR= (Note 2)	X'HHHH'	Address of instruction that triggers the display (must be in hex).	--
GO (Note 1)		End of initializer keyword entries.	--

Note 1 : GO is an invalid response to a request for a console correction to card input.

Note 2 : This keyword must be specified for dynamic display (printer & tape output are supported).

Note 3 : This keyword is valid only for multiprogramming systems, and must be used if the monitored phase is to be loaded into two different partitions while the display function is active. The keyword is not specified when an '*' phase is specified.

Keywords for Dynamic Display.

Keywords for Dynamic Patch

KEYWORD	PARAMETER	MEANING	DEFAULT
CEAID=	DP XX	Initiate dynamic patch. Terminate function. (Turn off all hooks.)	-- Function Continues
AAA=	X'HHHHHH',X'HHHHHH' or X'HHHHHH',LDDDDDDD	Use specified (lower limit address, upper limit address; or lower limit address, length of alternate area) alternate area addresses for dynamic patch table. (The addresses specified cannot be in the supervisor or beyond the machine core limits. The address parameters must contain 1-6 hex numberals; the length parameter must contain 1-7 decimal numberals)	Keep patch table in CE area.
PHASE= (Note 6)	NNNNNNNN (1-8 byte name field) * (Note 1)	Insert patch when the specified phase is loaded. Insert the patch at EOJ regardless of which phase is in core.	--
PRT= (Note 7)	SP BG	Insert patch when the phase is loaded into the supervisor. Insert patch when the phase is loaded into the background partition.	Insert patch whenever the phase is loaded, regardless of partition.

Keywords for Dynamic Patch

KEYWORD	PARAMETER	MEANING	DEFAULT
	F2	Insert patch when the phase is loaded into the foreground 1 partition.	
	F1	Insert patch when the phase is loaded into the foreground 1 partition.	
	SIZE (Note 3)	The size of the remaining patch area is put out on the console and the PRT= keyword is reissued.	Continue processing
	RESET (Note 3)	The system is reset and the PHASE keyword is reissued.	
DPADDR= (Note 1)	X'HHHH'	Address where patch is to be inserted (must be 1-6 hex numerals).	--
	SIZE (Note 3)	The size of the remaining patch area is issued and the DPADDR keyword is reissued.	Continue processing
	RESET (Note 3)	The system is reset and the PHASE= keyword is reissued.	
DATA= (Note 1)	2-74 hex numerals 1-37 bytes of data	Patch information to be inserted, starting at DPADDR.	--

KEYWORD	PARAMETER	MEANING	DEFAULT
	SIZE (Note 3)	The size of the remaining patch area is issued and the DATA keyword is reissued.	Continue processing
	RESET (Note 3)	The system is reset and the PHASE keyword is reissued.	
DPADDR= (Note 4)	X'HHHH' *	New patch address requested by initializer when console input is used -- if specified the PRT, DPADDR, and DATA parameters are requested.	PHASE keyword is repeated.
GO (Note 5)		End of initializer keyword entries.	--

Note 1 : This keyword must be specified for dynamic patch.
Note 2 : This keyword is valid only for multiprogramming systems.
Note 3 : This parameter is valid only for dynamic patch.
Note 4 : This keyword is repeated until the B response is given.
Note 5 : GO is an invalid response for a console correction to card input.
Note 6 : If '*' is specified, the Initializer inserts the patch (DPCHWRAP is not called)
Note 7 : If '*' is specified, this keyword is not specified.

Keywords for Dynamic Patch

Sample - trace I/O events from three specified devices, using printer output:

// JOB TYPINPT 2	
// EXEC CEAID	Calls for initializer
CEAID=--	Console request function
IT Ⓑ	CE response: I/O trace function
OD=CUU	Console requests output device
00E Ⓑ	CE response: Printer output
IGN=CUU	Console requests IGN parameters
Ⓑ	CE response: No devices to be ignored.
TRC=CUU	Console requests and CE specifies devices to be traced
180 Ⓑ	
TRC=CUU	
090 Ⓑ	
TRC=CUU	
01F Ⓑ	

Note: GO does not have to be specified here. The initializer knows this is the end of input because three TRC entries have been made.

TERMINATION

Any function can be terminated by recalling the initiator in the same fashion as before (// EXEC CEAID), and responding to the CEAID= keyword with XXⒷ. It is also possible to reset one function by loading another because the $$BZCE01 transient automatically resets all supervisor hooks before loading a function into the CE area.

CARD/TAPE-TO-PRINTER UTILITY PROGRAM (CEAIDLST)

The card/tape-to-printer utility program reads the tape (or card) input created by the tape or punch modules from SYS005, and then prints the information on SYSLST in the same format that is used by the print modules.

Input on tape or cards may contain output from a series of CEAID runs. Only one run of the CEAIDLST program is necessary to handle any combination of one output mode from CE serviceability programs. If an unrecognizable record is encountered in processing input data, a hex dump of that record (with a maximum of 256 bytes) is given.

When card input is used, the data cards _must_ be followed by a /* card. Failure to do so results in any following cards being formatted as data until a /* is encountered.

Caution: When tape is used, always reset (terminate) the function before executing CEAIDLST. If this is not done, the CEAIDLST input tape is used by the active function for output.

IBM Programming Handbook

TOS/DOS

STANDARD INSTRUCTION SET

NAME	MNEMONIC	TYPE	OPERAND	CODE
Add	AR	RR	R1,R2	1A
Add	A	RX	R1,D2(X2,B2)	5A
Add Halfword	AH	RX	R1,D2(X2,B2)	4A
Add Logical	ALR	RR	R1,R2	1E
Add Logical	AL	RX	R1,D2(X2,B2)	5E
AND	NR	RR	R1,R2	14
AND	N	RX	R1,D2(X2,B2)	54
AND	NI	SI	D1(B1),I2	94
AND	NC	SS	D1(L,B1),D2(B2)	D4
Branch and Link	BALR	RR	R1,R2	05
Branch and Link	BAL	RX	R1,D2(X2,B2)	45
Branch on Condition	BCR	RR	M1,R2	07
Branch on Condition	BC	RX	M1,D2(X2,B2)	47
Branch on Count	BCTR	RR	R1,R2	06
Branch on Count	BCT	RX	R1,D2(X2,B2)	46
Branch on Index High	BXH	RS	R1,R3D2(B2)	86
Branch on Index Low or Equal	BXLE	RS	R1,R3,D2(B2)	87
Compare	CR	RR	R1,R2	19
Compare	C	RX	R1,D2(X2,B2)	59
Compare Halfword	CH	RX	R1,D2(X2,B2)	49
Compare Logical	CLR	RR	R1,R2	15
Compare Logical	CL	RX	R1,D2(X2,B2)	55
Compare Logical	CLC	SS	D1(L,B1),D2(B2)	D5
Compare Logical	CLI	SI	D1(B1),I2	95
Convert to Binary	CVB	RX	R1,D2(X2,B2)	4F
Convert to Decimal	CVD	RX	R1,D2(X2,B2)	4E
Diagnose		SI		83
Divide	DR	RR	R1,R2	1D
Divide	D	RX	R1,D2(X2,B2)	5D
Exclusive OR	XR	RR	R1,R2	17
Exclusive OR	X	RX	R1,D2(X2,B2)	57
Exclusive OR	XI	SI	D1(B1),I2	97
Exclusive OR	XC	SS	D1(L,B1),D2(B2)	D7
Execute	EX	RX	R1,D2(X2,B2)	44
Halt I/O	HIO	SI	D1(B1)	9E
Insert Character	IC	RX	R1,D2(X2,B2)	43
Load	LR	RR	R1,R2	18
Load	L	RX	R1,D2(X2,B2)	58
Load Address	LA	RX	R1,D2(X2,B2)	41
Load and Test	LTR	RR	R1,R2	12
Load Complement	LCR	RR	R1,R2	13
Load Halfword	LH	RX	R1,D2(X2,B2)	48
Load Multiple	LM	RS	R1,R3,D2(B2)	98
Load Negative	LNR	RR	R1,R2	11
Load Positive	LPR	RR	R1,R2	10
Load PSW	LPSW	SI	D1(B1)	82
Move	MVI	SI	D1(B1),I2	92
Move	MVC	SS	D1(L,B1),D2(B2)	D2
Move Numerics	MVN	SS	D1(L,B1),D2(B2)	D1
Move with Offset	MVO	SS	D1(L1,B1),D2(L2,B2)	F1
Move Zones	MVZ	SS	D1(L,B1),D2(B2)	D3
Multiply	MR	RR	R1,R2	1C
Multiply	M	RX	R1,D2(X2,B2)	5C
Mulriply Halfword	MH	RX	R1,D2(X2,B2)	4C
OR	OR	RR	R1,R2	16
OR	O	RX	R1,D2(X2,B2)	56
OR	OI	SI	D1(B1),I2	96
OR	OC	SS	D1(L,B1),D2(B2)	D6
Pack	PACK	SS	D1(L1,B1),D2(L2,B2)	F2
Set Program Mask	SPM	RR	R1	04
Set System Mask	SSM	SI	D1(B1)	80
Shift Left Double	SLDA	RS	R1,D2(B2)	8F
Shift Left Single	SLA	RS	R1,D2(B2)	8B
Shift Left Double Logical	SLDL	RS	R1,D2(B2)	8D
Shift Left Single Logical	SLL	RS	R1,D2(B2)	89
Shift Right Double	SRDA	RS	R1,D2(B2)	8E
Shift Right Single	SRA	RS	R1,D2(B2)	8A
Shift Right Double Logical	SRDL	RS	R1,D2(B2)	8C
Shift Right Single Logical	SRL	RS	R1,D2(B2)	88
Start I/O	SIO	SI	D1(B1)	9C
Store	ST	RX	R1,D2(X2,B2)	50
Store Character	STC	RX	R1,D2(X2,B2)	42
Store Halfword	STH	RX	R1,D2(X2,B2)	40
Store Multiple	STM	RS	R1,R3,D2(B2)	90
Subtract	SR	RR	R1,R2	1B
Subtract	S	RX	R1,D2(X2,B2)	5B
Subtract Halfword	SH	RX	R1,D2(X2,B2)	4B
Subtract Logical	SLR	RR	R1,R2	1F
Subtract Logical	SL	RX	R1,D2(X2,B2)	5F

STANDARD INSTRUCTION SET

(Continued)

Supervisor Call	SVC	RR	I	0A
Test and Set	TS	SI	D1(B1)	93
Test Channel	TCH	SI	D1(B1)	9F
Test I/O	TIO	SI	D1(B1)	9D
Test Under Mask	TM	SI	D1(B1), I2	91
Translate	TR	SS	D1(L, B1), D2(B2)	DC
Translate and Test	TRT	SS	D1(L, B1), D2(B2)	DD
Unpack	UNPK	SS	D1(L1, B1), D2(L2, B2)	F3

DECIMAL FEATURE INSTRUCTIONS

Add Decimal	AP	SS	D1(L1, B1), D2(L2, B2)	FA
Compare Decimal	CP	SS	D1(L1, B1), D2(L2, B2)	F9
Divide Decimal	DP	SS	D1(L1, B1), D2(L2, B2)	FD
Edit	ED	SS	D1(L, B1), D2(B2)	DE
Edit and Mark	EDMK	SS	D1(L, B1), D2(B2)	DF
Multiply Decimal	MP	SS	D1(L1, B1), D2(L2, B2)	FC
Subtract Decimal	SP	SS	D1(L1, B1), D2(L2, B2)	FB
Zero and Add	ZAP	SS	D1(L1, B1), D2(L2, B2)	F8

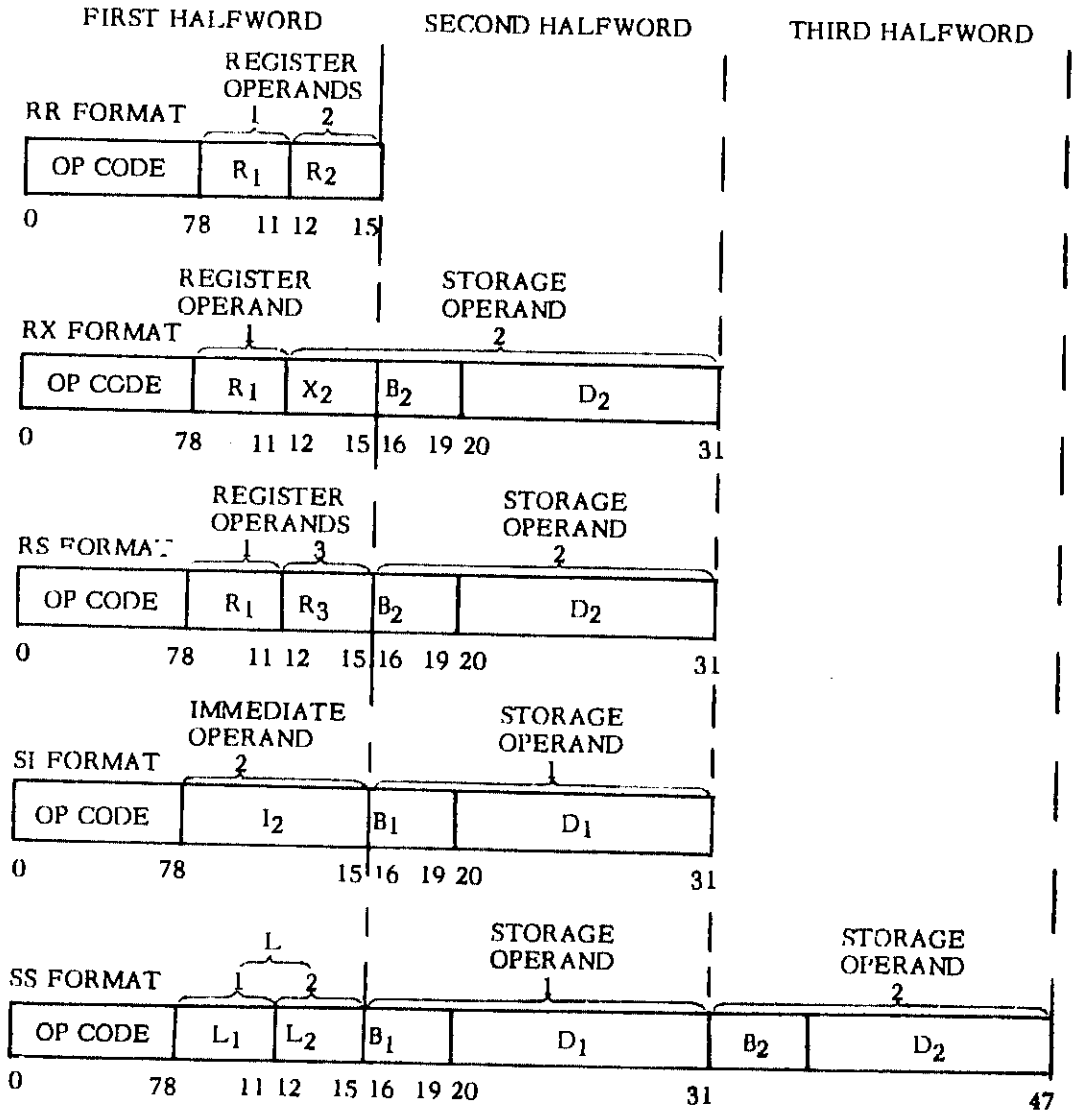
DIRECT CONTROL FEATURE INSTRUCTIONS

Rear Direct	RDD	SI	D1(B1), I2	85
Write Direct	WRD	SI	D1(B1), I2	84

PROTECTION FEATURE INSTRUCTIONS

Insert Storage Key	ISK	RR	R1, R2	09
Set Storage Key	SSK	RR	R1, R2	08

BASIC INSTRUCTION FORMATS



FLOATING-POINT FEATURE INSTRUCTIONS

Add Normalized (Long)	ADR	RR	R1,R2	2A
Add Normalized (Long)	AD	RX	R1,D2(X2,B2)	6A
Add Normalized (Short)	AER	RR	R1,R2	3A
Add Normalized (Short)	AE	RX	R1,D2(X2,B2)	7A
Add Unnormalized (Long)	AWR	RR	R1,R2	2E
Add Unnormalized (Long)	AW	RX	R1,D2(X2,B2)	6E
Add Unnormalized (Short)	AUR	RR	R1,R2	3E
Add Unnormalized (Short)	AU	RX	R2,D2(X2,B2)	7E
Compare (Long)	CDR	RR	R1,R2	29
Compare (Long)	CD	RX	R1,D2(X2,B2)	69
Compare (Short)	CER	RR	R1,R2	39
Compare (Short)	CE	RX	R1,D2(X2,B2)	79
Divide (Long)	DDR	RR	R1,R2	2D
Divide (Long)	DD	RX	R1,D2(X2,B2)	6D
Divide (Short)	DER	RR	R1,R2	3D
Divide (Short)	DE	RX	R1,D2(X2,B2)	7D
Halve (Long)	HDR	RR	R1,R2	24
Halve (Short)	HER	RR	R1,R2	34
Load and Test (Long)	LTDR	RR	R1,R2	22
Load and Test (Short)	LTER	RR	R1,R2	32
Load Complement (Long)	LCDR	RR	R1,R2	23
Load Complement (Short)	LCER	RR	R1,R2	33
Load (Long)	LDR	RR	R1,R2	28
Load (Long)	LD	RX	R1,D2(X2,B2)	68
Load Negative (Long)	LNDR	RR	R1,R2	21
Load Negative (Short)	LNER	RR	R1,R2	31
Load Positive (Long)	LPDR	RR	R1,R2	20
Load Positive (Short)	LPER	RR	R1,R2	30
Load (Short)	LER	RR	R1,R2	38
Load (Short)	LE	RX	R1,D2(X2,B2)	78
Multiply (Long)	MDR	RR	R1,R2	2C
Multiply (Long)	MD	RX	R1,D2(X2,B2)	6C
Multiply (Short)	MER	RR	R1,R2	3C
Multiply (Short)	ME	RX	R1,D2(X2,B2)	7C
Store (Long)	STD	RX	R1,D2(X2,B2)	60
Store (Short)	STE	RX	R1,D2(X2,B2)	70
Subtract Normalized (Long)	SDR	RR	R1,R2	2B
Subtract Normalized (Long)	SD	RX	R1,D2(X2,B2)	6B
Subtract Normalized (Short)	SER	RR	R1,R2	3B
Subtract Normalized (Short)	SE	RX	R1,D2(X2,B2)	7B
Subtract Unnormalized (Long)	SWR	RR	R1,R2	2F
Subtract Unnormalized (Long)	SW	RX	R1,D2(X2,B2)	6F
Subtract Unnormalixed (Short)	SUR	RR	R1,R2	3F
Subtract Unnormalized (Short)	SU	RX	R1,D2(X2,B2)	7F

CHARACTERISTICS FOR CONSTANTS

Code	Type	Machine Format
C	Character	8-Bit Code for each Character
X	Hexadecimal	4-Bit Code for each Hexadecimal Digit
B	Binary	Binary Digits (ones and zeros)
F	Fixed-point	Signed, Fixed-point Binary Format; Normally a Full Word
H	Fixed-point	Signed, Fixed-point Binary Format; Normally a Half Word
E	Floating-point	Short Floating-point Format; Normally a Full Word
D	Floating-point	Long Floating-point Format; Normally a Double Word
P	Decimal	Packed Decimal Format
Z	Decimal	Zoned Decimal Format
A	Address	Value of Address; Normally a Full Word
V	Address	Space Reserved for External Symbol Addresses; Each Address Normally a Full Word
S	Address	Address in Base Displacement Form
Y	Address	Value of Address; Normally a Half Word

EXTENDED MNEMONIC INSTRUCTION CODES

GENERAL

EXTENDED CODE		MACHINE INSTRUCTION	MEANING
B	D2(X2,B2)	BC 15,D2(X2,B2)	Branch Unconditionally
BR	R2	BCR15,R2	Branch Unconditionally
NOP	D2(X2,B2)	BC 0, D2(X2,B2)	No Operation
NOPR	R2	BCR0, R2	No Operation (RR)

AFTER COMPARE INSTRUCTIONS (A:B)

BH	D2(X2 B2)	BC2, D2(X2,B2)	Branch on A High
BL	D2(X2,B2)	BC4, D2(X2,B2)	Branch on A Low
BE	D2(X2,B2)	BC8, D2(X2,B2)	Branch on A Equal B
BNH	D2(X2,B2)	BC13, D2(X2,B2)	Branch on A Not High
BNL	D2(X2,B2)	BC11, D2(X2,B2)	Branch on A Not Low
BNE	D2(X2,B2)	BC7, D2(X2,B2)	Branch on A Not Equal B

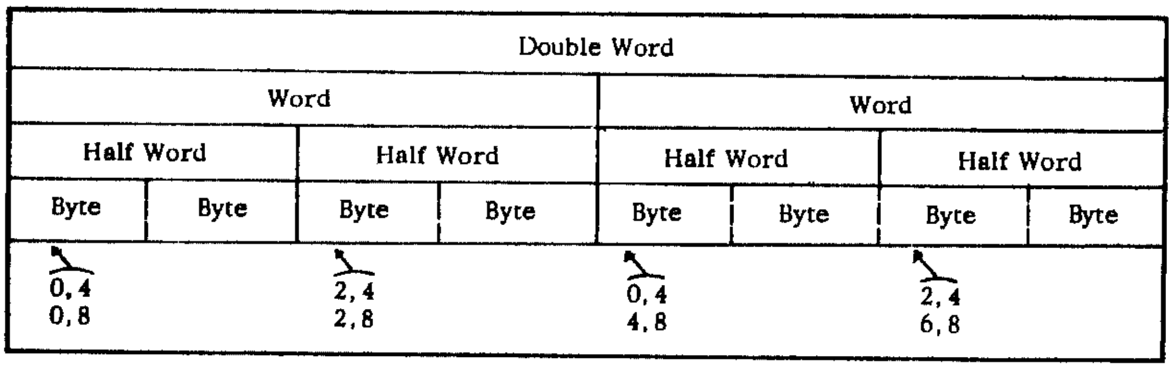
AFTER ARITHMETIC INSTRUCTIONS

BO	D2(X2,B2)	BC1, D2(X2,B2)	Branch on Overflow
BP	D2(X2,B2)	BC2, D2(X2,B2)	Branch on Plus
BM	D2(X2,B2)	BC4, D2(X2,B2)	Branch on Minus
BZ	D2(X2,B2)	BC8, D2(X2,B2)	Branch on Zero

AFTER TEST UNDER MASK INSTRUCTIONS

BO	D2(X2,B2)	BC1, D2(X2,B2)	Branch if Ones
BM	D2(X2,B2)	BC4, D2(X2,B2)	Branch if Mixed
BZ	D2(X2,B2)	BC8, D2(X2,B2)	Branch if Zeros

CNOP ALIGNMENT



<table>
<tr><td colspan="8">Double Word</td></tr>
<tr><td colspan="4">Word</td><td colspan="4">Word</td></tr>
<tr><td colspan="2">Half Word</td><td colspan="2">Half Word</td><td colspan="2">Half Word</td><td colspan="2">Half Word</td></tr>
<tr><td>Byte</td><td>Byte</td><td>Byte</td><td>Byte</td><td>Byte</td><td>Byte</td><td>Byte</td><td>Byte</td></tr>
<tr><td colspan="2">0,4
0,8</td><td colspan="2">2,4
2,8</td><td colspan="2">0,4
4,8</td><td colspan="2">2,4
6,8</td></tr>
</table>

EDIT AND EDIT & MARK SYMBOLS

Editorial Symbol	Mask	Meaning
b	hex 40	blank
	hex 21	significance start character
	hex 22	field separator character
d	hex 20	digit-select character

PERMANENT STORAGE ASSIGNMENT

DEC	ADDRESS HEX	BINARY	LENGTH	PURPOSE
0	0	0000 0000	double-word	Initial program loading PSW
8	8	0000 1000	double-word	Initial program loading CCW1
16	10	0001 0000	double-word	Initial program loading CCW2
24	18	0001 1000	double-word	External old PSW
32	20	0010 0000	double-word	Supervisor call old PSW
40	28	0010 1000	double-word	Program old PSW
48	30	0011 0000	double-word	Machine-check old PSW
56	38	0011 1000	double-word	Input/output old PSW
64	40	0100 0000	double-word	Channel status word
72	48	0100 1000	word	Channel address word
76	4C	0100 1100	word	Unused
80	50	0101 0000	word	Timer (uses bytes 50, 51 & 52)
84	54	0101 0100	word	Unused
88	58	0101 1000	double-word	External new PSW
96	60	0110 0000	double-word	Supervisor call new PSW
104	68	0110 1000	double-word	Program new PSW
112	70	0111 0000	double-word	Machine-check new PSW
120	78	0111 1000	double-word	Input/output new PSW
128	80	1000 0000	(1)	Diagnostic scan-out area

(1) The size of the diagnostic scan-out area depends on the particular model and I/O channels; for models 30 through 75, maximum size is 256 bytes.

CONDITION CODE SETTING

	8	4	2	1
FLOATING-POINT ARITHMETIC				
Add Normalized S/L	zerp	< zero	> zero	overflow
Add Unnormalized S/L	zero	< zero	> zero	overflow
Compare S/L (A:B)	equal	A low	A high	--
Load and Test S/L	zero	< zero	> zero	--
Load Complements S/L	zero	< zero	> zero	--
Load Negative S/L	zero	< zero	--	--
Load Positive S/L	zero	--	> zero	--
Subtract Normalized S/L	zero	< zero	> zero	overflow
Subtract Unnormalized S/L	zero	< zero	> zero	overflow
FIXED-POINT ARITHMETIC				
Add H/F	zero	< zero	> zero	overflow
Add Logical	zero, not carry	not zero, not carry	zero carry	not zero, carry
Compare H/F (A:B)	equal	A low	A high	--
Load and Test	zero	< zero	> zero	--
Load Complement	zero	< zero	> zero	overflow
Load Negative	zero	< zero	--	--
Load Positive	zero	--	> zero	overflow
Shift Left Double	zero	< zero	> zero	overflow
Shift Left Single	zero	< zero	> zero	overflow
Shift Right Double	zero	< zero	> zero	--
Shift Right Single	zero	< zero	> zero	--
Subtract H/F	zero	< zero	> zero	overflow
Subtract Logical	--	not zero, not carry	zero, carry	not zero, carry
DECIMAL ARITHMETIC				
Add Decimal	zero	< zero	> zero	overflow
Compare Decimal (A:B)	equal	A low	A high	--
Subtract Decimal	zero	< zero	> zero	overflow
Zero and Add	zero	< zero	> zero	overflow
LOGICAL OPERATIONS				
AND	zero	not zero	--	--
Compare Logical (A:B)	equal	A low	A high	--
Edit	zero	< zero	> zero	--
Edit and Mark	zero	< zero	> zero	--
Exclusive OR	zero	not zero	--	--
OR	zero	not zero	--	--
Test Under Mask	zero	mixed	--	one
Translate and Test	zero	incomplete	complete	--
INPUT/OUTPUT OPERATIONS				
Halt I/O	not working	halted	stopped	not oper
Star I/O	available	CSW stored	busy	not oper
Test Channel	not working	CSW ready	working	not oper
Test I/O	available	CSW stored	working	not oper

PROGRAM STATUS WORD

System Mask*	Key	AMWP*	Interruption Code
0 7	8 11	12 15	16 23 24 31

ILC	CC	Prog. Mask*	Instruction Address
32 33	34 35	36 39	40 47 48 55 56 63

0	Multiplexer channel mask
1	Selector channel 1 mask
2	Selector channel 2 mask
3	Selector channel 3 mask
4	Selector channel 4 mask
5	Selector channel 5 mask
6	Selector channel 6 mask
7	External mask
12	ASCII mode (A)
13	Machine check mask (M)
14	Wait state (W)
15	Problem state (P)
32-33	Instruction Length code (ILC)
34-35	Condition code (CC)
36	Fixed-point overflow mask
37	Decimal overflow mask
38	Exponent underflow mask
39	Significance mask

*A one-bit equals on, and permits and interrupt.

CODE FOR PROGRAM INTERRUPTION

Interruption Code			Program Interruption Cause
DEC	HEX	BINARY	
1	01	0000 0001	Operation
2	02	0000 0010	Privileged operation
3	03	0000 0011	Execute
4	04	0000 0100	Protection
5	05	0000 0101	Addressing
6	06	0000 0110	Specification
7	07	0000 0111	Data
8	08	0000 1000	Fixed-point overflow
9	09	0000 1001	Fixed-point divide
10	0A	0000 1010	Decimal overflow
11	0B	0000 1011	Decimal divide
12	0C	0000 1100	Exponent overflow
13	0D	0000 1101	Exponent underflow
14	0E	0000 1110	Significance
15	0F	0000 1111	Floating-point divide

HEXADECIMAL AND DECIMAL CONVERSION

To find the decimal number, locate the Hex number and its decimal equivalent for each position. Add these to obtain the decimal number. To find the Hex number, locate the next lower decimal number and its Hex equivalent. Each difference is used to obtain the next Hex number until the entire number is developed.

BYTE				BYTE				BYTE			
0123		4567		0123		4567		0123		4567	
HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC
0	0	0	0	0	0	0	0	0	0	0	0
1	1,048,576	1	65,536	1	4,096	1	256	1	16	1	1
2	2,097,152	2	131,072	2	8,192	2	512	2	32	2	2
3	3,145,728	3	196,608	3	12,288	3	768	3	48	3	3
4	4,194,304	4	262,144	4	16,384	4	1,024	4	64	4	4
5	5,242,880	5	327,680	5	20,480	5	1,280	5	80	5	5
6	6,291,456	6	393,216	6	24,576	6	1,536	6	96	6	6
7	7,340,032	7	458,752	7	28,672	7	1,792	2	112	7	7
8	8,388,608	8	524,288	8	32,768	8	2,048	8	128	8	8
9	9,437,184	9	589,824	9	36,864	9	2,304	9	144	9	9
A	10,485,760	A	655.360	A	40,960	A	2,560	A	160	A	10
B	11,534,336	B	720,896	B	45,056	B	2,816	B	176	B	11
C	12,582,916	C	786,432	C	49,152	C	3,072	C	192	C	12
D	13,631,488	D	851,968	D	53,248	D	3,328	D	208	D	13
E	14,680,064	E	917,504	E	57,344	E	3,584	E	224	E	14
F	15,728,640	F	983,040	F	61,440	F	3,840	F	240	F	15
6		5		4		3		2		1	

DEC ← HEX

DEC → HEX

POWERS OF 16		POWERS OF 2	
16^n	n	2^n	n
1	0	512	9
16	1	1 024	10
256	2	2 048	11
4 096	3	4 096	12
65 536	4	8 192	13
1 048 576	5	16 384	14
16 777 216	6	32 768	15
268 435 456	7	65 536	16
4 294 967 296	8	131 072	17
68 719 476 736	9	262 144	18
1 099 511 627 776	10	524 288	19
17 592 186 044 416	11	1 048 576	20
281 474 976 710 656	12	2 097 152	21
4 503 599 627 370 496	13	4 194 304	22
72 057 594 037 927 936	14	8 388 608	23
1 152 921 504 606 846 976	15	16 777 216	24

OPERATION CODES FOR:

RR FORMAT INSTRUCTIONS

	Decimal	Hexadecimal	Mnemonic	Graphic & Control Symbols		(2) 7-Track Tape BCDIC	Punched Card Code	System/360 8-bit Code	(3)
				BCDIC	EBCDIC				
Standard Instruction Set	0	00					12-0-9-8-1	0000 0000	CCW
	1	01					12-9-1	0000 0001	
	2	02					12-9-2	0000 0010	
	3	03					12-9-3	0000 0011	
	4	04	SPM		PF		12-9-4	0000 0100	
	5	05	BALR		HT		12-9-5	0000 0101	
	6	06	BCTR		LC		12-9-6	0000 0110	
	7	07	BCR		DEL		12-9-7	0000 0111	
	8	08	SSK				12-9-8	0000 1000	CCW
	9	09	ISK				12-9-8-1	0000 1001	
	10	0A	SVC				12-9-8-2	0000 1010	
	11	0B					12-9-8-3	0000 1011	
	12	0C	(EBCDIC+)				12-9-8-4	0000 1100	
	13	0D	(EBCDIC-)				12-9-8-5	0000 1101	
	14	0E					12-9-8-6	0000 1110	
	15	0F			CUI		12-9-8-7	0000 1111	
	16	10	LPR				12-11-9-8-1	0001 0000	CCW
	17	11	LNR				11-9-1	0001 0001	
	18	12	LTR				11-9-2	0001 0010	
	19	13	LCR				11-9-3	0001 0011	
	20	14	NR		RES		11-9-4	0001 0100	
	21	15	CLR		NL		11-9-5	0001 0101	
	22	16	OR		BS		11-9-6	0001 0110	
	23	17	XR		IL		11-9-7	0001 0111	
	24	18	LR				11-9-8	0001 1000	CCW
	25	19	CR				11-9-8-1	0001 1001	
	26	1A	AR		CC		11-9-8-2	0001 1010	
	27	1B	SR				11-9-8-3	0001 1011	
	28	1C	MR				11-9-8-4	0001 1100	
	29	1D	DR				11-9-8-5	0001 1101	
	30	1E	ALR				11-9-8-6	0001 1110	
	31	1F	SLR		CU2		11-9-8-7	0001 1111	
Floating-Point Feature Instructions	32	20	LPDR				11-0-9-8-1	0010 0000	CCW
	33	21	LNDR				0-9-1	0010 0001	
	34	22	LTDR				0-9-2	0010 0010	
	35	23	LCDR				0-9-3	0010 0011	
	36	24	HDR		BYP		0-9-4	0010 0100	
	37	25			LF		0-9-5	0010 0101	
	38	26			EOB		0-9-6	0010 0110	
	39	27			PRE		0-9-7	0010 0111	
	40	28	LDR				0-9-8	0010 1000	CCW
	41	29	CDR				0-9-8-1	0010 1001	
	42	2A	N ADR		SM		0-9-8-2	0010 1010	
	43	2B	N SDR				0-9-8-3	0010 1011	
	44	2C	N MDR				0-9-8-4	0010 1100	
	45	2D	N DDR				0-9-8-5	0010 1101	
	46	2E	AWR				0-9-8-6	0010 1110	
	47	2F	SWR		CU3		0-9-8-7	0010 1111	
	48	30	LPER				12-11-0-9-8-1	0011 0000	CCW
	49	31	LNER				9-1	0011 0001	
	50	32	LTER				9-2	0011 0010	
	51	33	LCER				9-3	0011 0011	
	52	34	HER		PN		9-4	0011 0100	
	53	35			RS		9-5	0011 0101	
	54	36			UC		9-6	0011 0110	
	55	37			EOT		9-7	0011 0111	
	56	38	LER				9-8	0011 1000	CCW
	57	39	CER				9-8-1	0011 1001	
	58	3A	N AER				9-8-2	0011 1010	
	59	3B	N SER				9-8-3	0011 1011	
	60	3C	N MER				9-8-4	0011 1100	
	61	3D	N DER				9-8-5	0011 1101	
	62	3E	AUR				9-8-6	0011 1110	
	63	3F	SUR				9-8-7	0011 1111	

(2) Note that check bit (C) is not shown; add C bit for odd or even parity as needed except for even parity, decimal 64 is CA, the same as decimal 122

(3) CCW flag bit assignments

(4) Decimal feature instructions

(5) System/360 assembler programs require these codes

RR Format

Op Code	R_1/M_1	R_2
0 … 7	8 … 11	12 … 15

R1, R2 - Meaningful for all RR instructions except SPM and SVC

BASE AND INDEX REGISTERS

▨	Base Address or Index
0 … 7	8 … 31

RX FORMAT INSTRUCTIONS

Standard Instruction Set (64–95)

Floating-Point Feature Instructions (95–127)

Decimal	Hexadecimal	Mnemonic	Graphic & Control Symbols BCDIC	Graphic & Control Symbols EBCDIC	(2) 7-Track Tape BCDIC	Punched Card Code	System/360 8-bit Code	(3)	(3)
64	40	STH	SP		(2)	no punches	0100 0000	CCW	
65	41	LA				12-0-9-1	0100 0001		
66	42	STC				12-0-9-2	0100 0010		
67	43	IC				12-0-9-3	0100 0011		
68	44	EX				12-0-9-4	0100 0100		
69	45	BAL				12-0-9-5	0100 0101		
70	46	BCT				12-0-9-6	0100 0110		
71	47	BC				12-0-9-7	0100 0111		
72	48	LH				12-0-9-8	0100 1000	CCW	
73	49	CH				12-8-1	0100 1001		
74	4A	AH		¢		12-8-2	0100 1010		
75	4B	SH		.	B A 8 2 1	12-8-3	0100 1011		
76	4C	MH	)	<	B A 8 4	12-8-4	0100 1100		
77	4D		:	(	B A 8 4 1	12-8-5	0100 1101		
78	4E	CVD	<	+	B A 8 4 2	12-8-6	0100 1110		(+
79	4F	CVB	±		B A 8 4 2 1	12-8-7	0100 1111		
80	50	ST	& +	&	B A	12	0101 0000	CCW	
81	51					12-11-9-1	0101 0001		
82	52					12-11-9-2	0101 0010		
83	53					12-11-9-3	0101 0011		
84	54	N				12-11-9-4	0101 0100		
85	55	CL				12-11-9-5	0101 0101		
86	56	O				12-11-9-6	0101 0110		
87	57	X				12-11-9-7	0101 0111		
88	58	L				12-11-9-8	0101 1000	CCW	
89	59	C				11-8-1	0101 1001		
90	5A	A		!		11-8-2	0101 1010		
91	5B	S	$	$	B 8 2 1	11-8-3	0101 1011		
92	5C	M	*	*	B 8 4	11-8-4	0101 1100		
93	5D	D	j	)	B 8 4 1	11-8-5	0101 1101		)
94	5E	AL	;	;	B 8 4 2	11-8-6	0101 1110		
95	5F	SL	^		B 8 4 2 1	11-8-7	0101 1111		
96	60	STD	-	-	B	11	0110 0000	CCW	
97	61		/	/	A 1	0-1	0110 0001		
98	62					11-0-9-2	0110 0010		
99	63					11-0-9-3	0110 0011		
100	64					11-0-9-4	0110 0100		
101	65					11-0-9-5	0110 0101		
102	66					11-0-9-6	0110 0110		
103	67					11-0-9-7	0110 0111		
104	68	LD				11-0-9-8	0110 1000	CCW	
105	69	CD				0-8-1	0110 1001		
106	6A	N AD				12-11	0110 1010		
107	6B	N SD			A 8 2 1	0-8-3	0110 1011		
108	6C	N MD	%(	%	A 8 4	0-8-4	0110 1100		
109	6D	NDD	√	\	A 8 4 1	0-8-5	0110 1101		
110	6E	AW		>	A 8 4 2	0-8-6	0110 1110		
111	6F	SW	⧻	?	A 8 4 2 1	0-8-7	0110 1111		
112	70	STE				12-11-0	0111 0000	CCW	
113	71					12-11-0-9-1	0111 0001		
114	72					12-11-0-9-2	0111 0010		
115	73					12-11-0-9-3	0111 0011		
116	74					12-11-0-9-4	0111 0100		
117	75					12-11-0-9-5	0111 0101		
118	76					12-11-0-9-6	0111 0110		
119	77					12-11-0-9-7	0111 0111		
120	78	LE				12-11-0-9-8	0111 1000	CCW	
121	79	CE				8-1	0111 1001		
122	7A	N AE		:	A	8-2	0111 1010		
123	7B	N SE	# =	#	8 2 1	8-3	0111 1011		
124	7C	N ME	@'	@	8 4	8-4	0111 1100		
125	7D	N DE	:	'	8 4 1	8-5	0111 1101		
126	7E	AU	>	=	8 4 2	8-6	0111 1110		=
127	7F	SU	√	"	8 4 2 1	8-7	0111 1111		

RX Format

Op Code	R_1/M_1	X_2	B_2	D_2
0 7	8 11	12 15	16 19	20 31

R1, D2(X2, B2)
R1, S2(X2)

R1, D2(0, B2)
R1, S2

SHORT FLOATING-POINT NUMBER

S	Characteristic	Fraction
0	1 7	8 31

LONG FLOATING-POINT NUMBER

S	Characteristic	Fraction
0	1 7	8 63

RS, SI FORMAT INSTRUCTIONS

Decimal	Hexadecimal	Mnemonic	Graphic & Control Symbols		(2) 7-Track Tape BCDIC	Punched Card Code	System/360 8-bit Code	(3)
			BCDIC	EBCDIC				
128	80	SSM				12-0-8-1	1000 0000	CCW
129	81			a		12-0-1	1000 0001	
130	82	LPSW		b		12-0-2	1000 0010	
131	83	(Diagnose)		c		12-0-3	1000 0011	
132	84	WRD		d		12-0-4	1000 0100	
133	85	RDD		e		12-0-5	1000 0101	
134	86	BXH		f		12-0-6	1000 0110	
135	87	BXLE		g		12-0-7	1000 0111	
136	88	SRL		h		12-0-8	1000 1000	CCW
137	89	SLL		i		12-0-9	1000 1001	
138	8A	SRA				12-0-8-2	1000 1010	
139	8B	SLA				12-0-8-3	1000 1011	
140	8C	SRDL				12-0-8-4	1000 1100	
141	8D	SLDL				12-0-8-5	1000 1101	
142	8E	SRDA				12-0-8-6	1000 1110	
143	8F	SLDA				12-0-8-7	1000 1111	
144	90	STM				12-11-8-1	1001 0000	CCW
145	91	TM		j		12-11-1	1001 0001	
146	92	MVI		k		12-11-2	1001 0010	
147	93	TS		l		12-11-3	1001 0011	
148	94	NI		m		12-11-4	1001 0100	
149	95	CLI		n		12-11-5	1001 0101	
150	96	OI		o		12-11-6	1001 0110	
151	97	XI		p		12-11-7	1001 0111	
152	98	LM		q		12-11-8	1001 1000	CCW
153	99			r		12-11-9	1001 1001	
154	9A					12-11-8-2	1001 1010	
155	9B					12-11-8-3	1001 1011	
156	9C	SIO				12-11-8-4	1001 1100	
157	9D	TIO				12-11-8-5	1001 1101	
158	9E	HIO				12-11-8-6	1001 1110	
159	9F	TCH				12-11-8-7	1001 1111	
160	A0					11-0-8-1	1010 0000	CCW
161	A1					11-0-1	1010 0001	
162	A2			s		11-0-2	1010 0010	
163	A3			t		11-0-3	1010 0011	
164	A4			u		11-0-4	1010 0100	
165	A5			v		11-0-5	1010 0101	
166	A6			w		11-0-6	1010 0110	
167	A7			x		11-0-7	1010 0111	
168	A8			y		11-0-8	1010 1000	CCW
169	A9			z		11-0-9	1010 1001	
170	AA					11-0-8-2	1010 1010	
171	AB					11-0-8-3	1010 1011	
172	AC					11-0-8-4	1010 1100	
173	AD					11-0-8-5	1010 1101	
174	AE					11-0-8-6	1010 1110	
175	AF					11-0-8-7	1010 1111	
176	B0					12-11-0-8-1	1010 0000	CCW
177	B1					12-11-0-1	1011 0001	
178	B2					12-11-0-2	1011 0010	
179	B3					12-11-0-3	1011 0011	
180	B4					12-11-0-4	1011 0100	
181	B5					12-11-0-5	1011 0101	
182	B6					12-11-0-6	1011 0110	
183	B7					12-11-0-7	1011 0111	
184	B8					12-11-0-8	1011 1000	CCW
185	B9					12-11-0-9	1011 1001	
186	BA					12-11-0-8-2	1011 1010	
187	BB					12-11-0-8-3	1011 1011	
188	BC					12-11-0-8-4	1011 1100	
189	BD					12-11-0-8-5	1011 1101	
190	BE					12-11-0-8-6	1011 1110	
191	BF					12-11-0-8-7	1011 1111	

RS Format

Op Code	R_1	R_3	B_2	D_2
0 7	8 11	12 15	16 19	20 31

R1, R3, D2(B2) R1, R3, S2	BXH, BXLE, LM, STM	R1, D2(B2) R1, S2	Shift Instructions

SI Format

Op Code	I_2	B_1	D_1
0 7	8 15	16 19	20 31

D1(B1) S1	LPSW, SSM, HIO, SIO TIO, TCH, TS
D1(B1), I2 S1, I2	All other SI Instructions

SS FORMAT INSTRUCTIONS

Decimal	Hexadecimal	Mnemonic	Graphic & Control Symbols BCDIC	Graphic & Control Symbols EBCDIC	(2) 7-Track Tape BCDIC	Punched Card Code	System/360 8-bit Code	(3)
192	C0		?		B A 8 2	12-0	1100 0000	CCW
193	C1		A	A	B A 1	12-1	1100 0001	
194	C2		B	B	B A 2	12-2	1100 0010	
195	C3		C	C	B A 2 1	12-3	1100 0011	
196	C4		D	D	B A 4	12-4	1100 0100	
197	C5		E	E	B A 4 1	12-5	1100 0101	
198	C6		F	F	B A 4 2	12-6	1100 0110	
199	C7		G	G	B A 4 2 1	12-7	1100 0111	
200	C8		H	H	B A 8	12-8	1100 1000	CCW
201	C9		I	I	B A 8 1	12-9	1100 1001	
202	CA					12-0-9-8-2	1100 1010	
203	CB					12-0-9-8-3	1100 1011	
204	CC					12-0-9-8-4	1100 1100	
205	CD					12-0-9-8-5	1100 1101	
206	CE					12-0-9-8-6	1100 1110	
207	CF					12-0-9-8-7	1100 1111	
208	D0		'		B 8 2	11-0	1101 0000	CCW
209	D1	MVN	J	J	B 1	11-1	1101 0001	
210	D2	MVC	k	k	B 2	11-2	1101 0010	
211	D3	MVZ	L	L	B 2 1	11-3	1101 0011	
212	D4	NC	M	M	B 4	11-4	1101 0100	
213	D5	CLC	N	N	B 4 1	11-5	1101 0101	
214	D6	OC	O	O	B 4 2	11-6	1101 0110	
215	D7	XC	P	P	B 4 2 1	11-7	1101 0111	
216	D8		Q	Q	B 8	11-8	1101 1000	CCW
217	D9		R	R	B 8 1	11-9	1101 1001	
218	DA					12-11-9-8-2	1101 1010	
219	DB					12-11-9-8-3	1101 1011	
220	DC	TR				12-11-9-8-4	1101 1100	
221	DD	TRT				12-11-9-8-5	1101 1101	
222	DE	ED (4)				12-11-9-8-6	1101 1110	
223	DF	EDMK (4)				12-11-9-8-7	1101 1111	
224	E0		•		A 8 2	0-8-2	1110 0000	CCW
225	E1					11-0-9-1	1110 0001	
226	E2		S	S	A 2	0-2	1110 0010	
227	E3		T	T	A 2 1	0-3	1110 0011	
228	E4		U	U	A 4	0-4	1110 0100	
229	E5		V	V	A 4 1	0-5	1110 0101	
230	E6		W	W	A 4 2	0-6	1110 0110	
231	E7		X	X	A 4 2 1	0-7	1110 0111	
232	E8		Y	Y	A 8	0-8	1110 1000	CCW
233	E9		Z	Z	A 8 1	0-9	1110 1001	
234	EA					11-0-9-8-2	1110 1010	
235	EB					11-0-9-8-3	1110 1011	
236	EC					11-0-9-8-4	1110 1100	
237	ED					11-0-9-8-5	1110 1101	
238	EE					11-0-9-8-6	1110 1110	
239	EF					11-0-9-8-7	1110 1111	
240	F0		0	0	8 2	0	1111 0000	CCW
241	F1	MVO	1	1	1	1	1111 0001	
242	F2	PACK	2	2	2	2	1111 0010	
243	F3	UNPK	3	3	2 1	3	1111 0011	
244	F4		4	4	4	4	1111 0100	
245	5		5	5	4 1	5	1111 0101	
246	F6		6	6	4 2	6	1111 0110	
247	F7		7	7	4 2 1	7	1111 0111	
248	F8	ZAP (4)	8	8	8	8	1111 1000	CCW
249	F9	CP (4)	9	9	8 1	9	1111 1001	
250	FA	AP (4)				12-11-0-9-8-2	1111 1010	
251	FB	SP (4)				12-11-0-9-8-3	1111 1011	
252	FC	MP (4)				12-11-0-9-8-4	1111 1100	
253	FD	DP (4)				12-11-0-9-8-5	1111 1101	
254	FE					12-11-0-9-8-6	1111 1110	
255	FF					12-11-0-9-8-7	1111 1111	

SS Format

Op Code	L_1	L_2	B_1	D_1	B_2	D_2
0 7	8 11	12 15	16 19	20 31	32 35	36 47

D1(L1,B1),D2(L2,B2) | PACK, UNPK, MVO, AP,
S1(L1),S2(L2) | CP, DP, MP, SP, ZAP

D1(L,B1),D2(B2) | NC, OC, XC, CLC, MVC, MVN,
S1(L),S2 | MVZ, TR, TRT, ED, EDMK

PACKED DECIMAL NUMBER

Digit	Digit	Digit	--- ---	Digit	Digit	Digit	Digit	Sign

ZONED DECIMAL NUMBER

Zone	Digit	Zone	--- ---	Digit	Zone	Digit	Sign	Digit

INPUT/OUTPUT

CHANNEL ADDRESS WORD

Key	0 0 0 0	Command Address
0 3	4 7	8 15 16 23 24 31

CHANNEL COMMAND WORD

Command Code	Data Address
0 7	8 15 16 23 24 31

Flags	0 0 0	▨	Byte Count
32 36	37 39	40 47	48 55 56 63

Refer to OPERATION CODE tables for flag bit (Bits 32-36) assignments.
Bit 32 causes the address portion of the next CCW to be used.
Bit 33 causes the command code and data address in the next CCW to be used.
Bit 34 causes a possible incorrect length indication to be suppressed.
Bit 35 suppresses the transfer of information to main storage.
Bit 36 causes an interruption as Program Control Interrupt

CHANNEL STATUS WORD

Key	0 0 0 0	Command Address
0 3	4 7	8 15 16 23 24 31

Status	Byte Count
32 39	40 47 48 55 56 63

32	Attention
33	Status modifier
34	Control unit end
35	Busy
36	Channel end
37	Device end
38	Unit check
39	Unit exception
40	Program-controlled interruption
41	Incorrect length
42	Program check
43	Protection check
44	Channel data check
45	Channel control check
46	Interface control check
47	Chaining check

Count: Bits 48 - 63 form the residual count for the last CCW used.

DASD CHANNEL COMMAND CODES (See A26-5988)

Command for CCW		Count	Multiple Track (M-T) Off			M-T On	
			8-Bit Code 0123 4567	Hex	Dec	Hex	Dec
Control	No Op	X	0000 0011	03	03		
	Release*	X	0001 0111	17	23		
	Restore	X	0001 0011	13	19		
	Seek	6	0000 0111	07	07		
	Seek Cylinder	6	0000 1011	0B	11		
	Seek Head	6	0001 1011	1B	27		
	Sense I/O	4	0000 0100	04	04		
	Set File Mask	1	0001 1111	1F	31		
	Space Record	X	0000 1111	0F	15		
	Transfer in Channel	X	xxxx 1000	x8			
Search	Home Address EQ	4 (usually)	0011 1001	39	57	B9	185
	Identifier EQ	5 (usually)	0011 0001	31	49	B1	177
	Identifier HI	5 (usually)	0101 0001	51	81	D1	209
	Identifier EQ or HI	5 (usually)	0111 0001	71	113	F1	241
	Key EQ	1 to 255	0010 1001	29	41	A9	169
	Key HI	1 to 255	0100 1001	49	73	C9	201
	Key EQ or HI	1 to 255	0110 1001	69	105	E9	233
	Key & Data EQ*	Note 1	0010 1101	2D	45	AD	173
	Key & Data HI*		0100 1101	4D	77	CD	205
	Key & Data EQ or HI*		0110 1101	6D	109	ED	237
Read	Home Address	5	0001 1010	1A	26	9A	154
	Count	8	0001 0010	12	18	92	146
	Record R0	Number of bytes transferred	0001 0110	16	22	96	150
	Data		0000 0110	06	06	86	134
	Key & Data		0000 1110	0E	14	8E	142
	Count, Key & Data		0001 1110	1E	30	9E	158
Write	Home Address	5 (usually)	0001 1001	19	25		
	Record R0	8+KL+DL of R0	0001 0101	15	21		
	Count, Key & Data	8+KL+DL	0001 1101	1D	29		
	Special Count, Key & Data*	8+KL+DL	0000 0001	01	01		
	Data	DL	0000 0101	05	05		
	Key & Data	KL & DL	0000 1101	0D	13		

* Special Feature   Note 1. Includes mask bytes in search argument.

M-T On = M-T Off except, during Search and Read bit 0 = 1 in M-T On.

x = not significant; KL = Key Length DL = Data Length; EQ = Equal; HI = High

CHANNEL COMMAND CODES

Device	Command for CCW		8-Bit Code 0	1	2	3	4	5	6	7	Hex	Dec
1052	Read Inquiry BCD		0	0	0	0	1	0	1	0	0A	10
	Read Reader 2 BCD		0	0	0	0	0	0	1	0	02	02
	Write BCD, Auto Carriage Return		0	0	0	0	1	0	0	1	09	09
	Write BCD, No Auto Carriage Return		0	0	0	0	0	0	0	1	01	01
	No Op		0	0	0	0	0	0	1	1	03	03
	Sense		0	0	0	0	0	1	0	0	04	04
	Alarm		0	0	0	0	1	0	1	1	0B	11
2540	Read, Feed, Select Stacker SS	Type AA	S	S	D	0	0	0	1	0		
	Read	Type AB	1	1	D	0	0	0	1	0		
	Read, Feed (1400 compatability mode only)		1	1	D	1	0	0	1	0		
	Feed, Select Stacker SS	Type BA	S	S	1	0	0	0	1	1		
	PFR Punch, Feed, Select Stacker SS	Type BA	S	S	D	0	1	0	0	1		
	Punch, Feed; Select Stacker SS	Type BB	S	S	D	0	0	0	0	1		

SS	Stacker
00	R1
01	R2
10	RP3

D	Data Mode
0	EBCDIC
1	Column Binary

Device		0	1	2	3	4	5	6	7
1442 N1	Read	M	M	M	0	0	0	1	0
	Write	M	M	M	0	0	0	0	1
	Control	M	M	0	0	0	0	1	1
	No Op	0	0	0	0	0	0	1	1
	Sense	0	0	M	M	0	1	0	0

	M	M	M	M	
Read	0	0	X		Eject and SS1
Read	1	0	X		Eject and SS1
Read	0	1	X		Eject and SS2
Read	1	1	X		Eject and SS2
Write	0	0	X		SS1
Write	1	0	X		Eject and SS1
Write	0	1	X		SS2
Write	1	1	X		Eject and SS2
Control	1	0			Eject and SS1
Control	0	1			SS2
Control	1	1			Eject and SS2
Sense			1	1	Punch diagnostic
Sense			0	1	Read diagnostic

X = 0 means EBCDIC mode
X = 1 means Column Binary Mode

Device	Command for CCW	0	1	2	3	4	5	6	7	Hex	Dec
1403 or 1443	Write, No Space	0	0	0	0	0	0	0	1	01	01
	Wṛite, Space 1 After Print	0	0	0	0	1	0	0	1	09	09
	Write, Space 2 After Print	0	0	0	1	0	0	0	1	11	17
	Write, Space 3 After Print	0	0	0	1	1	0	0	1	19	25
	Write, Skip To Channel N After Print	1	C	H	A	N	0	0	1		
	Diagnostic Read (1403)	0	0	0	0	0	0	1	0	02	02
	Diagnostic Read (1443)	0	0	0	0	0	1	1	0	06	06
	Test I/)	0	0	0	0	0	0	0	0	00	00
	Sense	0	0	0	0	0	1	0	0	04	04
Carriage Control	Space 1 Line Immediately	0	0	0	0	1	0	1	1	0B	11
	Space 2 Line Immediately	0	0	0	1	0	0	1	1	13	19
	Space 3 Line Immediately	0	0	0	1	1	0	1	1	1B	27
	Skip To Channel N Immediately	I	C	H	A	N	0	1	1		
	No Op	0	0	0	0	0	0	1	1	03	03

C	H	A	N	Channel
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6

C	H	A	N	Channel
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	10
1	0	1	1	11
1	1	0	0	12

Device	Command for CCW	0	1	2	3	4	5	6	7	Hex	Dec
2400 Tape*	Transfer in Channel	0	0	0	0	1	0	0	0	08	08
	Sense	0	0	0	0	0	1	0	0	04	04
	Read Backward**	0	0	0	0	1	1	0	0	0C	12
	Write	0	0	0	0	0	0	0	1	01	01
	Read	0	0	0	0	0	0	1	0	02	02
	Control	0	0	C	C	C	1	1	1		
	Mode Set	D	D	M	M	M	0	1	1		

* 9 track op. forces 800 BPI and odd parity;also. it overrides 7 track but does not reset 7 track. Load/Sys Reset forces 7 track to 800 BPI, odd parity, data converter on, translator off.

C	C	C	Control Codes	Hex	Dec
0	0	0	REW	7	7
0	0	1	RUN	0F	15
0	1	0	ERG	17	23
0	1	1	WTM	1F	31
1	0	0	BSR	27	39
1	0	1	BSF	2F	47
1	1	0	FSR	37	55
1	1	1	FSF	3F	63

D	D	7 Track Density
0	0	200
0	1	556
1	0	800
1	1	800

M	M	M	(Mode Modifiers)	Set Density	Set Odd Parity	Set Even Parity	Data Converter On	Data Converter Off	Translator On	Translator Off	Request TIE (Track in Error)
0	0	0	No Op								
0	0	1	Not Used								
0	1	0	Reset Condition	x	x		x			x	
0	1	1	Nine-track only								x
1	0	0		x		x		x		x	
1	0	1		x		x		x	x		
1	1	0	Reset Condition	x	x			x		x	
1	1	i		x	x			x	x		

**Overrides Data Converter On

NEW CCB FORMAT

0 1	2 3	4 5	6 7	8	9 10 11	12	13 14 15	16 - 23
COUNT	TRANS INFO	CSW STATUS	SYMBOLIC UNIT ADRESS	X'00'	CCW ADDRESS	X'20' X'40' X'80' NOTE	CSW/CCW ADDR ØR CHAN APND	SENSE CCW

BYTE 2

TRAFIC BIT	FLAG /* /&	UNREC I/O ERR	ACCEPT UNREC I/O ERR	RETURN DASD DATA CHECKS OR 2671 ERROR	POST DEV END	RETURN TAPE 2540P DASD ERR	USER ERROR RTN
0	1	2	3	4	5	6	7

BYTE 3

DASD COUNT DATA CHECKS	DASD TRACK OVERRUN	DASD END OF CYL	2540p EQ CHECK TAPE OR DASD RD ERROR	QUEST'L COND	UNUSED	CH.9 OVFLOW OR DASD VERIFY ERROR	COMMND CHAIN RETRY FROM MXT CCW
0	1	2	3	4	5	6	7

ccb - name	CCB	SYSxxx, ccw-name,X'nnnn', sense-address

NOTE: X'20' = SENSE INFO DESIRED, X'40' = T/P, X'80' = ERP USING CCB

Byte	Bit	Condition Indicated		On Values for Third Operand in CCB Macro	Mask for Test Under Mask Instruction
		1 (ON)	0 (OFF)		
2	0 Traffic Bit (WAIT)	I/O Completed. Normally set at Channel End. Set at Device End if Bit 5 is ON.	I/O Requested and not completed.		X'80'
	1 End of File on System Input	/* or /& on SYSRDR or SYSIPT. Byte 4, Unit Exception Bit is also ON.			X'40'
	2 Unrecoverable I/O Error	I/O error passed back due to program option or operator option	No program or operator option error was passed back		X'20'
	3* Accept Unrecoverable I/O Error (Bit 2 is ON)	Return to User after Physical IOCS Attempts to correct I/O Error. +	Operator Option: Dependent on the Error	X'1000'	X'10'
	4* 2671 Data Check	Operator Options: Ignore, Retry, or Cancel	Operator Option: Retry or Cancel	X'0800'	X'08'
	Return an, DASD Data Checks	Return to User			
	5* Post at Device End	Device End Condition will be posted i.e., byte 2, bit 0 and byte 3, bits 3 and 6 set at Device End. Also byte 4, bit 5 is set.	Device End Conditions will not be posted. Traffic Bit is set at Channel End.	X'0400'	X'04'
	6* Return: Uncorrectable tape read data check; 2540 or 2520 punch equipment check; or DASD read or verify data check. (Data checks on count not returned.)	Return to user after physical IOCS at tempts to correct tape or DASD error.	Operator Option: Ignore or Cancel for Tapes and punches. Retry or cancel for DASD.	X'0200'	X'02'
	7* User Error Routine	User will handle error recovery (Test Bit 2).¤	A Physical IOCS Error routine will be used.	X'0100'	X'01'
3	0 Data check in DASD count Field.	Yes-Byte 3, bit 3 is OFF; Byte 2, bit 2 is ON.	No		X'80'
	1 DASD Track overrun.	Yes	No		X'40'
	2 End of DASD Cylinder	Yes	No		X'20'
	3 Tape read data check; 2540 or 2520 punch equipment check; or any DASD data check.	Operation was unsuccessful. Byte 2, Bit 2 is also ON. Byte 3, Bit 0 is OFF.	No		X'10'
	4 Questionable Condition	Card: Unusual Command sequence (2540). DASD: No record found.			X'08'
3	5 Unused: Must be zero				
	6 Verify Error for DASD or Carriage Channel 9 Overflow	Yes. (Set ON when Channel 9 is reached only if Byte 2, Bit 5 is ON.)	No		X'02'
	7* Command Chain Retry	Retry begins at last CCW executed.	Retry begins at first CCW of channel program.	X'0001'	X'01'

* User Option Bits. Set in CCB macro. Physical IOCS sets the other bits OFF at EXCP time and ON when the condition specified above occurs.

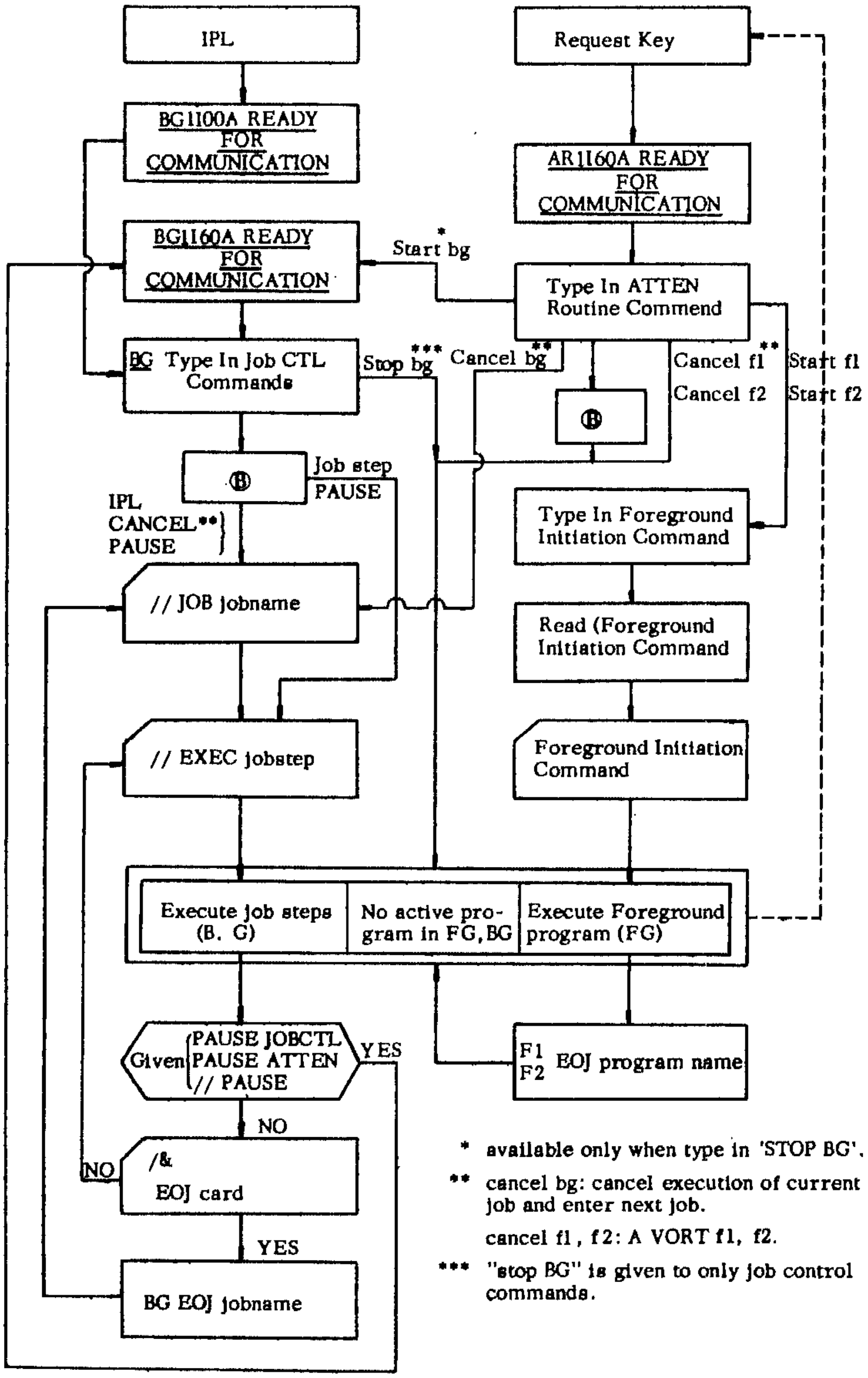
+ I/O program check, command reject, or tape equipment check will always terminate the program.

¤ User must handle all error or exceptional conditions except Channel Control Check, Interface Control Check, I/O Program Check, and I/O Protection Check.

Sense Bytes

	Sense Bit Position	Sense Bit Condition
DISK	Byte 0, Bit 0	Command Reject
	1	Intervention Required
	2	Bus Out Parity
	3	Equipment Check
	4	Data Check
	5	Overrun
	6	Track Condition Check
	7	Seek Check
	Byte 1, Bit 0	Data Check in Count (also causes Byte 0, Bit 4)
	1	Track Overrun
	2	End-of-Cylinder
	3	Invalid Sequence (also causes Byte 0, Bit 0)
	4	No Record Found
	5	File Protected (also causes Byte 0, Bit 0)
	6	Missing Address Marker (also causes Byte 0, Bit 4)
	7	Overflow Incomplete

	Sense Bit Position	Sense Bit Condition
TAPE	Byte 0, Bit 0	Command Reject
	1	Intervention Required
	2	Bus Out Parity
	3	Equipment Check
	4	Data Check
	5	Overrun
	6	Word Count Zero
	7	Data Converter Check
	Byte 1, Bit 0	Noice Record
	1	Tape Unit Status A (Selected unit is available)
	2	Tape Unit Status B (Selected unit is busy, rewinding, or switchd)
	3	7 Track Operation
	4	At Load Point
	5	In Write Status
	6	File Protected
	7	Tape Indicator (Status of tape indicate on the selected tape unit)


IPL
BG1100A READY FOR COMMUNICATION
BG1160A READY FOR COMMUNICATION
BG Type In Job CTL Commands
Stop bg***
Cancel bg**
Start bg*
Request Key
AR1160A READY FOR COMMUNICATION
Type In ATTEN Routine Commend
Cancel f1**
Cancel f2
Start f1
Start f2
B
Job step PAUSE
IPL
CANCEL**
PAUSE
B
// JOB jobname
// EXEC jobstep
Type In Foreground Initiation Command
Read (Foreground Initiation Command
Foreground Initiation Command
Execute job steps (B. G)
No active program in FG, BG
Execute Foreground program (FG)
Given
PAUSE JOBCTL
PAUSE ATTEN
// PAUSE
YES
NO
/&
EOJ card
NO
YES
BG EOJ jobname
F1
F2
EOJ program name

* available only when type in 'STOP BG'.

** cancel bg: cancel execution of current job and enter next job.

cancel f1, f2: A VORT f1, f2.

*** "stop BG" is given to only job control commands.

——— ..... SYSTEM TO OPERATOR MESSAGE

FOREGROUND INITIATION EXAMPLES

Initiating a foreground program in an environment where there is one card reader and it is used for the batch job stream (SYSRDR/SYSIPT).

1. At IPL time:

   a) Do not assign SYSRDR or SYSIPT or any logical unit to the card reader at System Generation.

   b) If possible, System Generate all Physical Unit Blocks needed for operating (DVCGEN macro).

   c) Place JCL statements for foreground program in the card reader followed by batch jobs and ready the reader.

   d) IPL from SYSRES.

   e) Press 1052 (SYSLOG) Attention.

   f) Type in any required ADD and DEL commands on SYSLOG.

   g) Type in SET command on SYSLOG.

   h) Type in STOP command.

   i) Press 1052 (SYSLOG) Attention.

   j) Request Foreground Initiator. Type in "START Fn."

   k) Assign card reader to SYSFGI. Type in "READ X'cuu'."

   l) After Foreground Initiation has completed (EXEC card read), press 1052 (SYSLOG) Attention and enter command "START BG."

   m) Type in "ASSGN SYSRDR, X'cuu' " (or SYSIN) with the card reader address. Type in Ⓑ . Batch processing will commence.

2. Between Jobs or Job Steps (unplanned):

   a) Press 1052 (SYSLOG) Attention and enter PAUSE and Ⓑ commands.

   b) When PAUSE occurs: Type in "ASSGN SYSRDR, UA" or if both RDR and IPT, "ASSGN SYSIN, UA" and "STOP."

   c) Place JCL statements for foreground program in card reader followed by batch jobs not yet read and ready the reader.

   d) Execute steps (i) through (m) under procedure 1 above.

3. Between Jobs or Job Steps (planned):

   a) Place between Jobs or Job Steps in the card reader the following: "ASSGN SYSRDR, UA" (or SYSIN) followed by the JCL statements for the foreground program.

   b) When Job Control encounters the unassignment and requests operator commands, execute steps (h) through (m) under procedure 1 above.

4. Asynchronously:

   a) Press 1052 (SYSLOG) Attention.

   b) Type in "START Fx" command.

   c) Type in all JCL statements for foreground program.

Initiating a foreground program in an environment where there is a card reader available exclusively for the foreground program:

   a) Place JCL statements for foreground program in card reader.

   If the program is to use the card reader, its data cards can follow the EXEC card (see Note). Ready the card reader.

   b) Press 1052 (SYSLOG) Attention.

   c) Request Foreground Initiator. Type in "START Fn."

   d) Assign card reader to SYSFGI. Type in "READ X'cuu'."

NOTE: JCL Statements can assign the card reader used to input initiation commands to the foreground program as a SYSnnn unit.

Operation	Operand	Remarks
ASSGN	SYSxxx, address {,X'as' / ,ALT} [,TEMP]	SYSxxx: can be SYSRDR SYSIPT SYSIN SYSLST SYSPCH SYSOUT SYSLOG SYSLNK SYS000-SYS244 address:can be X'cuu', UA, or IGN X'cuu': c = 0 - 6 uu = 00 - FE (0 - 254) in he: UA: unassign IGN: unassign and ignore X'ss': used for magnetic tape only as / Bytes per Inch / Parity / Translate Feature / Convert Feature 10 200 odd off on 20 200 even off off 28 200 even on off 30 200 odd off off 38 200 odd on off 50 556 odd off on 60 556 even off off 68 556 even on off 70 556 odd off off 78 556 odd on off 90 800 odd off on A0 800 even off off A8 800 even on off B0 800 odd off off B8 800 odd on off C0 800 single density 9 track tape C0 1600 dual density 9 track tape C8 800 dual density 9 track tape ALT: specifies alternate unit TEMP: assignment for logical unit will be destroyed by next JOB statement
CLOSE	SYSxxx {,X'cuu'[,X'ss'] / ,UA / ,IGN / ,ALT}	SYSxxx: for 2311 - SYSIN SYSRDR SYSIPT SYSPCH SYSLST for magnetic tape - SYSPCH SYSLST SYSOUT SYS000-SYS244 X'cuu', X'ss', UA, IGN, ALT: values as described in ASSGN command
DVCDN	X'cuu'	X'cuu': c = 0-6 uu = 00-FE (0-254) in hex

Operation	Operand	Remarks
DVCUP	X'cuu'	X'cuu': c = 0-6 uu = 00-FE (0-254) in hex
MTC	opcode, X'cuu' SYSxxx [,nn]	opcode: BSF, BSR, ERG, FSF, FSR, RUN, REW, or WTM
		X'cuu': c = 0-6 uu = 00-FE (0-254) in hex SYSxxx: any logical unit nn: decimal number (01-99)
RESET	SYS PROG ALL SYSxxx	Resets specified I/O device assignments
STOP	blank	Stops background program processing
LISTIO	SYS PROG F1 F2 ALL SYSxxx UNITS DOWN UA X'cuu'	Causes listing of specified I/O assignments
LOG	blank	Causes logging of job control statements and foreground initiation commands on SYSLOG
NOLOG.	blank	Suppresses logging of job control statements and foreground initiation commands on SYSLOG
CANCEL	blank	Cancels execution of background job
PAUSE	[any user comment]	Causes pause at end of current job step
MAP	blank	Causes a map of areas in main storage to be printed on SYSLOG

ALLOC	F1 = nk [,F2 = nk]
	F2 = nk [,F1 = nk]
		Allocates foreground program areas
		Value of n is an even number

UCS	SYSxxx, phasename [,FOLD] [,BLOCK] [,NULMSG]	Causes the 240-character universal character set contained in the core image library phase specified by phasename to be loaded as buffer storage in the IBM 2821 Control Unit. SYSxxx must be assigned to a 1403 Printer with the UCS feature.
HOLD	F1 [,F2] F2 [,F1]	Causes assignments for foreground logical units to be held across jobs.
RELSE	F1 [,F2] F2 [,F1]	Causes foreground logical units to be unassigned at EOJ.
UNA	F1 [,F2] F2 [,F1]	Causes immediate unassignment of foreground logical units.

Operation	Operand	Remarks
SET	[DATE=value1] [,CLOCK= value 2] [,UPSI=value 3] [,LINECT=value 4] [,RCLST=value 5] [,RCPCH=value 6]	value 1: in one of the following formats mm/dd/yy or dd/mm/yy mm: month (01-12) dd: day (01-31) yy: year (00-99) value 2: in the following format hh/mm/ss hh: hours (00-23) mm: minutes (00-59) ss: seconds (00-59) value 3: 0, 1, or X value 4: standard number of lines for output on each page of SYSLST Value 5: decimal number indicating minimum number of SYSLST disk records remaining to be written before operator warning value 6: decimal number indicating minimum number of SYSPCH disk records remaining to be written before operator warning
Ⓑ	blank	Ⓑ is alter code 5

ATTN COMMANDS

Operation	Operand	Remarks
PAUSE	[any user comments]	Causes pause at end of current job step
CANCEL	BG F1 F2	Cancels execution of current job in specified area
LOG	blank	Causes logging of job control statements and foreground initiation commands on SYSLOG
NOLOG	blank	Suppresses logging of job control statements and foreground initiation commands on SYSLOG
MAP	blank	Causes a map of areas in main storage to be printed on SYSLOG

ALLOC	F1 = nk [,F2 = nk]
	F2 = nk [,F1 = nk]
		Allocates foreground program areas
		Value of n is an even number

START	BG F1 F2	Initiates a background or foreground program
MSG	F1 F2	Transfers control to foreground program message routine
TIMER	BG F1 F2	Causes interval timer support to be given to program specified
Ⓑ	blank	Ⓑ is alter code 5

FOREGROUND INITIATION COMMANDS

Operation	Operand	Remarks
READ	X'cuu'	X'cuu': c = 0-6 uu = 00-FE (0-254) in hex Note: Device must be a card reader
LISTIO	{BG F1 F2 UA ALL}	Causes listing of specified I/O assignments
ASSGN	SYSnnn, address {,X'ss' ,ALT}	SYSnnn: can be SYS000, SYS001, ... address: can be X'cuu' or IGN X'cuu': c = 0-6 uu = 00-FE (0-254) in hex IGN: unassign and ignore X'ss': used for magnetic tape only ALT: specifies alternate unit
VOL	SYSnnn, filename	SYSnnn: can be SYS000, SYS001, ... filename: one to seven alphabetic characters
DLAB	'label fields 1-3' xxxx, yyddd, yyddd, 'system code' [,type]	
XTENT	type, sequence, lower, upper, 'serial no. SYSxxx [,B_2]	
TPLAB	'lable fields 3-10'	
TPLAB	'lable fields 3-10 label fields 11-13'	
CANCEL	blank	Cancels initiation of foreground program
EXEC	progname	progname: one to eight alphameric characters
LOG	blank	Causes logging of job control statements and foreground initiation commands on SYSLOG.
NOLOG	blank	Suppresses logging of job control statements and foreground initiation commands on SYSLOG.
HOLD	{F1 [,F2] F2 [,F1]}	Causes assignments for foreground logical units to be held across jobs.
RELSE	{F1 [,F2] F2 [,F1]}	Causes foreground logical units to be unassigned at EOJ.
UNA	{F1 [,F2] F2 [,F1]}	Causes immediate unassignment of foreground logical units.
Ⓑ	blank	Ⓑ is alter code 5

JOB CONTROL STATEMENTS

<table>
<tr><th>Name</th><th>Operation</th><th>Operand</th><th>72</th><th>Remarks</th></tr>
<tr><td>//</td><td>JOB</td><td>jobname</td><td>b̸</td><td>jobname: one to eight alphameric characters</td></tr>
<tr><td>//</td><td>EXEC</td><td>[progname]</td><td>b̸</td><td>progname: one to eight alphameric characters. Used only if the program is in the core image library.</td></tr>
<tr><td>//</td><td>ASSGN</td><td>SYSxxx, address
[{,X'ss'<br>,ALT}]</td><td>b̸</td><td>SYSxxx: can be SYSRDR
SYSIPT
SYSIN
SYSPCH
SYSLST
SYSLOG
SYSLNK
SYS000-SYS244

address: can be X'cuu', UA, or IGN
X'cuu': c = 0-6
uu = 00-FE (0-254)
in hex
UA: unassign
IGN: unassign and ignore

X'ss': used for magnetic tape only
<table>
<tr><th></th><th>Bytes</th><th></th><th>Trans-
late</th><th>Convert</th></tr>
<tr><th>ss</th><th>per Inch</th><th>Parity</th><th>Feature</th><th>Feature</th></tr>
<tr><td>10</td><td>200</td><td>odd</td><td>off</td><td>on</td></tr>
<tr><td>20</td><td>200</td><td>even</td><td>off</td><td>off</td></tr>
<tr><td>28</td><td>2U0</td><td>even</td><td>on</td><td>off</td></tr>
<tr><td>30</td><td>200</td><td>odd</td><td>off</td><td>off</td></tr>
<tr><td>38</td><td>200</td><td>odd</td><td>on</td><td>off</td></tr>
<tr><td>50</td><td>556</td><td>odd</td><td>off</td><td>on</td></tr>
<tr><td>60</td><td>556</td><td>even</td><td>off</td><td>off</td></tr>
<tr><td>68</td><td>556</td><td>even</td><td>on</td><td>off</td></tr>
<tr><td>70</td><td>556</td><td>odd</td><td>off</td><td>off</td></tr>
<tr><td>78</td><td>556</td><td>odd</td><td>on</td><td>off</td></tr>
<tr><td>90</td><td>800</td><td>odd</td><td>off</td><td>on</td></tr>
<tr><td>A0</td><td>800</td><td>even</td><td>off</td><td>off</td></tr>
<tr><td>A8</td><td>800</td><td>even</td><td>on</td><td>off</td></tr>
<tr><td>B0</td><td>800</td><td>odd</td><td>off</td><td>off</td></tr>
<tr><td>B8</td><td>800</td><td>odd</td><td>on</td><td>off</td></tr>
<tr><td>C0</td><td>800</td><td colspan="3">single density 9-track type</td></tr>
<tr><td>C0</td><td>1600</td><td colspan="3">dual density 9-track type</td></tr>
<tr><td>C8</td><td>800</td><td colspan="3">dual density 9-track type</td></tr>
</table>
ALT: specifies alternate unit</td></tr>
<tr><td>//</td><td>RESET</td><td>{SYS
PROG
ALL
SYSxxx}</td><td>b̸</td><td>Resets I/O device assignments</td></tr>
<tr><td>//</td><td>DATE</td><td>mm/dd/yy
or
dd/mm/yy</td><td>b̸</td><td>mm: month (01-12)
dd: day (01-31)
yy: year (00-99)</td></tr>
<tr><td>//</td><td>UPSI</td><td>nnnnnnnn</td><td>b̸</td><td>n: 0, 1, or X</td></tr>
<tr><td>//</td><td>VOL</td><td>SYSxxx, filename</td><td>b̸</td><td>SYSxxx: can be SYS000-SYS244
filename: one to seven alphabetic characters</td></tr>
</table>

Name	Operation	Operand	72	Remarks
//	DLAB	'label fields 1-3'' xxxx,yyddd, yyddd,'system code' [,type]	c	'label fields 1-3': first three fields of Format 1 DASD file label. Is a 51-byte character string, contained within apostrophes and followed by a comma. Entire 51-byte field must be contained in the first of the two statements. Field 1 is the file name (44-byte alphameric); field 2 is the format identifier (1-byte numeric); filed 3 is the file serial number (6-byte alphameric). c: any non-blank character in column 72 xxxx: volume sequence number (4-digit numeric). Must begin in column 16 of the continuation statement. Columns 1-15 are blank. yyddd,yyddd: file creation date followed by file expiration date. Each is 5-digit numeric. 'system code': not required. When used, a 13-character string, within apostrophes. type: SD, DA, ISC, or ISE. If omitted, SD is assumed.
//	XTENT	type, sequence, lower, upper, 'serial no.', SYSxxx [,B_2]	b̸	type: 1 for data area (no split cylinder) 2 for overflow area (for indexed sequential file) 4 for index area (for indexed sequential file) 128 for data area (split cylinder) sequence: sequence number of extent within multi-extent file. Can be 0 to 255. lower: lower limit of extent in the form $B_1C_1C_1C_2C_2C_2H_1H_2H_2$ where: B_1=0 for 2311; 0-9 for 2321 C_1C_1=00 for 2311; 0-9 for 2321 $C_2C_2C_2$=000-199 for 2311; 000-009 for 2321 H_1=0 for 2311; 0-4 for 2321 H_2H_2=00-09 for 2311; 00-19 for 2321 Note that the last 5 strips of subcell 19 are reserved for alternate tracks for 2321. upper: upper limit of extent in the same form as for lower limit. 'serial no.': 6-alphameric-chracter volume serial number contained within apostrophes. SYSxxx: can be SYS000-SYS244 B_2: 0 for 2311; 0-9 for 2321

Name	Operation	Operand	72	Remarks
//	TPLAB	'lable fields 3-10'	b̸	'label fields 3-10': Indicated fields of the standard tape file lable. A 49-byte character string, contained within apostrophes.
//	TPLAB	'label fields 3-10 lable fields 11-13'	c	'lable fields 3-10: same as above C: any nonblank character in column 72 label fields 11-13': 20-character direct continuation of the same character string begun with fields 3-10 (no blanks, apostrophes, or commas separating)
//	LBLTYP	{TAPE[(nn)] NSD (nn)}	b̸	TAPE: used when tape files requiring label information are to be processed and no nonsequential disk files are to be processed. (nn): optional and is present only for future expansion (it is ignored by Job Control) NSD: nonsequential disk files are to be processed (nn): largest number of extents per single file
//	RSTRT	SYSxxx,nnnn	b̸	SYSxxx: symbolic unit name of the device on which the checkpoint records are stored. Can be SYS000-SYS244. nnnn: four character identification of the checkpoint record to be used for restarting
//	LISTIO	{SYS PROG F1 F2 ALL SYSxxx UNITS DOWN UA X'cuu'}	b̸	Causes listing of I/O assignements on SYSLST
//	MTC	opcode, SYSxxx [,nn]	b̸	opcode: BSF, BSR, ERG, FSF, FSR, REW, RUN, or WTM SYSxxx: any logical unit nn: decimal number (01-99)

Name	Operation	Operand	72	Remarks
//	OPTION	optional [,option 2,....]	ƀ	option: can be any of the following LOG Log control statements on SYSLST NOLOG Suppress LOG option DUMP Dump registers and main storage on SYSLST in the case of abnormal program end NODUMP Suppress DUMP option LINK Write output of language translator on SYSLNK for linkage editing NOLINK Suppress LINK option DECK Output object module on SYSPCH NODECK Suppress DECK option LIST Output listing of source module on SYSLST NOLIST Suppress LIST option LISTX Output listing of object module on SYSLST NOLISTX Suppress LISTX option SYM Punch symbol deck on SYSPCH NOSYM Suppress SYM option XREF Output symbolic cross-reference list on SYSLST NOXREF Suppress XREF option ERRS Output listing of all errors in source program on SYSLST NOERRS Suppress ERRS option CATAL Catalog program or phase in core image library after completion of Linkage Editor run STDLABEL Causes all sequential disk or tape labels to be written on the standard label track USRLABEL Causes all sequential disk or tape labels to be written on the user label track 48C 48-character set 60C 60-character set
//	PAUSE	[comments]	ƀ	PAUSE statement is always printed on 1052 (SYSLOG). If no 1052 is available, the statement is ignored.
/*	ignored	ignored	ƀ	Columns 1 and 2 are the only columns checked.
/&	ignored	ignored	ƀ	Columns 1 and 2 are the only columns checked.
*		comments	ƀ	Column 2 must be blank.

JOB CONTROL (Sample)

COMPILE AND GO

```
//      JOB    SAMPLE
//      OPTION LINK, DUMP
          (PHASE card)
//      EXEC   ASSEMBLY
          (ASSEMBLER source deck)
/*
        (ENTRY card)
//      EXEC   LNKEDT
(//     ASSGN for user program)
//      EXEC
          (Data for user object program)
/*
//      PAUSE
```

LOAD AND GO

```
//      JOB
//      OPTION ~~NODUMP~~, LINK
        PHASE card
        INCLUDE ABC
        INCLUDE XYZ
        INCLUDE
          (Object deck to be included)
/*
        ~~ENTRY~~  // LBLTYP NSD(4)
//      EXEC LNKEDT
//      EXEC                          ASSGNS
          (Data for user object program)
/*
//      PAUSE
```

SPOOL UTILITY (COMPILE & CATAL)

```
//      JOB  SOL  (job name)
//      OPTION CATAL
        PHASE FGPCT, + 0, NOAUTO (FGPCT=program name)
//      EXEC ASSEMBLY
START          START    0
               INCARD
               OUTAPE   BUFSIZ=800
               END
/*
//      EXEC LNKEDT
/&
```

PHYSICAL IOCS (SAMPLE)

```
START      START   0
           BALR    5,0
           USING   *,5
X          EXCP    A
           WAIT    A
             .
             .
             .
           EXCP    B
           WAIT    B
           B       X
A          CCB     SYS004,N
B          CCB     SYS005,M
N          CCW     2,INPUT,X'20',80
M          CCW     1,OUTPUT,X'20',80
INPUT      DC      CL80'0'
OUTPUT     DC      CL80'0'
           END     START
```

PHASE CARD FORMAT

```
PHASE      Prog.name, origin, NOANTO
                1 ....... SYMBOL [(PHASE)] ± relocation
                2 ....... * ± relocation
                3 ....... S ± relocation
                4 ....... ROOT
                5 ....... + displacement
                6 ....... F + address
```

ALLOW SPACE
FOR LABEL CHECKING

UTILITY SAMPLE

D - P

```
// JOB DOS
// ASSGN SYSIPI,X'00C'
// ASSGN SYS000,X'191'
// ASSGN SYS005,X'00E'
// VOL SYS000,UIN
// DLAB 'BOS UTILITYbbbbbbbbbbbbbbbbbbbbbbbbbbbb1000000',bbbbbbbbbC
bbbbbbbbbbbbbb0001,66100,66100,'0000000000000'
// XTENT 1,000,000111000,000121009,'000000',SYS000
// EXEC DKPR
// UDP TD,FF,A=(80,80),B=(132),OC,S1,Py,R1
// END
```

C - T

```
// JOB COTOTP
// ASSGN SYS004,X'00C'
// ASSGN SYS005,X'182'
// UPSI 1010
// EXEC CDTP
// OCT TC,FF,A=(80,80),B=(80,80),I1,ON
// END
```

C - T (STANDARD LABEL)

```
// JOB COTOTP
// ASSGN SYS004,X'00C'
// ASSGN SYS005,X'181',X'68'
// UPSI 1000
// VOL SYS005,UOUT
// TPLAB 'ASDFGBVCXZBGNHMJK1111110001000100010l 66313 66313'
// EXEC CDTP
// OCT TC,FF,A=(80,80),B=(80,80),11,ON
// END
```

T - P (STANDARD LABEL)

```
// JOB CDTOPR
// ASSGN SYS004,X'181',X'68'
// ASSGN SYS005,X'00E'
// UPSI 0010
// VOL SYS004,UIN
// TPLAB 'ASDFGBVCXZBGNHMJK111111000100010001 01 66313 66313'
// EXEC TPPR
// UTP TD,FF,A=(80,80),B=(120),IN,OC,SI,PY,RI
// END
```

SORT/MERGE SAMPLE CONTROL CARDS

DISK SORT

SAMPLE 1 INPUT=DISK, WORK=DISK, OUTPUT=DISK

```
// JOB DOSORT
// ASSGN SYS004,X'191'
// ASSGN SYS005,X'191'
// ASSGN SYS006,X'191'
// VOL SYS004,FILEA
// DLAB 'BPS UTILITYbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb1000000',bbbbbbbbC
bbbbbbbbbbbbbbb0001,66100,66100,'0000000000000'
// XTENT 1,000,000001000,000010009,'000000',SYS004
// VOL SYS006,FILED
// DLAB 'BOS UTILITYbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb1000000',bbbbbbbbC
bbbbbbbbbbbbbbb0001,66100,66100,'0000000000000'
// XTENT 1,000,000111000,000121009,'000000',SYS006
// VOL SYS005,FILEW
// DLAB 'BWS UTILITYbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb1000000',bbbbbbbbC
bbbbbbbbbbbbbbb0001,66100,66100,'0000000000000',DA
// XTENT 1,000,000050000,000100009,'000000',SYS005
// EXEC DSORT
 SORT FIELDS=(3,1,D),FORMAT=B1,FILES=1,SIZE=200
 RECORD TYPE=F,LENGTH=(80,,80)
 INPFIL INPUT=D,BLKSIZE=(80,X)
 OUTFIL BLKSIZE=80,OUTPUT=D
 OPTION PRINT,LABEL=(S,S)
 END
```

SAMPLE 2 INPUT=TAPE, WORK=DISK, OUTPUT=TAPE

```
// JOB SMPL
// ASSGN SYS001,X'180',X'90'
// ASSGN SYS002,X'270'
// ASSGN SYS003,X'182'
// ASSGN SYS004,X'183'
// ASSGN SYS006,X'190'
// ASSGN SYS007,X'191'
// VOL SYS006,FILEW
// DLAB 'DISK WORK FILEbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb1111111',bbbbbbbbX
bbbbbbbbbbbbbbb0001,66311,66311,'DOSbbbbbbbbbb',DA
// XTENT 1,0,000151000,000198009,'111111',SYS006
// XTENT 1,1,000001000,000198009,'111111',SYS007
// EXEC DSORT
 RECORD TYPE=F,LENGTH=(80,,80)
 SORT FIELDS=(1,10,A,11,5,A),FORMAT=B1,FILES=3,SIZE=6000
 INPFIL INPUT=T,VOLUME=(1,1,1),BLKSIZE=(800,X),BYPASS
 OUTFIL BLKSIZE=800,OUTPUT=T,OPEN=RWD,CLOSE=RWD
 OPTION PRINT, STORAGE=32000,LABEL=(U,U)
 END
```

TAPE SORT

SAMPLE 1

```
// JOB SORT1
// ASSGN SYS001,X'182'
// ASSGN SYS002,X'180'
// ASSGN SYS003,X'182'
// ASSGN SYS004,X'181'
// ASSGN SYS005,X'183'
// ASSGN SYS006,X'180'
// EXEC TSRT
 SORT FIELDS=(7,2,A,14,6,A,64,1,A,11,2,A,33,1,A),FORMAT=BI,WORK=4
 RECORD TYPE=F,LENGTH=(84,,84)
 INPFIL VOLUME=1,BLKSIZE=(1680,X)
 OUTFIL BLKSIZE=1680
 OPTION PRINT,LABEL=(U,U,U)
 END
```

SAMPLE 2 TAPE DRIVE=4 (UNLABEL)

```
// JOB SORTSMPL
// ASSGN SYS002,X'181',X'90'
// ASSGN SYS002,X'180',ALT
// ASSGN SYS001,X'270'
// ASSGN SYS003,X'270'
// ASSGN SYS004,X'182'
// ASSGN SYS005,X'183'
// EXEC TSRT
 SORT FIELDS=(75,2,A,40,12,A,1,2,A),FORMAT=BI,WORK=3
 RECORD TYPE=F,LENGTH=120
 INPFIL VOLUME=3,BLKSIZE=(960,X),OPEN=RWD
 OUTFIL BLKSIZE=960,CLOSE=RWD
 OPTION LABEL=(U,U,U),PRINT
 END
```

SAMPLE 3 TAPE DRIVE=4 (STANDARD LABEL)

```
// JOB DOS TAPE SORT
// ASSGN SYS001,X'180',X'68'
// ASSGN SYS002,X'180',X'68'
// ASSGN SYS003,X'181',X'68'
// ASSGN SYS004,X'182',X'68'
// ASSGN SYS005,X'183',X'68'
// ASSGN SYS006,X'184',X'68'
// VOL SYS002,FILEA
// TPLAB 'LOAN-SUMbbbbbbbbb00088800010001000101 66180 66185'
// VOL SYS001,FILED
// TPLAB 'LOAN-SUMbbbbbbbbb00088800010001000101 66180 66185'
// EXEC TSRT
 SORT FIELDS=(5,9,A,1,4,A,19,24,A),FORMAT=81,WORK=4
 RECORD TYPE=F,LENGTH=(200,200,200)
 INPFIL VOLUME=1,BLKSIZE=(2000,X),BYPASS,CLOSE=UNLD
 OUTFIL BLKSIZE=2000
 OPTION LABEL=(S,S,S),PRINT
 END
```

FORMAT OF LANGUAGE TRANSLATOR OUTPUT CARDS AND THE USER REPLACE CARD

ESD card

1	Multiple punch (12-2-9). Indentifies this as a loader card.
2- 4	ESD -- External Symbol Dictionary card.
11-12	Number of bytes of information contained in this card.
15-16	External symbol identification number (ESID) of the first SD, PC, CM or ER on this card. Relates the SD, PC, CM or ER to a particular control section.
17-72	Variable information. 8 positions - Name 1 position - Type code to indicate SD, PC, LD, CM or ER 3 positions - Assembled origin 1 position - Blank 3 positions - Length, if an SD-type, CM-type, or a PC-type. If an LD-type, this field contains the external symbol identification number (ESID) of the SD containing the label.
73-80	May be used by the programmer for identification.

RLD card

1	Multiple punch (12-2-9). Identifies this as a loader card.
2- 4	RLD -- Relocation List Dictionary card.
11-12	Number of bytes of information contained in this card.
17-72	Variable information (multiple items). a. Two positions - pointer (relocation identifier) to the relocation factor of the contents of the load constant. b. Two positions - pointer (position identifier) to the relocation factor of the control section in which the load constant occurs. c. One position - flag indicating type of constant, as follows:
	Bits 0-2 ignored 3 0 - a non-branch type load constant 1 - a branch type load constant 4-5 00 - load constnat length = 1 byte 01 - load constant length = 2 bytes 10 - load constant length = 3 bytes 11 - load constnat length = 4 bytes 6 0 - relocation factor is to be added 1 - relocation factor is to be subtracted

TXT card

1	Multiple punch (12-2-9). Identifies this as a loader card.
2- 4	TXT -- Text card.
6- 8	Assembled origin (address of first byte to be loaded from this card).
11-12	Number of bytes of text to be loaded.
15-16	External symbol identification number (ESID) of the control section (SD or PC) containing the text.
17-72	Up to 56 bytes of text -- data or instructions to be loaded.
73-80	May be used for program identification.

RLD (continued)

	7 0 - Next load constant has different R and P identifiers: therefore, both R and P must be present. 1 - Next load constant has the same R and P identifiers: therefore they are both omitted. Five significant bits of this byte are expanded in the RSERV printout. d. Three positions - assembled origin of load constant.
73-80	May be used for program identification.

END card

1	Multiple punch (12-2-9). Identifies this as a loader card.
2- 4	END
6- 8	Assembled origin of the label supplied to the Assembler in the END card (optional).
15-16	ESID number of the control section to which this END card refers (only if 6-8 present).
17-22	Symbolic label supplied to the Assembler if this label was not defined within the assembly.
29-32	Control section length (if not specified in last SD or PC).
73-80	Not used.

REP card

1	Multiple punch (12-2-9). Identifies this. as a loader card.
2- 4	REP -- Replace text card.
5- 6	Blank.
7-12	Assembled address of the first byte to be replaced (hexadecimal). Must be right justified with leading zeros if needed to fill the field.
13	Blank.
14-16	External symbol identification number (ESID) of the control section (SD) containing the text (hexadecimal). Must be right justified with leading zeros if needed to fill the field.
17-70	From 1 to 11 4-digit hexadecimal fields separated by commas, each replacing two bytes. A blank indicates the end of information in this card.
71-72	Blank.
73-80	May be used for program identification.

Function	Unit	Element	Control Statements Required

Catalog	Core Image Library	Phase	// JOB jobname
			// OPTION CATAL
			(Linkage Editor control statements)
			// EXEC LNKEDT
			/&

	Relocatable Library	Module	// JOB jobname
			// EXEC MAINT
			CATALR modulename
			/*
			/&

	Source Statement Library	Book	// JOB jobname
			// EXEC MAINT
			CATALS sublib. bookname
			/*
			/&

Delete	Core Image Library	Phase	// JOB jobname
			// EXEC MAINT
			DELETC phase 1 [,phase 2,...]
			/*
			/&

		Program	// JOB jobname
			// EXEC MAINT
			DELETC prog 1.ALL
			[,prog 2.ALL,...]
			/*
			/&

	Relocatable Library	Module	// JOB jobname
			// EXEC MAINT
			DELETR module 1 [,module 2,...]
			/*
			/&

		Program	// JOB jobname
			// EXEC MAINT
			DELETR prog 1.ALL
			[,prog 2.ALL,...]
			/*
			/&

		Library	// JOB jobname
			// EXEC MAINT
			DELETR ALL
			/*
			/&

	Source Statement Library	Book	// JOB jobname
			// EXEC MAINT
			DELETS sublib.book 1
			[,sublib. book 2,...]
			/*
			/&

		Sub-library	// JOB jobname
			// EXEC MAINT
			DELETS sublib. ALL
			/*
			/&

Rename	Core Image Library	Phase	// JOB jobname
			// EXEC MAINT
			RENAMC oldname, newname
			[,oldname, newname,...]
			/*
			/&

Function	Unit	Element	Control Statements Required

	Relocatable Library	Module	// JOB jobname
			// EXEC MAINT
			RENAMR oldname, newname [,oldname, newname,...]
			/*
			/&

	Source Statement Library	Book	// JOB jobname
			// EXEC MAINT
			RENAMS sublib. oldname, sublib. newname[, sublib. oldname, sublib. newname,...]
			/*
			/&

Condense	Core Image Library	Library	// JOB jobname
			// EXEC MAINT
			CONDS CL
			/*
			/&

	Relocatable Library	Library	// JOB jobname
			// EXEC MAINT
			CONDS RL
			/*
			/&

	Source Statement Library	Library	// JOB jobname
			// EXEC MAINT
			CONDS SL
			/*
			/&

	Libraries	All	// JOB jobname
			// EXEC MAINT
			CONDS CL, RL, SL
			/*
			/&

Set Parameter for Automatic Condense	Libraries	Any or All	// JOB jobname
			// EXEC MAINT
			CONDL lib=nnnnn [,lib=nnnnn [,lib=nnnnn]]
			/*
			/&
			Notes: Values to be substituted for lib:
			CL -- Core image library
			RL -- Relocatable library
			SL -- Source statement library
			Values to be substituted for nnnnn:
			One to five decimal digits, with a maximum value of 65536.

Reallocation	System	Library	// JOB jobname
			// VOL SYSRES, IJSYSRES
			// DLAB 'DOS SYSTEM RESIDENCE FILE ...'
			// XTENT extent information
			// EXEC MAINT
			ALLOC id=cylin(tracks) [, id=cylin (tracks),...]
			/*
			/&
			Notes: Values to be substituted for id:
			CL -- Core image library
			RL -- Relocatable library
			SL -- Source statement library
			Values to be substituted for cylin and tracks:
			Any integer

Function	Unit	Element	Control Statements Required

Display	Core Image Library	Directory	// JOB jobname
			// EXEC DSERV
			DSPLY CD
			/*

	Relocatable Library	Module	// JOB jobname
			// EXEC RSERV
			DSPLY module 1, [,module 2,...]
			/*
			/&

		Program	// JOB jobname
			// EXEC RSERV
			DSPLY prog 1.ALL [,prog 2. ALL,...]
			/*
			/&

		Library	// JOB jobname
			// EXEC RSERV
			DSPLY ALL
			/*
			/&

		Directory	// JOB jobname
			// EXEC DSERV
			DSPLY RD
			/*
			/&

	Source Statement Library	Book	// JOB jobname
			// EXEC SSERV
			DSPLY sublib.book 1 [,sublib. book 2,...]
			/*
			/&

		Sub-library	// JOB jobname
			// EXEC SSERV
			DSPLY sublib. ALL
			/*
			/&

		Directory	// JOB jobname
			// EXEC DSERV
			DSPLY SD
			/*
			/&

	Transient Directory	Directory	// JOB jobname
			// EXEC DSERV
			DSPLY TD
			/*
			/&

	System Directory	Directory	// JOB jobname
			// EXEC DSERV
			/*
			/&

	Directories	All	// JOB jobname
			// EXEC DSERV
			DSPLY ALL
			/*
			/&

Punch	Relocatable Library	Module	// JOB jobname
			// EXEC RSERV
			PUNCH module 1 [,module 2,...]
			/*
			/&

Function	Unit	Element	Control Statements Required

Punch	Relocatable Library	Program	// JOB jobname
			// EXEC RSERV
			PUNCH prog 1. ALL [, prog 2. ALL, . . .]
			/*
			/&

		Library	// JOB jobname
			// EXEC RSERV
			PUNCH ALL
			/*
			/&

	Source Statement Library	Book	// JOB jobname
			// EXEC SSERV
			PUNCH sublib. book 1 [, sublib. book 2, . . .] [, CMPRSD]
			/*
			/&

		Sub-library	// JOB jobname
			// EXEC SSERV
			PUNCH sublib.ALL [, CMPRSD]
			/*
			/&

Display and Punch	Relocatable Library	Module	// JOB jobname
			// EXEC RSERV
			DSPCH module 1 [, module 2, . . .]
			/*
			/&

		Program	// JOB jobname
			// EXEC RSERV
			DSPCH prog 1. ALL [, prog 2. ALL, . . .]
			/*
			/&

		Library	// JOB jobname
			// EXEC RSERV
			DSPCH ALL
			/*
			/&

	Source Statement Library	Book	// JOB jobname
			// EXEC SSERV
			DSPCH sublib. book 1 [, sublib. book 2, . . .] [, CMPRSD]
			/*
			/&

		Sub-library	// JOB jobname
			// EXEC SSERV
			DSPCH sublib. ALL [, CMPRSD]
			/*
			/&

Copy	Core Image Library	Phase	// JOB jobname
			// ASSGN SYS002, X'cuu'
			// VOL SYS002, IJSYSRES
			// DLAB 'DOS SYSTEM RESIDENCE FILE. . .
			// XTENT extent information
			// ELEC CORGZ
			ALLOC id=cylin (tracks) [, id=cylin (tracks), . . .]
			* PRECEDING ALLOC STATEMENT REQUIRED IF NEW LIMITS TO BE ESTABLISHED COPYC phase 1 [, phase 2, . . .]
			/*
			/&

Function	Unit	Element	Control Statements Required

Copy	Core Image Library	Program	// JOB jobname
			// ASSGN SYS002, X'cuu'
			// VOL SYS002, IJSYSRES
			// DLAB 'DOS SYSTEM RESIDENCE
			FILE . . . '
			// XTENT extent information
			// EXEC CORGZ
			ALLOC id=cylin (tracks)[, id=cylin
			(tracks), . . .]
			* PRECEDING ALLOC STATEMENT
			REQUIRED IF NEW LIMITS TO BE
			ESTABLISHED COPYC prog 1. ALL
			[,prog 2. ALL, . . .]
			/*
			/&

		Library	// JOB jobname
			// ASSGN SYS002, X'cuu'
			// VOL SYS002, IJSYSRES
			// DLAB 'DOS SYSTEM RESIDENCE
			FILE . . .
			// XTENT extent information
			// EXEC CORGZ
			ALLOC id=cylin (tracks)[, id=cylin
			(tracks), . . .]
			* PRECEDING ALLOC STATEMENT
			REQUIRED IF NEW LIMITS TO BE
			ESTABLISHED COPYC ALL
			/*
			/&

	Relocatable Library	Module	// JOB jobname
			// ASSGN SYS002, X'cuu'
			// VOL SYS002, IJSYSRES
			// DLAB 'DOS SYSTEM RESIDENCE
			FILE . . . '
			// XTENT extent information
			// EXEC CORGZ
			ALLOC id=cylin (tracks) [, id=cylin
			(tracks), . . .]
			* PRECEDING ALLOC STATEMENT
			REQUIRED IF NEW LIMITS TO BE
			ESTABLISHED COPYR module 1
			[, module 2, . . .]
			/*
			/&

		Program	// JOB jobname
			// ASSGN SYS002, X'cuu'
			// VOL SYS002, IJSYSRES
			// DLAB 'DOS SYSTEM RESIDENCE
			FILE . . . '
			// XTENT extent information
			// EXEC CORGZ
			ALLOC id=cylin (tracks) [, id=cylin
			(tracks), . . .]
			* PRECEDING ALLOC STATEMENT
			REQUIRED IF NEW LIMITS TO BE
			ESTABLISHED COPYR prog 1. ALL
			[,prog 2. ALL, . . .]
			/*
			/&

		Library	// JOB jobname
			// ASSGN SYS002, X'cuu'
			// VOL SYS002, IJSYSRES
			// DLAB 'DOS SYSTEM RESIDENCE
			FILE . . . '
			// XTENT extent information
			// EXEC CORGZ
			ALLOC id=cylin (tracks)[, id=cylin
			(tracks), . . .]

Function	Unit	Element	Control Statements Required
			* PRECEDING ALLOC STATEMENT REQUIRED IF NEW LIMITS TO BE ESTABLISHED COPYR ALL /* /&

Copy	Source Statement Library	Book	// JOB jobname
			// ASSGN SYS002, X'cuu'
			// VOL SYS002, IJSYSRES
			// DLAB 'DOS SYSTEM RESIDENCE FILE ...
			// XTENT extent information
			// EXEC CORGZ
			ALLOC id=cylin (tracks) [, id=cylin (tracks), ...]
			* PRECEDING ALLOC STATEMENT REQUIRED IF NEW LIMITS TO BE ESTABLISHED COPYS sublib.book 1 [,sublib. book 2,...]
			/*
			/&

		Sub-library	// JOB jobname
			// ASSGN SYS002, X'cuu'
			// VOL SYS002, IJSYSRES
			// DLAB 'DOS SYSTEM RESIDENCE FILE ...'
			// XTENT extent information
			// EXEC CORGZ
			ALLOC id=cylin (tracks) [, id=cylin (tracks), ...]
			* PRECEDING ALLOC STATEMENT REQUIRED IF NEW LIMITS TO BE ESTABLISHED COPYS sublib. ALL
			/*
			/&

		Library	// JOB jobname
			// ASSGN SYS002, X'cuu'
			// VOL SYS002, IJSYSRES
			// DLAB 'DOS SYSTEM RESIDENCE FILE ...'
			// XTENT extent information
			// EXEC CORGZ
			ALLOC id=cylin (tracks) [, id=cylin (tracks), ...]
			* PRECEDING ALLOC STATEMENT REQUIRED IF NEW LIMITS TO BE ESTABLISHED COPYS ALL
			/*
			/&

	Libraries	All	// JOB jobname
			// ASSGN SYS002, X'cuu'
			// VOL SYS002, IJSYSRES
			// DLAB 'DOS SYSTEM RESIDENCE FILE ...
			// XTENT extent information
			// EXEC CORGZ
			ALLOC id=cylin (tracks) [, id=cylin (tracks), ...]
			* PRECEDING ALOC STATEMENT REQUIRED IF NEW LIMITS TO BE ESTABLISHED COPY ALL
			/*
			/&

I/O MODULE TABLE

	1ST CHARACTER	2ND	3RD	4TH		5TH		6TH		7TH		8TH	
CDMOD	I	J	C	F V U	RECFORM=FIXUNB =VARUNB =UNDEF	A Y C Z	CTLCHR=ASA =YES CONTROL=YES (NEITHER) CTLCHR (NOR) CONTPOL (SPECIFIED)	I O C	TYPEFLE=INPUT =OUTPUT =CMBND	Z W I B	(NEITHER) WORKA (NOR) IOAREA2 WORKA=YES IOAREA2=YES (BOTH) WORKA (AND) IOAREA2	0 1 2 3 4	DEVICE=2540 =1442 =2520 =2501 =2540 (& CRDERR SPECIFIED)
PRMOD	I	J	D	F V U	(AS IN) CDMOD	A Y C Z	(AS IN) CDMOD	P Z	PRINTOV=YES (PRINTOV NOT SPECIFIED)	I Z	IOAREA2=YES IOAREA2 (NOT SPECIFIED)	W Z	WORKA=YES WORKA (NOT SPECIFIED)
MTMOD (GET/ PUT)	I	J	F	F V U	FIXUNB (OR) FIXBLK VARUNB (OR) VARBLK UNDEFINED	B Z	READ=BACKWARD =FORWARD	C Z	CKPTREC=YES (CKPTREC NOT SPECIFIED)	W Z	WORKA=YES (WORKA NOT SPECIFIED)	Z	
MTMOD (WORK FILES)	I	J	F	W		E Z	IGNORE ERROPT=SKIP NAME (ERROPT NOT SPECIFIED)	N S Z	NOTEPNT=YES =POINTS (NOTEPNT NOT SPECIFIED)	Z		Z	
SDMOD (GET/ PUT)	I	J	G	F V U	(AS IN) MTMOD	I O U	TYPEFLE=INPUT =OUTPUT INPUT & UPDATE	O Z	ERROPT=YES (ERROPT NOT SPECIFIED)	T Z	TRUNCS=YES (TRUNCS NOT SPECIFIED)	C Z	CONTROL=YES (CONTROL NOT SPECIFIED)
SDMOD (WORK-FILES)	I	J	G	W		E Z	(AS IN) MTMOD	R N Z	NOTEPNT= POINTRW =YES (NOTEPOINT NOT SPECIFIED)	M Z	XTENT=MULTPLE XTENT (NOT SPECIFIED SINGLE XTENT IMPLIED)	Z	
DAMOD	I	J	I	F B	RECFORM=FIXUNB =UNDEF	A I Z	AFTER=YES AFTERID=YES (IF NEITHER OF THESE IS SPECIFIED)	I Z	IDLOC=YES IDLOC (NOT SPECIFIED)	Z		Z	
ISMOD	I	J	H	U F B	RECFORM=FIXUNB =FIXBLK =BOTH	L I R A	IOROUT=LOAD =ADD =RETRVE =ADDRTR	R S B Z	TYPEFLE= RANDOM =SEQNTL =RANSEQ TYPEFLE (NOT SPECIFIED)	R S B Z	UPDATE=RANDOM =SEQNTL =RANSEQ UPDATE (NOT SPECIFIED)	W Z	WORK=YES WORK (NOT SPECIFIED)

DTFCD

OPERATION	OPERAND	MUST BE INCLUDED	REMARKS
DTFCD		Each file	Header card. Specify symbolic file name.
	BLKSIZE=n	Each file	Length of I/O areas
	CONTROL= YES	If a CNTRL macro is issued to the file	
	CRDERR= RETRY	To RETRY card output error	For 2520 and 2540 only
	CTLCHR=YES ASA	For first-character control	YES for S/360 character set. ASA for American Standard Set.
	DEVADDR= SYSnnn	Each file	Specifies symbolic unit
	DEVICE= 2540 1442 2520 2501	For device other than 2540.	To indicate I/O device
	EOFADDR= name	For input or combined file	Specifies end-of-file routine
	IOAREA1= name	Each file	Name=address expression
	IOAREA2= name	Combined file output area	Second output area Name=address expression
	IOREG=(r)	If two I/O areas are used.	Specify r (register 2-12)
	MODNAME= name	If name other than standard or a more inclusive module is referenced	Specifies a user-named I/O module
	OUBLKSZ=n	For a combined file if IOAREA2 is specified.	n=maximum number of characters to be transferred at one time
	RECFORM= FIXUNB UNDEF VARUNB	If other than FIXUNB.	Specifies record format Only FIXUNB valid for input.
	RECSIZE=(r)	For undefined records	For undefined records, r=register containing length of output record
	SEPASMB= YES	If DTF is assembled separately	
	SSELECT=n	For stacker selection to pocket other than NR or NP	n=stacker select character
	TYPEFLE= INPUT OUTPUT CMBND	If other than input	Specifies an input, output, or combined file
	WORKA=YES		If I/O records are processed in work areas, answer YES

OPERATION	OPERAND	MUST BE INCLUDED	REMARKS
DTFPR		Each file	Specifies header card. Specifies symbolic file name
	BLKSIZE=n	If other than 121	n=length of I/O area. If the record is not fixed, enter the length of the longest record.
	CONTROL= YES	If a CNTRL macro will be used	

	CTLCHR=
	YES
	ASA
		For first character control	YES=S/360 character set
			ASA=American Standard Association set

	DEVADDR= SYSnnn	Each file	Symbolic unit
	DEVICE= 1403 1404 1443 1445	For file other than 1403.	Actual device
	IOAREA1= name	Each file	Specifies name as output area
	IOAREA2= name	If two I/O areas are specified	Second name output area
	IOREG=(r)	For two output areas	r=register 2-12
	MODNAME= name	If name other than standard or a more inclusive module is referenced	Specifies a user-named I/O module
	PRINTOV= YES	If PRTOV macro is used	
	RECFORM= FIXUNB UNDEF VARUNB	If record is not FIXUNB	
	RECSIZE=(r)	For undefined records	r=register 2-12 containing length of output record
	SEPASMB=YES	If DTF is assembled separately	
	WORKA=YES	If records are processed in work areas	

DTFMT

OPERATION	OPERAND	MUST BE INCLUDED	REMARKS
DTFMT		Each file	Specifies header card and symbolic file name.
	*BLKSIZE=n	Each file	n=length of the I/O area. If the record is not fixed enter the length of the longest record.
	CKPTREC= YES	If input file has checkpoint records among data records	IOCS will bypass checkpoint records.'
	*DEVADDR= SYSnnn	Each file	Specifies symbolic unit
	*EOFADDR= name	Input or work files	Specifies name of user's end-of-file routine.
	*ERROPT= IGNORE SKIP name	For error correction	IGNORE allows IOCS to handle the record as if no errors were detected. SKIP allows IOCS to bypass the record. Name is the name of a routine to which the program will branch.
	FILABL= STD NSTD NO	Each file	Specifies the type of labels.
	IOAREA1= name	Each file	Specifies I/O area. Name=address expression.
	IOAREA2= name	If two I/O areas are specified	Specifies a second I/O area. Name =address expression
	IOREG=(r)		r=register (2-12) if records are blocked or processed in the I/O area.
	LABADDR= name	To process user's labels	name=symbolic name of user's routine
	MODNAME =name	If name other than standard or a more inclusive module is referenced	Specifies a user named I/O module
	*NOTEPNT= YES POINTS	YES is required if NOTE, POINTR, POINTW, or POINTS is used	
	*READ= FORWARD BACK	If READ=BACK is specified	
	*RECFORM= * FIXUNB FIXBLK VARUNB VARBLK * UNDEF	For other than FIXUNB	
	RECSIZE=n or (r)	For FIXBLK or UNDEF	n=number of caracters in each record for fixed-length blocked records. r=register (2-12) containing record length for undefined records.
	*REWIND= UNLOAD NORWD		Specifies procedure for rewinding tape.
	SEPASMB= YES	If DTF is assembled separately	
	*TYPEFLE= INPUT OUTPUT *WORK	For output or work files	Specifies whether file is input or output or if a work file is specified.
	TPMARK= NO	If a tapemark is not to be the first record of a tape output file when no labels are specified, or if no tapemark is to be written following non-standard labels.	
	VARBLD= (r)	For variable-length blocked records.	r=general register (2-12)
	WLRERR= name	To branch to user's routine to handle wrong-length error correction.	name=symbolic name of user's routine. If omitted, error handled as in ERROPT, or if both entries omitted, WLR indication will be ignored.
	WORKA= YES	If records are processed in work areas	

* Entries for work files

OPERATION	OPERAND	MUST BE INCLUDED	REMARKS
DTFPT		Each file	Header card. Specify symbolic file name
	BLKSIZE=n	Each file	UNDEF: at least one greater than the longest record FIXUNB: size of every record
	DEVADDR= SYSnnn	Each file	Symbolic unit
	EOFADDR= Name	Each file	Name of user's EOF routine
	ERROPT= IGNORE SKIP Name		Error option. If absent, IOCS will terminate the job
	FTRANS= Name	For shifted codes	Name of user's figure shift translate table
	IOAREA1= Name	Each file	Name of input area
	IOAREA2= Name	For two input areas	Name of second input area
	IOREG=(r)	For two input areas	Register (2-12) containing current input area address
	LTRANS= Name	For shifted codes	Name of user's letter shift translate table
	MODNAME= Name	For name other than standard	
	OVBLKSZ=n	Only when FIXUNB format is used with SCAN	Number of characters to be read in to produce number specified in BLKSIZE. If omitted, will be equal to BLKSIZE
	RECFORM= FIXUNB UNDEF	If UNDEF format	
	RECSIZE=(r)		Register (2-12) containing final length of input records
	SCAN=Name	When shift and/or delete characters are in code	Name of user's scan table for shift and delete characters
	SEPASMB= YES	If the DTF is assembled separately	
	TRANS= Name	When unshifted codes are to be translated	Name of user's translate table
	WLRERR= Name		Name of user's wrong length record routine. If omitted, error handled as in ERROPT; if both entries omitted, WLR indication will be ignored.

OPERATION	OPERAND	MUST BE INCLUDED	REMARKS
DTFSD		Each file	Header card, specify symbolic file name.
	*BLKSIZE=n	Each file	Length of I/O area. n=maximum number of characters.
	*CONTROL= YES	CNTRL macro used	
	*DELETFL= NO	If CLOSE macro is not to delete the Format 1 and Format 3 label for a work file	Applies To work files.
	*DEVICE= 2311 2321	For 2321	
	*EOFADDR= name	For input or work files.	Symbolic name of end-of-file routine.
	*ERROPT= IGNORE SKIP name	For error correction on input or output files	Provides facility to handle errors. SKIP not allowed for output.
	IOAREA1= name	Each file	Symbolic name of I/O area.
	IOAREA2= name	If two I/O areas are used by GET and PUT	Symbolic name of I/O area.
	IOREG=(r)	For blocked records processed in the I/O area, or if two I/O areas are used and the records are processed in the I/O areas.	Register 2-12 contains address of the record. r=register 2-12.
	LABADDR= name	If user processes his own labels.	name=symbolic name of user's routine.
	MODNAME= name	If name other than standard or a more inclusive module is referenced.	Specifies a user-named I/O module.
	*NOTEPNT= YES POINTRW	If NOTE,POINTR or POINTW macros will be issued, POINTRW is specified. Specify YES for NOTE, POINTR, POINTW, and POINTS.	
	RECSIZE=n or (r)	Number of characters in record (fixed-length and blocked) or register 2-12 for undefined records.	Required for each file.
	*RECFORM= FIXUNB FIXBLK VARUNB VARBLK * UNDEF	For other than FIXUNB	Work files permit fixed blocked or undefined records only.
	SEPASMB= YES	If DTF is assembled separately	
	TRUNC= YES	With TRUNC macro for Output FIXBLK file, or if FIXBLK DASD files contain shaft blocks within an input file.	
	*TYPEFLE= INPUT OUTPUT * WORK	For OUTPUT or WORK	
	UPDATE= YES	If DASD input file is updated	
	*VERIFY= YES	To check a record written on 2311	Assumed for 2321
	VARBLD=(r)	Variable-length blocked records are built in output area	r=register 2-12
	WLRERR= name	To process wrong length records on input file	name=symbolic name of user's routine
	WORKA= YES		Omit this entry if IOREG=n

OPERATION	OPERAND#	MUST BE INCLUDED	REMARKS*
DTFDA+		Each file	Header Card. Specify symbolic file name (up to 7 ch.)
	AFTER=YES	Record reference AFTER used for an output record	CARREC is assumed.
	+BLKSIZE=n	Each file	Length of I/O area. n=maximum number of characters.
	CONTROL=YES	CNTRL macro used	
	+DEVICE=2311 2321	Each file	Identifies DASD unit
	+ERRBYTE=Name	Each file	Symbolic name of 2-byte field for error/status codes supplied by IOCS.
	IDLOC=Name	ID of same or next record to to supplied by IOCS	Symbolic name of 5-byte filed for ID.
	+IOAREA1=Name	Each file	Symbolic name of input/output area. Same as used in DS.
	KEYARG=Name	Record reference by Key	Symbolic name of key field.
	KEYLEN=n	Records contain key areas	All keys must be the same length. n=length of keys.
	LABADDR=Name	Check/write additional labels	Symbolic name of user's label routine.
	MODNAME=Name	If a name other than the standard or a more inclusive module is referenced.	
	READID=YES	Record reference by ID used for an input record	
	READKEY=YES	Record reference by key used for an input record	
	RECFORM= FIXUNB UNDEF	Fixed-length records Records not fixed-length, or Records added to a file and EOF record written	If this entry is omitted, IOCS assumes FIXUNB.
	RECSIZE=(r)	Undefined records	r=number of a register 2-12
	+SEEKADR=Name	Each file	Symbolic name of track-reference field. Field is 8 bytes long.
	SEPASMB=YES	If the DTF is assembled separarely	
	SRCHM=YES	Search multiple tracks	Applies to record reference by key.
	+TYPEFLE= INPUT OUTPUT	Each file	Read and check standard labels. Write standard labels.
	VERIFY=YES	Check record written on 2311	Assumed for 2321
	WRITEID=YES	Record reference by ID used for an output record	
	WRITEKY=YES	Record reference by key used for an output record	
	XTNTXIT=Name	To process extent card information	Symbolic name of user's extent routine.

+Must be included. Other entries are included when applicable.

#When two choices are shown, select only the appropriate one and enter it after the = sign.

*The header card and each detail card except the last one used in a file set must contain a continuation punch in column 72. Each detail card except the last one used must also contain a comma after the last operand.

In all entries: Solid caps must be entered as shown (For example, AFTER=YES)

Lowercase letters are to be replaced by programmer's symbolic name or a number (For example, Filename in header card, or BLKSIZE=n where n is replaced).

n is a decimal self-defining value.

ERRBYTE (DTFDA)

Byte	Bit	Error/Status code
0	0	---
	1	Wrong-length record
	2	---
	3	---
	4	No room found
	5	---
	6	---
	7	---
1	0	Data check in count area
	1	Track overrun
	2	End of cylinder
	3	Data check when reading key or data
	4	No record found
	5	End of file
	6	End of volume
	7	---

MACRO INSTRUCTION	ID SUPPLIED	
	With SRCHM	Without SRCHM
READ Filename, KEY	Same record	Next record
READ Filename, ID	Next record	Next record
WRITE Filename, KEY	Same record	Next record
WRITE Filename, ID	Next record	Next record
WRITE Filename, RZERO	None	None
WRITE Filename, AFTER [,EOF]	None	None

ID Supplied After a READ or WRITE Instruction

OPERATION	OPERAND#	MUST BE INCLUDED	REMARKS*
DTFIS^{+}		Each file	Header card. Specify symbolic file name.
	CYLOFL=n	Cylinder overflow areas	May be specified alone or with an independent overflow area. n=number of tracks for each area.
	$^{+}$DSKXTNT=n	Each file	Maximum number of extents specified for the file.
	DEVICE=$\frac{2311}{2321}$	Each file	Specifies Unit
	HINDEX=$\frac{2311}{2321}$		Specifies Unit containing high level indices.
	IOAREAL= Name	IOROUT specifies LOAD, ADD, or ADDRTR	Symbolic name of input/output area. Same as used in DS. At least one I/O area must be specified for a file.
	IOAREAR= Name	TYPEFLE specifies RANDOM or RANSEQ	
	IOAREAS= Name	TYPEFLE specifies SEQNTL or RANSEQ	
	IOREG=(r)	Process blocked records in I/O area	r=number of register 2-12
	$^{+}$IOROUT= LOAD	Each file	Build or extend a file on DASD.
	ADD		Insert new records in an organized file.
	RETRVE		Retrieve records for processing/updating.
	ADDRTR		Insert and retrieve records.
	KEYARG= Name	Required if random retrieval or sequential retrieval is initiated by key.	Symbolic name of key field in main storage.
	$^{+}$KEYLEN=n	Each file	All keys must be the some length. n=length of key.
	KEYLOC=n	With blocked records.	n=high-order position of key field within each record.
	MODNAME= Name	If a name other than the standard or a more inclusive module is referenced.	
	MSTIND= YES	Master index	
	$^{+}$NRECDS=n	Each file	n=number of records in a block.
	$^{+}$RECFORM= FIXUNB	Unblocked records	Applies to records in prime data area only.
	FIXBLK	Blocked records	
	$^{+}$RECSIZE=n	Each file	n=number of characters in each logical record.
	SEPASMB= YES	If the DTF is assembled separately.	

OPERATION	OPERAND#	MUST BE INCLUDED	REMARKS*
DTFIS+	TYPEFLE= RANDOM SEQNTL RANSEQ	IOROUT specified RETRVE or ADDRTR	Random processing. Sequential processing. Random and sequential processing.
	VERIFY=YES	Check records written on 2311	Assumed for 2321
	WORKL=Name	IOROUT specifies LOAD, ADD, or ADDRTR	
	WORKR=Name	TYPEFLE specifies RANDOM or RANSEQ and records are processed in a work area	Takes precedence over IOREG.
	WORKS=YES	TYPEFLE specifies SEQNTL or RANSEQ and records are processed in work areas	Takes precedence over IOREG.

+Must be included. Other entries are included when applicable.

#When two choices are shown, select only the appropriate one and enter it after the = sign.

*The header card and each detail card except the last one used in a file set must contain a continuation punch in column 72. Each detail card except the last one used must also contain a comma after the last operand.

In all entries: Solid caps must be entered as shown (For example, IOROUT= LOAD).

Lowercase letters are to be replaced by programmer's symbolic name or a number (For example, Filename in header card, or CYLOFL=n where n is replaced)·

n is a decimal self-defining value.

ADD, RETRVE, and ADDRTR

Bit	Cause
0	DASD error
1	Wrong length record
2	End of file
3	No record found
4	Illegal ID specified
5	Duplicate record
6	Overflow area full
7	Overflow

LOAD

Bit	Cause
0	DASD error
1	Wrong length record
2	Prime data area full
3	Cylinder Index area full
4	Master Index full
5	Duplicate record
6	Sequence check

FUNCTION	OUTPUT AREA REQUIREMENTS (IN BYTES)			
	Count	Key	Sequence Link	Data
Load Unblocked Records	8	Key Length	—	Record Length
Load Blocked Records	8	Key Length	—	Record Length x Blocking Factor
Add Unblocked Records	8	Key Length	10	Record Length
Add Blocked Records	8	Key Length	—	Record Length x Blocking Factor
			OR*	
	8	Key Length	10	Record Length

* Whichever Is Larger

Output Area Requirements for Loading or Adding Records to a File by ISFMS

FUNCTION	I/O AREA REQUIREMENTS (IN BYTES)			
	Count	Key	Sequence Link	Data
Retrieve Unblocked Records	—	Key Length for sequential unblocked records	10	Record Length
Retrieve Blocked Records	—		—	Record Length x Blocking Factor
			OR*	
	—		10	Record Length

*Whichever Is Larger

I/O Area Requirements for Random or Sequential Retrieval by ISFMS

OPERATION	OPERAND#	APPLIES TO								MUST BE INCLUDED	REMARKS*
		2311 DISK DRIVE	2400 MAGNETIC TAPE UNIT	1442/2501/2520 2540 READER	1442/2520/2540 PUNCH	1403/1404/1443/ 1445 PRINTER	1052 PRINTER-KEYBOARD	2671 PAPER TAPE READER			
DTFSR+		x	x	x	x	x	x	x		Each File	Header Card. Specify Symbolic File Name.
	ALTTAPE= SYSnnn		x							Multivolume File Using Two Tape Drives	Symbolic Unit for Alternate Tape Drive. (For compatibility purposes)
	BLKSIZE= n	x	x	x	x	x	x	x		Each File Except Combined File with Separate I/O Areas	Length of I/O Area. n=Maximum Number of Characters.
	CHECKPT= n		x							CHKPT Macro Used	(For compatibility purposes)
	CKPTREC= YES		x							Bypass Checkpoint Records on Input	Applies to Input File Only.
	CONTROL= YES	x	x	x	x	x				CNTRL Macro Used	CTLCHR Must Be Omitted. Does Not Apply to 2501.
	CRDERR= RETRY				x					Punch Again on Error Condition	Applies Only to 2540 and 2520
	CTLCHR= YES				x	x				Logical Records Have Control Character in First Position	Each Record Must Contain a Control Character. CONTROL Must Be Omitted and the CNTRL Macro Must Not Be Used for This File.
	DEVADDR= SYSnnn	x	x	x	x	x	x	x		Each File Except Disk	Symbolic Unit for the I/O Device Used for the File.
	+DEVICE= DISK11	x								Disk Input/Output File	Include for Each File, and Specify Proper Name after DEVICE=.
	TAPE		x							Tape Input/Output File	
	READ01			x						2501 Input File	
	READ20			x	x					2520 Input/Output File	
	READ40			x	x					2540 Input/Output File	
	READ42			x	x					1442 Input/Output File	
	PRINTER					x				1403, 1404, 1443, 1445 Output	
	CONSOLE						x			1052 Input/Output	
	PTAPERD							x		2671 Input File	
	EOFADDR= Name	x	x	x				x		Input File	Symbolic Name of End-of-File Routine.
	ERROPT= IGNORE	x	x					x		Process Error Records	Applies Only to Disk or Tape Input. Prevents Job Temination on Error Condition. Enter Desired Specification after ERROPT=.
	SKIP									Skip over Error Records	
	Name									User Routine for Error Records	

OPERATION	OPERAND#	APPLIES TO								MUST BE INCLUDED	REMARKS*
		2311 DISK DRIVE	2400 MAGNETIC TAPE UNIT	1442/2501/2520/2540 READER	1442/2520/2540 PUNCH	1403/1404/1443/1445 PRINTER	1052 PRINTER-KEYBOARD	2671 PAPER TAPE READER			
DTFSR+	FILABL= STD		x							Check or Write Standard Labels	Include for Tape Input/ Output and Specify Desired Operation after FILABL=.
	NSTD									File Contains Nonstandard Lables	
	NO									Unlabelled File	
	INAREA= Name			x						Separate Areas for Input and Output for a Combined File	Applies Only to 1442.
	INBLKSZ=n			x						Separate Areas for Input and Output for a Combined File	Applies Only to 1442. Length of INAREA.
	IOAREA1= Name	x	x	x	x	x	x	x		Each File Except Combined File with Separate I/O Areas	Symbolic Name of Input/Output Area.
	IOAREA2= Name	x	x	x	x	x	x	x		Two I/O Areas Used	Symbolic Name of Second Input/Output Area.
	IOREG=(r)	x	x	x	x	x	x	x		Process Blocked Records in I/O Area, or Process in Two I/O Areas	r=number of General Purpose register 2-12. Omit WORKA=YES.
	LABADDR= Name	x	x							Check/Build Additional User-Standard Labels, or Process Nonstandard Labels	Symbolic Name of User's Label Routine.
	OUAREA= Name			x						Separate Areas for Input and Output for a Combined File	Applies Only to 1442.
	OUBLKSZ= n			x						Separate Areas for Input and Output for a Combined File	Applies Only to 1442. Length of OUAREA.
	PRINTOV= YES					x				PRTOV Macro Used	
	READ= FORWARD		x								If This Entry Omitted, IOCS Assumes FORWARD.
	BACK									Read Tape Backwards	
	RECFORM= FIXUNB	x	x	x	x	x	x	x			Specify as Needed for Fixed-Length Unblocked Records. If This Entry Omitted, IOCS Assumes FIXUNB.
	FIXBLK	x	x							Fixed-Length Blocked Records	
	VARUNB	x	x		x	x				Variable-Length Unblocked Records	Disk or Tape Records Require Record-Length Field.
	VARBLK	x	x							Variable-Length Blocked Records	Blocks Require Block-Length Field. Records Require Record-Length Field.

OPERATION	OPERAND#	APPLIES TO								MUST BE INCLUDED	REMARKS*
		2311 DISK DRIVE	2400 MAGNETIC TAPE UNIT	1442/2501/2520/2540 READER	1442/2520/2540 PUNCH	1403/1404/1443/1445 PRINTER	1052 PRINTER-KEYBOARD	2671 PAPER TAPE READER			
DTFSR+	UNDEF	x	x		x	x	x	x		Undefined Records	
	RECSIZE= n or (r)	x	x		x	x	x	x		Fixed-Length Blocked Records Undefined Records	n=Number of Characters in Record. r=Number of register 2-12.
	REWIND= UNLOAD		x							Unload on CLOSE or End-of-Volume	Omit to Rewind Only at OPEN, CLOSE, or End-of-Volume.
	NORWD									Prevent Re winding	
	TPMARK= NO		x							If FILABL=NO or NSTD and No Tape Mark is Desired	If Omitted, YES is Assumed.
	TRANS= Name							x		For Tape Punched With Code Other than EBCDIC and IOCS is to Perform Translation	Symbolic Name of Code Translation Table.
	TRUNCS= YES	x								Fixed-Length Blocked Records with Short Blocks	Include for Output if TRUNC Macro Used. Include for Input if TRUNC Macro Was Used When File Was Created.
	TYPEFLE= INPUT	x	x	x			x	x		Each File	Specify Proper Type after TYPEFLE=.
	OUTPUT	x	x		x	x	x			INPUT is assumed	CMBND. Applies to 1442, 2520, or to 2540 if Punch-Feed-Read Special Feature is Installed.
	CMBND			x							
	UPDATE= YES	x								PUT Used For a Disk Input File	
	VARBLD= (r)	x	x							Variable-Length Blocked Records Built in Output Area	r=Number of a register 2-12.
	VERIFY= YES	x								Check Record Written on Disk	
	WLRERR= Name	x	x					x		User Routine for Wrong-Length Records	Symbolic Name of User's Routine. If Omitted, Error Handled As in EROPT; or if Both Entries Omitted; WLR indication will Be Ignored.
	**WORKA= YES	x	x	x	x	x	x			GET or PUT Specifies a Work Area	Omit IOREG=(r)

+Must be included. Other entries are included when applicable.

#When two or more choices are shown, select only the appropriate one and enter it after the = sign.

*The header and each detail card except the last one used in a file set must contain a continuation punch in column 72. Each detail card except the last one used must also contain a comma after the last operand.

**The 16K DTFSR does not support a work area when the 2671 Paper Tape Reader is specified as the device.

In all entries: Solid caps must be entered as shown (For example, CONTROL=YES)
Lowercase letters are to be replaced by programmer's symbolic name or a number (For example, Filename in header card, or BLKSIZE=n where n is replaced).
n is a decimal self-defining value.

DTFPH

NAME	OPERATION	OPERAND	APPLIES TO							MUST BE INCLUDED	REMARKS
			2311 DISK DRIVE	2400 MAGNETIC TAPE UNIT	1442/2501/2520 2540 READER	1442/2520/2540 PUNCH	1403/1404/1443 1445 PRINTER	1052 PRINTER-KEYBOARD	2321 Data Cell Drive		
Filename	DTFPH		X	X					X	Labeled DASD/Tape File	Symbolic File Name.
		DEVICE= {Tape 2311 2321}	X	X					X	Each File	
		DEVADDR= SYSnnn		X						Labeled Tape File	Symbolic Unit for the Device Used for the File.
		LABADDR= Name	X	X					X	Check/Build Additional User-Standard Lables	Symbolic Name of User's Label Routine. For Tape Input and DASD Files, Applies to Header Labels Only.
		MOUNTED= ALL SINGLE	X						X	Each DASD File	All Extents Are to Be Available at the Initial OPEN. Only the First Extent Is to Be Available at the Initial OPEN.
		TYPEFLE= INPUT OUTPUT	X	X					X	Labeled DASD/Tape Input File Labeled DASD/Tape Output File	
		XTNTXIT= Name	X						X		Symbolic Name of User's Extent Routine.

DTFCN

OPERATION	OPERAND	MUST BE INCLUDED	REMARKS.
DTFCN		Yes	Specify the header entry. Specify symbolic file name.
	BLKSIZE=n		Length of I/O area. n=actual length.

	DEVADDR= {SYSLOG
	SYSnnn}
		Yes	Symbolic unit.

	IOAREA1=name	Each file	Specifies the symbolic name of the I/O area.

	RECFORM= {FIXUNB
	UNDEF}
			Specifies the record format.

	RECSIZE=(r)	For each undefined output file	Indicates register containing length of each record.

	TYPEFLE= {INPUT
	OUTPUT}
		Yes	Specifies the type of file.

	WORKA=YES		Specifies that a work area will be used.

DIRECT ACCESS FILE

Name	Operation	Operand
(name)	READ	Filename, KEY
(name)	READ	Filename, ID
(name)	WRITE	Filename, KEY
(name)	WRITE	Filename, ID
(name)	WRITE	Filename, AFTER
(name)	WRITE	Filename, AFTER, EOF
(name)	WRITE	Filename, RZERO
(name)	WAITF	Filename
(name)	CNTRL	Filename, code

INDEXED SEQUENTIAL FILE

LOAD

Name	Operation	Operand
(name)	SETFL	Filename
(name)	WRITE	Filename, NEWKEY
(name)	ENDFL	Filename

ADD

Name	Operation	Operand
(name)	WRITE	Filename, NEWKEY
(name)	WAITF	Filename

RANDOM RETRIEVAL

Name	Operation	Operand
(name)	READ	Filename, KEY
(name)	WRITE	Filename, KEY
(name)	WAITF	Filename

SEQUENTIAL RETRIEVAL

Name	Operation	Operand
(name)	SETL	Filename, $\left\{\begin{array}{l}\text{ID Name}\\ \text{KEY}\\ \text{BOF}\\ \text{GKEY}\end{array}\right\}$
(name)	GET	Filename
(name)	GET	Filename, Workname
(name)	PUT	Filename
(name)	PUT	Filename, Workname
(name)	ESETL	Filename

JOB CONTROL

	File to File Programs	Tape Compare Program	Clear Disk	Clear Data Cell
JOB	Required	Required	Required	Required

LBLTYP(DOS)
NMTLB(TOS)
	If tape label checking	Not Used	Not Used	Not used

VOL	For label	Not Used	Required	Required
TPLAB	For tape label	Not Used	Not Used	Not Used
DLAB	For DASD label	Not Used	For DASD label	For DASD label
XTENT	For DASD	Not Used	Required for DASD	Required for DASD
ASSGN	Required if devices are different from those assigned at IPL time	Required if devices are different from those assigned at IPL time	Required if devices are different from those assigned at IPL time	Required if devices are different from those assigned at IPL time
UPSI	Optional	Optional	Optional	Optional
EXEC	Required	Required	Required	Requied
/*	For card input program*	Not Used	Not Used	Not Used
/&	Required	Required	Required	Required

* This card must immediately follow the data cards for card input programs. In addition, card columns 3-80 of the card must be entirely blank, otherwise the card will be ignored and treated as data.

	File to File Programs	Tape Compare Program	Clear Disk	Clear Data Cell
VOL (filename)	UIN, UOUT	Not Used	UOUT	UOUT
ASSGN device for logging operator messages	SYSLOG	SYSLOG	SYSLOG	SYSLOG
ASSGN utility control statement input device	SYSIPT	SYSIPT	SYSIPT	SYSIPT
ASSGN device for logging programmer messages	SYSLST	SYSLST	SYSLST	SYSLST
ASSGN Primary tape and card input and alternate tape input	SYS004	SYS004	Not Used	Not Used
ASSGN Primary tape and printer output and alternate tape output	SYS005	SYS005	Not Used	Not Used
ASSGN linkage editor*	SYS000 SYS001 SYS002	SYS000 SYS001 SYS002	SYS000 SYS001 SYS002	SYS000 SYS001 SYS002
ASSGN card output	SYS006	Not Used	Not Used	Not Used
ASSGN DASD input and or output device**	SYS000- SYSnnn	Not Used	SYS000- SYSnnn	SYS000- SYSnnn

* These units are available when not in use by linkage editor.
** SYSnnn can be no greater than the greatest physical unit block assigned and must not conflict with the assignment of any other device.

Program	NAME	Assumed Modifier Card
Tape to Tape	TPTP	//bUbTC, FU, A=(1000), B=(1000), IU, OU, RI
Tape to Disk	TPDK	//bUbTC, FU, A=(1000), B=(1000), IU, OY, RI
Tape to Data Cell	TPDC	//bUbTC, FU, A=(1000), B=(1000), IU, OY, RI
Tape to Card	TPCD	//bUbTC, FF, A=(80, 80), B=(80, 80), IU, O1, R1, S2
Tape to Printer	TPPT	//bUbTD, FU, A=(1000), B=(120), IU, OX, PY, R1, S1
Disk to Tape	DKTP	//bUbTC, FU, A=(1000), B=(1000), OU, R1
Disk to Disk	DKDK	//bUbTC, FU, A=(1000), B=(1000), OY, R1
Disk to Data Cell	DKDC	//bUbTC, FU, A=(1000), B=(1000), OY, R1
Disk to Card	DKCD	//bUbTC, FF, A=(80, 80), B=(80, 80), 01, R1, S2
Disk to Printer	DKPT	//bUbTD, FU, A=(1000), B=(120), OX, S1, PY, R1
Data Cell to Tape	DCTP	//bUbTC, FU, A=(1000), B=(1000), OU, R1
Data Cell to Disk	DCDK	//bUbTC, FU, A=(1000), B=(1000), OY, R1
Data Cell to Data Cell	DCDC	//bUbTC, FU, A=(1000), B=(1000), OY, R1
Data Cell to Printer	DCPT	//bUbTD, FU, A=(1000), B=(120), 0X, S1, PY, R1
Card to Tape	CDTP	//bUbTC, FF, A=(80, 80), B=(80, 80), I1, OU, R1
Card to Disk	CDDK	//bUbTC, FF, A=(80, 80), B=(80, 80), I1, OY, R1
Card to Printer and/or punch	CDPP (PUNCH)	//bUbTB, FF, A=(80, 80), B=(80, 80), I1, O1, S2, R1
	(PRINT)	//bUbTB, FF, A=(80, 80), B=(120), I1, OC, S2, R1
Clear Disk	CLRDSK	//bUCLbB=(K=0, D=100), X'00', OY

LABEL CHECKING

Bit 0 Off for standard input-label checking; on for nonstandard or no input-label checking.

Bit 1 Off if not doing user input-label checking; on if user input-label checking.

Bits 2 and 3 are switches for output-label checking.

Bit 2 Off for standard output-label checking; on for nonstandard or no output-label checking.

Bit 3 Off if not user output-label checking; on if user output-label checking.

Bit 4 is for nonstandard or no output-label handling.

Bit 4 Off = Write tape mark separating the label from data.

On = Do not write a tape mark to separate the label from the data.

A user label routine must be supplied only if bits 1 or 3 of the UPSI byte are ON.

PARAMET-ER	POSSIBLE FORMS	ENTRIES	EXPLANATION
Function Tt	TC TF TR TRF TD TL TLF TB TBF	T	The initial T identifies this as the type of function parameter.
		C	Copy
		F	Field Select
		R	Reblock
		RF	Reblock and Field Select
		D	Display
		L	List
		LF	List and Field Select
		B	Both print and punch
		BF	Both print and punch with field select.
Format Ff	FF FV FU	F	Fixed-length records.
		V	Variable-length records.
		U	Undefined records.
Input Description	A=(n, m)	(n, m)	For fixed-length input records, the input record length(the letter n) and the input block length (the letter m). For field select with variable-length input records, the fixed portion of each input record (the letter n) and the maximum block length(the letter m) must be enclosed in parentheses and separated by a comma.
	A=(K=1, D-1)	A=	This letter and symbol indicate this is the input-description parameter.
		(K=1, D=1)	For fixed-length DASD input records with keys, the letter K and symbol = must precede the length of the key field. The letter D and symbol = must precede the length of the data field.
	A=(g)	A=	This letter and symbol indicate this is the input-description parameter.
		(g)	For undefined input records or variable input records without field select.
Output Description	B=(n, m)	(n, m)	For fixed-length output records, the output record length(the letter n) and the output block length (the letter m). For field select with variable-length output records, the fixed portion of each output record(the letter n) and the maximum output block length (the letter m) must be enclosed in parentheses and separated by a comma.

	B=(K=1, D=1)
	B=(g)
		(K=1, D=1)	For fixed-length DASD output records with keys, the letter K and symbol = must precede the length of the key field. The letter D and symbol = must precede the length of the data field. These two fields must be separated by a comma and enclosed in parentheses.

		(g)	For undefined output records or variable input records without field select, the maximum block length must be enclosed in parentheses.
	B=(p)	(p)	For printer output the size of the print line (120, 132, 144) must be entered.
	B=(n, p)	(n, p)	For field select of variable length records with printer output records, the fixed portion of each output record (the letter n) and the size of the print line (the letter p) must be enclosed in parentheses and separated by a comma.
Optional	Ix Ox Sx Px Rx Q=(x, y)		These parameters are unique to each program and are explained under the discussions of the individual programs.

Utility-Modifier Statement Parameters

CARD TO PRINTER AND/OR PUNCH (CDPP)

Card to Punch:

```
//bUCPbTt,FF,A=(n,m),B=(a,b),Ix,Ox,Rx,Sx,Q=(x,y)
```

Card to Printer:

```
//bUCPbTt,FF,A=(n,m),B=(p),Ix,0x,Rx,Sx,Q=(x,y)
```

Card to Printer and Punch:

```
//bUCPbTt,FF,A=(n,m),B=(a,b),Ix,Px,Rx,Sx,Q=(x,y)
```

Card Input Ix	I1 I2	1 2	EBCDIC input. Binary input.
Printer or Punch Output 0x	01 02 0x 0C	1 2 X C	EBCDIC output (punch only). Binary output (punch only). Hexadecimal output (printed only). Character output (printer only).
Page Numbering Px	PY PN	Y N	Number pages. Do not number pages.
Sequence numbering Q=(x,y)	Q=(x,y)	x , y	This represents the position of a field in a card (relative to one) for sequence-numbering (1 or 2 digits). Separator. This represents the length of the field (maximum 10).
First Record Rx	Rx	x	(x-1 records will be bypassed)
Spacing and Stacker Control Sx	S1 S2 S3	1 2 3	Printer output; Single spacing. Punch output; Select stacker 1. Printer and Punch; Printer control only. Printer output; Double spacing. Punch output; Select stacker 2. Printer and Punch; Printer control only. Printer output; Triple spacing. Punch output; Invalid. Printer and Punch; Printer control only.

CARD TO DISK (CDDK)

```
//bUCDbTt,FF,A=(input),B=(output),Ix,Ox,Q=(x,y),Rx
```

Card Input Ix	I1 I2	1 2	EBCDIC input. Binary input.
Disk Check Ox	OY ON	Y N	Write-disk check. Do not write-disk check.
Sequence- numbering Q=(x,y)	Q=(x,y)	x , y	This represents the first position of a field in a card (relative to one) for sequence-numbering (1 or 2 digits). Separator. This represents the length of the field (maximum 10).
First Record Rx	Rx	x	(x-1 records will be by passed).

CARD TO TAPE (CDTP)

//bUCTbTt, Ff, A=(input), B=(output), Ix, Rx, Ox, Q=(x, y)

Card Input Ix	I1 I2	1 2	EBCDIC input Binary input.
Rewind Output Ox	OR ON OU	R N U	Rewind both before and after data transfer. Do not rewind either before or after data transfer. Rewind before and rewind and unload after data transfer.
Sequence-numbering Q=(x, y)	Q=(x, y)	x , y	This represents the first position of a field in a card (relative to one) for sequence-numbering (1 or 2 digits). Separator. This represents the length of the field (maximum 10).
First Record Rx	Rx	x	(x-1 records will be bypassed).

TAPE TO PRINTER (TPPT)

//bUTPbTt, Ff, A=(input), B=(output), Ix, Ox, Px, Rx, Sx

Rewind Input	IR IN IU	R N U	Rewind both before and after data transfer. Do not rewind either before or after data transfer. Rewind before and rewind and unload after data transfer.
Print Output Ox	OX OC	X C	Hexadecimal printout. (For data display only) Character printout. (Forced for data list)
Spring Option Sx	S1 S2 S3 SA SB SC SD	1 2 3 A B C D	Single spacing (Forced for data display) Double spacing. Triple spacing. Type A first character forms control. Type B first character forms control. Type C first character forms control. Type D first character forms control.
Page Numbering Px	PY PN	Y N	Number pages. (Forced for data display) Do not number pages. (Forced for first character forms control)

TAPE TO DISK (TPDK)

//bUTDbTt, Ff, A=(input), B=(output), Ix, Ox, Rx

Rewind Input Ix	IR IN IU	R N U	Rewind both before and after data transfer. Do not rewind either before or after data transfer. Rewind and unload both before and after data transfer.
Disk Check Ox	OY ON	Y N	Write-disk check. Do not write-disk check.
First Record Rx	Rx	x	(x-1 records will be bypassed).

TAPE TO CARD (TPCD)

//bUTCbTt, FF, A=(input), B=(output), Ix, Ox, Rx, Sx, Q=(x,y)

Rewind Input Ix	IR IN IU	I	The first letter in these forms identifies this parameter.
		R	Rewind both before and after data transfer.
		N	Do not rewind either before or after data transfer.
		U	Rewind before and rewind and unload after data transfer.
Sequence Numbering Q=(x,y)	Q=(x,y)	Q=	The letter and symbol identify this parameter.
		x	This represents the first position of a field in a card (relative to one) for sequence-numbering (1 or 2 digits).
		,	Separator.
		y	This represents the length of the field (maximum 10). The (x,y) parts of this parameter must be enclosed in parentheses. 'Absence of this parameter indicates no sequence numbers.
First Record Rx	Rx	R	The first letter in this form identifies this parameter.
		x	This represents the position of the first logical input record to be output (x-1 records will be bypassed). If the file is to be copied, the function parameter must be indicated to be reblocked and the input and output file description parameters must contain identical values.
Stacker Control Sx	S1 S2 S3	S	The first letter in these forms identifies this parameter.
		1	Select pocket 1
		2	Select pocket 2
		3	First character stacker control.

TAPE TO TAPE (TPTP)

//bUTTbTt, Ff, A=(input), B=(output), Ix, Ox, Rx

Rewind Option for input Ix	IR	R	Rewind both before and after data transfer.
		N	Do not rewind either before or after data transfer.
		U	Rewind before and rewind and unload after data transfer.
First Record Rx	Rx	x	(x-1 records will be bypassed.)
Rewind Output Ox	OR ON OU	R	Rewind both before and after data transfer.
		N	Do not rewind either before or after data transfer.
		U	Rewind before and rewind and unload after data transfer.

DISK TO CARD (DKCD)

//bUDCbTt, Ff, A=(input), B=(output), Ox, Rx, Sx, Q=(x,y)

Output Mode Ox	O1 O2	1	EBCDIC punching
		2	Binary punching
Sequence- Numbering Q=(x,y)	Q=(x,y)	Q=	The first letter and symbol identify this parameter.
		x	This represents the first position of a field in a card (relative to one) for sequence-numbering (1 or 2 digits).
		,	Separator.
		y	This represents the length of the field (maximum 10).
First Record Rx	Rx	x	(x-1 records will be bypassed.)
Stacker Select Sx	S1 S2 S3	1	Select pocket 1
		2	Select pocket 2
		3	First character stacket select

DISK TO TAPE (DKTP)

//bUDTbTt, Ff, A=(input), B=(output), Ox, Rx

Rewind Output Ox	OR ON OU	R N U	Rewind both before and after data transfer. Do not rewind either before or after data transfer. Rewind before and rewind and unload after data transfer.
First Record Rx	Rx	x	(x-1 records will be bypassed.)

DISK TO DISK (DKDK)

//bUDDbTt, Ff, A=(input), B=(output), Ox, Rx

Disk Check Ox	OY ON	Y N	Write-disk check. Do not write-disk check.
First Record Rx	Rx	x	(x-1 records will be bypassed.)

DISK TO PRINTER (DKPT)

//bUDPbTt, Ff, A=(input), B=(output), Ox, Sx, Px, Rx

Printer Output Ox	OX OC	X C	Hexadecimal printout. (For data display only). Alphameric printout. (Forced for data list mode).
Page-numbering Px	PY PN	Y N	Number pages (Forced for data display). Do not number pages. (Forced for first character forms control).
First Record Printed Rx	Rx	x	(x-1 records will be bypassed.)
Spacing Sx	S1 S2 S3 SA SB SC SD	1 2 3 A B C D	Single spacing. (Forced for data display) Double spacing. Triple spacing. Type A first character forms control. Type B first character forms control. Type C first character forms control. Type D first character forms control.

CLEAR DISK (CLRDSK)

//bUCLbB=(K=1, D=1), $\begin{Bmatrix}C'c'\\X'xx'\end{Bmatrix}$, O$\begin{Bmatrix}Y\\N\end{Bmatrix}$

Parameter	Entry	Explanation
B=(K=1, D=1)	B=	Identifies this parameter.
	(K=1, D=1)	Indicates the length of the key and data block in bytes. If a key length is not desired, the key length must be zero.
C'c' or	C'c'	C is entered and followed by the fill character (EBCDIC) enclosed in apostrophes.
X'xx'	X'xx'	The letter X is entered and followed by the hexadecimal fill character enclosed in apostrophes.
OY or	O	Identifies this as the output parameter.
ON	Y N	Indicates write-disk check. Indicates do not write-disk check.

OPERATION	OPERAND	MUST BE INCLUDED	REMARKS
INCARD	[,UNIT= {SYS001 SYSnnn}]	If other than SYS001 is wanted.	nnn - the programmer logical unit containing input. A 160 byte buffer is generated.
INTAPE	BUFSIZ=n	For each file.	n=maximum size of input block. A buffer of 2n bytes is generated.
	[,RECSIZ= {m namel}]	If logical record size within blocks is to be specified.	m=logical record size, namel= symbolic location containing logical record size. If omitted or value=0, records are treated as unblocked.
	[,UNIT= {SYS001 SYSnnn}]	If other than SYS001 is wanted.	nnn - the programmer logical unit containing input.
	[,FILE= {filename (r)}]	For each file bearing standard labels.	Identifies the filename for label processing. r=register pointing to the 7 character filename.
	[,LBL=name2]	If special label processing is desired.	name2=full-word area to be interpreted. If value=0, standard labels are assumed and user label are bypassed. If value is positive, value=address of user HDR record processing routine. If value=negative, or the parameter is omitted no label processing is attempted.
	[,ERROR= {SKIP IGNORE name3}]	If read errors are not to be entirely ignored.	SKIP=bypass any unreadable block. IGNORE=ignore error condition. , name3=symbolic address of a user's routine for unreadable block processing.
	[,CHKPT= {name4 NO}]	If checkpoint records are to be treated as data.	name4=full-word area to be interpreted. If value=non-zero, checkpoint will be treated as data. If value=zero or the parameter is omitted, checkpoint records are bypassed. If CHKPT=NO, checkpoint records are treated as data.
INDISK	BUFSIZ=n	For each file.	n=maximum size of input block. A buffer of 2n bytes is generated.
	[,RECSIZ= {m namel}]	If logical record size within blocks is to be specified.	m=logical record size namel= symbolic address containing logical record size. If omitted or value=0, records are treated as unblocked.
	[,FILE= {filename (r)}]	For each file.	Idnetifies the filename for label processing. r=register containing 8 character filename.
	[,LBL=name2]	If additional user label processing is desired.	name2=full-word area (designated name2) to be interpreated. If value=0, additional user labels are treated like data. Otherwise, value is address of user's HDR label processing routine.
	[,ERROR= {SKIP IGNORE name3}]	If read errors are not to be entirely ignored.	SKIP=bypass any unreadable block. IGNORE=ignore error condition. name3=symbolic address of a user's roution for unreadable block processing.

INLOG	BUFFER= {namel
	(r_b)}
		For each input via the 1052.	namel=symbolic location of the user's buffer area. r_b=register containing the buffer address.

OPERATION	OPERAND	MUST BE INCLUDED	REMARKS
INLOG	,COUNT= $\left\{\begin{matrix}\text{n}\\ (\text{r}_\text{c})\end{matrix}\right\}$	If BUFFER=(r_b).	b=number of characters to be read. r_c=register containing the number of characters to be read.
OUTCARD	$\left[\text{UNIT=}\left\{\begin{matrix}\underline{\text{SYS002}}\\ \text{SYSnnn}\end{matrix}\right\}\right]$	If other than SYS002 is wanted.	nnn=programmer logical unit for output. A buffer of 160 bytes is generated for the 1442 and 2520 (240 bytes for the 2540).
	$\left[\text{STCTL=}\left\{\begin{matrix}\underline{\text{NO}}\\ \text{YES}\\ \text{name1}\end{matrix}\right\}\right]$	If stacker selection is desired.	Omission, or NO=pocket2; YES=stacker selection is controlled by first character of each record; name1=symbolic location of area to be interpreted: 0=pocket 2; nonzero=YES.
	$\left[\text{,DEVICE=}\left\{\begin{matrix}\underline{\text{1442}}\\ \text{2520}\\ \text{2540}\end{matrix}\right\}\right]$	If other than a 1442 card punch is used.	Specifies error-recovery procedures.
	$\left[\text{,RETURN=}\left\{\begin{matrix}\underline{\text{YES}}\\ \text{NO}\end{matrix}\right\}\right]$	If user routine or additional output utility macros follow.	NO=continue to next sequential statement. YES=return to input routine or to optional user routine.
OUTAPE	BUFSIZ=n	For each file.	n=maximum size of output block. A buffer of 2n bytes is generated.
	$\left[\text{,BLK=}\left\{\begin{matrix}\text{m}\\ \text{name1}\end{matrix}\right\}\right]$	If record blocking is desired.	m=blocking factor; value of 0 indicates unblocked records. name1=symbolic location to be interrogated. A value of 0 indicates no blocking is performed. Otherwise value=blocking factor.
	$\left[\text{,UNIT=}\left\{\begin{matrix}\underline{\text{SYS002}}\\ \text{SYSnnn}\end{matrix}\right\}\right]$	If other than SYS002 is wanted.	nnn=programmer logical unit for output.
	$\left[\text{,FILE=}\left\{\begin{matrix}\text{filename}\\ \text{(r)}\end{matrix}\right\}\right]$	For each file bearing standard labels.	Identifies label information. r=register pointing to an 8 character filename.
	,LBL=[name2]	If label processing is desired.	name2=fullword area symbolically designated name2 to be interpreted. If value=0, standard labels are assumed and user labels are bypassed; if value is negative, no label processing is attempted; if value is positive, value=address of HDR processing routine.
	$\left[\text{,RETURN=}\left\{\begin{matrix}\underline{\text{YES}}\\ \text{NO}\end{matrix}\right\}\right]$	If user routine or additional output utility macros follow.	NO=continue to next sequential statement. YES=return to input routine or to optional user routine.
OUTDISK	BUFSIZ=n	For each file.	n=maximum size of output block. A buffer of 2n bytes is generated.
	$\left[\text{,BLK=}\left\{\begin{matrix}\text{m}\\ \text{name1}\end{matrix}\right\}\right]$	If record blocking is desired.	m=blocking factor; value of 0 indicates unblocked records. name1=symbolic location to be interrogated. A value of 0 indicates no blocking is performed. Otherwise value=blocking factor.
	FILE= $\left\{\begin{matrix}\text{filename}\\ \text{(r)}\end{matrix}\right\}$	For each file.	Identifies label information. r=register pointing to an 8 character filename.

OPERATION	OPERAND	MUST BE INCLUDED	REMARKS
OUTDISK (Cont'd)	[,LBL=name2]	If user label processing is desired.	name2=fullword area symbolically designated name2 to be interpreted. If value=0, no user HDR label processing is attempted; if value is nonzero, value=address of HDR record processing routine.
	$\left[,\text{ERROR}=\left\{\begin{matrix}\underline{\text{IGNORE}}\\ \text{name3}\end{matrix}\right\}\right]$	If a write check is desired.	IGNORE=ignore error condition. name3=symbolic address of user routine for error-handling.
	$\left[,\text{FORMAT}=\left\{\begin{matrix}\underline{\text{FULL}}\\ \text{n}\\ \text{name4}\end{matrix}\right\}\right]$	When a specified number of records are to appear on each track.	FULL=fill track as much as possible. n=number of records per track. name4=symbolic address containing number of records per track value. If value is 0, FULL is assumed.
	$,\text{RETURN}=\left\{\begin{matrix}\underline{\text{YES}}\\ \text{NO}\end{matrix}\right\}$	If user routine or additional output utility macros follows.	NO=continue to next sequential statement. YES=return to input routine or to optional user routine.
OUTPRT	BUFSIZ=n	If n should be less than 144.	n=maximum size of output block.
	$\left[,\text{UNIT}=\left\{\begin{matrix}\underline{\text{SYS002}}\\ \text{SYSnnn}\end{matrix}\right\}\right]$	If other than SYS002 is wanted.	nnn=programmer logical unit for output.
	$\left[,\text{FORMS}=\left\{\begin{matrix}\text{A}\\ \text{B}\\ \text{C}\\ \text{D}\end{matrix}\right\}\right]$	If other than single-spaced lines are desired.	Refer to the description of carriage control codes provided with macro description.
	$\left[,\text{RETURN}=\left\{\begin{matrix}\underline{\text{YES}}\\ \text{NO}\end{matrix}\right\}\right]$	If user routine or additional output utility macros follow.	NO=continue to next sequential statement. YES=return to input routine or to optional user routine.
OUTLOG	$\text{BUFFER}=\left\{\begin{matrix}\text{name1}\\ (r_b)\end{matrix}\right\}$	For each output on the 1052.	name1=symbolic location of the user's buffer area. r_b=register containing the buffer address (absolute or symbolic).
	$,\text{COUNT}=\left\{\begin{matrix}\text{n}\\ (r_c)\end{matrix}\right\}$	If Buffer=[r_b]	n=number of characters to be written. r_c=register containing the number of characters to be written.
	$\left[,\text{RETURN}=\left\{\begin{matrix}\underline{\text{YES}}\\ \text{NO}\end{matrix}\right\}\right]$	If user routine or additional output utility macros follow.	NO=continue to next sequential statement. YES=return to input routine or to optional user routine.

Code	Space or Skip Action
blank	Space one line before printing
0	Space two lines before printing
-	Space three lines before printing
+ (EBCDIC or BCDIC)	Suppress space before printing
1	Skip to Channel 1 before printing
2	Skip to Channel 2 before printing
3	Skip to Channel 3 before printing
4	Skip to Channel 4 before printing
5	Skip to Channel 5 before printing
6	Skip to Channel 6 before printing
7	Skip to Channel 7 before printing
8	Skip to Channel 8 before printing
9	Skip to Channel 9 before printing
A	Skip to Channel 10 before printing
B	Skip to Channel 11 before printing
C	Skip to Channel 12 before printing

Type A

8-Bit Code	Punch Combination	Function
00000001	12, 9, 1	Write (no automatic space)
00001001	12, 9, 8, 1	Write and space 1 line after printing
00010001	11, 9, 1	Write and space 2 lines after printing
00011001	11, 9, 8, 1	Write and space 3 lines after printing
10001001	12, 0, 9	Write and skip to channel 1 after printing
10010001	12, 11, 1	Write and skip to channel 2 after printing
10011001	12, 11, 9	Write and skip to channel 3 after printing
10100001	11, 0, 1	Write and skip to channel 4 after printing
10101001	11, 0, 9	Write and skip to channel 5 after printing
10110001	12, 11, 0, 1	Write and skip to channel 6 after printing
10111001	12, 11, 0, 9	Write and skip to channel 7 after printing
11000001	12, 1	Write and skip to channel 8 after printing
11001001	12, 9	Write and skip to channel 9 after printing
11010001	11, 1	Write and skip to channel 10 after printing
11011001	11, 9	Write and skip to channel 11 after printing
11100001	11, 0, 9, 1	Write and skip to channel 12 after printing
00001011	12, 9, 8, 3	Space 1 line immediately
00010011	11, 9, 3	Space 2 lines immediately
00011011	11, 9, 8, 3	Space 3 lines immediately
10001011	12, 0, 8, 3	Skip to channel 1 immediately
10010011	12, 11, 3	Skip to channel 2 immediately
10011011	12, 11, 8, 3	Skip to channel 3 immediately
10100011	11, 0, 3	Skip to channel 4 immediately
10101011	11, 0, 8, 3	Skip to channel 5 immediately
10110011	12, 11, 0, 3	Skip to channel 6 immediately
10111011	12, 11, 0, 8, 3	Skip to channel 7 immediately
11000011	12, 3	Skip to channel 8 immediately
11001011	12, 0, 9, 8, 3	Skip to channel 9 immediately
11010011	11, 3	Skip to channel 10 immediately
11011011	12, 11, 9, 8, 3	Skip to channel 11 immediately
11100011	0, 3	Skip to channel 12 immediately
00000011	12, 9, 3	No op

Type B

d	immediate skip to
1	channel 1
2	channel 2
3	channel 3
4	channel 4
5	channel 5
6	channel 6
7	channel 7
8	channel 8
9	channel 9
0	channel 10
#	channel 11
@	channel 12

d	Skip after print to
A	channel 1
B	channel 2
C	channel 3
D	channel 4
E	channel 5
F	channel 6
G	channel 7
H	channel 8
I	channel 9
?	channel 10 (EBCDIC or BCDIC)
.	channel 11
⌑	channel 12 (EBCDIC or BCDIC)

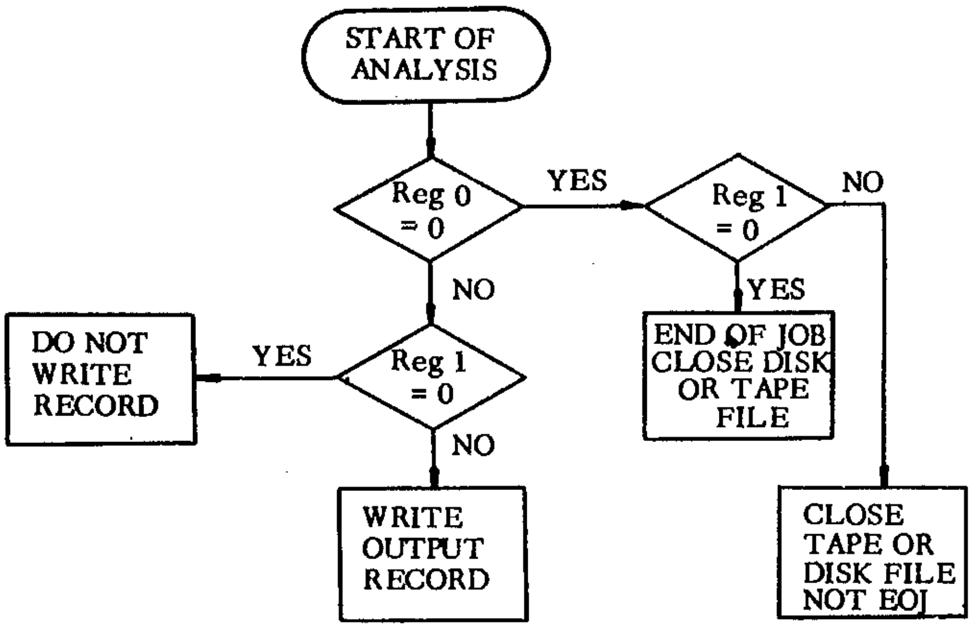
d	immediate space
J	1 space
K	2 spaces
L	3 spaces

d	after print-space
/	1 space
S	2 spaces
T	3 spaces

Type C

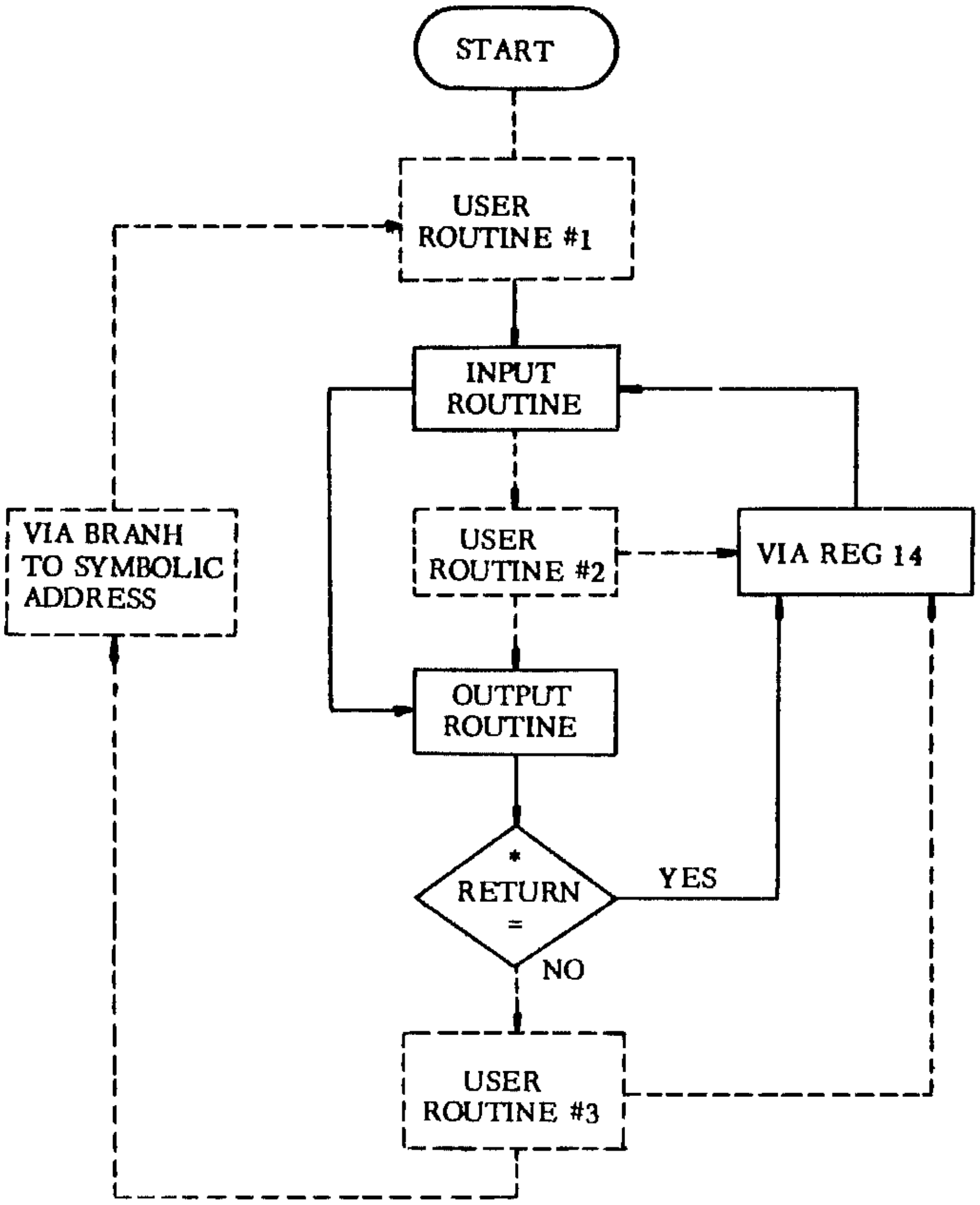
Code	Space or skip Action
Plus (EBCDIC or BCDIC)	Suppress space and print
blank	Print and single space
zero	Double space, print, and space
-	Triple space, print, and space
1-9 or J-R	Immediate skip to channel 1-9 (that is, 1 or J=skip to channel 1; 2 or K=skip to channel 2; etc), print, and then space.

OUTPUT ROUTINE DECISION USING REG 0, 1



REGISTER CONVENTIONS			CONTROL OF OUTPUT
USER ---- 2 —— 12			Rø≠0, R1≠0, ... WRITE RECORD
REG	0	RECORD ADDRESS	Rø=0, R1=0, ... CLOSE FILE, EOJ
	1	RECORD LENGTH	Rø≠0, R1=0, ... DON'T WRITE RECORD
	14	RETERN ADDRESS	Rø=0, R1≠0, ... CLOSE FILE, NOT EOJ
	15	BASE REG.	

TECHNIQUES FOR PASSING CONTROL BETWEEN ROUTINES



SOLID LINES REPRESENT NORMAL OPTIONS AND PROGRAM FLOW.

* ASSEMBLY TIME DECISION

DISK SORT/MERGE, TAPE SORT/MERGE

STATEMENT DEFINER	STATUS	OPERAND	STATUS	OPERAND REMARKS
SORT	Required for SORT runs	FIELD=(P_1,M_1,S_1,P_2, M_2, ...)	Required	P=Starting Position
				M=length
		FORMAT=XX	Required	S=A,... assending order =D,... dissending order
		XX=ZD ... Zoned decimal PD ... Packed decimal FI ... Fixed point BI ... Binary FL ... Floating point		
		FILES=m (DS only)	Optional	m=The number of files to be sorted. WORK (TS only) Required CHKPT(TS only) Optional
		SIZE=n (DS only)	Required	n=logical record length

MERGE	Required for Merge runs	FIELD=(P,M,S,...)
		FORMAT= XX
		FILES= X		

RECORD	Required	TYPE=X		x=F ... Fixed length V ... Variable length
		LENGTH=(L_1,L_2,L_3)	for F	L_1=input
		=(L_1,L_2,L_3,L_4, L_5)	for V	L_2=not used
				L_3=output
				L_4=minimum of input
				L_5=average of output
INPFIL	Required	INPUT=X (DS only)	Required	X=T ... Tape D ... Disk
		VOLUME=(Na,Nb ...)	Optional	Na= file A
				Nb= file B
				⋮
		BLKSIZE=(n, x)	Required	n=length
		OPEN=m	Optional	
		CLOSE=m	Optional	
		BYPASS	Optional	incorrect record will be bypassed
OUTFIL	Required	BLKSIZE=n	Required	n=length
		OUTPUT=x (DS only)	Required	x=T ... Tape D ... Disk
		OPEN=m	Optional	
		CLOSE=m	Optional	
		NOTPMK (DS only)	Optional	
MODS	for user's Routine	PH_1=(n,m,E_{11},E_{12},E_{13})	Optional	n=name
		PH_2=(n,m,E_{31},E_{32})	Optional	m=address
		PH_3=(n,m,E_n)	Optional	En=(E_{41},E_{42},E_{43},E_{44}, E_{45})

STATE-MENT DEFINER	STATUS	OPERAND	STATUS	OPERAND REMARKS
OPTION	Optional	PRINT	Optional	Control cards Printout
		STORAGE=X	Optional	* DS only
		NOTPMK	Optional	TS only
		VERIFY	Optional	DS only
		KEYLEN=X	Optional	DS only
		ADDROUT=X	Optional	DS only
		CALCAREA	Optional	DS only
		LABEL=(O,W,I) =(O, I)	Optional	(I,W,O)=TS I=input (I,O) =DS W=work O=output
		N=nonstandard label		
		S=standard label		
		U=unlabel		
		ALTWK	Optional	TS only
		FILES=X	Optional	TS only
		RESTART	Optional	DS only
END	Required			

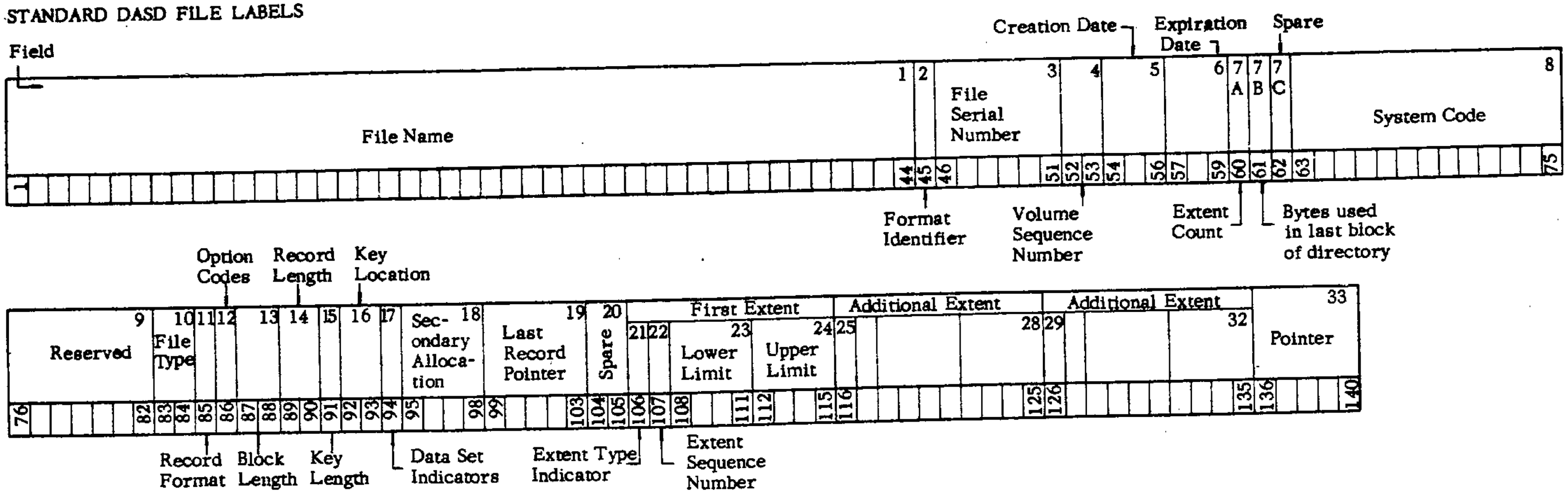
* DS = DISK SORT
TS = TAPE SORT

NO ALTERNATE DRIVE	USER'S REWIND SPECIFICATIONS		ALTERNATE DRIVE/S
Remarks	OPEN	CLOSE	Remarks
The volume is rewound and unloaded. The next volume is rewound.	RWD	RWD	The volume is rewound. The next volume is rewound.
The volume is rewound and unloaded. The next volume is rewound.	RWD	UNLD	The volume is rewound and unloaded. The next volume is rewound.
The volume is rewound and unloaded. The next volume is not rewound.	RWD	NORWD	The volume is not rewound, and the next volume is not rewound.
The volume is rewound and unloaded. The next volume is rewound.	NORWD	RWD	The volume is rewound, and the next volume is rewound.
The volume is rewound and unloaded. The next volume is not rewound.	NORWD	UNLD	The volume is rewound and unloaded. The next volume is rewound.
The volume is rewound and unloaded. The next volume is not rewound.	NORWD	NORWD	The volume is not rewound, and the next volume is not rewound.

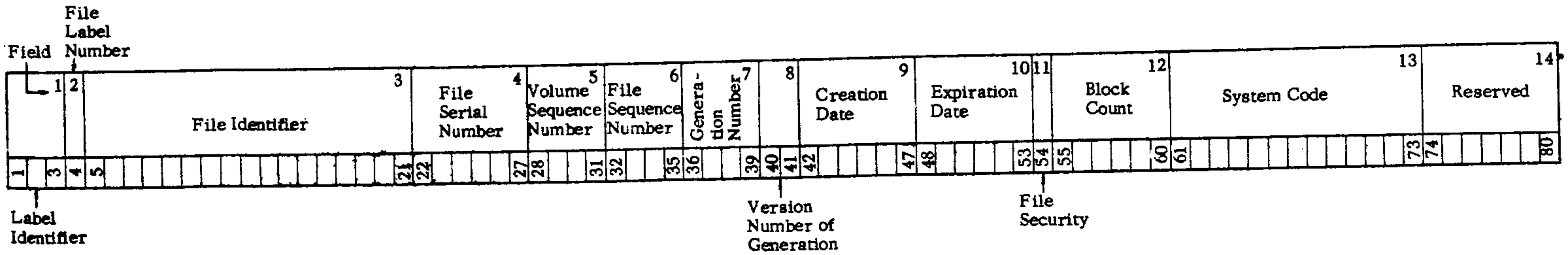
Rewind Action Taken at EOV Time
for Multi-Volume Files

OPTION Statement

STANDARD DASD FILE LABELS



STANDARD TAPE FILE LABELS



LABEL STORAGE AREA (1 CYLINDER)

Sequential DASD File Label Blocks

1. Always 104 bytes per extent.
2. Always read into the transient area.

Non-sequential DASD File Label Blocks

1. Always at least 104 bytes per file.
2. Additional extents will require an additional 20 bytes similar to bytes 85-104.
3. Always read into lower portion of user core.

BYTE	FUNCTION	CONTENT/FORMAT
1	No. of Extents	X 'bb' A. SEQ DISK 'bb' = '01' for all except last extent. B. SEQ DISK 'bb' = 'FF' for last extent. C. Non-SEQ 'bb' = number of extents (maximum of 125)
2-9	File Name	CL8 'filename' (DTF name)
10-53	File ID	CL44 'Qualified name (Gen# Ver#)'
54	Format ID	CL1 '1'
55-60	File Serial	CL6 'serial'
61-62	Volume Sequence	H 'n'
63	Creation Date	X 'yy'
64-65	" "	H 'ddd'
66	Expiration Date	X 'yy'
67-68	" "	H 'ddd'
69-71	Reserved	3X '00'
72-84	System Code	CL13 'alphamerics'
85-90	Extent Serial	CL6 'serial'
91	Extent type	X 'bb'
92	Extent Seq. No.	X 'bb' A. ISFMS without a master index 'bb' = '01' B. All others 'bb' = '00'
93-96	Lower limit	4X 'C1', 'C2', 'H1', 'H2'
97-100	Upper limit	4X 'C1', 'C2', 'H1', 'H2'
101-102	Symbolic unit from CCB	2X '0b', 'bb'
103	Old cell	X 'B1'
104	New cell	X 'B2'

Labeled Tape Label Blocks

1. Always 80 bytes per file.
2. Always read into lower portion of user core.

BYTE	FUNCTION	CONTENT/FORMAT
1	Reserved	X '00'
2-9	File name	CL8 'filename"
10-58	Mandatory File ID	CL49 'field 3 .... field 10'
59-78	Optional File ID	CL20 'field 11 ... field 13'
79-80	Symbolic unit from CCB	2X '0b', 'bb'

LABEL BLOCK KEY FOR <u>EVERY</u> LABEL BLOCK

BYTE	FUNCTION	CONTENT/FORMAT
1-8	File Name	CL8 'file name'
9	Reserved	X '00'
10	Extent Sequence #	X 'bb' A. Mag Tape 'bb' = '00' B. DASD 'bb' = # of first extent

LABEL BLOCKS SUMMARIZED

FILE TYPE	KEY	LABEL BLOCK
TAPE	10	80 for each file
SEQ DASD	10	104 for each extent
NON-SEQ DASD	10	84 + 20 (number of extents)

DISK STORAGE SPACE (Library and Directory)

ELEMENT	Logical record length	Physical record length	Logical records per physical record	Total physical records	Total logical records
CIL Directory	20	360	18	8	144
CIL	1728	1728	1	2	2
RL Directory	14	322	23	9	207
RL	322	322	1	9	9
SSL Directory	15	150	10	16	160
SSL	160	160	1	16	16

Functions which require transients are as follows:

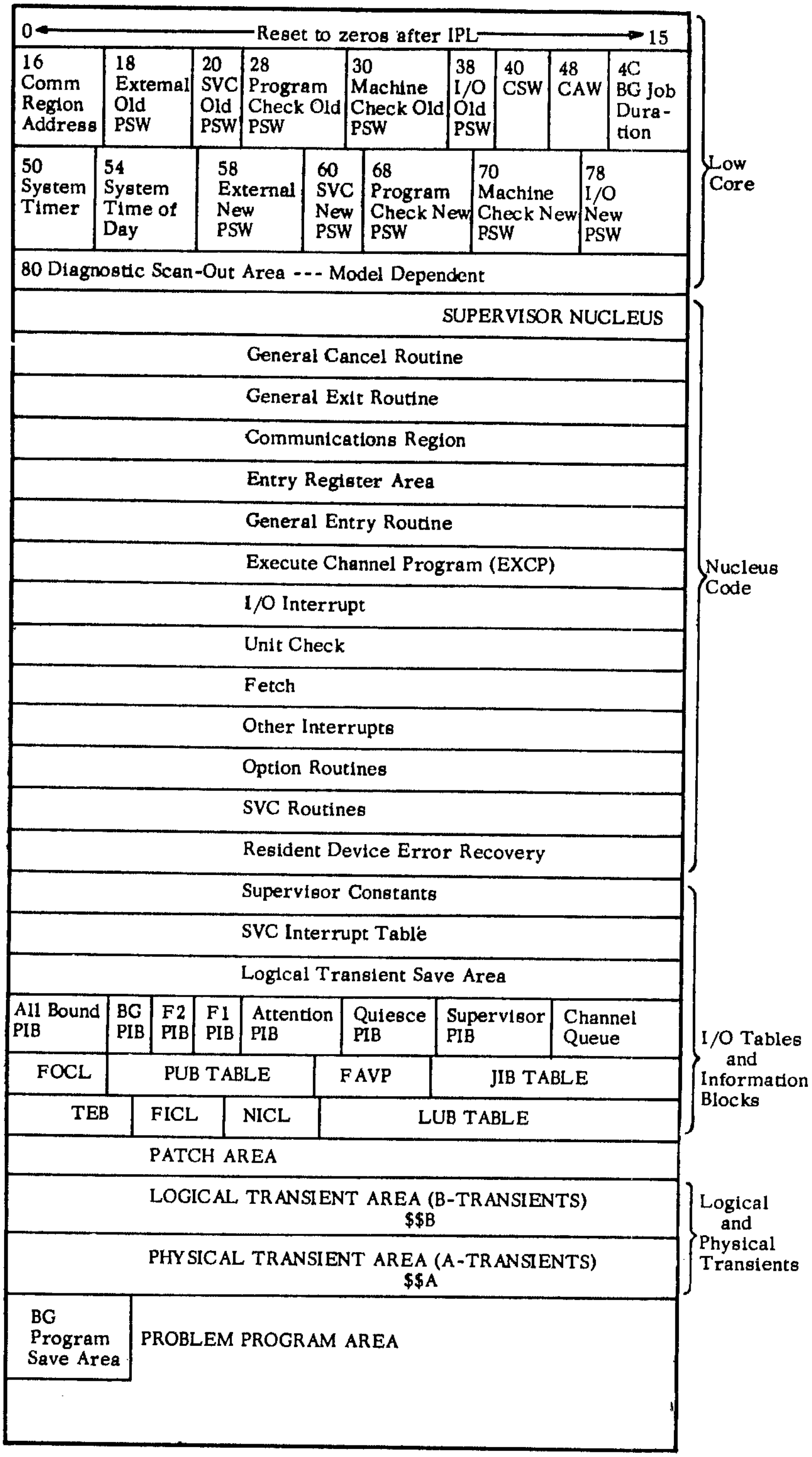
Mnemonic	Transient	Function
OPEN	$$BOPEN	open a file - other transient(s) will be called
CLOSE	$$CLOSE	close a file - other transient(s) will be called
DUMP	$$DUMP	dump core and cancel job
- - -	$$BCNCL	cancel a problem program (all job steps)
- - -	$$BPCHK	program check routine
- - -	$$A----	Type A transients (primarily device error routines)
CHKPT	$$BCHKPT	checkpoint
- - -	$$BRSTRT	restart
- - -	$$BILSVC	illegal (undefined) SVC
- - -	$$BMSCIN	process messages from operator
- - -	$$BATST	autotest transients
PDUMP	$$BPDUMP	dump core and return to caller
- - -	$$BOPNLP	OPEN SYSRES (disk system only)
SETFL	$$BSETFL	load routine (initialize) ISFMS
- - -	$$BSETFF	load routine (initialize) ISFMS
ENDFL	$$BENDFL	load routine (terminate) ISFMS
- - -	$$BENDFF	load routine (terminate) ISFMS
SETL	$$BSETL	sequential return routine (initialize) ISFMS
ESETL	&&BESETL	sequential return routine (terminate) ISFMS

Note: The IPL and Supervisor Nucleus will bear the names $$A$IPL and $$A$SUP. An eighth character may be used to distinguish phases of these programs.

DOS SUPERVISOR CALLS

Macro Supported	SVC	Function
EXCP	0	Execute channel programs.
FETCH	1	Fetch any phase.
	2	Fetch a logical transient (B-transient).
	3	Fetch or return from a physical transient (A-transient).
LOAD	4	Load any phase.
MVCOM	5	Modify supervisor communications region.
CANCEL	6	Cancel a problem program.
WAIT	7	Wait on a CCB or TECB.
	8	Transfer control to the problem program from a logical transient (B-transient).
LBRET	9	Return to a logical transient (B-transient) from the problem program after a SVC 8.
SETIME	*10	Set timer interval.
	11	Return from a logical transient (B-transient).
	12	Logical AND (Reset) to second Job Control byte (displacement 57 in communications region).
	13	Logical OR (Set) to second Job Control byte (displacement 57 in communications region).
EOJ	14	Cancel job and go to Job Control for end of job step.
	15	Same as SVC 0 except ignored if CHANQ table is full.
STXIT (PC)	*16	Provides supervisor with linkage to user's PC routine for program check interrupts.
EXIT (PC)	*17	Return from user's PC routine.
STXIT (IT)	*18	Provides Supervisor with linkage to user's IT routine for interval timer interrupts.
EXIT (IT)	*19	Return from user's IT routine.
STXIT (OC)	*20	Provides Supervisor with linkage to user's OC routine for external or attention interrupts (operator communications).
EXIT (OC)	*21	Return from user's OC routine.
	*22	The first SVC 22 seizes the system for the issuing program by disabling multiprogram operation. The second SVC 22 releases the system (enables multiprogram operation).
	*23	Load phase header. Phase load address is stored at user's address.
	*24	Provide Supervisor with linkage to user's TECB and set timer interval.
	*25	Issues HALT I/O on a teleprocessing device.
	*26	Validate address limits.

* = optional



0 ← Reset to zeros after IPL → 15

16 Comm Region Address	18 External Old PSW	20 SVC Old PSW	28 Program Check Old PSW	30 Machine Check Old PSW	38 I/O Old PSW	40 CSW	48 CAW	4C BG Job Duration

50 System Timer	54 System Time of Day	58 External New PSW	60 SVC New PSW	68 Program Check New PSW	70 Machine Check New PSW	78 I/O New PSW

80 Diagnostic Scan-Out Area --- Model Dependent

Low Core

SUPERVISOR NUCLEUS

General Cancel Routine

General Exit Routine

Communications Region

Entry Register Area

General Entry Routine

Execute Channel Program (EXCP)

I/O Interrupt

Unit Check

Fetch

Other Interrupts

Option Routines

SVC Routines

Resident Device Error Recovery

Nucleus Code

Supervisor Constants

SVC Interrupt Table

Logical Transient Save Area

All Bound PIB	BG PIB	F2 PIB	F1 PIB	Attention PIB	Quiesce PIB	Supervisor PIB	Channel Queue

FOCL	PUB TABLE	FAVP	JIB TABLE

TEB	FICL	NICL	LUB TABLE

I/O Tables and Information Blocks

PATCH AREA

LOGICAL TRANSIENT AREA (B-TRANSIENTS) $$B

PHYSICAL TRANSIENT AREA (A-TRANSIENTS) $$A

Logical and Physical Transients

BG Program Save Area

PROBLEM PROGRAM AREA

COMREG

Note: Displacement values illustrated can be used to access the listing and/or the key that follows the figure. The key offers more detailed information about each area when necessary.

Displacement hexadecimal	0	8	6A	0C	17	18	20	24	28	2C	2E	30	34	35
Displacement decimal	0	8	10	12	23	24	32	36	40	44	46	48	52	53
	Date	Addr of PPBEG	Addr of EOSSP	Problem Program Use	UPSI Byte	Job Name	Highest Storage Address	End Address of Last Phase Fetched or Loaded	End Address of Longest Phase Fetched or Loaded	Lbl Area Lng	PIK	End of Storage Address	Confg Byte	Date Conv
	xxxxxxxx	xx	xx	xxxxxxxxxxx	x	xxxxxxxx	xxxx	xxxx	xxxx	xx	xx	xxxx	x	x

Displacement hexadecimal	36	37	38	39	3A	38	3C	3E	40	42	44	46	48	4A	4C	4E	4F
Displacement decimal	54	55	56	57	58	59	60	62	64	66	68	70	72	74	76	78	79
	Standard Options		Job Control Byte	Linkage Control Byte	Language Translator Control Byte	Job Duration Indicator Byte	Disk Address of Labels	Addr of FOCL	Addr of PUB	Addr of FAVP	Addr of JIB	Addr of TEB	Addr of FICL	Addr of NICL	Addr of LUB	Line Count for SYSLST	System Date
	xx		x	x	x	x	xx	xx	xx	xx	xx	xx	xx	xx	xx	x	xxxxxxxx

Job Control Switches

Displacement hexadecimal	58	59	5A	5C	5E	60	62	64	66	68	6A	6C	6E
Displacement decimal	88	89	90	92	94	96	98	100	102	104	106	108	110
	Reserved	LIOCS Byte	PIB Table Addr	ID Number of Last Checkpoint	Lng. of LUB ID Queue No. of Channel Queue Entries	Address of Disk I/O Position Data	Address of Channel Scheduler Error Block	Address of PC Option Table - 8	Address of IT Option Table - 8 *IT Support Key	Address of OC Option Table - 8	Key to Program with Timer Support	Address of the LUBID Queue	Logical Transient Key
	x	x	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx

0 MM/DD/YY or DD/MM/YY obtained from the job control date statement. Format controlled by COMREG +53 (date convention byte) bit 0.

8 Address of the problem program label area. (End of transient area +1).

10 Address of the beginning of the problem program area. Y (EOSSP) = Y (PPBEG)-if the storage protection option has not been selected. Y (EOSSP) equals the first main storage location with a storage protection key of 1, if storage protection is supported.

12 User area

23 User program switch indicator.

24 Job name set by the job control program from information found in the job statement.

32 Address of the uppermost byte of the problem program area as determined by the IPL program. (Clear storage routine determines the address, ENDRT routine of $$A$IPL2 stores it.)

36 Address of the uppermost byte of the last phase of the problem program fetched or loaded. The initial value (as shown) is overlaid by the first fetch or load to the problem program area.

40 Address of the uppermost byte of the longest phase of the problem program fetched or loaded. The initial value is overlaid by the first fetch or load to the problem program area.

44 Length of the problem program label area.

46 Program interrupt Key: Value is equal to the displacement from the start of the PIB table to me PIB For the Task.

First Byte - always zero

Second Byte - Contains the key of the program that was last enabled for interrupts. (When an interrupt occurs, the PIK indicates to the supervisor which program was interrupted.)

Task	PIK Value
All Bound	X'00'
BG	X'10'
*F2	X'20'
*F1	X'30'
Attn Rtn	X'40'
Quiesce I/O	X'50'
Supervisor	X'60'

*These tasks do not exist in a batch-job-only system.

48 Logical end of main storage address

52 Configuration Byte (Values set at supervisor generation time.)

Bit 0: 1 = Storage protect
0 = No storage protect

1: 1 = Decimal feature
0 = No decimal feature

2: 1 = Floating point feature
0 = No floating point feature

3: Reserved

4: 1 = Timer feature
0 = No timer feature

5, 1 = Channel switching device
0 = No channel switching device

6: 1 = Burst mode on multiplex channel support
0 = No burst mode on multiplex support

7: 1 = 7-track SYSRES
0 = No 7-track SYSRES

53 Date Convention Byte

Bit 0: 1 = DDMMYYJJ (Set at generation time by STDJC)
0 MMDDYYJJ
1: 1 = Multiprogramming environment
0 = Batch job environment
2: 1 = DASD file protect supported
0 = No file protect support for DASD
3: 1 = DASD SYSIN-SYSOUT
0 = No DASD SYSIN-SYSOUT
4: 1 = RTAM = YES
0 = RTAM = NO
5-7: Reserved

54 This byte contains the standard language translator I/O options (set by the STDJC macro).

Bit 0:	DECK option	1 = yes, output object modules on SYSPCH
1:	LIST option	1 = yes, output source module listings and diagnostics on SYSLST.
2:	LISTX option	1 = yes, output hexadecimal object module listings on SYSLST (compilers only).
3:	SYM option	1 = yes, output symbol tables on SYSLST/ SYSPCH
4:	XREF option	1 = yes, output symbolic cross reference list on SYSLST
5:	ERRS option	1 = yes, output diagnostics on SYSLST (compilers only).
6:	CHARSET option	1 = 48, input on SYSIPT is 48 or 60 character set
7:	Reserved	

55 This byte contains the standard supervisor options for abnormal EOJ and control statement display.

Bit 0:	Not used	
1:	DUMP option	1 = yes, dump registers and storage on SYSLST
2:	Not used	
3:	LOG option	1 = yes, list all control statements on SYSLST
4-6:	Not used	
7:	Reserved	

56 Job control byte (JBCSW0)

Bit 0: Reserved
1: 1 = Return to caller on LIOCS disk open failure
0 = Do not return to caller on LIOCS disk open failure
2: 1 = Job control input from SYSRDR
0 = Job control input from SYSLOG
3: 1 = Job control output on SYSLOG
0 = Job control output not on SYSLOG
4: 1 = Cancel job
0 = Do not cancel job
5: 1 = Pause at end-of-job step
0 = No pause at end-of-job step
6: 1 = SYSLOG is not a 1052
0 = SYSLOG is a 1052
7: 1 = SYSLOG is assigned to the same device as SYSLST
0 = SYSLOG is not assigned to the same device as SYSLST

57 Job control byte (JBCSW1)

Bit 0: 1 = SYSLNK open for output
0 = SYSLNK not open for output
1: Reserved
2: 1 = Allow EXEC
0 = Suppress EXEC
3: 1 = Catalog linkage editor output
0 = Do not catalog linkage editor output
4: 1 = Supervisor has been updated
0 = Supervisor has not been updated
5: 1 = Executing in AUTOTEST mode
0 = Not executing in AUTOTEST mode
6: 1 = Ignore attention interrupt on 1052
0 = Do not ignore 1052 attention interrupt
7: 1 = Fetch MAINEOJ at end of job to update system directory
0 = Do not fetch MAINEOJ at end of job for update

58 Job control byte (JBCSW2; called the language processor control byte. This is a set of switches used to specify nonstandard language trarislator options. The switches within the byte are controlled by job control OPTION statements and when set to 1, override standard options. The format of this byte is identical to the standard option byte (displacement 54).

59 Job control byte (JBCSW3)

Bit 0: 1 = Within a job condition
       0 = Outside a job condition
    1: 1 = Dump on an abnormal end-of-job condition
       0 = No dump on abnormal (O;
    2: Reserved
    3: 1 = Job control output on SYSLST
       0 = Output not on SYSLST
    4: 1 = Job is being run out of sequence with a temporary assignment for SYSRDR
       0 = Conditions for 1 setting not met
    5: 1 = No OPEN
       0 = Initial entry to OPEN
    6: 1 = OPEN monitor entry is from the DTFCP OPEN phase
       0 = Conditions for a 1 setting not met
    7: Reserved

60 Binary disk address of the volume label area

62 → **76** As illustrated

78 Set to the value nn specified in the LINES = nn parameter of the STDJC macro.

79 The format of the system date contained within this field is determined by the IPL program from information supplied in the date convention byte (displacement 53). Bytes 85 - 87 contain the day count.

88 Reserved

89 Byte reserved for use by LIOCS. Transient dump programs insert a key to indicate to the LIOCS end-of-volume routine, $$BCMT07, that it was called by a B-transient.

90 Address of the program information block (PIB) table.

92 ID number of the last checkpoint

94 Length of the LUB ID queue (in bytes). This equals the number of channel queue entries. It can also be used to access the REQUID queue.

96 Address of disk I/O position data. This is the starting address of the disk information block (DIB) table.

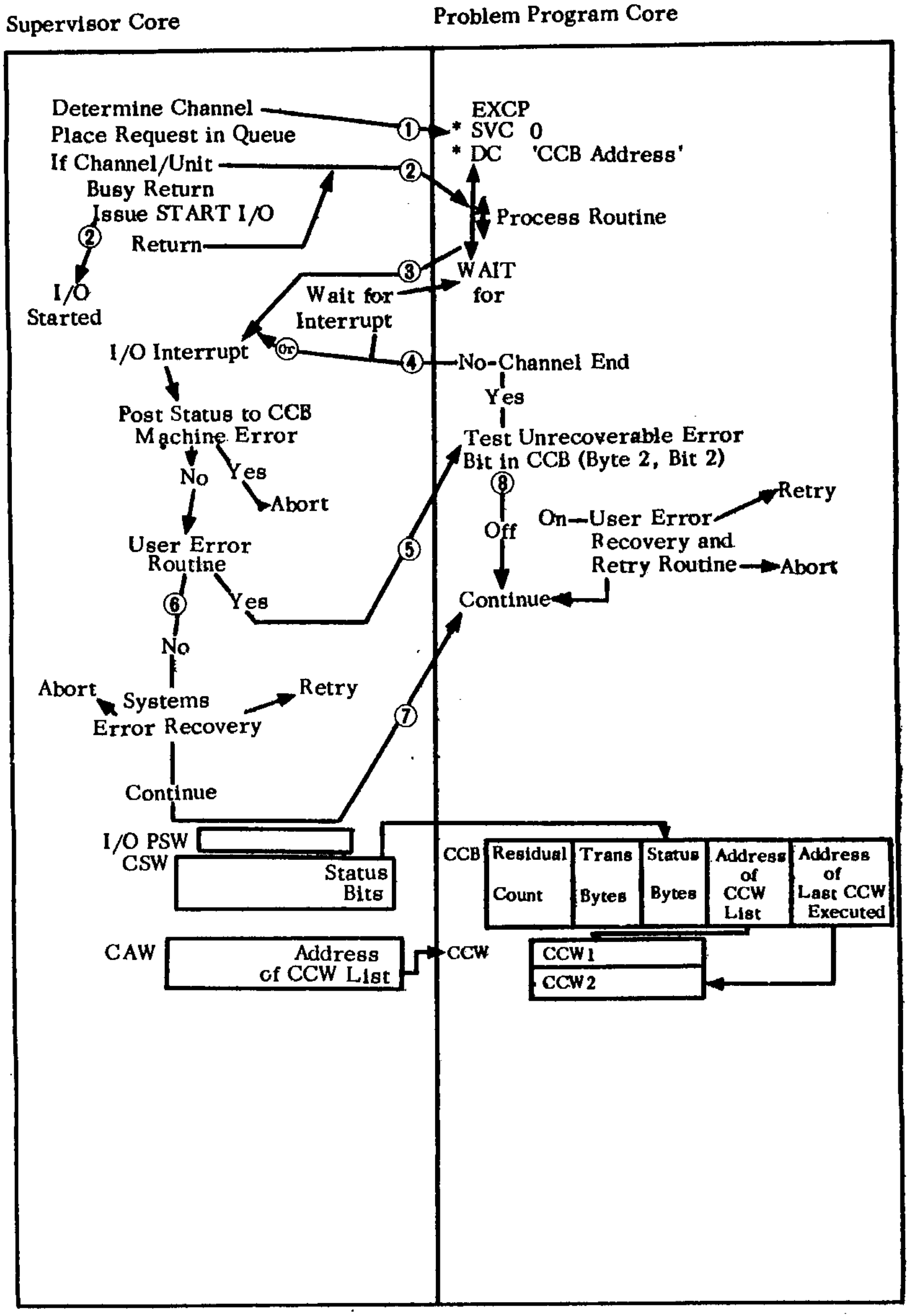
98 Address of the beginning of the error recovery block. The error recovery block contains addresses of error recovery exits, error recovery queue information that can be used by physical transient routines, and defines storage for the error queues entries.

100 → **104** As illustrated

106 Key of the program (BG, F2, or F1) that has timer support.

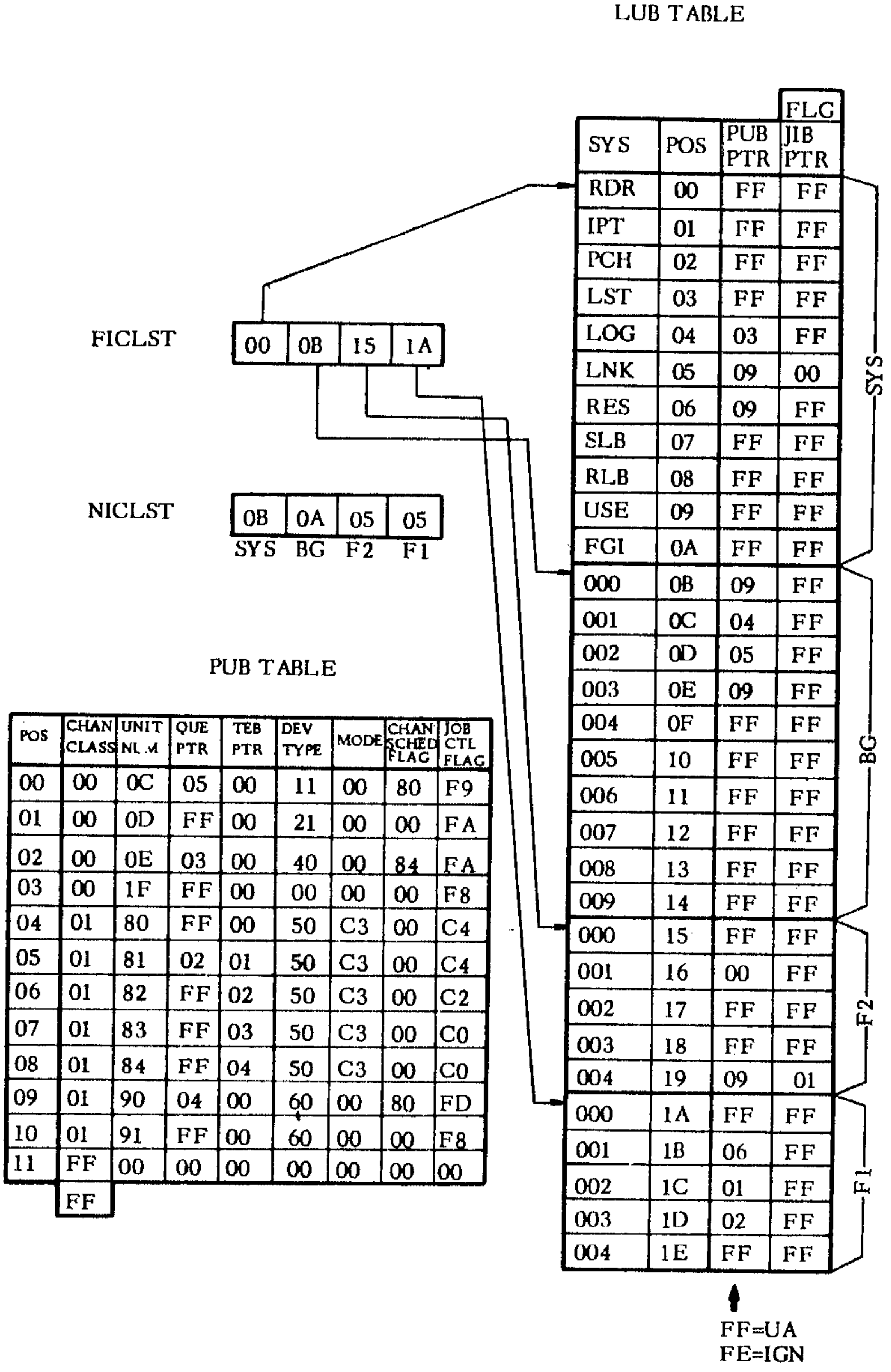
108 As illustrated

110 Logical transient Key (LTK) contains the same value as the PIK (displacement 46) when the logical transient is requested. When the transient area is not in use, LTK is equal to zero. The SVC 2 routine sets the LTK. The SVC 11 routine resets the LTK.



Record Retrieval Using Physical IOCS

PUB & LUB TABLE



LUB TABLE

SYS	POS	PUB PTR	FLG JIB PTR	
RDR	00	FF	FF	SYS
IPT	01	FF	FF	
PCH	02	FF	FF	
LST	03	FF	FF	
LOG	04	03	FF	
LNK	05	09	00	
RES	06	09	FF	
SLB	07	FF	FF	
RLB	08	FF	FF	
USE	09	FF	FF	
FGI	0A	FF	FF	
000	0B	09	FF	BG
001	0C	04	FF	
002	0D	05	FF	
003	0E	09	FF	
004	0F	FF	FF	
005	10	FF	FF	
006	11	FF	FF	
007	12	FF	FF	
008	13	FF	FF	
009	14	FF	FF	
000	15	FF	FF	F2
001	16	00	FF	
002	17	FF	FF	
003	18	FF	FF	
004	19	09	01	
000	1A	FF	FF	F1
001	1B	06	FF	
002	1C	01	FF	
003	1D	02	FF	
004	1E	FF	FF	

FF=UA
FE=IGN

FICLST

00	0B	15	1A

NICLST

0B	0A	05	05
SYS	BG	F2	F1

PUB TABLE

POS	CHAN CLASS	UNIT NUM	QUE PTR	TEB PTR	DEV TYPE	MODE	CHAN SCHED FLAG	JOB CTL FLAG
00	00	0C	05	00	11	00	80	F9
01	00	0D	FF	00	21	00	00	FA
02	00	0E	03	00	40	00	84	FA
03	00	1F	FF	00	00	00	00	F8
04	01	80	FF	00	50	C3	00	C4
05	01	81	02	01	50	C3	00	C4
06	01	82	FF	02	50	C3	00	C2
07	01	83	FF	03	50	C3	00	C0
08	01	84	FF	04	50	C3	00	C0
09	01	90	04	00	60	00	80	FD
10	01	91	FF	00	60	00	00	F8
11	FF	00	00	00	00	00	00	00
	FF							

CHAN. SCHED. FLAG

0	1	2	3	4	5	6	7
DEV BUSY	SWITCH ABLE	EOF SYSRDR OR IPT	I/O ERR QUEUED FOR RETRY	OPER INTV REQ	DEV END POST	BURST DEV ON MAX	7 TRK TAPE

JOB CTL FLAG

0	1	2	3	4	5	6	7
	MADE FOR TAPE				ASSGN TO BG	ASSGN TO F1	ASSGN TO F2

ALL ONE'S FOR NON-TAPE
ALL ZERO'S FOR DEV DOWN

ZERO IF DEV UNASSIGNED
OR SHARED

FLPTR

00

CHANQ

POS	CHAIN PTR	CCB ADDR		
00	FF	00	4B	58
01	FF	00	64	90
02	FF	00	21	1E
03	01	00	64	70
04	FF	00	4B	58
05	FF	00	49	98

LUBID REQID

CHQUE LUB PTR	CHQUE ID LIST	
19	F	F
1D	3	0
0D	1	0
1D	3	0
19	2	0
16	2	0

STOR KEY	USE: FF=UNUSED 60=SUPVR 61=SUP CCB FOR SYSLOG 62=FCH CCB

FAVP

02

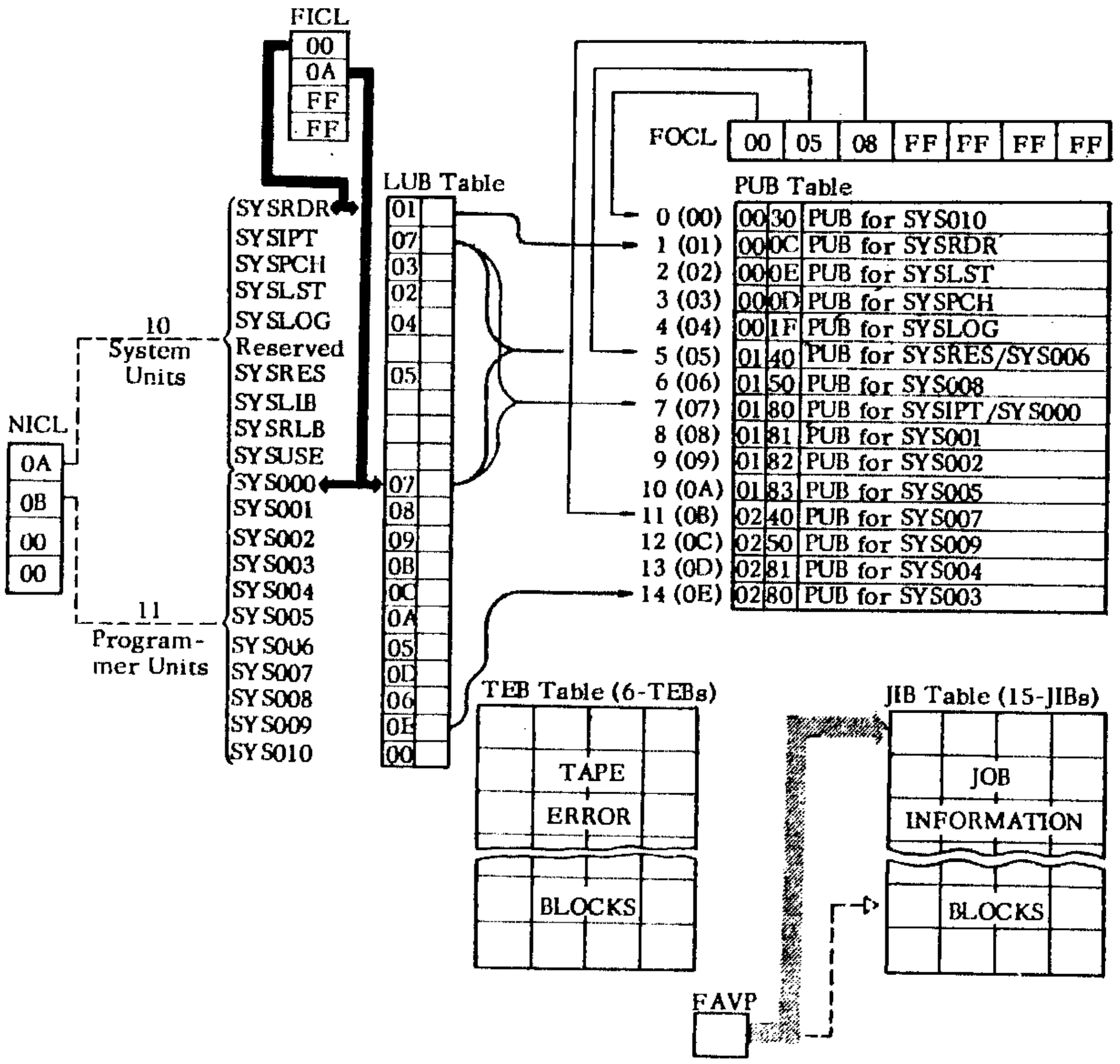
JIB TABLE

POS	STORED STD ALT ASSGN'S XTENT INFO		CON-TENT	OWNER	CHAIN PTR
00	BE	C6	2	8	FF
01	BE	C6	2	8	FF
02	00	00	0	0	03
03	00	00	0	0	04
04	00	00	0	0	05
05	00	00	0	0	06
06	00	00	0	0	FF

STORED STD	ALT ASSGN	2311 XTENT	2321 XTENT	SHARED ASSGN	BG	F1	F2
0	1	2	3	4	5	6	7

NOTE: TWO ENTRIES REQUIRED FOR 2321 JIB.

I/O TABLES GENERATED


FICL
00
0A
FF
FF
FOCL
00
05
08
FF
FF
FF
FF
LUB Table
PUB Table
SYSRDR
SYSIPT
SYSPCH
SYSLST
SYSLOG
Reserved
SYSRES
SYSLIB
SYSRLB
SYSUSE
SYS000
SYS001
SYS002
SYS003
SYS004
SYS005
SYS006
SYS007
SYS008
SYS009
SYS010
10
System Units
11
Programmer Units
NICL
0A
0B
00
00
01
07
03
02
04
05
07
08
09
0B
0C
0A
05
0D
06
0E
00
0 (00) 00 30 PUB for SYS010
1 (01) 00 0C PUB for SYSRDR
2 (02) 00 0E PUB for SYSLST
3 (03) 00 0D PUB for SYSPCH
4 (04) 00 1F PUB for SYSLOG
5 (05) 01 40 PUB for SYSRES/SYS006
6 (06) 01 50 PUB for SYS008
7 (07) 01 80 PUB for SYSIPT/SYS000
8 (08) 01 81 PUB for SYS001
9 (09) 01 82 PUB for SYS002
10 (0A) 01 83 PUB for SYS005
11 (0B) 02 40 PUB for SYS007
12 (0C) 02 50 PUB for SYS009
13 (0D) 02 81 PUB for SYS004
14 (0E) 02 80 PUB for SYS003
TEB Table (6-TEBs)
TAPE
ERROR
BLOCKS
JIB Table (15-JIBs)
JOB
INFORMATION
BLOCKS
FAVP

FICL (First in Class): First byte always points to position 0 of the LUB table (first system unit).
Second byte always points to the first programmer unit.

NICL (Number in Class): First byte contains the number of system units.
Second byte contains the number of programmer units.

LUB Table: The minimum LUB table has 15 entries; ten for system units plus five for programmer units SYS000-SYS004. Each assigned LUB points to a PUB in the PUB table with byte 1. Byte 2 is a LUB flag or JIB pointer.
See next page for LUB format.

PUB Table: There must be a PUB for each I/O device on the system. A PUB contains the physical characteristics of the I/O device it represents.
See Page 81 for PUB format.

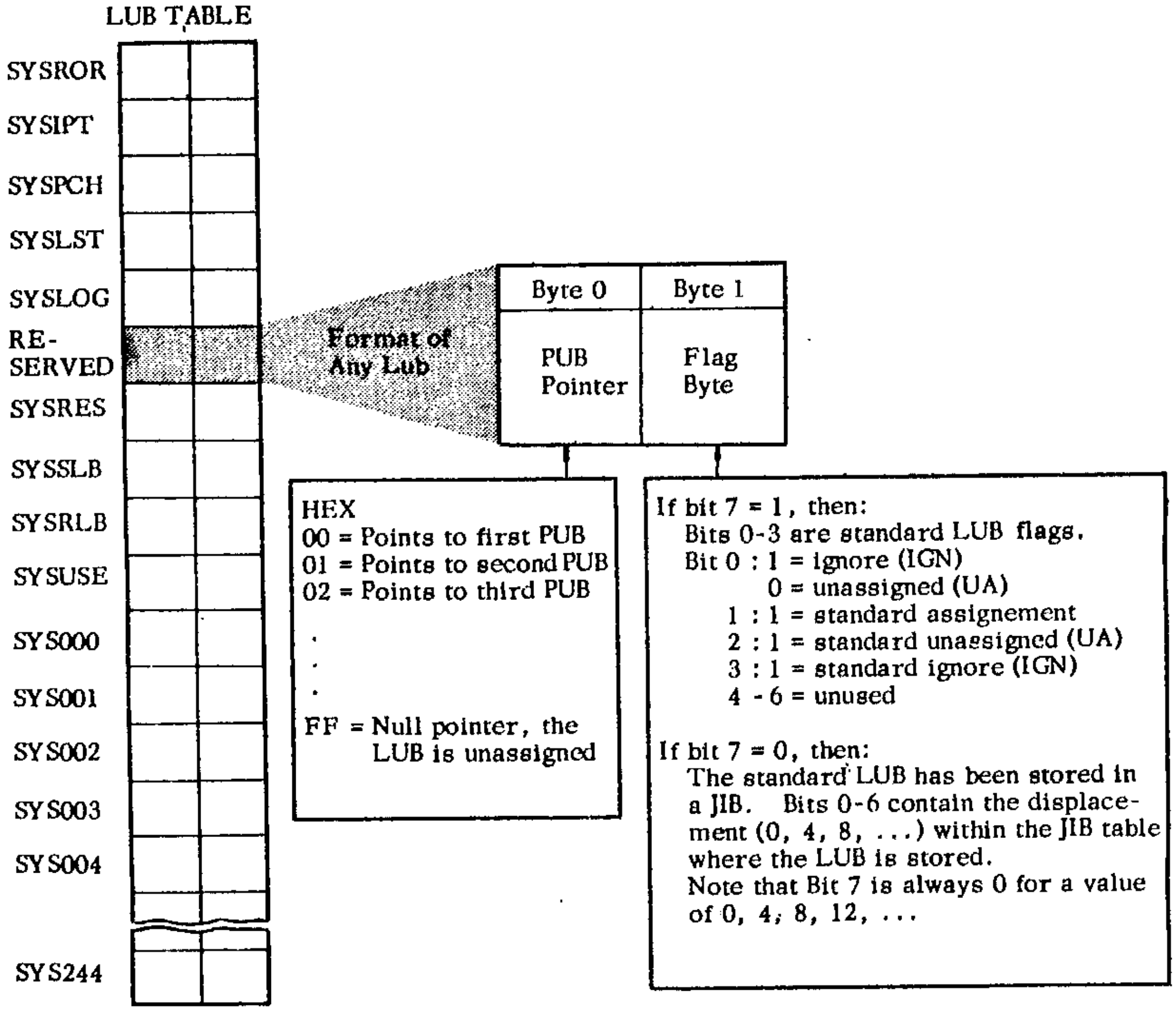
FOCL (First on Channel List): The FOCL is seven bytes long. Byte 0 points to the first PUB (highest priority) on channel zero. Byte 1 points to the first PUB (highest priority) on channel one, etc. Hexadecimal FF indicates the associated channel is not supported.

TEB (Tape Error Block): One TEB is generated for each tape unit at supervisor generation time if tape error statistics are required.
See Page 82 for TEB format.

JIB (Job Information Block): Each 4-byte JIB contains the temporary or alternate assignments for a LUB. The LUB points to the associated JIB.
See Page 82 for JIB format.

FAVP (First Available Pointer): The FAVP is a 1-byte pointer that points to the next available JIB (next JIB not in use).

LUB TABLE



HEX
00 = Points to first PUB
01 = Points to second PUB
02 = Points to third PUB
.
.
.
FF = Null pointer, the
LUB is unassigned

If bit 7 = 1, then:
Bits 0-3 are standard LUB flags.
Bit 0 : 1 = ignore (IGN)
0 = unassigned (UA)
1 : 1 = standard assignement
2 : 1 = standard unassigned (UA)
3 : 1 = standard ignore (IGN)
4 - 6 = unused

If bit 7 = 0, then:
The standard LUB has been stored in a JIB. Bits 0-6 contain the displacement (0, 4, 8, ...) within the JIB table where the LUB is stored.
Note that Bit 7 is always 0 for a value of 0, 4, 8, 12, ...

NOTE:

The number of entries in the LUB table is determined at supervisor generation time. The number of LUBS is equal to the number of system units plus the number of programmer units. The number of system units is always 10. The number of programmer units is specified in the IOTAB macro (PGR = n).

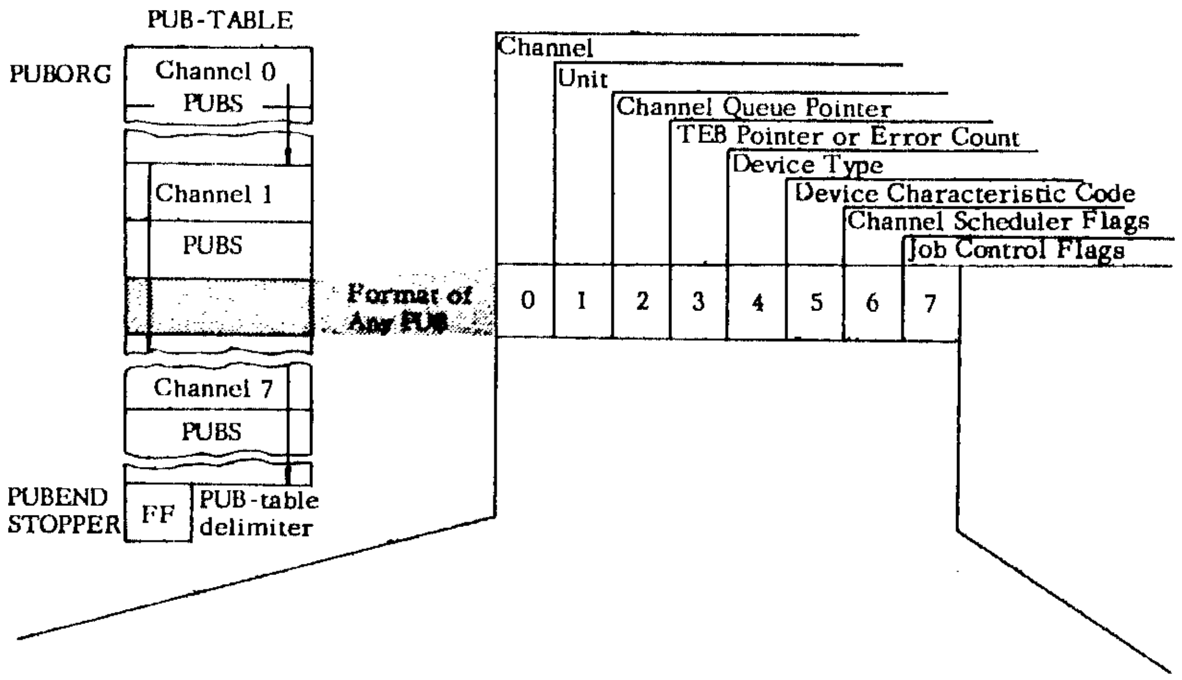
IF: LUBS = number of LUBS in the LUB table.

10 = number of system units (SYSRDR - SYSUSE).

n = number of programmer units (SYS000 - SYSXXX).

THEN: LUBS = 10 + n

PUB TABLE



BYTE 0 - Channel number. (Hex 0-7, FF = NULL)

BYTE 1 - I/O device unit number. (HEX IF = 1052, HEX 80 = magnetic, tape unit 0 ...).

BYTE 2 - HEX 0, 1, 2, ... points to the channel queue currently using this device.

BYTE 3 - If device is a magnetic tape unit and TEBS are specified, this byte is a TEB pointer (HEX 1, 2, 3 ...).
If device is a magnetic tape unit but TEBS are not specified, this byte is an error counter.
If device is not a magnetic tape unit, this byte is an error counter.

BYTE 4 - See Figure 17 for device type codes.

BYTE 5 - SS of the MODE = parameter in the DVCGEN macro for a tape unit.

BYTE 6 -

Bit 0 : 1 = Device busy
1 : 1 = Switchable device
2 : 1 = EOF for SYSRDR or SYSIPT
3 : 1 = Error recovery (I/O being reexecuted)
4 : 1 = DASD file protection required
5 : 1 = Device end received
6 : 1 = Burst device on MPX
7 : 1 = 7-track tape unit

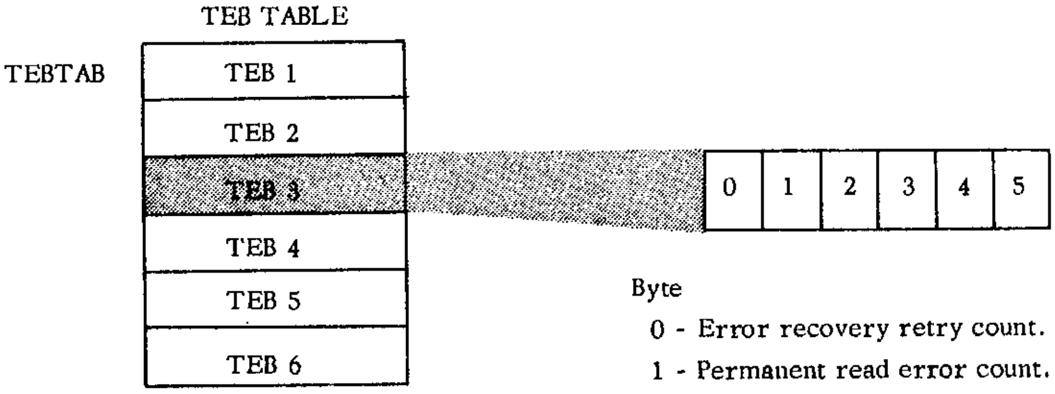
BYTE 7 -

Bit
0-4 : standard MODE assignment for 7-track tape (all ones if not tape, all zeros if device is down).
5 : device is assigned to a system unit (0 is UA).
6 : device is assigned to a programmer unit (0 if UA).
7 : unused (zeros if UA).

NOTE:

A null PUB is generated for each device to be supported by the supervisor. (See IOTAB macro in this section.)

Standard physical unit assignments are made to the PUB table at supervisor generation time. PUBS are ordered by channel and priority within a channel. (See DVCGEN macro in this section.)



One TEB is generated for each magnetic tape unit if the CONFG macro contains the TEB = yes parameter.

Job Control resets each TEB at normal or abnormal End-of-Job. A null or reset TEB contains HEX 'FF0000000000'.

A TEB is reference from byte 3 of a magnetic tape unit PUB.

Byte

0 - Error recovery retry count.

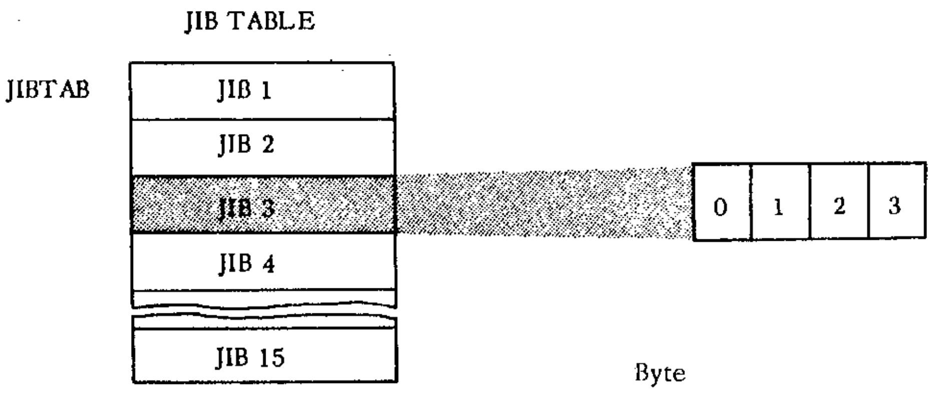
1 - Permanent read error count.

2 - Number of times the read error routine is entered.

3 - Number of times the write error routine is entered.

4 - Write skip (erase gap) count.

5 - Noise record count.



The number of JIBs generated is determined from the IOTAB macro JIB=n parameter.

JIB entries are referenced by LUBs to which temporary or alternate PUBs are assigned.

JIB chains are built by Job Control when on ASSGN statement is processed.

The byte FAVP contains a pointer to the next available JIB.

The number of JIBs must be sufficient to hold all alternate and temporary assignments that are needed in a single job-step.

Byte

0 - Contains a stored standard PUB pointer from a temporarily reassigned LUB. It can also contain an alternate PUB pointer.

1 - Contains HEX '00' or a stored standard LUB flag for a temporarily reassigned LUB.

2 - Present assignment LUB and JIB flags.

Bits 0 - 3 - Present assignment LUB flag

4 - Unused

5 - Stored standards JIB

6 - Alternate JIB

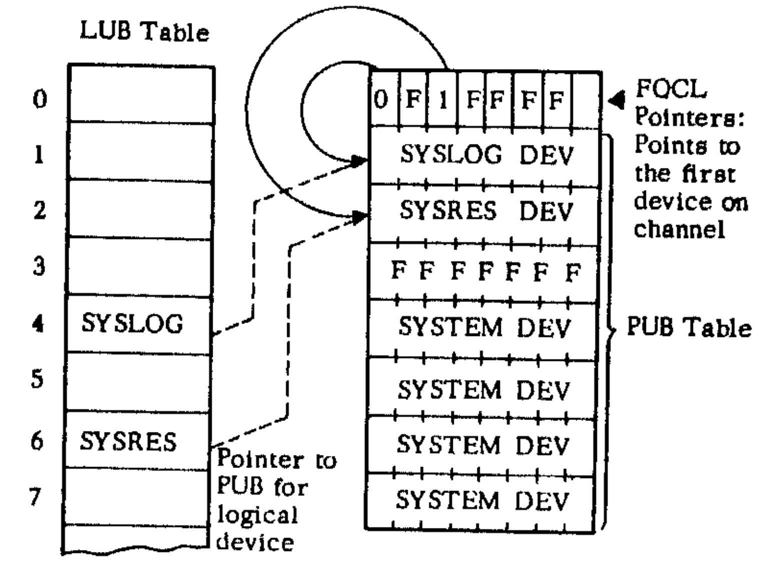
7 - Unused

3 - Chain field: Points to the next JIB in the chain. JIBs in a chain are not necessarily contiguous.

Bits 0 - 6 - Contain a HEX value of 0, 4, 8, ...

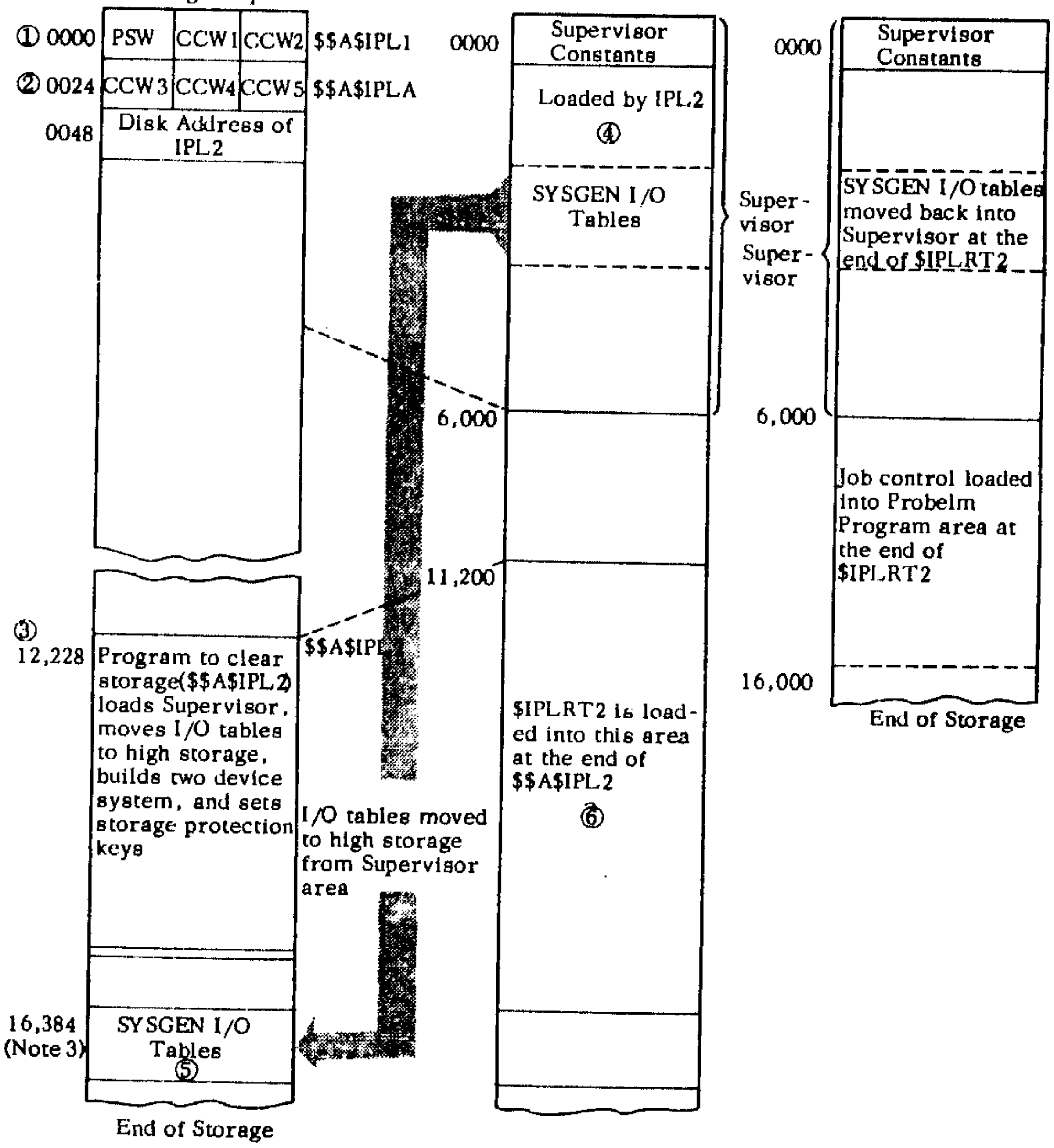
7 - When on indicates the end of the chain

I/O TABLE FOR TWO-DEVICE SYSTEM



NOTE: It is assumed that SYSRES is on channel 2 and that the communication device SYSLOG is on channel 0.

IPL Main Storage Map



① 0000
PSW
CCW1
CCW2
$$A$IPL1
② 0024
CCW3
CCW4
CCW5
$$A$IPLA
0048
Disk Address of IPL2
③ 12,228
Program to clear storage($$A$IPL2) loads Supervisor, moves I/O tables to high storage, builds two device system, and sets storage protection keys
$$A$IPL2
16,384 (Note 3)
SYSGEN I/O Tables ⑤
End of Storage
I/O tables moved to high storage from Supervisor area
0000
Supervisor Constants
Loaded by IPL2 ④
SYSGEN I/O Tables
6,000
11,200
$IPLRT2 is loaded into this area at the end of $$A$IPL2 ⑥
Super-visor
Super-visor
0000
Supervisor Constants
SYSGEN I/O tables moved back into Supervisor at the end of $IPLRT2
6,000
Job control loaded into Probelm Program area at the end of $IPLRT2
16,000
End of Storage

Note 1: Circled numbers represent sequence.

Note 2: Storage addresses are in decimal.

Note 3: The I/O tables will be at the end of the Supervisor in 16K machine. In larger machines, they will be at decimal 16,384.

Clear Storage - Manually (Model 40)

The following procedure for manually cleaning memory does not clear any of the general purpose or floating point registers:

1. Set "rate switch" to "process".
2. Press "system reset" key.
3. Set "rate switch" to "single cycle".
4. Set "diagnostic control" to "MS address".
5. Set bit 3 of byte 0 of the "address" bit switches in the down position.
6. Flip the "store status" switch. This calls in a micro-program that sets all of memory to zeros.
7. Insure that "Y3 Stat" is turned on.
8. Reset the "rate switch" back to "process".
9. Hit "start". Nothing should appear in bytes 0 and 1 of the "address" and "data" registers.
10. Restore "diagnostic CTL switch" to "off".

Address Compare (Address Stop) (Model 40)

To stop the CPU at a predetermined location:

1. Turn the "address compare" switch to "stop".
2. Set the bits in the "address" bit switches for the desired address.
3. Press the "start" key.

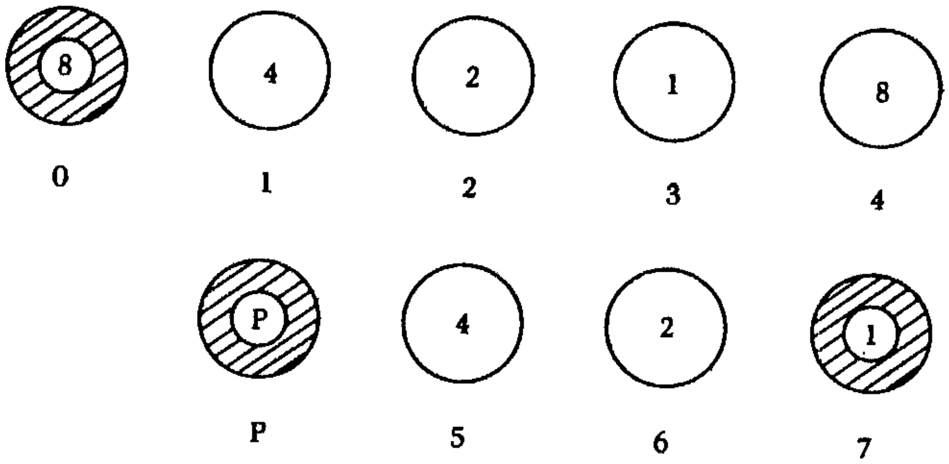
The system will resume processing until an equal address comparision is made. The CPU then switches itself to the "stopped" state.

1. To Write Tape Mark From TAU C. E. Console

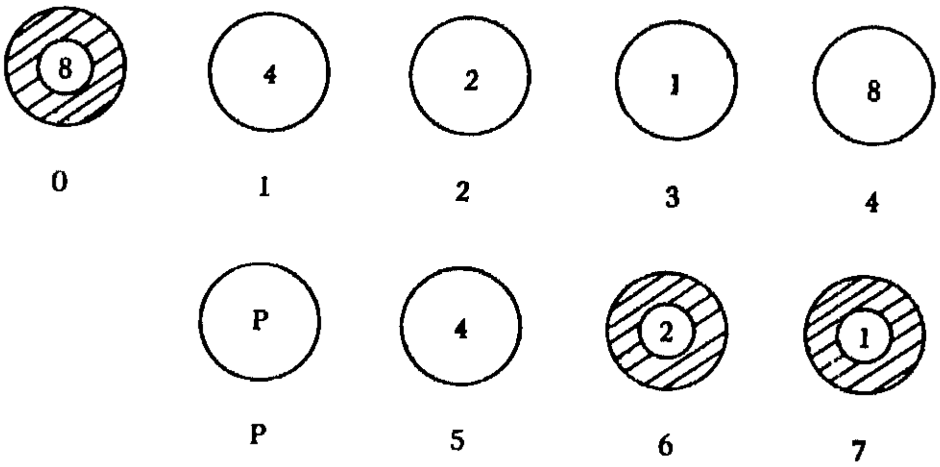
   a. Turn lower left corner switch to OFF-LINE.

   b. Address the tape drive by inserting pegs in the two rows under ADDRESS labeled 01234 and P567, with odd parity. The positions have the values 84218 and P421 respectively. The top set (0123), addresses the ten's position and the lower set (4567) the units' position of the drive address. The P is used for parity when required.

Example 1 Address for Drive '81'



Example 2 Address for Drive '83'



   c. Coding for TAPE MARK requires pegs in 34567 STOP of the first COMMAND row.

   d. Peg INTE either A or B in lower right corner.

   e. Set toggle switch on SINGLE and INTERFACE on AUTO.

   f. Press STOP on console to remove from SYSTEM state.

   g. Press MACHINE RESET, CHK RESET and START to write the tape mark.

   h. Restore by returning left corner switch to ON-LINE.

$$\underbrace{360\bigcirc}_{1} \quad — \quad \underbrace{\bigcirc\bigcirc}_{2} \quad — \quad \underbrace{\times\times\times}_{3}$$

System Number, Clasification Code, Sequence Number

1. System Number

360T	Model 20
360U	Model 20 Tape
360P	BPS
360B	BOS
360M	TOS
360N	DOS
360S	OS
360F	Model 44
360C	Emulater
360A	Type II (Last character of sequence Number is x)
360D	Type III (Format 2, 3 ... xx. x. xxx)

2. Programming System Type I

AS	Assembler
CB,CO	COBOL
CL	Control program
CQ	Communications Input/Output
CV	Conversion
DC	Documentor
DM	Data management
DN	Diagnostic
ED	Editor
EU	Emulator program
FO	Fortran
IO	Input/Output
LM	Library Material
LD	Loader
MI	Miscellaneous
OS	Operating system
PL	PL/I
PT	Autotest
RC	Remote computing
RG	RPG
SI	Simulator
SM	Sort/Merge
SV	Supervisor
UT	Utility

Programming Application Type II

Industry-Oriented Programs

DP	Publishing
DR	Retail
DW	Wholesale
DX	Other

Finance

FB	Banking
FF	Finances Companies
FI	Brokerage and Investment
FX	Other

Federal Government

GF	Government, Federial

Insurance

IB	Blue Cross and Shield
IF	Fire and Casualty
IL	Life
IX	Other

Manufacturing

MA	Aerospace
MD	Drug, Food, Chemical Products
ME	Electrical and Machinery
MF	Fabrication and Primary Metals
MP	Petroleum and Industrial Chemicals
MR	Transportation Equipment
MT	Textiles and Paper
MX	Other

Services

SC	Communication
ST	Transportation
SU	Utilities
SX	Other

Universities and Government

UC	Colleges and Universities
UG	Government, State and Local
UH	Hospital and Medical
US	Secondary Schools
UX	Other

Industry-Independent Programs

Cross Industry Group

CA	Statistical Applications
CC	Process Control
CM	Mathematical Applications
CN	Numerical Control Applications
CO	Operations Research
CP	Critical Path Scheduling
CR	Information Retrieval
CS	Simulators
CX	Other

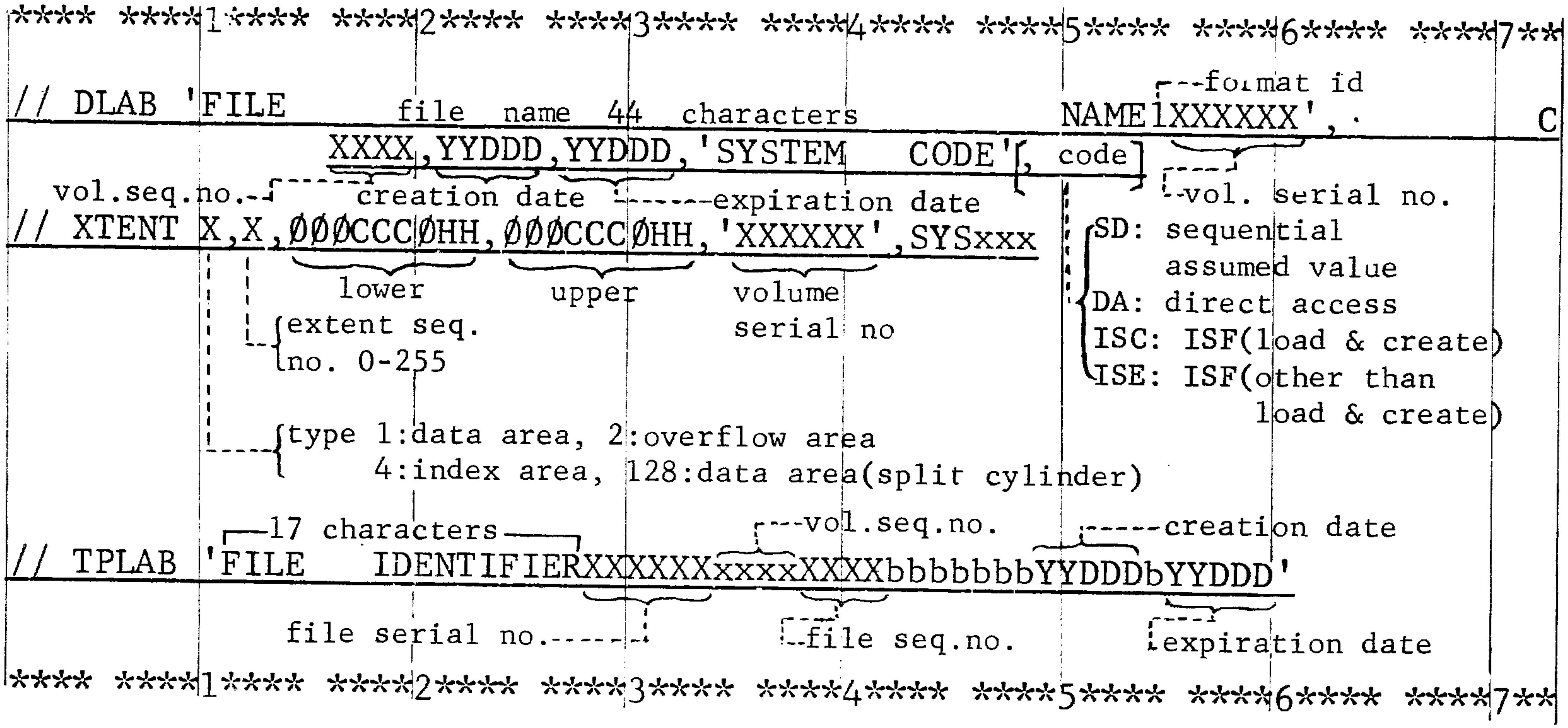
Engineering

EC	Civil Engineering
EE	Electrical Engineering
EH	Chemical Engineering
EM	Mechanical Engineering
EN	Nuclear Codes
EO	Optics
EX	Other

Exploratory

XP	Mathematics and Applications

TOS/360	Assembler	360M-AS-406
TOS/360	COBOL	360M-CB-402
TOS/360	System control	360M-CL-405
TOS/360	FORTRAN IV	360M-FO-409
TOS/360	IOCS	360M-IO-404
TOS/360	Autotest	360M-PT-407
TOS/360	RPG	360M-RG-408
TOS/360	SORT/Merge	360M-SM-400
TOS/360	Utility Programs	360M-UT-403
DOS/360	Assembler-Basic modules	360N-AS-465
DOS/360	COBOL	360N-CB-452
DOS/360	COBOL DASD macros	360N-CB-468
DOS/360	Sys. cont. &Basic IOCS	360N-CL-453
DOS/360	BTAM	360N-CQ-469
DOS/360	FORTRAN IV	360N-FO-451
DOS/360	Direct Access method	360N-IO-454
DOS/360	Consecutive Disk IOCS	360N-IO-455
DOS/360	Consecutive Tape IOCS	360N-IO-456
DOS/360	ISFMS	360N-IO-457
DOS/360	Consecutive P.T. IOCS	360N-IO-458
DOS/360	Compilar I/O modules	360N-IO-476
DOS/360	RPG	360N-RG-460
DOS/360	SORT/MERGE-Tape	360N-SM-400
DOS/360	SORT/MERGE-Disk/Tape	360N-SM-450
DOS/360	Supervisor 6K	360N-SU-474
DOS/360	Supervisor 8K	360N-SU-475
DOS/360	GROUP 1 utilities	360N-UT-461
DOS/360	GROUP 2 utilities	360N-UT-462
DOS/360	GROUP 3 utilities	360N-UT-463
DOS/360	MPS utility macros	360N-UT-471



```
**** ****1**** ****2**** ****3**** ****4**** ****5**** ****6**** ****7**
// DLAB 'FILE                                          NAME1XXXXXX', .    C
                XXXX,YYDDD,YYDDD,'SYSTEM   CODE'[, code]
// XTENT X,X,ØØØCCCØHH,ØØØCCCØHH,'XXXXXX',SYSxxx
// TPLAB 'FILE   IDENTIFIERXXXXXXxxxxXXXXbbbbbbYYDDDbYYDDD'
**** ****1**** ****2**** ****3**** ****4**** ****5**** ****6**** ****7**
```

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