IBM System/3
Models 4, 6, 8, 10, and 12
System Data Areas
and Diagnostic Aids

Program Numbers:
- 5702-SC1 (Models 8 and 10)
- 5703-SC1 (Models 4 and 6)
- 5705-SC1 (Model 12)

SY21-0045-3
File No. S3-36

Fourth Edition (March 1978)

This is a major revision of, and obsoletes, SY21-0045-2 and TNL SN21-5527. Changes to text and illustrations are indicated by a vertical line at the left of the change.

This edition applies to the System/3 program versions listed below and to all subsequent versions and modifications until otherwise indicated in new editions or technical newsletters:

SCP Program Number	System/3 Model	Version	Modification
5702-SC1	Models 8 and 10	14	00
5703-SC1	Models 4 and 6	14	00
5705-SC1	Model 12	04	00

Changes are made to this information periodically. Before using this publication to operate an IBM system, refer to the latest *IBM System/3 Bibliography,* GC20-8080, for the edition that is applicable and current.

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

Address your comments concerning the content of this manual to IBM Corporation, Publications, Department 245, Rochester, Minnesota 55901.

This handbook is designed to aid IBM personnel responsible for supporting the IBM System/3 Models 4, 6, 8, 10, and 12. It provides:

- An overview of system control programming.
- Descriptions of the data areas within the system.
- Descriptions of how to use the diagnostic aids available for diagnosing system malfunctions.

Terminology

Certain areas on the 3340 data module are treated as 5444 disks. These areas, called *simulation areas*, are used for the program libraries and can also be used for data files. The remainder of the disk space, called the *main data area*, can be used for data files only.

References in this handbook to the terms listed on the left of the chart should be interpreted according to the System/3 model being used.

	Meaning in Relation to		
Term	**Model 4**	**Models 6, 8, and 10**	**Model 12**
5444	5447 Disk Storage and Control	5444 Disk Storage Drive	5444 Simulation Area on 3340
5445	Not applicable	5445 Disk Storage (Model 10 only)	Main Data Area on 3340
5447	5447 Disk Storage and Control	Not applicable	Not applicable
5448	Not applicable	5448 Disk Storage Drive (Models 8 and 10 only)	Not applicable
Simulation Area	Not applicable	Not applicable	5444 Simulation Area on 3340
3340	Not applicable	Not applicable	Main Data Area on 3340
Main Data Area	Not applicable	Not applicable	Main Data Area on 3340

Related Publications

This handbook should be used with the following program logic manuals:

- *IBM System/3 Disk System Control Program Logic Manual,* SY21-0502.
- *IBM System/3 Model 12 System Control Program Logic Manual,* SY21-0046.
- *IBM System/3 Disk Systems Binary Synchronous Communications Programming Support Input/Output Control System Logic Manual,* SY21-0526.
- *IBM System/3 Disk System Data Management and Input/Output Supervisor Logic Manual,* SY21-0512.

Contents

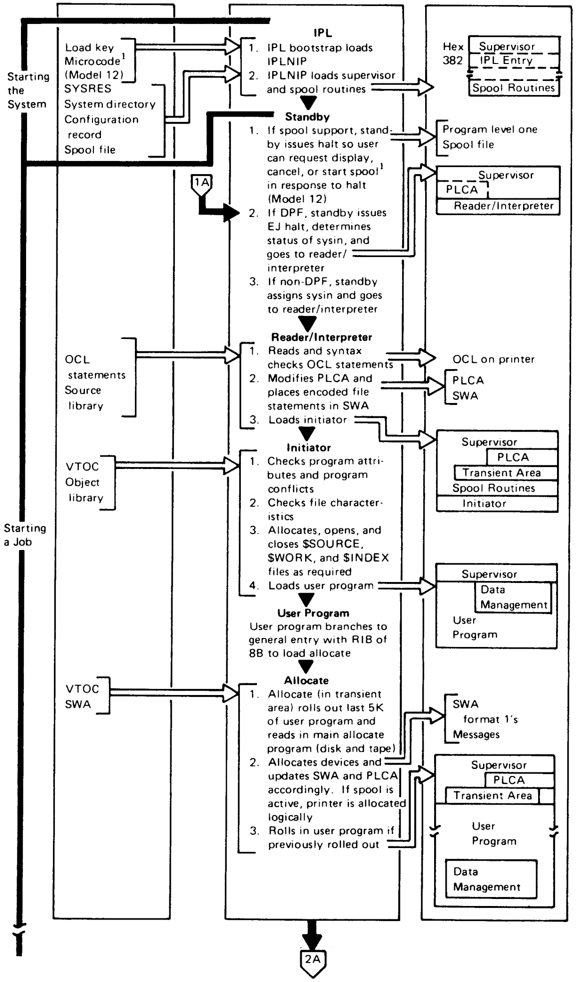
x

AAR	operand 2 address register
APL	advance program level
ARR	address recall register
BAM	basic access method
BAR	operand 1 address register
Bit	binary digit (smallest unit of information)
BSCA	binary synchronous communication adapter
Byte	eight bits of information plus parity bit
C/S/D	cylinder/sector/displacement
CONFIG	configuration record
CRR	condition recall register
DA	local display adapter
DCF	disk control field
DCP	diagnostic control program
DDDR	disk drive data register
DDCF	disk drive control field
DFCR	disk file control register
DFDR	disk file data register
DPF	dual program feature
DRR	data recall register
DTF	define the file
D1, D2	3340 drive 1, 3340 drive 2/5445 drive 1, 5445 drive 2
EOF	end of file
EOV	end of volume
EOX	end of extent
ERG	erase gap
IAR	instruction address register
IOB	input/output block
IOCB	input/output control block
IOCS	input/output control system
IOS	input/output supervisor
IPL	initial program load
LCR	length count register
LCRR	length count recall register
LPDAR	line printer data address register
LPIAR	line printer image address register
LSR	local store register
MLMP	multiline multipoint
MPCAR	MFCU punch data address register
MLTA	multiline terminal adapter
MPTAR	MFCU print data address register
MRDAR	MFCU read data address register
OBR	outboard recording
OCL	operator control language

PLCA	program level communication area (same as program level communication region)
PSR	program status register
PTF	program temporary fix
QFD	queue file description
RIB	request indicator byte
RLD	relocation dictionary
ROCA	reserved object communication area
SCA	system communication area (same as system communication region)
SDR	statistical data recording
SFD	spool file description
SWA	scheduler work area
VTOC	volume table of contents
XR1	index register 1
XR2	index register 2

Figure 1-1 shows an example of control flow between the major components from start of job to end of job. This control flow is for one particular program being executed in a program level and does not show dual programming.

CONTROL FLOW



[1]For more information, refer to the *IBM System/3 Model 12 System Control Program Logic Manual,* SY21-0046.

Figure 1-1 (Part 1 of 2). System Flow Overview Example

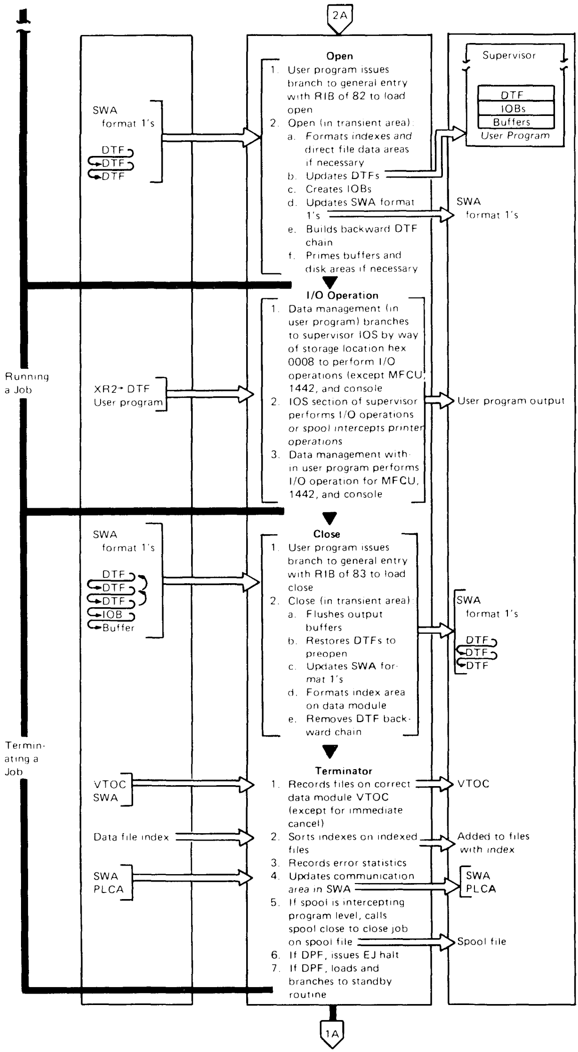


Figure 1-1 (Part 2 of 2). System Flow Overview Example

Figure 1-2 shows logic flow and the use of the index registers that results from a branch to general entry and a branch to IOS. Arrows that point in both directions indicate bidirectional flow.

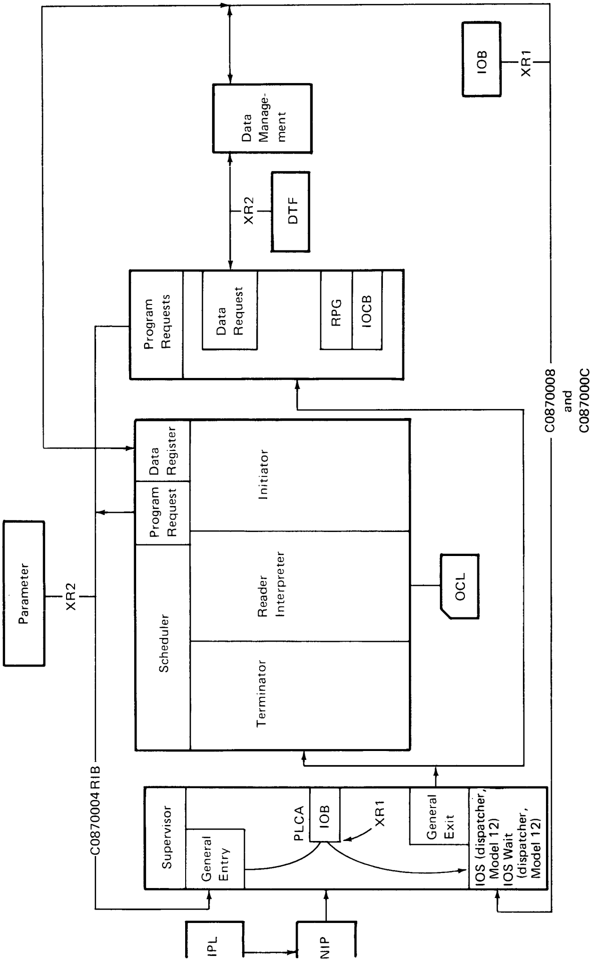
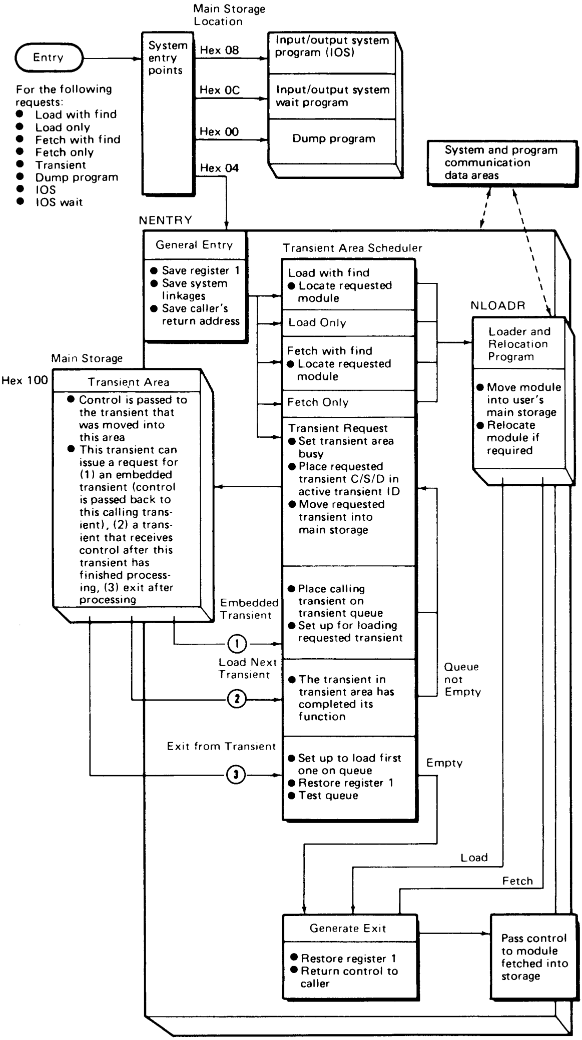


Figure 1-2. Logic Flow and Register Conventions

FUNCTIONAL FLOW OF SUPERVISOR



3340 Initial Program Load (Model 12 Only)

IPL loads the 3340 microprogram into the 3340 control storage and loads the system control programs into main storage.

Initial Microprogram Load (IMPL)

The programs used to load the 3340 microprogram (FA0) are:

- FA6, which contains microprogram to enable the 3340 to read and seek, and
- FA7, which is a System/3 machine language program that loads FA0 and IPLBOT.

FA6 and FA7 are five-record, 1280-byte sequential data sets. They are stored twice at locations cylinder 0, head 0, records 25-29 and 33-37. IPL selects the record that does not have any disk defects.

Initial Program Load (IPL)

After FA0 is loaded, IPLBOT (record 48) is read into main storage. IPLBOT loads IPLNIP and IPLNIP loads the supervisor.

Model 12 can perform IPL in two ways: a manual IPL with the IPL key (hard IPL) or with a 3340 SIO IPL instruction (soft IPL).

IPL Diagnostics

Figure 1-4 is designed to help you determine whether IPL problems are caused by the machine or by the program. It is divided into two interrelated main parts: the correct operation (left side) and the fault isolation (right side). The fault isolation flowchart can be used to diagnose problems. The operation portion can be used to determine the sequence of events that occurred before the failure.

5444 Initial Program Load (Models 4, 6, 8, and 10)

IPL on 5444 forces a read of cylinder 0, sector 0 of the selected disk.

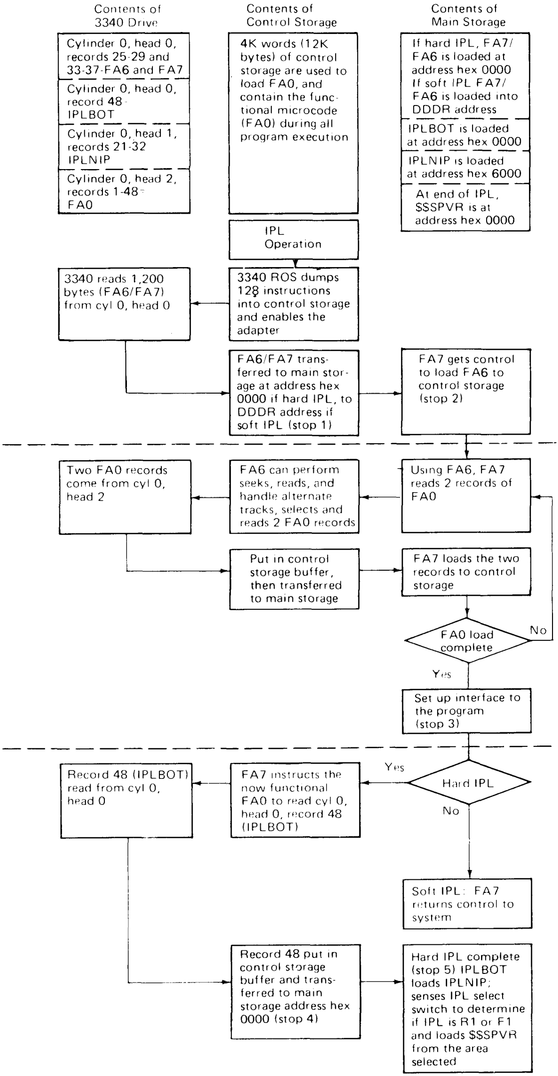


Figure 1-3 (Part 1 of 2). IPL Flowchart (Model 12 Only)

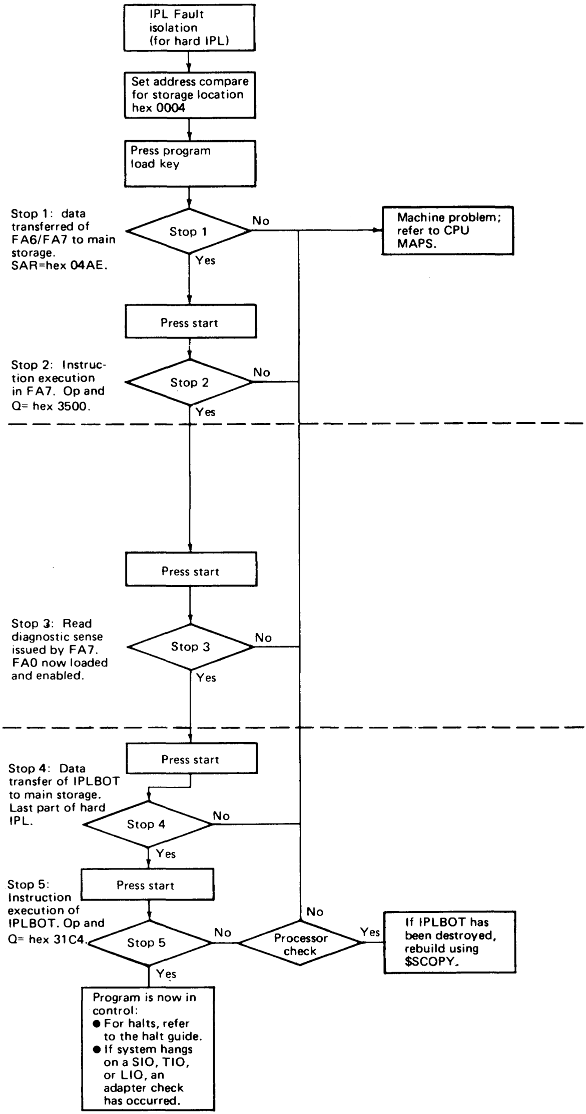


Figure 1-3 (Part 2 of 2). IPL Flowchart (Model 12 Only)

3340 DISK ORGANIZATION (Model 12 Only)

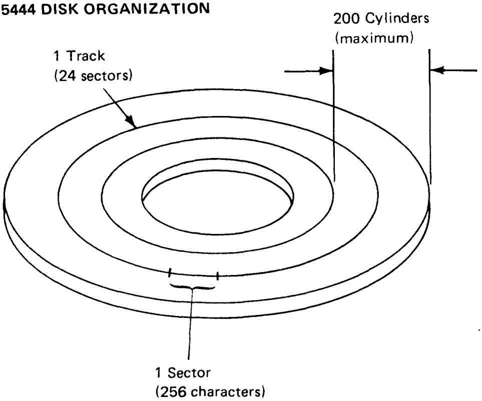
Characteristics	Simulation Area	Main Data Area
Bytes per record	256	256
Records per track	24	48
Bytes per track	6,144	12,288
Tracks per cylinder	2	20
Bytes per cylinder	12,288	245,760
Cylinders per area[1]	200	167
Bytes per area[1]	2,457,600	50,872,320
Tracks per area[1]	400	3,340
Records per area[1]	9,600	198,720
Maximum number of disk files per area[1]	50	1,000

[1] Excluding alternate tracks and CE tracks.

Each 3348 data module is divided into a main data area and four simulation areas. Following is a graphic representation of these areas of a 3340 subsystem:

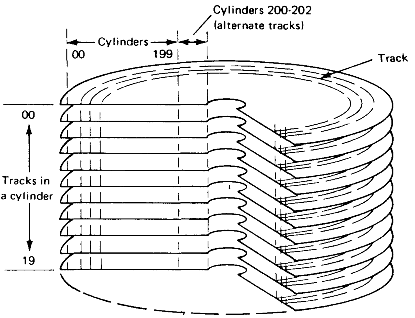
	Main Data Area	Simulation Backup Areas			
Drive 1	D1	F1	R1	D1C	D1D
Drive 2	D2	F2	R2	D2C	D2D

5444 DISK ORGANIZATION



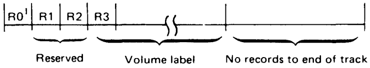
256	Bytes per sector
24	Sectors per track
6,144	Bytes per track
2	Tracks per cylinder
12,288	Bytes per cylinder
200	Cylinders per disk pack
2,457,600	Bytes per disk pack
400	Tracks per disk pack
9,600	Sectors per disk pack
50	Maximum number of disk files stored per disk pack

5445 DISK ORGANIZATION AND CYLINDER 0 CONTENTS

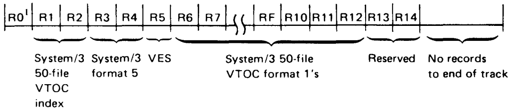


256 Bytes per sector
20 Sectors per track
5,120 Bytes per track
20 Tracks per cylinder
102,400 Bytes per cylinder
200 Cylinders per disk pack
20,480,000 Bytes per disk pack
4,000 Tracks per disk pack
80,000 Sectors per disk pack
50 Maximum number of disk files stored per disk pack

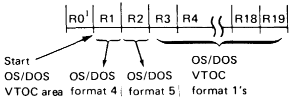
Head 0



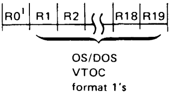
Head 1



Head 2



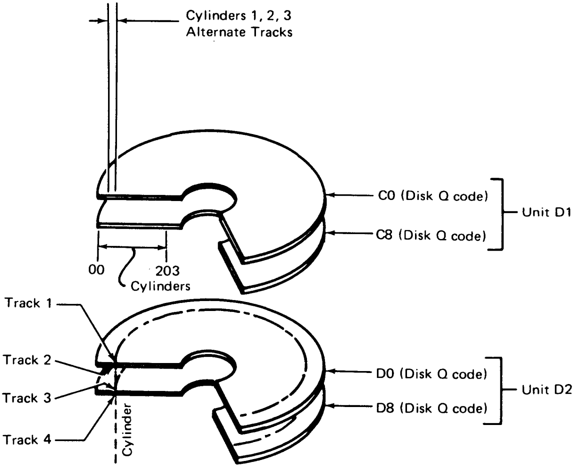
Heads 3 and 4



[1] Record 0 on all heads contains the physical address of the track, cylinder/head/record.

5448 DISK ORGANIZATION AND LAYOUT

Characteristics	Physical 5448	Logical 5445
Bytes per sector	256	256
Sectors per track	24	20
Bytes per track	6,144	5,120
Tracks per cylinder	4	20
Sectors per cylinder	96	400
Bytes per cylinder	24,576	102,400
Cylinders per unit	200	47-3/4
Maximum number of files per unit	50	50
Maximum number of tracks per unit	800	955



	Cylinder		Content
System Control Information	Cyl 0	Track 1	Cyl 0 5444 Format (sectors 00-5C)
		Track 2	Cyl 0 Head 0 5445 Format (20 sectors) | (4 sectors Reserved)
		Track 3	Cyl 0 5444 Format (sectors 00-5C)
		Track 4	Cyl 0 Head 1 5445 Format (20 sectors) | (4 sectors Reserved)
	Cyl 1-3 Alternate Tracks		
Data Area	Cyl 4	Track 1	Cyl 1 Head 0 (20 sectors) | Cyl 1 Head 1 (4 sectors)
		Track 2	Cyl 1 Head 1 (16 sectors) | Cyl 1 Head 2 (8 sectors)
		Track 3	Cyl 1 Head 2 (12 sectors) | Cyl 1 Head 3 (12 sectors)
		Track 4	Cyl 1 Head 3 (8 sectors) | Cyl 1 Head 4 (16 sectors)
	Cyl 5	Track 1	Cyl 1 Head 4 (4 sectors) | Cyl 1 Head 5 (20 sectors)
		Track 2	Cyl 1 Head 6 (20 sectors)
	Cyl 202	Track 1	Cyl 48 Head 10 | Cyl 48 Head 11 (12 sectors)
		Track 2	Cyl 48 Head 11 | Cyl 48 Head 12 (16 sectors)
		Track 3	Cyl 48 Head 12 (4 sectors) | Cyl 48 Head 13 (20 sectors)
		Track 4	Cyl 48 Head 14 (20 sectors) | (4 sectors Unmapped)
	Cyl 203		CE Tracks

Note: Six 5445 tracks are mapped on five 5448 tracks. Mapping is continuous through the data area.

Data Area Conversion Formulas (all values must be in decimal).

To convert from 5445 C/H/R to 5448 C/S:

$$\frac{400C + 20H + R - 17}{96} = \text{cylinder, remainder} = \text{sector}$$

If sector is greater than 48, subtract 48 to get sector number on lower disk.

To convert from 5448 C/S to 5445 C/H/R:

$$\frac{96C + S + 17}{400} = \text{cylinder,} \quad \frac{\text{remainder}}{20} = \text{head, remainder} = \text{record}^{1}$$

[1] Record 0 is invalid. If result is 0, subtract 1 from head and use record 20.

5448 DISK ORGANIZATION AND LAYOUT (Continued)

Sector No.	Top Surface (Track 0 or 2) Hardware Address	Bottom Surface (Track 1 or 3) Hardware Address
0	00	80
1	04	84
2	08	88
3	0C	8C
4	10	90
5	14	94
6	18	98
7	1C	9C
8	20	A0
9	24	A4
10	28	A8
11	2C	AC
12	30	B0
13	34	B4
14	38	B8
15	3C	BC
16	40	C0
17	44	C4
18	48	C8
19	4C	CC
20	50	D0
21	54	D4
22	58	D8
23	5C	DC

3340 SYSTEM RESIDENT SIMULATION AREA ORGANIZATION

Cylinder	Sector	Contents
0	00	Reserved
0	04	Configuration record
0	08	Volume label
0	0C-20	Error logging
0	24-28	VTOC index
0	2C-5C	VTOC format 1's
0	80-D8	Reserved
0	DC	PTF log sector
Variable	Variable	Source library directory
Variable	Variable	Source library
Variable	Variable	SWA program level 1
Variable	Variable	SWA program level 2 (if DPF)
Variable	Variable	SWA rollout program level
Variable	Variable	Maximum program level rollout area
Variable	Variable	Object library directory
Variable	Variable	Object library
Variable	Variable	Disk files

On the System/3 Model 12, system control programs must reside on the 3340 drive 1 data module in either the F1 or R1 simulation area. This format is logical; however, user program addressing is the same as program addressing on a 5444 disk pack.

To find the source library, SWA for program level 1, maximum program level rollout area, object library directory, and the object library, refer to the C/S pointer in the volume label.

There is also a C/S pointer in SYSCOM for the SWA and the object library.

3340 General Pack Layout

Cylinder	Contents
0	System data areas to support files, IPL, and CEFE dump.
1-166	Primary data area on the data module. Each track contains 48 records. Each record has key length of 0 and record length of 256 bytes. There are 20 tracks per cylinder. Available space, including cylinder 0, is 41,041,920 bytes.
167-168	Alternate tracks for the entire data module. Cylinder 0 head 0 is only track that cannot be assigned an alternate track.
169-208	Area for formatting four 5444 disk packs onto a data module as follows:

Cylinders	Area	Disk Drive	
		D1	D2
169–178	A	F1	F2
179–188	B	R1	R2
189–198	C	X	X
199–208	D	X	X

F1, R1, F2, and R2—simulation support areas only.
X (simulation backup) areas—accessed by $SCOPY only.

All tracks in these cylinders are written in compressed format. Also, alternate tracks can be assigned.

Cylinder	Contents
209 Head 0	Record of tape volume error statistics on the system data module (D1).
209 Head 1-2	Usage and error log information for 3340 drives D1 and D2. One track is allocated for each drive. D1 is only drive used to record this data.
209 Heads 5-7	CE tracks

Count Compressed Data Track Format

Even Home Address (HAE)	Record 0 Count (even) 9 Bytes	Record 0 Data (even) 8 Bytes	Record 1 Count 9 Bytes	Record 1 Data 256 Bytes	Record 2 Data 256 Bytes	Record 3 Data 256 Bytes	Record 4 Data 256 Bytes	Record 5 Count 9 Bytes	Record 5 Data 256 Bytes	Record 6 Data 256 Bytes		Record 23 Data 256 Bytes	Record 24 Data 256 Bytes	Odd Home Address (HAO)	Record 0 Count (odd) 9 Bytes	Record 0 Data (odd) 8 Bytes	Record 25 Count 9 Bytes	Record 25 Data 256 Bytes	Record 26 Data 256 Bytes	Record 27 Data 256 Bytes		Record 47 Data 256 Bytes	Record 48 Data 256 Bytes

Even Index

Odd Index

Except for cylinder 0, head 0 and cylinder 0, head 3, all 3340 tracks are written in compressed data format. The compressed data format is created by a write count compressed data command. Note that a count field is written for every four data fields. The two exception tracks on cylinder 0 are written in the standard data format in the following example.

Cylinder 0 Head 0 Track Format

Even Home Address (HAE)	Record 0 Count (even) 9 Bytes	Record 0 Data (even) 8 Bytes	Record 1 Count 9 Bytes	Record 1 Key 4 Bytes	Record 1 Data 24 Bytes	Record 2 Count 9 Bytes	Record 2 Key 4 Bytes	Record 2 Data 144 Bytes	Record 3 Count 9 Bytes	Record 3 Key 4 Bytes	Record 3 Data 80 Bytes	Gap to Odd Index		Odd Home Address HAO	Record 0 Count (odd) 9 Bytes	Record 0 Data (odd) 8 Bytes	Record 25 Count 9 Bytes	Record 25 Data 256 Bytes	Record 26 Data 256 Bytes	Record 27 Data 256 Bytes		Record 47 Data 256 Bytes	Record 48 Data 256 Bytes
			IPL 1			IPL 2			VOL 1														

Even Index

Odd Index

(The second half of this track is written in compressed data format.)

This track is formatted if the entire track is written in compressed data format, then the even half of the track is written in standard data format. The even half of the track contains two IPL System/370 standard data format records (R1 and R2) and the volume label (R3). The odd half of the track contains the System/3 records.

Cylinder 0 Head 3 Track Format

Even Home Address (HAE)	Record 0 Count 9 Bytes	Record 0 Data 8 Bytes	Record 1 Count 9 Bytes	Record 1 Key 44 Bytes	Record 1 Data 96 Bytes	Record 2 Count 9 Bytes	Record 2 Key 44 Bytes	Record 2 Data 96 Bytes		Record Count 9 Bytes	Record Key 44 Bytes	Record Data 96 Bytes	Odd Home Address (HAO)	Record 0 Count 9 Bytes	Record 0 Data 8 Bytes	Gap to End of Track	

Even Index

Odd Index

This track is formatted by a write count key data command on the even half of the track and a write R0 odd command to format the odd half of the track. The even half of the track contains the System/370 VTOC.

3340 Cylinder 0 Format (Model 12 Only)

Head 0

EC Level of IMPL Code

IPL System/370[1]	IPL System/370[1]	Volume Label	*Note:* Records 4-24 are not written. This meets the direct access storage device (DASD) label standard requirements.	System/3 IMPL code	Reserved	System/3 IMPL code	Reserved		IPL Bootstrap
R1	R2	R3	R24	R25 R29	R30 R32	R33 R37	R38	R47	R48

Head 1

Reserved	IPLNIP	Dump to Disk $$SPDA	TA Dump Program $$SPD1	DTF Dump Program $$SPDF	Dump to Disk $$SPDB	CEFE Program
R1 R20	R21 R28	R29	R33	R37	R41	R45 R48

Head 2

3340 Functional Microcode
R1 R48

Head 3

System/370 VTOC—written 44-byte key length, 96-byte data length, with one entry allocating the entire data module as a nonexpiring data file.	Remaining track area is not formatted.
R1 R22	R23 R48

Head 4

Reserved
R1 R48

Head 5

System/3 1000-file VTOC	Reserved	Adapter Check Recovery	TA Save Area
R1 R21	R22 R39	R40 R44	R45 R48

Heads 6-19

System/3 1000-File VTOC	Reserved
R1 R20	R21 R48

[1] These areas are written in count-key data format (standard data format) readable to System/3 and System/370. Other areas are written in compressed data format.

5444/5447 SYSTEM RESIDENT PACK ORGANIZATION

Cylinder	Sector	Contents
0	00	IPLBOT (IPL bootstrap)
0	04	Configuration record
0	08	Volume label—system directory
0	0C-20	OBR/SDR logging area
0	24-28	VTOC directory
0	2C-5C	VTOC format 1's and 7s
0	80-AC	Reserved
0	B0-B8	Rollout area for CDUMPD
0	BC-D8	IPLNIP (IPL nucleus initialization program)
0	DC	PTF logging area
1-3		Alternate tracks
Variable	Variable	Basic system work area, basic system program file (coresident only)
Variable	Variable	Source library
Variable	Variable	Scheduler work area(s)
Variable	Variable	Maximum program level rollout area
Variable	Variable	Object library directory
Variable	Variable	Object library
Variable	Variable	User file area
CB	00-DC	CE use

To find the source library, SWA, maximum program level rollout area, object library directory, and the object library, refer to the C/S pointer in the volume label. There is also a C/S pointer in SYSCOM for the SWA and the object library.

5444/5447 Volume Label

This is a 1-sector (256-byte) area located in the third sector of cylinder 0 on any 5444. The system directory (hex 0B-51) reflects the status and locations of the source and object libraries.

Disp Hex	Label	Lng Dec	Description
00-02	VLID	3	Label identifier (VOL)
03-08	VLNAME	6	Volume identifier, 1-6 characters
09-0A	VLVTO	2	Volume table of contents (VTOC) pointer (C/S)
0B-0C	VLDPN	2	Source directory pointer (C/S); hex FF00 indicates no library exists
0D-0E	VLNAS	2	Next available source library sector (C/S)
0F-10	VLEOL	2	End of source library (C/S)
11-12	VLDRS	2	Number of directory sectors in source library
13-14	VLPLS	2	Number of permanent source library sectors

Disp Hex	Label	Lng Dec	Description
15-16	VLACT	2	Number of active source library sectors
17-18	VLAVL	2	Number of available source library sectors
19-24	VLRES1	12	Reserved
25-26	VLDRP	2	Object library directory pointer (C/S); hex FF00 indicates no library exists
27-28	VLEOD	2	End of object directory (C/S)
29-2A	VLSOL	2	Start of object library (C/S)
2B-2C	VLAEL	2	Allocated end of object library (C/S)
2D-2E	VLEEL	2	Extended end of object library (C/S)
2F-30	VLAPE	2	Number of available directory entries in object library directory
31-32	VLATE	2	Number of available temporary directory entries
33-35	VLFTD	3	First temporary directory entry in object library directory (C/S/D)
36-38	VLNAT	3	Next available temporary directory entry in object library directory (C/S/D)
39-3A	VLNAL	2	Next available object library sector for permanent entries (C/S)
3B-3C	VLALT	2	Next available object library sector for temporary entries (C/S)
3D-3E	VLASP	2	Number of available object library sectors for permanent entries
3F-40	VLAST	2	Number of available object library sectors for temporary entries
41-42	VLALS	2	Number of active object library sectors
43-44	VLAOP	2	Number of active O-type permanent sectors
45-46	VLARP	2	Number of active R-type permanent sectors
47	VLVSYS	1	Valid system indicator; hex 80 indicates commercial system
48-49	VLARR	2	Rollout/rollin area pointer (C/S)
4A	VLSRR	1	Rollout/rollin area size

5444/5447 Volume Label (Continued)

Disp Hex	Label	Lng Dec	Description
4B-4C	VLASW	2	Scheduler work area pointer (C/S)
4D	VLSSW	1	Scheduler work area size
4E-4F	VLBOL	2	Start of libraries (C/S)
50-51	VLEND	2	End of libraries (C/S)
52-5B	VLOWNR	10	Owner identification
5C-69	VLDVC	14	Device constants
6A-75	VLALTA	12	Alternate track assignments
76-A8	VLF5	51	Available tracks, format 5: A 51-byte switch, with each bit representing an available track. If a bit is on, the track is being used and is not available. Byte 51, bit 7 (the rightmost bit in the switch) represents cylinder 0, track 0. Each bit from right to left represents the next higher track
A9-B3	VLCPK	11	Copypack save area
B4	VLIND	1	Library maintenance indicator
B5-B8		4	Reserved
B9-BA	VLCR	2	Checkpoint/restart
BB-CD		19	Reserved
CE-D7	VLSSFI	10	Scientific system file indicator
D8-FF	VLSDTI	24	Suspected defective track indicators
F0-FF	VLSSI	16	Scientific system indicators

5445 PACK ORGANIZATION

Cylinder	Head	Record	Contents
0	0	1-2	Reserved
0	0	3	Volume label
0	1	1-2	VTOC directory
0	1	3-4	Format 5
0	1	5	Volume error statistics
0	1	6-14	VTOC (format 1's and 7's)
0	2	1	OS/DOS format 4
0	2	2	OS/DOS format 5
0	2	3	OS/DOS format 1's
0	4	14	OS/DOS format 1's
0	5	0	Reserved
0	13	14	Reserved
1-C7			User file area
C8-CA			Alternate tracks
1			Alternate tracks
3			Alternate tracks User file area

5445/5448 Volume Label

Each pack has a volume label located in cylinder 0, head 0, record 3. This record has a key length of 4 (always contains VOL1) and a data length of 80.

Disp Hex	Label	Lng Dec	Description
00-03	V5KEY	4	Volume key (VOL1)
04-07	V5ID	4	Volume identifier (VOL1)
08-0D	V5NAME	6	Volume name
0E	V5SEC	1	Volume security indicator
0F-13	V5VTPT	5	VTOC pointer (OS/DOS VTOC) (CC/HH/R
14-2C	V5RES1	25	Reserved
2D-36	V5OWNR	10	Owner identification
37-53	V5RES2	29	Reserved

Note: On 5448, the 5445 volume label fields are all contained in the 256-byte data sector at cylinder 00, sector 88 of D1 upper disk and D2 upper disk.

VOLUME TABLE OF CONTENTS INDEX (5444/5447/SIMULATION AREA)

A VTOC resides on every disk at location cylinder 0, sector address hex 24-5C. This VTOC is comprised of file labels and an index. The index contains an entry for each file label, and points to the VTOC format 1's that describe the associated file on the disk.

Note: The file and volume label display program ($LABEL) can be used to print the VTOC, and can be useful (along with $BUILD) if it is necessary to reconstruct a VTOC entry. For more information on $LABEL and $BUILD, refer to the appropriate SRL and PLM for your system.

Note: The first byte of the file label is set to one of the following:

Hex Value	*Meaning*
00	Format 1 entry is not used. (No filename is present within the tag.)[1]
20	Format 1 entry is used. The filename is contained within a name list chain or the system scratch list (S list). (No filename is present within the tag.)[1]
40 or greater	Format 1 entry is used. The actual filename is contained within the tag.

[1] When a filename is not present, bytes 2-8 of the file label are zeros.

6 Bytes — 10 Bytes — Sector Displacement

C/S							
0024	Reserved	File Label 5C 7F	File Label 5C 3F	File Label			
	58 FF	File Label 58 BF	File Label 58 7F	File Label			
	58 3F	File Label 54 FF	File Label 54 BF	File Label 54 7F			
	File Label 54 3F	File Label 50 FF	File Label 50 BF				
	File Label 50 7F	File Label 50 3F	File Label 4C FF	File			
	Label 4C BF	File Label 4C 7F	File Label 4C 3F	File Label			
	48 FF	File Label 48 BF	File Label 48 7F	File Label			
	48 3F	File Label 44 FF	File Label 44 BF	File Label 44 7F			
0028	File Label 44 3F	File Label 40 FF	File Label 40 BF				
	File Label 40 7F	File Label 40 3F	File Label 3C FF	File			
	Label 3C BF	File Label 3C 7F	File Label 3C 3F	File Label			
	38 FF	File Label 38 BF	File Label 38 7F	File Label			
	38 3F	File Label 34 FF	File Label 34 BF	File Label 34 7F			
	File Label 34 3F	File Label 30 FF	File Label 30 BF				
	File Label 30 7F	File Label 30 3F	File Label 2C FF	File			
	Label 2C BF	File Label 2C 7F	File Label 2C 3F				

Note: Only P and T formats are considered not free (1 byte).

S/D address of the first member on the S list (2 bytes) (Models 4, 6, 8, and 10)

Number of Format 1's on the S list (1 byte) (Models 4, 6, 8, and 10)

S/D address of the last member on the S list (2 bytes) (Models 4, 6, 8, and 10)

Number of free tags in the VTOC index

VTOC FILE LABEL FORMAT 1 (5444/5447)

Disp Hex	Label	Lng Dec	Description
00	F1TAG	1	Tag ID of index pointer
01-02	F1CHAN	2	Chain address
03-0A	F1 LABL	8	File label
0B-10	F1DATE	6	Date of file
11	F1RTIN	1	Retain indicator for file
12-13	F1TYPE	2	Data management file types

The following information is in SWA and VTOC:

Status when file was created:

Hex Value	*Meaning*
0080	Indexed
0040	Sequential
0020	Update
0010	MVF
0008	Last pack for MVF
0004	Sequential add
0002	Random add
0001	Unordered add

Disp Hex	Label	Lng Dec	Description
14-15	F1RECL	2	Record length
16	F1KEYL	1	Key length
17-18	F1KEYO	2	Key location
19-1B	F1LSTR	3	Address of last record (C/S/D)
1C-1E	F1LSTK	3	Address of last key (C/S/D)

VTOC FILE LABEL FORMAT 1 (5444/5447) (Continued)

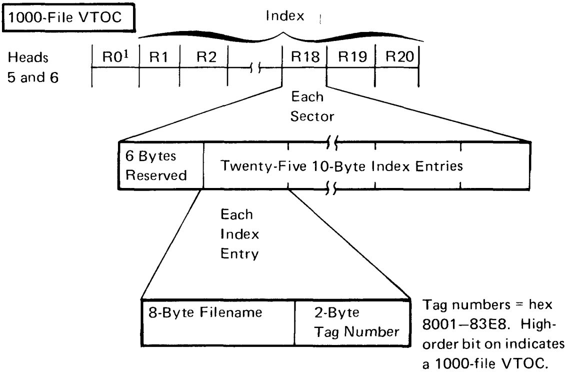
Disp Hex	Label	Lng Dec	Description
1F-20	F1STDA	2	Address of start of data (C/S)
21-22	F1ENDA	2	Address of end of data (C/S)
23-24	F1STIX	2	Address of start of index (C/S)
25-26	F1ENIX	2	Address of end of index (C/S)
27-29	F1RECN	3	Number of records at creation[1]
(27-29)	F1TRKN	3	Number of tracks at creation[1]
2A	F1SEQN	1	Volume sequence number

The following information is in VTOC only:

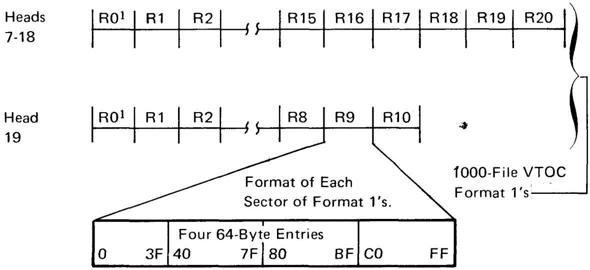
Disp Hex	Label	Lng Dec	Description
2B-2C	F1BACK	2	Backward VTOC chain pointer
2D-3F		19	Reserved

[1] If the high-order bit is on, the number specified is the number of tracks; otherwise, the number specified is the number of records.

3340 VTOC INDEX



Index entries are in ascending order by tag number starting in cylinder 0, head 5, record 1 through cylinder 0, head 6, record 20. The associated format 1's are also in ascending order by tag number starting in cylinder 0, head 7, record 1 through cylinder 0, head 19, record 10.



The number of available format 1's is kept at cylinder 0, head 1, record 1, displacement 4 and 5 (2 bytes).

Format 7s are kept on cylinder 0, head 1, record 18, displacement hex 80. No more than two format 7s are allowed per disk, each 64 bytes long.

[1] Hex 40 in the first byte of an index sector indicates that there are index entries in the sector. Hex 80 in the first byte of an index sector indicates that there are no index entries in that sector or in any of the following index sectors.

3340/5445/5448 VTOC FILE LABEL FORMAT 1

Disp Hex	Label	Lng Dec	Description
00-01	FXSTAG	2	Relative record number of VTOC entry (3340 only)
(00)	FXTAG	1	Tag ID of index pointer (5445/5448 only)
(01)	FXSCTG	1	Split chain tag (5445/5448 only; but reserved on 5448)
(02)	FXSPCL	1	Number of tracks in cylinder (5445/5448 only): *Hex Value* — *Meaning* 01-13 — Split cylinder file (5445 only) 14 — Nonsplit cylinder file
(02)		1	Reserved (3340 only)
03-0A	FXLABL	8	File label
0B-10	FXDATE	6	Date of file
11	FXRTIN	1	Retain indicator for file
12-13	FXTYPE	2	Data management file type Status when file created (right byte): *Hex Value* — *Meaning* 80 — Indexed 40 — Sequential 20 — Direct 10 — MVF Status when file closed: *Hex Value* — *Meaning* 08 — Last pack for MVF 04 — Sequential add 02 — Random add 01 — Unordered add

3340/5445/5448 VTOC FILE LABEL FORMAT 1 (Continued)

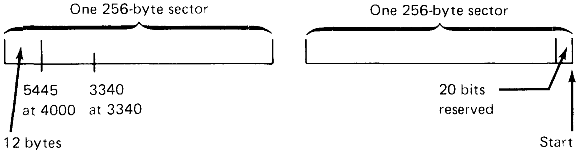
Disp Hex	Label	Lng Dec	Description
14-15	FXRECL	2	Record length
16	FXKEYL	1	Key length
17-18	FXKEYO	2	Key location
19-1C	FXLSTR	4	Address of last record (C/H/R/D)
1D-20	FXLSTK	4	Address of last key (C/H/R/D)
21-22	FXENDA	2	End of allocated space (C/H)
23-24	FXSTIX	2	Start of allocated space (C/H)
25-26	FXSTDA	2	Start of data (C/H)
27-29	FXRECN	3	Number of records at creation[1]
(27-29)	FXTRKN	3	Number of tracks at creation[1]
2A	FXSEQN	1	Volume sequence number for MVF
2B-2C		2	Reserved (zeros)
2D-2E		2	Forward chain pointer
2F-3F		17	Reserved

[1] If the high-order bit is on, the number specified is the number of tracks; otherwise, the number specified is the number of records.

5445 and 3340 Format 5

Location Cylinder 0, Head 1, Records 3 and 4

The format 5 indicates track usage. Each track has a bit that indicates whether it is being used (bit is on) or not.



Device	Tracks	Usable[1] Tracks
5445	4000	3980
3340	3340	3320

[1] The first 20 bits of right sector are reserved.

5444 and 5447 Format 5

5444/5447 format 5 is a 51-byte area in the volume label that indicates available tracks. Refer to index entry *volume label* for more information.

Format 7

3340/5445/5448 Location Cylinder 0, Head 1, Last Half of Record 12

5444/5447 Location Cylinder 0, Last Half of Sector Hex 5C

Disp Hex	Label	Lng Dec	Description
00	F7TAG	1	Format 7 tag number
01-02	F7CHAN	2	Chain pointer to format 1 3340 = Relative record number 5445/5448 = Record/displacement 5444/5447 = Sector/displacement
03	F7KEYL	1	Format 7 key length minus 1
04	F7INDX	1	SWA format 1 index number
05	F7SEQN	1	SWA format 1 sequence number
06-22	F7LOKE	29	Low key
23-3F	F7HIKE	29	High key

OS/DOS Format 4 Label Contents after System/3 Initialization

Disp Hex	Label	Lng Dec	Description
00-2B	–	44	Key field—each byte contains hex 04
2C	–	1	Format identifier—contains hex F4
2D-31	–	5	Last format 1: *Hex Value* — *Meaning* 000000000603 — 3340 file 000000000203 — 50-file VTOC on a 5445 000000000303 — 1000-file VTOC on a 5445 *Note:* After the 5445 data interchange utility program has been executed, these 5 bytes contain the CC/HH/R address of the last OS/DOS format 1 record.
32-33	–	2	Unused DSCB records: *Hex Value* — *Meaning* 0016 — 3340 file 0048 — 50-file VTOC on a 5445 002F — 1000-file VTOC on a 5445 *Note:* These bytes contained hex 004E minus the number of OS/DOS format 1 records on the pack.
34-37	–	4	Address of the next unused alternate track: *Hex Value* — *Meaning* 02BA0000 — 3340 file next track xxxxxxxx — CC/HH of next unused 5445 alternate track
38-39	–	2	Number of unused alternate tracks: *Hex Value* — *Meaning* 0000 — 3340 file xxxx — Number of alternate tracks available

OS/DOS Format 4 Label Contents after System/3 Initialization (Continued)

Disp Hex	Label	Lng Dec	Description
3A	–	1	VTOC indicators–contains hex 80
3B	–	1	Number of extents–contains hex 01
3C-3D	–	2	Reserved
3E-3F	–	2	Number of logical cylinders: *Hex Value* / *Meaning* 02B8 — 3340 file 00CB — 5445 50-file VTOC
40-41	–	2	Logical cylinder size: *Hex Value* / *Meaning* 000C — 3340 0014 — 5445
42-43	–	2	Track length: *Hex Value* / *Meaning* 20B0 — 3340 1C7E — 5445
44-45	–	2	Keyed record overhead–contains hex 0000
46	–	1	Nonkeyed record overhead–contains hex 00
47	–	1	Device indicators–contains hex 01
48-49	–	2	Tolerance factor–contains hex 0000
4A	–	1	DSCB per track: *Hex Value* / *Meaning* 16 — 3340 19 — 5445
4B	–	1	Directory blocks

OS/DOS Format 4 Label Contents after System/3 Initialization (Continued)

Disp Hex	Label	Lng Dec	Description
4C-63	–	24	Reserved (hex 00)
64-68	–	5	Format 6 pointer—contains hex 0000000000
69-72	–	10	VTOC extent:
73-8C	–	25	Reserved—each byte contains hex 00

VTOC extent values (69-72):

Hex Value	*Meaning*
00000000000600000006	3340
00000000000200000004	5445 50-file VTOC
00000000000300000004	5445 1000-file VTOC

OS/DOS Format 5 Label Contents after System/3 Initialization

Disp Hex	Label	Lng Dec	Description
00-03	–	4	Key identification—contains 05050505
04-05	–	2	First track—contains hex 0000
06-07	–	2	Number of cylinders—contains hex 0000
08	–	1	Number of tracks—contains hex 00
09-2B	–	35	Available extents—each byte contains hex 00
2C	–	1	Format identifier—contains hex F5
2D-86	–	90	Available extents—each byte contains hex 00
87-8B	–	5	Pointer to next format 5—contains hex 00 each byte

LIBRARIES

The system resident pack must contain an object library, but the object library is optional on the user 5444/5447/simulation area. The source library is optional on any 5444/5447/simulation area.

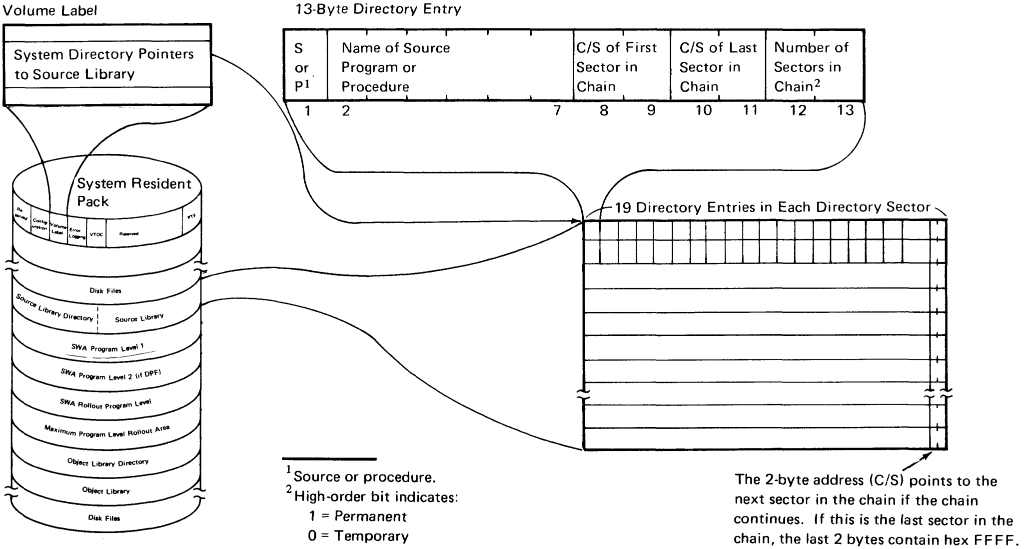
The system directory in the 5444/5447 volume label contains the location, size, available areas, and active areas of the libraries on the disk.

Source Library

Although the source library is optional on any 5444/5447/simulation area, its relative position is set (Figure 1-4). The library maintenance program creates the source library, and the user determines its size.

The minimum source library size is 1 track, and the first 2 sectors must contain source library directory entries. Each directory sector can contain up to 19 directory entries. If additional directory sectors are needed, they are taken from the available source library sectors. Each source library module (source program or procedure) has a 13-byte entry in the directory. The directory entries point to the library modules. Each library module, regardless of size, must begin on a sector boundary. However, a statement can begin in one sector and be continued in another.

The last 2 bytes of each source library sector point to the address (C/S) of the next chained sector. Directory sectors are chained, as are multiple sectors containing one library entry.



[1] Source or procedure.

[2] High-order bit indicates:

1 = Permanent

0 = Temporary

Source Library Format

Source library modules are in compressed format. Each 96-byte source statement is compressed as it is entered into the source library. The actual length of each statement in the source library is variable.

The compressed format is:

C	X	C	X	C	X	——————→ PTR

C = Actual hexadecimal character as it appears in the decompressed record

X = The number of times the character is repeated minus one (if repeated)

PTR = The last 2 bytes of a sector containing the C/S address of the next source library sector for this module. A pointer of hex FFFF indicates the end of the module

The X factor is placed in the compressed record if the character is repeated. The largest X factor is hex 3F. If a character is repeated more than 64 times, the character requires more than one X factor. To be placed in the source library, a character must be hex 40 or greater so that it does not conflict with the X factor.

For example, an END source statement followed by 90 blanks requires 10 bytes in the source library:

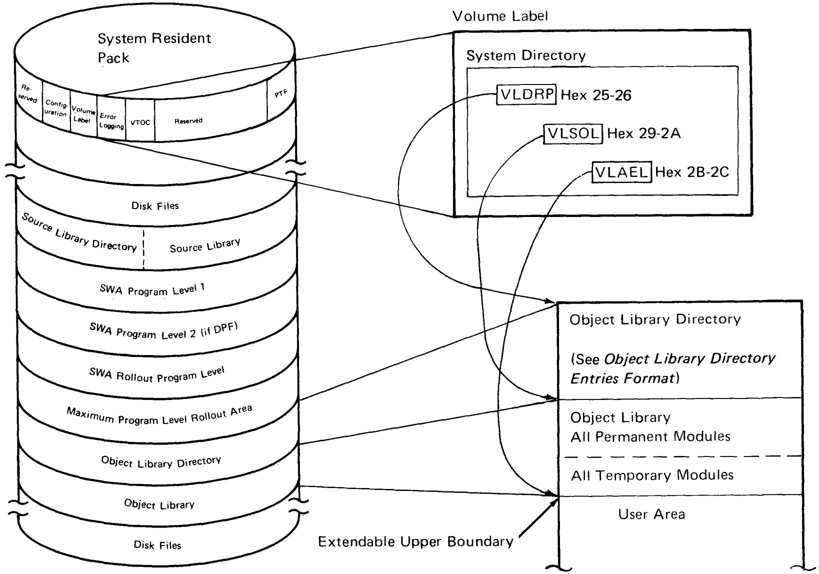
61	01	40	C5	D5	C4	40	3F	40	19

Object Library

The object library consists of a directory area and module area. The object library size is specified to the library maintenance program when the library is allocated. The upper boundary of the library can be extended, if necessary, to add more temporary modules.

The object library directory contains a 21-byte entry for each module in the library.

Whenever a permanent module is added to the library, or the library is reorganized, all temporary modules are deleted.


System Resident Pack
Re-served
Config-uration
Volume Label
Error Logging
VTOC
Reserved
PTF
Disk Files
Source Library Directory
Source Library
SWA Program Level 1
SWA Program Level 2 (if DPF)
SWA Rollout Program Level
Maximum Program Level Rollout Area
Object Library Directory
Object Library
Disk Files
Volume Label
System Directory
VLDRP Hex 25-26
VLSOL Hex 29-2A
VLAEL Hex 2B-2C
Object Library Directory
(See *Object Library Directory Entries Format*)
Object Library
All Permanent Modules
All Temporary Modules
User Area
Extendable Upper Boundary

Object Library Directory Entries Format

Disp Hex	Label	Lng Dec	Description
00	DIRTYP	1	Entry type O or R
01-06	DIRNAM	6	Module name
07	DIRCYL	1	Cylinder of library entry address
08	DIRSEC	1	Sector of library entry address
09	DIRTXT	1	Type O—Hex number of text sectors in library entry Type R—Category of routine
0A-0B	DIRLKN	2	Type O—Link-edit address in hex Type R—Reserved
0C	DIRRLD	1	Type O—RLD displacement in hex into the last sector of text Type R—Reserved
0D-0E	DIRSCA	2	Type O—Start control address in hex Type R—Reserved
0F	DIRSIZ	1	Main storage size to execute (in sectors)
10-11	DIRATR	2	Attribute byte 1:

Hex Value	*Meaning*
80	Permanent entry
40	Inquiry
20	Rollout evoking
10	Must run dedicated
08	Requires source information
04	Deferred mounting allowed
02	PTF applied
01	Overlay object program

Object Library Directory Entries Format (Continued)

Disp Hex	Label	Lng Dec	Description
10-11 (continued)			Attribute byte 2: *Hex Value* — *Meaning* 80 — System input dedication. The system input device must be dedicated to this program. The device can be released when it is no longer needed. 40 — Checkpoint/restart program 20 — Direct source read. This program can have a COMPILE statement and a no source required attribute (byte 1, bit 4 = 0). The program accesses the source itself. 10 — Macro processor allowed. This program can be preceded by the macro processor. If the source required attribute is present and a SWITCH 1xxxxxxx was processed, the $SOURCE file is opened as input instead of output. 04 — Program common. This program requires that a new load address be calculated at load time to place it in main storage beyond its own program common region. 02 — Model 12 compile
12	DIRLEV	1	Release level of this entry
13-14	DIRTOT	2	Total number of sectors in library entry

This section contains descriptions of data areas used by SCP. All displacements are in hexadecimal. The length of the field is in decimal. Displacements in parentheses have more than one use, depending on the System/3 being used.

These data areas are connected by a series of pointers. Figure 2-1 shows these pointers and how the user can find the data area by starting at hex address 10-11 in main storage.

MAIN STORAGE MAPS FOR DEDICATED AND DPF SUPERVISORS

Location (hex)	Contents
0000	Entry point to dump linkage
0004	General entry
0008	Entry point to IOS (SIO)
000C	Entry point to IOS (WAIT)
0010	Address of SYSCOM area
0012	Address of dump linkage
0014	Address of general entry routine
001A	Sysin history area (Models 8, 10, and 12)
(001A)	Keyboard save area (Models 4 and 6)
0029	Resident halt routine (DPF only)

MAIN STORAGE MAPS FOR DEDICATED AND DPF SUPERVISORS (Continued)

Location (hex)	Contents
00E8	LSR store/display routine
0100	Transient area
0400	Chain image (Models 4, 6, 8, and 10)
0500	Chain image (Model 12)

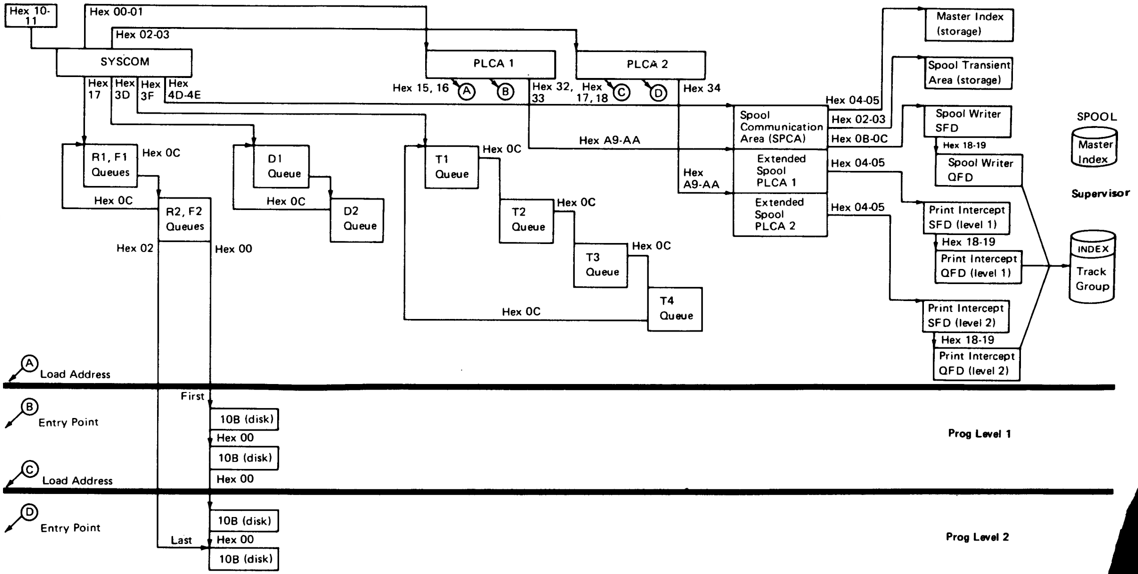


Figure 2-1. System Data Area Pointers

..	Label	Lng Dec	Description
00-01	NCPL1	2	Address of program level 1 communication area
02-03	NCPL2	2	Address of program level 2 communication area; hex 0000 if dedicated
04-05	NCXTAB	2	Address of transient scheduler tables
06	NCFCTR	1	Fetch trace ID: *Hex Value* — *Meaning* 80 — Fetch trace is active
(06)	NCSGEN	1	SYSGEN byte: *Hex Value* — *Meaning* 40 — Run $$OXRF, R1 ($MAINT) 20 — Run $$OXRF, F1 ($MAINT) 10 — Run $$OXRF, R2 ($MAINT) 08 — Run $$OXRF, F2 ($MAINT) 04 — Valid control statement received ($MAINT) 02 — System maintenance ($MAINT) 01 — Indicates to linkage editor that sysgen has control and wants the current chain image placed in the new supervisor; library maintenance should use the configuration record on F1 to allocate the library
07	NCPRTZ	1	Printer size[1]
08	NCLPSZ	1	Page size (5203 left tractor only)
09	NCRPSZ	1	Page size (5203 right tractor only)[1]
0A	NCSYSL	1	System list ID: *Hex Value* — *Meaning* F2 — Models 4 and 6 F1 — Models 8, 10, 12

[1]For Model 12, see PLCA.

SYSTEM COMMUNICATION REGION (Continued)

Disp Hex	Label	Lng Dec	Description
0B-0D	NCSLOG	3	Syslog indicator C/S/device (halt/syslog): *Hex Value* — *Meaning* E0 — Secondary C0 — Console B0 — Display screen on Models 4 and 6; otherwise reserved A0 — Primary 00 — Printer
(0B-0D)		3	Reserved (Model 12 only)
0E-0F	NCSWRK	2	C/S address of SWA
10	NCSYSQ	1	Q code for system pack from IPL routine: *Hex Value* — *Meaning* A9 — F1 A1 — R1
11-12	NCOLIB	2	C/S address of system object library
13	NCSCH1	1	Scheduler switches: *Hex Value* — *Meaning* 80 — Log device status (Models 4, 6, 8, and 10 only) 40 — System date received 20 — DPF system 10 — Scheduler interlock for program level 1 08 — Scheduler interlock for program level 2 04 — Date format DD/MM/YY 03 — F1, R1, R2, F2 disk drive configuration 01 — F1, R1, R2 disk configuration (Models 4, 6, 8, and 10 only) 00 — F1, R1 disk configuration

Disp Hex	Label	Lng Dec	Description
14	NCSMV1	1	Data management/scheduler switches: *Hex Value* — *Meaning* 80 — IPL successful 08 — Offline MVF on R1 (Models 4, 6, 8, and 10 only) 04 — Offline MVF on R2 (Models 6, 8, and 10 only) 02 — Other type of file on R1 (Models 4, 6, 8, and 10 only) (02) — Other type of file on R2 (Model 12) 01 — Other type of file on R2 (Models 4, 6, 8, and 10 only) (01) — Other type of file on F2 (Model 12)
15	NCSMV2	1	Data management/scheduler switches: *Hex Value* — *Meaning* 80 — Spool is active 40 — System IPL mode 20 — Spool supported 10 — Local display adapter supported 08 — Offline MVF on R1 (Models 4, 6, 8, and 10 only) 04 — Offline MVF on F1 (Models 4, 6, 8, and 10 only) 02 — Other type of file on R1 (Models 4, 6, 8, and 10 only) 01 — Other type of file on R2 (Models 4, 6, 8, and 10 only)
16	NCSCH	1	Scheduler byte: *Hex Value* — *Meaning* 80 — Printer/display screen interlock bit (printer opened) 40 — Rollin now processing 10 — Input for I-type program 08 — Rollout requested 04 — PARTITION statement received 02 — Rollout now processing 01 — Inquiry pending
17-18	NCDSKQ	2	Address of 5444 R1, F1 I/O queue (same contents as NCDSK5 for Model 12)

Disp Hex	Label	Lng Dec	Description
19	NCSCH2	1	Partition value for level 2 (number of sectors) or save area for matrix printer sense byte (Models 4 and 6)
1A	NCMBSV	1	Miscellaneous byte: *Hex Value* — *Meaning* 80 — Model 6 40 — Chained procedure being processed 20 — List RPG II 10 — Suppress OCL on a call cycle 08 — Unit record indicator for inquiry 04 — CCP/DLOG 02 — Local display adapter support (or ICA) 01 — NOEJECT specified (Models 4, 6, 8, 10 only)
1B	NCXTA	1	Miscellaneous byte: *Hex Value* — *Meaning* 80 — 5448 supported (Models 8 and 10 only)
1C-2F	NCSTOR	20	Transient storage area
30-31	NC@CIO	2	Main storage address of keyboard interrupt routine
32-34	NCRCSS	3	C/S of rollout area
35	NCCONF	1	Magnetic tape and 3340 configurations: *Hex Value* — *Meaning* 80 — HE halt issued by DLOG (macro has nonstop mode) 40 — Reserved for communications control program use 20 — Reserved for communications control program use 18 — D1, D2 10 — D1 07 — T1, T2, T3, T4 06 — T1, T2, T3 05 — T1, T2 04 — T1

SYSTEM COMMUNICATION REGION (Continued)

Disp Hex	Label	Lng Dec	Description
36-37	NCADDC	2	Address of additional communication area
38-39	NCARSV	2	Address of halt/syslog sysin save area
3A-3B	NC@PIO	2	5213 or 2222 printer (Model 6 only)
(3A-3B)	NC@PIO	2	5213 printer (Model 4 only)
3C	NCLPLC	1	Left page line count (Models 4 and 6 only)
3D	NCRPLC	1	Right page line count (Models 4 and 6 only)
3E	NCPEL	1	Print element location (Models 4 and 6 only)
(3A)	NCSCH3	1	Scheduler byte (Models 8, 10, and 12)
(3B)	NCSCH4	1	Scheduler byte (Models 8, 10, and 12)
(3C)	NCSMV3	1	Data management multivolume file (Models 8, 10, and 12):

Program level 1:

Hex Value	*Meaning*
80	MVF on D1 (Models 8 and 10 only)
40	MVF on D2
20	Other type of file on D1 (Models 8 and 10 only)
10	Other type of file on D2

Program level 2

Hex Value	*Meaning*
08	MVF on D1 (Models 8 and 10 only)
04	MVF on D2
02	Other type of file on D1 (Models 8 and 10 only)
01	Other type of file on D2

Disp Hex	Label	Lng Dec	Description
(3D-3E)	NCDSK5	2	Address of 5445/3340/5448 I/O queue (same contents as NCDSKQ on Model 12 and Models 8 and 10 with 5448)

SYSTEM COMMUNICATION REGION (Continued)

Disp Hex	Label	Lng Dec	Description

End of SYSCOM for Models 4 and 6

3F-40	NCTAPQ	2	Address of magnetic tape I/O queue

The next 9 bytes are used only by a DPF system:

41-42	NCSXR1	2	XR1 — Storage area for interrupt level 0
43-44	NCSXR2	2	XR2 — Storage area for interrupt level 0
45-46	NCSPSR	2	PSR — Storage area for interrupt level 0
47	NCSNS	1	Reader select switch sense information:

Hex Value	*Meaning*
80	Level 1
40	Cancel
20	MFCU
10	Auxiliary reader
08	Printer keyboard

End of SYSCOM for Models 8 and 10

48-49	NCHALT	2	Address of resident halt routine (NPHALT)
4A	NCHSLK	1	Syslog printer IOB interlock:

Hex Value	*Meaning*
04	Syslog print IOB interlock
02	Program level 2
01	Program level 1

4B-4C	NCBUF@	2	Address of syslog printer IOB

The next 6 bytes are used only by a spool system:

4D-4E	NCSPCA	2	Address of spool communications area
4F	NCUTL1	1	Reserved for spool:

Hex Value	*Meaning*
80	Spool using D1
40	Spool using D2
08	Auxiliary set for level 0 and spool is in that level

Disp Hex	Label	Lng Dec	Description
50	NCSPRT	1	Spool print device
51	NCSIM	1	D2 simulation: *Hex Value* *Meaning* 40 Simulation on (F2, R2)
52	NCPRTA	1	Printer allocate: *Hex Value* *Meaning* 80 1403/5203 supported 40 1403/5203 being used by program level 1 20 1403/5203 being used by program level 2 10 Secondary carriage supported 08 Printer allocated to rolled-out program 04 Program level 1 being intercepted 02 Program level 2 being intercepted
53	NCMISC	1	Miscellaneous byte: *Hex Value* *Meaning* 80 Set by $$TMIB during IPL
54-55	NCSPST	2	Start of spool modules in supervisor
56-57	NCPSVA	2	Printer save area address
58	NCCORE	1	Memory size: *Hex Value* *Meaning* 82 96K 81 80K 04 64K 02 48K 01 32K
59-5A	NCABFR	2	Address of adapter check rollout code
5B-5D		6	Entry point for $@SCI1
5E-60	NCFRMS	3	Formsno from // FORMS statement

SYSTEM COMMUNICATION REGION (Continued)

Disp Hex	Label	Lng Dec	Description
61-62	NCTENT	2	Address of table of trace entries
63-64	NCSPVE	2	End of base supervisor before spool

The following displacements apply to a Model 12 with more than 64K bytes of main storage:

Disp Hex	Label	Lng Dec	Description
65	NCMAP	1	Amount of level 2 mapped: *Hex Value* — *Meaning* D8 — 54K mapped D0 — 52K mapped C8 — 50K mapped
66-67	NCINTR	2	Address of BSCA interrupt routine
68-6D	NCATTS	6	Original values for ATT registers 2-4
6E-73	NCRMAP	6	New values for ATT registers 2-4
74-79	NCATR1	6	CCP ATTs for DFF/3
7A-7F	NCATR2	6	CCP ATTs for CM/MLMP
80-81	NCIDMP	2	Address of intercept 0 routine – CCP
82-83	NCIGNL	2	Address of intercept 4 routine – CCP
84-85	NCIIOS	2	Address of intercept 8 routine – CCP
86-87	NCIIOW	2	Address of intercept C routine – CCP

Additional Communications Area

Pointed to by SYSCOM hex 36-37

Disp Hex	Label	Lng Dec	Description
00-01	ADBSCA	2	Address of BSCA/LDA/locally attached work station interrupt handler
02-03	ADKATA	2	Reserved
04	ADBSL1	1	Program level BSCA indicators: *Hex Value* — *Meaning* 80 — BSCA statement received 40 — Line 1 20 — Line 2
05	ADBSL2	1	Program level 2 BSCA indicators: *Hex Value* — *Meaning* 80 — BSCA statement received 40 — Line 1 20 — Line 2
06-07	AD3741	2	Address of 3741 queue
08-09	ADCNVT	2	Address of entry point for 5448 disk address conversion (Models 8 and 10 only)

PROGRAM LEVEL COMMUNICATION REGION

Disp Hex	Label	Lng Dec	Description
(00)	NPIOB	0	Entry for program level IOB
00-01	NPCHAN	2	IOS chain pointer (disk IOS)
2	NIOCMP	1	Completion code (disk IOS)
3	NIOQB	1	IOB Q code
4	NIORB	1	IOB R code
5	NIOCB	1	IOB cylinder byte
6	NIOSB	1	IOB sector byte
7	NIONB	1	Number of sectors to be read minus 1
08-09	NIODAT	2	Data buffer address
0A-0B	NIOSNS	2	Sense bytes (disk IOS)
0C	NIOERR	1	IOS error retry counter
0D	NIOFLG	1	Flag bits (disk IOS)
0E-11	NIOOBR	4	OBR-SDR transient routine save areas for the caller's ARR, XR2 registers
12-13	NPDTF@	2	First DTF address (address of last opened DTF)
14	NPRIB	1	Program RIB

PROGRAM LEVEL COMMUNICATION REGION (Continued)

Disp Hex	Label	Lng Dec	Description	
15-16	NPBEG	2	Program level logical beginning address[1]	
(15-16)	NPBEG	2	Program level real beginning address (<64K-byte system)	
17-18	NPEND	2	Program level end address	
19	NPQ	1	Program level Q code (as in the LOAD statement)	
1A-1B	NPRLF	2	Program relocation factor	
1C-1D	NPCYL	2	C/S of load name for this program level	
1E-1F	NPOLIB	2	C/S of program object library	
20-21	NPXR1	2	Register 1 save area	
22-23	NPXR2	2	Register 2 save area	Used as save area for the program requesting general entry (NENTRY)
24-25	NPNSI	2	Return address	
26-27	NPORLF	2	Overlay relocation factor supplied by loader	
28-29	NPTXT	2	Overlay text address supplied by relocation program	
2A-2B	NPTEMP	2	Temporary storage for resident loader (NLOADR)	

Parameter List for the Resident Loader (NLOADR)

2C-2D	NPCS	2	C/S address of module to be loaded
2E	NP#S	1	Number of sectors to be read
2F-30	NPLNK	2	Link-edited address
31	NPRLD	1	Displacement of RLD
32-33	NPENT	2	Address of entry point of loaded module
34-35	NPLOD	2	Load address
(34-35)	NPPAR	2	Load address

[1] For Model 12 with more than 64K bytes of main storage

Disp Hex	Label	Lng Dec	Description
36	NPEOJ	1	End-of-job ID: *Hex Value* — *Meaning* 80 — RJE active/return to beginning of program level on cancel 40 — Successful IPL 20 — Program previously loaded 10 — Cancel pending 0E — RPG II syslog bits for EOJ 01 — Do not close DTFs at EOJ
37	NPUPSI	1	UPSI switches
38-3D	NPNAME	6	Program name that is currently being executed
3E	NPRELS	1	Release level
3F-44	NPDATE	6	Program date
45-48	NPSYSI	4	Sysin indicator (C/S/N sectors/device information): *Hex Value* — *Meaning* F0 — Hopper 1 MFCU F8 — Hopper 2 MFCU F4 — 1442 D0 — Data 96 C0 — Console B0 — Keyboard with display screen A0 — Keyboard (Model 6) 40 — 3741
49	NPSCH1	1	Reader/Interpreter switches: *Hex Value* — *Meaning* 80 — DATE statement received (INTRA) 40 — COMPILE statement received 20 — SWITCH statement received 10 — Procedure being processed 08 — Override request 04 — INTRA mode 02 — INTER mode 01 — IPL mode

Disp Hex	Label	Lng Dec	Description
4A	NPSCH2	1	Scheduler switches: *Hex Value* — *Meaning* 80 — Continuation of OCL statement 40 — Utility control statements in SWA 20 — /& from sysin device 10 — A file statement received 08 — End of job halt 04 — Clear sysin device 02 — Immediate cancel 01 — Controlled cancel
4B	NPSCH3 or NPLEVL	1	Scheduler switches: *Hex Value* — *Meaning* 80 — Tag sort required (5444/5447) 40 — Allocate transient required/work2 file present 20 — Source required by RPG II compiler 10 — Logging (halt/syslog) not specified (Models 4, 6, 8, and 10 only) 08 — MVF file allocated 04 — Additional procedure statement/ resource allocate done 02 — First LOAD-RUN job read 01 — Program level 2
4C	NPOBJQ	1	Object deck output Q code
4D	NPBPSD	1	Selected status of sysin device: *Hex Value* — *Meaning* 80 — MFCU or data recorder (Model 6) 40 — Console I/O 20 — 1442 10 — Auxiliary on reader select switch 08 — Console on reader select switch 04 — 3741 02 — Storage rolled out by allocate 01 — Nested procedure

PROGRAM LEVEL COMMUNICATION REGION (Continued)

Disp Hex	Label	Lng Dec	Description
4E	NPSCH4	1	Allocation information: *Hex Value* — *Meaning* 80 — This program level is active 40 — IMAGE statement received 20 — FORMS statement received 10 — F1 needed for allocation 08 — R1 needed for allocation 04 — F2 needed for allocation 02 — R2 needed for allocation or tape DTFs encountered in resource allocate 01 — Initial EOJ logic has been performed
4F	NPSCH8	1	Type of files needed: *Hex Value* — *Meaning* 80 — Reader statement received 40 — Console in use by data management 20 — Valid FILE statement received 10 — Shared I/O program 08 — I- or B-type program 04 — Allocate unsuccessful 02 — Maximum number of tracks for allocation are available 01 — Minimum number of tracks for allocation are available
50-51	NPSCH6	2	Save area for IAR pointer (Model 6)
52	NPSCHD	1	No stop mode
53	NPSCHE	1	Reserved
54-55	NPWKB	2	Disk IOS work area (address of IOB for last branch to 8 or C)

Disp Hex	Label	Lng Dec	Description
56	NPSCH9	1	Disk log unit for EOJ:
			Hex Value / *Meaning*
			80 F2 — These units are logged only once
			40 R2 — These units are logged only once
			20 F1 — These units are logged only once
			10 R1 — These units are logged only once
			08 F2 — All these units are logged at end of job
			04 R2 — All these units are logged at end of job
			02 F1 — All these units are logged at end of job
			01 R1 — All these units are logged at end of job
57	NPSCHA	1	Scheduler byte:
			Hex Value / *Meaning*
			20 Call tape DLOG at EJ
			08 Active file on T1
			04 Active file on T2
			02 Active file on T3
			01 Active file on T4
58	NPSCHB	1	Scheduler byte:
			Hex Value / *Meaning*
			80 Checkpoint program executing
			40 5445/3340 FILE statement present
			20 New file allocated on D1
			10 New file allocated on D2
			08 Deferred allocate requested
			04 Second-level halt required
			02 Tag sort required
			01 Resources allocation
59-5A	NPHLT2	2	Save area for second-level halt
5B-5C	NPEOJ@	2	End-of-job return address
5D	NPUNCH	1	Syspunch ID
(5D)	NPEDED	–	End of dedicated program level (Models 6, 8, and 10 only)

The following data areas are used only by the resident halt routine (NPHALT) in a DPF system (Models 8, 10, and 12):

Disp Hex	Label	Lng Dec	Description
5E-5F	NPHXR2	2	Parameter save area
60-67	NPHTRN	8	Transient storage area

PROGRAM LEVEL COMMUNICATION REGION (Continued)

Disp Hex	Label	Lng Dec	Description
68-8B	NPHQSV	36	Transient queue save area
8C	NPUTIL	1	Utility interlock byte: *Hex Value* — *Meaning* 80 — F2 allocated 40 — R2 allocated 20 — F1 allocated 10 — R1 allocated 08 — F2 in use 04 — R2 in use 02 — F1 in use 01 — R1 in use
8D-8E	NPSAVE	2	IAR save area used on cancel condition
8F-96	NPJUSV	8	Used to save registers on a JU halt
97	NPUTL1	1	Magnetic tape interlock: *Hex Value* — *Meaning* 80 — T1 in use 40 — T2 in use 20 — T3 in use 10 — T4 in use
98	NPUTL2	1	5445/3340 interlock: *Hex Value* — *Meaning* 80 — Library usage interlock 40 — 3881 interlock 20 — D2 allocated 10 — D1 allocated 02 — D2 in use 01 — D1 in use
99	NPSCH5	1	Reader select switch setting: *Hex Value* — *Meaning* 80 — Program level 1 20 — MFCU position 10 — AUX position 08 — Printer/keyboard position 04 — Tape FILE statement received

PROGRAM LEVEL COMMUNICATION REGION (Continued)

Disp Hex	Label	Lng Dec	Description
9A-9B	NPSTBY	2	Address of program level standby routine
9C	NPSCH7	1	Last sysin assignment (see NPSCH5, displacement 99)
9D	NPSCHC	1	Program level expansion value
9E	NPHALT	1	Program level HPL
9F	NPHLTQ	1	Q code for HPL
A0	NPHLTR	1	R code for HPL
A1-A4	NPHBCH	4	Branch for resident halt routine (NPHALT)

The following data areas are used by a dedicated or DPF system (Model 12 only):

Disp Hex	Label	Lng Dec	Description
A5-A6	NPHSR1	2	Register 1 save area for halt/syslog
A7-A8	NPHSR8	2	ARR save area for halt/syslog
A9-AA	NPSPPL	2	Address of extended spool PLCA
AB	NPSPOL	1	Reserved for spool:

Hex Value	*Meaning*
80	Trapping I/O request
40	Spool supported this level
20	End of group
10	Start spool requested
08	Stop spool requested
04	Spool IPL complete

Disp Hex	Label	Lng Dec	Description
AC-B3	NPJOBN	8	Job name
B4-BB	NPGRP	8	Group name
BC	NPATTR	1	Program attribute byte:

Hex Value	*Meaning*
80	Dedicated program running
10	3340 data management present (Model 12 compile)

Disp Hex	Label	Lng Dec	Description
BD	NPJBCT	1	Count of job names for group

The following data areas are used by a dedicated or DPF system (Model 12 only): (Continued)

Disp Hex	Label	Lng Dec	Description
BE	NPSCHF	1	Scheduler switches: *Hex Value* — *Meaning* 80 — JOB statement received 40 — RUN statement received 20 — Halt/syslog available 10 — Ignore log status on default 08 — Right tractor specified 04 — Default mode 03 — 3 option (severity 8) 02 — 2 option (severity 4) 01 — 1 option (severity 2) 00 — 0 option (severity 1)
BF	NPSM12	1	Simulation area interlock D1 areas being modified: *Hex Value* — *Meaning* 80 — D1A (F1) 40 — D1B (R1) 20 — D1C 10 — D1D D2 areas being modified: *Hex Value* — *Meaning* 08 — D2A (F2) 04 — D2B (R2) 02 — D2C 01 — D2D
C0	NPPRTZ	1	Printer size
C1	NPLPSZ	1	Left tractor page size
C2	NPRPSZ	1	Right tractor page size
C3-C4	NPHSAR	2	User ARR save area (halt/syslog)
C5-CB	NPTQSV	7	Additional transient queue save area

Disp Hex	Label	Lng Dec	Description

The following data areas are used by a dedicated or DPF system (Model 12 only): (Continued)

Disp Hex	Label	Lng Dec	Description
CC	NPMISC	1	Miscellaneous byte:

Hex Value	*Meaning*
80	Cancel not allowed
40	Spooling right carriage halt issued
20	Log printer operation has been done
10	EOJ indicator for halt/syslog (spool interface)
08	Printer IOS interface for halt/syslog
04	$$TMRI must reset unprintable character indicator
02	JU halt routine
01	EOJ scheduler—tape

Disp Hex	Label	Lng Dec	Description
CD-CE	NPPMR	2	PMR save area for disk IOS
CF-D0	NPSVMR	2	PMR save area for spool
D1-D3	NPSPAR	3	Reserved
D4-D6	NPSLOG	3	Syslog indicator:

Hex Value	*Meaning*
C0	Console
00	Printer

Disp Hex	Label	Lng Dec	Description
D7	NPLOGB	1	Program level log byte:

Hex Value	*Meaning*
80	Log on specified
40	RLD area in use
01	No eject specified

Disp Hex	Label	Lng Dec	Description
D8	NPCCPF	1	CCP is active
D9-DA	NPCCOM	2	Address of CCP communications area
DB-DC	NPIPM	2	Normal program level PMR values:

Hex Value	*Meaning*
0000	Level 1
0074	Level 2

PROGRAM LEVEL COMMUNICATION REGION (Continued)

Disp Hex	Label	Lng Dec	Description
DD	NPATRS	1	ATT reset byte: *Hex Value* *Meaning* 80 Spool, $$SPEJ interface
DE-DF	NPSPMR	2	PMR save area for dispatcher
E0-E1	NPPMRS	2	PMR save area for RLD processing
E2-E3	NPNPMR	2	Modified PMR for RLDs
E4-E7	NPSTOR	20	Save area for resident 5471 processing

SPOOL COMMUNICATIONS AREA (Model 12 Only)

Disp Hex	Label	Lng Dec	Description
00-01	SPLTBL	2	Address of spool load table
02-03	SPTRAN	2	Address of spool transient region
04-05	SPMAST	2	Address of master record
06-07	SPCMD@	2	Address of spool command
08-0A	SPDEFF	3	Default forms number
0B-0C	SPPRTE	2	Print writer SFD address
0D	SPSTAT	1	Status of spool:

Hex Value	*Symbol*	*Meaning*
80	SPWTR1	$SSWTR is loaded in level 1
40	SPWTR2	$SSWTR is loaded in level 2
20	SPINLK	Spool transient area busy
10	SPOCRD	Spool OCC reader 5741 (this bit off indicates sysin for level)
08	SPLOD2	$SSWTR is loaded in P2 of 80K/90K system

Disp Hex	Label	Lng Dec	Description
			Hex Value / *Symbol* / *Meaning*
			04 / SPINLV / Program level controlling the spool transient area: *Hex Value* / *Meaning*: 80 = Program level 2; 00 = Program level 1
0E	SPLSRT	—	Displacement to start of program level extension

Program Level Extensions of the Spool Communications Area (Model 12 Only)

Disp Hex	Label	Lng Dec	Description
00	SPCLID	1	Module ID for close
01-02	SPCRT@	2	Caller's return address
03	SPCC	1	Completion code
04-05	SPITC@	2	Address of program level's intercept SFD
06	SPSTA1	1	Spool status byte 1: *Hex Value* / *Symbol* / *Meaning* 80 / PRDEFR / Print defer; no request 20 / SPALGN / Printer forms alignment request
07	SPPRTY	1	Job priority
08-0A	SPFMNO	2	Forms ID number
0B	SPCOPY	1	Number of printed copies
0C	SPNXLV	—	Displacement to second-level program extension

DTF (DEFINE THE FILE)

The DTF control block is the primary interface to data management routines. When calling data mangement, XR2 must point to the first byte of the DTF. A preopen DTF is generated by the compilers or user programs. The device open routines change these preopen DTFs into postopen DTFs for use by the device data management routines. When processing is complete, the device close routines return the DTFs to preopen format.

A pointer in the PLCA (NPDTF@) for each partition points to the last opened DTF in that program level. All opened DTFs in a program level are chained together (Figure 2-2).

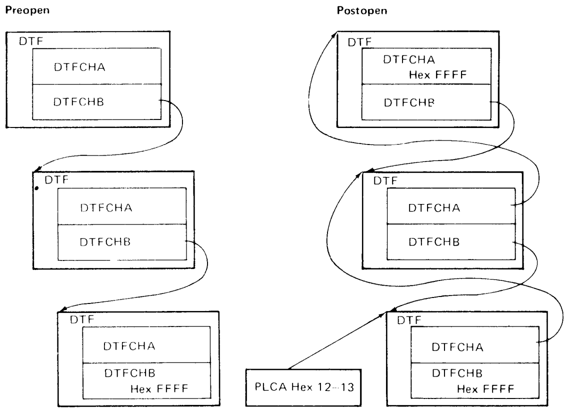


Figure 2-2 (Part 1 of 2). Chained DTFs

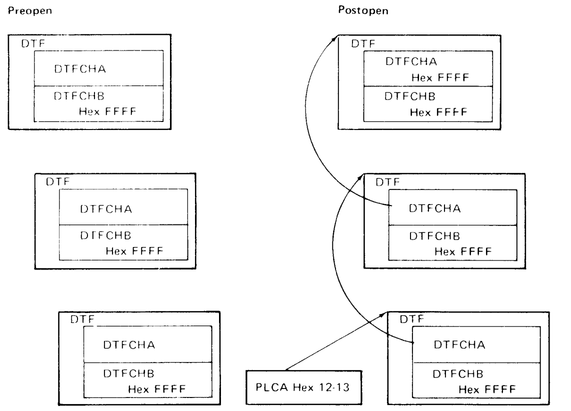
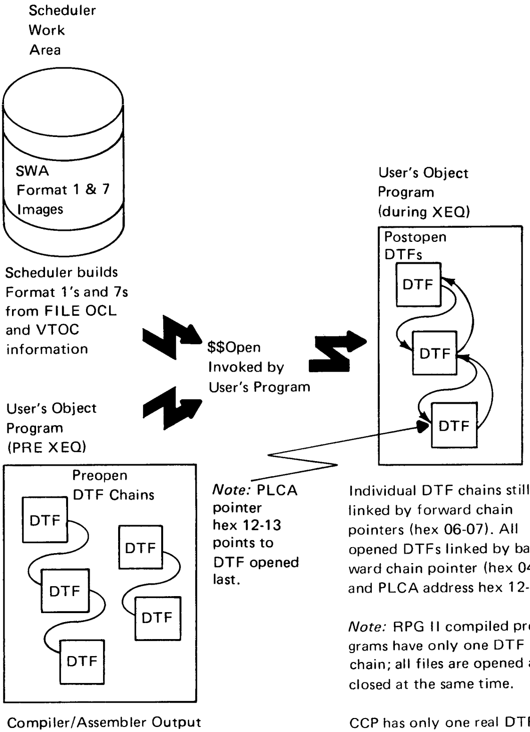


Figure 2-2 (Part 2 of 2). Unchained DTFs

Disk and Tape I/O Linkages (How Files are Opened)



Individual DTF chains still linked by forward chain pointers (hex 06-07). All opened DTFs linked by backward chain pointer (hex 04-05) and PLCA address hex 12-13.

Note: RPG II compiled programs have only one DTF chain; all files are opened and closed at the same time.

CCP has only one real DTF chain and all files are opened and closed at the same time.

After open, startup rearranges the DTF chains. Before close, shutdown reconstructs the DTF chain.

Disk Preopen DTF

Disp Hex	Label	Lng Dec	Description
00	DTFDEV	1	Device address (first 5 bits of Q code): *Hex Value* — *Meaning* C8 — D2 C0 — D1 B8 — F2 B0 — R2 A8 — F1 A0 — R1
01	DTFUPS	1	External indicator
02-03	DTFATR	2	Attributes (see 5445 Main Data Areas Postopen DTF for bit definitions)
04-05	DTFCHA	2	Record length
06-07	DTFCHB	2	Address of next DTF
08-0B		4	Reserved
0C-0D	DTFWKB	2	Logical record area (for shared I/O, I/O input logical record area)
0E-0F		2	Reserved
10-11	DTFIOB	2	I/O block address
12-13		2	Reserved (for shared I/O, output logical record area)
14-15	DTFBKL	2	Block length
16-19		4	Reserved (for shared I/O, I/O area address)
1A-1B	DTFMVF	2	Address of direct MVF extent table[1]
1C-1D	DTFNUM	2	Number of direct MVF extents[1]
1E		1	Reserved
1F-26	DTFNAM	8	Filename

[1] These fields are not used in the simulation areas.

Disk Preopen DTF (Continued)

Disp Hex	Label	Lng Dec	Description
27-30		10	Reserved
31-32	DTFCUR	2	Address of key of current record[1]
–	DTFKAD	(2)	Address of key being retrieved[1]
–	DTFHI	(2)	Address of high key (limits)[1]
33-36		4	Reserved
37-38	DTFKL	2	Key length
39-3A		2	Reserved
3B-3C	DTFKD	2	Displacement of key in record[1]
3D-3E	DTFMIX	2	Address of master index[1]
3F-40	DTFBYT	2	Number of bytes in master index[1]
41-93		83	Reserved

5444/5447/Simulation Area Postopen DTF

Note: Indexed and MVF files are not allowed on simulation area. Any fields pertaining to these types of files will be unused.

Disp Hex	Label	Lng Dec	Description
00	DTFDEV	1	Device address (Q code of SIO): *Hex Value* — *Meaning* B8 — F2 B0 — R2 A8 — F1 A0 — R1
01	DTFERP	1	Device and UPSI bytes

[1]These fields are not used in the simulation areas.

5444/5447/Simulation Area Postopen DTF (Continued)

Disp Hex	Label	Lng Dec	Description
02-03	DTFATR	2	File attributes
			Byte 1:
			Hex Value — *Meaning*
			80 — Indexed
			40 — Consecutive
			20 — Direct
			10 — MVF
			08 — Input
			04 — Output
			02 — Update
			01 — Add
			Byte 2:
			Hex Value — *Meaning*
			80 — Address out
			40 — Ordered load
			20 — Random
			10 — Limits
			08 — Dual I/O
			04 — EOV (close ignore bits)
			02 — EOV call to close
			01 — Opened
04-05	DTFCHA	2	DTF backward chain pointer
06-07	DTFCHB	2	DTF forward chain pointer
08-09	DTFARR	2	ARR save area
0A-0B	DTFXRS	2	XR1 save area
0C-0D	DTFWKB	2	Address of logical record
0E	DTFCMP	1	Completion:
			Hex Value — *Meaning*
			70 — End of extent
			62 — Out of sequence
			60 — Invalid load or add
			50 — Invalid update
			48 — Overflow (PTR)
			44 — No record found
			42 — EOF
			41 — I/O error
			40 — Normal

Disp Hex	Label	Lng Dec	Description
0F	DTFOPC	1	Operation: *Hex Value* — *Meaning* 80 — Get 40 — Put 20 — Update

End of Basic DTF (16 bytes)

Disp Hex	Label	Lng Dec	Description
10-11	DTFIOB	2	Current I/O IOB address
12-13	DTFPRB	2	Current process IOB address
14-15	DTFBKL	2	Block length
16-17	DTFRCL	2	Record length
18-19	DTFPTR	2	Data block index (address of next record)
1A-1B	DTFXTA	2	Data start extent
1A-1B	DTFMVF	2	Address of MVF extent table
1C-1D	DTFXTB	2	Data end extent
1C-1D	DTFNUM	2	Number of extents (direct MVF)
1E	DTFSWA	1	SWA format 1 label index
1F	DTFWAA	1	Work area A
20	DTFWAB	1	Work area B
21	DTFWAC	1	Work area C
22	DTFWAD	1	Work area D
23-24	DTFRMA	2	Spanning record work area 1 (work area, length of first part of overlap record)
25-26	DTFRMB	2	Spanning record work area 2
27	DTFIND	1	Indicator bits
28-2B	DTFNXR	4	Disk address of current record (C/S/D/D)

End of DTF for $$CSOP (44 bytes)

Disp Hex	Label	Lng Dec	Description
2C-2E	DTFEOF	3	Disk address of logical end of file (C/S/D) For direct files, relative record number of last record in binary
(2C-2E)	DTFNXK	(3)	Disk address of logical end of index (C/S/D)
End of DTF for $$CSIP $$CSUP (47 bytes)			
2F-30	DTFKPR	2	Pointer within index (pointer to next buffer entry)
31-32	DTFKAD	2	Address of relative record number in storage
End of DTF for $$DAIB $$DAID $$DAUB $$DAUD (51 bytes)			
(31-32)	DTFCUR	2	Address of current key (ISAD, ISUA)
(31-32)	DTFHI	2	Address of high key (limits)
33-34	DTFKXA	2	Start of extent of index
35-36	DTFKBF	2	Address of index IOB
37-38	DTFKL	2	Key length
39-3A	DTFKXB	2	End extent of index
3B-3C	DTFKD	2	Address of last key
End of DTF for $$IOUT $$ISIP $$ISUP (61 bytes)			
3D-3E	DTFLST	2	Address of last key
(3D-3E)	DTFMIX	2	Address of core index
(3D-3E)	DTFLOW	2	Address of low key (limit)
End of DTF for $$SCIL, $$SCUL, $$ISIL, $$ISUL (163 bytes)			
3F-41	DTFKXP	3	Logical end of prime index
End of DTF for $$SCIO, $$SCRR, $$SCRU, $$SCRA, $$SCRB, $$IOAD, $$IRIP, $$IRUP, $$IRAD, $$IRUA (166 bytes)			
42-43	DTFSNP	2	Save next index pointer (C/S)
End of DTF for $$ISAD, $$SCSA, $$SCSB (168 bytes)			
44-45	DTFSLA	2	Save last index pointer
46-47	DTFSLP	2	Save last index pointer
End of DTF for $$ISUA (172 bytes)			

5444/5447/Simulation Area Postopen DTF (Continued)

Disp Hex	Label	Lng Dec	Description
48	DTFSEQ	1	Sequence number of current volume
49	DTFNXT	1	Sequence number of next volume
Multivolume Files			
4A-88	DTFF1S	62	First byte of saved F1
89	DTFF1	1	Last byte of saved F1
8A-8B	DTFAR1	2	ARR save area for EOV
8C-8D	DTFXR1	2	XR1 save area for EOV
End of DTF for $$ISIM, $$ISUM, $$CSIM, $$CSOM, $$CSUM (142 bytes)			
8E-8F	DTFKEY	2	Volume high key/low key save area address
End of DTF for $$IOUM, $$ISAM, $$ISBM (144 bytes)			
90-91	DTFTAB	2	Address of indexed MVF extent table
92	DTFENT	1	Number of volume MSTNDX table
93	DTFVOL	1	Number of online indexed volumes
End of DTF for $$IRIM, $$IRUM, $$IRAM, $$IOAM, $$IRBM (148 bytes)			

5424 Preopen DTF

Disp Hex	Label	Lng Dec	Description
00	MDFDA	1	Device address: *Hex Value* — *Meaning* F0 — Primary F8 — Secondary
01	MDFUPS	1	External indicator
02	MDFAT1	1	Attribute byte 1
03	MDFAT2	1	Attribute byte 2
04-05	MDFRLN	2	Record length
06-07	MDFCHB	2	Address of next DTF
08-0D		6	Reserved

5424 Preopen DTF (Continued)

Disp Hex	Label	Lng Dec	Description
0E-0F	MDFR12	2	Address of second read IOB
10-11	MDFRB2	2	Address of second read I/O area
12-13	MDFUI2	2	Address of second punch IOB
14-15	MDFUB2	2	Address of second punch I/O area
16		1	Reserved
17-18	MDFERP	2	Pointer to ERP
19-1A	MDFRI1	2	Address of first read IOB
1B-1C	MDFRB1	2	Address of first read I/O area
1D-1E	MDFUI1	2	Address of first punch IOB
1F-20	MDFUB1	2	Address of first punch I/O area
21-22	MDFPTB	2	Address of first print I/O area
23-24		2	Reserved

5445/Main Data Area Postopen DTF

Disp Hex	Label	Lng Dec	Description
00	DTFDEV	1	Device address (Q code of SIO): *Hex Value* — *Meaning* C0 — D1 C8 — D2
01	DTFUPS	1	UPSI bytes
02	DTFATR	1	File attribute byte 1: *Hex Value* — *Meaning* 80 — Indexed 40 — Consecutive 20 — Direct 10 — Multivolume file 08 — Input 04 — Output 02 — Update 01 — Add

5445/Main Data Area Postopen DTF (Continued)

Disp Hex	Label	Lng Dec	Description
03	DTFATR	1	File attribute byte 2: *Hex Value* — *Meaning* 80 — Address out/online indexed MVF 40 — Ordered load 20 — Random 10 — Limits 08 — Dual I/O 04 — EOV (close ignore bit) 02 — EOV call to close 01 — Opened
04-05	DTFCHA	2	DTF backward chain pointer
06-07	DTFCHB	2	DTF forward chain pointer
08-09	DTFARR	2	ARR save
0A-0B	DTFXRS	2	XR1 save
0C-0D	DTFWKB	2	Address of logical record
0E	DTFCMP	1	Completion: *Hex Value* — *Meaning* 72 — Key to high last volume of indexed random MVF 70 — EOX 68 — Indexed sequential MVF key error 64 — Indexed random MVF key error 62 — Out of sequence 60 — Invalid load or add 50 — Invalid update 44 — No record found 42 — EOF 41 — I/O error 40 — Normal
0F	DTFOPC	1	Operation: *Hex Value* — *Meaning* 90 — Set new limits 80 — Get 40 — Put 20 — Update

End of Basic DTF (16 bytes)

5445/Main Data Area Postopen DTF (Continued)

Disp Hex	Label	Lng Dec	Description
10-11	DTFIOB	2	Current I/O IOB address
12-13	DTFPRB	2	Current process IOB address
14-15	DTFBKL	2	Block length
16-17	DTFRCL	2	Record length
18-19	DTFPTR	2	Data block index (address of next record)
1A-1B	DTFXTA	2	Data start extent
(1A-1B)	DTFMVF	2	Address of MVF extent table (direct MVF and BAM)
1C-1D	DTFXTB	2	Data end extent
(1C-1D)	DTFNUM	2	Number of extents (direct MVF)
1E	DTFSWA	1	SWA format 1 label index
1F	DTFWAA	1	Work area A
20	DTFWAB	1	Work area B
21	DTFWAC	1	Work area C
22	DTFWAD	1	Work area D
23-25	DTXRMA	3	Spanning record work area 1 (work area length of first part of overlap record)
26-28	DTXRMB	3	Spanning record work area 2 (work area length of second part of overlap record)
29	DTXIND	1	Indicator bits
2A-2E	DTXNXR	5	Disk address of current record (C/H/R/DD)
2F	DTXRES	1	Reserved (Model 12 only)
(2F)	DTXSPC	1	Number of tracks in split cylinder file (Models 4, 6, 8, and 10)
30-32	DTXIOA	3	Save area for IOB disk address
33-34	DTXDAT	2	Save area for buffer pointer from IOB

End of DTF for $$CFOP (53 bytes)

5445/Main Data Area Postopen DTF (Continued)

Disp Hex	Label	Lng Dec	Description
35-38	DTXEOF	4	Disk address of logical end of file (C/H/R/D) For direct files, relative record number of last record, in binary

End of DTF for $$CFID, $$CFUP (57 bytes)

(35-38)	DTXNXK	4	Disk address of next available key
39-3A	DTXKPR	2	Index block pointer
3B-3C	DTXKAD	2	Address of key in storage

End of DTF for $$DFIB, $$DFID, $$DFIM, $$DFIT, $$DFUB, $$DFUD, $$DFUM, $$DFUT (61 bytes)

(3B-3C)	DTXCUR	2	Address of current key (IHAD IHUA)
(3B-3C)	DTXHI	2	Address of high key (limits)
3D-3E	DTXKXA	2	Index start extent (C/H)
3F-40	DTXKBF	2	Index IOB address
41-42	DRXKL	2	Key length
43-45	KTXKXB	3	Index end extent
46-47	DTXKD	2	Displacement of key in record

End of DTF for $$IFUT, $$IHIP, $$IHUP (72 bytes)

48-49	DTXLST	2	Address of last key (IHAD IHUA)
(48-49)	DTXMIX	2	Address of core index
(48-49)	DTXLOW	2	Address of low key (limits)

End of DTF for $$IHUL, $$IHIL (74 bytes)

4A-4D	DTXKXP	4	Disk address of end of primary index (C/H/R/D)

End of DTF for $$IFAD, $$IGIP, $$IGUP, $$IGAD, $$IGUA (78 bytes)

5445/Main Data Area Postopen DTF (Continued)

Disp Hex	Label	Lng Dec	Description
4E-4F	DTXSNP	2	Save next index pointer
End of DTF for $$IHAD (80 bytes)			
50-52	DTXSLA	3	Save last address (C/H/R)
53-54	DTXSLP	2	Save last index pointer
End of DTF for $$IHUA (85 bytes)			
55	DTXSEQ	1	Sequence number of current format 1
56	DTXNXT	1	Sequence number of current volume
57	DTXF1S	1	First byte of saved format 1
96	DTXF1	1	Last byte of saved format 1
97-98	DTXAR1	2	ARR save area for EOV
99-9A	DTXXR1	2	XR1 save area for EOV
End of DTF for $$IHIM, $$IHUM, $$CFIM, $$CFOM, $$CFUM (155 bytes)			
9B-9C	DTXKEY	2	Volume high key/low key save area address Address of volume information label
End of DTF for $$IFUM, $$IHAM, $$IHBM (157 bytes)			
9D-9E	DTXTAB	2	Address of indexed MVF extent table
9F	DTXENT	1	Number of volume MSTNDX entries
A0	DTXVOL	1	Number of online indexed volumes
End of DTF for $$IGIM, $$IGUM, $$IGAM, $$IFAM, $$IGBM (161 bytes)			

1442 Preopen DTF

Disp Hex	Label	Lng Dec	Description
00	MDFDA	1	Device address: *Hex Value* *Meaning* 50 1442
01	MDFUPS	1	External indicator
02	MDFAT1	1	Attribute byte 1
03	MDFAT2	1	Attribute byte 2
04-05	MDFRLN	2	Record length
06-07	MDFCHB	2	Address of next DTF
08-0D		6	Reserved
0E-0F	MDFR12	2	Address of second read IOB
10-11	MDFRB2	2	Address of second read area
12-13	MDFU12	2	Address of second punch I/O
14-15	MDFUB2	2	Address of second punch I/O area
16		1	Reserved
17-18	MDFERP	2	Pointer to ERP
19-1A	MDFRI1	2	Address of first read IOB
1B-1C	MDFRB1	2	Address of first read I/O area
1D-1E	MDFUI1	2	Address of first punch IOB
1F-20	MDFUB1	2	Address of first punch I/O area
21-24		4	Reserved

5471 Preopen DTF

Disp Hex	Label	Lng Dec	Description
00	DTFDEV	1	Device address: *Hex Value* *Meaning* 10 Printer keyboard

5471 Preopen DTF (Continued)

Disp Hex	Label	Lng Dec	Description
01	DTFUPS	1	External indicator
02-03	DTFATR	2	Attributes
04-05	DTFCHA	2	Record length
06-07	DTFCHB	2	Address of next DTF
08-09	DTFARR	2	ARR save area (return address)
0A-0B	DTFXRS	2	XR1 save area (contents of object program XR1)
0C-15		11	Reserved

5424 Postopen DTF

Disp Hex	Label	Lng Dec	Description
00	MDFDEV	1	Device address (first 5 bits of Q code): *Hex Value* — *Meaning* F0 — Primary hopper F8 — Secondary hopper
01	MDFUPS	1	External indicator
02	MDFAT1	1	Attribute byte 1: *Hex Value* — *Meaning* 80 — Input 40 — Output 08 — Print
03	MDFAT2	1	Attribute byte 2: *Hex Value* — *Meaning* 80 — End of file on last read 40 — File allocated 08 — Dual I/O areas 04 — Hopper used as system input device 02 — /& read on last input operation 01 — File is opened

5424 Postopen DTF (Continued)

Disp Hex	Label	Lng Dec	Description
04-05	MDFCHA	2	Backward chain pointer
06-07	MDFCHB	2	Forward chain pointer
08-09	MDFARR	2	ARR save area (return address)
0A-0B	MDFXR1	2	XR1 save area (contents of object program XR1)
0C-0D	MDFLRA	2	Logical record address
0E	MDFCMP	1	Completion code: *Hex Value* — *Meaning* 42 — End-of-file indicator 41 — Abnormal condition 40 — Normal completion
0F	MDFOPR	1	Operation: *Hex Value* — *Meaning* 80 — Read 40 — Print 20 — Punch 10 — Move (deferred operation)
10	MDFSTS	1	Print 4 lines if hex 20 Stacker selection: *Hex Value* — *Meaning* 07 — Stacker 3 06 — Stacker 2 05 — Stacker 1 04 — Stacker 4
11	MDFQ	1	Q code (device address)
12	MDFR	1	R code
13		1	Reserved
14-16	DFWLA	3	Work area
17-18	MDFSVA	2	Address of 15-byte permanent save area
19-1A	MDFERP	2	Pointer to ERP

5424 Postopen DTF (Continued)

Disp Hex	Label	Lng Dec	Description
1B-1C	MDFRIO	2	Address of current read IOB
1D-1E	MDFUIO	2	Address of current punch IOB (not referenced)
1F-20	MDFPUB	2	Address of current punch I/O area
21-22	MDFPTB	2	Address of print IOB
23	MDFPTL	1	Print buffer length (not referenced)
24	MDFPUL	1	Punch buffer length (not referenced)

1442 Postopen DTF

Disp Hex	Label	Lng Dec	Description
00	FDFDEV	1	Device address (first 5 bits of Q code): *Hex Value* *Meaning* 50 1442
01	FDFUPS	1	External indicator
02	FDFAT1	1	Attribute byte 1: *Hex Value* *Meaning* 80 Input 40 Output
03	FDFAT2	1	Attribute byte 2: *Hex Value* *Meaning* 08 Dual I/O areas 02 /& read on last print operation 01 File is opened
04-05	FDFCHA	2	DTF chain pointer A
06-07	FDFCHB	2	DTF chain pointer B
08-09	FDFARR	2	ARR save area (return address)
0A-0B	FDFXR1	2	XR1 save area (contents of object program XR1)

1442 Postopen DTF (Continued)

Disp Hex	Label	Lng Dec	Description
0C-0D	FDFLRA	2	Logical record address
0E	FDFCMP	1	Completion code: *Hex Value* — *Meaning* 42 — End of file 41 — Abnormal condition 40 — Normal completion
0F	FDFOPR	1	Operation: *Hex Value* — *Meaning* 9x — Read card image 8x — Read 3x — Punch no feed 2x — Punch
10	FDFSTS	1	Stacker select: *Hex Value* — *Meaning* 06 — Stacker 2 03 — Stacker 1
11	FDFQ	1	Q code (device address)
12	FDFR	1	R code
13-16	FDFSTA	4	Work area
17-18	FDFSVA	2	Address of 9-byte permanent save area
19-1A	FDFERP	2	Pointer to ERP
1B-1C	FDFRIO	2	Current read IOB address
1D-1E	FDFUIO	2	Current punch IOB address
1F-20	FDFPUB	2	Current processing data area address
21-22	FDFPRV	2	Previous operation bytes
23-24	FDFPUL	2	Punch buffer length

5471 Postopen DTF

Disp Hex	Label	Lng Dec	Description
00	CDFDEV	1	Device address: *Hex Value* *Meaning* 10 Printer-keyboard
01	CDFUPS	1	External indicator
02	CDFAT1	1	Attribute byte 1
03	CDFAT2	1	Attribute byte 2: *Hex Value* *Meaning* 20 Halt on nonprintable characters
04-05	CDECHA	2	DTF chain pointer A
06-07	CDFCHB	2	DTF chain pointer B
08-09	CDFARR	2	ARR save area (return address)
0A-0B	CDFXR1	2	XR1 save area (contents of object program XR1)
0C-0D	CDFLRA	2	Logical record address
0E	CDFCMP	1	Completion code: *Hex Value* *Meaning* 4F Console is currently busy, request rejected 45 /& read on last read operation, request rejected 42 End of file 41 Abnormal completion 40 Normal completion 00 Operation started; a wait must be issued before another operation is requested

Disp Hex	Label	Lng Dec	Description
0F	CDFOPC	1	Operation: *Hex Value* — *Meaning* E0 — Assembler DTF, use CDFOP2 for operation code C0 — Write to operator 80 — Display 40 — Output 20 — System or assembler user, else RPG II 10 — Request key pressed before each input 02 — Exact length input 01 — Halt on nonprintable characters Ignore nonprintable characters, else halt
10	CDFCT1	1	Count of bytes in first area
11	CDFCT2	1	Count of bytes in second area. Data management puts in the actual length for the operation performed
12	CDFSPC	1	Space command
13-14	CDFIO2	2	Input buffer address. Same as CDFLRA for assembler. The last byte of the buffer should not be the last byte of the user's program
15	CDFOP2	1	Second operation byte (assembler only; not used by RPG II): *Hex Value* — *Meaning* 80 — Input 40 — Output C0 — Write to operator with reply 08 — Return without waiting 04 — Check and return if not complete, else wait

5203/1403 Preopen DTF (Model 12 Only)

Disp Hex	Label	Lng Dec	Description
00	PDFDEV	1	Device address: *Hex Value* — *Meaning* E8 — Right carriage E0 — Left carriage
01	PDFUPS	1	External indicator
02	PDFAT1	1	Attribute byte 1
03	PDFAT2	1	Attribute byte 2
04-05	PDFCHA	2	Record length
06-07	PDFCHB	2	Address of next DTF
08-15		14	Reserved
16-17	PDFIOB	2	Address of current IOB
18	PDFLP	1	Lines per page
19	PDFPCT	1	Reserved
1A	PDFOFL	1	Overflow line number
1B	PDFMSK	1	Maximum skip value
1C	PDFPGS	1	Reserved
1D-1E	PDFPRA	2	Address of current I/O area
1F-20	PDFRCL	2	Reserved

5203/1403 Preopen DTF (Models 8 and 10)

Disp Hex	Label	Lng Dec	Description
00-0D		Same as 5203/1403 preopen DTF (Model 12)	
0E-1B	PDFR2	14	Reserved
1C-1D	PDFPB1	2	Address of first IOB
1E-1F	PDFPR1	2	Address of first I/O area
20		1	Reserved

5203/1403 Preopen DTF (Models 8 and 10) (Continued)

Disp Hex	Label	Lng Dec	Description
21	PDFPOV	1	Overflow line
22	PDFPNL	1	Maximum number of lines
23-24	PDFPSV	2	Address IOS/ERP permanent save area

5203/1403 Postopen DTF/IOB (Models 8 and 10)

Note: The printer IOB starts at disp hex 14 into the DTF.

Disp Hex	Label	Lng Dec	Description
00-13			Same as 5203/1403 postopen DTF (Model 12)
(14)	PDFQ	1	Q code (device address)
(15)	PDFR	1	R code (control information)
16	PDFSTA	1	IOS status/completion byte: *Hex Value* — *Meaning* 20 — Wait 08 — Overflow 04 — Halt for unprintable character 02 — Unprintable character detected 01 — Abnormal condition
17-18	PDFSVA	2	IOS/ERP permanent save area
19-1A	PDFSNS	2	Device status and carriage location
1B	PDFWKA	1	Work area
1C-1D	PDFERP	2	Pointer to ERP
1E-1F	PDFIOB	2	Address of buffer associated IOB
20-21	PDFPRA	2	Address of current I/O area
22	PDFLRL	1	Logical record length
23	PDFOFL	1	Overflow line
24	PDFPCT	1	Position counter

5203/1403 Postopen DTF (Model 12)

Disp Hex	Label	Lng Dec	Description
00	PDFDEV	1	Device address: *Hex Value* *Meaning* E8 Right carriage E0 Left carriage
01	PDFUPS	1	Extended indicator
02	PDFAT1	1	Attribute byte 1
03	PDFAT2	1	Attribute byte 2: *Hex Value* *Meaning* 40 File allocated 08 Dual I/O areas 02 Halt for unprintable characters 01 File opened
04-05	PDFCHA	2	Backward chain pointer
06-07	PDFCHB	2	Forward chain pointer
08-09	PDFARR	2	ARR save area (return address)
0A-0B	PDFXR1	2	XR1 save area (contents of object program XR1)
0C-0D	PDFLRA	2	Logical record address
0E	PDFCMP	1	Completion code: *Hex Value* *Meaning* 48 Overflow 41 Abnormal condition 40 Normal condition
0F	PDFOPR	1	Operation code: *Hex Value* *Meaning* 40 Print operation code 00 No print requested
10	PDFSKB	1	Skip before indicator
11	PDFSPB	1	Space before indicator

5203/1403 Postopen DTF (Model 12) (Continued)

Disp Hex	Label	Lng Dec	Description
12	PDFSKA	1	Skip after indicator
13	PDFSPA	1	Space after indicator
14	PDFQ	1	Q code (device address)
15	PDFR	1	R code (control information)
16-17	PDFIOB	2	Address of current IOB
18	PDFLP	1	Lines per page
19	PDFPCT	1	Position counter
1A	PDFOFL	1	Overflow line number
1B	PDFMSK	1	Maximum skip value
1C	PDFPGS	1	Page size save area
1D-1E	PDFPRA	2	Address of current I/O area
1F	PDFRCL	1	Logical record length
20	PDFXXX	1	Reserved

3741 Preopen DTF

Disp Hex	Label	Lng Dec	Description
00	DTFDEV	1	Device code: *Hex Value* — *Meaning* 40 — 3741
01	DTFUPS	1	External indication
02-03	DTFATR-1	2	Attribute byte 1: *Hex Value* — *Symbol* — *Meaning* 40 — ATRCON — Consecutive 08 — ATRIN — Input 04 — ATROUT — Output

3741 Preopen DTF (Continued)

Disp Hex	Label	Lng Dec	Description
02-03 (continued)	DTFATR-1	2	Attribute byte 2:

Hex Value	*Symbol*	*Meaning*
08	ATRDB	Multiple buffer

Disp Hex	Label	Lng Dec	Description
04-05	DTFCHA	2	Record length
06-07	DTFCHB	2	Next DTF
0C-0D	DTFWKB	2	Left byte logical record address
0E-0F		2	Reserved
10-11	DTFIOB	2	I/O area (record length plus hex 26 times the buffer number)
12-1E		13	Reserved
1F	DTFNAM	8	Filename

3741 Postopen DTF

Disp Hex	Label	Lng Dec	Description
00	DTFDEV	1	Device code:

Hex Value	*Meaning*
40	3741

Disp Hex	Label	Lng Dec	Description
01	DTFUPS	1	External indicators
02	DTFATR-1	1	Attribute byte 1:

Hex Value	*Symbol*	*Meaning*
40	ATRCON	Consecutive
08	ATRIN	Input
04	ATROUT	Output

3741 Postopen DTF (Continued)

Disp Hex	Label	Lng Dec	Description
03	DTFATR	1	Attribute byte 2: *Hex Value* / *Symbol* / *Meaning* 40 ATRALL DTF allocated 20 ATRSIN Device sysin 08 ATRDB Multiple buffers (data) 04 ATRAMP /& read 01 ATROPN Opened
04-05	DTFCHA	2	Backward chain address
06-07	DTFCHB	2	Forward chain address
08-09	DTFARR	2	ARR save area
0A-0B	DTFXRS	2	XR1 save area
0C-0D	DTFWKB	2	Logical record address
0E	DTFCMP	1	Completion code: *Hex Value* / *Meaning* 42 End of file 41 Permanent error 40 Successful completion
0F	DTFOPC	1	Operation code: *Hex Value* / *Meaning* 80 Get 40 Put
10-11	DTFIOB	2	Postopen address of I/O IOB
12-13	DTFPRB	2	Address of process IOB
14-15	DTFBKL	2	Block length
16-17	DTFRCL	2	Record length
18-19	DTFPTR	2	Pointer to logical record in buffer
1A-1E		5	Reserved
1F-26	DTFNAM	8	Filename

Tape Preopen DTF

Disp Hex	Label	Lng Dec	Description
00	DTFQ	1	Device address (hex 60)
01	DTFUPI	1	External indicator
02	DTFAT0	1	Attribute byte 0: *Hex Value* — *Meaning* 40 — Consecutive (always on) 10 — Multivolume file (input) 08 — Input 04 — Output 02 — Basic access method
03	DTFAT1	1	Attribute byte 1: *Hex Value* — *Meaning* C0 — Rewind 80 — Unload 40 — Leave 20 — Standard label file 10 — Local mode 08 — Multiple buffering 04 — Deferred open 02 — Force EOV call to close 01 — Opened
04-05	DTFCNA	2	Record length
06-0B		6	Reserved
0C-0D	DTFLRA	2	Address of the logical record
0E-0F		2	Reserved
10-11	DTFIO	2	Address of I/O area
12-13	DTFLIO	2	Length of I/O area
14-15	DTFBL	2	Block length (length of data buffer)
16-1B		6	Reserved

Tape Preopen DTF (Continued)

Disp Hex	Label	Lng Dec	Description
1C	DTFAT2	1	Attribute byte 2:

Hex Value	*Meaning*
FC	Record format bits
80	Fixed length
40	Variable length
20	Unblocked
10	Blocked
08	Spanned
04	ASCII format D
02	ASCII file being processed
01	DTF closed by EOV

Disp Hex	Label	Lng Dec	Description
1D-1E		2	Reserved
1F-26	DTFNME	8	Filename
27	DTFBO	1	Buffer offset (ASCII only)

Tape Postopen DTF

Disp Hex	Label	Lng Dec	Description
00	DTFQ	1	Device address (hex 60, 68, 70, 78)
01	DTFUPI	1	External indicator
02	DTFAT0	1	Attribute byte 0:

Hex Value	*Meaning*
40	Consecutive (always on)
10	Multivolume file (input)
08	Input
04	Output
02	Basic access method

Tape Postopen DTF (Continued)

Disp Hex	Label	Lng Dec	Description
03	DTFAT1	1	Attribute byte 1: *Hex Value* — *Meaning* C0 — Rewind 80 — Unload 40 — Leave 20 — Standard labeled file 10 — Locate mode 08 — Multiple buffering 04 — Deferred open 02 — Force EOV call to close 01 — Opened
04-05	DTFCNA	2	DTF backward chain pointer
06-07	DTFCNB	2	DTF forward chain pointer
08-09	DTFAR	2	ARR save area (return address)
0A-0B	DTFR1	2	XR1 save area (object program's XR1)
0C-0D	DTFLRA	2	Address of the logical record
0E	DTFCOM	1	Completion code: *Hex Value* — *Meaning* 90 — Incorrect length on input operation 70 — End of volume (output) 42 — End of file (input) 41 — Controlled cancel taken on permanent I/O error 40 — Normal completion
0F	DTFOP	1	Operation: *Hex Value* — *Meaning* 80 — Get 40 — Put
10-11	DTFIO	2	Address of current I/O IOB
12-13	DTFCPR	2	Address of current process IOB
14-15	DTFBL	2	Block length (length of data buffer)

Tape Postopen DTF (Continued)

Disp Hex	Label	Lng Dec	Description
16-17	DTFMRL	2	Maximum record length[1]
18-19	DTFBIX	2	Block index[1]
1A-1B	DTFCRL	2	Current record length
1C	DTFAT2	1	Attribute byte 2:

Hex Value	Meaning
FC	Record format bits
80	Fixed length
40	Variable length
20	Unblocked
10	Blocked
08	Spanned
04	ASCII format D
02	ASCII file being processed
01	DTF closed by EOV

Disp Hex	Label	Lng Dec	Description
1D	DTFHTC	1	Halt code for error transient
1E	DTFF1#	1	SWA format 1 number
1F-20	DTFWRA	2	Work area A (block length counter for variable-length records)[1]
21-22	DTFWRB	2	Work area B (buffer offset for ASCII)[1]
23-24	DTFWRC	2	Work area C (block count)[1]
25-26	DTFWRD	2	Work area D (block count save area)[1]
27	DTFIDR	1	Indicator bits:

Hex Value	Meaning
80	CPR IOB has not been waited on
40	Truncated block
20	Empty variable length block
10	EOV call to close
08	$$CTVE encountered error reading trailer label
04	Trailer label to be written

[1] These positions are not used in the postopen basic DTF.

How to Find the BSC DTF, IOB, Work Area

To locate BSC DTFs and IOBs in a dump, scan the EBCDIC translation of the dump for the characters WKA. These characters denote the beginning of the BSC work area. The first 21 bytes of the BSC work area contain the BSC delay IOB. Bytes 20 and 21 of the BSC delay IOB contain the address of the active BSC DTF (provided BSC has been used). This DTF contains chaining addresses to other BSC DTFs as well as the address of the BSC IOB in process.

BSC Preopen DTF

Disp Hex	Lng Dec	Description
00	1	Device
01	1	UPSI: U1-U8, customer controlled program switches: *Hex Value* — *Meaning* 80 — U8 40 — U7 20 — U6 10 — U5 08 — U4 04 — U3 02 — U2 01 — U1
02-03	2	Attributes
04-0F	12	Reserved
10-11	2	Address of lead graphics characters
12	1	Length of lead graphics characters
13-14	2	Poll select characters or address of dial number
15	1	Length of dial number
16-17	2	Address of receive ID field
18	1	Length of receive ID field
19-1A	2	Address of send ID field
1B	1	Length of send ID field
1C-1D	2	Wait time: maximum time BSC waits for customer program
1E-1F	2	Record length
20-21	2	Block length

BSC Preopen DTF (Continued)

Disp Hex	Lng Dec	Description
22-23	2	Address of the first byte in the BSC I/O area
24-25	2	Address of the last byte in the BSC I/O area
26-27	2	Reserved
28	1	Permanent error indicator mask
29-2A	2	Address of permanent error indicator
2B	1	Record available indicator mask
2C-2D	2	Address of record available indicator
2E-30	4	Reserved

BSC Postopen DTF (RPG II)

Disp Hex	Label	Lng Dec	Description
00	DTFDEV	1	Device ID: *Hex Value* — *Meaning* 88 — BSCA 2/ICA/LDA/locally attached work station 80 — BSCA 1
01	DTFUPS	1	UPSI: U1-U8, user controlled program switches
02	DTFATT	1	File attributes: *Hex Value* — *Symbol* — *Meaning* C0 — CONV — Conversational file 80 — INPUT — Input file 40 — OUTP — Output file 20 — ITBBIT — ITB mode 10 — TRANSP — Transparent mode 08 — GET — Primary receive file 04 — ATTCOD — ASCII code 02 — ATT78 — Remove 2770 or 2780 01 — ATTASM — Assembler user

BSC Postopen DTF (RPG II) (Continued)

Disp Hex	Label	Lng Dec	Description
03	DTFATR	1	File attributes:

Hex Value	*Symbol*	*Meaning*
88	MPCTL	Multipoint control station
80	MPOINT	Multipoint line
40		DTF allocated
20	MANUAL	Manual line
10	ANSWER	Answer line
08	SWLINE	Switched line
04	FILUSD	File used
02	FILEAC	File active
01	FILOPN	File opened

Disp Hex	Label	Lng Dec	Description
04-05	DTFCHN	2	Backward chain pointer
06-07	DTFNXT	2	Forward chain pointer
08-09	DTFWK1	2	Work area (XR1 save area)
0A-0B	DTFWK2	2	Work area 2 (XR2 save area)
0C-0D	DTFWKB	2	Address of user logical buffer
0E	DTFCMP	1	Completion code:

Hex Value	*Symbol*	*Meaning*
4F	PRMER	Permanent error
4B	ASCERR	Invalid ASCII character
46	CRPEND	Conversational reply received
43	NONTRY	Invalid ID
42	EOTRCV	End of file
40	DONE	Normal completion

Disp Hex	Label	Lng Dec	Description
0F	DTFOP	1	Operation code:

Hex Value	*Symbol*	*Meaning*
80	DMGETO	Get operation
40	DMPUTO	Put operation

Disp Hex	Label	Lng Dec	Description
10-12		3	Reserved
13-14	DTFDCH	2	Address of dial number for switched line
(13-14)	DTFPSC	2	Poll/address characters for multipoint line

BSC Postopen DTF (RPG II) (Continued)

Disp Hex	Label	Lng Dec	Description
15	DTFDCC	1	Number of dial characters for switched line
16-17	DTFRID	2	Address of receive ID character or switched ID parameter list for switched line (Must be a valid address)
18	DTFRC	1	Number of receive ID characters (Must be zero if no ID)
19-1A	DTFSID	2	Address of send ID character for switched line (Must be a valid address)
1B	DTFSC	1	Number of send ID characters or entry selector
1C-1D	DTFDLY	2	Wait time allowed BSC between block transmissions
1E-1F	DTFREL	2	Record length
20-21	DTFBKL	2	Block length
22-23	DTFIOB	2	Address of IOB in process
24-25	DTFBKX	2	Pointer to data in BSC buffer
26-27	DTFITB	2	ITB character count
28-2A	DTFPRM	3	Permanent error indicator mask and displacement. First byte is mask; next 2 bytes are address. Address must be valid. Mask must be zero if not used
2B-2D	DTFRVI	3	Record available indicator mask and displacement. First byte is mask; next 2 bytes are address. Address must be valid. Mask must be zero if not used
2E	DTFNDX	1	Index for line initialization
2F-30	DTFWKA	2	Address of BSC work area
31-32	DTFCS	2	Disk address of first line initialization load

Disp Hex	Label	Lng Dec	Description
33	DTFDED	1	Indicator byte for IBM 2770 and IBM 2780:

Hex Value	*Symbol*	*Meaning*
10	EMREC	IBM 2780 transmitting variable-length records; EM character is the last byte of a record
08	SPABE4	Space before
04	RETURN	Transparent return
02	SPTRAN	Space for transparency
01	SPONLY	Space only

Disp Hex	Label	Lng Dec	Description
34	DTFDVI	1	Device attribute for an IBM 2770 or IBM 2780:

Hex Value	*Symbol*	*Meaning*
80	RT2780	IBM 2780
40	RT2770	IBM 2770
20	SELDC2	SELDC1 on, SELDC2 off —DC1 (output channel 1) SELDC1 off, SELDC2 on —DC2 (output channel 2) SELDC1 on, SELDC2 on —DC3 (output channel 3) SELDC1 off, SELDC2 off —(optional output channel)
10	SELDC1	Output channel for IBM 2770
04	SPACEA	Spacing allowed
02	PRNT78	Print
01	PNCH78	Punch

Disp Hex	Label	Lng Dec	Description
35	DTFSKB	1	Skip before (2770/2780)
36	DTFSPB	1	Space before (2770/2780)
37	DTFSKA	1	Skip after (2770/2780)
38	DTFSPA	1	Space after (2770/2780)
39	DTFCUR	1	Current line count (2770/2780)

BSC Postopen DTF (RPG II) (Continued)

Disp Hex	Label	Lng Dec	Description
3A	DTFNUM	1	Number of form lines (2770/2780)
3B	DTFOVF	1	Overflow line number (2770/2780)
3C	DTFMAX	1	Maximum number of records per buffer (2770/2780)

BSC Postopen DTF (non-RPG II)

Disp Hex	Label	Lng Dec	Description
00	DTFDEV	1	Device ID
01	DTFUPS	1	UPSI: U1-U8 user-controlled program switches
02	DTFATT	1	Attribute byte 1:

DTFDEV device ID values:

Hex Value	*Meaning*
88	BSCA 2/ICA/LDA/locally attached work station
80	BSCA 1

DTFATT attribute byte 1 values:

Hex Value	*BSC IOS Label*	*Assembler Macro Label*	*Meaning*
C0	CONB	$BCCNV	Conversational file
80	INPUT	$BCINP	Input file
40	OUTP	$BCOUT	Output file
20	ITBBIT	$BCITB	ITB mode
10	TRANSP	$BCRAN	Transparent mode
08	GET	$BCGET	Get file
02	ATTCOD	$BCASK	ASCII file
01	ATTASM	$BCASM	Macro assembler DTF

BSC Postopen DTF (non-RPG II) (Continued)

Disp Hex	Label	Lng Dec	Description
03	DTFATR	1	Attribute byte 2:
04-05	DTFCHN	2	Chaining pointer to postopen DTFs
06-07	DTFNXT	2	Chaining pointer to next DTF, preopen or postopen
08-09	DTFWK1	2	Work area for MLMP routines
0A-0B	DTFWK2	2	Work area for MLMP routines
0C-0D	DTFWKB	2	Address of user's logical buffer
0E	DTFCMP	1	Completion codes:

Attribute byte 2 (DTFATR):

Hex Value	*BSC IOS Label*	*Assembler Macro Label*	*Meaning*
88	MPCTL	$BCMCN	Control station
80	—	$BCMPT	Tributary station
40	MPOINT	—	DTF allocated
20	MANUAL	$BCMAN	Manual line
10	ANSWER	$BCANS	Answer line
08	SWLINE	$BCSWI	Switched line
04	FILUSD	$BCUSD	File used
02	FILEAC	$BCACT	File active
01	FILOPN	$BCOPN	File opened

Completion codes (DTFCMP):

Hex Value	*BSC IOS Label*	*Assembler Macro Label*	*Meaning*
58	—	$BCRLE	Maximum record length exceeded
57	—	$BCACD	No active DTFs in check list
56	—	$BCCMP	No completion in check list
55	CMPADP	$BCADP	Adapter check
54	CMPRSP	$BCRSP	Invalid response received
53	CMPCON	$BCCON	Lost connection
52	CMPLOS	$BCLOS	Lost data or no record separator found in two blocks
51	CMPDC	$BCDAT	Data check
50	CMPTIM	$BCTIM	No response from remote device

BSC Postopen DTF (non-RPG II) (Continued)

Disp Hex	Label	Lng Dec	Description			
			Hex Value	*BSC IOS Label*	*Assembler Macro Label*	*Meaning*
0E (continued)			4F	PRMER	$BCERR	No permanent error
			4E	LSTCNT	$BCLST	Delay count (DLYCT in $DTFG) exceeded
			4D	INVCAL	$BCCAL	Invalid request
			4C	NOCON	$BCNCN	No connection
			4B	ASCERR	$BCASC	Invalid ASCII character
			4A	CMPIGN	$BCIGN	Request ignored
			49	NOACTV	$BCNAC	No active entry in polling list
			48	CMPOLT	$BCOLT	Invalid SRFT (request for online test)
			47	NODATA	$BCNDT	No data for conversational get (null message received)
			46	CRPEND	$BCCRP	Conversational reply pending
			45	NORSP	$BCNON	No response to poll/address
			44	NEGRES	$BCNEG	Negative response to poll/address
			43	NONTRY	$BCBID	Invalid ID
			42	EOTRCB	$BCEOT	End of file
			41	CMPUER	$BCUER	User error
			40	DONE	$BCDNE	Normal completion
			00	OPACC	$BCREQ	Request accepted
0F	DTFOP	1	Operation code:			
			Hex Value	*BSC IOS Label*	*Assembler Macro Label*	*Meaning*
			81	CMGETB	$BOGBK	Get a block
			80	DMGETO	$BOGET	Get
			44	PUTEOW	$BOPEW	Put EOT to WACK response
			42	PUTEOF	$BOPEF	Put end of file
			41	PUTEOB	$BOPEB	Put end of block
			40	DMPUTO	$BOPUT	Put

Disp Hex	Label	Lng Dec	Description
10-11	DTFMRL	2	Save area for maximum record length
(10-11)	DTFLGR		RJE save area:
12	DTFADD	1	

Hex Value	*BSC IOS Label*	*Meaning*
80	ADSWID	Switched ID list is being used
20	FILOPD	File has been opened
10	EOBTWO	End-of-block indicator
08	SPNRCL	Span indicator for record length
04	MAXOFL	Truncate record indicator
02	POL1ST	First time poll resident indicator
01	ADARA1	First add-on area included

Disp Hex	Label	Lng Dec	Description
13-14	DTFDCH	2	Address of dial number if this is a switched line
(13-14)	DTFPSC	2	Polling/addressing characters if this is for a tributary station
(13-14)	DTFLST		Address of polling/addressing list if this is for a control station
15	DTFDCC	1	Length of dial number if this is for a switched line
(15)	DTFID	1	Polling/addressing list entry ID if this is for a control station
16-17	DTFRID	2	Address of receive ID field or switched ID parameter list if this is for a switched line
(16-17)	DTFWCT	2	List count (number of times to go through a polling list when all responses are negative) if this is for a control station
18	DTFRC	1	Length of receive ID field, or entry selector
(18)	DTFLID	1	Last polling/addressing ID or last polling/addressing function (hex F0 or F1)
19-1A	DTFSID	2	Address of send ID field
1B	DTFSC	1	Length of send ID field
1C-1D	DTFDLY	2	Delay count (DLYCT in $DTFB)

BSC Postopen DTF (non-RPG II) (Continued)

Disp Hex	Label	Lng Dec	Description
1E-1F	DTFREL	2	Record length
20-21	DTFBKL	2	Block length
22-23	DTFIOB	2	Address of IOB in process
24-25	DTFBKX	2	Pointer to data in BSCA buffer
26-27	DTFITB	2	ITB character count
28-2A	DTFPRM	3	Reserved
2B-2D	DTFRVI	3	RVI (reverse interrupt request) mask and displacement. First byte is mask; next 2 bytes are address. Address must be valid. Mask must be zero if not used
2E	DTFNDX	1	Index for line initialization
2F-30	DTFWKA	2	Address of BSCA work area
31-32	DTFCS	2	Disk address of line initialization module
33	DTFDED	1	Work area for MLMP routines
34	DTFAT1	1	Terminal attribute byte:

Hex Value	*BSC IOS Label*	*Assembler Macro Label*	*Meaning*
40	POLRES	$BCPLR	Polling resident
10	RESTOR	$BCRES	Restore after spanning
08	PUT	$BCPUT	PUT span file
04	SPANOW	$BCNOW	Spanning in process
02	SPAN	$BCSPN	Spanned records used
01	RESP	$BCSEP	Record separator used

Disp Hex	Label	Lng Dec	Description
35	DTFSEP	1	Record separator character
36-37	DTFSBF	2	Save area for user's logical buffer address
38-39	DTFSRL	2	Save area for record length
3A-3B	DTFRFT	2	Save area for address of online test parameter list
3C-3D	DTFLTS	2	Address of terminal statistics logging area

BSC Postopen DTF (non-RPG II) (Continued)

Disp Hex	Label	Lng Dec	Description

The following are in the DTF only if main storage resident polling, auto response, or user error retry count are being used:

3E-3F	DTFRLO	2	Storage resident line initialization
40-41	DTFRCL	2	Storage resident close
42-43	DTFARA	2	Auto response module $$BSMD
44	DTFERR	1	Retry count
45-46	DTFT1A	2	Save area of online test cylinder/sector

5496 Preopen and Postopen DTF

Disp Hex	Label	Lng Dec	Description
00	MDFQ	1	Device address (hex F1)
01	MDFUPS	1	External indicator
02-03	MDFATT	2	File attribute byte 1: *Hex Value* — *Meaning* 80 — Input 40 — Output File attribute byte 2: *Hex Value* — *Meaning* 08 — Dual I/O 01 — File open
04-05	MDFCHA	2	DTF chain address A
06-07	MDFCHB	2	DTF chain address B
08-09	MDFARR	2	ARR save area (return address)
0A-0B	MDFXR1	2	XR1 save area
0C-0D	MDFREC	2	Address of record

5496 Preopen and Postopen DTF (Continued)

Disp Hex	Label	Lng Dec	Description
0E	MDFCOM	1	Completion code: *Hex Value* — *Meaning* 42 — End of file (/* or /&) 41 — Controlled cancel 40 — Complete without error
0F	MDFOP	1	Operation code: *Hex Value* — *Meaning* 80 — Read 20 — Punch 00 — Wait on punch
10	MDFQB	1	Q code (read or punch)
11	MDFR	1	R code

Preopen DTF Only

Disp Hex	Label	Lng Dec	Description
12-13	MPDFB2	2	Address of IOB 2
14-15	MPDFA2	2	Address of I/O area 2
16-17	MPDFB1	2	Address of IOB 1
18-19	MPDFA1	2	Address of I/O area 1
1A-1D		4	Reserved

Postopen DTF Only

Disp Hex	Label	Lng Dec	Description
(12-13)	MDFSNS	2	Sense area
(14)	MDFSTA	1	ERP status information: *Hex Value* — *Meaning* 80 — ERP in process
(15-16)	MDFSVA	2	ERP call ARR save area
(17)	MDFWKA	1	Work area
(18-19)	MDFRIO		Current read IOB address

Disp Hex	Label	Lng Dec	Description
(1A-1B)	MDFDMA	2	Data management routine address (C/S)
(1C-1D)	MDFPUB	2	Punch I/O address

Models 4 and 6 Keyboard Preopen and Postopen DTF

Disp Hex	Label	Lng Dec	Description
00	KDFQ	1	Device address hex 12
01	KDFUPS	1	External indicator
02-03	KDFATT	2	File attribute byte 1: *Hex Value* — *Meaning* 80 — Input File attribute byte 2: *Hex Value* — *Meaning* 80 — Recall $$SLK0 40 — Dup allowed 20 — World Trade use 10 — Console support 08 — 1-byte print to printer ERP 02 — World Trade use 01 — File open DTF chain address A DTF chain address B ARR save area (return address) XR1 save area Address of field Completion code: *Hex Value* — *Meaning* 41 — Controlled cancel 40 — Complete without errors
0F	KPDFRL	1	Record length (preopen only)

Models 4 and 6 Keyboard Preopen and Postopen DTF (Continued)

Disp Hex	Label	Lng Dec	Description
(0F)	KDFOP	1	Operation code (postopen only):

Hex Value	*Meaning*
C1	Manual mode on primary and secondary
81	Manual mode on primary
41	Manual mode on secondary
2C	Blind key R field
2A	Display R field
10	Turn off command key lights
0C	Blind key numeric field
0A	Display numeric field
04	Blind key alpha field
02	Display

Disp Hex	Label	Lng Dec	Description
10	KDFFL	1	Field length for display and blind key element return position manual mode
11	KDFFLM	1	Field light mask
12-13	KDFCKM	2	Allowed command key mask byte 1:

Hex Value	*Meaning*
80	Command key 16
40	Command key 15
20	Command key 14
10	Command key 13
08	Command key 12
04	Command key 11
02	Command key 10
01	Command key 9

Allowed command key mask byte 2:

Hex Value	*Meaning*
80	Command key 8
40	Command key 7
20	Command key 6
10	Command key 5
08	Command key 4
04	Command key 3
02	Command key 2
01	Command key 1

Disp Hex	Label	Lng Dec	Description
14-15	KDFTTA	2	Address of tab table (manual mode only)

Models 4 and 6 Keyboard Preopen and Postopen DTF (Continued)

Disp Hex	Label	Lng Dec	Description
16-17	KDFCLM	2	Keyed command key mask byte 1: *Hex Value* — *Meaning* 80 — Command key 16 40 — Command key 15 20 — Command key 14 10 — Command key 13 08 — Command key 12 04 — Command key 11 02 — Command key 10 01 — Command key 9 Keyed command key mask byte 2: *Hex Value* — *Meaning* 80 — Command key 8 40 — Command key 7 20 — Command key 6 10 — Command key 5 08 — Command key 4 04 — Command key 3 02 — Command key 2 01 — Command key 1
18-19	KDFPIO	2	Address of associated printer IOB
1A-1B	KDFKMA	2	Data management routine address (C/S)
1C	KDFPOS	1	Internal work area
1D-1E	KDFBF2	2	Second buffer address for duplication

Model 6 Console Preopen and Postopen DTF

Disp Hex	Label	Lng Dec	Description
00	XDFQ	1	Device address hex 12
01	XDFUPS	1	External indicators

Model 6 Console Preopen and Postopen DTF (Continued)

Disp Hex	Label	Lng Dec	Description
02	XDFATT	1	Attribute byte 1: *Hex Value* — *Meaning* 80 — Input 40 — Output
03	XDFATT	1	Attribute byte 2: *Hex Value* — *Meaning* 10 — Console support 02 — World Trade use 01 — File open
04-05	XDFCHA	2	DTF chain address A
06-07	XDFCHB	2	DTF chain address B
08-09	XDFARR	2	ARR save area (return address)
0A-0B	XDFXR1	2	XR1 save area
0C-0D	XFDREC	2	Address of field
0E	XDFCOM	1	Completion code: *Hex Value* — *Meaning* 42 — End of file (/* or /&) 41 — Controlled cancel 40 — Normal completion
0F	KPDFRL	1	Record length (preopen DTF only)
(0F)	XDFOP	1	Operation code: *Hex Value* — *Meaning* C0 — Write to operator with reply 80 — Input 40 — Output 02 — Operator must key exact number of characters

Model 6 Console Preopen and Postopen DTF (Continued)

Disp Hex	Label	Lng Dec	Description
10	XDFLN1	1	Length of input or output
11	XDFLN2	1	Length of reply on WTOR
12	XDFSPC	1	Space before (bits 0-3) or space after (bits 4-7)
13-14	XDFADR	2	Address of I/O area
15-19	XDFFLG	5	Parameter list build area
1A-1B	XDFDMA	2	Data management C/S address
1C-1D	XDFSVA	2	Save area

2265 Preopen and Postopen DTF

Disp Hex	Label	Lng Dec	Description
00	CDFQ	1	Device address hex 90
01	CDFUPS	1	External indicator
02-03	CDFATT	1	Attributes
04-05	CDFCHA	2	Chain pointer A
06-07	CDFCHB	2	Chain pointer B
Preopen DTF Only			
08-13		12	Reserved
14-15	CDFBFA	2	Address of I/O area
16-1D		8	Reserved
Postopen DTF Only			
(08-09)	CDFARR	2	ARR save area (return address)
0A-0B	CDFXR1	2	XR1 save area
0C-0D	CDFREC	2	Record address

2265 Preopen and Postopen DTF (Continued)

Disp Hex	Label	Lng Dec	Description
0E	CDFCOM	1	Completion code: *Hex Value* — *Meaning* 41 — Errors cancel 40 — Normal
0F	CDFOP	1	Operation code: *Hex Value* — *Meaning* 40 — Display
10	CDFSKB	1	Blank screen command (hex 01)
11	CDFSPB	1	Space before count (leftmost 4 bits)
12	CDFSPA	1	Space after count (leftmost 4 bits)
13	CDFRLE	1	Input data length
14-15	CDFBFA	2	Buffer start address
16-17	CDFNXL	2	Line count
18-19	CDFBFE	2	Buffer and address
1A-1B	CDFDMA	2	C/S address of $$SLTO
1C-1D	CDFSNS	2	Status sense area

Ledger Card Device Preopen and Postopen DTF

Disp Hex	**Label**	**Lng Dec**	**Description**
00	LDFQ	1	Device address hex E9
01	LDFUPS	1	External indicator
02	LDFTYP	1	Attribute byte 1: *Hex Value* — *Meaning* C0 — Combined 80 — Input 40 — Output 20 — Carbon copy tractor 2 10 — Overflow process switch 08 — Index pending indicator

Ledger Card Device Preopen and Postopen DTF (Continued)

Disp Hex	Label	Lng Dec	Description
03	LDFATT	1	Attribute byte 2:
			Hex Value *Meaning*
			08 Last print line in use
			01 File is opened
04-05	LDFCHA	2	DTF chain pointer A
06-07	LDFCHB	2	DTF chain pointer B
08-09	LDFARR	2	ARR save area (return address)
0A-0B	LDFXRL	2	XR1 save area
0C-0D	LDFREC	2	Record address. Write ID; start address of user's ID field. Print, start address of data buffer
0C-0D			Completion code:
			Hex Value *Meaning*
			48 Card overflow
			41 Abnormal condition
			40 Normal completion
0F	LDFOP	1	Operation code:
			Hex Value *Meaning*
			80 Read
			40 Print
			20 Write ID
10	LDFSPA	1	Index after print count:
			Hex Value *Meaning*
			80 Eject command code
			01-09 Index after count
			00 No indexing

Ledger Card Device Preopen and Postopen DTF (Continued)

Disp Hex	Label	Lng Dec	Description
11	LDFIDP	1	ID write pending indicator: *Hex Value* — *Meaning* 14 — ID pending; write ID command given 00 — No ID pending
12	LDFPOS	1	Start print position
13	LDFRLE	1	Record length (length of print line)
14-15	LDFIOL	2	LCD IOB start address
16-17	LDFLL@	2	Address of LLAR value
18-19	LDFIOP	2	Print IOB start address
1A-1B	LPDFBA	2	I/O buffer address (preopen only)
(1A-1B)	LDFDMA	2	C/S address of $$SLXO (postopen only)
1C-1D	LDFLLR	2	LLAR value (initial value is hex 110E)
1E	LDFLCR	1	LRC check parity byte for ID
1F	LDFIDB	1	Start of ID hold area
20-27	LDFIDE	2	End of ID hold area
28	LDFSWT	1	Internal switch: *Hex Value* — *Meaning* 80 — Complete ID indicator to $$SLX1 40 — Read mark check 20 — $$SLX5 return indicator 10 — Feed required by ERP 08 — $$SLX1 needed to write ID during ERP 04 — No ID compare required by ERP 02 — No card in LCD to print 01 — Reserved
29	LDFCT0	1	Internal counter byte 0
2A	LDFCT1	1	Internal counter byte 1
2B	LDFCT2	1	Internal counter byte 2
2C-2E	WRKEND	3	End of work area

Ledger Card Device Preopen and Postopen DTF (Continued)

Disp Hex	Label	Lng Dec	Description
2F-30	LDFONE	2	Constant hex 0001
31	LDFSN1	1	Sense byte 1
32	LDFSNS	1	Sense byte 2
33	ELMLOC	1	Print element location save
34-35	LDFWRK	2	Secondary load save area
36	LDFPRT	1	Print element location save area

5213/2222 Preopen and Postopen DTF

Disp Hex	Label	Lng Dec	Description
00	BDFQ	1	Device address: *Hex Value* — *Meaning* E1 — Primary tractor E2 — Secondary tractor
01	BDFUPS	1	External indicator
02-03	BDFATT	2	File attributes: *Hex Value* — *Meaning* 0010 — ECS 0008 — One character print 0004 — Bidirectional 0002 — Vertical forms control 0001 — File open
04-05	BDFCHA	2	DTF chain address A
06-07	BDFCHB	2	DTF chain address B
08-09	BDFARR	2	ARR save area (return address)
0A-0B	BDFXR1	2	XR1 save area
0C-0D	BDFREC	2	Address of field or line

5213/2222 Preopen and Postopen DTF (Continued)

Disp Hex	Label	Lng Dec	Description
0E	BDFCOM	1	Completion code: *Hex Value* — *Meaning* 48 — Page overflow 41 — Controlled cancel 40 — Complete without errors
0F	BDFOP	1	Operation code: (postopen only) *Hex Value* — *Meaning* 80 — Wait 40 — Print 00 — Carriage move and tabbing
(0F)	BPDFRL	1	Record length (preopen only)
10	BDFSKB	1	Skip before (line number)
11	BDFSPB	1	Space before (1, 2, 3)
12	BDFSKA	1	Skip after (line number)
13	BDFSPA	1	Space after (1, 2, 3)
14	BDFPOS	1	Start print position
15	BDFRLE	1	Field or line length
16	BDFEPS	1	End print position
17	BDFPS	1	Internal page size
18	BDFLC	1	Internal line count
19	BDFPEL	1	Internal print element location
1A-1B	BDFDMA	2	Data management routine address (C/S)
(1A-1B)	BPDFBA	2	I/O area address
1C-1D	BDFIO1	2	Address of printer IOB
1E	BDFOVF	1	Overflow line number

Disp Hex	Label	Lng Dec	Description
1F	BDFWA1	1	Internal work area
20	BDFWA2	1	Internal work area
21	BDFWA3	1	Internal work area
22	BDFWA4	1	Internal work area

IOB

The IOB (input/output block) is the interface between the calling routine (usually data management) and IOS. The area for the IOB must be provided by the calling routine. When a branch is made to the IOS dispatcher, register 1 normally points to the IOB.

The IOBs for each device can be located via a pointer in the respective DTF. (See Figure 2-1 for IOB chaining.) The active IOBs for tape and disk can also be found indirectly through the queue via a pointer in SYSCOM.

BSC IOB

Disp Hex	Label	Lng Dec	Description
00-01	IOBNXT	2	Address of next IOB
02	IOBQ	1	SIO Q code of last operation:

Adapter 1 – Hex Value	*Adapter 2 – Hex Value*	*Symbol*	*Meaning*
84	8C	DIALOP	Auto dial
83	8B	RCVI	Receive initial
82	8A	TROP	Transmit and receive
81	89	RCVO	Receive only

Note: For more information on the BSCA instruction set, see *IBM System/3 Models 8, 10, 12, and 15 Component Reference Manual*, GA21-9236, or *IBM System/3 Models 4 and 6 Components Reference Manual*, GA34-0001.

Disp Hex	Label	Lng Dec	Description
03-04	IOBDBL	2	Data buffer length

BSC IOB (Continued)

Disp Hex	Label	Lng Dec	Description
05	IOBFLA	1	Flag byte:

Hex Value	*Symbol*	*Meaning*
80	ENQSNT	ENG has been sent
40	INVACK	Invalid ACK received
20	TDLAY	Two-second timeout started
10	LSTBLK	Indicates last block for ITB and transparent modes
08	EXCP	Execute channel program
04	FIRST	Indicates first-time logic in current file
02	DELAY	Delay IOB bit
01	TXTSNT	Data has been sent from this buffer

Disp Hex	Label	Lng Dec	Description
06	IOBFLG	1	Flag byte:

Hex Value	*Symbol*	*Meaning*
C0	CONV	Conversational file
80	INPUT	Input file
40	OUTP	Output file
20	ITBBIT	ITB mode
10	TRANSP	Transparent mode
08	GET	Primary receive file
04	ATTCOD	ASCII code
02	ATT78	Remote 2770 or 2780
01	ATTASM	RPG II assembly

BSC IOB (Continued)

Disp Hex	Label	Lng Dec	Description
07	IOBCMP	1	IOB completion code:

Hex Value	*Symbol*	*Meaning*
88	ONLINE	IOB being transmitted
84	READY	IOB ready for transmit
80	PROC	IOB in process
58	CMPRLE	Record length exceeded
55	CMPADP	Adapter check
54	CMPRSP	Invalid response from remote device
53	CMPCON	Lost connection
52	CMPLOS	Lost data
51	CMPDC	Data check
50	CMPTIM	No response from remote device
4F	PRMER	Permanent error
4E	LSTCNT	Delay count exceeded
4D	INVCAL	Invalid request
4C	NOCON	No connection
4B	ASCERR	Invalid ASCII character
4A	CMPIGN	Request ignored
49	NOACTV	No active entry in poll/address list
48	CMPOLT	Invalid request for test (RFT)
47	NODATA	No data for conversational GET (null message received)
46	CRPEND	Conversational reply pending
45	NORSP	No response to poll/address
44	NEGRES	Negative response to poll/address
43	NONTRY	Invalid ID
42	EOTRCV	End of file
41	CMPUER	Use error
40	DONE	Normal completion
00	OPACC	Request accepted

Disp Hex	Label	Lng Dec	Description
08-09	IOBDAT	2	Address of BSC data buffer

BSC IOB (Continued)

Disp Hex	Label	Lng Dec	Description
0A	IOBSNS	1	Sense area (right byte):

Hex Value	Symbol	Meaning
80	TIMOUT	Timeout error
40	DATCHK	Data check
30	ADCHK	Adapter check, receive
20	TADCHK	Adapter check, transmit
08	ASCII	Data contains invalid ASCII character
06	LSTDIS	Lost connection or disconnect
04		Abortive disconnect
02	BSCABT	Disconnect timeout

Disp Hex	Label	Lng Dec	Description
0B	IOBSNS	1	Sense area (left byte):

Hex Value	Symbol	Meaning
02	DSR	Data set ready

Disp Hex	Label	Lng Dec	Description
0C	IOBERR	1	Retry count
0D-0E	IOBCAR	2	Current address register save area
0F-10	IOBTAR	2	Transition address register save area
11-12	IOBSAR	2	Stop address register save area
13-14	IOBDTF	2	Address of associated DTF

Ledger Card Device IOB (Model 6 only)

Hex Disp	Label	Lng Dec	Description	
00	LIOLRC	1	LRC byte for ID tests	
01	LIOIDB	1	First byte of ID—Next line available location	
01	LIOLFI	(1)	Line finder mark location	
02-03	LIOID1	2	ID mark 1 location	
04-05	LIOID2	2	ID mark 2 location	
06	LIOFLG	1	Flag byte	
07-0B	LIOLFE	5	End of ID and line finder buffer	
0C	LIOCMD	—	First byte of command chain	
0C-13		8	Command	Byte
				0C 0D 0E 0F 10 11 12 13
			Eject	00 — — — — — — —
			Index	01 — — — — — — —
			Read mark and eject	02 08 — — — — — —
			Feed, read ID, and locate	03 05 04 00 05 04 06 13
			Feed, read ID, and eject	03 05 04 00 05 04 07 13

Ledger Card Device Print IOB (Model 6 only)

Disp Hex	Label	Lng Dec	Description
00	BIOQ	1	Q code
01	BIOR	1	R code
02	BIOSN1	1	Sense byte 1
03	BIOSN2	1	Sense byte 2
04	BIOSN3	1	ERP work area
05	BIOSN4	1	ERP work area
06	BIOFLG	1	Flag byte: *Hex Value* — *Meaning* 80 — Horizontal cycle check retry switch 40 — Vertical cycle check retry switch 20 — Data check or read only storage check switch 10 — Data check or read only storage retry switch 04 — ERP in operation switch 01 — Printer IOB, else LCD IOB
07	BIOCOM	1	Completion code: *Hex Value* — *Meaning* 41 — Controlled cancel 40 — Normal
08-09	BIOBFA	2	Buffer address
0A-0B	BIODTF	2	DTF address
0C-15	BIOCC	(10)	Command chain

The following is a detailed description of these 10 bytes:

0C	BIOCC1	1	Skip or space before command
0D	BIOCC2	1	Count
0E	BIOCC3	1	Tab command
0F	BIOCC4	1	Count
10	BIOCC5	1	Print command

Ledger Card Device Print IOB (Model 6 Only) (Continued)

Disp Hex	Label	Lng Dec	Description
11	BIOCC6	1	Count
12	BIOCC7	1	Skip or space after command
13	BIOCC8	1	Count
14	BIOCC9	1	Tab after command
15	BIOC10	1	Count

Model 6 Keyboard IOB (Models 4 and 6)

Disp Hex	Label	Lng Dec	Description
00	IOBQ	1	Q code
01	IOBR	1	R code
02	IOBSN1	1	Sense byte 1
03	IOBSN2	1	Sense byte 2
04	IOBCNT	1	Count of character to be read
05	IOBCRT	1	Control byte
06	IOFLG	1	Flag byte: *Hex Value* — *Meaning* 40 — Keyboard ready 08 — Numeric field 02 — 0 = Blind key; 1 = Display mode 01 — Manual mode
07	IOBCOM	1	Completion code: *Hex Value* — *Meaning* 46 — Error 45 — Buffer full 44 — Not allowed 40 — Normal
08-09	IOBUFA	2	Address of buffer
0A-0B	IODTF	2	Address of DTF

Tape IOB (Models 8, 10, and 12)

Disp Hex	Label	Lng Dec	Description
00-01	IOBCHN	2	Chain pointer used by IOS queue I/O requests. The calling routine must provide this area but need not initialize it.
02	IOBCMP	1	Completion code set by tape IOS to inform the calling routine of the requested operation's status. The calling routine checks this byte before assuming that data transfer is complete. After the wait call is complete, each bit in the byte has the following code: *Hex Value* — *Meaning* 60 — NOP condition—Check bits in IOBSNS for reason. May be retried. 50 — Wrong length record (WLR). Residual count is placed in byte count field in IOB. 45 — User took 0 option on permanent read data check halt. User wants to proceed to next record. 43 — End of tape encountered on write and permanent data check occurred on the write. 42 — Unit exception 1. Tape mark found on read or read backward. 2. End-of-tape mark encountered on a write. 41 — Permanent I/O error 40 — Successful completion Any code other than the above means the requested operation is in process or not yet complete. To ensure completion of the I/O operation, the calling routine must branch to the common IOS wait routine (storage location 12) with register 1 pointing to the IOB. The wait routine will not return control until the operation is complete and one of the above codes is posted in IOB.
03	IOBQB	1	The Q code of the start I/O (SIO) command. The calling routine must set this byte to indicate the type of operation desired.

Disp Hex	Label	Lng Dec	Description
04	IOBRB	1	The R code of the SIO command. The calling routine must set this byte when issuing a control command.
05-06	IOBBC	2	The byte count or residual count. The record length is entered in this byte before a read or write command is issued. If WLR occurs, tape IOS places the residual count in this field.
07	IOBMOD	1	The R code for the mode set SIO command. The calling routine must set this byte.
08-09	IOBDAT	2	Pointer to the leftmost byte of the calling routine's data area, for a read forward or write command, and to the rightmost byte for a read backward command.
0A-0B	IOBSNS	2	Area used by IOS to contain subsystem sense bytes 0 and 1 if an error condition occurred. (If adapter check, this field is not valid.)
0C	IOBERR	1	Used by tape IOS/ERP as a count of the number of retries used to complete an I/O request.
0D	IOBFLG	1	Contains bit indicators for special handling of I/O operations. The bit settings are:

Hex Value	*Meaning When Set to 1*
80	No ERP for data check
40	Command issued is a rewind, rewind and unload, or data security erase. This bit must be zero for any other command.
20	Return to user program. Do not log or halt for permanent error or log temporary error.
10	Disregard data on noise, and read next block.
08	No DTF for this IOB (Model 12)
(08)	Used within IOS
04	Used within IOS
02	Used within IOS
01	Used within IOS

The calling routine sets this type. The bits that it wants ignored must be set to zero.

Tape IOB (Models 8, 10, and 12) (Continued)

Disp Hex	Label	Lng Dec	Description
0E-0F	IOBARR	2	Save area for the address recall register (ARR)
10-11	IOBXR2	2	Save area for the index register 2 (XR2)
12-13	IOBDCH	2	The data management chain pointer
14-15	IOBDTF	2	Pointer to the DTF associated with the IOB

5213/2222 IOB (Models 4 and 6)

Disp Hex	Label	Lng Dec	Description

Note: 2222 is on Model 6 only.

Disp Hex	Label	Lng Dec	Description
00	BIOQ	1	Q code
01	BIOR	1	R code
02	BIOSN1	1	Sense byte 1
03	BIOSN2	1	Sense byte 2
04	BIOSN3	1	ERP work area
05	BIOSN4	1	ERP work area
06	BIOFLG	1	Flag byte:

Hex Value	*Meaning*
80	Horizontal cycle check retry switch
40	Vertical cycle check retry switch
20	Data check or read only storage check switch
10	Data check or read only storage retry switch
04	ERP in operation switch
01	Printer IOB, else LCD IOB

Disp Hex	Label	Lng Dec	Description
07	BIOCOM	1	Completion code:

Hex Value	*Meaning*
41	Controlled cancel
40	Normal

5213/2222 IOB (Models 4 and 6) (Continued)

Disp Hex	Label	Lng Dec	Description
08-09	BIOBFA	2	Buffer address
0A-0B	BIODTF	2	DTF address
0C-15	BIOCC	(10)	Command chain

The following is a detailed description of these 10 bytes:

0C	BIOCC1	1	Skip or space before command
0D	BIOCC2	1	Count
0E	BIOCC3	1	Tab command
0F	BIOCC4	1	Count
10	BIOCC5	1	Print command
11	BIOCC6	1	Count
12	BIOCC7	1	Skip or space after command
13	BIOCC8	1	Count
14	BIOCC9	1	Tab after command
15	BIOC10	1	Count
16-25	BIOEND	16	16-byte print area associated with keyboard DTF

5471 IOB (Models 8, 10, and 12)

Disp Hex	Label	Lng Dec	Description
00	IOBQ	1	Q code
01	IOBR	1	R code
02-03	IOBSNS	2	Sense bytes
04-05	IOBUFF	2	Buffer address
06	IOBCTL	1	Control byte
07	IOBFLG	1	Flag byte
08	IOBCNT	1	Number of characters in buffer
09-0A	IOBDTF	2	Pointer to DTF
0B	IOBINQ	1	Inquiry status
0C-0D	IOBSAV	2	Data management save area
0E	IOBSTS	1	IOB status byte:

Hex Value	*Meaning*
80	Return without calling
40	Check for completion on recall and return not done, else wait for completion
20	Recall
10	Assembler user
08	End of form found
07	ID of halt to be issued (set by $$STEC for $$STCI)

Disp Hex	Label	Lng Dec	Description
0F	IOBFL1	1	Second flag byte:

Hex Value	*Meaning*
80	Entered via level 1 HPL
40	Entered via level 2 HPL
20	Return carriage only (used by data management)
10	Level 2 using IH; otherwise level 1 using IH

5496 IOB (Model 6 Only)

Disp Hex	Label	Lng Dec	Description
00-01	MIODAT	2	Record area address
02	MIOFLG	1	Flag
03-04	MIODCH	2	Pointer to next IOB

5203/1403 IOB (Model 12 Only)

Disp Hex	Label	Lng Dec	Description
00-01	POBCHN	2	Chain pointer
02	POBCMP	1	Completion/status byte: *Hex Value* — *Meaning* 80 — ERP no-op indicator 40 — Operation complete 10 — Wait on buffer end 08 — IOB waited on 02 — Operation started 01 — Abnormal condition
03	POBQB	1	Q code of SIO
04	POBRB	1	R code of SIO
05	POBFLG	1	Flag byte: *Hex Value* — *Meaning* 80 — Second execute indicator 40 — First execute indicator 20 — DFC supported 10 — Do a LIO to LPFLR (forms length register) 08 — Do not spool intercept; this IOB is from the spool writer 04 — Halt for unprintable character 02 — Unprintable character detected
06-07	POBSNS	2	Device status on errors (local return address for ERP when going to halt/syslog)
08-09	POBDAT	2	Buffer address (LIO)
0A-0B	POBWKA	2	Work area; contains forms length when hex 10 is on in IOBFLG. If DFC, left byte for left carriage and right byte for right carriage (contains carriage location during carriage check or forms jam recovery)

5203/1403 IOB (Model 12 Only) (Continued)

Disp Hex	Label	Lng Dec	Description
0C-0D	POBSVA	2	Address of permanent save area
0E-0F	POBARR	2	Save area for caller's return address
10-11	POBXR2	2	Save area for caller's register 2
12-13	POBRET	2	ARR save area for return from error recovery
14-17	POBRES	3	Reserved

DISK IOB (5444/5447/5448)

Disp Hex	Label	Lng Dec	Description
00-01	IOBCHN	2	Chain pointer used by disk IOS to queue I/O requests; when operation complete, last C/S or H/R operated upon
02	IOBCMP	1	Completion code: *Hex Value* — *Meaning* 45 — Permanent error on associated IOB (5444 only) 44 — Scan equal found 42 — Scan not satisfied 41 — Permanent I/O error 40 — Successful operation Bits used by IOS during disk operation: *Hex Value* — *Meaning* 80 — Seek started 20 — Data transfer pending 10 — Data transfer started 08 — Wait call 04 — Scan equal found 02 — Scan was not found
03	IOBQB	1	Q code of SIO
04	IOBRB	1	R code of SIO
05	IOBCB	1	Cylinder address
06	IOBSB	1	Sector address
07	IOBNB	1	Number of sectors minus 1
08-09	IOBDAT	2	Data (LIO) address

Disp Hex	Label	Lng Dec	Description
0A-0B	IOBSNS	2	Sense area byte 0 (3340):
			Hex Value — *Meaning*
			80 — Unit check (drive 1)
			40 — Unit check (drive 2)
			08 — Seek complete (drive 1)[1]
			04 — Seek complete (drive 2)[1]
			Sense area byte 1 (3340):
			Hex Value — *Meaning*
			40 — Scan equal
			20 — Program load switch R1
			10 — Op end[1]
			08 — No op
			04 — Data module attention[1]
			01 — Adapter check
			Sense area byte 0 (5444/5447/5448):
			Hex Value — *Meaning*
			80 — No operation performed
			40 — Intervention required
			20 — Missing address marker
			10 — Equipment check
			08 — Data check
			04 — No record found
			02 — Track condition check
			01 — Seek check
			Sense area byte 1 (5444/5447/5448):
			Hex Value — *Meaning*
			80 — Scan equal
			40 — Cylinder 0
			20 — End of cylinder
			10 — Seek busy
			08 — 100-cylinder overrun
			01 — Disk drive 1 set
0C	IOBERR	1	Error counts

[1] These bits are active only if an SIO enable interrupt has been issued. They should never be on for a Model 12.

DISK IOB (5444/5447/5448) (Continued)

Disp Hex	Label	Lng Dec	Description
0D	IOBFLG	1	Flag bits:

Hex Value	*Meaning*
80	No error recovery
40	No verify desired
20	No error logging
10	Write ID (5444/5447/5448)
08	No DTF associated with this IOB
04	No LIO of DDDR (IOS) (5444/ 5447)
02	(Model 12) Invalid simulation IOB
(02)	(Models 4, 6, 8, and 10) Error logging in process
	(5448) Call DLOG for this IOB
01	Operation involving alternate track
(01)	(IOS) (5444/5447)
(01)	5448 C/S (5448 only)
(01)	Translate I/O (>64K-byte system only)

Disp Hex	Label	Lng Dec	Description
0E-0F	IOBARR	2	ARR save area
10-11	IOBXR2	2	XR2 save area
12-13	IOBDCH	2	Data management chain pointer (address of second IOB)
14-15	IOBDTF	2	Address of associated DTF

The following entries apply only to a program that performs read ID or write ID operations:

Disp Hex	Label	Lng Dec	Description
12	WRIDFB		Write ID flag byte
13	WRIDCB		Write ID cylinder byte
14	WRIDSB		Write ID sector byte
15	RDIDFB		Read ID flag byte
16	RDIDCB		Read ID cylinder byte
17	RDIDSB		Read ID sector byte

Disk IOB (5445/Main Data Area)

Disp Hex	Label	Lng Dec	Description
00-01	IOBCHN	2	Chain pointer used by disk IOS to queue I/O requests; 3340 contains last H/R operated upon
02	IOBCMP	1	Completion code: *Hex Value* — *Meaning* 44 — Scan equal found 42 — Scan not satisfied 41 — Permanent I/O error 40 — Successful operation Bits used by IOS during disk operation: *Hex Value* — *Meaning* 80 — Seek started 20 — Data transfer pending 10 — Data transfer started 08 — Wait call 04 — Scan equal found 02 — Scan was not found
03	IOBQB	1	Q code of SIO
04	IOBRB	1	R code of SIO
05	IOBFL2	1	Second flag byte: *Hex Value* — *Meaning* 80 — Seek C/H supplied by user at end of IOB[1] (end of cylinder for IOS only) (Model 10) (80) — Seek C/H supplied by user at end of IOB[1] (end of cylinder for IOS only) (Model 10) 40 — End of cylinder (user) 20 — Invalid operation to a cylinder greater than 168 (3340) (20) — Invalid 3340 operation (greater than cylinder 168) (Model 12) 10 — Access greater than cylinder 168 (3340) 02 — No seek needed 01 — Use FCCHHRKDDN field

[1] This bit is valid only when hex 02 is on in IOBFL2.

Disp Hex	Label	Lng Dec	Description
06-07	IOBDAD	2	Start address of disk address field at end of IOB
08-09	IOBDAT	2	Data (LIO) address
0A-0B	IOBSNS	2	Sense area byte 0 (3340 only):

Hex Value	*Meaning*
80	Unit check (drive 1)
40	Unit check (drive 2)
08	Seek complete (drive 1)[1]
04	Seek complete (drive 2)[1]

Sense area byte 1 (3340 only):

Hex Value	*Meaning*
40	Scan equal
20	Program load switch R1
10	Op end[1]
08	No op
04	Data module attention[1]
01	Adapter check

Sense area byte 0 (5445 only):

Hex Value	*Meaning*
80	Format error
40	Intervention required
20	Missing address mark
10	Equipment check
08	Data check
04	No record found
02	No operation
01	Data overrun

[1] These bits are active only if an SIO enable interrupt has been issued. They should never be on for a Model 12.

Disk IOB (5445/Main Data Area) (Continued)

Disp Hex	Label	Lng Dec	Description
			Sense area byte 1 (5445 only): *Hex Value* — *Meaning* 80 — Disk drive error 40 — Unsafe 20 — Seek complete 1 10 — Seek complete 2 08 — Data operation complete 04 — End of cylinder 02 — Scan equal 01 — Disk drive identifier
0C	IOBERR	1	Error counts
0D	IOBFLG	1	Flag bits: *Hex Value* — *Meaning* 80 — No error recovery 40 — No verify desired 20 — No error logging 08 — No DTF associated with this IOB 04 — No LIO of DDDR (IOS) 01 — Operation involving alternate track (Models 4, 6, 8, 10, and 12 with less than 64K bytes of storage) (01) — IOS use only Translate I/O (>64K-byte system only)
0E-0F	IOBARR	2	ARR save area
10-11	IOBXR2	2	XR2 save area
12-13	IOBDCH	2	Data management chain pointer (address of second IOB)
14-15	IOBDTF	2	Address of associated DTF
16	IOBCC	1	Cylinder
17	IOBHH	1	Head
18	IOBR	1	Record where operation is to begin
19	IOBN	1	Number of records (minus 1) to be operated upon

Disk IOB (5445/Main Data Area) (Continued)

Disp Hex	Label	Lng Dec	Description
The following entries are for programs that use read or write HA, R0 count, or write count key and data commands:			
16	IOBF	1	Flag byte in DDCF: *Hex Value* — *Meaning* 03 — Defective alternate track 02 — Defective primary track 01 — Good alternate track 00 — Good primary track
17-18	IOBCYL	2	Cylinder address in DDCF
19-1A	IOBHD	2	Head in DDCF
1B	IOBREC	1	Record in DDCF
1C	IOBKEY	1	Key length in DDCF
1D-1E	IOBDTA	2	Data length in DDCF
1F	IOBNUM	1	Number of records (minus 1) to be operated upon

3741 IOB

Disp Hex	Label	Lng Dec	Description
00-01	IOBCHN	2	IOS queue chain pointer (next IOB on queue)
02	IOBCMP	1	Completion code: *Hex Value* — *Meaning* 42 — 3741 at EOF 41 — Permanent I/O error 40 — Successful operation 08 — Wait call

3741 IOB (Continued)

Disp Hex	Label	Lng Dec	Description
03	IOBQB	1	Q code of SIO
04	IOBRB	1	R code of SIO
05	IOBKLG	1	Data length (256)
06-07	IOBSLC	2	Sense area for LCR
08-09	IOBDAT	2	Data address (LIO)
0A-0B	IOBSNS	2	Sense area byte 0:

Hex Value	*Meaning*
80	Always 0
40	Always 1
20	Always 0
10	Always 0
08	3741 attached (always 1)
04	3741 busy in I/O transfer
02	Write mode in I/O transfer
01	Read mode in I/O transfer

Sense area byte 1:

Hex Value	*Meaning*
40	EOD/OUT in I/O transfer
20	Parity error bus in
10	End of record
08	EOJ/OUT in I/O transfer
04	3741 needs operator attention

Disp Hex	Label	Lng Dec	Description
0C	IOBERR	1	Error counts
0D	IOBFLG	1	Flag bits:

Hex Value	*Meaning*
80	No ERP-return completion code 41
40	ERP requested
20	Halt for wrong mode
10	3741 offline
08	Indicates if spool IOB
04	Data address is real
02	Real data address is greater than 64K
01	Device offline

Disp Hex	Label	Lng Dec	Description
0E-0F	IOBARR	2	ARR save area
10-11	IOBXR2	2	XR2 save area

3741 IOB (Continued)

Disp Hex	Label	Lng Dec	Description
12-13	IOBDCH	2	Data management chain pointer
14-15	IOBDTF	2	Address of associated DTF

SCHEDULER WORK AREA (SWA) FORMAT

There are three scheduler work areas on the system resident pack (Figure 2-3). These areas reside in three consecutive cylinders as follows:

SWA cylinder 1 = SWA for program level 1
SWA cylinder 2 = SWA for program level 2 (DPF only)
SWA cylinder 3 = SWA for rolled-out program level (checkpoint/restart or rollout/rollin)

A pointer to the cylinder/sector address of the SWA for program level 1 is in SYSCOM and in the 5444/5447/simulation area volume label. The SWA for program level 2 can be found if 1 is added to the cylinder address of program level 1 SWA. If DPF, the SWA for the rolled-out level can be found if 2 is added to the cylinder address of program level 1 SWA. If no DPF, the rollout SWA is at the program level 1 SWA plus 1 cylinder.

Sectors 7-16 are divided into 40 areas for format 1's and format 7s. The format 1's are placed in the SWA starting at sector 7 and can extend through sector 16. The format 7s are placed in the SWA starting at sector 16 and extend back toward sector 7.

Relative Sector

0	1	2-6	7-16	17-29	30-37	38-47
Common Sector	Index Sector	SWA Format 5s	SWA Format 1's and 7s	Initiator Table	Miscellaneous Work Area	Utility Control Statement Area

|← 1 cylinder →|

Figure 2-3. Scheduler Work Area Location and Organization

SCHEDULER WORK AREA (SWA) FORMAT (Continued)

Pointed to by volume label hex 4B-4C

Relative Sector 00

Disk address is C/S from volume label

Disp Hex	Lng Dec	Description
00-05	6	System date, EBCDIC characters from the DATE statement
06-1E	25	System temporary configuration record maintained by the IOS open routines Bytes relative to the start of the configuration area displacement:

Hex Value	*Meaning*
18	Auxiliary
17	Auxiliary
16	Console
15	Console
14	End of Configuration Area (FF) (Models 4, 6, 8, and 10)
13	3741 (Models 6, 8, 10, and 12)
12	BSCA Line 2/ICA/LDA/Locally Attached Work Station
11	Magnetic Tape (Models 8, 10, and 12)
10	3340/5445/5448
0F	1403 Printer (Models 10 and 12)
0E	1270 Optical Reader Sorter
0D	1255 Magnetic Character Reader Models 21, 22, or 23
0C	1255 Magnetic Character Reader Models 1, 2, or 3
0B	5475 Data Entry Keyboard (Model 10 only)
0A	Display Screen (Model 6 only)
09	BSCA Line 1
08	Data Recorder (Model 6 only)
07	Ledger Card (Model 6 only)
06	Keyboard (Model 6 only)
05	Matrix Printer (Model 6 only)
04	5444/5447 Disk Drive (simulation area)
03	1442 (Models 8, 10, and 12)
02	5471 Console I/O (Models 8, 10, and 12)
01	5203/1403 Printer (Models 8, 10, and 12)
00	MFCU (Models 10 and 12)

Disp Hex	Lng Dec	Description
1F-46	40	Reserved

Relative Sector 00 (Continued)

Disp Hex	Lng Dec	Description
47-FE	184	These bytes contain information used by the loader to find modules during IPL. Labels identify the $$name of the module to which the 4 bytes of information pertain: Byte 1 = Cylinder number Byte 2 = Sector number Byte 3 = Number of sectors Byte 4 = RLD displacement

Disp Hex	Label	Lng Dec	Description
47-4A	TMIP	4	
4B-4E	TMRI	4	
4F-52	TMST	4	
53-56	INPS	4	
57-SA	INP2	4	
5B-5E	INPD	4	
5F-62	INDF	4	
63-66	INDS	4	
67-6A	INDC	4	
6B-6E	INA1	4	If a module is not on the disk pack used for IPL, the 4 bytes identified by the module's $$name only contain the 4-character label
6F-72	INA2	4	
73-76	INA3	4	
77-7A	INA4	4	
7B-7E	INMX	4	
7F-82	INMS	4	
83-86	INB1	4	
87-8A	INB2	4	
8B-8E	INB3	4	
8F-92	INB4	4	

Relative Sector 00 (Continued)

Disp Hex	Label	Lng Dec	Description
93-96	INT1	4	If a module is not on the disk pack used for IPL, the 4 bytes identified by the module's $$name only contain the 4-character label
97-9A	TMEO	4	
9B-9E	INDX	4	
9F-A2	INAT	4	
A3-A6	SSVI	4	
(A3-A6)	TMSK[1]	4	
A7-AA	TMDS	4	
AB-AE	TMEJ	4	
AF-B2	TMSB	4	
B3-B6	TMEX	4	
B7-BA	SSSC	4	
BB-BE	SSVT	4	
BF-C2	STXV	4	
(BF-C2)	SSXV[1]	4	
C3-C6	TMSI	4	
C7-CA	TMIB	4	
(C7-CA)	STSA[1]	4	
CB-CE	RBIP	4	
CF-D2	RBCO	4	
D3-D6	STF7	4	
D7-DA	INMY	4	
DB-DE	OTAO	4	
DF-E2	INBX	4	
E3-E6	TMKS	4	

[1] Models 4, 6, 8, and 10 only.

Relative Sector 00 (Continued)

Disp Hex	Label	Lng Dec	Description
E7-EA	TMSD	4	If a module is not on the disk pack used for IPL, the 4 bytes identified by the module's $$name only contain the 4-character label
EB-EE	RDML	4	
EF-F2	RDFL	4	
F3-F6	RDRT	4	
F7-FA	RDMK	4	
FB-FE	SSDL	4	
FF		1	Reserved

Relative Sector 01

Disk address is C/S from volume label

Disp Hex	Label	Lng Dec	Description
00-01	FORMT1	2	C/S address of the first sector that contains the format 1 images used by the scheduler and data management
02-03		2	C/S address of the last sector containing the format 1 images
04-05		2	C/S address of the last sector from which information was read
06		1	Displacement into the last format 1 sector from which information was read
07-08		2	C/S address of the last format sector into which information was written
09		1	Displacement into the last format 1 sector into which information was written
0A-0B	UTILCC	2	C/S address of the first sector that contains the utility control statements
0C-0D		2	C/S address of the last sector containing the utility control statements
0E-0F		2	C/S address of the last utility control statement sector from which information was read

Relative Sector 01 (Continued)

Disp Hex	Label	Lng Dec	Description
10		1	Displacement into the last utility control statement sector from which information was read
11-12		2	C/S address of the last utility control statement sector into which information was written
13		1	Displacement into the last utility control statement sector into which information was written
14-15	INITAB	2	C/S address of the first sector that contains the initiator table
16-17		2	C/S address of the last sector containing the initiator table
18-19		2	C/S address of the last initiator table sector from which information was read
1A		1	Displacement into the last initiator table sector from which information was read
1B-1C		2	C/S address of the last initiator table sector into which information was written
1D		1	Displacement into the last initiator table sector into which information was written
1E-1F	MISCEL	2	C/S address of the first sector that contains miscellaneous work area for the scheduler and data management
20-21		2	C/S address of the last sector containing the miscellaneous work area
22-23		2	C/S address of the last miscellaneous work area sector from which information was read
24		1	Displacement into the last miscellaneous work area sector from which information was read
25-26		2	C/S address of the last miscellaneous work area sector into which information was written

Relative Sector 01 (Continued)

Disp Hex	Label	Lng Dec	Description
27		1	Displacement into the last miscellaneous work area sector into which information was written
28-67	CONFIG	64	Program's temporary configuration record used with the system configuration record to maintain proper feature checking (see sector 0, with the displacement of 06)
68-69	FORMT5	2	C/S address of the format 5s for the mounted packs
6A-6B		2	Attributes of the current program (these attributes are the same as those found in the directory)
6C-71		6	Source name from the COMPILE statement
72		1	Source unit from the COMPILE statement
73		1	Sector where last format 7 was placed
74		1	Displacement into sector where last format 7 was placed
75-76		2	C/S address of 5445/3340 format 5
77-96		32	Reserved
97		1	Relative displacement from hex 97 of the procedure in process (maximum displacement is hex 63)
98-E7		80	Models 4 and 6–8 byte format *Byte* *Meaning* 1 Disk Q code 2-3 C/S address of start of procedure 4-5 C/S address of the end of the procedure 6-8 C/S/D into the procedure

SCHEDULER WORK AREA (SWA) FORMAT (Continued)

Relative Sector 01 (Continued)

Disp Hex	Label	Lng Dec	Description
(98-FA)		99	Models 8, 10, 12—11-byte format *Byte* — *Meaning* 1 — Function byte of $$SYSG (source library get) 2 — Disk Q code 3-4 — C/S address of start of procedure 5-6 — C/S address of end of procedure 7-9 — C/S/D into procedure 10-11 — Main storage address of buffer for $$SYSG

Relative Sector 02

Disk address is C/S from volume label.

Disp Hex	Label	Lng Dec	Description
00-3F		64	Format 5 for F1
40-7F		64	Format 5 for R1
80-BF		64	Format 5 for F2
C0-FF		64	Format 5 for R2

Note: See the following for a breakdown of the above areas.

Disp Hex	Label	Lng Dec	Description
00-05	FOR5PK	6	Pack ID
06	FOR5AT	1	Attribute byte: *Hex Value* — *Meaning* 40 — This unit is dedicated to this level 20 — This is this level's program or system disk 10 — This program level is using this disk
07	FOR5NF	1	Number of new files for this job
08	FOR5N7	1	Number of new format 7s for this job
09-0D		5	Reserved
0E-3F		51	Format 5 for this 5444/5447

Relative Sector 03-04

Format 5 image for D1

Relative Sector 05-06

Format 5 image for D2

Note: See the following for a breakdown of the above areas.

Disp Hex	Label	Lng Dec	Description
00-05	FOR5PK	6	Pack ID
06	FOR5AT	1	Attribute byte: *Hex Value* — *Meaning* 40 — This unit dedicated to this level 20 — System or program pack 10 — This level is using this unit
07	FOR5NF	1	Number of new files for this job
08	FOR5N7	1	Number of new format 7s for this job
09-0B		3	Reserved
0C-01FF		500	D1 or D2 format 5 bit

Relative Sector 07-16

Disk address is C/S from volume label.

Disp Hex	Label	Lng Dec	Description
00-3F		64	Format 1 and 7 images (see index entry: *format 1 and format 7)*
40-7F		64	
80-BF		64	
C0-FF		64	

Relative Sector 17-29

Disk address is C/S from volume label (contains initiator table).

Relative Sector 30-33

Disk address is C/S from volume label (contains miscellaneous work area).

Relative Sector 34-47

Disk address is C/S from volume label plus hex A8 (utility control statement storage area).

5445/5448/3340 FORMAT 1

Disp Hex	Label	Lng Dec	Description
00	FXTAG	1	Tag ID of index pointer (5445)
01	FXSCTG	1	Split chain tag (5445)
(00-01)	FXSTAG	2	Relative record number of VTOC entry (3340)
02	FXSPCL	1	Number of tracks in cylinder (hex 01-13 indicates split cylinder)
(02)	FXATT4	1	Attribute byte 4 (3340): *Hex Value* — *Meaning* 40 — EOJ bypass—read only
03-0A	FXLABL	8	File label
0B-10	FXDATE	6	Date
11	FXRTIN	1	Retain type
12-13	FXTYPE	2	File type: Status when file was opened: *Hex Value* — *Meaning* 8000 — Indexed 4000 — Sequential 2000 — Direct 1000 — MVF 0800 — Input 0400 — Output 0200 — Update 0100 — Add

Disp Hex	Label	Lng Dec	Description
12-13 (continued)			Status when file was created: *Hex Value* — *Meaning* 0080 — Indexed 0040 — Sequential 0020 — Direct 0010 — MVF Status when file was closed: *Hex Value* — *Meaning* 0008 — Last pack for MVF 0004 — Sequential add 0002 — Random add 0001 — Unordered load
14-15	FXRECL	2	Record length
16	FXKEYL	1	Key length
17-1B	FXKEYO	2	Key location
19-1C	FXLSTR	4	Last record (C/H/R/D)
1D-20	FXLSTK	4	Last key (C/H/R/D)
21-22	FXENDA	2	End of allocated space (C/H)
23-24	FXSTIX	2	Start of allocated space (C/H)
25-26	FXSTDA	2	Start of data (end index) (C/H)
27-29	FXRECN	3	Number of records at creation
(27-29)	FXTRKN	3	Number of tracks at creation
2A	FXSEQN	1	Volume sequence number for MVF
2B-30	FXPACK	6	Pack ID for this file
31-38	FXNAME	8	Filename
39	FXUNIT	1	Unit address of this file

Disp Hex	Label	Lng Dec	Description
3A	FXATT1	1	Attribute byte 1: *Hex Value* — *Meaning* 80 — Online pack 40 — File not processed 20 — Deferred mount 10 — OCL multivolume file 08 — New file 04 — Location given in OCL 02 — Space and location equal 01 — Date given in OCL
3B	FXATT2	1	Attribute byte 2: *Hex Value* — *Meaning* 80 — Primary pack of MVF 40 — Reserved (3340) RETAIN-A on FILE statement (5445/5448) 20 — Remove format 1 from VTOC 10 — Open 08 — Closed 04 — Ignore VTOC update 02 — Check for VTOC space 01 — File allocated
3C	FXATT3	1	Attribute byte 3: *Hex Value* — *Meaning* 80 — D2 in use by file 40 — Reserved (3340) (40) — Master split cylinder (5445) 20 — D1 in use by file 08 — Load to old file 04 — Format 7 images given for file 02 — DTF supplied for file 01 — Special format 1 image
3D	FXINDX	1	SWA index
3E	FXUPSI	1	Save area for open—UPSI
3F	FXBYTE	1	Save area for open—other

- Pointed to by SWA sector 01 hex disp 00-09
- Located on CYL 00 relative sector 7-16
- Length 64 bytes (hex 40)
- Each 5444 format 1 is on that disk CYL 00 sectors 2C-5C

Disp Hex	Label	Lng Dec	Description
00	F1TAG	1	Tag ID of index pointer
01-02	F1CHAN	2	Chain address
03-0A	F1LABL	8	File label
0B-10	F1DATE	6	System date
11	F1RTIN	1	Retain type
12-13	F1TYPE	2	File type

Current status, status when file opened (left byte):

Hex Value	*Meaning*
80	ISAM
40	Consecutive
20	Direct
10	MVF
08	Input
04	Output
02	Update
01	Add

Status when file created (right byte):

Hex Value	*Meaning*
80	ISAM
40	Consecutive
20	Direct
10	MVF

Status when file closed (right byte):

Hex Value	*Meaning*
08	Last pack for consecutive MVF
04	Sequential add
02	Random add
01	Unordered add

Disp Hex	Label	Lng Dec	Description
14-15	F1RECL	2	Record length
16	F1KEYL	1	Key length
17-18	F1KEYO	2	Key location
19-1B	F1LSTR	3	C/S/D of last record
1C-1E	F1LSTK	3	C/S/D of last key
1F-20	F1STDA	2	C/S of start data
21-22	F1ENDA	2	C/S of end data
23-24	F1STIX	2	C/S of start index
25-26	F1ENIX	2	C/S of end index
27-29	F1RECN	3	Number of records at creation[1]
(27-29)	F1TRKN	3	Number of tracks at creation[1]
2A	F1SEQN	1	Volume sequence number for MVF
2B-30	F1PACK	6	Pack ID for file
31-38	F1NAME	8	File name
39	F1UNIT	1	Unit address of file
3A	F1ATT1	1	Attribute byte 1:

Hex Value	*Meaning*
80	Online—Pack and units are equal
40	File not processed
20	Deferred mount
10	OCL multivolume file
08	New
04	Location given
02	Space and location given and equal
01	Two labels are the same

[1] If the high-order bit is on, the number specified is the number of tracks; otherwise, the number specified is the number of records.

Disp Hex	Label	Lng Dec	Description
3B	F1ATT2	1	Attribute byte 2:

Hex Value	*Meaning*
80	Primary pack of MVF
40	RETAIN-A on FILE statement
20	Remove F1 from VTOC at EOJ
10	Open
08	Closed
04	Do not reassign at end of job
02	Not used
01	File allocated

Disp Hex	Label	Lng Dec	Description
3C	F1ATT3	1	Attribute byte 3 (5444 files only):

Hex Value	*Meaning*
80	F1 used
40	F2 used
20	R1 used
10	R2 used
08	Load to old file
04	F7 image given for file
02	DTF supplied for file
01	Special F1 image

Disp Hex	Label	Lng Dec	Description
3D	FXINDX	1	DTF SWA index
3E	F1UPSI	1	Save area for open routine
3F	F1BYTE	1	Save area for open routine

TAPE FORMAT 1

Disp Hex	Label	Lng Dec	Description
00	FTATT1	1	Attribute byte 1:
			Hex Value — *Meaning*
			80 — Allocated
			40 — Opened
			20 — Closed
			10 — Not used
			08 — Additional unspecified volume
			04 — Unlabeled file
			02 — Nonstandard labeled file
			01 — Last F1 for file
01	FTATT2	1	Attribute byte 2:
			Hex Value — *Meaning*
			C0 — Rewind
			80 — Unload
			40 — Leave (end)
			20 — Unused
			10 — Volume ID given (reel)
			08 — ASCII translate (ASCII)
			04 — Date given (date)
			02 — Deferred mount (defer)
			01 — Bypass label processing
02	FTATT3	1	Attribute byte 3:
			Hex Value — *Meaning*
			80 — Fixed
			40 — Variable
			20 — Unblocked
			10 — Blocked
			08 — Spanned (from DTF)
			04 — ASCII format D
			02 — Reserved
			01 — Reserved

TAPE FORMAT 1 (Continued)

Disp Hex	Label	Lng Dec	Description
03-0A	FTLABL	8	File label
0B-10	FTCDAT	6	File creation date (ƀYYDDD)
11-16	FTXDAT	6	Expiration date (ƀYYDDD)
17-18	FTBLKL	2	Block length
19-1A	FTRECL	2	Record length
1B-1C	FTDCNA	2	Save area for DTF chain address A
1D-1E	FTDIO	2	Save area for DTF I/O area address
1F-20	FTDLIO	2	Save area for the length of the I/O area
21-22	FTDBL	2	Save area for the block length
23	FTVSEQ	1	Volume sequence counter (system)
24	FTVCTR	1	Volume counter (user, input)
25	FTDISP	1	Disp to unit to be allocated
26-29	FTUTBL	4	Table of unit(s) specified (unit)
2A-2F	FTREEL	6	Volume ID (reel)
30	FTATT4	1	Attribute byte 4:

Hex Value	*Meaning*
80	Seven-track tape
40	Even parity
20	Convert
10	Translate
08	1600 bpi
04	800 bpi
02	556 bpi
01	200 bpi

TAPE FORMAT 1 (Continued)

Disp Hex	Label	Lng Dec	Description
31-38	FTNAME	8	File name (name)
39	FTUNIT	1	Unit being allocated
3A	FTDAT0	1	Save area for DTF attribute byte 1
3B	FTDAT1	1	Save area for DTF attribute byte 2
3C	FTDAT2	1	Save area for DTF attribute byte 3
3D	FTINDX	1	DTF SWA index
3E-3F	FTFIL#	2	Reserved

SWA FORMAT 7

Disp Hex	Label	Lng Dec	Description
00	F7TAG	1	Format 7 tag number
01-02	F7CHAN	2	Pointer to corresponding format 1: 5444/5447 = Sector/displacement of corresponding format 1 5445/5448 = Record/displacement of corresponding format 1 3340 = Relative record number of corresponding format 1
03	F7KEYL	1	Key length minus 1
04	F7INDX	1	Format 1 index number
05	F7SEQN	1	Format 1 sequence number
06-22	F7LOKE	29	Low key
23-3F	F7HIKE	29	High key

BSC WORK AREA

- Length 179 bytes (hex B3)
- Located by eyecatcher WKA
- For dual line operations, two work areas are provided

Disp Hex	Label	Lng Dec	Description
00-12	DLYIOB	19	BSC IOB used to send delay messages and termination sequences (DLYIOB includes WKDTFD)
13-14	WRKDTF	2	Address of the BSC DTF
15	BSRJF1	1	Reserved
16	BSRJF2	1	Reserved
17	BSPOL1	1	Polling indicator byte:

Hex Value	*Symbol*	*Meaning*
80	PL1POL	Polling being done
40	PL1EOT	Excessive record length data
20	PL1ACT	Active terminal in the list
10	PL1RES	Reset poll requested
08	PL1PAD	Addressing indicator
04	PL1CNC	Cancel
02	PL1CIH	Common interrupt handler supported by this module
01	PL1CHS	Common interrupt handler being used during this job

Disp Hex	Label	Lng Dec	Description
18-19	WKLIST	2	Pointer to the current polling entry
1A	WKID	1	ID of the current polling entry
1B-1C	WKIOB@	2	Address of the last IOB
1D	BSFLG3	1	Flag byte:

Hex Value	*Symbol*	*Meaning*
80	F3RVI	RVI sent
40	F3SRVI	Sending RVI
20	F3OLTE	ERP disable for online test
10	F3HALT	Error post to DTF
08	F3OLT	Online test
04	F3MOVE	Data moved
02	F3RFTA	Online test allowed
01	F3AUTO	Auto response running

BSC WORK AREA (Continued)

Disp Hex	Label	Lng Dec	Description
1E	WKPCT	1	Count of the times through the polling list
1F-20	–	2	Reserved
21-22	ADRIOB	2	Address of the delay IOB used by interrupt and data management to locate BSC work area
23	BSCFLG	1	Flag byte:

Hex Value	*Symbol*	*Meaning*
80	WTRTN	Signals wait to return via ARR after permanent errors. Set by line initialization and close
40	TTDRCV	Signals error recovery procedures that a TTD message was the last message received from a remote station
20	TROPID	Signals error recovery procedures to transmit and receive rather than receive only
10	ACTIVE	Indicates that the BSCA is enabled
08	BSCDSC	Signals interrupt that a disconnect sequence is being affected by error recovery procedures. When this bit is on, interrupt reenters error recovery procedures at BSDISC
04	FWDABT	Signals interrupt that a forward abort sequence is being affected by error recovery procedures. When this bit is on, interrupt reenters error recovery procedures at WRTEOT

Disp Hex	Label	Lng Dec	Description		
23 (continued)			*Hex Value*	*Symbol*	*Meaning*
			02	NEWBUF	Signals close that a new file is being opened, and that close should not disable the BSCA
			01	ERRMSG	Used by error recovery procedures to force reading of an error message after an abort sequence
24	ACKS	1	Flag byte:		
			Hex Value	*Symbol*	*Meaning*
			80	NULSNT	Null message was sent and data management is waiting for conversational reply
			40	AKDPF	DPF system
			20	IDHALT	Invalid ID exchange has occurred
			10	EOTRCD	Signals IOS that EOT has been received on a GET file
			08	SWICH	Switched line is being used
			04	AKERR	Error posted, line disabled
			02	RCVACK	Alternating acknowledgments last received and last sent by this station
			01	SNDACK	

BSC WORK AREA (Continued)

Disp Hex	Label	Lng Dec	Description
25	BSFLG2	1	Flag byte:

Hex Value	*Symbol*	*Meaning*
80	CLOSET	Close is in progress
40	BADCAL	Invalid call by user
20	NULL78	Send NULL message for IBM 2770 or 2780
10	LG2LOG	Error already logged
08	RJEBIT	RJE is running
04	HLTY9	Issue Y9 halt from close
02	NAKSNT	NAK was the last message sent by this station
01	IDXCH	Signals wait to return to line initialization (after an error occurred during line initialization)

Disp Hex	Label	Lng Dec	Description
26-27	–	2	Save area for the address of the new DTF on multiple file BSC jobs
28-29	–	2	Address of entry to interrupt
2A-2B	–	2	Address of entry to IOS
2C-2D	–	2	Address of entry to wait
2E-2F	–	2	C/S address of close

Disp Hex	Label	Lng Dec	Description	*Constant Values EBCDIC*	*ASCII*
30-31	AKEVND	2	Even acknowledgment	1070	1030
32-33	ACK1D	2	Odd acknowledgment	1061	1031
34-35	DLESTD	2	DLE STX sequence	1002	1002
36	SYND	1	SYN sequence	32	16
37	SNEOTD	1	SYN EOT sequence	37	04
38-39	WAKD	2	WACK sequence	106B	103B
3A-3B	TTD (ENQD)	2	STX ENQ sequence	022D	0205

Disp Hex	Label	Lng Dec	Description	*Constant Values* *EBCDIC*	*ASCII*
3C-3D	RVID	2	RVI sequence	107C	103C
3E-3F	DISCO	2	Disconnect sequence	1037	1004
40	ETBCON	1	ETB sequence	26	17
41	NAKD	1	NAK sequence	3D	15
42	PCTD	1	Percent sequence	6D	25
43-44	WKLICS	2	C/S address of line initialization		
45-46	—	2	Address of the VTOC read/write parameter list in either $$BSEL or $$BSMF statistic logging module		
47	—	1	First character received		
48	—	1	Second character received		
49	—	1	Next to last character received		
4A	—	1	Last character received		
4B-4C	ZERO	2	Constant of 0		
4D-4E	ONE	2	Constant of 1		
4F	—	1	2770-2780 blank		
50	—	1	2770-2780 escape		
51	—	1	2770-2780 space 1		
52	—	1	2770-2780 space 2		
53	—	1	2770-2780 space 3		
54	—	1	2770-device select 4		
55-56	—	2	Terminal successful I/Os		
57-58	—	2	Terminal unsuccessful I/Os		
59	—	1	Local display adapter indicator byte		
5A-5B	—	2	Address of MLTERFUL for MLMP		
5C-5D	—	2	Save area for record length during transmission in ITB-transparent mode		

BSC WORK AREA (Continued)

Disp Hex	Label	Lng Dec	Description
5E-5F	–	2	Save area for TAR during transmission in ITB-transparent mode
60-7B	STABLE	28	Error and statistics counters:

Disp Hex	*BSC IOS Label*	*Lng Dec*	*Meaning*
60-61	SNTTXT	2	Text blocks sent
62-63	RCVTXT	2	Text blocks received
64-65	NAKTBL	2	NAKs received
66-67	DATTBL	2	Data checks
68-69	FABTBL	2	Forward aborts
6A-6B	ABRTBL	2	Aborts received
6C-6D	TADTBL	2	Adapter checks on transmit
6E-6F	ADTBL	2	Adapter checks on receive
70-71	INVTBL	2	Invalid responses received
72-73	ENQTBL	2	ENQs received to ACKs sent
74-75	LSTTBL	2	Lost data errors
76-77	LATBUF	2	Disconnect timeouts and abort disconnect
78-79	TOTBL	2	Receive timeouts
7A-7B	DCOUNT	2	Delay time count

Disp Hex	Label	Lng Dec	Description
7C-7F	–	4	Reserved
80-81	ETABLE	2	Address of HPL/APL instruction in wait
82-83	–	2	Reserved
84-8B	ERLIST	8	Error logging parameter list
8C-90	HLTLST	5	Y7, Y8 halt parameter list
91-9E	OLTPRM	14	Save area for the online test parameters[1]
9F-A0	TOLTCS	2	Cylinder/sector area for online test parameters[1]
A1-AE	OLTSAV	14	Online test save and work area[1]
AF-B2	–	4	Online test counter area[1]

[1] These fields are not generated for RPG II.

IOS QUEUES

The active IOBs in the system are chained indirectly by device via the IOS queues.

A pointer in SYSCOM points to the respective IOS queues.

Tape IOS Queues

Disp Hex	Label	Lng Dec	Description
00-01	QFIRST	2	Address of first IOB on queue
02-03	QLAST	2	Address of last IOB on queue
04-05	QSELF	2	Address of this queue
06-07	QSAVE	2	Save area for Q code and R code
08	QFLAG	1	Flag byte
09-0A	QSIO	2	Number of SIOs
0B	QERG	1	Number of ERGs
0C-0D	QNEXT	2	Address of next unit's queue
0E	QBYTE	1	Q code associated with this queue
0F-10	QSNSAP	2	Adapter sense bytes 0 and 1
11-12	QSNS01	2	Subsystem sense bytes 0 and 1
13-14	QSNS23	2	Subsystem sense bytes 2 and 3
15-16	QSNS45	2	Subsystem sense bytes 4 and 5
17-18	QSNS67	2	Subsystem sense bytes 6 and 7
19-1A	QRESID	2	Subtract from byte count to get residual
1B-1C	QSNDAT	2	LSR sense
1D-1E	QCOMN	2	Address of tape IOS common region

The following displacements apply to Model 12 with more than 64K bytes of main storage:

1F-20	QPMR	2	PMR save area

3340 IOS Queue (Model 12 Only)

Disp Hex	Label	Lng Dec	Description
00-01	QFIRST	2	Address of first IOB on queue
02-03	QLAST	2	Address of last IOB on queue
04-05	QSELF	2	Address of this queue (QFIRST minus 1)
06-07	QSNS23	2	Sense information used to test for adapter check
(06-07)	SNS23	2	Equate to Model 10 label
08-09	QSENSE	2	Save area for IOB sense
0A	QLSTCC	1	Save area for last cylinder address-seek
0B	QLSTHH	1	Save area for last head-seek
0C-0D	QUENXT	2	Pointer to next queue
(0C-0D)	NXTQUE	2	Equate to Model 10 label
0E	QLSTSK	1	Reserved except on Model 10
(0E)	LASTSK	1	Equate to Model 10 label
0F-10	QSAVOP	2	Save area for Q code and R code from IOBRB and IOBQB
(0F-10)	SAVEOP	2	Equate to Model 10 label
11	QSTATS	1	Status of queue: *Hex Value* — *Meaning* 40 — Special scan 20 — Queue busy with a seek 10 — Queue busy because of residuals 08 — Simulation IOB 04 — 3340 cylinder address check for validity 02 — Disk unit check, logging pending 01 — 3340 adapter check, logging pending
12	QUECYL	1	Simulation area converted cylinder
13	QUEHD	1	Simulation area converted head
14	QUEREC	1	Simulation area converted record
15	QUEQ	1	Simulation area converted Q code

Disp Hex	Label	Lng Dec	Description
16	QUEFLG	1	Disk IOS program control flag: *Hex Value* — *Meaning* 80 — Reseek is needed to ensure correct access position and head selection 40 — Ensure correct access arm position for no seek IOB 20 — A read home address is required prior to a write home address 10 — Correctable data check occurred on this operation 08 — Drive not write inhibited 04 — No LIO of DDDR 02 — Not wrong DM size 01 — Alternate track
17	QRESVD	1	Reserved
18-19	Q@DFCA	2	Address of count field
(18-19)	DFCA45	2	Model 10 label equate *count field*
1A	QCTFLD	1	Left end of count fields
(1A)	QCTFLG	1	Flag
1B-1C	QCNTCC	2	Cylinder number
1D-1E	QCNTHH	2	Head number
1F	QCTREC	1	Record number
20	QCTKLN	1	Key length
21-22	QCTDLN	2	Data length
23	QCNTN	1	Number of records minus 1
(23)	QCOUNT	1	Model 10 label equate (left end count)
24-25	Q@HA	2	Address of HA field
(24-25)	ADHA	2	Equate to Model 10 label (HA address)
26	QHAFLD	1	HA field
(26)	HAFLD	1	Model 10 label equate (HA field)
(26)	QHAFLG	1	Flag
27-28	QHACC	2	Cylinder number
29-2A	QHAHH	2	Head number

3340 IOS Queue (Model 12 Only) (Continued)

Disp Hex	Label	Lng Dec	Description
2B-2C	Q@R0	2	Address of R0 field
(2B-2C)	ADR0	2	Model 10 label equate (R0 field address)
2D	QR0FLD	1	R0 field
(2D)	R0FLD	1	Equate to Model 10 label (R0 field)
(2D)	QR0FLG	1	Flag
2E-2F	QR0CC	2	Cylinder number
30-31	QR0HH	2	Head number
32	QR0REC	1	Record number
33-35		3	Reserved
36	QQCODE	1	Q code for drive on this queue
37-38	QDAREA	2	Residual DDD save
39-3A	QUEDAT	2	IOBDAT save area
3B-3C	Q@DIAG	2	Address of diagnostic sense
3D	QDGSNS	1	Diagnostic sense information
(3D)	QDSNS0	1	Diagnostic sense byte 0:

Label	*Hex Value*	*Meaning*
CMDRJT	80	Command reject
INTREQ	40	Intervention required
EQUPCK	10	Equipment check
DATACK	08	Data check
DATOVR	04	Data overrun
TRCNCK	02	Track condition check
SEEKCK	01	Seek check

Disp Hex	Label	Lng Dec	Description
3E	QDSNS1	1	Diagnostic sense byte 1:

Label	*Hex Value*	*Meaning*
INVTRK	40	Invalid track format
EOP	20	End of pack
NRF	08	No record found
	04	File protect
WRTINH	02	Write inhibited drive
INCPLT	01	Operation incomplete

3340 IOS Queue (Model 12 Only) (Continued)

Disp Hex	Label	Lng Dec	Description
3F	QDSNS2	1	Diagnostic sense byte 2:

Label	*Hex Value*	*Meaning*
CORECT	40	Correctable data check
ENVDAT	10	Environmental data present
	07	Data module size
MODSIZ	01	Only valid module size on System/3

Disp Hex	Label	Lng Dec	Description
40	QDSNS7	1	Diagnostic sense byte 7
41-42[1]	QUEPMR	2	PMR value
43-44[1]	QXTCCP	2	Address of priority queue CCP
45-46[1]	QDRVXT	2	Address of other queue this spindle
47-48	DLSN23	2	Save area for adapter check sense for DLOG
49-4A	DLSNS	2	Save area for adapter status for DLOG
4B-4C	DLCH	2	Save area for C/H address of error for DLOG
4D-64	DLDSND	24	Save area for 3340 diagnostic sense for DLOG

3741 IOS Queue

There is a 3741 queue only if there is a 3741 on the system.

Disp Hex	Label	Lng Dec	Description
00	Q3741	20	Start of the 3741 queue
00-01	Q1ST	2	Address of first IOB on queue
02-03	QLST	2	Address of last IOB on queue
04-05	QTHIS	2	Address of next IOB on the queue
06-07	QKLCST	2	3741 sense area

[1] For Model 12 with more than 64K bytes of main storage.

3741 IOS Queue (Continued)

Disp Hex	Label	Lng Dec	Description
08	QKSWIT	1	3741 switches: *Hex Value* — *Meaning* 08 — SIO to read/write has been issued 02 — ERP must halt for 3741 I/O attention 01 — ERP in progress
09-0A	QERIOB	2	Address of 3741 IOB in error
0B-0C	QWKARR	2	ARR save area in IOS
0D-0E	QERARR	2	ARR save area in ERP
0F-10	QERXR1	2	XR1 save area in ERP
11-12	QERXR2	2	XR2 save area in ERP
13-14	TMPDC	2	IOB save area
15-16	QWSNS	2	SNS loop save area
17-18	–	2	Constants
19-1A[1]	IOBPMR	2	Current PMR save area

[1] For Model 12 with more than 64K bytes of main storage.

5444/5447/5448 Disk IOS Queues

There is a 2-byte pointer in SYSCOM that points to the first queue. A pointer in the queue contains the address of the next queue.

Disp Hex	Label	Lng Dec	Description
00	DIODQ1	0	Start of 5444 queues
00-13	QONE	20	Queue for drive 1 (5444)
14-27	QTWO	20	Queue for drive 2 (5444)
28-3B	QTHREE	36	Queue for drive 1 (5448)
3C-4F	QFOUR	36	Queue for drive 2 (5448)

Offsets for 5444/5447/5448 Queue

Disp Hex	Label	Lng Dec	Description
00-01	QFIRST	2	Address of first IOB on queue
02-03	QLAST	2	Address of last IOB on queue
04-05	QSELF	2	Address of this queue
06	QFBYTE	1	Flag byte for disk operation
07	QCBYTE	1	Cylinder byte for disk operation
08	QSBYTE	1	Sector byte for disk operation
09	QNBYTE	1	Number byte for disk operation
0A-0B	QSENSE	2	Sense save area
0C-0D	NXTQUE	2	Address of next spindle's queue
0E	LASTSK	1	Logical cylinder number of last seek
0F-10	PHYSCS	2	Physical C/S save area
11-12	SAVEOP	2	Save area for Q and R code during verify
13	QSTATS	1	Status of drive

5448 Queue Extension Offsets

Disp Hex	Label	Lng Dec	Description
14	QUEQ	1	Original IOB Q code
15	QUER	1	Original IOB R code
16	QUEFL2	1	Original IOBFL2 byte
17-18	QUEDAD	2	Original IOBDAD bytes
19	QUECB	1	5445 cylinder to convert
1A	QUEHB	1	5445 head to convert
1B	QUERB	1	5445 record to convert
1C	QUENB	1	Number of records to process
1D	QUEC	1	5444 cylinder to convert
1E	QUES	1	5444 sector to convert
1F-23		5	Reserved

5445 Disk IOS Queues (Model 10 Only)

There is one 54-byte queue for each 5445 disk drive on the system. A pointer in SYSCOM points to the first queue. The queues are chained together.

Disp Hex	Label	Lng Dec	Description
00	DIODQ2	0	Start of 5445 queues
00-35	QX1	54	Queue for D1
36-68	QX2	54	Queue for D2

Format of Each 54-Byte Queue

Disp Hex	Label	Lng Dec	Description
00-01	QFIRST	2	Address of first IOB on the queue
02-03	QLAST	2	Address of last IOB on the queue
04-05	QSELF	2	Address of this queue
06	QSNS2	1	Sense byte 2
07	QSNS3	1	Sense byte 3
08-09	QCHR	2	Sense C/H/R home address register
0A	QSNS0	1	Sense byte 0
0B	QSNS1	1	Sense byte 1
0C-0D	NXTQUE	2	Address next queue
0E-0F	ADHA	2	Address of home address save area (HA field 1)
10	LASTSK	1	Logical cylinder numbers of last seek
11-12	QSAVOP	2	Save area for Q and R codes
13	QSTATS	1	Drive status
14-15	ADR0	2	Address of record 0 save area
16-1F	QCOUNT	10	SIO counters
20-24	HAFLD	5	Home address field
25-2C	R0FLD	8	Record 0 field
2D	QR0CNT	1	Record 0 count field
2E-2F	DFCA45	2	Address of record 0 count field (COUNTX)
30-31	QCHST	2	Save area for starting cyl/head address
32-33	QSIORS	2	SIO read and scan counter
34-35	QSIOWT	2	SIO write counter

CONFIGURATION RECORD (CONFIG)

The CONFIG record contains information on the devices supported on a particular system.

The CONFIG record is always located at cylinder 0, sector 04, of the system-resident simulation area.

Four bytes are allowed for each device that can be on the system. The first byte (byte 0) indicates whether the device is supported on the system. The other 3 bytes for each device contain unique characteristics of the device.

Cylinder 00, Sector 04

Disp Hex	Label	Lng Dec	Description
00	CF5424	1	5424 MFCU byte 0: *Hex Value* — *Meaning* 80 — Device supported
01-03		3	Reserved
04	CF5203	1	5203/1403 Printer byte 0: *Hex Value* — *Meaning* 80 — Device supported 04 — Dual feed carriage 03 — 132 print positions 01 — 120 print positions 00 — 96 print positions
05-07		3	Reserved
08-0B	CF5471	4	5471 console I/O (printer/keyboard) byte 0: *Hex Value* — *Meaning* 80 — Device supported 5471 console I/O (printer/keyboard) byte 1: *Hex Value* — *Meaning* 80 — CCP has set console device unavailable to system

Disp Hex	Label	Lng Dec	Description
08-0B (continued)			5471 console I/O (printer/keyboard) byte 2:
			Area for CCP to save the reader select switch console device selected byte
			5471 console I/O (printer/keyboard) byte 3:
			Area for CCP to save the reader select switch auxiliary position selected byte
0C	CF1442	1	1442 Card Read Punch byte 0:
			Hex Value — *Meaning*
			80 — Device supported
0D-0F		3	Reserved
10-11	CF5444	2	Disk drive configuration byte 0:
			Hex Value — *Meaning*
			80 — Device supported
			10 — 200 cylinders
			08 — 100 cylinders
			Disk drive configuration byte 1:
			Hex Value — *Meaning*
			03 — R1, F1, R2, F2
			01 — R1, F1, R2
			00 — R1, F1
12-13		2	Reserved
14-15	CFMTXR	2	Matrix printer byte 0:
			Hex Value — *Meaning*
			80 — Device supported
			04 — Bidirectional print
			02 — 22-inch/220 print positions
			01 — 13-inch/132 print positions

CONFIGURATION RECORD (Continued)

Disp Hex	Label	Lng Dec	Description
14-15 (continued)			Matrix printer byte 1:
			Hex Value — *Meaning*
			40 — Variable forms control
			20 — Pin feed
			01 — Reserved for World Trade
16-17		2	Reserved
18-1A	CFKEYB	3	Input keyboard byte 0:
			Hex Value — *Meaning*
			80 — Device supported
			Input keyboard byte 1:
			Hex Value — *Meaning*
			80 — 16 command keys
			40 — 8 command keys
			Input keyboard byte 2:
			Hex Value — *Meaning*
			20 — Reserved for World Trade
			10 — Reserved for World Trade
			0A — Katakana
			09 — United Kingdom
			08 — Brazil/Portugal
			07 — Spain
			06 — Finland/Sweden
			05 — Norway
			04 — Denmark
			03 — Belgium/France
			02 — Austria/Germany
			01 — England
1B		1	Reserved
1C	CFLGCD	1	Ledger card device byte:
			Hex Value — *Meaning*
			80 — Device supported

CONFIGURATION RECORD (Continued)

Disp Hex	Label	Lng Dec	Description
1D-1F		3	Reserved
20	CRDTRC	1	Data recorder byte: *Hex Value* *Meaning* 80 Device supported

Disp Hex	Label	Lng Dec	Description
21-23		3	Reserved
24-25	CFBSCA	2	Binary synchronous communications adapter, line 1 byte 0: *Hex Value* — *Meaning* 80 — Device supported Binary synchronous communications adapter, line 1 byte 1: *Hex Value* — *Meaning* 20 — RJE 0B — Local display adapter 0A — Line 1 and local display adapter 05 — Line 1, ICA 04 — ICA 01 — Line 1
26-27		2	Reserved
28	CFCRT	1	Cathode ray tube (display screen) byte: *Hex Value* — *Meaning* 80 — Device supported
29-2B		3	Reserved
2C	CF5475	1	5475 data entry keyboard byte: *Hex Value* — *Meaning* 80 — Device supported
2D-2F		3	Reserved
30	CFMICR	1	Magnetic character reader byte: *Hex Value* — *Meaning* 80 — 1255 Model 1, 2, or 3 supported 40 — 1419 Model 1 supported
31-33		3	Reserved

Disp Hex	Label	Lng Dec	Description
34	CFMIC2	1	Magnetic character reader byte: *Hex Value* — *Meaning* 80 — 1255 Models 21, 22, or 23 supported
35-37		3	Reserved
38	CF1270	1	1270 optical character sorter (WTC only): *Hex Value* — *Meaning* 80 — Device supported
39-3B		3	Reserved
3C	CF1403	1	1403 Printer byte: *Hex Value* — *Meaning* 80 — Device supported if displacement hex 04 is hex 83 also
3D-3F		3	Reserved
40-42	CF5445	3	5445/5448/3340 disk byte 0: *Hex Value* — *Meaning* 80 — Device supported 5445/5448/3340 disk byte 1: *Hex Value* — *Meaning* 03 — D1, D2 01 — D1 5448 disk byte 2: *Hex Value* — *Meaning* 80 — 5448 supported
43		1	Reserved

CONFIGURATION RECORD (Continued)

Disp Hex	Label	Lng Dec	Description
44-47	CF3410	4	Magnetic tape unit byte 0:

Hex Value	*Meaning*
80	Device supported

Magnetic tape unit byte 1:

Hex Value	*Meaning*
08	T1, T2, T3, T4
04	T1, T2, T3
02	T1, T2
01	T1

Magnetic tape unit byte 2:

Hex Value	*Meaning*
08	T4 (dual density supported)
04	T3 (dual density supported)
02	T2 (dual density supported)
01	T1 (dual density supported)

Magnetic tape unit byte 3:

Hex Value	*Meaning*
08	T4 is 7-track
04	T3 is 7-track
02	T2 is 7-track
01	T1 is 7-track

Disp Hex	Label	Lng Dec	Description
48-49	CFBSC2	2	Binary synchronous communications adapter, line 2 byte 0:

Hex Value	*Meaning*
80	Device supported

Binary synchronous communications adapter, line 2 byte 1:

Hex Value	*Meaning*
02	Line 2 supported

Disp Hex	Label	Lng Dec	Description
4A-4B		2	Reserved

CONFIGURATION RECORD (Continued)

Disp Hex	Label	Lng Dec	Description
4C	CF3741	1	3741 data station/programmable work station byte 0:
			Hex Value — *Meaning*
			80 — Device supported
4D-4F		3	Reserved
50	CFENDD	1	End-of-device indicator (hex FF)
51-52	CFCNSL	2	Console options byte 0:
			Hex Value — *Meaning*
			80 — Device supported
			Console options byte 1:
			Hex Value — *Meaning*
			04 — 3741
			03 — 1442
			02 — 5471
			01 — MFCU2
53-54	CFAUXR	2	Auxiliary reader device byte 0:
			Hex Value — *Meaning*
			80 — Device supported
			Auxiliary reader device byte 1:
			Hex Value — *Meaning*
			04 — 3741
			03 — 1442
			02 — 5471
			01 — MFCU2
55-CF		123	Reserved

CONFIGURATION RECORD (Continued)

Disp Hex	Label	Lng Dec	Description
D0	CFSAUT	1	Spool indicator byte 0: *Hex Value* — *Meaning* 60 — Spool both levels 40 — Spool level 1 20 — Spool level 2 10 — Use 5471 OCC reader; otherwise, use sysin defined for level as OCC reader
D1-D4	CFSFNO	4	Spool default form number
D5	CFSPPR	1	Spool print device indicator by Q code byte 0: *Hex Value* — *Meaning* E0 — Printer Q code
D6	CFSPDK	1	Spool disk byte 0: *Hex Value* — *Meaning* 02 — D2 01 — D1
D7		1	Reserved
D8-D9	CFSPCL	2	Spool number of cylinders (001-166)
DA	CFSPEX	1	Spool file track group size (track 1, 2, 4, 5, or 10) byte 0
DB-F6		28	Reserved
F7	CFOUTD	1	System punch device byte 0: *Hex Value* — *Meaning* FF — No punch device 81 — 1442 04 — 3741 02 — Data recorder 01 — MFCU2 00 — MFCU1

Disp Hex	Label	Lng Dec	Description
F8	CFSIAM	1	Shared I/O access method: *Hex Value* — *Meaning* 80 — Supported
F9	CFTYPE	1	System type: *Hex Value* — *Meaning* 80 — Model 6 40 — Model 4 00 — Model 8, 10, or 12
FA	CFIQCR	1	Options: *Hex Value* — *Meaning* 40 — Inquiry 20 — DPF 10 — Checkpoint/restart
FB	CFDATE	1	Date format: *Hex Value* — *Meaning* 04 — DDMMYY 00 — MMDDYY
FC	CFLINE	1	Number of lines per page
FD-FF	CFCTRL	3	Total main storage size: *Hex Value* — *Meaning* 018000 — 96K 014000 — 80K 010000 — 64K 00C000 — 48K 008000 — 32K 006000 — 24K 004000 — 16K 003000 — 12K 002000 — 8K

SPOOL FILE DESCRIPTION (SFD) (MODEL 12 ONLY)

The SFDs provide descriptions of the spool file. There are three possible SFDs in the system: One for the spool writer and one for each program level.

The spool communication area contains a pointer to the spool writer SFD. The spool extension to the program level communications area contains a pointer to the spool intercept SFD.

Disp Hex	Label	Lng Dec	Description
00	SFDMID	1	Module ID: *Hex Value* — *Meaning* 80 — Refresh entry 40 — Spool transient load request 20 — Spool file full 10 — Spool file disk error 0F — Spool transient module ID
01-02	SFDRT@	2	Caller's return address
03	SFDCC	1	Completion code: *Hex Value* — *Symbol* — *Meaning* 80 — SFDIVP — Invalid display (OCC) 70 — SFDEOX — End of extent 60 — SFDEOB — End of block 48 — SFDERC — Disk error (OCC) 44 — SFDNSP — Space not available 41 — SFDERR — Disk error 40 — SFDOK — Successful
04	SFDX1	1	Translate op 1 only for setting PMR
05	SFDX2	1	Translate op 2 only for setting PMR
06	SFDX12	1	Translate op 1 and op 2 for setting PMR
07	SFDFG1	1	Flag byte 1: *Hex Value* — *Symbol* — *Meaning* 80 — SFDINT — Intercept SFD 40 — SFDCLZ — Intercept close request 20 — SFDFLC — Forms length change required 10 — SFDOP — Input operation 08 — SFDDEJ — Defer job at EOJ 04 — SFDNDR — Nondata record

SPOOL FILE DESCRIPTION (SFD) (Continued)

Disp Hex	Label	Lng Dec	Description
08	SFDFG2	1	Flag byte 2:

Hex Value	*Symbol*	*Meaning*
80	SFDSTP	Stop writer
40	SFDCCF	New class—change forms
20	SFDCLS	Class output indicator
10	SFDCLO	Writer close request
08	SFDEND	End request
04	SFDSYI	Read OCC from sysin
02	SFDKEY	Read OCC from 5471
01	SFDNDT	No data transfer

Disp Hex	Label	Lng Dec	Description
09-0A	SFDSRL	2	Source record length
0B-0C	SFDSRA	2	Source record address
0D-0E	SFDDRL	2	Destination record length
0F-10	SFDDRA	2	Destination record address
11-14	SFDCXA	4	Current extent address (CC/H/R)
15-16	SFDNAR	2	Number minus 1 of available records
17-18	SFDIOB	2	Disk IOB address
19-1A	SFDPLR	2	Address of PLCA
1B-1C	SFDQMP	2	Address of queue management parameter list (pointer to QFD)
1D-1E	SFDOCC	2	Address of OCC command list
1F-20	SFDERP	2	Error log parameter list address
21-22	SFDMNT	2	Maintenance area
23-24	SFDR1A	2	XR1 save area A
25-26	SFDR2A	2	XR2 save area A
27-28	SFDARA	2	ARR save area A
29-2A	SFDR1B	2	XR1 save area B
2B-2C	SFDR2B	2	XR2 save area B
2D-2E	SFDARB	2	ARR save area B

SPOOL FILE DESCRIPTION (SFD) (Continued)

Disp Hex	Label	Lng Dec	Description
2F-30	SFDR1C	2	XR1 save area C
31-32	SFDR2C	2	XR2 save area C
33-34	SFDARC	2	ARR save area C

Spool Writer SFD Offsets

Disp Hex	Label	Lng Dec	Description
35	SFDFG3	1	Flag byte:

Hex Value	*Symbol*	*Meaning*
80	SFDFTM	Print writer first time bit
40	SFDALN	IP alignment
20	SFDLEV	Program level 1 indicator
10	SFDSEP	Separator pages
08	SFDCAN	Cancel request
04	SFDHLD	Hold current job
02	SFDRST	Restart request
01	SFDACT	SFD active

Disp Hex	Label	Lng Dec	Description
36	SFDFG4	1	Flag byte:

Hex Value	*Symbol*	*Meaning*
80	SFDFRM	Forms length change halt
40	SFDREL	Release request
20	SFDSRT	Start OCC indicator
10	SFDAUT	Autowrite
08	SFDROC	Reread OCC
04	SFDDAL	Device being allocated
02	SFDSPC	Separator pages complete
01	SFDPWL	$SSOPW loaded

Disp Hex	Label	Lng Dec	Description
37-38	SFDPHY	2	Physical IOB pointer
39-3A	SFDLOG	2	Logical IOB pointer
3B-3D	SFDFTY	3	Forms type
3E	SFDCPY	1	Number of copies
3F	SFDFLG	1	Forms length
40-42	SFDOFM	3	Old forms type

Spool Intercept SFD (Model 12 Only)

Disp Hex	Label	Lng Dec	Description
35	SFDIFG	1	Flag byte: *Hex Value* / *Symbol* / *Meaning* 80 SFDRQ1 SFD open for this job 40 SFDALC File index allocated 20 SFDDER Permanent disk error 10 SFDUPD File index updated 08 SFDOJB Opened for this group 04 SFDFUL Spool file full 02 SFDIXE Disk error in index 01 SFDDFR Writer waiting for data
36-37	SFDCHN	2	Intercept SFD chain
38-39	SFDIIB	2	Intercept IOB address
3A-3B	SFDRBA	2	Address of current request block
3C-3C	SFDRB2	2	Index register 2 save area
3E-3F	SFDRBR	2	ARR save area
40	SFDL	1	Compression length
41	SFDLEN	1	Length of disk record
42	SFDQB	1	Intercepted IOB Q code
43	SFDRB	1	Intercepted IOB R code
44-45	SFDDAT	2	Intercepted IOB data address
46	SFDLCT	1	Current line count
47-48	SFDPCT	2	Current page count
49	SFDPFL	1	Printer forms length
4A	SFDFMR	1	Forms length change record
4B-4D	SFDFML	3	New forms length

SPOOL FILE ORGANIZATION (Model 12 Only)

The spool file is divided into an index area and a data area. The data area is divided into track groups. All track groups are the same size, either 1, 2, 4, 5, or 10 tracks. Each track group has an index entry (Figure 2-4). The index area also contains a master index. The formats of the spool file master index and spool file index follow.

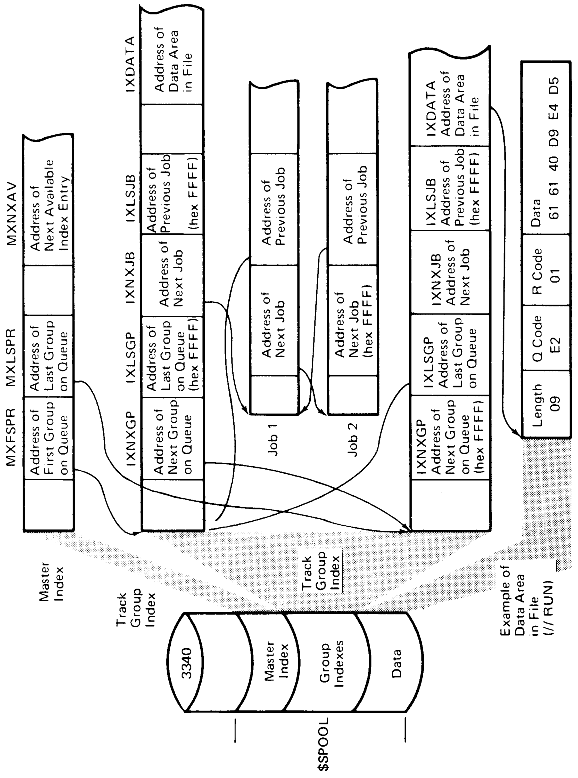


Figure 2-4. Spool File

Spool File Master Index (Model 12 Only)

Disp Hex	Label	Lng Dec	Description
00-04	MXFSIN	5	Reserved
05-09	MXLSIN	5	Reserved
0A-0E	MXFSPR	5	Address of first group on print queue
0F-13	MXLSPR	5	Address of last group on print queue
14-18	MXFSPU	5	Reserved
19-1D	MXLSPU	5	Reserved
1E-22	MXNXAV	5	Address of next available index entry
23-24	MXNOIX	2	Number of index entries
25-26	MXNOTK	2	Number of sector/index entry
27-29	MXADRF	3	Address of the spool file
2A	MXQCDE	1	Q code of the spool file
2B	MXHOLD	1	Queue hold indicator/transient interlock:

Hex Value	*Symbol*	*Meaning*
40	PRTHLD	Print queue hold state
10	MSDJOB	Display: get next job
04	MXICLS	Intercept close using transient area

Disp Hex	Label	Lng Dec	Description
2C-30	MXDSGP	5	Pointer to next group display
31-35	MXDSJB	5	Pointer to next job display
36	MXLOAD	1	Module ID currently loaded
37-38	MXALCS	2	Allocated size of file cylinder
39-3A	MXAEXT	2	Allocated number of track groups
3B-3C	MXIEND	2	Pointer to end of index
3D-3E	MXSCHN	2	Reserved
3F	MXEXTR	1	Reserved
—	MXEND	—	End of master index

Track Group Index

Disp Hex	Label	Lng Dec	Description
00-07	IXGRPN	8	Group ID
08-0F	IXJOBN	8	Job name
10-14	IXNXGP	5	Address of next group on queue
15-19	IXLSGP	5	Address of previous group on queue
1A-1E	IXNXJB	5	Address of next job in this group
1F-23	IXLSJB	5	Address of previous job
24-28	IXADDL	5	Address of additional data extent
29-2B	IXDATA	3	Address of data area in file
2C	IXSTA1	1	Status byte:

Hex Value	*Symbol*	*Meaning*
80	IXHOLD	Job is in a hold
40	IXSAVE	Job is owned by the writer
20	IXACTV	Job is in process
10	IXDEFR	Defer print
08	IXSPOL	Spool *no* given
04	IXALGN	First page alignment needed
02	IXHALT	Halt on unprintable characters

Disp Hex	Label	Lng Dec	Description
2D	IXSTA2	1	Reserved
2E	IXPRTY	1	Program level priority:

Hex Value	*Symbol*	*Meaning*
05	IXPTY5	Priority 5
04	IXPTY4	Priority 4
03	IXPTY3	Priority 3
02	IXPTY2	Priority 2
01	IXPTY1	Priority 1
00	IXPTY0	Priority 0

Disp Hex	Label	Lng Dec	Description
2F	IXPART	1	Reserved
30	IXFMLG	1	Forms length
31	IXCOPY	1	Number of copies
32-34	IXNUMB	3	Forms type

Track Group Index (Continued)

Disp Hex	Label	Lng Dec	Description
35	IXCORE	1	Reserved
36-37	IXEXTC	2	Extent count
38-3C	IXLAST	5	CC/H/R/D of last extent
3D	IXLIN#	1	Current line number
3E-3F	IXPAG#	2	Current page number
40	IXDIS#	1	Displacement of data in block
41-7F	IXEXTR	63	Reserved
–	IXEND	–	End of index

Queue File Description (QFD)

Each SFD (spool file description) has a QFD for providing information about the related queue on the spool file. Each SFD contains a pointer to the related QFD.

Disp Hex	Label	Lng Dec	Description
00	QFDMID	1	Module ID:

Hex Value	*Symbol*	*Meaning*
80		Refresh entry
40		Spool transient load request
20		Spool file full detected
10		Spool file disk error
0F		Spool transient module IDs
07	$$SOCC	OCC handler
06	$$SOCB	OCC handler
05	$$SOCA	OCC handler
04	$$SOIT	Intercept close
03	$$SOIO	Intercept open
02	$$SOQD	Queue management-deallocate
01	$$SOQM	Queue management-allocate

Disp Hex	Label	Lng Dec	Description
01-02	QFDRT@	2	Caller's return address

Queue File Description (QFD) (Continued)

Disp Hex	Label	Lng Dec	Description
03	QFDCOM	1	Completion code: *Hex Value* / *Meaning* 44 No more extents found 41 Disk error 40 Successful
04	QFDX1	1	Translate op 1 only for setting PMR
05	QFDX2	1	Translate op 2 only for setting PMR
06	QFDX12	1	Translate op 1 and op 2 for setting PMR
07	QFDCID	1	Caller's ID:

Hex Value	*Symbol*	*Meaning*
80		Refresh to calling module
40		Spool transient load request
0F		Calling module ID
07	$$SOCC	OCC handler
06	$$SOCB	OCC handler
05	$$SOCA	OCC handler
04	$$SOIT	Intercept close
03	$$SOIO	Intercept open
02	$$SOQD	Queue management-deallocate
01	$$SOQM	Queue management-allocate

Disp Hex	Label	Lng Dec	Description
08	QFDFUN	1	Function code Disk space allocation function bytes:

Hex Value	*Meaning*
89	Get next available extent—first request for a group
09	Get next available extent—first request for a job
01	Get next available extent

Queue File Description (QFD) (Continued)

Disp Hex	Label	Lng Dec	Description
08 (continued)			Input extent function bytes: *Hex Value* — *Meaning* 19 — Get next extent in forward chain 11 — Get next extent, first time Other queue management functions: *Hex Value* — *Meaning* 41 — Deallocate disk space 21 — Update directory entry
09-0B	QFDSTR	3	Address of start (CC/H)
0C-0D	QFDREC	2	Number of records in group
0E-0F	QFDPD@	2	Main storage address of primary directory
10-14	QFDCDD	5	Address of current directory (CC/H/R/D)
15-19	QFDCND	5	Address of next directory (CC/H/R/D)
1A-1E	QFDPDD	5	Address of primary directory (CC/H/R/D)
1F-23	QFDPND	5	Address of next primary directory (CC/H/R/D)
24-25	QFDCEC	2	Number of groups in entry
26-27	QFDSF@	2	Address of associated SFD
28-A8	QFDPRI	128	Primary directory Function bit settings: *Hex Value* — *Symbol* — *Meaning* 88 — QFEGRP — Primary request for group 40 — QFEDEA — Deallocate request 20 — QFEUPD — Update request 10 — QFEINP — Input extent request 08 — QFEJOB — Primary request for job 00 — QFEALO — Allocation request

TAPE LABEL FORMATS

This section contains information concerning magnetic tape terminology and explanations of the standard magnetic tape label formats used by System/3.

Tape Label Usage

The format of a labeled tape is shown in Figure 2-5. The format of unlabeled tapes is shown in Figure 2-6. The label's volume, header, and trailer (end of volume or end of reel) are written on tape to provide a programmed identification of the file. Labels are checked by tape data management before any processing is performed, to determine whether the reel containing the desired file has been mounted.

Tape Label Terminology

System/3 considers a tape label to be standard if it follows either the IBM Magnetic Tape Label Standard for EBCDIC data or the American National Standards Institute (ANSI) tape label standard for ASCII data. This provides compatibility with other systems that adhere to either IBM Magnetic Tape Label Standards or ANSI tape label standards.

Nonstandard labels contain whatever information the user desires to include. These labels can vary in length and format and are the complete responsibility of the user. Nonstandard labels are not checked by System/3 tape data management for input files and they cannot be written for output files.

User standard labels are file labels that follow standard header and trailer label conventions (ANSI or IBM). They are a variation of standard labels with a partially fixed format. These labels are sometimes provided by other systems. User standard labels are not checked by System/3 data management and cannot be written as part of the label group.

A volume label is written by the System/3 tape initialization program at the time a reel is prepared for use. The volume label identifies the reel and is always the first record on a reel. The information contained in the volume label is checked by tape data management and never altered during file processing. Any additional volume labels that have been written on another system are ignored by tape data management.

Header and trailer labels are written before and after the data on a reel. Trailer labels are either end of file or end of volume. End-of-file trailer labels are written at the end of the logical file. End-of-volume trailer labels are written at the end of a reel indicating that the file is continued on another reel.

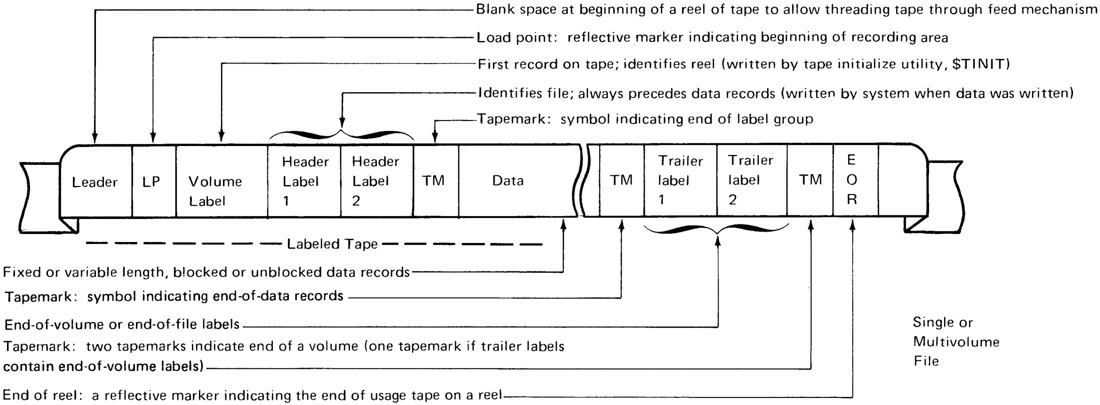


Figure 2-5. Tape Format: Labeled Single or Multivolume Files

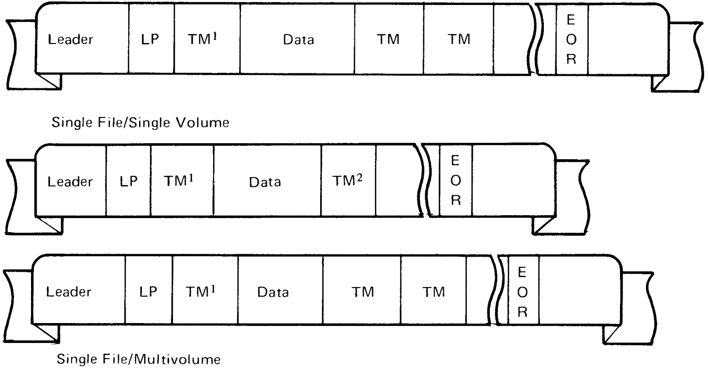
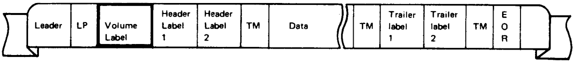


Figure 2-6. Tape Formats: Unlabeled Single or Multivolume Files

[1] Optional; if present it is ignored.
[2] For ASCII files, a second tapemark follows the data.

Volume Label Format

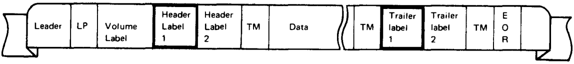
The volume label is written in EBCDIC format with a block length and record length equal to 80 bytes.



Disp Hex	Name	Lng Dec	Description
00	Label identifier	3	The first record on tape that identifies the reel. This position always contains VOL.
03	Volume label number	1	Indicates the sequence of a volume label. This position contains a 1 for System/3 tapes.
04	Volume identifier	6	This position uniquely identifies the volume. This field contains from 1 to 6 alphabetic and/or numeric characters. If the volume identifier is less than 6 characters, it is left-justified and the remainder of the field is padded with spaces. In the case of the first or only volume of a file, the contents of this field are also used as the file identifier in the header and trailer labels.
A	Volume security	1	This character is for installation use as a security indicator for the entire volume. It is installation defined, and can be any alphabetic or numeric character or a space. The System/3 tape initialization program initially sets this position to zero.
B	Reserved	30	This field is reserved and initially set to blanks (hex 40).
29	Owner identification	10	This field is not used by System/3 label processing. However, it indicates the name and address of the installation or user to whom the volume belongs. The 10 most significant (leftmost) user-supplied characters are used to set this field. If the user-supplied name and address code is less than 10 characters in length, it is left-justified and the remainder of the field is padded with spaces.
33	Reserved	29	This field is reserved and initially set to blanks (hex 40).

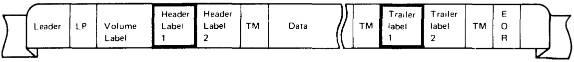
Header Label 1 and Trailer Label 1 Format

The first header and trailer labels identify the data contained on tape. These labels are written for the exclusive use of the system. They are written in EBCDIC format with a block length and record length equal to 80 bytes.



Disp Hex	Name	Lng Dec	Description
00	Label identifier	3	This field identifies the type of label: HDR Header label EOF End-of-file trailer label EOV End-of-volume trailer label (for all but the final volume of a multivolume file)
03	Label number	1	Indicates the sequence of the label. This position contains a 1 for System/3 tapes.
04	File identifier	17	These characters are assigned by the user to identify the file. System/3 is concerned only with the leftmost 8 characters. These characters are left-justified by System/3 and the remainder of the field is padded with spaces.
15	Aggregate identifier	6	These characters identify the aggregate on which the file is included. The characters are identical to the volume identifier field VOL (04). In the case of an aggregate on two or more volumes, this field contains the identifier of the first volume.
1B	Volume sequence number	4	This is a number field (0001-9999) indicating the order of a volume within a multivolume file. The volume sequence number is the same for every header and trailer label on the volume. It is incremented by one for each additional volume.
1F	File sequence number	4	This is a numeric field (0001-9999) indicating the order of a file within a multifile volume. The sequence number is the same for every label associated with portions of the same file.

Header Label 1 and Trailer Label 1 Format (Continued)

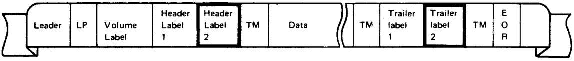


Disp Hex	Name	Lng Dec	Description
23	Generation number	4	This is a numeric field (0001-9999) indicating a single stage in the succession in which one file replaces another. This field is not verified on input by System/3.
27	Version number of generation	2	This is a numeric field (00-99) indicating an iteration of a generation. This field is not verified on input by System/3.
29	Creation date	6	This field indicates the year and day of the year the data set was created. It is of the form b̸YYDDD; a space, followed by the year (YY=00-99), followed by the day of the year (DDD=001-366). For example, February 1, 1970 would be recorded as b̸70032.
2F	Expiration date	6	This field indicates the year and day of the year when the file may be purged. The format of this field is identical to the creation date field.
35	Security	1	This field indicates whether or not you must supply additional qualifications in order to access the file. This field is set to zero on System/3 tapes and is not verified by System/3.
36	Block count	6	This is a numeric field (000000-999999) indicating the number of blocks between the last label of the header label group and the first trailer label. The count is recorded in the trailer label only (EOF1 or EOV1). These characters are recorded as zeros in the header label.
3C	System code	13	This field contains 'IBMb̸SYSTEM/3b̸.
49	Reserved	7	This field is not used by System/3.

Header Label 2 and Trailer Label 2 Format

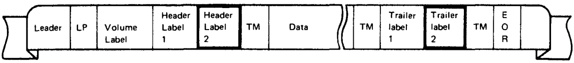
The second header and trailer labels provide additional information about the file. These labels are checked by System/3 if they are present for input files and are created for output files. However, System/3 accepts a file without the second header or trailer label. The labels are written in EBCDIC format with a block length and record length equal to 80 bytes.

IBM Standard for Tape Header 2 and Trailer Label 2



Disp Hex	Name	Lng Dec	Description
00-02	Label identifier	3	This field identifies the type of label: HDR Header label EOF End-of-file trailer label EOV End-of-file trailer label (for all but the final volume of a multivolume file)
03	Label number	1	Indicates the sequence of the label. This position contains a 2 for System/3 tapes.
04	Record/block format	1	Indicates the record/block format of the file: V Variable-length records in variable-length blocks F Fixed-length records in fixed-length blocks D Variable-length ASCII records
05-09	Block length	5	This field indicates the following length attributes: V Maximum block length (00009-32767) F Constant block length (00018-32767) *Note:* The minimum physical record length for magnetic tapes is 18; therefore, if the block length is to equal the physical record length, 18 should be used as the minimum in place of those given above.

IBM Standard for Tape Header 2 and Trailer Label 2 (Continued)



Disp Hex	Name	Lng Dec	Description
0A-0E	Record length	5	This field indicates the following length attributes: V — Maximum record length (00005-32767) F — Constant record length (00001-32767)
0F-21	Reserved	19	This field is not used by System/3.
22-23	Tape recording technique	2	This field indicates the tape recording technique used to create the file: Cƀ — Data conversion required Eƀ — Even parity Tƀ — BCD to EBCDIC translation required ET — Even parity and BCD to EBCDIC translation required ƀƀ — Odd parity, no translation required (9-track)
24-25	Reserved	2	This field is not used by System/3.
26	Record attributes	1	This field indicates one of the following record attributes: B — Records are blocked and not spanned S — Records are spanned and not blocked R — Records are blocked and spanned ƀ — Records are not blocked and not spanned
27-50	Reserved	41	This field is not used by System/3.

TAPE VOLUME ERROR STATISTICS

Error information is stored in a temporary logging area on F1 during the processing of a tape file. The location is cylinder 0, sectors hex A0 and A4. One sector is used for each program level.

Records are written on the CE tracks, except for the first sector of each track, at end of job time. A pointer to the next available space on the CE tracks is kept on F1, cylinder 0, sector hex 18, displacement hex 0A-0B.

Three types of records are written in a wraparound table. The type V record is a 64-byte area that contains the record of temporary errors on a single unit for a single job. The type O record is a 32-byte area that contains the permanent error record. The format of the type N record is a 32-byte area that contains the null record used for format consistency within a sector. There are never more than two type N records logged.

Disp Hex	Lng Dec	Description
00	1	Record type: character V
01-06	6	Date: format MMDDYY
07-0C	6	Volume ID
0D-12	6	First volume ID Last volume ID
13	1	Unit: C3, C4, C5, C6
14	1	*Hex Value* / *Meaning* 80 7-track 40 Even parity 20 Convert 0C Density mask bits: 00 = 1,600 10 = 556 01 = 800 11 = 200 03 Model ID mask bits: 00 = Model 1 10 = Model 3 01 = Model 2 00 Translate
15-16	2	Block length
17	1	Number of volumes

TAPE VOLUME ERROR STATISTICS (Continued)

Disp Hex	Lng Dec	Description
Counters for Last Volume on Unit		
18-19	2	SIO
1A	1	Noise block
1B	1	ERG
1C	1	Temporary read forward error
1D	1	Temporary read backward error
1E	1	Temporary write error
Counters for All Volumes on Unit		
1F-20	2	SIO
21	1	Noise block
22	1	ERG
23	1	Temporary read forward error
24	1	Temporary read backward error
25	1	Temporary write error
Error Counters for This Unit/Job		
26	1	Diagnostic track errors
27	1	Start velocity check
28	1	Tape mark check
29	1	End velocity check
2A	1	Write feedthrough
2B	1	No readback data

TAPE VOLUME ERROR STATISTICS (Continued)

Disp Hex	Lng Dec	Description
2C	1	Overrun
2D	1	Short gap mode
2E-2F	2	Multitrack error
30	1	End data check
31	1	Envelope check
32	1	False end marker
33	1	PE ID burst error
34	1	VRC error
35-38	4	Tracks in error
39-3F	7	Reserved

N Record Format

Length is 32 bytes (hex 20). Type N record.

Disp Hex	Lng Dec	Description
00	1	Record type character 'N'
01-1F	31	Unused (this is a null record)

O Record Format

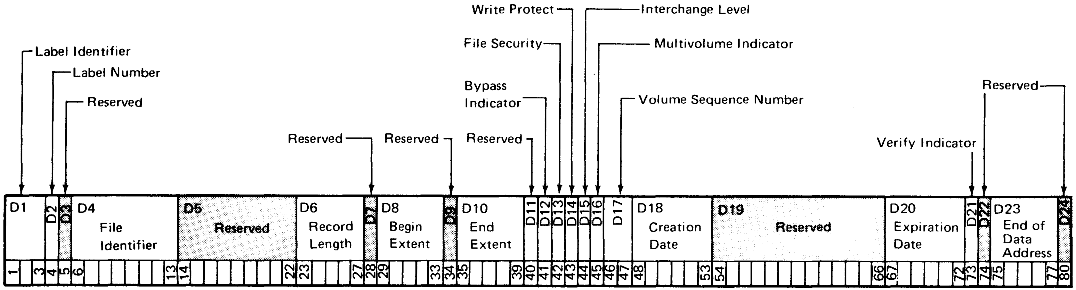
Length is 32 bytes (hex 20). Type O record.

Disp Hex	Lng Dec	Description
00	1	Record type: character O
01-06	6	Date: format MMDDYY
07-0C	6	Volume ID

TAPE VOLUME ERROR STATISTICS (Continued)

Disp Hex	Lng Dec	Description
Q Code and R Codes		
0D	1	Q code
0E	1	R code
Adapter Sense Bytes		
0F	1	Sense byte 0
10	1	Sense byte 1
Subsystem Sense Bytes		
11	1	Sense byte 0
12	1	Sense byte 1
13	1	Sense byte 2
14	1	Sense byte 3
15	1	Sense byte 4
16	1	Sense byte 5
17	1	Sense byte 6
18	1	Sense byte 7
19-1F	7	Reserved

3741 HEADER LABEL



Note: Shaded areas are reserved.

STANDARD DISKETTE HDR1 LABEL

Sector and Position	Description	Entry: Required, Optional, or Not Applicable
1-4	Label ID; must be HDR1	Required
5	Reserved	
6-13	Data set name (user name for data set)	Optional
14-22	Reserved	
23-27	Block/record length. An entry of 1-128 tells the system how much of each 128-position sector contains actual data. (Each sector-track position can contain one logical record.)	Required
28	Reserved	
29-33	BOE. Address of the first sector of the data set is identified as follows: track number in positions 29 and 30; 0 in position 31; sector number in positions 32 and 33.	Required
34	Reserved	
35-39	EOE. Address of the last sector reserved for this data set is in the same format as BOE.	Required
40	Reserved	
41	Bypass indicator: ƀ entry indicates data set is intended for processing. B entry indicates data set is not intended for processing even though it resides on the diskette; that is, a 3741 or 3742 user could store 3741 or 3742 programs on a diskette (identified with B in the label) as well as data (identified with ƀ in the label), and neither a 3747 nor a 3540 would read the programs. Also, a data set identified with a B in this position would not be transmitted by a 3741 Model 2 or Model 4 operating in tele-processing transmit mode.	Optional

Sector and Position	Description	Entry: Required, Optional, or Not Applicable
42	Data set security: ƀ entry indicates that the data set is not secured and can be accessed. A nonblank character (which can be written only by the 3540) indicates restricted access. When set to nonblank, the volume accessibility indicator must also be set to nonblank. The data cannot be read by a 3741, a 3742, or a 3747, but can be read by a 3540 with operator qualification. The data set cannot be written upon, and the volume accessibility indicator cannot be changed from non-blank by the 3741, 3742, or 3747, or by 3540 programming support.	Optional
43	Write protect: P entry indicates data set can be read only. ƀ entry allows both reading and writing.	Not applicable for reading; optional for writing
44	Interchange type indicator: ƀ entry is required to indicate that the data set can be used for data interchange.	
45	Multivolume indicator: ƀ entry indicates entire data set is on this diskette. C entry indicates data set is continued to another diskette. L entry indicates last diskette on which a continued data set resides.	Optional (modes 3, 4, 5)
46-47	Volume sequence number: Volume sequence specifies the sequence of volumes in a multivolume data set. The sequence must be consecutive, beginning with 01 (to a maximum of 99). ƀ entry indicates that volume sequence checking is not to be performed.	Not applicable

Sector and Position	Description	Entry: Required, Optional, or Not Applicable
48-53	Creation date. Can be used to record the date the data set was created. The format is digits representing YYMMDD, where YY is the low-order two digits of the year, MM is the two-digit representation of the month, and DD is the two-digit representation of the day of the month.	Not applicable
54-66	Reserved	
67-72	Expiration date. Can be used to contain the date that the data set (and its label) can be purged. The format is as specified for the creation date.	Not applicable
73	Verify mark: This field must contain a V or a blank. V indicates that the data set has been verified.	Not applicable
74	Reserved	
75-79	EOD. Address of the next unused sector within the data set extent is in the same format as BOE.	Required
80	Reserved	

ERROR LOGGING SECTORS

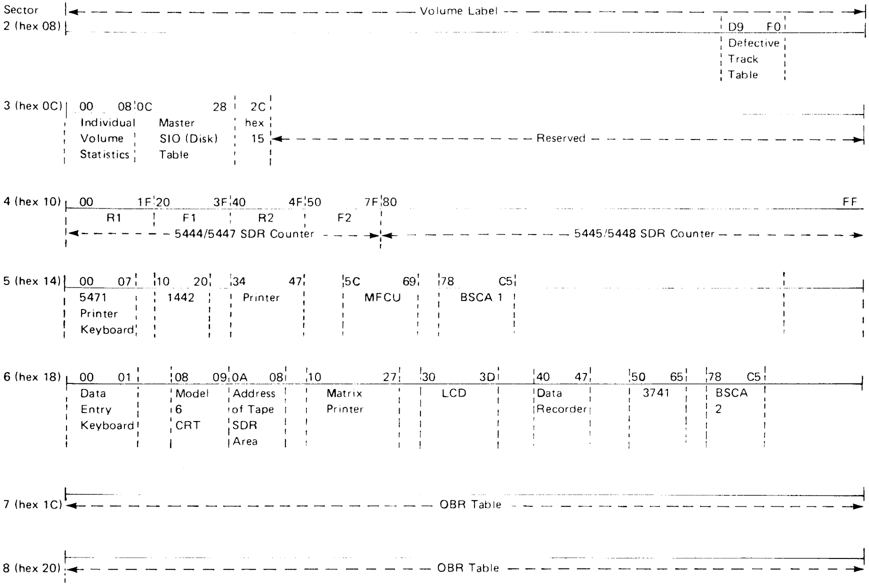
Cylinder 0 of every disk and F1 simulation area is used to record error statistics. Five types of data are recorded, but not all types are recorded on every disk.

Type	Where Found
Defective track table (5444/5448)	Every disk (contained in the volume label) See *5444 Volume Label* (unused in the simulation area)
Defective track table (5445)	Cylinder 0 head 1 record 5
Defective track table (3340)	Cylinder 0 head 1 record 5 of affected data module
Individual volume statistics	Every disk at cylinder 0 sector 3 (hex 0C) displacement hex 00-0B (unused in the simulation area) The format of these 12 bytes is: *Byte* *Contents* 00-03 Number of temporary errors 04-07 Number of SIO writes or verifies 08-0B Number of SIO reads or scans
5444 SIO table	F1 only at cylinder 0 sector 3 (hex 0C) displacement hex 0C-2B (unused in the simulation area)
5448 SIO table	D1 lower at cylinder 0 sector 3 (hex 0C) displacement hex 0C-2B
Statistical data recording (SDR) (for Models 4, 6, 8, and 10)	F1 only at cylinder 0 sector 4-6 (hex 10-18)
Statistical data recording (SDR) (for Model 12)	F1 only at cylinder 0 sectors 5-6 (hex 14-18)
Outboard recording (OBR)	F1 only at cylinder 0 sectors 7-8 (hex 1C-20)

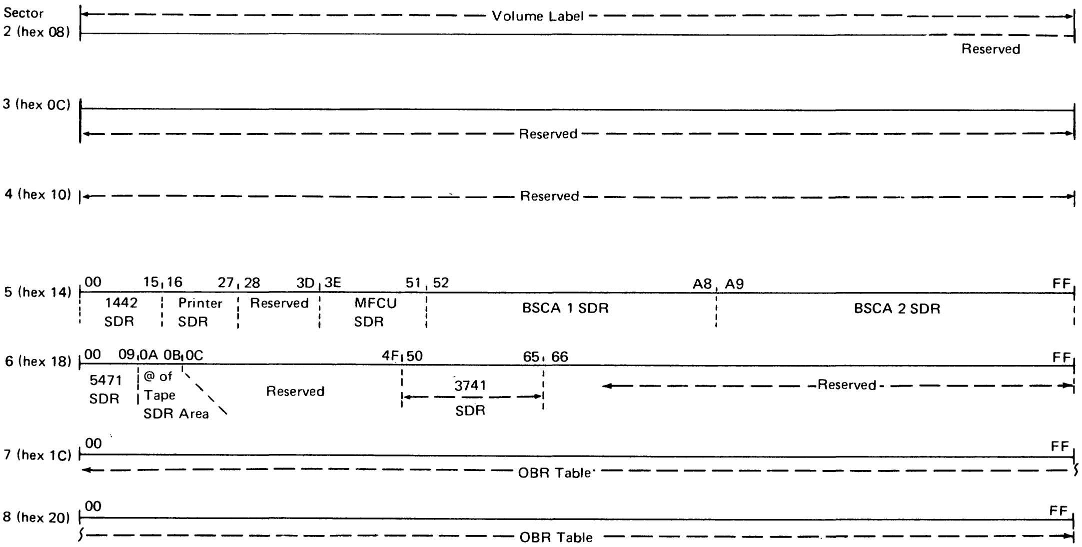
Disk I/O statistics are kept in 3340 drive 1 as follows:

Cylinder	*Head*	*Contents*
209	0	Tape volume error statistics
209	1	Statistics for D1
209	2	Statistics for D2

Error Logging Sectors Diagram (Models 4, 6, 8, and 10)



Error Logging Sectors Diagram (Model 12)



5444/5448 SIO Table

This table contains a record of all SIO writes and nonwrites issued to each 5444/5448 unit on the system. These 32 bytes are divided into eight 4-byte counters, starting at sector 3 (hex 0C), displacement 0C.

4-Byte Displacement	*5444 Contents*	*5448 Contents*
0C-0F	R1 writes	D1 upper writes
10-13	R1 nonwrites	D1 upper nonwrites
14-17	F1 writes	D1 lower writes
18-1B	F1 nonwrites	D1 lower nonwrites
1C-1F	R2 writes	D2 upper writes
20-23	R2 nonwrites	D2 upper nonwrites
24-27	F2 writes	D2 lower writes
28-2B	F2 nonwrites	D2 lower nonwrites
2C	Hex 15	–

Statistical Data Recording (SDR)

Two sectors contain counts of permanent and temporary errors for each device (except tape and disk) on the system. This data is formatted and printed by the ERAP program. Tape SDR information is contained in the CE tracks and is pointed to by an address in the SDR area.

5444 SDR

This 128-byte area of cylinder 0, sector 4 contains 64 two-byte counters, 16 for each disk.

Disk	*Error Type*	*Temporary Error Counter (hex)*	*Permanent Error Counter (hex)*
R1	Overrun	00-01	10-11
	Data check on ID	02-03	12-13
	Data check on write	04-05	14-15
	Data check on read	06-07	16-17
	No record found	08-09	18-19
	Equipment check	0A-0B	1A-1B
	Missing address mark	0C-0D	1C-1D
	Seek check	0E-0F	1E-1F
F1	Same as above	20-2F	30-3F
R2	Same as above	40-4F	50-5F
F2	Same as above	60-6F	70-7F

5448 SDR

This 128-byte area of cylinder 0, sector 4 contains 64 two-byte counters, 16 for each disk. It is located in bytes 80-FF.

Disk	*Error Type*	*Temporary Error Counter (hex)*	*Permanent Error Counter (hex)*
D1	Overrun	80-81	90-91
Upper	Data check in ID	82-83	92-93
Disk	Data check on write	84-85	94-95
	Data check on read	86-87	96-97
	No record found	88-89	98-99
	Equipment check	8A-8B	9A-9B
	Missing address mark	8C-8D	9C-9D
	Seek check	8E-8F	9E-9F
D1 Lower Disk	Same as above	A0-AF	B0-BF
D2 Upper Disk	Same as above	C0-CF	D0-DF
D2 Lower Disk	Same as above	E0-EF	F0-FF

5445 SDR

This 128-byte area of cylinder 0, sector 4 contains 64 two-byte counters, 16 for each disk.

Disk	*Error Type*	*Temporary Error Counter (hex)*	*Permanent Error Counter (hex)*
D1	Data check in count	80-81	82-83
	Data check on write	84-85	86-87
	Data check on read	88-89	8A-8B
	No record found	8C-8D	8E-8F
	Equipment check	90-91	92-93
	Missing address mark	94-95	96-97
	Seek incomplete	98-99	9A-9B
	Overrun	9C-9D	9E-9F
D2	Same as above	A0-BD	A2-BF

3340 SDR

See *3340 OBR.*

1442 SDR

This 22-byte area of cylinder 0, sector 5 contains nine 2-byte counters.

Error Type	*Bytes (Model 12)*	*Bytes (Model 10)*
Punch station jam	00-01	10-11
Read station jam	02-03	12-13
Transport jam	04-05	14-15
Hopper misfeed	06-07	16-17
Extra feed cycle	08-09	18-19
Read compare	0A-0B	1A-1B
Data overrun	0C-0D	1C-1D
Punch check	0E-0F	1E-1F
Read invalid	10-11	20-21
Reserved	12-15	–

Printer SDR

This 20-byte area of cylinder 0, sector 5 on F1 contains six 2-byte counters.

5203 Error Type	*Bytes (Model 12)*	*Bytes (Models 8 and 10)*
Chain sync check	16-17	34-35
Incrementer sync check	18-19	36-37
Incrementer failure	1A-1B	38-39
Hammer Echo check	1C-1D	3A-3B
Any hammer on check	1E-1F	3C-3D
Hammer unit thermal check	20-21	3E-3F
Carriage sync check	22-23	40-41
Carriage space check	24-25	42-43
Forms check	26-27	44-45
Unprintable character		46-47

1403 Error Type	*Bytes (Model 12)*
Chain sync check	16-17
Not used	18-19
Print data check	1A-1B
Hammer echo check	1C-1D
Any hammer on check	1E-1F
Reserved	20-21
Carriage sync check	22-23
Reserved	24-25
Forms check	26-27

MFCU SDR

This 20-byte area of cylinder 0, sector 5 contains eight 2-byte counters.

Error Type	*Bytes (Model 12)*	*Bytes (Model 10)*
Feed check	3E-3F	5C-5D
Punch check	40-41	5E-5F
Punch invalid	42-43	60-61
Print data check	44-45	62-63
Print clutch check	46-47	64-65
Read check	48-49	66-67
Hopper check	4A-4B	68-69
Data overrun	4C-4D	6A-6B
Reserved	4E-51	—

BSCA SDR

This area of cylinder 0, sector 5 contains both temporary and cumulative error counters.

Line	*Error Type*	*Cumulative Error Counter*		*Temporary Error Counter*	
		Model 12	*Model 10*	*Model 12*	*Model 10*
1	Text blocks sent	52-55	78-7B	86-87	AC-AD
	Text blocks received	56-59	7C-7F	88-89	AE-AF
	NAKs received	5A-50	80-83	8A-8B	B0-B1
	Data checks	5E-61	84-87	8C-8D	B2-B3
	Forward aborts received	62-65	88-8B	8E-8F	B4-B5
	Aborts received	66-69	8C-8F	90-91	B6-B7
	Adapter checks, transmit	6A-60	90-93	92-93	B8-B9
	Adapter checks, receive	6E-71	94-97	94-95	BA-BB
	Invalid responses	72-75	98-9B	96-97	BC-BD
	ENQs received to ACKs sent	76-79	9C-9F	98-99	BE-BF
	Last data errors	7A-70	A0-A3	9A-9B	C0-C1
	Disconnect timeouts	7E-81	A4-A7	9C-9D	C2-C3
	Receive timeouts	82-85	A8-AB	9E-9F	C4-C5
	Reserved	A0-A8	—	—	—
2	Same as above	A9-DC	78-AB	DD-F6	AC-C5
	Reserved	F7-FF	—	—	—

Tape SDR

The SDR information for magnetic tape is not kept in the 3 SDR sectors. During the job, the information is kept in a temporary logging area on F1, cylinder 0, sectors 32 and 33. At end of job, this data is written to the CE tracks in a wrap-around table. A pointer to the next available space within the CE tracks is kept in the SDR area (cylinder 0, sector 6, displacement hex 0A-0B).

Three types of records are written for tape:

Type V (64 bytes)	Record of temporary errors on a single unit for a single job
Type O (32 bytes)	Permanent error record
Type N (32 bytes)	Null record used for format consistency within a sector. There are never more than two N-type records logged

The format of the V-type record is:

Disp Hex	Description
00	Character V = record type
01-06	Data, format mmddyy
07-0C	First volume ID
0D-12	Last volume ID
13	Unit (character C, D, E, or F)
14	Attributes:

Hex Value	*Meaning*
80	9 track
40	Even parity
20	Convert off
10	Translate off
03	Device type (bits 6 and 7 of subsystem sense byte 4)
0C	Density:

Bit Value	*Meaning*
00	1,600 bpi
01	800 bpi
10	556 bpi
11	200 bpi

Disp Hex	Description
15-16	Block length
17	Number of volumes

Disp Hex	Description	
18-19	SIO counter	
1A	Noise block counter	
1B	Write skip counter	
1C	Temporary read forward errors	Counters for last volume
1D	Temporary read backward errors	
1E	Temporary write errors	
1F-20	SIO counter	
21	Noise block counter	
22	Write skip counter	Counters for all volumes
23	Temporary read forward errors	
24	Temporary read backward errors	
25	Temporary write errors	
26	Diagnostic track errors	
27	Start velocity check count	
28	Tape mark check count	
29	End velocity check count	
2A	Write feed through count	
2B	No read-back data count	
2C	Overrun count	
2D	Short gap mode	
2E-2F	Multitrack error	
30	End data check	
31	Envelope check	
32	False end marker	
33	PE ID burst error	
34	VRC error	
35-38	Tracks in error (1/2 byte counter per track)	
39-3F	Reserved	

The format for the Q-type record is:

Disp Hex	**Description**
0	Character Q = record type
1-6	Date: Format mmddyy
7-C	Volume ID
D	Q code
E	R code
F	Adapter sense byte 0
10	Adapter sense byte 1
11-18	Subsystem sense bytes 0-7
19-1F	Reserved

3741 SDR

This 22-byte area of cylinder 0, sector 6 contains five 2-byte counters.

Error Type	*Byte (hex)*
3741 needs attention	50-51
Bus-in parity error	52-53
Bus-out parity error	54-55
Wrong mode	56-57
Wrong length record	58-59
Reserved	5A-65

5471 SDR

This low-byte area of cylinder 0, sector 6 contains four 2-byte counters.

Error Type	*Byte (hex)*
Keyboard data check	00-01
Printer malfunction	02-03
Printer temporary translator check	04-05
Printer permanent translator check	06-07
Reserved	08-09

Outboard Recording (OBR)

These 2 sectors contain a history of errors. Each error, whether temporary or permanent, is entered in a history table. This table is 2 sectors long (sectors hex 10 and 21 of cylinder 00 on simulation area F1) and provides 63 eight-byte entries. The first 4 bytes of sector 1D are two 2-byte displacements. The first is the displacement of the next available entry in the table and the second is the end of the table. This table is a recursive, and no overflow or stop logic is provided. The sixty-fourth time an entry is made, it overlays the first entry; the sixty-fifth time it overlays the second, etc. Therefore, the table always contains entries for the 63 most recent errors.

5444/5447/5448 OBR

Each OBR table entry for an error requires 16 bytes.

Contents	*Bytes (hex)*
S/N associated with this error (see byte 0F for C byte)	00-01
Volume ID	02-07
Q code and R code for which error occurred	08-09
Primary sense register	0A-0B
Secondary sense register	0C-0D
Error count	0E
C byte for this error (with bytes 00-01, this becomes C/S/N)	0F

5445 OBR

Each OBR table entry for a 5445 error requires 16 bytes.

Contents	*Bytes (hex)*
Arrived at home address	00-01
Volume ID	02-07
Q code	08
Error count	09
Cylinder address register	0A
Head address register	0B
Start home address	0C-0D
Destination home address	0E-0F

The home address fields contain the cylinder/head address. The rightmost byte of each home address field contains the head.

Byte	*Bit*	*Meaning*	
0D	0 and 1	Bits 6 and 7 of the SIO R code	
	2	Identifies the significance of destination home address and arrived-at home address	
		Bit 2 = 0 ↓	Bit 2 = 1 (surface errors) ↓
0F	0	Equipment check	Missing address mark
	1	Unsafe	Data check
	2	Track overflow ↓	No record found ↓
01	0	Seek incomplete	Overrun
	1	Not used	Key
	2	Not used	Data

The head address register contains the following additional information:

Byte	*Bit*	*Meaning*
0B	0	Read/write unsafe
	1	Head unsafe
	2	Write unsafe

1442, Printer, 5471, and MFCU OBR

Each entry in the OBR table for these devices requires 8 bytes

Contents	*Bytes (hex)*
Q code and R bytes for which error occurred	00-01
Sense bytes (If sense byte 0 contains hex 1F, 2F, 3F, or 8F for a display screen [Q=10] or a 3284 [Q=11], an attachment check has occurred.)	02-03
LPDAR (1403 hammer echo check only)	04-05
Reserved	06-07

BSCA OBR

Each entry in the OBR table for a BSCA error requires 8 bytes.

Contents	*Bytes (hex)*
Q code for which error occurred	00
Retry count set by user	01
Sense byte	02-03
Completion code	04
Type of error Hex 0 is temporary Hex 80 is permanent	05
Address of temporary counters in BSCA storage	06-07

3340 Log Entry

Each 3340 entry requires 64 bytes.

Contents	*Bytes*
Volume ID	00-05
Read usage count	06-0B
Seek usage count	0C-0F
Diagnostic sense	10-27
ERP retry count	28
Date	29-2E
Reserved	2F-40

REQUEST INDICATOR BYTE (RIB)

The general entry routine passes requests from the System/3 supervisor to disk system management. The calling program must place the address of the leftmost byte of the parameter list in register 2. Then the general entry routine is entered by a branch to hex 0004 in the supervisor. The caller's branch to general entry must be followed by a 1-byte constant called an *RIB* (request indicator byte) that defines the calling programs request.

Note: An RIB of hex 20 is a special RIB used only by the Model 12 spool routines. This RIB is used to request spool data management functions of the spool supervisor routines and to call spool intercept close at EJ.

RIB Value (hex)	*Meaning*
0000 0000	Load XR2 with the address of the current PLCA
0xxx xxxx	Loader requests
1xxx xxxx	Transient requests

RIB Table

	RIB								
	0	1	2	3	4	5	6	7	Hex
Search system pack	0	1	1	0	0	0	0	0	60
Search program pack	0	1	0	0	0	0	0	0	40
Fetch	0	1	0	1	0	0	0	0	50
Fetch to address	0	1	0	1	1	0	0	0	58
System fetch	0	1	0	1	0	1	0	0	54
Load	0	1	0	0	1	0	0	0	48
RPG load	0	1	0	0	0	0	0	0	40
With find	0	1	0	0	0	0	0	1	41
Without find	0	1	0	0	0	0	0	0	40

The above values can be combined to form multiple RIB meanings. (The unshaded values determine the function.)

The following examples indicate some of the possibilities. The hexadecimal value on the right is used as the RIB value.

Examples	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**Hex**
Fetch, SYS IOB	0	1	1	1	0	0	0	0	70
Fetch, PGM IOB	0	1	0	1	0	0	0	0	50
Fetch, PGM IOB, find	0	1	0	1	0	0	0	1	51
Fetch to @, SYS IOB	0	1	1	1	1	0	0	0	78
Fetch to @, PGM IOB	0	1	0	1	1	0	0	0	58
Fetch to @, SYS IOB, find	0	1	1	1	1	0	0	1	79
System fetch, SYS IOB	0	1	1	1	0	1	0	0	74
System fetch, PGM IOB	0	1	0	1	0	1	0	0	54
Load, SYS IOB	0	1	1	0	1	0	0	0	68
Load, PGM IOB	0	1	0	0	1	0	0	0	48
Load, PGM IOB, find	0	1	0	0	1	0	0	1	49
RPG load, PGM IOB	0	1	0	0	0	0	0	0	40

The following are RIB values for the supervisor transient:

Transient	Normal Value	Refresh Value
Request transient by C/S number	80	C0
System find	81	C1
Open	82	C2
Close	83	C3
End of job ($$SPEJ)	84	C4
Supported halt/syslog	85	C5
Supported sysin	86	C6
Scheduler work area—Get ($$SSGT)	87	C7
Scheduler work area—Put ($$SSPT)	88	C8
Scheduler work area—R/W ($$SSSC)	89	C9
VTOC read/write ($$SSVT)	8A	CA
Allocation initiator ($$STA3)	8B	CB
Reserved (named $$SYPP)	8C	CC
Transient free ($$STNQ)	8D	CD
Rollout ($$STRO)	8E	CE
RPG halt processor	8F	CF
OBR/SDR	90	D0
5445 VTOC read/write ($$SSXV)	91	D1
3340 VTOC R/W ($$STXV) (Model 12)	91	D1

GENERAL ENTRY BRANCH TABLE (Model 12 Only)

This table, located in the supervisor and delimited by the phrases START HISTORY TABLE and END HISTORY TABLE, can be used to reconstruct events prior to a system failure.

The table contains information concerning the latest branches to the general entry routine, with the most recent one being the first entry in the table. The entries are 7 bytes for a dedicated system and 8 bytes for a DPF system.

The table contains a maximum of eight entries. Each entry contains the following:

Contents	Dedicated System (byte number)	DPF System (byte number)
Program level indicator (hex): 84 = PL1 48 = PL2	N/A	1
XR2	1-2	2-3
Address of RIB + 1	3-4	4-5
RIB value	5	6
XR1	6-7	7-8

Note: RIBs of hex 00 (PLCA) are not saved.

TABLE OF HALT IDENTIFIERS

Models 8, 10, and 12

Character Displayed	Hex Value
0	6F
1	03
2	76
3	57
4	1B
5	5D
6	7D
7	07
8	7F
9	5F
A	3F

Character Displayed	Hex Value
C	6C
E	7C
F	3C
H	3B
J	63
L	68
P	3E
U	6B
Y	5B
'	02 (quote)
	00 (blank)
-	10 (dash)

|← Identifiers →|

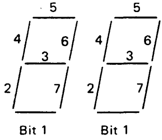
F0	Tens	Units

Example:

F0	7C	63

Displays

E J



Models 4 and 6

Character Displayed	Bit Value
A	40
B	20
C	10
D	08
1	40
2	20
3	10
4	08
5	04

|← Identifiers →|

F0	Alpha	Numeric

Example:

F0	78	7C

Displays

A B C D
1 2 3 4 5

RESERVED OBJECT COMMUNICATIONS AREA (ROCA)

ROCA is the first 256 bytes of the root segment of every RPG II program.

Disp Hex	Description
00-8F	Prime work area:

Object Code	*Bytes Used (hex)*
TESTZ	00-03
Z-ADD	00-0F
ADD	00-19
Z-SUB	00-19
SUB	00-19
Multiply	00-32
Divide	00-3D
SORT	00-3D
LOKUP	00-3D
Control fields	00-8F
Matching fields	00-8F
Chain packed keys	07-0F
MVR	1B-2A
Table load	60-83

Disp Hex	Description
90-97	Commonly used constants
98-99	Address of first IOCB in IOCB chain
9A-9B	Address of current IOCB
9C-9D	Address of forced file IOCB
9E-9F	Reserved
A0-A1	Address of first page output error restart routine
A2-A7	UDATE (in user specified format)
A8-A9	Date of compile
AA-AB	Reserved
AC-AF	Branch to controlled cancel
B0-B3	Branch to input mainline
B4-B8	Halt parameter list
B9-BA	Address of ALT collate segment table
BB-BD	Constants used by output routines

RESERVED OBJECT COMMUNICATIONS AREA (ROCA) (Continued)

Disp Hex	Description
BE-BF	Address of ROCA
C0-C1	Reserved
C2-D9	Indicators
DA	Reserved
DB	Modification level
DC	Release level

RPG II Indicator Table (ROCA)

Beginning at displacement hex C2 into ROCA

Displacement from XR1	Hexadecimal Byte Mask 80	40	20	10	08	04	02	01
C2	H4	H3	H2	H1		MR[2]	MR[1]	1P
C3	L1	L0	LR	H9	H8	H7	H6	H5
C4	L9	L8	L7	L6	L5	L4	L3	L2
C5	U1	U2	U3	U4	U5	U6	U7	U8
C6	KH	KG	KF	KE	KD	KC	KB	KA
C7	KQ	KP	KN	KM	KL	KK	KJ	KI
C8	Reserved	—	—	—	—	—	—	—
C9	07	06	05	04	03	02	01	
CA	15	14	13	12	11	10	09	08
CB	23	22	21	20	19	18	17	16
CC	31	30	29	28	27	26	25	24
CD	39	38	37	36	35	34	33	32
CE	47	46	45	44	43	42	41	40
CF	55	54	53	52	51	50	49	48
D0	63	62	61	60	59	58	57	56
D1	71	70	69	68	67	66	65	64
D2	79	78	77	76	75	74	73	72
D3	87	86	85	84	83	82	81	80
D4	95	94	93	92	91	90	89	88
D5					99	98	97	96
D6	OV[1]	OG[1]	OF[1]	OE[1]	OD[1]	OC[1]	OB[1]	OA[1]
D7	OV 1st[2]	OG 1st[2]	OF 1st[2]	OE 1st[2]	OD 1st[2]	OC 1st[2]	OB 1st[2]	OA 1st[2]
D8	OV 2nd[2]	OG 2nd[2]	OF 2nd[2]	OE 2nd[2]	OD 2nd[2]	OC 2nd[2]	OB 2nd[2]	OA 2nd[2]
D9	Total cycle switch	Control fields processed	Overflow being processed	EOF on look ahead	Close has been entered	**RESERVED		

Note: For each overflow indicator, there are two internal indicators. The first internal indicator indicates that overflow has occurred; the second indicator indicates that the overflow output code has been fetched. The indicators KA thru KQ are Models 4 and 6 command key indicators. They are reserved on Models 8, 10, and 12.

[1] External
[2] Internal

RPG II I/O Control Block (IOCB)

Pointed to by ROCA. Displacement (hex 98-99)
Length is 17 bytes for output files (hex 11)
Length is 38 bytes for input files (hex 26)

Disp Hex	Lng Dec	Description	
		Hex Value	*Meaning*
00	1	80	End of file has occurred
		40	File not open
		20	Identify look-ahead file
		10	Noninput control file (not primary or secondary)
		08	Translate file
		02	End of file specified on file description specifications
		01	Buffer full (does not need to be read from this cycle)
		Hex Value	*Meaning*
01	1	80	BSCA *last* file
		40	Limits file
		20	Combined file
		10	Update file
		Record address type:	
		Hex Value	*Meaning*
		0C	Record number
		08	Record ID
		04	Key
		01	Record address file
		00	Data base
02-03	2	IOCB chain address	
04-05	2	DTF address	
06-07	2	Translate table address	
08-09	2	File relocation *from* or *to* address	
0A	1	Overflow indicator mask	
0B-0C	2	Record length	
0D-0E	2	Address of output work area	
0F	1	Sequence number	
10	1	External indicator	

Disp Hex	Lng Dec	Description

The following appears for input files only:

Disp Hex	Lng Dec	Description
11-12	2	Input buffer address
13-14	2	Alpha sequence input processing address
15-16	2	Address of last numeric input record
17	1	Numeric input sequence information:

Hex Value	*Meaning*
04	Mandatory, else optional
02	Mandatory record found
01	Numerous, else single

Disp Hex	Lng Dec	*Hex Value*	*Meaning*
18	1	80	Recycle check bit
		40	Numeric sequence in this file
		20	Console file
		10	Numeric sequence in record
		08	Matching fields present in records
		04	Control fields present in record
		02	Data fields present in record
		01	Stacker select request (Models 10 and 12)

Disp Hex	Lng Dec	Description
19	1	Result indicator mask
1A	1	Result indicator displacement
1B	1	Op code for IOCS
1C	1	MFCU-stacker:

Hex Value	*Meaning*
07	Stacker 3
06	Stacker 2
05	Stacker 1
04	Stacker 4
00	None

Disp Hex	Lng Dec	Description
1D-1E	2	Address of move input fields, code for this record type
1F-20	2	Address of control fields move code for this record type

RPG II I/O Control Block (IOCB) (Continued)

Disp Hex	Lng Dec	Description
21-22	2	Address of matching records moves code for this record type
23-24	2	Address of next numeric sequence checking code for this file
25	1	Numeric sequence information:

Hex Value	*Meaning*
04	Mandatory, else optional
02	Mandatory record found
01	Numerous, else one

1442 STORAGE AREAS

A temporary work/storage area (located in the calling program) is used by IOS to communicate with the 1442 error recovery procedure.

Byte	Description
0-1	Address of 9-byte permanent area
2-11	Queue work area
12	Status information
13-14	Sense bytes
15-16	Q code and R code to be executed
17-21	Work area

This IOS/ERP interface contains a 20-byte general storage area and a 2-byte pointer to a permanent storage area. The 9-byte permanent storage area contains a history of the two most recent 1442 operations.

Byte	Description
0	Status information
1-2	Address of previous I/O area
3-4	Punch length
5-6	Previous operation bytes
7-8	Last before previous operation bytes

When the error recovery procedure is given control, XR2 contains a pointer to a 22-byte work area that contains the address of this 9-byte permanent area. Sense bytes in the work area are tested to determine which error occurred, and the correct halt code is set.

MFCU PERMANENT SAVE AREA (Models 10 and 12 Only)

The permanent save area is located at main storage location hex 001A and is referenced only by routines that perform I/O operations using the MFCU. The following displays the format of the permanent save area.

Name	Offset	Length	Contents
MPMSTA	0	1	Status information: Bit 0 = Reserved Bit 1 = Execute a command Bit 4 = Card in primary wait station Bit 5 = Card in secondary wait station Bit 7 = Abnormal condition
MPMRPR	1	2	Previous read operation buffer address
MPMUPR	3	2	Previous punch operation buffer address
MPMPRV	5	2	Previously executed Q and R codes
MPMTPR	7	8	Q and R codes of four most recent transport commands

The following illustrates a history table of stored Q and R codes before and after a start I/O instruction is issued. Q and R codes should be stored in the order below:

Lowest Cylinder Address				Highest Cylinder Address
Q and R Codes of Last SIO	Fourth (previous) Transport Operation	Third Transport Operation	Second Transport Operation	First Transport Operation

Q and R Codes of This SIO	This Transport Operation	Fourth Transport Operation	Third Transport Operation	Second Transport Operation

Note: After the next SIO is issued, the transport history should be updated as above.

MFCU Parameter List

The format of the parameter list (located in the calling program) used by MFCU ERP to test for errors is:

Disp Hex	Lng Dec	Description
00-01	2	Address of permanent save area
02-03	2	Sense bytes
04-0F	17	Work area

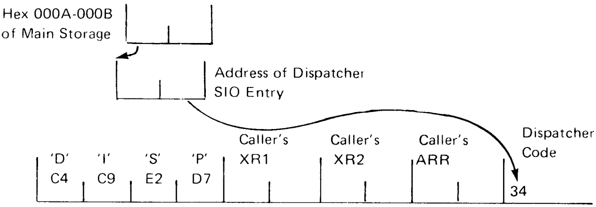
PRINTER HISTORY AREA (Model 12 Only)

A printer history area in printer IOS is used to communicate with ERP. It is located by a pointer in SYSCOM at NCPSVA (hex 56-57).

Disp Hex	Label	Lng Dec	Description
00-01	PRMRES	2	Q and R code for last SIO issued
02-03	PRMQR1	2	Q and R code for last SIO accepted
04-05	PRMQR2	2	Previous SIO Q code and R code
06-07	PRMSNS	2	Sense save area
08-09	PRMDAT	2	Buffer address for last SIO accepted
0A-0B	PRMIOB	2	Address of last IOB started or the IOB for ERP on errors
0C-12	PRMLST	7	Halt/syslog parameter list
13-14	WATIOB	2	Address of last IOB waited on

DISPATCHER HISTORY/SAVE AREA (MODEL 12 ONLY)

A save area for the dispatcher contains a history of the last IOB through the dispatcher. It can be located by the label DISP in the translated column of the dump or by system pointers when trace is not active:



When the 0 halt is displayed, this history area may be used to find the failing IOB (XR1), the caller's return address (ARR), and the caller's XR2.

CUSTOMER ENGINEERING PROGRAM SUPPORT PROGRAMS

Four System/3 programs fix other programs, and one Model 12 program lists the modules that have been fixed. These programs are:

Program	Use
Program temporary patch ($SGFIX)	Applies a temporary patch to an object library load module (O module)
Program temporary fix ($SGPTF)	Applies an IBM-supplied PTF to an object library load module (O module)
Program temporary fix ($SGPTR)	Applies an IBM-supplied PTF to an object library routine (R module)
Temporary fix link-edited subroutines ($SGPVR)	Apply an IBM-supplied PTF to subroutines after they have been link-edited together (Model 12 only)
PTF list ($SGLOG)	Lists the names of object library modules that have PTFs applied (Model 12 only)

Program Temporary Patch ($SGFIX)

When an error in an object library load module (O module) in the disk resident object library is found and no existing PTF covers the problem, the CE can make a temporary repair using the program temporary patch program while waiting for an updated module or PTF to be distributed. Once the patches necessary to correct the error are determined, the following OCL statements must be prepared:

```
// LOAD $SGFIX,unit
// RUN
```

The OCL statements are followed by these control statements:

```
HDR O program name, unit
PTF module identification
DATA disp, chkbyte, hh, hhhh, hhhhR
END
/*
```

The following is an explanation of the format and parameters of the control statements.

HDR Statement

The HDR statement must follow the RUN statement.

HDR – Must start in column 1. HDR identifies the control statement.

O program name – The character O must be in column 5. The program name must be 6 characters long and start in column 6. Use blanks if necessary. O program name identifies the object library type and the program name as it exists in the object library directory.

unit – Must start in column 13. Unit identifies the unit on which the patch is to be applied. When system modules (module names starting with $$) are patched, the patch should be applied to the program pack. If the patch is applied to the IPL pack, and a system module is being patched, unexpected results may occur.

PTF Statement

PTF – Must start in column 1. PTF identifies the control statement.

Module identification – Must start in column 5 and be 6 characters long. The module identification consists of the first 3 characters of the module name and three overlay numbers. When a root phase or a program with no overlays is patched, the overlay numbers are always 000. When a program that has overlays is patched, the overlay number is from 001 (first overlay) to xxx (last overlay) depending on the overlay being patched. The highest numbered overlay that can be patched is 037. More than one PTF statement can be provided with each HDR statement. However, each PTF statement must be followed by at least one DATA statement.

DATA Statement

DATA – Must start in column 1. DATA identifies the control statement.

disp – Must start in column 6 and be 4 characters in length. Disp provides the displacement into the module where the patch is applied.

chkbyte – Must start in column 11 and be 2 characters in length. Chkbyte represents the first byte being overlaid by the first byte of patch information on the data statement.

hh – 1 byte of text patch

hhhh – 2 bytes of text patch that are not relocatable

hhhhR – 2 bytes of text patch that are relocatable

The bytes of text patches can be grouped in any order but must be separated by commas. The bytes of the text patches must start in column 14, and can fill the entire statement.

The DATA statement can be followed by:

Another DATA statement
Another PTF statement
An END statement

END Statement

END identifies the end of the control statements. It means the module has been patched and may be placed back in the library. The END statement can be followed by another HDR statement or a /* statement.

/ Statement*

The /* statement indicates patching is complete, and end of job occurs.

Procedures for Running $SSGFIX

SSGFIX can only patch programs that reside on the system pack or on the pack that SSGFIX was loaded from.

The 5444/5447 on which the module to be patched is located must contain enough work space to hold the patched module.

Program Temporary Fix Programs

The program temporary fix programs ($SSGPTF, $SSGPTR, and $SSGPVR) are used to apply program temporary fixes (PTFs) to programs in the object library. SSGPTF applies PTFs to load modules (O modules). $SSGPTR applies PTFs to routines (R modules). $SSGPVR applies PTFs to subroutines after they have been link-edited together.

Control Statements

The following control statements are supplied as part of each PTF:

- For SSGPTF:
  ```
  HDR ptfid,cksum,unit1[,unit2]
  PTF module-name,level,cksum
  DATA cksum,disp,hh,hhhh[R], . . .
  END cksum
  /*
  ```
- For SSGPTR (Model 12):
  ```
  HDR ptfid,cksum,unit1[,unit2]
  PTR module-name,level,cksum[,length]
  DATA cksum,Sccdd,hh,hhhh, . . .
        and/or
  Data cksum,disp,hh,hhhh[R],hhhh[E], . . .
  END cksum
  /*
  ```

- For $SGPVR (Model 12):
  HDR ptfid,cksum,unit1 [,unit2]
  PTF module-name,level,cksum,table-pointer-disp
  DATA cksum,dispMtable-number,hh,hhhh [Mtable-number] ,hhhh [R] , . . .
  END cksum
  /*
- For $SGPTR (Models 4, 6, 8, and 10):
  HDR ptfid,cksum,unit1 [,unit2]
  PTF module-name,level,cksum
  DATA cksum,disp,hh,hhh, . . .
  END cksum
  /*

Header Statement

HDR Must start in position 1. HDR identifies the header control statement.

ptfid — Must start in position 5. This is the 6-character identification number of the PTF. The first 3 characters are the first 3 characters of the module name. The last 3 characters are the PTF log number (001-254). The log number is converted to a 1-byte binary constant when it is placed in the log sector.

cksum — Must start in position 12. This is the 4-character accumulative check sum for the PTF.

unit1 — Must start in position 17. This is a 2-character field (R1, F1, R2, or F2) that identifies the unit to which the PTF is to be applied. The unit must be the system pack or the program pack.

unit2 — Must start in position 20 (if required). This field identifies the disk (R1, F1, R2, or F2) on which the PTF control statements reside. If unit2 is not specified, the PTF must be entered from the system input device. When unit2 is specified, the ptfid field is the name of the source library entry containing the PTF control statements.

The header statement must be followed by a PTF or PTR control statement.

PTF Statement

PTF — Must start in position 1. PTF identifies the control statement.

module-name — Must start in position 5. This is a 7-character field. The first character identifies the library type of module. The remaining 6 characters are the name of the module.

level -- Must start in position 13. This is the release number (00-99) of the module.

cksum — Must start in position 16. This is a 4-character accumulative check sum for the PTF.

table-pointer-disp — Must start in position 21. This is the displacement of a pointer to the EXTERN table. The value in the table is used to change displacement and/or data on the DATA statement so that a subroutine can be found and patched.

Every PTF statement must be followed by at least one DATA statement.

PTR Statement (Model 12 Only)

PTR – Must start in position 1. PTR identifies the control statement.

module-name – Must start in position 5. This is a 7-character field. The first character identifies the library type of module. The remaining 6 characters are the name of the module.

level – Must start in position 13. This is the release number (00-99) of the module.

cksum – Must start in position 16. This is a 4-character accumulative check sum for the PTF.

length – Must start in position 21 if specified. This is the new module length. Changing the length creates a maintenance area at the end of the module.

Every PTR statement must be followed by at least one DATA statement.

DATA Statement

DATA – Must start in position 1. Identifies the control statement.

cksum – Must start in position 6. This is a 4-character accumulative check sum for the PTF.

disp – Must start in position 11. This is the displacement for the patch. To obtain the displacement, subtract the start address of the module from the address for the patch.

Sccdd – Must start in position 11. This is the displacement for a patch of an ESL record. The cc is the record number (01-FF), and dd is the displacement on the record (01-3F).

Mtable-number – Must follow disp and can follow hhhh. This is the number that references an entry in the EXTERN table. The table entry is added to disp or hhhh. Number 01 refers to the first subroutine, 02 to the second, etc, so that every subroutine can be patched.

hh – 1 byte of text patch

hhhh – 2 bytes of text patch that are not relocatable

hhhhR – 2 bytes of text patch that are relocatable

hhhhM – 2 bytes of text patch that are relocatable

hhhhE – 2 bytes of text patch that reference an ESL field

Any combination of text patches can be supplied as long as they are separated by commas. For example; hhhh,hh,hhhhR,hh,hhhhE,hhhh

The DATA statement can be followed by:

Another DATA statement
Another PTF or PTR statement (not for $SGPVR)
An END statement

END Statement

END – Must start in position 1. END identifies the control statement.

cksum – Must start in position 5. This is a 4-character accumulative check sum for the PTF.

The END statement can be followed by another HDR statement or a /* statement.

For $SGPTF, $SGPTR (Models 4, 6, 8, and 10), and $SGPVR, after the END statement is read and no errors have occurred, the PTF is applied to the disk and logged. On Model 12 only, for $SGPTR, after the /* statement is read and no errors have occurred, the $WORK file is closed and the modules that were patched can be copied from it if the library maintenance program ($MAINT) is used.

How to Apply a PTF

Before PTFs can be applied, the system should reside on F1. [This system should contain the library maintenance program ($MAINT).] The program or modules to be fixed should have been copied to the unit specified on the HDR statement if they are not already there. PTFs can then be applied.

1. Mount the user distribution disk/data module (PID pack) on R1. This pack contains the PTF installation programs and procedures. Or, if the PTF installation programs are on F1, change the LOAD or CALL statement unit from R1 to F1. Also, add the following procedure override LOAD statement for every CALL statement:

   //LOAD ,F1

2. Perform IPL from F1.

3. Load the PTF deck into a card reader. The PTF deck contains the replacement or additional information for a module. The PTF deck also includes all the OCL statements necessary to apply the PTF to the module(s).

4. Use the library maintenance program ($MAINT) to copy the updated module(s) to other user packs as required, unless the PTF was applied by means of $SGPVR. In the latter case, the module(s) patched should not be copied to other user packs because they can contain support for different system or program configurations.

Considerations

The operator should examine the comment cards in each PTF deck before actually applying the PTF. This ensures that the PTF is the one required to fix the program.

When $SGPTF and $SGPTR[1] are used to PTF a module, 6 tracks of work space are required on the 5444/5447 that contains the module to be patched.

[1] Models 4, 6, 8, and 10.

If there is not enough space available for the $WORK file used by $SGPTR or $SGPVR, a procedure override file statement can be used to change the file to any other simulation area (Model 12 only).

The second procedure ($SGPT2) must be called for all $SGPTR PTFs to copy the module(s) back to the library from the $WORK file. This procedure will put the module on F1. If the module is needed on another unit, an additional $MAINT copy is necessary (Model 12 only).

If an LM68DF or LM68LF message is issued during the second procedure for a $SGPTR patch, be sure to take a 3 option to prevent the loss of both the $WORK file and the module in the library (Model 12 only).

Support personnel should not punch a module containing PTFs or copy it to a file. When the module is copied back to the library, all the PTF logs for that module, except the last one, are removed.

Note: Since the PTF log sector may not hold all PTFs applied, support personnel should keep a log of all PTFs applied to the current release of a system.

PTF List Program (Model 12)

The PTF list program $SGLOG is used to list modules in the object library that have had a PTF applied to them.

To produce this list the following OCL statements must be prepared:

```
// LOAD $SGLOG,unit
// RUN
```

The OCL statements are followed by these control statements:

```
// PTFLIST UNIT-unit
// END
```

The unit can be any simulation area. Any number of PTFLIST control statements can be supplied.

The list produced includes the library, name, and release level of the module. It includes the PTF log number if one can be found in the PTF log sector. If this number is the one reserved for $SGFIX, then $SGFIX is printed instead of the number.

Example:

```
// LOAD $SGLOG,R1
// RUN
// PTFLIST UNIT-R1
// PTFLIST UNIT-F1
// END
```

This example produces a list of all modules that have a PTF in the object libraries from R1 and F1.

Note: To list the PTF log for Models 4, 6, 8, and 10, the CEFE dump procedure must be used to copy the PTF log sector from the system resident and/or program packs. The disk address of the PTF log sector is 00DC.

HOW TO SUBMIT AN APAR

The type of information that should be submitted with an APAR depends on the major component trouble area.

For All APARs

(If both program levels are running programs at the time of failure, submit information for both levels.)

Submit:

1. The contents of the CPU roller bar display (for processor check).

2. A main storage CEFE dump. (Place the leftmost data switch in the F position, then press RESET and START.)

3. The source for failing program if other than a system program, including any user written relocatable modules.

4. The object program if other than a system program.

5. All OCL required to execute the failing program.

6. Any card data required to reproduce the failure.

7. A hexadecimal dump of the scheduler work area (using CEFE).

8. A list of all applied PTFs (use $SGLOG on Model 12; use CEFE dump on Models 4, 6, 8, and 10).

9. A description of how to execute the program and get the failure.

10. For tape problems, a hexadecimal dump of all tape files, including labels or copies of the tape files.

11. For disk problems, a hexadecimal dump of cylinder 0 and hexadecimal dumps of all files or copies of all files.

For System Generation Failures

Submit:

1. System generation listing.

2. A disk dump of $SGEN1, $SGEN2, and $SGEN3 (if problem occurred during system generation—// CALL $SGEN,R1). Locations of these files can be found from the VTOC on F1.

3. If problem occurs after system generation, send:
   a. A listing of $SGLNK and $SGCOM (in library P).
   b. A listing of $SGSVE in library S on the distribution pack/data module after sysgen.

For Spooling Failures

Submit a dump of $SPOOL file using CEFE.

For Library Maintenance Failures

Submit a volume label dump and directory printout of the FROM 5444/5447 and/or the TO simulation area.

5444/5447/5448 DISK ORGANIZATION

The 24 sectors of each 5444/5447/5448 track have their own addresses. The hardware sector address is different from the numbering sequence in this manual. The CEFE dump shows the hardware address scheme. The following table shows the relationship between the sector number and the hardware address (in hex):

Sector Number	Hardware Address	Sector Number	Hardware Address	Sector Number	Hardware Address
0	00	16	40	32	A0
1	04	17	44	33	A4
2	08	18	48	34	A8
3	0C	19	4C	35	AC
4	10	20	50	36	B0
5	14	21	54	37	B4
6	18	22	58	38	B8
7	1C	23	5C	39	BC
8	20	24	80	40	C0
9	24	25	84	41	C4
10	28	26	88	42	C8
11	2C	27	8C	43	CC
12	30	28	90	44	D0
13	34	29	94	45	D4
14	38	30	98	46	D8
15	3C	31	9C	47	DC

HOW TO DISPLAY LSRs

To display LSRs:

1. Set roller SW to position 2, CPU not running.
2. Set LSR display selector to off.
3. Tie up the LSR pin to selected tie down point.

MODEL 6 TIE-DOWNS

Use Tie-down point A-B2C2M08

Base LSR A-B2C2 ALD Page MA107 | **Feature 1 LSR A-B2D2 ALD Page MA212**

	U		S			P		M	
		2		IAR-INT 1			2		
LCD/CRT		3		DFCR			3		
AAR		4		ARR/IAR			4		
BAR		5		PSR			5		ARR-INT 2
		6					6		
		7					7		
		8					8		
		9		PCAR			9		
ARR-INT 1		10		DRR/LCR	IAR-INT 2		10		CRT
DRAR		11		PDAR			11		
IAR/ARR		12		XR1	SIAR		12		BSCAR
XR2		13		DFDR	ARR-INT 4		13		IAR-INT 4

MODEL 10 TIE-DOWNS

Use Tie-~~down~~ up point 01 A-B3B2M08

Base LSR 01A-B3C2 ALD Page MA107 | **Feature 1 LSR 01A-B3D2**

	U		S			P		M	
		2		IAR INT 1			2		ARR INT 0
		3		MFCU Print	DFCR		3		P2 PSR
AAR		4		P1 ARR	P2 XR 2		4		DFDR
BAR		5		P1 PSR	P2 XR1		5		ARR INT 2
		6					6		
		7					7		
		8					8		
		9		LPIAR			9		IAR INT 0
ARR INT 1		10		DRR	IAR INT 2		10		
MFCU PCH		11		LPDAR	P2 IAR		11		P2 ARR
P1 IAR		12		XR1 P1	SIAR		12		BSCAR
XR2 P1		13		MFCU RD	ARR INT 4				IAR INT 4

MODEL 12 TIE-DOWNS

Use Tie-down point 01A-B3B2M08

Base LSR 01A-B3C2 ALD Page MA107

	U		S	
	○	2	○	IAR INT 1
	○	3	○	MFCU Print
AAR	○	4	○	P1 ARR
BAR	○	5	○	P1 PSR
	○	6	○	
	○	7	○	
	○	8	○	
	○	9	○	LPIAR
ARR INT 1	○	10	○	DRR
MFCU PCH	○	11	○	LPDAR
P1 IAR	○	12	○	XR1 P1
XR2 P1	○	13	○	MFCU RD

Feature 1 LSR 01A-B3D2

	P		M	
	○	2	○	ARR INT 0
FDCR	○	3	○	P2 PSR
P2 XR2	○	4	○	DFDR
P2 XR1	○	5	○	ARR INT 2
	○	6	○	
	○	7	○	
	○	8	○	
	○	9	○	IAR INT 0
IAR INT 2	○	10	○	
P2 IAR	○	11	○	P2 ARR
SIAR	○	12	○	BSCAR
ARR INT 4	○		○	IAR INT 4

LSR Display Routine

The routine allows you to display any information available to store (ST) and sense (SNS) instructions.

1. Alter SAR to hex 00EE.
2. Set leftmost address/data switches to 34 (store) or 30 (sense).
3. Set rightmost address/data switches to the desired store or sense Q code.
4. Press start. The leftmost byte of sense information or register data is displayed in the Q code of roller 3.
5. Press start again. The desired rightmost byte is displayed in the Q code of roller 3.
6. You may change the rightmost switches to continue or return to step 1 to change leftmost switches.

Table of Local Storage Registers

Base System

Q Code	High	Low	LSR Acronym
20	Program level 1 instruction address register		P1-IAR
08	Program level 1 address recall register		P1-ARR
08	Operand 2 address register		ARR
	Spare		
01	Program level 1 index register 1		P1-XR1
04	Length count recall register	Condition recall register	P1-PSR
	Operand 1 address register		BAR
F4	MFCU print data address register		MPTAR
02	Program level 1 index register 2		P1-XR2
E6	Line printer data address register		LPDAR
E4	Line printer image address register		LPIAR
F6	MFCU punch data address register		MPCAR
F5	MFCU read address register		MRDAR
	Length count registers	Data recall register	LCR DRR
CO	Interrupt level 1 instruction address register		IAR-1
	Interrupt level 1 address recall register		ARR-1

STORAGE DUMP SELECTION PROCEDURE
(Models 4 and 6 halts are listed in parentheses)

You can elect to print out either of the following:

- The entire contents of main storage
- The contents of a specified area of main storage

To display the entire main storage area:

1. Set address/data switches to any value other than CEFE.
2. Press SYSTEM RESET.
3. Press console START.

The entire System/3 main storage area is printed out on the syslog device. After the last byte has been displayed, the EJ halt code is displayed on the console stick lights.

You can selectively print the contents of a specified area of storage by performing the following steps:

1. Press console STOP.
2. Set address/data switches to CEFE.
3. Press SYSTEM RESET.
4. Press console START. A halt code of 50 (D) is displayed.
5. Set rightmost address/data switch to:

   0 — Indicating a request for a main storage dump
   1 — Indicating a request for a DTF dump
   2 — Indicating a request for a 5444/5447 dump
   3 — Indicating a request for a 5445/main data area disk dump
   4 — Indicating a request for a tape dump
   5 — Indicating a request for a scheduler work area dump
   6 — Indicating a request for a main storage to disk dump (Models 4 and 12 only)
   7 — Indicating a request for physical 5448 dump (Models 8 and 10 only)

   Any other setting causes a halt code of 50 (D).

   Note: If more than one dump is required, dump them in the following order:
   1. Main storage dump to printer
   2. DTF dump
   3. Main storage dump to disk
   4. Disk/tape/SWA dump

6. Press console START.

   Then, depending upon which address/data switch was set, one of the following occurs:
   a. If DTF dump, halt 50 (D) is issued after DTFs and IOBs are dumped.
   b. If main storage dump, go to step 7.
   c. If disk dump 5444/5447, go to step 10.
   d. If disk dump 5445/3340 main data area, go to step 12.
   e. If tape dump, go to step 14.
   f. If scheduler work area dump, go to step 17.
   g. If main storage to disk dump, go to step 19.

The following steps are performed only for a main storage dump:

7. After console START has been pressed, a halt code of 5E (D1) is displayed on the console stick lights.
   a. Set the two leftmost address/data switches to the two high-order hexadecimal digits of the dump start address.
   b. Set the two rightmost address/data switches to the two high-order hexadecimal digits of the dump end address.

   For example, to dump an 8K memory hex 0C00, set the two leftmost address/data switches to 0C and the two rightmost switches to 1F. This dumps hex location 0C00 through 1FFF. The transient area is printed after the main storage dump. (The transient area is 3 sectors long on Models 4, 6, 8, and 10, and 4 sectors long on Model 12.)

8. Press console START.

9. After the requested area has been displayed, a halt code of 50 (D) is displayed. Either continue displaying storage by going back to step 5 or perform the IPL procedure again.

The following steps are performed only for a 5444/5447/5448 dump:

10. After console START has been pressed, a halt code of 55 (D2) is displayed on the console stick lights.
    a. Set the two leftmost address/data switches to the beginning cylinder number in hexadecimal.
    b. Set the two rightmost address/data switches to the beginning sector number in hexadecimal (Figure 3-1).
    c. Press console START; a halt code of E5 (D3) is displayed on the console stick lights.
    d. Set the two leftmost address/data switches to the ending cylinder number in hexadecimal.
    e. Set the two rightmost address/data switches to the ending sector number in hexadecimal (Figure 3-1).
    f. Press console START.

11. After the selected area of disk is dumped, halt 55 (D2) is displayed. You may then go back to step 10 to continue with another 5444/5447 dump or select another option by setting the two rightmost address/data switches to FF and press console START. When halt 50 is displayed, you can go back to step 5 or perform the IPL procedure again.

The following steps are performed only on Model 4:

12. After console START has been pressed, a halt code of CH is displayed on the console stick lights.
    a. Set the two leftmost address/data switches to the beginning cylinder number in hexadecimal.
    b. Set the two rightmost address/data switches to the beginning head number in hexadecimal.
    c. Press the console START; a halt code of AU is displayed.
    d. Set the two leftmost address/data switches to the beginning record number in hexadecimal.
    e. Set the rightmost address/data switch to the disk drive: 00 for drive 1; 01 for drive 2.
    f. Press console START.

13. The disk dump continues until the rightmost two address/data switches are set to a value other than 00 or 01; then halt CH is displayed. You can then go back to step 12 to continue with another 5445 main data area dump or set the two rightmost address/data switches to FF and press console START. Halt 50 is displayed. You may go back to step 5 or perform the IPL procedure again.

The following steps are performed only for a tape dump:

14. After console START has been pressed, a halt code of 14 is displayed on the console stick lights.
    a. Set the two rightmost address/data switches (3 and 4) to unit and option.
    b. Press console START. The specified option is performed, one block at a time, unless 7-track tape is supported. If 7-track tape is not supported, go to step 15. If 7-track tape is supported, a halt code 07 is displayed on the console stick lights.
    c. Set the leftmost address/data switches (1 and 2) to specify the density and recording technique. The rightmost address/data switches must remain at their previous setting.
    d. Press console START. The specified option is performed, one block at a time.

    Note: To dump a standard label, set address/data switch 2 to 2. When the label has been dumped, reset switch 2 to indicate the recording technique used to create the data.

15. The specified option is continued until the option switch is changed, a tapemark is encountered, or an I/O error occurs. If a new option is specified, the present operation is completed for the current block, and the new option is performed. To select a new option, press console stop; select the new option, then press console START. When a tapemark is detected or an I/O error occurs, halt 05 is displayed on the console stick lights and a message giving the reason for the halt is printed. You can perform the same option or a new option on the same unit, or change to another unit by selecting the rewind option, then returning to step 14. If 7-track tape is supported, the response to the 05 halt is followed by a 07 halt. You can then change the 7-track tape options, if desired.

Note: Before any option can be performed on a new unit, the present unit must be rewound (option 3). If option 3 is not specified, the new unit specification is ignored and the new option is performed on the same unit.

16. To terminate the tape dump routine, set the leftmost address/data switches to FF at the 14 halt. Halt 50 is displayed. You can return to step 5 or perform the IPL procedure again.

17. After you press console START, a halt code of PL is displayed on the console stick lights.
    a. Set the rightmost address/data switch to:
       1 – Level 1, or
       2 – Level 2, or
       3 – Rollout
    b. Press console START. Forty sectors of the scheduler work area are dumped.

18. After the requested area has been displayed, halt PL is displayed. You can either go back to step 17 or set the two rightmost address/data switches to FF and press console START. Halt 50 is displayed, and you can either go back to step 5 or perform the IPL procedure again.

The following pertains to the main storage to disk dump (Model 4 only).

19. The following messages are printed by the dump program:

```
**********   $CEFE FILE NOT ON R1      **********
**********   $CEFE FILE TOO SMALL      **********
**********   CORE TO DISK COMPLETED    **********
```

A program named $$CEFE creates an 11-track file on R1 and prints the file.

To run $$CEFE, enter the following OCL:

Keyword	To Create the File Response	To Dump to Printer Response
Ready	LOAD	LOAD
Load Name	$$CEFE	$$CEFE
UNIT	nn (system pack)	nn (system pack)
Filename	$CEFE	$CEFE
UNIT	R1	nn (any unit)
PACK	NAME	NAME
TRACKS	11	–
LOCATION	Track number	–
Retain	P	–
MODIFY	RUN	RUN

The program prompts ENTER '//' CONTROL STATEMENT. After this, enter one of the following:

	(Comment statement can be anything)
// CREATE	CREATE the file
// DUMP	DUMP to printer
// DUMP ALL	DUMP to printer
// DUMP X'LLLL',X'HHHH'	Dump to printer with limits LLLL is the lower limit HHHH is the higher limit
// END	END the program

The file $CEFE can only be created on R1 and there can only be one $CEFE file on R1. The file can be copied to other packs using copy/dump utility ($COPY). The file can be printed from any of the supported units.

$CEFE issues the following halts:

Log		**Option**		
VC	D	01	13	Reason: Syntax error on a control statement Recovery 1: Correct statement and reenter
VC	D	03	3	Reason: Creating $CEFE file and it is not on R1 or not 11 tracks Recovery 3: Immediate cancel

The following information applies to dump to disk (Model 12 only).

20. You must ensure that a file labeled $SYSDUMP exists on D1 before you use the dump to disk option. If more than one $SYSDUMP file exists, the dump is written to the file with the most recent date.

    The minimum size that $SYSDUMP can be depends on the main storage size of the system being dumped. The following table can help you determine the size of $SYSDUMP:

Size of Main Storage (of system being dumped)	**Tracks**
32K bytes	7
48K bytes	8
64K bytes	10
80K bytes	11
96K bytes	12

After you use the dump-to-disk option, the $SYSDUMP file contains:

Track 1	Records 1–30	SWA for P1
Track 2	Records 1–30	SWA for P2 (if DPF system)
Track 3	Records 1–30	SWA for rolled out program[1]
Track 4	Records 1–4	TA at time of dump
Track 5	End of file	Main storage

You can use any legitimate method to create the $SYSDUMP file. The following OCL statements can be used to create $SYSDUMP if you want to use the $COPY utility program:

```
// LOAD $COPY,unit
// FILE NAME-COPYO, PACK-name, UNIT-D1
   RETAIN-P, LABEL-$SYSDUMP, TRACKS-xx[2]
// RUN
// COPYFILE OUTPUT-DISK, INPUT-device
// OUTDM DATAMGMT-DIRECT
// END
```

A /* record (end of file) must then be read by the input device listed on the COPYFILE statement.

The $SYSDUMP file can be printed on the 1403 or 5203 if you use the $CPRNT utility. The following OCL is required:

```
// LOAD $CPRNT,unit
// FILE NAME-$SYSDUMP, UNIT-D1, PACK-name
// RUN
```

A main storage dump should be taken first, then a DTF dump, and finally a disk and/or tape dump. System/3 does not support an automatic main storage dump at end of job or after an abnormal job termination.

5444/5447/5448 DUMP

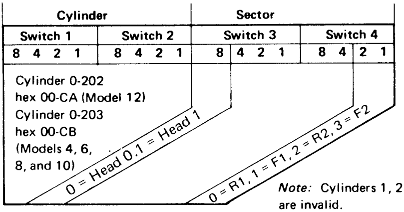
5444/5447/5448 Organization

The 24 sectors of each 5444/5447/5448 track have their own addresses. The machine sector address is different from the numbering sequence in this manual. The CEFE dump shows the machine address scheme. Figure 3-1 shows the relationship between the sector number and the machine address.

[1] Only if a program has been rolled out but not yet rolled back in. If this is not a DPF system, this SWA is on track 2 and track 3 is unused.

[2] Refer to the table in Step 20 of the *Storage Dump Selection Procedure.*

5444 Dump



Note: Cylinders 1, 2, and 3 are invalid.

	Sector	R1	F1	R2	F2
	0	00	01	02	03
	1	04	05	06	07
	2	08	09	0A	0B
	3	0C	0D	0E	0F
	4	10	11	12	13
	5	14	15	16	17
	6	18	19	1A	1B
	7	1C	1D	1E	1F
	8	20	21	22	23
	9	24	25	26	27
	10	28	29	2A	2B
Head 0	11	2C	2D	2E	2F
	12	30	31	32	33
	13	34	35	36	37
	14	38	39	3A	3B
	15	3C	3D	3E	3F
	16	40	41	42	43
	17	44	45	46	47
	18	48	49	4A	4B
	19	4C	4D	4E	4F
	20	50	51	52	53
	21	54	55	56	57
	22	58	59	5A	5B
	23	5C	5D	5E	5F
	0 (24)	80	81	82	83
	1 (25)	84	85	86	87
	2 (26)	88	89	8A	8B
	3 (27)	8C	8D	8E	8F
	4 (28)	90	91	92	93
	5 (29)	94	95	96	97
	6 (30)	98	99	9A	9B
	7 (31)	9C	9D	9E	9F
	8 (32)	A0	A1	A2	A3
	9 (33)	A4	A5	A6	A7
	10 (34)	A8	A9	AA	AB
Head 1	11 (35)	AC	AD	AE	AF
	12 (36)	B0	B1	B2	B3
	13 (37)	B4	B5	B6	B7
	14 (38)	B8	B9	BA	BB
	15 (39)	BC	BD	BE	BF
	16 (40)	C0	C1	C2	C3
	17 (41)	C4	C5	C6	C7
	18 (42)	C8	C9	CA	CB
	19 (43)	CC	CD	CE	CF
	20 (44)	D0	D1	D2	D3
	21 (45)	D4	D5	D6	D7
	22 (46)	D8	D9	DA	DB
	23 (47)	DC	DD	DE	DF

*For 5448:
- 0 = D1 Upper disk
- 1 = D1 lower disk
- 2 = D2 upper disk
- 3 = D2 lower disk

Figure 3-1. 5444/5447/5448 Dump

5445/MAIN DATA AREA DUMP

Bits		Bits		Bits		Bits	
8 4 2 1		8 4 2 1		8 4 2 1		8 4 2 1	
Model 10 – Cylinder 0-202 hex 00-CA Model 12 – Cylinder 0-209 hex 00-D1				Head 0-19 hex 00-13			

Bits	Bits	Bits	Bits
8 4 2 1	8 4 2 1	8 4 2 1	8 4 2 1
Model 10 – Record 1-20 hex 01-14 Model 12 – Record 1-48 hex 01-30		0	0 = D1 1 = D2

The upper limit is C/H 209/07 (Model 12).

TAPE DUMP

Switch 1[1]	Switch 2[1]	Switch 3	Switch 4[2]
0 – 200 bpi 1 – 556 bpi 2 – 800 bpi	0 – Even parity 1 – Odd parity 2 – Even parity 3 – Odd parity translate 4 – Odd parity convert	1 – Drive 1 2 – Drive 2 3 – Drive 3 4 – Drive 4	0 – Skip 1 – Read and print 2 – Backspace 3 – Rewind

[1] Switches 1 and 2 are used only with 7-track at a 07 halt.
[2] If incorrect options are selected for 7-track tape, data check and/or tape runaway may occur.

Note: To dump a standard label, set address/data switch 2 to 2. When the label has been dumped, reset switch 2 to indicate the recording technique used to create the data.

SNAP DUMP MAIN STORAGE ($SNAP)

The $SNAP macro instruction generates linkage to a system storage dump routine. You must provide dump identification and dump limits. The output from the dump routine is printed on the system logging device. Output consists of:

- The dump identification
- The contents of registers 1 and 2
- The address of the next sequential instruction after the $SNAP macro instruction
- The contents of main storage identified by the dump limits

$SNAP Macro Instruction Format

```
[name]    $SNAP    ID–hex,START–address,END–address
```

ID–hex: Specifies a 2-byte parameter to identify the dump. The parameter is printed at the beginning of the dump output.

START–address: Specifies the symbolic address of the location where the dump should begin.

END–address: Specifies the symbolic address of the location where the dump should end.

How to Dump the Spool File (Model 12 Only)

The main data area disk dump feature of CEFE or of the $DUMP program can be used to obtain the contents of the $SPOOL file. To determine cylinder/head address for the start of the $SPOOL file, use the $LABEL utility, or from a CEFE dump of main storage, locate the main storage copy of the spool file master index and get the cylinder/head address from displacement MXADRF into the master index. The beginning of the spool file contains the index portion formatted as shown under *Spool File* in Section 2. To obtain the data portion of the spool file, first dump the indexes, then get the cylinder/head address form displacement IXDATA into the index for the job.

MODEL 12 DISK AND TAPE DUMP PROGRAM ($DUMP)

$DUMP allows listing the contents of a disk or magnetic tape. The selection is entered on control statements. The following OCL statements load the dump program:

```
// LOAD $DUMP,unit
// RUN
```

Control statements are read from the system input device or from a procedure.

Disk Dump

The control statements must be in one of the following formats:

Simulation area dump — D uu/ccss/ccss
Main data area dump — D uu/cchhrr/cchhrr

Small letters represent a code. Capital letters and slashes must be entered as shown.

Simulation Area

Code	Meaning	Column
uu	Unit (R1, F1, R2, F2)	3-4
cc	Beginning cylinder	6-7
ss	Beginning sector	8-9
cc	Ending cylinder	11-12
ss	Ending sector	13-14

Main Data Area

Code	Meaning	Column
uu	Unit (D1, D2)	3-4
cc	Beginning cylinder	6-7
hh	Beginning head	8-9
rr	Beginning record	10-11
cc	Ending cylinder	13-14
hh	Ending head	15-16
rr	Ending record	17-18

Coding Rules

- All information except unit must be in hexadecimal.
- D must be in column 1.
- Slashes must be in columns 5 and 10 for the simulation area and in columns 5 and 12 for the main data area.

Simulation Area Operating Instructions

- cc must be 00 or a hexadecimal number between 04 and CA.
- ss must be a hexadecimal number between 00 and 5C or 80 and DC. If the sector is not a multiple of 4, it is rounded down to a multiple of 4.
- The end address must be greater or equal to the start address.

Main Data Area Operating Instructions

- cc must be a hexadecimal number between 00 and D1 inclusive.
- hh must be a hexadecimal number between 00 and 13 inclusive.
- rr must be a hexadecimal number between 00 and 30 inclusive.

The following exceptions apply:

- Cylinder 00, head 00 – Only records 1-3 and 19-30 are valid.
- Cylinder 00, head 03 – Only records 1-16 are valid.
- The last valid address is cylinder D1, head 07, record 30.

Errors

The following error halts are issued for disk dump. Options 0 and 3 are allowed:

Halt	**Meaning**
UHCJ20	Invalid address
UHCJ21	Invalid cylinder
UHCJ22	Invalid head
UHCJ23	Invalid record
UHCJ24	Invalid sector
UHCJ25	Invalid control statement
UHCJ26	Invalid unit

A 0 option causes the request to be ignored.

The following text is issued without halts:

- Permanent I/O error has occurred
- Defective alternate track
- No more records on this track

Tape Dump

The first time a tape is selected, it is rewound before the request is honored. Successive requests to the same drive does not cause a rewind. The control statements must be in the following format:

T uu/o/nnnnn/d/p

Small letters represent a code. Capital letters and slashes must be entered as shown. An exception is that slashes are not needed if the values they delimit are not required:

Code	Meaning	Column
uu	Unit (T1, T2, T3, T4)	3-4
o	Option	6
nnnnn	Number of blocks (00001-99999)	8-12
d	Density (7-track tape)	
p	Parity (7-track tape)	

Coding Rules

- T must be in column 1.
- Slash must be in column 5.
- Slash must be in column 7 for options 0, 1, and 2.
- Slash must be in columns 13 and 15 if the tape is 7-track and option is 0, 1, or 2.

Tape Operating Instructions

- o (option) must be one of the following:
  - 0 – Skip
  - 1 – Read and print
  - 2 – Backspace
  - 3 – Rewind
- nnnnn (number of blocks) must be a decimal number between 00001 and 99999.
- d (density) is applicable only for 7-track tape and must be one of the following:
  - 0 – 200 bpi
  - 1 – 556 bpi
  - 2 – 800 bpi
- p (parity) is applicable only for 7-track tape and must be one of the following:
  - 0 – Even parity
  - 1 – Odd parity
  - 2 – Even parity translate
  - 3 – Odd parity translate
  - 4 – Odd parity convert

Note: A 2 option (even parity translate) must be taken to dump a standard label tape. If incorrect options are taken for either the tape density or parity, the results are unpredictable.

Errors

The following error halts are issued for tape dump:

Halt	Option	Meaning
UHCJ25	0, 3	Invalid control statement
UHCJ30	0, 3	Invalid unit
UHCJ31	0, 3	Syntax error
UHCJ32	0, 3	Invalid option
UHCJ33	0, 3	Invalid block number
UHCJ34	0, 3	Invalid density
UHCJ35	0, 3	Invalid parity
UHCJ36	0, 3	Tape not supported
UHCJ37	0, 3	Permanent tape error
UHCJT1	0, 1, 3	Tape not available
UHCJT2	0, 1, 3	Tape not available
UHCJT3	0, 1, 3	Tape not available
UHCJT4	0, 1, 3	Tape not available

A 0 option causes the request to be ignored. A 1 option causes a retry

FILE COMPRESS PROGRAM ($FCOMP)

$FCOMP can copy files from one main data area to another main data area without FILE statements. $FCOMP can continue copying files even though a permanent I/O error is detected on a track within a file.

The data on the defective track is lost during copy, but the rest of the file is recovered. The cylinder and head address of the missing data on the receiving main data area is logged to the logging device.

The following OCL statements are required to continue copying files even though a permanent I/O error has been detected:

```
// LOAD $FCOMP, unit
// SWITCH 11111111
// RUN
// COPYFILES FROM-code, TO-code [,PACKIN-name] [,PACKO-name]
// END
```

More explanation of the control statements is found in the *IBM System/3 Model 12 System Control Program Reference Manual,* GC21-5130. The SWITCH statement is not documented there because the SWITCH statement allows the user to bypass the permanent I/O error.

MODEL 12 DISK REBUILD PROGRAM ($$DISK)

$$DISK allows correction, replacement, and verification of any disk information. The following OCL statements load the program:

```
// LOAD $$DISK,unit
// RUN
```

The program reads records from the system input device.

Function

The disk rebuild program performs the following functions at the CE's request:

- Allows access to any 3340 address from cylinder 0 through cylinder 209
- Allows access to any simulation area from cylinder 0 through cylinder 202
- Reads, verifies, and replaces data to a specified disk location
- Reads the next record from the system input device
- Goes to end of job

When the program is loaded, it issues a warning halt (UHCJ00). You can continue or cancel the program at this point. There is no checking to determine whether a specified unit is supported or is being used by the other program level.

VREP (Verify/Replace) Statement

Data from a good statement is written to the specified disk location.

Statements are read from the system input device or from a procedure. The statements should be in one of the following formats. Small letters represent a code and capital letters must be entered as shown:

- Statement 1: VREP uu cchhrrdd vv,xxxxxx (3340 VREP)

  or

  VREP uu ccssdd vv,xxxxxx (simulation area VREP)
- Statement 2: xx

  Data statement (valid only if data in the preceding statement was terminated with a comma):

Code	Meaning	Column
uu	Unit (D1, D2)	6-7
cc	Cylinder	9-10
hh	Head	11-12
rr	Record	13-14
dd	Displacement	15-16
vv	Verify data	18-19
xx	Data	21-80

or:

Code	Meaning	Column
uu	Unit (R1, F1, R2, F2)	6-7
cc	Cylinder	9-10
ss	Sector	11-12
dd	Displacement	13-14
vv	Verify data	16-18
xx	Data	19-20

Coding Rules

- All the information (except for the unit) must be in hexadecimal.
- VREP must be in columns 1 through 4.
- The first blank following the data terminates the data.
- Commas may be interspersed with data (on a byte boundary).
- xx coded instead of hexadecimal data leaves 1 byte unchanged.
- If the data is terminated by a comma, the next statement is assumed to be continuation data unless it has VREP or REPL (replace) in columns 1 through 4.
- Data is not replaced across a record boundary without another VREP statement.

REPL (Replace) Statement

A record (256 bytes) on the FROM parameter is written to the TO location.

The possible combinations are:

- REPL FROM-uu cchhrr,TO-uu cchhrr
- REPL FROM-uu cchhrr,TO-uu cchhrr vv
- REPL FROM-uu cchhrr vv,TO-uu cchhrr
- REPL FROM-uu cchhrr vv,TO-uu cchhrr vv
- REPL FROM-uu ccss vv,TO-uu ccss vv
- REPL FROM-uu ccss vv,TO-uu ccss
- REPL FROM-uu ccss,TO-uu ccss vv
- REPL FROM-uu ccss,TO-uu ccss

3340 Format:

Code	Meaning	Column
FROM		
uu	Unit (D1, D2)	11-12
cc	Cylinder	14-15
hh	Head	16-17
rr	Record	18-19
vv	Verify data (optional)	21-22
TO		
uu	Unit (D1, D2)	24-25 or 27-28
cc	Cylinder	27-28 or 30-31
hh	Head	29-30 or 32-33
rr	Record	31-32 or 34-35
vv	Verify data (optional)	34-35 or 37-38

5444 Format:

Code	Meaning	Column
FROM		
uu	Unit	11-12
cc	Cylinder	14-15
ss	Sector	16-17
vv	Verify data (optional)	19-20
TO		
uu	Unit	19-20 or 22-23
cc	Cylinder	22-23 or 25-26
ss	Sector	25-26 or 27-28
vv	Verify data (optional)	27-28 or 30-31

Coding Rules

- All the information (except for the unit) must be in hexadecimal.
- REPL must be in columns 1 through 4.
- FROM must be in columns 6 through 10.
- TO must immediately follow comma with no spaces.
- If the verify byte is included, it is compared to the first byte of the corresponding CC/HH/RR address.
- No checking is done to ensure equal key and data lengths on the from and to addresses.

  System halts are issued.

Output

For a VREP statement data from a good statement is written to disk.

For a REPL statement, a record (256 bytes) is read at the from CC/HH/RR or CC/SS address and written to the to CC/HH/RR or CC/SS address.

Error halts are issued for bad or unverifiable input. Options 0 and 3 are allowed.

Errors

Halt	Meaning
UHCJ00	Warning halt
UHCJ01	Sysin error (a 2 option was taken to an ERP message)
UHCJ02	Blank statement
UHCJ03	Invalid control statement
UHCJ04	Invalid VERP statement
UHCJ05	Invalid unit parameter
UHCJ06	Disk error (a 2 option was taken to a disk ERP message)
UHCJ07	Invalid hexadecimal data
UHCJ08	Invalid cylinder parameter
UHCJ09	Invalid head parameter
UHCJ10	Invalid record parameter
UHCJ11	Invalid displacement parameter
UHCJ12	Invalid verify data
UHCJ13	Verify error
UHCJ14	Displacement too high
UHCJ15	Data bytes ignored
UHCJ16	Invalid sector parameter

RIB FETCH/TRACE (Models 4 and 6)

Load sequence:

```
// LOAD $$FTRC,xx
// RUN
```

The program is loaded, then relocates itself at the top of main storage and goes to end of job. To activate, record IAR value, alter SAR to displacement hex 06 into SYSCOM, alter storage to hex 80, alter SAR to recorded IAR value, and continue. To deactivate, perform IPL again, or alter aforementioned storage location to hex 00.

Printed output occurs for each branch to hex 0004. Output consists of RIB, XR1, XR2, PSR, ARR, and one of the following:

- If RIB is hex 80 or C0, C/S disk address of requested transient.
- If RIB is hex 01, LDR-O or R module, name of module (6 characters), P (program pack find), sorts (system pack find), and load address.
- If any other request, C/S disk address, number of sectors, link-edit address, displacement to RLDs, entry point, and load address.

Note: The RIB fetch/trace must not be used under CCP.

Refer to index entry: *request indicator byte* for RIB definitions.

RIB/IOB TRACE ($$FTRC) (MODELS 8, 10, and 12)

Trace is loaded into program level 1 and extends the supervisor area by changing the NPBEG address to a point following trace. Trace allows only one copy of itself to be main storage resident. If an attempt is made to load trace into program level 2 or to load it a second time, an error message is issued via halt syslog. Trace is loaded with the following OCL:

```
// LOAD $$FTRC,XX
// RUN
```

Trace then initializes intercepts for all branches to main memory locations hex 0004, 0008, and 000C. Upon completion of initialization, trace returns to end of job.

At this point the data switches should be set for those functions desired. Trace uses the two rightmost data switches (data switches 3 and 4).

CAUTION
Data switches should not be altered while trace is active because a processor check could occur. Data switch 3 controls the tracing of RIB requests; data switch 4 controls the tracing of IOS and WAIT requests.

An odd value in either data switch causes the function to be active. Due to the large number of RIB 0 requests that occur, a further function has been added for data switch 3. This function allows RIBs of 0 to be traced when the value 2 is entered into data switch 3. Therefore, the values 1, 5, 9, and D cause all non-0 RIBs to be traced; 3, 7, B, and F cause all RIBs to be traced; 2, 4, 6, 8, A, C, and E make RIB trace inactive.

On a Model 12 with more than 64K bytes of main storage, the dispatcher intercepts all branches to 0004, 0008, and 000C. If trace is active, the dispatcher branches to the appropriate point in $$FTRC.

Summary of Switch Settings (Models 8, 10, and 12)

Address/ Data Switch 3	Traces RIB Requests	Odd Active	1, 5, 9, D Traces All Non-zero RIBs	3, 7, B, F Traces All RIBs	0, 2, 4, 6, 8, A, C, E Inactive
Address/ Data Switch 4	Traces IOS and Wait Requests	Odd Active			0, 2, 4, 6, 8, A, C, E Inactive

The printer output from trace is the following format:

AAAA XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX IIII
1111 2222 PPPP RR B L

All output is printable hexadecimal, and:

- AAAA is the address recall register content
- XXXX is the parameter or DTF for RIB trace or the IOB for EXECUTE and WAIT trace
- IIII is the last 2 IOB bytes, or the C/S for RIBs hex 80 and C0
- 1111 is the content of register 1
- 2222 is the content of register 2
- PPPP is the content of the program mode register (for Model 12 with more than 64K bytes of main storage only)
- RR is the RIB (prints only for general entry requests)
- B is the branch to main memory location 4, 8, or C
- L is the program level for this request (prints only when DPF active)

A halt can be specified for a transient when loaded by C/S requests. To initiate this halt, data switches 3 and 4 are set to EC. When this data switch setting is sensed, a halt of is displayed in the console display lights. The C/S can then be entered via data switches 1 through 4 and halt reset pressed. Halt is then issued so that the data switches can be reset. When the C/S defined transient load request is intercepted, halt EC is issued.

If trace is no longer required, it can be terminated if data switches 3 and 4 are set to ED, which causes trace to reset all intercept addresses, and NPBEG is reset to its original address.

The main storage requirement for trace is hex 2300 to load and hex 0300 to trace.

CARD IMAGE FORMATS

O Module

The following are descriptions of the header, text, RLD, and end statements for an object directory O module.

Header Statement

96-Column	80-Column	Contents
1	1	H
2-4	2-4	Blank
5	5	O (character O)
6-8	6-8	Blank
9-14	9-14	Module name
15-17	15-17	Blank
18-21	18-21	0000 (character zeros)
22-23	22-23	Number of text sectors in hexadecimal
24-27	24-27	Link-edit address in hexadecimal
28-29	28-29	Displacement of RLD in hexadecimal
30-33	30-33	SCA in hexadecimal
34-35	34-35	Main storage size in hexadecimal
36-39	36-39	Attributes in hexadecimal
40-41	40-41	Level in hexadecimal
42-45	42-45	Total number of sectors in hexadecimal
46-49	46-49	Blank
50-56	50-56	Number of the last PTF applied to this module (either an IBM-supplied PTF or a user punched module containing an IBM-supplied PTF)
57	57	Blank
58-63	58-63	Current system date
64-85	64-69	Blank
86-88	70-72	Self-check bytes
89-92	73-76	First 4 characters of module name
93-96	77-80	Sequence number (always 0001)

Text Statement

96-Column	80-Column	Contents
1	1	T
2	2	Length of text minus 1
3-5	3-4	Link-edit address of last text byte in card
6-85	5-64	Text
	65-69	Blank
86-88	70-72	Self-check bytes
89-92	73-76	First 4 characters of module name
93-96	77-80	Sequence number

Note: Columns 2-85 are in 4-for-3 format for 96-column device.

RLD Statement

96-Column	80-Column	Contents
1	1	R
2-5	2-4	Blank
6-85	5-64	Blanks and RLDs
	65-69	Blank
86-88	70-72	Self-check bytes
89-92	73-76	First 4 characters of module name
93-96	77-80	Sequence number

Note: Columns 2-85 are in 4-for-3 format for 96-column device.

End Statement

96-Column	80-Column	Contents
1	1	E
2-35	2-35	Blank
36-60	36-60	The characters LAST
61-85	61-69	Blank
86-88	70-72	Self-check bytes
89-92	73-76	First 4 bytes of module name
93-96	77-80	Sequence number

R Module

The following are descriptions of the header, external symbol list (ESL), text-relocation dictionary, and end statements for an object directory R module.

Header Statement

96-Column	80-Column	Contents
1	1	H
2-4	2-4	Blank
5	5	R (character R)
6-8	6-8	Blank
9-14	9-14	Module name
15-17	15-17	Blank
18-21	18-21	0000 (character zeros)
22-23	22-23	Category
24-35	24-35	0000 (character zeros)
36-39	36-39	Attributes in hexadecimal
40-41	40-41	Level in hexadecimal
42-45	42-45	Total number of sectors in hexadecimal
46-49	46-49	Blank
50-56	50-56	Number of the last PTF applied to this module (either an IBM-supplied PTF or a user-punched module containing an IBM-supplied PTF)
57	57	Blank
58-63	58-63	Current system date
64-85	64-69	Blank
86-88	70-72	Self-check bytes
89-92	73-76	First 4 characters of module name
93-96	77-80	Sequence number (always 0001)

External Symbol List Statement

96-Column	80-Column	Contents
1	1	S
2	2	Length of ESL record minus 1
3-85	3-64	ESL record
	65-69	Blank
86-88	70-72	Self-check bytes
89-92	73-76	First 4 characters of module name
93-96	77-80	Sequence number

Note: Columns 2-85 are in 4-for-3 format for 96-column device.

Text-RLD Statement

96-Column	80-Column	Contents
1	1	T
2	2	Length of text portion minus 1
3-5	3-4	End address of text portion
6-85	5-64	Text and RLD portion
	65-69	Blank
86-88	70-72	Self-check bytes
89-92	73-76	First 4 characters of module name
93-96	77-80	Sequence number

Note: Columns 2-85 are in 4-for-3 format for 96-column device.

End Statement

96-Column	80-Column	Contents
1	1	E
2-3	2-3	Entry address of object program
4-85	4-64	Program to transfer control to entry address
	65-69	Blank
86-88	70-72	Self-check bytes
89-92	73-76	First 4 characters of module name
93-96	77-80	Sequence number

Note: Columns 2-85 are in 4-for-3 format for 96-column devices.

MLMP (BSCA)

Trace Table

The trace table contains I/O information recorded by the trace module ($$BSTT). The trace table is 323 bytes long, beginning at symbolic address MTBSML and ending at symbolic address MTBSMM. The format of the trace table is:

The eyecatcher BSML followed by:

Pointer	WRAP	Entry 1	Entry 2		Entry 20

Pointer – Address of the first byte of the last entry in the table used by trace (2 bytes).

WRAP – Status byte:

Hex Value	*Meaning*
01	Each entry has been filled at least once, and entries are now being overlaid, beginning with entry 1.
00	No more than 20 entries have been written to the table.

Entry = 16 bytes. The format of each entry is:

			Data			
Q Code	Control Code	Sense/Status Bytes	D1	D2	D3	D4

Q code – From the BSCA SIO instruction initiating the event recorded.

Control code – From the SIO instruction initiating the event recorded; 1 byte.

Byte	Bit	Meaning When Set to 1
1	0	Time-out status: a. A receive time-out occurred during a receive operation with the adapter in the busy state. b. An autocall operation was terminated by an abandon call and retry signal from the autocalling unit (ACU) indicating that a connection was not established.
1	1	Data check during receive operation: a. A BCC compare check occurred (EBCDIC). b. A VRC check occurred (ASCII). *Note:* Characters having VRC checks are distinguished by a high-order bit in main storage. These characters are never recognized as control characters by the BSCA.
1	2	Adapter check during transmit operation: a. DBI register parity check. b. I/O cycle steal overrun. c. LSR or shift register parity check. d. Transmit control register check.
1	3	Adapter check during receive operation: a. DBI register parity check. b. I/O cycle steal overrun. c. LSR or shift register parity check.
1	4	Invalid ASCII character (A byte fetched from main storage by an adapter using ASCII code contained a 1-bit in the high-order bit position.)
1	5	Abortive disconnect. Indicates BSCA on switched network was enabled, then the data set became ready, then not ready. This bit indicates the connection has been released and causes data terminal ready to turn off.

Byte	Bit	Meaning When Set to 1
1	6	Disconnect time-out. Indicates disconnect time-out occurred on a switched network. Disconnect time-out causes data terminal ready to turn off. May not apply to systems using the IBM remote job entry program. *Note:* The program must perform a disconnect operation.
1	7	Not assigned
2	0	Not assigned
2	1	
2	2	
2	3	
2	4	
2	5	
2	6	Data set ready. This indicates that the data set is ready to operate and that the BSCA has been enabled.
2	7	Data line occupied. This bit is used on a switched network when the BSCA is equipped with the autocall feature. This bit indicates that the data receive initial instruction will be rejected.

Note: Byte 1 equals leftmost byte; byte 2 equals rightmost byte.

Data:

D1 – Contents, at the time the I/O operation was started, of the byte addressed by the current address register (CAR) and the 2 bytes that follow.

D2 – Contents, at the time the I/O operation was started, of the 3 bytes preceding the byte addressed by the transition address register (TAR).

D3 – Contents, at the time the I/O operation was completed, of byte addressed by the TAR and the 2 bytes that follow.

D4 – Contents, at the time the I/O operation was completed, of the 3 bytes preceding the byte addressed by the CAR.

Note: When a 2-second time-out occurs, D1-D4 are set to hex FFs. When a receive time-out occurs, D3 and D4 are set to hex FF. When the I/O operation is receive-initial (RCVI), receive only (RCVO), or autocall, D2 and D3 are set to hex FF.

Trace

If you are familiar with System/3 BSCA hardware and BSC line control procedures, you may find a record of the BSCA I/O sequence helpful in isolating an MLMP programming problem. MLMP provides a trace module ($$BSTT) to record I/O information after each BSCA interrupt.

Once the trace module is included in your program, each MLMP I/O operation calls trace to record the event in a trace table. Dump the trace table when you are ready to examine the information recorded in it. You can use the $SNAP macro instruction to dump the table. Dump main storage from symbolic of the trace table. (MTBSML and MTBSMM each require that an EXTRN be defined in the program requesting the dump.)

Trace Considerations

- ITB interrupts, BSCA enabling operations, and BSCA disabling operations are not recorded by trace.
- Trace entries are recorded independently of your programming operations. That is, entries are recorded when an interrupt occurs regardless of current operations occurring in your program, and can be recorded at any time, even during a snap dump (see following discussion). Consequently, be aware that entries may have been made to the trace table after a request to dump the table.
- Trace requires 512 bytes of main storage.
- For program efficiency, include trace in your program only when you are trying to diagnose a problem.

Include Trace, Assembler

Include the trace module in your program by specifying EXTRN $$BSTT in your program or by placing an INCLUDE card in the linkage editor input deck:

```
// INCLUDE NAME-$$BSTT,UNIT-xx
```

(xx is the unitname R1, F1, R2, or F2.)

Note: If you use an INCLUDE statement to call the trace module, the overlay linkage editor generates a *name not referenced* error message (0L031). This error does not affect the output of the linkage editor, however, and should be ignored.

Include Trace, RPG II

If your program is running under RPG II as a subroutine, $$BSMT is automatically link-edited as a dummy trace module. If you want to include the actual trace module in your program, you must rename the dummy and actual trace modules. After renaming the modules, recompile your program to get the actual module link-edited. The following statements are used to rename the trace modules:

```
// LOAD $MAINT,xx
// RUN
// RENAME FROM–xx,LIBRARY–R,NAME–$$BSMT,NEWNAME–$$BSAV
// RENAME FROM–xx,LIBRARY–R,NAME–$$BSTT,NEWNAME–$$BSMT
// END
```

(xx is the unitname R1, F1, R2, or F2.)

To replace the actual trace module with dummy trace module:

1. Rename the modules:

```
// LOAD $MAINT,xx
// RUN
// RENAME FROM–xx,LIBRARY–R,NAME–$$BSMT,
  NEWNAME–$$BSTT
// RENAME FROM–xx,LIBRARY–R,NAME–$$BSAV,
  NEWNAME–$$BSMT
// END
```

   (xx is the unitname R1, F1, R2, or F2.)

2. Recompile your program.

System/3 RPG II 3270 Display Control Feature Debug Trace

The display control feature currently supports a trace, in addition to the multiline/multipoint (ML/MP) trace, known as the SUBR13 Debug Trace. The debug trace, which can be optionally included into an application program, records to a 40 entry trace table that provides such information as the points of entry and exit within SUBR13, the symbolic terminal name, and the operation and return codes involved in the operation.

There are three R-modules associated with the SUBR13 Debug Trace to be considered:

- $$DURS, the real trace module
- $$DUXS, the dummy trace module
- $$DUTR, the module that link-edits with SUBR13

When an application program utilizing the display control feature (SUBR13) is compiled, $$DUTR is always automatically link-edited.

In order to activate the debug trace, by inclusion of the actual trace module ($$DURS) into an application program, the following procedure should be followed:

1. Replace the contents of $$DUTR with $$DURS as follows:

```
// LOAD $MAINT,xx
// RUN
// COPY FROM-R1,TO-R1,LIBRARY-R,RETAIN-R,NAME-$$DURS,
   NEWNAME-$SDUTR
// END
```

   Note: Program pack assumed to be on R1.

2. Recompile the application program to link-edit the active trace module.

Then, in order to deactivate the debug trace when it is no longer required, perform the following:

1. Replace the contents of $SDUTR with $SDUXS as follows:

```
// LOAD $MAINT,xx
// RUN
// COPY FROM-R1,TO-R1,LIBRARY-R,RETAIN-R,NAME-$SDUXS,
   NEWNAME-$$DUTR
// END
```

2. Recompile the application program.

   Note: With the next release of each programming system that supports the display control feature, two procedures (DBUG and NODBUG) will be provided to include or remove the SUBR13 debug trace.

Locating the SUBR13 Debug Trace Table

The trace table can be located by scanning the right side of the storage dump for the eyecatcher(b̸SUBR13b̸DEBUGb̸TRACEb̸).

Trace Considerations

The trace module ($$DURS) is active at all times and cannot be turned on and off.

The trace requires approximately 900 bytes of main storage when active.

SUBR13 Debug Trace Format

The trace table format is as follows:

ƀSUBR13ƀDEBUGƀTraceƀ

Table Start @	Table End @	Eyecatcher	Last Entry @	WRAP	Work Area	Entry #1	Entry #2		Entry #40
2 bytes	2 bytes	20 bytes	2 bytes	1 byte	*	640 bytes			

*Work area length is variable.

WRAP = Wrap Status Byte:

Hex Value	*Meaning*
01	Each entry has been filled at least once, and entries are now being overlaid, beginning with entry number 1.
00	No more than 40 entries have been written to table.

Entry = 16 bytes. The format of each entry is as follows:

SUBR13 ID Byte	Symbolic Terminal Name	Length	Symbolic Operation Code	Return Code	Completion Code	Operation Code
1	2–7	8–11	12	13–14	15	16

SUBR13 ID Byte – SUBR13 entry type

Hex Value	*Meaning*
C1 (A)	SUBR13 mainline entered from application program
C7 (G)	Get routine entered
C8 (H)	Get routine exited
D4 (M)	MTF put routine entered
D5 (N)	MTF get routine entered
D7 (P)	Put routine entered
D8 (Q)	Put routine exited
E3 (T)	Initialization routine entered
E9 (Z)	SUBR13 mainline exited to application program

Symbolic Terminal Name – Symbolic terminal name of the terminal involved in the operation.

Length – The contents of the message length/MTF field in the parameter list at the time the entry was made:

Output message length
The maximum input message length
The beginning MTF indicator and the number of indicators saved (input)
The length of all MTF data fields (output)

Symbolic Operation Code – Contents of the operation code field in the parameter list at the time the entry was made.

Hex Value	*Meaning*
C1 (A)	Read with mapping
C6 (F)	Read or write format
D4 (M)	Read or write MTFLGFIL
E6 (W)	Read without mapping
F1 (1)	Write
F5 (5)	Erase and write
F6 (6)	Erase unprotected fields
F7 (7)	Copy terminal buffer

Return Code – The contents of the return code field in the parameter list at the time this entry was made. See Appendix A in the *IBM RPG II 3270 Display Control Feature Reference and Logic Manual*, SC21-5161, for a listing of all the possible return codes.

Completion Code – The completion code contained in the active DTF at the time the entry was made. See Chapter 4 in the *IBM System/3 Multiline/ Multipoint Binary Synchronous Communications Reference Manual*, GC21-7573, for explanation of the various completion codes.

Operation Code – The operation code in the active DTF at the time the entry was made.

Hex Value	*Meaning*
80	Get
44	Put

MLTA TRACE

F0 SIO

Disp Hex	Lng Dec	Description
00	1	Entry ID hex F0
01	1	Op code from DTF (contains hex FF during open/close)
02-03	2	ARR save area contents from DTF
04	1	Receive length count (HDB-8)
05	1	HDB-9: *Hex Value* — *Meaning* 80 — PCI flag 40 — Break/skip flag 10 — Terminal interrupt 08 — Inhibit receive flag 04 — Inhibit time-out 02 — Terminal dependent flag 01 — Terminal control type
06-07	2	Address to receive control at next op-end interrupt
08-09	2	Contents of XR2 save area in DTF
0A-0B	2	SIO Q and R codes in IOB
0C-0D	2	CAR contents in IOB
0E-0F	2	TAR contents in IOB

F1

Disp Hex	Lng Dec	Description
00	1	Entry ID
01	1	Contents of high-density buffer position 0 (DTF)
02	1	Contents of high-density buffer position 6 (DTF)
03	1	Contents of high-density buffer position 7 (DTF)
04-05	2	CAR contents (MLTCOM)[1]
06-07	2	TAR contents (MLTCOM)
08-09	2	Two characters stored at CAR contents (MLTCOM)[2]
0A	1	Bit switch of attribute byte 2 (DTF)
0B	1	Interrupt level 3 source bits (MLTCOM)
0C-0D	2	Address of DTF associated with this line (XR2)
0E	1	IOCS switches (MLTCOM)[2]
0F	1	Count of PCI processing that is pending (MLTCOM)

Note: If this current trace entry is identical to the last interrupt level entry trace entry (except when at beginning of table), it is not added to the table.

F2

Disp Hex	Lng Dec	Description
00	1	Entry ID
01[3]	1	Operation code being processed on this line (DTF)
02	1	Internal IOCS completion code set when interrupt processing is complete (DTF)
03	1	Internal IOCS ERP switches (DTF)
04-05	2	Contents of high density buffer positions 8 and 9 (DTF)
06-07	2	Address to receive control at next op-end interrupt (DTF)
08-09	2	Internal IOCS switches (DTF)

[1] MLTA IOCS common area.
[2] If bits 0 or 1 are on in the switches (displacement E) then the CAB characters are not meaningful.
[3] Contains hex FF during open and close operations.

F2 (Continued)

Disp Hex	Lng Dec	Description
0A-0B	2	SIO Q codes and control bytes (SIO)
0C-0D	2	CAR contents (IOB)
0E-0F	2	TAR contents (IOB)

Note: If this current trace entry is identical to the last interrupt level exit trace entry in the table (except when at beginning of table), it is not added to the table.

F3 Op Complete

Disp Hex	Lng Dec	Description
00	1	Hex F3 trace ID read/write operation complete
01-02	2	Current record length (DTF)
03-04	2	Current record address (DTF)
05-0F	11	Data stored at current record address (nonpolled terminal)
05-0D	(9)	Data stored at current record address (polled terminal)
0E-0F	(2)	Terminal address (DTF) (polled terminal)

BSCA TRACE

Disp Hex	Lng Dec	Description
00	1	Q code of SIO:

Hex Value	*Meaning*
88	BSCA line 2/LDA/locally attached work station
80	BSCA line 1
06	Loop test
04	Autocall
03	Receive initial
02	Transmit and receive
01	Receive only
00	Control

Disp Hex	Lng Dec	Description
01	1	R code of SIO:

Hex Value	*Meaning*
C0	Enable BSCA
A0	Enable test mode
90	Enable step mode
04	Start 2-second time-out
02	Enable interrupt requestability
01	Reset interrupt request

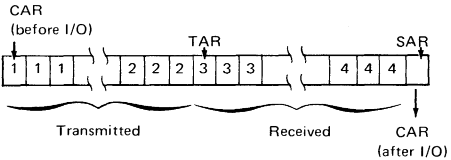
Disp Hex	Lng Dec	Description
02	1	Sense byte 1:

Hex Value	*Meaning*
80	Receive time-out, aborted autocall
40	Data check during receive operation
20	Adapter check during transmit operation
10	Adapter check during receive operation
08	Invalid ASCII character
04	Abortive disconnect (lost connection)
02	Disconnect (20-second) time-out

Disp Hex	Lng Dec	Description
03	1	Sense byte 2:

Hex Value	*Meaning*
02	Data set ready
01	Data line occupied (switched, autocall)

Disp Hex	Lng Dec	Description	
04-06	3	First 3 characters transmitted (1)	For transmit and receive
07-09	3	Last 3 characters transmitted (2)	
0A-0C	3	First 3 characters received (3)	
0D-0F	3	Last 3 characters received (4)	



CAR = Current address register
TAR = Transition address register
SAR = Stop address register

MLTERFIL

MLTERFIL is located on F1 and consists of twenty-four 256-byte records.

- Record 0 MLTA OBR (outboard recorder) contains permanent error indications.

Bytes 0-1	Displacement to the most recent entry (6, 11 . . . 251)
2-3	Reserved
4-5	Total error count
6-255	Fifty 5-byte permanent error entries

Byte 0 line number (1-8):

1 Terminal address (hex 00 if nonpolled)

2 High-density buffer position 0 (HDB0):

Hex Value	*Meaning*
80	PCI overrun
40	Upper shift case
20	Text-in mode
10	Text-out mode

Bits 4-7 Bit time count field

3 High-density buffer position 6 (HDB6):

Hex Value	*Meaning*
80	Time-out
40	Data check
20	Transmit abort
10	Receive abort
08	Overrun
04	Terminal interrupt
02	Instruction no-op
01	Lost data

4 High-density buffer position 7 (HDB7):

Hex Value	*Meaning*
80	Modem not ready
10	Line not ready

Bits 5-7 SIO N code

- Records 1-8 MLTA SDR (statistical data recorder)

Bytes 0-1 Invalid terminal address count
2-3 Reserved
4-255 Forty-two 6-byte statistical entries (one for each terminal address). Order of entries by terminal address is: /, A-Z, 0-9, @, -, $, ., &.

Byte 0-1 Number of errors of all types
2-5 Number of successful read/write operations (exclusive of poll with negative response and WTDS)

- Records 9-17 Not used

- Records 18-20 MLMP terminal statistics LINE 1

Byte 0 of each sector is the displacement to the next available byte (hex 00 indicates no logging has been done in this sector).

L	A	...	U	S

Entries are variable length

L = Length of terminal address (1 byte)
A = Terminal address (1-7 bytes long)
U = Number of unsuccessful operations (2 bytes)
S = Number of successful operations (4 bytes)

The last entry in a sector delimited by hex F0
The last entry for the line delimited by hex FE

- Records 21-23 MLMP terminal statistics line 2

BSCA SDR/OBR

F1 C/S 0014

Displacement (hex) of 4-byte cumulative counters		
	Displacement (hex) of 2-byte temporary counters	
77	AB	Text blocks sent
7B	AD	Text blocks received
7F	AF	NAKs received
83	B1	Data checks
87	B3	Forward aborts received
8B	B5	Aborts received
8F	B7	Adapter checks on transmit
93	B9	Adapter checks on receive
97	BB	Invalid responses
9B	BD	ENQs received to ACKs sent
9F	BF	Lost data errors
A3	C1	Disconnect time-outs
A7	C3	Receive time-outs

BSCA CONTROL CHARACTERS AND CODES

EBCDIC

Hex	Char	Hex	Char	Hex	Char
00	NUL	3F	SUB	A1	~
01	SOH	40	SP	A2	s
02	STX	4A	¢	A3	t
03	ETX	4B	.	A4	u
04	PF	4C	<	A5	v
05	HT	4D	(	A6	w
06	LC	4E	+	A7	x
07	DEL	4F	|	A8	y
09	RLF	50	&	A9	z
0A	SMM	5A	!	C0	{
0B	UT	5B	$	C1	A
0C	FF	5C	*	C2	B
0D	CR	5D	)	C3	C
0E	SO	5E	;	C4	D
0F	SI	5F	¬	C5	E
10	DLE	60	–	C6	F
11	DC1	61	/	C7	G
12	DC2	6A	|	C8	H
13	DC3	6B	, (comma)	C9	I
14	RES	6C	%	D0	}
15	NL	6D	___	D1	J
16	BS	6E	>	D2	K
17	IL	6F	?	D3	L
18	CAN	79	\	D4	M
19	EM	7A	:	D5	N
1A	CC	7B	#	D6	O
1C	IFS	7C	@	D7	P
1D	EGS	7D	' (single quote)	D8	Q
1E	IRS	7E	=	D9	R
1F	IUS	7F	"	E0	\
20	DS	81	a	E2	S
21	SOS	82	b	E3	T
22	FS	83	c	E4	U
24	BYP	84	d	E5	V
25	LF	85	e	E6	W
26	EOB[1]	86	f	E7	X
27	PRE[2]	87	g	E8	Y
2A	SM	88	h	E9	Z
2D	ENQ	89	i	F0	0
3E	ACK	91	j	F1	1
2F	BEL	92	k	F2	2
32	SYN	93	l	F3	3
34	PN	94	m	F4	4
35	RS	95	n	F5	5
36	UC	96	o	F6	6
37	EOT	97	p	F7	7
3C	DC4	98	q	F8	8
3D	NAK	99	r	F9	9

[1] Character
[2] ETB

ASCII

Hex	Char	Hex	Char	Hex	Char
00	NUL	2C	, (comma)	58	X
01	SOH	2D	-	59	Y
02	STX	2E	.	5A	Z
03	ETX	2F	/	5B	[
04	EOT	30	0	5C	\
05	ENQ	31	1	5D	]
06	ACK	32	2	5E	¬
07	BEL	33	3	5F	_
08	BS	34	4	60	' (single quote)
09	HT	35	5	61	a
0A	LF	36	6	62	b
0B	VT	37	7	63	c
0C	FF	38	8	64	d
0D	CR	39	9	65	e
0E	SO	3A	:	66	f
0F	SI	3B	;	67	g
10	DLE	3C	<	68	h
11	DC1	3D	=	69	i
12	DC2	3E	>	6A	j
13	DC3	3F	?	6B	k
14	DC4	40	@	6C	l
15	NAK	41	A	6D	m
16	SYN	42	B	6E	n
17	ETB	43	C	6F	o
18	CAN	44	D	70	p
19	EM	45	E	71	q
1A	SUB	46	F	72	r
1B	ESC	47	G	73	s
1C	FS	48	H	74	t
1D	GS	49	I	75	u
1E	RS	4A	J	76	v
1F	US	4B	K	77	w
20	SP	4C	L	78	x
21	!	4D	M	79	y
22	"	4E	N	7A	z
23	#	4F	O	7B	{
24	$	50	P	7C	¦
25	%	51	Q	7D	}
26	&	52	R	7E	~
27	' (single quote)	53	S	7F	DEL
28	(	54	T		
29	)	55	U		
2A	*	56	V		
2B	+	57	W		

CONTROL CHARACTERS

Character	EBCDIC	ASCII	Character	EBCDIC	ASCII
ACK0	1070	1030	ITB	1F	1F
ACK1	1061	1030	NAK	3D	15
DISC	1037	1004	RVI	107C	103L
DLE	10	10	SOH	01	01
ENQ	2D	05	STX	02	02
EOT	37	04	SYN	32	16
ETB	26	17	TTD	022D	0205
ETX	03	03	WACK	106B	103B

HALT CONVERSION

To convert Model 8, 10, or 12 halt to a Model 4 or 6 halt:

1. Using the table, determine the displacement of the first character.
2. Multiply the displacement by 22.
3. Determine the displacement of the second character and add it to the result of step 2.
4. Convert the result of step 3 from decimal to hexadecimal.
5. Write the 9-bit binary equivalent of the hex value obtained in step 4. Bits on indicate display lights are on.

For example, to convert U2 halt:

U displacement is 7
2 displacement is 4

7 x 22 = 154
154 + 4 = 158
158 decimal = 9E hex
9E = 0000 1001 1110
        A BCD12345

Model 4 or 6 halt is B 1 234.

Note: The following are exceptions to the conversion algorithm.

Model 8, 10, or 12 Halt	Model 4 or 6 Halt
EJ	ABCD12345
HE	BCD12345
5Y	A CD12 5
80	35
blank0	12 45
0C	AB D12 45
7E	CD1 3
0A	AB D 2345
γ	CD123

Any halt that ends in –, except ––, cannot be converted. If Model 4 or 6 receives a halt that it cannot convert, Model 4 or 6 issues an ABC 13 halt.

To convert a Model 4 or 6 halt to a Model 6, 8, 10, or 12 halt, reverse the algorithm. For example:

Halt B1234
0000 1001 1110 = 9E hex
9E hex is 158 decimal
158 = 7 + 4
22
7 is displacement for U
4 is displacement for 2
U2 is converted halt

Character to Displacement Conversion

Character		9	6	E	2	0	C	U	L	J	8	6	3	Y	A	P	F	H	4	*	7	1	–
Displacement	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22

How to Determine the Real Beginning Address of Program Level 2 (Model 12 with More Than 64K Bytes of Main Storage)

Follow this procedure to determine the real beginning address of program level 2 on a Model 12 with more than 64K bytes of main storage:

1. Determine the storage size by checking displacement 58, label NCORE, in the system communication region.

2. Determine the logical start address of program level 2 by checking displacement 15-16, label NPBEG, in the PLCA.

3. If the system has 96K bytes of main storage, add hex 8000 to the logical address of program level 2 (indicated at displacement 15-16, label NPBEG in PLCA). This is the real address of program level 2.

4. If the system has 80K bytes of main storage, add hex 4000 to the logical address of program level 2 (indicated at displacement 15-16, label NPBEG, in PLCA). This is the real address of program level 2.

	Mnem	Op	Q	Operands				Comments
Two-Address Instruction	ZAZ	4	L_1L_2					Zero and add zoned
	AZ	6	L_1L_2					Add zoned decimal
	SZ	7	L_1L_2					Subtract zoned decimal
	MVX	8						Move hexadecimal characters
	ED	A	L_1					Edit
	ITC	B	L_1					Insert and test characters
	MVC	C	L					Move characters
	CLC	D	L					Compare logical characters
	ALC	E	L					Add logical characters
	SLC	F	L					Subtract logical characters
		0		Op1		Op2		Op1 direct, Op2 direct
		1		Op1		Op2		Op1 direct, Op2 indexed by XR1
		2		Op1		Op2		Op1 direct, Op2 indexed by XR2
		4		Op1	Op2			Op1 indexed by XR1, Op2 direct
		5		Op1	Op2			Op1 indexed by XR1, Op2 indexed by XR1
		6		Op1	Op2			Op1 indexed by XR1, Op2 indexed by XR2
		8		Op1	Op2			Op1 indexed by XR2, Op2 direct
		9		Op1	Op2			Op1 indexed by XR2, Op2 indexed by XR1
		A		Op1	Op2			Op1 indexed by XR2, Op2 indexed by XR2

STANDARD INSTRUCTION SET (Continued)

	Mnem	Op	Q	Operands		Comments
One-Address Instruction (nonbranch)	SNS	0	M N			Sense I/O
	LIO	1	M N			Load I/O
	ST	4	Reg			Store register
	L	5	Reg			Load register
	A	6	Reg			Add to register
	TBN	8	Mask			Test bits on
	TBF	9	Mask			Test bits off
	SBN	A	Mask			Set bits on
	SBF	B	Mask			Set bits off
	MVI	C	I_2			Move logical immediate
	CLI	D	I_2			Compare logical immediate
		3		Op1 Addr		Op1 direct
		7		Op1		Op1 indexed by XR1
		B		Op1		Op1 indexed by XR2
One-Address Instruction (branch)	BC	0	Condition			Branch on condition
	TIO	1	DA M N			Test I/O and branch
	LA	2	Bit 6-XR2 Bit 7-XR1			Load address
		C		Op2 Addr		Op2 direct
		D		Op2		Op2 indexed by XR1
		E		Op2		Op2 indexed by XR2
Command Instruction	HPL	F0	Tens	Unit		Halt program level
	APL	F1	DA M N	N U		Advance program level
	JC	F2	Condition	Number of bytes to jump		Jump on condition
	SIO	F3	DA M N	Control		Start I/O

I/O INSTRUCTIONS FORMAT

Op Code	Q Code		
Bits 0-7	Bits 8-11	Bit 12	Bits 13-15
Operation	Device	M	N

Op Codes	Definition	Index
30	Sense I/O	Direct
31	Load I/O	Direct
70	Sense I/O	XR1
71	Load I/O	XR1
B0	Sense I/O	XR2
B1	Load I/O	XR2
C1	Test I/O	Direct
D1	Test I/O	XR1
E1	Test I/O	XR2
F1	APL	–
F3	Start I/O	–

Q Code Addressing

Bits 0-3	Hex	Device Addressed
0000	0X	CPU, DPF feature
0001	1X	5471 Printer Keyboard
0010	2X	MLTA
0011	3X	Serial I/O channel
0100	4X	3741
0101	5X	1442 Card Read/Punch
0110	6X	3410/3411 devices 0 and 1
0111	7X	3410/3411 devices 2 and 3
1000	8X	BSCA line 1 or 2
1001	9X	2265 Display Station
1010	AX	5444/5447 (R1 and F1) on drive 1
1011	BX	5444/5447 (R2 and F2) on drive 2
1100	CX	5445/Main data area/5448
1101	DX	5448
1110	EX	5203/1403 Printer
1111	FX	5424 MFCU

Note: The I/O instruction detailed breakdown that follows is in order by Q code to facilitate working from a main storage dump.

BASIC ASSEMBLER LANGUAGE

The following chart shows the allowable operand formats for each operand group. The instructions using each operand group are also listed.

For the extended mnemonics of the MVX instruction, the I-field information is inherent in the mnemonic and the I-field is omitted from the operand. For the extended mnemonics of the BC and JC instructions, the second operand (I-field) is not used, since the information is inherent in the mnemonic (see *Extended Mnemonic Codes* in this section).

Data movement is from operand 2 to operand 1 in a two-address format instruction (group 1 and group 2). This operand order is equivalent to that of machine instructions.

In groups 3, 4, 5, and 6, the Q code operand is always on the right:

Group	Instructions	Allowable Operand Format			
1	ZAZ, AZ, SZ	A, A	A (L), A	D(,R), A	D (L, R), A
		A, A (L)	A (L), A (L)	D (,R), A (L)	D (L, R), A (L)
		A, D (,R)	A (L), D (,R)	D (,R), D (R)	D (L, R), D (,R)
		A, D (L, R)	A (L), D (L, R)	D (,R), D (L, R)	D (L, R), D (L, R)
2	MVC, CLC, ALC,	A, A	A (L), A	D (,R), A	D (L, R), A
	SLC, ITC, ED	A, A (L)	A (L), D (,R)	D (,R), A (L)	D (L, R), D (,R)
		A, D (,R)		D (,R), D (,R)	
		A, D (L, R)		D (,R), D (L, R)	
	MVX	A, A (I)	A (I), A	D (,R), A (I)	D (I, R), A
		A, D (I, R)	A (I), D (,R)	D (,R), D (I, R)	D (I, R), D (,R)
3	MVI, CLI, SBN,	A, I		D (,R), I	
	SBF, TBN, TBF,				
	TIO, SNS, LIO				
	BC				
	L, ST, A, LA	A, R		D (,R), R	
4	APL	I			
5	HPL, SIO	I, I			
6	JC	A, I			

The following codes are used to describe the possible operand formats:

Code	Meaning	Acceptable Form
A	Address	Relocatable expression, absolute expression, or self-defining value
D	Displacement	Relocatable expression, absolute expression, or self-defining value
L	Length	Absolute expression or self-defining value
R	Register	Absolute expression or self-defining value
I	Immediate data (bit masks, condition bit masks, or control bits to be used in the instruction)	Absolute expression or self-defining value

MACRO PROCESSOR

Control Records

Macro definitions are composed of control records. The values established in the control records are used by the macro processor to generate assembler source statements. The control records existing within the macro definitions are:

Record Type	Macro Definition
Header	MACRO
Keyword	Prototype (1-6 records)
Global arithmetic	GBLA
Global binary	GBLB
Global character	GBLC
Local arithmetic	LCLA
Local binary	LCLB
Local character	LCLC
Table	TABLE
Table definition	TABDF (argument and value)
Text	TEXT
Comment	* or .*
Conditional branch forward	AIF
Conditional branch backward	AIFB
Unconditional branch forward	AGO
Unconditional branch backward	AGOB
Set arithmetic	SETA
Set binary	SETB
Set character	SETC
No-op	ANOP
Message	MNOTE
Trailer (logical end)	MEXIT
Trailer (physical end)	MEND

EXTENDED MNEMONIC CODES

Instruction	Mnemonic Operation Code	Hex Q Code
Move hexadecimal character (MVX)		
Move to zone from zone	MZZ	00
Move to numeric from zone	MNZ	02
Move to zone from numeric	MZN	01
Move to numeric from numeric	MNN	03
Branch on condition (BC)		
Branch	B	87
Branch high	BH	84
Branch low	BL	82
Branch equal	BE	81
Branch not high	BNH	04
Branch not low	BNL	02
Branch not equal	BNE	01
Branch overflow zoned	BOZ	88
Branch overflow logical	BOL	A0
Branch no overflow zoned	BNOZ	08
Branch no overflow logical	BNOL	20
Branch true	BT	10
Branch false	BF	90
Branch plus	BP	84
Branch minus	BM	82
Branch zero	BZ	81
Branch not plus	BNP	04
Branch not minus	BNM	02
Branch not zero	BNZ	01
Jump on condition (JC)		
Jump	J	87
Jump high	JH	84
Jump low	JL	82
Jump equal	JE	81
Jump not high	JNH	04
Jump not low	JNL	02
Jump not equal	JNE	01
Jump overflow zoned	JOZ	88
Jump overflow logical	JOL	A0
Jump no overflow zoned	JNOZ	08
Jump no overflow logical	JNOL	20
Jump true	JT	10
Jump false	JF	90
Jump plus	JP	84
Jump minus	JM	82
Jump zero	JZ	81
Jump not plus	JNP	04
Jump not minus	JNM	02
Jump not zero	JNZ	01

MNEMONIC OPERATION CODES (MACHINE)

Instruction	Mnemonic Operation Code	
Zero and add zoned decimal	ZAZ	Two-Address Format
Add zoned decimal	AZ	
Subtract zoned decimal	SZ	
Move hex character	MVX	
Move characters	MVC	
Compare logical characters	CLC	
Add logical characters	ALC	
Subtract logical characters	SLC	
Insert and test characters	ITC	
Edit	ED	
Move logical immediate	MVI	One-Address Format
Compare logical immediate	CLI	
Set bits on masked	SBN	
Set bits off masked	SBF	
Test bits on masked	TBN	
Test bits off masked	TBF	
Store register	ST	
Load register	L	
Add to register	A	
Branch on condition	BC	
Test I/O and branch	TIO	
Sense I/O	SNS	
Load I/O	LIO	
Load address	LA	
Advance program level	APL	Command Format
Halt program level	HPL	
Start I/O	SIO	
Jump on condition	JC	

MACHINE INSTRUCTION DESCRIPTION

ZAZ

Second operand placed byte by byte into first operand.
High-order zeros inserted.
Zone bits except rightmost set to 1's.
Operands addressed by rightmost byte.
Q code designates length of both operands.[1]

AZ

Second operand added algebraically to first operand.
Operands addressed by rightmost bytes.
Zone bits except rightmost set to 1's.
Q code specifies length of both operands.[1]
Second operand remains unchanged unless overlapped.
No check is made for valid digits in operands.

SZ

Operand 2 subtracted algebraically from op 1 byte by byte; result in op 1.
Operands addressed by rightmost byte.
Q code specifies length of operands.[1]
No check for valid decimal digits.

ALC

Positive binary number in op 2 is added byte by byte to positive binary number in operand 1; result stored in op 1.
Q code specifies length of operands.
Operand 2 not changed unless it overlaps operand 1.

SLC

Positive binary number in operand 2 subtracted from positive binary number in operand 1; result stored in operand 1.
Result can never be negative.
Q code specifies length of operands.
Both operands must be same length.
Second operand not changed unless overlap.

---

[1] For more detailed information, refer to the *IBM System/3 Models 8, 10, 12 and 15 Components Reference Manual,* GA21-9236.

A

Positive binary number contained in operand address added to register selected by Q code.

Result replaces contents of register.

Operand addressed by rightmost byte.

If bit 0 of Q code is zero, remaining bits cause modification of registers as follows:

Bits:
- 1 = PL2 IAR
- 2 = PL1 IAR
- 3 = IAR in use when A instruction is executed
- 4 = ARR
- 5 = Program status register
- 6 = IX2
- 7 = IX1

If high-order byte is 1, alter 5 interrupt level IAR.

Bit:
- None = IL0
- 1 = IL1
- 2 = IL2
- 3 = IL3
- 4 = IL4

Note: Must not be used to add to more than one register at a time.

MVX

Numeric portion or zone portion of single byte second operand is placed in corresponding portion of first operand.

Q code specifies portion of each operand:
- 00 = Z to Z
- 01 = N to Z
- 02 = Z to N
- 03 = N to N

Condition register not affected.

MVC

Second operand placed byte by byte in first operand location.

Operands addressed by rightmost byte.

Q code specifies length of operation.

This instruction does not affect condition register.

ED

Decimal numeric characters in operand replaces bytes containing 20 in first operand.

Operands addressed by rightmost byte.

Q code specifies length of op 1.

ITC

Single character at second operand address replaces all the characters in the first operand to the first significant digit.

First operand addressed by leftmost byte that can contain a character that should be replaced.

Q code contains length in bytes of operand 1.

MVI

Data contained in Q code moved to byte located at operand address.

SBN

Byte of data contained in mask is used to set to one the corresponding bits in byte located at operand address.

SBF

Byte of data set into Q code is used to set to zero corresponding bits of the byte located at operand address.

ST

Contents of register specified by Q code are placed in field addressed by operand address.

Note: Not to be used for setting more than one register at a time.

L

Contents of 2-byte field addressed by operand are placed in LSR specified by Q code.

Note: Not to be used for setting more than one register at a time.

LA

If instruction is D2 or E2, a 1-byte operand is added to contents of index register specified by operand code and loaded into LSR specified by Q code.
If instruction is C2, operand is loaded into register specified by Q code.

CLC

First operand compared to second operand. Condition register is set.
Operands addressed by rightmost byte.
Q code specifies length of operands.

CLI

Binary immediate operand contained in Q code is compared with binary operand in storage location of operand address; result sets condition register; neither operand is changed.

TBN

Bits of storage located at operand address are tested for bit = 1 as defined by mask contained in Q code; storage operand is not changed.

TBF

Bits of storage located at the operand address are tested for bit = 0 as defined by mask contained in Q code.

BC

Condition register is tested under control of Q code; if the condition register satisfied the condition tested for, the next instruction is taken from the branch address.

JC

Condition register is tested under control of Q code. If condition register satisfied condition tested for, the control code is added to the IAR and the sum becomes the address of the next instruction.

HPL

This instruction prevents the execution of the next sequential instruction and displays a halt identifier that is controlled by the bytes in the halt identifier bytes.

I/O

SIO

No operation is performed if unit check condition that prevents the execution of the SIO exists in addressed device.

The instruction is executed if it specifies the reset of an interrupt condition regardless of unit check condition.

It resets any unit check condition that does not prevent execution of that SIO.

If dual program feature is installed, an SIO instruction addressed to a device that is busy results in program level advance.

On systems without dual programming, this condition results in a test for busy loop.

SNS

Contents of data source specified by N portion of Q code are placed in 2-byte field specified by operand address.

LIO

The contents of the 2 bytes addressed by the operand are transferred to the destination specified by the N code of the Q code.

A Q code of 00 results in a no op.

With dual programming installed, an SIO to a busy device results in a program level advance.

TIO

Condition specified by Q code is tested in the addressed device if condition is present. Branch to address is transferred to IAR. If condition is not present, branch to address is transferred to ARR (no branch).

APL

With dual program feature, the program level advances if condition specified by N code of Q code is present.

If condition is not present the instruction is made not operational (no op).

If dual program feature is not installed, instruction acts loop if busy.

INSTRUCTION FORMAT REFERENCE

<table>
<tr><th>Op Code</th><th>Mnemonic</th><th>Type</th></tr>
<tr><td>04
06
07
08
0A
0B
0C
0D
0E
0F</td><td>ZAZ
AZ
SZ
MVX
ED
ITC
MVC
CLC
ALC
SLC</td><td>2 Address
Direct<table><tr><td>Op</td><td>Q</td><td>Operand 1</td><td>Operand 2</td></tr></table>6 Bytes</td></tr>
<tr><td>14
16
17
18
1A
1B
1C
1D
1E
1F</td><td>ZAZ
AZ
SZ
MVX
ED
ITC
MVC
CLC
ALC
SLC</td><td>2 Address
Direct Indexed<table><tr><td>Op</td><td>Q</td><td>Operand 1</td><td>D2</td></tr></table>5 Bytes
XR1</td></tr>
<tr><td>24
26
27
28
2A
2B
2C
2D
2E
2F</td><td>ZAZ
AZ
SZ
MVX
ED
ITC
MVC
CLC
ALC
SLC</td><td>2 Address
Direct Indexed<table><tr><td>Op</td><td>Q</td><td>Operand 1</td><td>D2</td></tr></table>5 Bytes
XR2</td></tr>
<tr><td>30
31
34
35
36
38
39
3A
3B
3C
3D
3E
3F</td><td>SNS
LIO
ST
L
A
TBN
TBF
SBN
SBF
MVI
CLI
SCP
LCP</td><td>1 Address
Direct<table><tr><td>Op</td><td>Q</td><td>Operand 1</td></tr></table>4 Bytes</td></tr>
</table>

Op Code	Mnemonic	Type
44	ZAZ	2 Address Op | Q | D1 | Operand 2 5 Bytes XR1
46	AZ	
47	SZ	
48	MVX	
4A	ED	
4B	ITC	
4C	MVC	
4D	CLC	
4E	ALC	
4F	SLC	
54	ZAZ	2 Address Indexed Op | Q | D1 | D2 4 Bytes XR1 XR1
56	AZ	
57	SZ	
58	MVX	
5A	ED	
5B	ITC	
5C	MVC	
5D	CLC	
5E	ALC	
5F	SLC	
64	ZAZ	2 Address Op | Q | D1 | D2 4 Bytes XR1 XR2
66	AZ	
67	SZ	
68	MVX	
6A	ED	
6B	ITC	
6C	MVC	
6D	CLC	
6E	ALC	
6F	SLC	
70	SNS	1 Address Op | Q | D1 3 Bytes XR1
71	LIO	
74	ST	
75	L	
76	A	
78	TBN	
79	TBF	
7A	SBN	
7B	SBF	
7C	MVI	
7D	CLI	
7E	SCP	
7F	LCP	

Op Code	Mnemonic	Type
84	ZAZ	
86	AZ	2 Address
87	SZ	
88	MVX	Indexed Direct
8A	ED	Op | Q | D1 | Operand 2
8B	ITC	
8C	MVC	5 Bytes
8D	CLC	
8E	ALC	XR2
8F	SLC	
94	ZAZ	
96	AZ	2 Address
97	SZ	
98	MVX	Indexed
9A	ED	Op | Q | D1 | D2
9B	ITC	
9C	MVC	4 Bytes
9D	CLC	
9E	ALC	XR2 XR1
9F	SLC	
A4	ZAZ	
A6	AZ	2 Address
A7	SZ	
A8	MVX	Indexed
AA	ED	Op | Q | D1 | D2
AB	ITC	
AC	MVC	4 Bytes
AD	CLC	
AE	ALC	XR2 XR2
AF	SLC	
B0	SNS	
B1	LIO	1 Address
B4	ST	
B5	L	Indexed
B6	A	Op | Q | D1
B8	TBN	
B9	TBF	3 Bytes
BA	SBN	
BB	SBF	
BC	MVI	XR2
BD	CLI	
BE	SCP	
BF	LCP	

Op Code	Mnemonic	Type	
C0 C1 C2	BC TIO LA	Direct Op Q Address ← 4 Bytes →	
D0 D1 D2	BC TIO LA	Op Q D2 ← 3 Bytes →	+XR1
E0 E1 E2	BC TIO LA	Op Q D2 ← 3 Bytes →	+XR2
F0 F1 F2 F3 F4	HPL APL JC SIO CCP	Op Q R ← 3 Bytes →	

Load and Store Register Q Codes

Op	Q	Operand 1

0123 4567

01 = 0000 0001 = XR1
02 = 0000 0010 = XR2
04 = 0000 0100 = PSR
08 = 0000 1000 = ARR
10 = 0001 0000 = IAR
20 = 0010 0000 = P1-IAR
40 = 0100 0000 = P2-IAR
80 = 1000 0000 = IAR-0
C0 = 1100 0000 = IAR-1
A0 = 1010 0000 = IAR-2
90 = 1001 0000 = IAR-3
88 = 1000 1000 = IAR-4

CONDITION CODE SETTINGS

Binary Value	8	4	2	1	8	4	2	1
Bits	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Meaning			**Binary Overflow**	**Test False**	**Decimal Overflow**	**High**	**Low**	**Equal**
Decimal								
Add decimal			–	–	overflow	> zero	< zero	zero
Subtract decimal			–	–	overflow	> zero	< zero	zero
Zero and add			–	–		> zero	< zero	zero
Logical								
Add logical			overflow	–	–	Carry	No Carry	zero
Subtract logical			–	–	–	1 > 2	1 < 2	zero
Compare			–	–	–	1 > 2	1 < 2	EQ
CLI						1 > I	1 < I	1 = I
Edit (second operand)			–	–	–	> zero	< zero	zero
Test bits on			–	Note 1	–	–	–	–
Test bits off			–	Note 2	–	–	–	–
Branch on condition	X		–	Note 3	–	–	–	–

When 1, branch if any of the tested bits are on.
When 0, branch when all the tested bits are off.

Notes:
1. Selected bits are not all 1.
2. Selected bits are not all 0.
3. Turn off if tested.

CPU INSTRUCTIONS (Model 12 With More Than 64K Bytes of Main Storage)

LCP/SCP Instructions

CCP, LCP, and SCP instructions are not supported by System/3 Basic Assembler.

Op Code (0–7)	Q Code (8–15)	Operand 1 Address (16–23)	(24–31)
3F-LCP	Register	2-byte direct address	
7F-LCP	to be	1-byte indexed by XR1	
BF-LCP	loaded	1-byte indexed by XR2	
3E-SCP	or stored	2-byte direct address	
7E-SCP	(see below)	1-byte indexed by XR1	
BE-SCP		1-byte indexed by XR2	
		EB2 Operand address –1	EB1 Operand address
	00	Att register 01	Att register 00
	01	Att register 03	Att register 02
	02	Att register 05	Att register 04
LCP	03	Att register 07	Att register 06
or	04	Att register 09	Att register 08
SCP	05	Att register 0B	Att register 0A
	06	Att register 0D	Att register 0C
	07	Att register 0F	Att register 0E
	08	Att register 11	Att register 10
	09	Att register 13	Att register 12
	0A	Att register 15	Att register 14
	0B	Att register 17	Att register 16
	0C	Att register 19	Att register 18
	0D	Att register 1B	Att register 1A
	0E	Att register 1D	Att register 1C
	0F	Att register 1F	Att register 1E
	10		PMR program level 1
	11		PMR program level 2
	18		PMR interrupt level 0
	19	*Note:* SCP (EB2	PMR interrupt level 1
	1A	cycle)	PMR interrupt level 2
	1B	Storage location	PMR interrupt level 3
	1C	addressed is set to	PMR interrupt level 4
		00	
		LCP (EB2 cycle)	
		no data is transferred	
	40		PMR current level

Command CPU (CCP)

Op Code	Q Code	Command Code	
F4	30	Immediate bits 0123 4567	Load current PMR
		Bit 0	Unused
		1	EB cycle address translate
		2	EA cycle address translate
		3	I cycle address translate
		4	Unused
		5	I/O cycle address translate
		6	Unused
		7	MASK interrupt state

LOAD I/O

The following instruction formats are in Q code sequence:

Op Code	Q Code			Operand 1
	DA	M	N	
0 7	8 11	12	13 15	16
31				Direct addressing, operand = 2-byte address
71				XR1 addressing, operand = 1-byte displacement
B1				XR2 addressing, operand = 1-byte displacement
Model	0001			Model 6 console keyboard printer
6		0		M bit unused, can be either 0 or 1
Key-			0xx	High-order bit unused, can be 0 or 1
board			000	Turn off command indicators
Printer			001	Turn on command indicators
			01x	Set field indicators (low-order bit unused)
5471	0001			5471 device address
Printer		1		M bit must be 1 to select printer
Key-			000	Load character to be printed
board				All other N codes are invalid
5475	0001			5475 device address
		0		M bit must be 0 to select keyboard
			000	Set sticklight indicators
				All other N codes are invalid
MLTA	0010			Device address MLTA (2)
		0		Individual line instruction
			000	Load LRC and diagnostic buffers
			001	Load current length count and time-out buffers
			010	Load transition address buffer
			011	Load line status buffer
			100	Load flag and receive length count buffer
			101	Load control and branch buffers
			110	Load current address buffer
			111	Load cycle steal and line interface buffers
		1		General adapter instruction
			000	Load control storage
			001	Load op decode register
			010	Load select[1]
			011	Load storage address buffer
			1xx	Invalid N field
				[1] Data byte at operand address
				Data at operand −1 address (EB2) / Data at operand 1 address (EB1)
				Bit position 0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7
				A logical 1 in the appropriate bit position selects the indicated line
				Line number Unused 8 7 6 5 4 3 2 1
SIOC	0011			Device address for serial I/O channel
		0		M bit must be zero
			001	I/O function register
			010	Length count register
			100	Data address register
			101	Data transfer register
				All other N codes are invalid

[1] Invalid if not in diagnostic mode.

Op Code 0 7	Q Code DA 8 11	M 12	N 13 15	Operand 1 16
3881	0011			Device address for serial I O channel
Optical		0		M bit must be zero
Mark			001	I O function register
Reader			010	Length count register
			100	Data address register
			101	Data transfer register
1255	0011			Device address for serial I O channel
1419		0		M bit must be zero
Mag-			001	I O function register
netic			010	Length count register
Char-			100	Data address register
acter			101	Data transfer register
Reader				
1270	0011			1270 device address
Optical		0		Must be 0
Reader			001	I O function register
Sorter			010	Length count register
			100	Data address register
			101	Data transfer register
3741	0100	0	001	Load function register
	0100	0	010	Load length count register
	0100	0	100	Load data address register
1442	0101			1442 device address
Card		0		Must be 0
I O			000	Length count register
			100	Data address register
				All other N codes are invalid
3410	0110	0		Device 0 address
3411		1		Device 1 address
Tape	0111	0		Device 2 address
		1		Device 3 address
			000	Byte count register (in 3411)
			100	MTAR
BSCA	1000	0		BSCA Line 1
		1		BSCA Line 2
			001	Stop address register
			010	Transaction address register
			100	Current address register
			1100	Diagnostic use only
				All other N codes are invalid
2265	1001	0	000	Set keyboard/display screen address register
Dis-				M and N bits must be zero
play				
Station				
5444/	1010			Drive 1 (top drawer)
5447	1011			Drive 2 (bottom drawer)
		0		M bit unused, should be zero
			011	Diagnostic use
			100	Read/write address register
			110	Control address register
5448	1100			Drive 1
	1101			Drive 2
		0		M bit unused. Should be zero
			011	Diagnostic use
			100	Read write address register
			110	Control address register

LOAD I/O (Continued)

Op Code 0 7	Q Code DA 8 11	M 12	N 13 15	Operand 1 16	
5445 Disk	1100			5445 device address	
		0		M bit unused	
			100	Data address register	
			101	Diagnostic use	
			110	Control address register	
			111	Diagnostic use	
3340	1100	0		3340 Drive 1 Device Address	
	1100	1		3340 Drive 2 Device Address	
			100	DDDR	
			101	Diagnostic LIO 1	
			110	DDCR	
			111	Diagnostic LIO 2	
				Note: The M-bit is a *don't care* bit when the DDCR or DDDR is being loaded.	
1403	1110			1403 Device Address	
				Byte 2 (EB2) Data from operand address –1	*Byte 1 (EB1)* Data from operand address
		0	000	Forms length	Unused
		0	100	LPIAR high	LPIAR low
		0	110	LPDAR high	LPDAR low
		1	000	RAR[1]	Unused[1]
		1	010	IAR[1]	Unused[1]
		1	100	Buffer[1]	DAR[1]
		1	110	SCR[1]	Unused[1]
5203 Printer	1110			Printer device address	
		0		M bit unused, should be zero	
			000	Load forms length	
			100	Line printer image address register	
			110	Data address register	
				All other N codes are invalid	
2222 Printer & 5213	1110			Printer device address	
		0		Specify printer device	
		1		Specify ledger card device	
			000	Locate line address register (ledger card only)	
			010	Load bit significant register in device	
			100	Print data address register	
			110	Print command address register	
0129 Card I/O	1111			129 device address	
		0		M bit always zero	
			000	N code always zero, specifies load address register	
5424 MFCU	1111			MFCU device address	
		0		Normal mode	
		1		Diagnostic mode	
			100	Print address register	
			101	Read address register	
			110	Punch address register	
5496 Card I/O	1111			5496 device address	
		0		M bit always zero	
			000	N code always zero, specifies load address register	

[1] Invalid if not in diagnostic mode.

LOAD I/O (Continued)

Op Code 0 7	Q Code DA 8 11	Q Code M 12	Q Code N 13 15	Operand 1 16			
5424	1111			5424 Device Address			
				Byte 2 - EB2 Data from operand address 1			Byte 1 - EB1 Data from operand address
		0		Normal mode			
		1		Diagnostic mode			
			100	MFCU print address register MPTAR			
			101	MFCU read address register MRDAR			
			110	MFCU punch address register			
			111	LIO interrupt control			
				EB1 not used	EB2 (data used to control interrupts) 0123	4567	
						1	Enable interrupt
						0	Disable interrupt
					1		Reset op-end interrupt
					1		Reset print buffer 1 interrupt
					1		Reset print buffer 2 interrupt

SENSE (SNS) INSTRUCTION FORMATS

In Q-code sequence

Op Code 0 7	Q Code DA 8 11	 M 12	 N 13 15	Operand 1 16		
30 70 B0				Operand 1 = 2 bytes direct addressing. Byte 1 = operand 1 address Operand 1 = 1 byte indexed by XR1. Byte 2 = operand 1 address Operand 1 = 1 byte indexed by XR2		
DPF	0000				Device address CPU (0)	
		0			Must be zero	
					Low Storage Address	**High Storage Address**
			000		*Byte 2 (EB2)* 0 1 Address 2 switch 1 3 4 5 Address 6 switch 2 7	*Byte 1 (EB1)* 0 1 Address 2 switch 3 3 4 5 Address 6 switch 4 7
				xxxx xxxx	Operand address (sense bytes destinations)	
5471 Printer/ Key-board	0001				Device address 5471 (1)	
		0 1			Selects keyboard Selects printer	
					Low Storage Address	**High Storage Address**
			001		*Byte 2 (EB2)* 0 - Not used 1 - Not used 2 - B D E 3 - A B B 4 - 8 I C → → 5 - 4 X D 6 - 2 L I 7 - 1 A C T O R	*Byte 1 (EB1)* 0 - Register key interrupt pending 1 - End or cancel interrupt pending 2 - Cancel key 3 - End key 4 - Return or data key interrupt pending 5 - Return key 6 - Keyboard translator check 7 - Keyboard data check

SENSE (SNS) INSTRUCTION FORMATS (Continued)

Op Code 0 7	Q Code DA 8 11	Q Code M 12	Q Code N 13 15	Operand 1 16				
5471 Printer/ Keyboard (continued)			011			0 - Keyboard mode switch		0 - Request key enabled
						1 - P		1 - Data key enabled
						2 - B		2 - Strobe switch
						3 - A	Keyboard code	3 - Strobe switch sampled
						4 - 8		4 - Request end cancel key
						5 - 4	Diagnostic mode	5 - Request end cancel key sampled
						6 - 2		6 - Keyboard shifting
						7 - 1		7 - Reserved
						Printer (M-bit 1)		
			001			0 - Enable printer		0 - Printer interrupt pending
						1 - 5.24 ms		1 - Reserved
						2 - 2.68 seconds		2 - Unprintable character
						3 - Cycle FL		3 - Printer busy
						4 - Reserved		4 - End of line
						5 - Feedback too late		5 - End of form
						6 - Extra cycle		6 - Print translator check
						7 - Cycle too long		7 - Printer malfunction
			011			0 - Shift mode switch		0 - Lower shift required
						1 - No print		1 - Upper shift required
						2 - T2		2 - Reserved
						3 - T1		3 - Feedback switch
						4 - R5		4 - Feedback switch sampled
						5 - R2A	(Diagnostic mode)	5 - Long function switch
						6 - R2		6 - Long function switch sampled
						7 - R1		7 - CE SNS bit (active for MST down level at A-B2N2U06)
				xxxx	xxxx	Operand address (sense bytes destinations)		

SENSE (SNS) INSTRUCTION FORMATS (Continued)

Op Code 0–7	Q Code DA 8–11	Q Code M 12	Q Code N 13–15	Operand 1 16		Description	
MLTA	0010					Device address MLTA (2)	
		0				Individual line instruction	
			000			Sense LRC and diagnostic buffers	
			001			Sense current length count and time-out buffers	
			010			Sense transaction address buffers	
			011			Sense line status	
			100			Sense flag and receive length count buffers	
			101			Sense control and branch buffers	
			110			Sense current address buffers	
			111			Sense cycle steal and line interface buffers	
		1				General adapter instruction	
			000			Sense control storage	
			001			Sense op end interrupt source	
			010			Sense PCI interrupt source	
			011			Sense storage address buffer	
			1xx			Invalid N code	
SIOC	0011					Device address SIOC (3)	
		0				Must be zero	
						Low Storage Address	**High Storage Address**
						Byte 2 (EB2)	Byte 1 (EB1)
			000			Invalid	
			001			0 - Write mode set service response	Diagnostic mode
						1 - Reset service response after 6 ms	Spare
						2 - Transfer line 2 EOT	Latch transfer line 4
						3 - Transfer line 1 EOT	Latch transfer line 3
						4 - Odd parity	Latch transfer line 1
						5 - Decrement DAR	Trans line 3 reset disc latch
						6 - Latch I/O 1 select	Reset disc latch after 6 ms
						7 - Slave (transfer line 6 and 7 latch)	Trans line 5 reset disc latch

SENSE (SNS) INSTRUCTION FORMATS (Continued)

Op Code 0 7	Q Code DA 8 11	 M 12	 N 13 15	Operand 1 16			
SIOC (continued)			010			0 - Spare 1 - End request 2 - Interrupt pending 3 - I/O attention 4 - Data transfer register parity check 5 - No-op latch 6 - LCR overflow 7 - I/O ready	0-7 Length count register
			011			0 - I/O ID bit 8 1 - I/O ID bit 4 2 - I/O ID bit 2 3 - I/O ID bit 1 4 - I/O device attached 5 - I/O transfer line 11 6 - I/O transfer line 10 7 - I/O transfer line 9	I/O transfer line 8 I/O transfer line 7 I/O transfer line 6 I/O transfer line 5 I/O transfer line 4 I/O transfer line 3 I/O transfer line 2 I/O transfer line 1
			100			0-7 DAR high	0-7 DAR low
			101			0 - SIOC request latch 1 - Service request 2 - Service response 3 - Interrupt enable 4 - I/O disconnect 5 - Write cell 6 - Read cell 7 - I/O selected	0-7 Data transfer register
			110			Invalid	
			111			Invalid	
				xxxx	xxxx	Operand address (sense bytes destinations)	

SENSE (SNS) INSTRUCTION FORMATS (Continued)

Op Code (0–7)	Q Code DA (8–11)	Q Code M (12)	Q Code N (13–15)	Operand 1 (16)	
3881 Optical Mark Reader	0011				3881 (SIOC) device address
		0			Unused, always zero
			000		Invalid
			001		I/O function register
			010		Length count register and status byte Status byte breakdown bit/meaning 0 - Unused 1 - End request 2 - Interrupt pending 3 - Unused 4 - Data transfer register parity check 5 - No op 6 - Length count register overflow 7 - I/O ready
			011		I/O transfer lines and I/O ID I/O transfer line breakdown bit/meaning *High-order byte:* 0 = 0 1 = 0 2 = 1 3 = 0 } 0010 = 3881 ID 4 - Device attached 5 - Unused 6 - Unused 7 - Unused *Low-order byte:* 0 - Unused 1 - 3881 ready check 2 - Equipment 3 - Output record ready 4 - Diag not ready 5 - Unused 6 - Unused 7 - End of file
			100		Data address register
			101		Data transfer register and diagnostic byte
			110		Invalid
			111		Invalid
1255/1419 Magnetic Character Reader	0011				1255 (SIOC) device address
		0			Unused, always zero
			000		Invalid N code
			001		I/O function
			010		Length count reg and status byte *Status byte:* **Bit Meaning** 0 Spare 1 End request 2 Interrupt pending 3 I/O attention 4 Data transfer register parity check 5 No op 6 Length count register overflow 7 I/O ready

Op Code	Q Code			Operand 1	
	DA	M	N		
0 7	8 11	12	13 15	16	
1255/ 1419 Mag- netic Char- acter Reader (con- tinued)			011		I/O transfer & I/O ID The I/O transfer lines *High-order byte:* **Bit** **Meaning** Models 1, 2, 3: / Models 21, 22 23: 0 Will be 0[1] / Will be 0[1] 1 Will be 0[1] / Will be 0[1] 2 Will be 1[1] / Will be 1[1] 3 Will be 1[1] / Will be 1[1] 4 1255 attached / Not used 5 Not used / Field 7 valid 6 Not used / Field 6 valid 7 Sorter is stopped / Sorter is stopped *Low-order byte:* **Bit** **Meaning** Models 1, 2, 3: / Models 21, 22, 23: 0 Auto reject / 0 Auto reject 1 Serial number field valid / Field 5 valid 2 Transit rout-ing field valid / Field 4 valid 3 Account number field valid / Field 3 valid 4 Process control field valid / Field 2 valid 5 Amount field valid / Field 1 valid 6 Document under read head / Document under read head 7 Document to be read / Document to be read
			100		Data address register
			101		Data transfer register and diagnostic byte
			110		Invalid
			111		Invalid
3741 Sense	0100	0	001		I/O function register
			010		Length count register and status byte
			011		I/O transfer lines
			100		Data address register

[1] If the attached device is an IBM 1255.

Op Code 0 7	Q Code DA 8 11	M 12	N 13 15	Operand 1 16			
1442	0101					Device address 1442 (5)	
Sense		0				Must be zero	
			001			0 - Not assigned	0 - All calls on
						1 - Not assigned	1 - Read cells 7, 8, 9
						2 - Not assigned	2 - Read cells 4, 5, 6
						3 - Punch incremental drive CB A	3 - Read cells 1, 2, 3
						4 - Punch CB 2	4 - Read cells 12, 11, 0
						5 - Punch CB 1	5 - Read emitter
						6 - Punch incremental drive CB 8	6 - Feed CB 2, 3, 4
						7 - CE diagnostic bit 1	7 - Feed CB 1
			010			0 - Punch echo 9	0 - Punch echo 1
						1 - Punch echo 8	1 - Punch echo 0
						2 - Punch echo 7	2 - Punch echo 11
						3 - Punch echo 6	3 - Punch echo 12
						4 - Punch echo 5	4 - Punch echo valid
						5 - Punch echo 4	5 - Not assigned
						6 - Punch echo 3	6 - Punch cell dark
						7 - Punch echo 2	7 - CE diagnostic bit 2
			011			**Low Storage Address** *Byte 2 (EB2)*	**High Storage Address** *Byte 1 (EB1)*
						0 - Not assigned	0 - Read compare
						1 - Not assigned	1 - Last card indicator
						2 - Not assigned	2 - Punch check
						3 - Read station jam	3 - Data overrun
						4 - Hopper misfeed	4 - I/O attention
						5 - Extra feed cycle	5 - No-op latch
						6 - Punch station jam	6 - Feed check
						7 - Transport jam	7 - Invalid card code
			100			Store 1442 DAR	
				xxxx	xxxx	Operand address (sense bytes destinations)	

SENSE (SNS) INSTRUCTION FORMATS (Continued)

Op Code 0–7	Q Code DA 8–11	Q Code M 12	Q Code N 13–15	Operand 1 16		
3410	0110	0			Tape unit 0	
	0110	1			Tape unit 1	
	0111	0			Tape unit 2	
	0111	1			Tape unit 3	
					Byte 2 - EB2 Data to operand address - 1	Byte 1 - EB1 Data to operand address
					Byte 0	*Byte 1*
			000		0 - Noise	0 - Data converter check
					1 - Wrong length block	1 - Command reject
					2 - Unit exception	2 - Backward ALT P
					3 - Data check	3 - Start velocity check
					4 - Diag track check	4 - Illegal command
					5 - NOP	5 - TV status changed
					6 - Equipment check	6 - Word count zero
					7 - Sense valid	7 - Not capable
			001		*Byte 2*	*Byte 3*
					0 - Backward status	0 - Tapemark check
					1 - Not file protect	1 - End velocity check
					2 - Tape indicate	2 - TV position check
					3 - Beginning of tape	3 - Reject tape unit
					4 - Write status	4 - Write feed through check
					5 - Start key	5 - No readback data
					6 - Tape unit check	6 - Tach check
					7 - Not busy	7 - Overrun

SENSE (SNS) INSTRUCTION FORMATS (Continued)

Op Code 0 7	Q Code DA 8 11	 M 12	 N 13 15	Operand 1 16		
3410 (continued)			010		*Byte 4* 0 - Seven-track 1 - Short gap mode 2 - Dual density feature 3 - Alternate density 4-7 - Model 01 Model 1 10 Model 2 11 Model 3	*Byte 5* 0 - Bus out check 1 - Multitrack error 2 - Data timing error 3 - End data/CRC 4 - Envelope/phase error 5 - False end marker 6 - PE ID burst check 7 - VRC error
			011		*Byte 6* 0 - Lamp check 1 - Left column check 2 - Right column check 3 - Ready reset 4 - Data security erase 5 - Spare 6 - Spare 7 - Spare	*Byte 7* 0 1 2 - Track 3 - In 4 - Error 5 6 7
	0110	0			Tape unit 0	
	0110	1			Tape unit 1	
	0111	0			Tape unit 2	
	0111	1			Tape unit 3	
					Byte 2 - EB2 Data to operand address - 1	Byte 1 - EB1 Data to operand address
			100		MTDAR-HI	MTDAR-LO
			101		Attach Byte 0 0 - Spare 1 - ABI parity error 2 - ABO parity error 3 - CU disabled 4 - Two tag error 5 - Subsystem busy 6 - Out of sequence 7 - Sense valid	Attach Byte 1 0 - Address out response 1 - Service out response 2 - Command out response 3 - Address in error 4 - Service in error 5 - Command in error 6 - Status in error 7 - Spare

Op Code 0–7	Q Code DA 8–11	Q Code M 12	Q Code N 13–15	Operand 1 16		
3410 (continued)			110			Hardware Sense *Use this chart if bit 7 is off* 0 - Spare 0 1 - Instruction CTR error 1 2 - XFR error 2 3 - ALU error 3 Not used 4 - Spare 4 5 - ROS parity error 5 6 - Spare 6 7 - This bit off 7 *Use this chart if bit 7 is on* 0 - ALU FRU error 0 1 - Instruction CTR error 1 2 - ABO parity error 2 3 - Control tag error 3 Not used 4 - Instruction tag error 4 5 - Spare 5 6 - Spare 6 7 - This bit on 7
			111			Bit 0 - Dev 0 op end Not used 1 - Dev 1 op end 2 - Dev 2 op end 3 - Dev 3 op end 4 - Subsys op end 5 - Forced to 0 6 - Forced to 0 7 - Forced to 0

SENSE (SNS) INSTRUCTION FORMATS (Continued)

Op Code 0 7	Q Code DA 8 11	 M 12	 N 13 15	Operand 1 16			
BSCA Sense	1000					Device address BSCA (8)	
		0				BSCA 1	
		1				BSCA 2	
						Low Storage Address	**High Storage Address**
						Byte 2 (EB2)	*Byte 1 (EB1)*
			000			0 - Reserved	0 - Reserved
						1 - Bit time counter 4	1 - Reserved
						2 - Bit time counter 2	2 - Reserved
						3 - Bit time counter 1	3 - Reserved
						4 - Reserved	4 - Block cycle steal request (ITB, BCC or VRC check)
						5 - Transmit trigger	5 - LSR/shift register parity check
						6 - Receive trigger	6 - I/O cycle steal overrun
						7 - CE SNS bit	7 - DBI parity check
			001			Stop address register	
			010			Transition address register	
			011			0 - Time-out	0 - Reserved
						1 - CRC/LRC/VRC	1 - Reserved
						2 - Adapter check on transmit	2 - Reserved
						3 - Adapter check on receive	3 - Reserved
						4 - Invalid ASCII character	4 - Reserved
						5 - Abortive disconnect	5 - Reserved
						6 - Disconnect time-out	6 - Data set ready
						7 - Reserved	7 - Data line occupied
			100			Current address register	
			101			Invalid	
			110			0	0
						1	1
						2 CRC high	2 CRC low
						3 (zeros for	3 (LRC for
						4 ASCII)	4 ASCII)
						5	5
						6	6
						7	7
			111			Invalid	
				xxxx	xxxx	Operand address (sense byte destination)	

SENSE (SNS) INSTRUCTION FORMATS (Continued)

Op Code 0 7	Q Code DA 8 11	Q Code M 12	Q Code N 13 15	Operand 1 16		
3340	1100	0				3340 disk drive 1 device address
Sense	1100	1				3340 disk drive 2 device address
			100			DDDR local storage register
			101			Adapter status bytes 0 and 1
						Byte 0 0 - Unit check, drive 1 1 - Unit check, drive 2 4 - Seek complete, drive 1[1] 5 - Seek complete, drive 2[1] Byte 1 0 - Diagnostics 1 - Scan equal 2 - Program load selector switch 1 = disk R1 select 3 - Op end[1] 4 - No-op 5 - Data module attention[1] 6 - Unused 7 - Adapter check
			110			DDCR local store register
			111			Diagnostic status

[1] These bits are active only if an SIO enable interrupt has been issued. They should never be on for a Model 12.

SENSE (SNS) INSTRUCTION FORMATS (Continued)

Op Code 0 7	Q Code DA 8 11	M 12	N 13 15	Operand 1 16			
5444/	1010					Device address disk drive 1 (A)	
5447	1011					Device address disk drive 2 (B)	
		0				Upper disk (removable)	
		1				Lower disk (fixed)	
						Low Storage Address *Byte 2 (EB2)*	**High Storage Address** *Byte 1 (EB1)*
			000			Invalid	
			001			Invalid	
			010			0 - No-op	0 - Scan equal hit
						1 - Intervention required	1 - Cylinder zero
						2 - Missing address marker	2 - End of cylinder
						3 - Equipment check	3 - Seek busy
						4 - Data check	4 - 100 cylinder
						5 - No record found	5 - Overrun
						6 - Track condition check	6 - Reserved
						7 - Seek check	7 - Disk drive 2 set
			011			0 - Unsafe	0 - Reserved
						1 - TAP line A	1 - Jumperable CE bit
						2 - TAP line B	2 - Jumperable CE bit
						3 - TAP line C	3 - Not bit ring inhibit
						4 - Index	4 - Standard write trigger
						5 - Head setting	5 - Condition priority request
						6 - Jumperable CE bit	6 - Bit ring 0
						7 - Reserved	7 - Not CC register position 17
			100			DFDR	
			101			Invalid	
			110			DFCR	
			111			Invalid	
				xxxx	xxxx	Operand address (sense bytes destination)	
5445	1100	0				5445 disk drive 1	
Disk		1				5445 disk drive 2	
Sense	1101	0				Reserved	
		1				Reserved	
			000			Status bytes 0, 1	
			001			Status bytes 2,3	
			010			Status bytes 4,5	
			011			Status bytes 6,7	
			100			DDDR local store register	
			101			Status bytes 8, 9	
			110			DDCR local store register	

Op Code	Q Code			Operand 1		
	DA	M	N			
0 7	8 11	12	13 15	16		
5445			111		Invalid	
Disk					*(EB2)*	*(EB1)*
Sense					*Byte 0*	*Byte 1*
(con-					0 - Format error	0 - Disk drive error
tinued)					1 - Intervention required	1 - Unsafe
					2 - Missing address mark	2 - Seek complete 1
					3 - Equipment check	3 - Seek complete 2
					4 - Data check	4 - Data op complete
					5 - No record found	5 - End of cylinder
					6 - No operation	6 - Scan equal
					7 - Data overrun	7 - Disk drive identifier
					(EB2)1	*(EB1)*
					Byte 2	*Byte 3*
					0 - Decode 6	0 - Key time
					1 - Decode parity	1 - Data time
					2 - Spare	2 - Prerequest latch
					3 - Serial read parity	3 - Count oriented
					4 - Disk busy	4 - Write gate OE HA
					5 - Address mark good	5 - Disk drive bus test control tag
					6 - Spare	6 - Index
					7 - CE sense latch	7 - Push, pull mode
					Byte 4	*Byte 5*
					0 - End time, bit time parity	0 - Gap time, field time
					1 - Begin, SAM, write sync, or post times	1 - SERDES
					2 - Op parity	2 - Single buffer select
					3 - Count time, bit time 1	3 - SAM, check time
					4 - Read gate	4 - Erase gate, R0 latch
					5 - Seek stop, diagnostic mode	5 - Tag select parity, VFO gate
					6 - Count found	6 - Write data
					7 - Previous field time	7 - Select parity
					Byte 6	*Byte 7*
					0 - Track difference counter counter bit 128	0 - Intermediate speed
					1 - 64	1 - Slow speed
					2 - 32	2 - Stop
					3 - 16	3 - Detent in
					4 - 8	4 - Forward latch
					5 - 4	5 - Initial seek latch
					6 - 2	6 - Spare
					7 - 1	7 - Spare

Op Code	Q Code			Operand 1			
	DA	M	N				
0 7	8 11	12	13 15	16			
5445 Disk Sense (continued)						*Byte 8*	*Byte 9*
						0 - Cylinder address register bit 128	0 - Read/write unsafe
						1 - 64	1 - Head unsafe
						2 - 32	2 - Write unsafe
						3 - 16	3 - Head address register bit 16
						4 - 8	4 - 8
						5 - 4	5 - 4
						6 - 2	6 - 2
						7 - 1	7 - 1
						Note: N field specifies the data source. An invalid N-field specification causes a processor check.	
5448	1100					Drive 1	
	1101					Drive 2	
		0				Upper disk	
		1				Lower disk	
						Low Storage Address *Byte 2 (EB2)*	**High Storage Address** *Byte 1 (EB1)*
			000			Invalid	
			001			Invalid	
			010			0 - No operation	0 - Scan equal hit
						1 - Intervention required	1 - Cylinder 0
						2 - Missing address marker	2 - End of cylinder
						3 - Equipment check	3 - Seek busy
						4 - Data check	4 - 100 cylinder
						5 - No record found	5 - Overrun
						6 - Track condition check	6 - Reserved
						7 - Seek check	7 - Disk drive 2 set
			011			0 - Unsafe	0 - Reserved
						1 - TAP line A	1 - Jumperable CE bit
						2 - TAP line B	2 - Jumperable CE bit
						3 - TAP line C	3 - Not bit ring inhibit
						4 - Index	4 - Standard write trigger
						5 - Head setting	5 - Condition priority request
						6 - Jumperable CE bit	6 - Bit ring 0
						7 - Reserved	7 - Not CC register position 17
			100			DFDR	
			101			Invalid	
			110			DFCR	
			111			Invalid	
				xxxx	xxxx	Operand address (sense byte destination)	

SENSE (SNS) INSTRUCTION FORMATS (Continued)

Op Code (0–7)	Q Code DA (8–11)	Q Code M (12)	Q Code N (13–15)	Operand 1 (16)		
1403 Printer	1110				Device Address 1403	
					Byte 2	*Byte 1*
			000		Carriage line location	Character count
			010		0 - High-speed drive	0 - Hammer set
					1 - Low-speed drive	1 - PSS1
					2 - Carriage emitter	2 - Cycle steal latch
					3 - Chain emitter	3 - Chain/train ready
					4 - 1403 attached	4 - Print time
					5 - Home pulse	5 - Hammer off echo
					6 - Carriage setting	6 - End of forms
					7 - CE SNS bit	7 - Inhibit carriage
		0	011		0 - Carriage sync check	0 - Channel sync check
					1 - Not used	1 - Not used
					2 - Forms check	2 - Not used
					3 - Print data check	3 - Echo check (SA)
					4 - CE SNS bit latched	4 - Interlock check
					5 - Hammer echo check	5 - 48-character train
					6 - Any hammer on check	6 - Unprintable character
					7 - No op	7 - CE SNS bit
			100		LPIAR	
			110		LPDAR	
		1[1]	000		IAR	DAR
			001		Hammer address Y	
			010		Not used	0 - Hammer reset 1–7 - Not used
			011		Hammer address X	
			100		Buffer bits 0–7	Buffer parity bit
			110		SCR	RAR
5203 Printer Sense	1110				Device address printer (E)	
		0			Must be zero	
					Low Storage Address	**High Storage Address**
			000		Byte 2 (EB2) 0–7 Left carriage line location	Byte 1 (EB1) 0–7 Right carriage line location

[1] Invalid if not in diagnostic mode. All MN codes not listed are invalid.

Op Code 0 7	Q Code DA 8 11	M 12	N 13 15	Operand 1 16		
5203 Printer Sense (continued)			001		0 1 Binary amount 2 to be added or 3 subtracted to 4 the line printer 5 data address 6 register (LPDAR) 7	0 Not printing – 1 contains charac- 2 ter in chain 3 counter equal 4 to character at 5 print position 1 6 Printing – con- 7 tains character in chain counter indicating character at position being addressed
			010		0 - Left or right carriage emitter 1 - Execute print latch 2 - Chain emitter SS 3 - PSS 1 4 - Print line 5 - CE sense bit latched 6 - HMR unit at extreme left (M1) 7 - Home gate	0 - Hammer shift clutch 1 - Print start SS emitter pulse 2 - Left or right carriage clutch 3 - Print cycle 1 4 - Print cycle 2 5 - Print cycle 3 6 - Hammer set latch 7 - Hammer bar right
			011		0 - Carriage sync check 1 - Carriage space check 2 - Forms jam check 3 - Incrementer failure check 4 - CE sense bit latched 5 - Hammer echo check 6 - Any hammer on check 7 - No op	0 - Chain sync check 1 - Incrementer sync check 2 - Hammer unit thermal check 3 - } Not used 4 - } 5 - 48 character chain installed 6 - Unprintable character 7 - CE sense bit
			100		0–7 } LPIAR - Hi	0–7 } LPIAR - Lo
			101		Invalid	

SENSE (SNS) INSTRUCTION FORMATS (Continued)

Op Code 0 7	Q Code DA 8 11	M 12	N 13 15	Operand 1 16		
5203 Printer Sense (continued)			110		0	0
					1	1
					2	2
					3 LPDAR -	3 LPDAR -
					4 Hi	4 Lo
					5	5
					6	6
					7	7
			111		Invalid	
				xxxx xxxx	Operand address (sense bytes destination)	
5213	1110		•		Device address serial printer	
2222		0			Select printer (must be 0)	
Printer					**High Storage Address**	**Low Storage Address**
			010		*Byte 1*	*Byte 2*
					0 - Horizontal cycle check	0 - Count end latch
					1 - Data check	1 - Print left command
					2 - Margin check	2 - Matrix counter trigger 1
					3 - Sync check	3 - Matrix counter trigger 2
					4 - ROS check	4 - Matrix counter trigger 4
					5 - Vertical cycle check	5 - Cover interlock switch
					6 - Primary carriage EOF	6 - SS 2
					7 - Invalid command	7 - SS 1
			011		*Byte 3*	*Byte 4*
					0 - High-speed latch	0 - SS A
					1 - Matrix output hammer drive 1	1 - SS 3
					2 - Matrix output hammer drive 2	2 - Stepper trigger A
					3 - Matrix output hammer drive 3	3 - Stepper trigger B
					4 - Matrix output hammer drive 4	4 - SS Z
					5 - Matrix output hammer drive 5	5 - SS Y
					6 - Matrix output hammer drive 6	6 - SS X
					7 - Matrix output hammer drive 7	7 - SS W
			000		LLAR-Lo	LLAR-Hi
			100		PDAR-Lo	PDAR-Hi
			110		PCAR -Lo	PCAR-Hi

SENSE (SNS) INSTRUCTION FORMATS (Continued)

Op Code 0 7	Q Code DA 8 11	M 12	N 13 15	Operand 1 16			
5213		1				Select LCD	
2222 Printer (continued)			010			*Byte 1* 0 - Sense amp check 1 - Card skew check 2 - Drive check 3 - Read mark check 4 - Line finder mark check 5 - Invalid command 6 - Card in switch 7 - Card out switch	*Byte 2* 0 - Sense amp 1 1 - Sense amp 2 2 - Sense amp 3 3 - Sense amp 4 4 - Timing pulse 5 - Drive check SS 6 - Activate LCD feed clutch 7 - Hold busy SS
			011			*Byte 3* 0 - Skip line SS 1 1 - Skip line SS 2 2 - Late mark 3 - Special tie off 4 - Card alignment SS 5 - Spare 6 - Spare 7 - Stop SS	*Byte 4* 0 - 5213 printer attachment 1 - Not VFC 2 - Not bidirectional feature 3 - Secondary carriage EOF 4 - Not LMAR switch 2 and not RMAR switch 1 5 - RMAR switch or LMAR switch 1 (slow) 6 - Primary or secondary forms motion contact 7 - Primary forms emitter advance
				xxxx	xxxx	Operand address (sense destination)	
0129	1111					Device address - 129	
Card I/O		0				Unused, always zero	
			x0x			Data address register	
			x1x			Status byte High-order for diagnostic use Low-order byte breakdown Bit/meaning 0 - Offline 1 - Transport jam 2 - Stacker/hopper check 3 - Unused 4 - Incorrect card code 5 - Compare error on read or punch 6 - [illegible] if 129, 1 if 5496 7 - Reserved	

SENSE (SNS) INSTRUCTION FORMATS (Continued)

Op Code 0 7	Q Code: DA 8 11	Q Code: M 12	Q Code: N 13 15	Operand 1 16		
5424 Sense	1111				Device address for MFCU (F)	
		0			Must be zero	
					Low Storage Address	**High Storage Address**
			000		*Byte 2 (EB2)*	*Byte 1 (EB1)*
					0 - Punch CB	0 - Hopper 1 or 2 magnet
					1 - Punch strobe	1 - Hopper call covered
					2 - Punch magnet one	2 - Gear count 1, 3, 5, 7, 9, 11
					3 - Ind 1 byte 2 bit 3 (spare)	3 - Read cell 1 exposed
					4 - Print time	4 - Read cell 18 exposed
					5 - Print fire CB	5 - Allow read
					6 - Print magnet 1 (A1) 9 (A2)	6 - Hopper CB
					7 - Indicator 1 byte 2 bit 7 (spare)	7 - Indicator 2 byte 1 bit 7 (spare)
			001		0 - Corner kick magnet	0 - Punch registration roll 1 or 2
					1 - Print stepper clutch magnet	1 - Prepunch cell covered
					2 - Post-print cell covered	2 - Punch gate magnet
					3 - Print inject CB	3 - Punch eject roll magnet
					4 - Print kick CB	4 - Punch stepper roll magnet
					5 - Print stepped CB	5 - Corner cell covered
					6 - Print allow, punch execute	6 - Punch stepper CB
					7 - Indicator 2-byte 1-bit 7 (spare)	7 - Indicator 2-byte 2-bit 7 (spare)

SENSE (SNS) INSTRUCTION FORMATS (Continued)

Op Code (0–7)	Q Code DA (8–11)	Q Code M (12)	Q Code N (13–15)	Operand 1 (16)			
5424 Sense (continued)			011			0 - Print buffer 1 busy	0 - Read check
						1 - Print buffer 2 busy	1 - Punch check
						2 - Card in wait 1	2 - Punch invalid
						3 - Card in wait 2	3 - Print data check
						4 - Reserved	4 - Print clutch check
						5 - Hopper cycle not complete	5 - Hopper check
						6 - Card in transport counter bit 2	6 - Feed check
						7 - Card in transport counter bit 1	7 - No op
			010			Invalid	
			100			MFCU print address register	Stores register contents at operand address 1 and operand address 1 minus 1
			101			MFCU read address register	
			110			MFCU punch address register	
			111			Invalid	
				xxxx	xxxx	Operand address (sense bytes destination)	
5496 Data Recorder (Model 6 only)	1111					Device address data recorder	
		0				M bit is not used; it should be zero	
						High Storage Address	**Low Storage Address**
			010			*Byte 1*	*Byte 2*
						0 - Offline	0
						1 - Transport jam	1
						2 - Stacker full, hopper error or hopper jam	2
						3 - Reserved	3
						4 - Incorrect card code	4 Contents of DR attachment multifunction register
						5 - Compare error on read op punch I/O cycles or failure to take read cycle steals	5
						6 - Reserved for FE use	6
						7 - Reserved for FE use	7
			000			DRAR-Lo	DRAR-Hi

START I/O

In Q code sequence

Op Code	Q Code			Control Code		
	DA	M	N			
0 7	8 11	12	13 15	16		
F3						Start I/O operation
DPF	0000	0	000			Dual program feature address
				xxxx	xNxx	Enable DPF = 1 Disable DPF = 0
				xxxx	xxNx	Enable LEU0 = 1 Disable LEU0 = 0
				xxxx	xxx1	Reset int LEU 0 request
Mod	0001					Device address keyboard
6		0				M bit is not used; it should be zero
Con-			000			N field is not used; it should be zero
sole				xx10	0000	CE diagnostic (set interrupt request)
Key-				xx01	0000	Reset parity check
board				xx00	1000	Drop bail (lock keyboard)
				xx00	0100	Pick up bail (unlock keyboard)
				xx00	0010	Enable interrupt
				xx00	0000	Disable interrupt
				xx00	0001	Turn off current interrupt request
5471	0001					Device address - printer keyboard - (1)
Printer		0				Select keyboard
Key-			000			Must be zero — All other N codes invalid
board				00xx	0xxx	Zero indicates unused position. Must be zero
				1		Turn on request pending indicator
				0		Turn off request pending indicator
				1		Turn on proceed indicator
				0		Turn off proceed indicator
					1	Enable request key interrupts
					0	Disable request key interrupts
					1	Enable data key interrupts
					0	Disable data key interrupts
					1	Reset request or data key interrupts
		1				Select printer
			000			Must be zero. All other N codes invalid
				1		Start print
				0		Do not print
				1		Start carrier return (and index)
				0		Do not carrier return
				1		Force a printer feedback switch response
				1		Force a printer log function switch response
					0	Not used. Must be zero
					1	Enable printer interrupt
					0	Disable printer interrupt
					1	Degate printer magnets
					1	Reset printer interrupt
5475 Key- board	0001	0	000			Device address keyboard. M and N must be zero
				1		Program numeric shift
				1		Program lower shift
				1		Turn error indicator on
				0		Bit 3 reserved
					1	Restore key
					1	Unlock keyboard
					0	Disable interrupt
					1	Enable interrupt
					1	Turn off interrupt request

Op Code 0–7	Q Code DA 8–11	Q Code M 12	Q Code N 13–15	Control Code 16		
MLTA	0010					Device address MLTA (2)
		0				Individual line instruction
			000			Control
			001			Receive
			010			Transmit and receive
			011			Receive initial
			100			Spare
			101			Reset
			110			Loop test
			111			Auto poll
				1xxx	x	If a 1, bits 1, 2, 3, and 4 of control code are effective
				0xxx	x	If a 0, bits 1, 2, 3, and 4 of control code are disregarded
				1		Enable data adapter
				0		Disable data adapter
				1		Enable test mode
				0		Disable test mode
				1		Select switched line facility
				0		Select nonswitched line facility
					1	Select 600 bps line speed
					0	Select 134.5 bps line speed
					1	Start interval time-out
					0	Cancel interval time-out
					1	Reset PCI interrupt
					0	No action
					1	Reset op end interrupt request
					0	No action
		1				General adapter instruction
			000			Control
			xxx			Invalid N field
				1xxx	x	If a 1, bits 1, 2, 3, and 4 of control code are effective
				0xxx	x	If a 0, bits 1, 2, 3, and 4 of control code are disregarded
				0		Disable MLTA
				1		Enable MLTA
				0		Disable microcontroller
				1		Enable microcontroller
				0		Disable wrap mode
				1		Enable wrap mode
					0	Spare
					1	Spare
					0	Spare
					1	Spare
					0	Disable PCI interrupt capability
					1	Enable PCI interrupt capability
					0	Disable op end interrupt capability
					1	Enable op end interrupt capability

Op Code	Q Code			Control Code			
	DA	M	N				
0 7	8 11	12	13 15	16			
SIOC	0011					Device address SIOC (3)	
		0				Not used. A zero is preferred	
			000	0000	0001	Reset interrupt request	These control codes may also
			000	0000	0010	Enable interrupt ability	be used with N codes 001
			000	0000	0100	Reset interrupt ability	or 010 below
			000	0000	1000	Remove SIOC from busy state	
			000	0001	0000	Set interrupt request	
			001	0000	0000	Read I/O device	
			010	0000	0000	Write I/O device	
			011			I/O control 1	
				1		I/O select 8	
				1		I/O select 7	
				1		I/O select 6	
				1		I/O select 5	
					1	I/O select 4	
					1	I/O select 3	
					1	I/O select 2	
					1	I/O select 1	
			100			I/O control 2	
				1		I/O select 14	
				1		I/O select 13	
				1		I/O select 12	
				1		I/O select 11	
					1	I/O select 10	
					1	I/O select 9	
					1	I/O unit 2 select	All other N codes
					1	I/O unit 1 select	invalid
3881 Optical Mark Reader	0011					3881 (SIOC) device address	
		0				Unused, must be zero	
			000	0000	0000	Read function only	
				0000	0001	Reset interrupt request	
			000	0000	0010	Enable interrupt	
			or	0000	0100	Disable interrupt	
			001	0000	1000	Reset SIOC adapter	
				0001	0000	Set interrupt request	
			011	0000	0001	Feed and select normal stacker	
				0000	0010	Feed and select select stacker	
				0000	0100	Enable record	
1255/ 1419 Magnetic Character Reader	0011					1255 (SIOC) device address	
		0				Unused, must be zero	
			000	0000	0000	Read I/O	
			or	0000	0001	Reset interrupt request	
			001	0000	0010	Enable interrupt	
				0000	0100	Disable interrupt	
				0000	1000	Reset SIOC adapter	
				0001	0000	Set interrupt request	
			011			Control I/O stacker selection	
			100			Control I/O stacker selection	

Op Code	Q Code			Control Code		
	DA	M	N			
0 7	8 11	12	13 15	16		
F3	0100	0	000	0000	0001	Reset interrupt
3741				0000	0010	Enable interrupt
				0000	0100	Disable interrupt
				0000	1000	Remove from busy state
				0001	0000	Set interrupt request
			001	0000	0000	Read from 3741
			010	0000	0000	Write to 3741
			011	0001	0100	Wrong mode sense response
				0000	1000	Normal response
				0101	0000	End of job-in response
				0001	0000	Record length error response
				1001	0000	Parity error response
				0011	0000	End of data set-in response
1442	0101					Device address - 1442 RPQ (5)
		0				Must be zero
			000			Feed
			001			Read translate mode
			010			Punch and feed
			011			Read column binary mode
			100			Punch - no feed
				xxxx	x001	*Note:* All other N codes invalid. Select stacker 2. x indicates *don't care* bits. Any other control code combination than 001 is invalid and will result in the card going to stacker 1.
3410	0110	0				Device 0 address
3411		1				Device 1 address
Tape	0111	0				Device 2 address
		1				Device 3 address
			000			Control
			001			Read forward
			010			Write data
			011			Read backward
			100			Diagnostic, subsystem (write)
			101			Diagnostic, subsystem (read)
			110			Diagnostic, adapter (write)
			111			Diagnostic, adapter (read)

Op Code	Q Code			Control Code		
	DA	M	N			
0 7	8 11	12	13 15	16		
BSCA	1000					Device address BSCA (8)
		0				BSCA 1
		1				BSCA 2
			000			Control
			001			Receive
			010			Transmit and receive
			011			Receive initial
			100			Auto call
			101			Invalid
			110			Loop test
			111			Invalid
				1xxx	x	If a 1, bits 1, 2, 3, and 4 of control code are effective
				0xxx	x	If a 0, bits 1, 2, 3, and 4 of control are disregarded
				1		Enable BSCA
				0		Disable BSCA
				1		Enable test mode
				0		Disable test mode
				1		Enable step mode
				0		Disable step mode
					x	Spare (no effect)
					1	Start 2-second time-out
					0	Cancel 2-second time-out
					1	Enable interrupt
					0	Disable interrupt
					1	Reset interrupt request
					0	No action
						Note: The control code is effective with every N-code function except that the start 2-second time-out must be used only with the control function (N = 000)

5444/5447/5448 Q Code and R Code

Op Code	Q Code			Control Code[1]		
	DA	M	N[2]			
0 7	8 11	12	13 15	16		
5444/	1010					Device address disk drive 1 (A)
5447	1011					Device address disk drive 2 (B)
		0				Upper disk (removable)
		1				Lower disk (fixed)
			000	0000	0000	Control - seek
			001	0000	0000	Read data
			001	0000	0001	Read identifier
			001	0000	0010	Read diagnostic
			001	0000	0111	Read verify
			010	0000	0000	Write data
			010	0000	0001	Write identifier
			011	0000	0000	Scan equal
			011	0000	0001	Scan low or equal
			011	0000	0010	Scan high or equal
Simu-	1010					Device address disk drive 1 (A)
lation	1011					Device address disk drive 2 (B)
Area		0				Removable disk
		1				Fixed disk
			000	0000	0000	Control - seek
			001	0000	0000	Read data
			001	0000	0111	Read verify
			010	0000	0000	Write data
5448	1100					Drive 1
	1101					Drive 2
		0				Upper disk
		1				Lower disk
			000	0000	0000	Control seek
			001	0000	0000	Read data
			001	0000	0001	Read identifier
			001	0000	0010	Read diagnostic
			001	0000	0111	Read verify
			010	0000	0000	Write data
			010	0000	0001	Write identifier
			011	0000	0000	Scan equal
			011	0000	0001	Scan low or equal
			011	0000	0010	Scan high or equal

Notes:
1. Bits 16-23 are not used by the attachment.
2. All other N codes invalid.

Op Code	Q Code			Control Code (R Byte)		
	DA	M	N			
0 7	8 11	12	13 15	16 19	20 23	
F3	1100	0				5445 disk drive 1 device address
5445		1				5445 disk drive 2 device address
	1101	0				5445 disk drive 3 device address
		1				5445 disk drive 4 device address
						Control
			000		0000	Seek
					0001	Recalibrate
						Read
					0000	Key-data
					0001	Home address and record R0
			001		0010	Count-key data
					0011	Verify-key data
					0100	Count-key-data diagnostic
					0111	Buffer diagnostic
						Write
					0000	Key-data
			010		0001	Home address and record R0
					0010	Count-key-data
						Scan
					1000*	Scan key-data, equal
			011		1001*	Scan key-data, low or equal
					1010*	Scan key-data, high or equal
						Interrupt
				1000		Enable interrupt
				0100		Reset seek 1 interrupt
				0010		Reset seek 2 interrupt
			100	0001		Reset seek 3 interrupt
					1000	Reset seek 4 interrupt
					0100	Reset op end interrupt
					0010	Reset enable interrupt
						Note: An unassigned R byte specification causes the attachment to hang-up in the busy state

*Bit 20 on; perform scan read low, high, or equal

Op Code 0–7	Q Code DA 8–11	Q Code M 12	Q Code N 13–15	Control Code 16		
F3						
3340	1100	0				3340 drive 1 device address
(Model	1100	1				3340 drive 2 device address
12			000			Control
only)					0000	Seek
					0001	Recalibrate
			001			Read
					0000	Key data
					0001	HA and R0 count even
					0010	Count key data
					0011	Verify key data
					0100	Count key data diagnostic
					0101	and reset buffered log
					0111	Diagnostic sense
					1000	R0 key data odd
					1001	HA and R0 count odd
					1011	Extended functional sense *byte 0:* Hex 80 = Data module attention pending drive 1 Hex 40 = Data module attention pending drive 2 *byte 1:* Unused (set to 0)
					1101	Data module attention control reset
			010			Write
					0000	Key data
					0001	HA and R0 even
					0010	Count key data
					0011	Repeat key data
					0110	R0 odd
					1000	Write count compressed data
					1001	HA and R0 odd
			011			Scan
					0000	Equal
					0010	High or equal
					1100	Read or equal
					1101	Read or high or equal

Note: Any valid device address may be used with the interrupt control commands where drive is important (reset seek complete).

The first 5 bytes of a 3340 read diagnostic sense SIO are:

Byte 0:

0 - Command reject
1 - Intervention required
2 - Unused
3 - Equipment check
4 - Data check
5 - Data overrun
6 - Track condition check
7 - Seek check

Byte 1:

0 - Permanent error
1 - Invalid track format
2 - End of cylinder (pack)
3 - Unused
4 - No record found
5 - Unused
6 - Write inhibited
7 - Operation incomplete

Byte 2:

0 - Unused
1 - Correctable
2 - Unused
3 - Environmental data present
4 - Unused
5 - Data
6 - module
7 - size (must be 010)

Byte 3:

R code of failing instruction

Byte 4:

Q code of failing instruction

Op Code	Q Code			Control Code			
	DA	M	N				
0 7	8 11	12	13 15	16			
1403	1110					Device address 1403	
Printer		0	000			Space only	
			010			Print followed by spacing	
			100			Skip only	
			110			Print followed by skip	
		1	001			Diagnostic instruction 1	
			010[1]			Diagnostic instruction 2	
				0000	0000	No space	A number greater than 3 is not permitted and results in a space zero operation.
				0000	0001	One space	
				0000	0010	Double space	
				0000	0011	Triple space	
				0000	0001	Skip to line 1	112 lines are the maximum length of a form (8 lines per inch).
				0000	0010	Skip to line 2	
				||||	||||	| |	
				||||	||||	| |	
				0110	1111	Skip to line 110	
				0111	0000	Skip to line 112	
5203	1110					Device address printer (E)	
Printer		0				Left carriage is used (single feed carriage)	
		1				Right carriage is used	
			000			Space only	
			001			Invalid	
			010			Print followed by spacing	
			011			Invalid	
			100			Skip only	
			101			Invalid	
			110			Print followed by skip	
			111			Invalid	
				0000	0000	No space	A number greater than 3 is not permitted and results in a space zero operation.
				0000	0001	One space	
				0000	0010	Double space	
				0000	0011	Triple space	
				0000	0001	Skip to line 1	112 lines are the maximum length of a form (8 lines per inch).
				0000	0010	Skip to line 2	
				||||	||||	| |	
				||||	||||	| |	
				0110	1111	Skip to line 110	
				0111	0000	Skip to line 112	

START I/O (Continued)

Op Code 0 7	Q Code DA 8 11	 M 12	 N 13 15	Control Code 16		
5213	1110					Device address serial printer
2222		0				Selects printer
Printer		1				Selects LCD
			xxx			N field is not used; zeros are preferred
				0000	0000	Serial print operation
				0000	0001	Line print operation
0129	1111					Device address, 129
Card		0				Always 0
I/O			x01			Card read
			x10			Punch
				xxxx	xxxx	Data not used, should be zero
5424	1111					Device address MFCU (F)
MFCU		0				Primary card path is used
		1				Secondary card path is used
			000			Feed
			001			Read
			010			Punch feed
			011			Punch read
			100			Print feed
			101			Print read
			110			Punch print feed
			111			Punch print read
				0		Print buffer 1 is used
				1		Print buffer 2 is used
				1		8-bit IPL read
				1		Print 4 lines
				x		Reserved
					x	Reserved
					000	No selection
					100	Select stacker 4
					101	Select stacker 1
					110	Select stacker 2
					111	Select stacker 3

TEST I/O AND BRANCH (TIO) INSTRUCTION

In Q-byte sequence

Op Code	Q Code			Operand 1		
	DA	M	N			
0 7	8 11	12	13 15	16		
5496	1111					Device address data recorder
Data		0				M bit is not used; it should be zero
Re-			x01			Read a card
corder			x10			Punch a card
			x11			Diagnostic data
			x00			Diagnostic cycle steal
				xxxx	xxxx	Data used in diagnostic data
C1						2 byte direct address
D1						1 byte indexed by XR1
E1						1 byte indexed by XR2
DPF	0000					Device address DPF (0)
		0				Must be zero
			0xx			Program level 1
			1xx			Program level 2
			x00			Cancel program level — Tests setting of DPF switch
			x01			Load program level from MFCU
			x10			Load from console I/O
				xxxx	xxxx	Branch to address if condition is met. Op codes D1 and E1 are indexed.
Model 6 Key-board 5471/ 5475	0001					Device address keyboard
		Test I/O is invalid and results in invalid Q-byte processor check.				
MLTA	0010					Device address MLTA (2)
		0				Individual line instruction
			x00			Line unit check
			x01			Op-end interrupt pending
			x10			Line busy
			x11			PCI interrupt pending
		1				General adapter instruction
			000			Adapter not ready
			001			Line op-end interrupt pending
			010			Any line busy
			011			Line PCI pending
			100			Any line unit check
			101			Adapter check
			110			Diagnostic bit
			111			Any line selected
				xxxx	xxxx	Branch to address if condition met.

TEST I/O AND BRANCH (TIO) INSTRUCTION (Continued)

Op Code 0 7	Q Code DA 8 11	M 12	N 13 15	Operand 1 16		
SIOC	0011					Device address SIOC
		0				M bit not used
			000			SIOC not ready
			010			SIOC busy
				xxxx	xxxx	Branch to address if condition met
3741	0100	0				
			000			Attachment not ready/check
			010			Attachment busy
1442	0101					Device address 1442 (5)
		0				Must be zero
			000			Test for 1442 not ready
			010			Test for 1442 busy
						Note: All other N codes invalid
				xxxx	xxxx	Branch to address if condition is met
						D1 and E1 are indexed

Op Code	Q Code			Control Code		
	DA	M	N			
0 7	8 11	12	13 15	16		
3410	0110	0				Unit 0 device address
3411	0110	1				Unit 1 device address
Tape	0111	0				Unit 2 device address
	0111	1				Unit 3 device address
			000			Not ready
			010			Busy
BSCA	1000					Device address BSCA (8)
		0				Must be zero
			000			Not ready/unit check
			001			Op-end interrupt
			010			Busy
			011			ITB interrupt
			100			Interrupt pending
			101			Invalid
			110			New data
			111			Invalid
				xxxx	xxxx	Branch to address if condition is met D1 to E1 are indexed
2265	1001					Device address display screen
		0				M bit is not used; it should be zero
			x1x			Display screen busy
			x0x			Display screen check (D-register parity error or display screen not ready)
				xxxx	xxxx	Branch to address if condition met
5444/	1010					Upper disk (removable)
5447	1011					Lower disk (fixed)
		0				Removable disk
		1				Fixed disk
			000			Not ready or error[1]
			010			Busy data transfer in process
			100			Scan found
				xxxx	xxxx	Branch to address if condition is met

[1] Condition can vary depending on disk drive selected. Refer to status byte.

TEST I/O AND BRANCH (TIO) INSTRUCTION (Continued)

Op Code 0 7	Q Code DA 8 11	M 12	N 13 15	Control Code 16		
5445	1100	0				5445 disk drive 1
		1				5445 disk drive 2
	1101	0				Reserved
		1				Reserved
			000			Not ready/unit check
			001			Seek busy
			010			Attachment busy
			011			Scan hit
			100			Invalid
			101			Invalid
			110			Invalid
			111			Invalid
5448 Disk	1100					Drive 1
	1101					Drive 2
		0				Upper disk
		1				Lower disk
			000			Not ready or error
			010			Busy data transfer in process
			100			Scan found
				xxxx	xxxx	Branch to address if condition is met
3340	1100	0				3340 drive 1 device address
	1100	1				3340 drive 2 device address
			000			Not ready/unit check
			001			Seek busy
			010			Attachment busy
			011			Scan hit
			100			Interrupt pending
1403 Printer	1110					Device address 1403 (E)
		0				Test printer condition
			000			Not ready/no op
			010			Print buffer busy
			100			Carriage busy
			110			Printer busy
		1	001			Test for diagnostic mode off
						Note: All MN codes not listed are invalid.
5203 Printer	1110					Device address printer (E)
		0				Left carriage
		1				Right carriage
			000			Not ready
			001			Invalid
			010			Print buffer busy
			011			Invalid
			100			Carriage busy
			101			Invalid
			110			Printer busy
			111			Invalid
				xxxx	xxxx	Branch to address if condition met. Op codes D1 and E1 are indexed.

TEST I/O AND BRANCH (TIO) INSTRUCTION (Continued)

Op Code 0 7	Q Code DA 8 11	M 12	N 13 15	Control Code 16		
5213/ 2222 Printer	1110					Device address serial printer
		0				Selects printer
			000			Unit check
			001			End of forms
			010			Busy
			011			Busy or end of forms
			100			Element at left margin
			101			End of forms or element at left margin
			110			Element at left margin or busy
			111			End of forms, on at left margin or busy
		1				Selects LCD
			000			Unit check
			001			Last printable line
			010			LCD busy
			011			LSR busy
			10x			Read ID busy
			11x			Card not aligned
				xxxx	xxxx	Branch to address if condition met
0129	1111					129 device address
		0				Unused, must be zero
			x0x			I/O check or not ready
			x1x			Busy
5424 MFCU	1111					Device address MFCU (F)
		0				Primary
		1				Secondary
			000			Feed not ready or error
			001			Read feed busy (condition 1)
			010			Punch data busy (condition 2)
			011			Condition 1 or 2
			100			Print data busy (condition 4)
			101			Condition 1 or 4
			110			Condition 2 or 4
			111			Condition 1, 2, or 4
				xxxx	xxxx	Branch to address if condition met. Op codes D1 and E1 are indexed.

HEXADECIMAL AND DECIMAL CONVERSION/ADDITION

To find the decimal number, locate the hexadecimal number and its decimal equivalent for each position. Add these to obtain the decimal number. To find the hexadecimal number, locate the next lower decimal number and its hexadecimal equivalent. Each difference is used to obtain the next hexadecimal 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	7	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	12,582,912	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	

Hexadecimal Addition

	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
1	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	10
2	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	10	11
3	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	10	11	12
4	05	06	07	08	09	0A	0B	0C	0D	0E	0F	10	11	12	13
5	06	07	08	09	0A	0B	0C	0D	0E	0F	10	11	12	13	14
6	07	08	09	0A	0B	0C	0D	0E	0F	10	11	12	13	14	15
7	08	09	0A	0B	0C	0D	0E	0F	10	11	12	13	14	15	16
8	09	0A	0B	0C	0D	0E	0F	10	11	12	13	14	15	16	17
9	0A	0B	0C	0D	0E	0F	10	11	12	13	14	15	16	17	18
A	0B	0C	0D	0E	0F	10	11	12	13	14	15	16	17	18	19
B	0C	0D	0E	0F	10	11	12	13	14	15	16	17	18	19	1A
C	0D	0E	0F	10	11	12	13	14	15	16	17	18	19	1A	1B
D	0E	0F	10	11	12	13	14	15	16	17	18	19	1A	1B	1C
E	0F	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D
F	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E

CODE CONVERSION CHART

Dec Val	Hex Val	Card Code DCBA8421	Mnem	IPL[1] T1T3	IPL[1] T2T3	80-Col Card Code	Symbol
000	00	C		4	1	12-0-1-8-9	
001	01	DCBA 1		A @	A 3	12-1-9	
002	02	DCBA 2		B @	B 3	12-2-9	
003	03	DCBA 21		C @	C 3	12-3-9	
004	04	DCBA 4	ZAZ	D @	D 3	12-4-9	
005	05	DCBA 4 1		E @	E 3	12-5-9	
006	06	DCBA 42	AZ	F @	F 3	12-6-9	
007	07	DCBA 421	SZ	G @	G 3	12-7-9	
008	08	DCBA8	MVX	H @	H 3	12-8-9	
009	09	DCBA8 1		I @	I 3	12-1-8-9	
010	0A	CBA8 2	ED	¢ 4	¢ 1	12-2-8-9	
011	0B	CBA8 21	ITC	. 4	. 1	12-3-8-9	
012	0C	CBA84	MVC	< 4	< 1	12-4-8-9	
013	0D	CBA84 1	CLC	(4	(1	12-5-8-9	
014	0E	CBA842	ALC	+ 4	+ 1	12-6-8-9	
015	0F	CBA8421	SLC	| 4	| 1	12-7-8-9	
016	10	C A8 2		& 4	& 1	12-11-1-8-9	
017	11	DCB 1		J @	J 3	11-1-9	
018	12	DCB 2		K @	K 3	11-2-9	
019	13	DCB 21		L @	L 3	11-3-9	
020	14	DCB 4	ZAZ	M @	M 3	11-4-9	
021	15	DCB 4 1		N @	N 3	11-5-9	
022	16	DCB 42	AZ	O @	O 3	11-6-9	
023	17	DCB 421	SZ	P @	P 3	11-7-9	
024	18	DCB 8	MVX	Q @	Q 3	11-8-9	
025	19	DCB 8 1		R @	R 3	11-1-8-9	
026	1A	CB 8 2	ED	! 4	! 1	11-2-8-9	
027	1B	CB 8 21	ITC	$ 4	$ 1	11-3-8-9	
028	1C	CB 84	MVC	* 4	* 1	11-4-8-9	
029	1D	CB 84 1	CLC	) 4	) 1	11-5-8-9	
030	1E	CB 842	ALC	; 4	; 1	11-6-8-9	
031	1F	CB 8421	SLC	¬ 4	¬ 1	11-7-8-9	
032	20	CB		- 4	- 1	11-0-1-8-9	
033	21	C A 1		/ 4	/ 1	0-1-9	
034	22	DC A 2		S @	S 3	0-2-9	
035	23	DC A 21		T @	T 3	0-3-9	
036	24	DC A 4	ZAZ	U @	U 3	0-4-9	
037	25	DC A 4 1		V @	V 3	0-5-9	
038	26	DC A 42	AZ	W @	W 3	0-6-9	
039	27	DC A 421	SZ	X @	X 3	0-7-9	

[1] If both tier 1 and tier 2 columns are being used, the tier 3 punches are added together as shown in the table at the end of this chart.

CODE CONVERSION CHART (Continued)

Dec Val	Hex Val	Card Code DCBA8421	Mnem	IPL[1] T1T3	IPL[1] T2T3	80-Col Card Code	Symbol
040	28	DC A8	MVX	Y @	Y3	0-8-9	
041	29	DC A8 1		Z @	Z3	0-1-8-9	
042	2A	DCBA	ED	} @	} 3	0-2-8-9	
043	2B	C A8 21	ITC	, 4	, 1	0-3-8-9	
044	2C	C A84	MVC	% 4	% 1	0-4-8-9	
045	2D	C A84 1	CLC	_ 4	_ 1	0-5-8-9	
046	2E	C A842	ALC	> 4	> 1	0-6-8-9	
047	2F	C A8421	SLC	? 4	? 1	0-7-8-9	
048	30	DC A	SNS	0 @	0 3	12-11-0-1-8-9	
049	31	DC 1	LIO	1 @	1 3	1-9	
050	32	DC 2		2 @	2 3	2-9	
051	33	DC 21		3 @	3 3	3-9	
052	34	DC 4	ST	4 @	4 3	4-9	
053	35	DC 4 1	L	5 @	5 3	5-9	
054	36	DC 42	A	6 @	6 3	6-9	
055	37	DC 421		7 @	7 3	7-9	
056	38	DC 8	TBN	8 @	8 3	8-9	
057	39	DC 8 1	TBF	9 @	9 3	1-8-9	
058	3A	C 8 2	SBN	: 4	: 1	2-8-9	
059	3B	C 8 21	SBF	# 4	# 1	3-8-9	
060	3C	C 84	MVI	@ 4	@ 1	4-8-9	
061	3D	C 84 1	CLI	' 4	' 1	5-8-9	
062	3E	C 842		= 4	= 1	6-8-9	
063	3F	C 8421		" 4	" 1	7-8-9	
064	40	None				None	Space
065	41	D BA 1	A 8	A 2		12-0-1-9	
066	42	D BA 2	B 8	B 2		12-0-2-9	
067	43	D BA 21	C 8	C 2		12-0-3-9	
068	44	D BA 4	ZAZ	D 8	D 2	12-0-4-9	
069	45	D BA 4 1		E 8	E 2	12-0-5-9	
070	46	D BA 42	AZ	F 8	F 2	12-0-6-9	
071	47	D BA 421	SZ	G 8	G 2	12-0-7-9	
072	48	D BA8	MVX	H 8	H 2	12-0-8-9	
073	49	D BA8 1		I 8	I 2	12-1-8	
074	4A	BA8 2	ED	¢	¢	12-2-8	¢
075	4B	BA8 21	ITC			12-3-8	
076	4C	BA84	MVC	<	<	12-4-8	<
077	4D	BA84 1	CLC	(	(	12-5-8	(
078	4E	BA842	ALC	+	+	12-6-8	+
079	4F	BA8421	SLC	|	|	12-7-8	|

[1] If both tier 1 and tier 2 columns are being used, the tier 3 punches are added together as shown in the table at the end of this chart.

CODE CONVERSION CHART (Continued)

Dec Val	Hex Val	Card Code DCBA8421	Mnem	IPL[1] T1T3	T2T3	80-Col Card Code	Symbol
080	50	A8 2		&	&	12	&
081	51	D B 1		J 8	J 2	12-11-1-9	
082	52	D B 2		K 8	K 2	12-11-2-9	
083	53	D B 21		L 8	L 2	12-11-3-9	
084	54	D B 4	ZAZ	M 8	M 2	12-11-4-9	
085	55	D B 4 1		N 8	N 2	12-11-5-9	
086	56	D B 42	AZ	O 8	O 2	12-11-6-9	
087	57	D B 421	SZ	P 8	P 2	12-11-7-9	
088	58	D B 8	MVX	Q 8	Q 2	12-11-8-9	
089	59	D B 8 1		R 8	R 2	11-1-8	
090	5A	B 8 2	ED	!	!	11-2-8	!
091	5B	B 8 21	ITC	$	$	11-3-8	$
092	5C	B 84	MVC	•	•	11-4-8	•
093	5D	B 84 1	CLC	)	)	11-5-8	)
094	5E	B 842	ALC	;	;	11-6-8	;
095	5F	B 8421	SLC	¬	¬	11-7-8	¬
096	60	B		–	–	11	–
097	61	A 1		/	/	0-1	/
098	62	D A 2		S 8	S 2	11-0-2-9	
099	63	D A 21		T 8	T 2	11-0-3-9	
100	64	D A 4	ZAZ	U 8	U 2	11-0-4-9	
101	65	D A 4 1		V 8	V 2	11-0-5-9	
102	66	D A 42	AZ	W 8	W 2	11-0-6-9	
103	67	D A 421	SZ	X 8	X 2	11-0-7-9	
104	68	D A8	MVX	Y 8	Y 2	11-0-8-9	
105	69	D A8 1		Z 8	Z 2	0-1-8	
106	6A	D BA	ED	} 8	} 2	12-11	:
107	6B	A8 21	ITC	,	,	0-3-8	,
108	6C	A84	MVC	%	%	0-4-8	%
109	6D	A84 1	CLC	_	_	0-5-8	_
110	6E	A842	ALC	>	>	0-6-8	>
111	6F	A8421	SLC	?	?	0-7-8	?
112	70	D A	SNS	0 8	0 2	12-11-0	
113	71	D 1	LIO	1 8	1 2	12-11-0-1-9	
114	72	D 2		2 8	2 2	12-11-0-2-9	
115	73	D 21		3 8	3 2	12-11-0-3-9	
116	74	D 4	ST	4 8	4 2	12-11-0-4-9	
117	75	D 4 1	L	5 8	5 2	12-11-0-5-9	
118	76	D 42	A	6 8	6 2	12-11-0-6-9	
119	77	D 421		7 8	7 2	12-11-0-7-9	

[1] If both tier 1 and tier 2 columns are being used, the tier 3 punches are added together as shown in the table at the end of this chart.

CODE CONVERSION CHART (Continued)

Dec Val	Hex Val	Card Code DCBA8421	Mnem	IPL[1] T1T3	IPL[1] T2T3	80-Col Card Code	Symbol
120	78	D 8	TBN	8 8	8 2	12-11-0-8-9	
121	79	D 8 1	TBF	9 8	9 2	1-8	
122	7A	8 2	SBN	:	:	2-8	:
123	7B	8 21	SBF	#	#	3-8	#
124	7C	84	MVI	@	@	4-8	@
125	7D	84 1	CLI	'	'	5-8	'
126	7E	842		=	=	6-8	=
127	7F	8421		"	"	7-8	"
128	80	DC		@	3	12-0-1-8	
129	81	CBA 1		A 4	A 1	12-0-1	a
130	82	CBA 2		B 4	B 1	12-0-2	b
131	83	CBA 21		C 4	C 1	12-0-3	c
132	84	CBA 4	ZAZ	D 4	D 1	12-0-4	d
133	85	CBA 4 1		E 4	E 1	12-0-5	e
134	86	CBA 42	AZ	F 4	F 1	12-0-6	f
135	87	CBA 421	SZ	G 4	G 1	12-0-7	g
136	88	CBA8	MVX	H 4	H 1	12-0-8	h
137	89	CBA8 1		I 4	I 1	12-0-9	i
138	8A	DCBA8 2	ED	¢ @	¢ 3	12-0-2-8	
139	8B	DCBA8 21	ITC	. @	. 3	12-0-3-8	
140	8C	DCBA84	MVC	< @	< 3	12-0-4-8	≤
141	8D	DCBA84 1	CLC	(@	(3	12-0-5-8	(
142	8E	DCBA842	ALC	+ @	+ 3	12-0-6-8	+
143	8F	DCBA8421	SLC	| @	| 3	12-0-7-8	±
144	90	CBA		} 4	M 1	12-11-1-8	
145	91	CB 1		J 4	N 1	12-11-1	j
146	92	CB 2		K 4	O 1	12-11-2	k
147	93	CB 21		L 4	P 1	12-11-3	l
148	94	CB 4	ZAZ	} 1	M 4	12-11-4	m
149	95	CB 4 1		J 1	N 4	12-11-5	n
150	96	CB 42	AZ	K 1	O 4	12-11-6	o
151	97	CB 421	SZ	L 1	P 4	12-11-7	p
152	98	CB 8	MVX	Q 4	Q 1	12-11-8	q
153	99	CB 8 1		I 4	I 1	12-11-9	r
154	9A	DCB 8 2	ED	' @	' 3	12-11-2-8	
155	9B	DCB 8 21	ITC	$ @	$ 3	12-11-3-8	

[1] If both tier 1 and tier 2 columns are being used, the tier 3 punches are added together as shown in the table at the end of this chart.
[2] Symbols for Dec Val 129 through 143 are not handled by 6-bit devices.
[3] Symbols printed by System/3 devices equipped with TN character sets. 8D and 8E are superscript characters.

CODE CONVERSION CHART **(Continued)**

Dec Val	Hex Val	Card Code DCBA8421	Mnem	IPL[1] T1T3	IPL[1] T2T3	80-Col Card Code	Symbol[2]	
156	9C	DCB 84	MVC	· @	· 3	12-11-4-8	¤	
157	9D	DCB 84 1	CLC	) @	) 3	12-11-5-8	)	
158	9E	DCB 842	ALC	; @	; 3	12-11-6-8	±	3
159	9F	DCB 8421	SLC	¬ @	¬ 3	12-11-7-8	□	
160	A0	DCB		- @	- 3	11-0-1-8	–	
161	A1	DC A 1		/ @	/ 3	11-0-1	~	
162	A2	C A 2		S 4	S 1	11-0-2	s	
163	A3	C A 21		T 4	T 1	11-0-3	t	
164	A4	C A 4	ZAZ	U 4	U 1	11-0-4	u	
165	A5	C A 4 1		V 4	V 1	11-0-5	v	
166	A6	C A 42	AZ	W 4	W 1	11-0-6	w	
167	A7	C A 421	SZ	X 4	X 1	11-0-7	x	
168	A8	C A8	MVX	Y 4	Y 1	11-0-8	y	
169	A9	C A8 1		Z 4	Z 1	11-0-9	z	
170	AA	DC A8 2	ED	& @	& 3	11-0-2-8		
171	AB	DC A8 21	ITC	, @	, 3	11-0-3-8	└	
172	AC	DC A84	MVC	% @	% 3	11-0-4-8	┌	
173	AD	DC A84 1	CLC	_ @	_ 3	11-0-5-8	│	
174	AE	DC A842	ALC	> @	> 3	11-0-6-8	>	
175	AF	DC A8421	SLC	? @	? 3	11-0-7-8	●	
176	B0	C A	SNS	0 4	0 1	12-11-0-1-8	0	
177	B1	C 1	LIO	1 4	1 1	12-11-0-1	1	
178	B2	C 2		2 4	2 1	12-11-0-2	2	
179	B3	C 21		3 4	3 1	12-11-0-3	3	
180	B4	C 4	ST	4 4	4 1	12-11-0-4	4	
181	B5	C 4 1	L	5 4	5 1	12-11-0-5	5	
182	B6	C 42	A	6 4	6 1	12-11-0-6	6	
183	B7	C 421		7 4	7 1	12-11-0-7	7	
184	B8	C 8	TBN	8 4	8 1	12-11-0-8	8	
185	B9	C 8 1	TBF	9 4	9 1	12-11-0-9	9	
186	BA	DC 8 2	SBN	: @	: 3	12-11-0-2-8		
187	BB	DC 8 21	SBF	# @	# 3	12-11-0-3-8	┘	
188	BC	DC 84	MVI	@ @	@ 3	12-11-0-4-8	┐	
189	BD	DC 84 1	CLI	' @	' 3	12-11-0-5-8	|	
190	BE	DC 842		= @	= 3	12-11-0-6-8	≠	
191	BF	DC 8421		" @	" 3	12-11-0-7-8	–	

[1] If both tier 1 and tier 2 columns are being used, the tier 3 punches are added together as shown in the table at the end of this chart.

[2] These characters are not handled by 6-bit devices.

[3] Symbols printed by System/3 devices equipped with TN character sets. 9D, A0, and B0 through B9 are superscript characters.

CODE CONVERSION CHART (Continued)

Dec Val	Hex Val	Card Code DCBA8421	Mnem	IPL[1] T1T3	IPL[1] T2T3	80-Col Card Code	Symbol	
192	C0	D	BC	8	2	12-0		
193	C1	BA 1	TIO	A	A	12-1	A	
194	C2	BA 2	LA	B	B	12-2	B	
195	C3	BA 21		C	C	12-3	C	
196	C4	BA 4		D	D	12-4	D	
197	C5	BA 4 1		E	E	12-5	E	
198	C6	BA 42		F	F	12-6	F	
199	C7	BA 421		G	G	12-7	G	
200	C8	BA8		H	H	12-8	H	2
201	C9	BA8 1		I	I	12-9	I	2
202	CA	D BA8 2		¢ 8	¢ 2	12-0-2-8-9	o	2
203	CB	D BA8 21		8	2	12-0-3-8-9		2
204	CC	D BA84		< 8	< 2	12-0-4-8-9		2 and 3
205	CD	D BA84 1		(8	(2	12-0-5-8-9		2 and 3
206	CE	D BA842		+ 8	+ 2	12-0-6-8-9		2 and 3
207	CF	D BA8421		| 8	| 2	12-0-7-8-9		2 and 3
208	D0	BA	BC	}	}	11-0	}	2 and 3
209	D1	B 1	TIO	J	J	11-1	J	2 and 3
210	D2	B 2	LA	K	K	11-2	K	2 and 3
211	D3	B 21		L	L	11-3	L	2 and 3
212	D4	B 4		M	M	11-4	M	
213	D5	B 4 1		N	N	11-5	N	
214	D6	B 42		O	O	11-6	O	
215	D7	B 421		P	P	11-7	P	
216	D8	B 8		Q	Q	11-8	Q	
217	D9	B 8 1		R	R	11-9	R	
218	DA	D B 8 2		' 8	' 2	12-11-2-8-9		
219	DB	D B 8 21		$ 8	$ 2	12-11-3-8-9		
220	DC	D B 84		· 8	· 2	12-11-4-8-9		
221	DD	D B 84 1		) 8	) 2	12-11-5-8-9		
222	DE	D B 842		, 8	, 2	12-11-6-8-9		
223	DF	D B 8421		¬ 8	¬ 2	12-11-7-8-9		
224	E0	D B	BC	- 8	- 2	0-2-8	\	2
225	E1	D A 1	TIO	/ 8	/ 2	11-0-1-9		
226	E2	A 2	LA	S	S	0-2	S	
227	E3	A 21		T	T	0-3	T	

[1] If both tier 1 and tier 2 columns are being used, the tier 3 punches are added together as shown in the table at the end of this chart.

[2] These characters are not handled by 6-bit devices.

[3] Symbols printed by System/3 devices equipped with TN character sets.

Dec Val	Hex Val	Card Code DCBA8421	Mnem	IPL[1] T1T3	IPL[1] T2T3	80-Col Card Code	Symbol
228	E4	A 4		U	U	0-4	U
229	E5	A 4 1		V	V	0-5	V
230	E6	A 42		W	W	0-6	W
231	E7	A 421		X	X	0-7	X
232	E8	A8		Y	Y	0-8	Y
233	E9	A8 1		Z	Z	0-9	Z
234	EA	D A8 2		& 8	& 2	11-0-2-8-9	
235	EB	D A8 21		8	2	11-0-3-8-9	
236	EC	D A84		% 8	% 2	11-0-4-8-9	
237	ED	D A84 1		_ 8	_ 2	11-0-5-8-9	
238	EE	D A842		> 8	> 2	11-0-6-8-9	
239	EF	D A8421		? 8	? 2	11-0-7-8-9	
240	F0	A	HPL	0	0	0	0
241	F1	1	APL	1	1	1	1
242	F2	2	JC	2	2	2	2
243	F3	21	SIO	3	3	3	3
244	F4	4		4	4	4	4
245	F5	4 1		5	5	5	5
246	F6	42		6	6	6	6
247	F7	421		7	7	7	7
248	F8	8		8	8	8	8
249	F9	8 1		9	9	9	9
250	FA	D 8 2		: 8	: 2	12-11-0-2-8-9	[2]
251	FB	D 8 21		# 8	# 2	12-11-0-3-8-9	
252	FC	D 84		@ 8	@ 2	12-11-0-4-8-9	
253	FD	D 84 1		' 8	' 2	12-11-0-5-8-9	
254	FE	D 842		= 8	= 2	12-11-0-6-8-9	
255	FF	D 8421		" 8	" 2	12-11-0-7-8-9	

Tier 3 Character Addition Table

Tier 3 Card Bits Required by Tier 2 Character

Tier 3 Card Bits Required by Tier 1 Character

	1	2	3 (1+2 bits)
4	5 (4+1 bits)	6 (4+2 bits)	7 (4+2+1 bits)
8	9 (8+1 bits)	(8+2 bits)	# (8+2+1 bits)
@ (4+8 bits)	(8+4+1 bits)	= (8+4+2 bits)	" (8+4+2+1 bits)

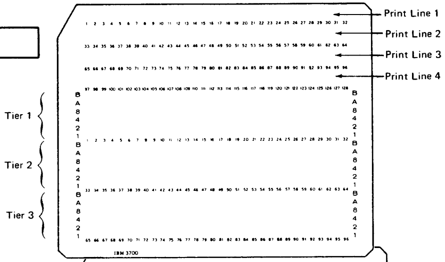
[1] If both tier 1 and tier 2 columns are being used, the tier 3 punches are added together as shown in the table at the end of this chart.

[2] This character is not handled by 6-bit devices.

96-COLUMN CARD LAYOUT

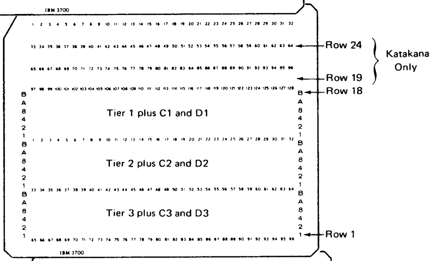
6 Bit Format

3 Tiers of BCD Data



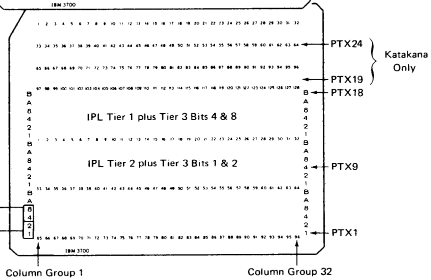
Katakana Format

3 Tiers of 8 Bit-Hex Data	
Hex Bits	Card Code
0	D1, 2, 3
1	C1, 2, 3
2	B
3	A
4	8
5	4
6	2
7	1



IPL Format

Hex Bits	Card Code	Tier 2	Tier 1
0	D	2	8
1	C	1	4
2	B	B	B
3	A	A	A
4	8	8	8
5	4	4	4
6	2	2	2
7	1	1	1



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